TEST REPORT

Product Name:	Forklift reader
FCC ID:	2BC5T-R9564
Trademark:	N/A
Model Number:	R9564
Prepared For:	Hatrida(Shenzhen)IOT Technology Co.,Ltd
Address:	3 / F, Building A, Longquan Science Park, 15 Huaxing Road, Dalang Street, Longhua District, Shenzhen
Manufacturer:	Hatrida(Shenzhen)IOT Technology Co.,Ltd
Address:	3 / F, Building A, Longquan Science Park, 15 Huaxing Road, Dalang Street, Longhua District, Shenzhen
Prepared By:	Shenzhen CTB Testing Technology Co., Ltd.
Address:	1&2/F., Building A, No.26, Xinhe Road, Xinqiao, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, China
Sample Received Date:	Jul. 31, 2023
Sample tested Date:	Jul. 31, 2023 to Sep. 06, 2023
Issue Date:	Sep. 06, 2023
Report No.:	CTB230906013RF
Test Standards	FCC Part15.247 ANSI C63.10:2013
Test Results	PASS
Remark:	This is RFID radio test report.

Compiled by:	Reviewed by:	Approved by:
Zhou Kui	Arron Liu	Bin Mei
Zhou Kui	Arron Liu	Bin Mei / Director

Note: If there is any objection to the inspection results in this report, please submit a written report to the company within 15 days from the date of receiving the report. The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen CTB Testing Technology Co., Ltd. this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client. "*" indicates the testing items were fulfilled by subcontracted lab. "#" indicates the items are not in CNAS accreditation scope.

TABLE OF CONTENT

Test Report Declaration Page
1. VERSION 4
2. TEST SUMMARY 5
3. MEASUREMENT UNCERTAINTY 6
4. PRODUCT INFORMATION AND TEST SETUP 7
4.1 Product Information 7
4.2 Test Setup Configuration 7
4.3 Support Equipment 7
4.4 Channel List 8
4.5 Test Mode 8
4.6 Test Environment 8
5. TEST FACILITY AND TEST INSTRUMENT USED 9
5.1 Test Facility 9
5.2 Test Instrument Used 9
6. AC POWER LINE CONDUCTED EMISSION 11
6.1 Block Diagram Of Test Setup 11
6.2 Limit 11
6.3 Test procedure 11
6.4 Test Result 12
7. RADIATED SPURIOUS EMISSION 14
7.1 Block Diagram Of Test Setup 14
7.2 Limit 14
7.3 Test procedure 15
7.4 Test Result 16
8. BAND EDGE AND RF COUNDUCTED SPURIOUS EMISSIONS 21
8.1 Block Diagram Of Test Setup 21
8.2 Limit 21
8.3 Test procedure 21
8.4 Test Result 22
9. COUDUCTED PEAK OUTPUT POWER 25
9.1 Block Diagram Of Test Setup 25
9.2 Limit 25
9.3 Test procedure 25
9.4 Test Result 26
10. 20DB OCCUPIED BANDWIDTH 28
10.1 Block Diagram Of Test Setup 28
10.2 Limit 28
10.3 Test procedure 28
10.4 Test Result 28
11. CARRIERFREQUENCIES SEPARATION 30
11.1 Block Diagram Of Test Setup 30
11.2 Limit 30
11.3 Test procedure 30
11.4 Test Result 30
12. HOPPING CHANNEL NUMBER 32
12.1 Block Diagram Of Test Setup 32
12.2 Limit 32
12.3 Test procedure 32
12.4 Test Result 32
13. DWELL TIME 33
13.1 Block Diagram Of Test Setup 33
13.2 Limit 33
13.3 Test procedure 33

13.4 Test Result 34
14. ANTENNA REQUIREMENT 36
15. EUT TEST SETUP PHOTOGRAPHS 37

(Note: N/A means not applicable)

1. VERSION

Report No.	Issue Date	Description	Approved
CTB230906013RF	Sep. 06, 2023	Original	Valid

2. TEST SUMMARY

The Product has been tested according to the following specifications:

Test Item	Test Requirement	Test method	Result
AC Power Line Conducted Emission	47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013	PASS
Radiated Spurious emissions	47 CFR Part 15 Subpart C Section 15.205/15.209/15.247(d)	ANSI C63.10-2013	PASS
Band edge and RF Conducted Spurious Emissions	47 CFR Part 15 Subpart C Section 15.247(d)/15.205(a)	ANSI C63.10-2013	PASS
Conducted Peak Output Power	47 CFR Part 15 Subpart C Section 15.247 (b)(2)	ANSI C63.10-2013	PASS
20dB Occupied Bandwidth	47 CFR Part 15 Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Carrier Frequencies Separation	47 CFR Part 15 Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Hopping Channel Number	47 CFR Part 15 Subpart C Section 15.247 (b)	ANSI C63.10-2013	PASS
Dwell Time	47 CFR Part 15 Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Antenna Requirement	47 CFR Part 15 Subpart C Section 15.203/15.247 (c)	/	PASS

Remark:
Test according to ANSI C63.10-2013.

3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Item	Uncertainty
Occupancy bandwidth	U=±54.3Hz
Conducted output power Above 1G	U=±1.0dB
Conducted output power below 1G	U=±0.9dB
Power Spectral Density , Conduction	U=±1.0dB
Conduction spurious emissions	U=±2.8dB
Out of band emission	U=±54Hz
3m camber Radiated spurious emission(30MHz-1GHz)	U=±4.3dB
3m chamber Radiated spurious emission(1GHz-18GHz)	U=±4.5dB
humidity uncertainty	U=±5.3%
Temperature uncertainty	U=±0.59℃
Supply voltages	U=±3%
Time	U=±5%

4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Model(s):	R9564
Model Description:	N/A
Hardware Version:	V1.0
Software Version:	V1.0
Operation Frequency:	902-928MHz
Max. RF output power:	20.825dBm
Type of Modulation:	ASK
Antenna installation:	External antenna
Antenna Gain:	5.5dBi
Ratings:	ADAPTER: INPUT: AC120-240V 50/60Hz OUTPUT: DC12V⎓5A

4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Data Cable	Power Cord
1.	Laptop	DELL	Vostro 5490	N/A	N/A	N/A
2	AC/DC ADAPTER	/	SPF-1205	N/A	N/A	N/A

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Channel List

Channel List							
Channel	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**
1	902.75	14	909.25	27	915.75	40	922.25
2	903.25	15	909.75	28	916.25	41	922.75
3	903.75	16	910.25	29	916.75	42	923.25
4	904.25	17	910.75	30	917.25	43	923.75
5	904.75	18	911.25	31	917.75	44	924.25
6	905.25	19	911.75	32	918.25	45	924.75
7	905.75	20	912.25	33	918.75	46	925.25
8	906.25	21	912.75	34	919.25	47	925.75
9	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		
13	908.75	26	915.25	39	921.75		

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Low channel	Middle channel	High channel
Transmitting (ASK)	902.75MHz	914.75MHz	927.25MHz
Receiving (ASK)	902.75MHz	914.75MHz	927.25MHz

4.6 Test Environment

Humidity(%):	54
Atmospheric Pressure(kPa):	101
Normal Voltage(DC):	12V
Normal Temperature(℃)	23
Low Temperature(℃)	0
High Temperature(℃)	40

5. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at 1&2F., Building A, No. 26, Xinhe Road, Xinqiao, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

5.2 Test Instrument Used

Item	Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	Agilent	N9020A	MY52090073	2024.07.05
2	Power Sensor	Agilent	U2021XA	MY56120032	2024.07.05
3	Power Sensor	Agilent	U2021XA	MY56120034	2024.07.05
4	Communication test set	R&S	CMW500	108058	2024.07.05
5	Spectrum Analyzer	KEYSIGHT	N9020A	MY51289897	2024.07.05
6	Signal Generator	Agilent	N5181A	MY50140365	2024.07.05
7	Vector signal generator	Agilent	N5182A	MY47420195	2024.07.05
8	Communication test set	Agilent	E5515C	MY50102567	2024.07.06
9	2.4 GHz Filter	Shenxiang	MSF2400-2483.5MS-1154	20181015001	2024.07.05
10	5 GHz Filter	Shenxiang	MSF5150-5850 MS-1155	20181015001	2024.07.06
11	Filter	Xingbo	XBLBQ-DZA120	190821-1-1	2024.07.06
12	BT&WI-FI Automatic test software	Micowave	MTS8000	Ver. 2.0.0.0	/
13	Rohde & Schwarz SFU Broadcast Test System	R&S	SFU	101017	2023.10.30
14	Temperature humidity chamber	Hongjing	TH-80CH	DG-15174	2024.07.05
15	234G Automatic test software	Micowave	MTS8200	Ver. 2.0.0.0	/
16	966 chamber	C.R.T.	966	/	2024.08.11
17	Receiver	R&S	ESPI	100362	2024.07.05
18	Amplifier	HP	8447E	2945A02747	2024.07.05
19	Amplifier	Agilent	8449B	3008A01838	2024.07.05
20	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	00869	2024.07.08

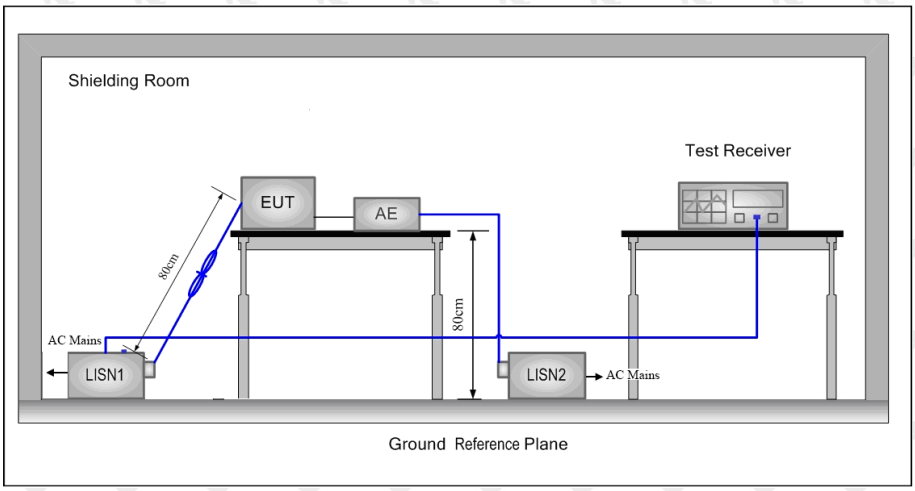
21	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA9120D	01911	2024.07.08
22	EMI test software	Fala	EZ-EMC	FA-03A2 RE	/
23	Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-224	2024.07.08
24	loop antenna	ZHINAN	ZN30900A	GTS534	/
25	40G Horn antenna	A/H/System	SAS-574	588	2023.10.30
26	Amplifier	AEROFLEX	Aeroflex	097	2023.10.30

Continuous disturbance					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	LISN	ROHDE&SCHWARZ	ESH3-Z5	100318	2024.07.05
2	Pulse limiter	ROHDE&SCHWARZ	ESH3Z2	357881052	2024.07.05
3	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100428/003	2024.07.05
4	Coaxial cable	ZDECL	Z302S-NJ-SMA J-12M	18091905	2024.07.05
5	ISN	Schwarzbeck	NTFM8158	183	2024.07.05
6	Communication test set	Agilent	E5515C	MY50102567	2024.07.05
7	Communication test set	R&S	CMW500	108058	2024.07.05
8	EZ-EMC	Frad	EMC-con3A1.1	/	/

Radiated emission					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	01911	2024.07.08
2	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	00869	2024.07.08
3	Amplifier	Agilent	8449B	3008A01838	2024.07.05
4	Amplifier	HP	8447E	2945A02747	2024.07.05
5	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100428/003	2024.07.05
6	Coaxial cable	ETS	RFC-SNS-100-NMS-80 NI	/	2024.07.05
7	Coaxial cable	ETS	RFC-SNS-100-NMS-20 NI	/	2024.07.05
8	Coaxial cable	ETS	RFC-SNS-100-SMS-20 NI	/	2024.07.05
9	Coaxial cable	ETS	RFC-NNS-100 -NMS-300 NI	/	2024.07.05
10	Communication test set	Agilent	E5515C	MY50102567	2024.07.05
11	Communication test set	R&S	CMW500	108058	2024.07.05
12	EZ-EMC	Frad	EMC-con3A1.1	/	/

6. AC POWER LINE CONDUCTED EMISSION

6.1 Block Diagram Of Test Setup



6.2 Limit

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

6.3 Test procedure

1) The mains terminal disturbance voltage test was conducted in a shielded room.

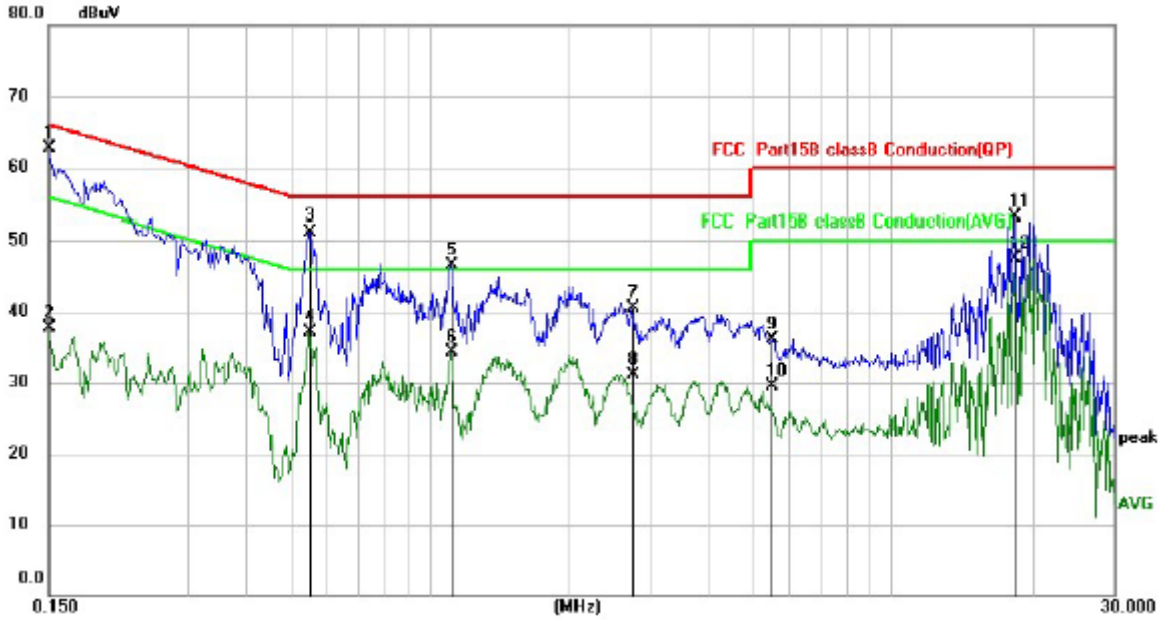
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the 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,

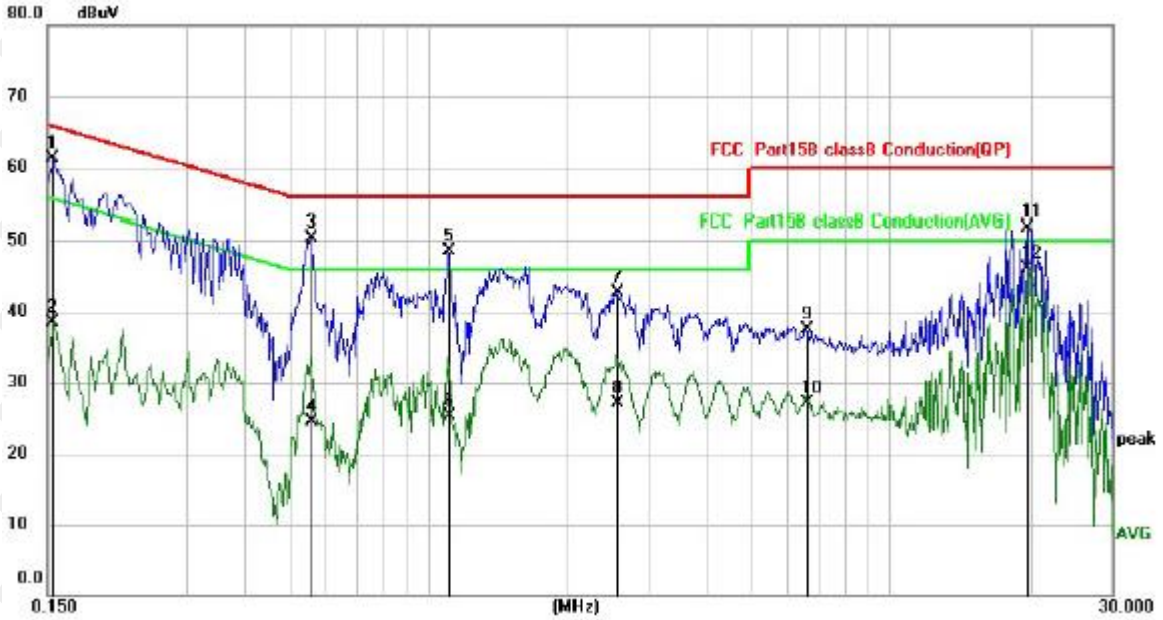
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0,4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0,8 m from the boundary of the unit under test 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 on conducted measurement.

6.4 Test Result



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1500	52.71	9.95	62.66	66.00	-3.34	QP
2		0.1500	27.74	9.95	37.69	56.00	-18.31	AVG
3		0.5500	41.18	10.00	51.18	56.00	-4.82	QP
4		0.5500	27.14	10.00	37.14	46.00	-8.86	AVG
5		1.1140	36.46	10.02	46.48	56.00	-9.52	QP
6		1.1140	24.31	10.02	34.33	46.00	-11.67	AVG
7		2.7540	30.31	10.16	40.47	56.00	-15.53	QP
8		2.7540	21.03	10.16	31.19	46.00	-14.81	AVG
9		5.5058	25.70	10.42	36.12	60.00	-23.88	QP
10		5.5058	19.07	10.42	29.49	50.00	-20.51	AVG
11		18.2419	42.34	10.79	53.13	60.00	-6.87	QP
12	*	18.2419	36.62	10.79	47.41	50.00	-2.59	AVG



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1539	51.33	9.95	61.28	65.79	-4.51	QP
2		0.1539	28.56	9.95	38.51	55.79	-17.28	AVG
3		0.5580	40.37	10.00	50.37	56.00	-5.63	QP
4		0.5580	14.50	10.00	24.50	46.00	-21.50	AVG
5		1.1100	38.49	10.02	48.51	56.00	-7.49	QP
6		1.1100	15.26	10.02	25.28	46.00	-20.72	AVG
7		2.5539	32.51	10.14	42.65	56.00	-13.35	QP
8		2.5539	17.02	10.14	27.16	46.00	-18.84	AVG
9		6.6219	26.97	10.49	37.46	60.00	-22.54	QP
10		6.6219	16.71	10.49	27.20	50.00	-22.80	AVG
11		19.7099	40.84	10.81	51.65	60.00	-8.35	QP
12	*	19.7099	35.36	10.81	46.17	50.00	-3.83	AVG

Remark:
1. Factor = Cable loss + LISN factor, Margin = Limit – Level
2. All modes were tested at AC 120V and 240V, only the worst result of AC 120V 60Hz was reported.
3. All the test modes completed for test. Only the worst result of GFSK Low Channel was reported.

7. RADIATED SPURIOUS EMISSION

7.1 Block Diagram Of Test Setup

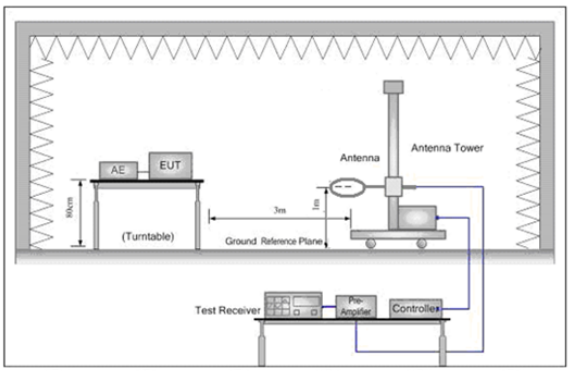


Figure 1. Below 30MHz

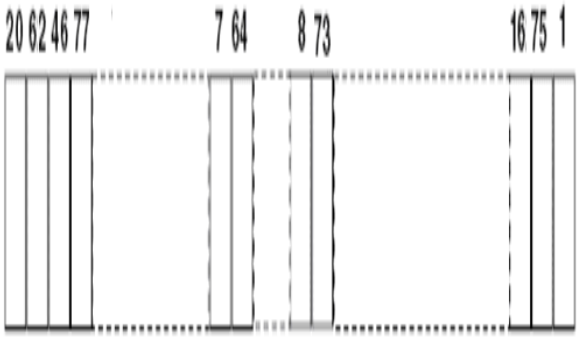


Figure 2. 30MHz to 1GHz

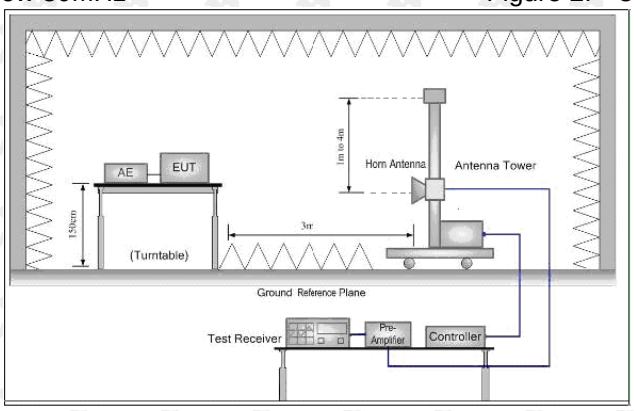


Figure 3. Above 1GHz

7.2 Limit

Spurious Emissions:

Frequency	Field strength (microvolt/meter)	Limit (dBμV/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

Note: a.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.
b. The lower limit shall apply at the transition frequencies.
c. Emission level(dBuV/m)=20log Emission level(uV/m)

7.3 Test procedure

Below 1GHz test procedure as below:

a.The EUT was placed on the top of a rotating table 0.8 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.

b.The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c.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.

d.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 rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.

e.The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f.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.

Above 1GHz test procedure as below:

g.Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).

h.Test the EUT in the lowest channel ,the middle channel ,the Highest channel

j.Repeat above procedures until all frequencies measured was complete.

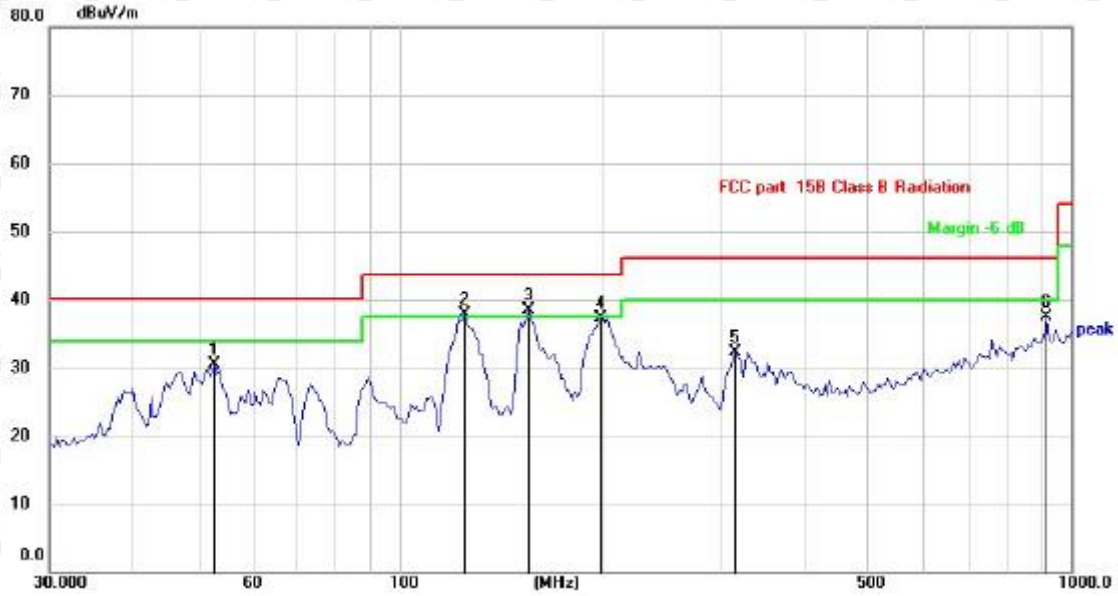
Receiver set:

Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30KHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30KHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30KHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30KHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30KHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	100 kHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

7.4 Test Result

Low channel below 1GHz Test Results:

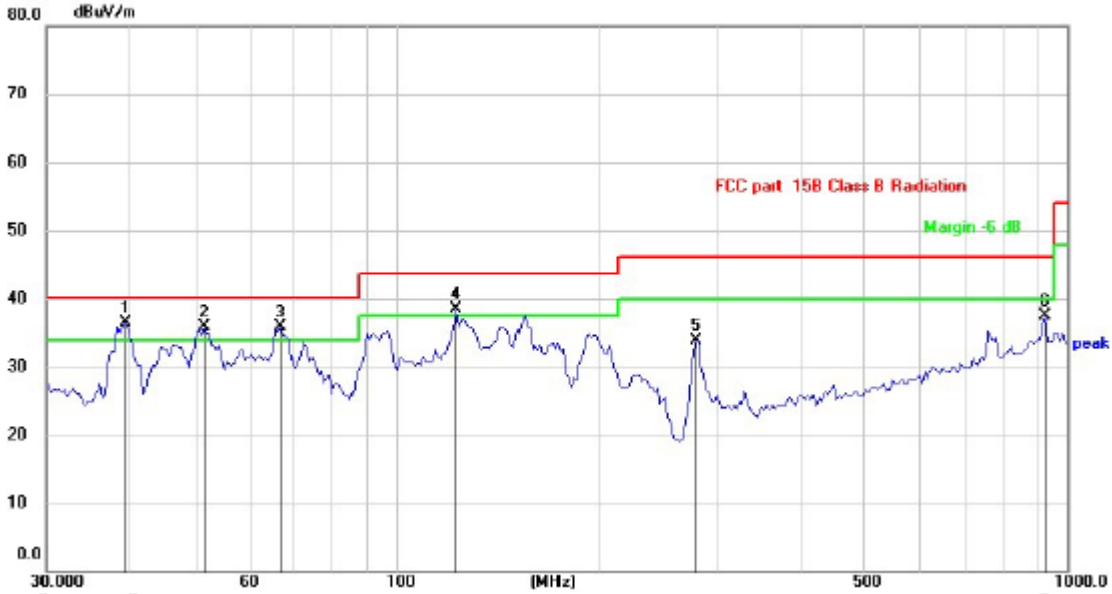
Antenna polarity: H



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		53.0382	37.18	-6.67	30.51	40.00	-9.49	QP
2	!	125.2258	42.99	-5.03	37.96	43.50	-5.54	QP
3	*	155.9100	41.80	-3.38	38.42	43.50	-5.08	QP
4		199.2855	44.83	-7.48	37.35	43.50	-6.15	QP
5		317.1444	36.58	-4.30	32.28	46.00	-13.72	QP
6		916.0685	30.55	7.03	37.58	46.00	-8.42	QP

Remark: Transd = Cableloss + Antenna factor - Pre-amplifier; Margin = Limit – Level.

Antenna polarity: V



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1	*	39.3680	41.45	-4.94	36.51	40.00	-3.49	QP
2	!	51.6613	42.59	-6.65	35.94	40.00	-4.06	QP
3	!	67.2021	43.65	-7.68	35.97	40.00	-4.03	QP
4	!	123.0494	43.58	-5.13	38.45	43.50	-5.05	QP
5		280.5151	39.41	-5.58	33.83	46.00	-12.17	QP
6		924.1345	30.46	7.11	37.57	46.00	-8.43	QP

Remark: Transd = Cableloss + Antenna factor - Pre-amplifier; Margin = Limit – Level

Above 1 GHz Test Results:
CH Low

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
1805.5	108.33	-5.84	52.69	74	-21.31	peak
1805.5	95.61	-5.84	43.65	54	-10.35	AVG
2708.25	56.28	-3.64	52.64	74	-21.36	peak
2708.25	47.20	-3.64	43.56	54	-10.44	AVG
3611	58.11	-0.95	57.16	74	-16.84	peak
3611	48.02	-0.95	47.07	54	-6.93	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
1805.5	108.38	-5.84	52.69	74	-21.31	peak
1805.5	95.49	-5.84	43.65	54	-10.35	AVG
2708.25	56.43	-3.64	52.79	74	-21.21	peak
2708.25	47.16	-3.64	43.52	54	-10.48	AVG
3611	58.13	-0.95	57.18	74	-16.82	peak
3611	48.20	-0.95	47.25	54	-6.75	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

CH Middle

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
1829.5	108.26	-5.71	52.67	74	-21.33	peak
1829.5	95.04	-5.71	45.61	54	-8.39	AVG
2744.25	56.05	-3.51	52.54	74	-21.46	peak
2744.25	46.72	-3.51	43.21	54	-10.79	AVG
3659	58.08	-0.82	57.26	74	-16.74	peak
3659	47.99	-0.82	47.17	54	-6.83	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
1829.5	108.40	-5.71	52.67	74	-21.33	peak
1829.5	95.10	-5.71	45.61	54	-8.39	AVG
2744.25	56.05	-3.51	52.54	74	-21.46	peak
2744.25	46.84	-3.51	43.33	54	-10.67	AVG
3659	58.03	-0.82	57.21	74	-16.79	peak
3659	47.89	-0.82	47.07	54	-6.93	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

CH High
Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
1854.5	56.36	-5.65	52.36	74	-21.64	peak
1854.5	47.19	-5.65	46.89	54	-7.11	AVG
2781.75	56.23	-3.43	52.80	74	-21.20	peak
2781.75	47.41	-3.43	43.98	54	-10.02	AVG
3709	57.28	-0.75	56.53	74	-17.47	peak
3709	47.57	-0.75	46.82	54	-7.18	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

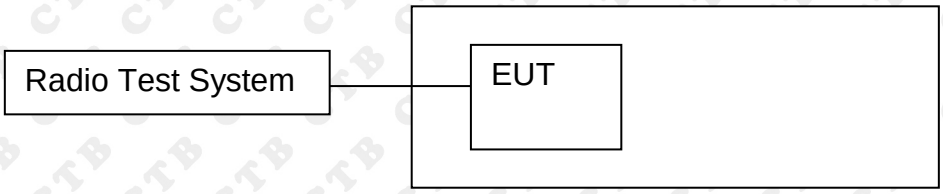
Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
1854.5	56.30	-5.65	52.36	74	-21.64	peak
1854.5	47.36	-5.65	46.89	54	-7.11	AVG
2781.75	56.09	-3.43	52.66	74	-21.34	peak
2781.75	47.38	-3.43	43.95	54	-10.05	AVG
3709	57.26	-0.75	56.51	74	-17.49	peak
3709	47.62	-0.75	46.87	54	-7.13	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark:
(1) Measuring frequencies from 1 GHz to the 25 GHz。
(2). All modes of operation were investigated and the worst-case emissions are reported.
(3). Radiated emission test from 9kHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9kHz to 30MHz and not recorded in this report.

8. BAND EDGE AND RF COUNDUCTED SPURIOUS EMISSIONS

8.1 Block Diagram Of Test Setup



8.2 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

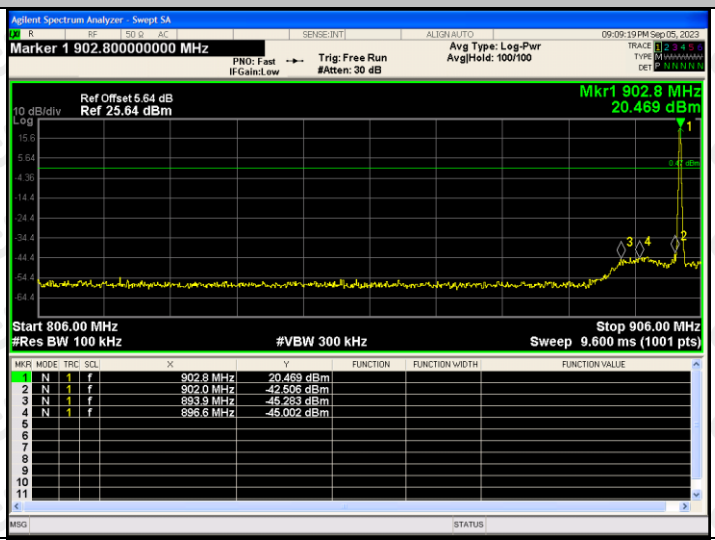
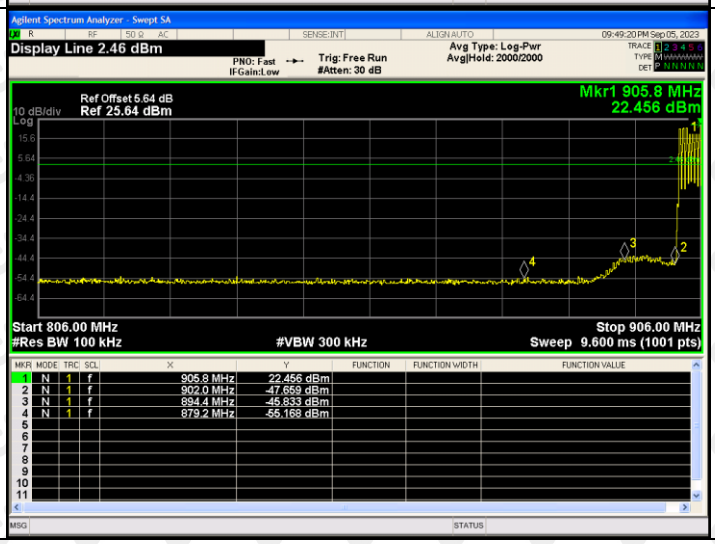
8.3 Test procedure

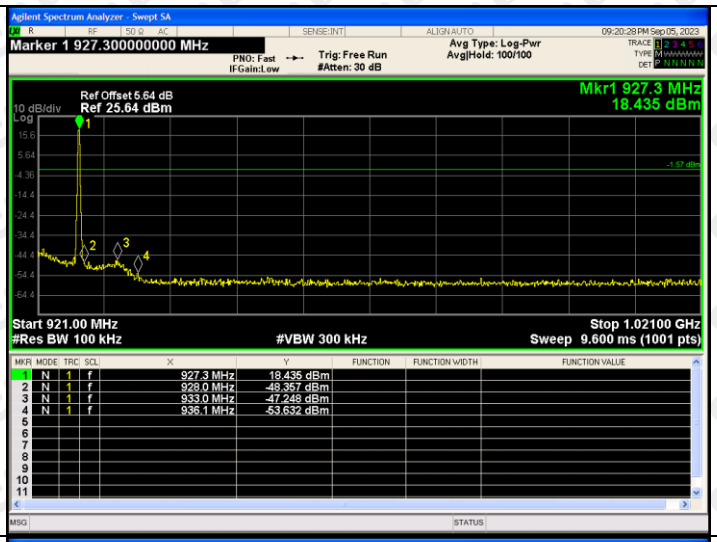
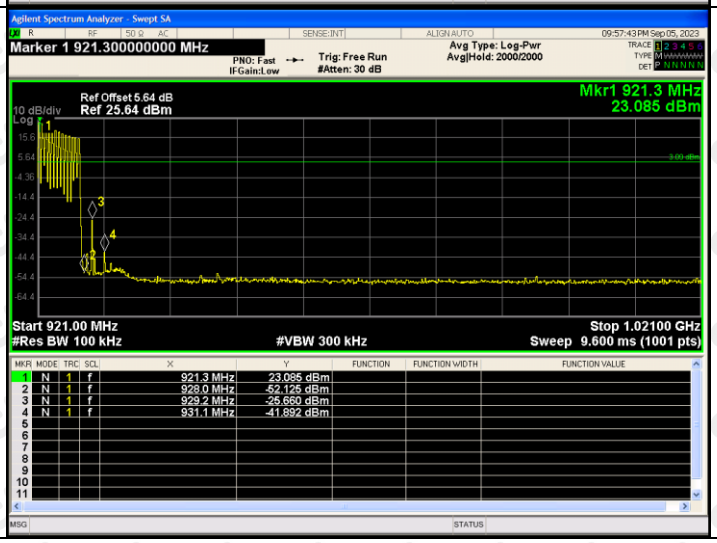
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer:

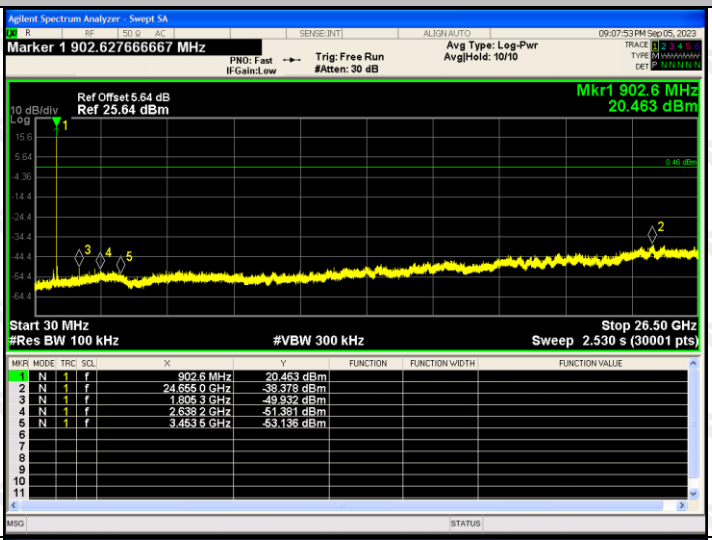
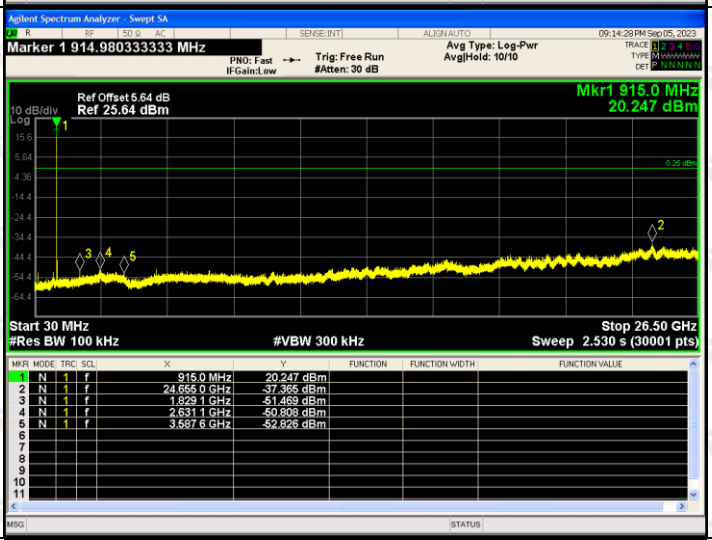
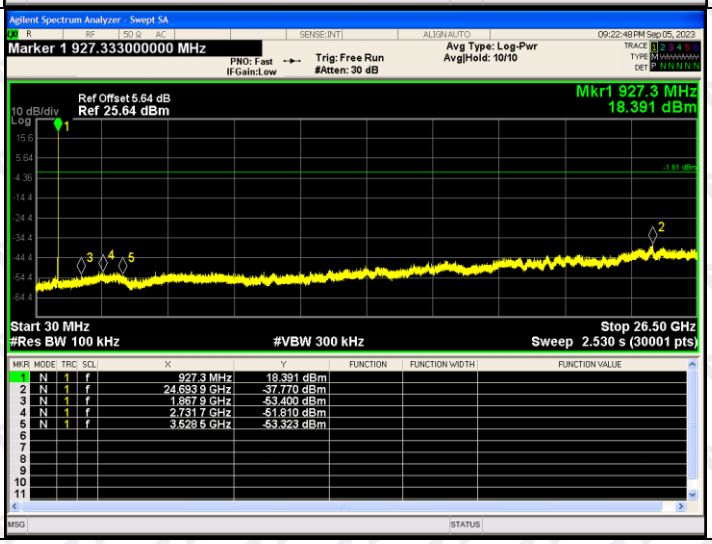
Blow 30MHz:
RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold
Above 30MHz:
RBW = 100KHz, VBW = 300KHz, Sweep = auto
Detector function = peak, Trace = max hold

8.4 Test Result

The worst data: ANT1:

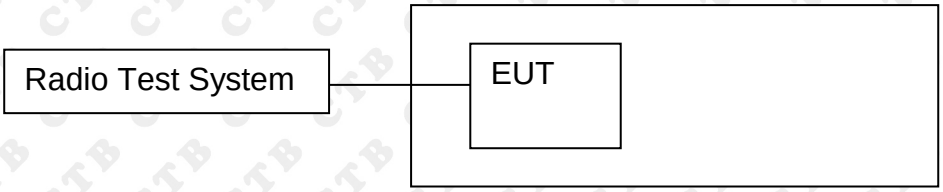
BAND EDGE Graphs			
LCH/ No Hop			
LCH/ Hop			

HCH/ No Hop			
HCH/ Hop			

RF Conducted Spurious Emissions Graphs			
LCH			
MCH			
HCH			

9. COUDUCTED PEAK OUTPUT POWER

9.1 Block Diagram Of Test Setup



9.2 Limit

The maximum peak conducted output power of the intentional radiator shall not exceed the following:
(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
(2) 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.
(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.
(4) 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.

Peak output Power: <1W=30dBm

9.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, middle and highest channel individually. Record the max value.

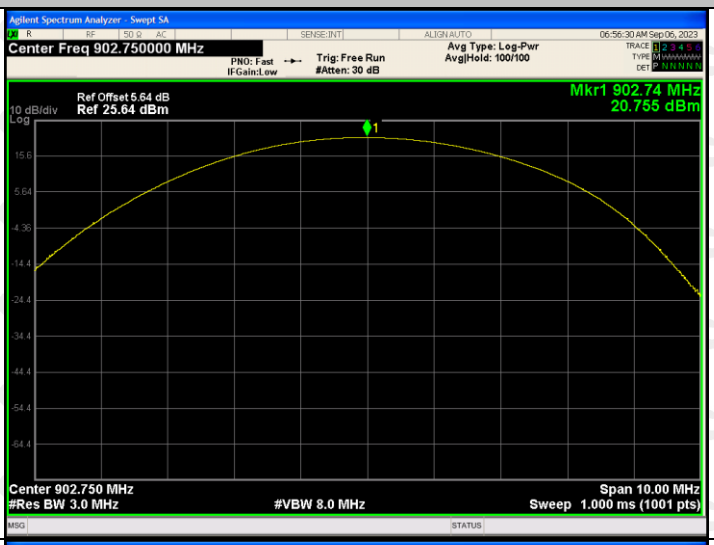
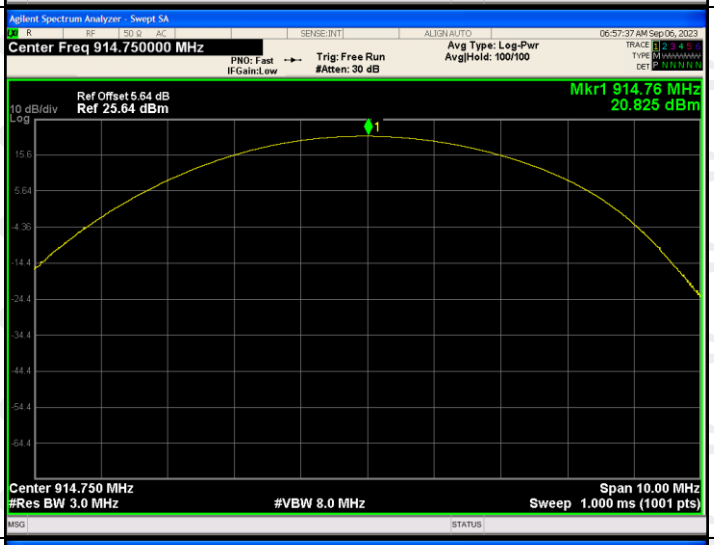
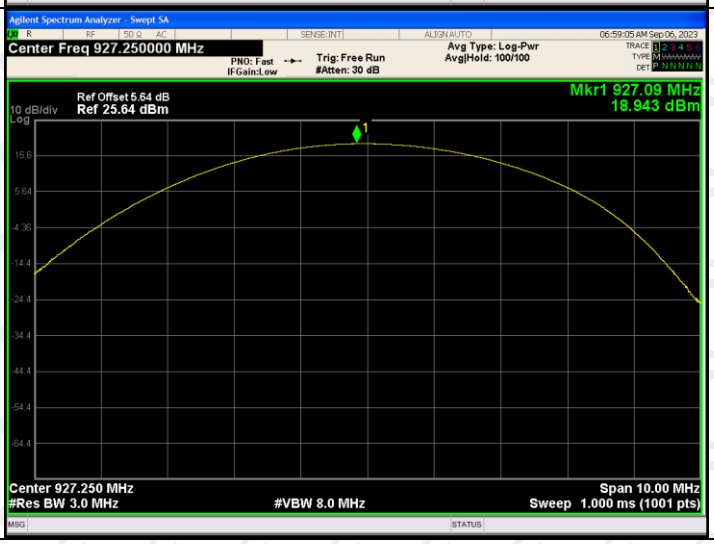
9.4 Test Result

The worst data: ANT1:
Antenna Gain: 5.5dBi

Channel.	Maximum Peak Output Power [dBm]	Limit [dBm]	Verdict
LCH	20.755	30	PASS
MCH	20.825	30	PASS
HCH	18.943	30	PASS

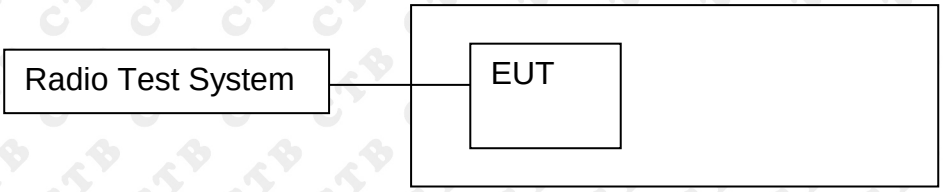
The worst data: ANT1:

Test Graph:

Graphs			
LCH			
MCH			
HCH			

10. 20DB OCCUPIED BANDWIDTH

10.1 Block Diagram Of Test Setup



10.2 Limit

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

10.3 Test procedure

1. Rem1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

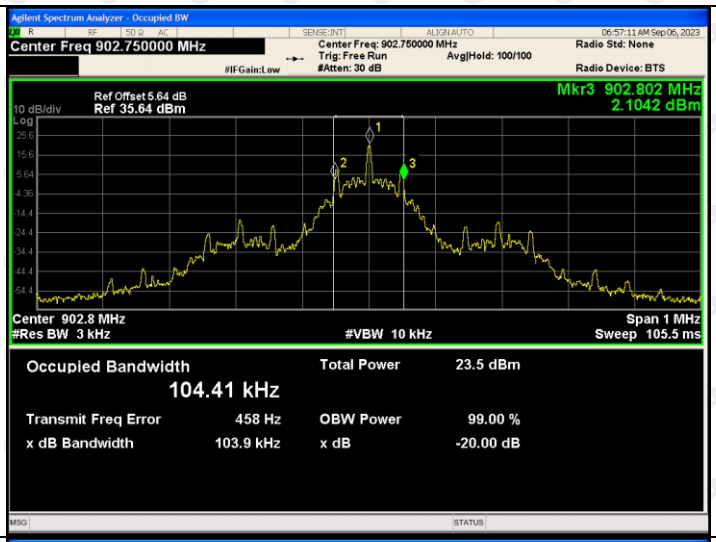
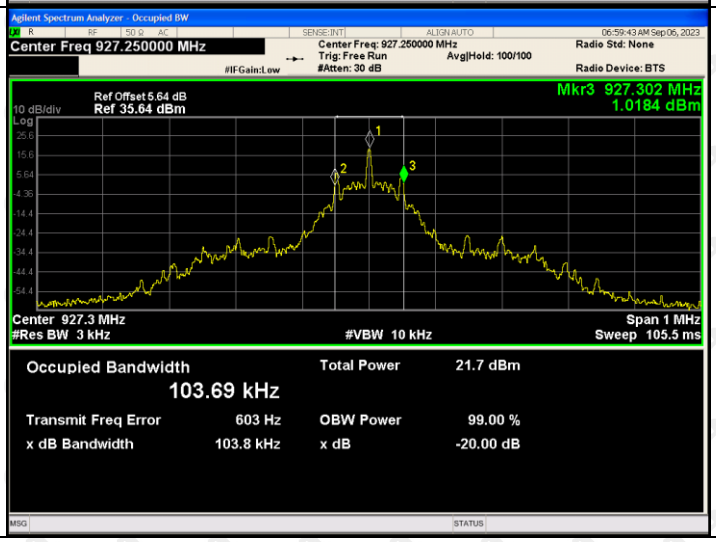
10.4 Test Result

The worst data: ANT1:

Frequency	20dB Bandwidth (kHz)	Result
Low channel	104.41	PASS
Mid channel	103.97	PASS
High channel	103.69	PASS

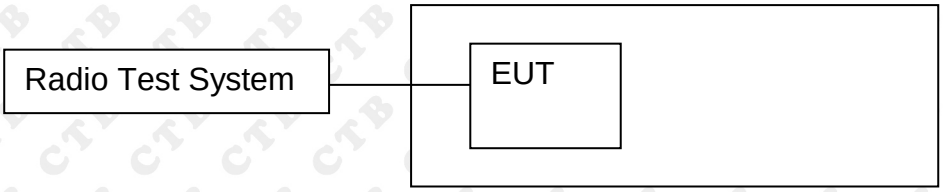
Note: All modes of operation were Pre-scan and the worst-case emissions are reported.

The worst data: ANT1:
Test Graph:

Low channel			
Mid channel			
High channel			

11. CARRIERFREQUENCIES SEPARATION

11.1 Block Diagram Of Test Setup



11.2 Limit

At least 25kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

11.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 10kHz. VBW = 30kHz , Span = 3.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

11.4 Test Result

The worst data: ANT1:

Channel.	Carrier Frequency Separation [MHz]	Verdict
LCH	0.500	PASS
MCH	0.500	PASS
HCH	0.500	PASS

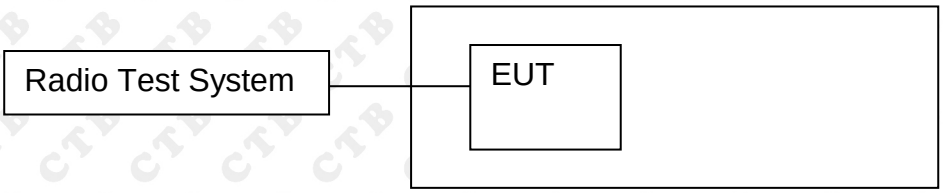
The worst data: ANT1:

Test Graph

Graphs			
LCH			
MCH			
HCH			

12. HOPPING CHANNEL NUMBER

12.1 Block Diagram Of Test Setup



12.2 Limit

Frequency hopping systems in the 920-928 MHz band shall use at least 50 channels.

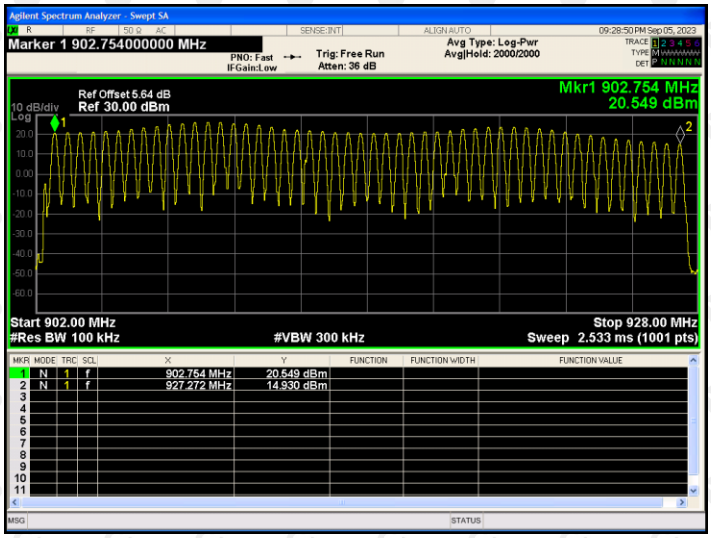
12.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100kHz. VBW = 300kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

12.4 Test Result

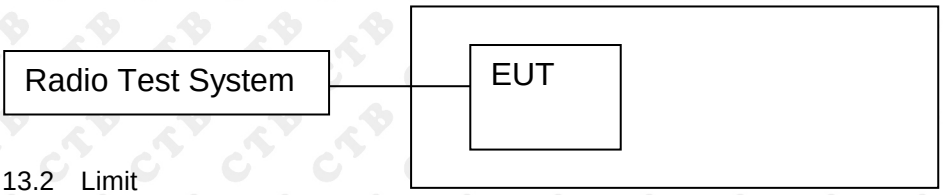
The worst data: ANT1:

Mode	Channel.	Number of Hopping Channel	Verdict
ASK	Hop	50	PASS



13. DWELL TIME

13.1 Block Diagram Of Test Setup



13.2 Limit

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.

13.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. Centred on a hopping channel;
3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

13.4 Test Result

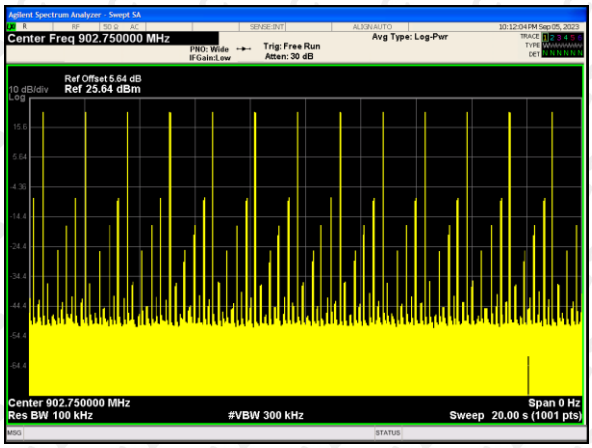
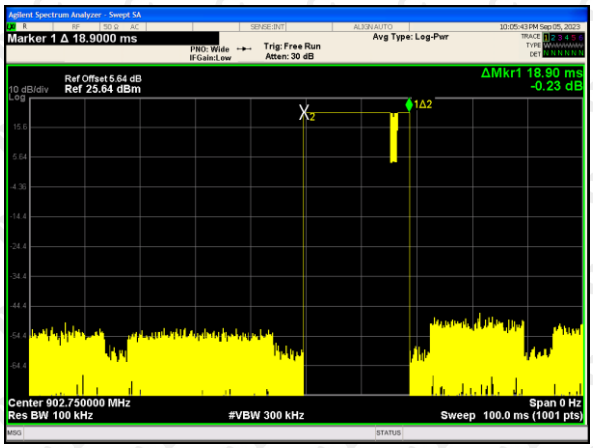
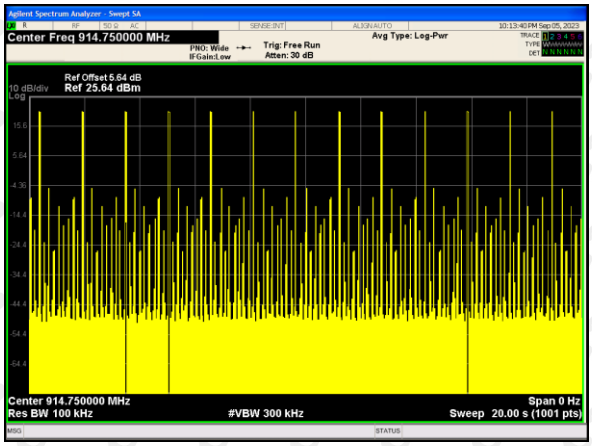
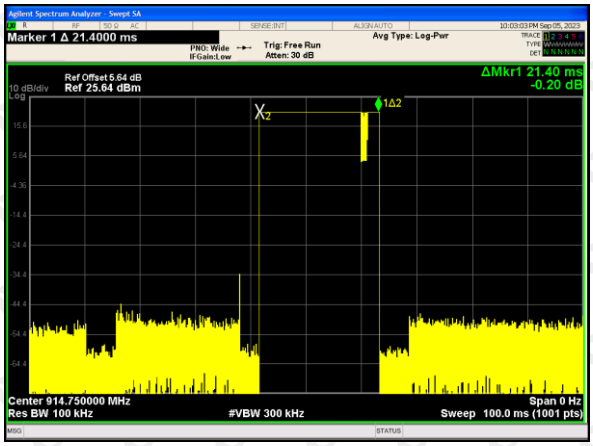
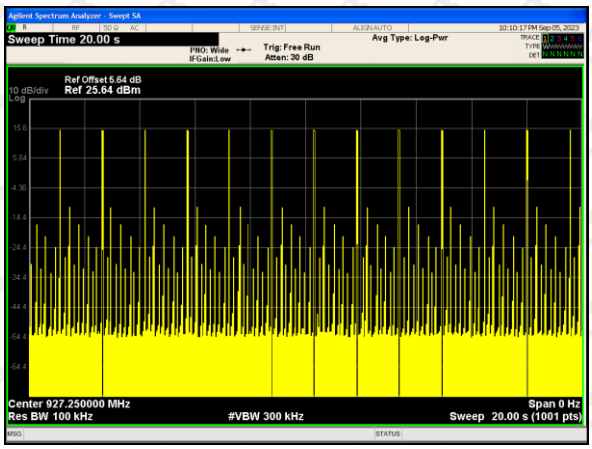
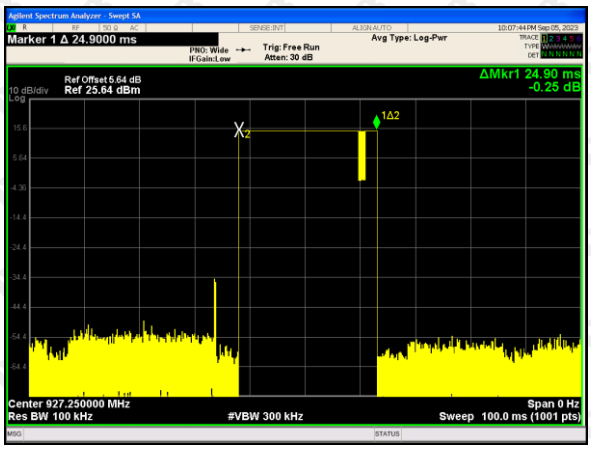
The worst data: ANT1:

Channel	No. of transmission in20s(a)	Pulse Time (ms)(b)	Total Dwell Time in 20s (ms) (c)	Limit (ms)	Verdict
LCH	13	18.9	245.7	400	PASS
MCH	13	21.4	278.2	400	PASS
HCH	13	24.9	323.7	400	PASS

Remark: Total dwell time in 20s, c=(a)*(b)

The worst data: ANT1:

Test Graph

Graphs		
LCH		
MCH		
HCH		

14. ANTENNA REQUIREMENT

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.

EUT Antenna:

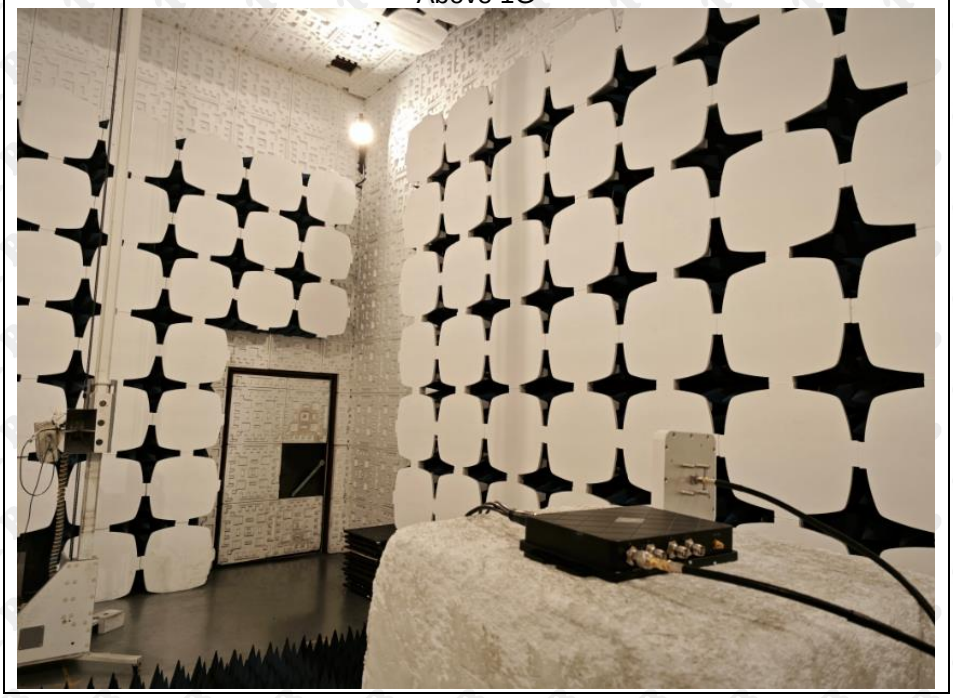
The antenna is External Antenna and no consideration of replacement. The best case gain of the antenna is 5.5dBi.

15. EUT TEST SETUP PHOTOGRAPHS

Radiated Emission

Below 1G

Above 1G



Conducted Emission

※※※※※ **END OF REPORT** ※※※※※