



TEST REPORT

For LORA

Report No..... : CHTW25040017
Project No : SHT2409082801W
FCC ID : 2BQILN3US915
Applicant's name : WIKA Alexander Wiegand SE & Co. KG
Address : Alexander-Wiegand-Str. 30•63911 Klingenberg Germany
Product Name : NETRIS ® 3
Trade Mark..... : -
Model No..... : NETRIS ® 3 - *L2*
Listed Model(s) : -
Standard : **FCC CFR Title 47 Part 15 Subpart C § 15.247**
Date of receipt of test sample..... : 2024/10/9
Date of testing..... : 2024/12/14- 2025/4/10
Date of issue..... : 2025/4/11
Result..... : **Pass**



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Test Report Form No. : R0054

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1. TEST STANDARDS AND REPORT VERSION

1.1. Test Standards

The tests were performed according to following standards:

- [FCC CFR Title 47 Part 15 Subpart C § 15.247](#): Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz
- [ANSI C63.10:2020](#): American National Standard for Testing Unlicensed Wireless Devices
- [KDB 558074 D01 15.247 Meas Guidance v05r02](#): Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of The FCC Rules

1.2. Report version

Revision No.	Date of issue	Description
N/A	2025-04-11	Original

2. TEST DESCRIPTION

Report clause	Test Items	Standard Requirement	Result	Test Engineer
5.1	Antenna Requirement	15.203/15.247 (c)	PASS	Chenxin Ling
5.2	AC Conducted Emission	15.207	N/A ^{*2}	N/A
5.3	Peak Output Power	15.247 (b)(1)	PASS	Chenxin Ling
5.4	20 dB Bandwidth	15.247 (a)(1)	PASS	Chenxin Ling
5.5	99% Occupied Bandwidth	-	PASS ^{*1}	Chenxin Ling
5.6	Carrier Frequency Separation	15.247 (a)(1)	PASS	Chenxin Ling
5.7	Hopping Channel Number	15.247 (a)(1)	PASS	Chenxin Ling
5.8	Dwell Time	15.247 (a)(1)	PASS	Chenxin Ling
5.9	Duty Cycle Correction Factor	-	PASS ^{*1}	Chenxin Ling
5.10	Pseudorandom Frequency Hopping Sequence	15.247(b)(4)	PASS	Chenxin Ling
5.11	Conducted Band Edge and Spurious Emission	15.247(d)/15.205	PASS	Chenxin Ling
5.12	Radiated Band Edge Emission	15.205/15.209	N/A ^{*3}	N/A
5.13	Radiated Spurious Emission	15.247(d)/15.205/15.209	N/A ^{*3}	N/A

Note:

- The measurement uncertainty is not included in the test result.
- *1: No requirement on standard, only report these test data.
- *2: This product is battery powered
- *3: Radiated Spurious Emission (1-10GHz) reference report: 110704-FCC-ISED-1]

3. SUMMARY

3.1. Client Information

Applicant:	WIKA Alexander Wiegand SE & Co. KG
Address:	Alexander-Wiegand-Str. 30•63911 Klingenberg Germany
Manufacturer:	WIKA Alexander Wiegand SE & Co
Address:	Alexander-Wiegand-Straße 3063911 Klingenberg am Main DE
Factory:	WIKA Alexander Wiegand SE & Co
Address:	Alexander-Wiegand-Straße 3063911 Klingenberg am Main DE

3.2. Product Description

Main unit information:	
Product Name:	NETRIS ® 3
Trade Mark:	-
Model No.:	NETRIS ® 3 - *L2* * = configuration digit which are not relevant for the hardware or radio comportement (ex : customer personnalisation, mounting accessories)
Listed Model(s):	-
Power supply:	DC 3.0V from Battery
Hardware version:	r7.v243
Software version:	3.5.0

3.3. Radio Specification Description

Support function:	LORA
Modulation:	Chip Spread Spectrum
Operation frequency:	902.3MHz~914.9MHz
Channel number:	64
Channel separation:	200kHz
Antenna type:	Monopol IFA PCB Antenna
Antenna gain:	2.16dBi

3.4. Testing Laboratory Information

Laboratory Name	Shenzhen Huatongwei International Inspection Co., Ltd.	
Laboratory Location	Building 7, Baiwang Idea Factory, No.1051, Songbai Road, Yangguang Community, Xili Subdistrict, Nanshan District, Shenzhen, Guangdong, China	
Contact information:	Tel: 400-963-0755 E-mail: cs@szhtw.com.cn http://www.szhtw.com.cn	
Qualifications	Type	Accreditation Number
	FCC Registration Number	762235
	FCC Designation Number	CN1181

4. TEST CONFIGURATION

4.1. Test frequency list

According to section 15.31(m), regards to the operating frequency range over 10 MHz, must select three channels which were tested. The Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the below blue front.

Channel	Frequency (MHz)
CH _L	902.3
CH _M	908.5
CH _H	914.9

4.2. Descriptions of Test mode

For RF test items
The engineering test program was provided and enabled to make EUT continuous transmit (duty cycle>98%).
For AC power line conducted emissions:
The EUT connect to laptop by USB cable. the laptop control LORA transmitting.
For Radiated spurious emissions test item:
The engineering test program was provided and enabled to make EUT continuous transmit (duty cycle>98%). The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data Recorded in the report.

4.3. Test sample information

Test item	HTW sample no.
RF Conducted test items	Please refer to the description in the appendix report
RF Radiated test items	YPHT24090828001
EMI test items	YPHT24090828001

Note:

RF Conducted test items: Peak Output Power, 20 dB Bandwidth, 99% Occupied Bandwidth, Carrier Frequency Separation, Hopping Channel Number, Dwell Time, Duty Cycle Correction Factor, Pseudorandom Frequency Hopping Sequence ,Conducted Band Edge and Spurious Emission

RF Radiated test items: Radiated Band Edge Emission, Radiated Spurious Emission

EMI test items: AC Conducted Emission

4.4. Support unit used in test configuration and system

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The following peripheral devices and interface cables were connected during the measurement:

Whether support unit is used?			
✓ Yes(Provided by the laboratory)			
Item	Equipment	Trade Name	Model No.
1	Laptop	Lenovo	K4e-ACL
2			

4.5. Testing environmental condition

Type	Requirement	Actual
Temperature:	15~35°C	25°C
Relative Humidity:	25~75%	50%
Air Pressure:	860~1060mbar	1000mbar

4.6. Statement of the measurement uncertainty

No.	Test Items	Measurement Uncertainty
1	AC Conducted Emission	3.21dB
2	Peak Output Power	1.07
3	Power Spectral Density	1.07
4	6dB Bandwidth	0.002%
5	99% Occupied Bandwidth	0.002%
6	Duty cycle	-
7	Conducted Band Edge and Spurious Emission	1.68dB
8	Radiated Band Edge Emission	4.54dB for 30MHz-1GHz 5.10dB for above 1GHz
9	Radiated Spurious Emission	4.54dB for 30MHz-1GHz 5.10dB for above 1GHz

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4.7. Equipment Used during the Test

● RF Conducted test item							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Signal and spectrum Analyzer	R&S	HTWE0242	FSV40	100048	2024/08/27	2025/08/26
●	Signal & Spectrum Analyzer	R&S	HTWE0262	FSW26	103440	2024/08/21	2025/08/20
●	Vector signal generator	R&S	HTWE0244	SMBV100A	260790	2024/03/14	2025/03/13
●	Test software	Tonscend	N/A	JS1120	N/A	N/A	N/A

● Conducted Emission							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	EMI Test Receiver	R&S	HTWE0111	ESCI	101247	2024/08/12	2025/08/11
●	Artificial Mains	SCHWARZBECK	HTWE0113	NNLK 8121	573	2024/08/12	2025/08/11
●	Protection Network	SCHWARZBECK	HTWE0567	VTSD9561FN	00899	2024/08/12	2025/08/11
●	ISN	FCC	HTWE0148	FCC-TLISN-T2-02	20371	2024/08/12	2025/08/11
●	ISN	FCC	HTWE0150	FCC-TLISN-T8-02	20375	2024/08/12	2025/08/11
●	Test Software	R&S	N/A	EMC32	N/A	N/A	N/A

● Radiated Emission – 9kHz~30MHz							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0127	SAC-3m-02	C11121	2023/04/06	2026/04/05
●	EMI Test Receiver	R&S	HTWE0099	ESCI 7	100900	2024/08/12	2025/08/11
●	Loop Antenna	R&S	HTWE0170	HFH2-Z2	100020	2024/04/08	2027/04/07
●	Test Software	R&S	N/A	EMC32	N/A	N/A	N/A

● Radiated Emission - 30MHz~1GHz							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0127	SAC-3m-02	C11121	2023/04/06	2026/04/05
●	EMI Test Receiver	R&S	HTWE0099	ESCI 7	100900	2024/08/12	2025/08/11
●	Ultra-Broadband Antenna	SCHWARZBEC K	HTWE0119	VULB9163	546	2023/02/22	2026/02/21
●	Pre-Amplifier	SCHWARZBEC K	HTWE0295	BBV 9742	/	2024/05/24	2025/05/23
●	Test Software	R&S	N/A	EMC32	N/A	N/A	N/A

● Radiated emission- Above 1GHz							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0122	SAC-3m-01	C11121	2023/04/17	2026/04/16
●	Spectrum Analyzer	R&S	HTWE0098	FSP40	100597	2024/08/12	2025/08/11
●	Spectrum Analyzer	R&S	HTWE0385	N9020A	MY54486658	2024/08/12	2025/0811
●	Horn Antenna	SCHWARZBECK	HTWE0126	BBHA 9120D	1011	2023/02/14	2026/02/13
●	Pre-Amplifier	CD	HTWE0071	PAP-0102	12004	2024/06/06	2025/06/05
●	Broadband Pre-amplifier	SCHWARZBECK	HTWE0551	SCU18F	100855	2024/06/06	2025/06/05
●	Test Software	Audix	N/A	E3	N/A	N/A	N/A

5. TEST CONDITIONS AND RESULTS

5.1. Antenna Requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C Section 15.203:

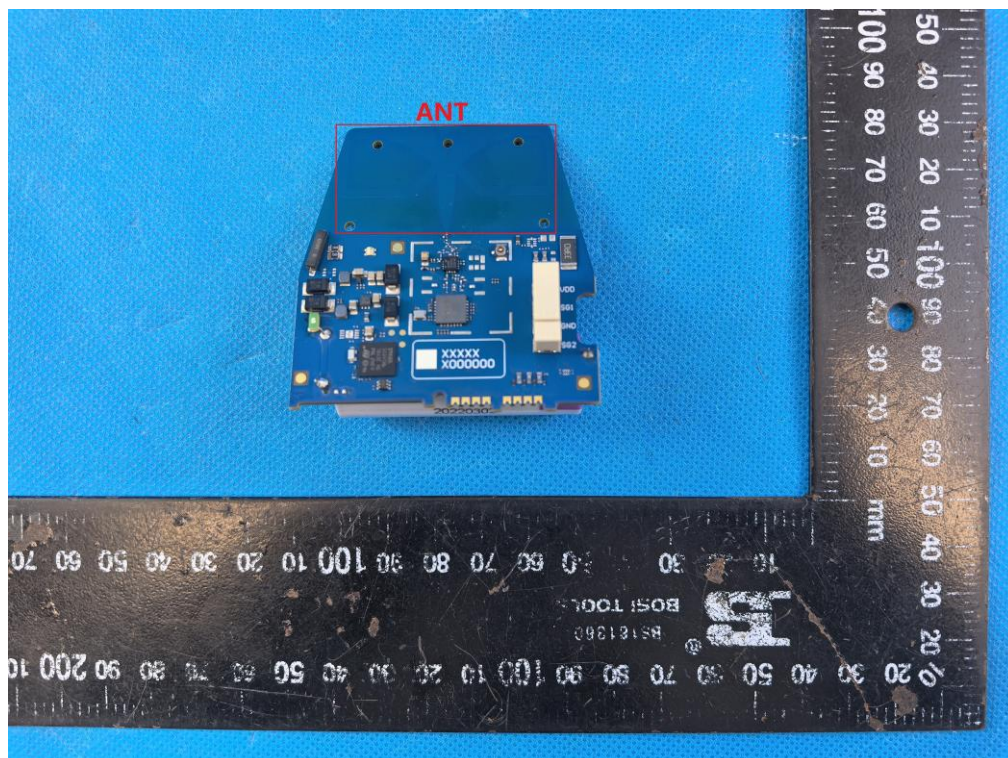
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

The antenna type is a Monopol IFA PCB Antenna, please refer to the below antenna photo.

|



5.2. AC Conducted Emission

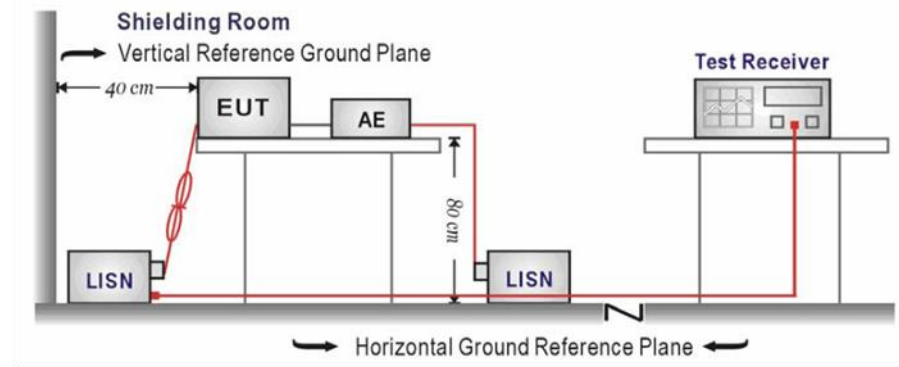
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

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 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 50 ohm /50uH coupling impedance for the measuring equipment.
4. 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)
5. 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.
6. 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.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

TEST MODE:

Refer to the clause 4.2

TEST RESULT

☐ Passed ☒ Not Applicable

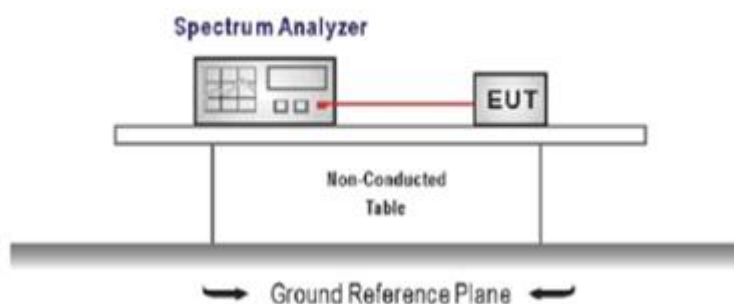
5.3. Peak Output Power

LIMIT

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

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.

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the pathloss 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:
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW $\geq$ the 20 dB bandwidth of the emission being measured, VBW $\geq$ RBW
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE:

Refer to the clause 4.2

TEST RESULT

☒ Passed ☐ Not Applicable

TEST DATA

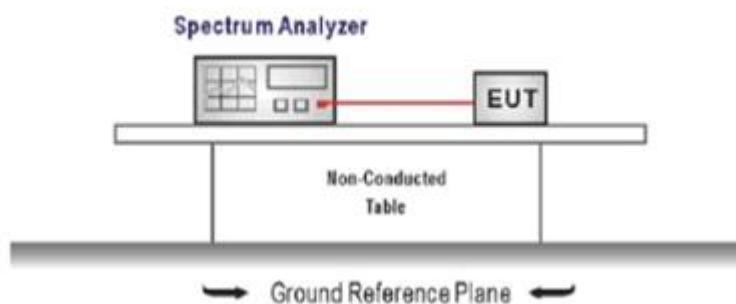
Refer to the appendix report

5.4. 20 dB Bandwidth

LIMIT

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz

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:
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW $\geq$ 1% of the 20 dB bandwidth, VBW $\geq$ RBW
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE:

Refer to the clause 4.2

TEST RESULT

☒ Passed ☐ Not Applicable

TEST DATA

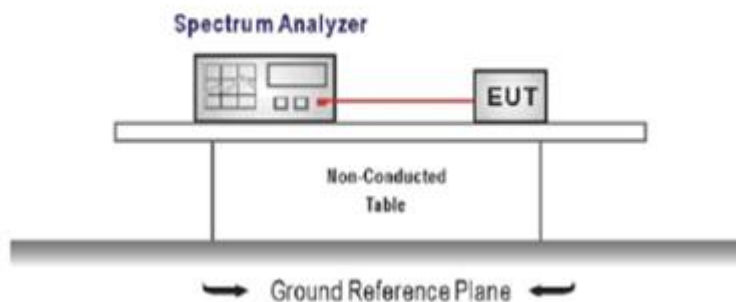
Refer to the appendix report

5.5. 99% Occupied Bandwidth

LIMIT

N/A

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).
Center Frequency = channel center frequency
Span $\geq 1.5 \times \text{OBW}$
RBW = 1%~5%OBW
VBW $\geq 3 \times \text{RBW}$
Sweep time = auto couple
Detector = Peak
Trace mode = max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.

TEST MODE:

Refer to the clause 4.2

TEST RESULT

☒ Passed ☐ Not Applicable

TEST DATA

Refer to the appendix report

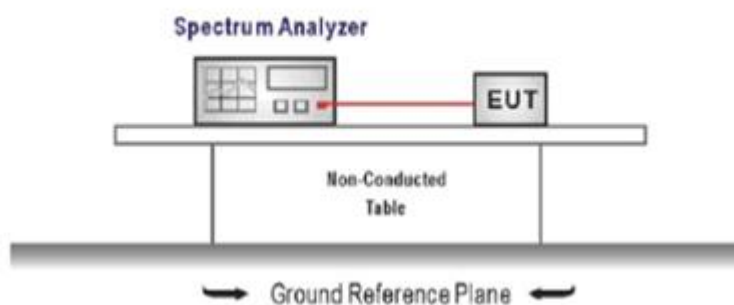
5.6. Carrier Frequencies Separation

LIMIT

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

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

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:
Span = wide enough to capture the peaks of two adjacent channels
RBW $\geq$ 1% of the span, VBW $\geq$ RBW
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE:

Refer to the clause 4.2

TEST RESULTS

☒ Passed ☐ Not Applicable

TEST DATA

Refer to the appendix report

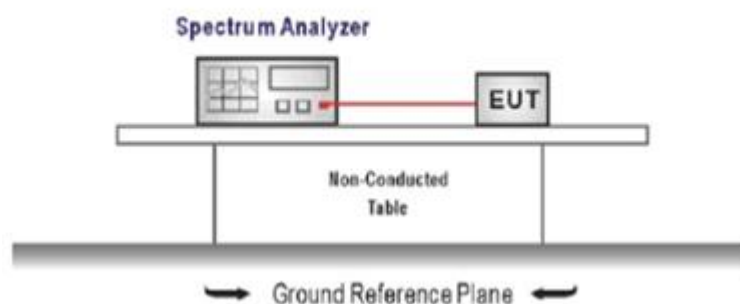
5.7. Hopping Channel Number

LIMIT

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

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.

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:
Span = the frequency band of operation
RBW $\geq$ 1% of the span, VBW $\geq$ RBW
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE:

Refer to the clause 4.2

TEST RESULTS

☒ Passed ☐ Not Applicable

TEST DATA

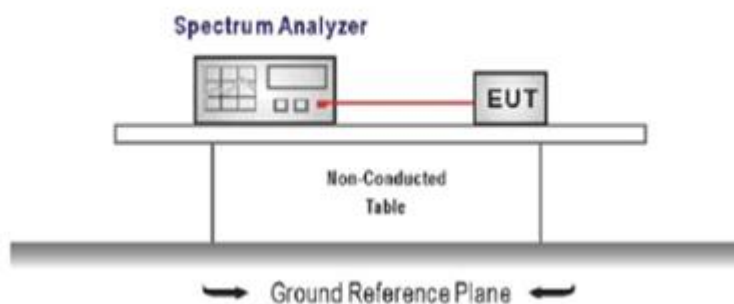
Refer to the appendix report

5.8. Dwell Time

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..

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:
Span = zero span, centered on a hopping channel, RBW= 1 MHz, VBW $\geq$ RBW
Sweep = as necessary to capture the entire dwell time per hopping channel,
Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE:

Refer to the clause 4.2

TEST RESULTS

☒ Passed ☐ Not Applicable

TEST DATA

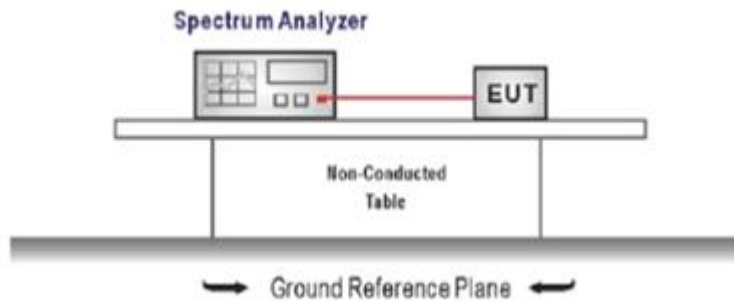
Refer to the appendix report

5.9. Duty Cycle Correction Factor (DCCF)

LIMIT

N/A

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:
Span = zero span, centered on a hopping channel, RBW= 1 MHz, VBW $\geq$ RBW
Sweep = as necessary to capture the entire dwell time per hopping channel,
Detector function = peak, Trigger mode
4. Measure and record the duty cycle data

TEST MODE:

Refer to the clause 4.2

TEST DATA

Refer to the appendix report

5.10. Pseudorandom Frequency Hopping Sequence

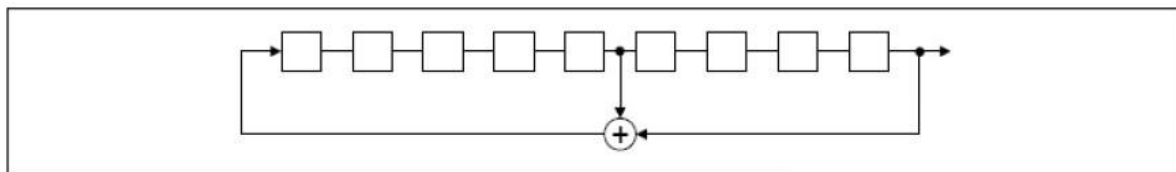
LIMIT

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

TEST RESULTS

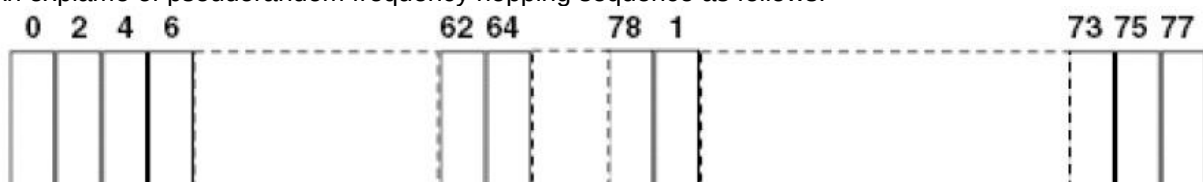
The pseudorandom frequency hopping sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: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

- Number of shift register stages: 9
- Length of pseudo-random sequence: $2^9 - 1 = 511$ bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.

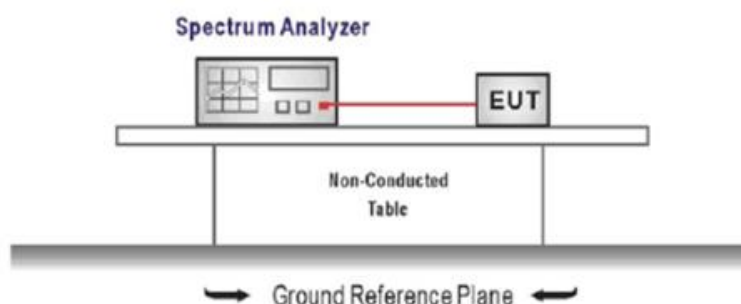
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

5.11. Conducted Band edge and Spurious Emission

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.

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Emission level measurement
Set the center frequency and span to encompass frequency range to be measured
 $RBW = 100 \text{ kHz}$, $VBW \geq 3 \times RBW$
Detector = peak, Sweep time = auto couple, Trace mode = max hold
Allow trace to fully stabilize
Use the peak marker function to determine the maximum amplitude level.
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.
4. Ensure that the amplitude of all unwanted emission outside of the authorized frequency band excluding restricted frequency bands) are attenuated by at least the minimum requirements specified (at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz). Report the three highest emission relative to the limit.

TEST MODE:

Refer to the clause 4.2

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST DATA

Refer to the appendix report

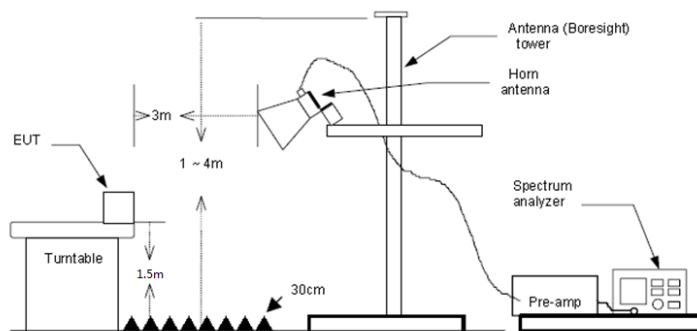
5.12. Radiated Band edge Emission

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 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._

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10 .
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 on radiated measurement.
5. Use the following spectrum analyzer settings:
 - a) Span shall wide enough to fully capture the emission being measured
 - b) Set RBW=100kHz for <1GHz, VBW=3*RBW, Sweep time=auto, Detector=peak, Trace=max hold
 - c) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=peak, Trace=max hold for Peak measurement

For average measurement: use duty cycle correction factor method (DCCF)
 Averager level = Peak level + DCCF

TEST MODE:

Refer to the clause 4.2

TEST RESULT

☐ Passed ☒ Not Applicable

5.13. Radiated Spurious Emission

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

Frequency	Limit (dBuV/m)	Value
0.009 MHz ~0.49 MHz	2400/F(kHz) @300m	Quasi-peak
0.49 MHz ~ 1.705 MHz	24000/F(kHz) @30m	Quasi-peak
1.705 MHz ~30 MHz	30 @30m	Quasi-peak

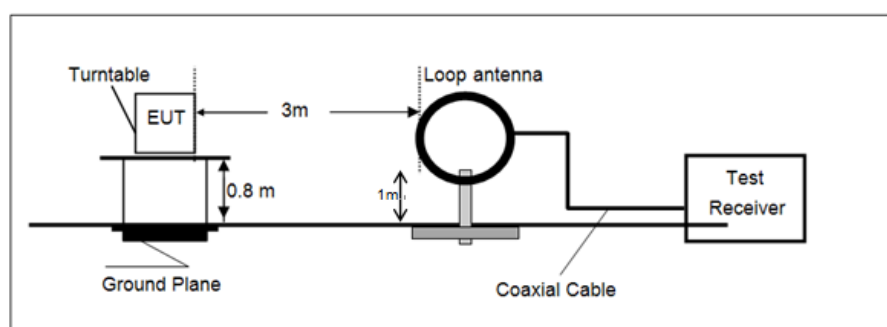
Note: Limit dBuV/m @3m = Limit dBuV/m @300m + 40*log(300/3)= Limit dBuV/m @300m +80,

Limit dBuV/m @3m = Limit dBuV/m @30m +40*log(30/3)= Limit dBuV/m @30m + 40.

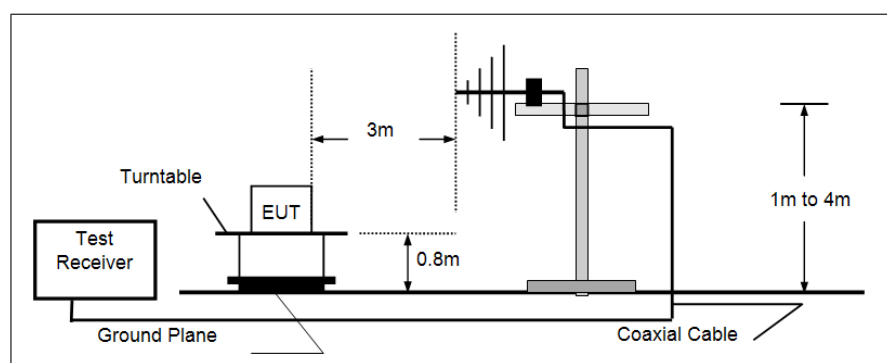
Frequency	Limit (dBuV/m @3m)	Value
30MHz~88MHz	40.00	Quasi-peak
88MHz~216MHz	43.50	Quasi-peak
216MHz~960MHz	46.00	Quasi-peak
960MHz~1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

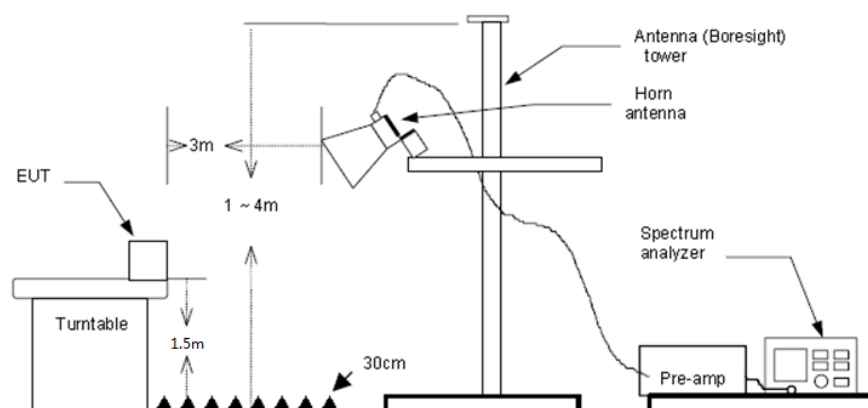
- 9 kHz ~ 30 MHz



- 30 MHz ~ 1 GHz



- Above 1 GHz



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10 .
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
 - a) Span shall wide enough to fully capture the emission being measured;
 - b) 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.
 - c) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=peak, Trace=max hold for Peak measurement

For average measurement: use duty cycle correction factor method (DCCF)

Averager level = Peak level + DCCF

TEST MODE:

Refer to the clause 4.2

TEST RESULT

☐ Passed ☒ Not Applicable

Note:

- 1) Level= Reading + Factor/Transd; Factor/Transd =Antenna Factor+ Cable Loss- Preamp Factor
- 2) Over Limit = Level– Limit
- 3) Average measurement was not performed if peak level is lower than average limit(54 dBuV/m) for above 1GHz.

FOR 9 kHz ~ 30 MHz

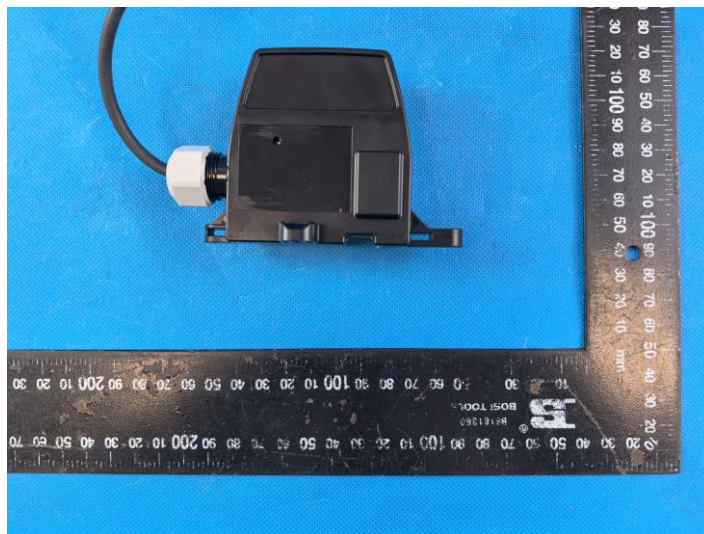
The EUT was pre-scanned this frequency band, found the radiated level 20dB lower than the limit, so don't show data on this report.

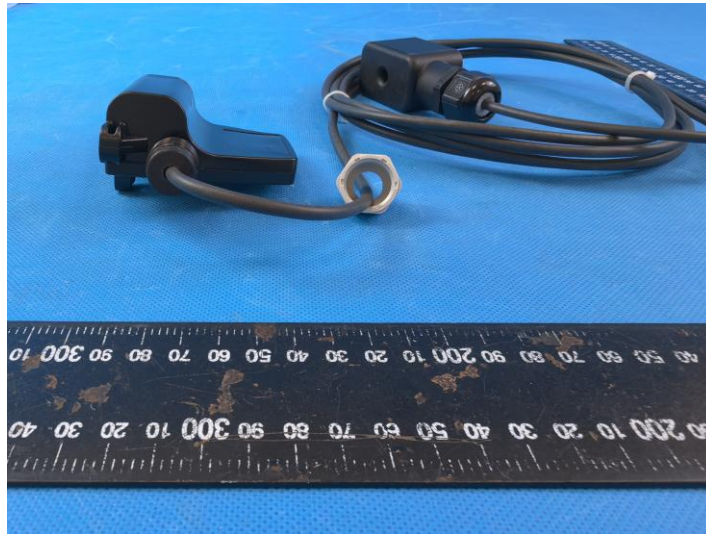
FOR 30 MHz ~ 1000 MHz

Have pre-scan all test channel, found **CH_L** which it was worst case, so only show the worst case's data on this report.

6. EXTERNAL AND INTERNAL PHOTOS

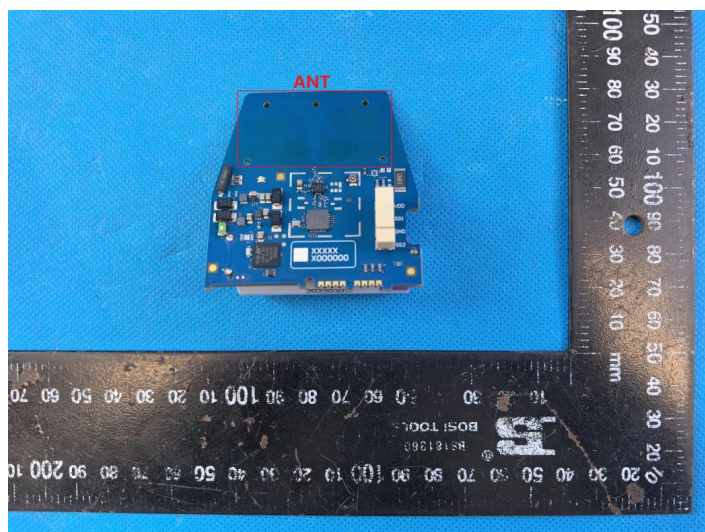
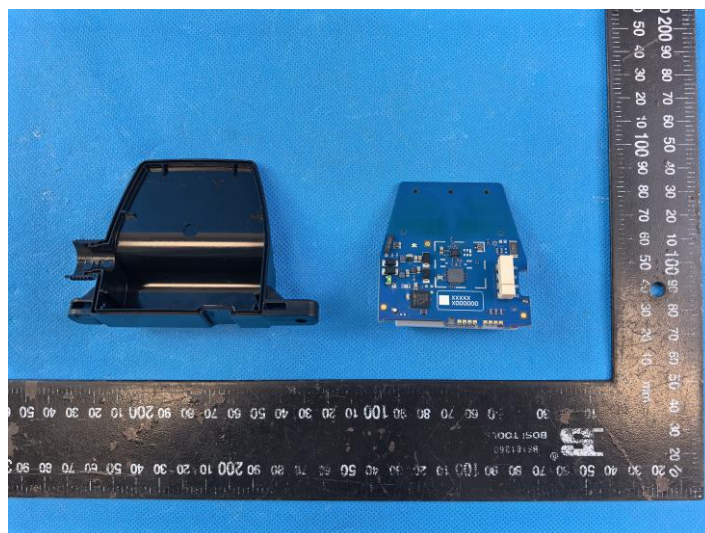
6.1. External Photos

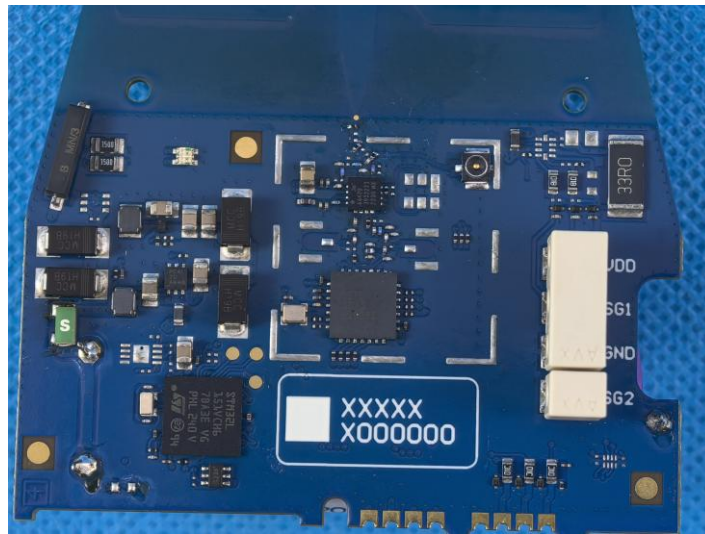






6.2. Internal Photos





7. APPENDIX REPORT

APPENDIX REPORT

Project No.	SHT2409082801W	Radio Specification	LORA
Test sample No.	YPHT24090828001	Model No.	NETRIS ® 3 - *L2*
Start test date	2024-12-16	Finish date	2024-12-17
Temperature	24.5℃	Humidity	50%
Test Engineer	Chenxin Ling	Auditor	Xiaodong Zheo

Appendix clause	Test item	Result
A	Peak Output Power	Pass
B	20 dB Bandwidth	Pass
C	99% Occupied Bandwidth	Pass
D	Carrier Frequencies Separation	Pass
E	Hopping Channel Number	Pass
F	Dwell Time	Pass
G	Duty Cycle Correction Factor (DCCF)	Pass
H	Band edge and Spurious Emissions(coducted)	Pass

Appendix A: Peak Output Power

Modulation type	Channel	Peak Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
CSS	CH-L	12.70	12.56	≤ 30.00	Pass
	CH-M	12.70	12.57		
	CH-H	12.68	12.52		

Modulation Type:		CSS
CH-L	Spectrum Ref Level 20.00 dBm Att 30 dB Offset 0.50 dB RBW 1 MHz SWT 1 ms VBW 3 MHz Mode Auto Sweep Count 300/300 1Pk View 12.70 dBm 902.34340 MHz M1[1] 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm CF 902.3 MHz 691 pts Span 5.0 MHz Date: 16 DEC 2024 20:40:49	
CH-M	Spectrum Ref Level 20.00 dBm Att 30 dB Offset 0.50 dB RBW 1 MHz SWT 1 ms VBW 3 MHz Mode Auto Sweep Count 300/300 1Pk View 12.70 dBm 908.46380 MHz M1 M1[1] 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm CF 908.5 MHz 691 pts Span 5.0 MHz Date: 16 DEC 2024 20:42:05	
CH-H	Spectrum Ref Level 20.00 dBm Att 30 dB Offset 0.50 dB RBW 1 MHz SWT 1 ms VBW 3 MHz Mode Auto Sweep Count 300/300 1Pk View 12.68 dBm 914.84930 MHz M1 M1[1] 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm CF 914.9 MHz 691 pts Span 5.0 MHz Date: 16 DEC 2024 20:43:41	

Appendix B : 20 dB Bandwidth

Modulation type	Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Result
CSS	CH-L	162.00	500	Pass
	CH-M	163.00		
	CH-H	162.00		

Modulation Type:

CSS

CH-L	Spectrum Ref Level 20.00 dBm Att 30 dB Offset 0.50 dB RBW 10 kHz SWT 189.6 μs VBW 30 kHz Mode Auto FFT Count 300/300 1Pk View 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm M1 M2 M1[1] M2[1] D1 D3 -7.57 dBm 902.221000 MHz 12.66 dBm 902.305000 MHz -7.337 dBm CF 902.3 MHz 1001 pts Span 1.0 MHz Marker <table><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-value</th><th>Y-value</th><th>Function</th><th>Function Result</th></tr><tr><td>M1</td><td></td><td>1</td><td>902.221 MHz</td><td>-7.57 dBm</td><td></td><td></td></tr><tr><td>M2</td><td></td><td>1</td><td>902.305 MHz</td><td>12.66 dBm</td><td></td><td></td></tr><tr><td>D3</td><td>M1</td><td>1</td><td>162.0 kHz</td><td>-0.43 dB</td><td></td><td></td></tr></table> Date: 16 DEC 2024 20:40:33	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1		1	902.221 MHz	-7.57 dBm			M2		1	902.305 MHz	12.66 dBm			D3	M1	1	162.0 kHz	-0.43 dB		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																							
M1		1	902.221 MHz	-7.57 dBm																									
M2		1	902.305 MHz	12.66 dBm																									
D3	M1	1	162.0 kHz	-0.43 dB																									
CH-M	Spectrum Ref Level 20.00 dBm Att 30 dB Offset 0.50 dB RBW 10 kHz SWT 189.6 μs VBW 30 kHz Mode Auto FFT Count 300/300 1Pk View 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm M1 M2 M1[1] M2[1] D1 D3 -7.83 dBm 908.420000 MHz 12.56 dBm 908.467000 MHz -7.444 dBm CF 908.5 MHz 1001 pts Span 1.0 MHz Marker <table><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-value</th><th>Y-value</th><th>Function</th><th>Function Result</th></tr><tr><td>M1</td><td></td><td>1</td><td>908.42 MHz</td><td>-7.83 dBm</td><td></td><td></td></tr><tr><td>M2</td><td></td><td>1</td><td>908.467 MHz</td><td>12.56 dBm</td><td></td><td></td></tr><tr><td>D3</td><td>M1</td><td>1</td><td>163.0 kHz</td><td>-0.20 dB</td><td></td><td></td></tr></table> Date: 16 DEC 2024 20:41:49	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1		1	908.42 MHz	-7.83 dBm			M2		1	908.467 MHz	12.56 dBm			D3	M1	1	163.0 kHz	-0.20 dB		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																							
M1		1	908.42 MHz	-7.83 dBm																									
M2		1	908.467 MHz	12.56 dBm																									
D3	M1	1	163.0 kHz	-0.20 dB																									
CH-H	Spectrum Ref Level 20.00 dBm Att 30 dB Offset 0.50 dB RBW 10 kHz SWT 189.6 μs VBW 30 kHz Mode Auto FFT Count 300/300 1Pk View 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm M1 M2 M1[1] M2[1] D1 D3 -7.98 dBm 914.821000 MHz 12.27 dBm 914.851000 MHz -7.734 dBm CF 914.9 MHz 1001 pts Span 1.0 MHz Marker <table><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-value</th><th>Y-value</th><th>Function</th><th>Function Result</th></tr><tr><td>M1</td><td></td><td>1</td><td>914.821 MHz</td><td>-7.98 dBm</td><td></td><td></td></tr><tr><td>M2</td><td></td><td>1</td><td>914.851 MHz</td><td>12.27 dBm</td><td></td><td></td></tr><tr><td>D3</td><td>M1</td><td>1</td><td>162.0 kHz</td><td>0.01 dB</td><td></td><td></td></tr></table> Date: 16 DEC 2024 20:43:26	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1		1	914.821 MHz	-7.98 dBm			M2		1	914.851 MHz	12.27 dBm			D3	M1	1	162.0 kHz	0.01 dB		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																							
M1		1	914.821 MHz	-7.98 dBm																									
M2		1	914.851 MHz	12.27 dBm																									
D3	M1	1	162.0 kHz	0.01 dB																									

Appendix C: 99% Occupied Bandwidth

Modulation type	Channel	99% Occupied Bandwidth (kHz)	Limit (MHz)	Result
CSS	CH-L	178.82	-	Pass
	CH-M	176.82		
	CH-H	176.82		

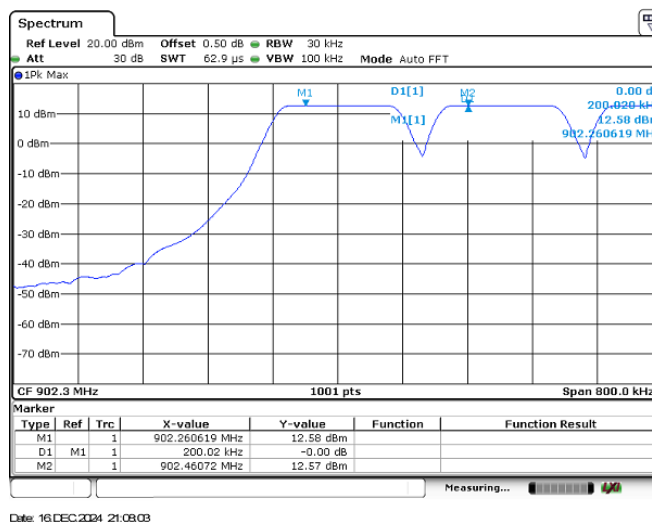
Modulation Type:		CSS
CH-L	Spectrum Ref Level 20.00 dBm Offset 0.50 dB RBW 30 kHz Att 30 dB SWT 63.1 μs VBW 100 kHz Mode Auto FFT Count 300/300 1Pk View 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm M1 M1[1] Occ Bw 13.08 dBm 902.256000 MHz 178.821178821 kHz CF 902.3 MHz 1001 pts Span 1.0 MHz Date: 16 DEC 2024 20:40:41	
CH-M	Spectrum Ref Level 20.00 dBm Offset 0.50 dB RBW 30 kHz Att 30 dB SWT 63.1 μs VBW 100 kHz Mode Auto FFT Count 300/300 1Pk View 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm M1 M1[1] Occ Bw 13.03 dBm 908.453000 MHz 176.823176823 kHz CF 908.5 MHz 1001 pts Span 1.0 MHz Date: 16 DEC 2024 20:41:57	
CH-H	Spectrum Ref Level 20.00 dBm Offset 0.50 dB RBW 30 kHz Att 30 dB SWT 63.1 μs VBW 100 kHz Mode Auto FFT Count 300/300 1Pk View 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm M1 M1[1] Occ Bw 13.01 dBm 914.858000 MHz 176.823176823 kHz CF 914.9 MHz 1001 pts Span 1.0 MHz Date: 16 DEC 2024 20:43:33	

Appendix D: Carrier Frequencies Separation

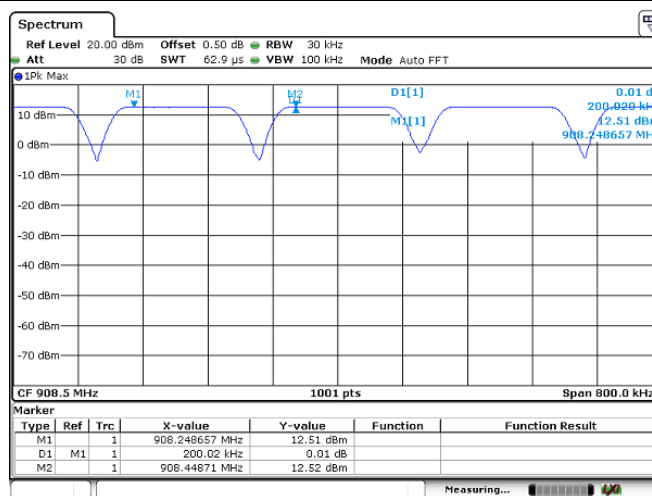
Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (kHz) *	Result
CSS	CH-L	0.2	≥162.00	Pass
	CH-M	0.2	≥162.00	Pass
	CH-H	0.2	≥162.00	Pass

Note:

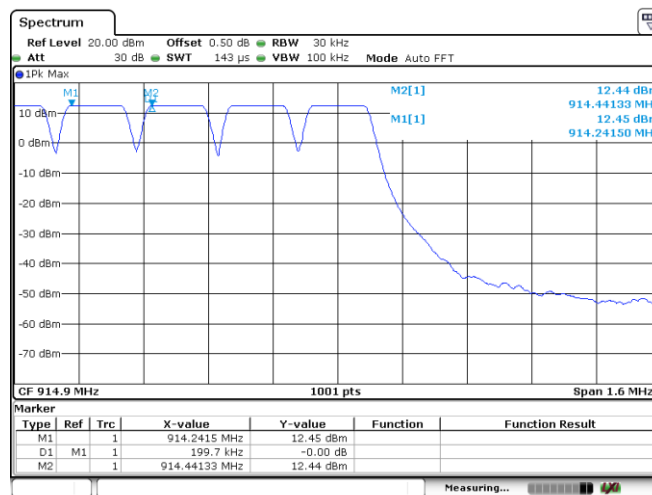
*: GFSK limit = The maximum 20 dB Bandwidth for CSS modulation on the appendix B.



Date: 16 DEC 2024 21:08:03



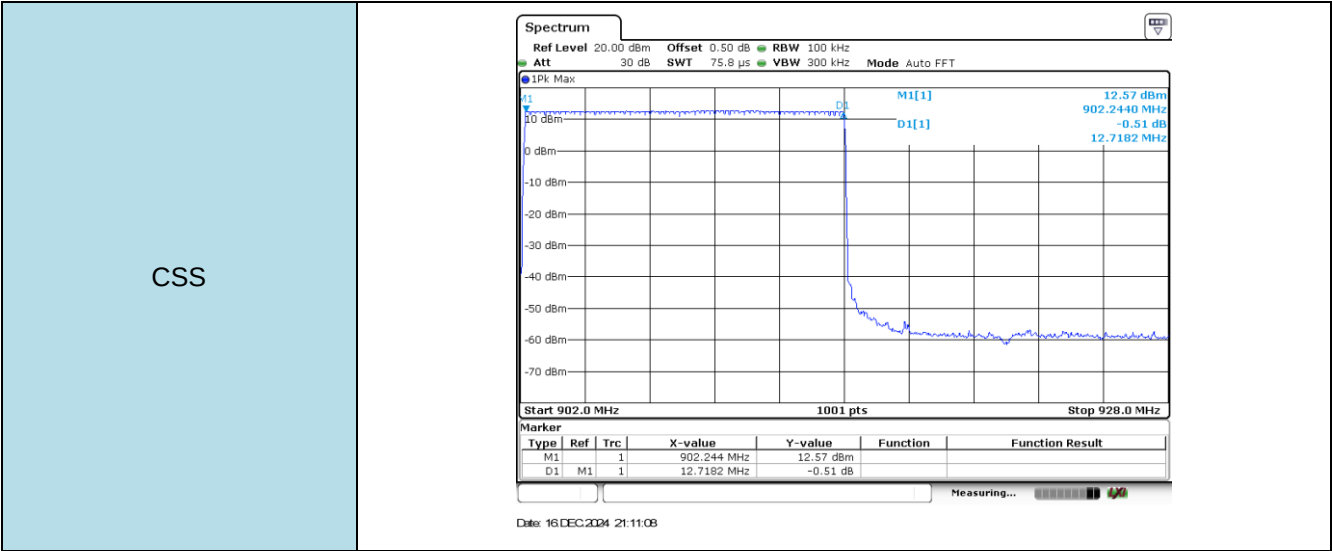
Date: 16 DEC 2024 21:10:03



Date: 16 DEC 2024 21:10:38

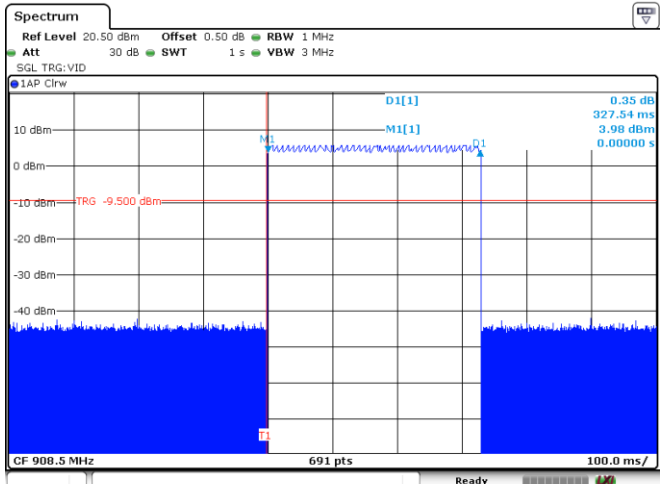
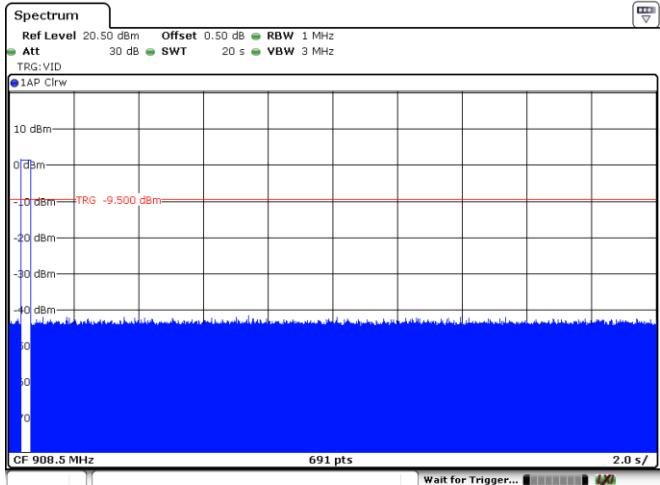
Appendix E: Hopping Channel Number

Modulation type	Channel number	Limit	Result
CSS	64	≥50	Pass



Appendix F: Dwell Time

Modulation type	Packet	Burst Width [ms]	Total Hops[hop*ch]	Dwell time (Second)	Limit (Second)	Result
CSS	CH-M	327.54	1	0.33	≤ 0.40	Pass

Modulation Type: CSS	
CH-M Burst width	 Date: 16 DEC 2004 21:12:00
CH-M Burst number	 Date: 16 DEC 2004 21:12:10

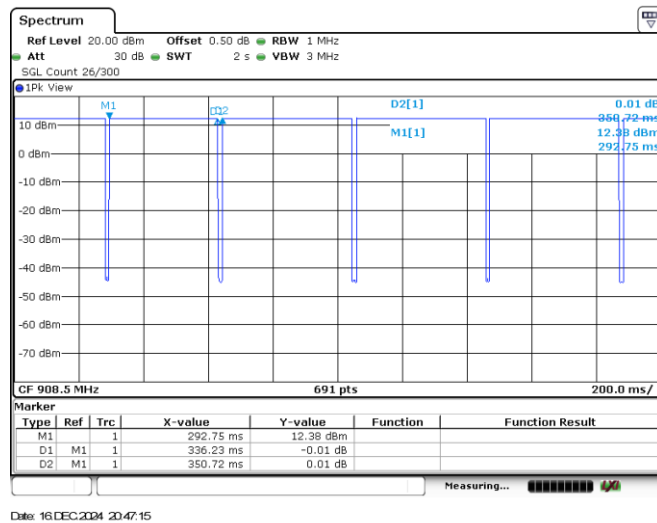
Appendix G: Duty Cycle Correction Factor (DCCF)

DCCF Calculate Formula

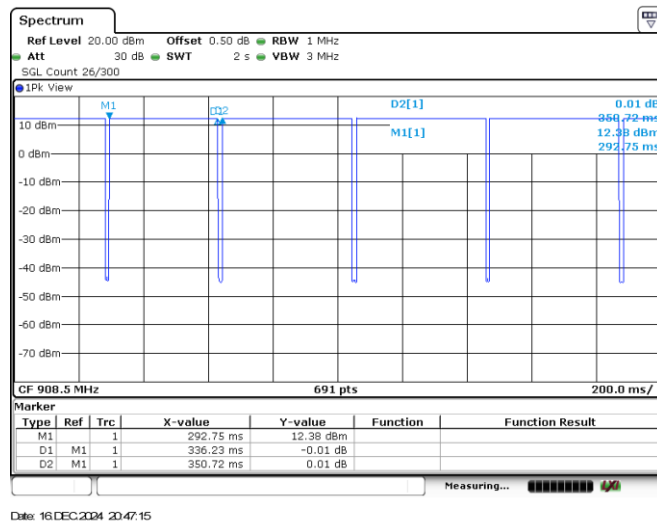
$$\text{DCCF} = 20 * \text{Log}(\text{duty cycle}) = 20 * \text{Log}(T_{\text{on time}} / T_{\text{period}})$$

Modulation type	Test Frequency (MHz)	T _{on time} for single burst [ms]	T _{period} [ms]	Burst Quantity	DCCF [dB]
CSS	908.5	400	2000	4	-13.98

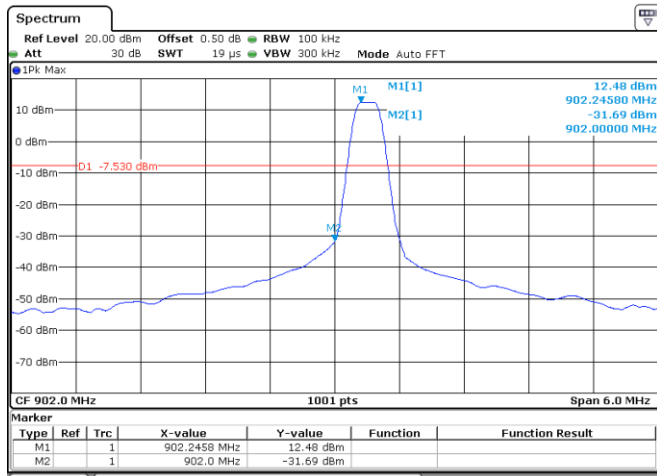
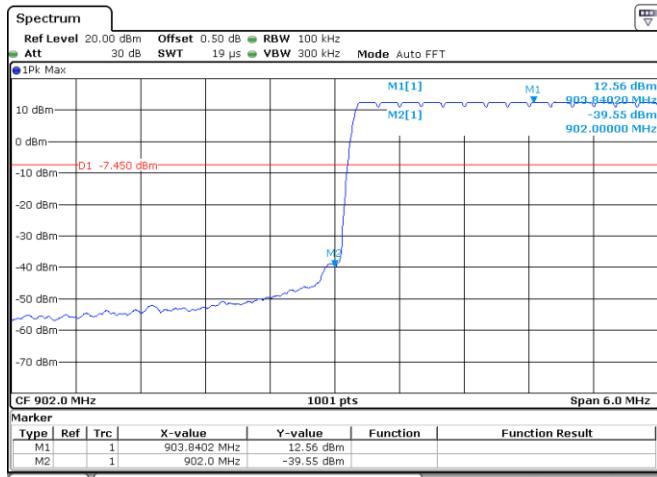
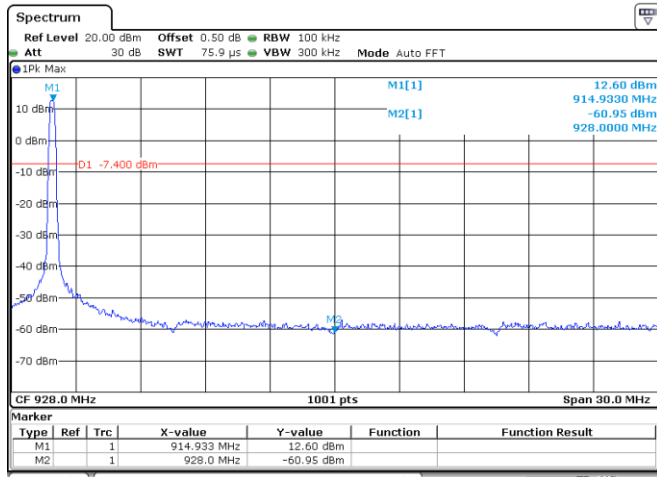
Burst Quantity



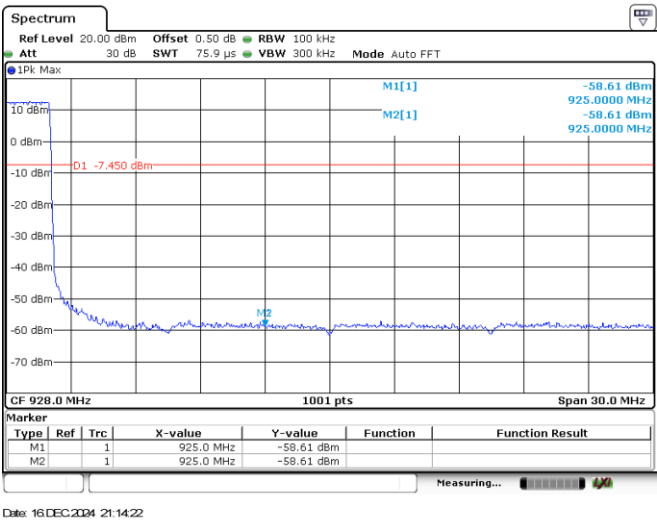
T_{on time} for single burst

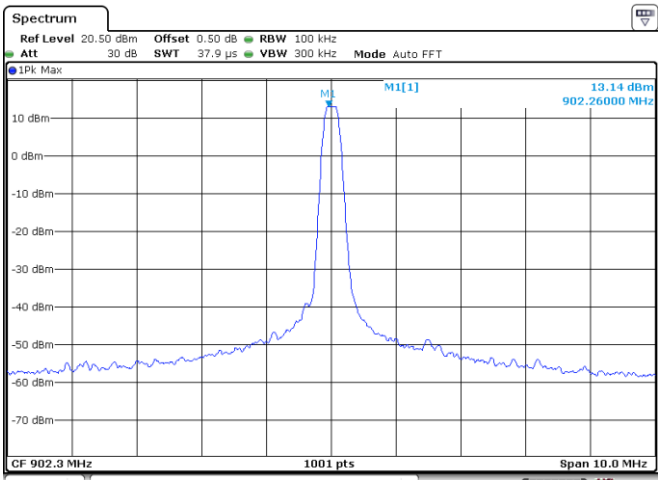
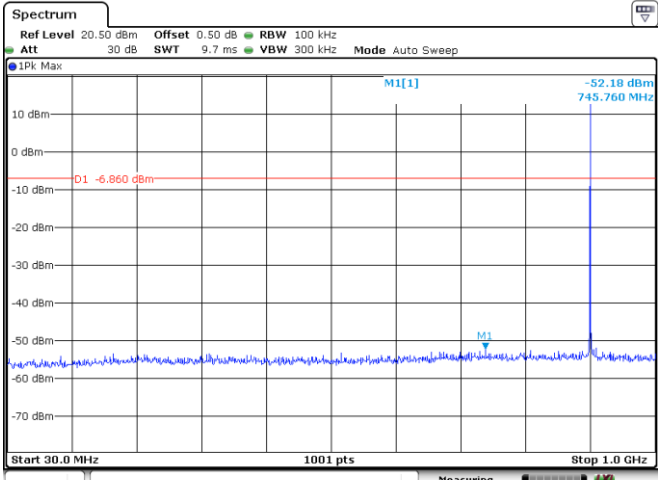
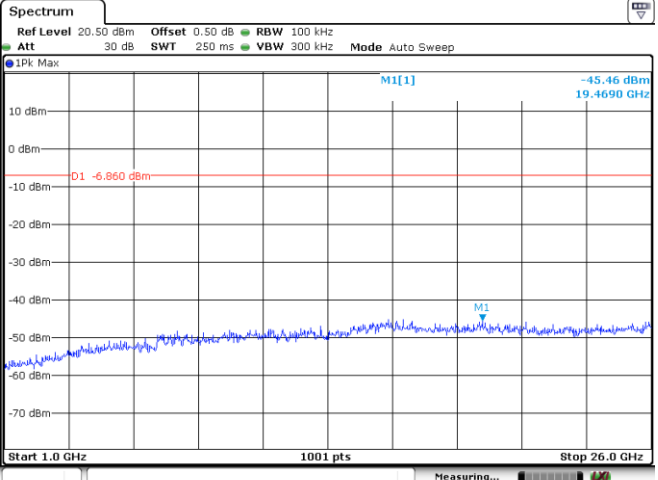


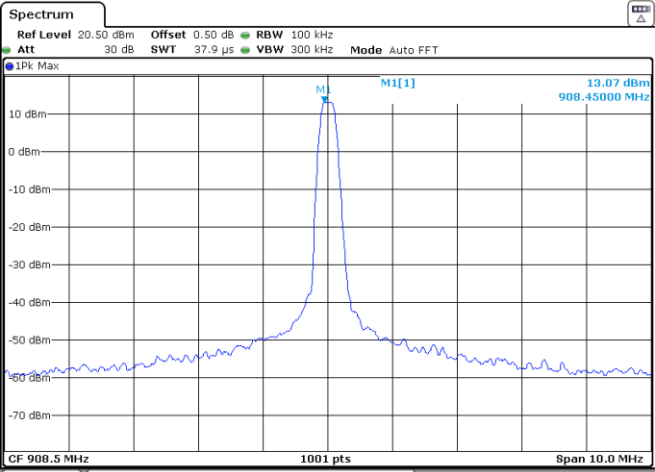
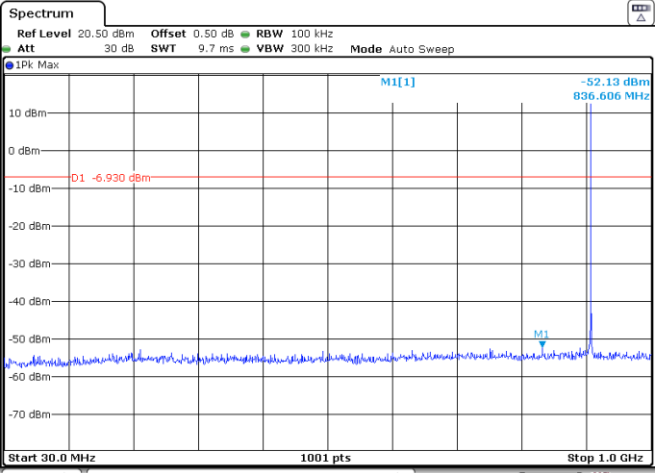
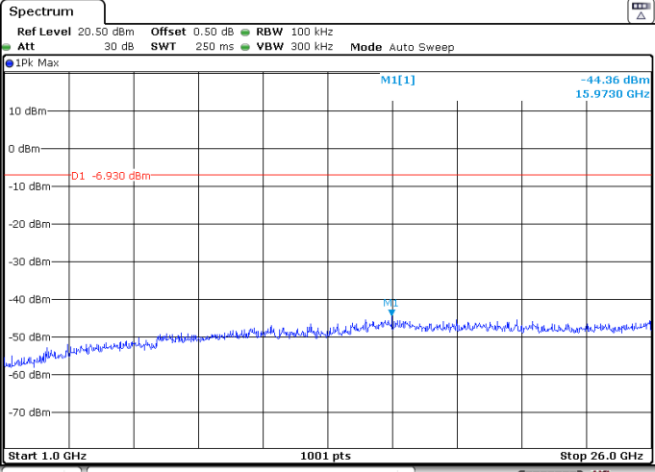
Appendix H: Band edge and Spurious Emissions (conducted)

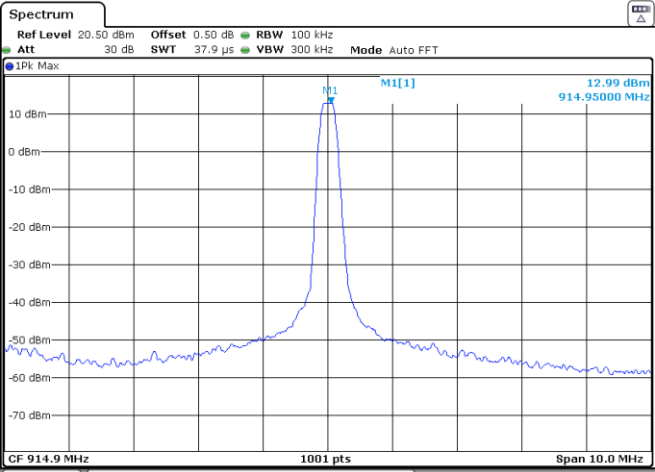
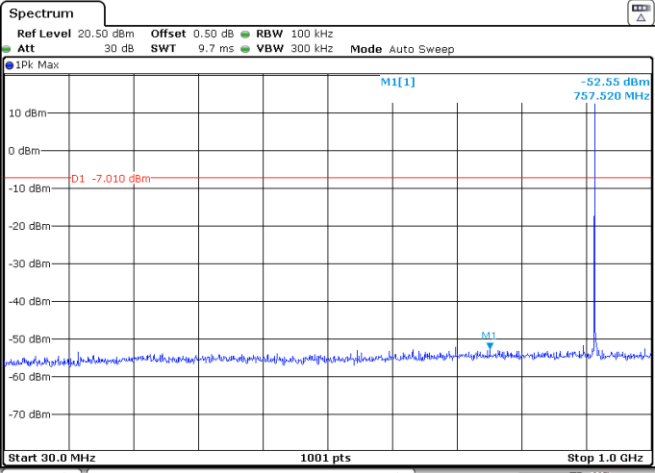
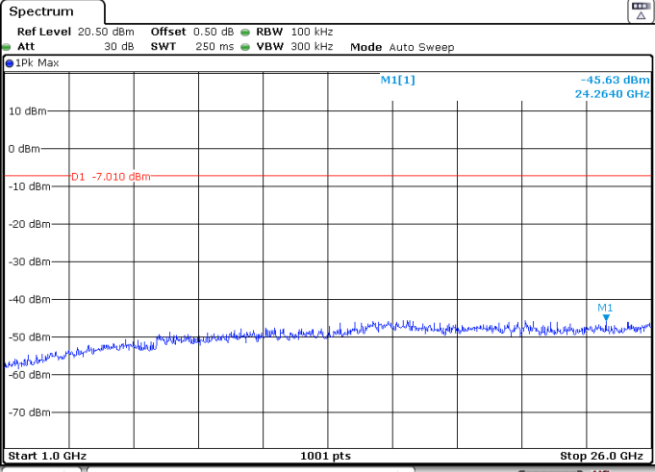
Test Item:	Band edge	Modulation type:	CSS																					
CH-L No hopping mode	 Spectrum Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz Att 30 dB SWT 19 µs VBW 300 kHz Mode Auto FFT 1Pk Max M1 M1[1] 12.48 dBm 902.24580 MHz M2 M2[1] -31.69 dBm 902.00000 MHz D1 -7.530 dBm CF 902.0 MHz 1001 pts Span 6.0 MHz <table><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-value</th><th>Y-value</th><th>Function</th><th>Function Result</th></tr><tr><td>M1</td><td>1</td><td></td><td>902.2458 MHz</td><td>12.48 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>902.0 MHz</td><td>-31.69 dBm</td><td></td><td></td></tr></table> Date: 16 DEC 2004 21:13:09	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		902.2458 MHz	12.48 dBm			M2	1		902.0 MHz	-31.69 dBm				
Type	Ref	Trc	X-value	Y-value	Function	Function Result																		
M1	1		902.2458 MHz	12.48 dBm																				
M2	1		902.0 MHz	-31.69 dBm																				
CH-L Hopping mode	 Spectrum Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz Att 30 dB SWT 19 µs VBW 300 kHz Mode Auto FFT 1Pk Max M1 M1[1] 12.56 dBm 903.84020 MHz M2 M2[1] -39.55 dBm 902.00000 MHz D1 -7.450 dBm CF 902.0 MHz 1001 pts Span 6.0 MHz <table><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-value</th><th>Y-value</th><th>Function</th><th>Function Result</th></tr><tr><td>M1</td><td>1</td><td></td><td>903.8402 MHz</td><td>12.56 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>902.0 MHz</td><td>-39.55 dBm</td><td></td><td></td></tr></table> Date: 16 DEC 2004 21:13:43	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		903.8402 MHz	12.56 dBm			M2	1		902.0 MHz	-39.55 dBm				
Type	Ref	Trc	X-value	Y-value	Function	Function Result																		
M1	1		903.8402 MHz	12.56 dBm																				
M2	1		902.0 MHz	-39.55 dBm																				
CH-H No hopping mode	 Spectrum Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz Att 30 dB SWT 75.9 µs VBW 300 kHz Mode Auto FFT 1Pk Max M1 M1[1] 12.60 dBm 914.9330 MHz M2 M2[1] -60.95 dBm 928.00000 MHz D1 -7.400 dBm CF 928.0 MHz 1001 pts Span 30.0 MHz <table><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-value</th><th>Y-value</th><th>Function</th><th>Function Result</th></tr><tr><td>M1</td><td>1</td><td></td><td>914.933 MHz</td><td>12.60 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>928.0 MHz</td><td>-60.95 dBm</td><td></td><td></td></tr></table> Date: 16 DEC 2004 21:14:05	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		914.933 MHz	12.60 dBm			M2	1		928.0 MHz	-60.95 dBm				
Type	Ref	Trc	X-value	Y-value	Function	Function Result																		
M1	1		914.933 MHz	12.60 dBm																				
M2	1		928.0 MHz	-60.95 dBm																				

CH-H
Hopping mode



Test Item:	Spurious Emission	Modulation type:	CSS
CH-L Reference level	 19.14 dBm 902.26000 MHz CF 902.3 MHz 1001 pts Span 10.0 MHz Date: 16 DEC 2024 21:16:25		
CH-L 30MHz~1000MHz	 -52.18 dBm 745.760 MHz Start 30.0 MHz 1001 pts Stop 1.0 GHz Date: 16 DEC 2024 21:17:41		
CH-L 1GHz~26GHz	 -45.46 dBm 19.4690 GHz Start 1.0 GHz 1001 pts Stop 26.0 GHz Date: 16 DEC 2024 21:18:09		

CH-M Reference level	 Spectrum plot showing a peak at 908.45000 MHz with a level of 13.07 dBm. The plot includes parameters: Ref Level 20.50 dBm, Att 30 dB, Offset 0.50 dB, RBW 100 kHz, Mode Auto FFT, Span 10.0 MHz, and CF 908.5 MHz.
CH-M 30MHz~1000MHz	 Spectrum plot showing a peak at 836.606 MHz with a level of -52.13 dBm. The plot includes parameters: Ref Level 20.50 dBm, Att 30 dB, Offset 0.50 dB, RBW 100 kHz, Mode Auto Sweep, Span 10.0 MHz, and CF 908.5 MHz.
CH-M 1GHz~26GHz	 Spectrum plot showing a peak at 15.9730 GHz with a level of -44.36 dBm. The plot includes parameters: Ref Level 20.50 dBm, Att 30 dB, Offset 0.50 dB, RBW 100 kHz, Mode Auto Sweep, Span 10.0 MHz, and CF 908.5 MHz.

CH-H Reference level	 12.99 dBm 914.95000 MHz CF 914.9 MHz 1001 pts Span 10.0 MHz Date: 16 DEC 2004 21:22:01
CH-H 30MHz~1000MHz	 -52.55 dBm 757.520 MHz Start 30.0 MHz 1001 pts Stop 1.0 GHz Date: 16 DEC 2004 21:22:48
CH-H 1GHz~26GHz	 -45.63 dBm 24.2640 GHz Start 1.0 GHz 1001 pts Stop 26.0 GHz Date: 16 DEC 2004 21:23:08

-----End of Report-----