FCC RADIO TEST REPORT

FCC ID	:	**2AEUPBHARC011**
Equipment	:	**Spotlight cam wired**
Brand Name	:	**Ring**
Model Name	:	**5L5C4T**
Applicant	:	**Ring LLC** **1523 26th St Santa Monica, CA 90404 USA**
Manufacturer	:	**Ring LLC** **1523 26th St Santa Monica, CA 90404 USA**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Aug. 31, 2021 and testing was started from Feb. 17, 2022 to Apr. 24, 2022. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Reviewed by: Louis Wu

Sporton International Inc. Wensan Laboratory
No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C)

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History of this test report

Report No.	Version	Description	Issued Date
FR240817A	01	Initial issue of report	May 02, 2022
FR240817A	02	1. Revise Equipment Name 2. Add remark for Radiated Spurious Emission Plots	Sep. 23, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(1)	Number of Channels	Pass	-
3.2	15.247(a)(1)	Hopping Channel Separation	Pass	-
3.3	15.247(a)(1)	Dwell Time of Each Channel	Pass	-
3.4	15.247(a)(1)	20dB Bandwidth	Pass	-
3.4	2.1049	99% Occupied Bandwidth	Reporting only	-
3.5	15.247(b)(2)	Output Power	Pass	-
3.6	15.247(d)	Conducted Band Edges	Pass	-
3.7	15.247(d)	Conducted Spurious Emission	Pass	-
3.8	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	Under limit 0.19 dB at 609.090 MHz
3.9	15.207	AC Conducted Emission	Pass	Under limit 18.35 dB at 12.968 MHz
3.10	15.203 & 15.247(b)	Antenna Requirement	Pass	-

Declaration of Conformity:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
   It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to this report "Uncertainty of Evaluation".

Comments and Explanations:

The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Keven Cheng

Report Producer: Cindy Liu

1 General Description

1.1 Product Feature of Equipment Under Test

LoRa

Product Feature	
Antenna Type	PIFA Antenna

Antenna information		
902 MHz ~ 928 MHz	Peak Gain (dBi)	0.73

Remark: The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.2 Modification of EUT

No modifications are made to the EUT during all test items.

1.3 Testing Location

Test Site	Sporton International Inc. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.**
	TH02-HY (TAF Code: 1190)
Remark	The Conducted test item subcontracted to Sporton International Inc. EMC & Wireless Communications Laboratory

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	03CH12-HY, CO07-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW1190 and TW3786

1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

LoRa 125KHz FHSS

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
902 – 928 MHz	1	902.2	28	907.6	55	913.0	82	918.4	109	923.8
	2	902.4	29	907.8	56	913.2	83	918.6	110	924.0
	3	902.6	30	908.0	57	913.4	84	918.8	111	924.2
	4	902.8	31	908.2	58	913.6	85	919.0	112	924.4
	5	903.0	32	908.4	59	913.8	86	919.2	113	924.6
	6	903.2	33	908.6	60	914.0	87	919.4	114	924.8
	7	903.4	34	908.8	61	914.2	88	919.6	115	925.0
	8	903.6	35	909.0	62	914.4	89	919.8	116	925.2
	9	903.8	36	909.2	63	914.6	90	920.0	117	925.4
	10	904.0	37	909.4	64	914.8	91	920.2	118	925.6
	11	904.2	38	909.6	65	915.0	92	920.4	119	925.8
	12	904.4	39	909.8	66	915.2	93	920.6	120	926.0
	13	904.6	40	910.0	67	915.4	94	920.8	121	926.2
	14	904.8	41	910.2	68	915.6	95	921.0	122	926.4
	15	905.0	42	910.4	69	915.8	96	921.2	123	926.6
	16	905.2	43	910.6	70	916.0	97	921.4	124	926.8
	17	905.4	44	910.8	71	916.2	98	921.6	125	927.0
	18	905.6	45	911.0	72	916.4	99	921.8	126	927.2
	19	905.8	46	911.2	73	916.6	100	922.0	127	927.4
	20	906.0	47	911.4	74	916.8	101	922.2	128	927.6
	21	906.2	48	911.6	75	917.0	102	922.4	129	927.8
	22	906.4	49	911.8	76	917.2	103	922.6	-	-
	23	906.6	50	912.0	77	917.4	104	922.8	-	-
	24	906.8	51	912.2	78	917.6	105	923.0	-	-
	25	907.0	52	912.4	79	917.8	106	923.2	-	-
	26	907.2	53	912.6	80	918.0	107	923.4	-	-
	27	907.4	54	912.8	81	918.2	108	923.6	-	-

FSK 250 Kbps

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
902 – 928 MHz	1	902.5	28	916.0
	2	903.0	29	916.5
	3	903.5	30	917.0
	4	904.0	31	917.5
	5	904.5	32	918.0
	6	905.0	33	918.5
	7	905.5	34	919.0
	8	906.0	35	919.5
	9	906.5	36	920.0
	10	907.0	37	920.5
	11	907.5	38	921.0
	12	908.0	39	921.5
	13	908.5	40	922.0
	14	909.0	41	922.5
	15	909.5	42	923.0
	16	910.0	43	923.5
	17	910.5	44	924.0
	18	911.0	45	924.5
	19	911.5	46	925.0
	20	912.0	47	925.5
	21	912.5	48	926.0
	22	913.0	49	926.5
	23	913.5	50	927.0
	24	914.0	51	927.5
	25	914.5		
	26	915.0		
	27	915.5		

2.2 Test Mode

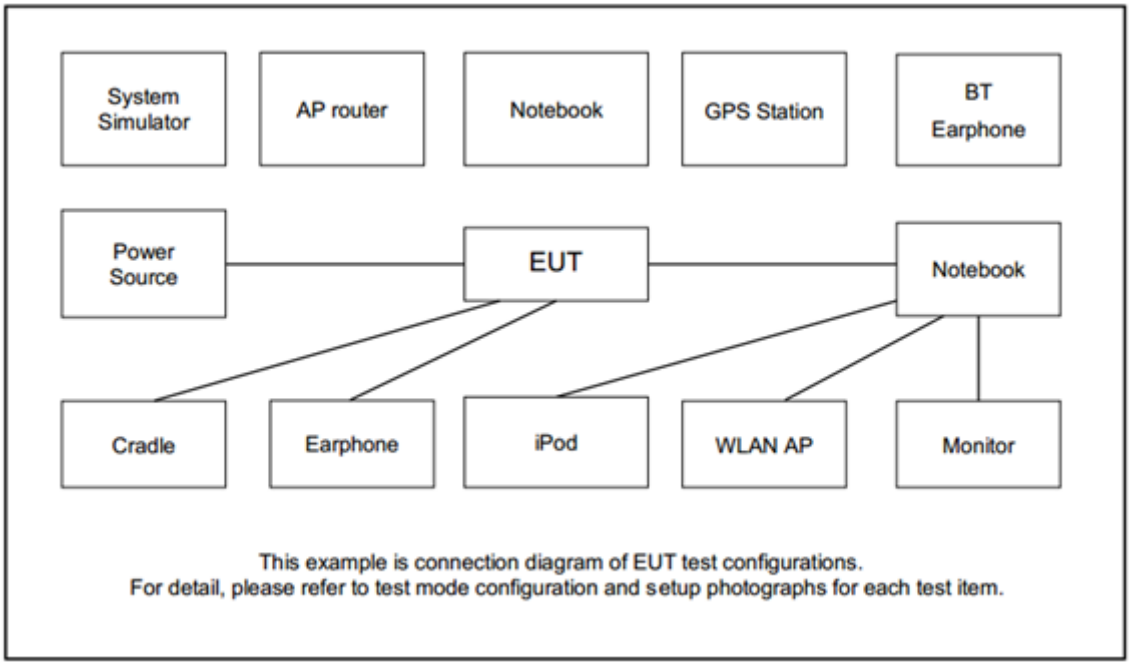
a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find Z plane as worst plane.

b. AC power line Conducted Emission was tested under maximum output power.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Test Cases		
Test Item	**Feature**	**LoRa/FSK**
Conducted Test Cases	**LoRa 125 KHz FHSS_SF8**	Mode 1: CH01 Tx_902.20 MHz Mode 2: CH65 Tx_915.00 MHz Mode 3: CH129 Tx_927.80 MHz
	LoRa 125 KHz FHSS_SF9	Mode 4: CH01 Tx_902.20 MHz Mode 5: CH65 Tx_915.00 MHz Mode 6: CH129 Tx_927.80 MHz
	FSK 250 Kbps FHSS	Mode 7: CH01 Tx_902.50 MHz Mode 8: CH26 Tx_915.00 MHz Mode 9: CH51 Tx_927.50 MHz
Radiated Test Cases	**LoRa 125 KHz FHSS_SF8**	Mode 1: CH01 Tx_902.20 MHz Mode 2: CH65 Tx_915.00 MHz Mode 3: CH129 Tx_927.80 MHz
	FSK 250 Kbps FHSS	Mode 4: CH01 Tx_902.50 MHz Mode 5: CH26 Tx _915.00 MHz Mode 6: CH51 Tx _927.50 MHz
AC Conducted Emission	Mode 1: LoRa Tx + USB Cable (Chariging from Adapter)	

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Adapter	DVE	DSA-5PFM-05 FUS	FCC DoC	N/A	N/A
2.	USB Cable	NA	NA	N/A	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “J-Link RTT Viewer V7.54a” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 Number of Channel Measurement

3.1.1 Limits of Number of Hopping Frequency

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; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies.

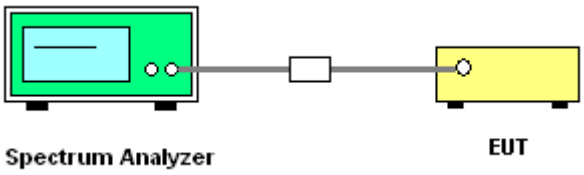
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.3.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation;
   RBW = 50kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for LoRa 125kHz FHSS.
   RBW = 100kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for FSK 250Kbps FHSS.
6. The number of hopping frequency used is defined as the number of total channel.
7. Record the measurement data derived from spectrum analyzer.

3.1.4 Test Setup



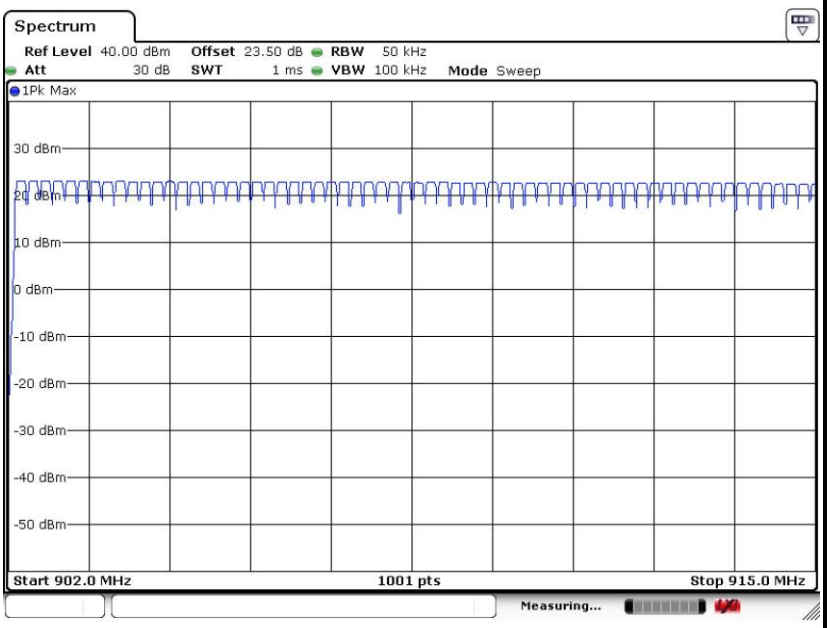
3.1.5 Test Result of Number of Hopping Frequency

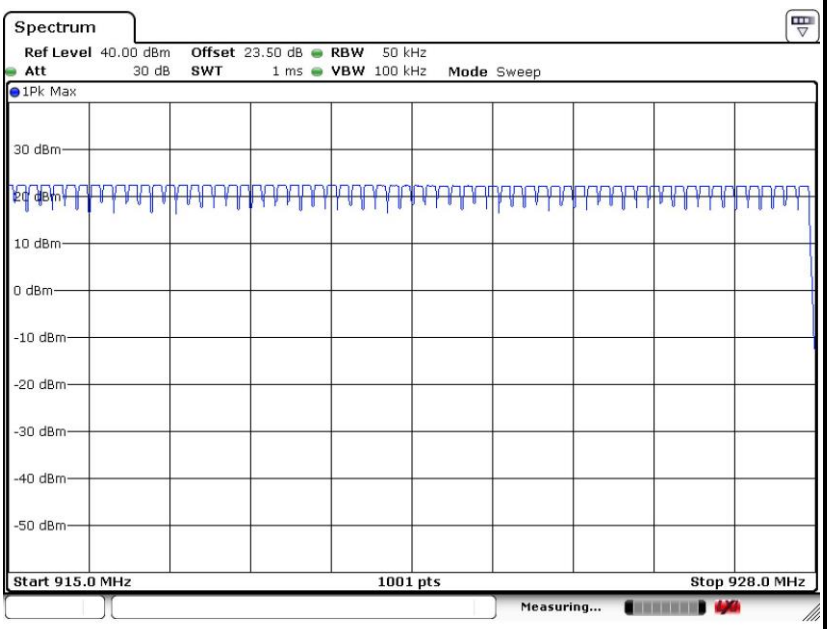
Please refer to Appendix A.

<LoRa 125kHz FHSS>

<Data Rate: SF8>

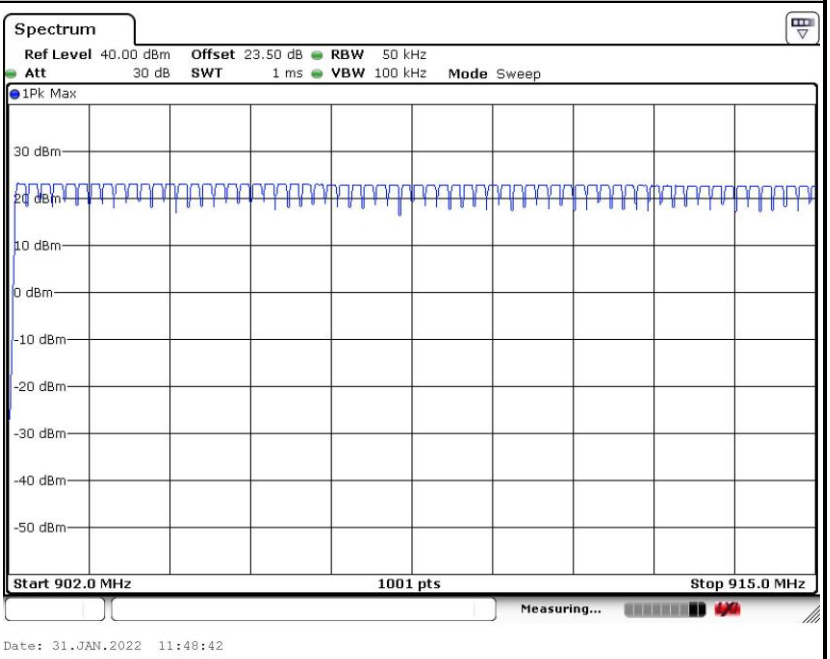
Number of Hopping Channel Plot on Channel 01 - 129

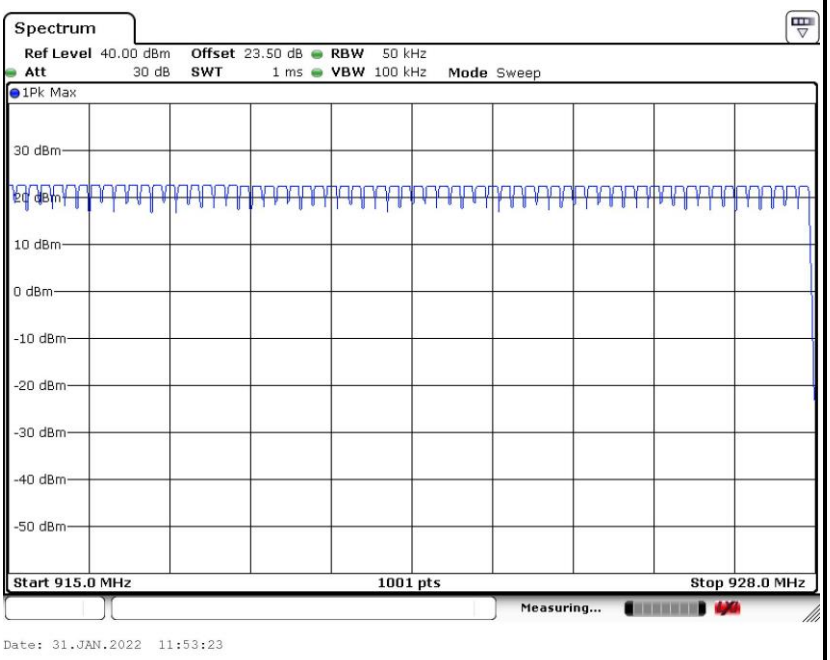




<Data Rate: SF9>

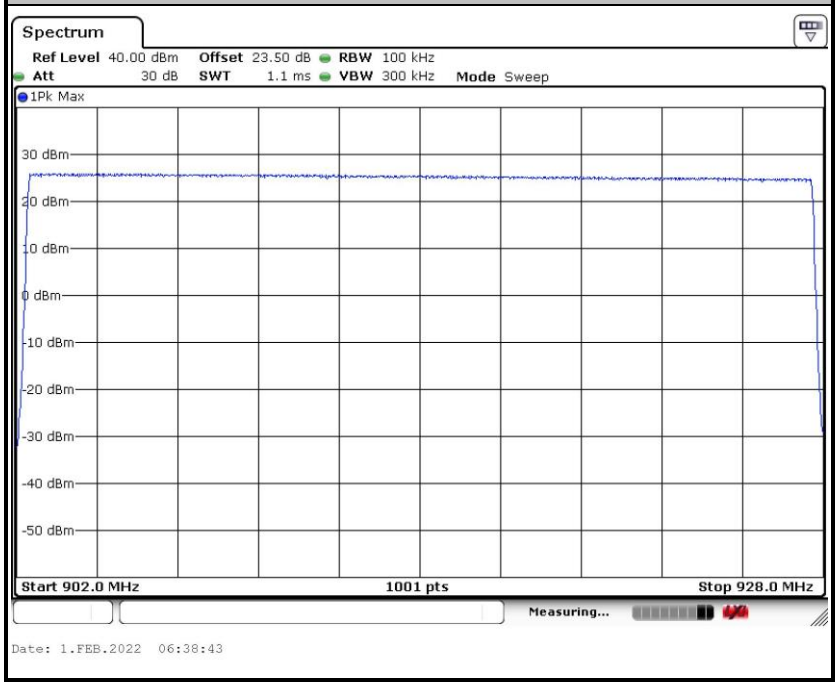
Number of Hopping Channel Plot on Channel 01 - 129





<FSK 250Kbps FHSS>

Number of Hopping Channel Plot on Channel 01 - 51



3.2 Hopping Channel Separation Measurement

3.2.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 902 – 928 MHz band 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.

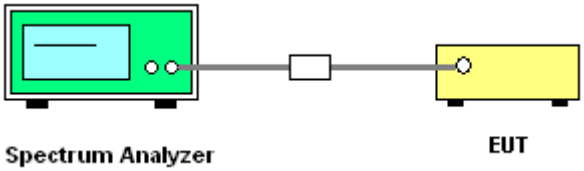
3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

3.2.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.2.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels;
   RBW = 50kHz for; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for LoRa 125KHz FHSS.
   RBW = 200kHz for; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for FSK 250Kbps FHSS.
6. Measure and record the results in the test report.

3.2.4 Test Setup

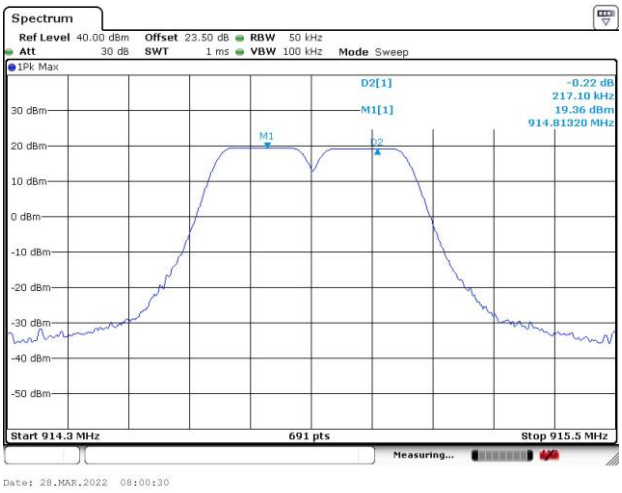
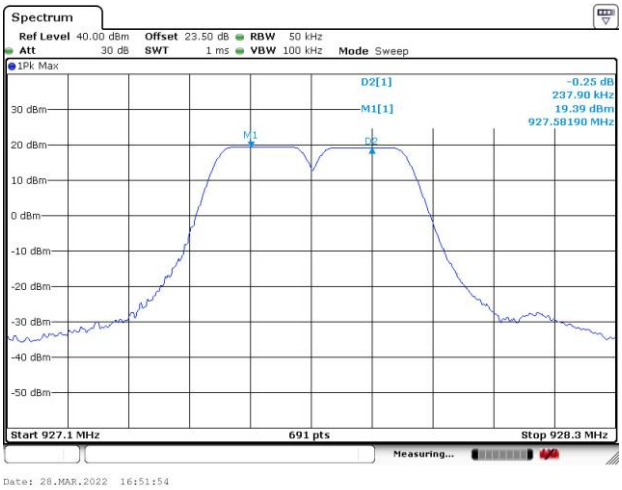


3.2.5 Test Result of Hopping Channel Separation

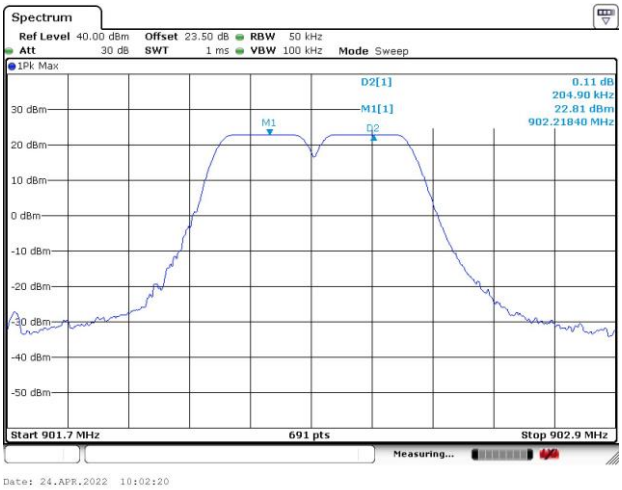
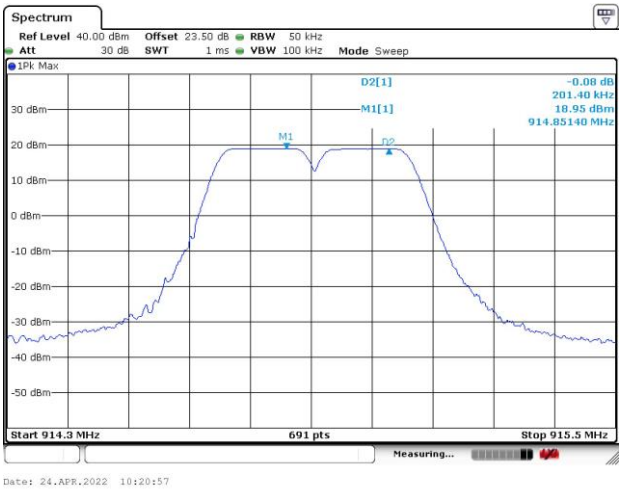
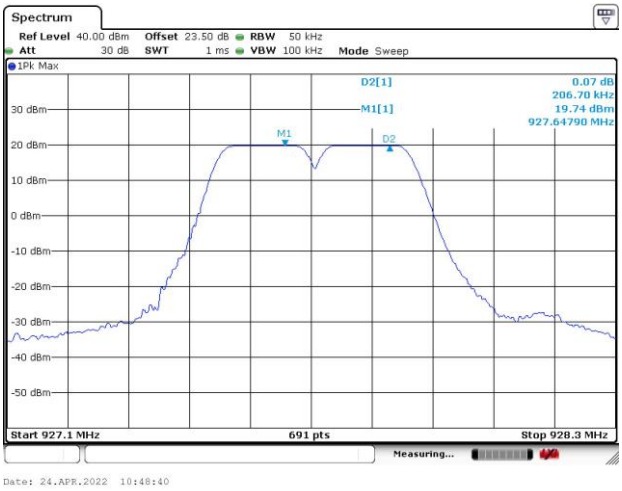
Please refer to Appendix A.

<LoRa 125KHz FHSS>

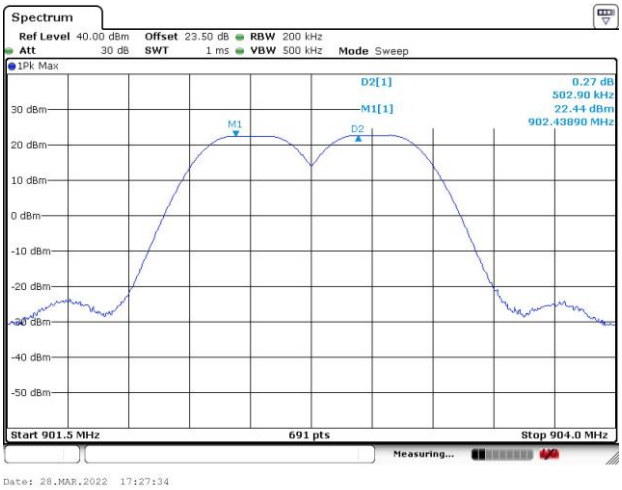
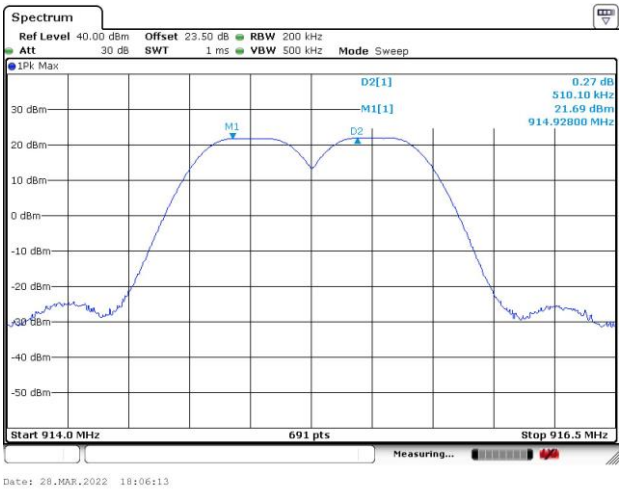
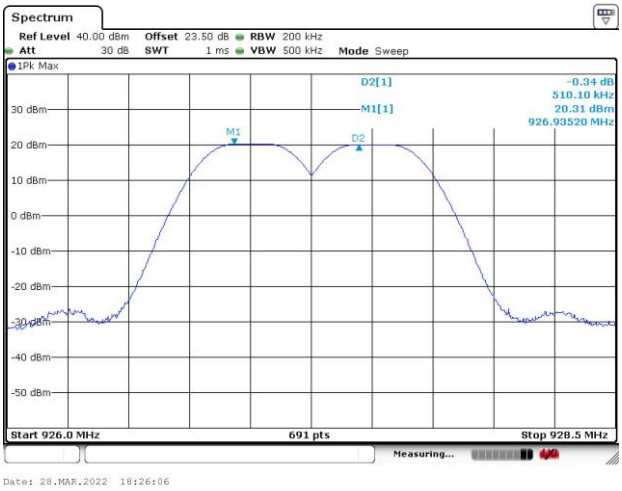
<Data Rate: SF8>

Channel Separation Plot on Channel 01 - 02	Channel Separation Plot on Channel 64 - 65
	
Channel Separation Plot on Channel 128 - 129	**-**
	**N/A**

<Data Rate: SF9>

Channel Separation Plot on Channel 01 - 02	Channel Separation Plot on Channel 64 - 65
	
Channel Separation Plot on Channel 128 - 129	**-**
	**N/A**

<FSK 250Kbps FHSS>

Channel Separation Plot on Channel 01 - 02	Channel Separation Plot on Channel 25 - 26
	
Channel Separation Plot on Channel 50 - 51	**-**
	**N/A**

3.3 Dwell Time Measurement

3.3.1 Limit of Dwell Time

If the 20 dB bandwidth of the hopping channel is less than 250 kHz, 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 average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

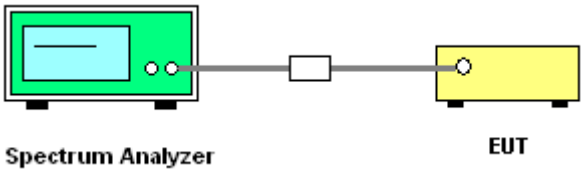
3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.4.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 20 kHz; VBW ≥ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.3.4 Test Setup



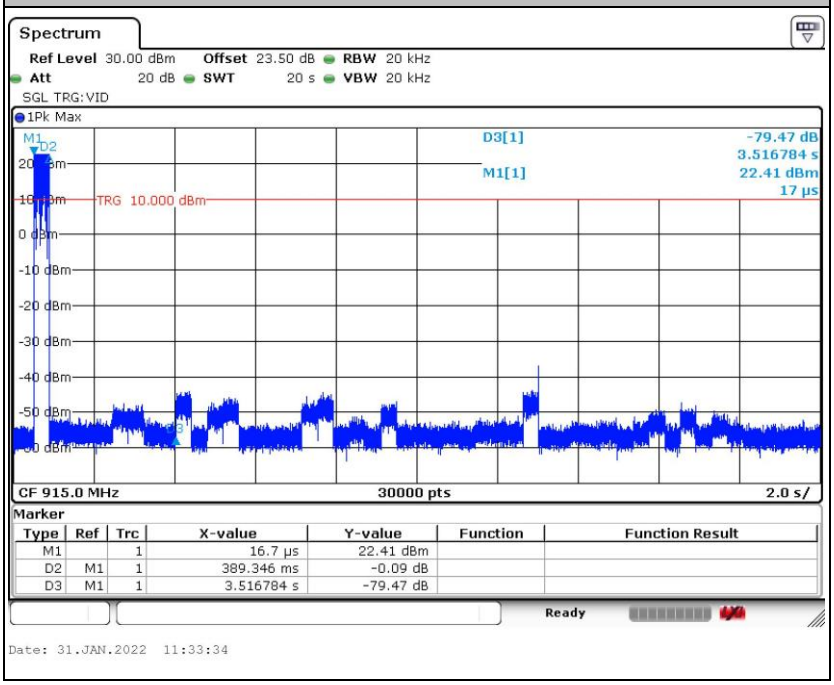
3.3.5 Test Result of Dwell Time

Please refer to Appendix A.

<LoRa 125KHz FHSS>

<Data Rate: SF8>

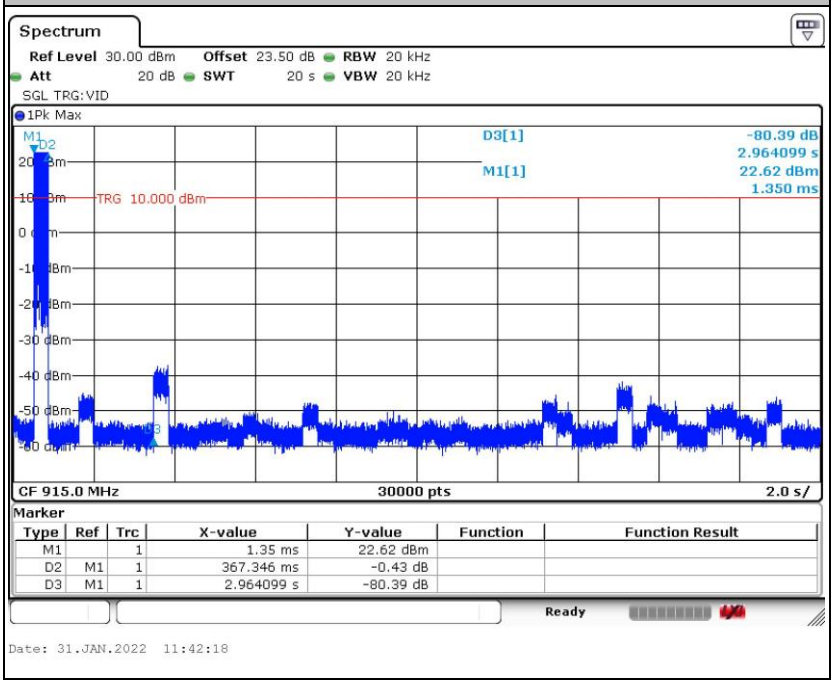
Package Transfer Time Plot



Remark: Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

<Data Rate: SF9>

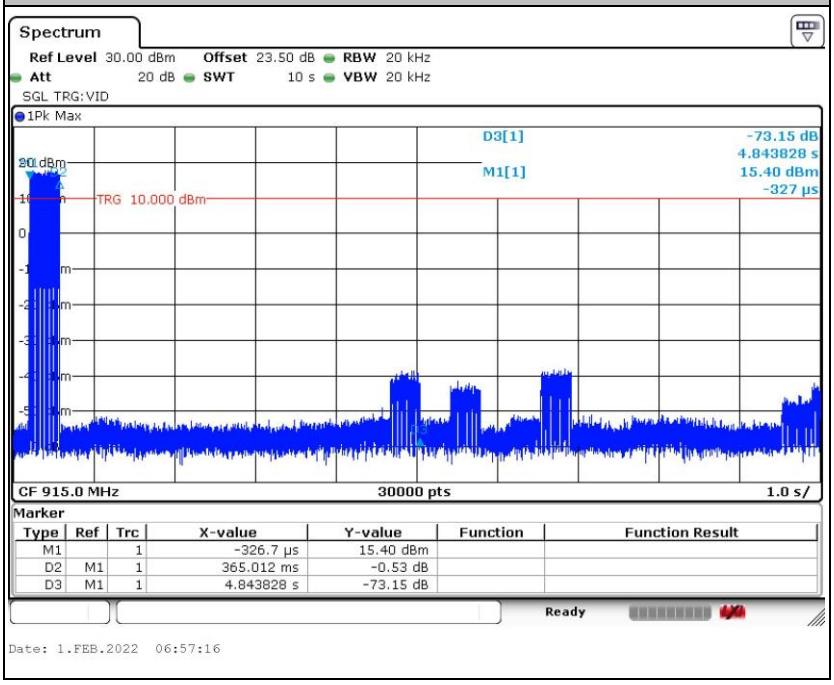
Package Transfer Time Plot



Remark: Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

<FSK 250Kbps FHSS>

Package Transfer Time Plot



Remark: Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

3.4 20dB and 99% Bandwidth Measurement

3.4.1 Limit of 20dB and 99% Bandwidth

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

99% Bandwidth is reporting only.

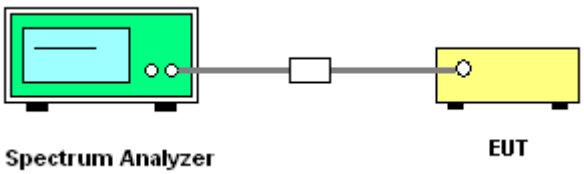
3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 6.9.2 and 6.9.3.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.
   Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel;
   RBW ≥ 1% of the 20 dB bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
5. Use the following spectrum analyzer settings for 99 % Bandwidth measurement.
   Span = approximately 1.5 to 5 times the 99% bandwidth, centered on a hopping channel;
   RBW ≥ 1-5% of the 99% bandwidth; VBW ≥ 3 * RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
6. Measure and record the results in the test report.

3.4.4 Test Setup

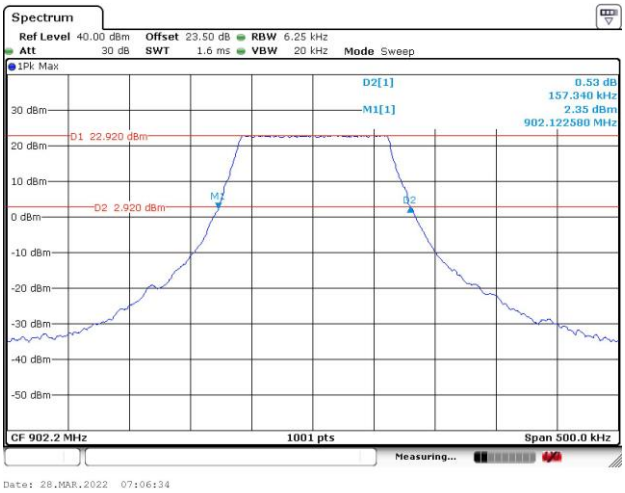
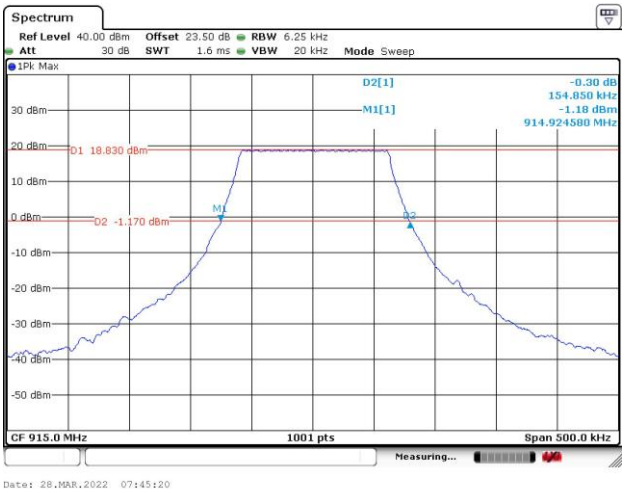
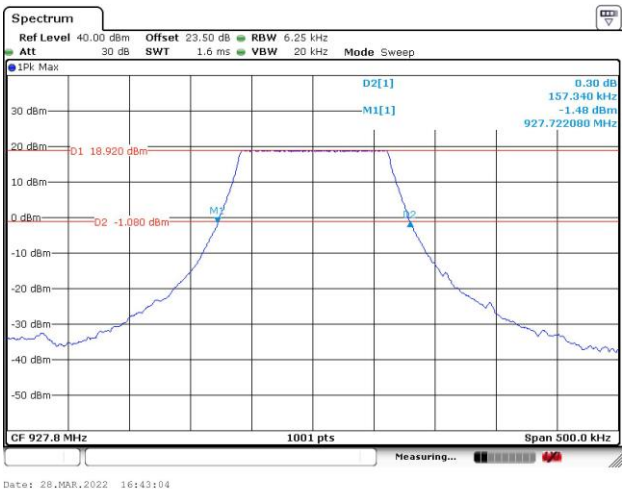


3.4.5 Test Result of 20dB Bandwidth

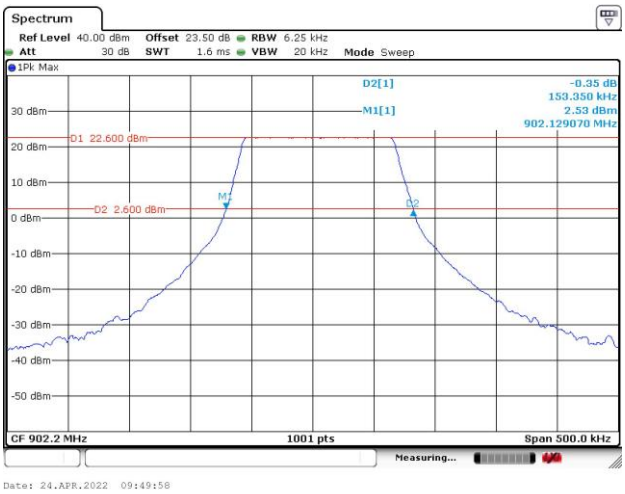
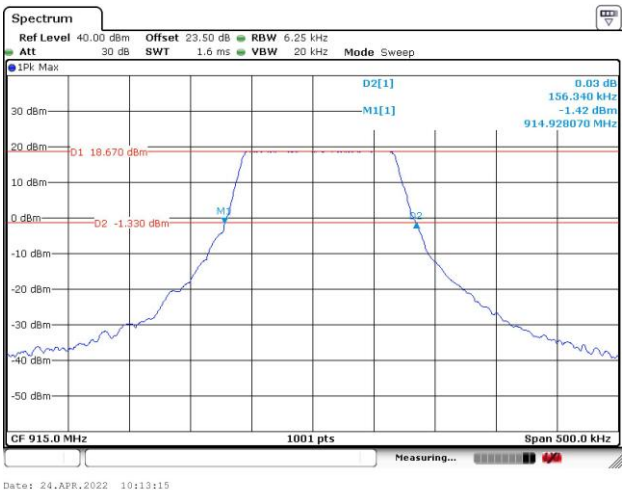
Please refer to Appendix A.

<LoRa 125KHz FHSS>

<Data Rate: SF8>

20 dB Bandwidth Plot on Channel 01	20 dB Bandwidth Plot on Channel 65
	
20 dB Bandwidth Plot on Channel 129	**-**
	**N/A**

<Data Rate: SF9>

20 dB Bandwidth Plot on Channel 00	20 dB Bandwidth Plot on Channel 65
	
20 dB Bandwidth Plot on Channel 129	**-**
	N/A

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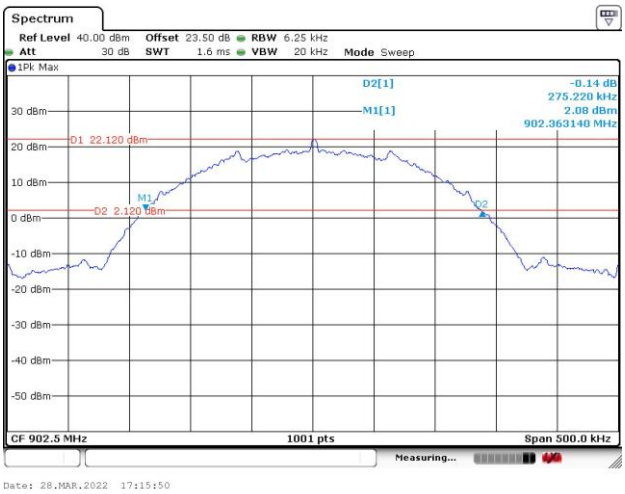
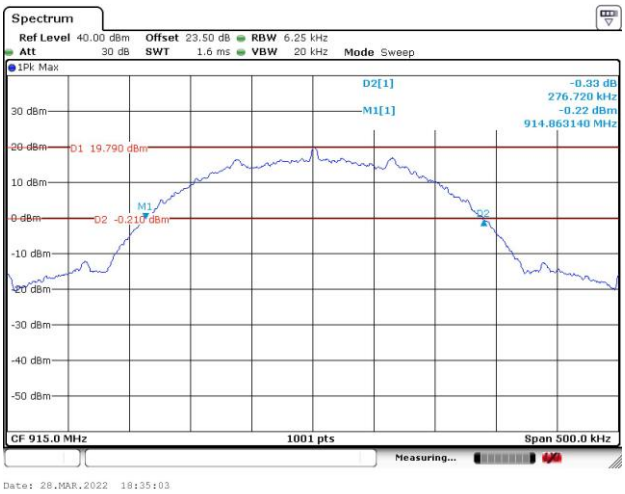
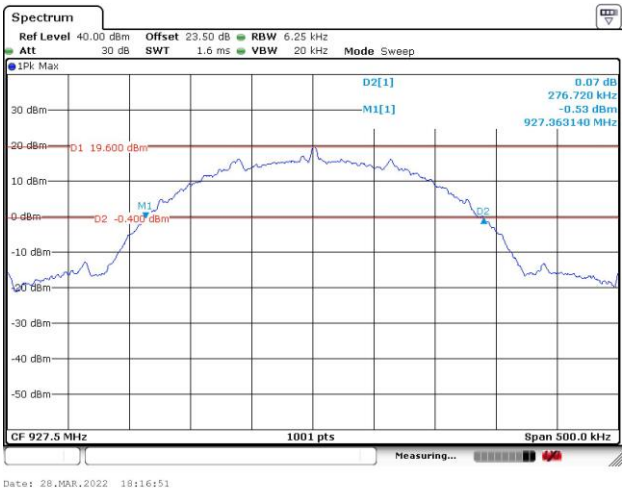
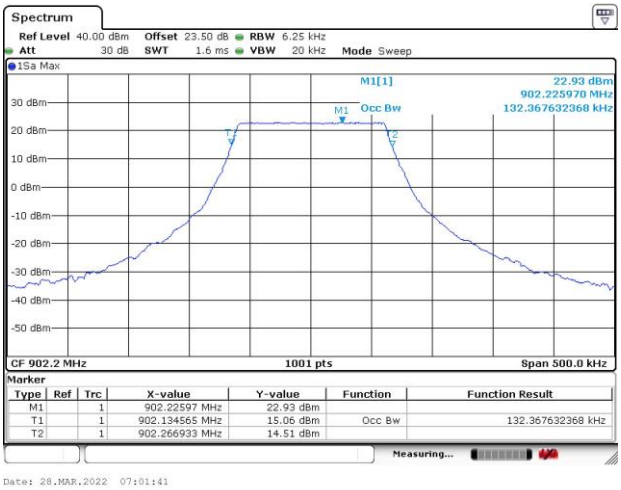
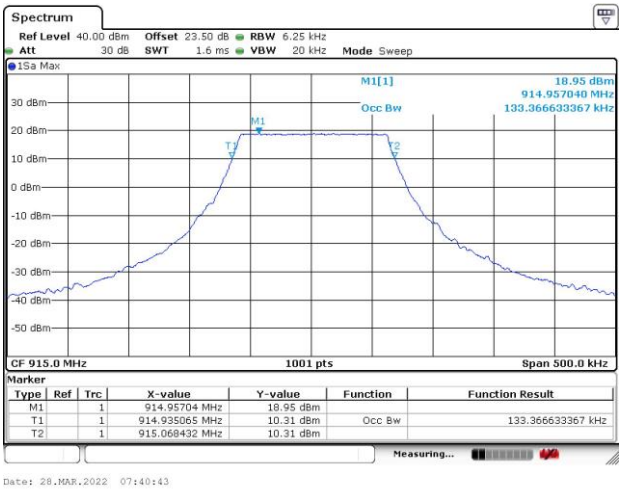
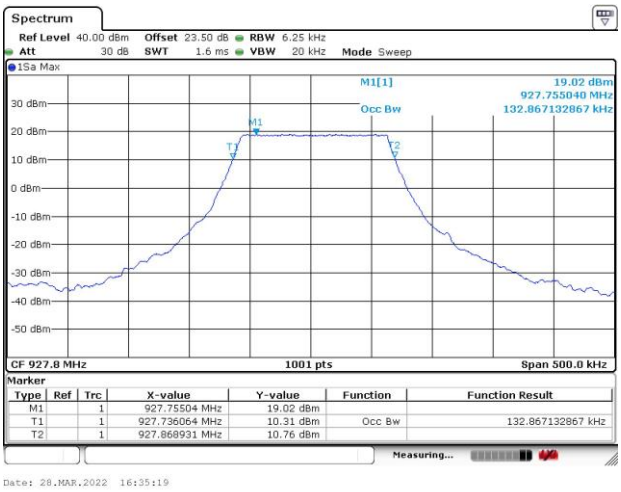
20 dB Bandwidth Plot on Channel 01	20 dB Bandwidth Plot on Channel 26
	
20 dB Bandwidth Plot on Channel 51	**-**
	**N/A**

3.4.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

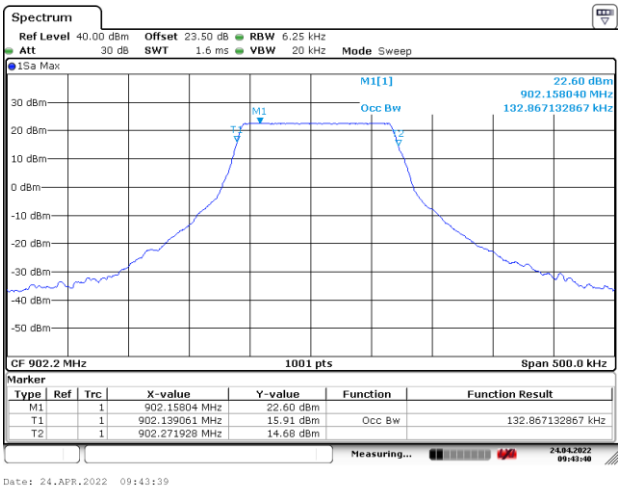
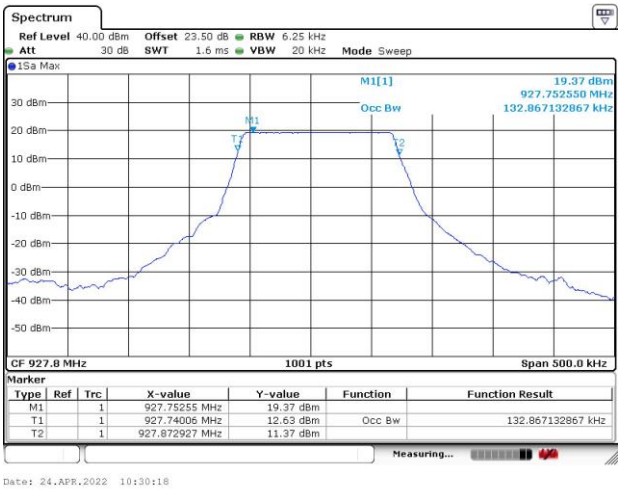
<LoRa 125KHz FHSS>

<Data Rate: SF8>

99% Occupied Bandwidth on Channel 01	99% Occupied Bandwidth on Channel 65
	
99% Occupied Bandwidth on Channel 129	**-**
	**N/A**

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

<Data Rate: SF9>

99% Occupied Bandwidth on Channel 01	99% Occupied Bandwidth on Channel 65
	
99% Occupied Bandwidth on Channel 129	**-**
	**N/A**

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

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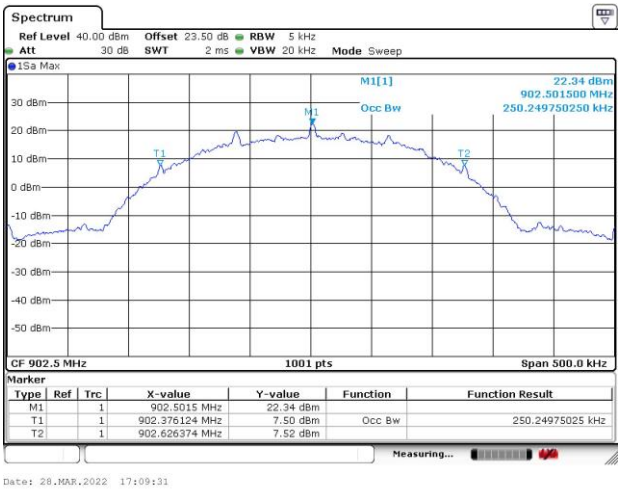
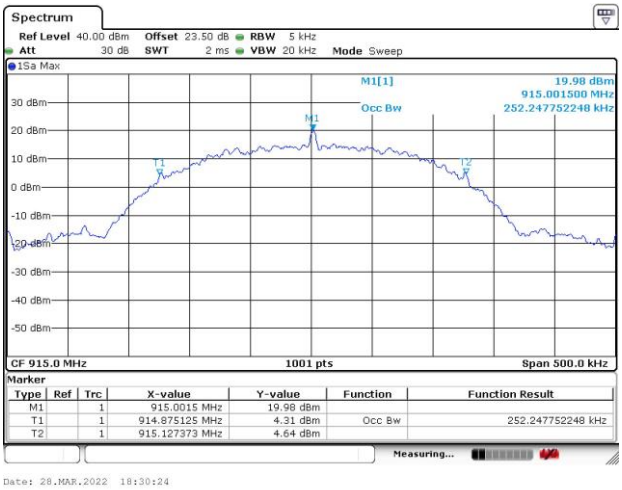
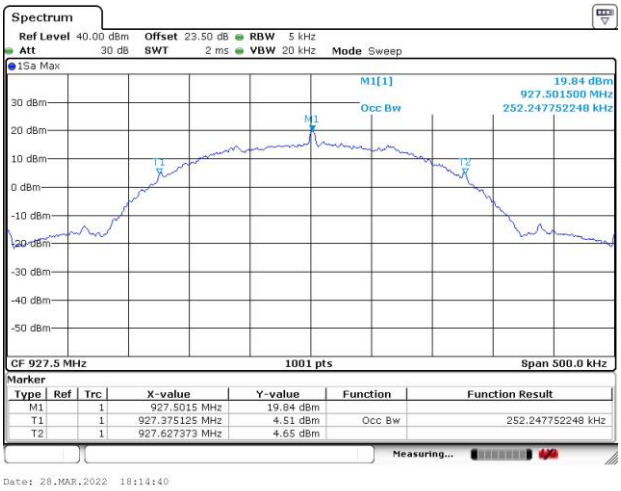
99% Occupied Bandwidth on Channel 01	99% Occupied Bandwidth on Channel 26
	
99% Occupied Bandwidth on Channel 51	**-**
	**N/A**

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.5 Output Power Measurement

3.5.1 Limit of Output Power

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.

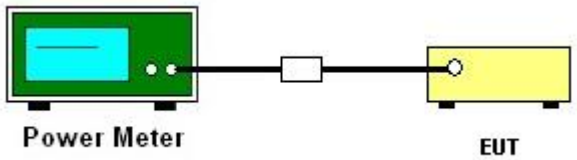
3.5.2 Measuring Instruments

See list of measuring equipment of this test report.

3.5.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.5.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

3.5.4 Test Setup



3.5.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.5.6 Test Result of Average Output Power (Reporting Only)

Please refer to Appendix A.

3.6 Conducted Band Edges Measurement

3.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

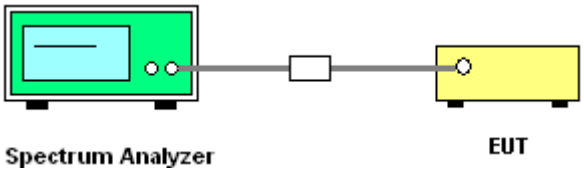
3.6.2 Measuring Instruments

See list of measuring equipment of this test report.

3.6.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.6.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz, VBW = 300kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2. and 3.
5. Measure and record the results in the test report.

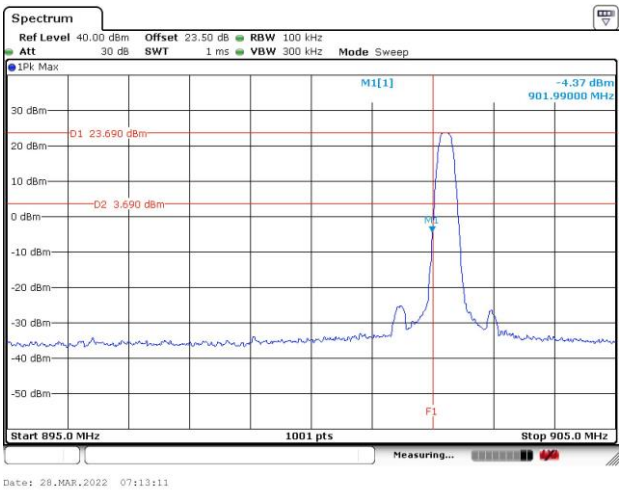
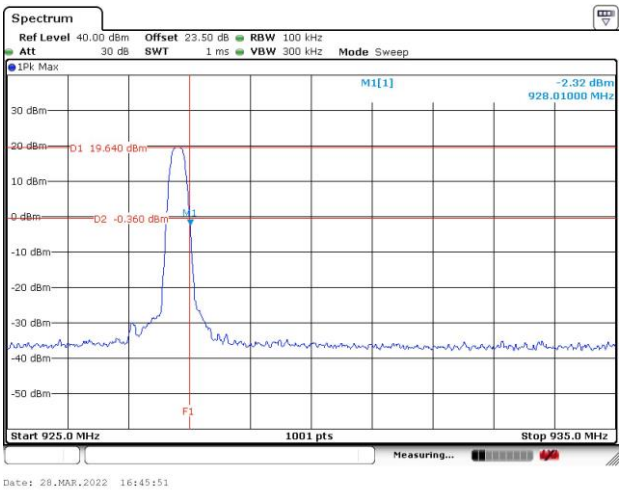
3.6.4 Test Setup



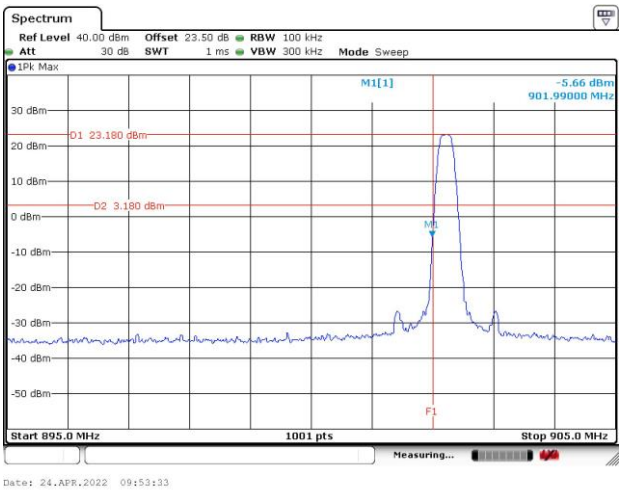
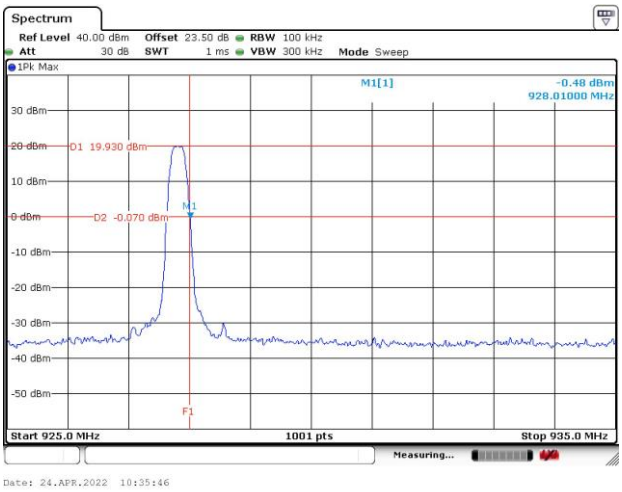
3.6.5 Test Result of Conducted Band Edges

<LoRa 125KHz FHSS>

<Data Rate: SF8>

Low Band Edge Plot on Channel 01	High Band Edge Plot on Channel 129
	

<Data Rate: SF9>

Low Band Edge Plot on Channel 01	High Band Edge Plot on Channel 129
	

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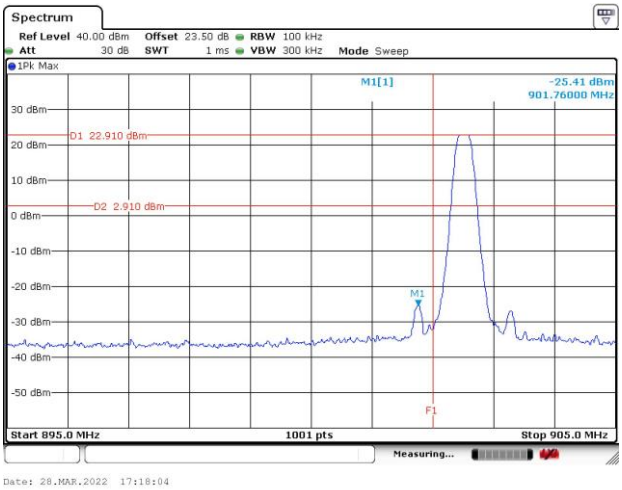
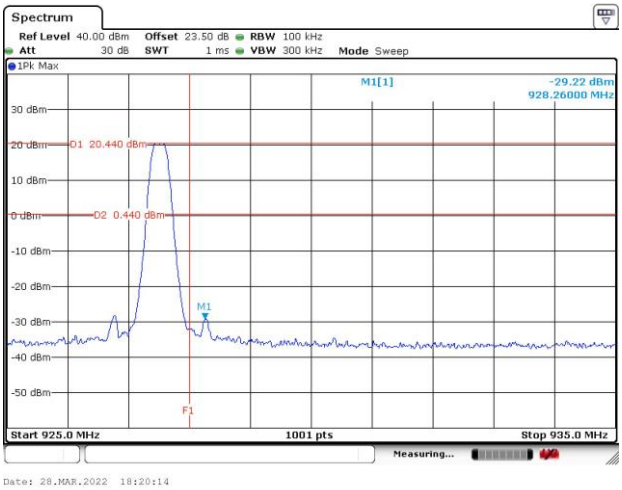
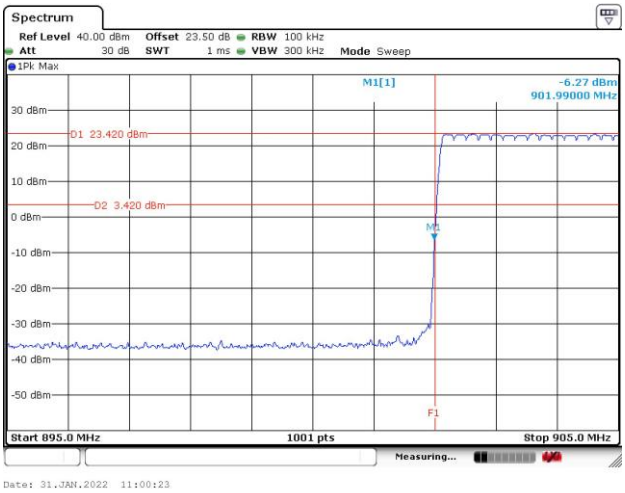
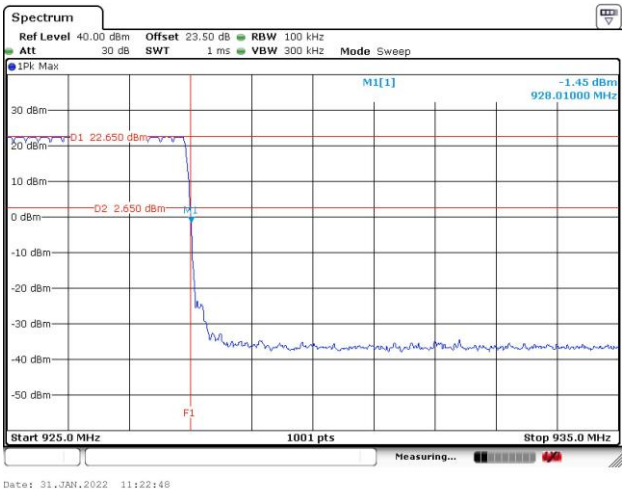
Low Band Edge Plot on Channel 01	High Band Edge Plot on Channel 51
	

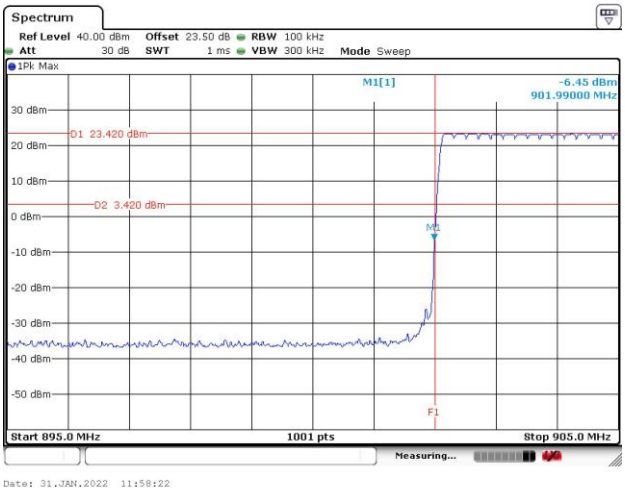
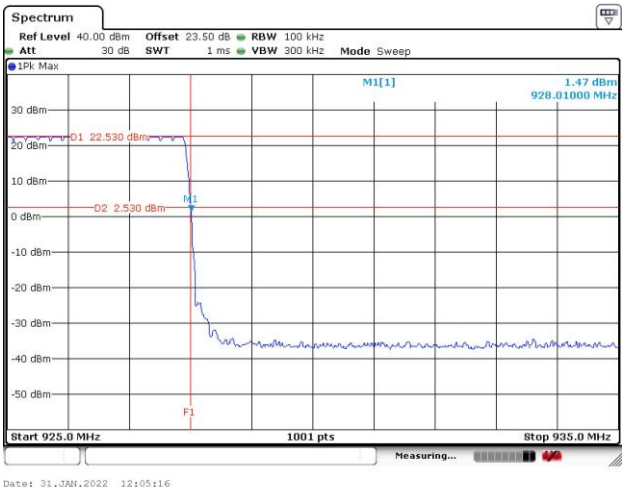
3.6.6 Test Result of Conducted Hopping Mode Band Edges

<LoRa 125KHz FHSS>

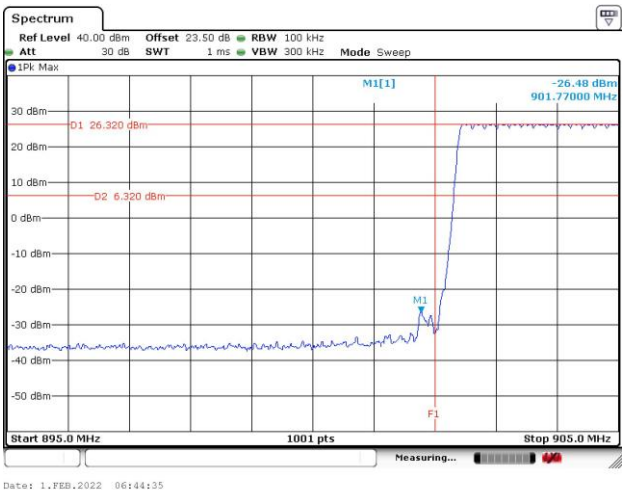
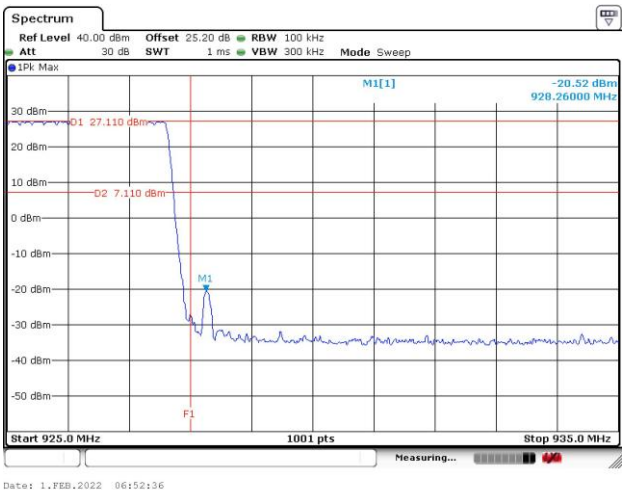
<Data Rate: SF8>

Hopping Mode Low Band Edge Plot	Hopping Mode High Band Edge Plot
	

<Data Rate: SF9>

Hopping Mode Low Band Edge Plot	Hopping Mode High Band Edge Plot
	

<FSK 250Kbps FHSS>

Hopping Mode Low Band Edge Plot	Hopping Mode High Band Edge Plot
	

3.7 Conducted Spurious Emission Measurement

3.7.1 Limit of Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

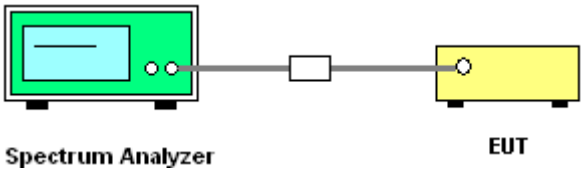
3.7.2 Measuring Instruments

See list of measuring equipment of this test report.

3.7.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.8.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

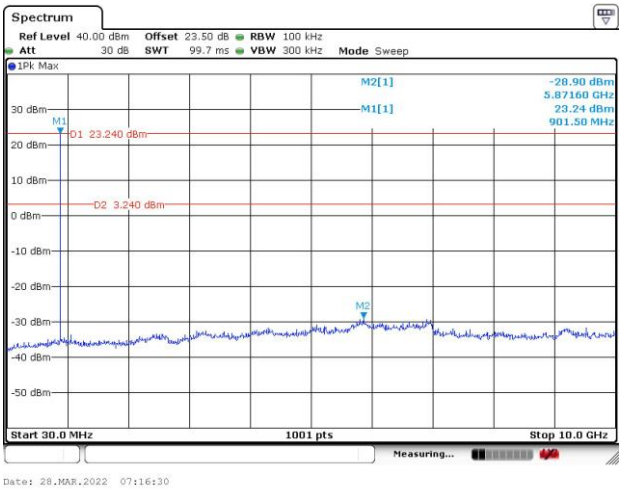
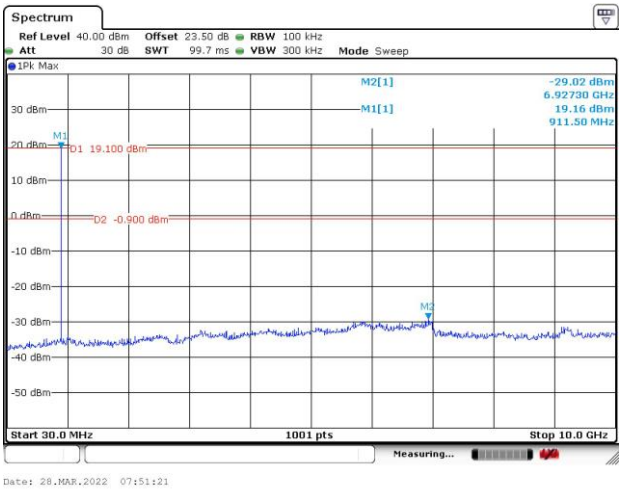
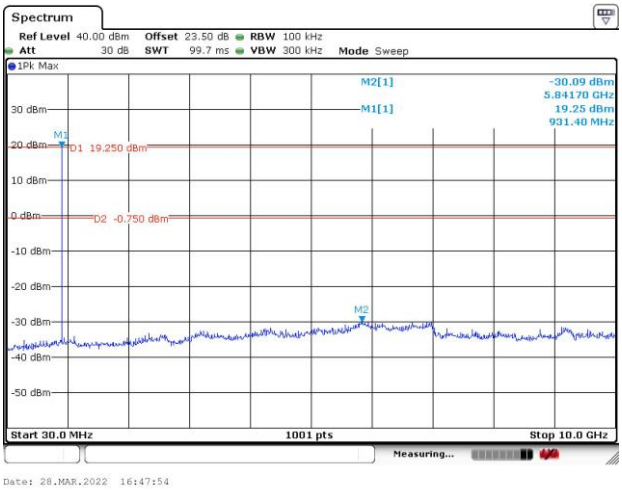
3.7.4 Test Setup



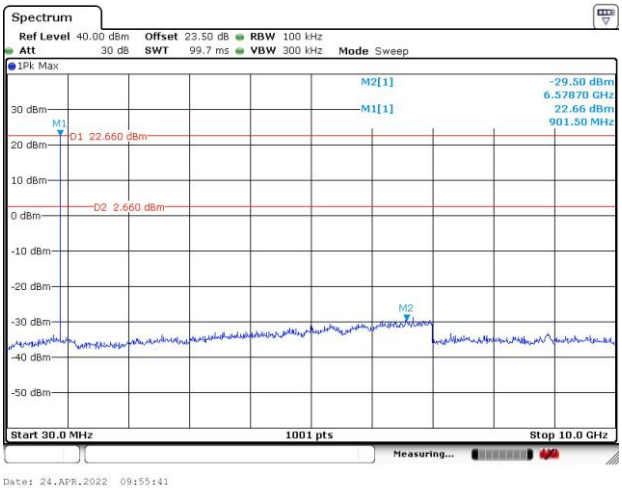
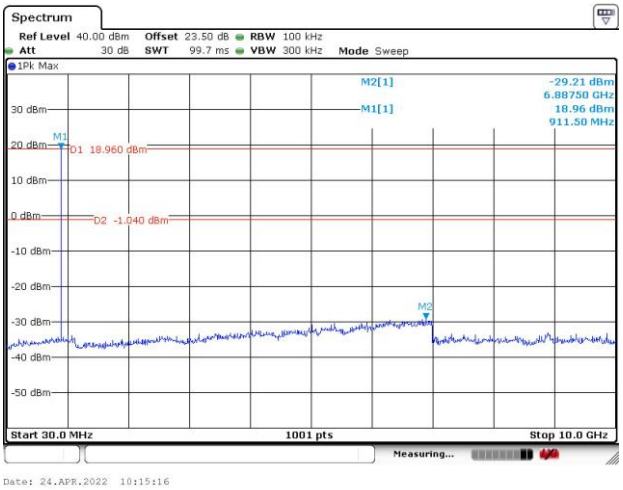
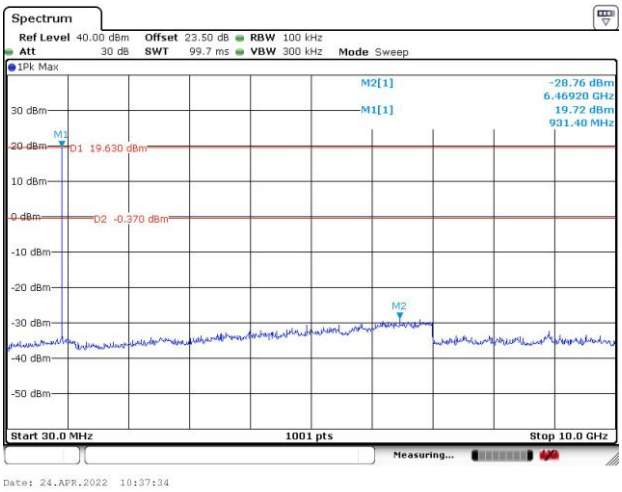
3.7.5 Test Result of Conducted Spurious Emission

<LoRa 125KHz FHSS>

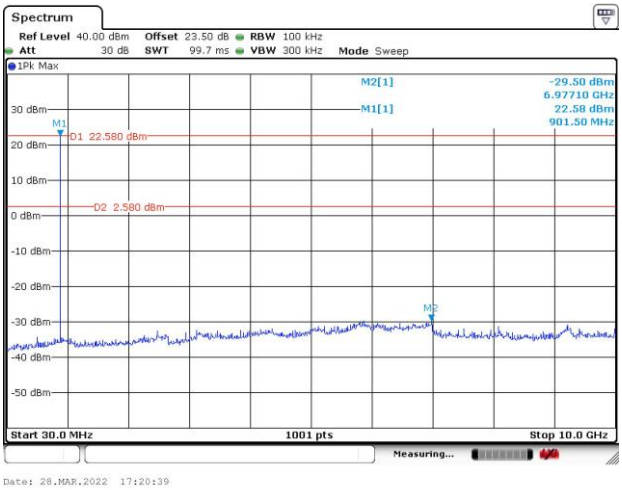
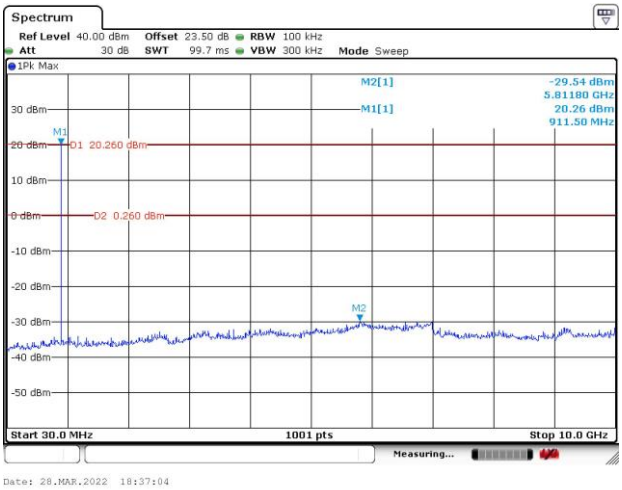
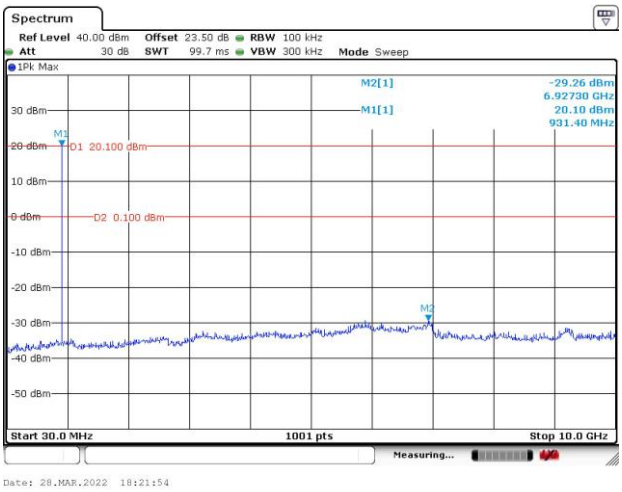
<Data Rate: SF8>

CSE Plot on Ch 01 between 30MHz ~ 10 GHz	CSE Plot on Ch 65 between 30MHz ~ 10 GHz
	
CSE Plot on Ch 129 between 30MHz ~ 10 GHz	**-**
	**N/A**

<Data Rate: SF9>

CSE Plot on Ch 01 between 30MHz ~ 10 GHz	CSE Plot on Ch 65 between 30MHz ~ 10 GHz
	
CSE Plot on Ch 129 between 30MHz ~ 10 GHz	**-**
	**N/A**

<FSK 250Kbps FHSS>

CSE Plot on Ch 01 between 30MHz ~ 10 GHz	CSE Plot on Ch 26 between 30MHz ~ 10 GHz
	
CSE Plot on Ch 51 between 30MHz ~ 10 GHz	**-**
	**N/A**

3.8 Radiated Band Edges and Spurious Emission Measurement

3.8.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

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
Above 960	500	3

3.8.2 Measuring Instruments

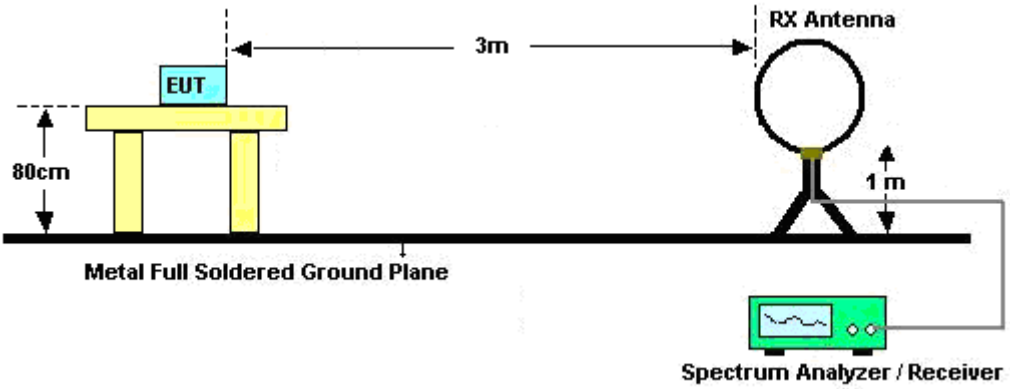
See list of measuring equipment of this test report.

3.8.3 Test Procedures

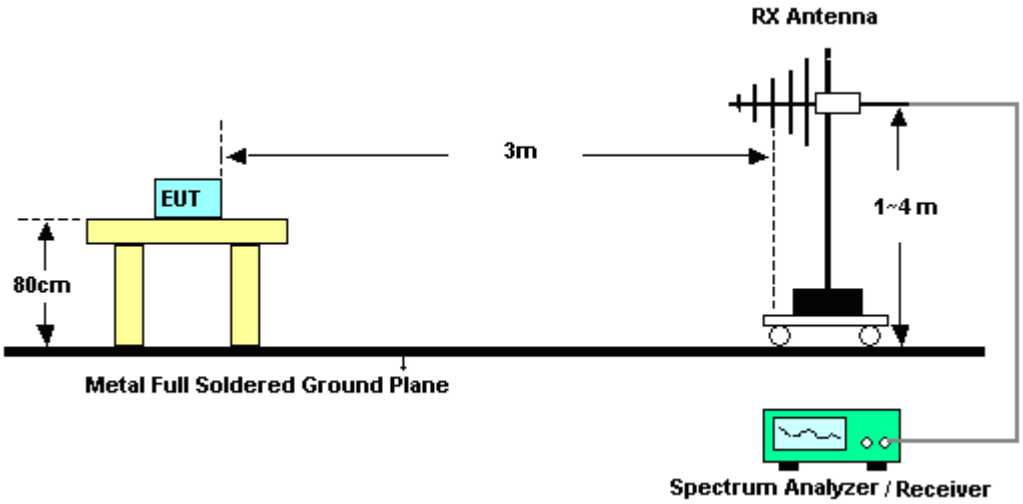
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, 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.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (3) For average measurement: use duty cycle correction factor method per 15.35(c).
   Duty cycle = On time/100 milliseconds
   On time = $N_1*L_1+N_2*L_2+...+N_{n-1}*LN_{n-1}+N_n*L_n$
   Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
   Average Emission Level = Peak Emission Level + 20*log(Duty cycle)
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
7. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.8.4 Test Setup

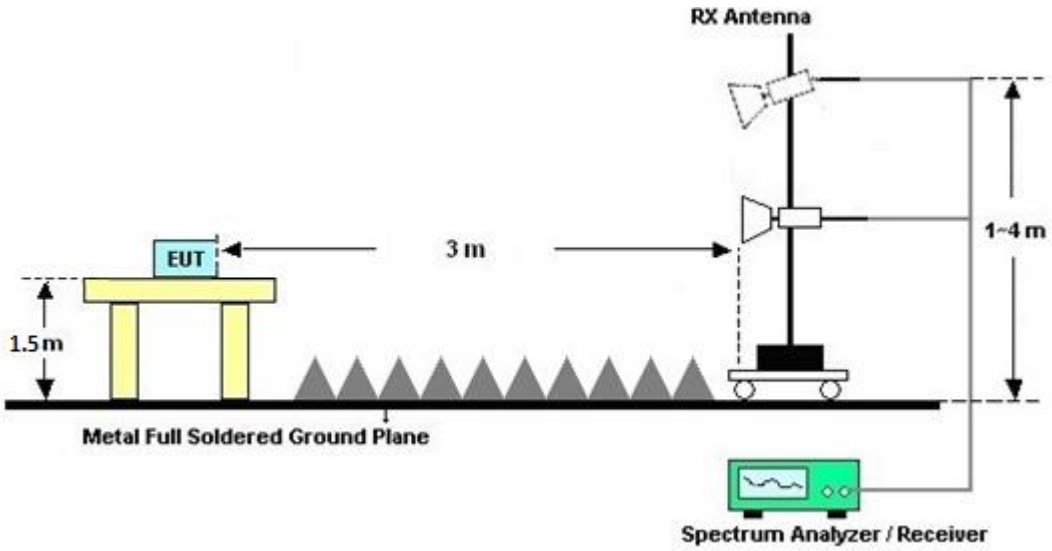
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.8.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.8.7 Duty Cycle

Please refer to Appendix E.

3.8.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix C and D.

3.9 AC Conducted Emission Measurement

3.9.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	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.

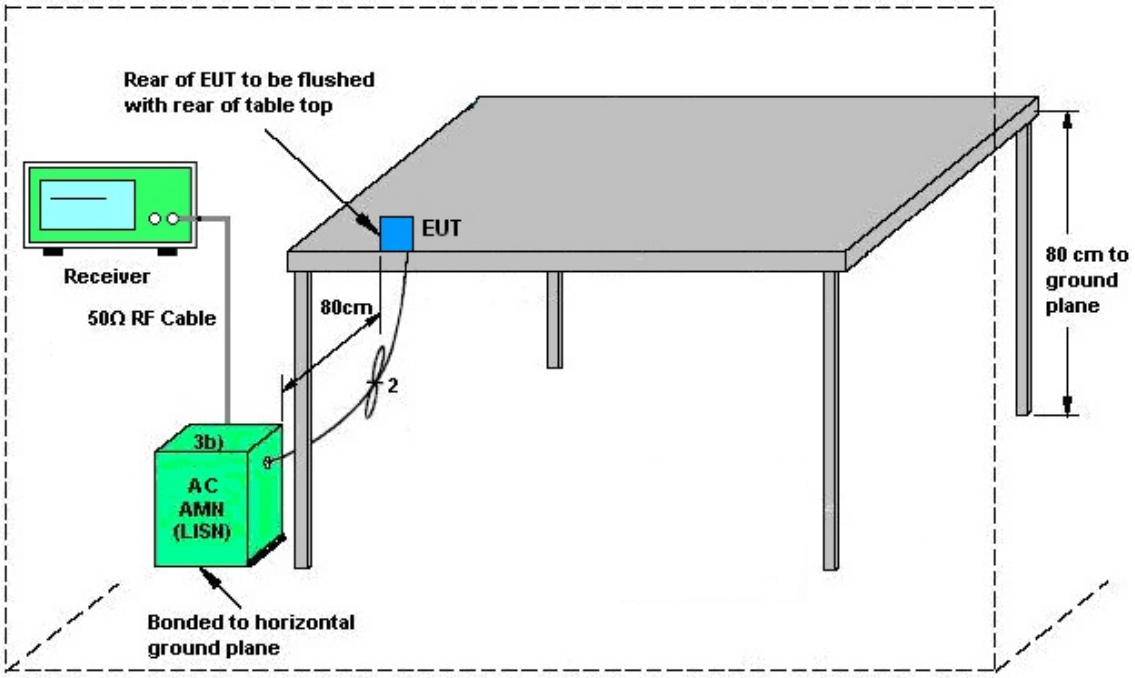
3.9.2 Measuring Instruments

See list of measuring equipment of this test report.

3.9.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.9.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.9.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.10 Antenna Requirements

3.10.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.10.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.10.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 07, 2021	Feb. 17, 2022~ Mar. 04, 2022	Sep. 06, 2022	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01 N-06	37059 & 01	30MHz~1GHz	Oct. 09, 2021	Feb. 17, 2022~ Mar. 04, 2022	Oct. 08, 2022	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1328	1GHz~18GHz	Dec. 03, 2021	Feb. 17, 2022~ Mar. 04, 2022	Dec. 02, 2022	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA9170	00993	18GHz-40GHz	Nov. 30, 2021	Feb. 17, 2022~ Mar. 04, 2022	Nov. 29, 2022	Radiation (03CH12-HY)
Preamplifier	COM-POWER	PA-103	161075	10MHz~1GHz	Mar. 24, 2021	Feb. 17, 2022~ Mar. 04, 2022	Mar. 23, 2022	Radiation (03CH12-HY)
Preamplifier	Agilent	8449B	3008A02375	1GHz~26.5GHz	May 25, 2021	Feb. 17, 2022~ Mar. 04, 2022	May 24, 2022	Radiation (03CH12-HY)
Preamplifier	E-INSTRUME NT TECH LTD.	ERA-100M-1 8G-56-01-A7 0	EC1900270	1GHz-18GHz	Dec. 27, 2021	Feb. 17, 2022~ Mar. 04, 2022	Dec. 26, 2022	Radiation (03CH12-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz~40GHz	Dec. 24, 2021	Feb. 17, 2022~ Mar. 04, 2022	Dec. 23, 2022	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA9170	00993	18GHz-40GHz	Nov. 30, 2021	Feb. 17, 2022~ Mar. 04, 2022	Nov. 29, 2022	Radiation (03CH12-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Jan. 12, 2022	Feb. 17, 2022~ Mar. 04, 2022	Jan. 11, 2023	Radiation (03CH12-HY)
Filter	Wainwright	WLKS1200-1 2SS	SN2	1.2GHz Low Pass Filter	Mar. 17, 2021	Feb. 17, 2022~ Mar. 04, 2022	Mar. 16, 2022	Radiation (03CH12-HY)
Filter	Wainwright	WHKX12-27 00-3000-180 00-60ST	SN2	3GHz High Pass Filter	Jul. 12, 2021	Feb. 17, 2022~ Mar. 04, 2022	Jul. 11, 2022	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY9837/4PE	9kHz~30MHz	Mar. 11, 2021	Feb. 17, 2022~ Mar. 04, 2022	Mar. 10, 2022	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30MHz~18GHz	Dec. 10, 2021	Feb. 17, 2022~ Mar. 04, 2022	Dec. 09, 2022	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz~40GHz	Feb. 22, 2021	Feb. 17, 2022~ Feb. 20, 2022	Feb. 21, 2022	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz~40GHz	Feb. 21, 2022	Feb. 21, 2022~ Mar. 04, 2022	Feb. 20, 2023	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz~40GHz	Feb. 22, 2021	Feb. 17, 2022~ Mar. 20, 2022	Feb. 21, 2022	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz~40GHz	Feb. 21, 2022	Feb. 21, 2022~ Mar. 04, 2022	Feb. 20, 2023	Radiation (03CH12-HY)
Hygrometer	TECPEL	DTM-303B	TP210090	N/A	Oct. 08, 2021	Feb. 17, 2022~ Mar. 04, 2022	Oct. 07, 2022	Radiation (03CH12-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Feb. 17, 2022~ Mar. 04, 2022	N/A	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500 -B	N/A	1m~4m	N/A	Feb. 17, 2022~ Mar. 04, 2022	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Feb. 17, 2022~ Mar. 04, 2022	N/A	Radiation (03CH12-HY)
Software	Audix	E3 6.2009-8-24	RK-000989	N/A	N/A	Feb. 17, 2022~ Mar. 04, 2022	N/A	Radiation (03CH12-HY)

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ACPOWER	AFC-11003G	F317040033	N/A	N/A	Mar. 08, 2022	N/A	Conduction (CO07-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Mar. 08, 2022	N/A	Conduction (CO07-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	9561-F N00373	9kHz-200MHz	Oct. 29, 2021	Mar. 08, 2022	Oct. 28, 2022	Conduction (CO07-HY)
RF Cable	HUBER + SUHNER	RG 214/U	1358175	9kHz~30MHz	Mar. 17, 2021	Mar. 08, 2022	Mar. 16, 2022	Conduction (CO07-HY)
Two-Line V-Network	TESEQ	NNB 51	45051	N/A	Feb. 16, 2022	Mar. 08, 2022	Feb. 15, 2023	Conduction (CO07-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102317	9kHz~3.6GHz	Oct. 21, 2021	Mar. 08, 2022	Oct. 20, 2022	Conduction (CO07-HY)
Hygrometer	TECPEL	TR-32	HE17XB2468	N/A	Mar. 09, 2021	Jan. 28, 2022~ Mar. 07, 2022	Mar. 08, 2022	Conducted (TH02-HY)
Hygrometer	TECPEL	TECPEL	TP210073	N/A	Nov. 16, 2021	Mar. 07, 2022~ Apr. 24, 2022	Nov. 15, 2022	Conducted (TH02-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz~40GHz	Aug. 30, 2021	Jan. 28, 2022~ Apr. 24, 2022	Aug. 29, 2022	Conducted (TH02-HY)
Power Meter	Anritsu	ML2495A	1036004	N/A	Aug. 01, 2021	Jan. 28, 2022~ Apr. 24, 2022	Jul. 31, 2022	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	1027253	300MHz~40GHz	Aug. 01, 2021	Jan. 28, 2022~ Apr. 24, 2022	Jul. 31, 2022	Conducted (TH02-HY)
Switch Box & RF Cable	Burgeon	ETF-058	EC1208321 (Box2)	N/A	Jun. 08, 2021	Jan. 28, 2022~ Apr. 24, 2022	Jun. 07, 2022	Conducted (TH02-HY)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.3 dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.8 dB

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.4 dB

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.9 dB

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Tommy Lee	Temperature:	20-25	°C
Test Date:	2022/1/28~2022/4/24	Relative Humidity:	49-56	%

<Lora 125KHz>

TEST RESULTS DATA
20dB and 99% Occupied Bandwidth and Hopping Channel Separation

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	20db BW (MHz)	99% Bandwidth (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping Channel Separation Measurement Limit (MHz)	Pass/Fail
Lora 125KHz	SF8	1	1	902.2	0.157	0.132	0.228	0.1573	Pass
Lora 125KHz	SF8	1	65	915	0.155	0.133	0.217	0.1549	Pass
Lora 125KHz	SF8	1	129	927.8	0.157	0.133	0.238	0.1573	Pass

TEST RESULTS DATA
Dwell Time

Mod.	Hopping Channel Number Rate	Hops Over Occupancy Time(hops)	Package Transfer Time (msec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
Lora 125KHz	129	1	389.35	0.39	0.4	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
Lora 125KHz	0	1	**22.71**	30.00	Pass
	39	1	18.85	30.00	Pass
	78	1	19.37	30.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

Mod.	CH.	NTX	Average Power (dBm)	Duty Factor (dB)
Lora 125KHz	0	1	**22.62**	0.00
	39	1	18.69	0.00
	78	1	19.22	0.00

TEST RESULTS DATA
Number of Hopping Frequency

Number of Hopping (Channel)	Limits (Channel)	Pass/Fail
129	> 50	Pass

TEST RESULTS DATA
20dB and 99% Occupied Bandwidth and Hopping Channel Separation

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	20db BW (MHz)	99% Bandwidth (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping Channel Separation Measurement Limit (MHz)	Pass/Fail
Lora 125KHz	SF9	1	1	902.2	0.153	0.133	0.205	0.1534	Pass
Lora 125KHz	SF9	1	65	915	0.156	0.135	0.201	0.1563	Pass
Lora 125KHz	SF9	1	129	927.8	0.154	0.133	0.207	0.1539	Pass

TEST RESULTS DATA
Dwell Time

Mod.	Hopping Channel Number Rate	Hops Over Occupancy Time(hops)	Package Transfer Time (msec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
Lora 125KHz	129	1	367.35	0.37	0.4	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
Lora 125KHz	0	1	**22.26**	30.00	Pass
	39	1	18.40	30.00	Pass
	78	1	18.97	30.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

Mod.	CH.	NTX	Average Power (dBm)	Duty Factor (dB)
Lora 125KHz	0	1	**22.17**	0.00
	39	1	18.25	0.00
	78	1	18.83	0.00

TEST RESULTS DATA
Number of Hopping Frequency

Number of Hopping (Channel)	Limits (Channel)	Pass/Fail
129	> 50	Pass

Report Number : FR240817A

<FSK 250Kbps>

TEST RESULTS DATA
20dB and 99% Occupied Bandwidth and Hopping Channel Separation

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	20db BW (MHz)	99% Bandwidth (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping Channel Separation Measurement Limit (MHz)	Pass/Fail
FSK	250Kbps	1	1	902.5	0.275	0.250	0.503	0.2752	Pass
FSK	250Kbps	1	26	915	0.277	0.252	0.510	0.2767	Pass
FSK	250Kbps	1	51	927.5	0.277	0.252	0.510	0.2767	Pass

TEST RESULTS DATA
Dwell Time

Mod.	Hopping Channel Number Rate	Hops Over Occupancy Time(hops)	Package Transfer Time (msec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
FSK	51	1.00	365.01	0.37	0.4	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
FSK	1	1	**21.83**	30.00	Pass
	26	1	19.84	30.00	Pass
	51	1	20.21	30.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

Mod.	CH.	NTX	Average Power (dBm)	Duty Factor (dB)
FSK	1	1	**21.76**	0.42
	26	1	19.83	0.42
	51	1	20.20	0.42

TEST RESULTS DATA
Number of Hopping Frequency

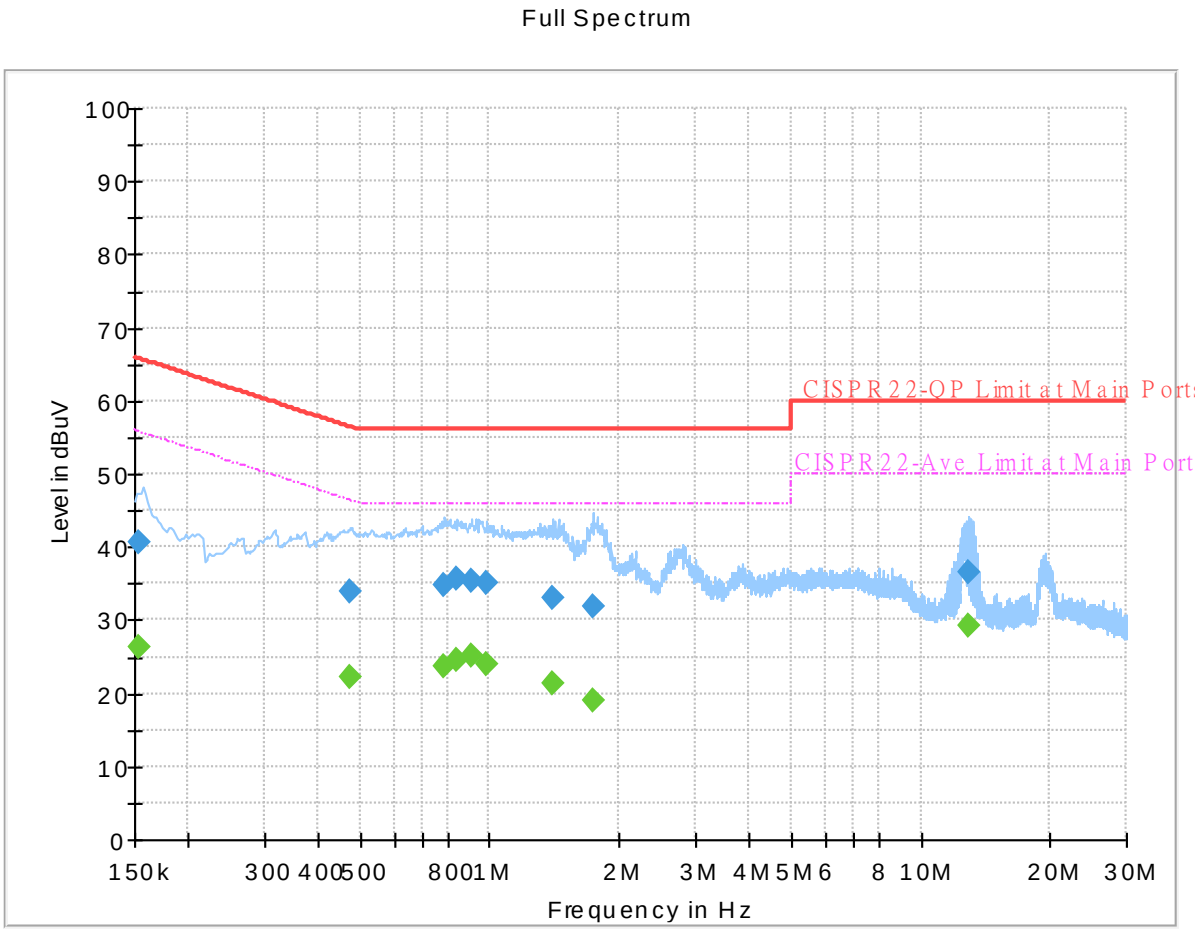
Number of Hopping (Channel)	Limits (Channel)	Pass/Fail
51	25	Pass

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Louis Chung	**Temperature :**	23~26℃
		Relative Humidity :	45~55%

EUT Information

Report NO :	240817
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line

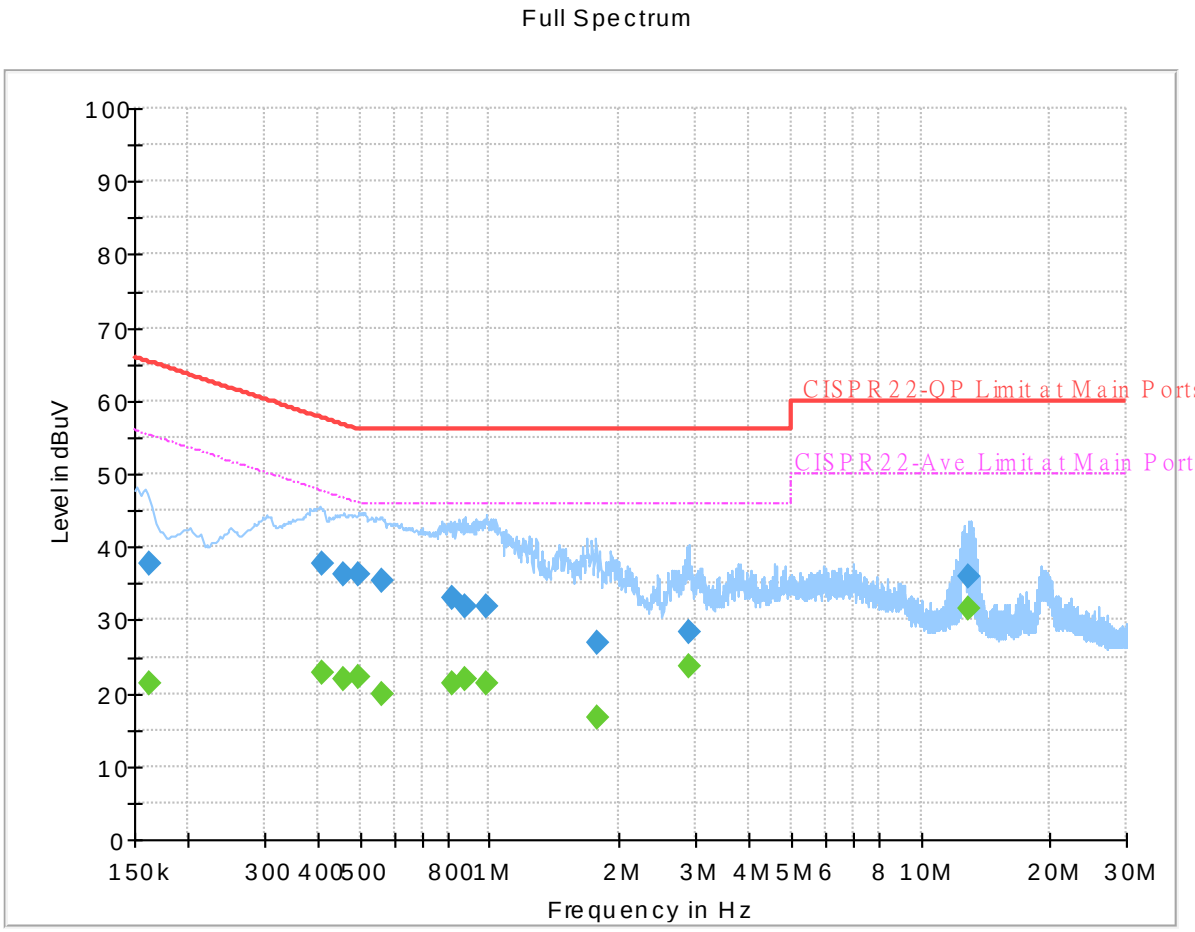


Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152790	---	26.31	55.85	29.54	L1	OFF	19.7
0.152790	40.61	---	65.85	25.24	L1	OFF	19.7
0.474810	---	22.34	46.43	24.09	L1	OFF	19.7
0.474810	34.06	---	56.43	22.37	L1	OFF	19.7
0.784320	---	23.83	46.00	22.17	L1	OFF	19.7
0.784320	34.73	---	56.00	21.27	L1	OFF	19.7
0.841560	---	24.66	46.00	21.34	L1	OFF	19.7
0.841560	35.73	---	56.00	20.27	L1	OFF	19.7
0.904650	---	25.02	46.00	20.98	L1	OFF	19.7
0.904650	35.41	---	56.00	20.59	L1	OFF	19.7
0.978000	---	24.11	46.00	21.89	L1	OFF	19.7
0.978000	35.13	---	56.00	20.87	L1	OFF	19.7
1.402620	---	21.22	46.00	24.78	L1	OFF	19.7
1.402620	33.16	---	56.00	22.84	L1	OFF	19.7
1.743000	---	19.13	46.00	26.87	L1	OFF	19.7
1.743000	31.90	---	56.00	24.10	L1	OFF	19.7
12.853860	---	29.27	50.00	20.73	L1	OFF	19.9
12.853860	36.40	---	60.00	23.60	L1	OFF	19.9

EUT Information

Report NO :	240817
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.162690	---	21.37	55.33	33.96	N	OFF	19.7
0.162690	37.72	---	65.33	27.61	N	OFF	19.7
0.408480	---	22.76	47.68	24.92	N	OFF	19.7
0.408480	37.62	---	57.68	20.06	N	OFF	19.7
0.456630	---	21.85	46.75	24.90	N	OFF	19.7
0.456630	36.37	---	56.75	20.38	N	OFF	19.7
0.495780	---	22.12	46.07	23.95	N	OFF	19.7
0.495780	36.27	---	56.07	19.80	N	OFF	19.7
0.561750	---	19.95	46.00	26.05	N	OFF	19.7
0.561750	35.34	---	56.00	20.66	N	OFF	19.7
0.816000	---	21.41	46.00	24.59	N	OFF	19.7
0.816000	32.97	---	56.00	23.03	N	OFF	19.7
0.877110	---	21.97	46.00	24.03	N	OFF	19.7
0.877110	32.00	---	56.00	24.00	N	OFF	19.7
0.980340	---	21.45	46.00	24.55	N	OFF	19.7
0.980340	31.75	---	56.00	24.25	N	OFF	19.7
1.770000	---	16.71	46.00	29.29	N	OFF	19.7
1.770000	27.05	---	56.00	28.95	N	OFF	19.7
2.902740	---	23.57	46.00	22.43	N	OFF	19.7

2.902740	**28.48**	**---**	**56.00**	**27.52**	**N**	**OFF**	**19.7**
12.968250	**---**	**31.65**	**50.00**	**18.35**	**N**	**OFF**	**19.9**
12.968250	**35.89**	**---**	**60.00**	**24.11**	**N**	**OFF**	**19.9**

Appendix C. Radiated Spurious Emission

Test Engineer :	Jack Cheng and Lance Chiang	Temperature :	22~26°C
		Relative Humidity :	59~66%

902~928MHz

LoRa (125KHz)_SF8 (Harmonic @ 3m)

LoRa	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
LoRa(125KHz)_SF8 Ch01 902.2MHz		2706.6	56.18	-17.82	74	54.05	28.17	7.49	33.53	300	135	P	H
		2706.6	48.43	-5.57	54	46.3	28.17	7.49	33.53	300	135	A	H
		3608.8	51.87	-22.13	74	79.69	29.22	9.9	66.94	333	253	P	H
		3608.8	49.34	-4.66	54	77.16	29.22	9.9	66.94	333	253	A	H
		4511	52.09	-21.91	74	78.02	30.64	10.73	67.3	152	32	P	H
		4511	46.29	-7.71	54	72.22	30.64	10.73	67.3	152	32	A	H
		5413.2	47.72	-26.28	74	70.59	31.75	11.65	66.27	-	-	P	H
		8119.8	46.61	-27.39	74	61.77	36.76	14.46	66.38	-	-	P	H
		9022	46.41	-27.59	74	61.04	37.74	15.1	67.47	-	-	P	H
		2706.6	51.95	-22.05	74	49.82	28.17	7.49	33.53	200	71	P	V
		2706.6	42.2	-11.8	54	40.07	28.17	7.49	33.53	200	71	A	V
		3608.8	47.15	-26.85	74	74.97	29.22	9.9	66.94	-	-	P	V
		4511	46.83	-27.17	74	72.76	30.64	10.73	67.3	-	-	P	V
		5413.2	42.02	-31.98	74	64.89	31.75	11.65	66.27	-	-	P	V
		8119.8	47.04	-26.96	74	62.2	36.76	14.46	66.38	-	-	P	V
		9022	46.44	-27.56	74	61.07	37.74	15.1	67.47	-	-	P	V

LoRa	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
LoRa(125KHz)_SF8 Ch65 915MHz		2745	49	-25	74	46.94	28.02	7.56	33.52	-	-	P	H
		3660	40.36	-33.64	74	68.08	29.32	9.94	66.98	-	-	P	H
		4575	40.16	-33.84	74	65.53	30.95	10.9	67.22	-	-	P	H
		7320	48.78	-25.22	74	64.82	36.38	13.53	65.95	-	-	P	H
		8235	44.65	-29.35	74	60.16	36.53	14.47	66.51	-	-	P	H
		9150	46.52	-27.48	74	60.73	38.1	15.19	67.5	-	-	P	H
		2745	48.56	-25.44	74	46.5	28.02	7.56	33.52	-	-	P	V
		3660	39.46	-34.54	74	67.18	29.32	9.94	66.98	-	-	P	V
		4575	40.61	-33.39	74	65.98	30.95	10.9	67.22	-	-	P	V
		7320	53.2	-20.8	74	69.24	36.38	13.53	65.95	100	354	P	V
		7320	49.05	-4.95	54	65.09	36.38	13.53	65.95	100	354	A	V
		8235	44.24	-29.76	74	59.75	36.53	14.47	66.51	-	-	P	V
		9150	46.47	-27.53	74	60.68	38.1	15.19	67.5	-	-	P	V
LoRa(125KHz)_SF8 Ch129 927.8MHz		2783.4	49.01	-24.99	74	46.88	28	7.63	33.5	-	-	P	H
		3711.2	44.26	-29.74	74	71.87	29.44	9.97	67.02	-	-	P	H
		4639	40.22	-33.78	74	65.16	31.26	10.95	67.15	-	-	P	H
		7422.4	47.1	-26.9	74	62.84	36.7	13.65	66.09	-	-	P	H
		8350.2	44.2	-29.8	74	59.91	36.4	14.54	66.65	-	-	P	H
													H
		2783.4	49.28	-24.72	74	47.15	28	7.63	33.5	-	-	P	V
		3711.2	42.46	-31.54	74	70.07	29.44	9.97	67.02	-	-	P	V
		4639	40.24	-33.76	74	65.18	31.26	10.95	67.15	-	-	P	V
		7422	54.9	-19.1	74	70.64	36.7	13.65	66.09	100	360	P	V
		7422	51	-3	54	66.74	36.7	13.65	66.09	100	360	A	V
		8350.2	44.96	-29.04	74	60.67	36.4	14.54	66.65	-	-	P	V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.
3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

Emission below 1GHz

LoRa (125KHz)_SF8

LoRa	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
LoRa(125KHz)_SF8 Ch01 902.2MHz LF		44.55	28.68	-11.32	40	33.37	16.95	10.99	32.63	-	-	P	H
		147.37	32.59	-10.91	43.5	36.33	17.13	11.69	32.56	-	-	P	H
		279.29	39.29	-6.71	46	40.67	18.78	12.37	32.53	-	-	P	H
		446.13	38.99	-7.01	46	35.3	23.16	13.07	32.54	-	-	P	H
		536.34	39.25	-6.75	46	34.26	24.18	13.37	32.56	-	-	P	H
		582.9	38.72	-7.28	46	32.09	25.68	13.52	32.57	-	-	P	H
	*	902.2	116.67	-	-	104.89	28.99	14.47	31.68	210	103	P	H
													H
													H
													H
													H
													H
		37.76	35.35	-4.65	40	36.43	20.66	10.9	32.64	100	39	QP	V
		44.55	36.4	-3.6	40	41.09	16.95	10.99	32.63	100	54	QP	V
		86.26	29.37	-10.63	40	36.56	14.09	11.3	32.58	-	-	P	V
		145.43	31.25	-12.25	43.5	34.97	17.16	11.68	32.56	-	-	P	V
		261.83	35.73	-10.27	46	36.18	19.82	12.26	32.53	-	-	P	V
		450.98	38.46	-7.54	46	34.69	23.23	13.08	32.54	-	-	P	V
	*	902.2	111.64	-	-	99.86	28.99	14.47	31.68	105	201	P	V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db and the result which was 20dB lower than the limit line was not reported.
4. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only.

LoRa	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
LoRa(125KHz)_SF8 Ch65 915MHz LF		30	28.84	-11.16	40	26.05	24.67	10.77	32.65	-	-	P	H
		44.55	27.88	-12.12	40	32.57	16.95	10.99	32.63	-	-	P	H
		154.16	33.61	-9.89	43.5	37.62	16.82	11.72	32.55	-	-	P	H
		260.86	39.51	-6.49	46	39.97	19.82	12.25	32.53	-	-	P	H
		334.58	33.51	-12.49	46	33.48	19.91	12.65	32.53	-	-	P	H
		450.98	37.56	-8.44	46	33.79	23.23	13.08	32.54	-	-	P	H
	*	915	111.9	-	-	99.68	29.29	14.5	31.57	201	111	P	H
													H
													H
													H
													H
													H
		37.76	34.93	-5.07	40	36.01	20.66	10.9	32.64	100	59	QP	V
		43.58	36.26	-3.74	40	40.56	17.35	10.98	32.63	100	84	QP	V
		145.43	30.37	-13.13	43.5	34.09	17.16	11.68	32.56	-	-	P	V
		259.89	36.42	-9.58	46	36.9	19.8	12.25	32.53	-	-	P	V
		280.26	33.09	-12.91	46	34.44	18.8	12.38	32.53	-	-	P	V
		609.09	36.64	-9.36	46	29.85	25.76	13.59	32.56	-	-	P	V
	*	915	107.06	-	-	94.84	29.29	14.5	31.57	106	210	P	V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db and the result which was 20dB lower than the limit line was not reported.
4. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only.

LoRa	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
LoRa(125KHz)_SF8 Ch129 927.8MHz LF		45.52	31.98	-8.02	40	37.07	16.54	11	32.63	-	-	P	H
		146.4	33.54	-9.96	43.5	37.23	17.18	11.69	32.56	-	-	P	H
		255.04	39.63	-6.37	46	40.86	19.09	12.21	32.53	-	-	P	H
		274.44	37.89	-8.11	46	39.33	18.75	12.34	32.53	100	286	QP	H
		450.01	37.78	-8.22	46	34.02	23.22	13.08	32.54	-	-	P	H
		461.65	39.89	-6.11	46	35.9	23.41	13.12	32.54	-	-	P	H
	*	927.8	111.65	-	-	98.86	29.73	14.52	31.46	205	109	P	H
													H
													H
													H
													H
													H
		37.76	32.76	-7.24	40	33.84	20.66	10.9	32.64	100	104	QP	V
		44.55	35.3	-4.7	40	39.99	16.95	10.99	32.63	100	102	QP	V
		143.49	31.54	-11.96	43.5	35.22	17.21	11.67	32.56	-	-	P	V
		267.65	37.75	-8.25	46	38.61	19.38	12.29	32.53	-	-	P	V
		273.47	34.14	-11.86	46	35.54	18.8	12.33	32.53	-	-	P	V
		459.71	39.07	-6.93	46	35.13	23.37	13.11	32.54	-	-	P	V
	*	927.8	108.83	-	-	96.04	29.73	14.52	31.46	110	203	P	V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db and the result which was 20dB lower than the limit line was not reported.
4. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only.

902~928MHz

FSK 250Kbps (Harmonic @ 3m)

FSK	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
FSK 250Kbps FHSS CH 01 902.5MHz		2707.5	48.79	-25.21	74	46.66	28.17	7.49	33.53	-	-	P	H
		3610	49.44	-24.56	74	77.25	29.22	9.91	66.94	100	125	P	H
		3610	46.81	-7.19	54	74.62	29.22	9.91	66.94	100	125	A	H
		4512.5	44.55	-29.45	74	70.46	30.65	10.74	67.3	-	-	P	H
		5415	41.24	-32.76	74	64.09	31.76	11.66	66.27	-	-	P	H
		8122.5	44.93	-29.07	74	60.09	36.76	14.46	66.38	-	-	P	H
		9025	46.62	-27.38	74	61.24	37.75	15.1	67.47	-	-	P	H
		2707.5	48.44	-25.56	74	46.31	28.17	7.49	33.53	-	-	P	V
		3610	45.91	-28.09	74	73.72	29.22	9.91	66.94	-	-	P	V
		4512.5	43.5	-30.5	74	69.41	30.65	10.74	67.3	-	-	P	V
		5415	40.3	-33.7	74	63.15	31.76	11.66	66.27	-	-	P	V
		8122.5	44.65	-29.35	74	59.81	36.76	14.46	66.38	-	-	P	V
		9025	46.77	-27.23	74	61.39	37.75	15.1	67.47	-	-	P	V
													V
FSK 250Kbps FHSS CH 25 915MHz		2745	48.81	-25.19	74	46.75	28.02	7.56	33.52	-	-	P	H
		3660	42.48	-31.52	74	70.2	29.32	9.94	66.98	-	-	P	H
		4575	40.01	-33.99	74	65.38	30.95	10.9	67.22	-	-	P	H
		7320	57.59	-16.41	74	73.63	36.38	13.53	65.95	316	83	P	H
		7320	49.02	-4.98	54	65.06	36.38	13.53	65.95	316	83	A	H
		8235	45.12	-28.88	74	60.63	36.53	14.47	66.51	-	-	P	H
		9150	47.85	-26.15	74	62.06	38.1	15.19	67.5	-	-	P	H
		2745	48.86	-25.14	74	46.8	28.02	7.56	33.52	-	-	P	V
		3660	40.4	-33.6	74	68.12	29.32	9.94	66.98	-	-	P	V
		4575	40.83	-33.17	74	66.2	30.95	10.9	67.22	-	-	P	V
		7320	57.37	-16.63	74	73.41	36.38	13.53	65.95	172	343	P	V
		7320	48.13	-5.87	54	64.17	36.38	13.53	65.95	172	343	A	V
		8235	46.37	-27.63	74	61.88	36.53	14.47	66.51	-	-	P	V
		9150	47.9	-26.1	74	62.11	38.1	15.19	67.5	-	-	P	V

FSK	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
FSK 250Kbps FHSS CH 51 927.5MHz		2782.5	49.02	-24.98	74	46.89	28	7.63	33.5	-	-	P	H
		3710	50.26	-23.74	74	77.87	29.44	9.97	67.02	115	127	P	H
		3710	47.07	-6.93	54	74.68	29.44	9.97	67.02	115	127	A	H
		4637.5	43.31	-30.69	74	68.26	31.25	10.95	67.15	-	-	P	H
		7420	59.56	-14.44	74	75.3	36.7	13.64	66.08	334	89	P	H
		7420	50.9	-3.1	54	66.64	36.7	13.64	66.08	334	89	A	H
		8347.5	44.98	-29.02	74	60.67	36.41	14.54	66.64	-	-	P	H
		2782.5	49.25	-24.75	74	47.12	28	7.63	33.5	-	-	P	V
		3710	45.31	-28.69	74	72.92	29.44	9.97	67.02	-	-	P	V
		4637.5	41.47	-32.53	74	66.42	31.25	10.95	67.15	-	-	P	V
		7420	59.2	-14.8	74	74.94	36.7	13.64	66.08	104	87	P	V
		7420	49.55	-4.45	54	65.29	36.7	13.64	66.08	104	87	A	V
		8347.5	45.2	-28.8	74	60.89	36.41	14.54	66.64			P	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

Emission below 1GHz

FSK 250Kbps

FSK	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
FSK 250Kbps FHSS CH 01 902.5MHz		37.76	29.03	-10.97	40	27.12	20.66	10.9	29.65	-	-	P	H
		199.75	37.62	-5.88	43.5	40.2	14.98	11.94	29.5	-	-	P	H
		267.65	35.42	-10.58	46	33.11	19.38	12.29	29.36	123	30	QP	H
		327.79	38.49	-7.51	46	35.46	19.68	12.62	29.27	-	-	P	H
		609.09	45.81	-0.19	46	35.32	25.76	13.59	28.86	147	56	QP	H
	*	902.5	113.51	-	-	98.24	28.99	14.47	28.19	201	101	P	H
		987.39	45.77	-8.23	54	28.78	30.3	14.74	28.05	-	-	P	H
													H
													H
													H
													H
		37.76	30.66	-9.34	40	28.75	20.66	10.9	29.65	-	-	P	V
		198.78	31.43	-12.07	43.5	34.07	14.92	11.94	29.5	-	-	P	V
		279.29	39.85	-6.15	46	38.04	18.78	12.37	29.34	-	-	P	V
		292.87	38.96	-7.04	46	36.67	19.14	12.46	29.31	-	-	P	V
		609.09	41.41	-4.59	46	30.92	25.76	13.59	28.86	116	102	QP	V
	*	902.5	115.32	-	-	100.05	28.99	14.47	28.19	105	200	P	V
		974.78	46.75	-7.25	54	29.55	30.6	14.68	28.08	-	-	P	V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db and the result which was 20dB lower than the limit line was not reported.
4. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only.

FSK	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
FSK 250Kbps FHSS CH 25 915MHz		114.39	27.52	-15.98	43.5	28.61	17.05	11.49	29.63	-	-	P	H
		128.94	28.11	-15.39	43.5	28.75	17.4	11.59	29.63	-	-	P	H
		274.44	32.97	-13.03	46	31.23	18.75	12.34	29.35	100	54	QP	H
		399.57	38.16	-7.84	46	32.57	21.94	12.85	29.2	-	-	P	H
		602.3	34.1	-11.9	46	23.82	25.58	13.57	28.87	140	348	QP	H
	*	915	113.22	-	-	97.62	29.28	14.5	28.18	204	111	P	H
		977.69	45.88	-8.12	54	28.7	30.55	14.7	28.07	-	-	P	H
													H
													H
													H
													H
													H
		113.42	27.86	-15.64	43.5	29.03	16.98	11.48	29.63	-	-	P	V
		117.3	28.41	-15.09	43.5	29.32	17.22	11.51	29.64	-	-	P	V
		324.88	32.48	-13.52	46	29.55	19.59	12.61	29.27	-	-	P	V
		395.69	34.55	-11.45	46	29.13	21.78	12.84	29.2	-	-	P	V
		609.09	34.29	-11.71	46	23.8	25.76	13.59	28.86	100	67	QP	V
	*	915	108.37	-	-	92.77	29.28	14.5	28.18	108	203	P	V
		983.51	45.26	-8.74	54	28.19	30.4	14.73	28.06	-	-	P	V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db and the result which was 20dB lower than the limit line was not reported.
4. The emission position marked as "-" means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only.

FSK	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
FSK 250Kbps FHSS CH 51 927.5MHz		112.45	27.62	-15.88	43.5	28.85	16.93	11.47	29.63	-	-	P	H
		256.98	37.18	-8.82	46	34.96	19.37	12.23	29.38	-	-	P	H
		284.14	39.05	-6.95	46	37.05	18.92	12.4	29.32	-	-	P	H
		327.79	28.34	-17.66	46	25.31	19.68	12.62	29.27	118	318	QP	H
		609.09	43.58	-2.42	46	33.09	25.76	13.59	28.86	161	305	QP	H
	*	927.5	112.52	-	-	-	29.7	14.52	28.16	206	102	P	H
		971.87	44.95	-9.05	54	27.73	30.64	14.67	28.09	-	-	P	H
													H
													H
													H
													H
													H
		165.8	25.97	-17.53	43.5	27.84	15.9	11.78	29.55	-	-	P	V
		279.29	39.64	-6.36	46	37.83	18.78	12.37	29.34	-	-	P	V
		329.73	30.79	-15.21	46	27.69	19.74	12.63	29.27	-	-	P	V
		404.42	33.69	-12.31	46	27.87	22.14	12.87	29.19	-	-	P	V
		602.3	33.84	-12.16	46	23.56	25.58	13.57	28.87	100	355	QP	V
	*	927.5	110.17	-	-	-	29.7	14.52	28.16	113	211	P	V
		966.05	46.44	-7.56	54	29.11	30.79	14.64	28.1	-	-	P	V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db and the result which was 20dB lower than the limit line was not reported.
4. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only.

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

LoRa	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
LoRa CH 01 902.2MHz		910	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		910	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 910MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 910MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

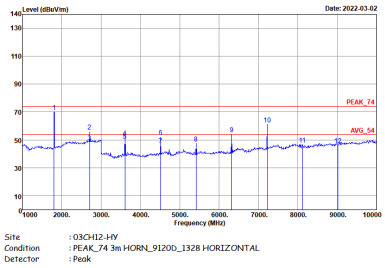
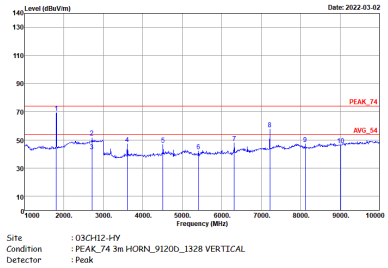
Both peak and average measured complies with the limit line, so test result is “PASS”.

Appendix D. Radiated Spurious Emission Plots

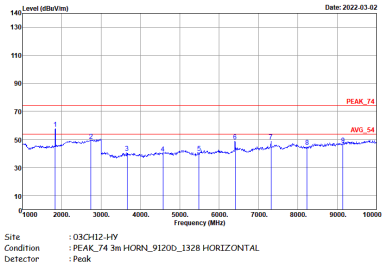
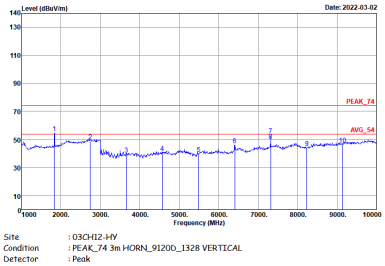
Test Engineer :	Jack Cheng and Lance Chiang	Temperature :	22~26°C
		Relative Humidity :	59~66%

902~928MHz

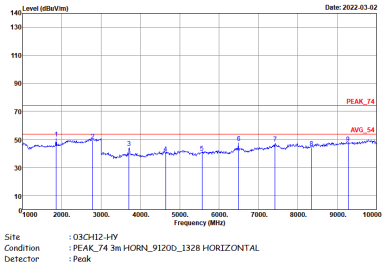
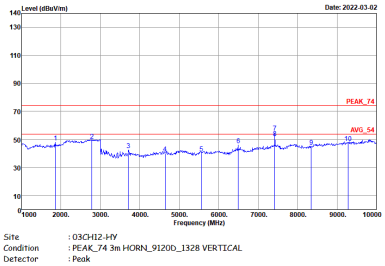
LoRa (125KHz)_SF8 (Harmonic @ 3m)

LoRa	902~928MHz Harmonic @ 3m	
	LoRa (125KHz)_SF8 Ch01 902.2MHz	
	Horizontal	Vertical
Peak Avg.		

Remark: The unwanted signal of mark #1.9.10 in Horizontal plot and #1.7.8 in Vertical plot falls within the non-restricted band and meet the requirements of 15.247 (d).

LoRa	902~928MHz Harmonic @ 3m	
	LoRa (125KHz)_SF8 Ch65 915MHz	
	Horizontal	Vertical
Peak Avg.		

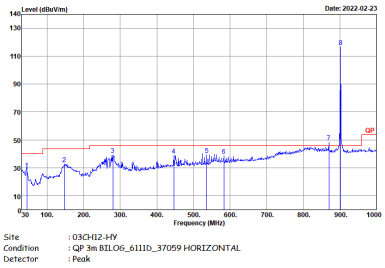
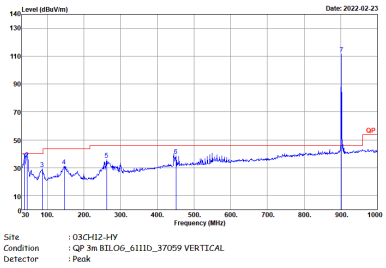
Remark: The unwanted signal of mark #1.5.6 in Horizontal plot and #1.5.6 in Vertical plot falls within the non-restricted band and meet the requirements of 15.247 (d).

LoRa	902~928MHz Harmonic @ 3m	
	LoRa (125KHz)_SF8 Ch129 927.8MHz	
	Horizontal	Vertical
Peak Avg.		

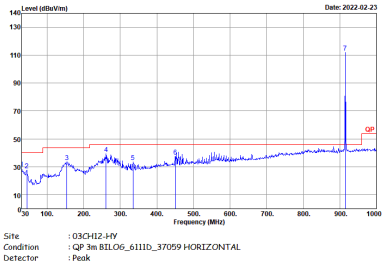
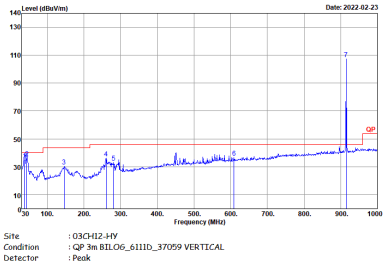
Remark: The unwanted signal of mark #1.5.6.9 in Horizontal plot and #1.5.6.10 in Vertical plot falls within the non-restricted band and meet the requirements of 15.247 (d).

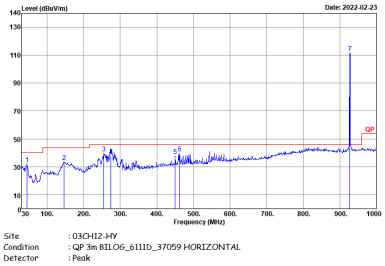
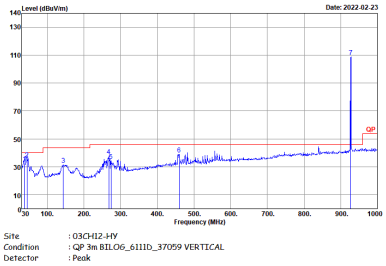
Emission below 1GHz

LoRa (125KHz)_SF8

LoRa	902~928MHz	
	LoRa (125KHz)_SF8 Ch01 902.2MHz LF	
	Horizontal	Vertical
QP / Peak		

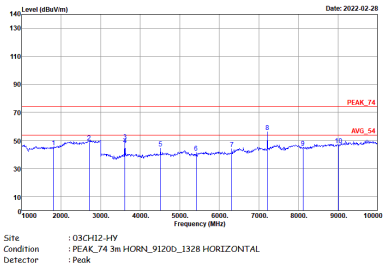
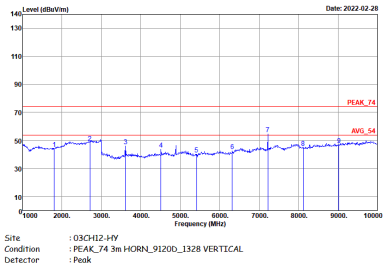
Remark: The unwanted signal of mark #7 in Horizontal plot falls within the non-restricted band and meet the requirements of 15.247 (d).

LoRa	902~928MHz	
	LoRa (125KHz)_SF8 Ch65 915MHz LF	
	Horizontal	Vertical
QP / Peak		

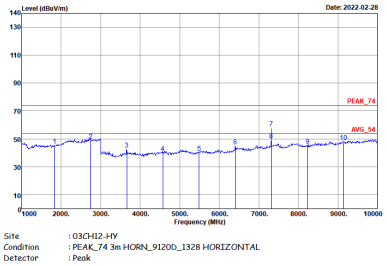
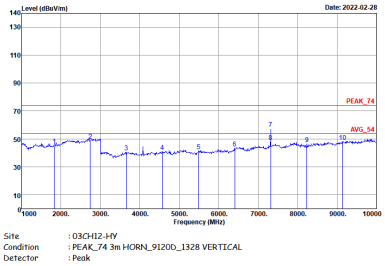
LoRa	902~928MHz	
	LoRa (125KHz)_SF8 Ch129 927.8MHz LF	
	Horizontal	Vertical
Peak Avg.		

902~928MHz

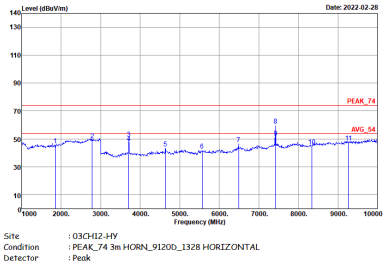
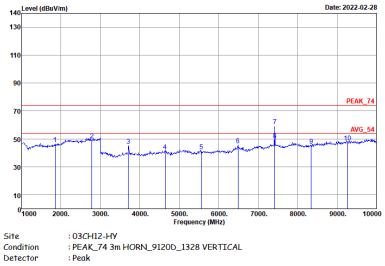
FSK 250Kbps (Harmonic @ 3m)

FSK	902~928MHz Harmonic @ 3m	
	FSK 250Kbps CH01 902.5MHz	
	Horizontal	Vertical
Peak Avg.		

Remark: The unwanted signal of mark #1.7.8 in Horizontal plot and #1.6.7 in Vertical plot falls within the non-restricted band and meet the requirements of 15.247 (d).

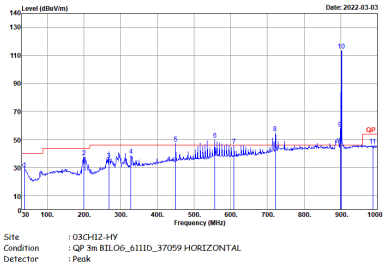
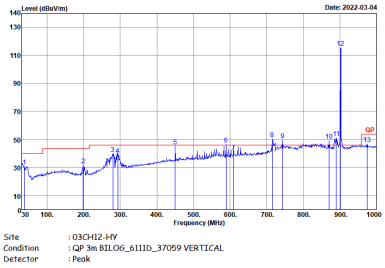
FSK	902~928MHz Harmonic @ 3m	
	FSK 250Kbps CH26 915MHz	
	Horizontal	Vertical
Peak Avg.		

Remark: The unwanted signal of mark #1.7.8 in Horizontal plot and #1.6.7 in Vertical plot falls within the non-restricted band and meet the requirements of 15.247 (d).

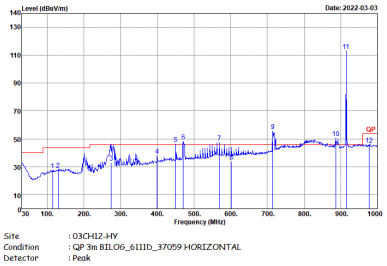
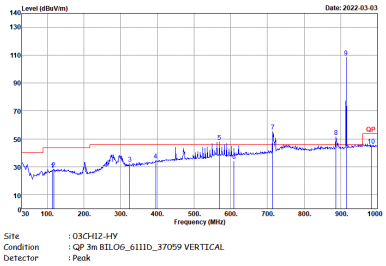
FSK	902~928MHz Harmonic @ 3m	
	FSK 250Kbps CH51 927.5MHz	
	Horizontal	Vertical
Peak Avg.		

Remark: The unwanted signal of mark #1.6.7.11 in Horizontal plot and #1.5.6.10 in Vertical plot falls within the non-restricted band and meet the requirements of 15.247 (d).

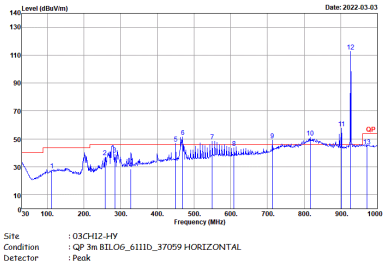
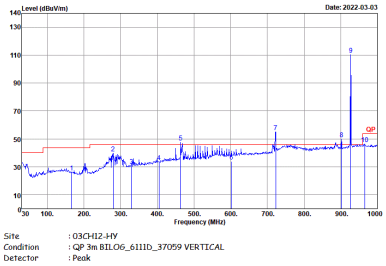
Emission below 1GHz

FSK	902~928MHz	
	FSK 250Kbps CH01 902.5MHz LF	
	Horizontal	Vertical
QP / Peak		

Remark: The unwanted signal of mark #5.6.8.9 in Horizontal plot and #5.6.8.9.10.11 in Vertical plot falls within the non-restricted band and meet the requirements of 15.247 (d).

FSK	902~928MHz	
	FSK 250Kbps CH26 915MHz LF	
	Horizontal	Vertical
QP / Peak		

Remark: The unwanted signal of mark #5.6.7.9.10 in Horizontal plot and #5.7.8 in Vertical plot falls within the non-restricted band and meet the requirements of 15.247 (d).

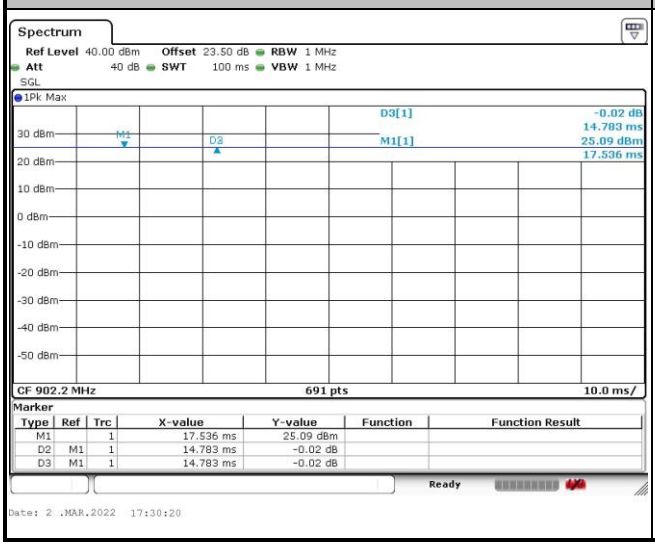
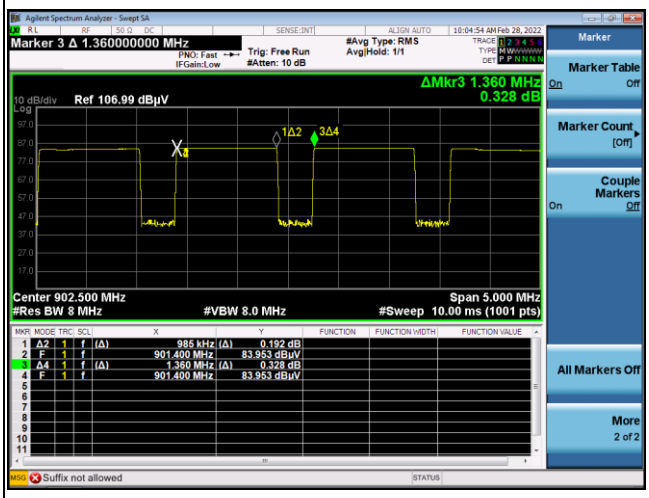
FSK	902~928MHz	
	FSK 250Kbps CH51 927.5MHz LF	
	Horizontal	Vertical
Peak Avg.		

Remark: The unwanted signal of mark #5.6.7.9.10.11 in Horizontal plot and #5.7.8 in Vertical plot falls within the non-restricted band and meet the requirements of 15.247 (d).

Appendix E. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
LoRa (125KHz)_SF8	100.00	-	-	10Hz
FSK 250Kbps	72.43	985	1.02	3kHz

LoRa (125KHz)_SF8



FSK 250Kbps