



Shenzhen Huaxin Information Technology Service Co., Ltd

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TEST REPORT

Report No.: **HX250516R001**

FCC ID.....: **2BM2K-M4**

IC.....: **33426-M4**

Applicant.....: **Shenzhen Navynav Technology Co., Ltd.**

Address.....: Room 502, Han's Laser Technology Centre Shennan Ave No.9988, Nanshan District, Shenzhen, Guangdong Province, China

Manufacturer.....: Shenzhen Navynav Technology Co., Ltd.

Address.....: Room 502, Han's Laser Technology Centre Shennan Ave No.9988, Nanshan District, Shenzhen, Guangdong Province, China

Product Name.....: **Wireless data transceiver**

Trade Mark.....: /

Model/Type reference.....: M4

Listed Model(s): /

Standard.....: **FCC CFR Title 47 Part 15 Subpart C Section 15.247**
RSS-247 Issue 3

Date of receipt of test sample...: May. 13, 2025

Date of testing.....: May. 14, 2025 ~ May. 19, 2025

Date of issue.....: May. 20, 2025

Result.....: **PASS**

Compiled by:

(Printed name + signature)

Terry Su



Approved by:

(Printed name + signature)

Michael Wu

Testing Laboratory Name.....: **Shenzhen Huaxin Information Technology Service Co., Ltd**

Address.....: 101, R & D Building, No.3 guansheng 4th Road, Luhua Community, Guanhu Street, Longhua District, Shenzhen, Guangdong, China

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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.

[RSS-Gen Issue 5](#): General Requirements for Compliance of Radio Apparatus.

1.2. Report version

Revised No.	Date of issue	Description
01	May. 20, 2025	Original



1.3. Test Description

FCC Part 15 Subpart C (15.247)/ RSS-247 Issue 3				
Test Item	Standard Section		Result	Test Engineer
	FCC	IC		
Antenna Requirement	15.203&15.247(b)(4)	/	Pass	Sain Liao
Conducted Emission	15.207	RSS-Gen 8.8	Pass	Ann Lu
Hopping Channel Separation	15.247(a)(1)(i)	RSS 247 5.1 (c)	Pass	Sain Liao
Dwell Time	15.247(a)(1)(i)	RSS 247 5.1 (c)	Pass	Sain Liao
Peak Output Power	15.247(b)(2)	RSS 247 5.4 (a)	Pass	Sain Liao
Number of Hopping Frequency	15.247(a)(1)(iii)	RSS 247 5.1 (d)	Pass	Sain Liao
Conducted Band Edge and Spurious Emissions	15.247(d)	RSS 247 5.5	Pass	Sain Liao
Radiated Emissions Restricted Band and Radiated Spurious Emissions	15.205&15.209&15.247(d)	RSS 247 5.5	Pass	Sain Liao
Radiated Spurious Emission	15.247(d)&15.209	RSS 247 5.5&RSS-Gen 8.9	Pass	Sain Liao
20dB Bandwidth	15.247(a)(1)(i)	RSS 247 5.1 (c)	Pass	Sain Liao

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



1.4. Test Facility

Shenzhen Huaxin Information Technology Service Co., Ltd

Add: 101, R & D Building, No.3 guansheng 4th Road, Luhuhu Community, Guanhu Street, Longhua District, Shenzhen, Guangdong, China

Laboratory accreditation

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

A2LA-Lab Cert. No.: 6855.01

Shenzhen Huaxin Information Technology Service Co., Ltd 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 (Company Number: 31786, CAB Identifier: CN0147)

Shenzhen Huaxin Information Technology Service Co., Ltd EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 31786.

FCC (Registration No.: 932271, Designation Number CN1344)

Shenzhen Huaxin Information Technology Service Co., Ltd EMC Laboratory has been registered and fully described in a report filed with the (FCC)Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration NO.: 932271.

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 in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen Huaxin Information Technology Service Co., Ltd 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 Shenzhen Huaxin Information Technology Service Co., Ltd



Test Items	Measurement Uncertainty	Notes
20dB Emission Bandwidth	$\pm 3.70\%$	(1)
Carrier Frequency Separation	$\pm 1.9\%$	(1)
Number of Hopping Channel	$\pm 1.9\%$	(1)
Time of Occupancy	$\pm 0.028\%$	(1)
Max Peak Conducted Output Power	$\pm 0.60\text{dB}$	(1)
Band-edge Spurious Emission	$\pm 4.40\text{dB}$	(1)
Conducted Spurious Emissions	$\pm 1.40\text{dB}$	(1)
Conducted Emissions 9kHz~30MHz	$\pm 1.65\text{dB}$	(1)
Radiated Emissions 9kHz~30MHz	$\pm 3.62\text{dB}$	(1)
Radiated Emissions 30~1000MHz	$\pm 4.63\text{dB}$	(1)
Radiated Emissions 1~18GHz	$\pm 4.40\text{dB}$	(1)
Radiated Emissions 18~40GHz	$\pm 4.40\text{dB}$	(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 Navynav Technology Co., Ltd.
Address:	Room 502, Han's Laser Technology Centre Shennan Ave No.9988, Nanshan District, Shenzhen, Guangdong Province, China
Manufacturer:	Shenzhen Navynav Technology Co., Ltd.
Address:	Room 502, Han's Laser Technology Centre Shennan Ave No.9988, Nanshan District, Shenzhen, Guangdong Province, China

2.2. General Description of EUT

Product Name:	Wireless data transceiver
Trade Mark:	/
Model/Type reference:	M4
Listed Model(s):	/
Power supply:	3.3~3.6Vdc from PCB board
Hardware version:	V1R0
Software version:	B039.00.09
Sample number:	YP250507-E001
LoRa Specification	
Modulation:	CSS
Operation frequency:	902.50MHz ~ 927.49MHz
Channel number:	50
Channel separation:	510kHz
Antenna type:	Dipole Antenna
Antenna gain:	1.34dBi



2.3. Accessory Equipment information

Equipment Information			
Name	Model	S/N	Manufacturer
Laptop	ThinkPad E460	PF-0132W7	Lenovo
AC/DC Adapter	DQS181-120150-19218E	---	Citiland
Cable Information			
Name	Shielded Type	Ferrite Core	Length
USB to RS-232	With	Without	1M
DC In cable	Without	Without	1.5M
Test Software Information			
Name	Version	/	/
SSCOM	V5.13.1	/	/



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 mode for testing. Channels 00/25/49 were selected for testing.

Operation Frequency List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	902.50	13	909.13	26	915.76	39	922.39
01	903.01	14	909.64	27	916.27	40	922.90
02	903.52	15	910.15	28	916.78	41	923.41
03	904.03	16	910.66	29	917.29	42	923.92
04	904.54	17	911.17	30	917.80	43	924.43
05	905.05	18	911.68	31	918.31	44	924.94
06	905.56	19	912.19	32	918.82	45	925.45
07	906.07	20	912.70	33	919.33	46	925.96
08	906.58	21	913.21	34	919.84	47	926.47
09	907.09	22	913.72	35	920.35	48	926.98
10	907.60	23	914.23	36	920.86	49	927.49
11	908.11	24	914.74	37	921.37	/	/
12	908.62	25	915.25	38	921.88	/	/

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 engineering test program was provided and enabled to make EUT continuous transmit
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 - SRD					
Item	Test Equipment	Manufacturer	Model No.	Versions/ Serial No.	Calibrated until
1	Spectrum Analyzer	Agilent	N9020A	MY51280803	Apr. 08, 2026
2	Wideband Radio Communication Tester	R&S	CMW500	157763	Apr. 08, 2026
3	MXG Vector Signal Generator	Agilent	N5182A	101795	Apr. 08, 2026
4	EXG Analog Signal Generator	Agilent	N5181A	MY47421151	Apr. 08, 2026
5	RF Sensor Unit	Techy	TR1029-2	20220428P009	Apr. 08, 2026
6	High and low temperature test chamber	Asprey	LX-225L	2020091401	Apr. 08, 2026
7	SRD Test Software	TACHOY	RTS	V1.0.0	/
8	2G/3G/4G Test Software	TST	TST-PASS	V2.0	/

Radiated emission					
Item	Test Equipment	Manufacturer	Model No.	Versions/ Serial No.	Calibrated until
1	EMI spectrum receiver	R&S	ESR7	102543	Apr. 08, 2026
2	9*6*6 anechoic chamber	Mao Rui	9*6*6	/	Apr. 08, 2026
3	Spectrum analyzer	R&S	FSV40-N	101795	Apr. 09, 2026
4	Preamplifier	Agilent	8449B	3008A00551	Apr. 09, 2026
5	Preamplifier	HP	8447D	1616A02061	Apr. 08, 2026
6	Horn Antenna	A. H. System, Inc	SAS-571	915	Apr. 18, 2026
7	Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	01318	Apr. 18, 2026
8	6dB Fixed Attenuator	SKET	AP_DC01G-2W-N-6 dB	SK2021012803	Apr. 08, 2026
9	Test Software	SKET	EMC-I	V1.4.0.1	/
10	Wideband Radio Communication Tester	R&S	CMW500	157763	Apr. 08, 2026

Conducted emission					
Item	Test Equipment	Manufacturer	Model No.	Versions/ Serial No.	Calibrated until
1	LISN	R&S	ENV216	101291	Apr. 09, 2026
2	LISN	R&S	ESH3-Z5	894981/024	Apr. 09, 2026
3	EMI Test Receiver	R&S	ESR7	102543	Apr. 08, 2026
5	Test Software	SKET	EMC-I	V1.4.0.1	/
6	Wideband Radio Communication Tester	R&S	CMW500	157763	Apr. 08, 2026

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

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

3. TEST ITEM AND RESULTS

3.1. Conducted Emission

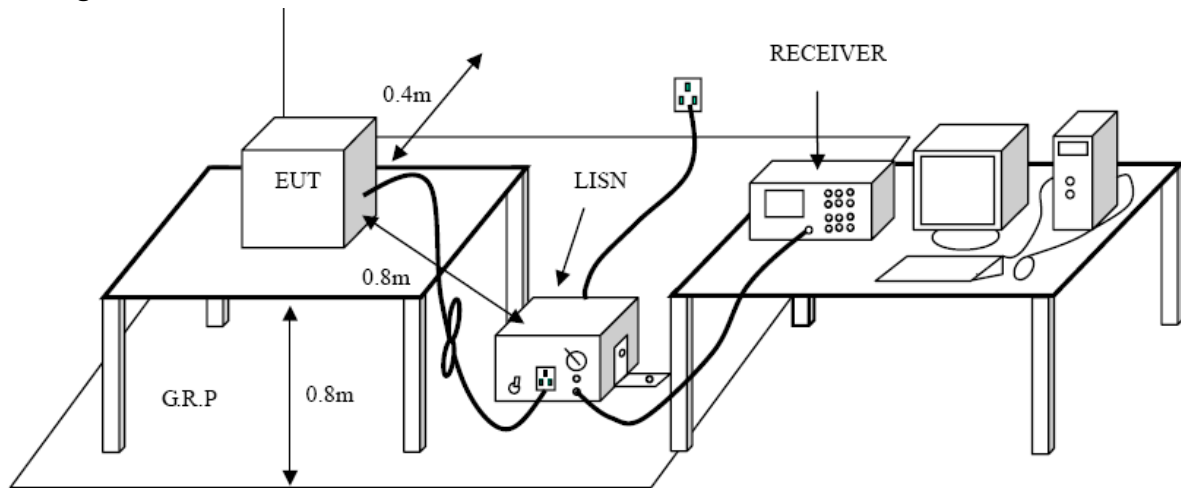
Limit

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

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

Test Configuration

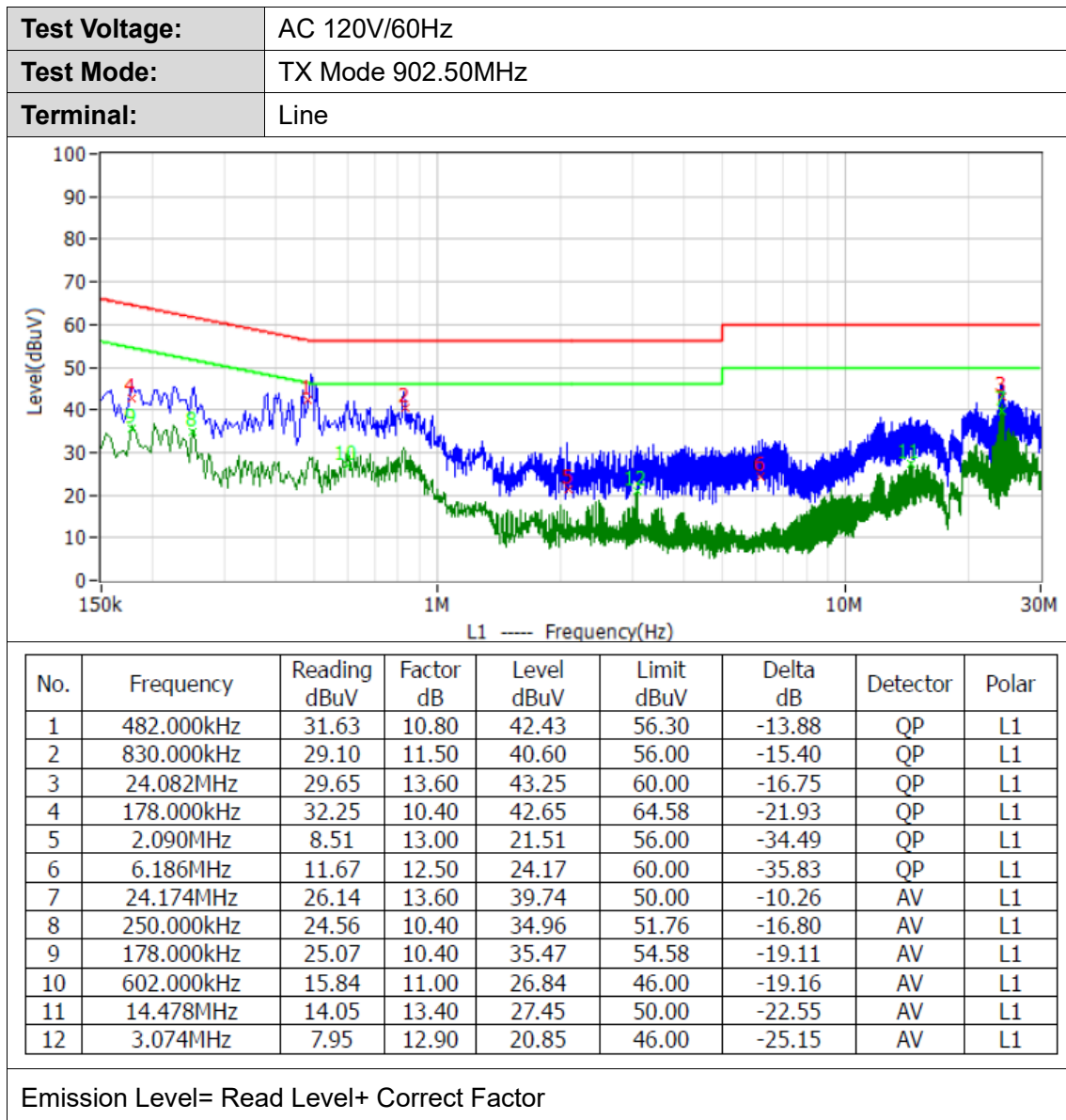


Test Procedure

1. The EUT was setup according to ANSI C63.10:2013 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.

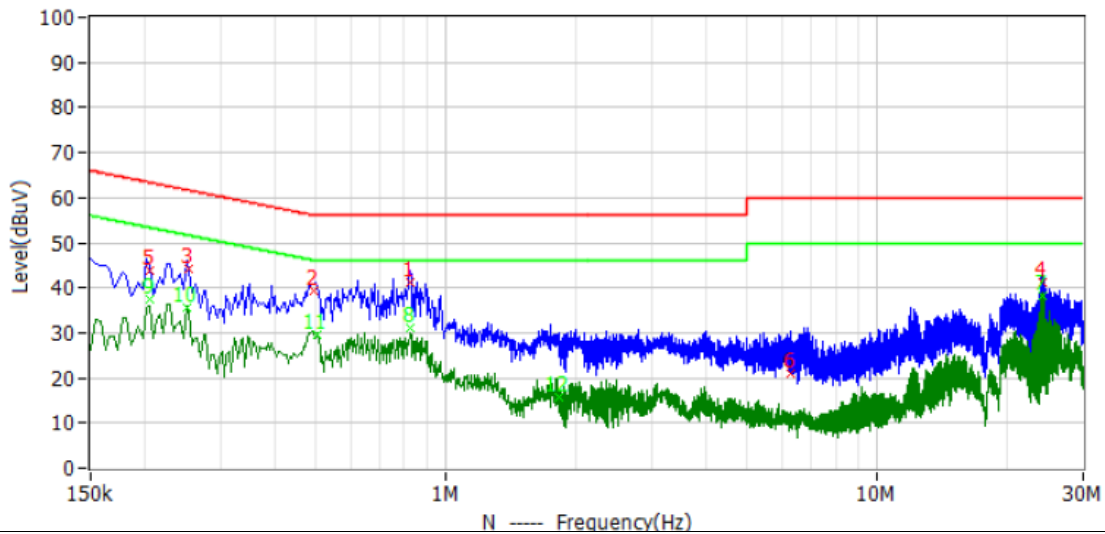
Test Mode

Please refer to the clause 2.4.

**Test Results**



Test Voltage:	AC 120V/60Hz
Test Mode:	TX Mode 902.50MHz
Terminal:	Neutral



No.	Frequency	Reading dBuV	Factor dB	Level dBuV	Limit dBuV	Delta dB	Detector	Polar
1	826.000kHz	29.60	11.50	41.10	56.00	-14.90	QP	N
2	494.000kHz	28.48	10.90	39.38	56.10	-16.72	QP	N
3	254.000kHz	33.59	10.60	44.19	61.63	-17.43	QP	N
4	24.174MHz	27.26	13.80	41.06	60.00	-18.94	QP	N
5	206.000kHz	33.37	10.60	43.97	63.37	-19.39	QP	N
6	6.322MHz	8.54	12.50	21.04	60.00	-38.96	QP	N
7	24.266MHz	24.52	13.80	38.32	50.00	-11.68	AV	N
8	826.000kHz	19.47	11.50	30.97	46.00	-15.03	AV	N
9	206.000kHz	26.70	10.60	37.30	53.37	-16.06	AV	N
10	250.000kHz	25.04	10.60	35.64	51.76	-16.12	AV	N
11	502.000kHz	18.65	10.90	29.55	46.00	-16.45	AV	N
12	1.834MHz	2.93	12.80	15.73	46.00	-30.27	AV	N

Emission Level= Read Level+ Correct Factor



3.2. Radiated Emission

Limit

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

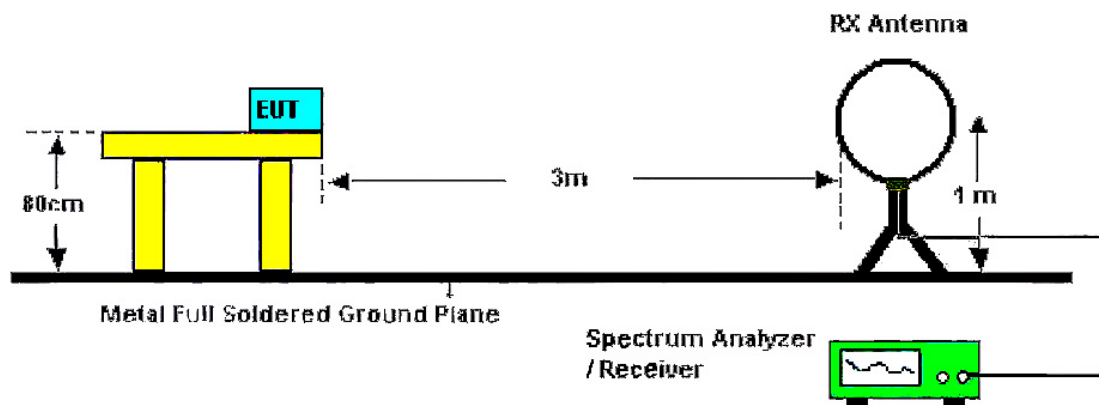
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F (kHz)	300
0.490~1.705	24000/F (kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

Frequency Range (MHz)	dBμV/m (at 3 meters)	
	Peak	Average
Above 1000	74	54

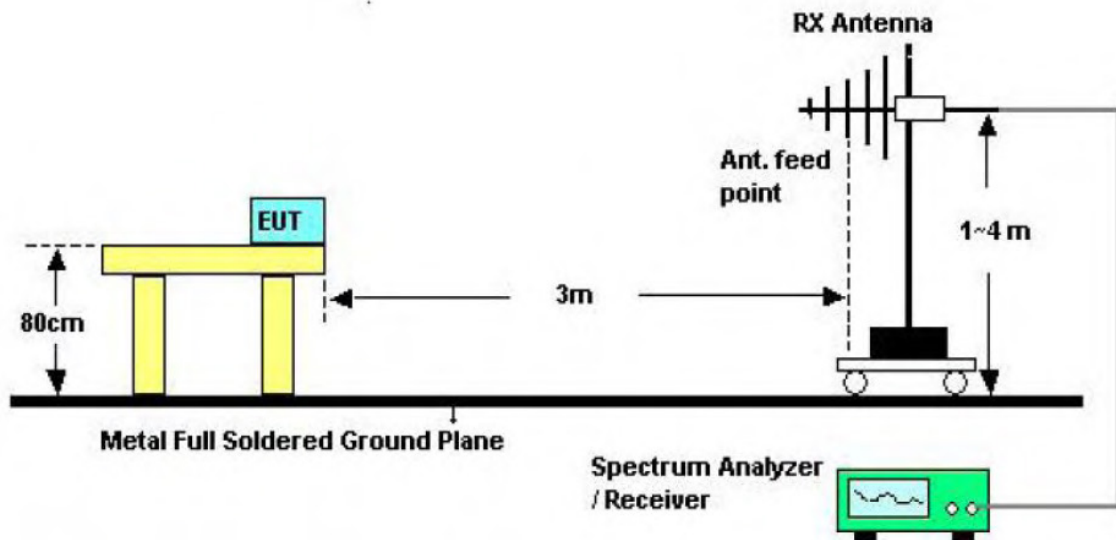
Note:

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

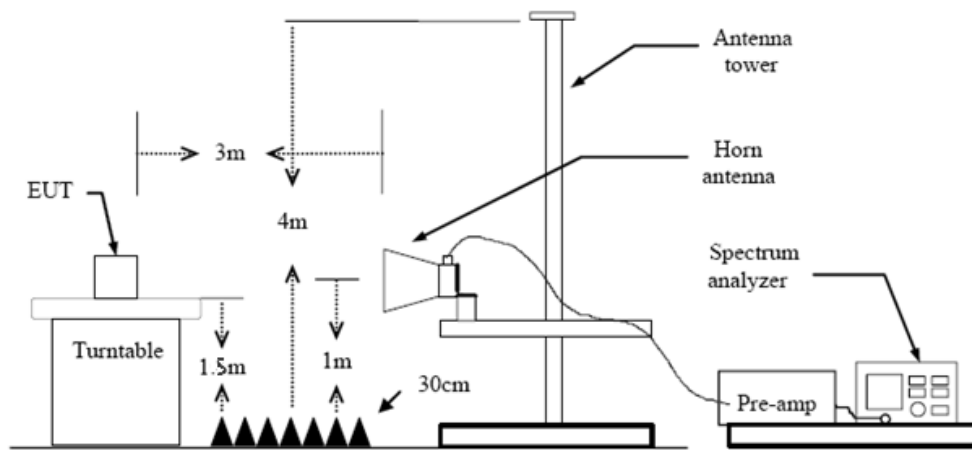
Test Configuration



Below 30MHz Test Setup



Below 1000MHz Test Setup



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 30 MHz:
9kHz – 150kHz, RBW=200Hz, VBW \geq RBW, Sweep=auto, Detector function=peak, Trace=max hold;
150kHz – 30MHz, RBW=9kHz, VBW \geq RBW, 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) 30 MHz - 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.

(4) 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.

Test Result

9 KHz~30 MHz

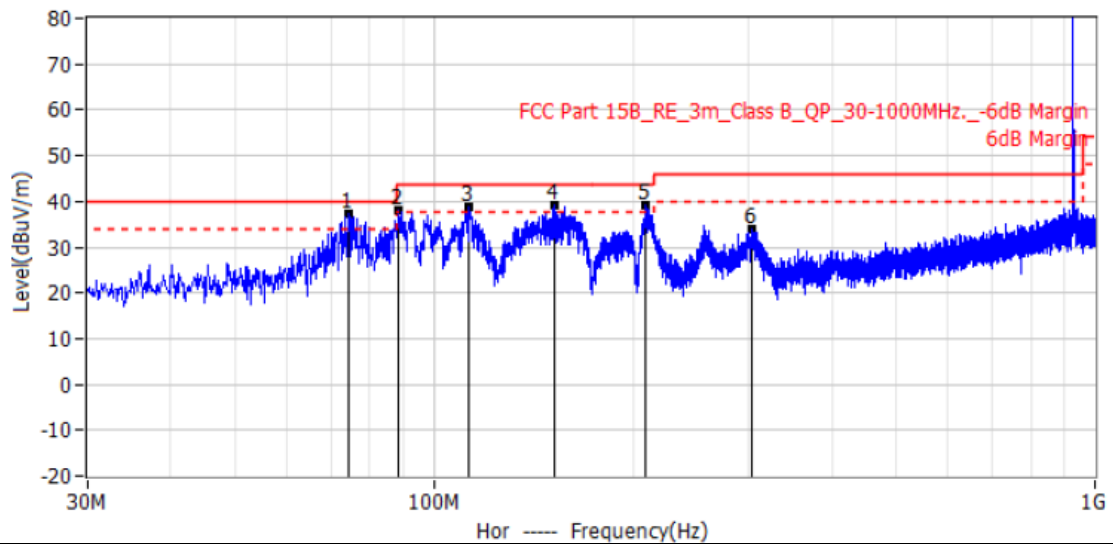
From 9 kHz to 30 MHz Conclusion: PASS

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



30MHz-1GHz

Ant. Pol.	Horizontal
Test Mode:	TX Mode 902.50MHz
Remark:	Only worse case is reported



No.	Frequency	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Delta dB	Detector	Polar
1*	74.499MHz	23.1	12.3	35.4	40.0	-4.6	QP	Hor
2*	88.443MHz	26.4	11.6	38.0	43.5	-5.5	QP	Hor
3*	112.693MHz	25.1	13.6	38.7	43.5	-4.8	QP	Hor
4*	152.705MHz	23.0	16.1	39.1	43.5	-4.4	QP	Hor
5*	209.571MHz	26.1	13.1	39.2	43.5	-4.3	QP	Hor
6*	302.691MHz	17.9	16.0	33.9	46.0	-12.1	QP	Hor

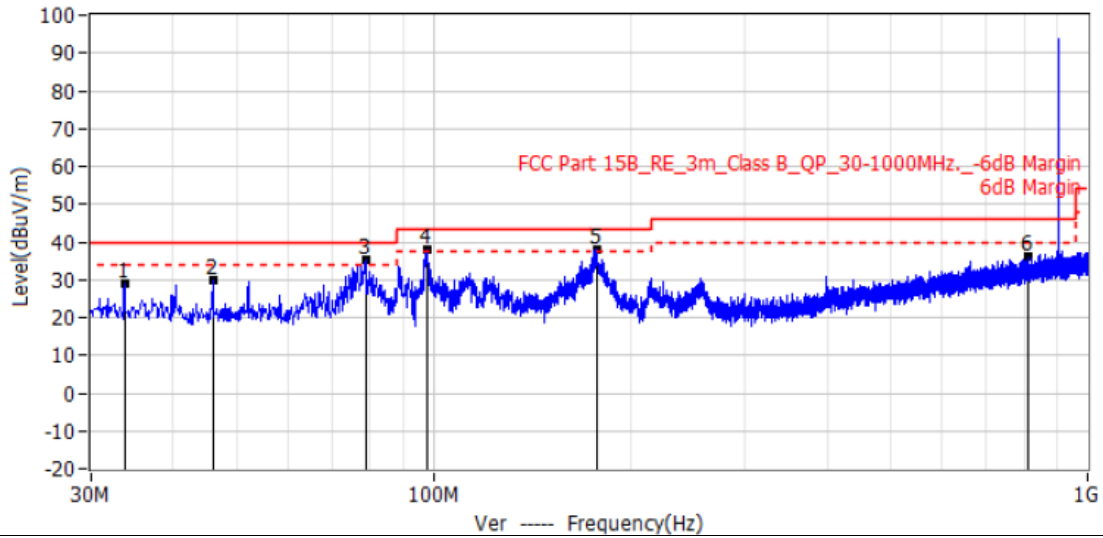
Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	TX Mode 902.50MHz
Remark:	Only worse case is reported



No.	Frequency	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Delta dB	Detector	Polar
1*	33.759MHz	13.8	15.1	28.9	40.0	-11.1	QP	Ver
2*	46.005MHz	14.5	15.3	29.8	40.0	-10.2	QP	Ver
3*	78.743MHz	23.7	11.8	35.5	40.0	-4.5	QP	Ver
4*	98.021MHz	25.6	12.2	37.8	43.5	-5.7	QP	Ver
5*	177.925MHz	23.7	14.5	38.2	43.5	-5.3	QP	Ver
6*	812.426MHz	10.1	25.9	36.0	46.0	-10.0	QP	Ver

Remarks:

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

**Above 1GHz**

902.50MHz							
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Polarization	Detector
1805	47.56	-5.98	41.58	74	-32.42	Horizontal	Peak
1805	43.41	-5.98	37.43	74	-36.57	Vertical	Peak
1805	44.26	-5.98	38.28	54	-15.72	Horizontal	Average
1805	38.95	-5.98	32.97	54	-21.03	Vertical	Average
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value 3.No report for the emission which more than 10 dB below the prescribed limit							

915.25MHz							
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Polarization	Detector
1831.5	48.51	-5.79	42.72	74	-31.28	Horizontal	Peak
1831.5	44.21	-5.79	38.42	74	-35.58	Vertical	Peak
1831.5	45.51	-5.79	39.72	54	-14.28	Horizontal	Average
1831.5	38.74	-5.79	32.95	54	-21.05	Vertical	Average
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value 3.No report for the emission which more than 10 dB below the prescribed limit							

927.49MHz							
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Polarization	Detector
1854.9	47.85	-5.62	42.23	74	-31.77	Horizontal	Peak
1854.9	43.47	-5.62	37.85	74	-36.15	Vertical	Peak
1854.9	44.12	-5.62	38.50	54	-15.50	Horizontal	Average
1854.9	39.77	-5.62	34.15	54	-19.85	Vertical	Average
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value 3.No report for the emission which more than 10 dB below the prescribed limit							

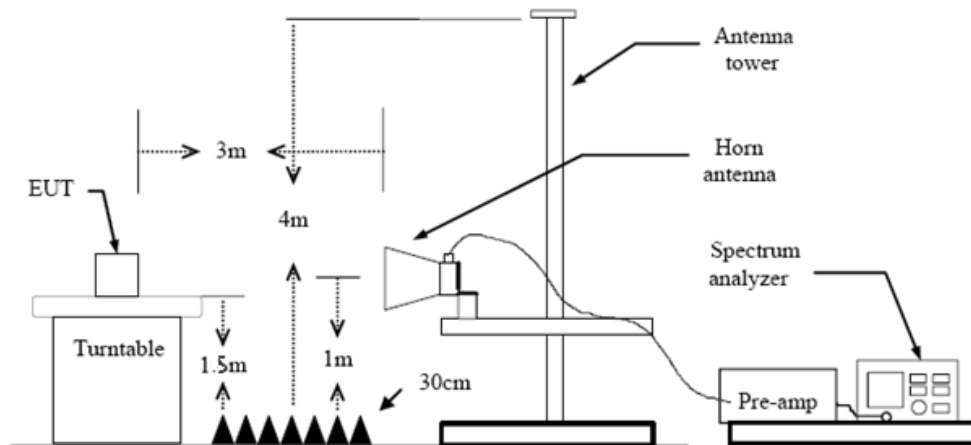
3.3. Radiated Emissions Restricted Band

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.205:

Restricted Frequency Band (MHz)	(dBuV/m)(at 3m)	
	Peak	Average
608 ~ 614	74	54
960 ~ 1240	74	54

Test Configuration



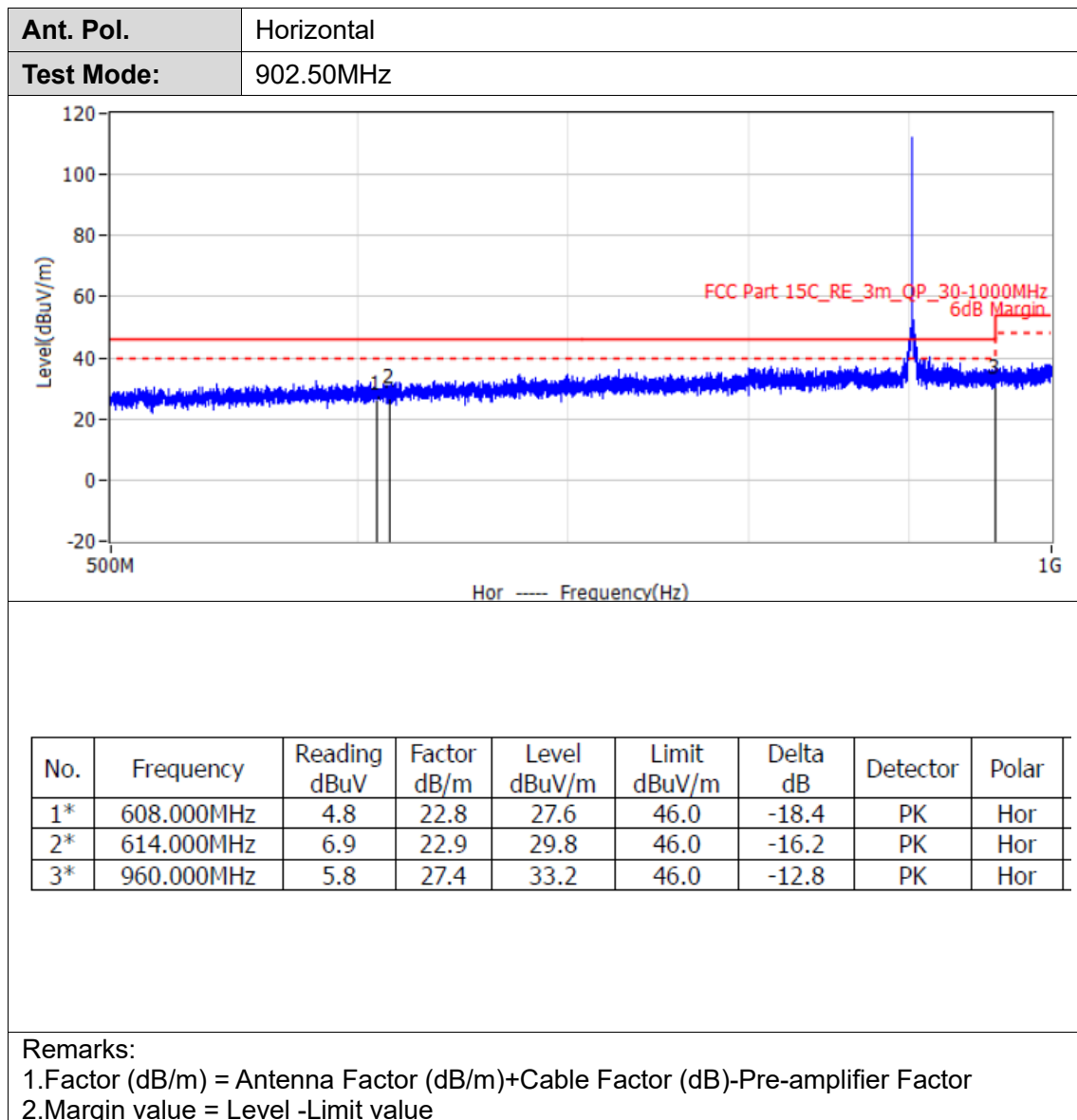
Test Procedure

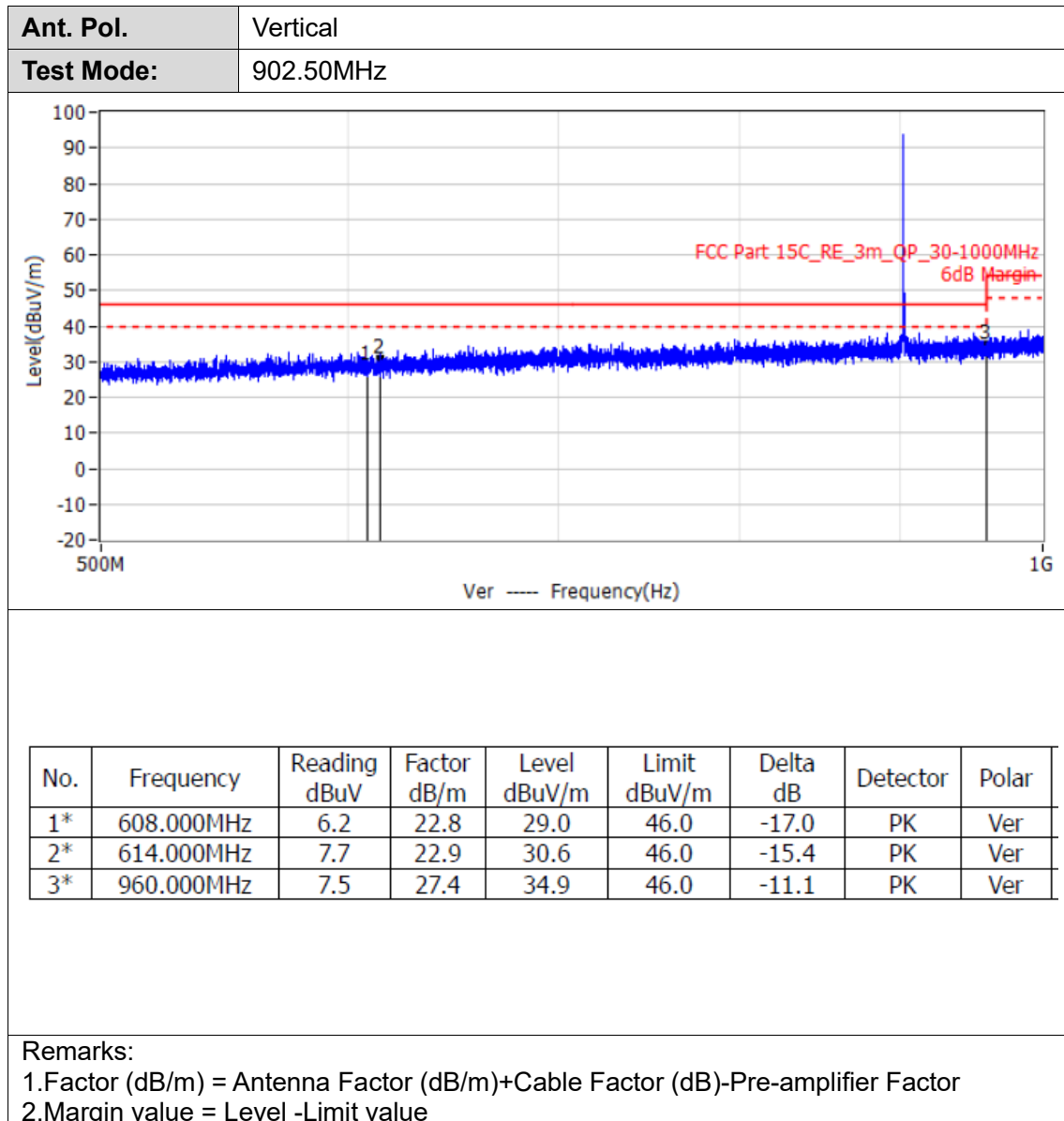
1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna 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.

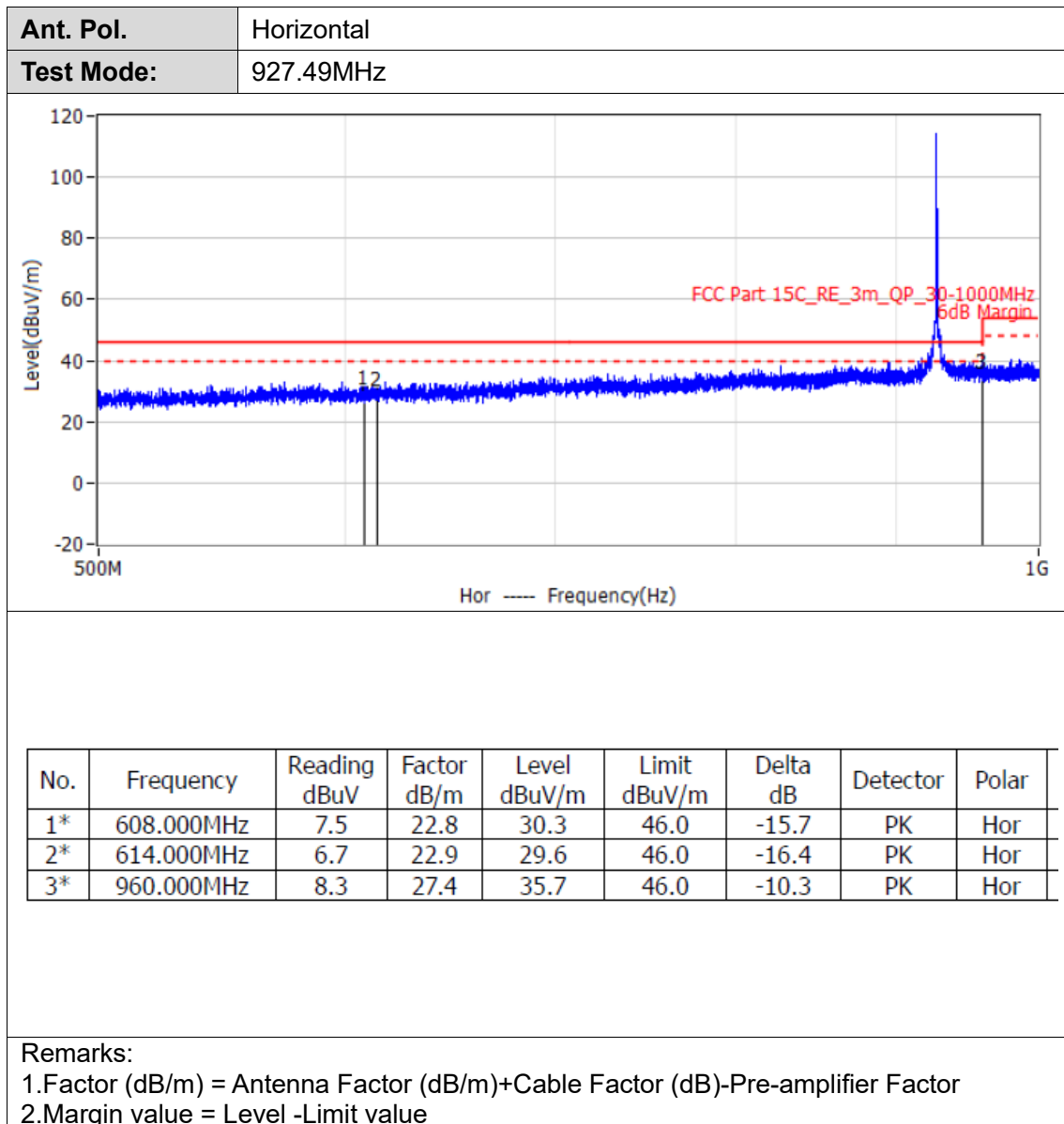
Note 1: For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 3.10 Duty Cycle.

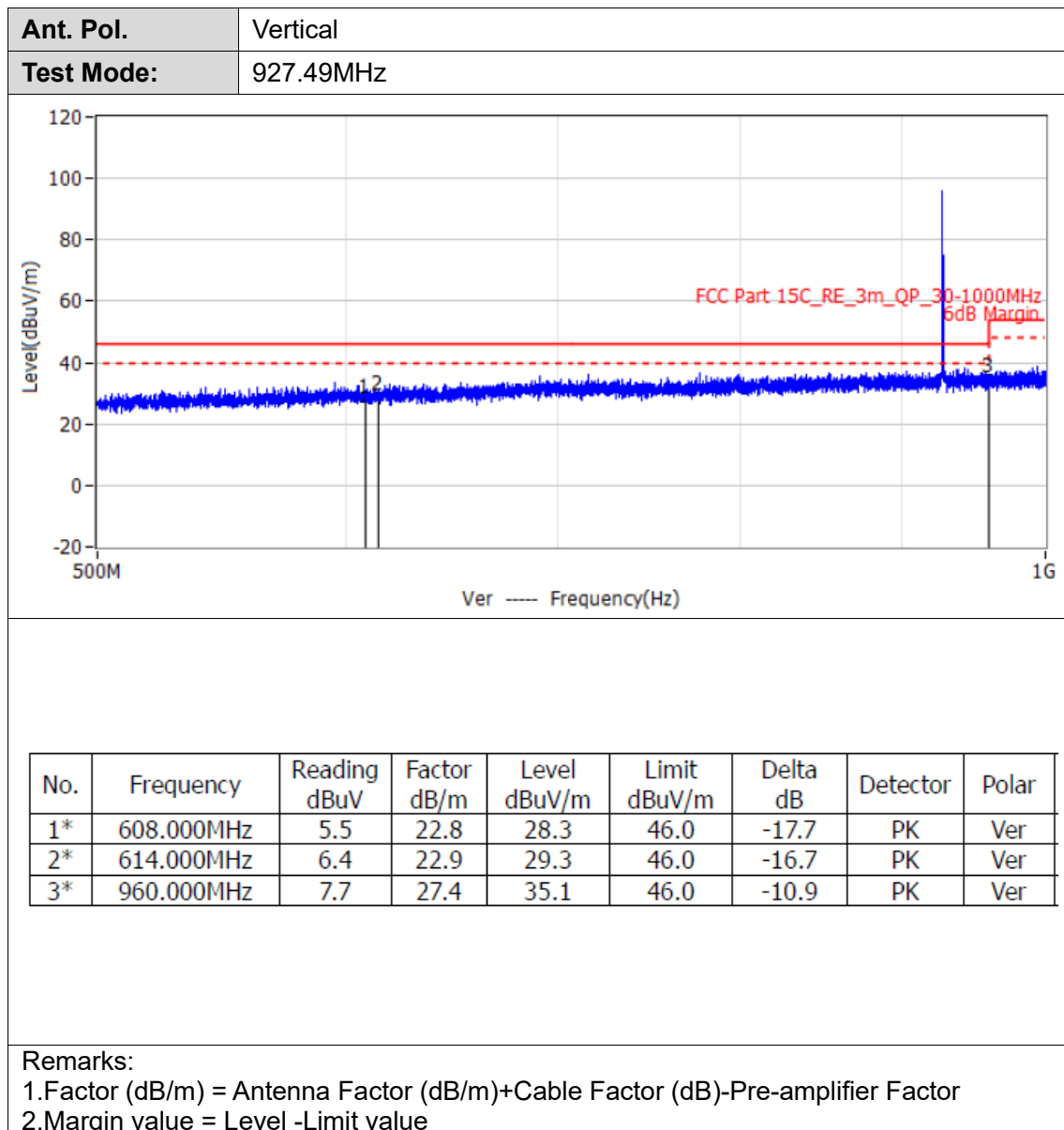
Test Mode

Please refer to the clause 2.4.

**Test Results**









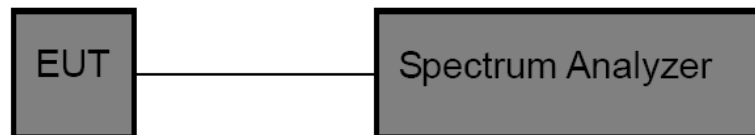
3.4. Band edge and Spurious Emissions (Conducted)

Limit

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 be 30 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 ≥ 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.

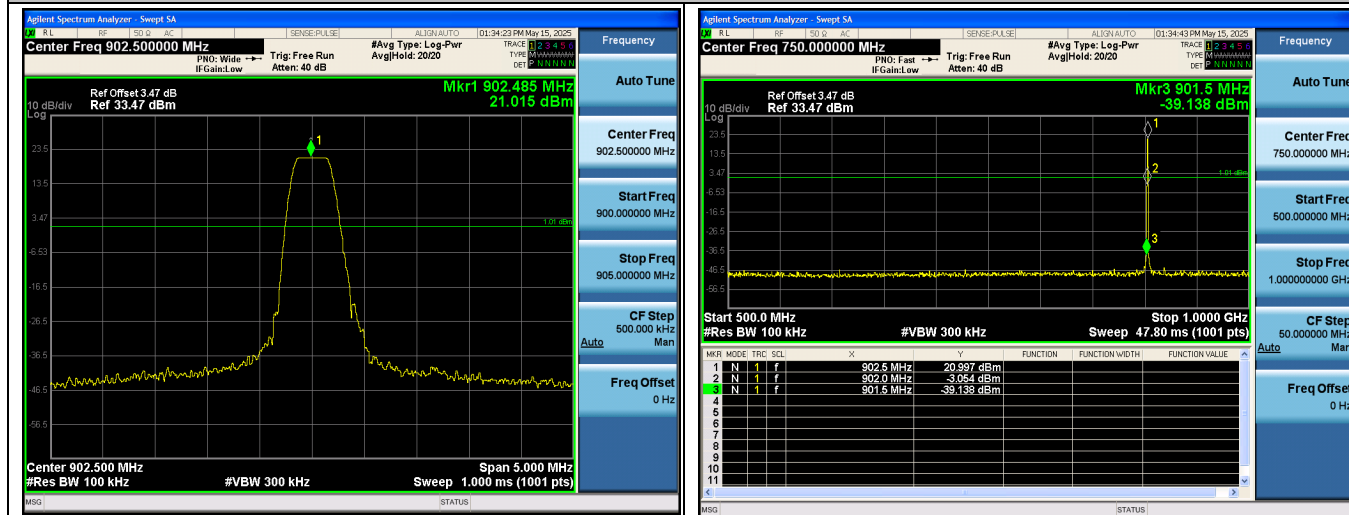
Test Results

(1) Band edge Conducted Test

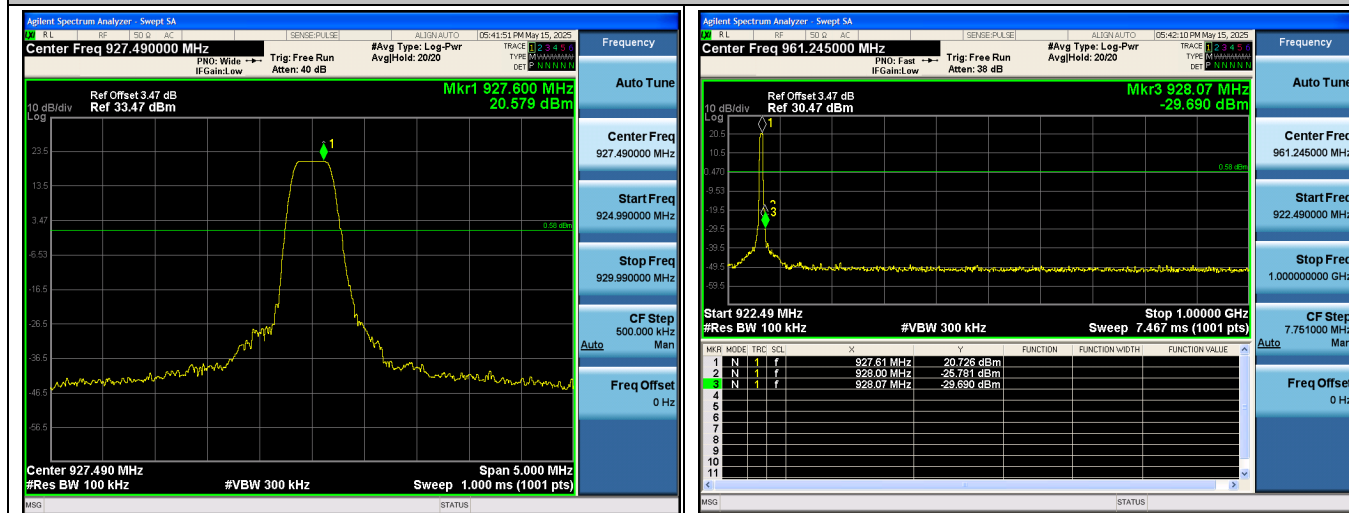
Test Mode	Frequency [MHz]	Ref Level[dBm]	Result[dBm]	Limit[dBm]	Verdict
LoRa	902.50	21.015	-3.054	1.01	PASS
	927.49	20.579	-25.781	0.58	PASS
	Hop_902.50	21.162	-36.720	1.16	PASS
	Hop_927.49	21.200	-32.110	1.20	PASS



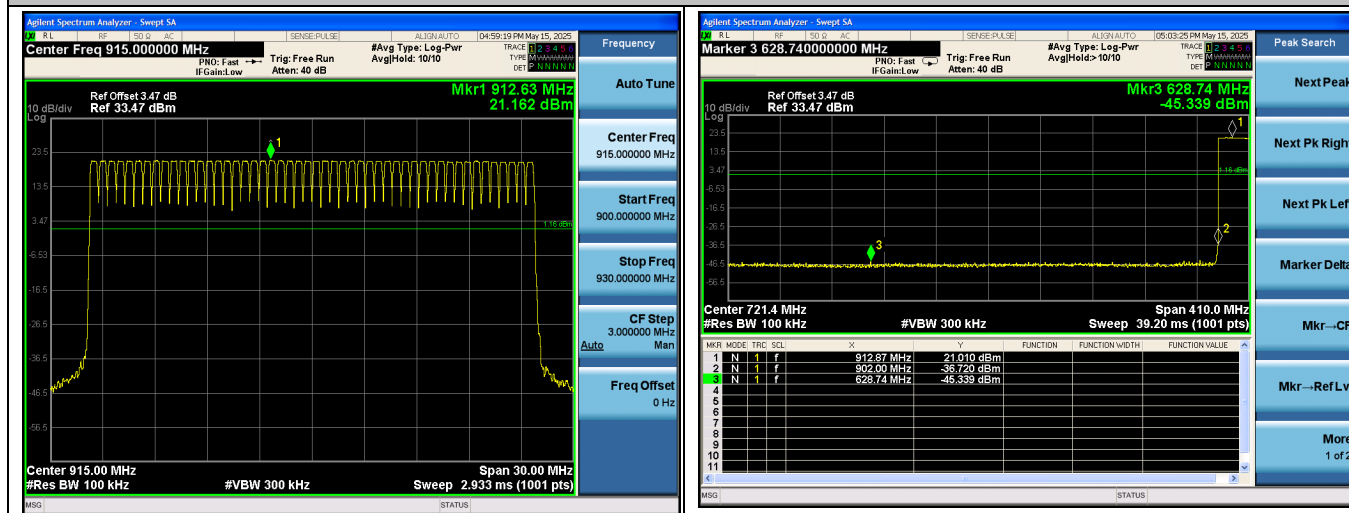
LoRa_902.50



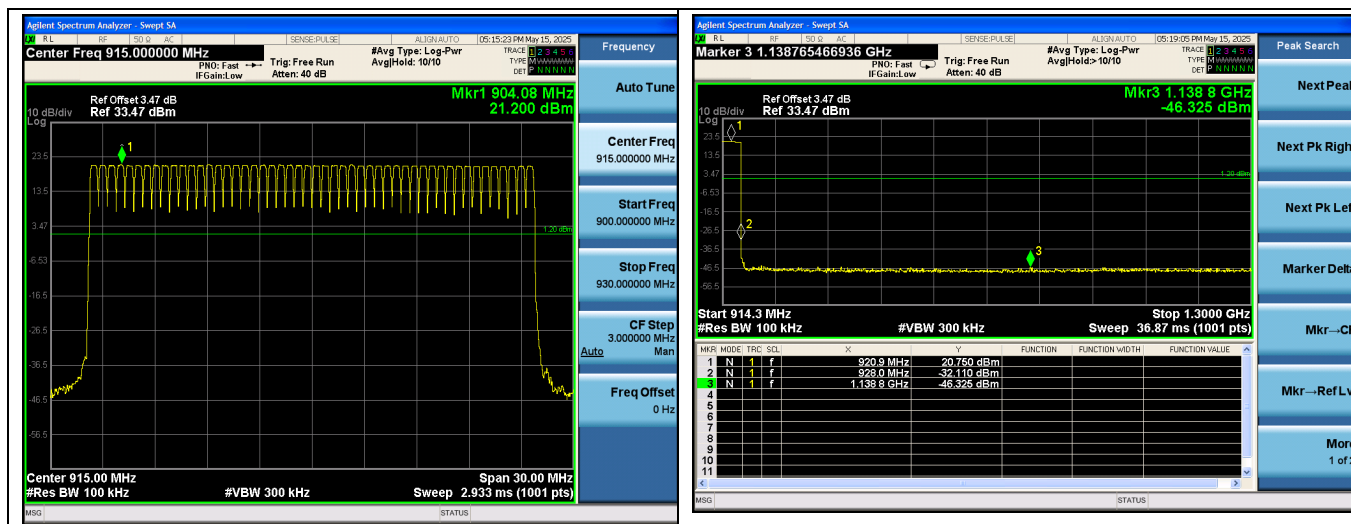
LoRa_927.49



LoRa_Hop_902.50



LoRa_Hop_927.49

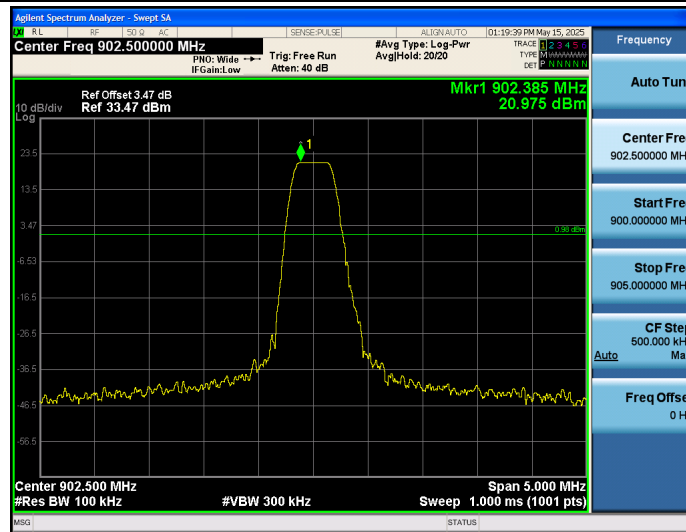


**(2) Conducted Spurious Emissions Test**

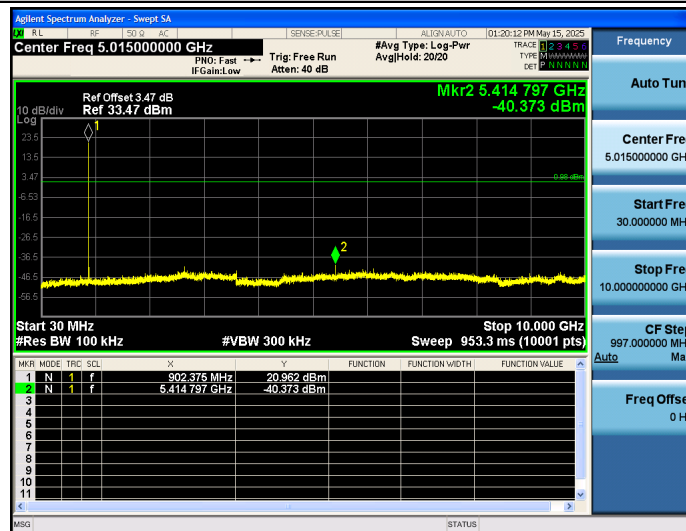
Test Mode	Frequency [MHz]	Freq Range [MHz]	Ref Level [dBm]	Result [dBm]	Limit [dBm]	Verdict
LoRa	902.50	Reference	20.975	20.975	---	PASS
		30~10000	20.975	-40.373	0.98	PASS
	915.25	Reference	21.035	21.035	---	PASS
		30~10000	21.035	-39.150	1.03	PASS
	927.49	Reference	20.697	20.697	---	PASS
		30~10000	20.697	-36.677	0.70	PASS



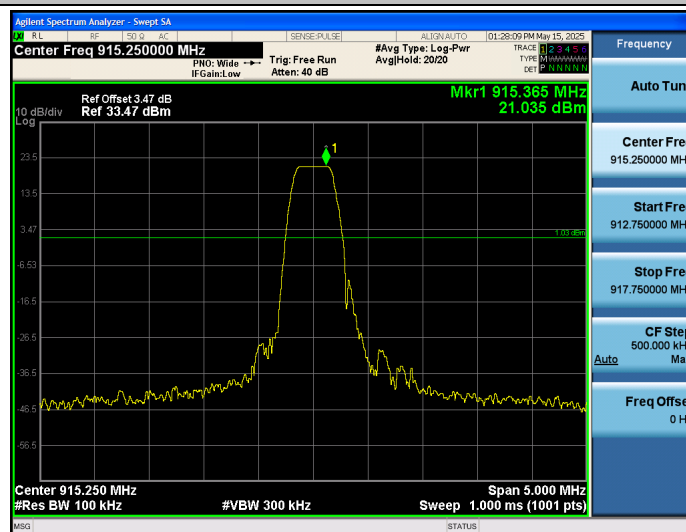
LoRa_902.50_0~Reference



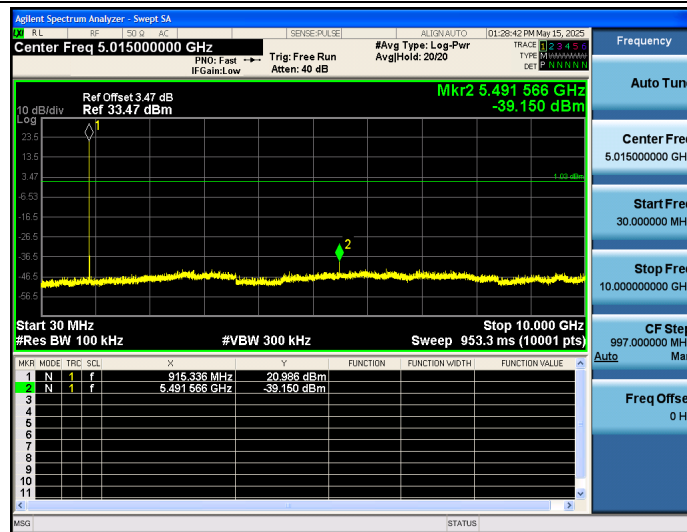
LoRa_902.50_30~10000



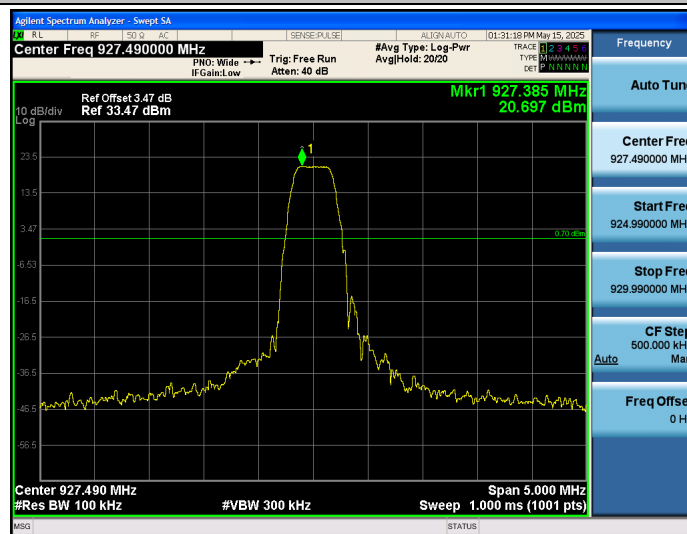
LoRa_915.25_0~Reference



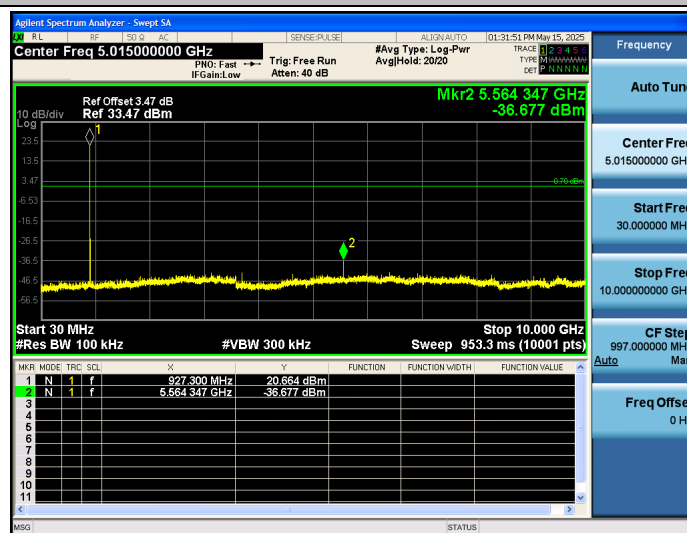
LoRa_915.25_30~10000



LoRa_927.49_0~Reference



LoRa_927.49_30~10000



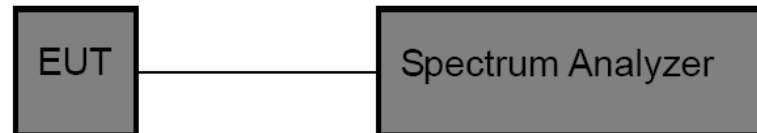


3.5. 20DB Bandwidth

Limit

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% ~ 5% occupied bandwidth.
 - (2) Set the video bandwidth (VBW) ≥ 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.

Test Mode

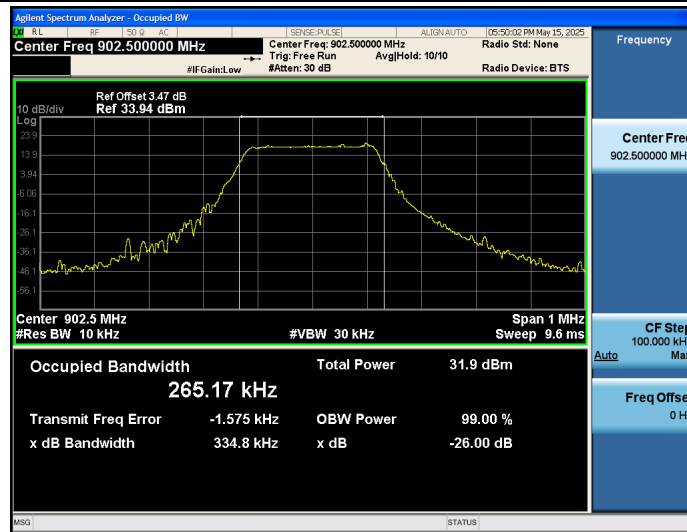
Please refer to the clause 2.4.

Test Results

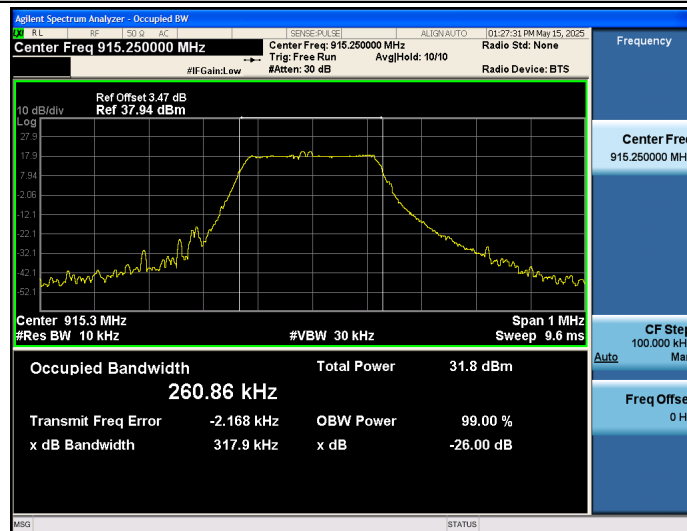
Test Mode	Frequency[MHz]	OBW[kHz]	20db EBW[kHz]	Limit[kHz]	Verdict
LoRa	902.50	265.17	297.6	500	PASS
	915.25	260.86	298.5	500	PASS
	927.49	261.39	297.8	500	PASS



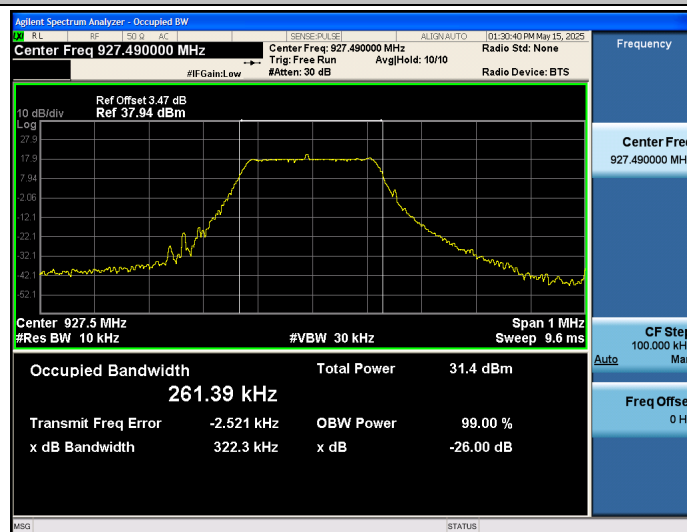
LoRa_OBW_902.50



LoRa_OBW_915.25

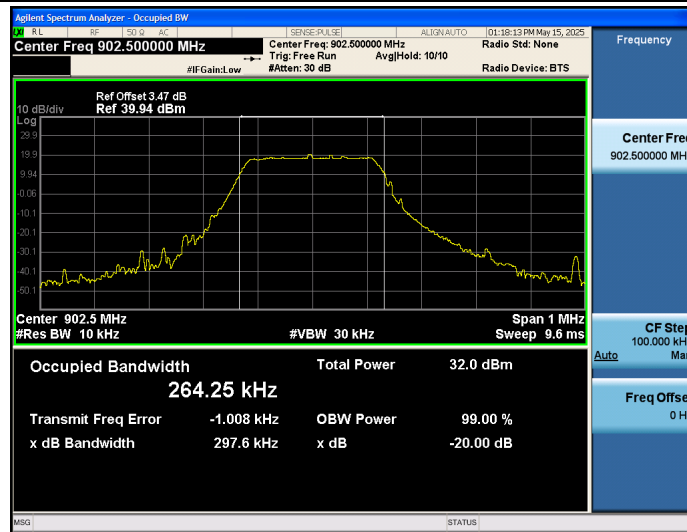


LoRa_OBW_927.49

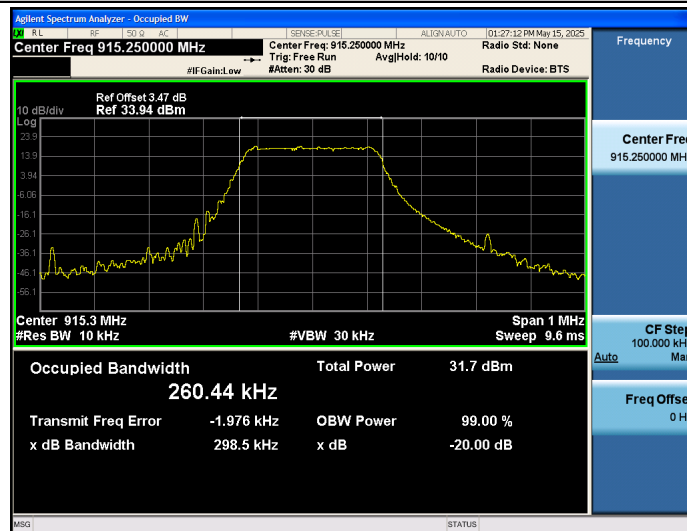




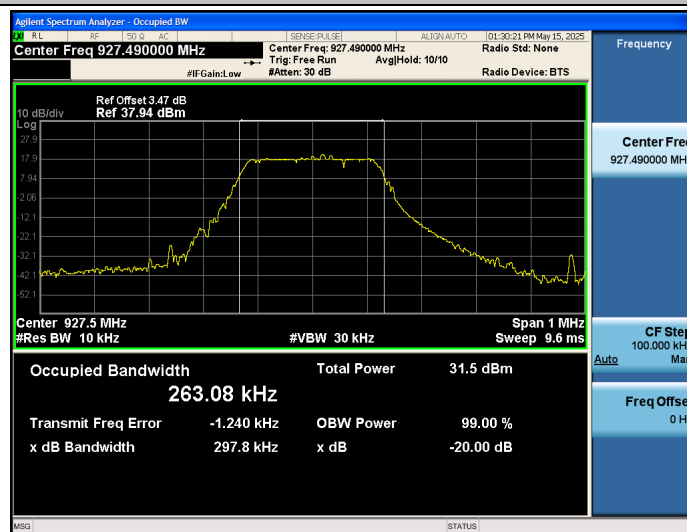
LoRa_20db EBW_902.50



LoRa_20db EBW_915.25



LoRa_20db EBW_927.49





3.6. Channel Separation

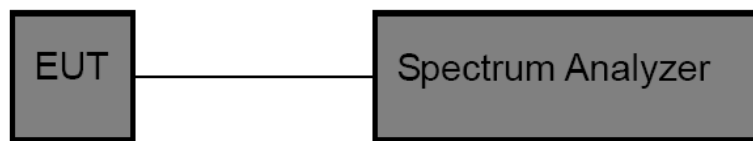
Limit

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.

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 = Set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
 - (2) Set the video bandwidth (VBW) ≥ 3 RBW.
 - (3) Detector = Peak.
 - (4) Trace mode = Max hold.
 - (5) Sweep = Auto couple.

Test Mode

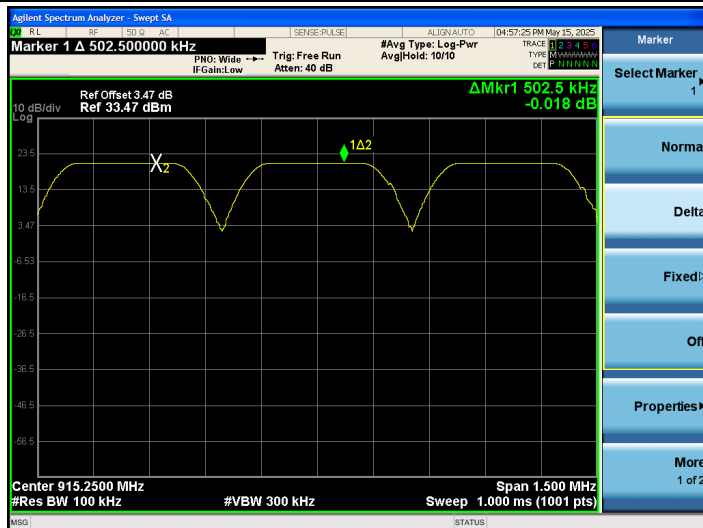
Please refer to the clause 2.4.

Test Results

Test Mode	Frequency[MHz]	Result[kHz]	Limit[kHz]	Verdict
LoRa	Hop_915.25	502.5	>298.5	PASS



Hop_915.25





3.7. Number of Hopping Channel

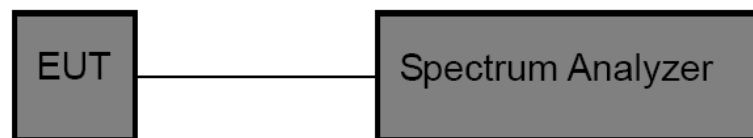
Limit

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

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) Peak Detector: RBW=100 kHz, VBW \geq RBW, Sweep time= Auto.
 - (2) Detector = Peak.
 - (3) Trace mode = Max hold.
 - (4) Sweep = Auto couple.

Test Mode

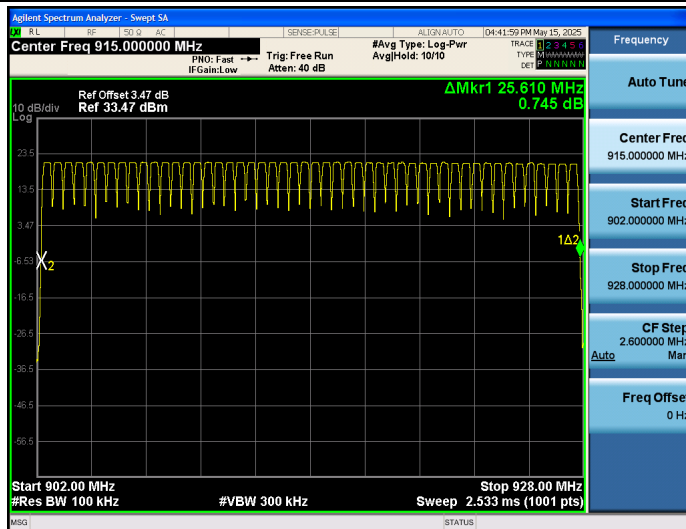
Please refer to the clause 2.4.

Test Result

Test Mode	Frequency [MHz]	Result[Num]	Limit[Num]	Verdict
LoRa	Hop	50	≥ 25	PASS



LoRa





3.8. Dwell Time

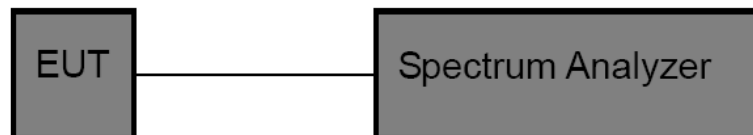
Limit

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

FCC 15.247: (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

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) Spectrum Setting: RBW=1MHz, VBW \geq 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.

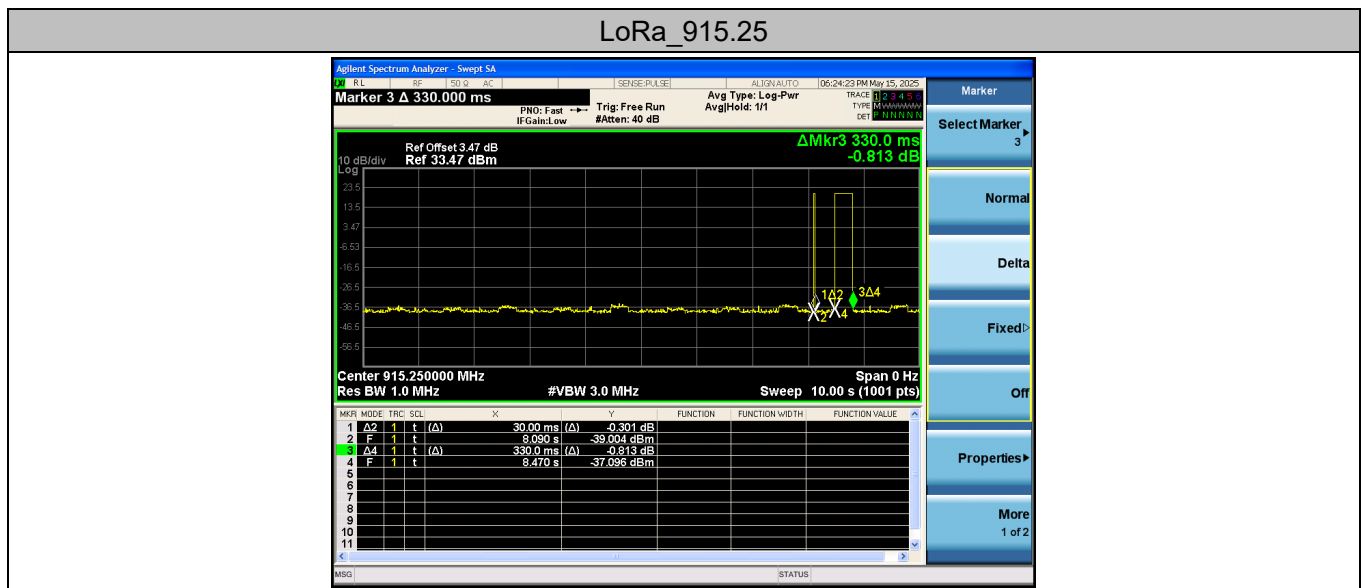


Test Result

Test Mode	Frequency [MHz]	Pulse Time (ms)	Total of Dwell (ms)	Limit (Second)	Verdict
LoRa	915.25	360	360	≤ 0.4	PASS

Note:

1. Occupied time for each channel = 330 ms + 30 ms = 360 ms
2. The number of occupied channels per 10 seconds = 1
3. (Total dwell time) = (Occupied time) x (Channel number)
 $360 \times 1 = 360 \text{ (ms)}$





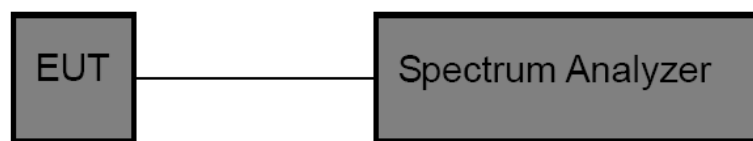
3.9. Peak Output Power

Limit

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

Test Item	Limit	Frequency Range(MHz)
Maximum Conducted Peak Output Power	Hopping Channels ≥ 50 Power $< 1\text{W}(30\text{dBm})$ $25 < \text{Hopping Channels} < 50$ Other $< 0.25\text{W}(24\text{dBm})$	902 ~ 928
E.I.R.P	4 Watt or 36dBm	902 ~ 928

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.

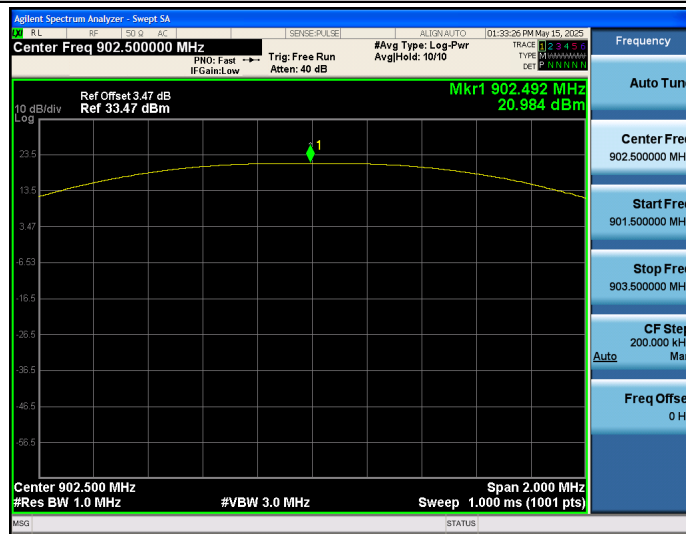
Test Result

Test Mode	Frequency [MHz]	Gain [dBi]	Result[dBm]	IC EIRP Result[dBm]	FCC Limit[dBm]	IC Limit[dBm]	Verdict
LoRa	902.50	1.34	20.98	22.32	≤ 30	≤ 36	PASS
	915.25	1.34	20.96	22.30	≤ 30	≤ 36	PASS
	927.49	1.34	20.67	22.01	≤ 30	≤ 36	PASS

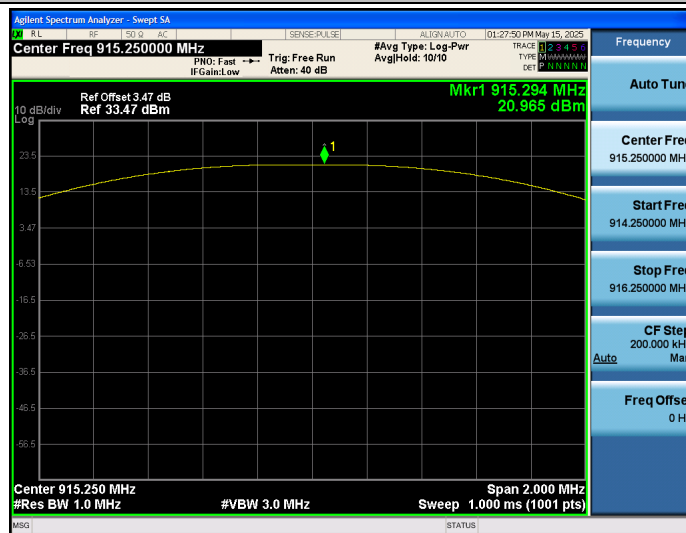
Note: Test results increased RF cable loss by 1dB.



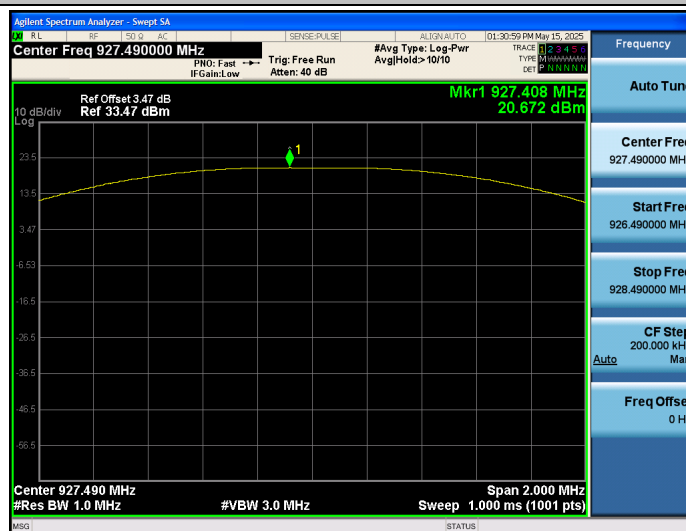
LoRa_902.50



LoRa_915.25



LoRa_927.49



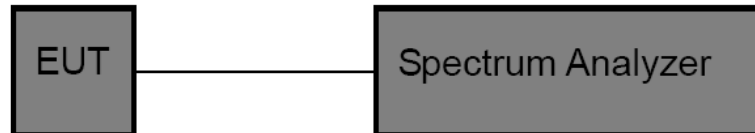


3.10. Duty Cycle

Limit

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 1MHz
Set the VBW to 3MHz
Detector: Peak
Sweep time: Auto
Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

Test Mode

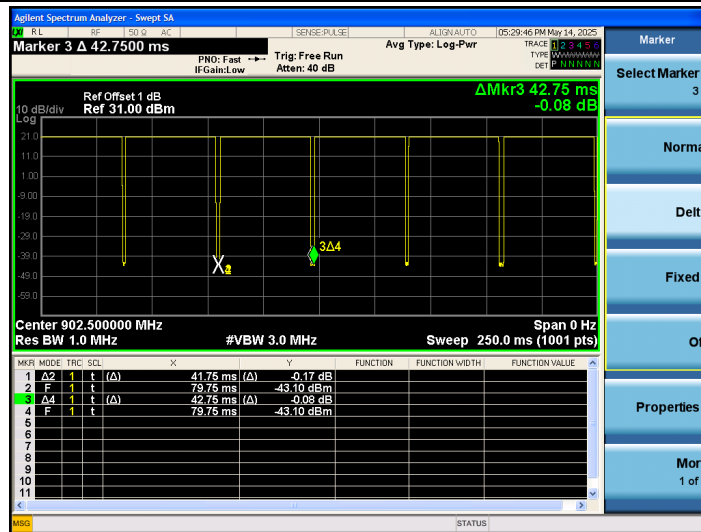
Please refer to the clause 2.4.

Test Result

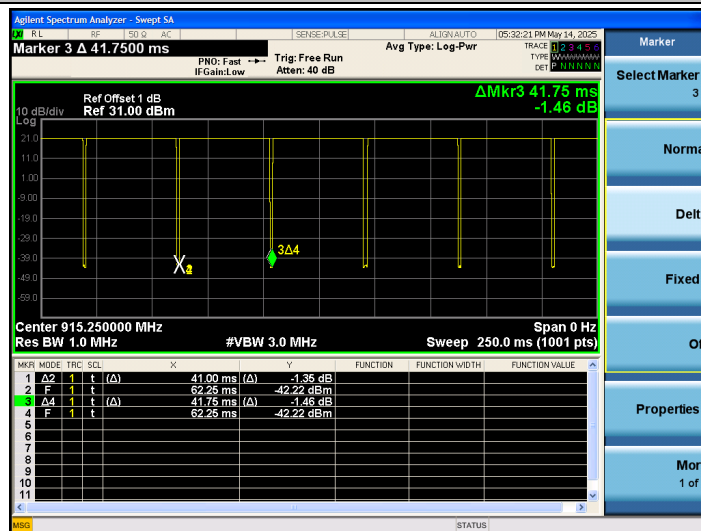
Test Mode	Frequency [MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	1/T Minimum VBW (kHz)	Final setting For VBW (kHz)
LoRa	902.50	41.75	42.75	97.66	0.02	1
	915.25	41.00	41.75	98.20	0.02	1
	927.49	41.00	42.00	97.62	0.02	1



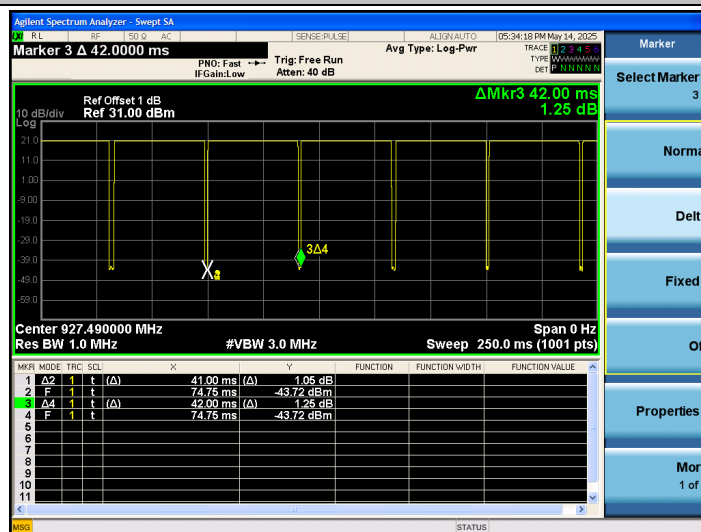
LoRa_902.50



LoRa_915.25



LoRa_927.49





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.

*****THE END*****