

FCC Test Report

Report No.: AGC00688201002FE03

FCC ID : RVVELOR AHL1

APPLICATION PURPOSE : Original Equipment

PRODUCT DESIGNATION : LoRa FAMILY

BRAND NAME : N/A

MODEL NAME : IDF32XXXX

APPLICANT : ELA Innovation

DATE OF ISSUE : Feb. 05, 2021

STANDARD(S) : FCC Part 15.247

REPORT VERSION : V1.2

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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jan. 22, 2021	Invalid	Initial Release
V1.1	1st	Feb. 02, 2021	Invalid	Update the comments.
V1.2	2st	Feb. 05, 2021	Valid	Update the comments.

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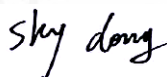
1. VERIFICATION OF CONFORMITY

Applicant	ELA Innovation
Address	297 rue Maurice Bégart, 34080 Montpellier, France
Manufacturer	ELA Innovation
Address	297 rue Maurice Bégart, 34080 Montpellier, France
Product Designation	LoRa FAMILY
Brand Name	N/A
Test Model	IDF32XXXX
Date of test	Nov. 04, 2020 to Jan. 22, 2021
Deviation	No any deviation from the test method
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BR/RF

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC Rules Part 15.247.

Prepared By



Sky Dong
(Project Engineer)

Jan. 22, 2021

Reviewed By



Max Zhang
(Reviewer)

Feb. 02, 2021

Approved By



Forrest Lei
(Authorized Officer)

Feb. 02, 2021

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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is “RFID” designed as a “LoRa FAMILY”. It is designed by way of utilizing the FHSS technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	902MHz to 928MHz
RF Output Power	14.239dBm(Max)
Modulation	LORA
BW/Frequency Range	UP:125kHz
Number of channels	UP:64 channel
Hardware Version	V1.02
Software Version	V1.0
Antenna Designation	PCB antenna (Comply with requirements of the FCC part 15.203)
Antenna Gain	0dBi
Power Supply	DC 3.6V by battery

2.2. TABLE OF CARRIER FREQUENCIES

Uplink:

Frequency Band	Channel Number	Frequency
902.3~914.9MHz	0	902.3MHz
	1	902.5MHz
	:	:
	62	914.7MHz
	63	914.9MHz

Note: The channel spacing is 0.2MHz.

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2.3. RECEIVER INPUT BANDWIDTH

The input bandwidth of the receiver is 125kHz.

2.4. EXAMPLE OF A HOPPING SEQUENCY IN DATA MODE

Example of a 64 hopping sequence in data mode:

21,23,33,25,27,31,07,09,13,11,15,02,06,01,03,05,04,08,10,12,14,16,17,18,19,20,
24,26,27,28,29,30,32,34,35,36,37,38,40,41,42,43,45,44,47,46,48,49,50,51, 52, 53,
54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64

2.5. EQUALLY AVERAGE USE OF FREQUENCIES AND BEHAVIOUR

The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter.

2.6. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.7. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013). Radiated testing was performed at an antenna to EUT distance 3 meters.

2.8. SPECIAL ACCESSORIES

Refer to section 5.2.

2.9. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

2.10. ANTENNA REQUIREMENT

This intentional radiator is designed with a spring antenna of an antenna to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.

3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

- Uncertainty of Conducted Emission, $U_c = \pm 3.2$ dB
- Uncertainty of Radiated Emission below 1GHz, $U_c = \pm 3.9$ dB
- Uncertainty of Radiated Emission above 1GHz, $U_c = \pm 4.8$ dB
- Uncertainty of total RF power, conducted, $U_c = \pm 0.8$ dB
- Uncertainty of spurious emissions, conducted, $U_c = \pm 2.7$ dB
- Uncertainty of Occupied Channel Bandwidth: $U_c = \pm 2$ %
- Uncertainty of Dwell Time: $U_c = \pm 2$ %
- Uncertainty of Frequency: $U_c = \pm 2$ %

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4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low TX(902.3MHz)
2	Middle TX(908.7MHz)
3	High TX(914.9MHz)
4	Hopping mode

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
3. The test software is the MurataLoRaModuleTestTool(v0.0.01) which can set the EUT into the individual test modes.

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5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Radiated Emission Configure:



5.2. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	LoRa FAMILY	IDF32XXXX	RVVELOR AHL1	EUT

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.247	Peak Output Power	Compliant
§15.247	20 dB Bandwidth	Compliant
§15.247	Spurious Emission	Compliant
15.247&15.209	Radiated Emission	Compliant
§15.207	Conduction Emission	Compliant
§15.247	Number of Hopping Frequency	Compliant
§15.247	Time of Occupancy	Compliant
§15.247	Frequency Separation	N/A

Note: The conducted emission tests at AC port are not required for devices which only employ battery power for operation.

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6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	May 15, 2020	May 14, 2021
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 07, 2020	Dec. 06, 2021
2.4GHz Fliter	EM Electronics	2400-2500MHz	N/A	Feb. 26, 2020	Feb. 25, 2021
Attenuator	ZHINAN	E-002	N/A	Aug. 24, 2020	Aug. 23, 2021
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep.21, 2019	Sep. 20, 2021
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	Jun. 12, 2020	Jun. 11, 2021
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May. 24, 2020	May. 23, 2021
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Sep. 03, 2020	Sep. 02, 2022
ANTENNA	SCHWARZBECK	VULB9168	D69250	Jan. 09, 2019	Jan. 08, 2021
Test software	FARA	EZ-EMC (Ver RA-03A)	N/A	N/A	N/A

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7. PEAK OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

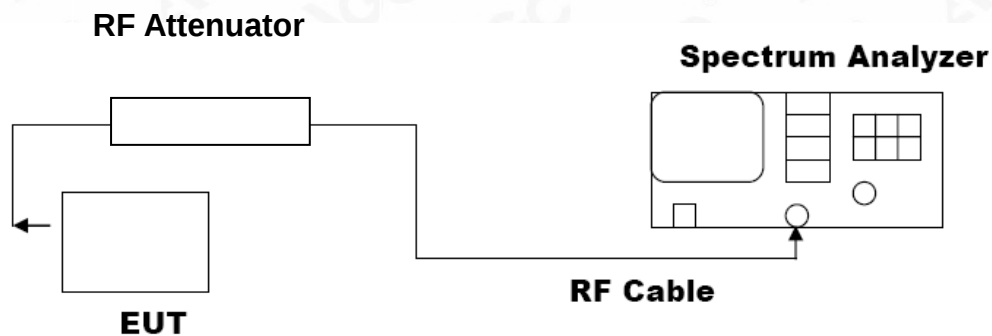
For peak power test:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
3. RBW > 20 dB bandwidth of the emission being measured.
4. VBW $\geq$ RBW.
5. Sweep: Auto.
6. Detector function: Peak.
7. Trace: Max hold.

Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

PEAK POWER TEST SETUP



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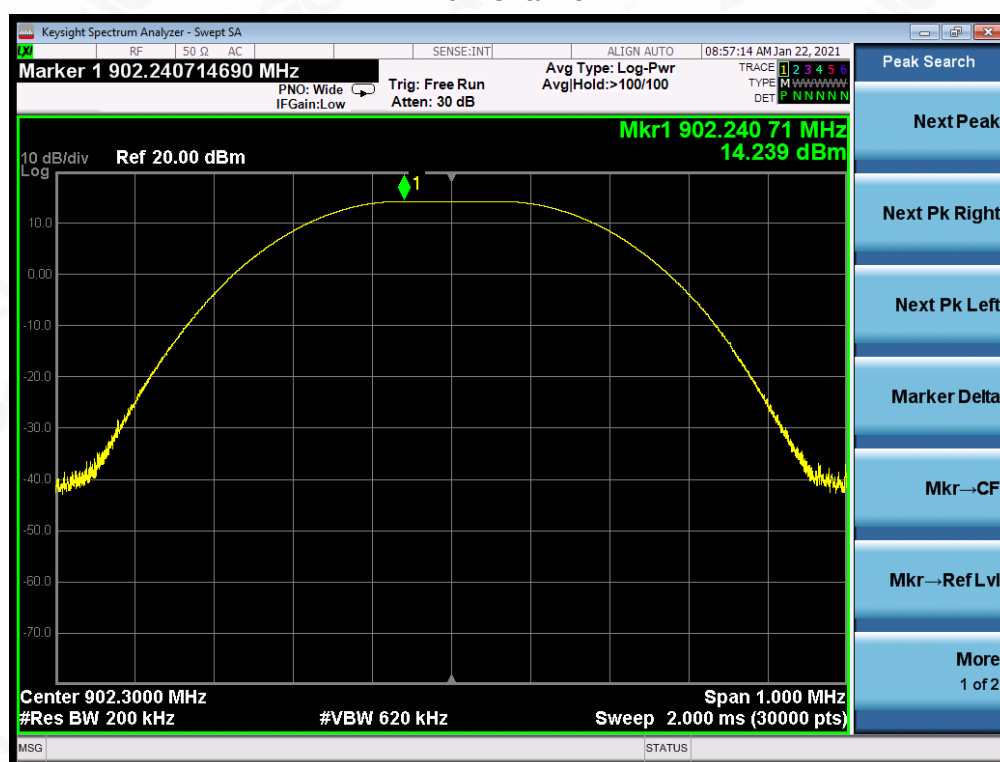
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7.3. LIMITS AND MEASUREMENT RESULT

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MODULATION			
Frequency (MHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
902.3	14.239	30	Pass
908.7	14.039	30	Pass
914.9	13.827	30	Pass

Low Channel

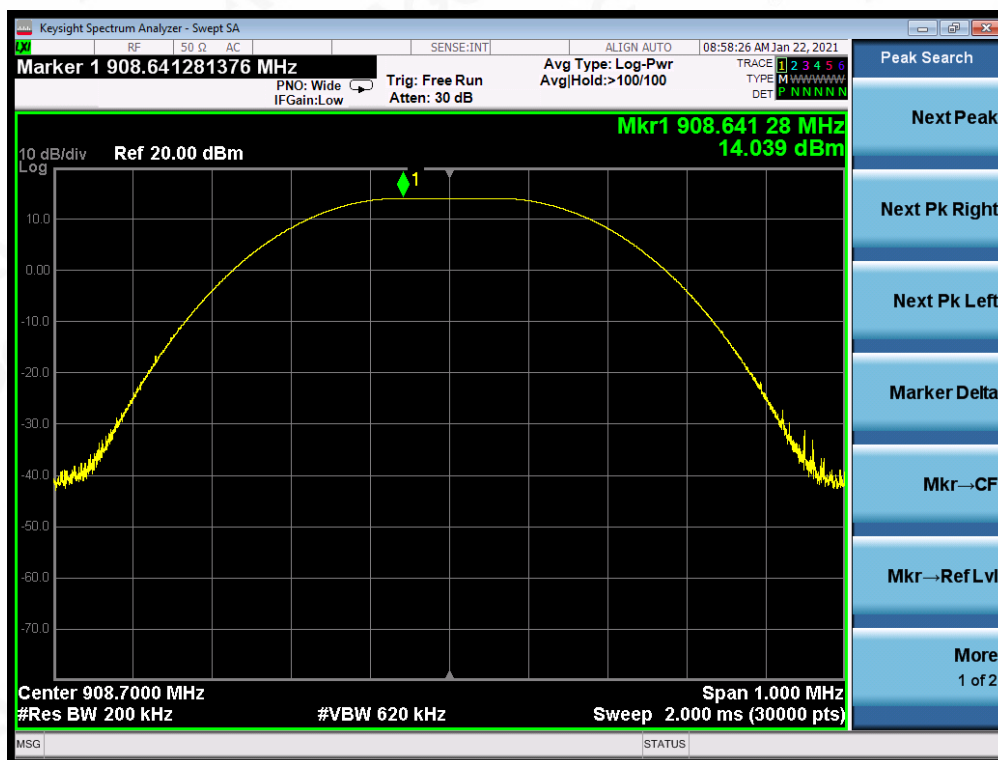


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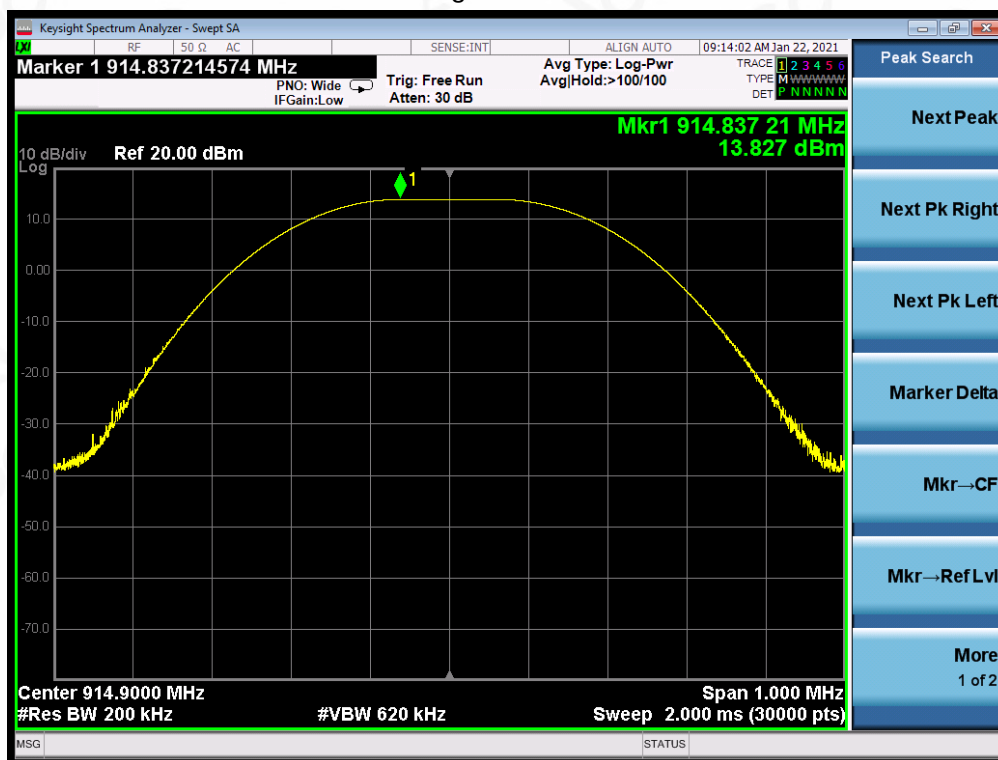
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Middle Channel



High Channel



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8. 20DB BANDWIDTH

8.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel
The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW; Sweep = auto; Detector function = peak
4. Set SPA Trace 1 Max hold, then View.

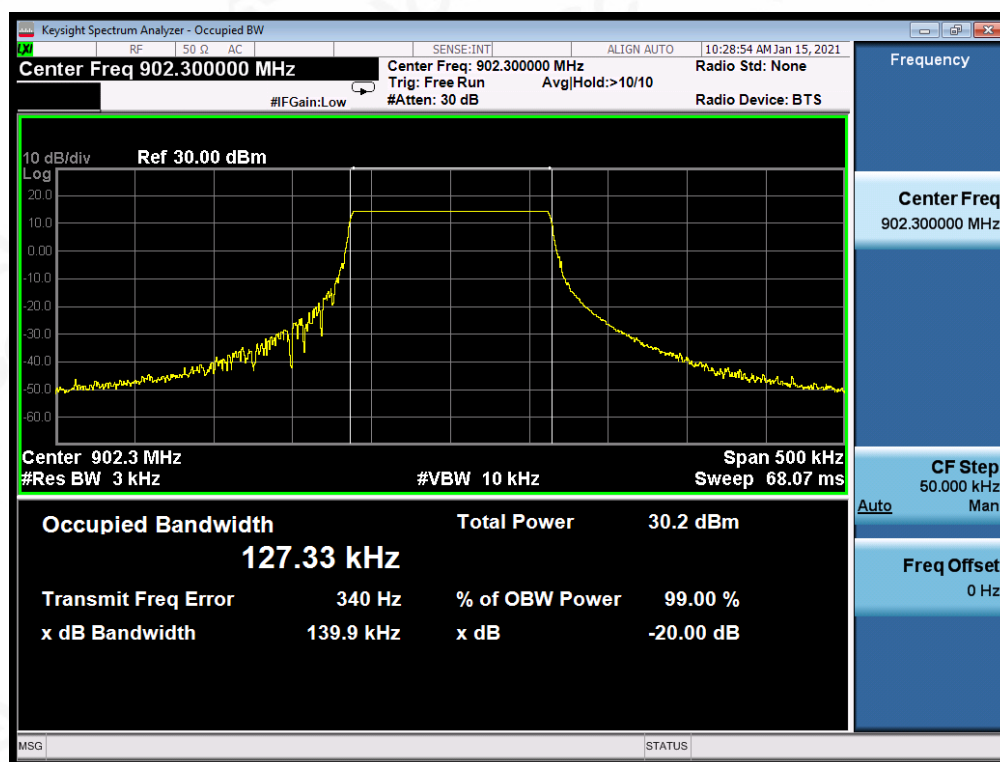
8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 7.2.

8.3. LIMITS AND MEASUREMENT RESULTS

MEASUREMENT RESULT FOR GFSK MOUDULATION			
Applicable Limits	Measurement Result		
	Test Data (kHz)		Criteria
500kHz	Low Channel	139.9	PASS
	Middle Channel	137.3	PASS
	High Channel	137.9	PASS

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

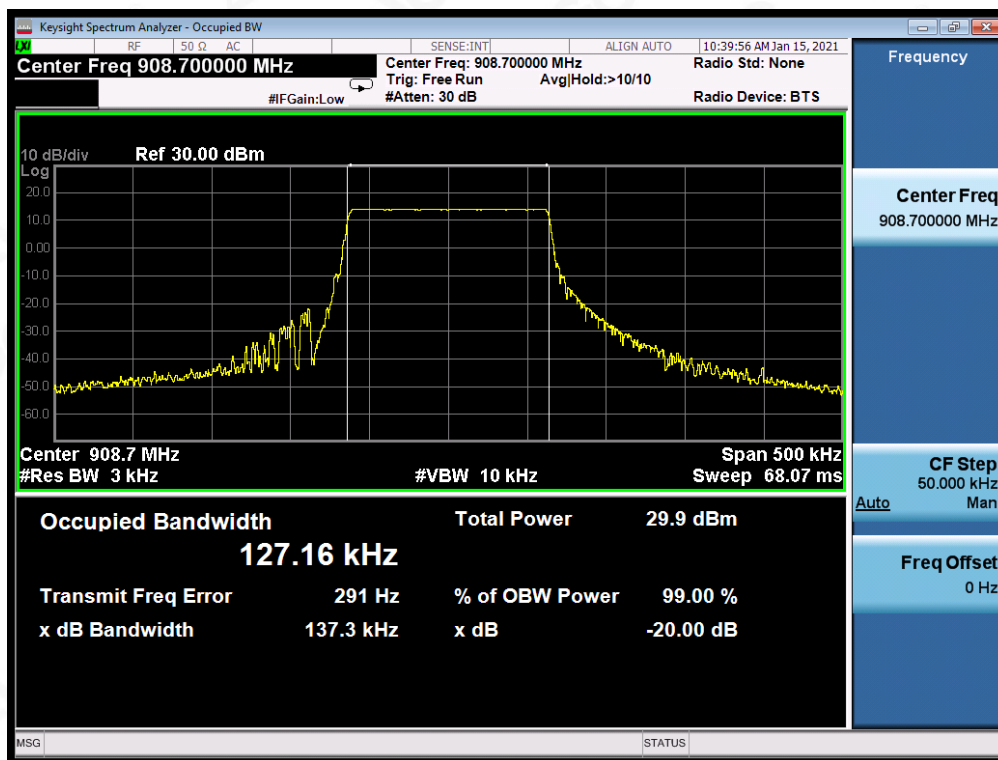


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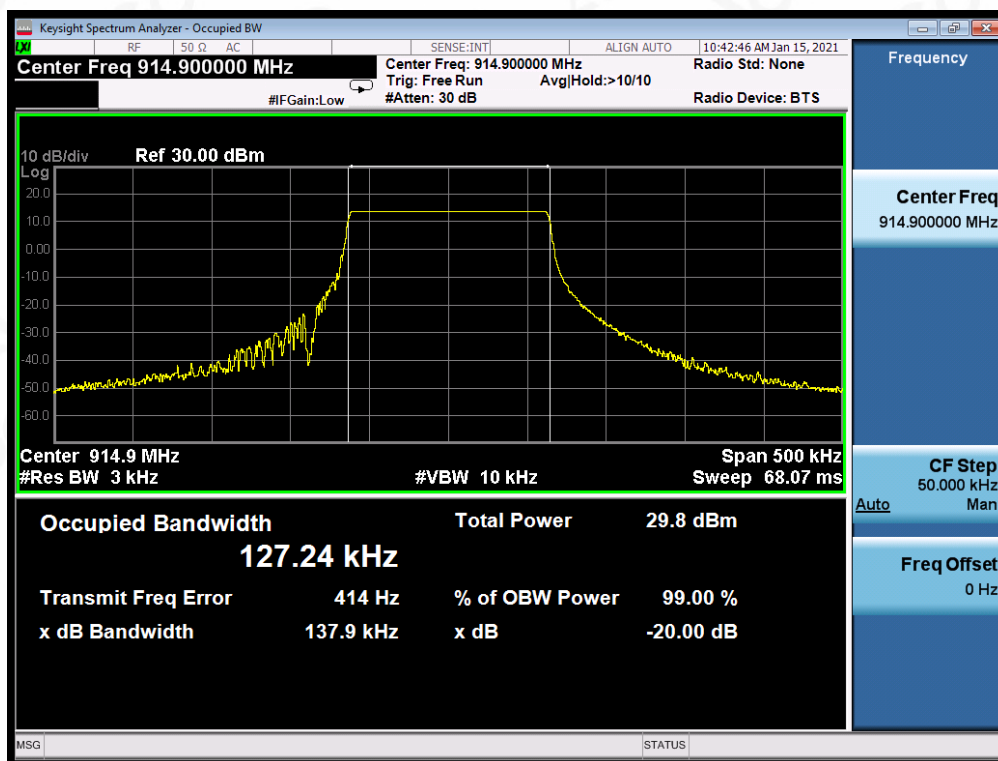
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TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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9. CONDUCTED SPURIOUS EMISSION

9.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the Middle and the bottom operation frequency individually.
3. Set the Span = wide enough to capture the peak level of the in-band emission and all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic.
RBW = 100 kHz; VBW= 300 kHz; Sweep = auto; Detector function = peak.
4. Set SPA Trace 1 Max hold, then View.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 8.2

9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

9.4. LIMITS AND MEASUREMENT RESULT

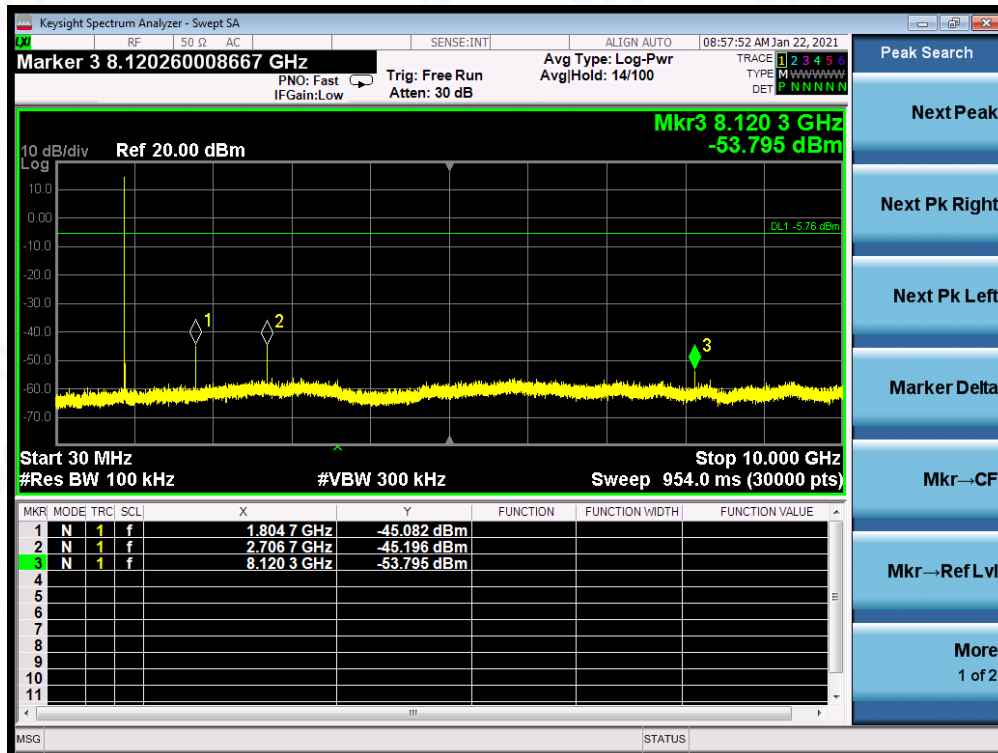
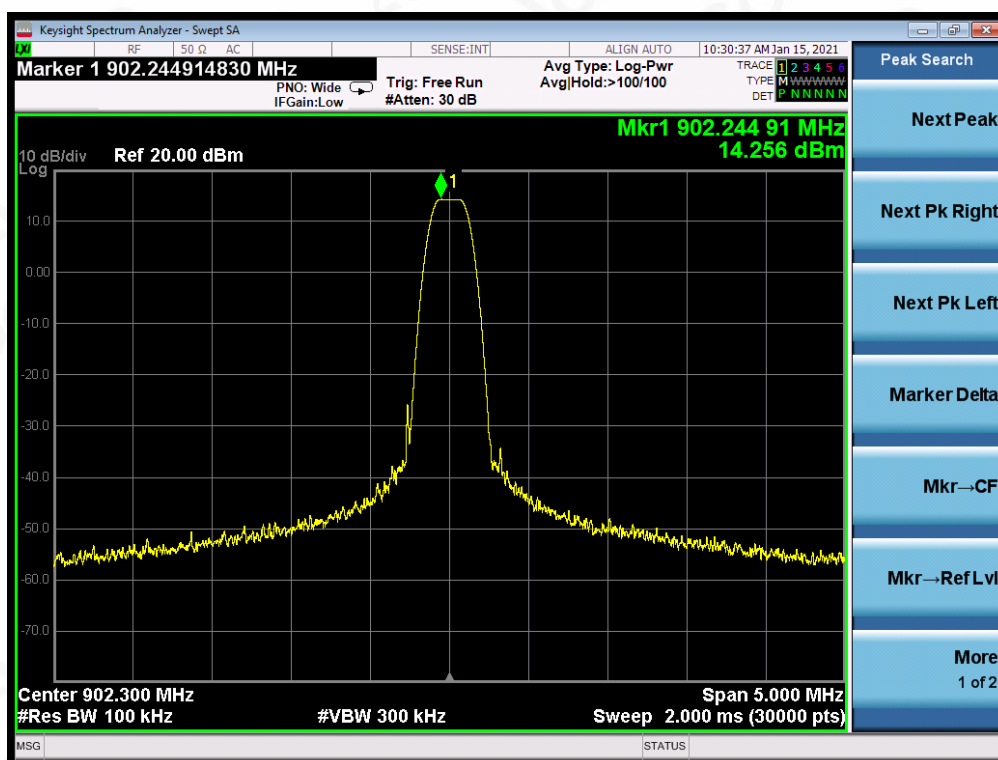
LIMITS AND MEASUREMENT RESULT		
Applicable Limits	Measurement Result	
	Test Data	Criteria
In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in§15.209(a))	At least -20dBc than the limit Specified on the BOTTOM Channel	PASS
	At least -20dBc than the limit Specified on the TOP Channel	PASS

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TEST RESULT FOR ENTIRE FREQUENCY RANGE GFSK MODULATION IN LOW CHANNEL

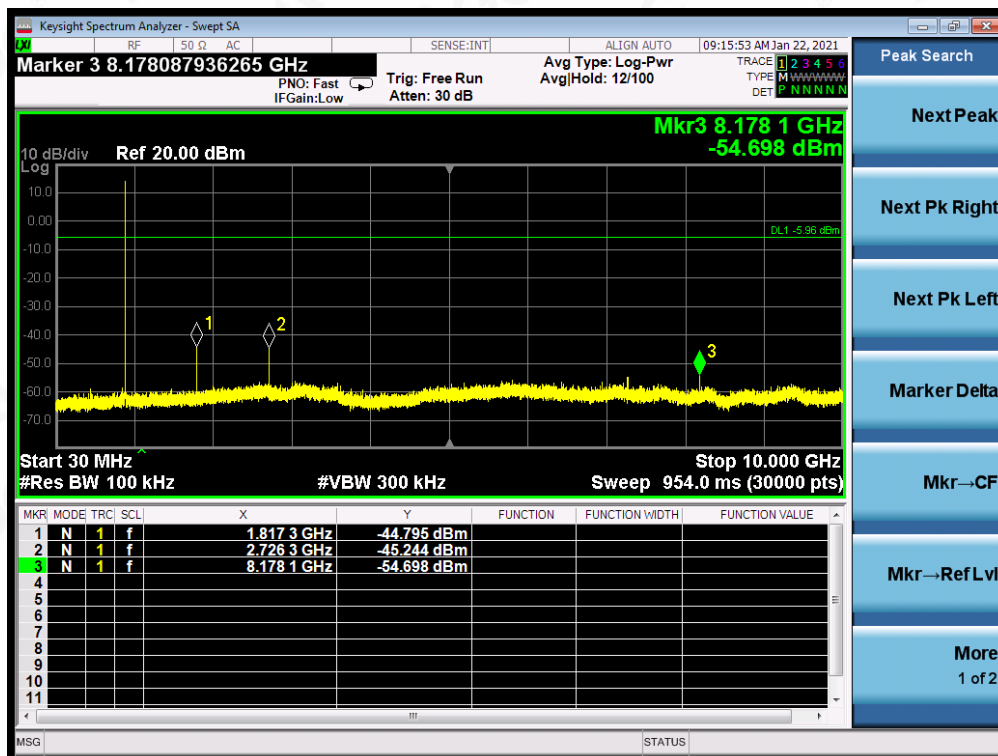
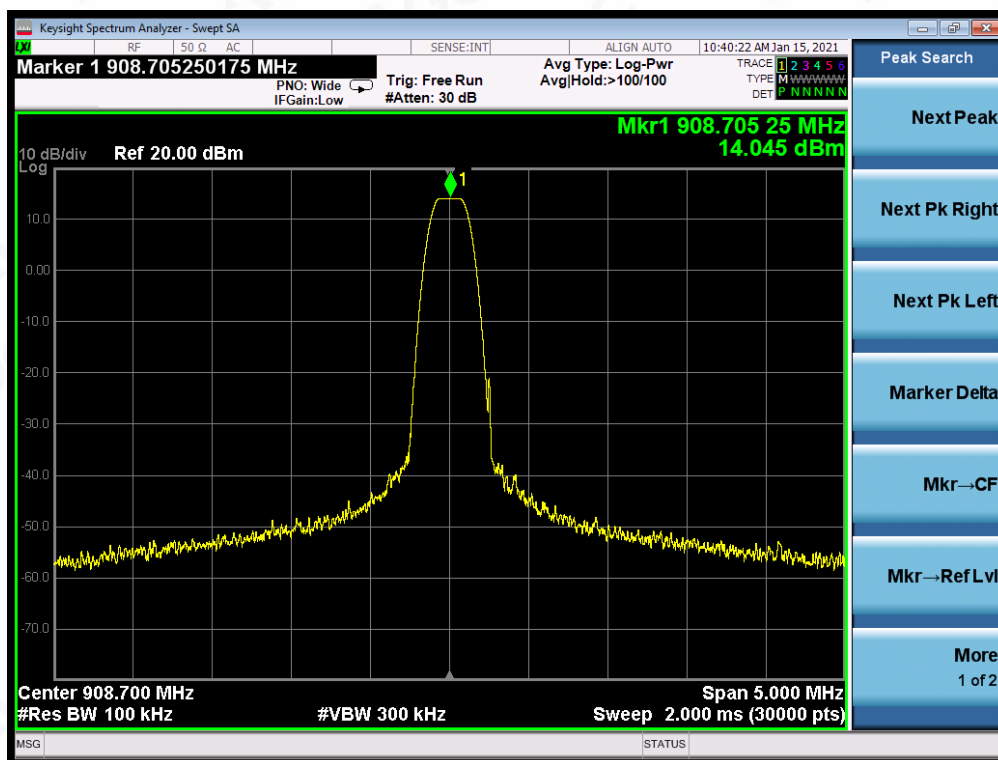


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FSK MODULATION IN MIDDLE CHANNEL

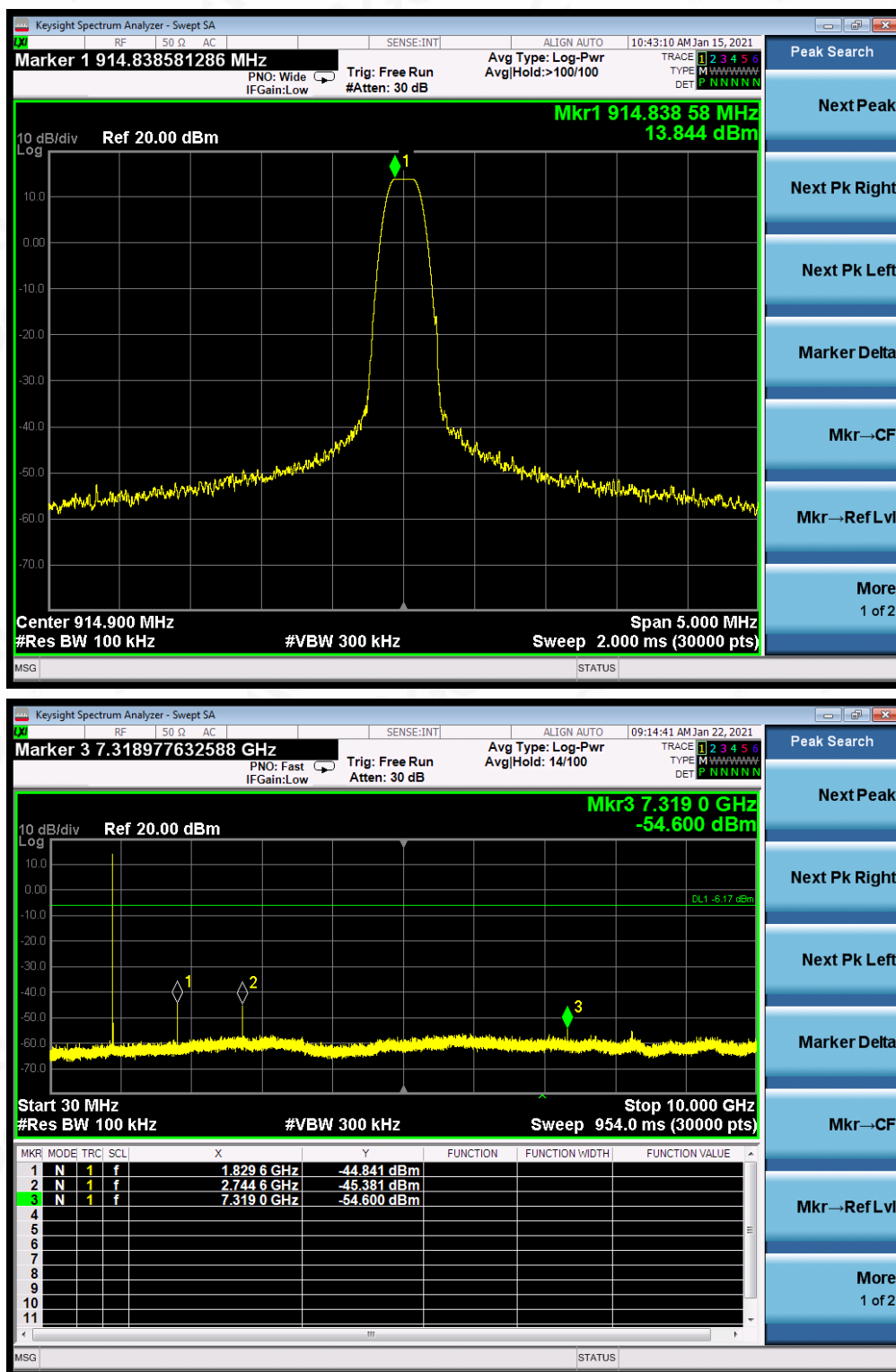


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GFSK MODULATION IN HIGH CHANNEL



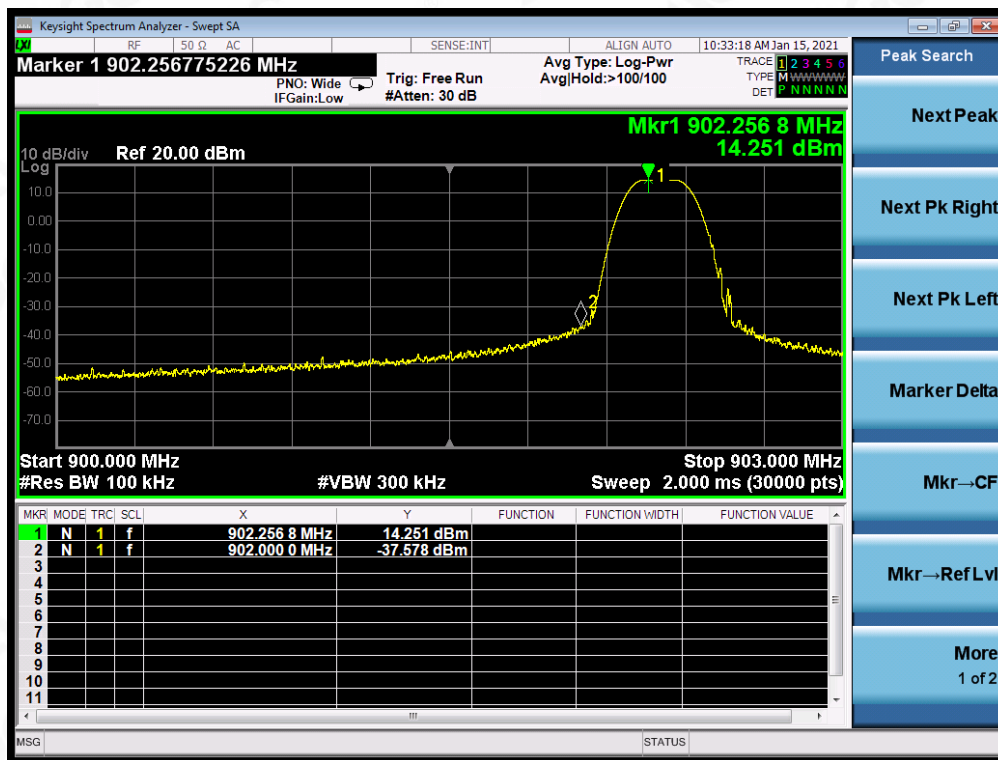
Note: The peak emissions without marker on the above plots are fundamental wave and need not to compare with the limit.

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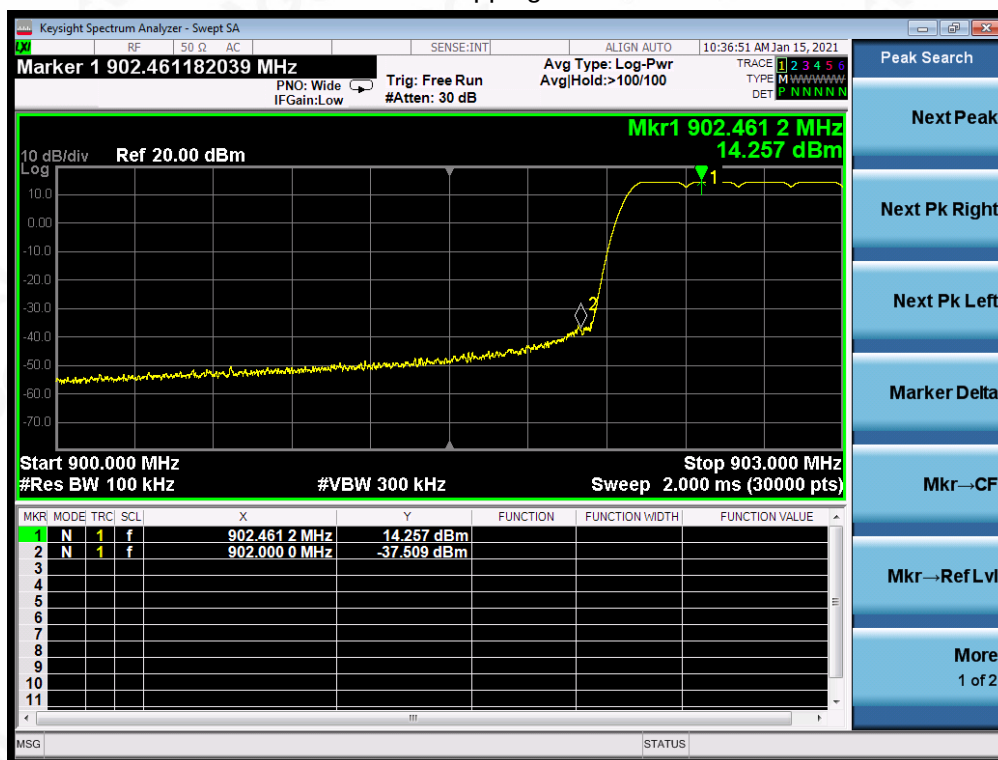
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TEST RESULT FOR BAND EDGE GFSK MODULATION IN LOW CHANNEL Hopping off



Hopping on



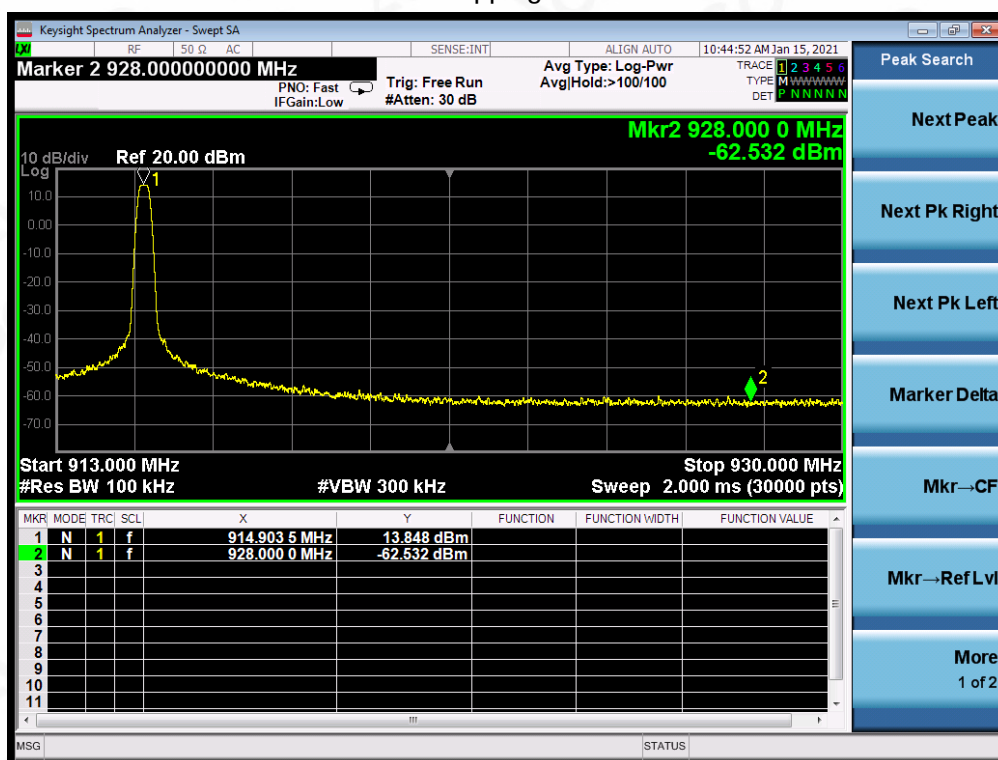
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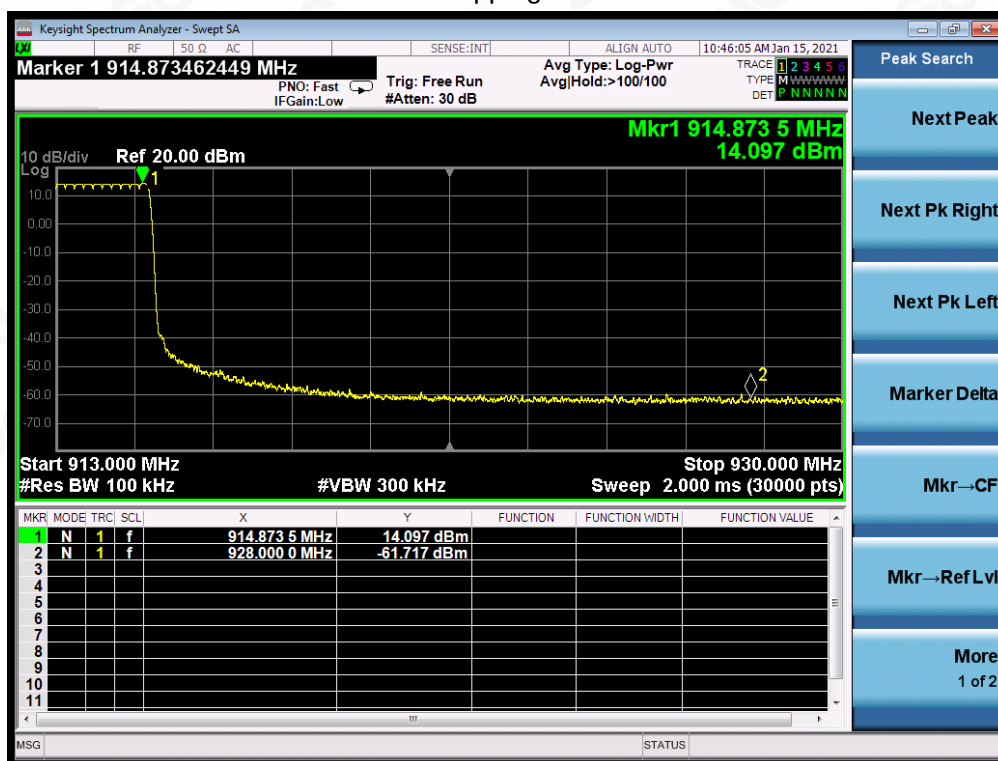


GFSK MODULATION IN HIGH CHANNEL

Hopping off



Hopping on



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10. RADIATED EMISSION

10.1. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

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The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz 1MHz/1MHz for Peak, 1MHz/10Hz for Average

Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

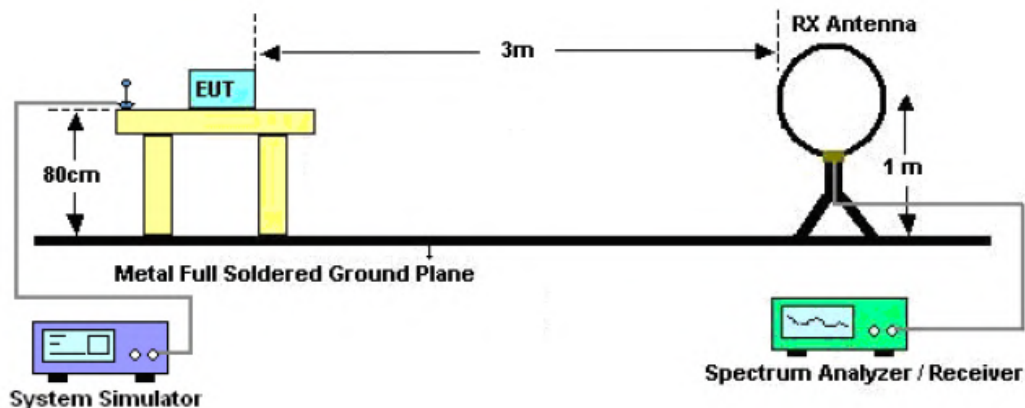
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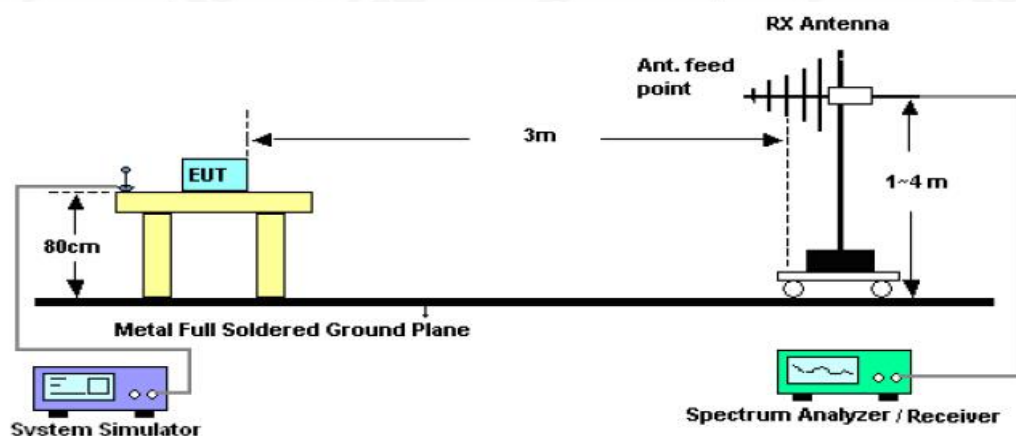


10.2. TEST SETUP

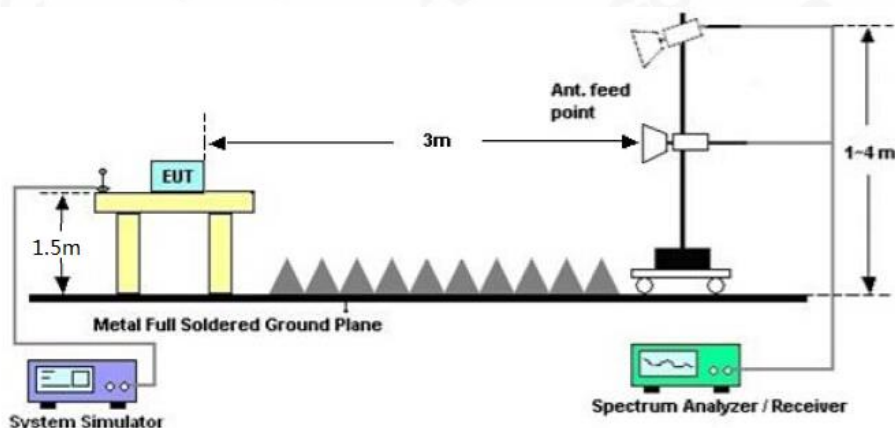
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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10.3. LIMITS AND MEASUREMENT RESULT

15.209(a) Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (micorvolts/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

Note: All modes were tested For restricted band radiated emission, the test records reported below are the worst result compared to other modes.

10.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

The amplitude of spurious emissions from 9kHz to 30MHz which are attenuated more than 20 dB below the permissible value need not be reported.

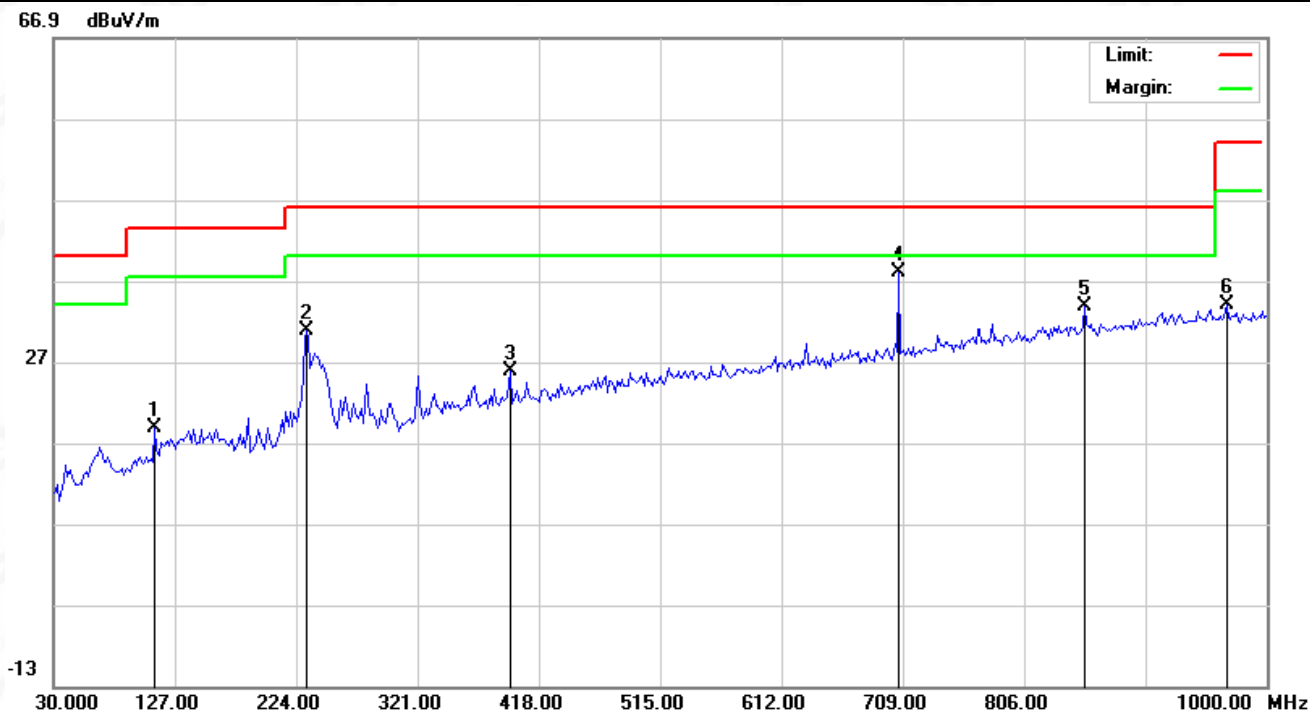
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RADIATED EMISSION BELOW 1GHZ

EUT	LoRa FAMILY	Model Name	IDF32XXXX
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		110.8333	1.66	17.07	18.73	43.50	-24.77	peak
2		232.0833	13.46	17.31	30.77	46.00	-15.23	peak
3		395.3667	3.01	22.82	25.83	46.00	-20.17	peak
4	*	705.7667	9.74	28.28	38.02	46.00	-7.98	peak
5		854.5000	2.74	31.11	33.85	46.00	-12.15	peak
6		967.6667	1.80	32.28	34.08	54.00	-19.92	peak

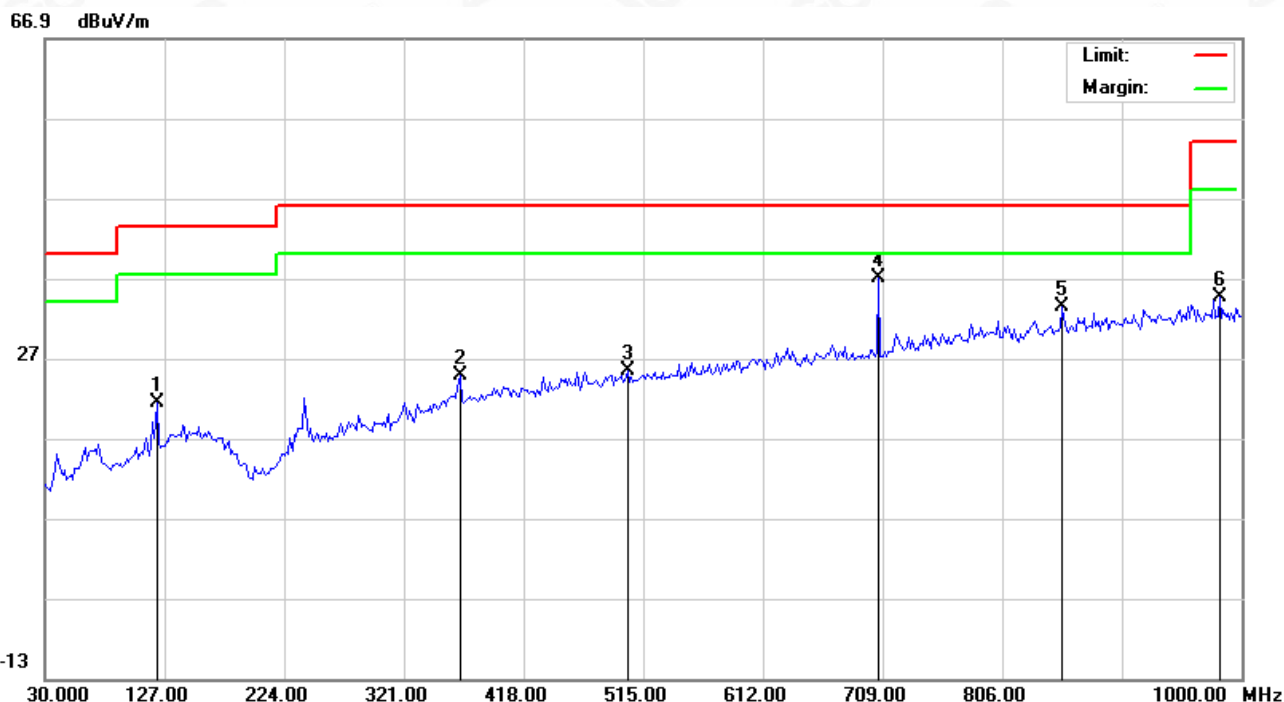
RESULT: PASS

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EUT	LoRa FAMILY	Model Name	IDF32XXXX
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		120.5333	3.45	18.00	21.45	43.50	-22.05	peak
2		366.2667	2.97	21.80	24.77	46.00	-21.23	peak
3		502.0667	0.35	25.03	25.38	46.00	-20.62	peak
4	*	705.7667	8.80	28.28	37.08	46.00	-8.92	peak
5		854.5000	2.38	31.11	33.49	46.00	-12.51	peak
6		982.2167	2.16	32.41	34.57	54.00	-19.43	peak

RESULT: PASS

Note:

1. Factor=Antenna Factor + Cable loss, Margin= Limit- Measurement.
2. The “Factor” value can be calculated automatically by software of measurement system.
3. All test modes had been pre-tested. The mode 1 is the worst case and recorded in the report.

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RADIATED EMISSION ABOVE 1GHZ

EUT	LoRa FAMILY	Model Name	IDF32XXXX
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
1804.6	59.37	-9.27	50.10	74.00	-23.90	peak
1804.6	48.26	-9.27	38.99	54.00	-15.01	AVG
2706.9	55.87	-7.68	48.19	74.00	-25.81	peak
2706.9	44.28	-7.68	36.60	54.00	-17.40	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	LoRa FAMILY	Model Name	IDF32XXXX
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
1804.6	59.12	-9.27	49.85	74.00	-24.15	peak
1804.6	41.02	-9.27	31.75	54.00	-22.25	AVG
2706.9	54.87	-7.68	47.19	74.00	-26.81	peak
2706.9	45.73	-7.68	38.05	54.00	-15.95	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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EUT	LoRa FAMILY	Model Name	IDF32XXXX
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
1817.4	60.49	-9.18	51.31	74.00	-22.69	peak
1817.4	51.75	-9.18	42.57	54.00	-11.43	AVG
2726.1	56.32	-7.54	48.78	74.00	-25.22	peak
2726.1	46.29	-7.54	38.75	54.00	-15.25	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	LoRa FAMILY	Model Name	IDF32XXXX
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
1817.4	59.24	-9.18	50.06	74.00	-23.94	peak
1817.4	50.49	-9.18	41.31	54.00	-12.69	AVG
2726.1	55.47	-7.54	47.93	74.00	-26.07	peak
2726.1	46.07	-7.54	38.53	54.00	-15.47	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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EUT	LoRa FAMILY	Model Name	IDF32XXXX
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
1829.8	61.28	-9.07	52.21	74.00	-21.79	peak
1829.8	50.46	-9.07	41.39	54.00	-12.61	AVG
2744.7	57.29	-7.38	49.91	74.00	-24.09	peak
2744.7	48.12	-7.38	40.74	54.00	-13.26	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	LoRa FAMILY	Model Name	IDF32XXXX
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
1829.8	62.05	-9.07	52.98	74.00	-21.02	peak
1829.8	51.43	-9.07	42.36	54.00	-11.64	AVG
2744.7	56.89	-7.38	49.51	74.00	-24.49	peak
2744.7	47.31	-7.38	39.93	54.00	-14.07	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

RESULT: PASS

Note:

Other emissions from 1G~10GHz are attenuated more than 20 dB below the permissible value. No recording in the test report.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

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11. NUMBER OF HOPPING FREQUENCY

11.1. MEASUREMENT PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
2. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
3. VBW $\geq$ RBW. Sweep: Auto. Detector function: Peak. Trace: Max hold.
4. Allow the trace to stabilize.

11.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

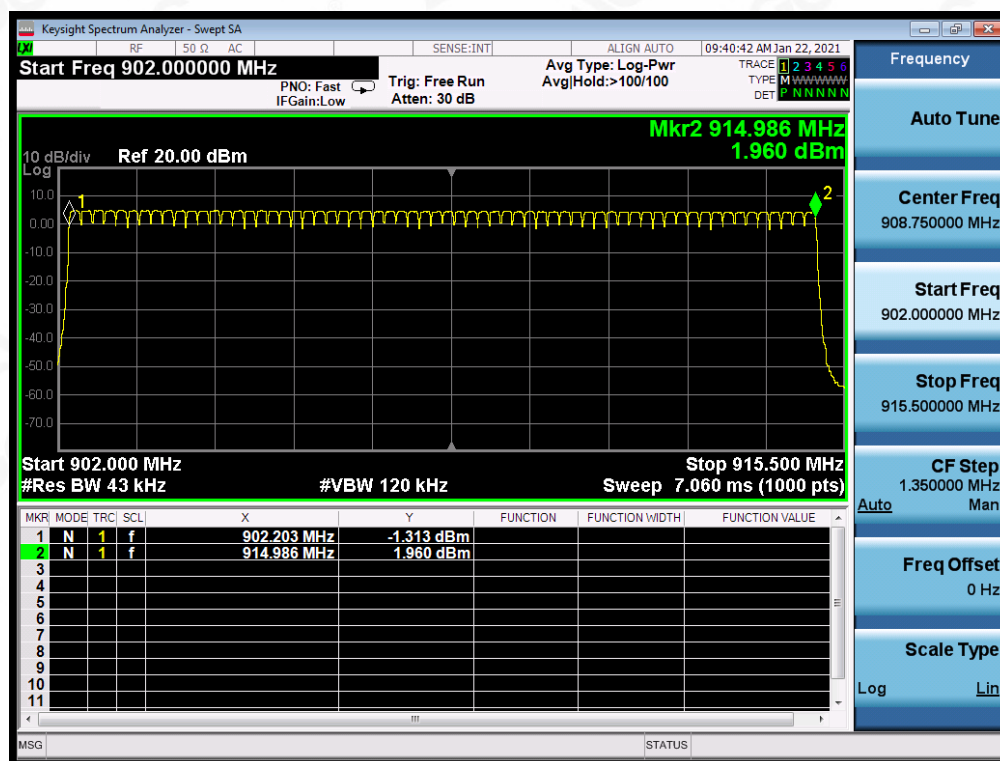
11.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

11.4. LIMITS AND MEASUREMENT RESULT

TOTAL NO. OF HOPPING CHANNEL	LIMIT (NO. OF CH)	MEASUREMENT (NO. OF CH)	RESULT
	≥ 25	64	PASS

TEST PLOT FOR NO. OF TOTAL CHANNELS



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12. TIME OF OCCUPANCY (DWELL TIME)

12.1. MEASUREMENT PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: Zero span, centered on a hopping channel.
2. RBW shall be $\leq$ channel spacing and where possible RBW should be set $\gg 1/T$, where T is the expected dwell time per channel.
3. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
4. Detector function: Peak. Trace: Max hold.
5. Use the marker-delta function to determine the transmit time per hop.
6. Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

$$(\text{Number of hops in the period specified in the requirements}) = (\text{number of hops on spectrum analyzer}) \times (\text{period specified in the requirements} / \text{analyzer sweep time})$$
7. The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements.

12.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

12.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

12.4. LIMITS AND MEASUREMENT RESULT

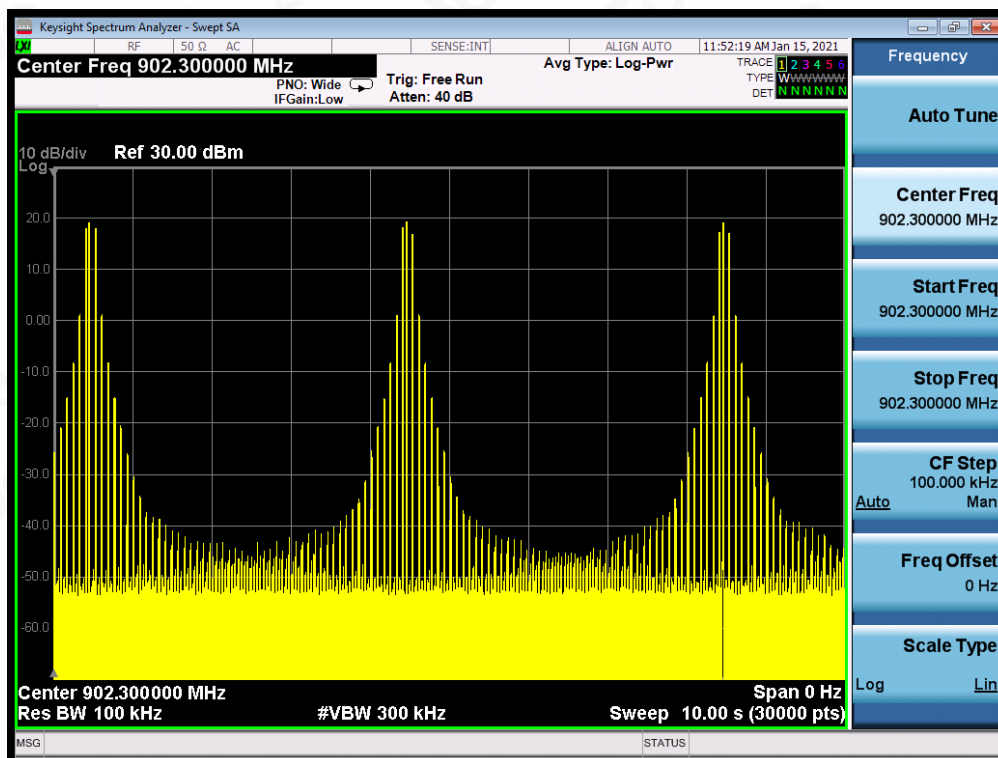
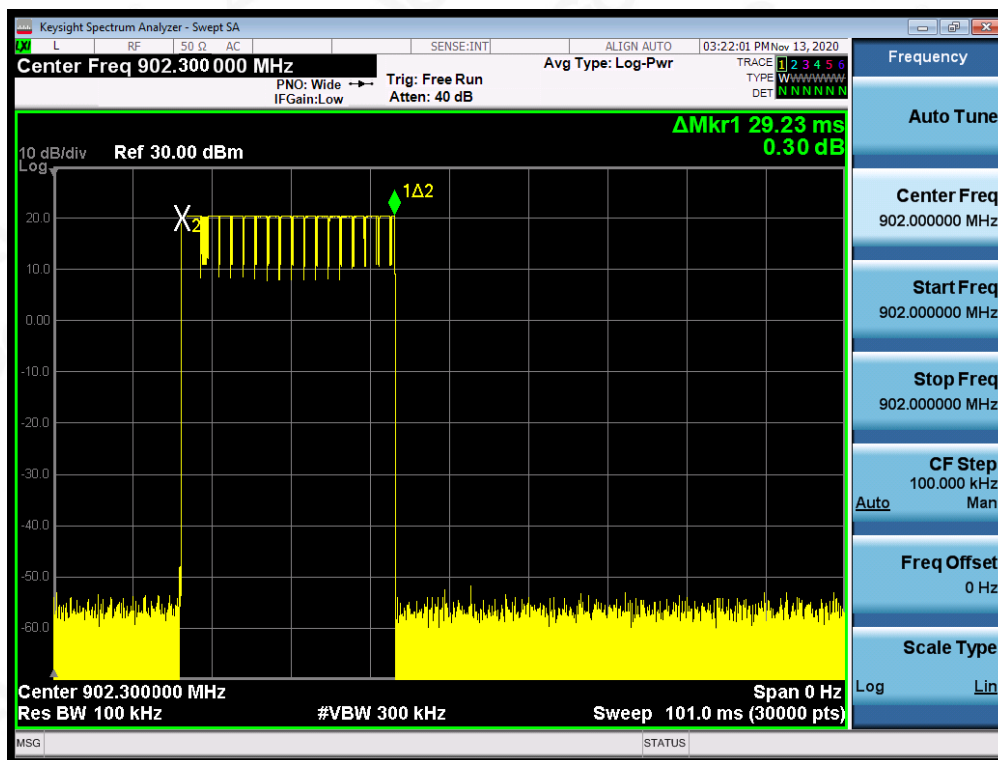
Channel	Time of Pulse (ms)	Number of hops in the period specified in the requirements	Dwell Time (ms)	Limit (ms)
Low	29.23	3*2	175.38	400
Middle	29.20	3*2	175.20	400
High	29.11	3*2	174.66	400

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TEST PLOT OF LOW CHANNEL

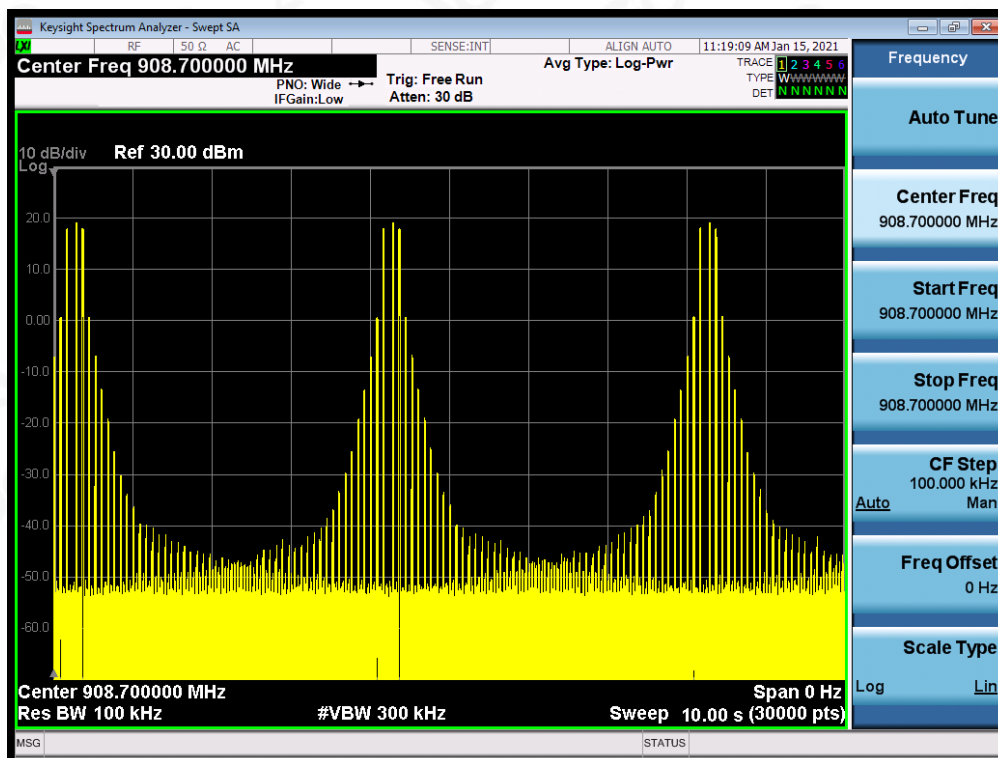
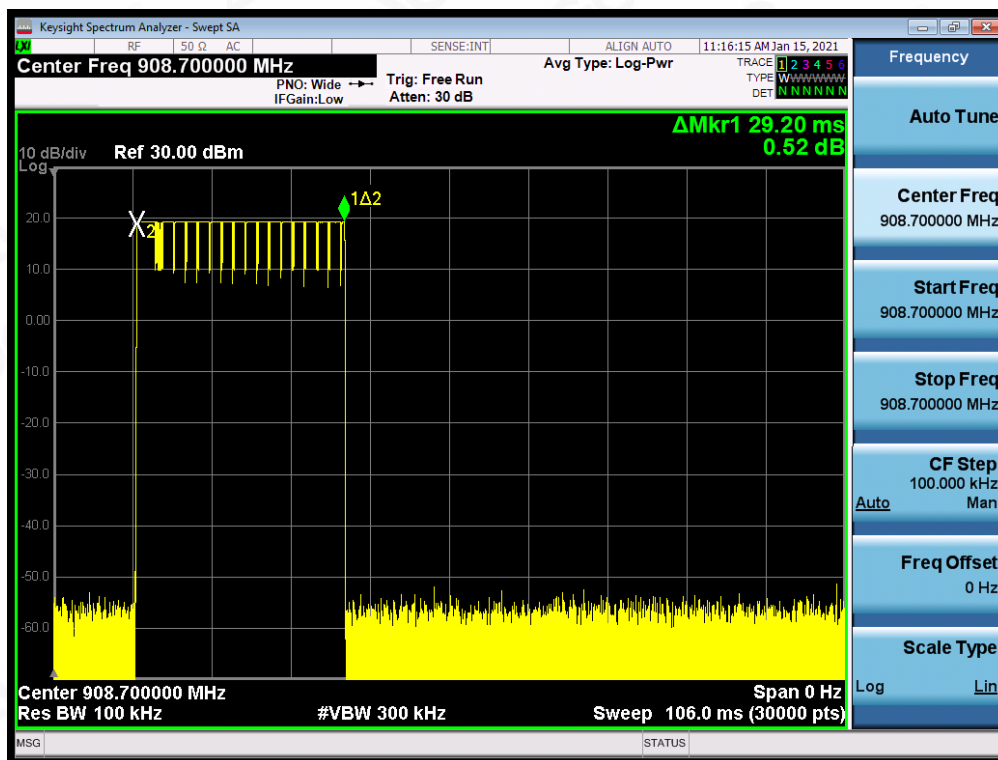


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TEST PLOT OF MIDDLE CHANNEL

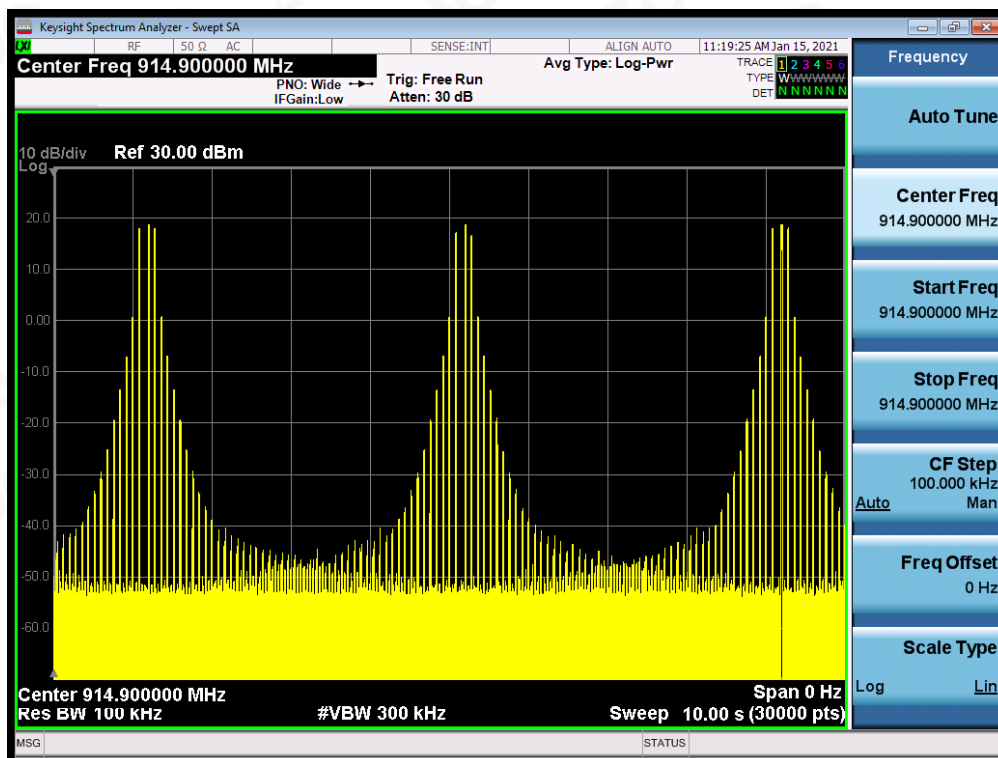
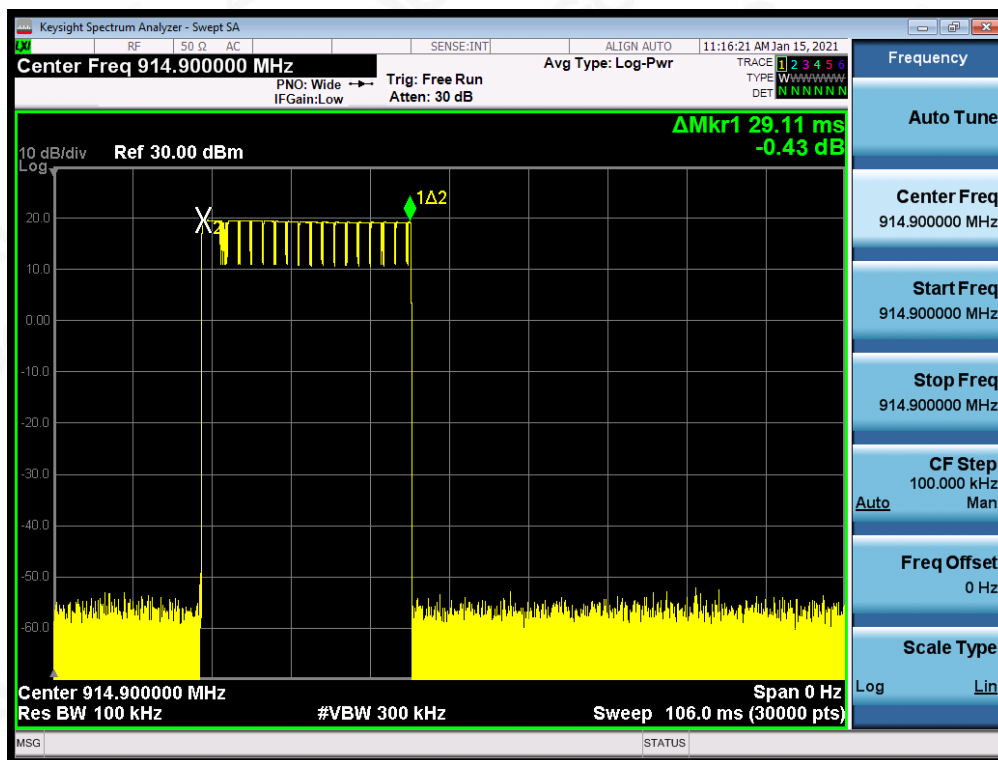


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TEST PLOT OF HIGH CHANNEL



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13. FREQUENCY SEPARATION

13.1. MEASUREMENT PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: Wide enough to capture the peaks of two adjacent channels.
 2. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
 3. Video (or average) bandwidth (VBW) $\geq$ RBW.
 4. Sweep: Auto. e) Detector function: Peak. f) Trace: Max hold. g) Allow the trace to stabilize.
- Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

13.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 6.2

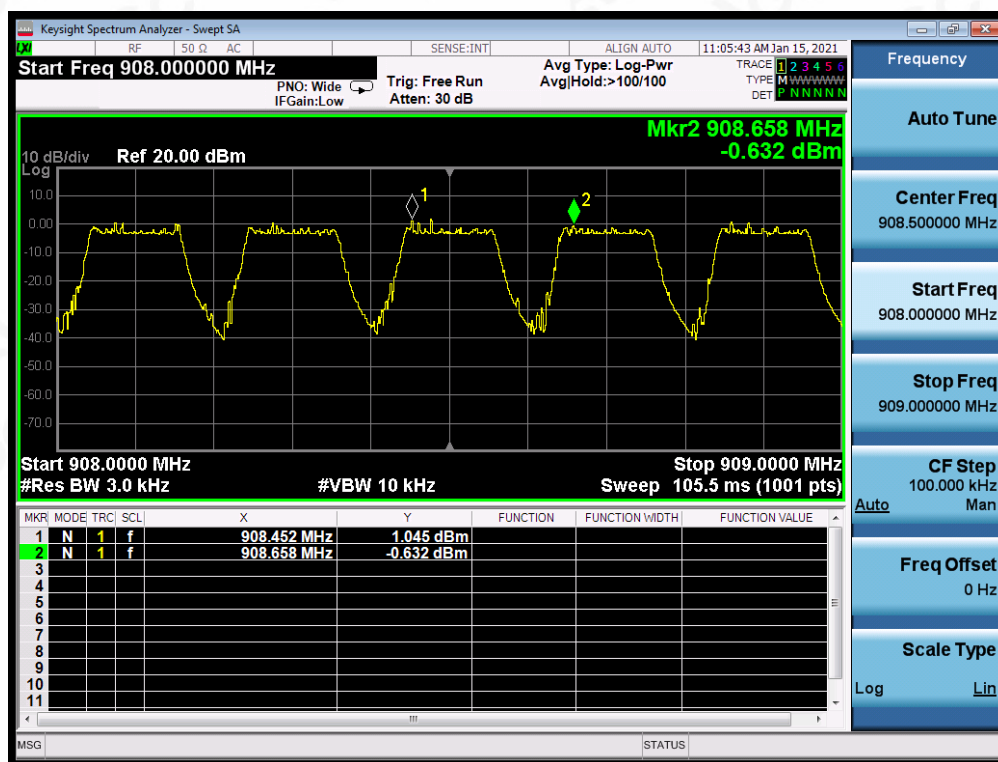
13.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6.3

13.4. LIMITS AND MEASUREMENT RESULT

MODE	CHANNEL SEPARATION	LIMIT	RESULT
	KHz	KHz	
hopping	206	≥ 20 dB BW	Pass

TEST PLOT FOR FREQUENCY SEPARATION

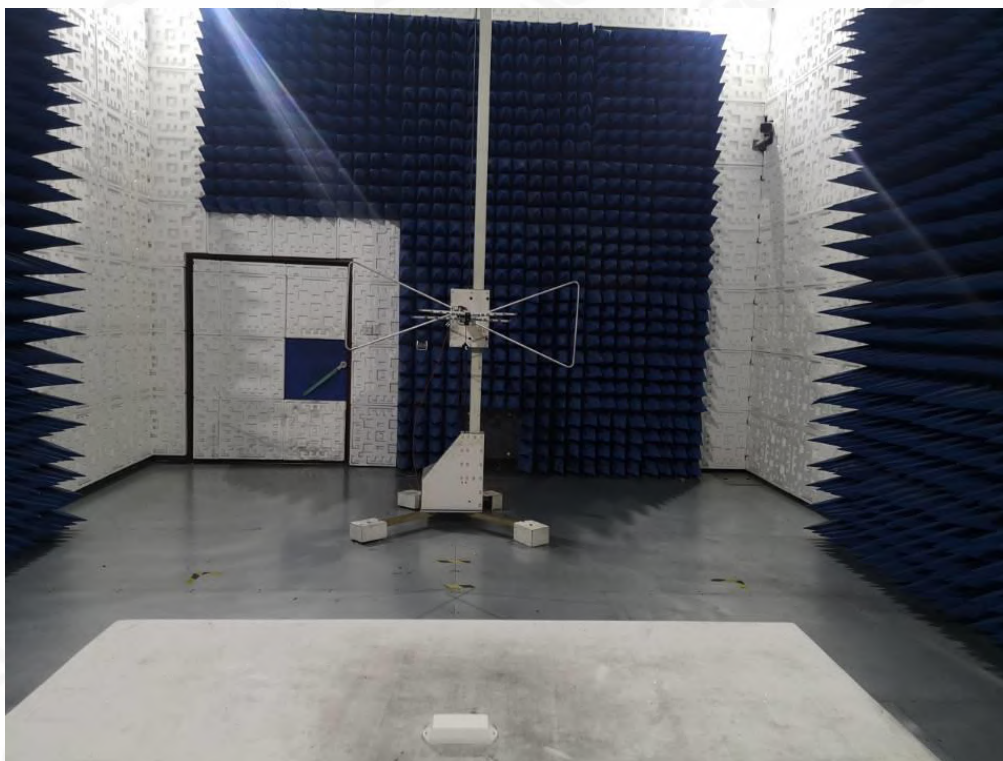


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APPENDIX A: PHOTOGRAPHS OF TEST SETUP

RADIATED EMISSION TEST SETUP BELOW 1GHz



RADIATED EMISSION TEST SETUP ABOVE 1GHz

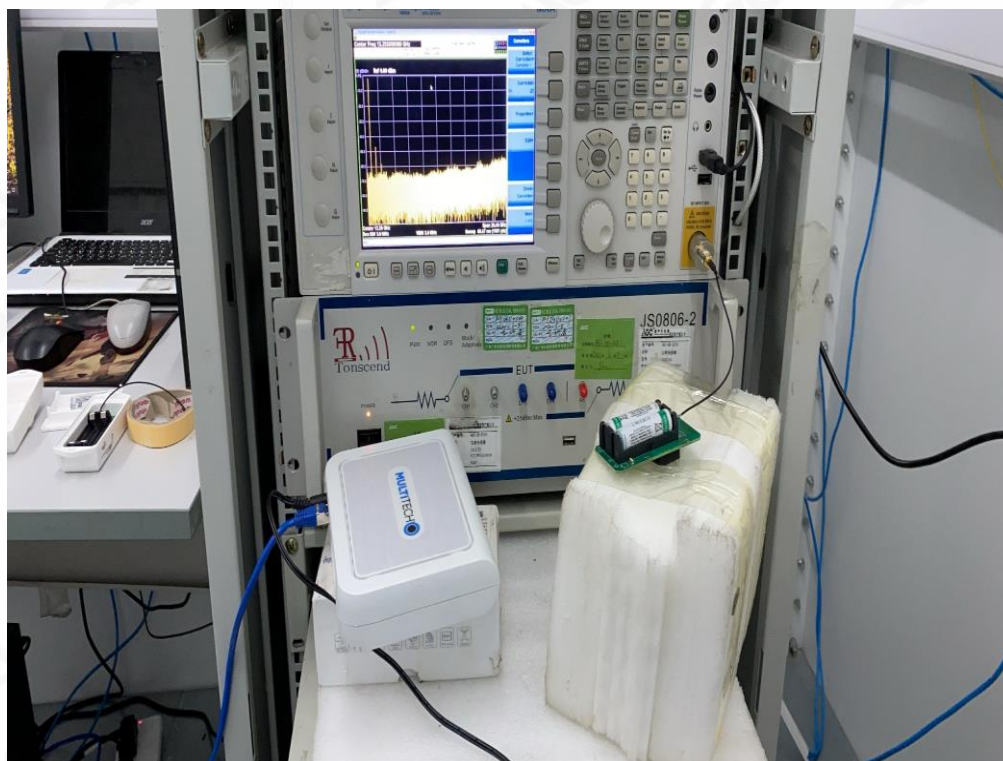


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CONDUCTED TEST SETUP

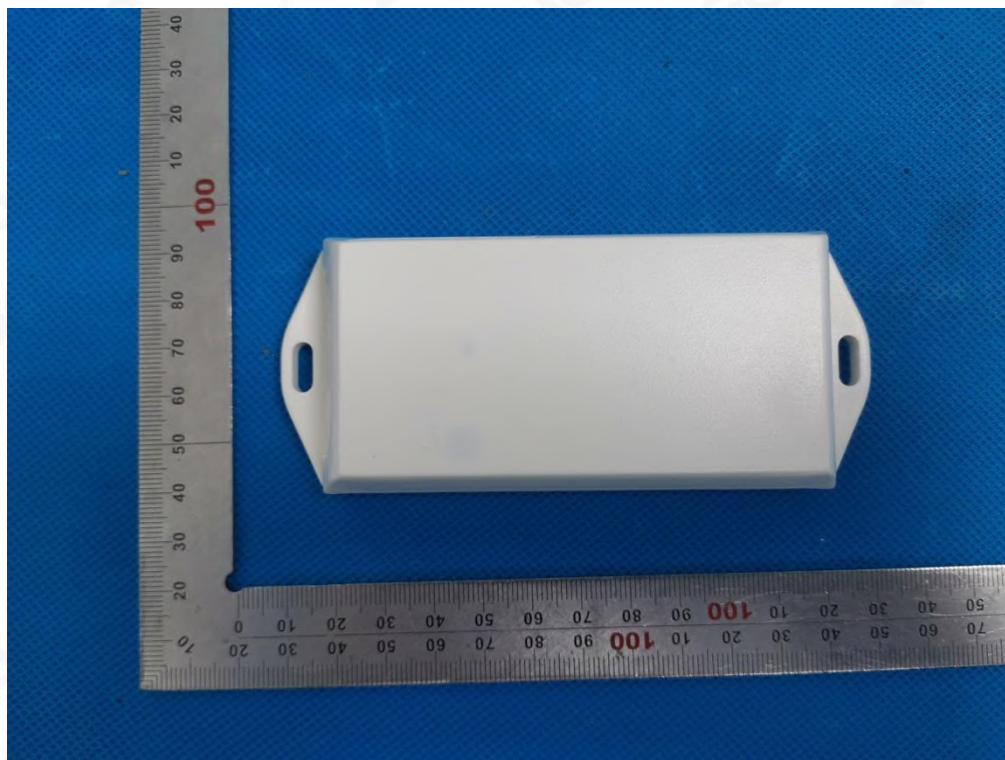


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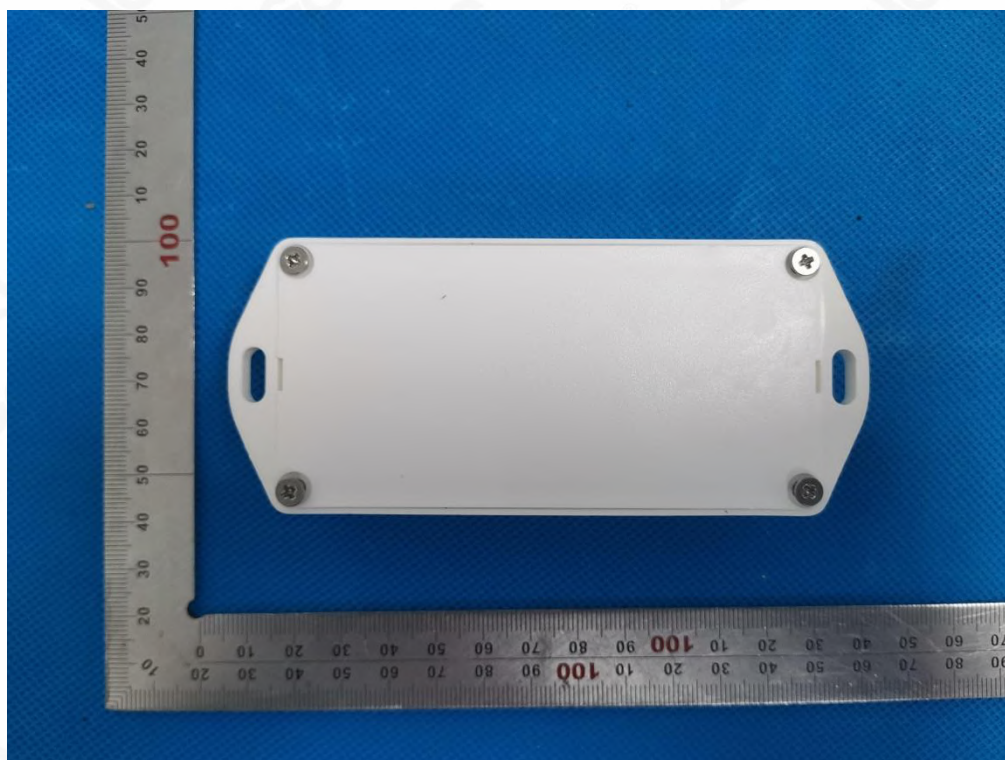
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APPENDIX B: PHOTOGRAPHS OF EUT
EXTERNAL VIEW-1 OF EUT



EXTERNAL VIEW-2 OF EUT

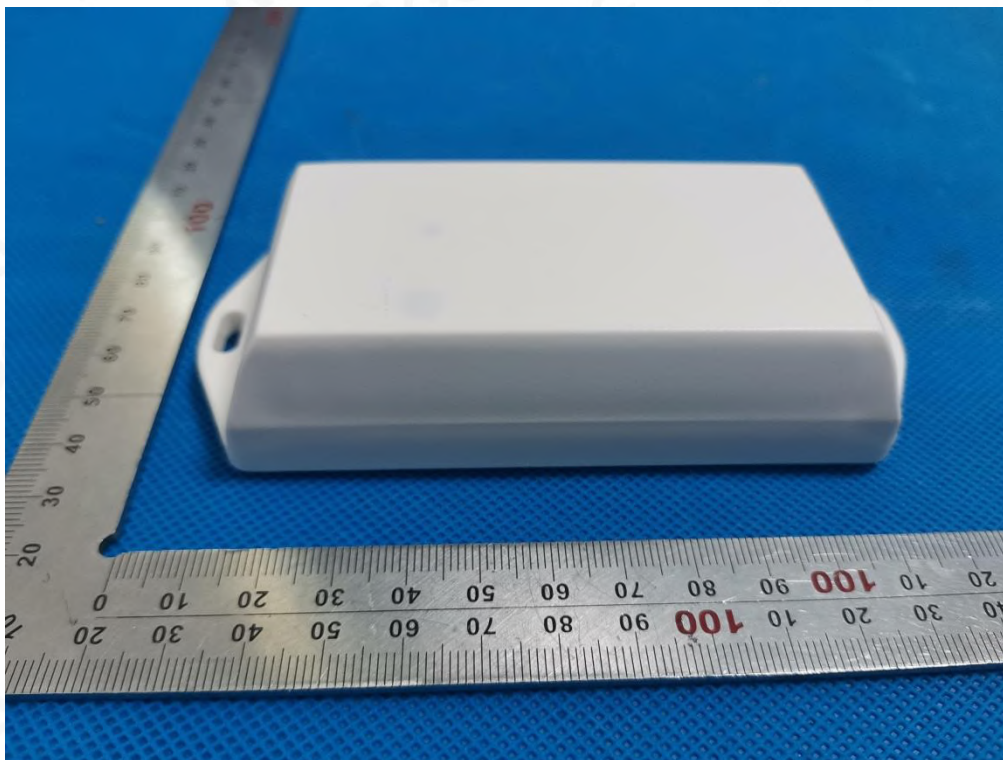


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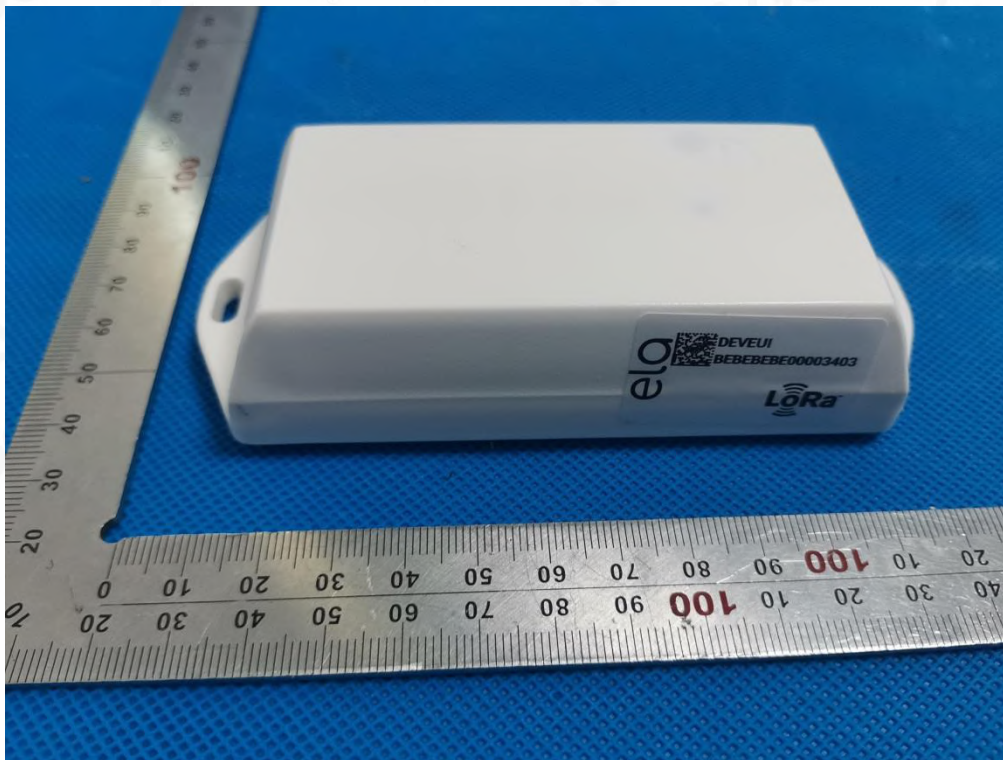
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EXTERNAL VIEW-3 OF EUT



EXTERNAL VIEW-4 OF EUT

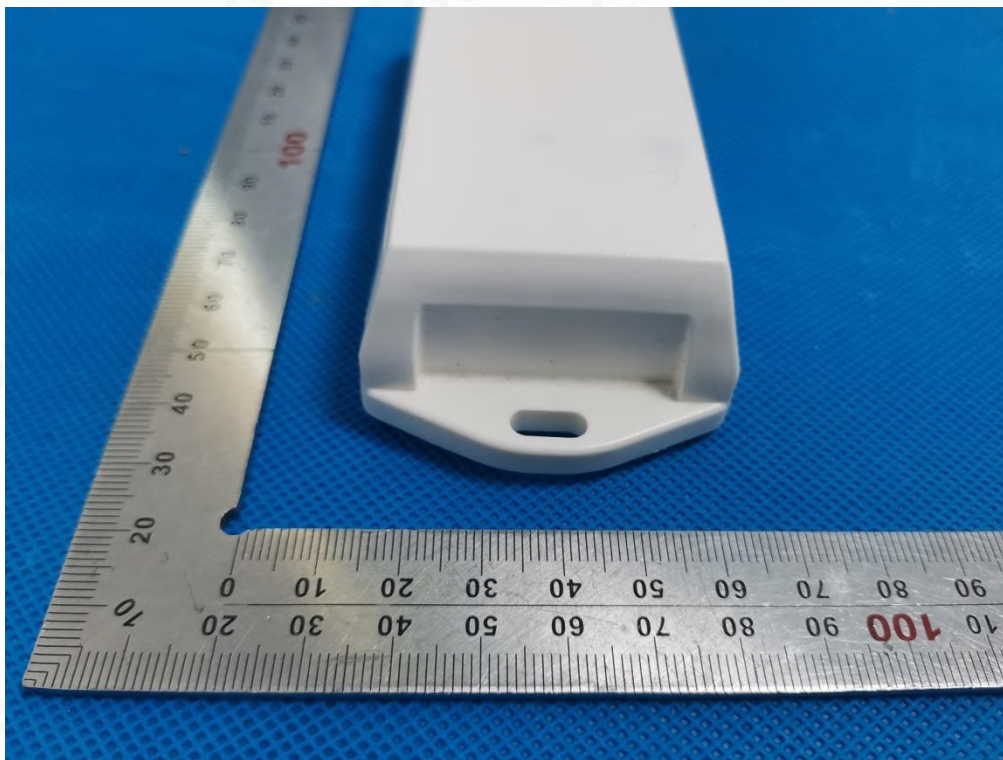


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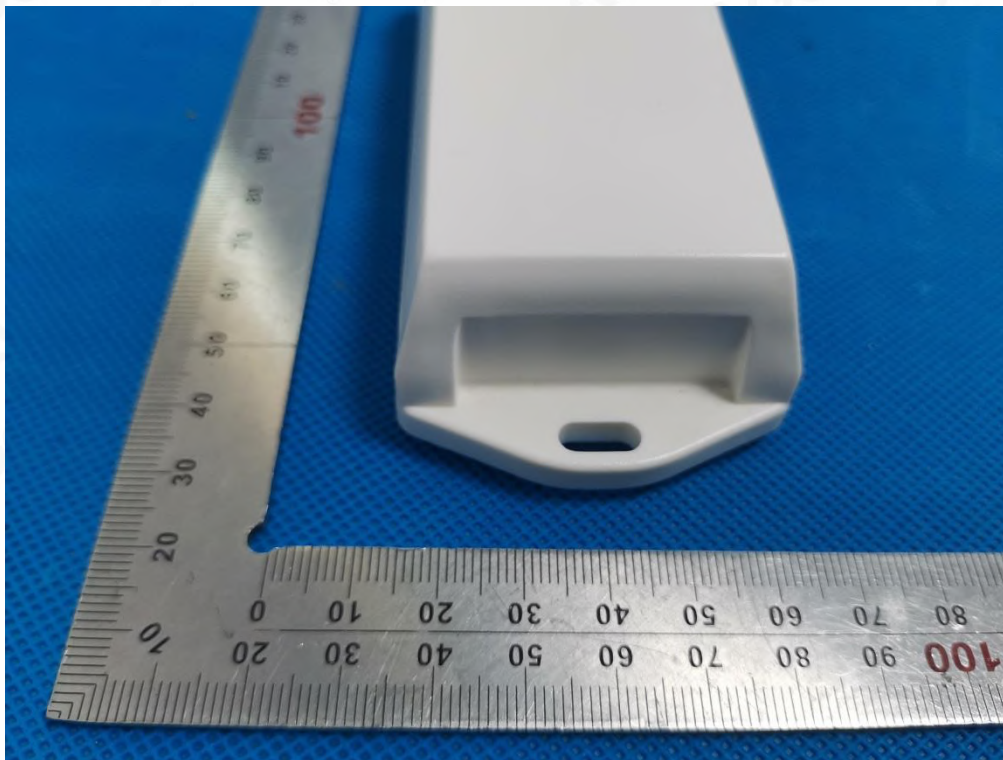
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EXTERNAL VIEW-5 OF EUT



EXTERNAL VIEW-6 OF EUT

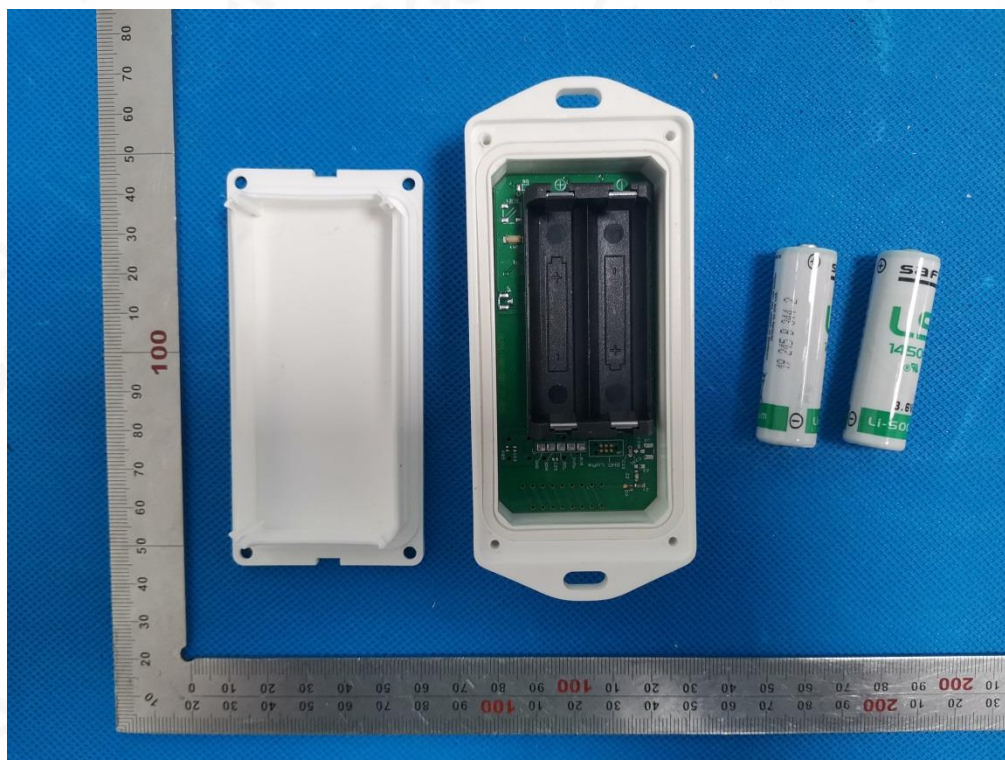


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INTERNAL VIEW-1 OF EUT



INTERNAL VIEW-2 OF EUT

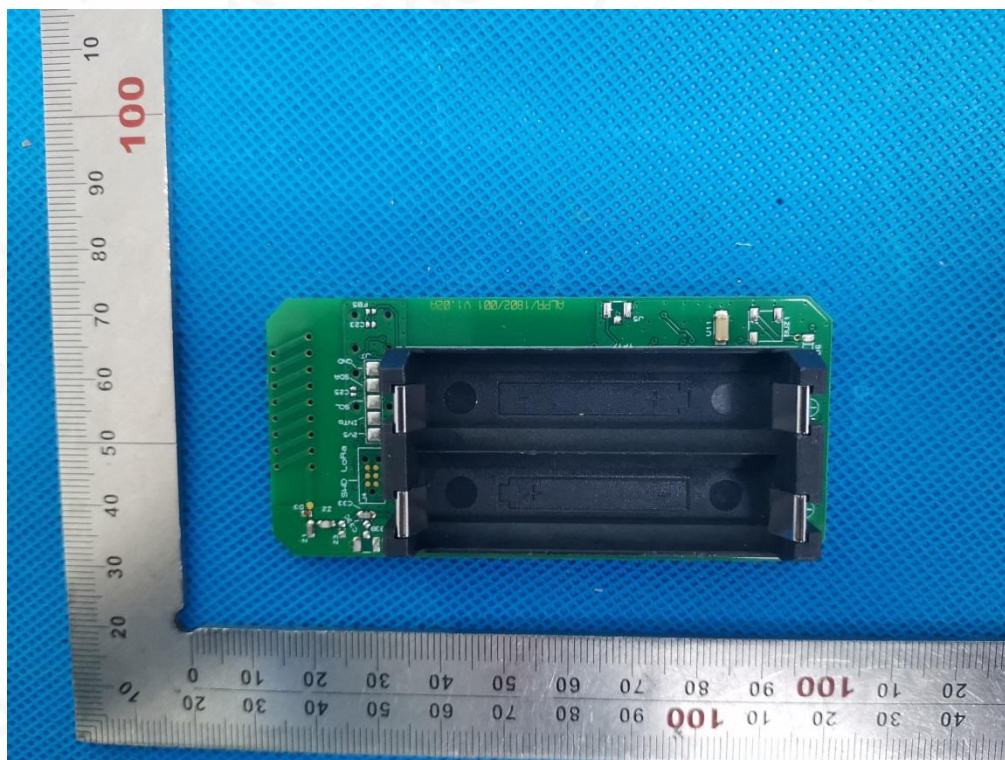


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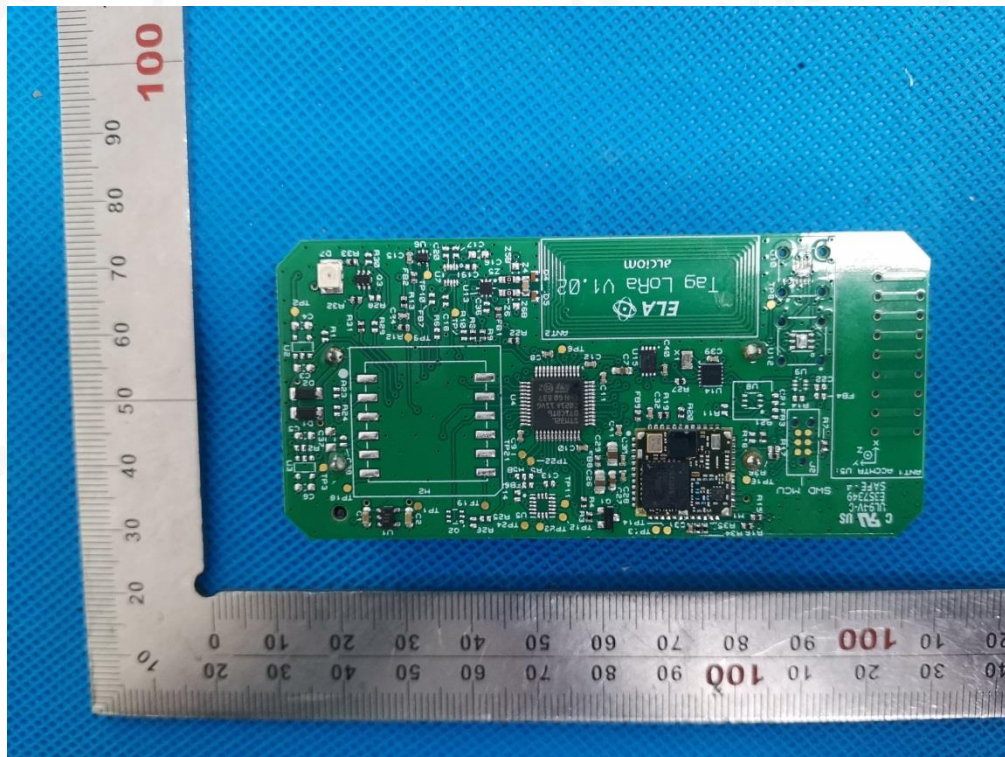
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INTERNAL VIEW-3 OF EUT



INTERNAL VIEW-4 OF EUT

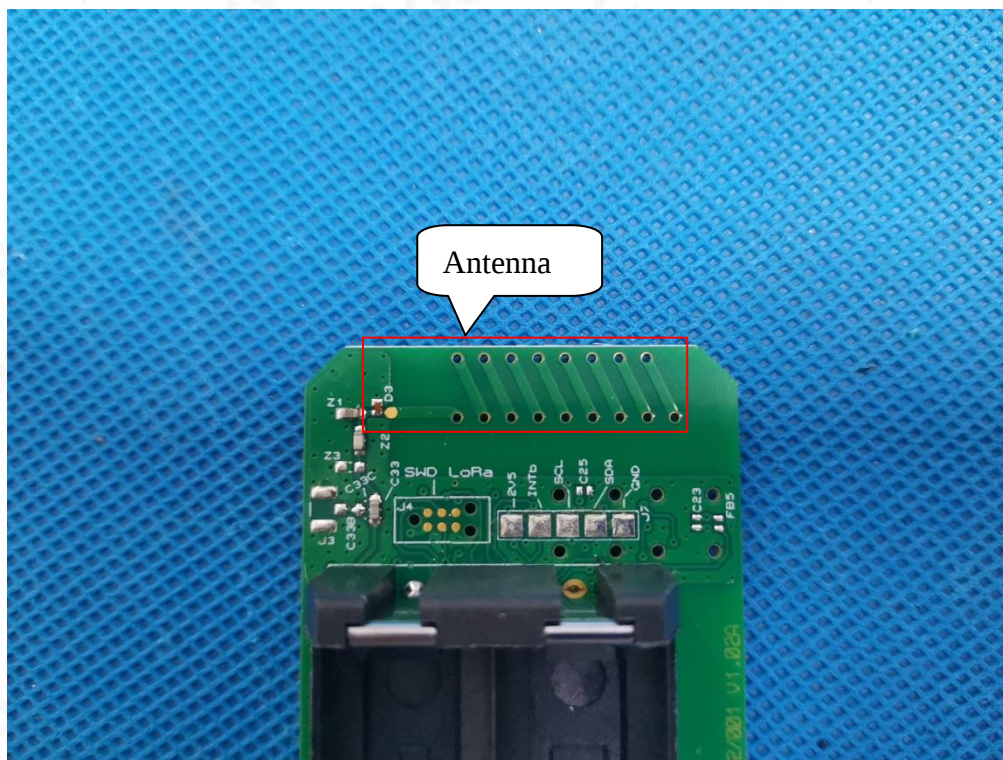


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INTERNAL VIEW-5 OF EUT



INTERNAL VIEW-6 OF EUT

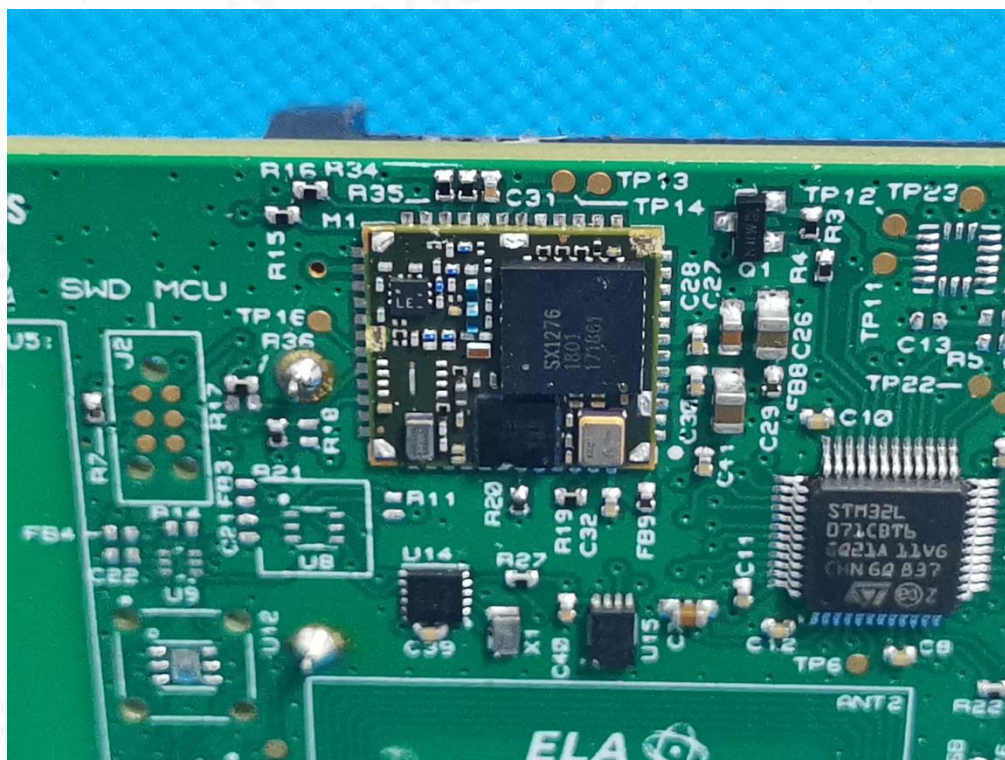


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INTERNAL VIEW-7 OF EUT



VIEW OF BATTERY



-----END OF REPORT-----

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Conditions of Issuance of Test Reports

1. All samples and goods are accepted by the Attestation of Global Compliance (Shenzhen) Co., Ltd (the “Company”) solely for testing and reporting in accordance with the following terms and conditions. The company provides its services on the basis that such terms and conditions constitute express agreement between the company and any person, firm or company requesting its services (the “Clients”).
2. Any report issued by Company as a result of this application for testing services (the “Report”) shall be issued in confidence to the Clients and the Report will be strictly treated as such by the Company. It may not be reproduced either in its entirety or in part and it may not be used for advertising or other unauthorized purposes without the written consent of the Company. The Clients to whom the Report is issued may, however, show or send it, or a certified copy thereof prepared by the Company to its customer, supplier or other persons directly concerned. The Company will not, without the consent of the Clients, enter into any discussion or correspondence with any third party concerning the contents of the Report, unless required by the relevant governmental authorities, laws or court orders.
3. The Company shall not be called or be liable to be called to give evidence or testimony on the Report in a court of law without its prior written consent, unless required by the relevant governmental authorities, laws or court orders.
4. The non-CMA report issued by AGC is only permitted to be used by the client as internal reference use and shall not be used for public demonstration purpose.
5. In the event of the improper use of the report as determined by the Company, the Company reserves the right to withdraw it, and to adopt any other additional remedies which may be appropriate.
6. Samples submitted for testing are accepted on the understanding that the Report issued cannot form the basis of, or be the instrument for, any legal action against the Company.
7. The Company will not be liable for or accept responsibility for any loss or damage however arising from the use of information contained in any of its Reports or in any communication whatsoever about its said tests or investigations.
8. Clients wishing to use the Report in court proceedings or arbitration shall inform the Company to that effect prior to submitting the sample for testing.
9. The Company is not responsible for recalling the electronic version of the original report when any revision is made to them. The Client assumes the responsibility to providing the revised version to any interested party who uses them.
10. Subject to the variable length of retention time for test data and report stored hereinto as otherwise specifically required by individual accreditation authorities, the Company will only keep the supporting test data and information of the test report for a period of six years. The data and information will be disposed of after the aforementioned retention period has elapsed. Under no circumstances shall we provide any data and information which has been disposed of after retention period. Under no circumstances shall we be liable for damage of any kind, including (but not limited to) compensatory damages, lost profits, lost data, or any form of special, incidental, indirect, consequential or punitive damages of any kind, whether based on breach of contract of warranty, tort (including negligence), product liability or otherwise, even if we are informed in advance of the possibility of such damages.

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