DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29507456

Test Report No:
79301RRF.006

Test Report

Ordinance Regulating Radio Equipment, Radio Regulatory Commission Regulations No 18 - November 30, 1950 (as amended).
Second generation low power data communication system / Wireless LAN system.

ARIB STD-T66 V 3.7 (2014-10-02)

(*) Identification of item tested	Rechargeable hearing instrument
(*) Trademark	ReSound, Beltone, Interton, GN Hearing, Danavox, Audigy, Jabra, GN Audio
(*) Model and /or type reference	LUBR90
Other identification of the product	FCC ID: X26LUBR90 IC: 6941C-LUBR90
(*) Features	BT 1/2Mbit, proximity & MI radio, rechargeable battery, IP68 enclosure HW version: LUBR90,V2,C6.0 SW version: Dooku3
Applicant	GN Hearing A/S Lautrupbjerg 7, DK-2750 Ballerup, Denmark
Test method requested, standard	平成十六年総務省告示第八十八号(特定無線設備の技術基準適合証明等に関する規則別表第一号一(3)の規定に基づく特性試験の試験方法)別表第四十三 Public notice of MIC No. 88 test method of specified radio equipment Annex 43, Article 2 Paragraph 1 Item 19 ARIB STD-T66 V 3.7 (2014-10-02). Ordinance Regulating Radio Equipment, Radio Regulatory Commission Regulations No 18 - November 30, 1950 (as amended). Article 2 Paragraph 1 Item 19.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager Firmado digitalmente por 53680346W JOSE MANUEL GOMEZ (C:A29507456)
Date of issue	2025-07-10
Report template No	FDT08_25 (*) "Data provided by the client"

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Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification S.A.U.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

- Transmitting equipment. Antenna power and tolerances for antenna power: Measurement uncertainty ≤ ± 2.01 dB
- Transmitting equipment. Frequency tolerance: Measurement uncertainty ≤ ± 4.75 kHz
- Transmitting equipment. Spurious emission intensity: Measurement uncertainty ≤ ± 2.85 dB
- Transmitting equipment. Permissible value for occupied bandwidth: Measurement uncertainty ≤ ± 6.35 kHz
- Transmitting equipment. Spread bandwidth: Measurement uncertainty ≤ ± 710.28 kHz
- Receiving equipment. Limit on secondary radiated emissions: Measurement uncertainty ≤ ± 2.95 dB

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").

2. The sample consists of a rechargeable wireless hearing aid.

3. The next page contains a statement from the client regarding the different brand versions of the device under test.

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Docusign Envelope ID: 406873B7-6690-43FA-A5E1-7B8408B35C17

GN Hearing A/S

20.03.2025

Statement of equivalence

As manufacturer of the "LUBR90" hearing aid, GN Hearing A/S, hereby confirm that the devices may be marketed under several different brands. There are no differences in electronics or mechanics between the different brand versions. The only difference is the brand name appearing on the devices.

Consequently, all devices marketed under below brands will have equivalent electrical and mechanical properties and performance as the model tested which is the ReSound "LUBR90" hearing aid version.

GN Hearing "LUBR90" hearing aid may be marketed under the brands:

- GN Hearing A/S
- GN Audio A/S
- ReSound
- Beltone
- Jabra
- Interton
- Audigy
- Danavox

Sincerely,

DocuSigned by:
Søren Carlsen
389D2E3E10D14FE...

GN Hearing A/S
Lautrupbjerg 7
DK-2750 Ballerup
Denmark
CVR: 55082715

Søren Carlsen
Regulatory Certification Engineer
GN Hearing A/S

4. Declaration of the Applicant, 'Interference Prevention Function':

GN

16.09.2024

To whom it may concern.

GN Hearing A/S hereby believe we comply with the below requirement, for our Proximity Protocol. **MIC Public Notice 88:2004, Annex 43. Ordinance Article 2, Paragraph 1, Item 19 and Item 19-2-2 of the Certification Regulations 1, 14. Interference prevention function.**

Our pairing service described in the document referenced below, requires that our Hearing aid and any of our Proximity based accessories, when paired, meet the requirement above.

For pairing to be successful, the two devices are required to exchange their Proximity MAC addresses. If this has failed, the two devices will not connect successfully afterwards. For this to occur, the required transmission and demodulation of the MAC address must have been successfully completed.

The Proximity MAC address used in our devices, is a random number generated during production. This value is not normally needed, as it is just used internally, so we do not have tools available for reading this information out.

Please see section **4.2.9.1 Pairing Services**, in Document **0441470rl SW COMPONENT DSGN DOOKU3, OS.doc** for further details.

Best regards,

GN Hearing A/S
Lautrupbjerg 7
DK-2750 Ballerup
Denmark
CVR: 55082715

Name: Mohammad Elhaj
Title: Regulatory Certification Engineer

GN Hearing A/S | Lautrupbjerg 7 | DK-2750 Ballerup | +45 45 75 11 11
Co. Reg. no. 55082715 | info@gn.com | www.gn.com

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results. The laboratory is not responsible for such information and it is not covered by accreditation.

Usage of samples

Samples undergoing test have been selected by: The client.

Id	Control Number	Description	Model	Serial Nº	Date of Reception	Application
S/01	79301D_32.1	Hearing Aid	LUBR90	--	2025-03-18	Element Under Test
	72126_17.1	Speedlink device	--	1881274590	2022-10-03	Auxiliary Element
	72126_24.1	Programming cable	--	--	2022-10-03	Auxiliary Element

Notes referenced to samples during the project:

Id	Type
S/01	Conducted

Test sample description

<table>
<tr><td>Ports…… :</td><td colspan="6"><table>
<tr><th rowspan="2">Port name and description</th><th colspan="4">Cable</th></tr>
<tr><th>Specified max length [m]</th><th>Attached during test</th><th>Shielded</th><th>Coupled to patient(3)</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Supplementary information to the ports…… :</td><td colspan="6"></td></tr>
<tr><td>Rated power supply .....:</td><td colspan="6"><table>
<tr><th colspan="2" rowspan="2">Voltage and Frequency</th><th colspan="5">Reference poles</th></tr>
<tr><th>L1</th><th>L2</th><th>L3</th><th>N</th><th>PE</th></tr>
<tr><td></td><td>AC:</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>AC:</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="5">DC: 3.7V (rechargeable battery)</td></tr>
<tr><td></td><td colspan="5">DC:</td></tr>
</table></td></tr>
<tr><td>Rated Power .....:</td><td colspan="6">3.73V, 50 mAh, 0,187Wh</td></tr>
<tr><td>Clock frequencies.....:</td><td colspan="6">CPU XTAL: 32 MHz</td></tr>
<tr><td>Other parameters .....:</td><td colspan="6"></td></tr>
<tr><td>Software version .....:</td><td colspan="6">Dooku3</td></tr>
<tr><td>Hardware version .....:</td><td colspan="6">LUBR90,V2,C6.0</td></tr>
<tr><td>Dimensions in cm (W x H x D) ....:</td><td colspan="6">40x15x9mm</td></tr>
<tr><td>Mounting position .....:</td><td colspan="6"><table>
<tr><td></td><td>Table top equipment</td></tr>
<tr><td></td><td>Wall/Ceiling mounted equipment</td></tr>
<tr><td></td><td>Floor standing equipment</td></tr>
<tr><td></td><td>Hand-held equipment</td></tr>
</table></td></tr>
</table>

		Other:

Modules/parts.....:	Module/parts of test item	Type	Manufacturer

Accessories (not part of the test item) .....:	Description	Type	Manufacturer

Documents as provided by the applicant.....:	Description	File name	Issue date

Identification of the client

GN Hearing A/S
Lautrupbjerg 7, DK-2750 Ballerup, Denmark

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2025-07-02
Date (finish)	2025-07-07

Document history

Report number	Date	Description
79301RRF.006	2025-07-10	First release.

Environmental conditions

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 5 ºC Max. = 35 ºC
Relative humidity	Min. = 45 % Max. = 85 %

Remarks and comments

The tests have been performed by the technical personnel: Rubén Mora and Victoria Olmedo.

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
07702	DC POWER SUPPLY 30V/3A 90W	GPS-3030D	GW INSTEK	N/A
07755	DIGITAL MULTIMETER	175	FLUKE	2025-11-25
08835	SIGNAL AND SPECTRUM ANALYZER 2 Hz - 50 GHz	FSW50	ROHDE AND SCHWARZ	2027-04-15
08661	SHIELDED ROOM	-	SIEPEL	N/A
07552	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2026-04-23
04848	EMC/RF MEASUREMENT SOFTWARE	EMC32	ROHDE AND SCHWARZ	N/A
04530	AVG POWER SENSOR 6 GHZ	NRP-Z91	ROHDE AND SCHWARZ	2025-07-29
07794	SIGNAL AND SPECTRUM ANALYZER 10Hz-40GHz	FSV40	ROHDE AND SCHWARZ	2027-06-10

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

Bluetooth Low Energy 5.4 (1M). Appendix A

MIC No. 88 Annex 43			
Requirement – Test case		**Verdict**	**Remark**
Article 49-20 and Article 14.7 Table 8	Transmitting equipment. Antenna power. Tolerances for antenna power.	P	--
Article 5 and Annex 1 table 7-8	Transmitting equipment. Frequency tolerance.	P	--
Article 7 and Annex 3. 26	Transmitting equipment. Spurious emission intensity.	P	--
Article 6 and Annex 2. 30	Transmitting equipment. Permissible value for occupied bandwidth.	P	--
Article 24.2	Receiving equipment. Limit on secondary radiated emissions.	P	--
Article 9.4-5	Controlling equipment. Interference prevention function. Identification code transmission/reception.	P	--
Article 49-20	Antenna. Antenna gain	P	--
Supplementary information and remarks: The performed tests also show compliance with ARIB STD-T66 V 3.7 requirements.			

Bluetooth Low Energy 5.4 (2M). Appendix B

MIC No. 88 Annex 43			
Requirement – Test case		**Verdict**	**Remark**
Article 49-20 and Article 14.7 Table 8	Transmitting equipment. Antenna power. Tolerances for antenna power.	P	--
Article 5 and Annex 1 table 7-8	Transmitting equipment. Frequency tolerance.	P	--
Article 7 and Annex 3. 26	Transmitting equipment. Spurious emission intensity.	P	--
Article 6 and Annex 2. 30	Transmitting equipment. Permissible value for occupied bandwidth.	P	--
Article 24.2	Receiving equipment. Limit on secondary radiated emissions.	P	--
Article 9.4-5	Controlling equipment. Interference prevention function. Identification code transmission/reception.	P	--
Article 49-20	Antenna. Antenna gain	P	--
Supplementary information and remarks: The performed tests also show compliance with ARIB STD-T66 V 3.7 requirements.			

Proximity (2M). Appendix C

MIC No. 88 Annex 43			
Requirement – Test case		**Verdict**	**Remark**
Article 49-20 and Article 14.7 Table 8	Transmitting equipment. Antenna power. Tolerances for antenna power.	P	--
Article 5 and Annex 1 table 7-8	Transmitting equipment. Frequency tolerance.	P	--
Article 7 and Annex 3. 26	Transmitting equipment. Spurious emission intensity.	P	--
Article 6 and Annex 2. 30	Transmitting equipment. Permissible value for occupied bandwidth.	P	--
Article 24.2	Receiving equipment. Limit on secondary radiated emissions.	P	--
Article 9.4-5	Controlling equipment. Interference prevention function. Identification code transmission/reception.	P	(1)
Article 49-20	Antenna. Antenna gain	P	--

Supplementary information and remarks:

The performed tests also show compliance with ARIB STD-T66 V 3.7 requirements.

(1) Declaration of Proximity MAC Address Statement in section Data provided by the client.

Appendix A: Test results. Bluetooth Low Energy 5.4 (1M)

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Article 9.4-5. Controlling equipment. Interference prevention function. Identification code transmission/reception 59

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TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal:	3.7 Vdc
Type of Power Supply:	Battery

ANTENNA (*):

Type of Antenna:	Internal
Maximum Declared Antenna Gain:	-8.3 dBi

TEST FREQUENCIES (*):

Modulation	Data rates	Low Channel:	Middle Channel	High Channel
BLE GFSK	1 Mbit/s	2402 MHz	2440 MHz	2480 MHz

During transmitter test the EUT was controlled by a SW tool provided by the client to operate in a continuous transmit mode on the modulation schemes and test channels as required.

ENVIRONMENTAL CONDITIONS DURING TESTING:

Temperature: 23 ºC
Humidity: 55 %

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and its antenna port (SMA type) is connected to the spectrum analyser through a low loss RF cable. The reading of the spectrum analyser is corrected with the cable loss.

The DC supply voltage is applied using a power supply.

The Equipment Under Test (E.U.T) is set in continuous transmission with modulation using an implemented test mode. The test mode also permits to set the E.U.T. in receiving mode with the transmission disabled

PRODUCT INFORMATION

Information	Description
Modulation:	GFSK.
Spread spectrum system:	No (Other digital modulation methods).
Nominal necessary Bandwidth:	1 MHz.
Maximum declared antenna gain:	-8.3 dBi.
Rated Antenna Power:	9.5 dBm (8.912509381 mW).
Type of Antenna:	Integral antenna
Operating nominal frequency range:	2402 MHz to 2483.5 MHz.
Nominal power supply:	3.7 Vdc.
Type of power supply:	Battery.

Article 49-20 and Article 14.7 Table 8. Transmitting equipment. Antenna power. Tolerances for antenna power

Limits:

Mode	Limit	Tolerance
a) FH, FH+DS, FH+OFDM	3 mW/MHz	+20%
b) OFDM (Narrow bandwidth), DS	10 mW/MHz	
c) Other than a & b	10 mW	
d) OFDM (Wide band)	5 mW/MHz	

Results:

Mode: Other digital modulation methods than a & b.

Maximum Rated Antenna Power: 9.5 dBm (8.912509381 mW)

Vnom:

Channel	Measured antenna power (dBm)	Radiated power EIRP (dBm)	Antenna power EIRP (mW)	Deviation from maximum rated antenna power (%)
Low (2402 MHz)	8.527000	0.23	1.05	-20.07180601
Middle (2440 MHz)	8.552000	0.25	1.06	-19.61037551
High (2480 MHz)	8.067000	-0.23	0.95	-28.10478281

Vmin:

Channel	Measured antenna power (dBm)	Radiated power EIRP (dBm)	Antenna power EIRP (mW)	Deviation from maximum rated antenna power (%)
Low (2402 MHz)	8.496000	0.20	1.05	-20.64030318
Middle (2440 MHz)	8.266000	-0.03	0.99	-24.73379829
High (2480 MHz)	7.918000	-0.38	0.92	-30.52956793

Vmax:

Channel	Measured antenna power (dBm)	Radiated power EIRP (dBm)	Antenna power EIRP (mW)	Deviation from maximum rated antenna power (%)
Low (2402 MHz)	8.546000	0.25	1.06	-19.7213612
Middle (2440 MHz)	8.331000	0.03	1.01	-23.59883165
High (2480 MHz)	8.114000	-0.19	0.96	-27.32249662

Measurement uncertainty: < ± 2.01 dB

Verdict:

PASS

Article 5 and Annex 1 table 7-8. Transmitting equipment. Frequency tolerance

Limits:

Frequency tolerance shall be ± 50 x 10^{-6} (50 ppm).

Unmodulated carrier.

Results:

Vnom:

Channel	Frequency error (Hz)	Frequency error (ppm)
Low (2402 MHz)	7965	3.315986678
Middle (2440 MHz)	8055	3.301229508
High (2480 MHz)	7965	3.211693548
Measurement uncertainty	<± 7.10 kHz	

Vmin:

Channel	Frequency error (Hz)	Frequency error (ppm)
Low (2402 MHz)	8055	3.353455454
Middle (2440 MHz)	8055	3.301229508
High (2480 MHz)	7965	3.211693548
Measurement uncertainty	<± 7.10 kHz	

Vmax:

Channel	Frequency error (Hz)	Frequency error (ppm)
Low (2402 MHz)	7905	3.291007494
Middle (2440 MHz)	7965	3.264344262
High (2480 MHz)	7965	3.211693548
Measurement uncertainty	<± 7.10 kHz	

Verdict:

PASS

Article 6 and Annex 2. 30. Transmitting equipment. Permissible value for occupied bandwidth

Limits:

Mode	Limit
FH	83.5 MHz
FH+DS	83.5 MHz
FH+OFDM	83.5 MHz
OFDM (Narrow bandwidth), DS	26 MHz
OFDM (Wide band)	38 MHz
Others	26 MHz

Results:

Mode: Other digital modulation methods.

Vnom:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
99% occupied bandwidth (MHz)	1.0229	1.02322	1.0259
Limit	<26 MHz		
Measurement uncertainty (kHz)	<± 6.06		

Vmin:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
99% occupied bandwidth (MHz)	1.0173	1.0245	1.0278
Limit	<26 MHz		
Measurement uncertainty (kHz)	<± 6.06		

Vmax:

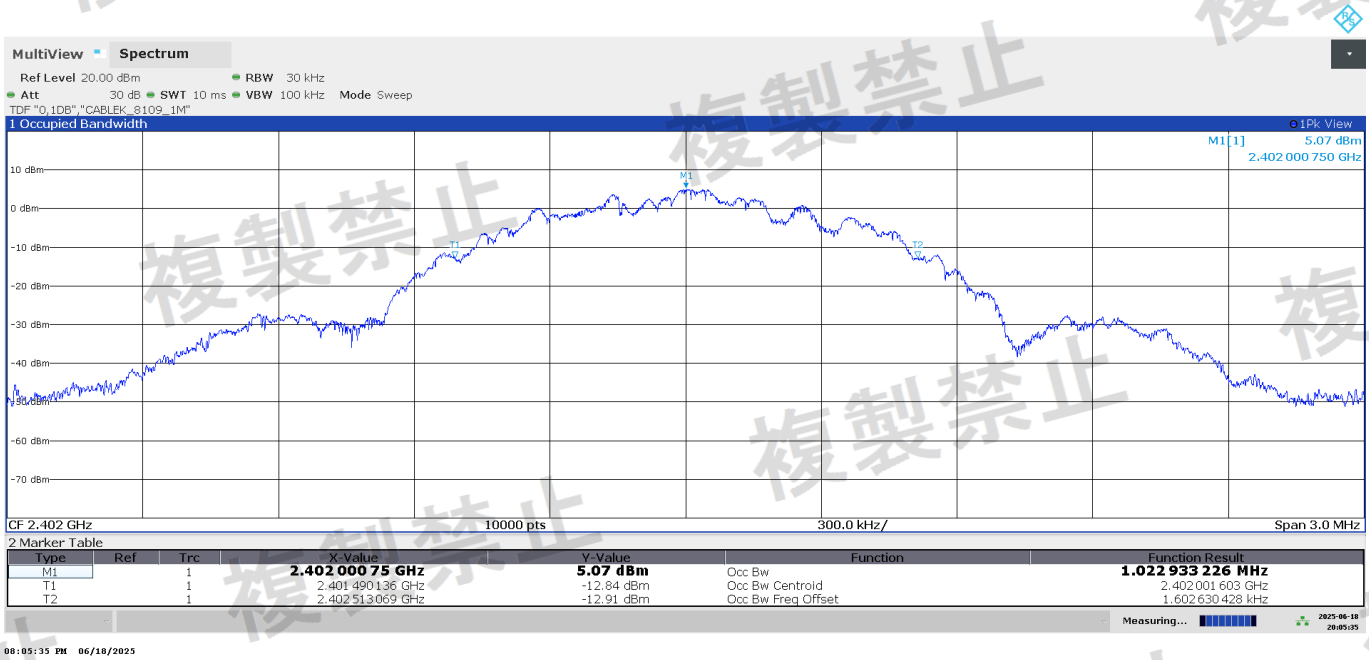
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
99% occupied bandwidth (MHz)	1.0266	1.0323	1.0272
Limit	<26 MHz		
Measurement uncertainty (kHz)	<± 6.06		

Verdict:

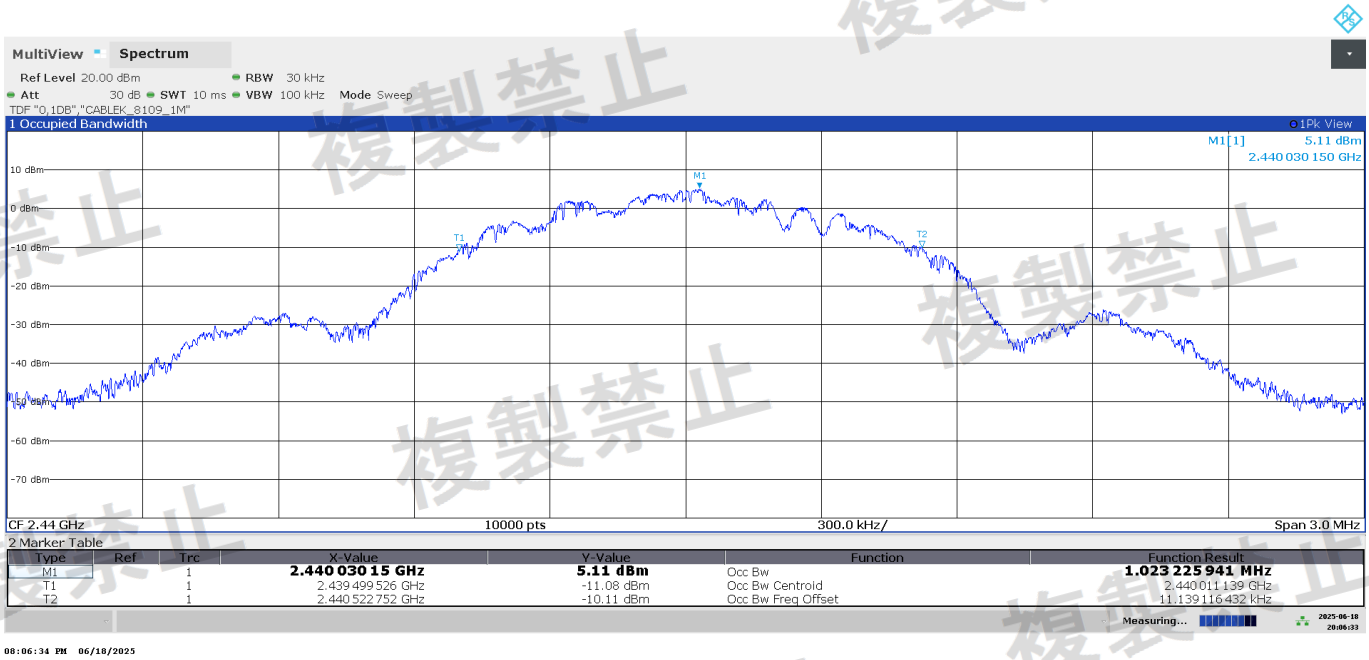
PASS

Vnom:

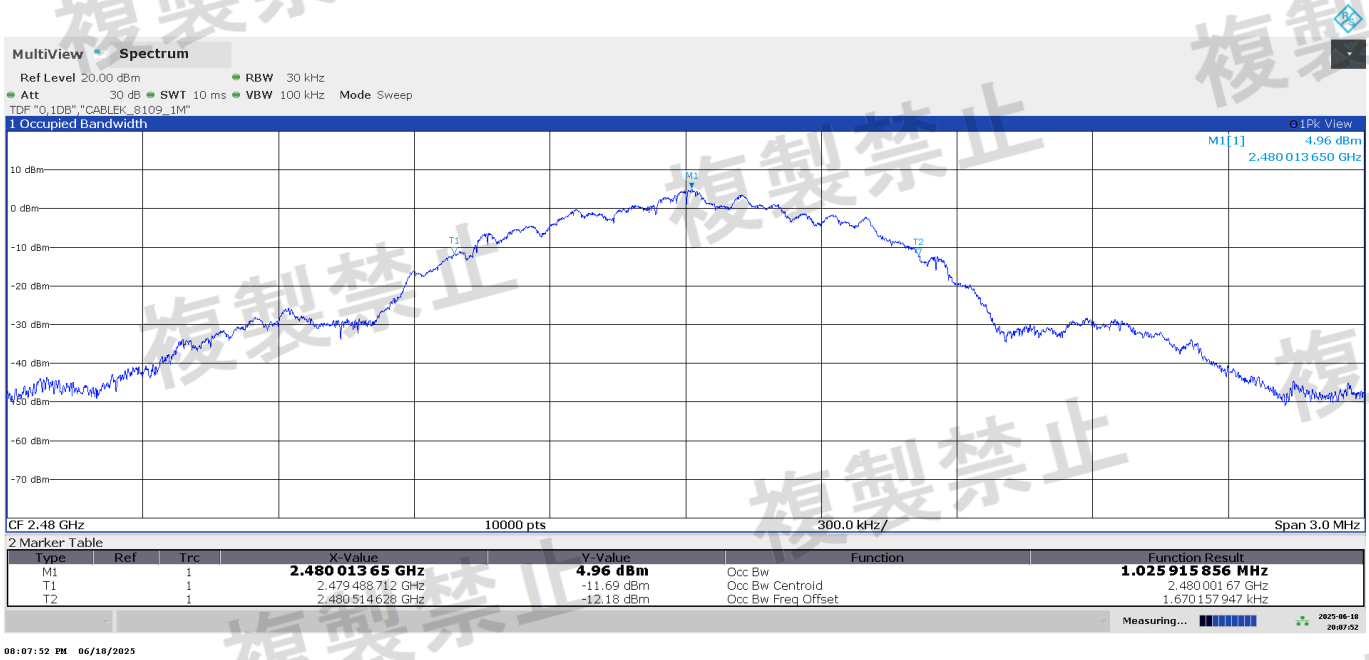
- LOW CHANNEL:



- MIDDLE CHANNEL:

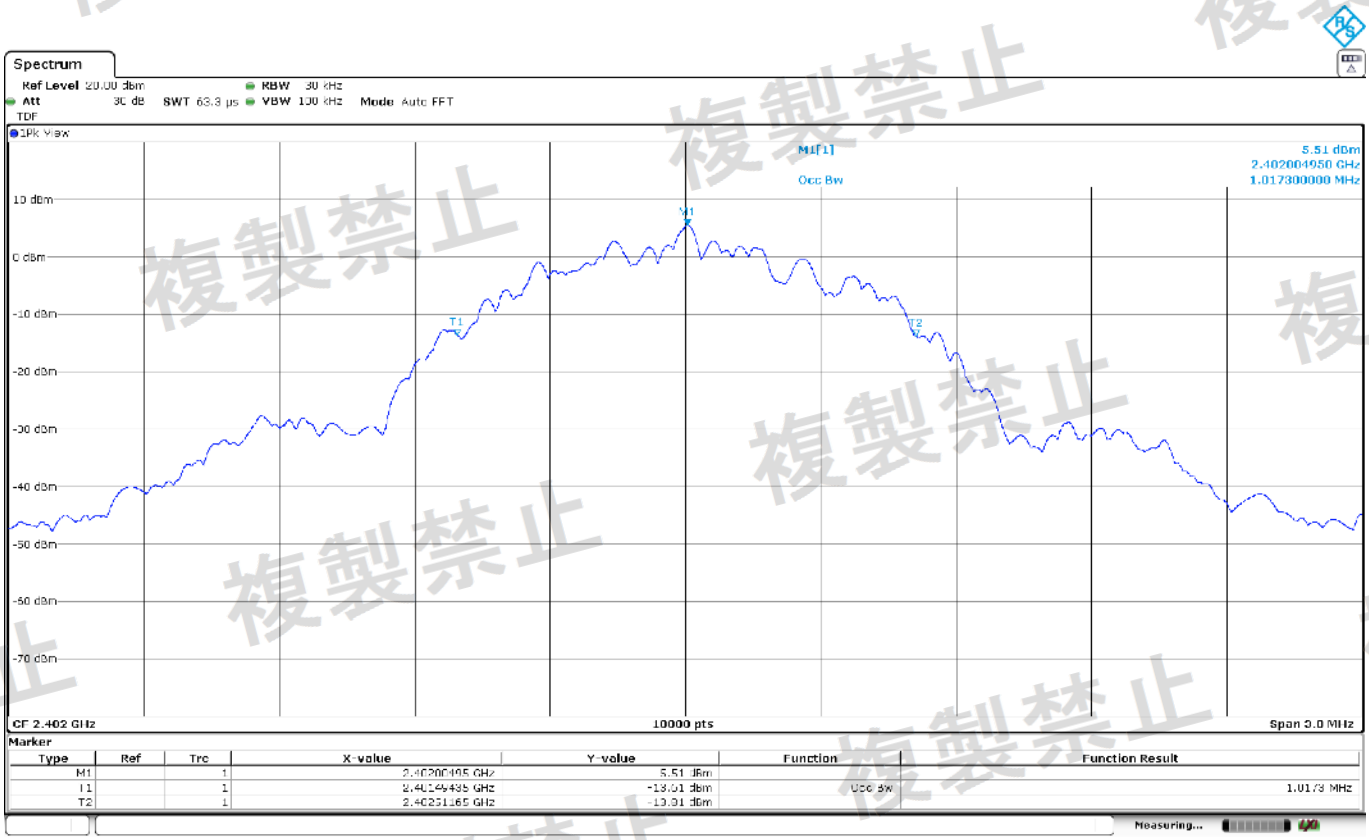


- HIGH CHANNEL:

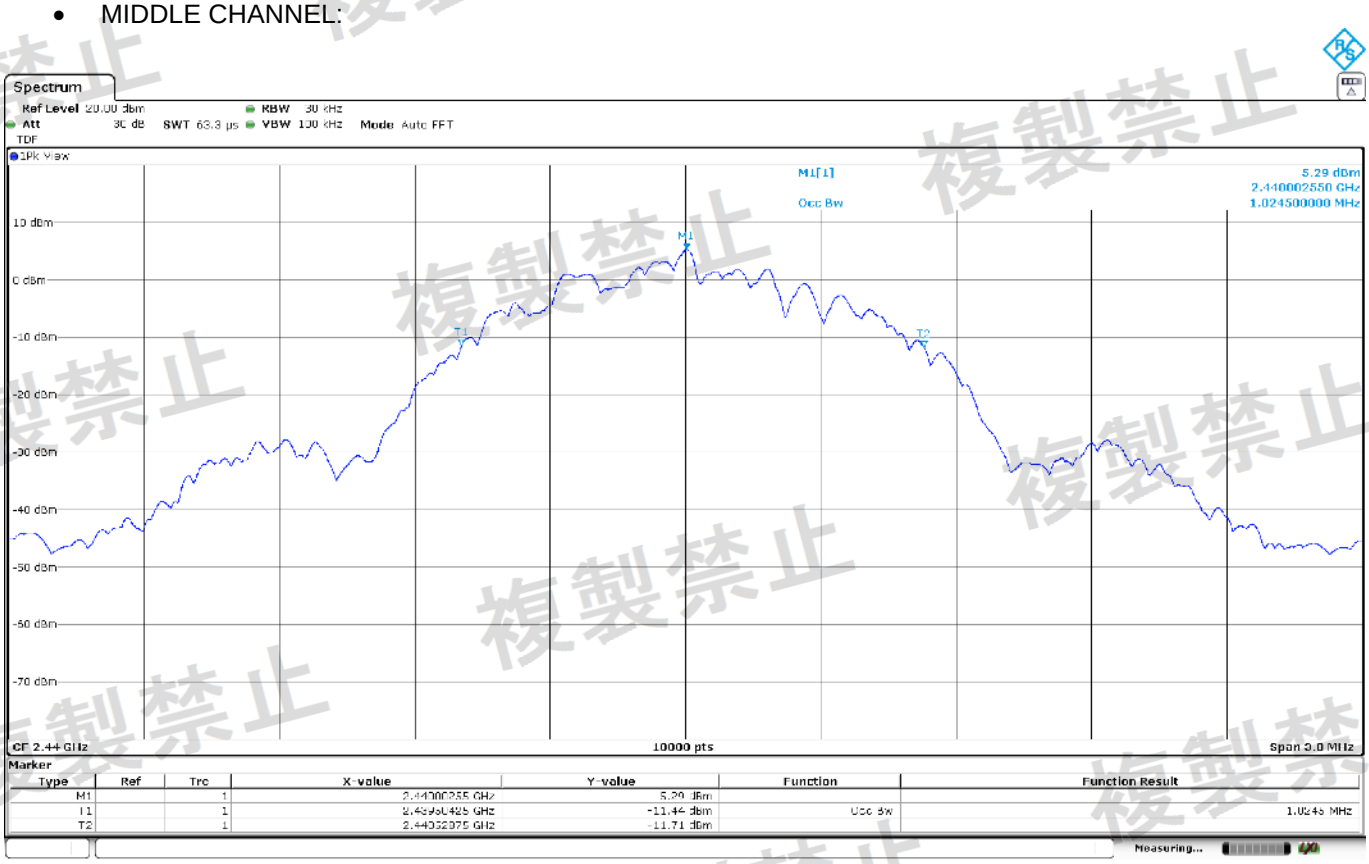


Vmin:

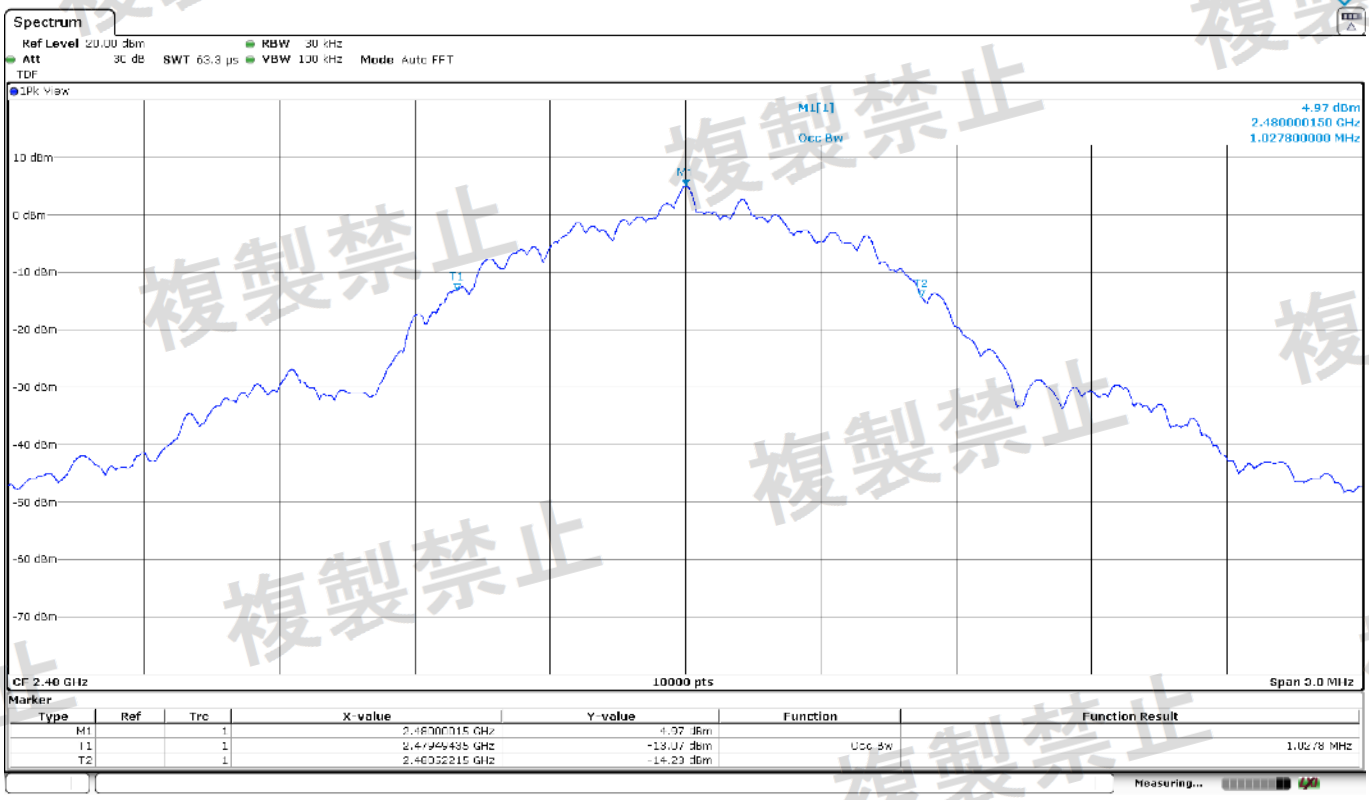
- LOW CHANNEL:



- MIDDLE CHANNEL:

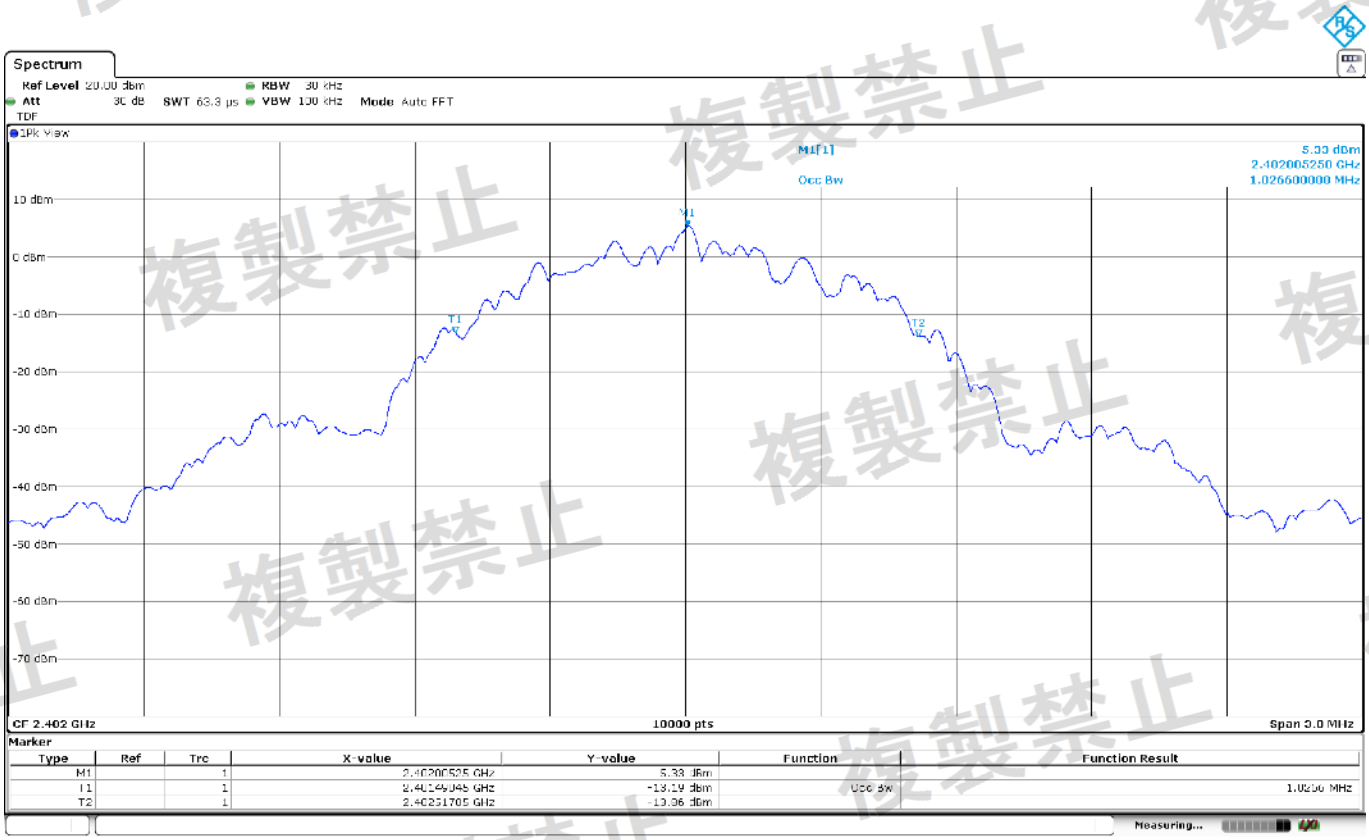


- HIGH CHANNEL:

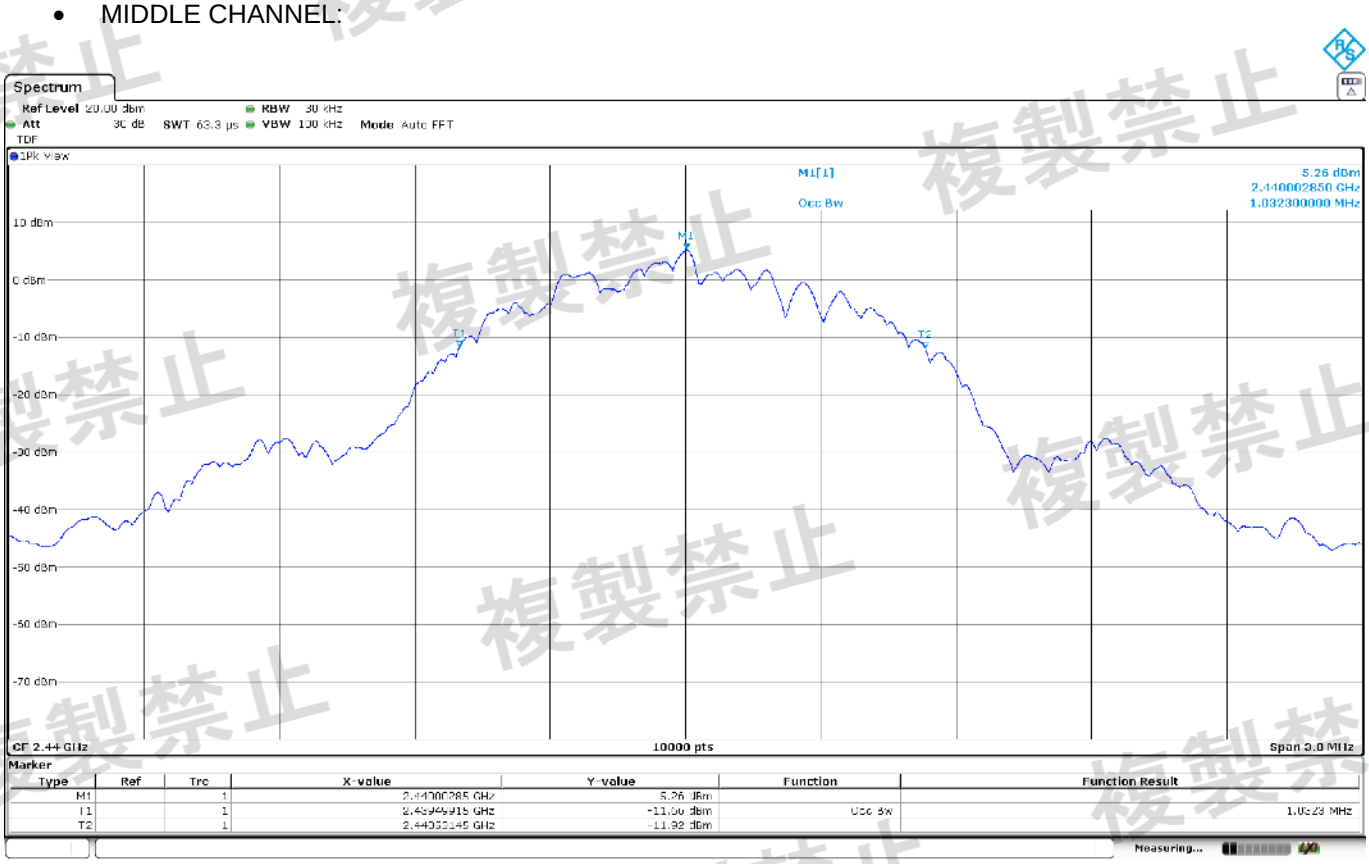


Vmax:

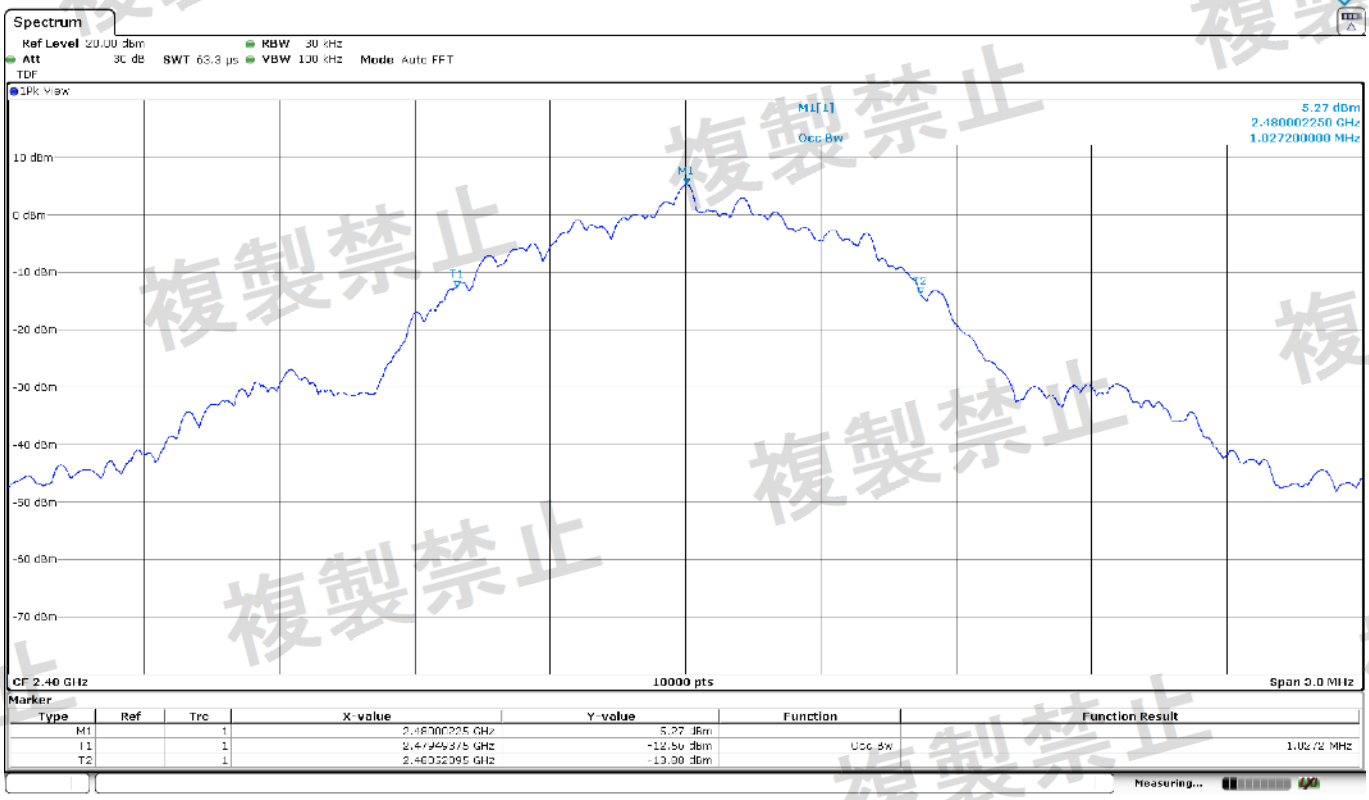
- LOW CHANNEL:



- MIDDLE CHANNEL:



- HIGH CHANNEL:



Article 7 and Annex 3. 26. Transmitting equipment. Spurious emission intensity

Limits:

Permissible mean power of spurious emission of each frequency supplied to a feeder, that is, mean power of spurious emission in the 1 MHz bandwidth at frequency f other than frequency band used shall be as follows:

a. 2,387 MHz ≤ f ≤ 2,400 MHz and 2,483.5 MHz < f ≤ 2,496.5 MHz	25 μW (-16 dBm) or less.
b. 2,387 MHz > f and 2,496.5 MHz < f	2.5 μW (-26 dBm) or less.

Results:

Vnom:

- LOW CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty <± 2.77 dB

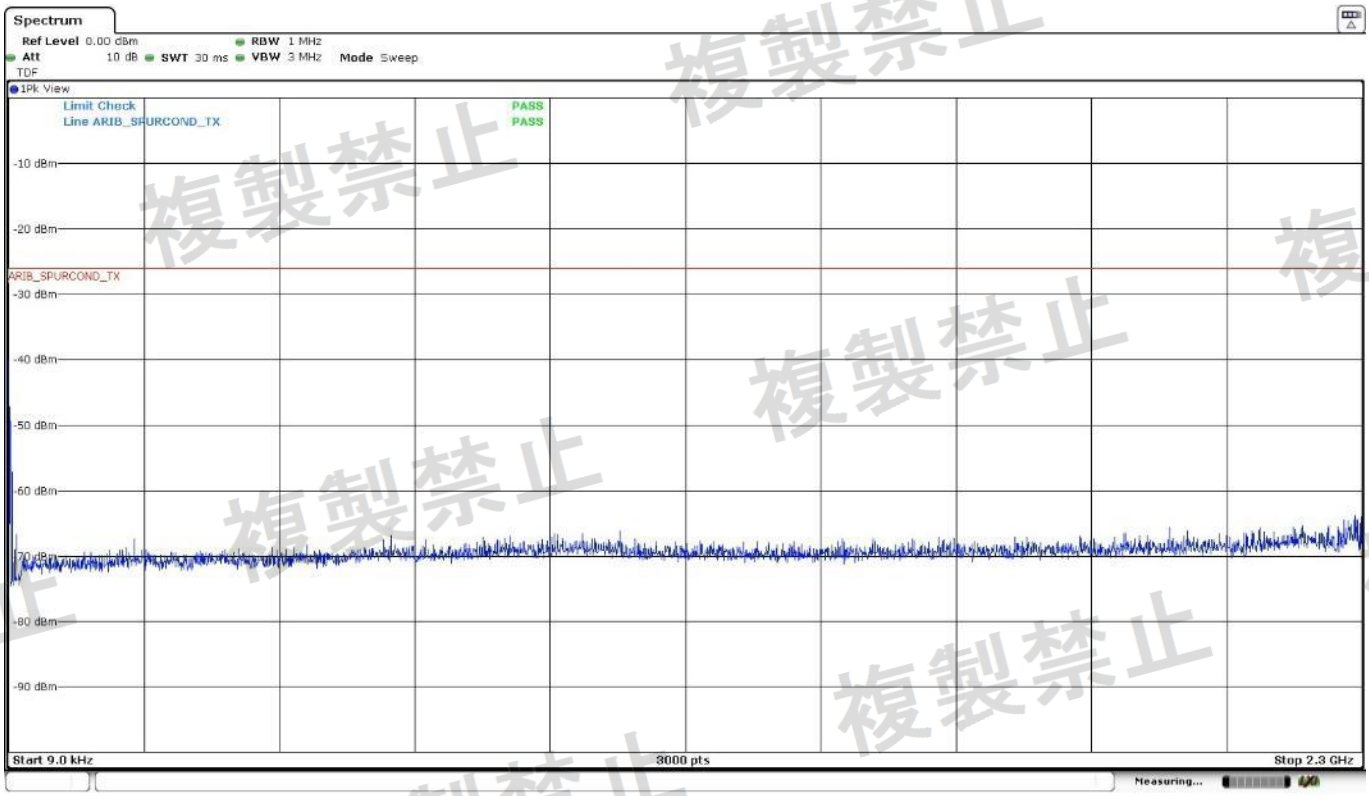
Verdict:

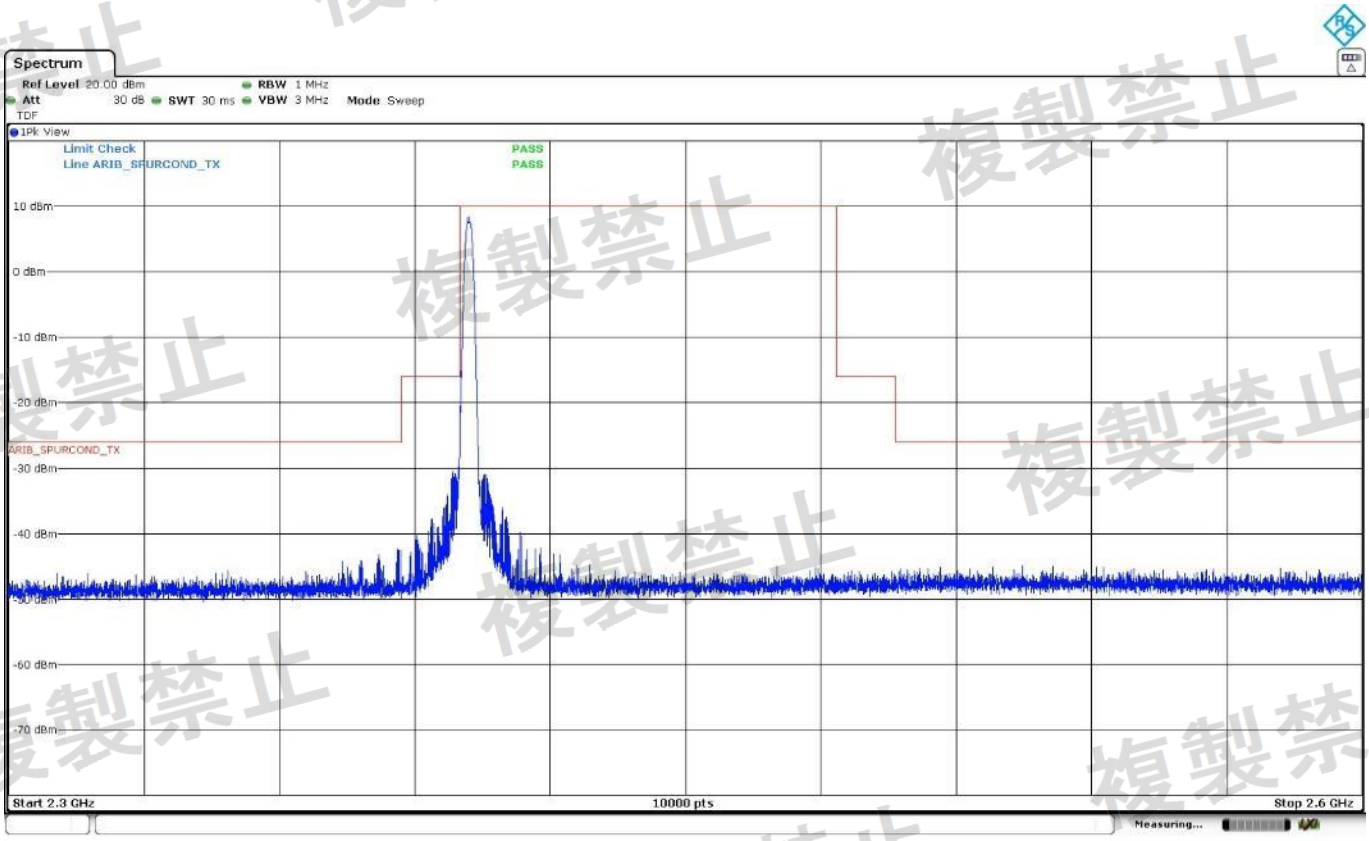
PASS

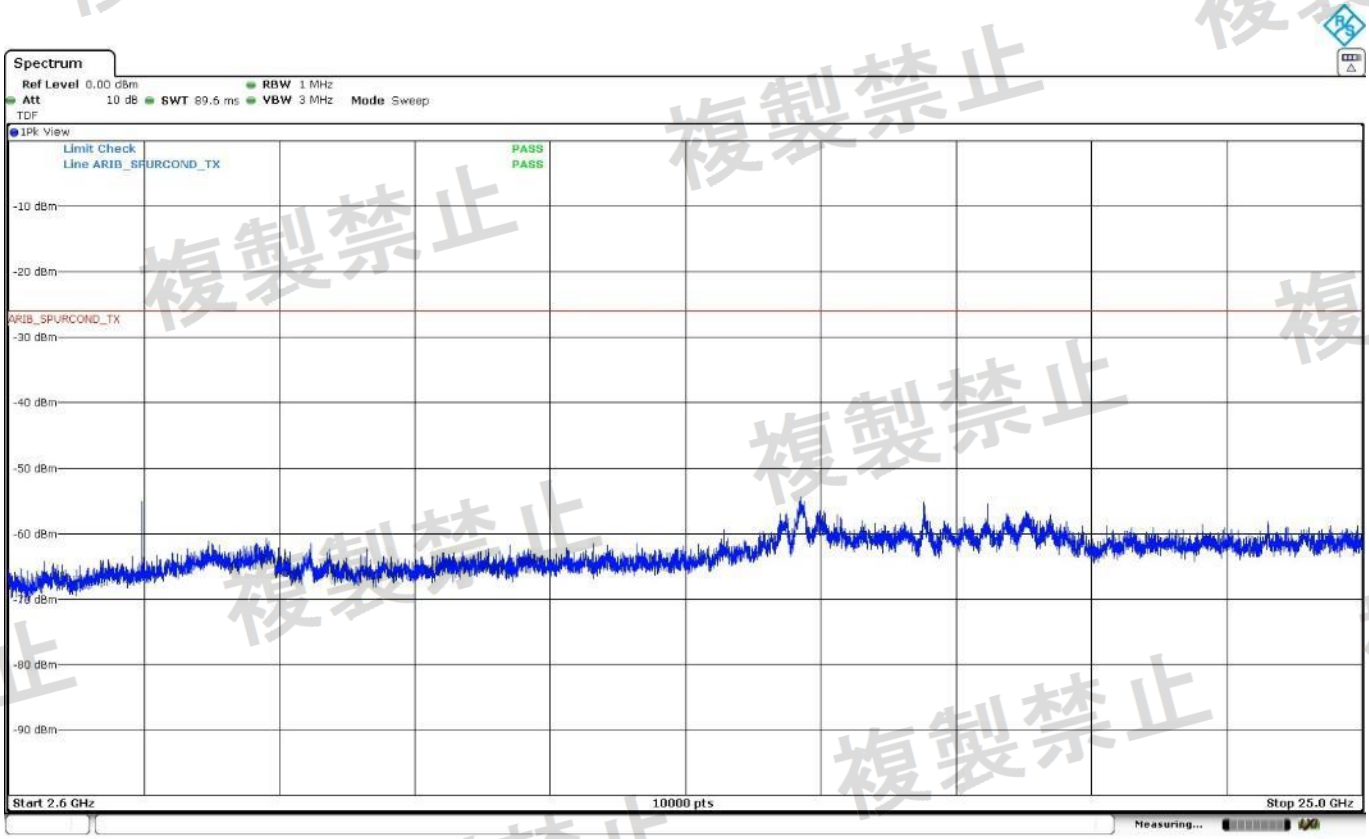
Vnom:

- LOW CHANNEL:

Frequency range 9 kHz - 25 GHz:

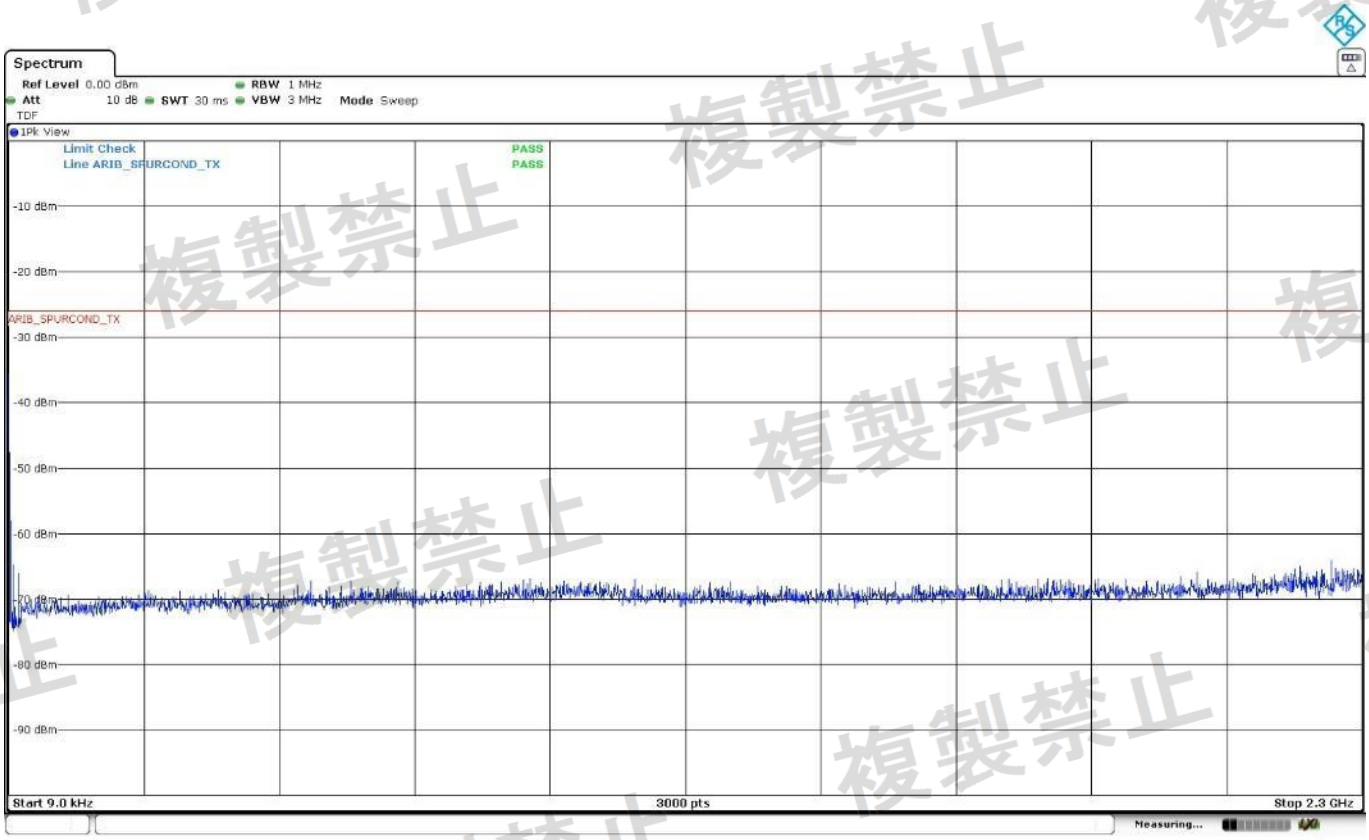


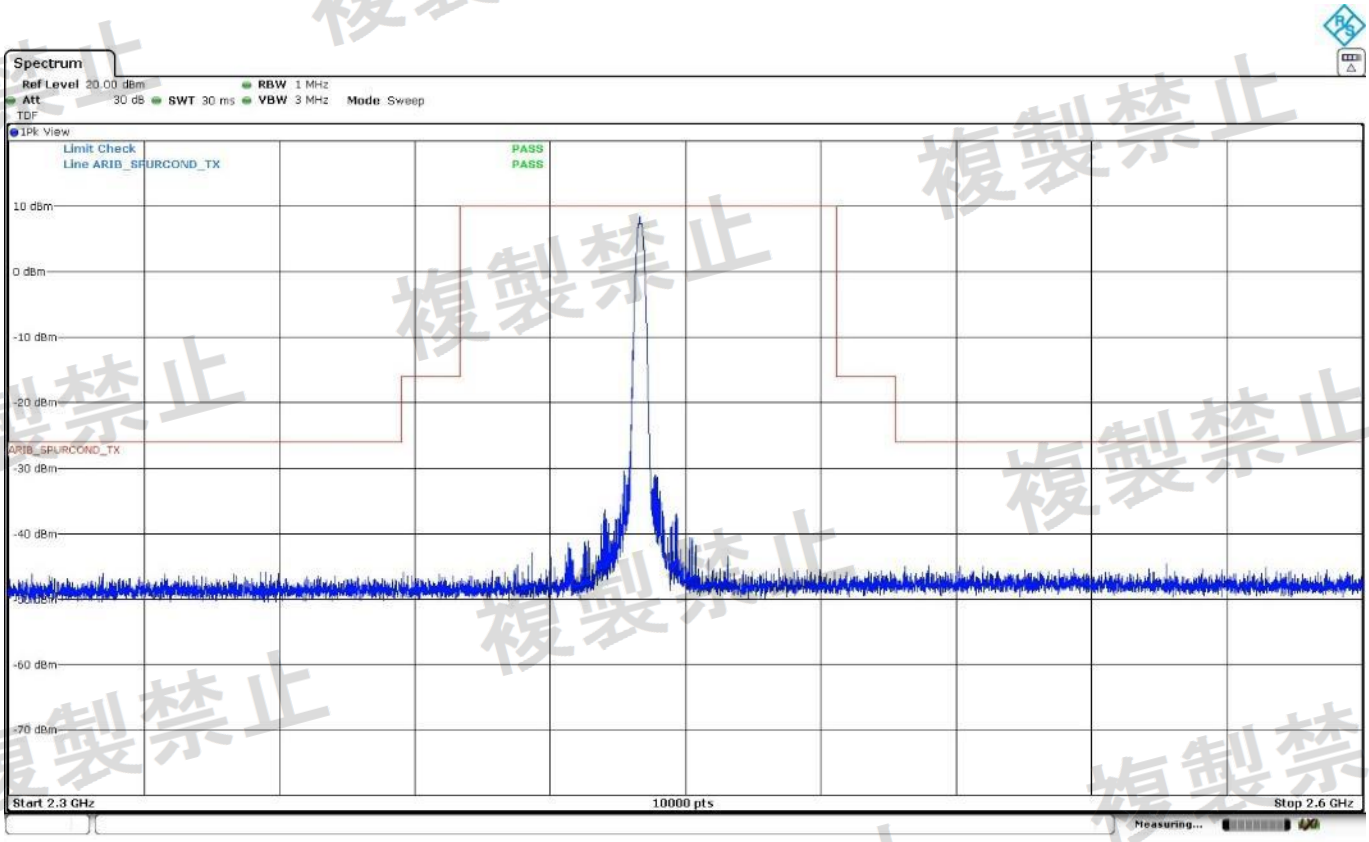


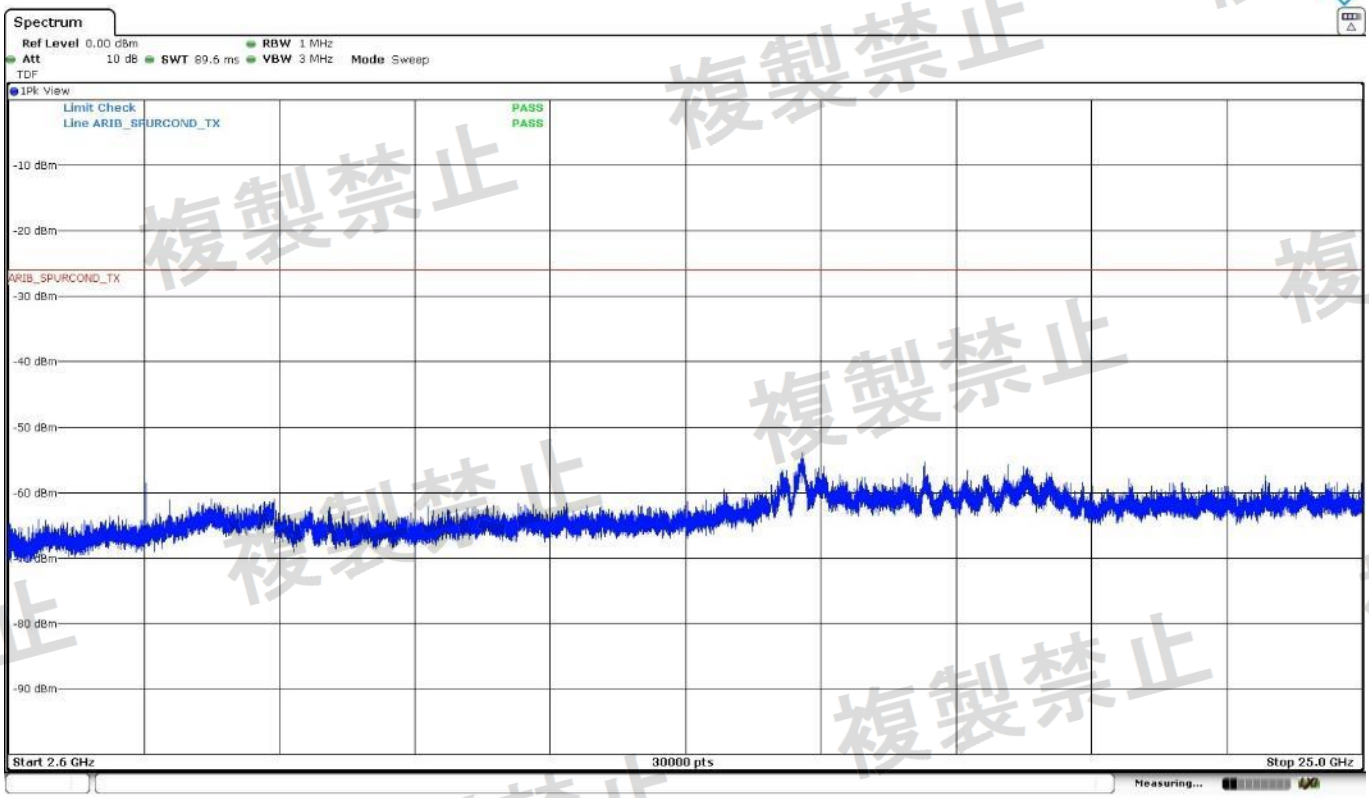

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB
SWT 89.6 ms
VBW 3 MHz
Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
10000 pts
Stop 25.0 GHz
Measuring...

- MIDDLE CHANNEL:

Frequency range 9 kHz - 25 GHz:

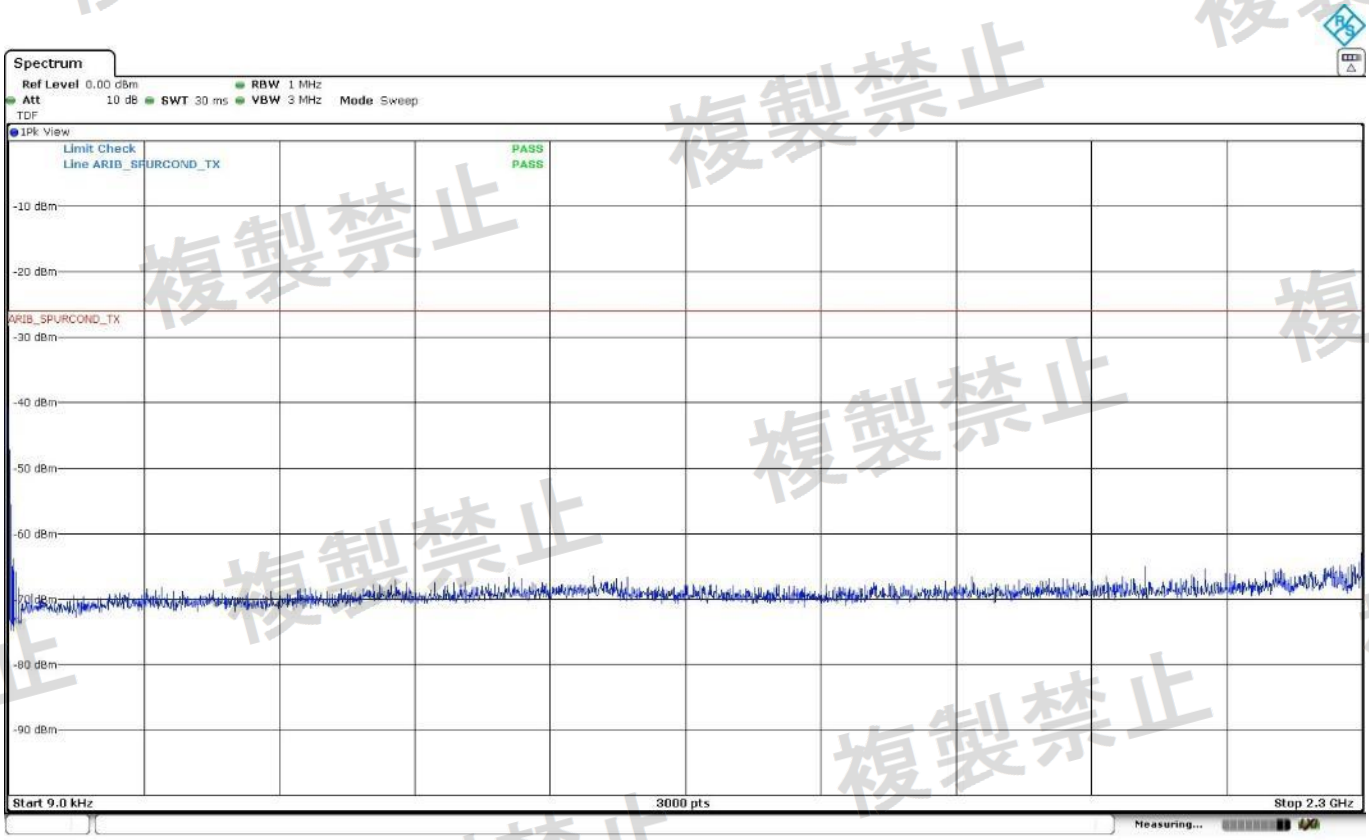


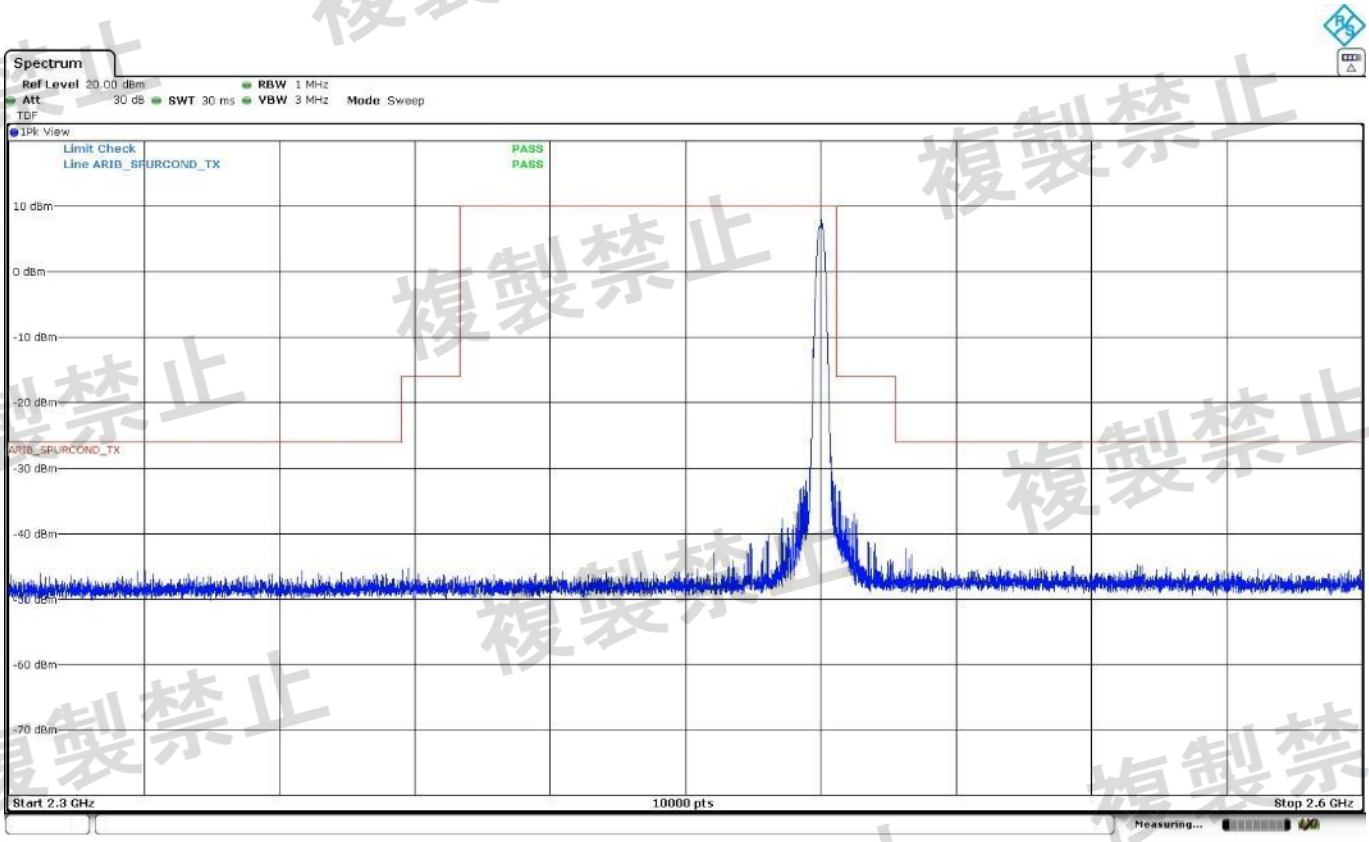


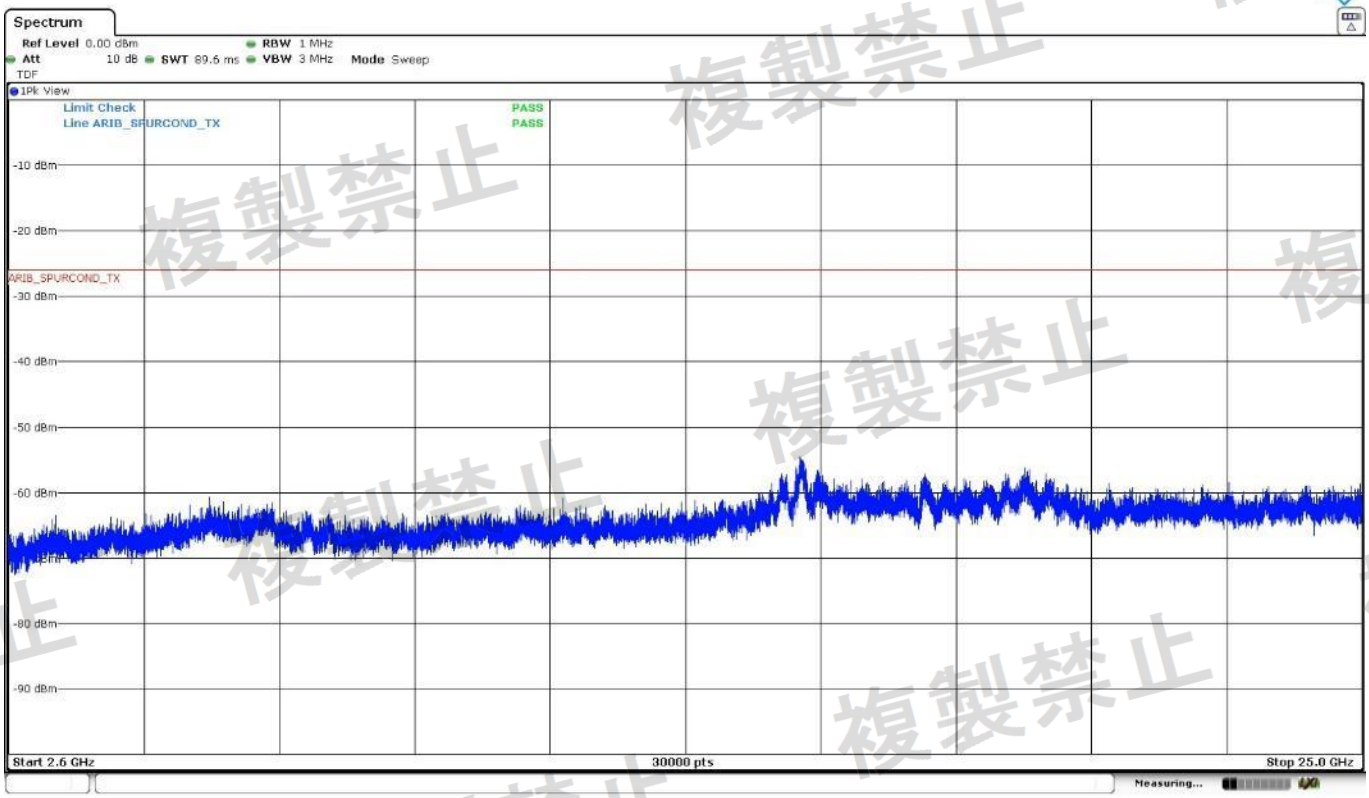

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB
SWT 89.6 ms
VBW 3 MHz
Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- HIGH CHANNEL:

Frequency range 9 kHz - 25 GHz:






Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB
SWT 89.6 ms
VBW 3 MHz
Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

Vmin:

- LOW CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty <± 2.77 dB

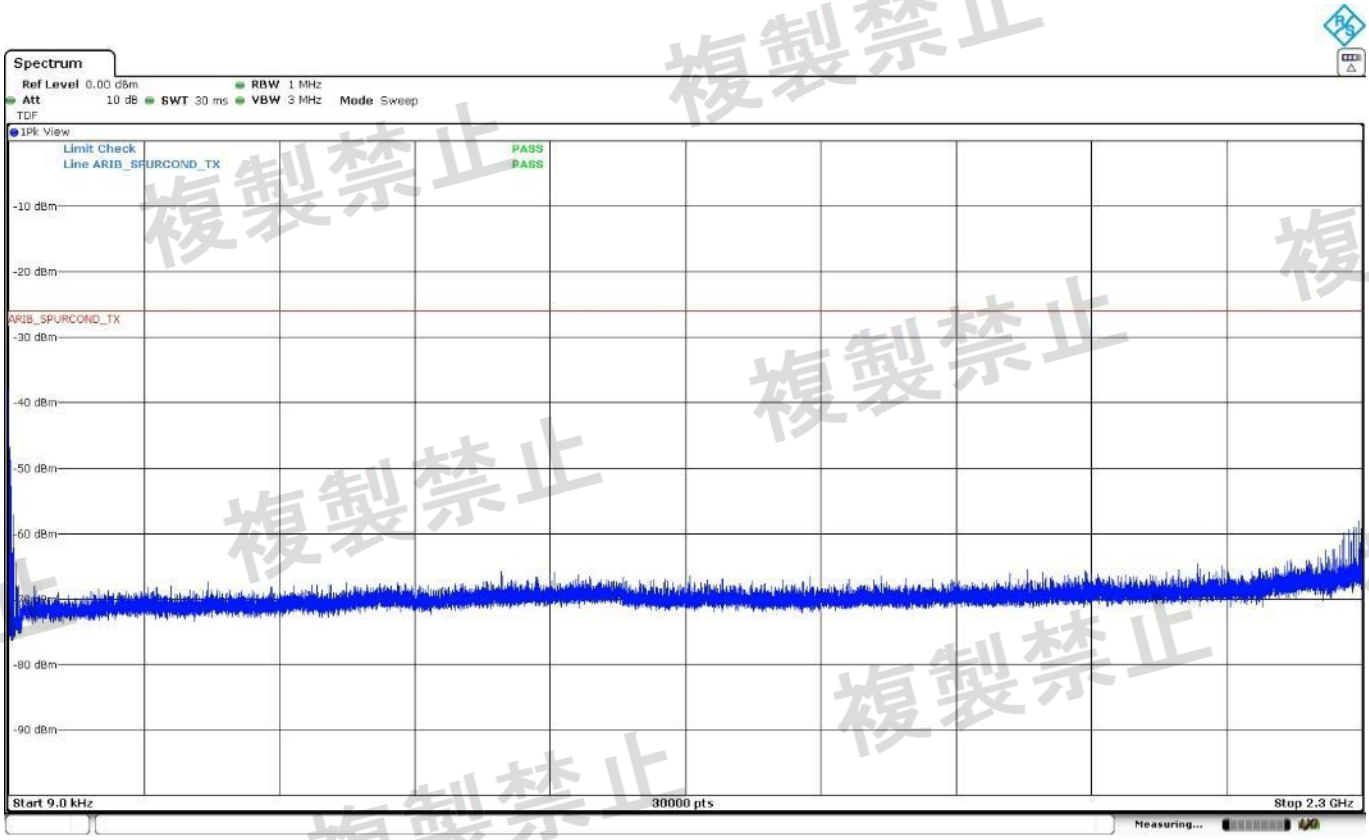
Verdict:

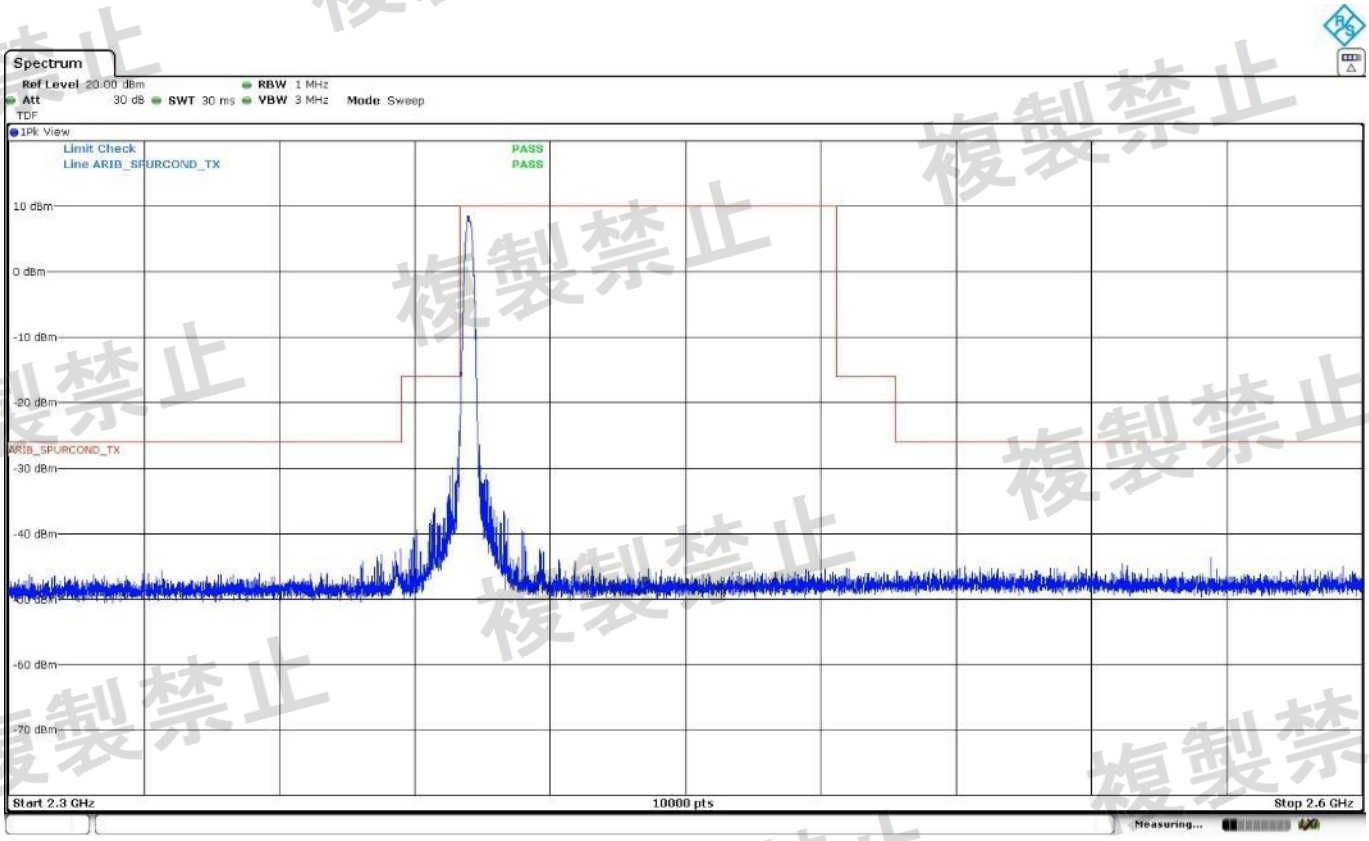
PASS

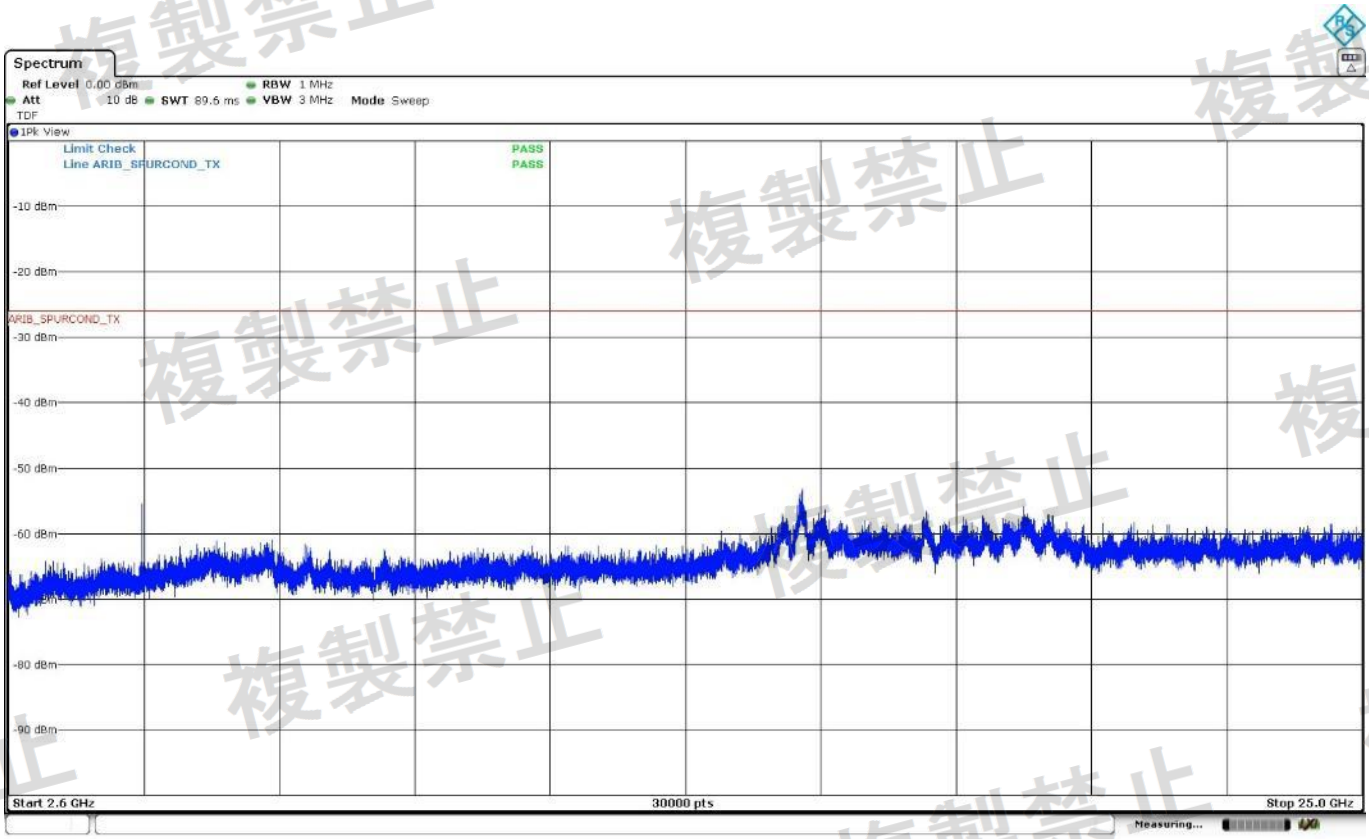
Vmin:

- LOW CHANNEL:

Frequency range 9 kHz - 25 GHz:

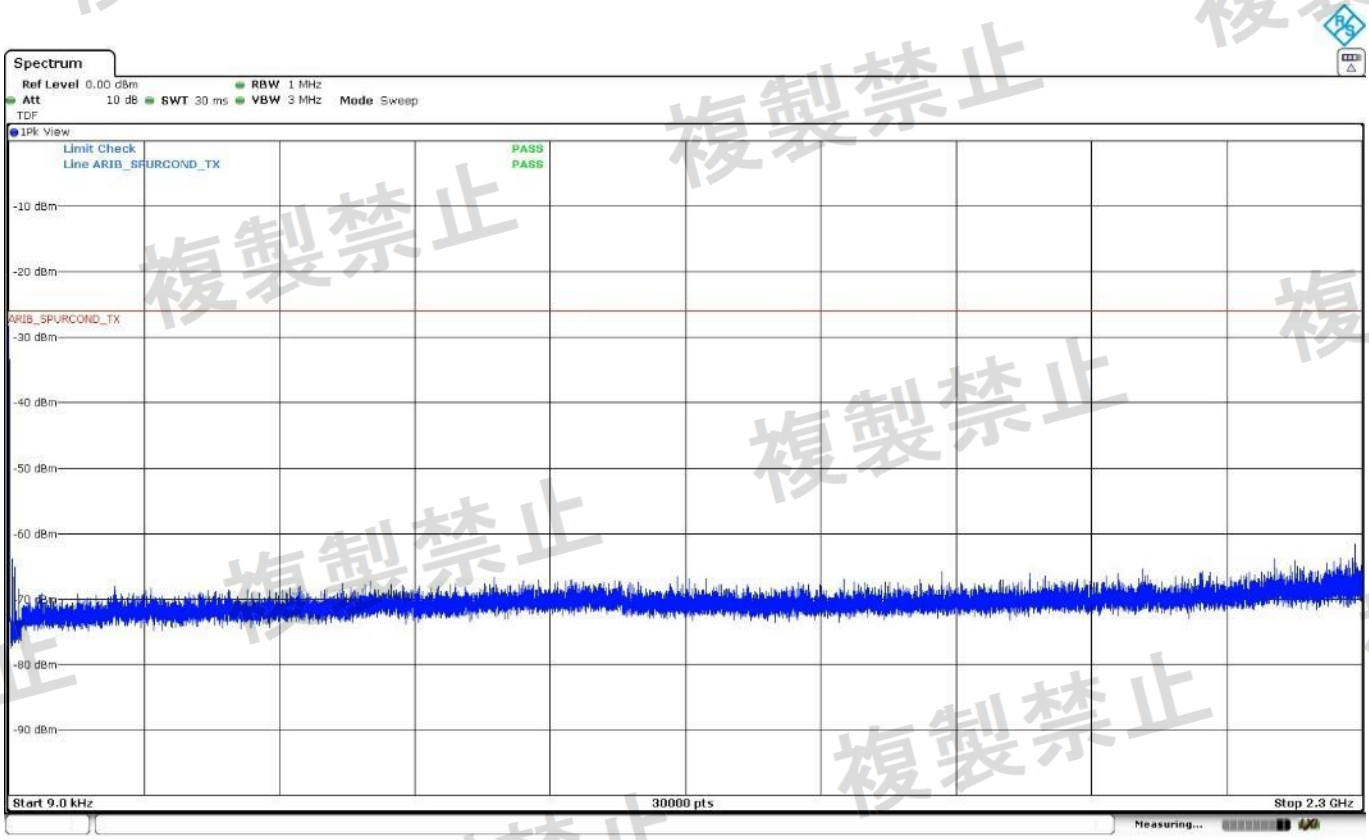


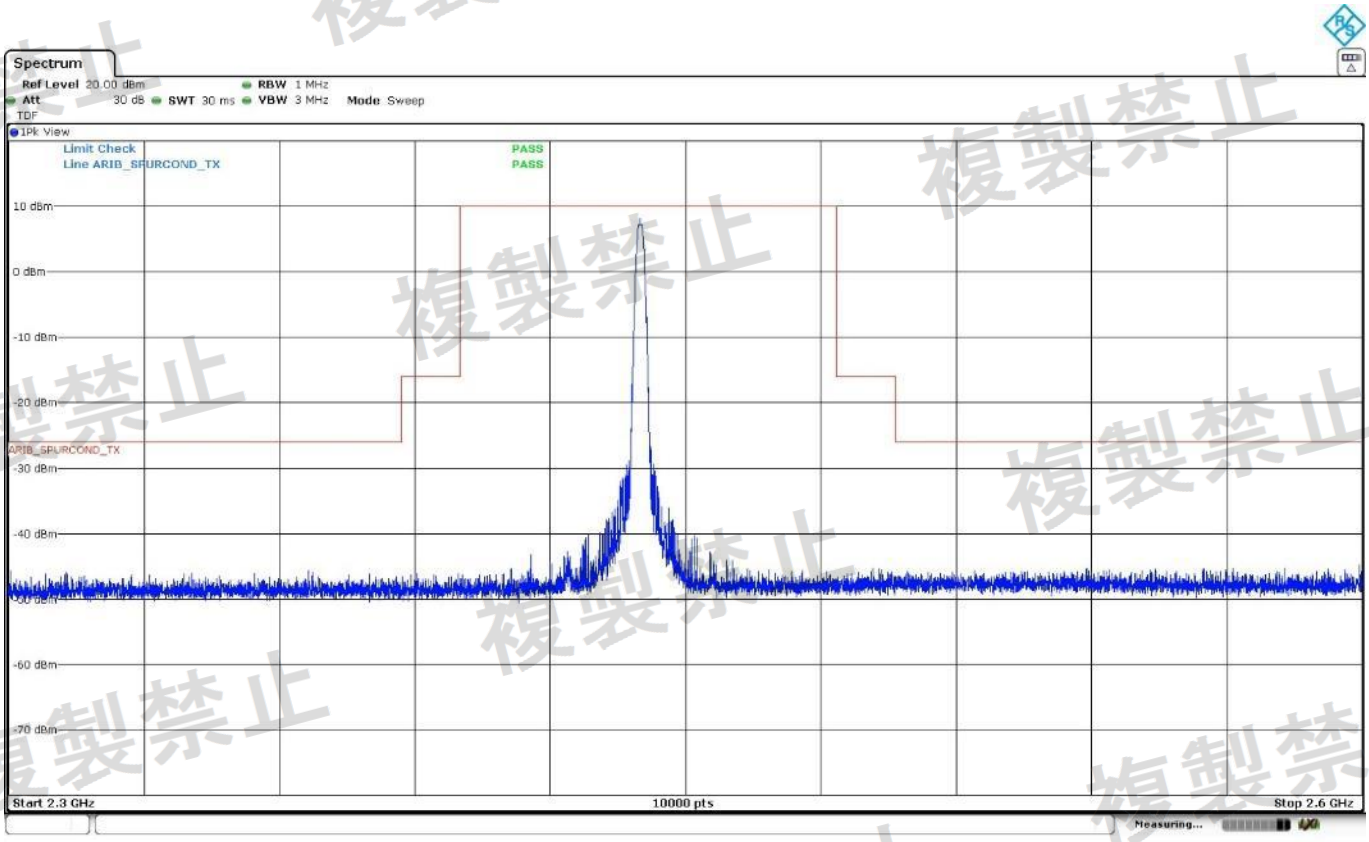


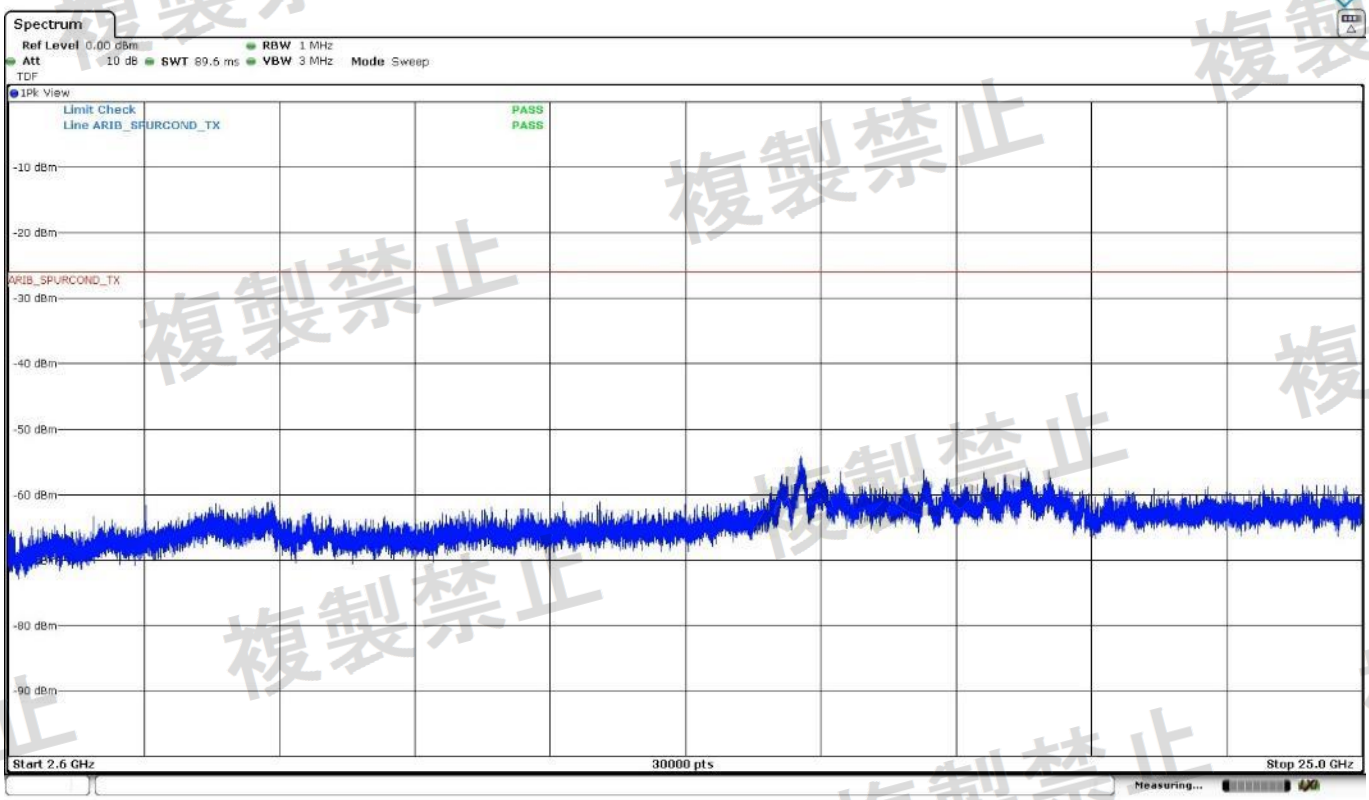

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- MIDDLE CHANNEL:

Frequency range 9 kHz - 25 GHz:

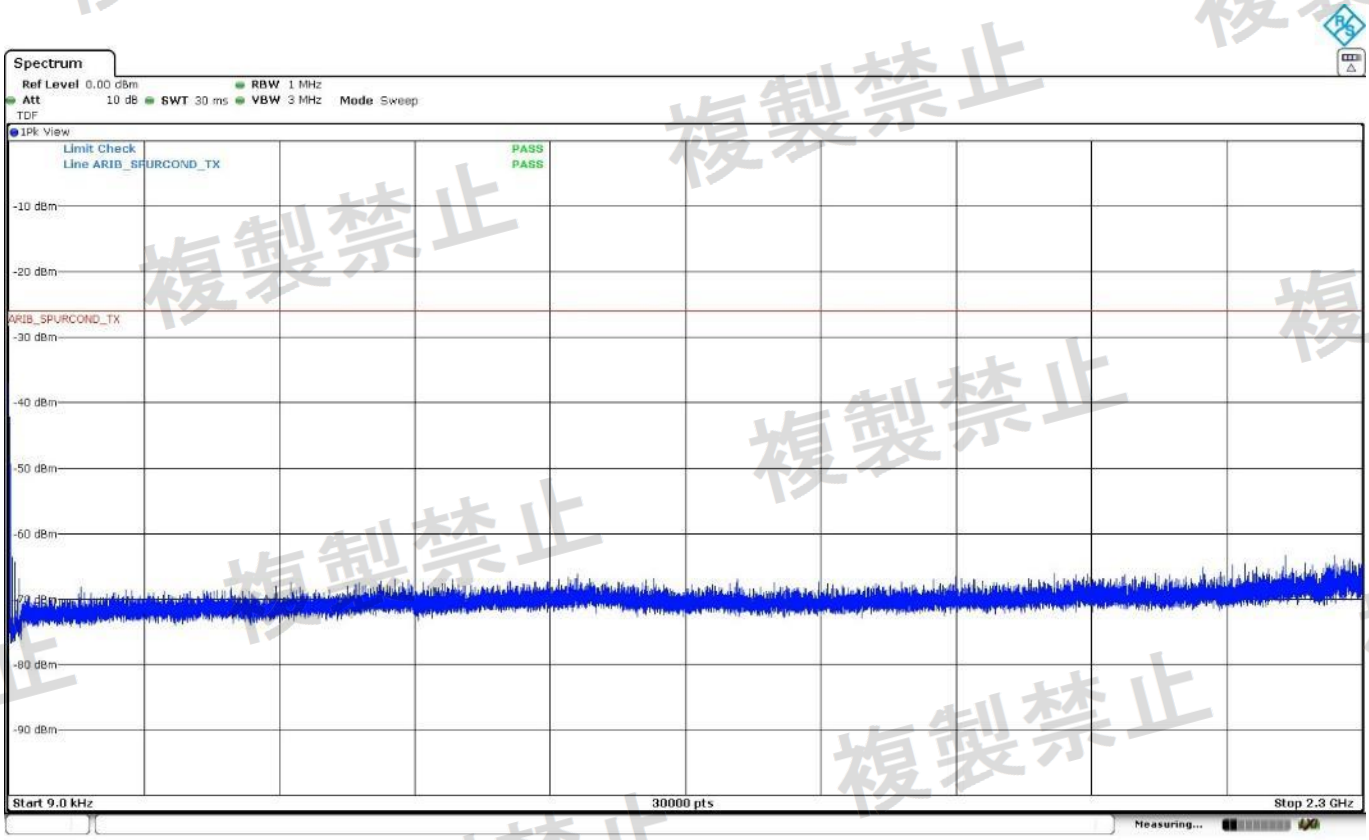


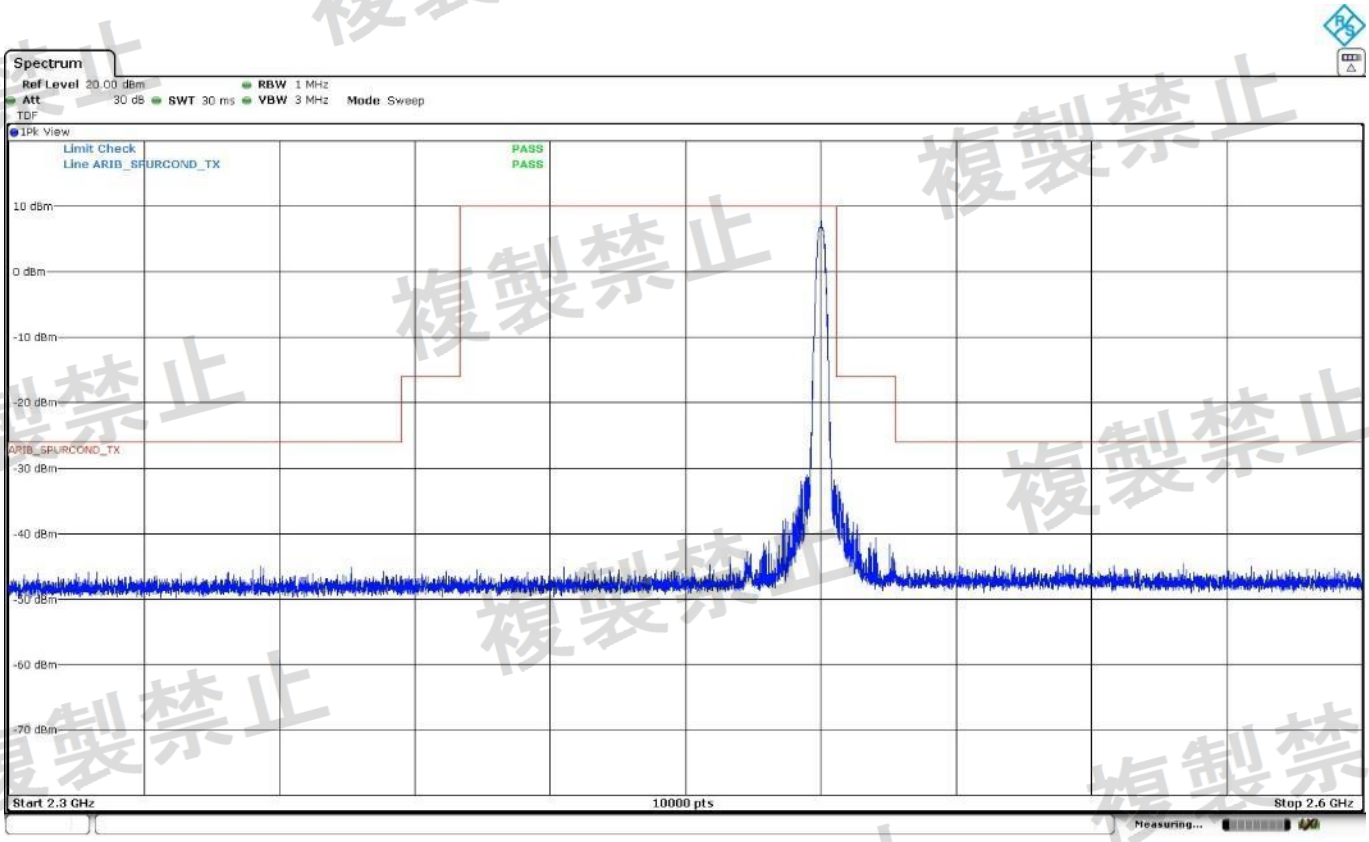


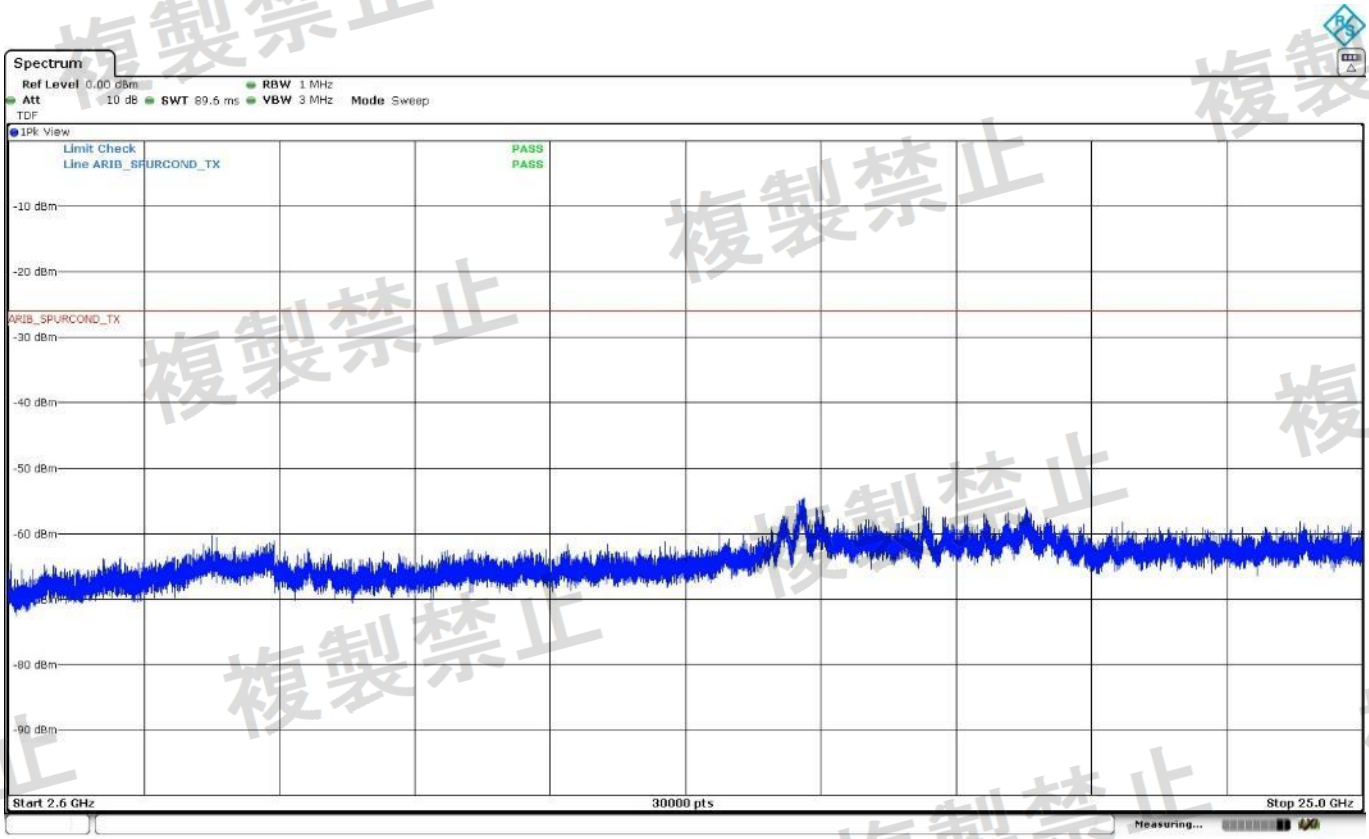

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- HIGH CHANNEL:

Frequency range 9 kHz - 25 GHz:






Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

Vmax:

- LOW CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty <± 2.77 dB

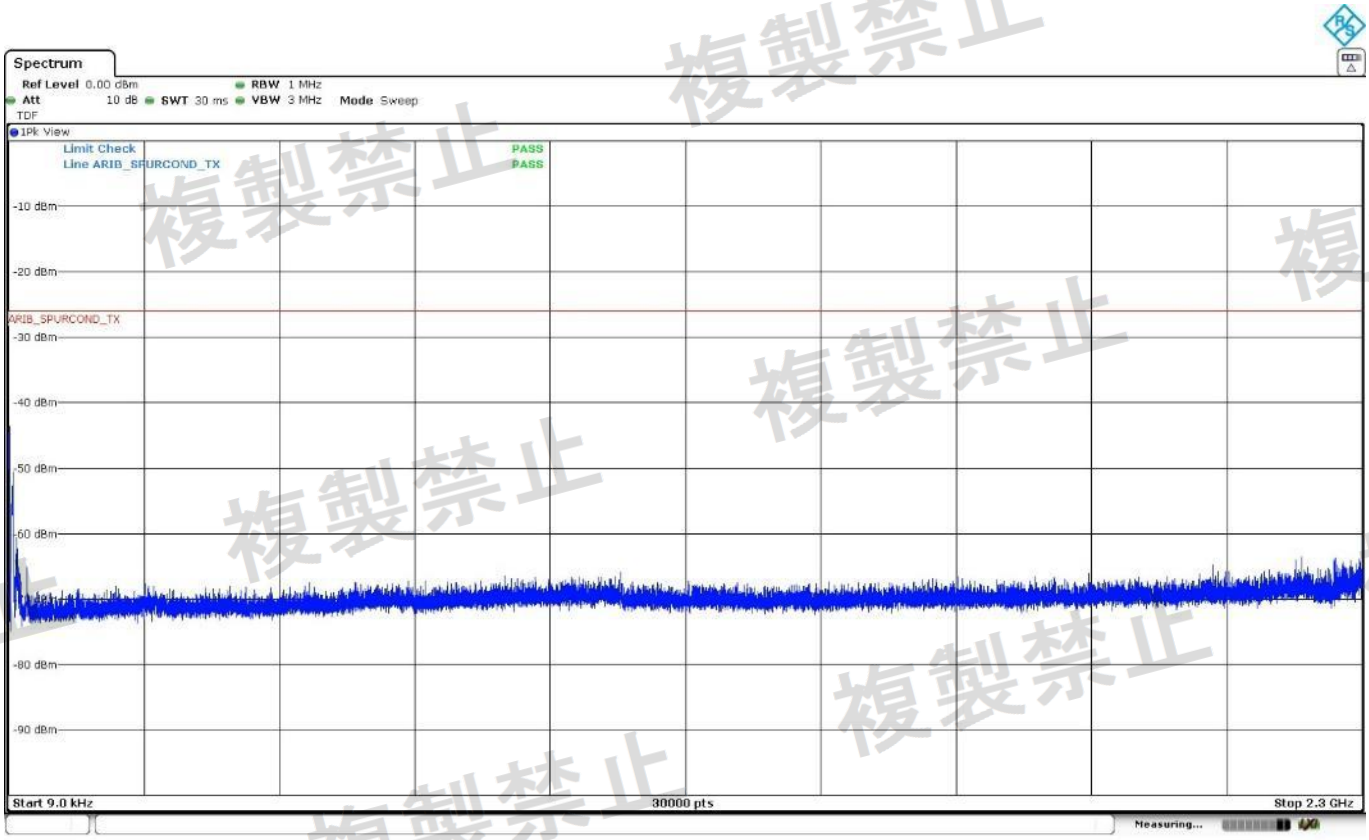
Verdict:

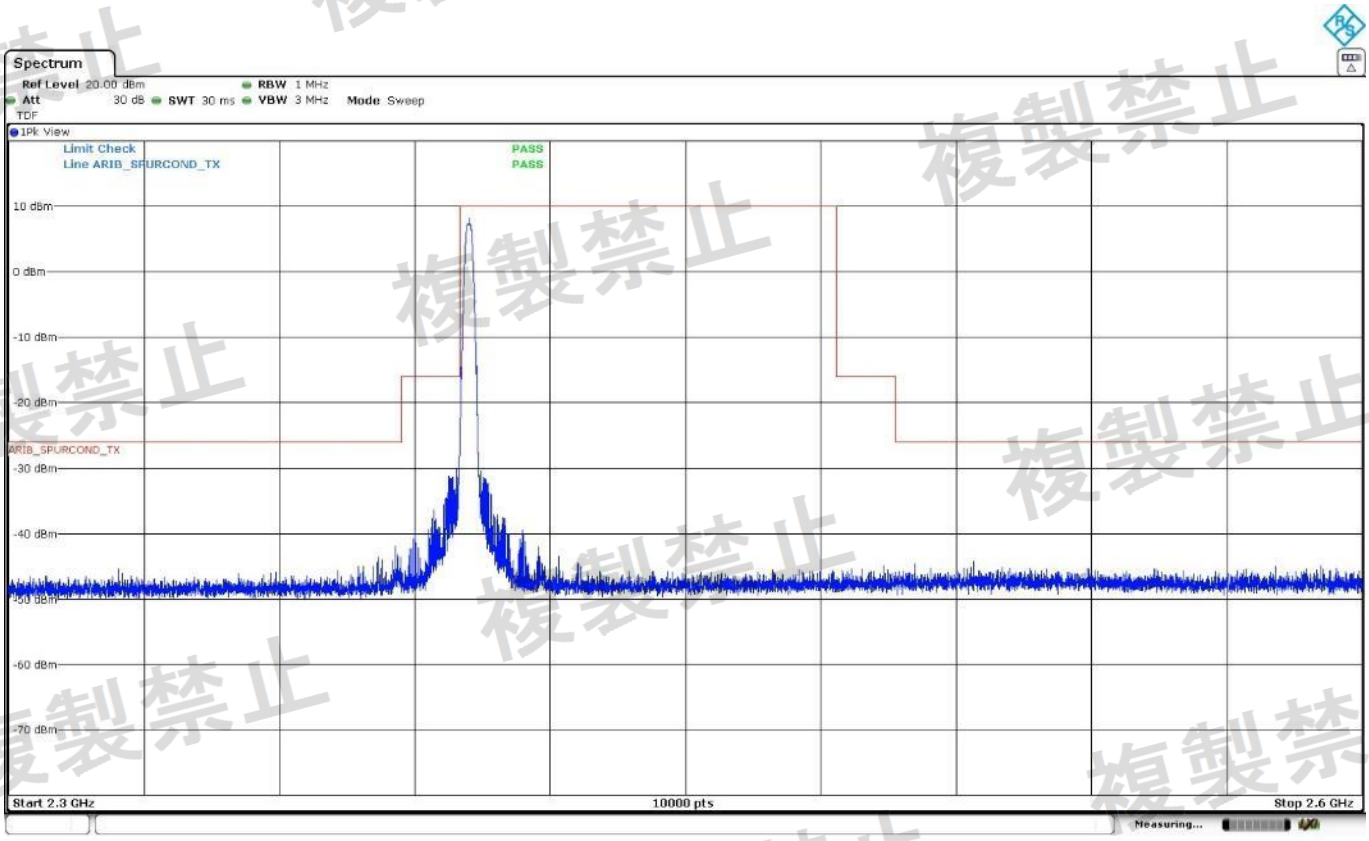
PASS

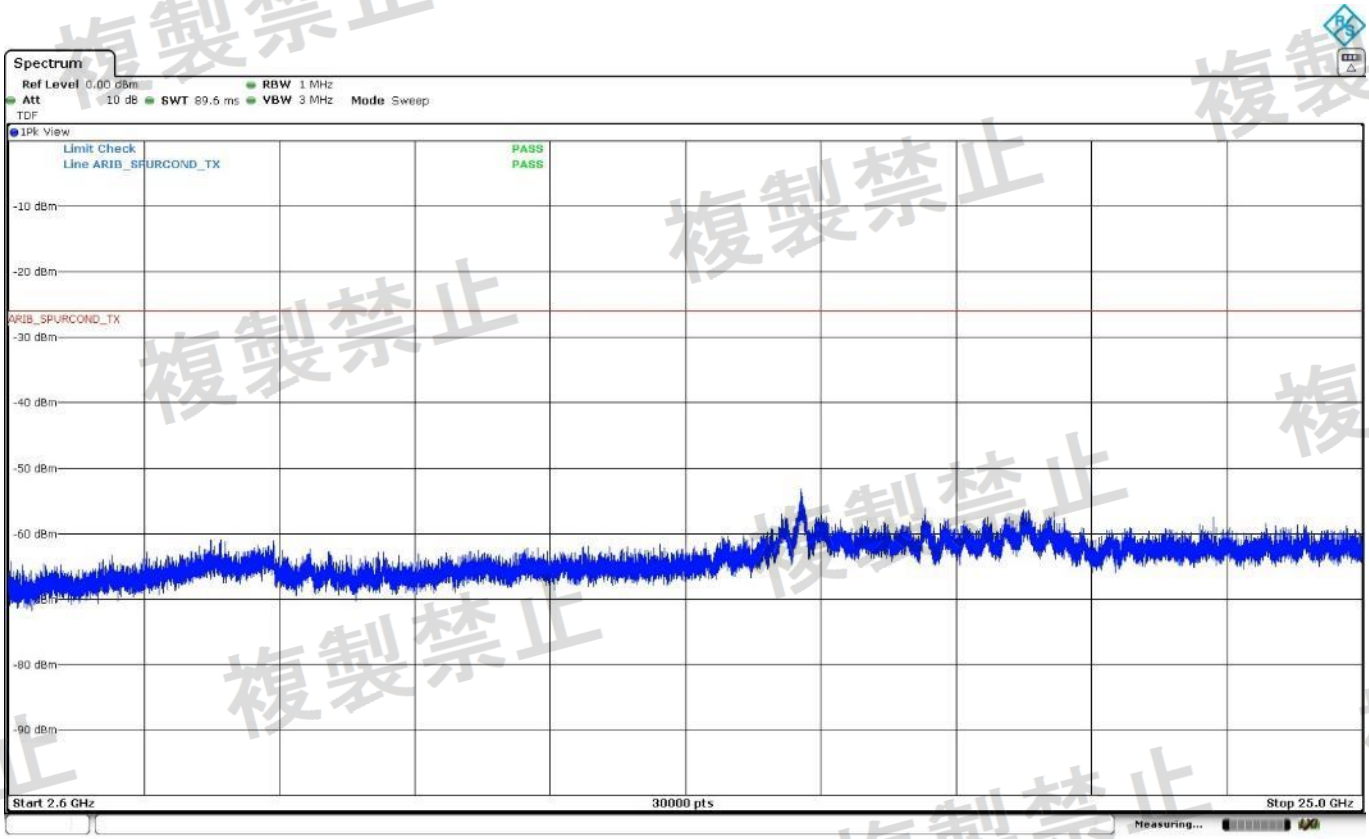
Vmax:

- LOW CHANNEL:

Frequency range 9 kHz - 25 GHz:

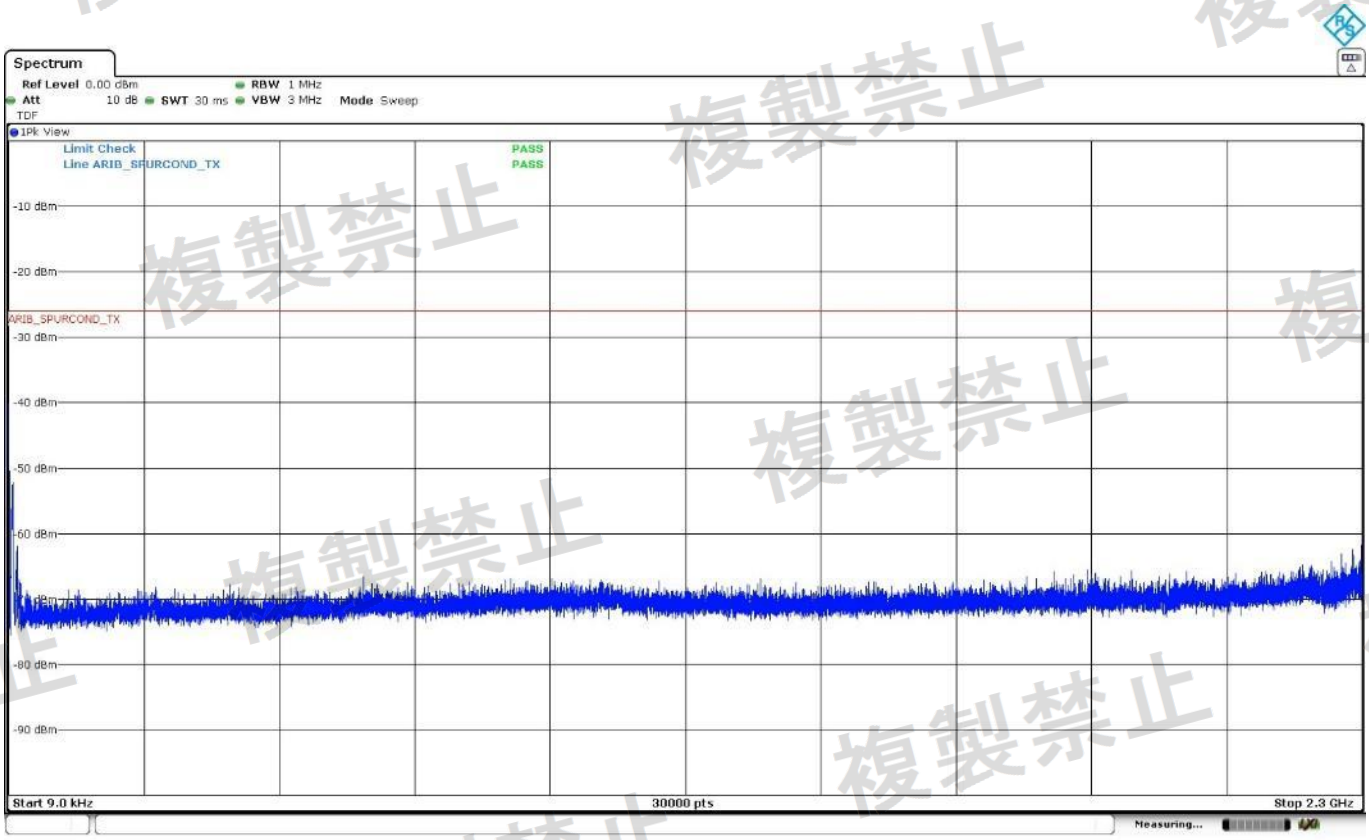


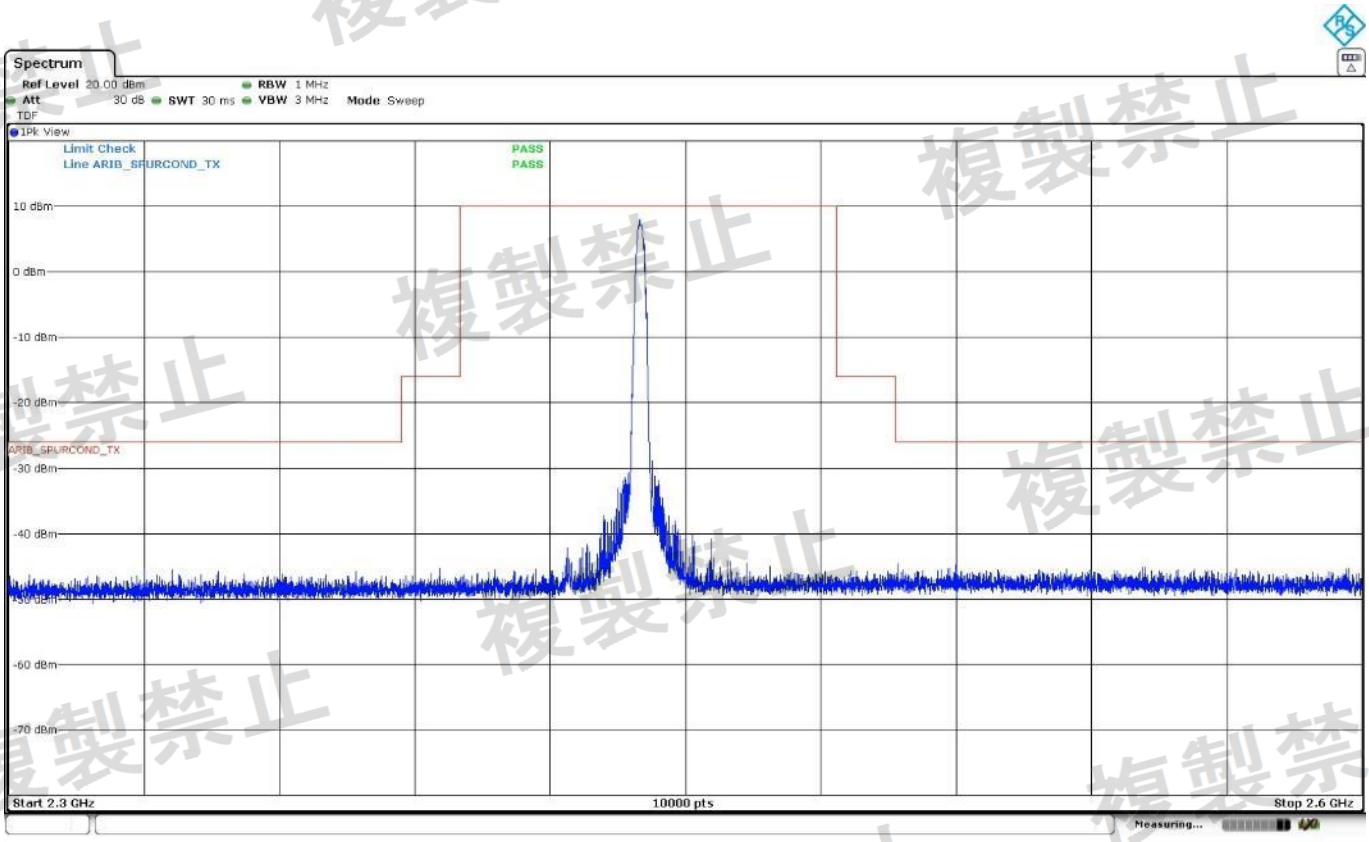


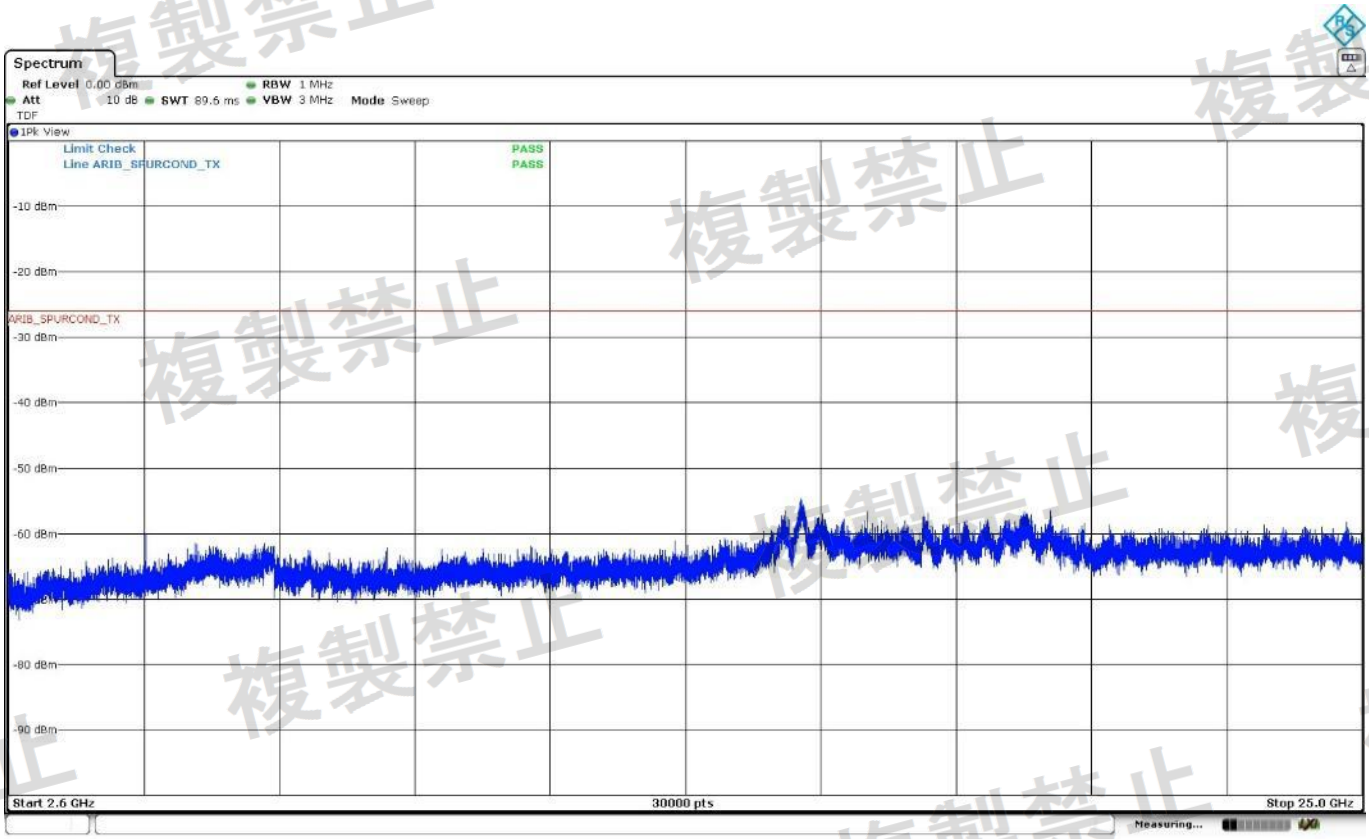

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- MIDDLE CHANNEL:

Frequency range 9 kHz - 25 GHz:

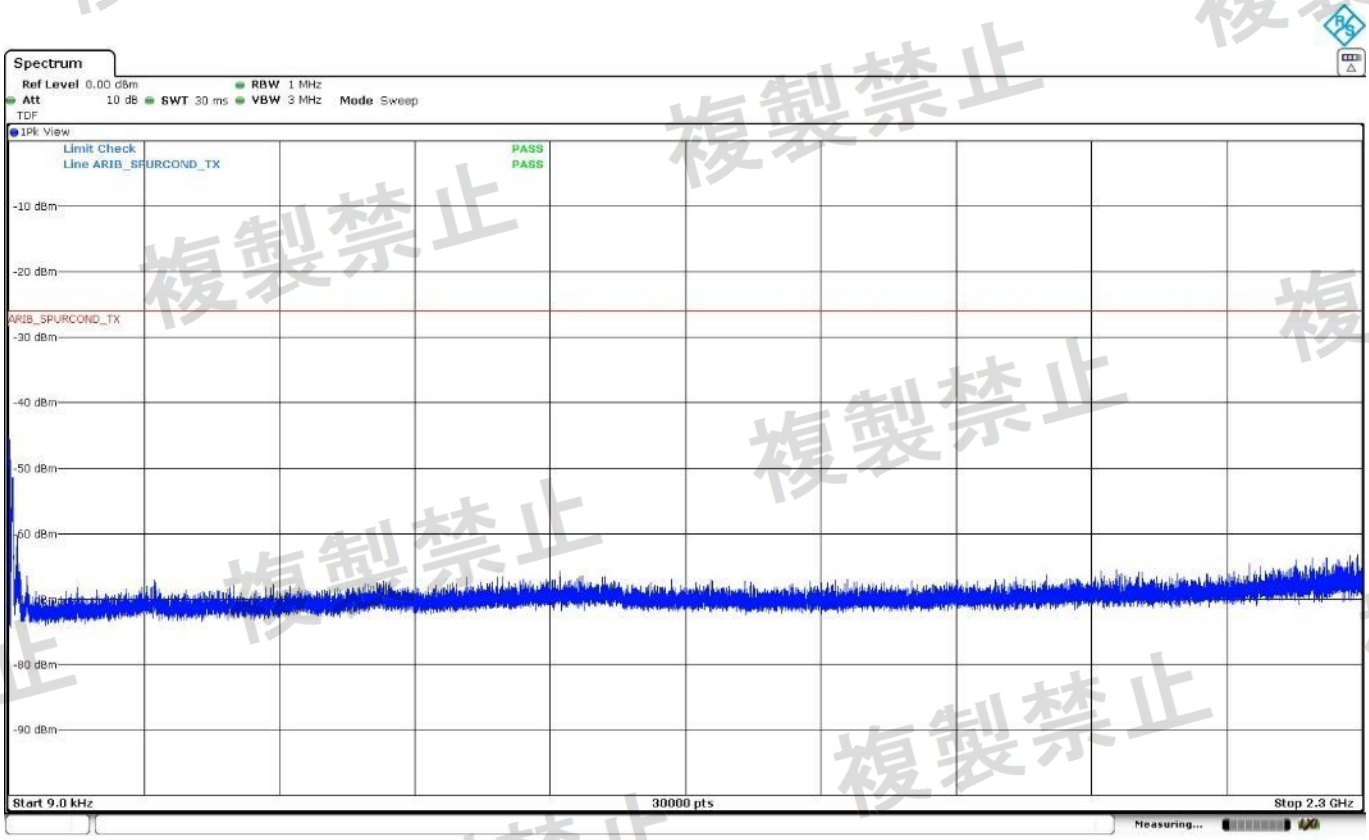


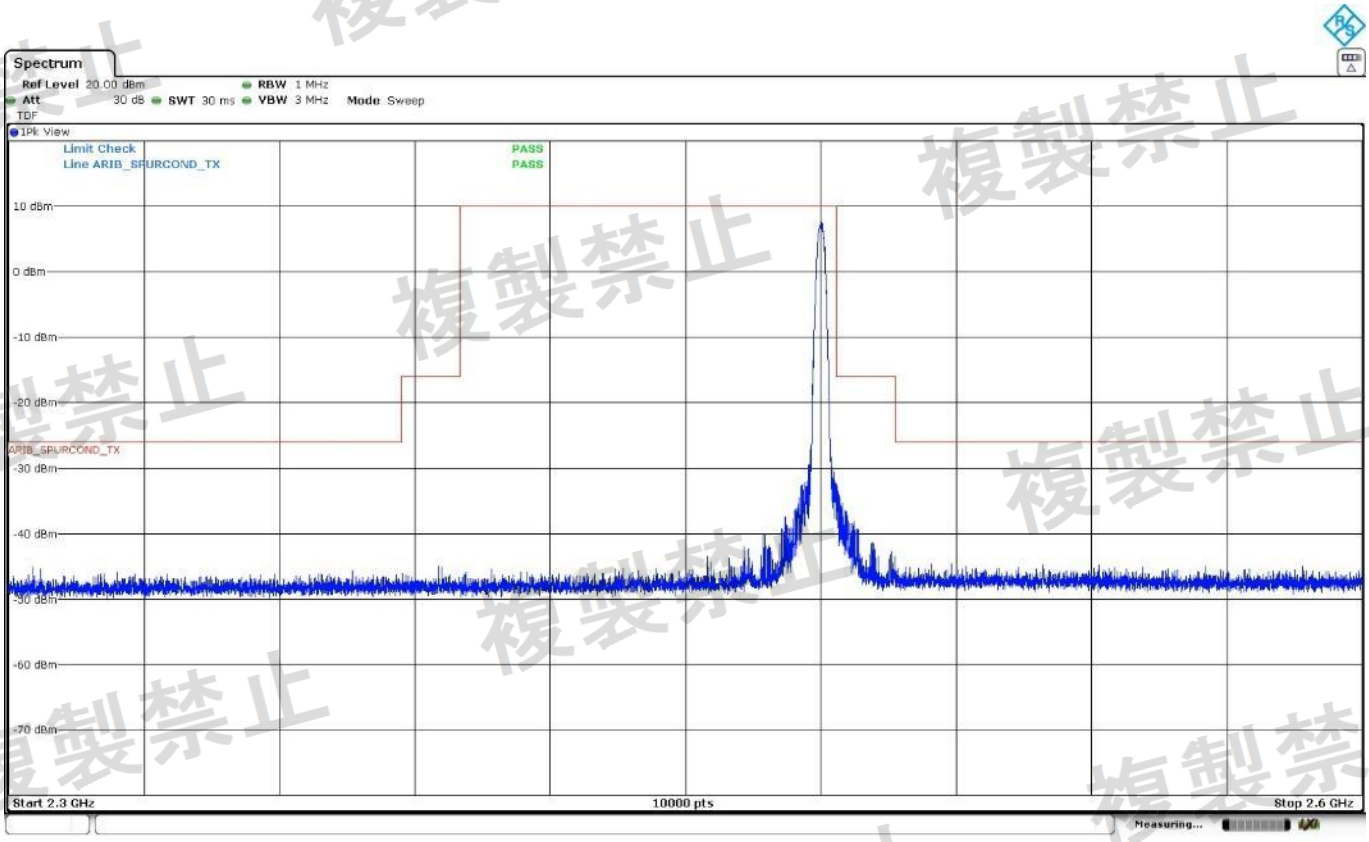


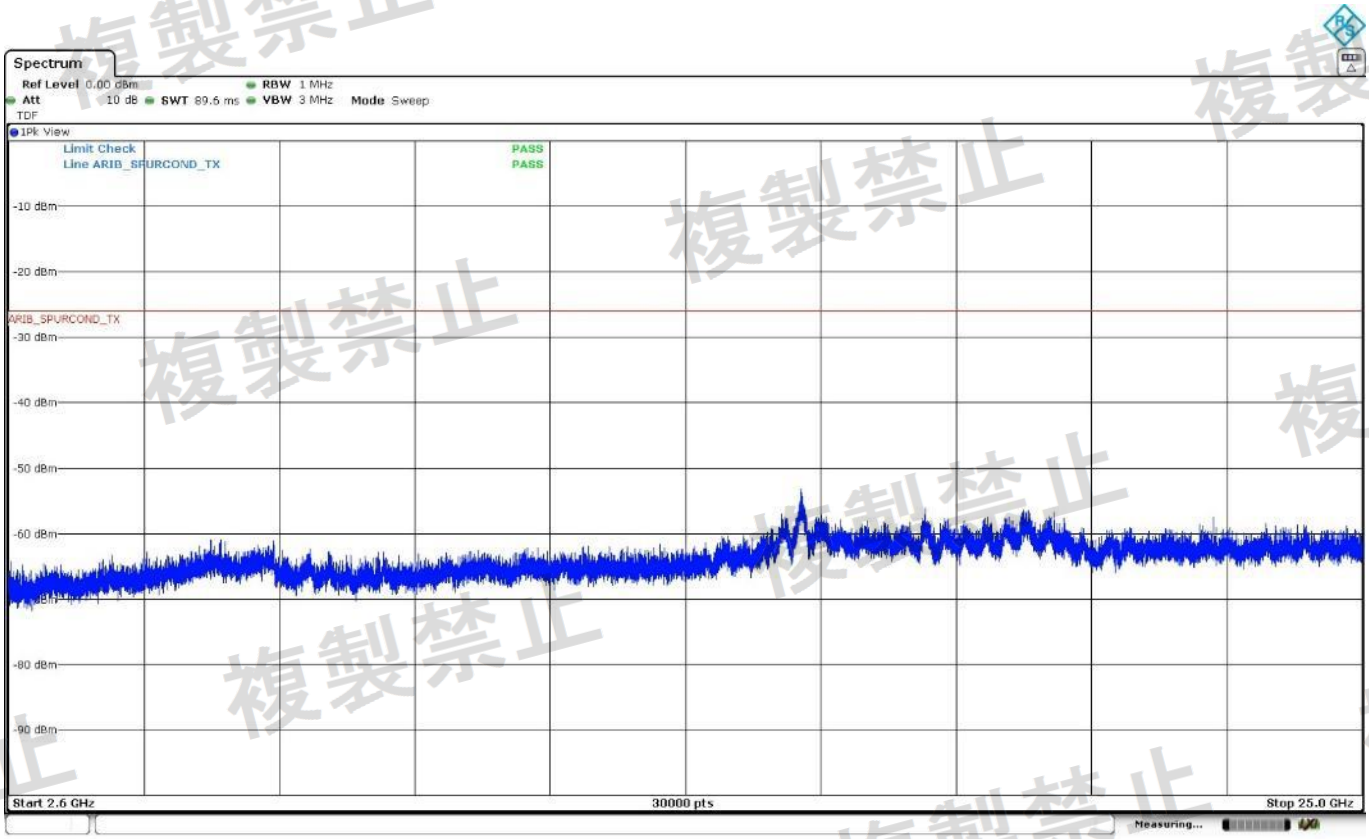

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- HIGH CHANNEL:

Frequency range 9 kHz - 25 GHz:






Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

Article 24.2. Receiving equipment. Limit on secondary radiated emissions

Limits:

The limit on secondary emissions radiated from the receiving equipment within which the function of other radio equipment will not be impaired shall be, in terms of the power of a dummy antenna circuit that has the same electrical constant as the receiving antenna, 4 nW (-54 dBm) or less at a frequency below 1 GHz and 20 nW (-47 dBm) or less at a frequency of 1 GHz or higher as measured using the circuit.

Results:

Vnom:

- LOW CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty	<± 2.94 dB

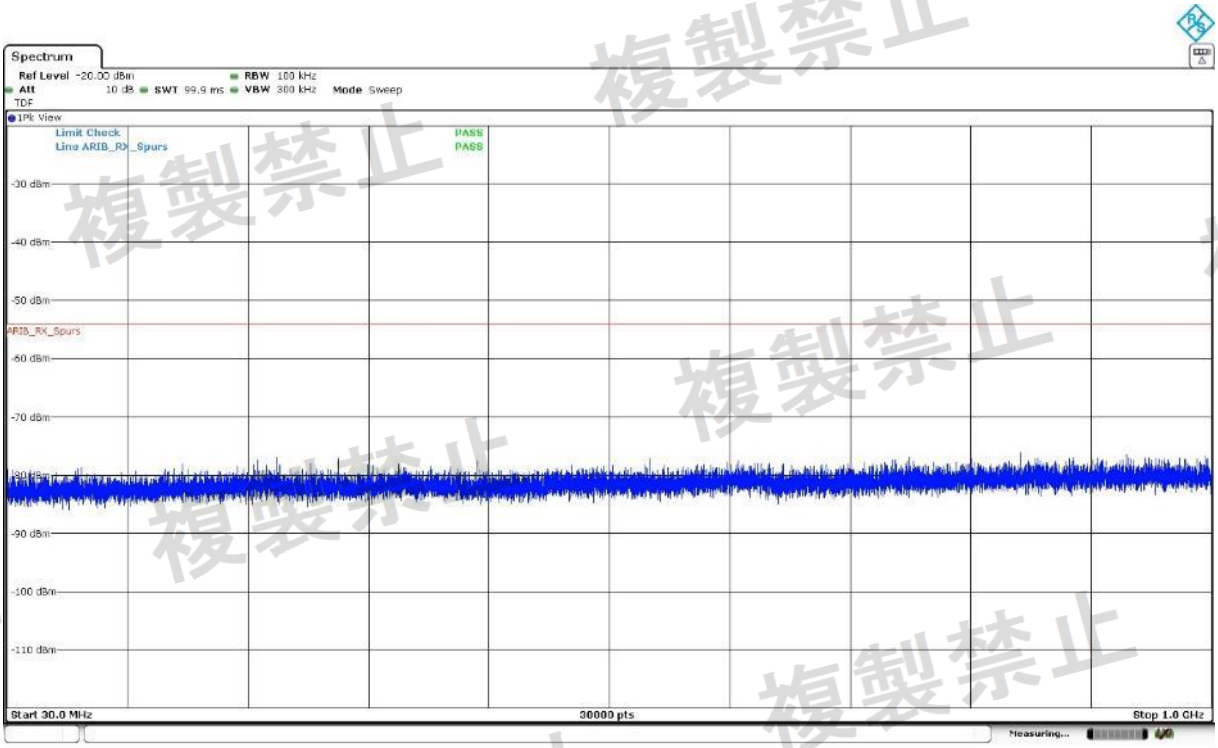
Verdict:

PASS

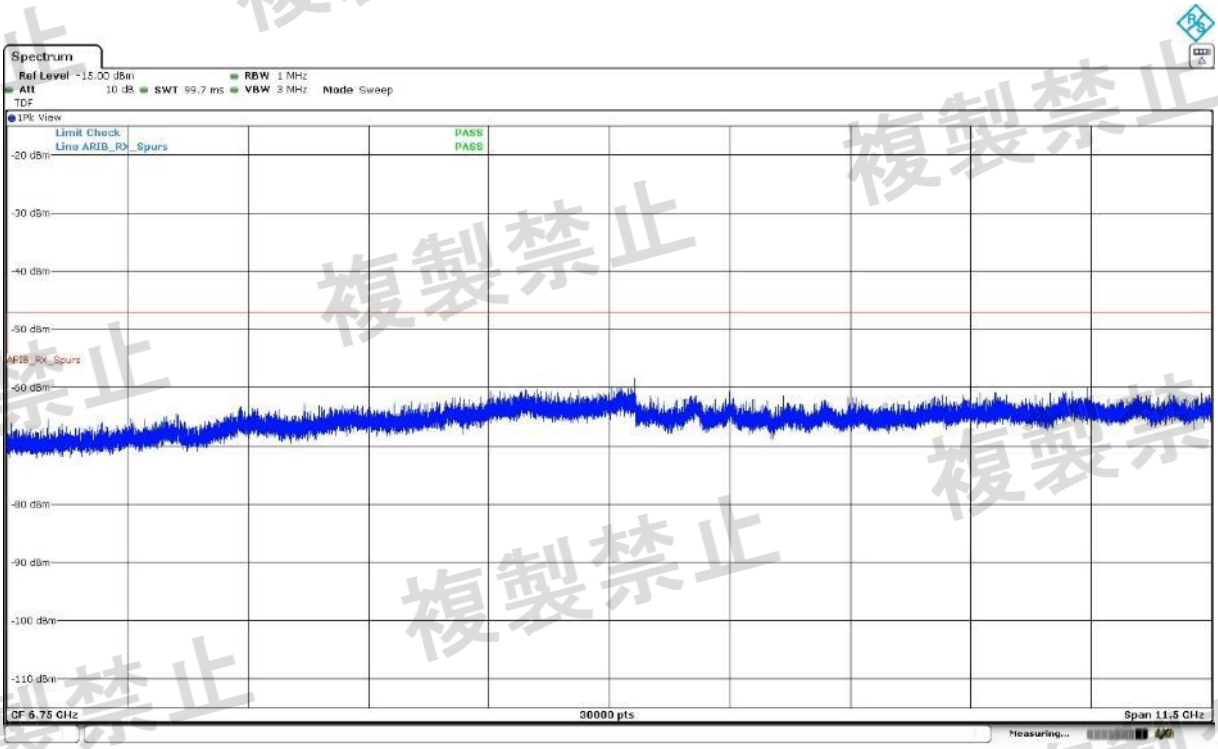
Vnom:

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

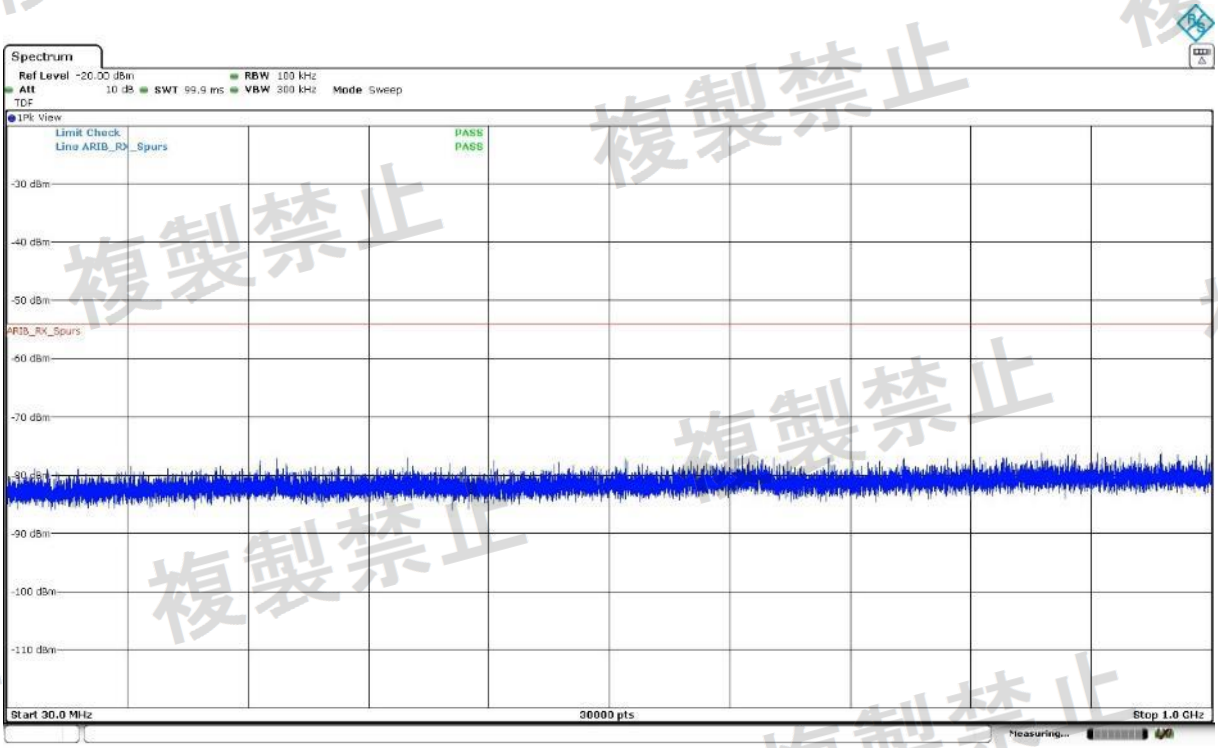


Frequency range 1 – 12.75 GHz:

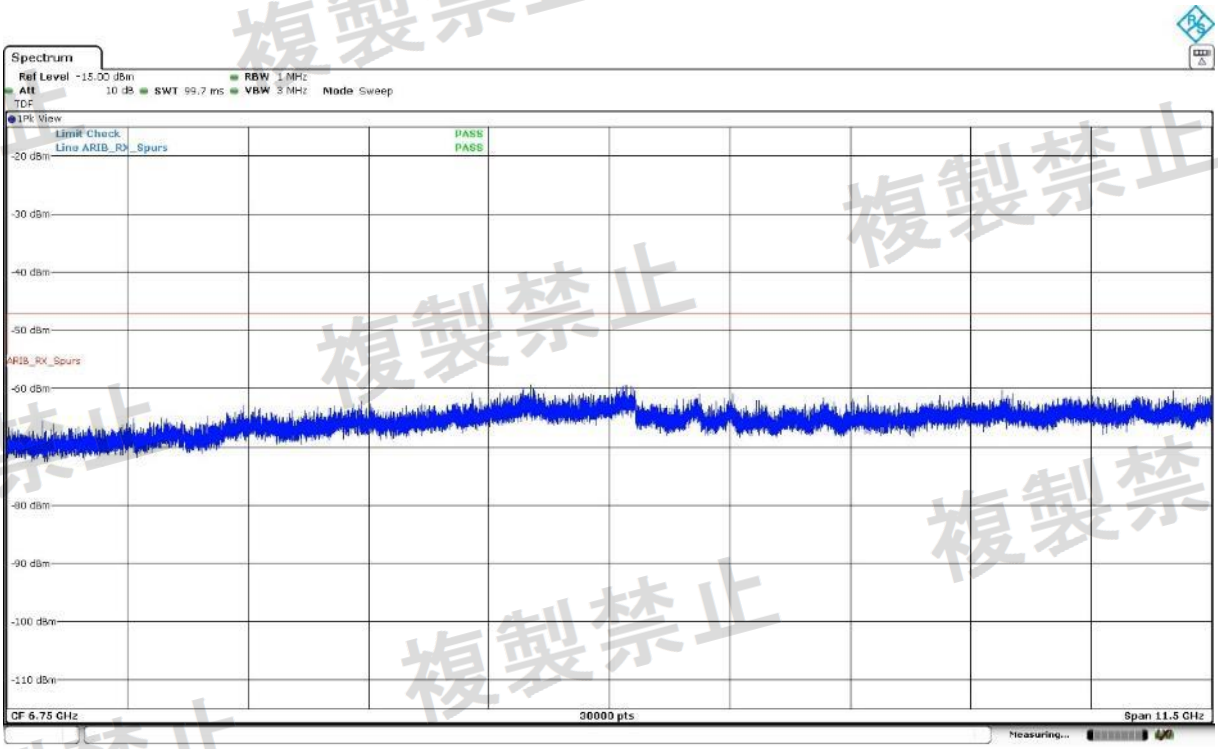


- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

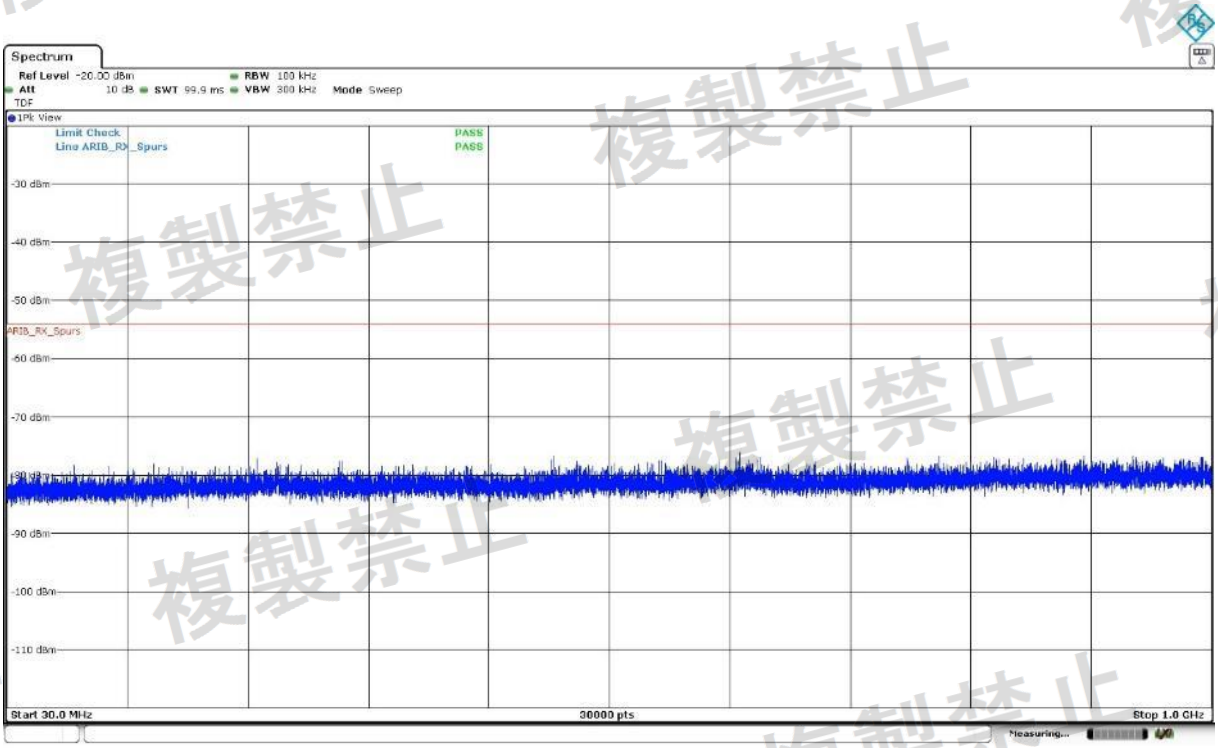


Frequency range 1 – 12.75 GHz:

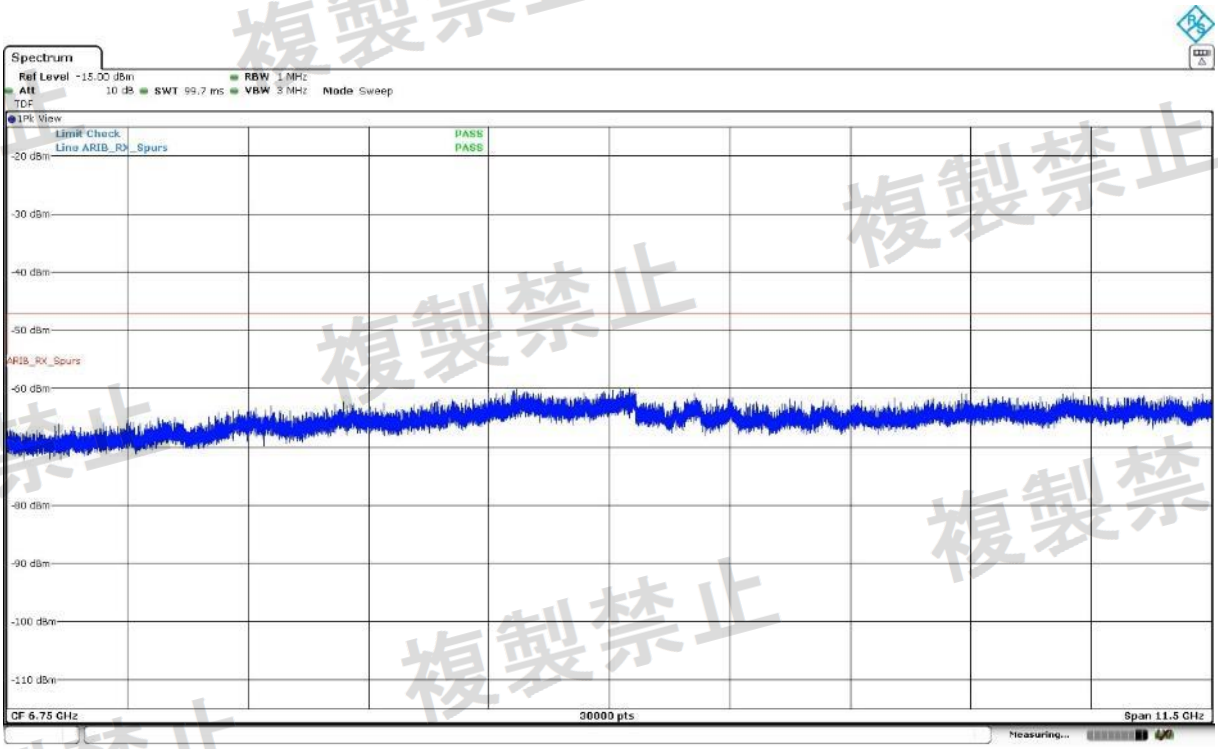


- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:



Frequency range 1 – 12.75 GHz:



Vmin:

- LOW CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty <± 2.94 dB

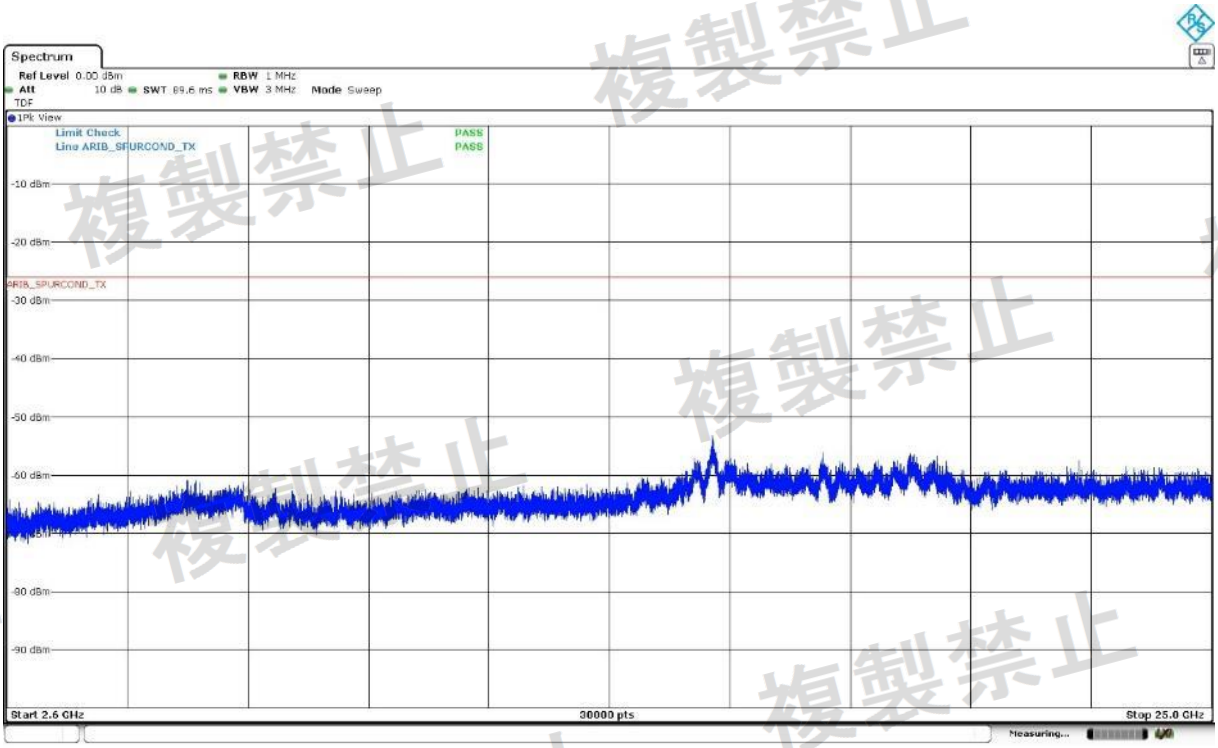
Verdict:

PASS

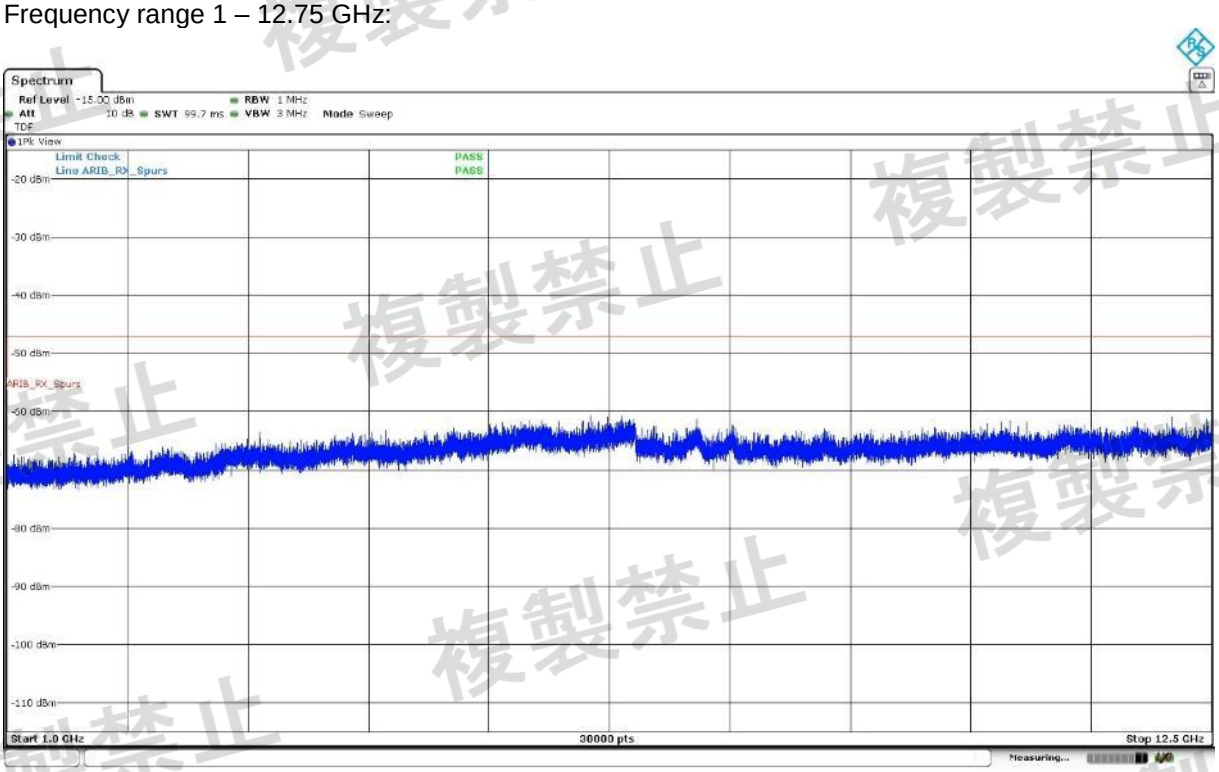
Vmin:

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

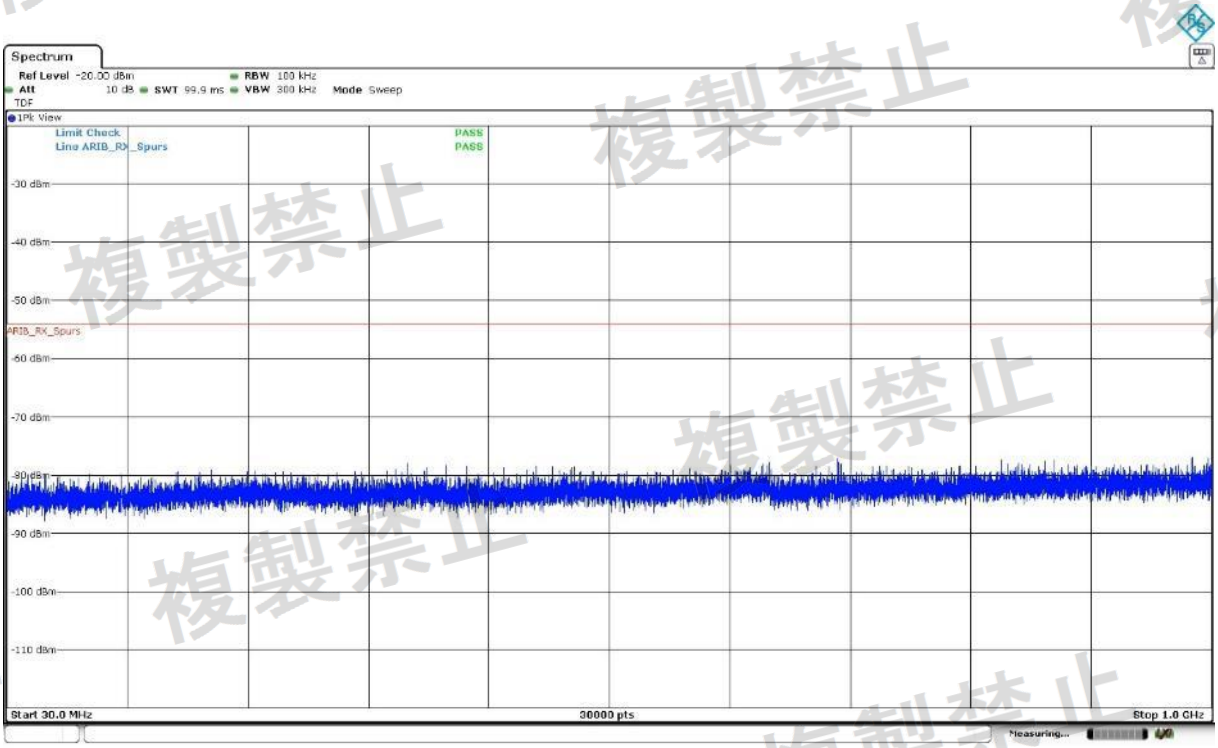


Frequency range 1 – 12.75 GHz:

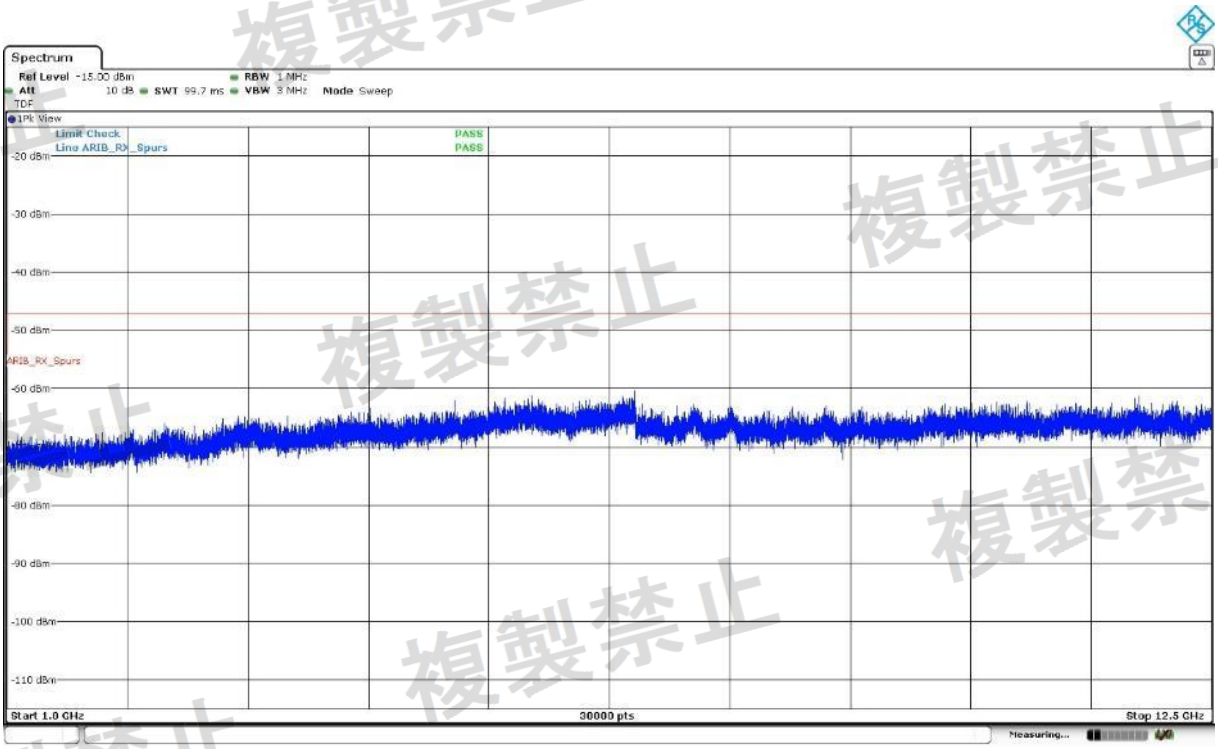


- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

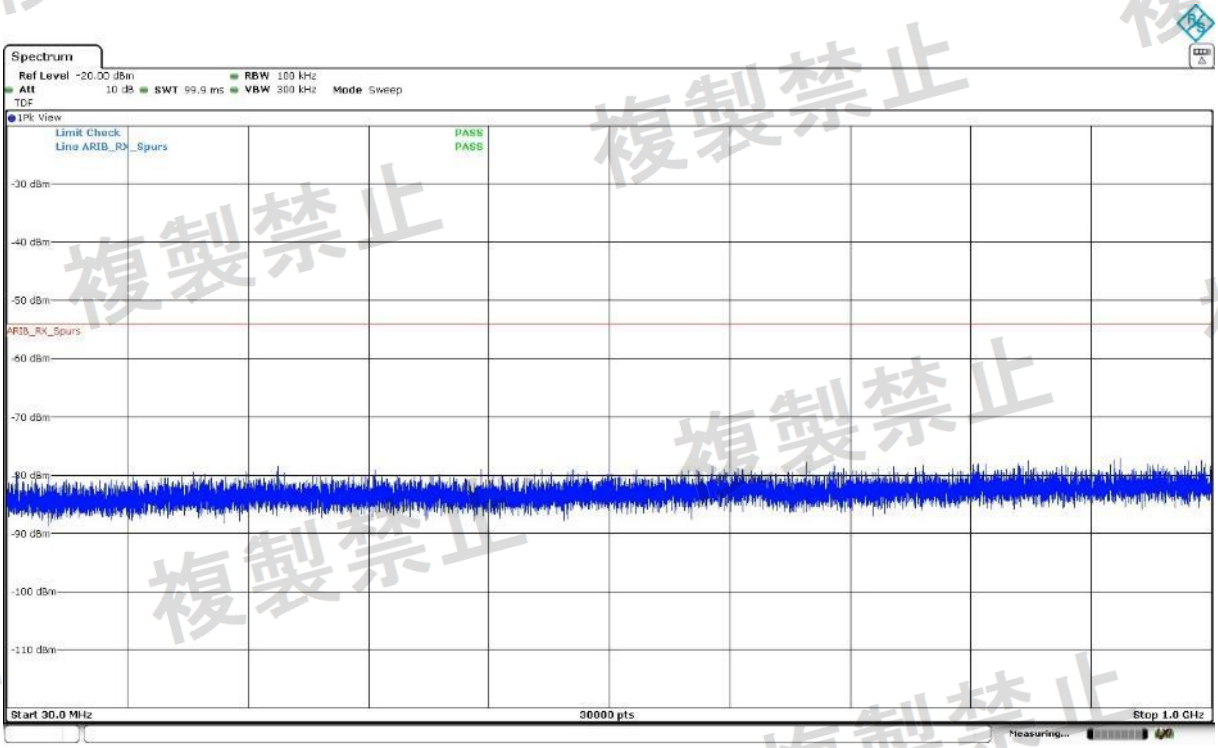


Frequency range 1 – 12.75 GHz:

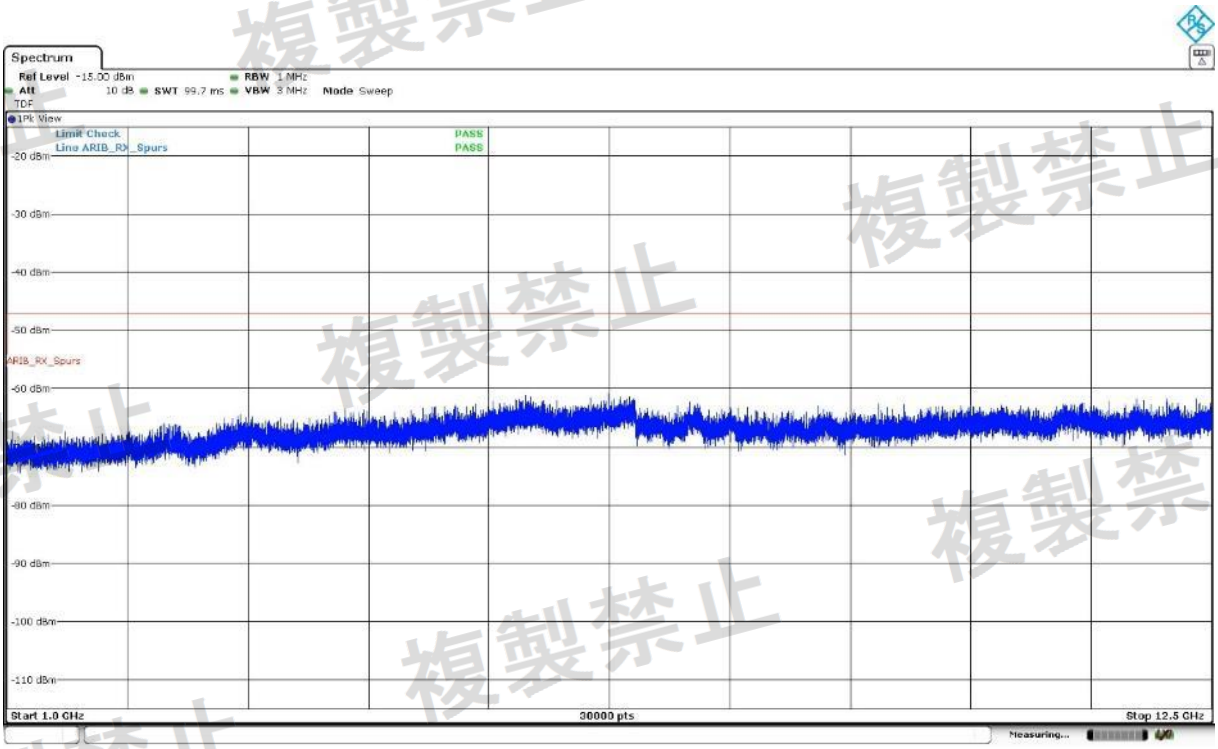


- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:



Frequency range 1 – 12.75 GHz:



Vmax:

- LOW CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty	<± 2.94 dB

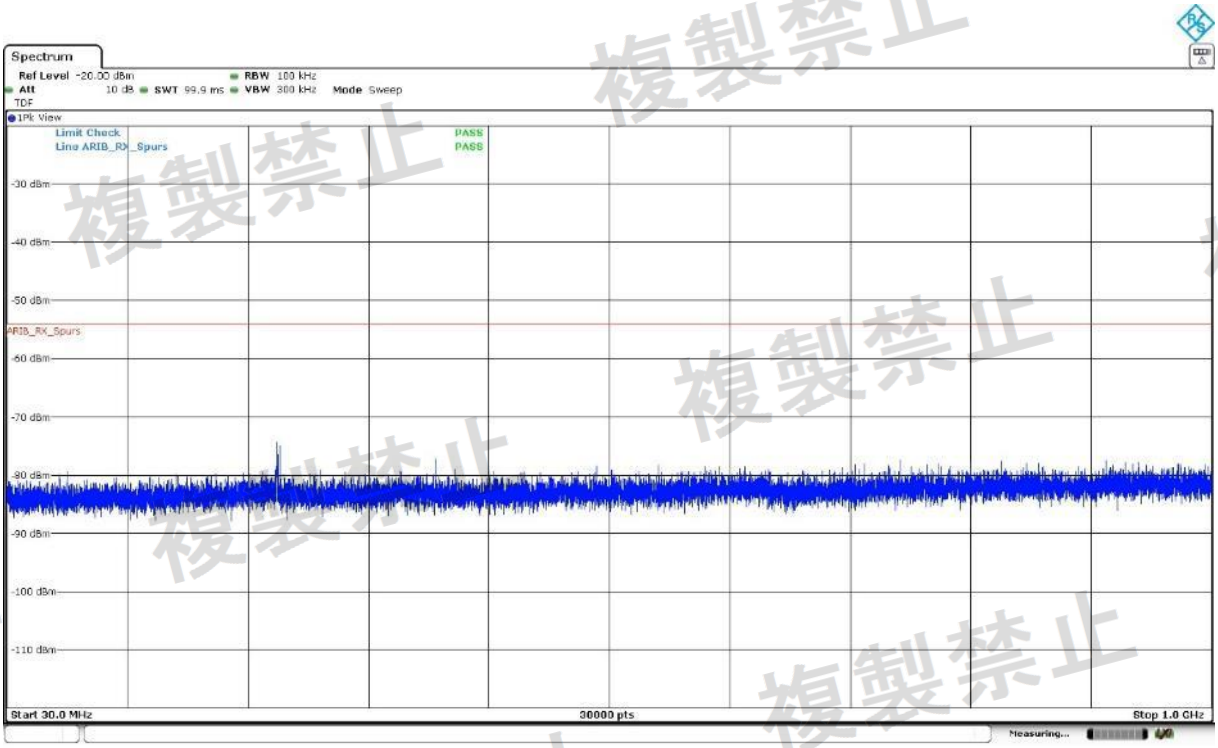
Verdict:

PASS

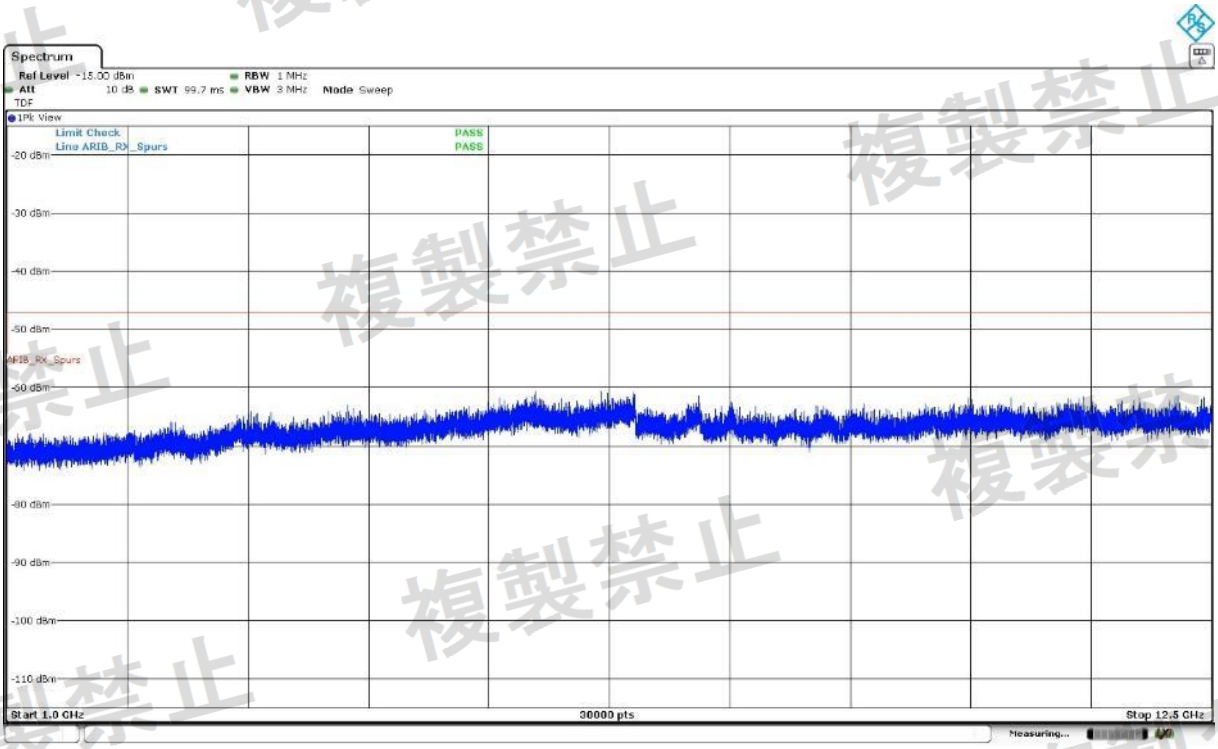
Vmax:

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

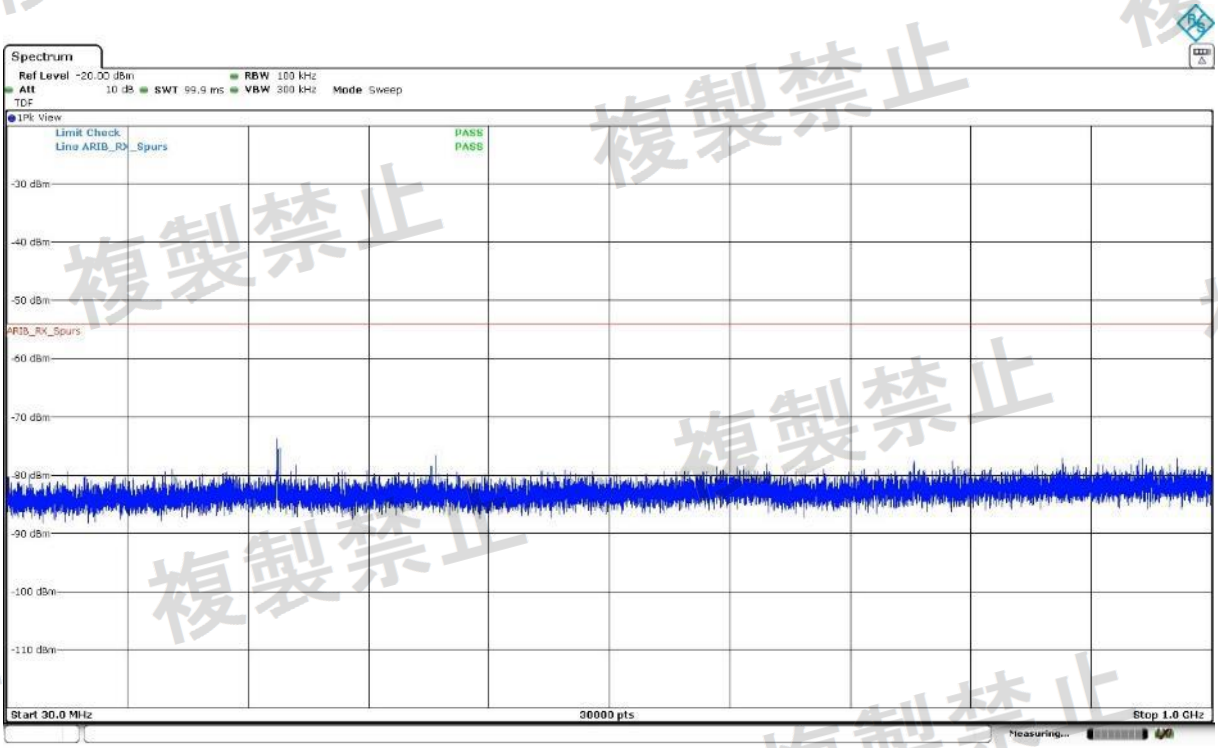


Frequency range 1 – 12.75 GHz:

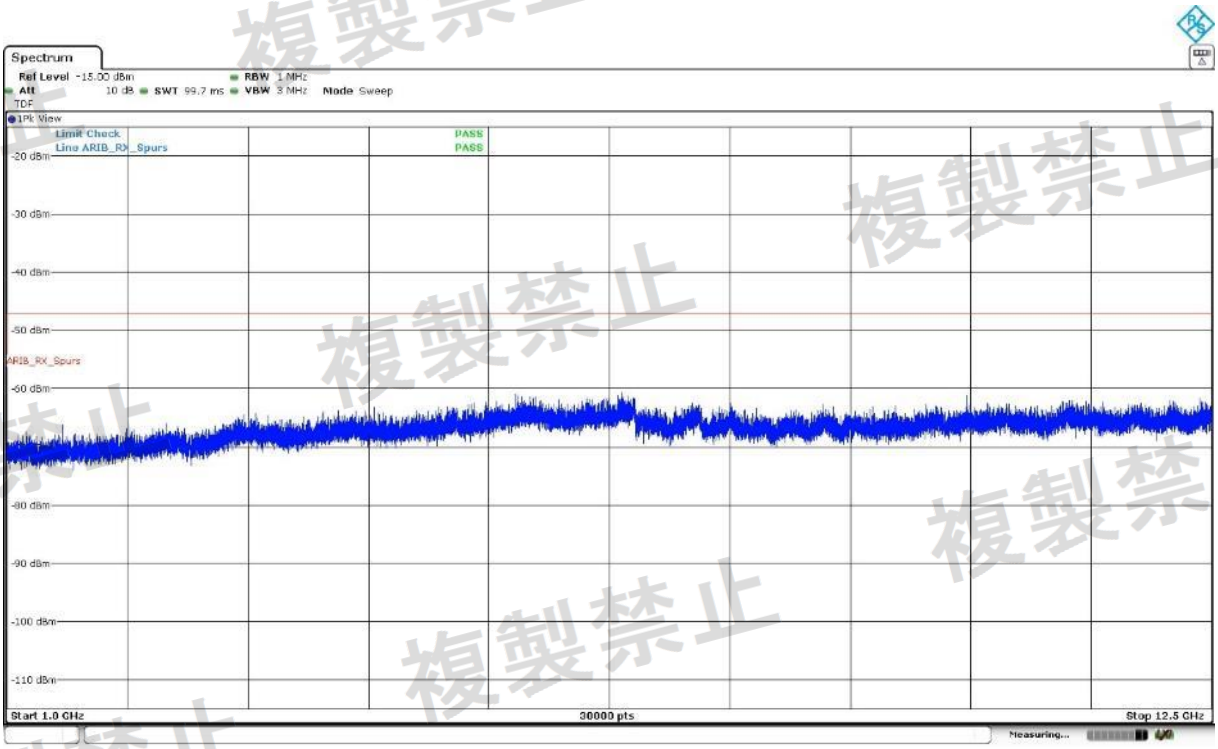


- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

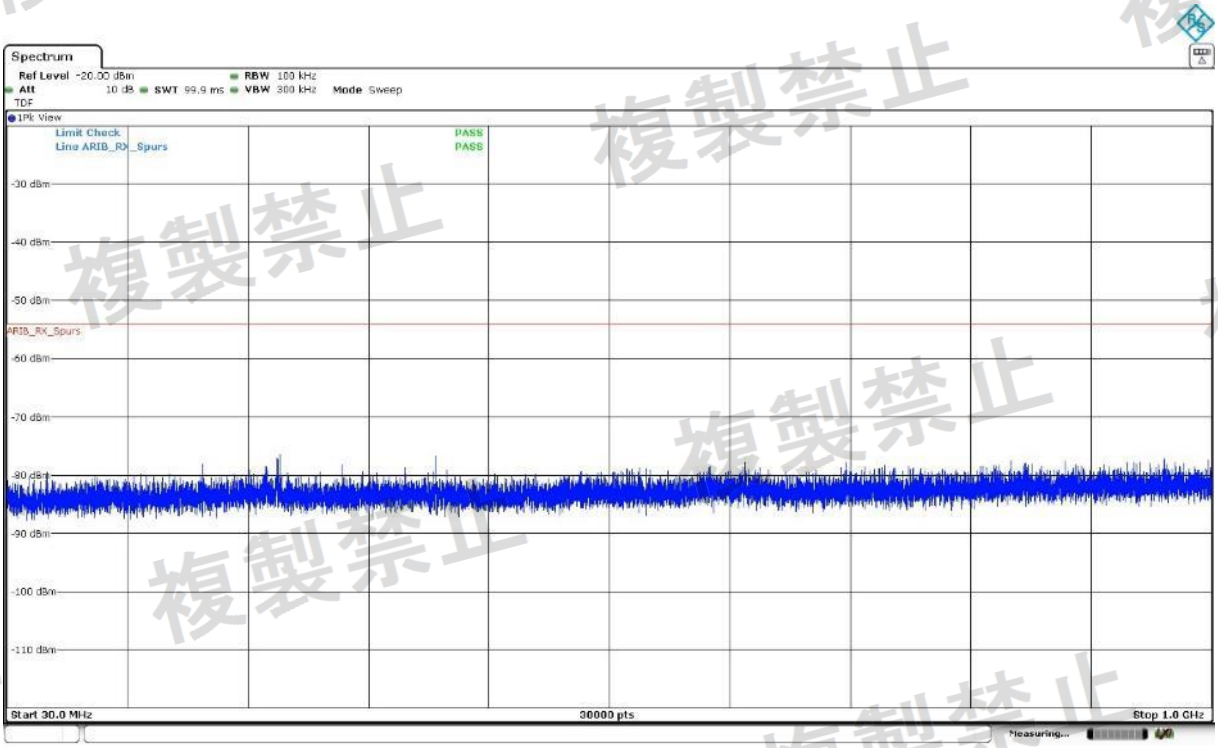


Frequency range 1 – 12.75 GHz:

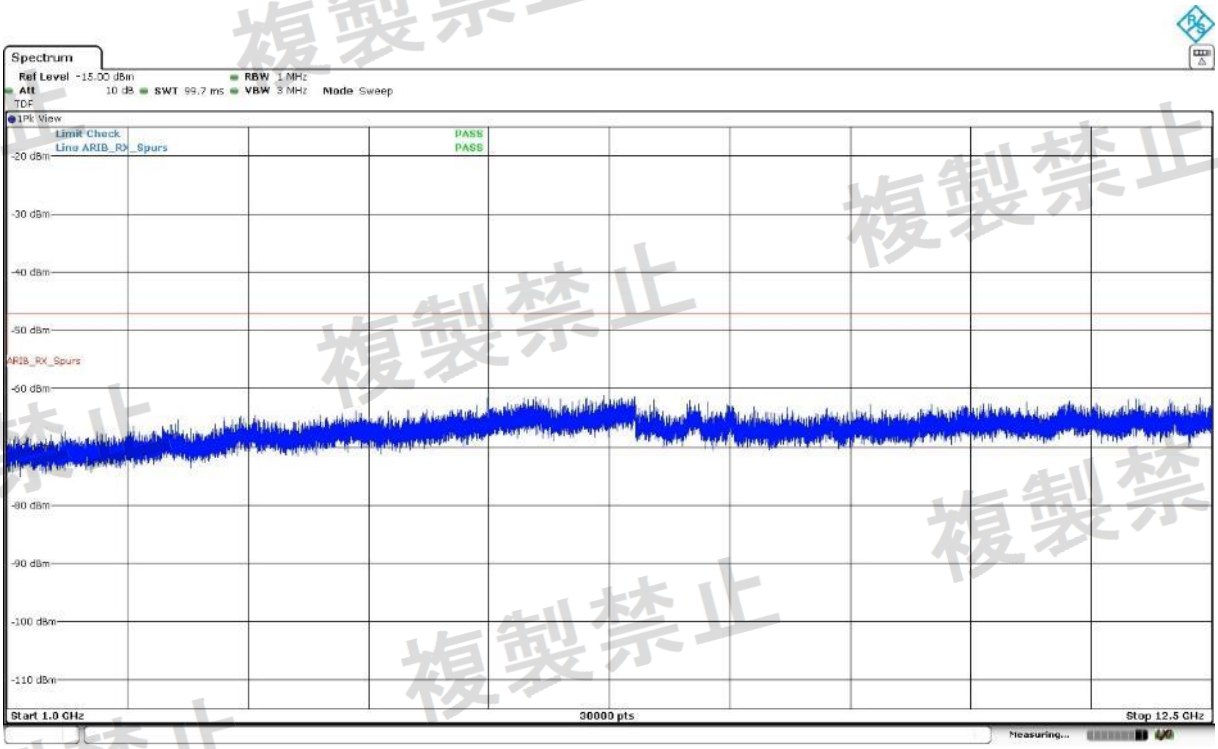


- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:



Frequency range 1 – 12.75 GHz:



Article 9.4-5. Controlling equipment. Interference prevention function. Identification code transmission/reception

Limits:

Radio equipment used mainly on the same premises and automatically transmits or receives identification code.

Results:

BLE MAC
4E:6A:F3:7E:77:A9

Verdict:

PASS

Article 49-20. Antenna. Antenna gain

Limits:

a: The absolute gain of the transmitting antenna shall be 12.14 dB or less. However, when the equivalent isotropic radiated power EIRP (equivalent isotropic radiated power in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems) is equal to or less than the value obtained by applying an antenna power with the mean power of 10 mW with its absolute gain being 12.14 dB, the shortage shall be compensated for by the gain of the transmitting antenna (Note that mean power is 10 mW in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems; however, mean power of 3 mW in the 1 MHz bandwidth is applied if the FH system, a hybrid system combining DS and FH systems, or a hybrid system combining FH and OFDM systems is employed and the frequency band of 2,427 - 2,470.75 MHz is used).

b: The Half-Power Beam width Angle HPBA (angle between two points at which radiated power becomes 1/2) of the transmitting antenna's horizontal and vertical planes shall not exceed the value as determined by the following formula:

$$HPBA \leq 360 / A \text{ [degrees]}$$

where constant A is equal to the value obtained by dividing the equivalent isotropic radiated power EIRP (equivalent isotropic radiated power in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems) by the value obtained by applying an antenna power with the mean power of 10 mW with its absolute gain being 2.14 dB, and shall be assumed to be 1 if it is less than 1 (Note that mean power is 10 mW in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems; however, mean power of 3 mW in the 1 MHz bandwidth is applied if the FH system, a hybrid system combining DS and FH systems, or a hybrid system combining the FH and OFDM systems is employed and the frequency band of 2,427 - 2,470.75 MHz is used).

Therefore

$$A = EIRP\ (mW) / (10\ mW \times \text{absolute gain}) = EIRP\ (mW) / 16.37$$

Where absolute gain is the linear value corresponding to 2.14 dB = 1.637.

Results:

Maximum Declared Antenna Gain: -8.3 dBi

Vnom:

Channel	Radiated power EIRP (mW)	A = EIRP (mW) /16.37
Low (2402 MHz)	1.05	< 1
Middle (2440 MHz)	1.06	< 1
High (2480 MHz)	0.95	< 1

Since A is < 1, it is assumed to be 1, and therefore the half-power beam width must be 360º or less.

Vmin:

Channel	Radiated power EIRP (mW)	A = EIRP (mW) /16.37
Low (2402 MHz)	1.05	< 1
Middle (2440 MHz)	0.99	< 1
High (2480 MHz)	0.92	< 1

Since A is < 1, it is assumed to be 1, and therefore the half-power beam width must be 360º or less.

Vmax:

Channel	Radiated power EIRP (mW)	A = EIRP (mW) /16.37
Low (2402 MHz)	1.06	< 1
Middle (2440 MHz)	1.01	< 1
High (2480 MHz)	0.96	< 1

Since A is < 1, it is assumed to be 1, and therefore the half-power beam width must be 360º or less.

Verdict:

PASS

DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29507456

Appendix B: Test results. Bluetooth Low Energy 5.4 (2M)

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TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal:	3.7 Vdc
Type of Power Supply:	Battery

ANTENNA (*):

Type of Antenna:	Internal
Maximum Declared Antenna Gain:	-8.3 dBi

TEST FREQUENCIES (*):

Modulation	Data rates	Low Channel:	Middle Channel	High Channel
BLE GFSK	2 Mbit/s	2404 MHz	2440 MHz	2478 MHz

During transmitter test the EUT was controlled by a SW tool provided by the client to operate in a continuous transmit mode on the modulation schemes and test channels as required.

ENVIRONMENTAL CONDITIONS DURING TESTING:

Temperature: 25 ºC
Humidity: 55 %

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and its antenna port (SMA type) is connected to the spectrum analyser through a low loss RF cable. The reading of the spectrum analyser is corrected with the cable loss.

The DC supply voltage is applied using a power supply.

The Equipment Under Test (E.U.T.) is set in continuous transmission with modulation using an implemented test mode. The test mode also permits to set the E.U.T. in receiving mode with the transmission disabled.

PRODUCT INFORMATION

The following information is provided by the client, in accordance with clause 5.4.1:

Information	Description
Modulation:	GFSK.
Spread spectrum system:	No (Other digital modulation methods).
Nominal necessary Bandwidth:	2 MHz.
Maximum declared antenna gain:	-8.3 dBi.
Rated Antenna Power:	9.5 dBm (8.912509381 mW).
Type of Antenna:	Integral antenna
Operating nominal frequency range:	2402 MHz to 2483.5 MHz.
Nominal power supply:	3.7 Vdc.
Type of power supply:	Battery.

Article 49-20 and Article 14.7 Table 8. Transmitting equipment. Antenna power. Tolerances for antenna power

Limits:

Mode	Limit	Tolerance
a) FH, FH+DS, FH+OFDM	3 mW/MHz	+20%
b) OFDM (Narrow bandwidth), DS	10 mW/MHz	
c) Other than a & b	10 mW	
d) OFDM (Wide band)	5 mW/MHz	

Results:

Mode: Other digital modulation methods than a & b.

Maximum Rated Antenna Power: 9.5 dBm (8.912509381 mW)

Vnom:

Channel	Measured antenna power (dBm)	Radiated power EIRP (dBm)	Antenna power EIRP (mW)	Deviation from maximum rated antenna power (%)
Low (2404 MHz)	8.514000	0.21	1.05	-20.31070219
Middle (2440 MHz)	8.508000	0.21	1.05	-20.42072101
High (2478 MHz)	8.262000	-0.04	0.99	-24.80308911

Vmin:

Channel	Measured antenna power (dBm)	Radiated power EIRP (dBm)	Antenna power EIRP (mW)	Deviation from maximum rated antenna power (%)
Low (2404 MHz)	8.842000	0.54	1.13	-14.0590797
Middle (2440 MHz)	8.372000	0.07	1.02	-22.8741435
High (2478 MHz)	7.961000	-0.34	0.92	-29.83831669

Vmax:

Channel	Measured antenna power (dBm)	Radiated power EIRP (dBm)	Antenna power EIRP (mW)	Deviation from maximum rated antenna power (%)
Low (2404 MHz)	8.867000	0.57	1.14	-13.56293736
Middle (2440 MHz)	8.314000	0.01	1.00	-23.89731141
High (2478 MHz)	7.971000	-0.33	0.93	-29.67657731

Measurement uncertainty: < ± 2.01 dB

Verdict:

PASS

Article 5 and Annex 1 table 7-8. Transmitting equipment. Frequency tolerance

Limits:

Frequency tolerance shall be ± 50 x 10^{-6} (50 ppm).

Unmodulated carrier.

Results:

Vnom:

Channel	Frequency error (Hz)	Frequency error (ppm)
Low (2404 MHz)	7965	3.315986678
Middle (2440 MHz)	8055	3.301229508
High (2478 MHz)	8055	3.247983871
Measurement uncertainty	<± 7.10 kHz	

Vmin:

Channel	Frequency error (Hz)	Frequency error (ppm)
Low (2404 MHz)	7665	3.191090758
Middle (2440 MHz)	8055	3.301229508
High (2478 MHz)	7995	3.223790323
Measurement uncertainty	<± 7.10 kHz	

Vmax:

Channel	Frequency error (Hz)	Frequency error (ppm)
Low (2404 MHz)	8175	3.403413822
Middle (2440 MHz)	7965	3.264344262
High (2478 MHz)	7755	3.127016129
Measurement uncertainty	<± 7.10 kHz	

Verdict:

PASS

Article 6 and Annex 2. 30. Transmitting equipment. Permissible value for occupied bandwidth

Limits:

Mode	Limit
FH	83.5 MHz
FH+DS	83.5 MHz
FH+OFDM	83.5 MHz
OFDM (Narrow bandwidth), DS	26 MHz
OFDM (Wide band)	38 MHz
Others	26 MHz

Results:

Mode: Other digital modulation methods.

Vnom:

	Low Channel 2404 MHz	Middle Channel 2440 MHz	High Channel 2478 MHz
99% occupied bandwidth (MHz)	2.0228	2.0145	2.0187
Limit	<26 MHz		
Measurement uncertainty (kHz)	<± 6.06		

Vmin:

	Low Channel 2404 MHz	Middle Channel 2440 MHz	High Channel 2478 MHz
99% occupied bandwidth (MHz)	2.0295	2.0315	2.0155
Limit	<26 MHz		
Measurement uncertainty (kHz)	<± 6.06		

Vmax:

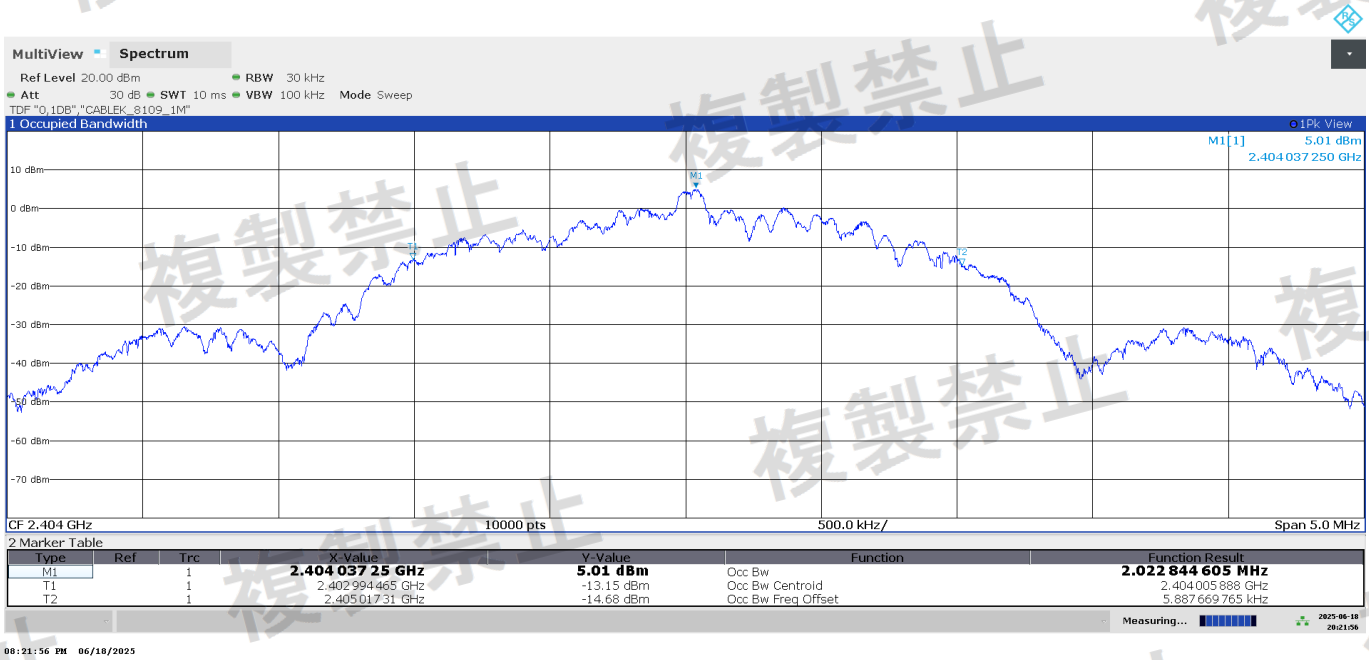
	Low Channel 2404 MHz	Middle Channel 2440 MHz	High Channel 2478 MHz
99% occupied bandwidth (MHz)	2.027	2.0305	2.0165
Limit	<26 MHz		
Measurement uncertainty (kHz)	<± 6.06		

Verdict:

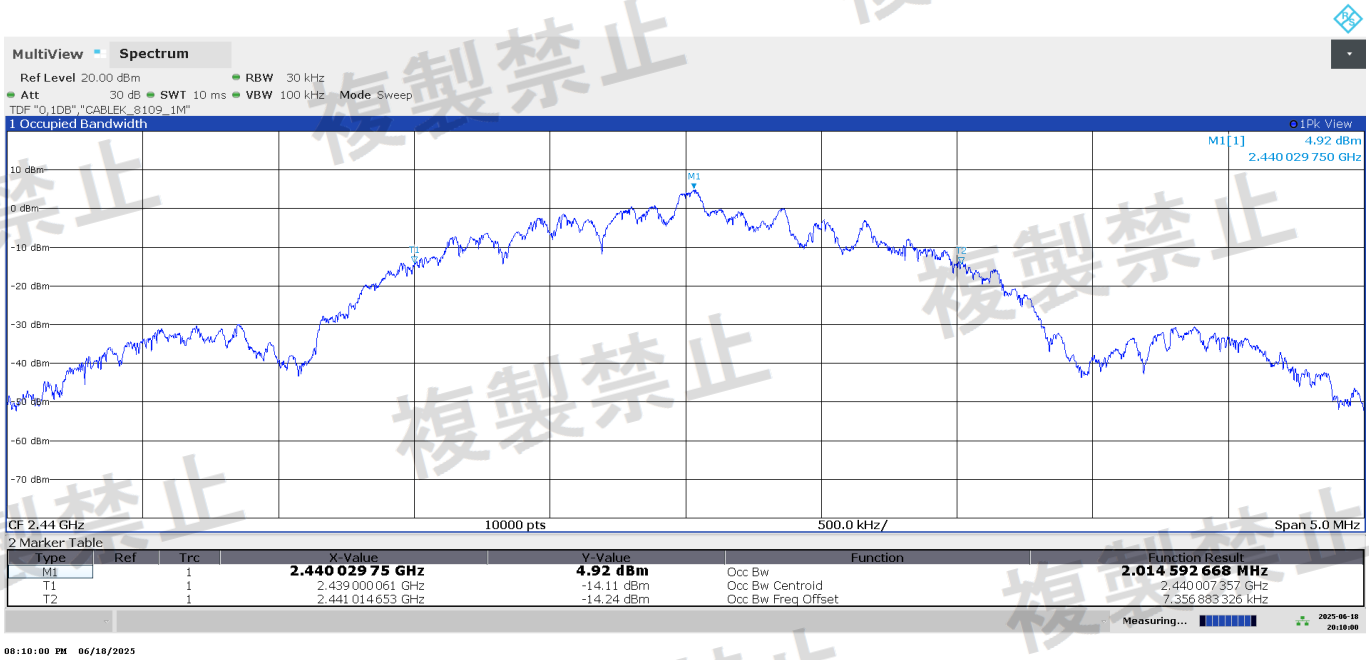
PASS

Vnom:

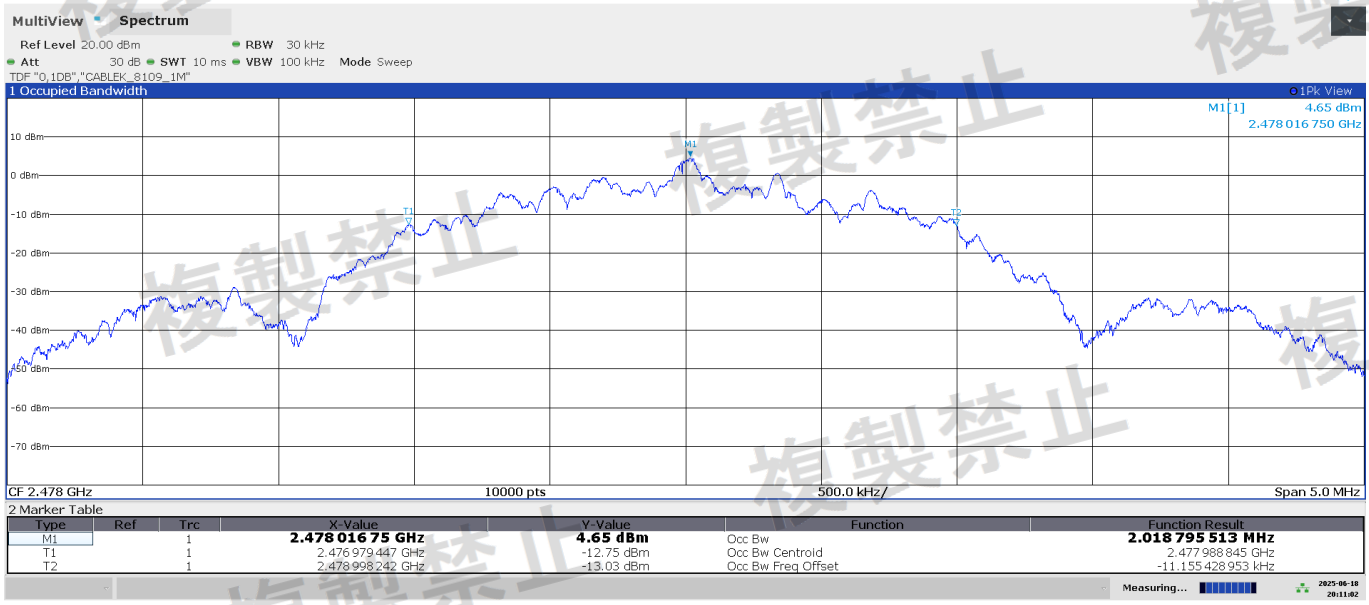
- LOW CHANNEL:



- MIDDLE CHANNEL:

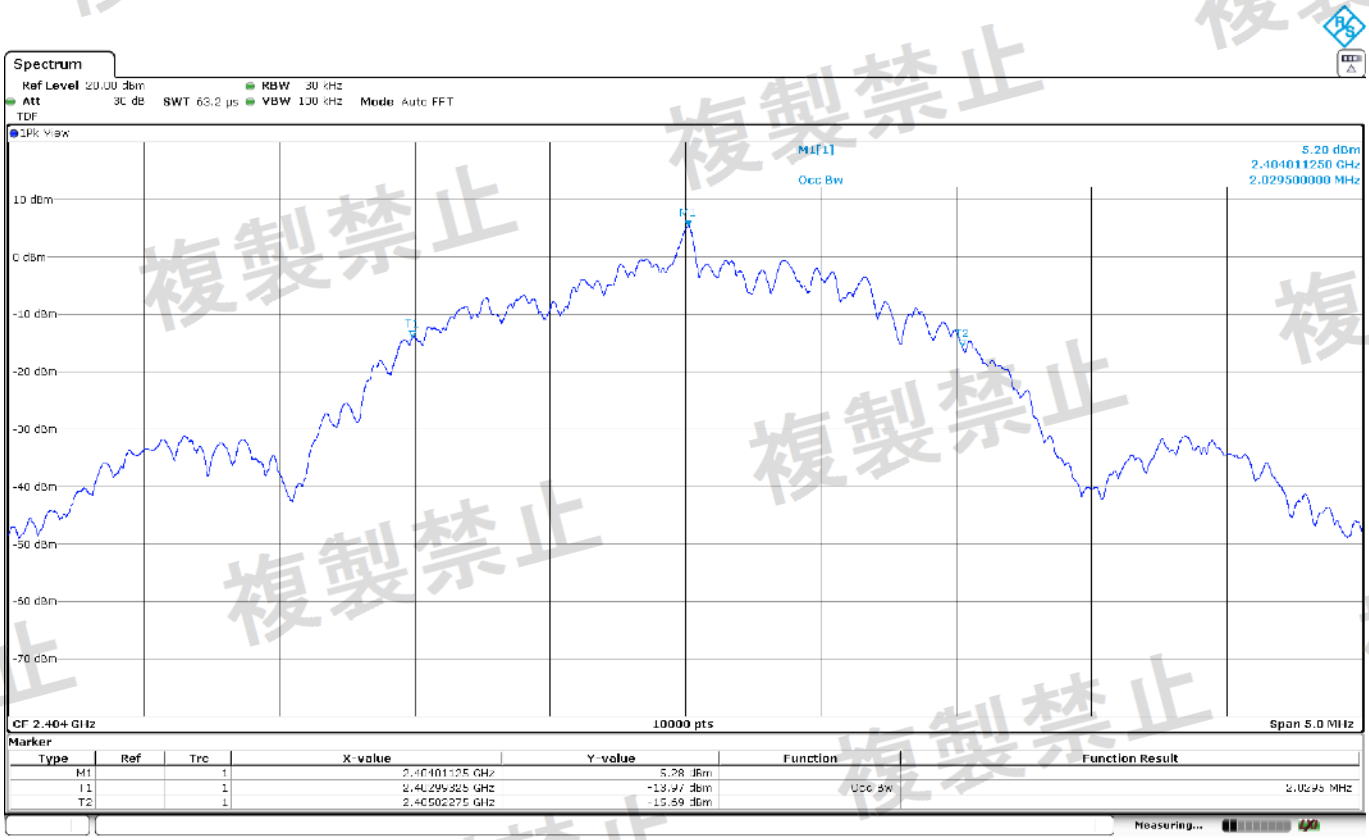


- HIGH CHANNEL:

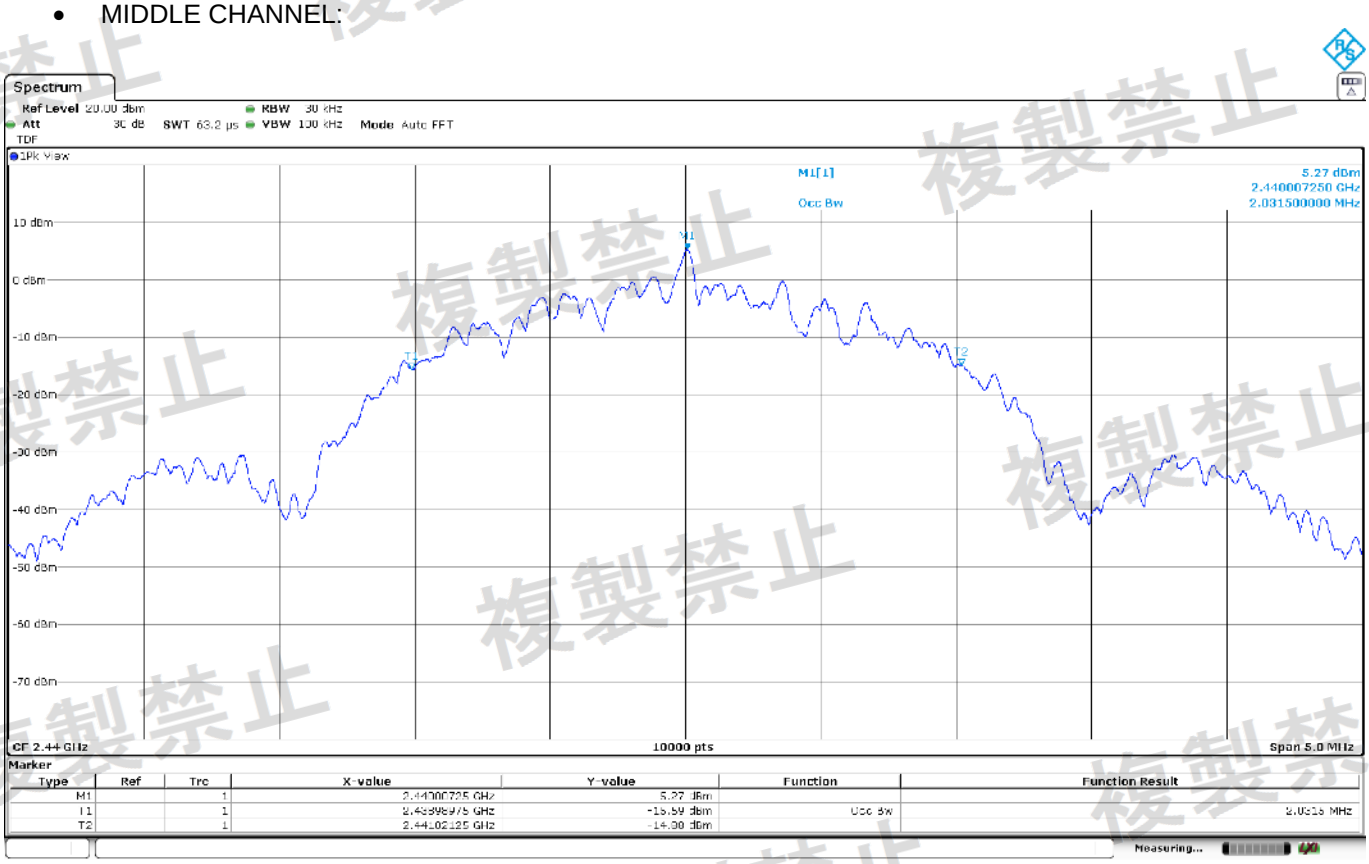


Vmin:

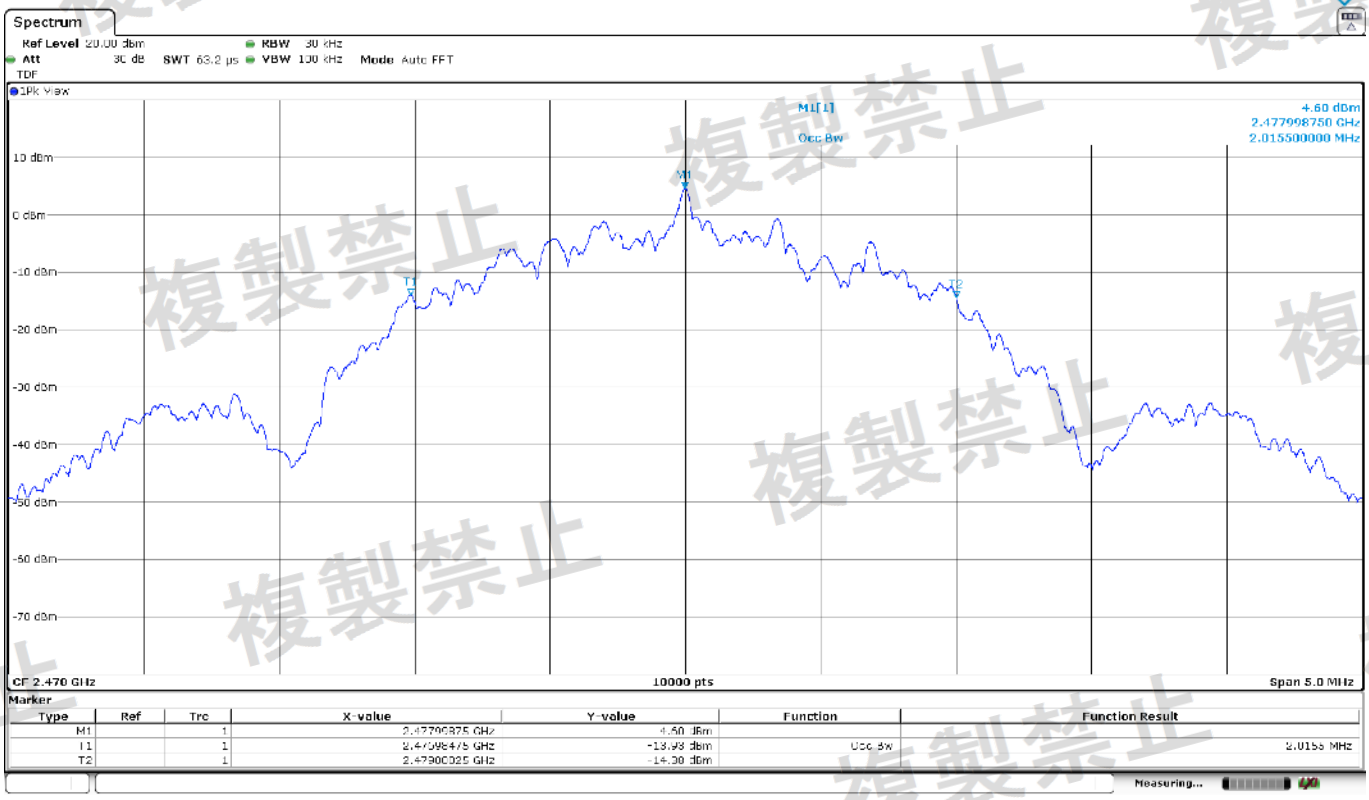
- LOW CHANNEL:



- MIDDLE CHANNEL:

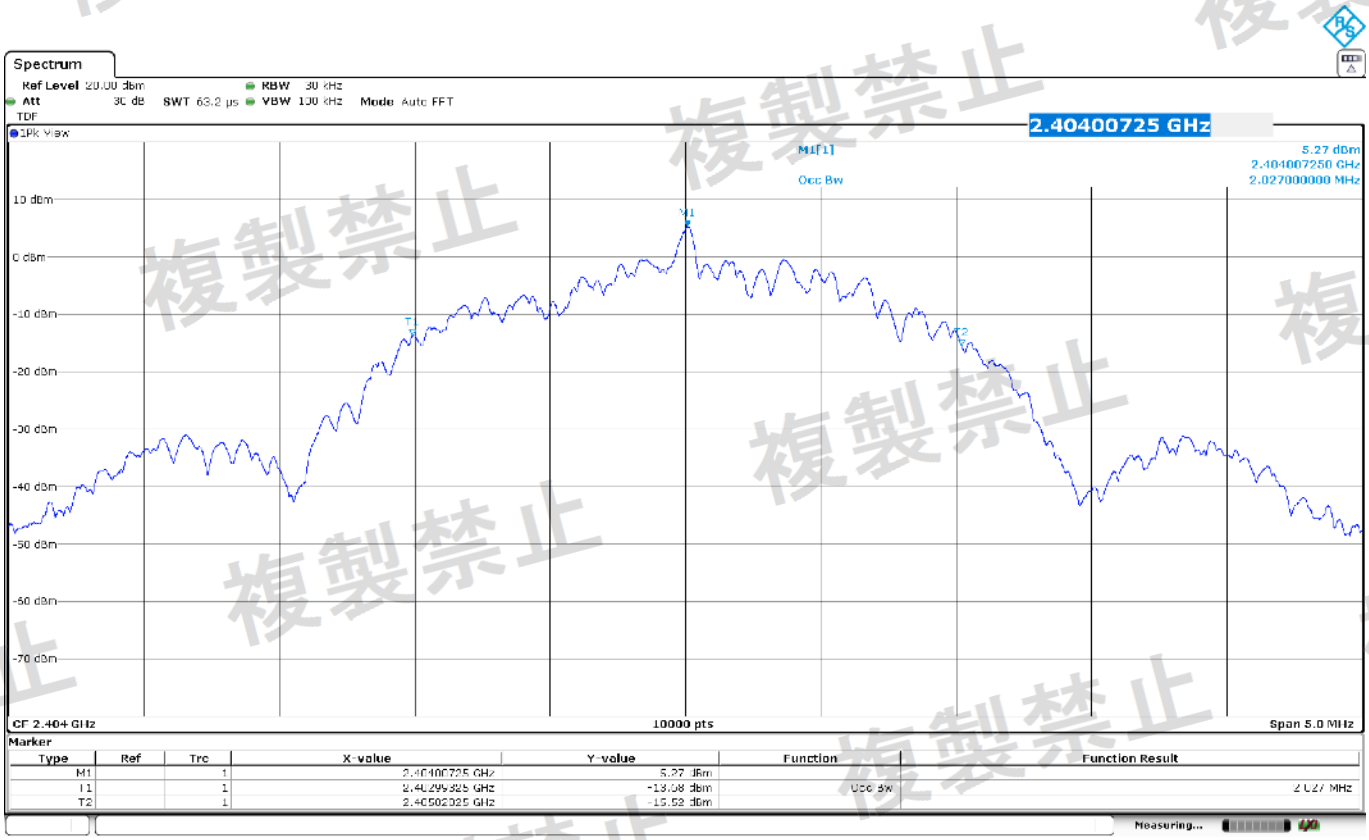


- HIGH CHANNEL:

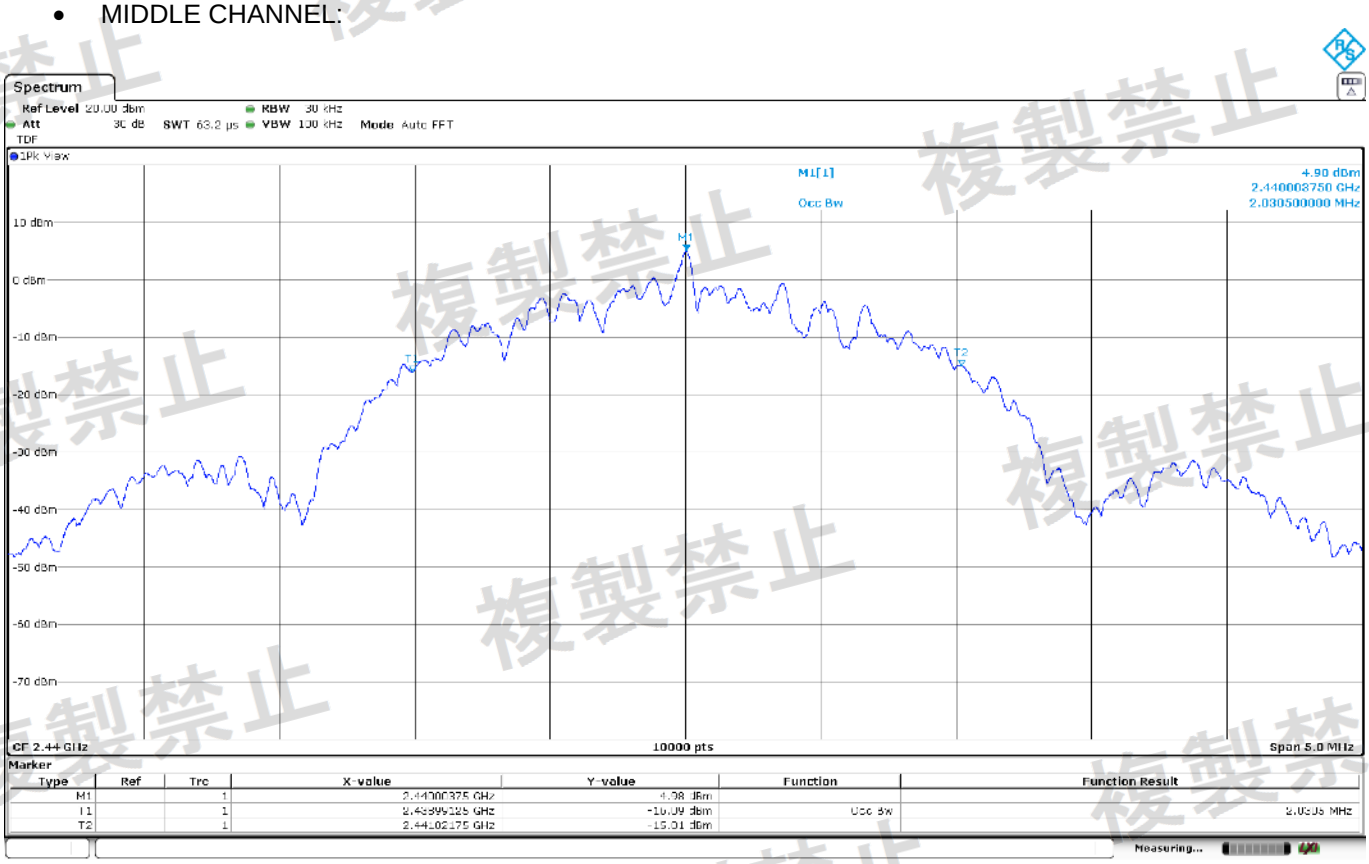


Vmax:

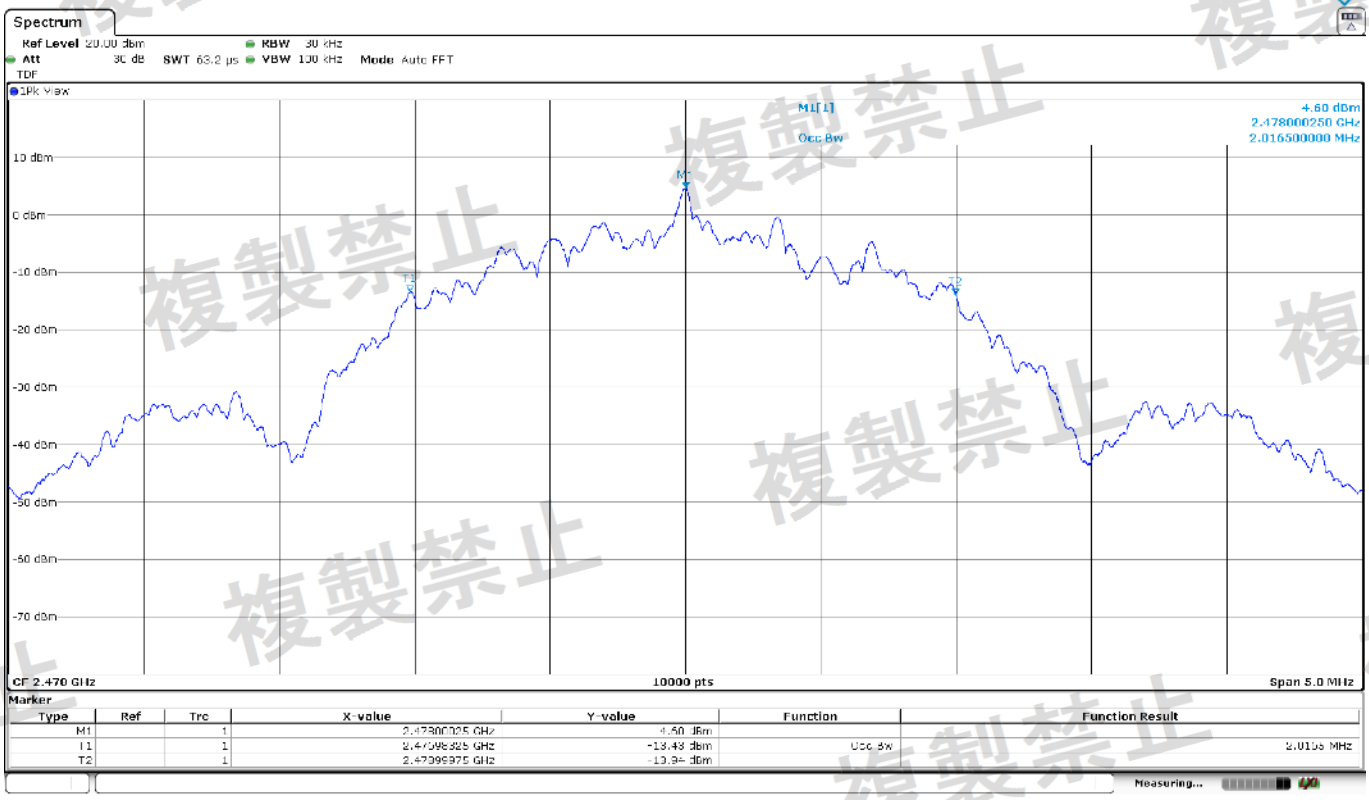
- LOW CHANNEL:



- MIDDLE CHANNEL:



- HIGH CHANNEL:



Article 7 and Annex 3. 26. Transmitting equipment. Spurious emission intensity

Limits:

Permissible mean power of spurious emission of each frequency supplied to a feeder, that is, mean power of spurious emission in the 1 MHz bandwidth at frequency f other than frequency band used shall be as follows:

a. 2,387 MHz ≤ f ≤ 2,400 MHz and 2,483.5 MHz < f ≤ 2,496.5 MHz	25 μW (-16 dBm) or less.
b. 2,387 MHz > f and 2,496.5 MHz < f	2.5 μW (-26 dBm) or less.

Results:

Vnom:

- LOW CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty <± 2.77 dB

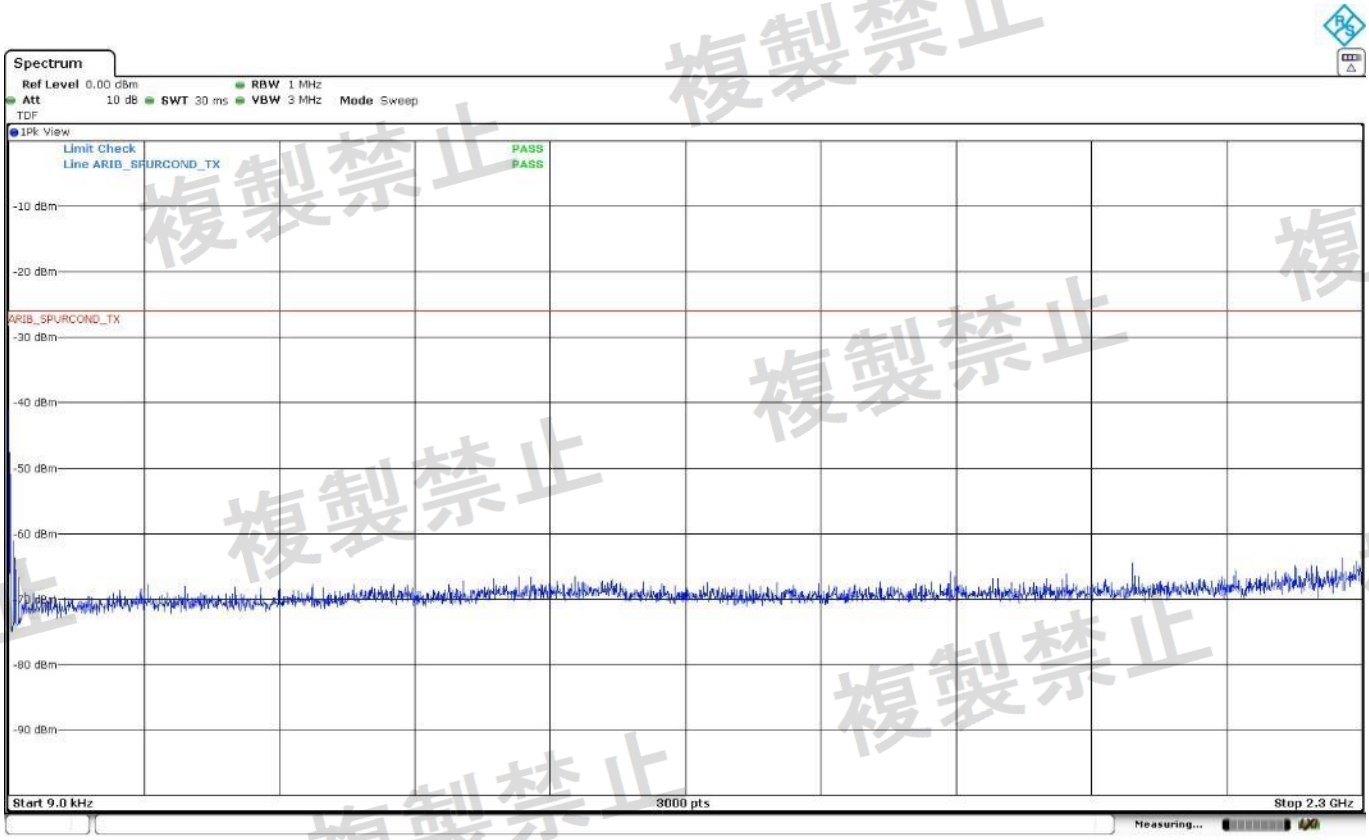
Verdict:

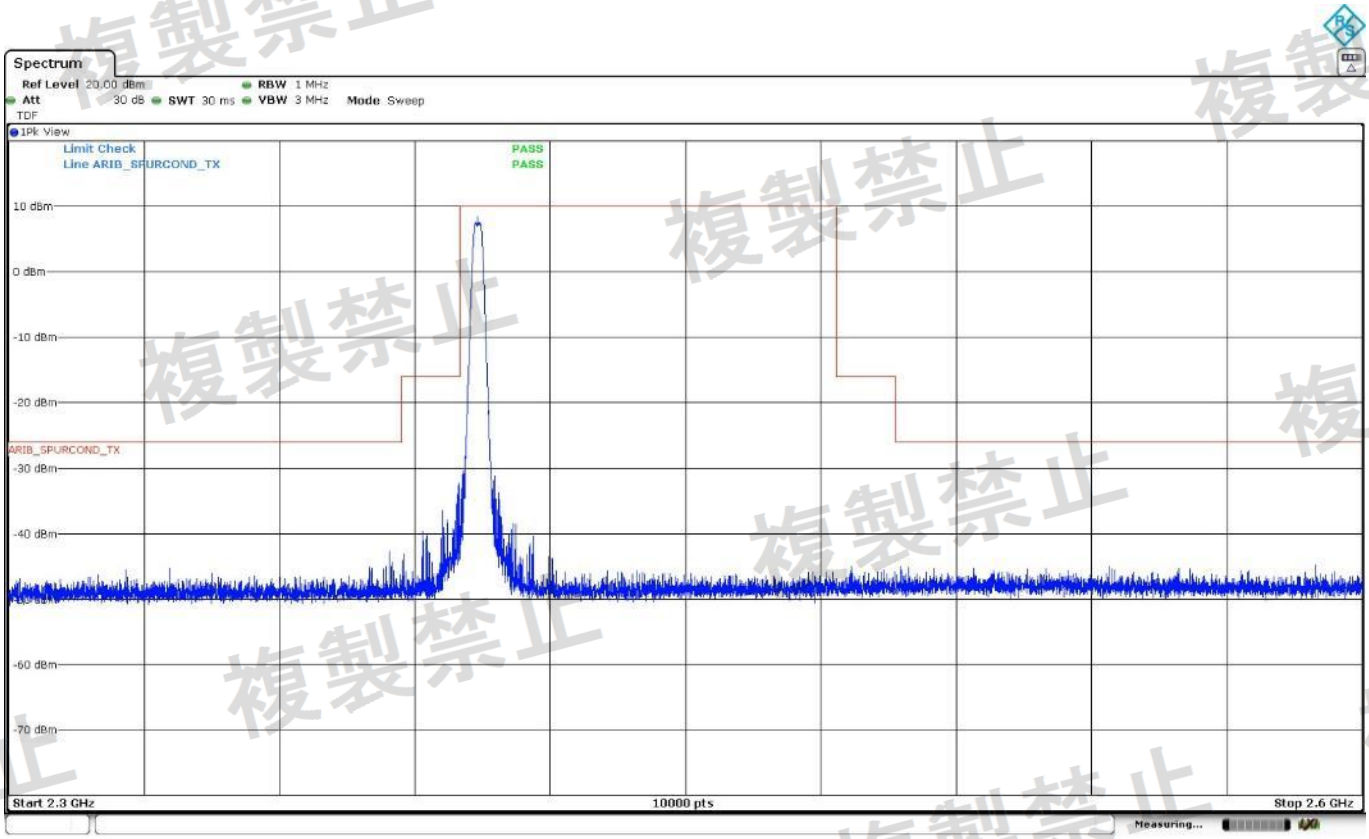
PASS

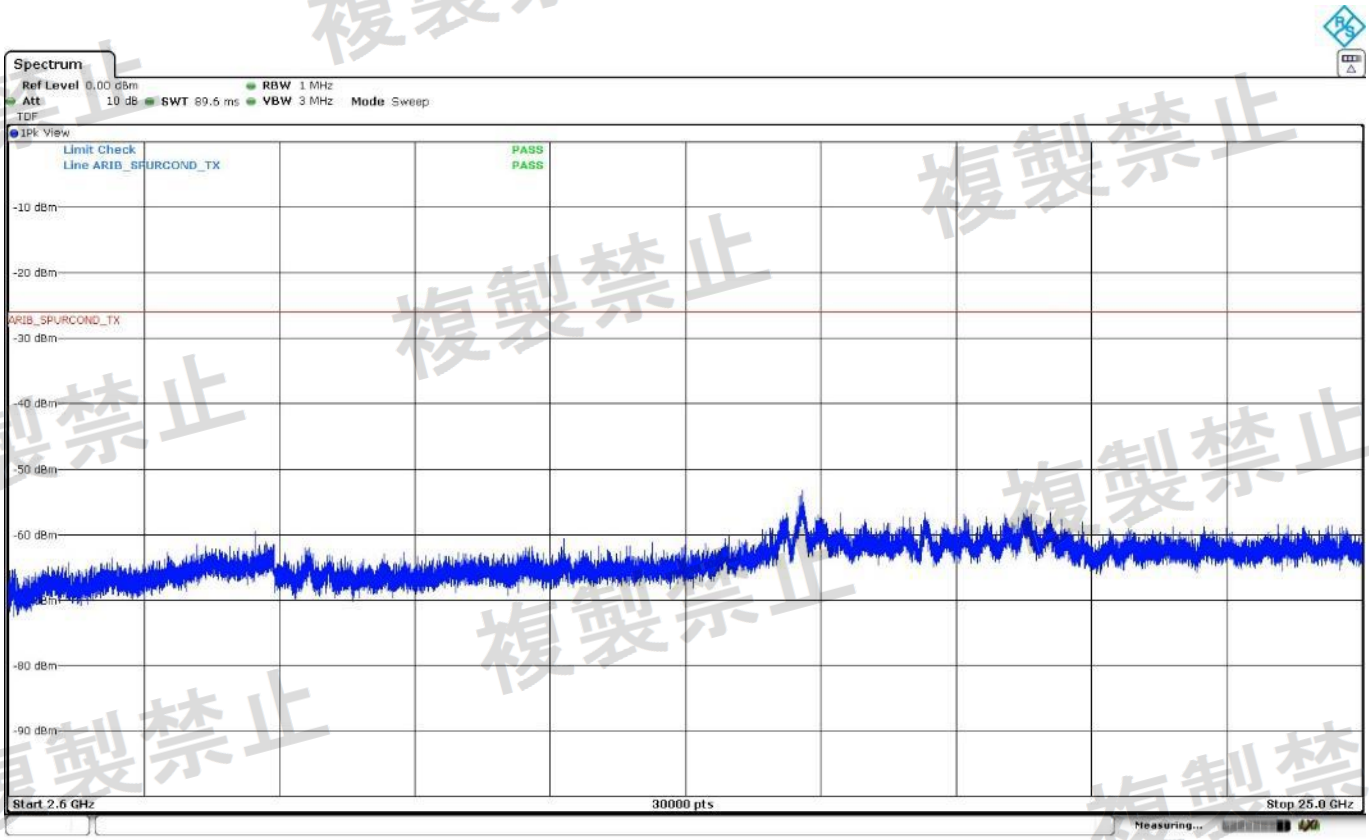
Vnom:

- LOW CHANNEL:

Frequency range 9 kHz - 25 GHz:

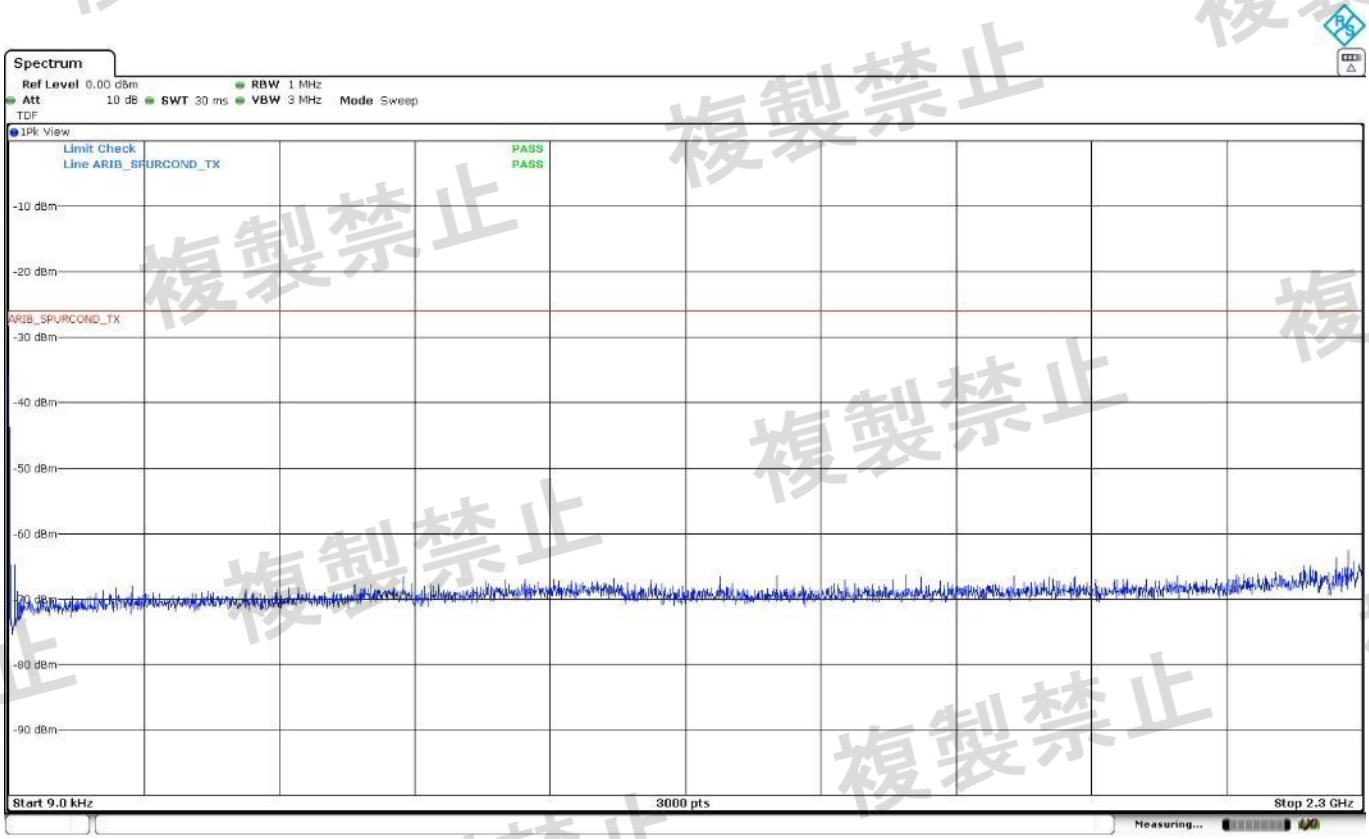


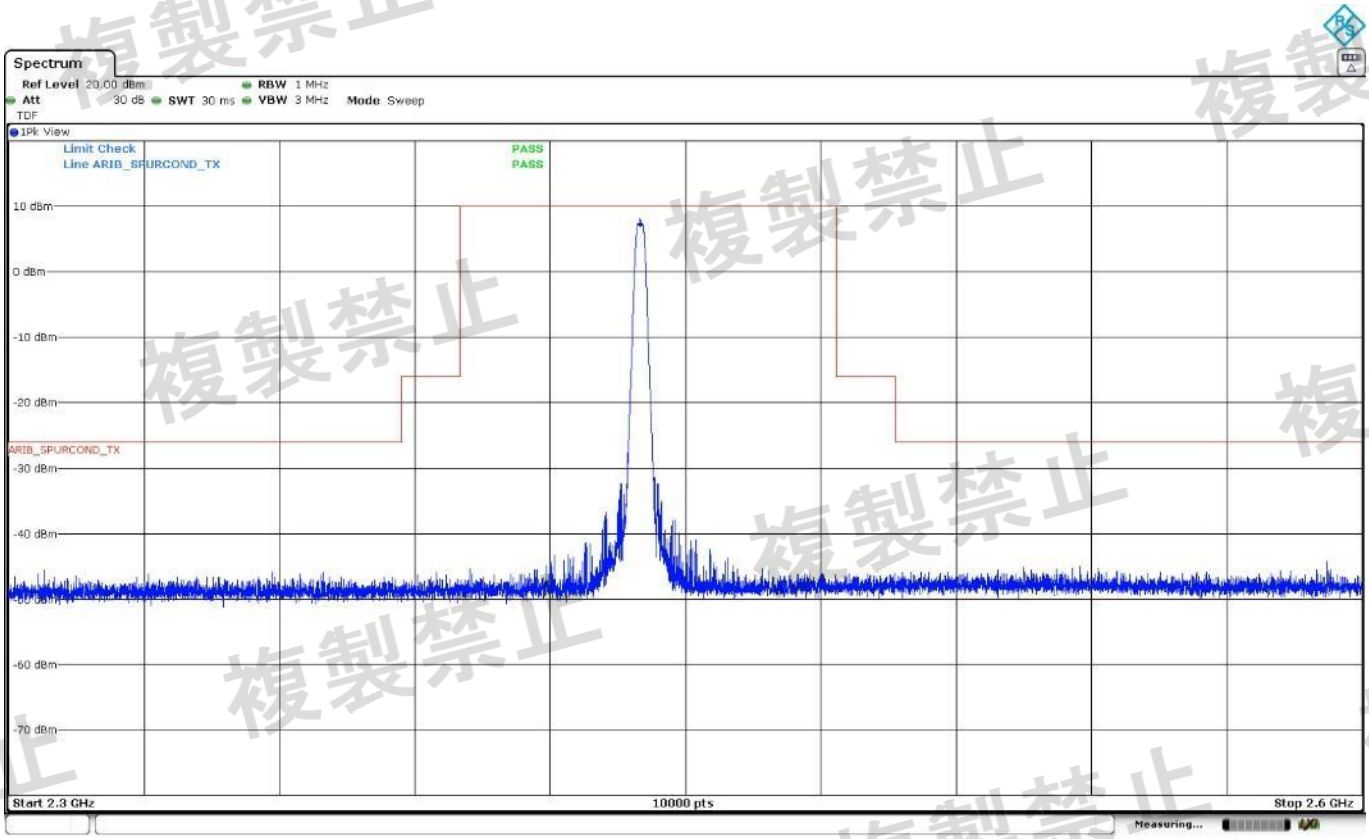

Spectrum
Ref Level 20.00 dBm
RBW 1 MHz
Att 30 dB SWT 30 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
10 dBm
0 dBm
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-60 dBm
-70 dBm
Start 2.3 GHz
10000 pts
Stop 2.6 GHz
Measuring...

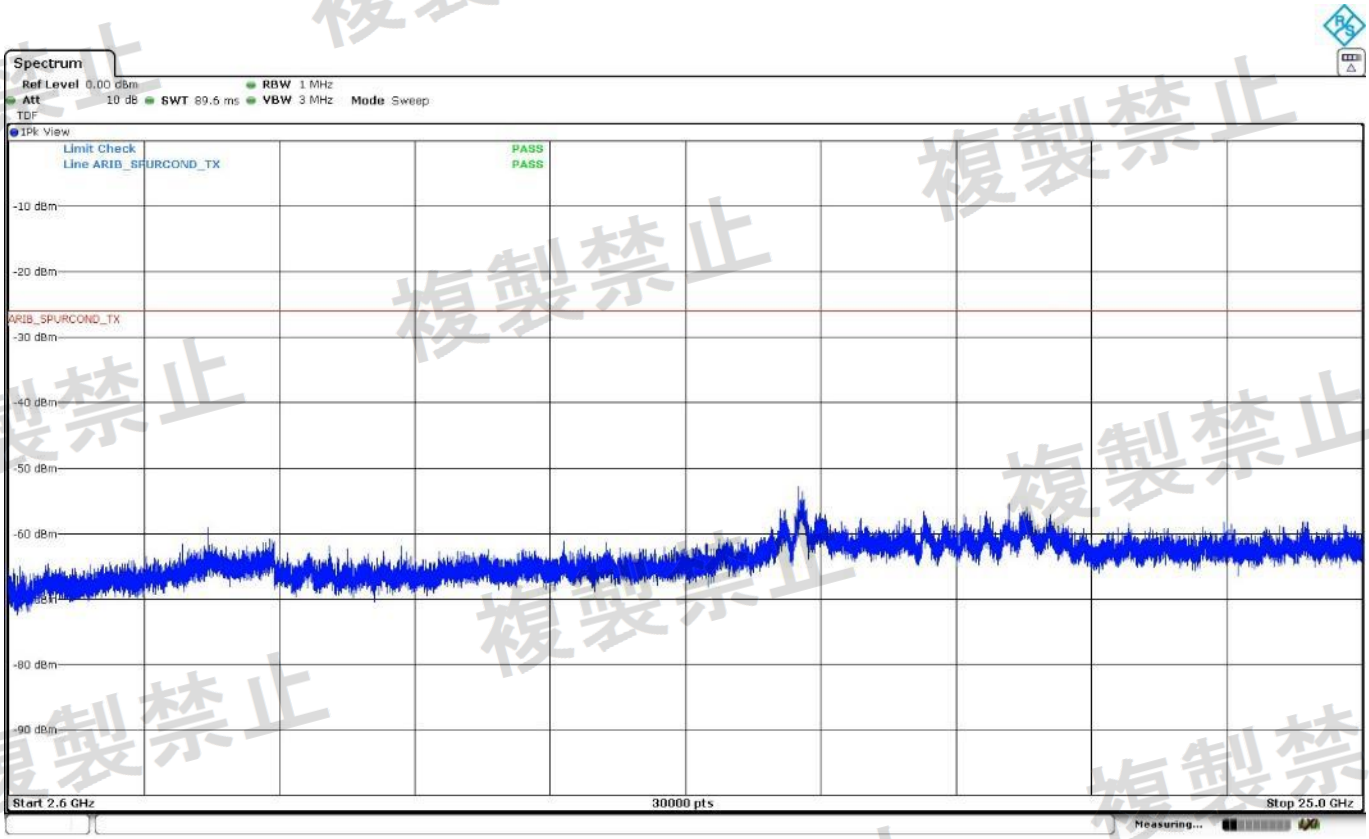

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- MIDDLE CHANNEL:

Frequency range 9 kHz - 25 GHz:

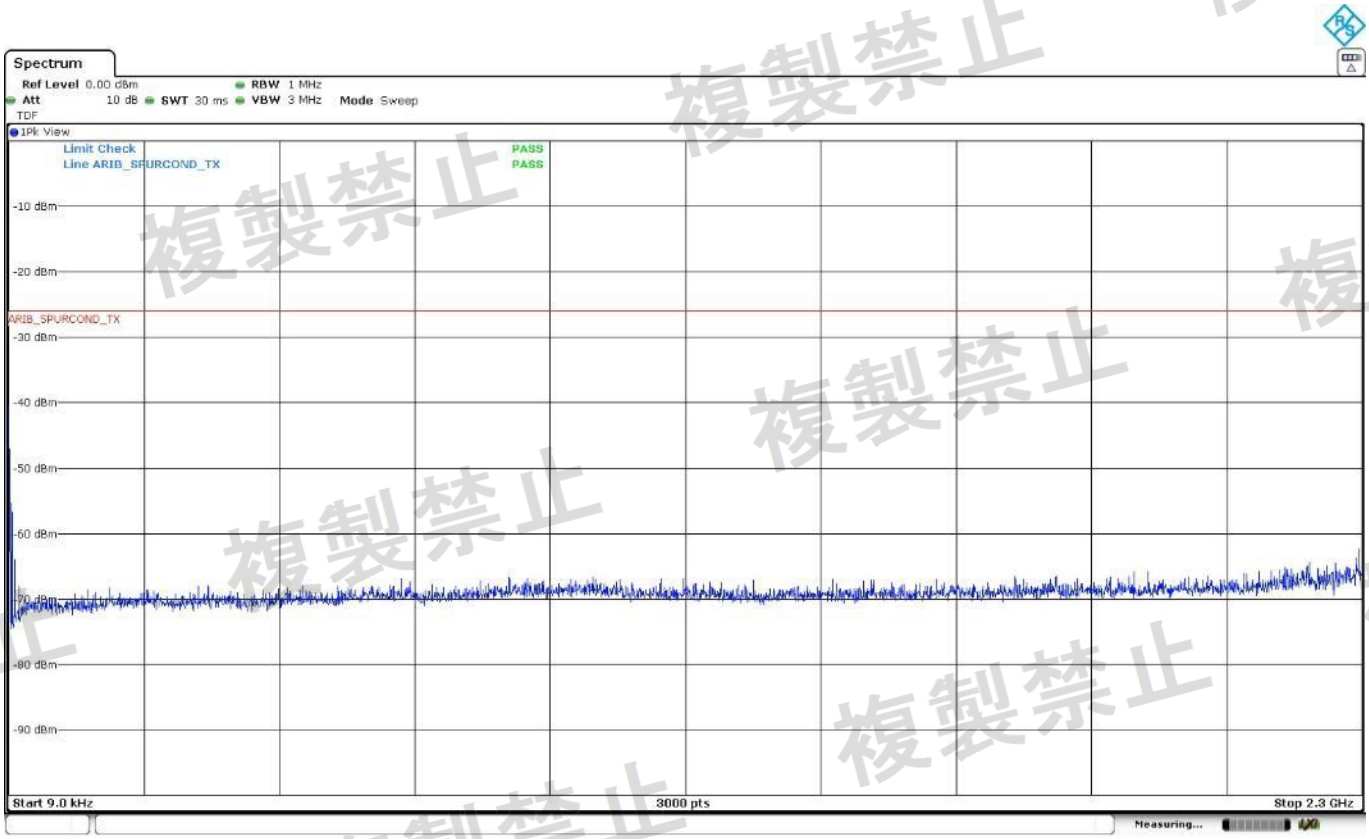


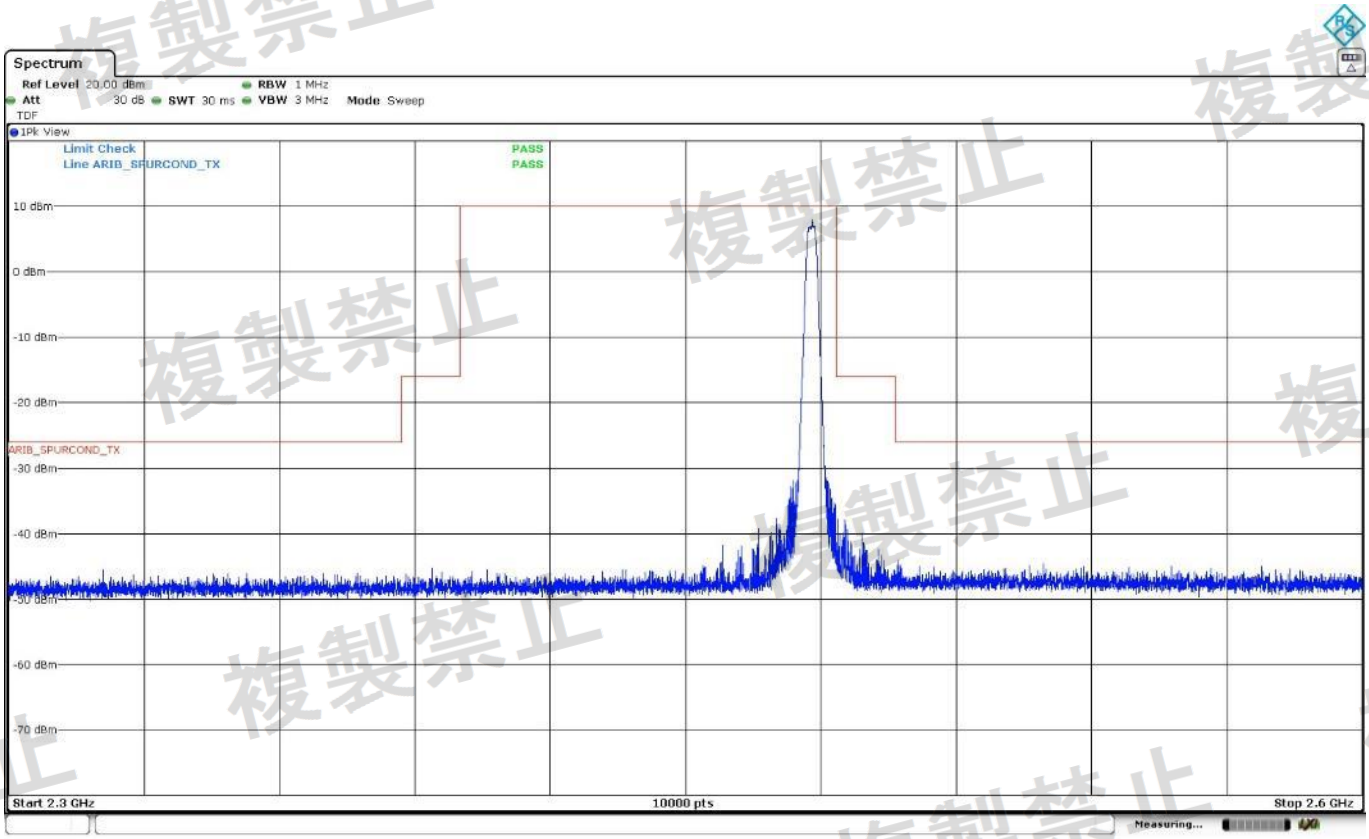

Spectrum
Ref Level 20.00 dBm
RBW 1 MHz
Att 30 dB SWT 30 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
10 dBm
0 dBm
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-60 dBm
-70 dBm
Start 2.3 GHz
10000 pts
Stop 2.6 GHz
Measuring...

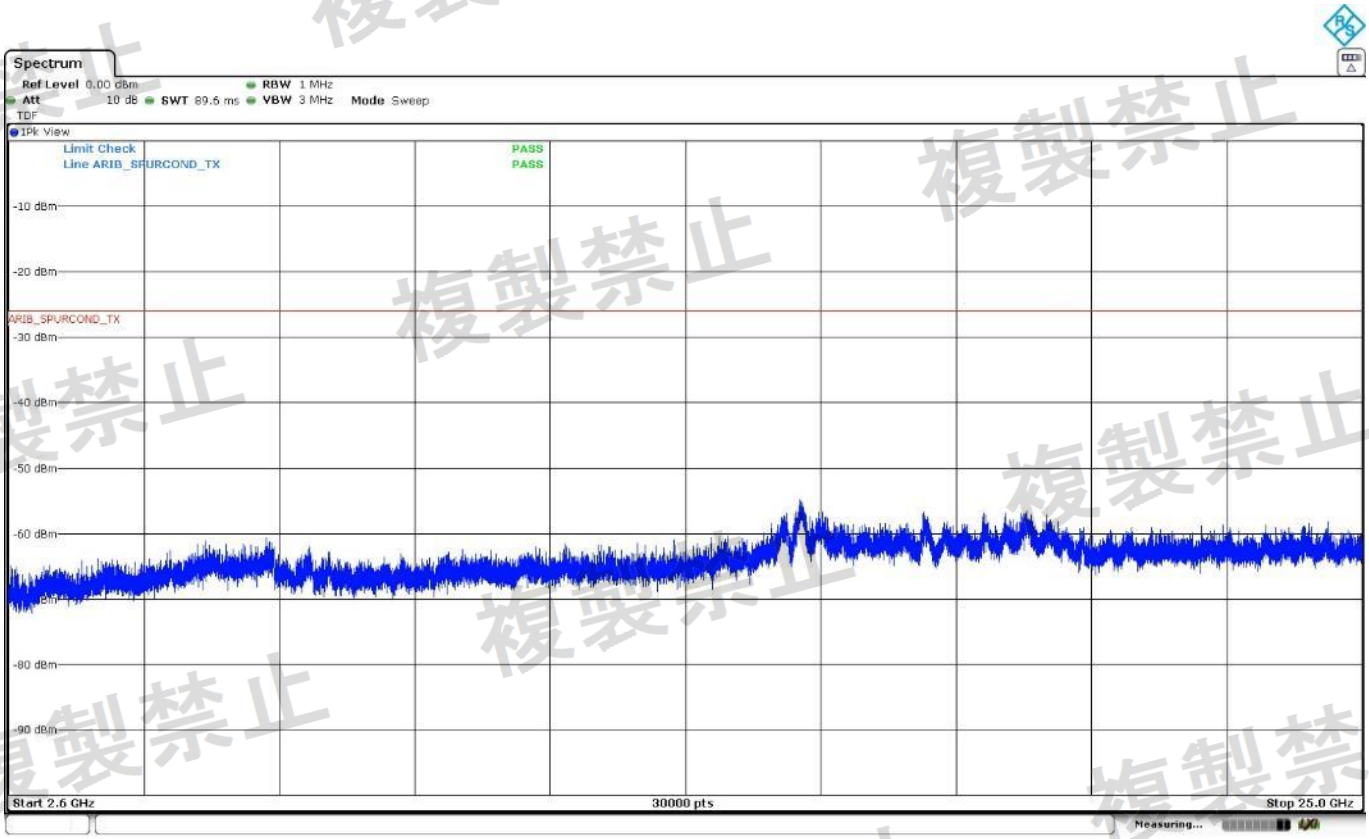

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- HIGH CHANNEL:

Frequency range 9 kHz - 25 GHz:




Spectrum
Ref Level 20.00 dBm
RBW 1 MHz
Att 30 dB SWT 30 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
10 dBm
0 dBm
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
Start 2.3 GHz
10000 pts
Stop 2.6 GHz
Measuring...


Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

Vmin:

- LOW CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty <± 2.77 dB

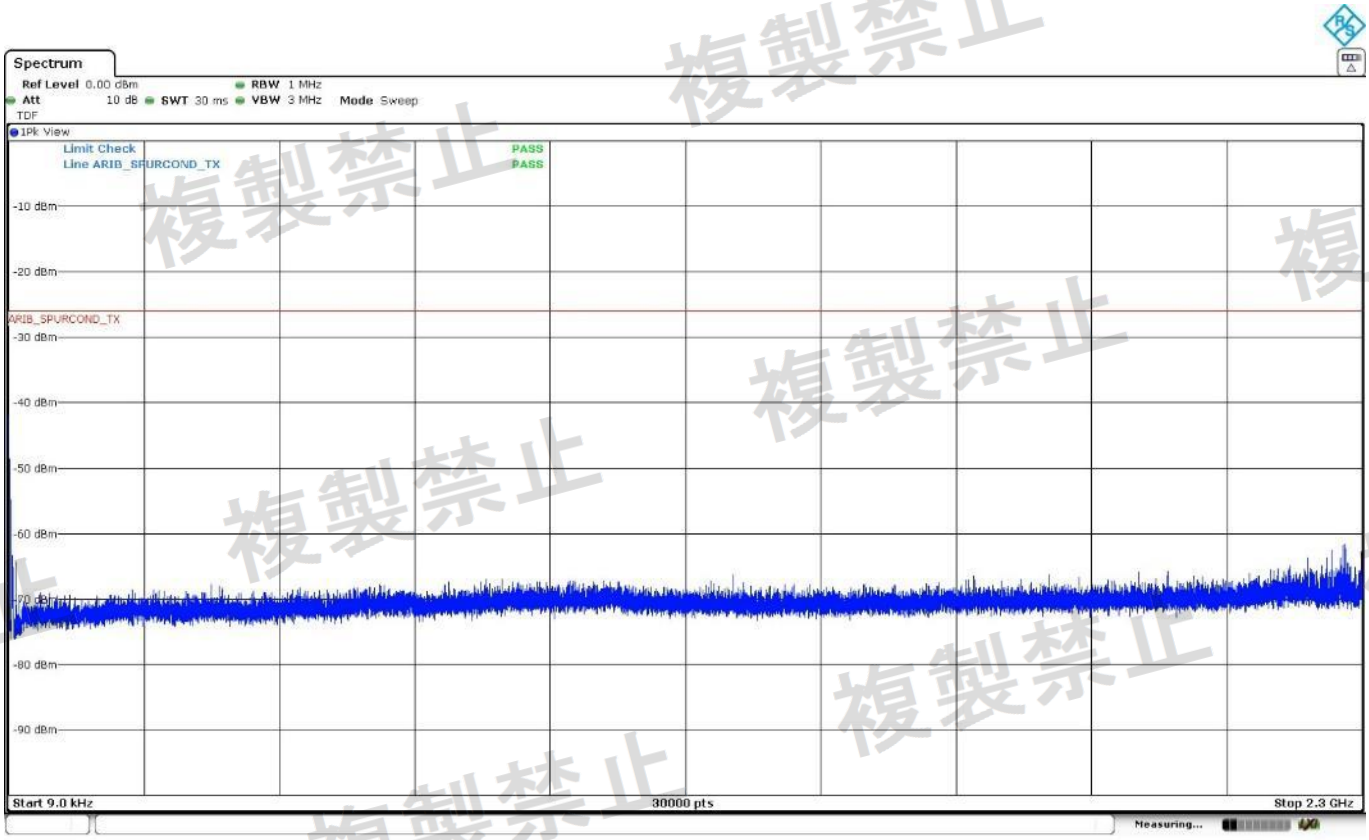
Verdict:

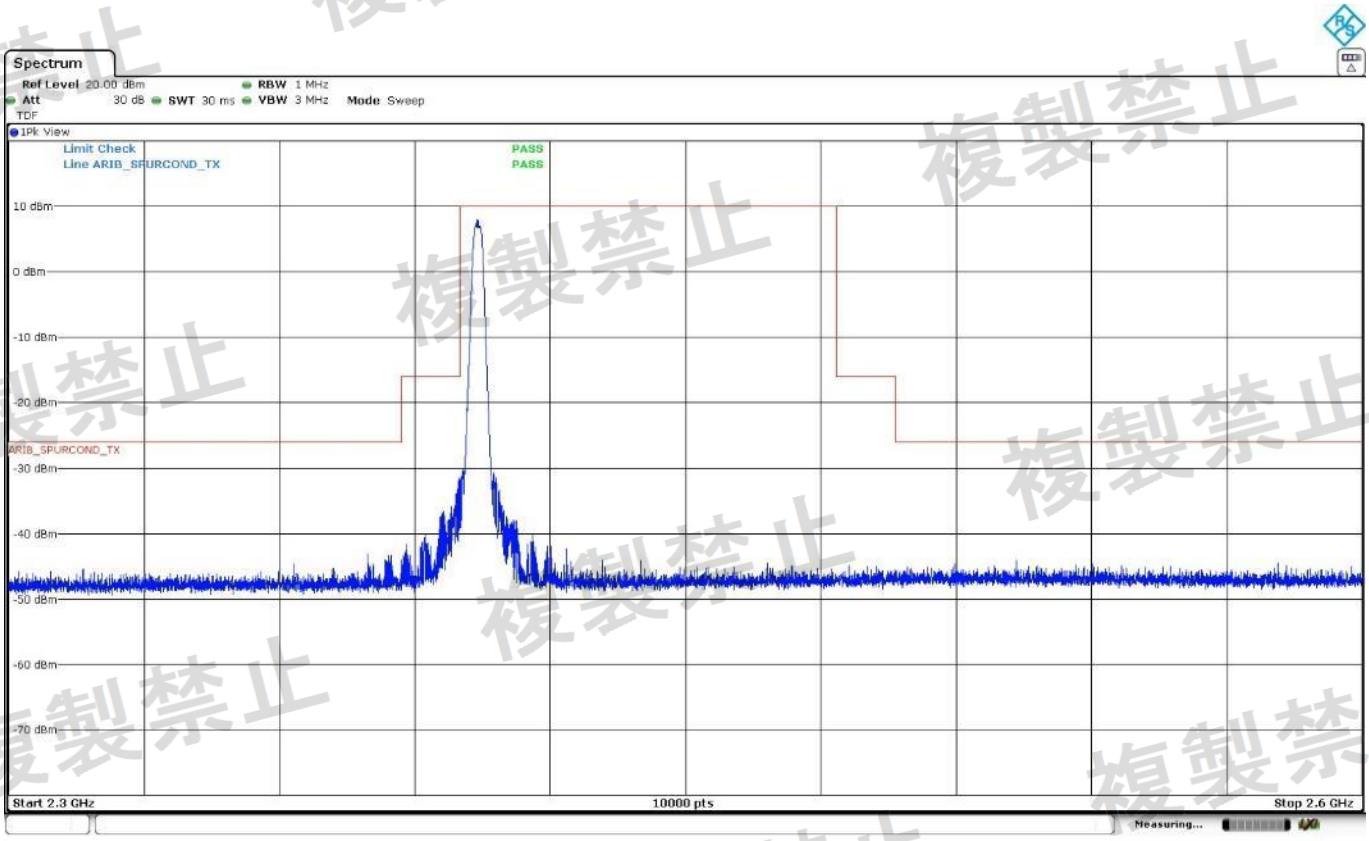
PASS

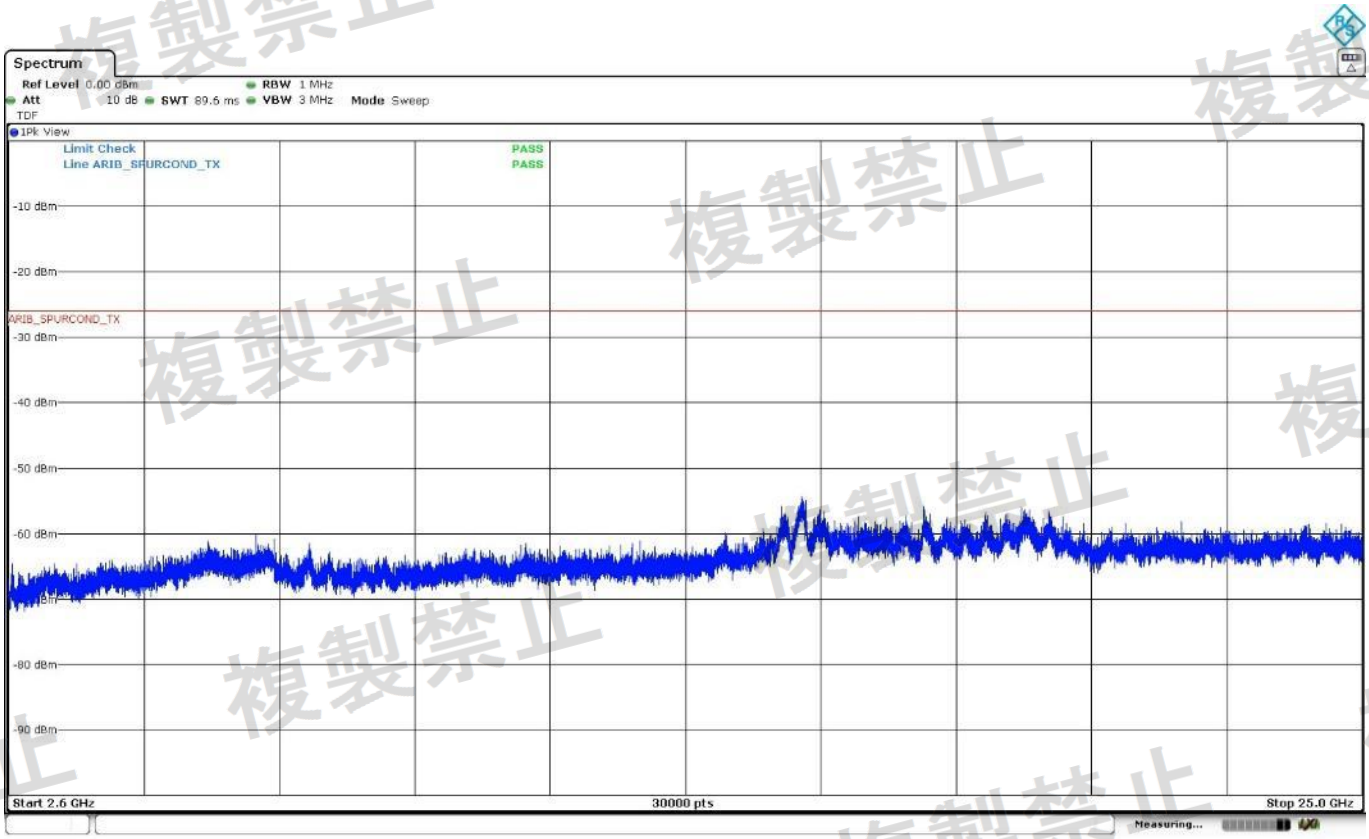
Vmin:

- LOW CHANNEL:

Frequency range 9 kHz - 25 GHz:

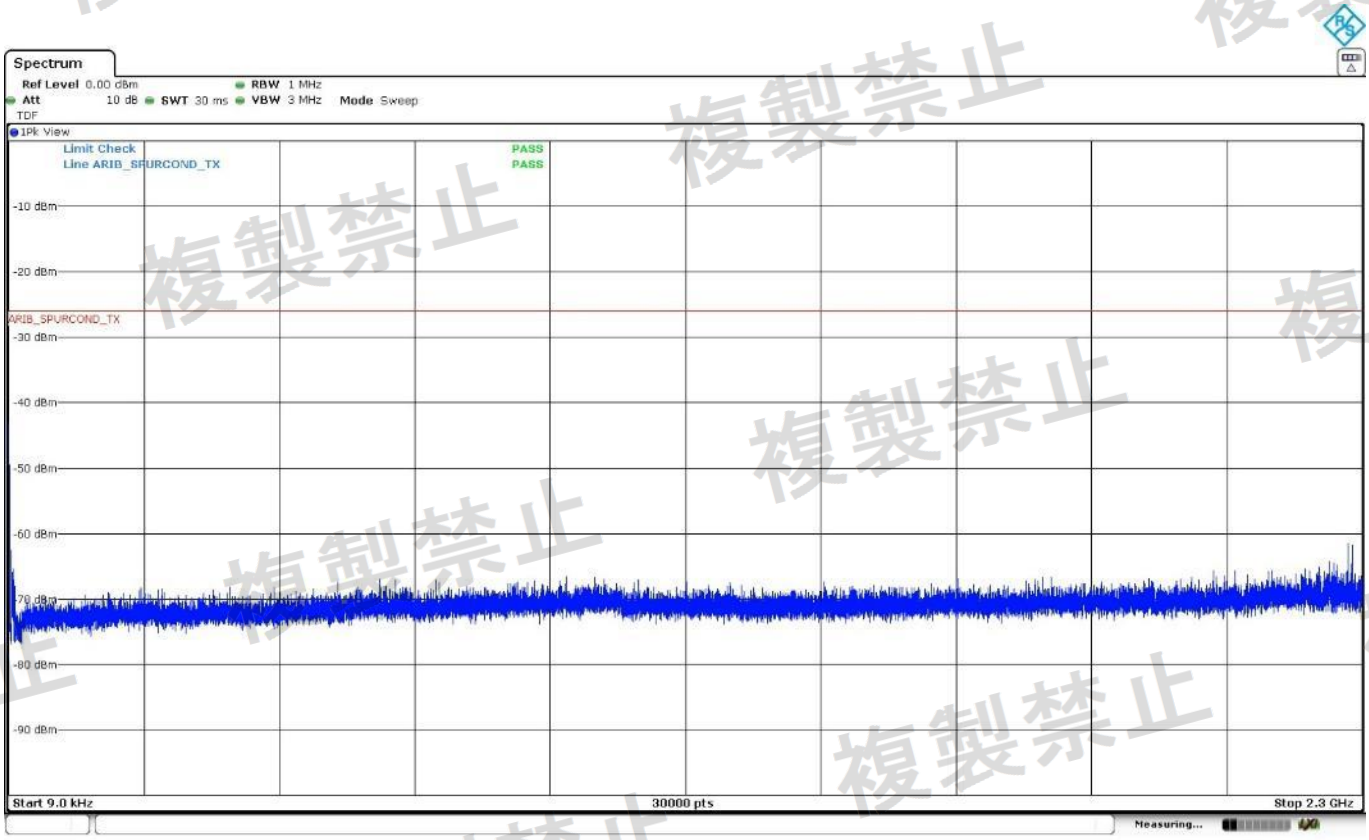


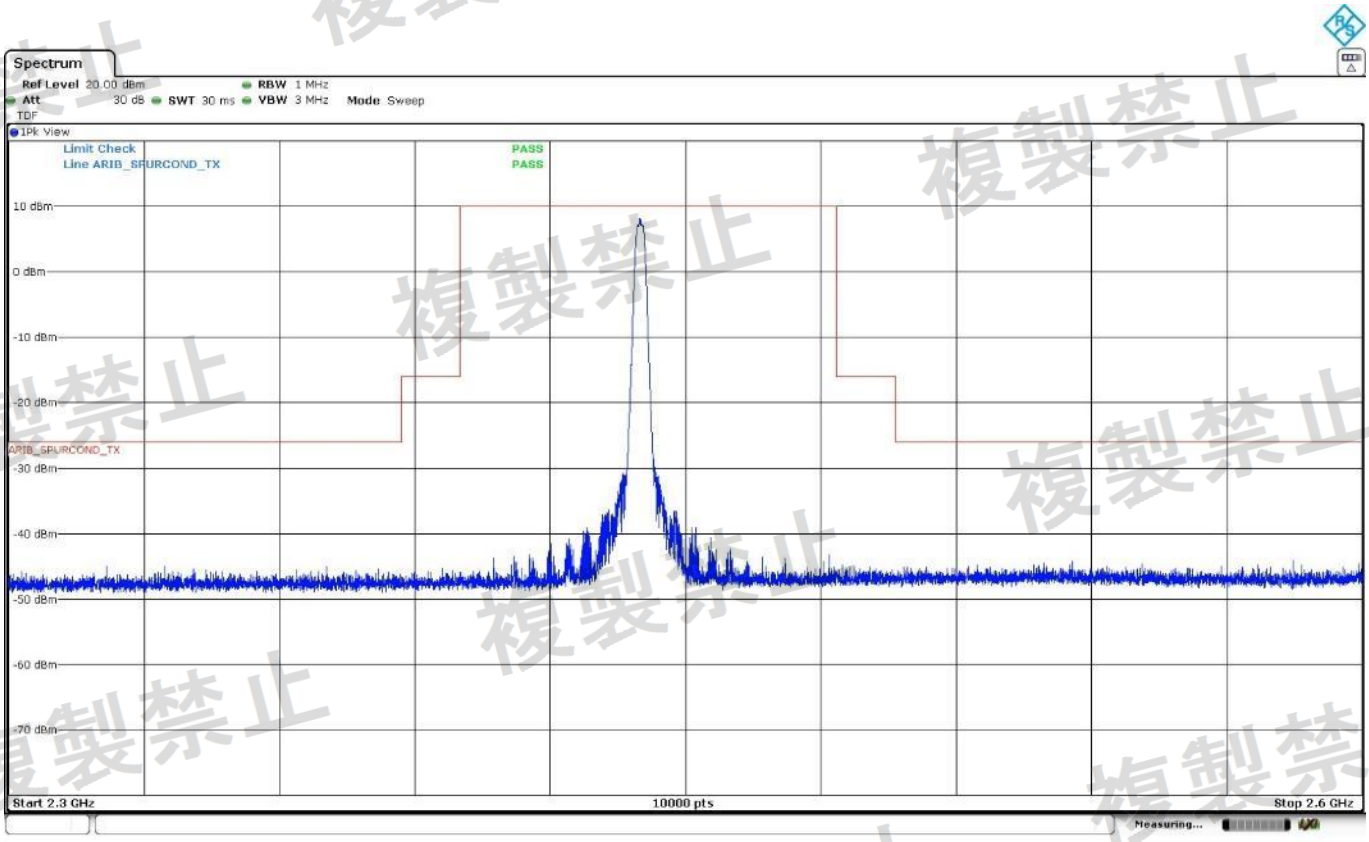


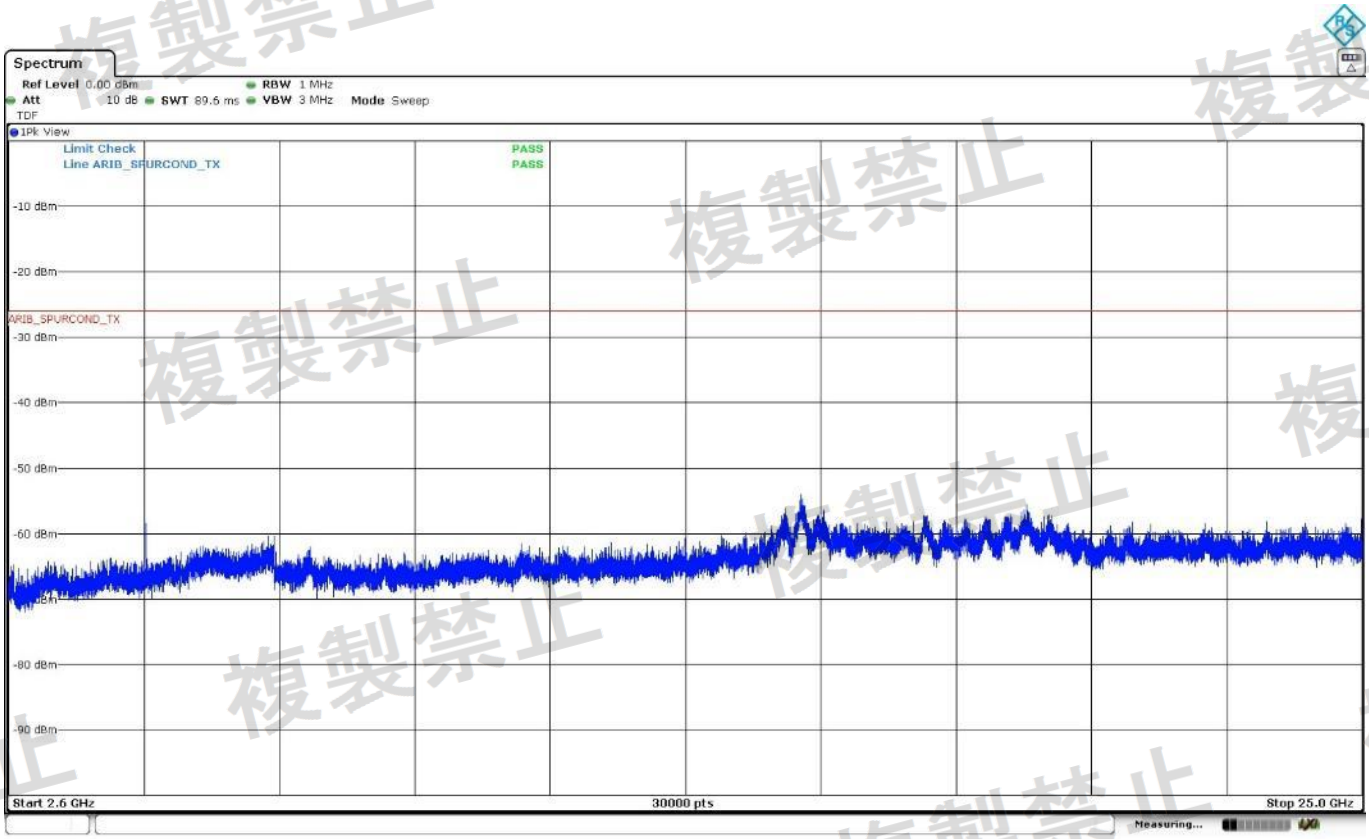

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- MIDDLE CHANNEL:

Frequency range 9 kHz - 25 GHz:

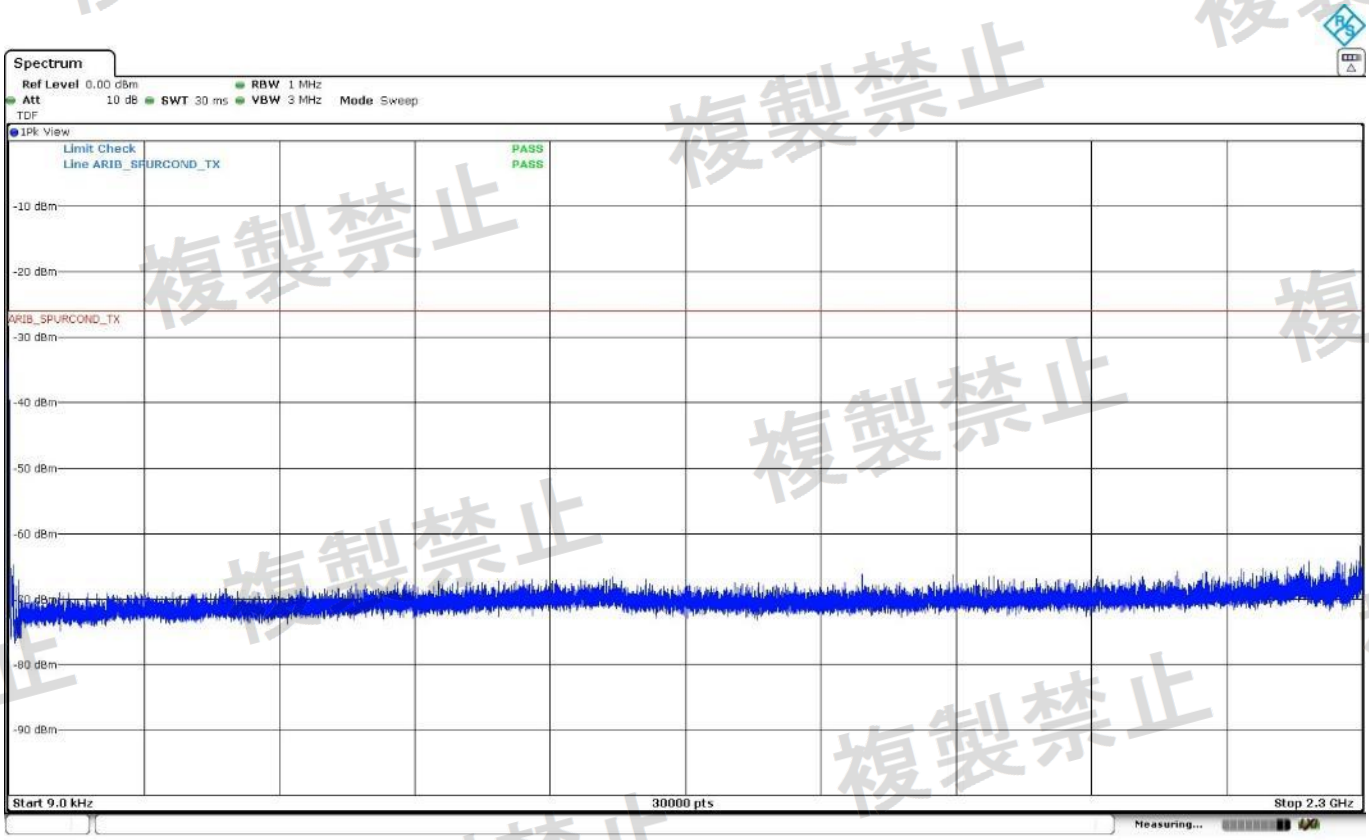


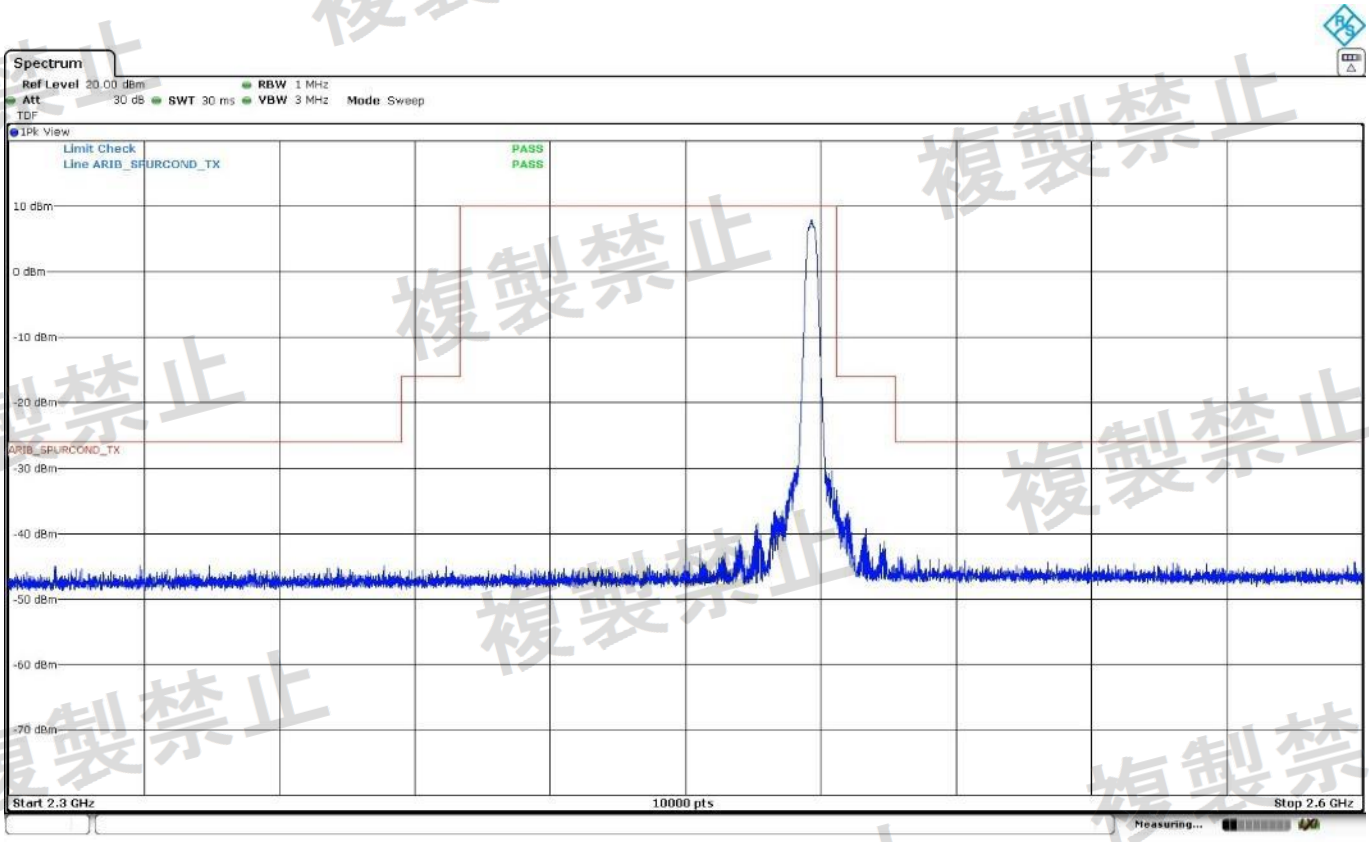


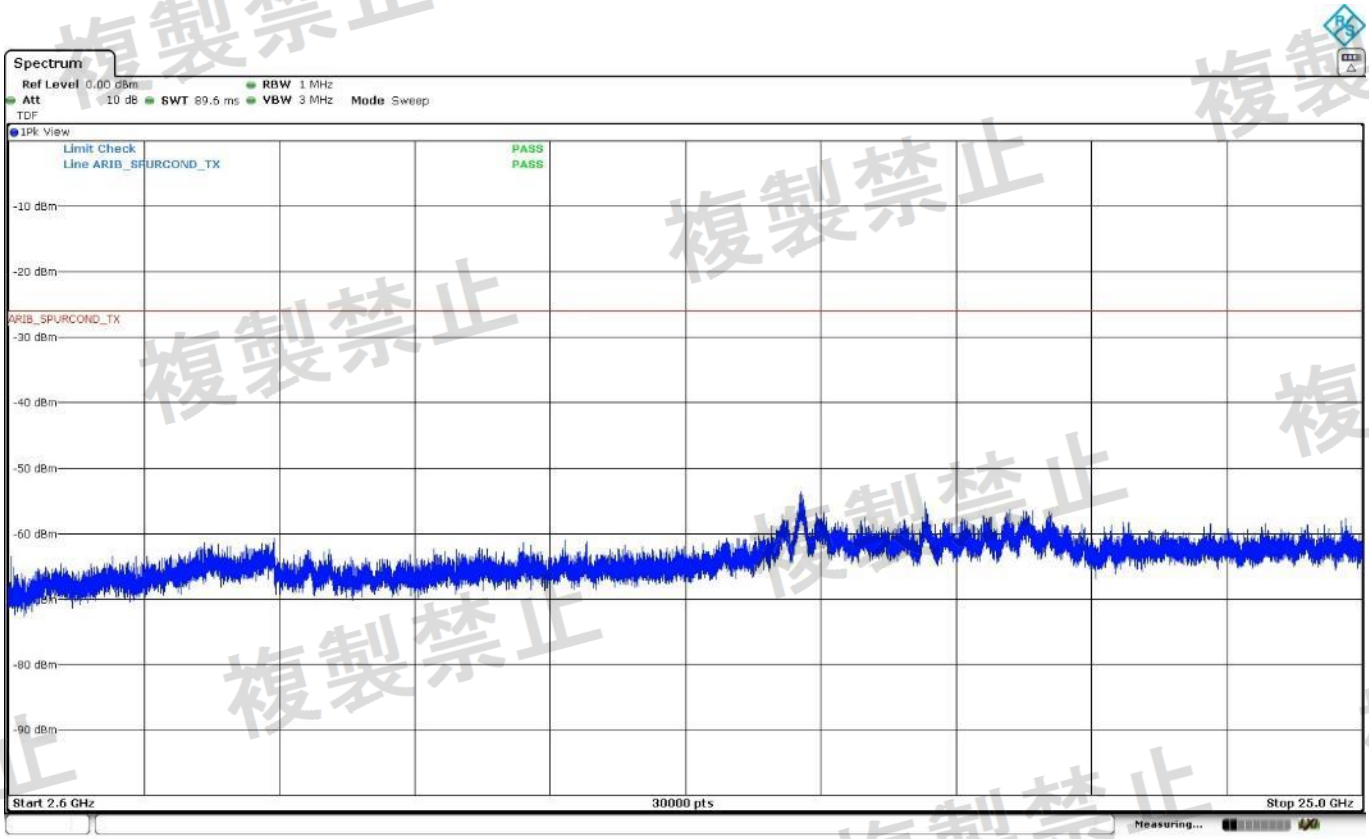

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- HIGH CHANNEL:

Frequency range 9 kHz - 25 GHz:






Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
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Line ARIB_SPURCOND_TX PASS
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-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

Vmax:

- LOW CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty <± 2.77 dB

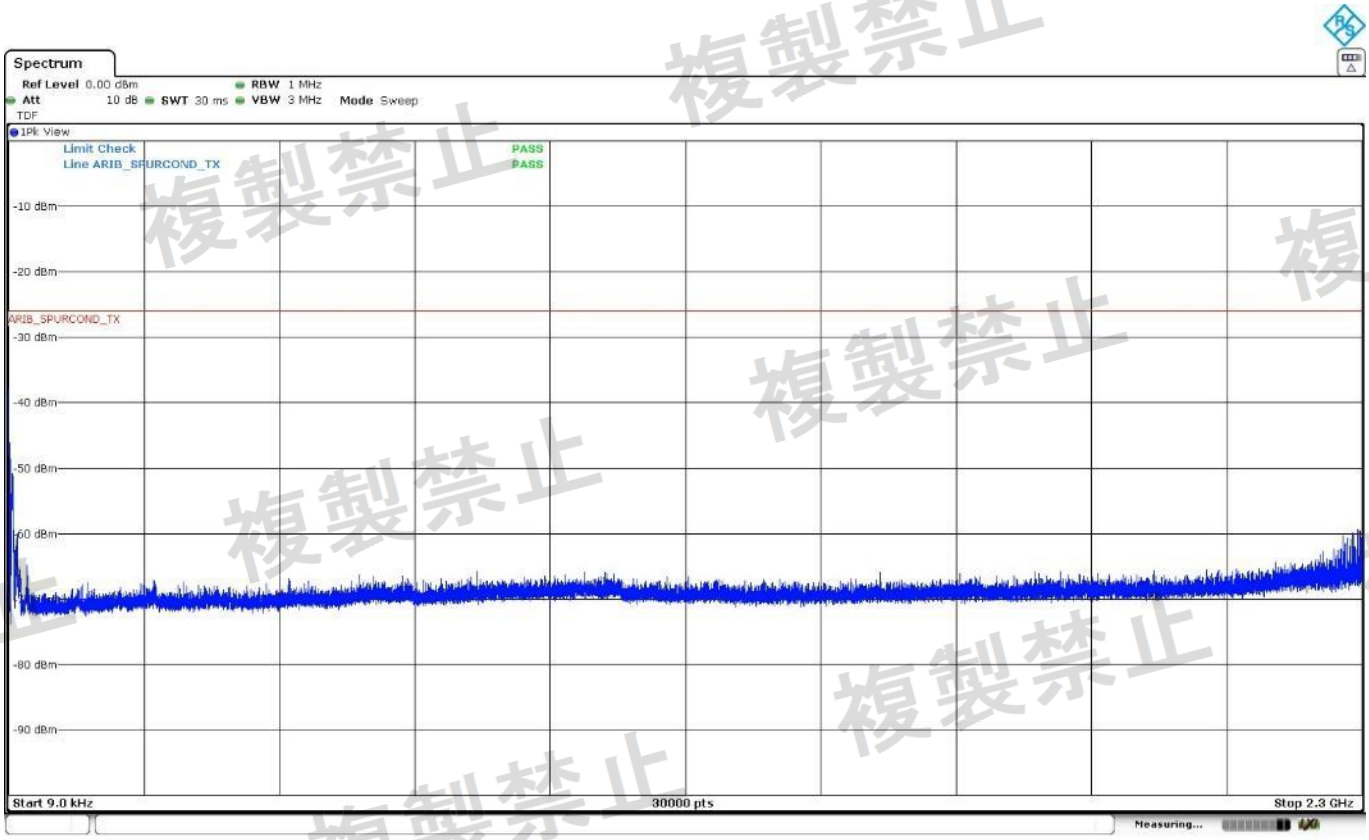
Verdict:

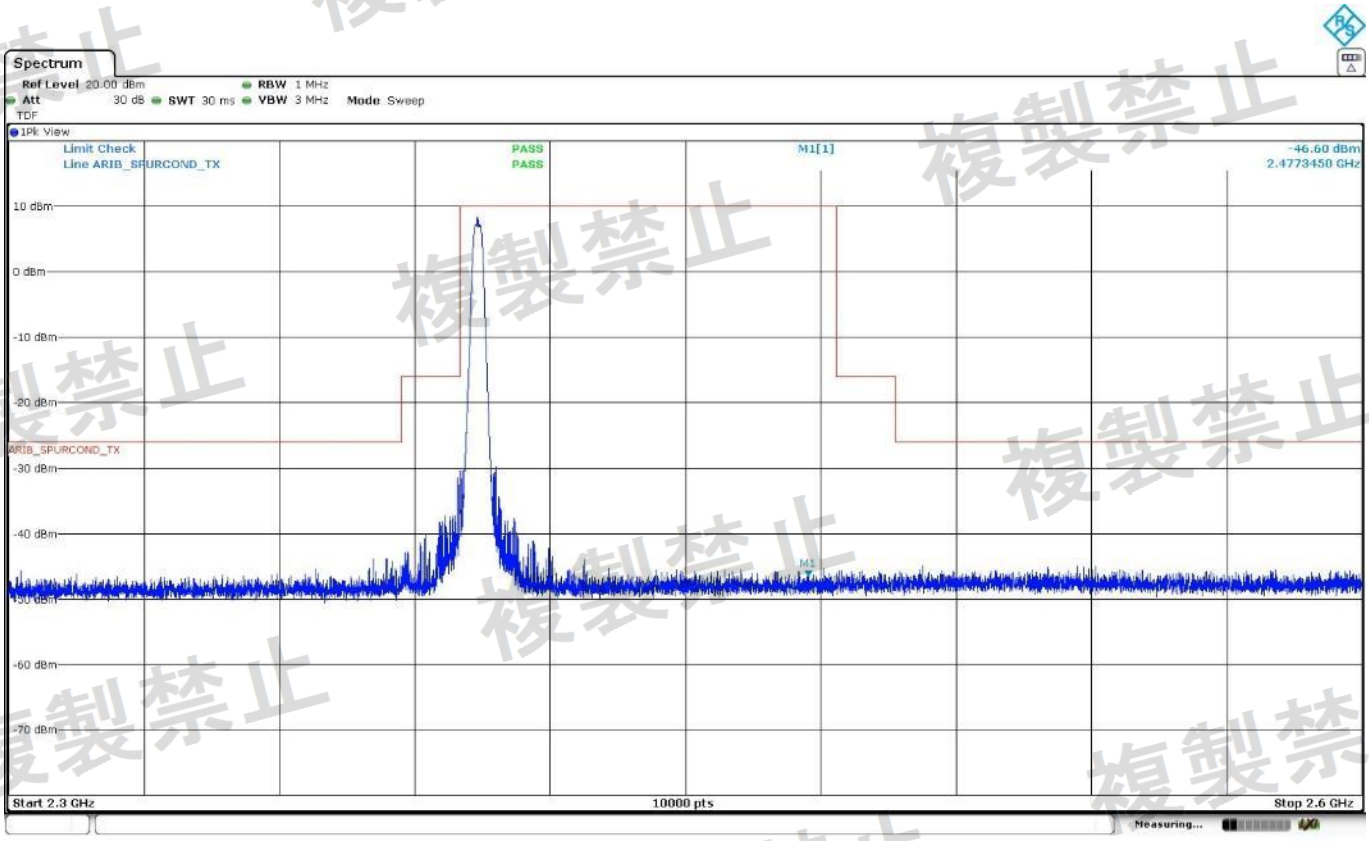
PASS

Vmax:

- LOW CHANNEL:

Frequency range 9 kHz - 25 GHz:





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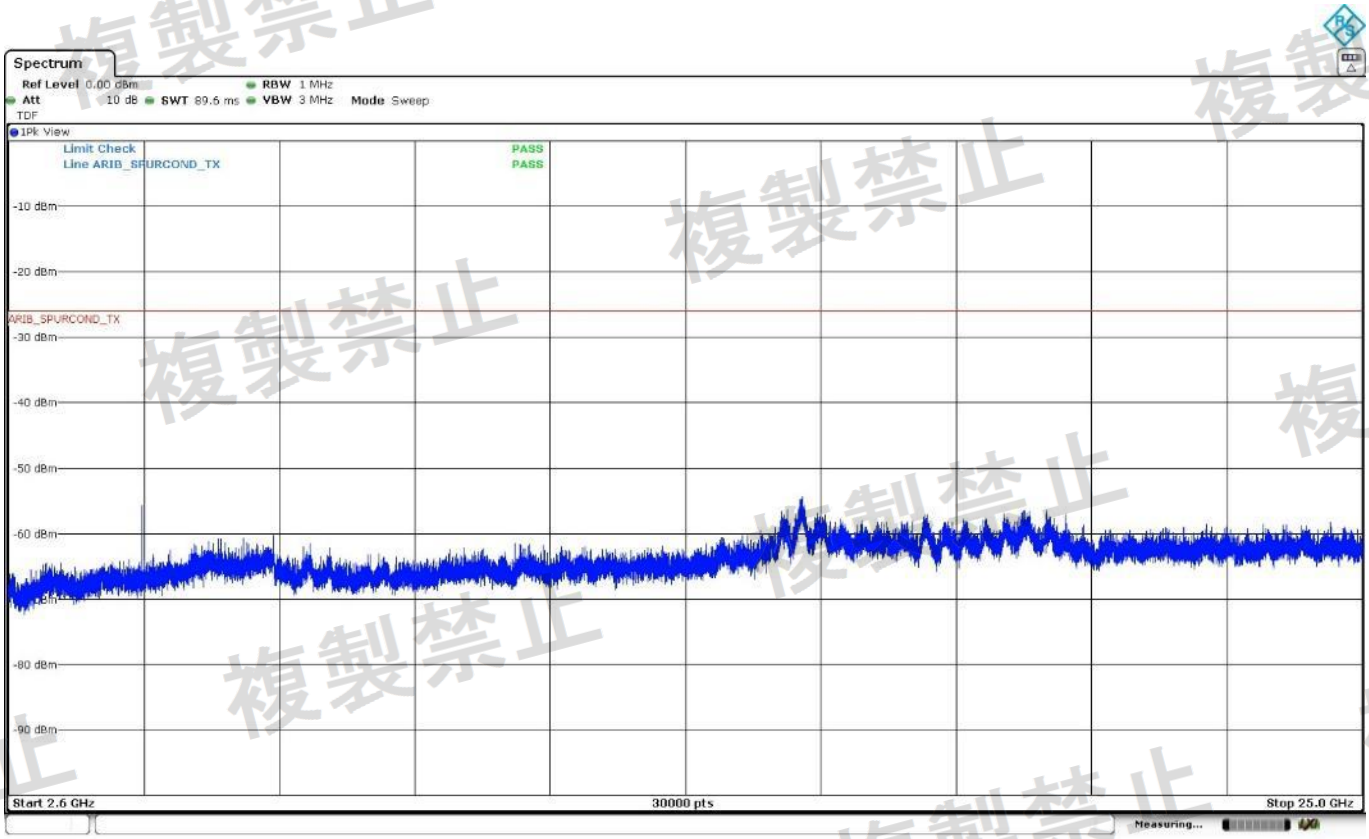
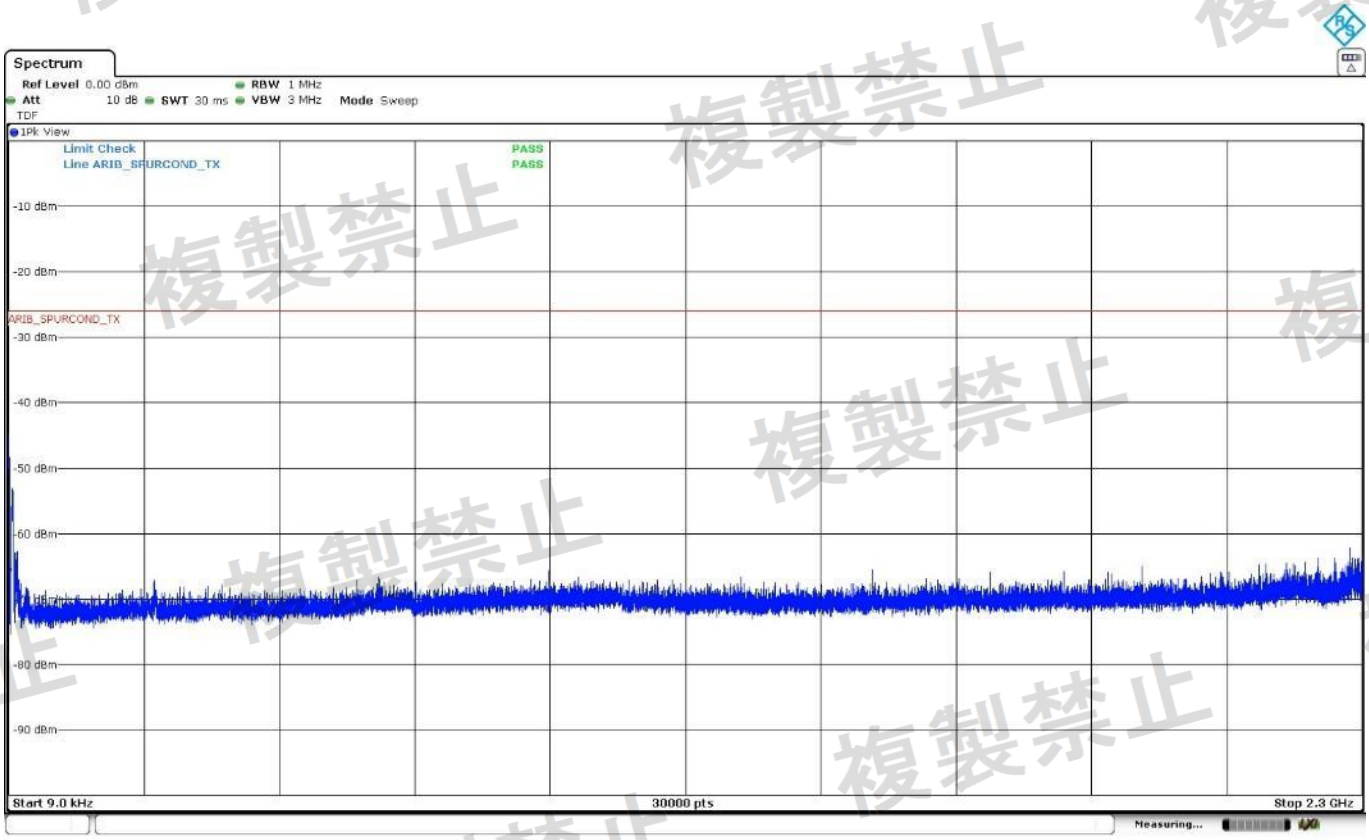
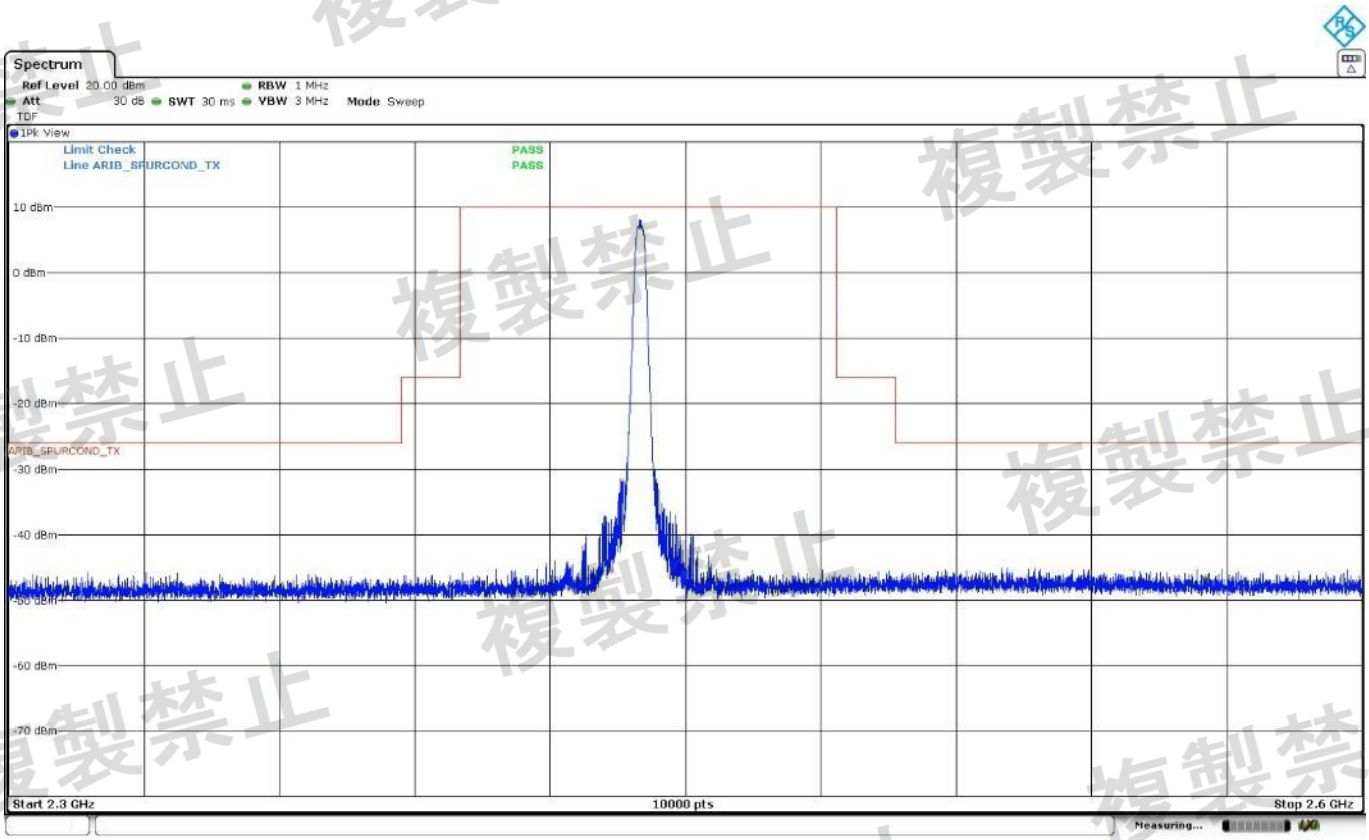
C.I.F. A29507456

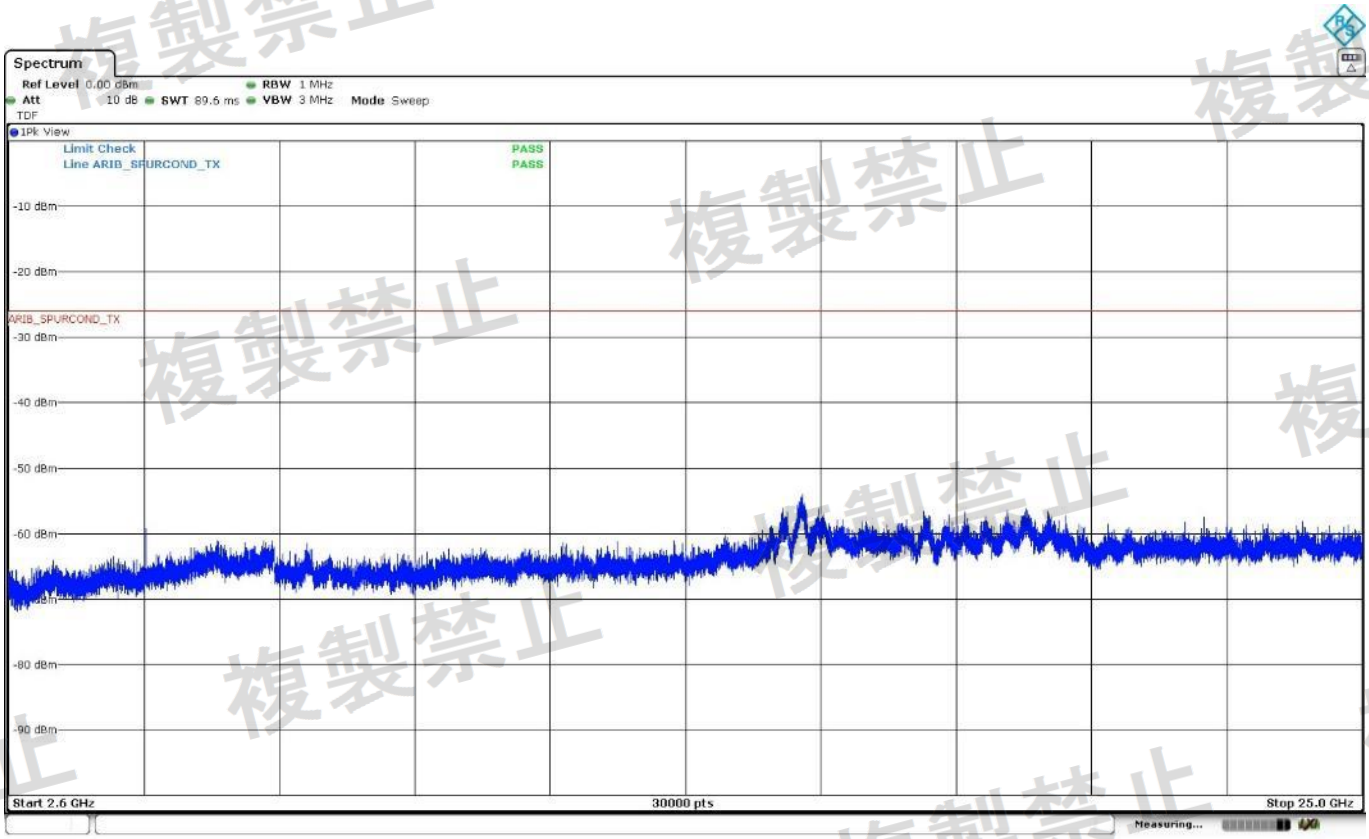


- MIDDLE CHANNEL:

Frequency range 9 kHz - 25 GHz:

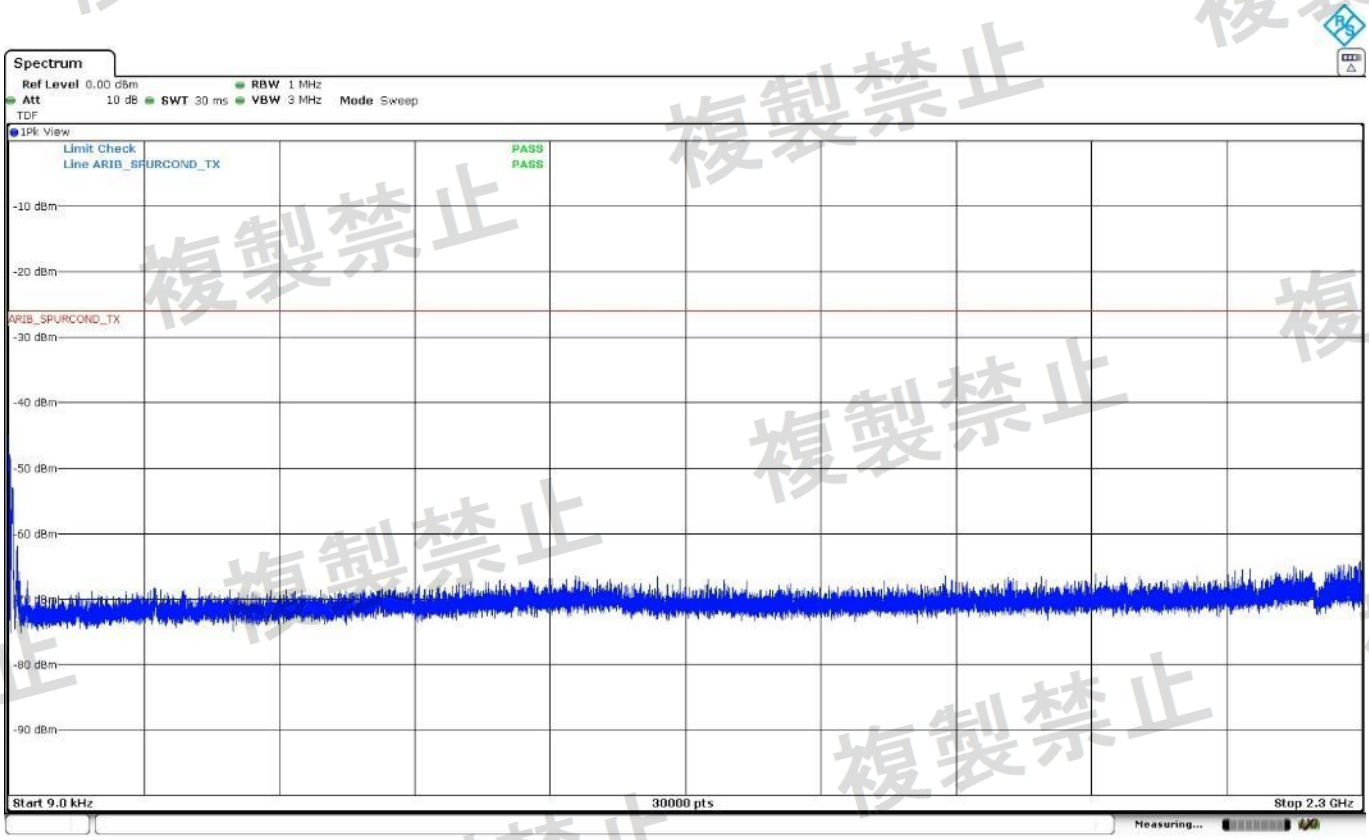


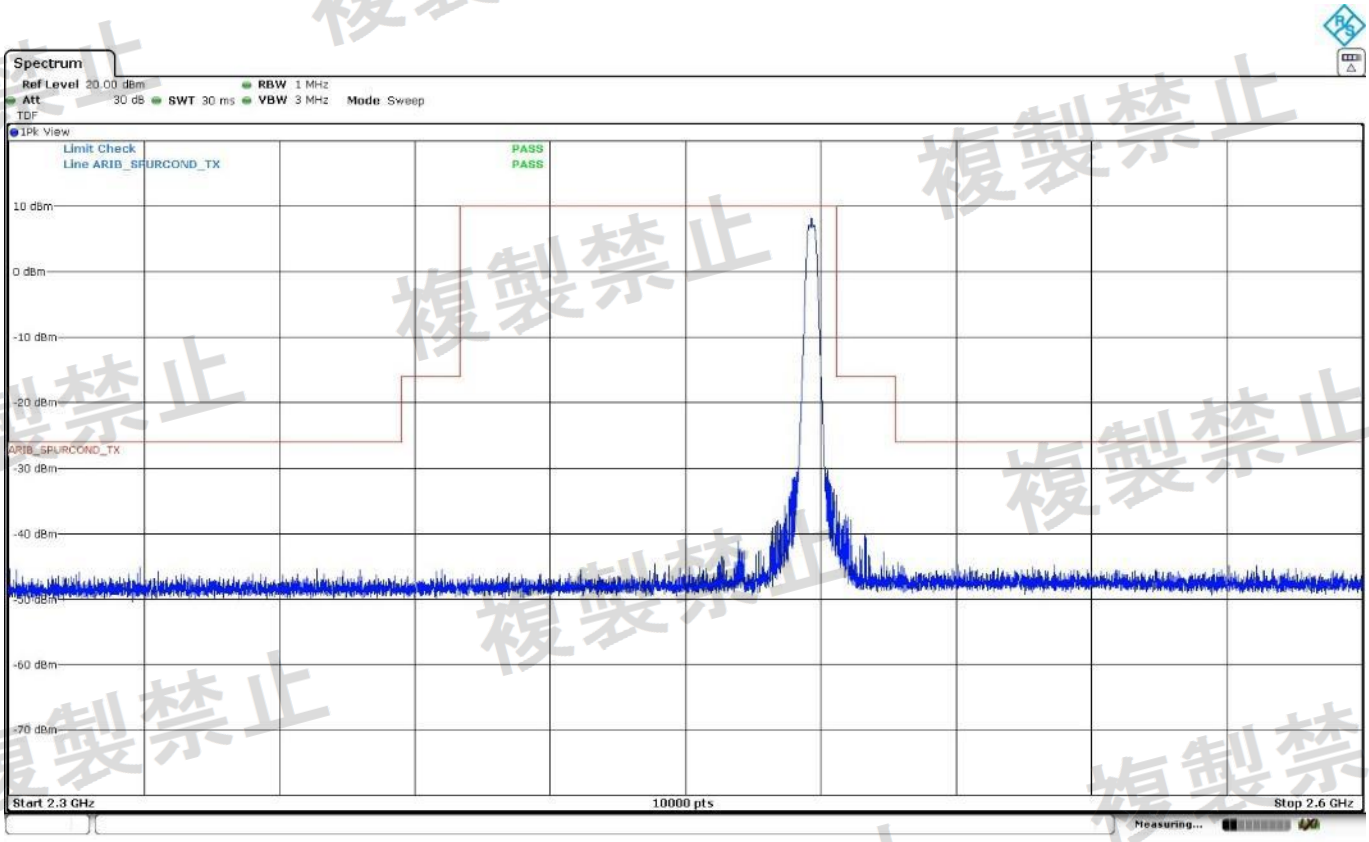


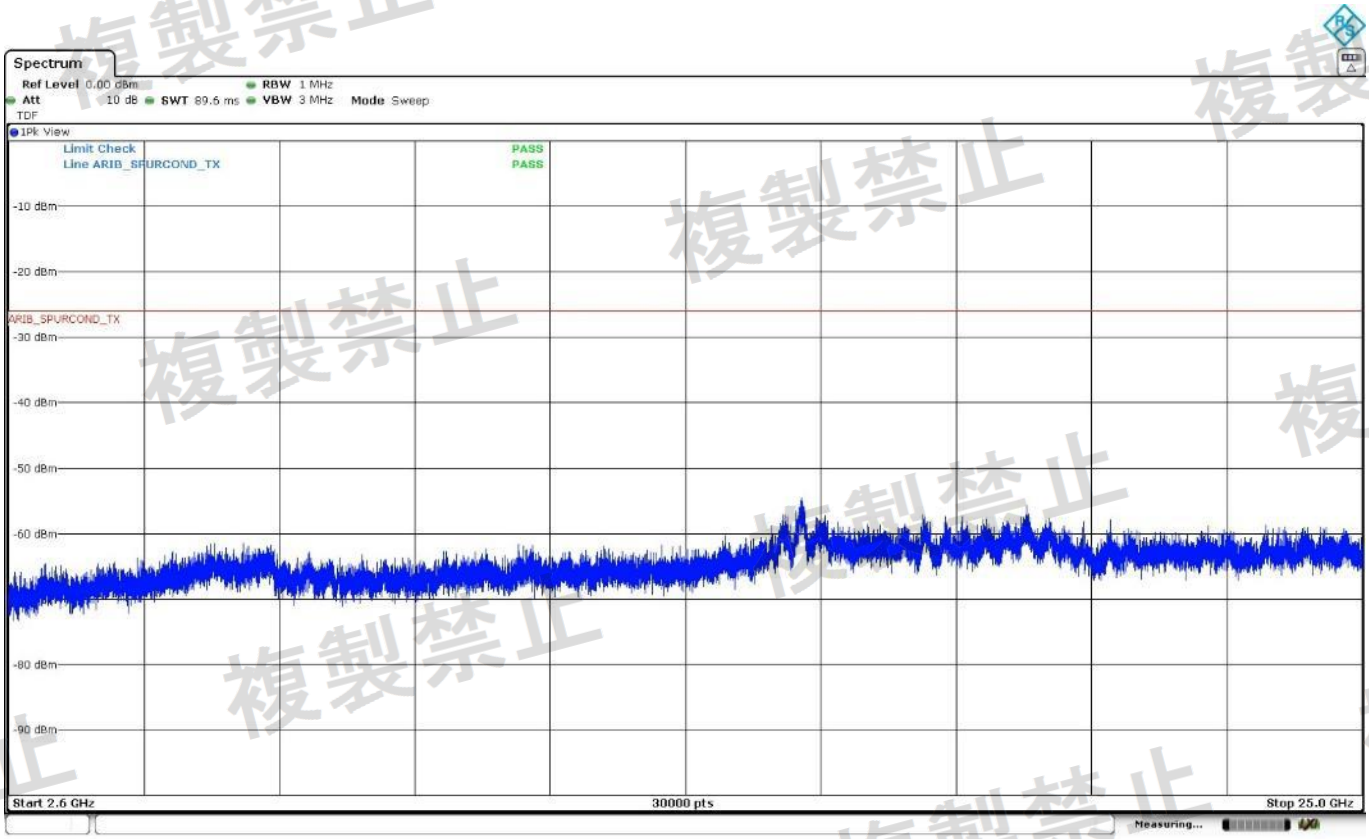

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- HIGH CHANNEL:

Frequency range 9 kHz - 25 GHz:






Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

Article 24.2. Receiving equipment. Limit on secondary radiated emissions

Limits:

The limit on secondary emissions radiated from the receiving equipment within which the function of other radio equipment will not be impaired shall be, in terms of the power of a dummy antenna circuit that has the same electrical constant as the receiving antenna, 4 nW (-54 dBm) or less at a frequency below 1 GHz and 20 nW (-47 dBm) or less at a frequency of 1 GHz or higher as measured using the circuit.

Results:

Vnom:

- LOW CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty <± 2.94 dB

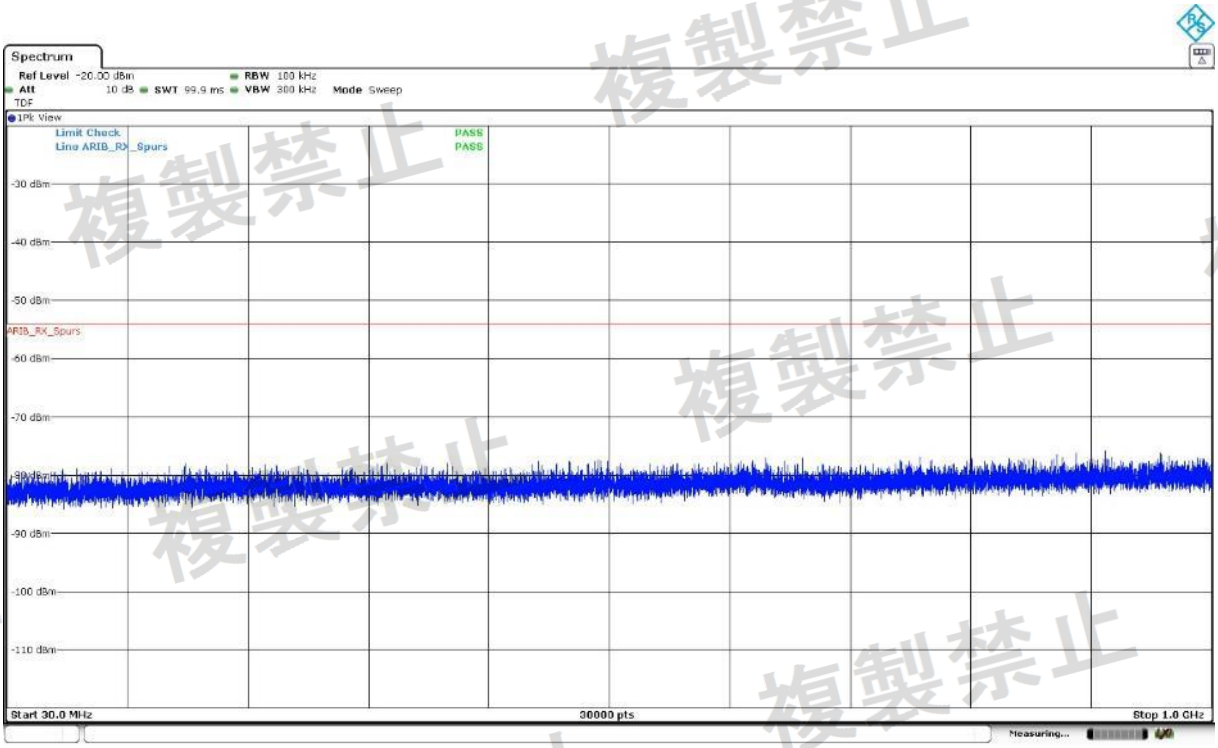
Verdict:

PASS

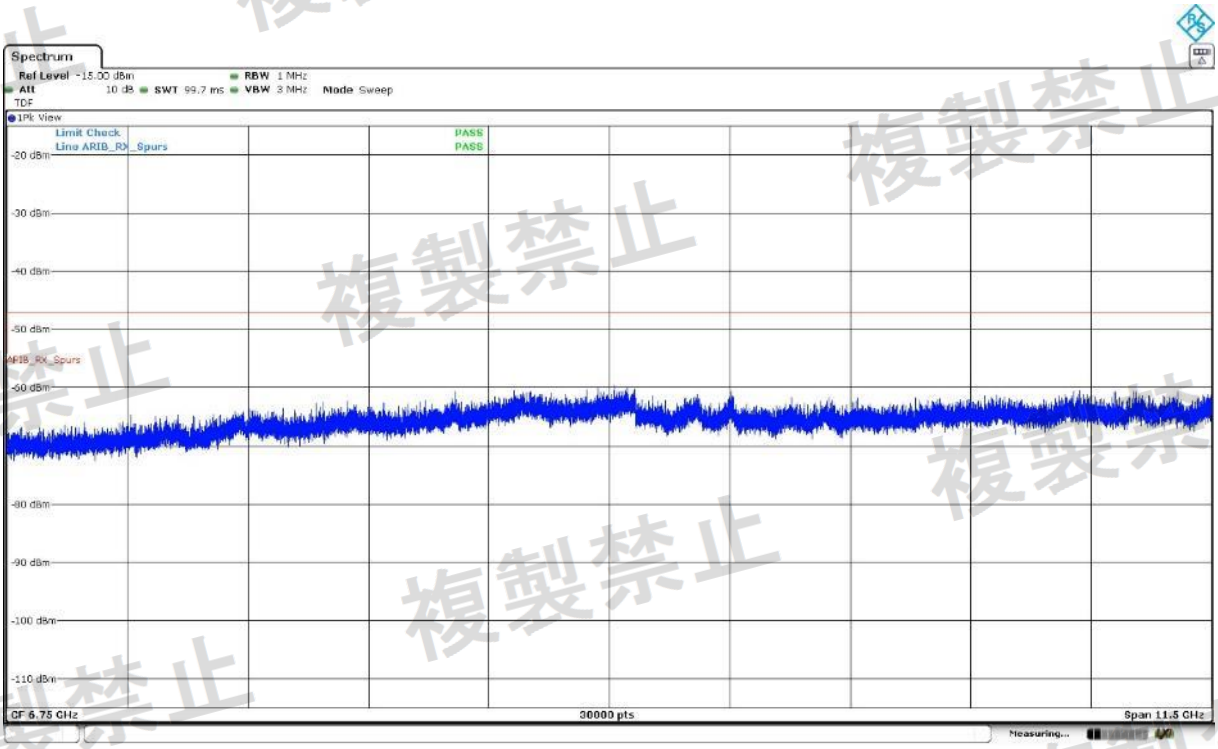
Vnom:

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

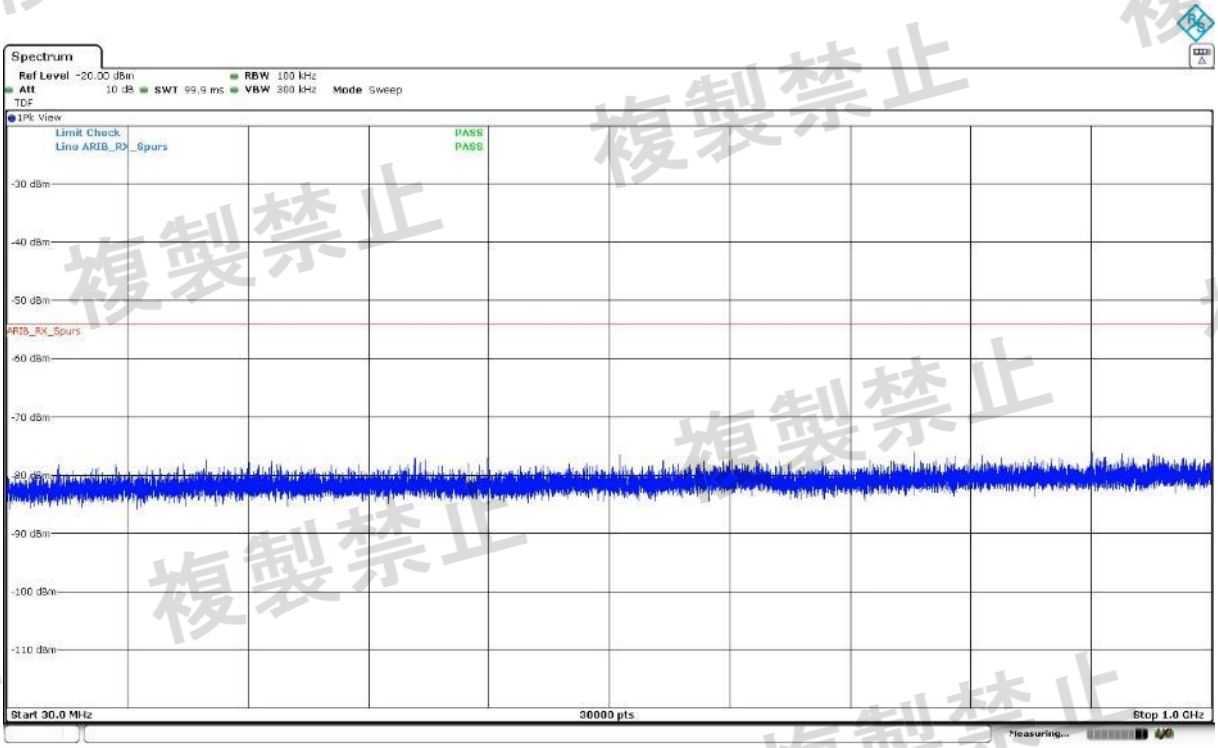


Frequency range 1 – 12.75 GHz:

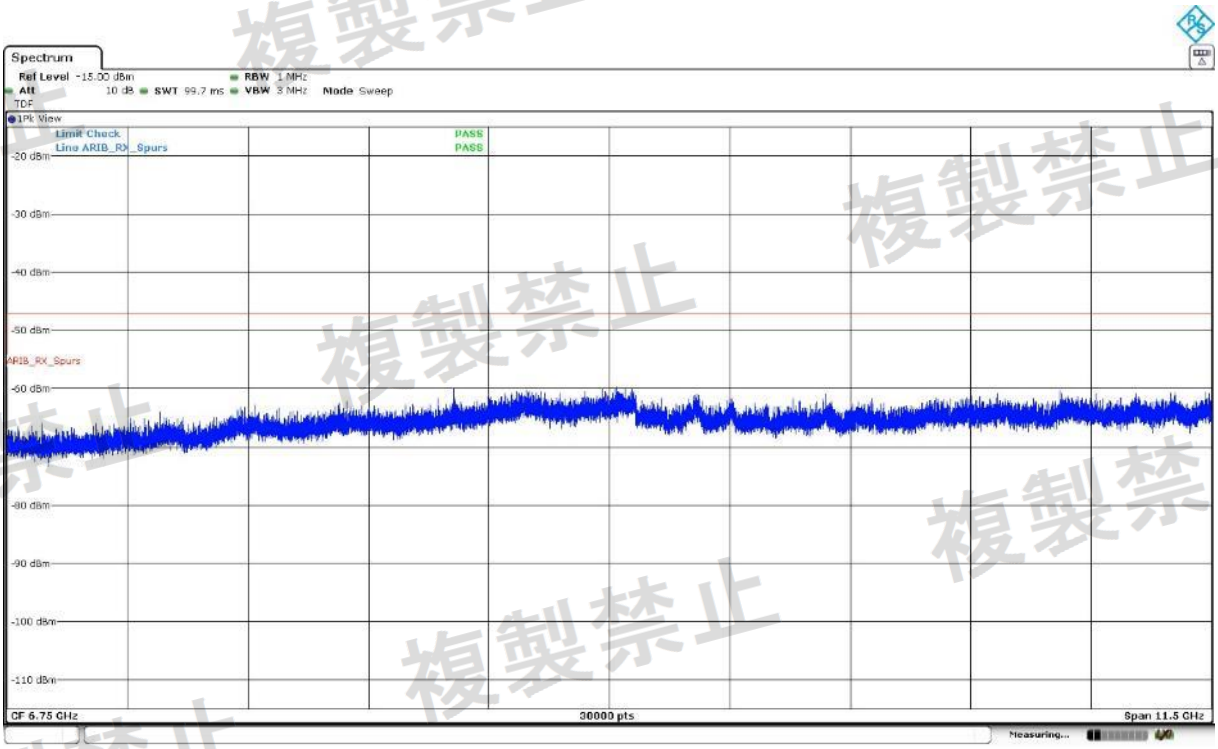


- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

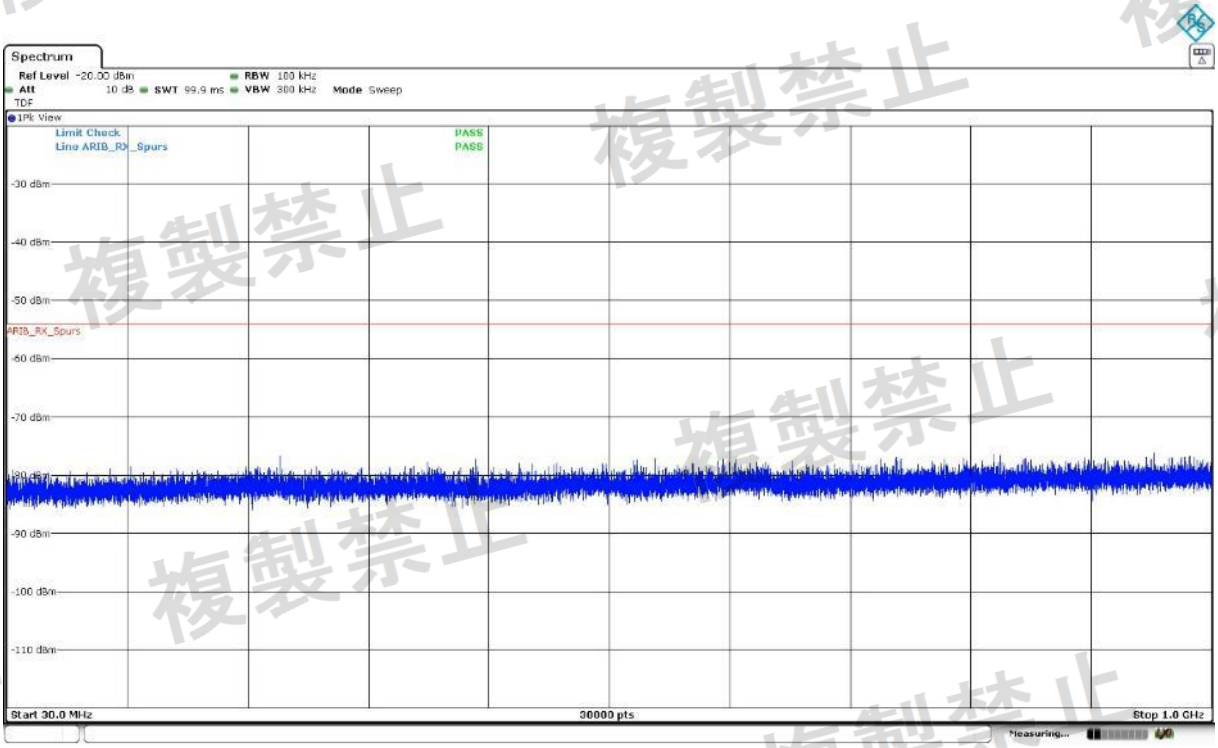


Frequency range 1 – 12.75 GHz:

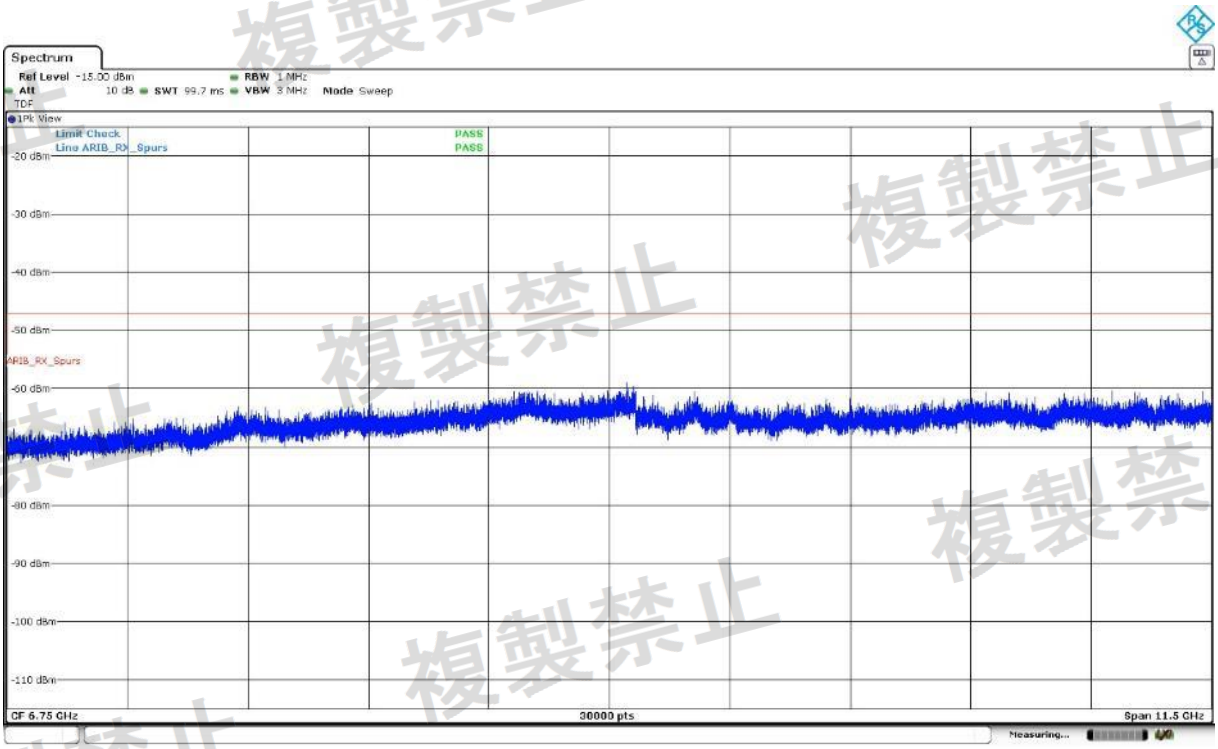


- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:



Frequency range 1 – 12.75 GHz:



Vmin:

- LOW CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty	<± 2.94 dB

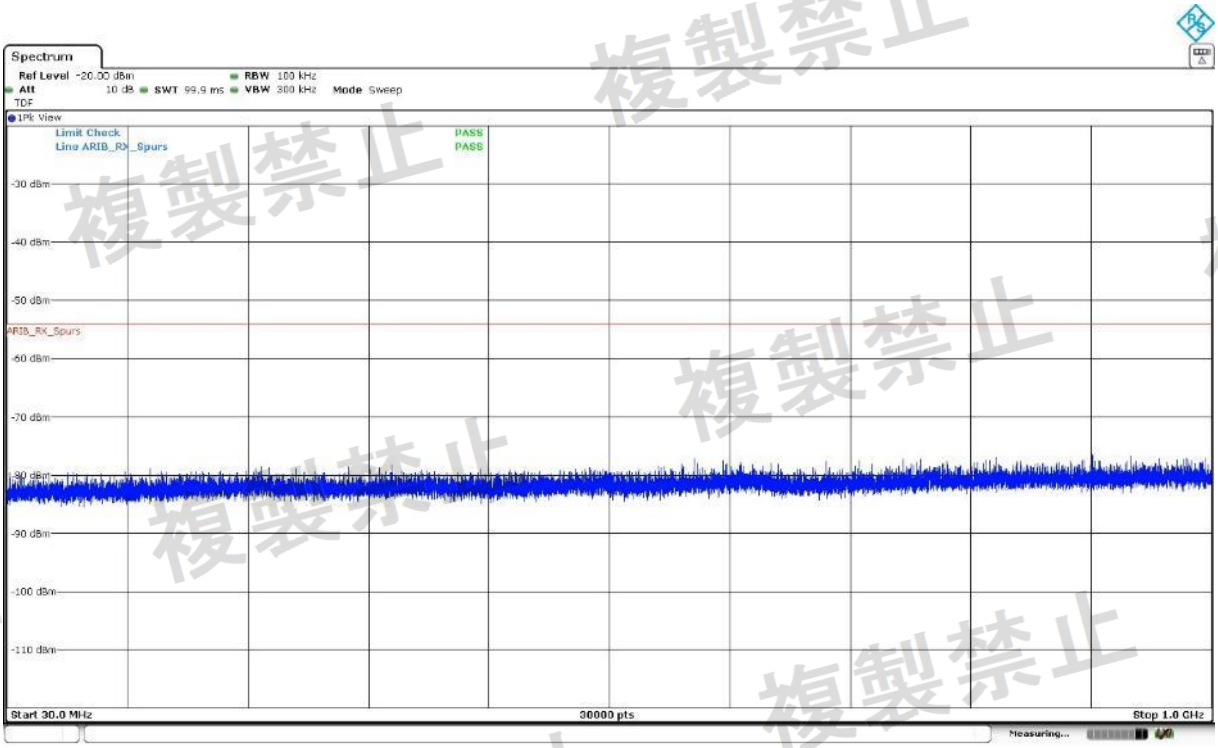
Verdict:

PASS

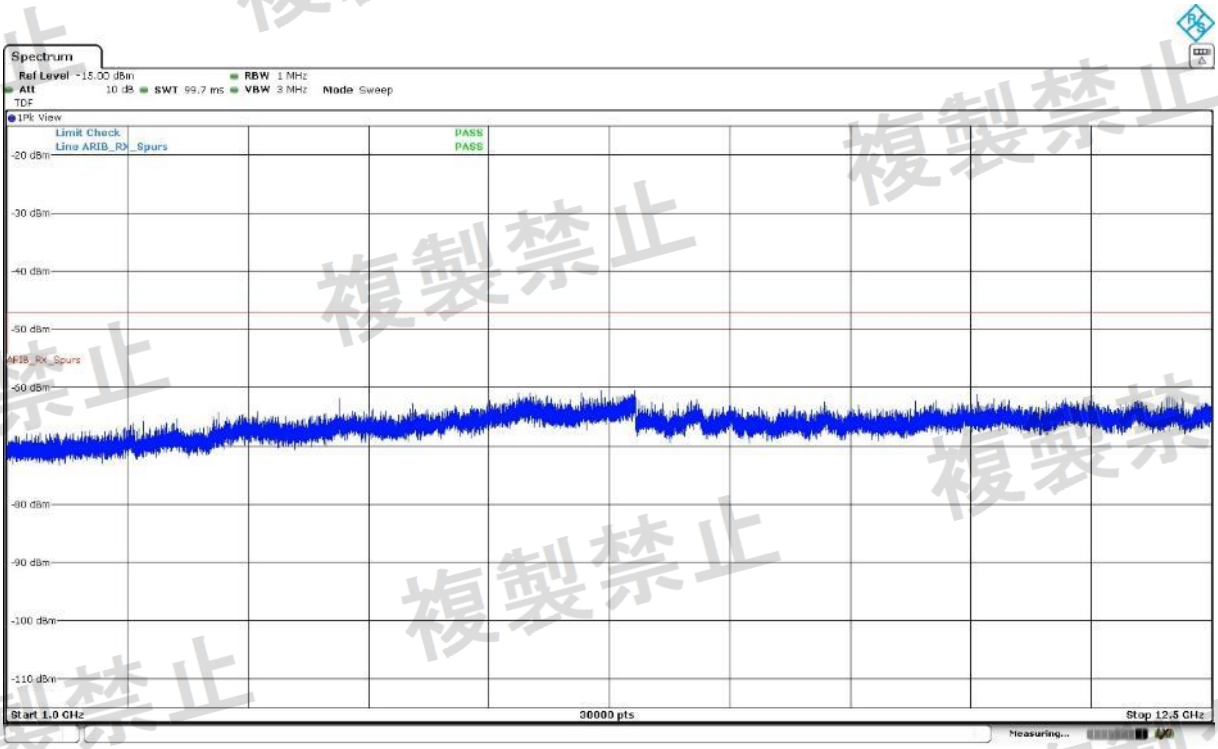
Vmin:

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

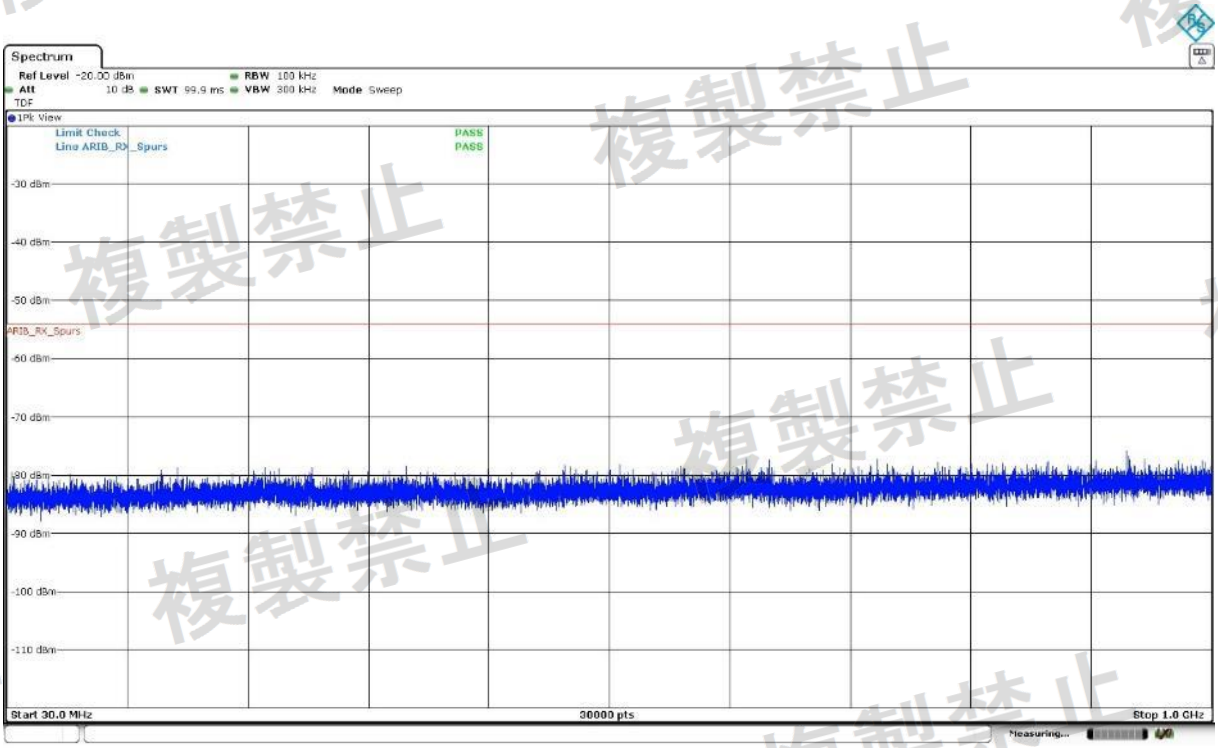


Frequency range 1 – 12.75 GHz:

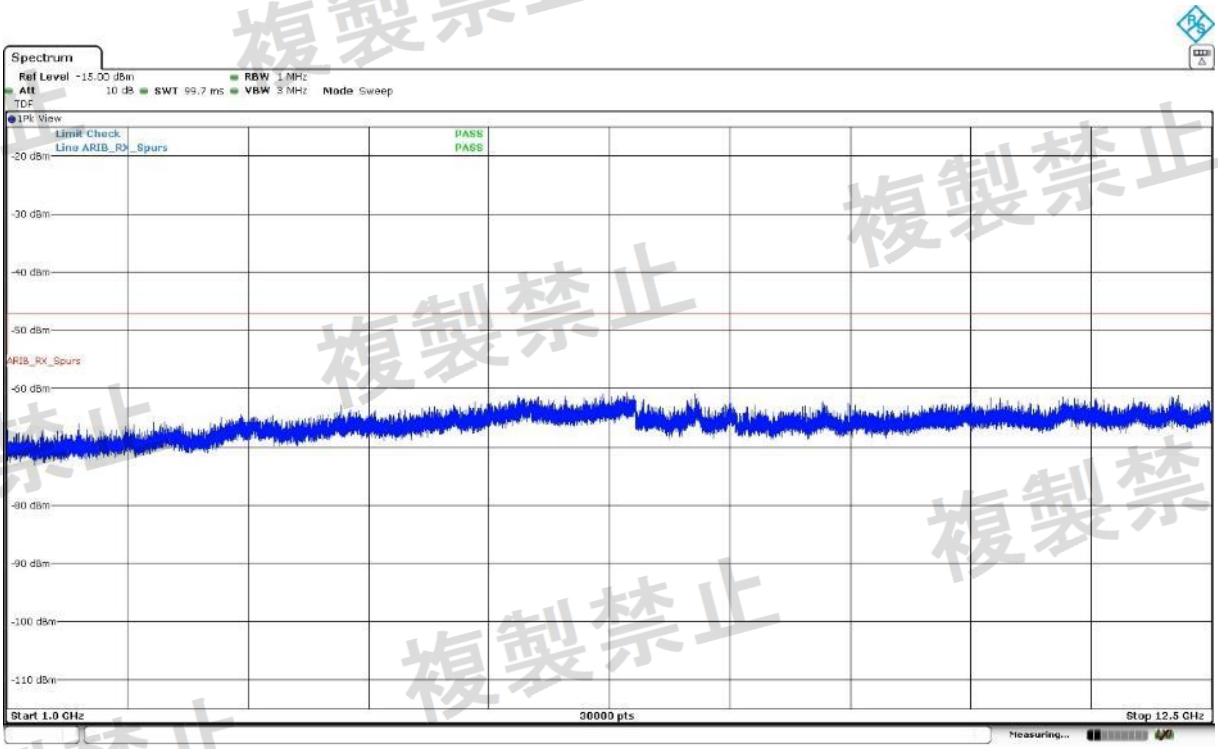


- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

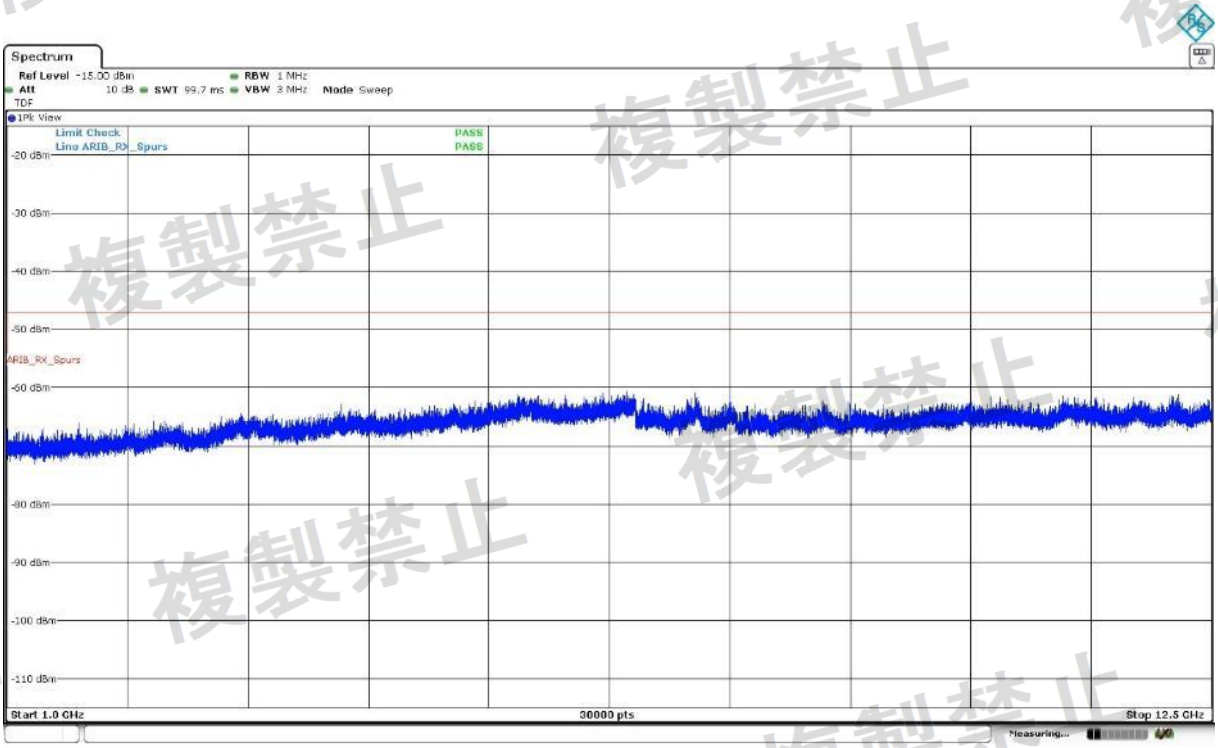


Frequency range 1 – 12.75 GHz:

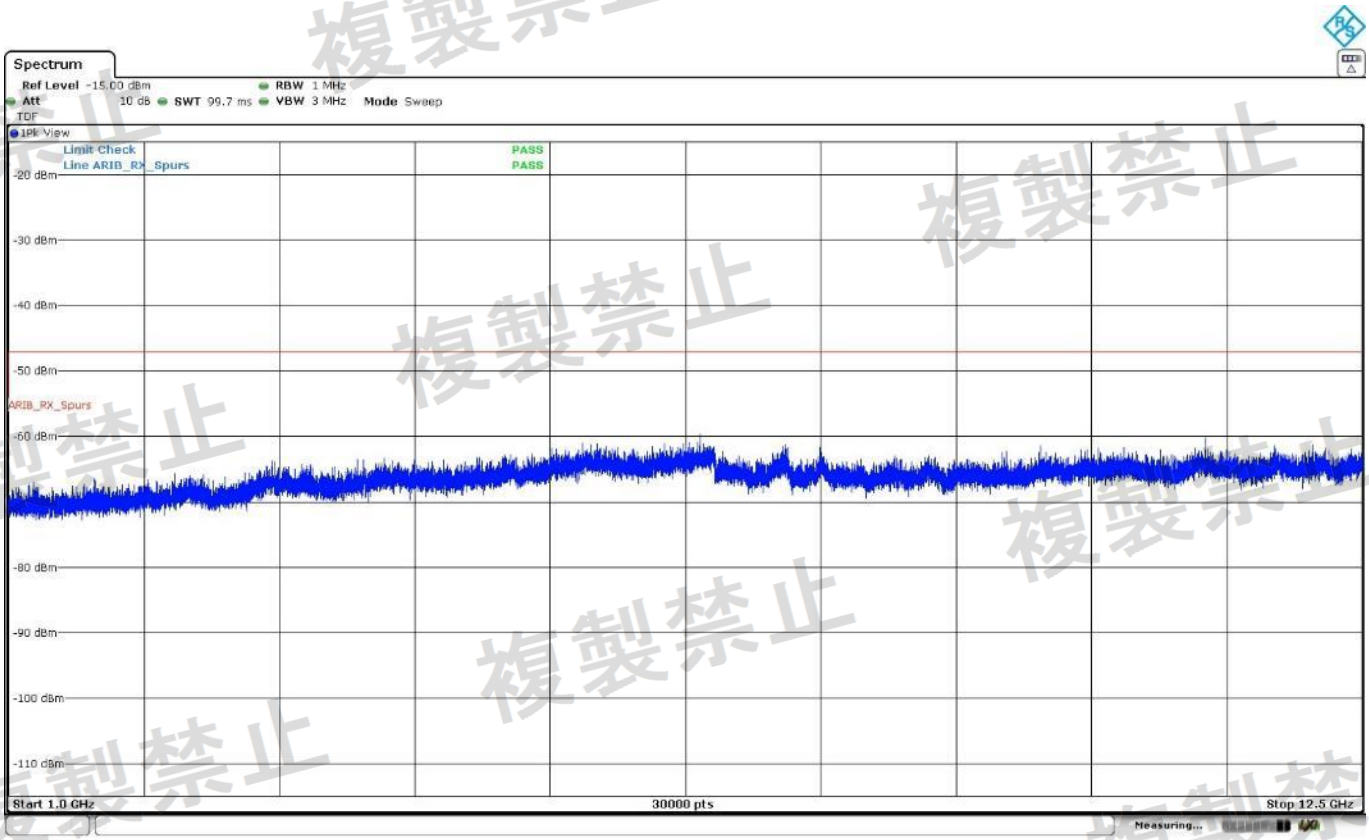


- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:



Frequency range 1 – 12.75 GHz:



Vmax:

- LOW CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty	<± 2.94 dB

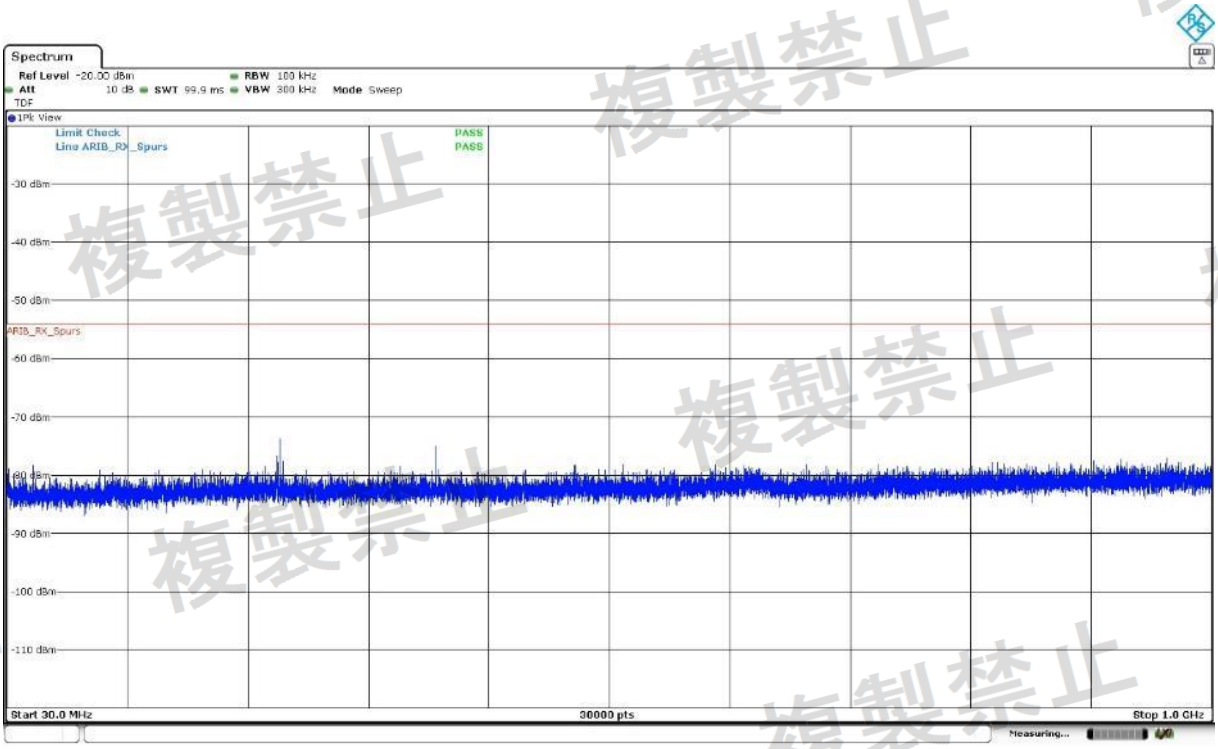
Verdict:

PASS

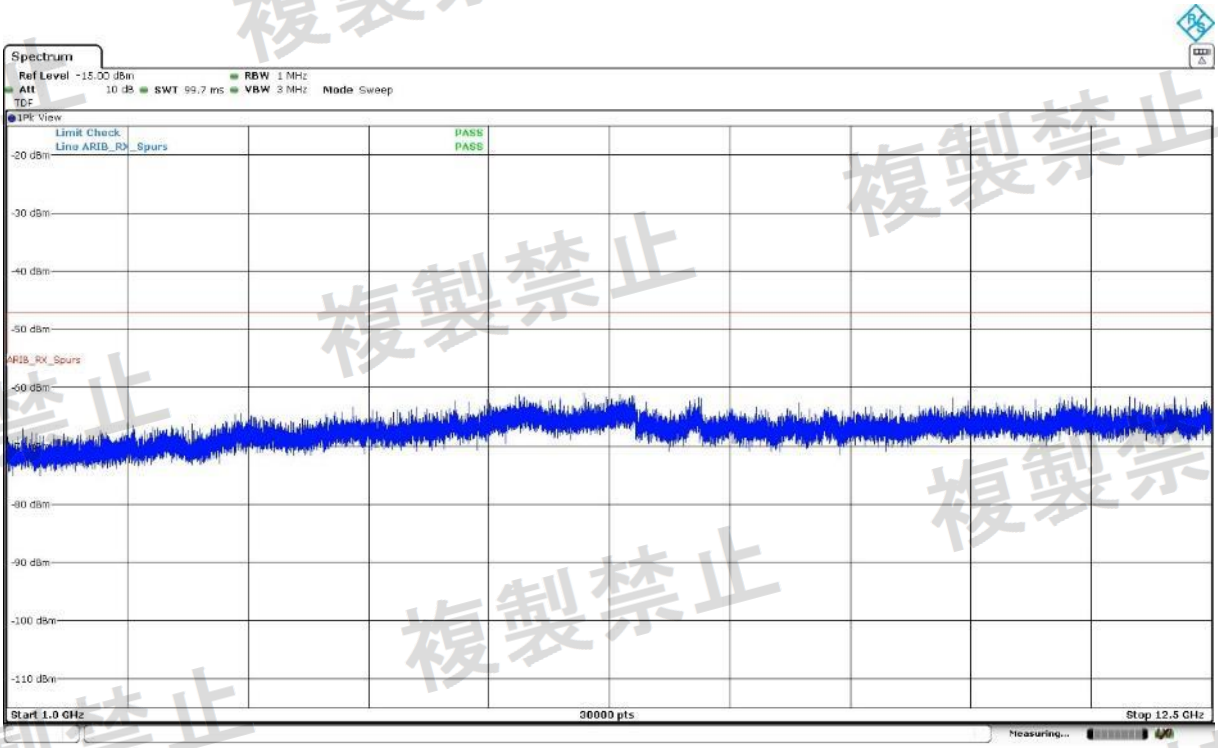
Vmax:

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

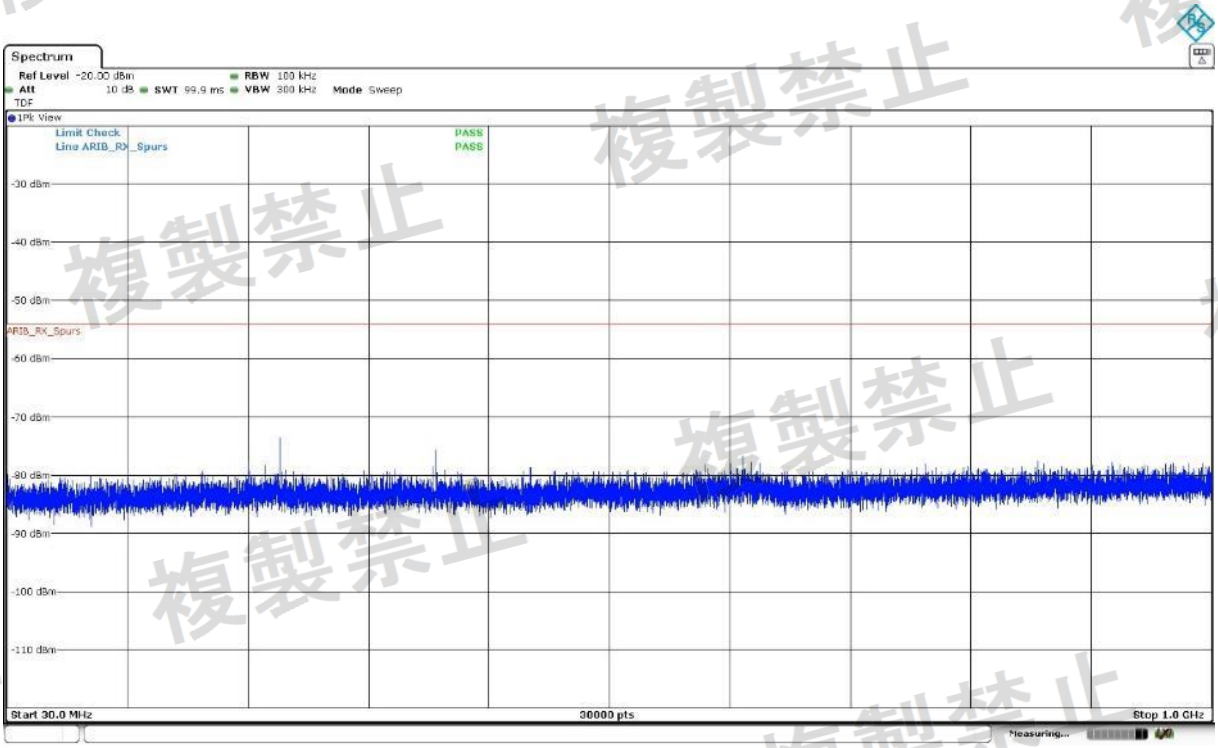


Frequency range 1 – 12.75 GHz:

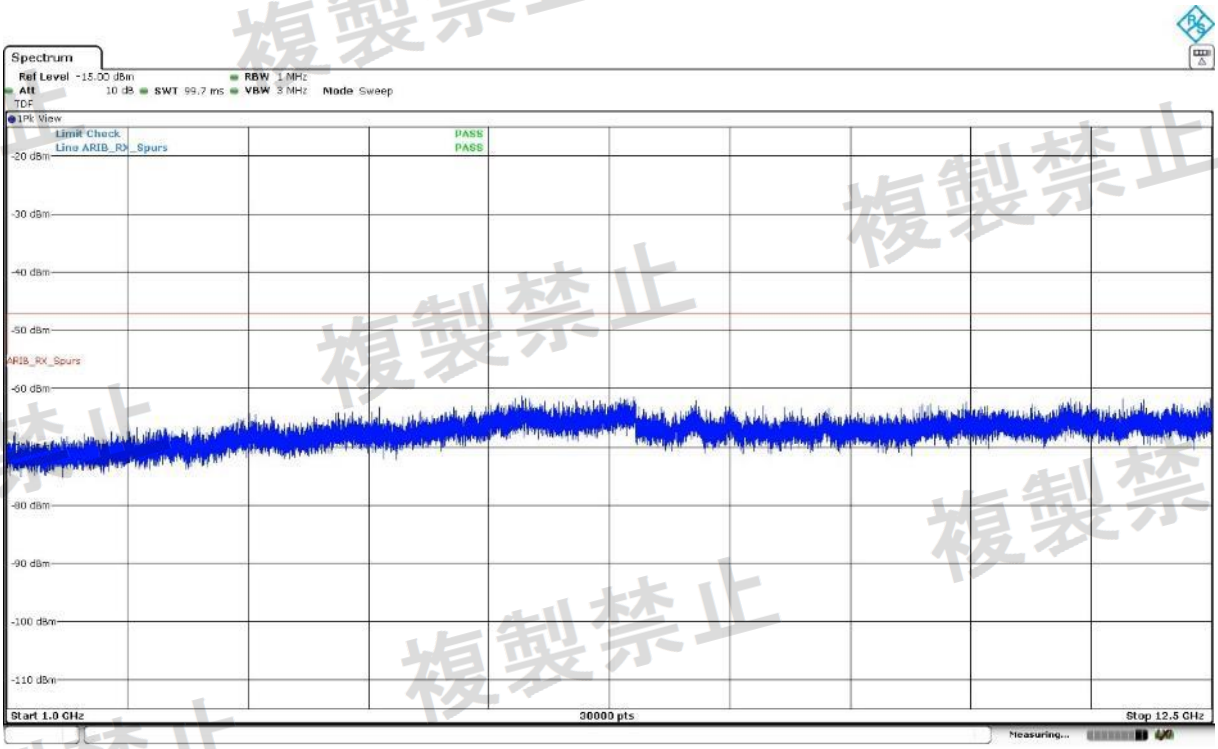


- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

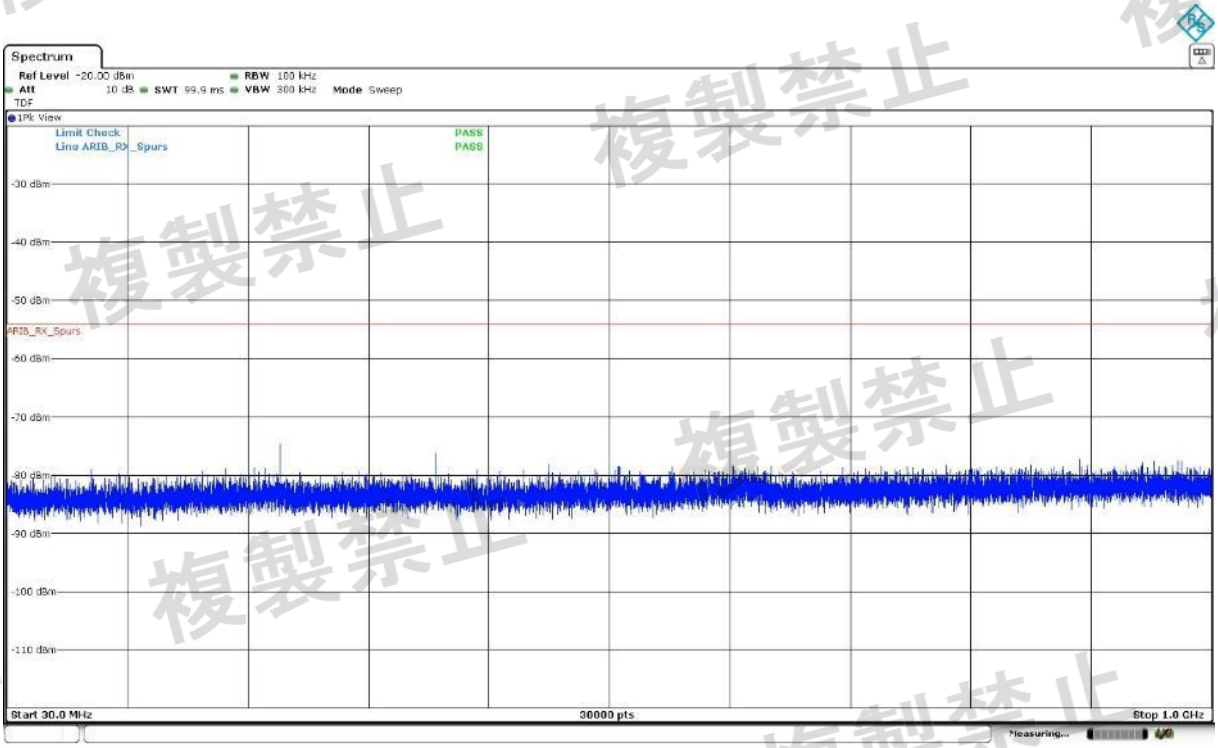


Frequency range 1 – 12.75 GHz:

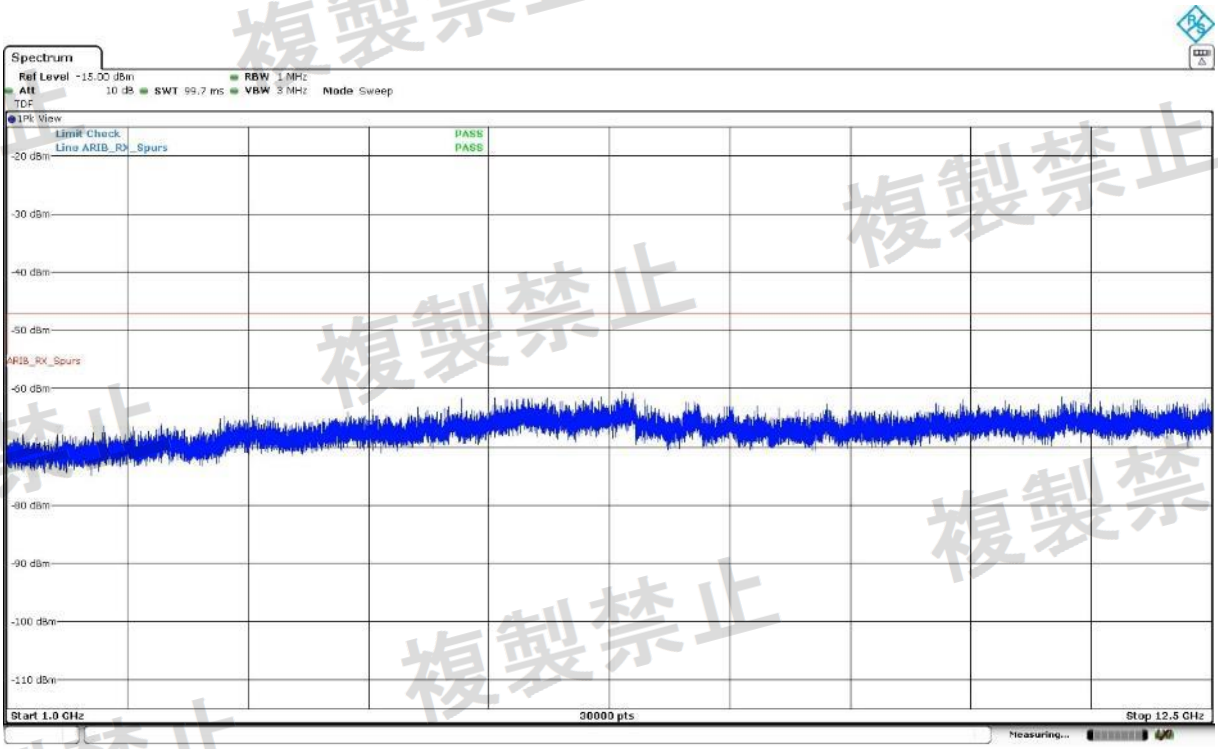


- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:



Frequency range 1 – 12.75 GHz:



Article 9.4-5. Controlling equipment. Interference prevention function. Identification code transmission/reception

Limits:

Radio equipment used mainly on the same premises and automatically transmits or receives identification code.

Results:

BLE MAC
4E:6A:F3:7E:77:A9

Verdict:

PASS

Article 49-20. Antenna. Antenna gain

Limits:

a: The absolute gain of the transmitting antenna shall be 12.14 dB or less. However, when the equivalent isotropic radiated power EIRP (equivalent isotropic radiated power in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems) is equal to or less than the value obtained by applying an antenna power with the mean power of 10 mW with its absolute gain being 12.14 dB, the shortage shall be compensated for by the gain of the transmitting antenna (Note that mean power is 10 mW in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems; however, mean power of 3 mW in the 1 MHz bandwidth is applied if the FH system, a hybrid system combining DS and FH systems, or a hybrid system combining FH and OFDM systems is employed and the frequency band of 2,427 - 2,470.75 MHz is used).

b: The Half-Power Beam width Angle HPBA (angle between two points at which radiated power becomes 1/2) of the transmitting antenna's horizontal and vertical planes shall not exceed the value as determined by the following formula:

$$HPBA \leq 360 / A \text{ [degrees]}$$

where constant A is equal to the value obtained by dividing the equivalent isotropic radiated power EIRP (equivalent isotropic radiated power in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems) by the value obtained by applying an antenna power with the mean power of 10 mW with its absolute gain being 2.14 dB, and shall be assumed to be 1 if it is less than 1 (Note that mean power is 10 mW in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems; however, mean power of 3 mW in the 1 MHz bandwidth is applied if the FH system, a hybrid system combining DS and FH systems, or a hybrid system combining the FH and OFDM systems is employed and the frequency band of 2,427 - 2,470.75 MHz is used).

Therefore

$$A = EIRP (mW) / (10 mW \times \text{absolute gain}) = EIRP (mW) / 16.37$$

Where absolute gain is the linear value corresponding to 2.14 dB = 1.637.

Results:

Vnom:

Channel	Radiated power EIRP (mW)	A = EIRP (mW) /16.37
Low (2404 MHz)	1.05	< 1
Middle (2440 MHz)	1.05	< 1
High (2478 MHz)	0.99	< 1

Since A is < 1, it is assumed to be 1, and therefore the half-power beam width must be 360º or less.

Vmin:

Channel	Radiated power EIRP (mW)	A = EIRP (mW) /16.37
Low (2404 MHz)	1.13	< 1
Middle (2440 MHz)	1.02	< 1
High (2478 MHz)	0.92	< 1

Since A is < 1, it is assumed to be 1, and therefore the half-power beam width must be 360º or less.

Vmax:

Channel	Radiated power EIRP (mW)	A = EIRP (mW) /16.37
Low (2404 MHz)	1.14	< 1
Middle (2440 MHz)	1.00	< 1
High (2478 MHz)	0.93	< 1

Since A is < 1, it is assumed to be 1, and therefore the half-power beam width must be 360º or less.

Verdict:

PASS

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C.I.F. A29507456

Appendix C: Test results. Proximity (2M)

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TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal: 3.7 Vdc

Type of Power Supply: Rechargeable battery.

TEST FREQUENCIES (*):

Modulation	Data rates	Low Channel:	Middle Channel	High Channel
PROXIMITY	2 Mbit/s	2402 MHz	2440 MHz	2480 MHz

During transmitter test the EUT was controlled by a SW tool provided by the client to operate in a continuous transmit mode on the modulation schemes and test channels as required.

ENVIRONMENTAL CONDITIONS DURING TESTING:

Temperature: 23 ºC
Humidity: 55 %

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and its antenna port (SMA type) is connected to the spectrum analyser through a low loss RF cable. The reading of the spectrum analyser is corrected with the cable loss.

The DC supply voltage is applied using a power supply.

The Equipment Under Test (E.U.T) is set in continuous transmission with modulation using an implemented test mode. The test mode also permits to set the E.U.T. in receiving mode with the transmission disabled

PRODUCT INFORMATION

Modulation:	GFSK.
Spread spectrum system:	No (Other digital modulation methods).
Nominal necessary Bandwidth:	2 MHz
Maximum declared antenna gain:	-8.3 dBi.
Rated Antenna Power:	9.5 dBm (8.912509381 mW).
Type of Antenna:	Integral antenna
Operating nominal frequency range:	2402 MHz to 2483.5 MHz.
Nominal power supply:	3.7 Vdc.
Type of power supply:	Battery.

Article 49-20 and Article 14.7 Table 8. Transmitting equipment. Antenna power. Tolerances for antenna power

Limits:

Mode	Limit	Tolerance
a) FH, FH+DS, FH+OFDM	3 mW/MHz	+20%
b) OFDM (Narrow bandwidth), DS	10 mW/MHz	
c) Other than a & b	10 mW	
d) OFDM (Wide band)	5 mW/MHz	

Results:

Mode: Other digital modulation methods than a & b.

Maximum Rated Antenna Power: 9.5 dBm (8.91251 mW)

Vnom:

Channel	Measured antenna power (dBm)	Radiated power EIRP (dBm)	Antenna power EIRP (mW)	Deviation from maximum rated antenna power (%)
Low (2402 MHz)	8.757000	0.46	1.11	-15.72475961
Middle (2440 MHz)	8.297000	0.00	1.00	-24.19462509
High (2480 MHz)	8.032000	-0.27	0.94	-28.68186133

Vmin:

Channel	Measured antenna power (dBm)	Radiated power EIRP	Antenna power EIRP (mW)	Deviation from maximum rated antenna power (%)
Low (2402 MHz)	8.560000	0.26	1.06	-19.46215588
Middle (2440 MHz)	8.647000	0.35	1.08	-17.8325139
High (2480 MHz)	7.979000	-0.32	0.93	-29.54691739

Vmax:

Channel	Measured antenna power (dBm)	Radiated power EIRP	Antenna power EIRP (mW)	Deviation from maximum rated antenna power (%)
Low (2402 MHz)	8.625000	0.32	1.08	-18.24769621
Middle (2440 MHz)	8.359000	0.06	1.01	-23.10466382
High (2480 MHz)	8.079000	-0.22	0.95	-27.90585428

Measurement uncertainty: < ± 2.01 dB

Verdict:

PASS

Article 5 and Annex 1 table 7-8. Transmitting equipment. Frequency tolerance

Limits:

Frequency tolerance shall be ± 50 x 10^{-6} (50 ppm).

Unmodulated carrier.

Results:

Vnom:

Channel	Frequency error (Hz)	Frequency error (ppm)
Low (2402 MHz)	7965	3.315986678
Middle (2440 MHz)	8055	3.301229508
High (2480 MHz)	7965	3.211693548
Measurement uncertainty	<± 7.10 kHz	

Vmin:

Channel	Frequency error (Hz)	Frequency error (ppm)
Low (2402 MHz)	8055	3.353455454
Middle (2440 MHz)	8055	3.301229508
High (2480 MHz)	7965	3.211693548
Measurement uncertainty	<± 7.10 kHz	

Vmax:

Channel	Frequency error (Hz)	Frequency error (ppm)
Low (2402 MHz)	7905	3.291007494
Middle (2440 MHz)	7965	3.264344262
High (2480 MHz)	7965	3.211693548
Measurement uncertainty	<± 7.10 kHz	

Verdict:

PASS

Article 6 and Annex 2. 30. Transmitting equipment. Permissible value for occupied bandwidth

Limits:

Mode	Limit
FH	83.5 MHz
FH+DS	83.5 MHz
FH+OFDM	83.5 MHz
OFDM (Narrow bandwidth), DS	26 MHz
OFDM (Wide band)	38 MHz
Others	26 MHz

Results:

Mode: Other digital modulation methods.

Vnom:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
99% occupied bandwidth (MHz)	1.6723	1.6775	1.6844
Limit	<26 MHz		
Measurement uncertainty (kHz)	<± 6.06		

Vmin:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
99% occupied bandwidth (MHz)	1.6925	1.7020	1.6980
Limit	<26 MHz		
Measurement uncertainty (kHz)	<± 6.06		

Vmax:

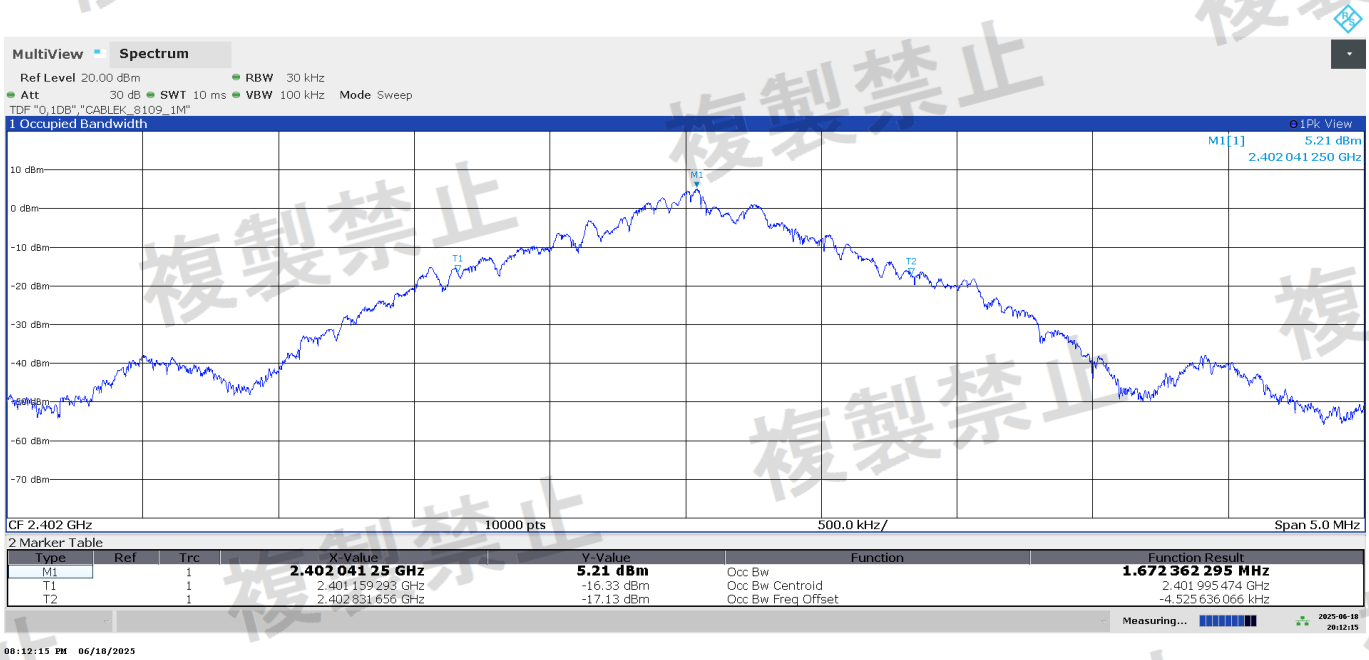
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
99% occupied bandwidth (MHz)	1.6920	1.6860	1.7055
Limit	<26 MHz		
Measurement uncertainty (kHz)	<± 6.06		

Verdict:

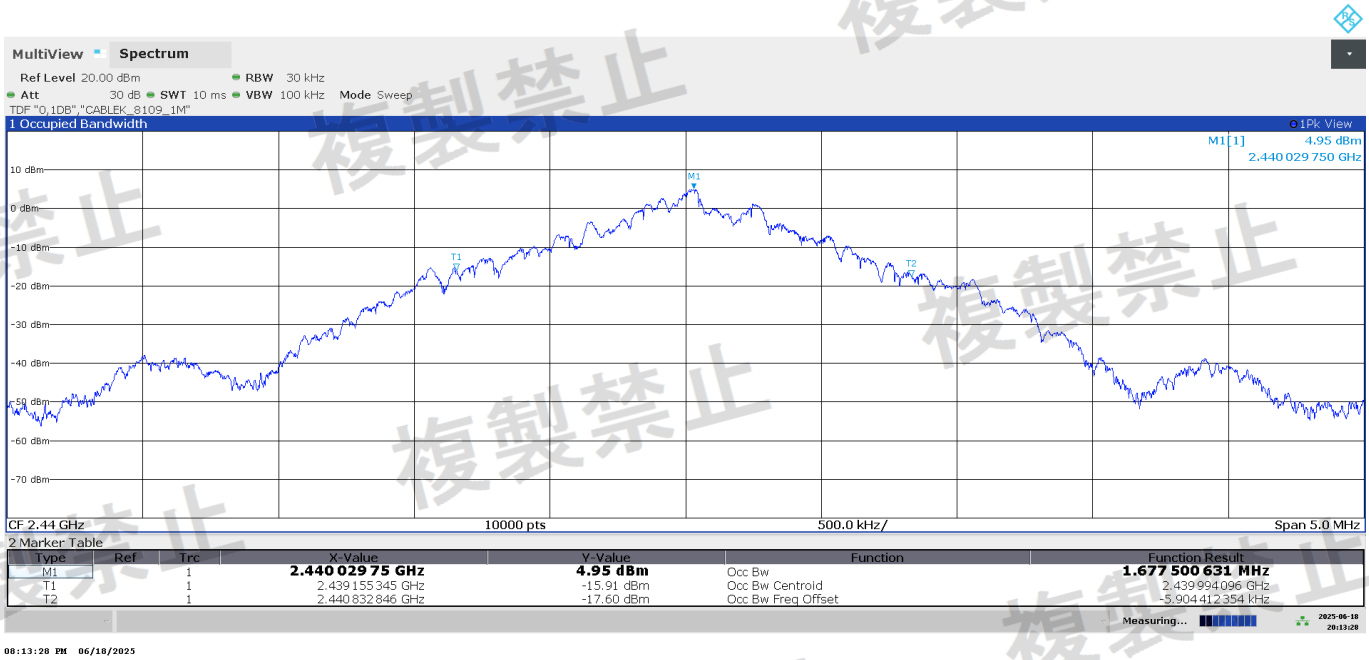
PASS

Vnom:

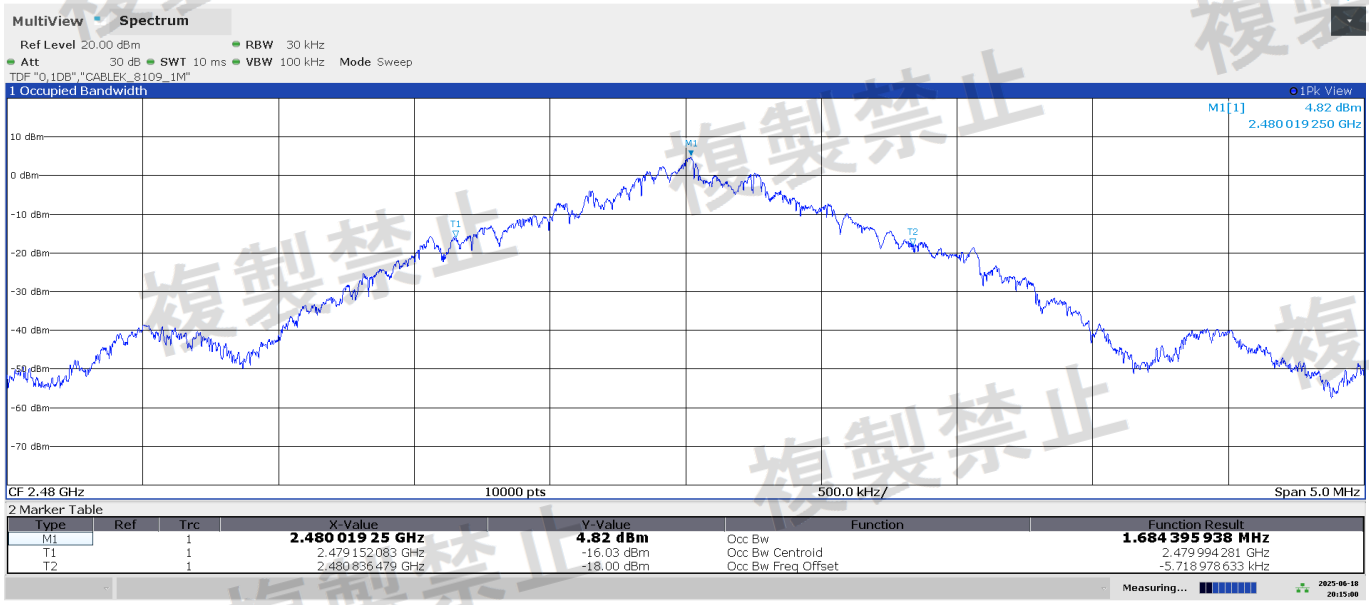
- LOW CHANNEL:



- MIDDLE CHANNEL:

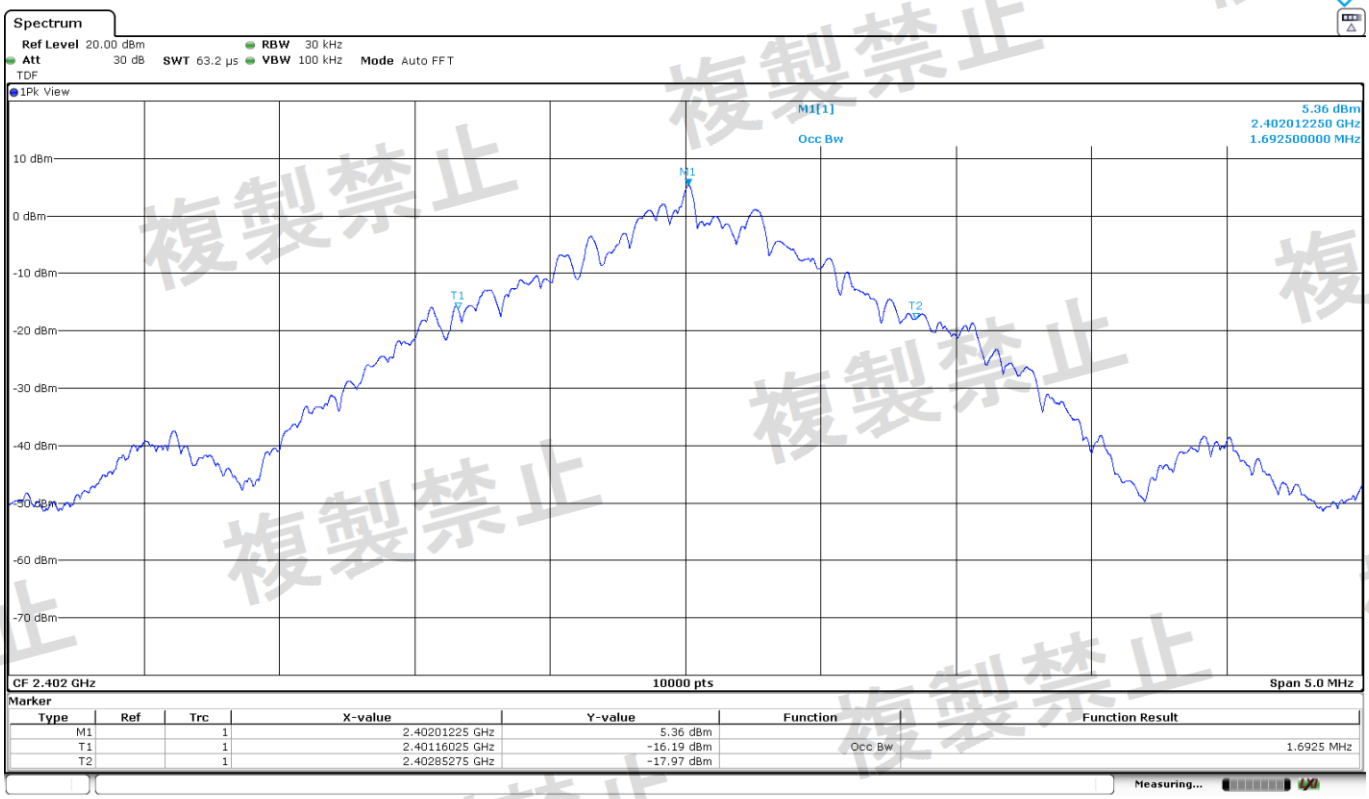


- HIGH CHANNEL:

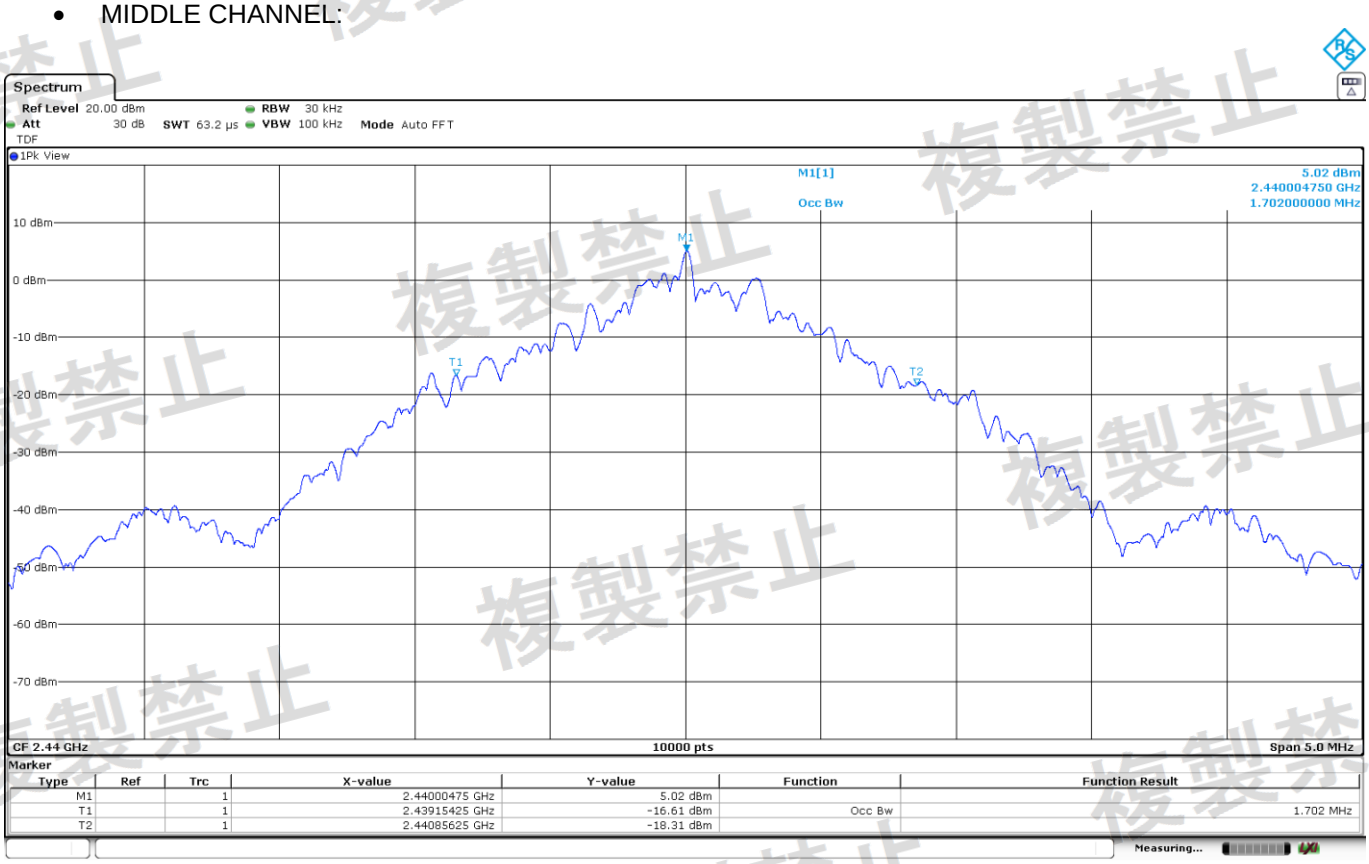


Vmin:

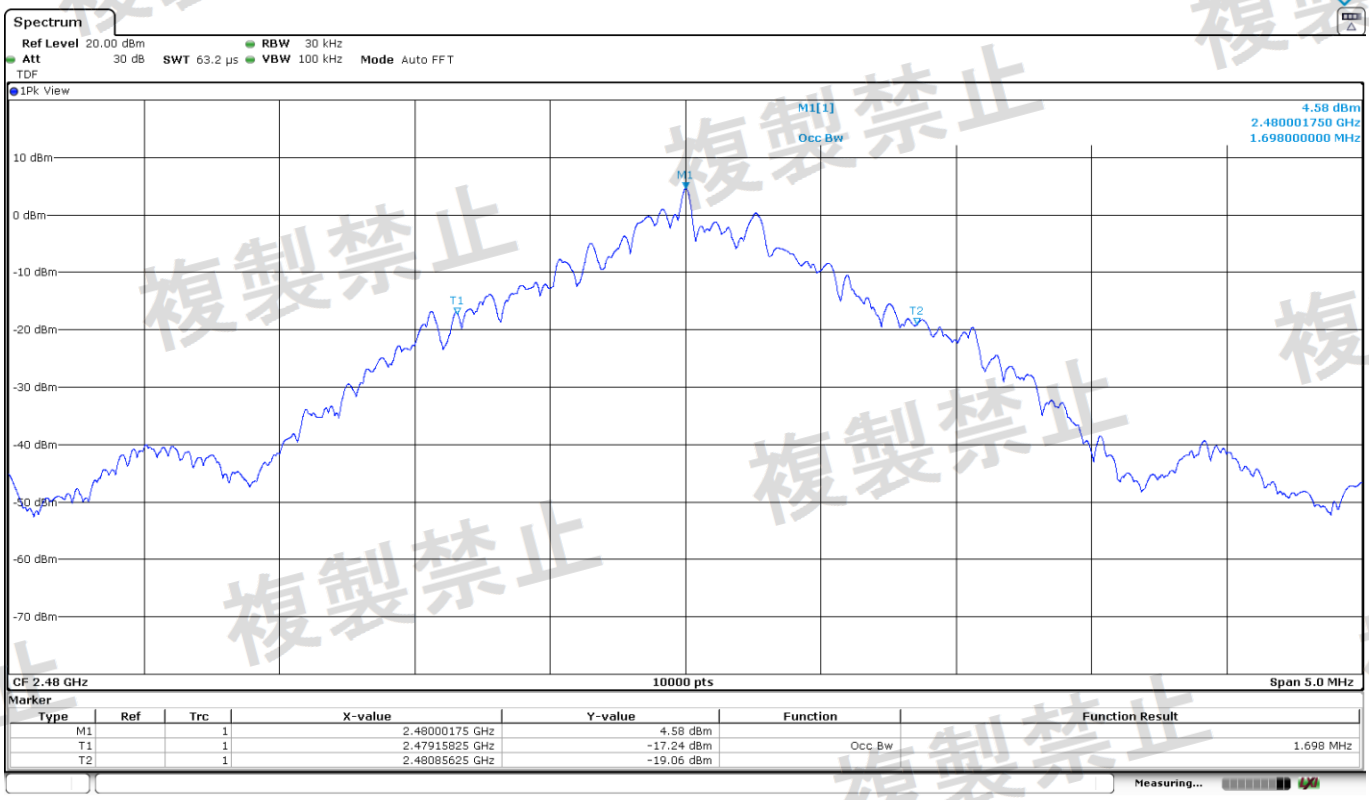
- LOW CHANNEL:



- MIDDLE CHANNEL:

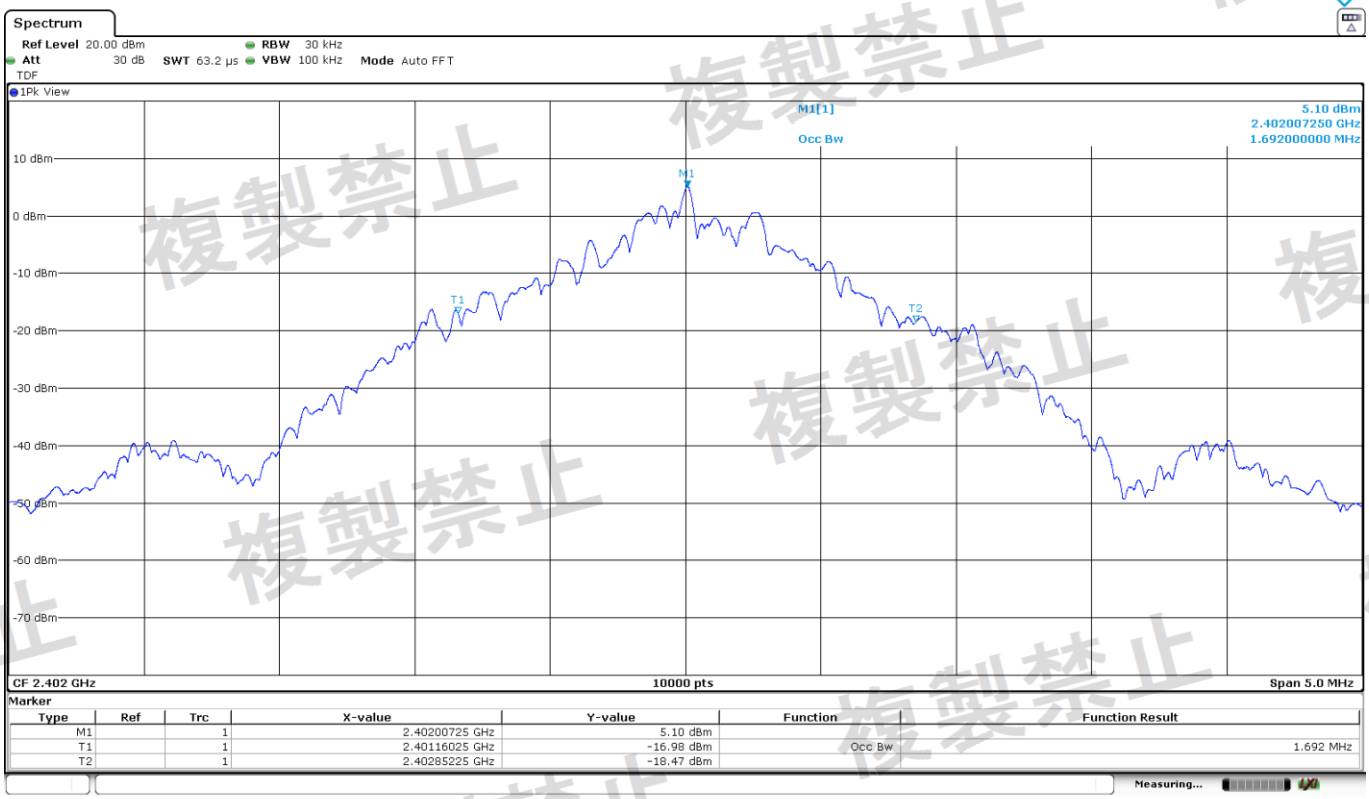


- HIGH CHANNEL:

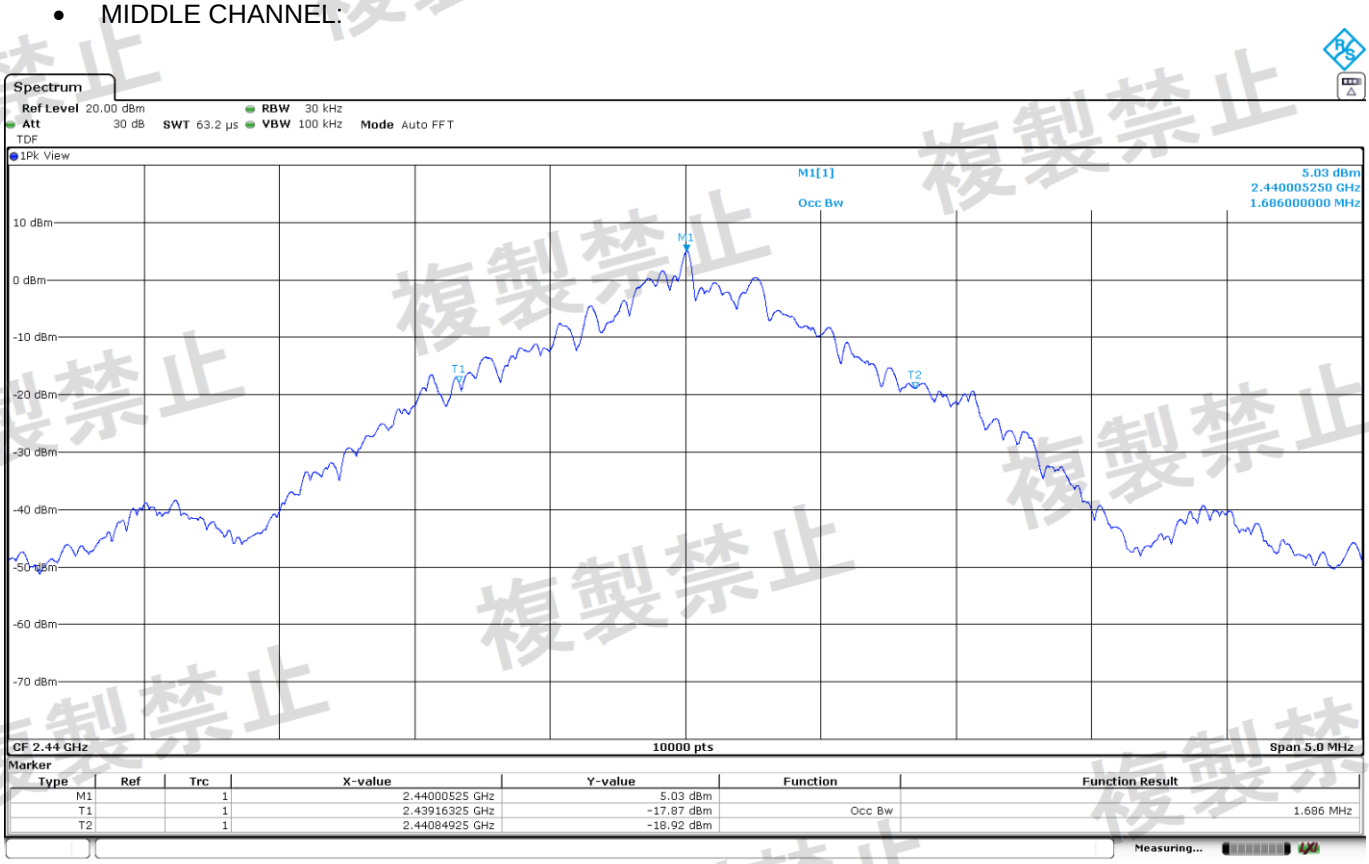


Vmax:

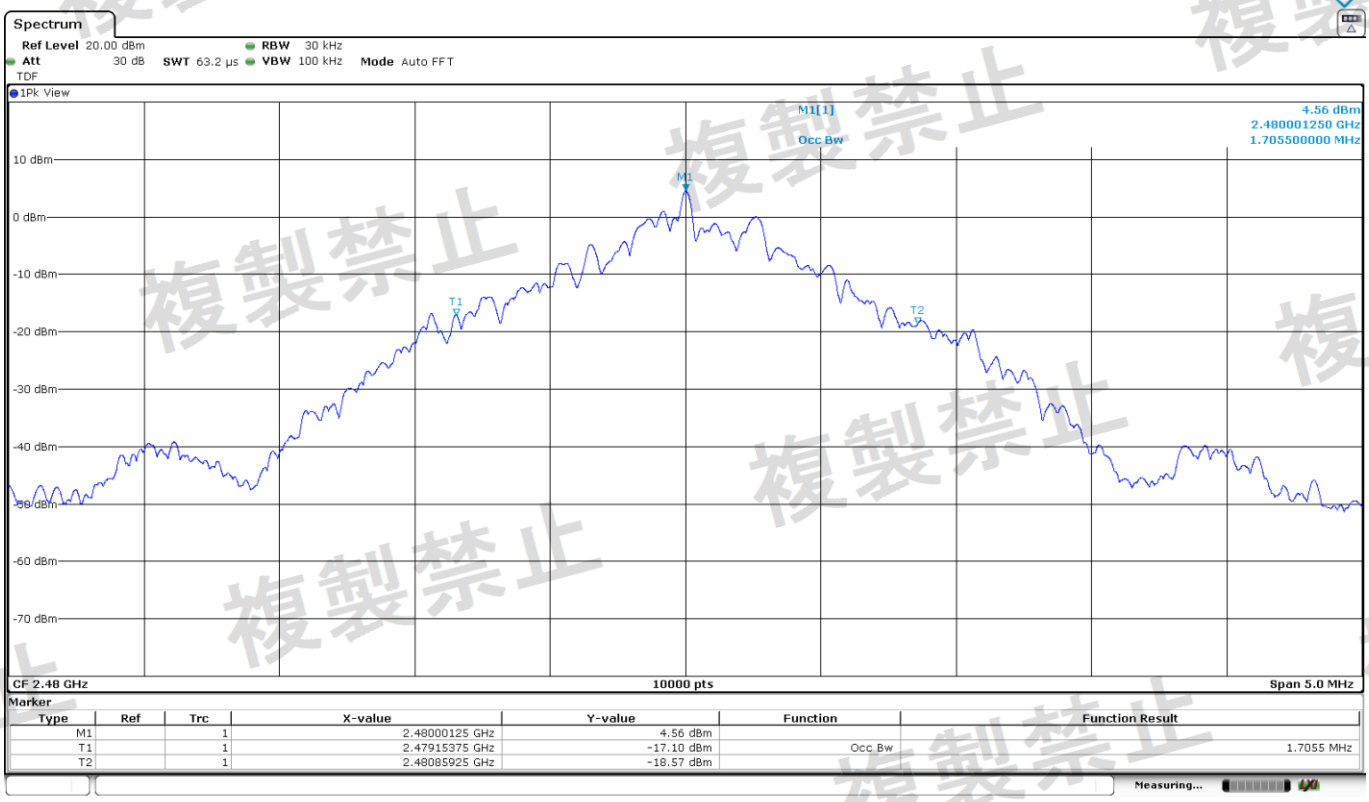
- LOW CHANNEL:



- MIDDLE CHANNEL:



- HIGH CHANNEL:



Article 7 and Annex 3. 26. Transmitting equipment. Spurious emission intensity

Limits:

Permissible mean power of spurious emission of each frequency supplied to a feeder, that is, mean power of spurious emission in the 1 MHz bandwidth at frequency f other than frequency band used shall be as follows:

a. 2,387 MHz ≤ f ≤ 2,400 MHz and 2,483.5 MHz < f ≤ 2,496.5 MHz	25 μW (-16 dBm) or less.
b. 2,387 MHz > f and 2,496.5 MHz < f	2.5 μW (-26 dBm) or less.

Results:

Vnom:

- LOW CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty <± 2.77 dB

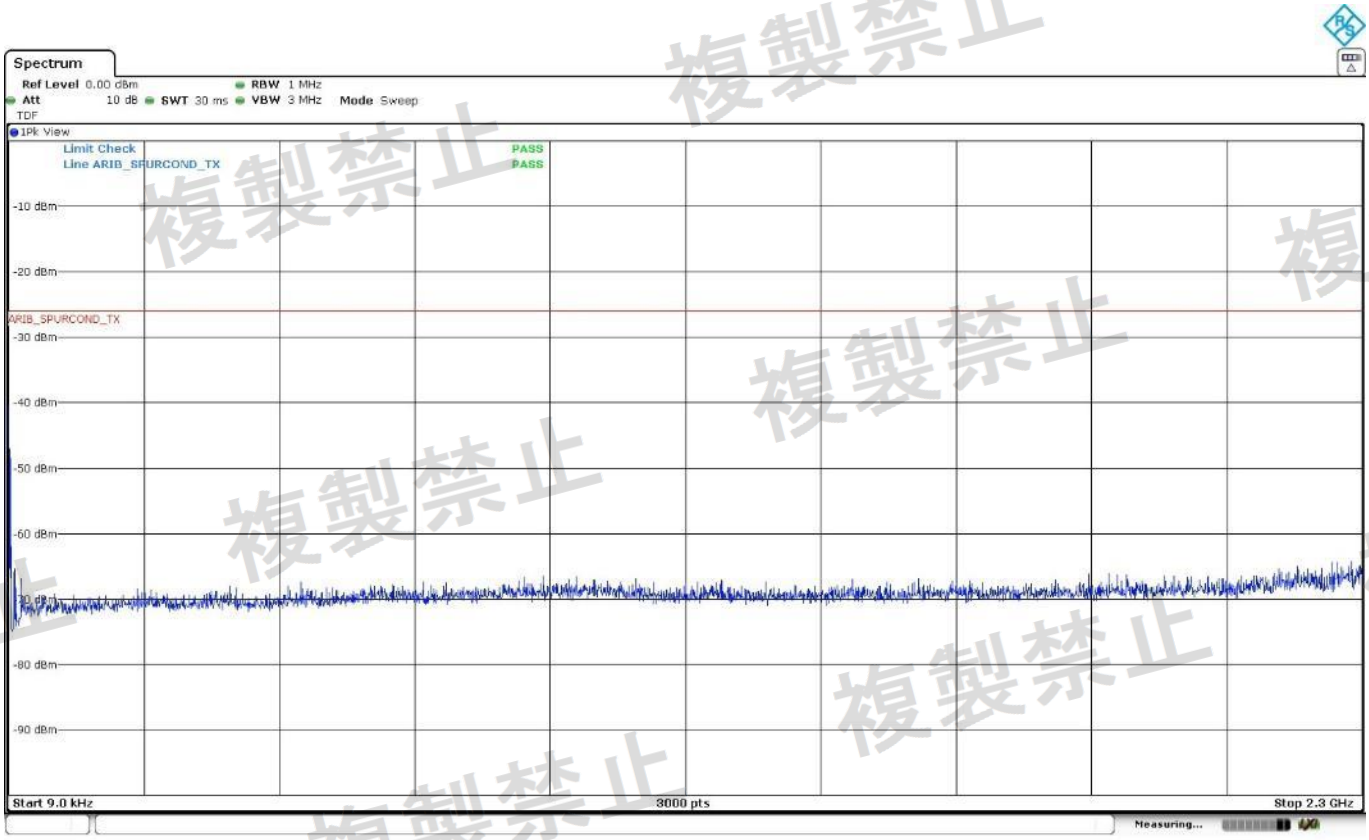
Verdict:

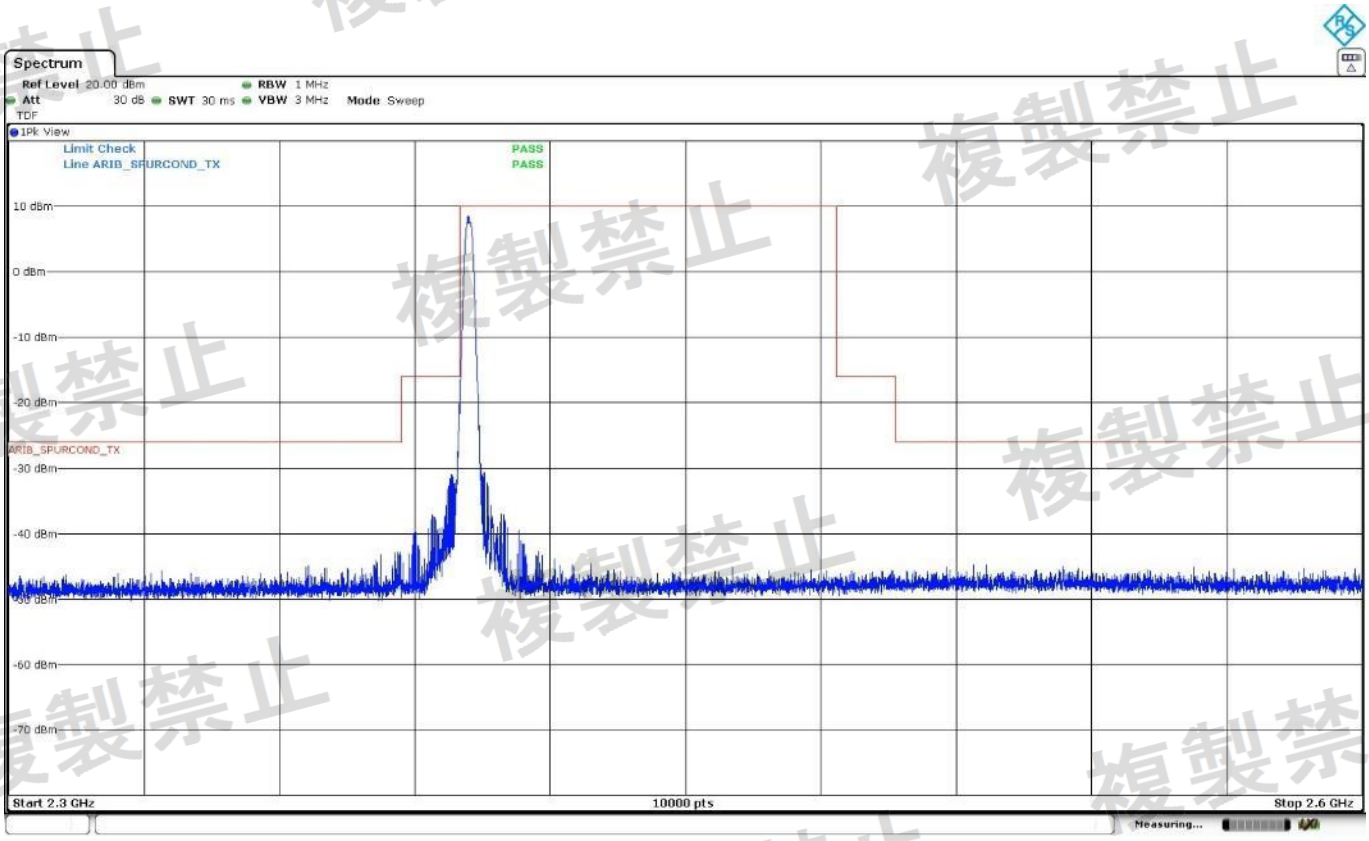
PASS

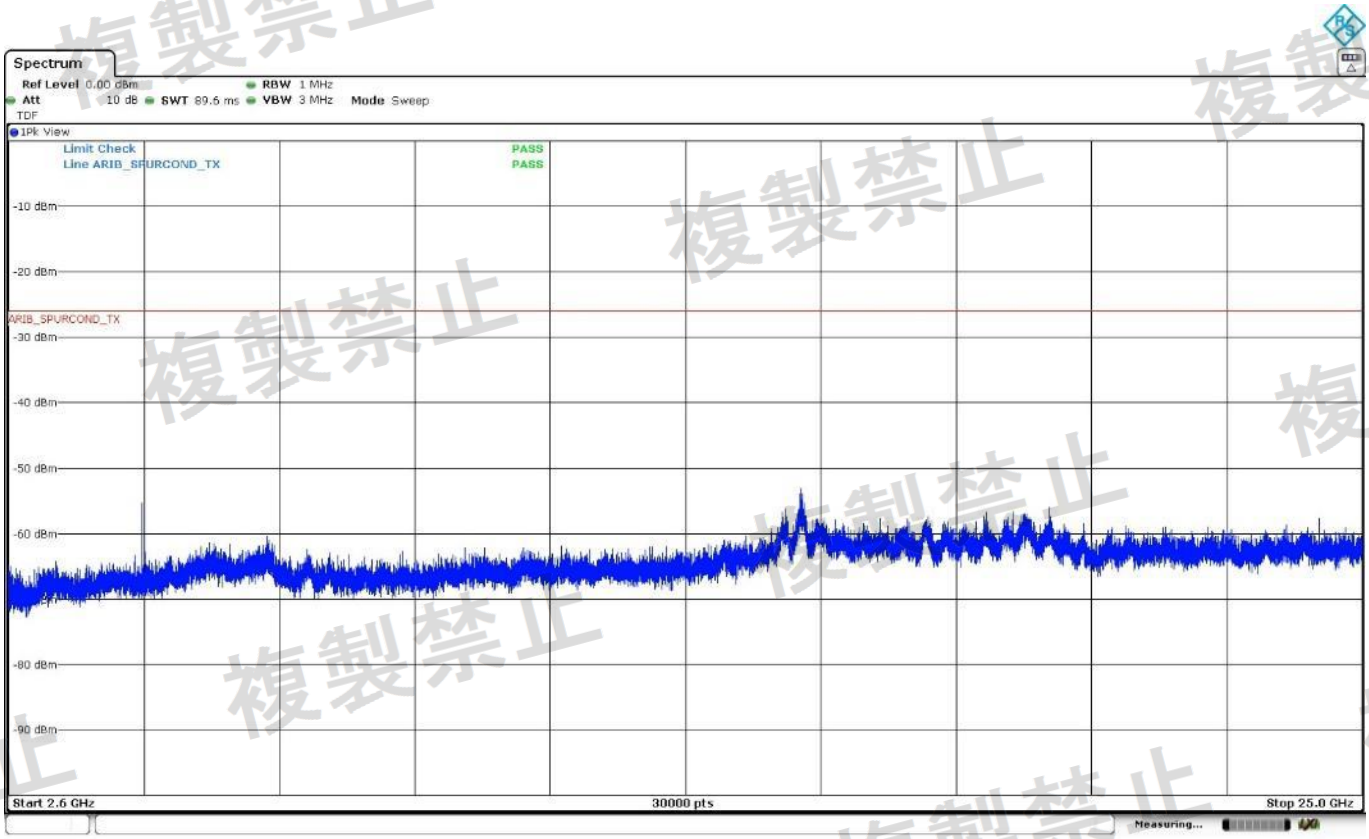
Vnom:

- LOW CHANNEL:

Frequency range 9 kHz - 25 GHz:

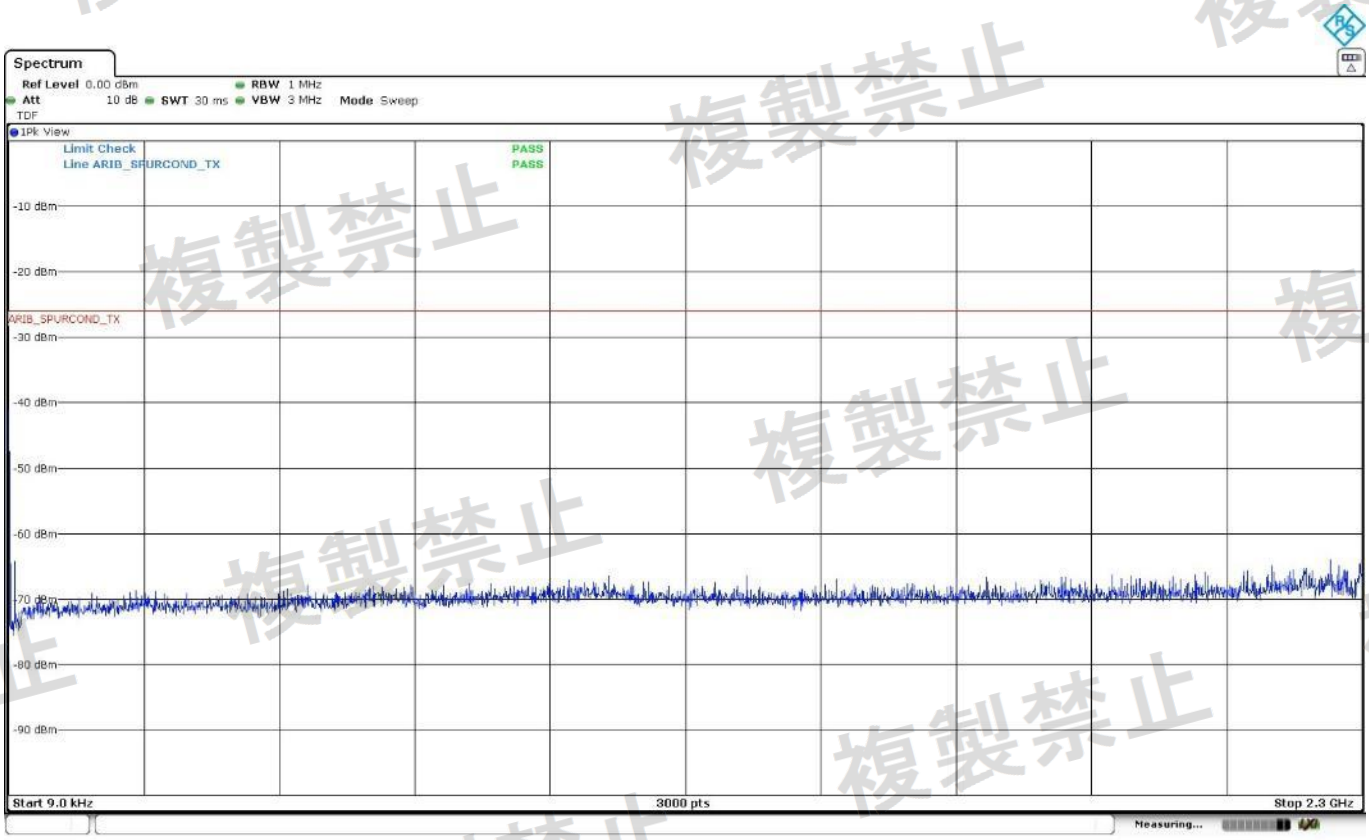


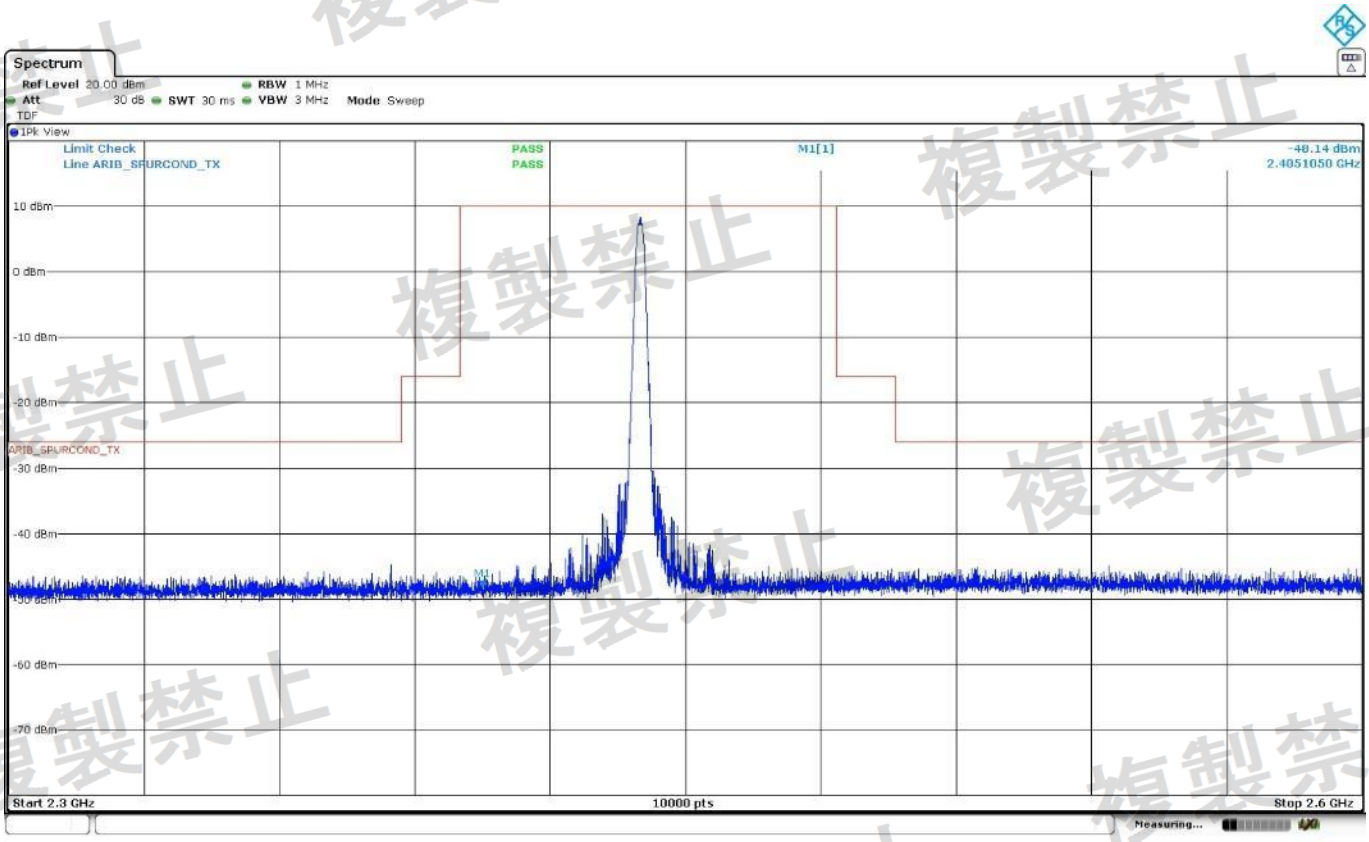


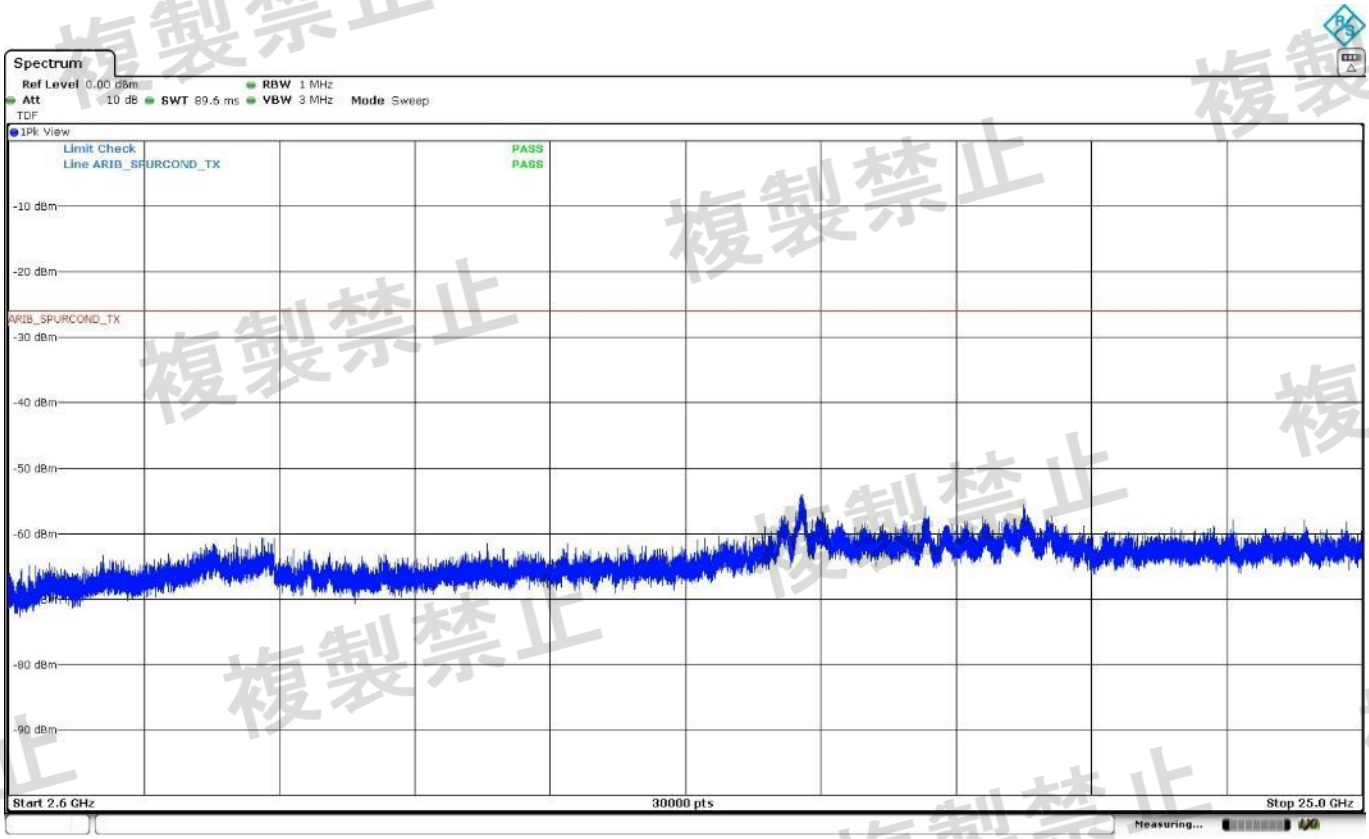

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- MIDDLE CHANNEL:

Frequency range 9 kHz - 25 GHz:

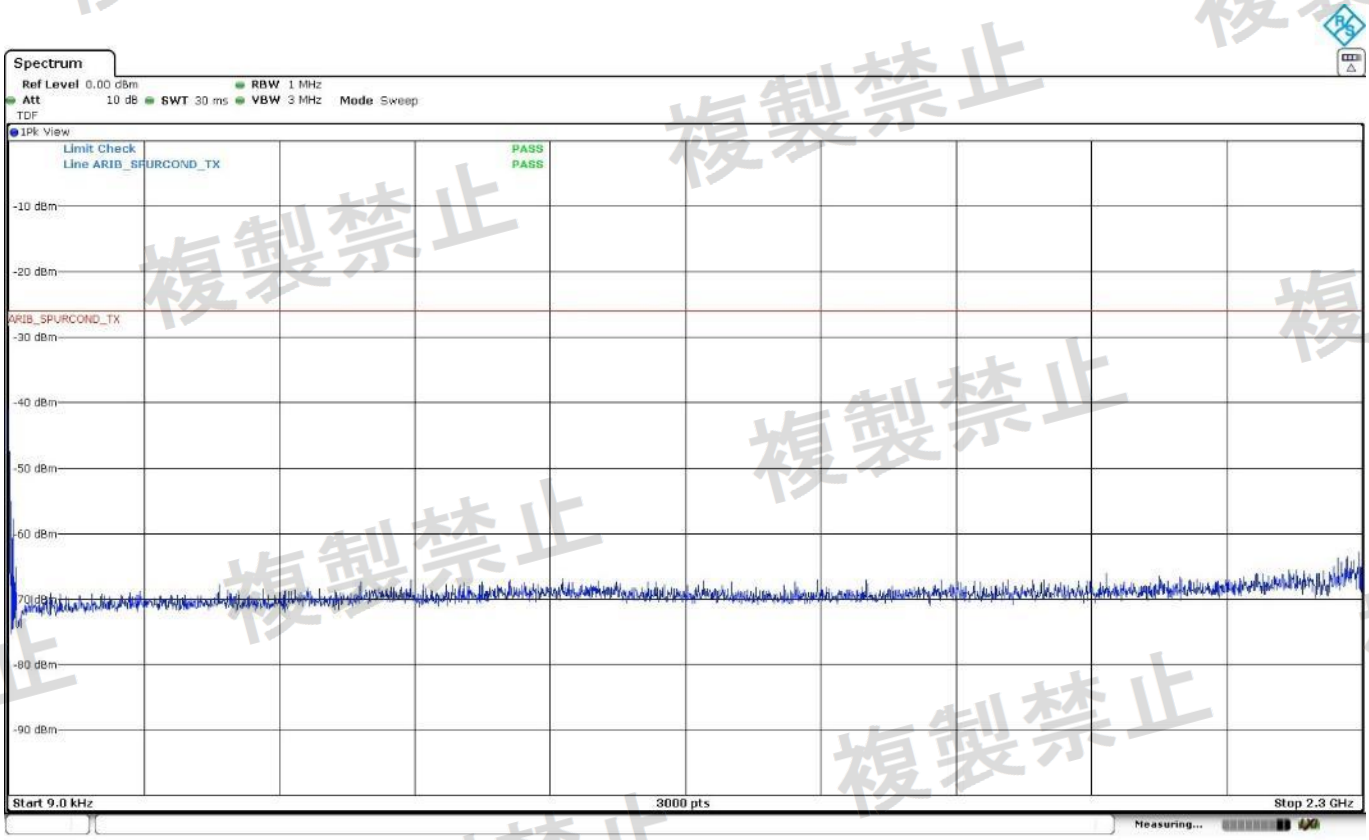


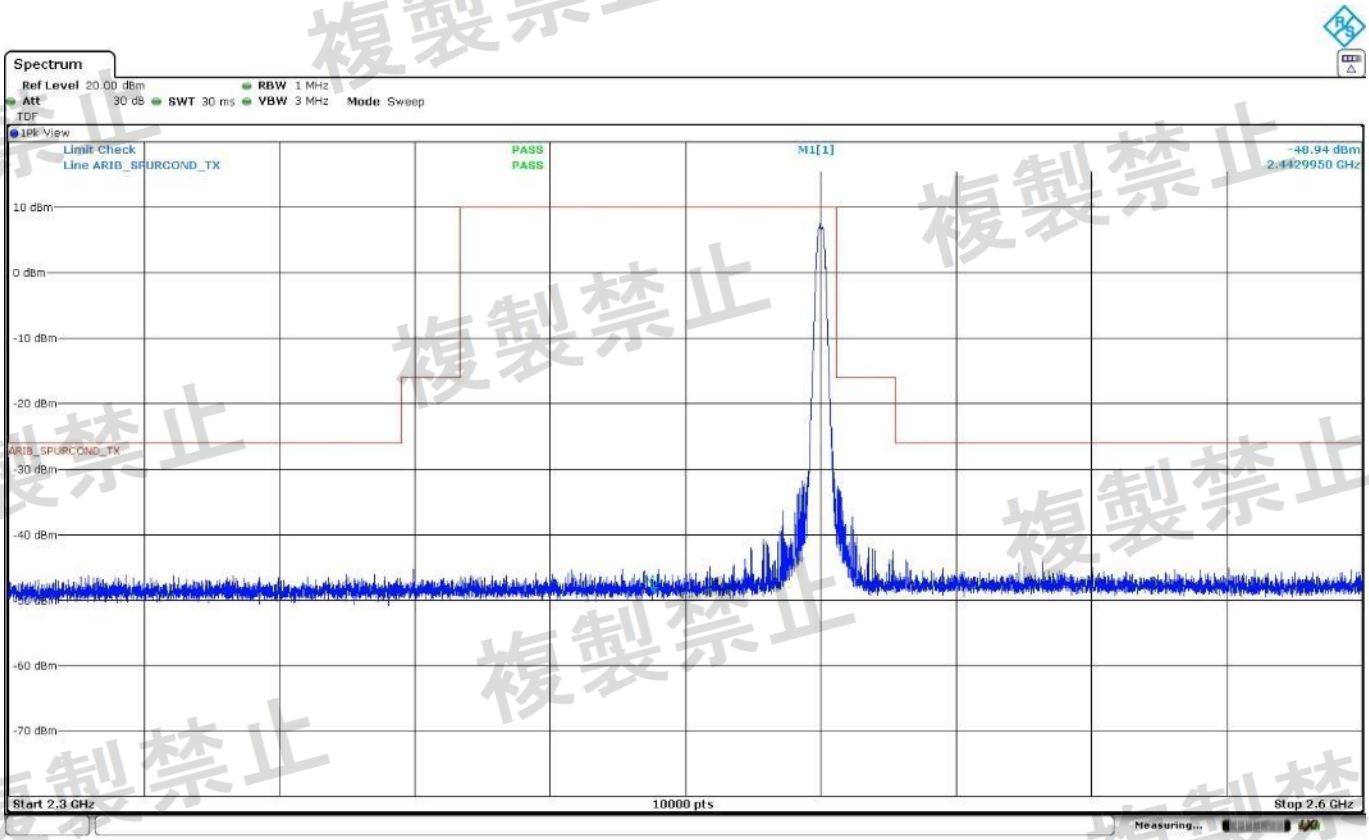


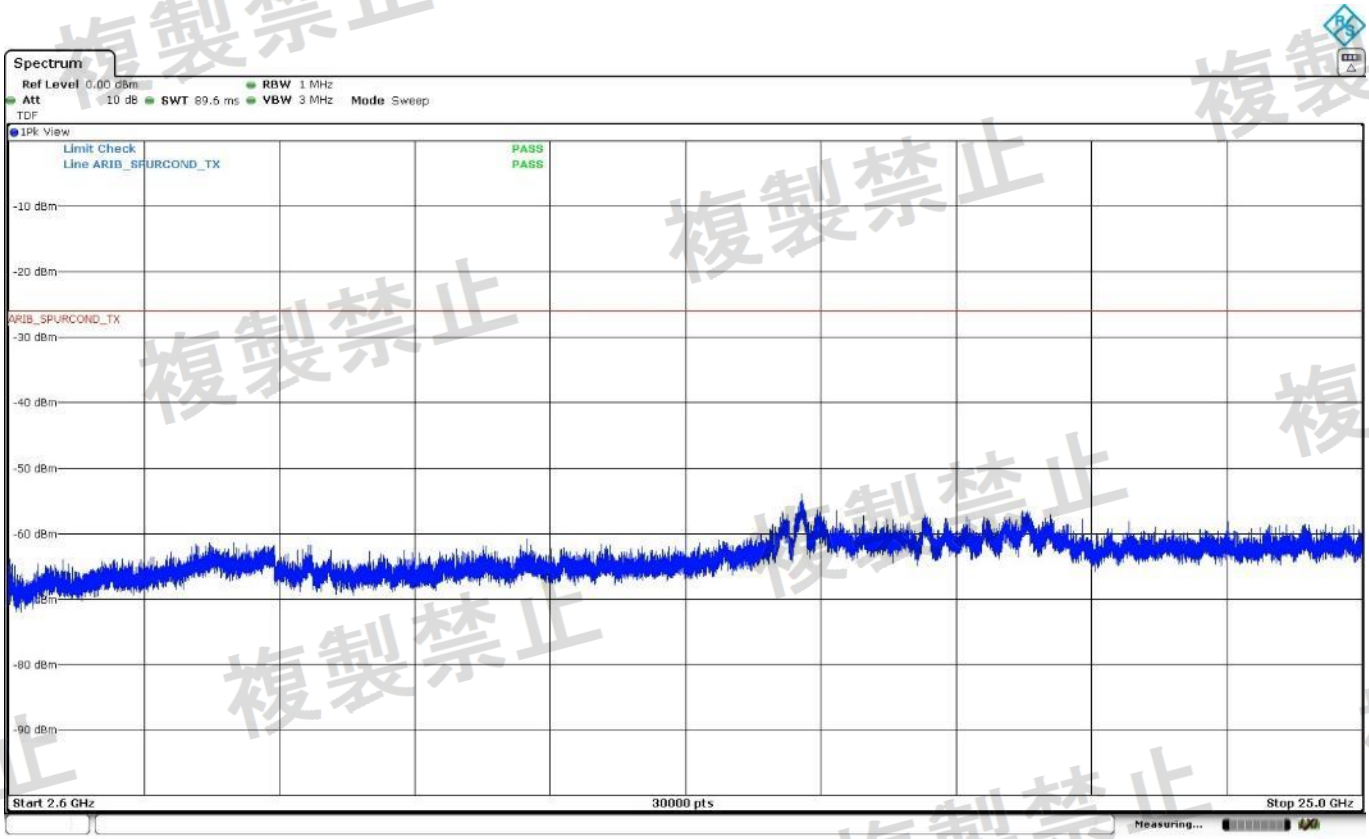

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- HIGH CHANNEL:

Frequency range 9 kHz - 25 GHz:






Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

Vmin:

- LOW CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty <± 2.77 dB

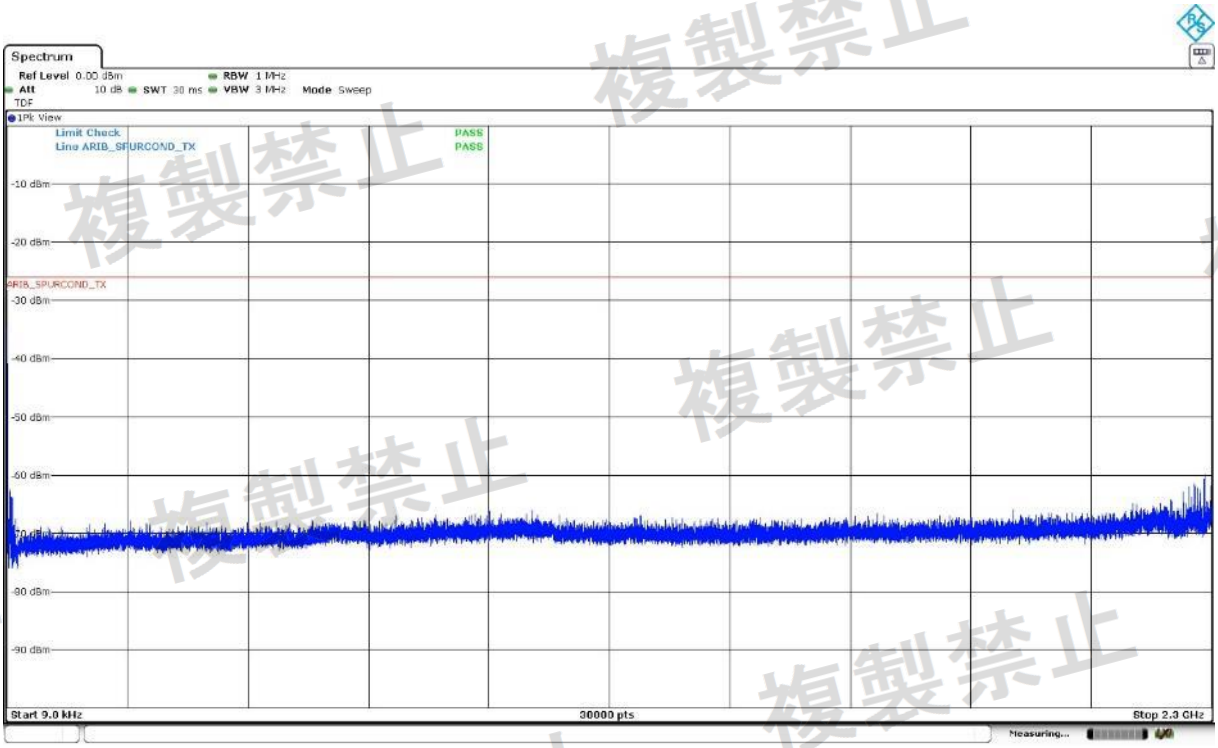
Verdict:

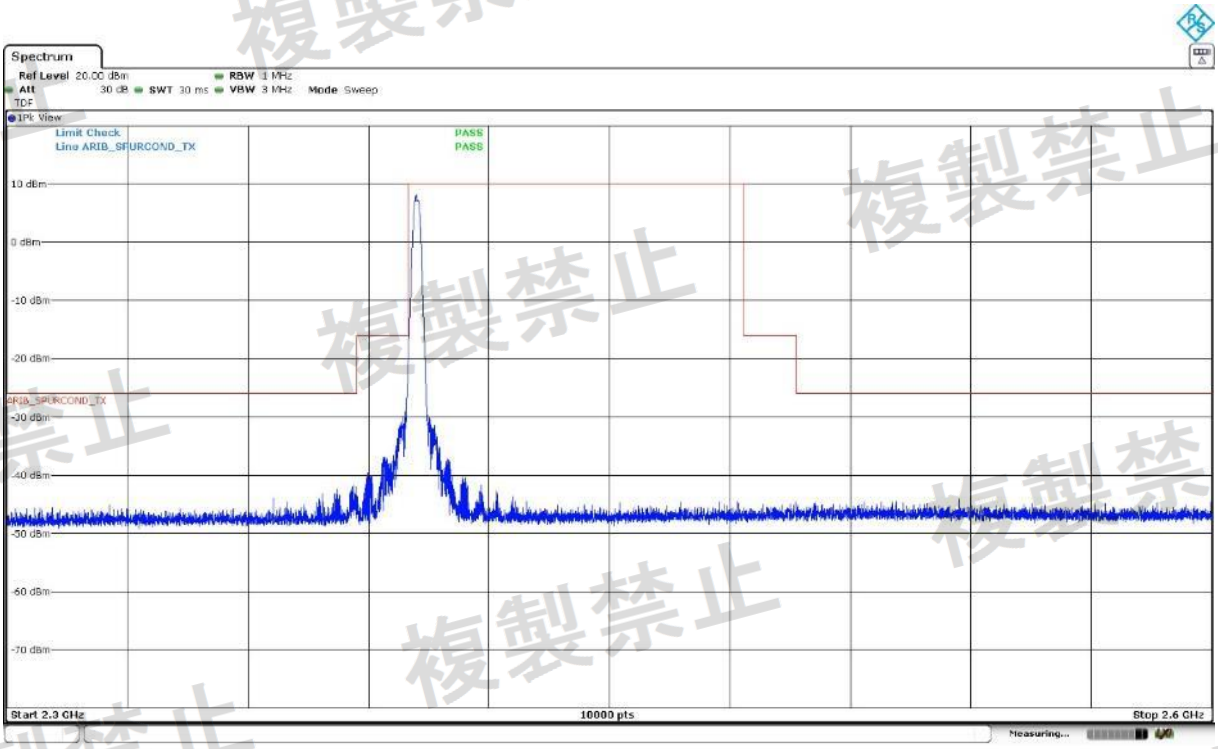
PASS

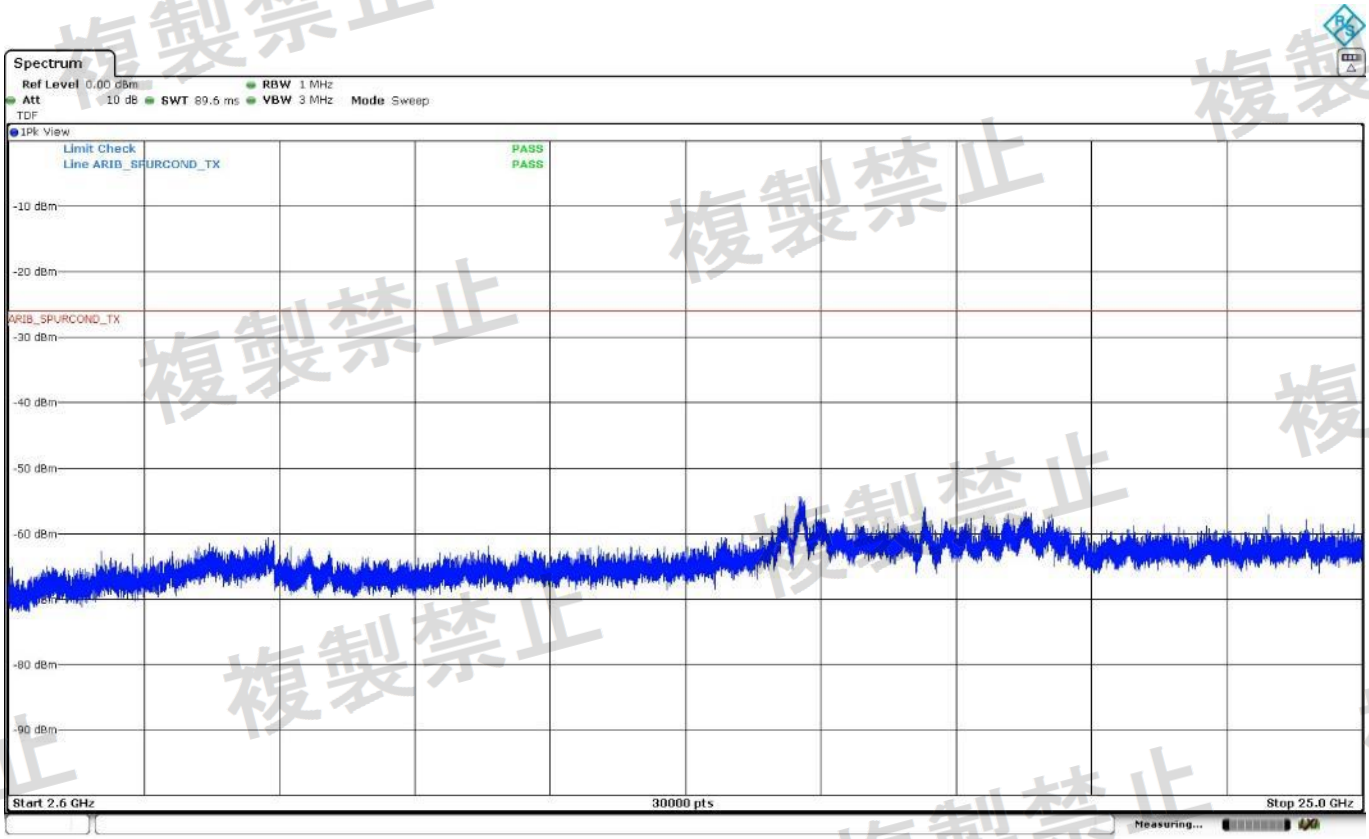
Vmin:

- LOW CHANNEL:

Frequency range 9 kHz - 25 GHz:

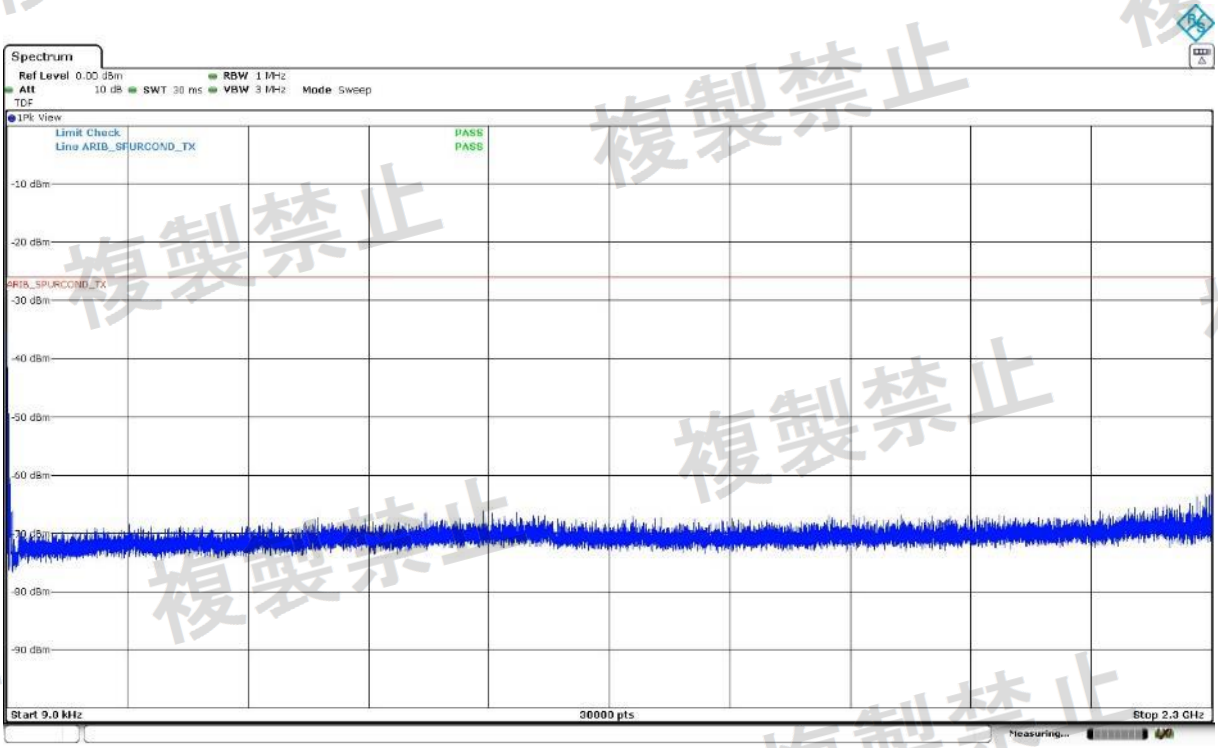


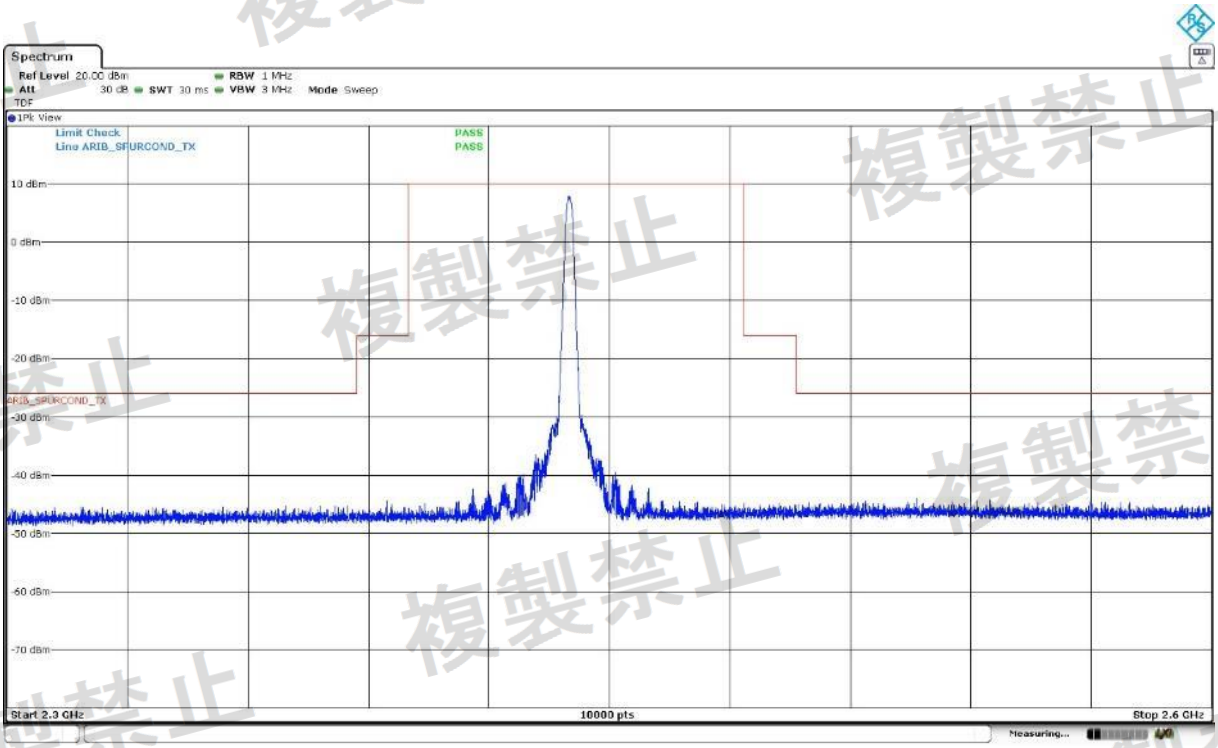


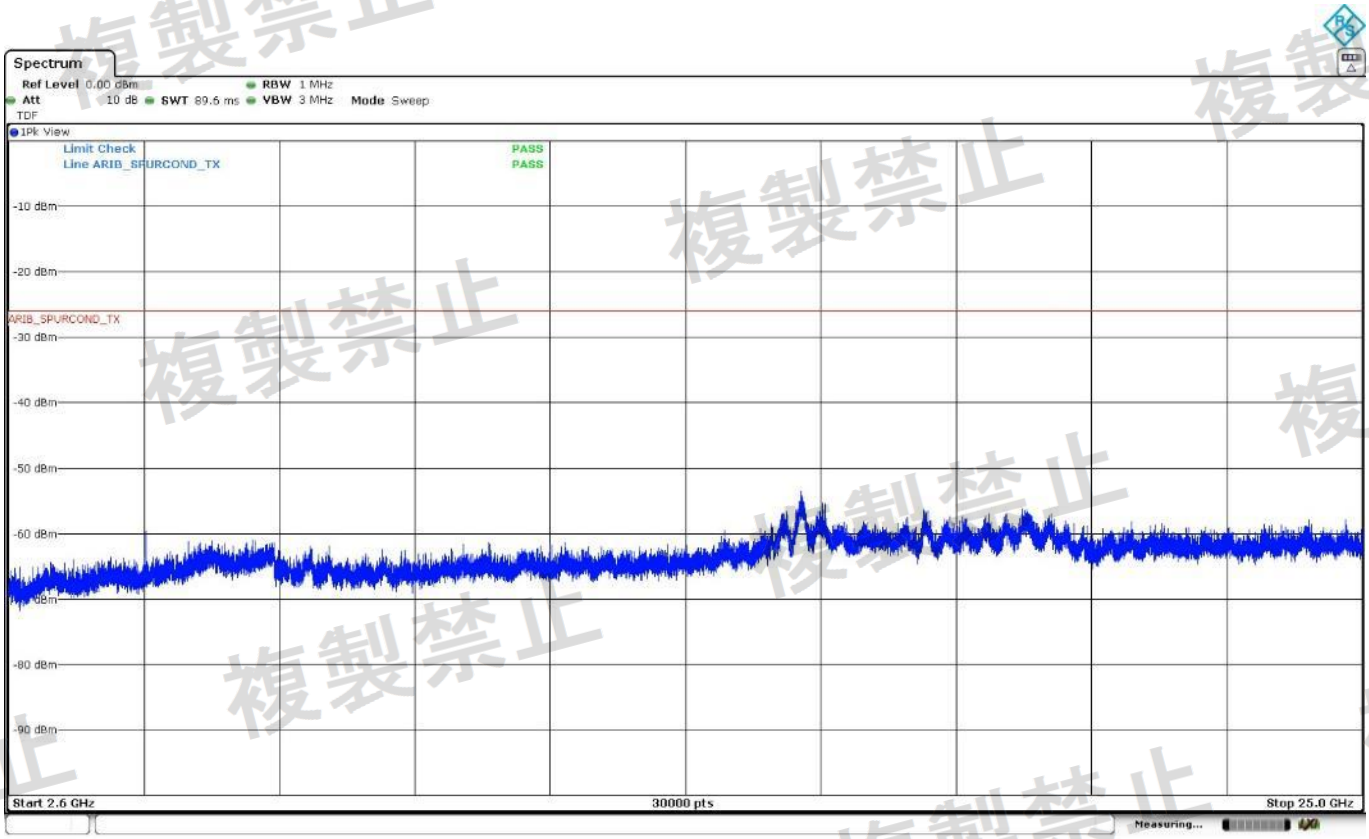

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- MIDDLE CHANNEL:

Frequency range 9 kHz - 25 GHz:

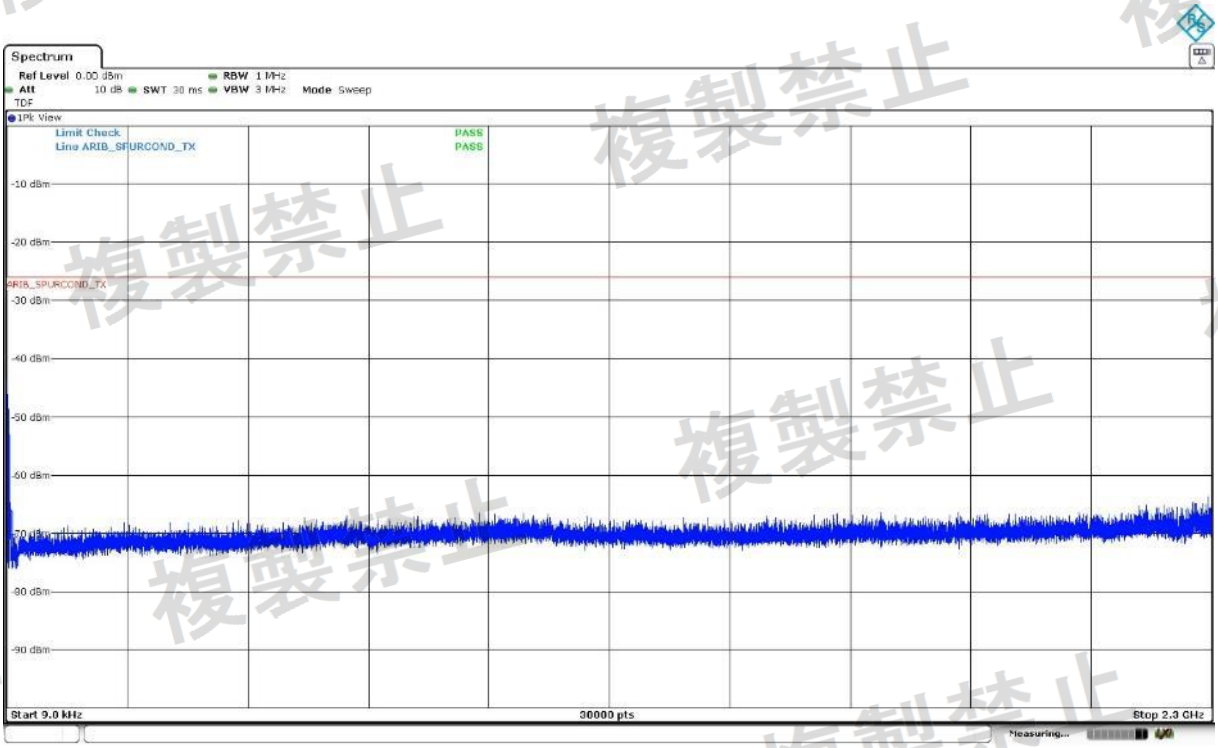


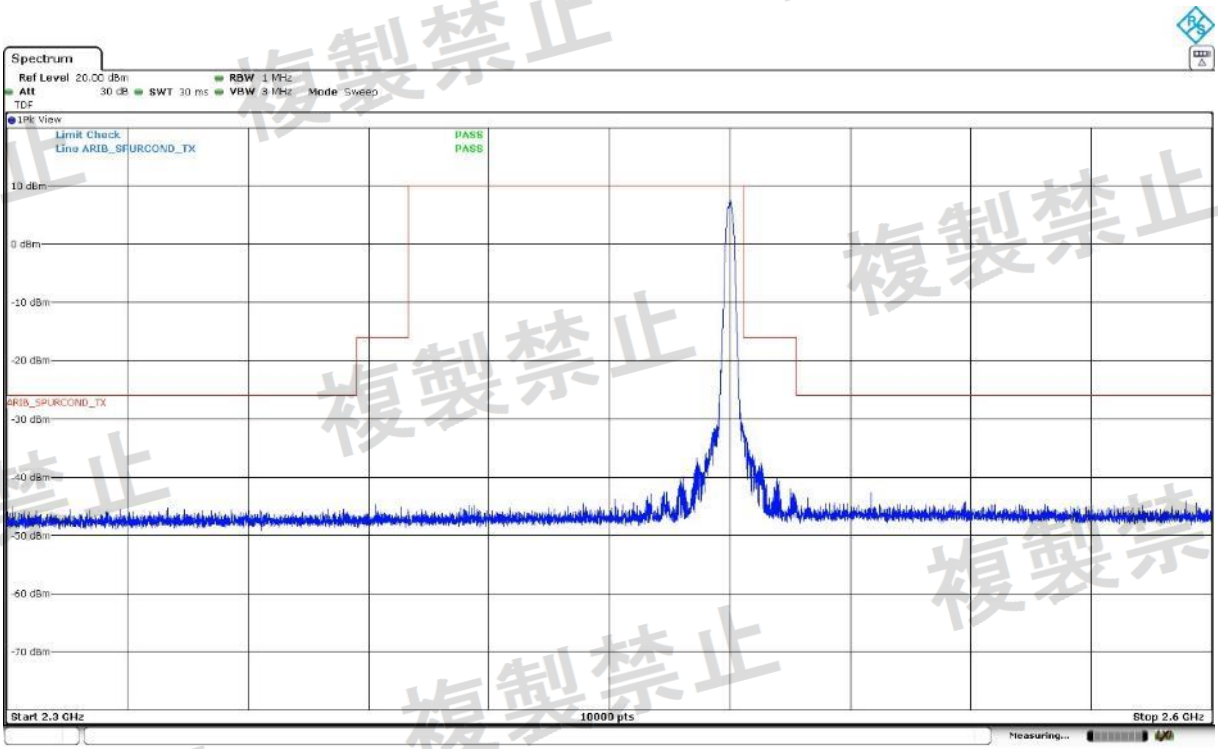


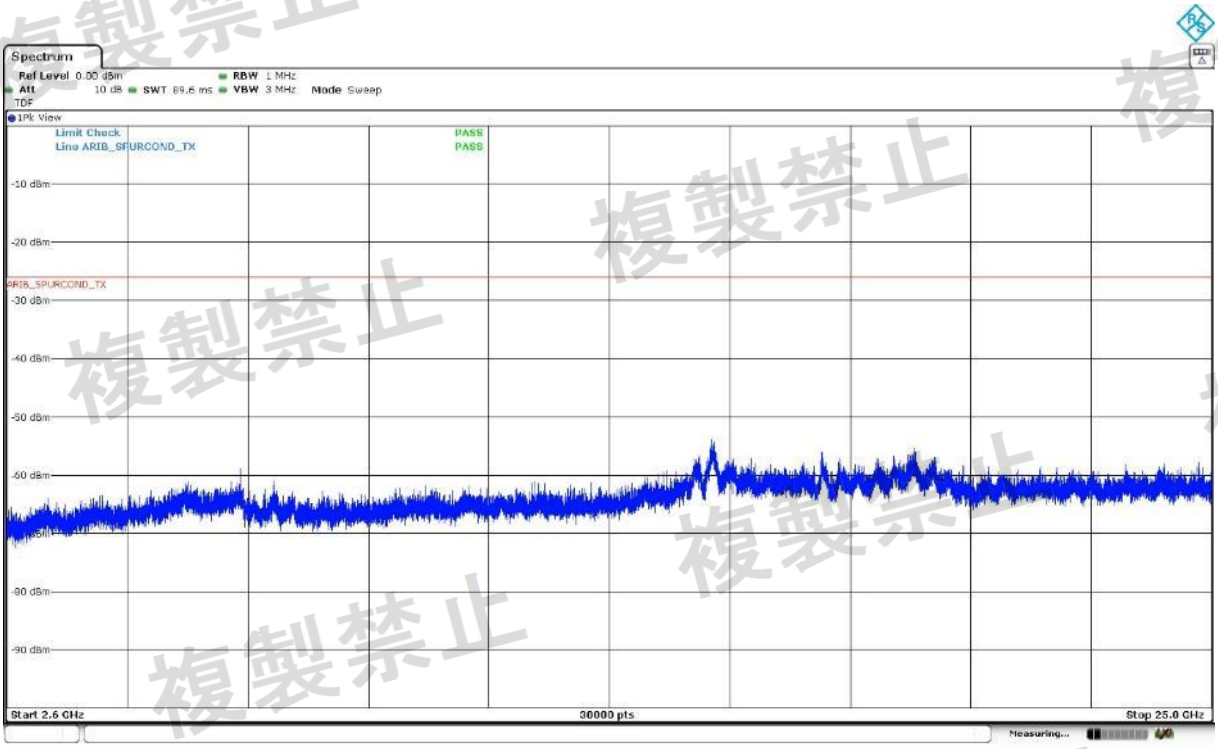

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- HIGH CHANNEL:

Frequency range 9 kHz - 25 GHz:






Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

Vmax:

- LOW CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty <± 2.77 dB

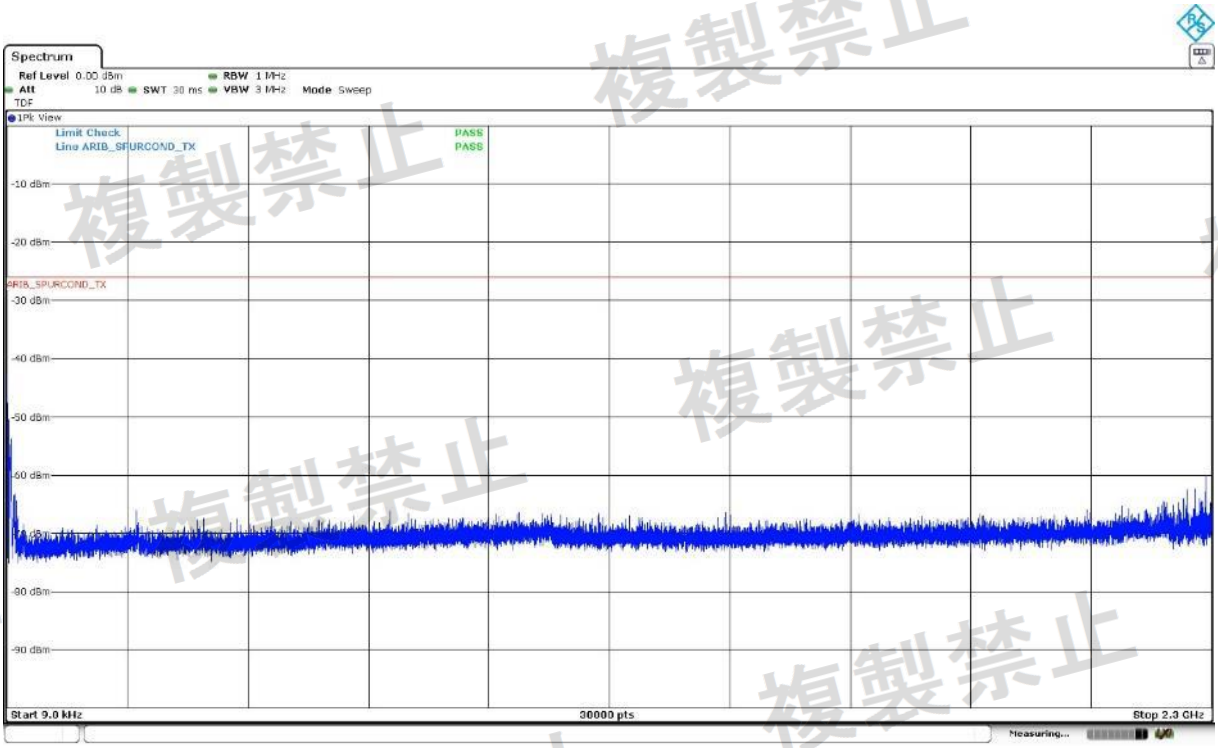
Verdict:

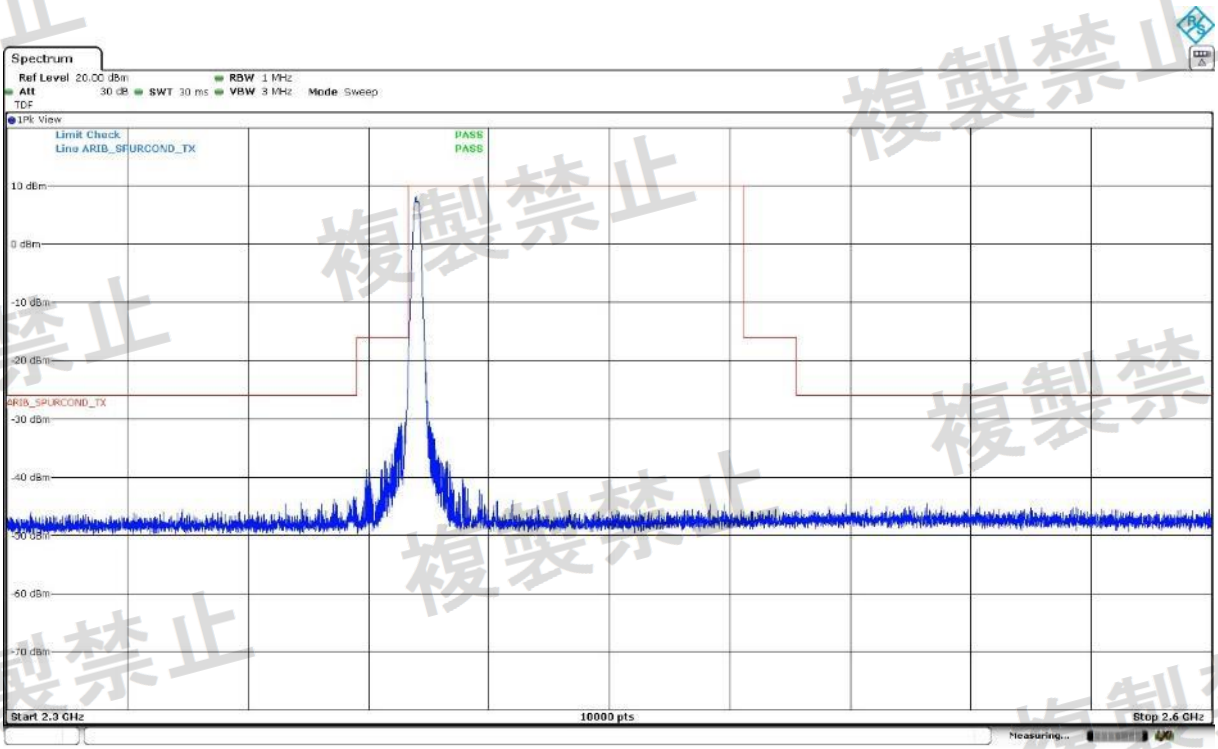
PASS

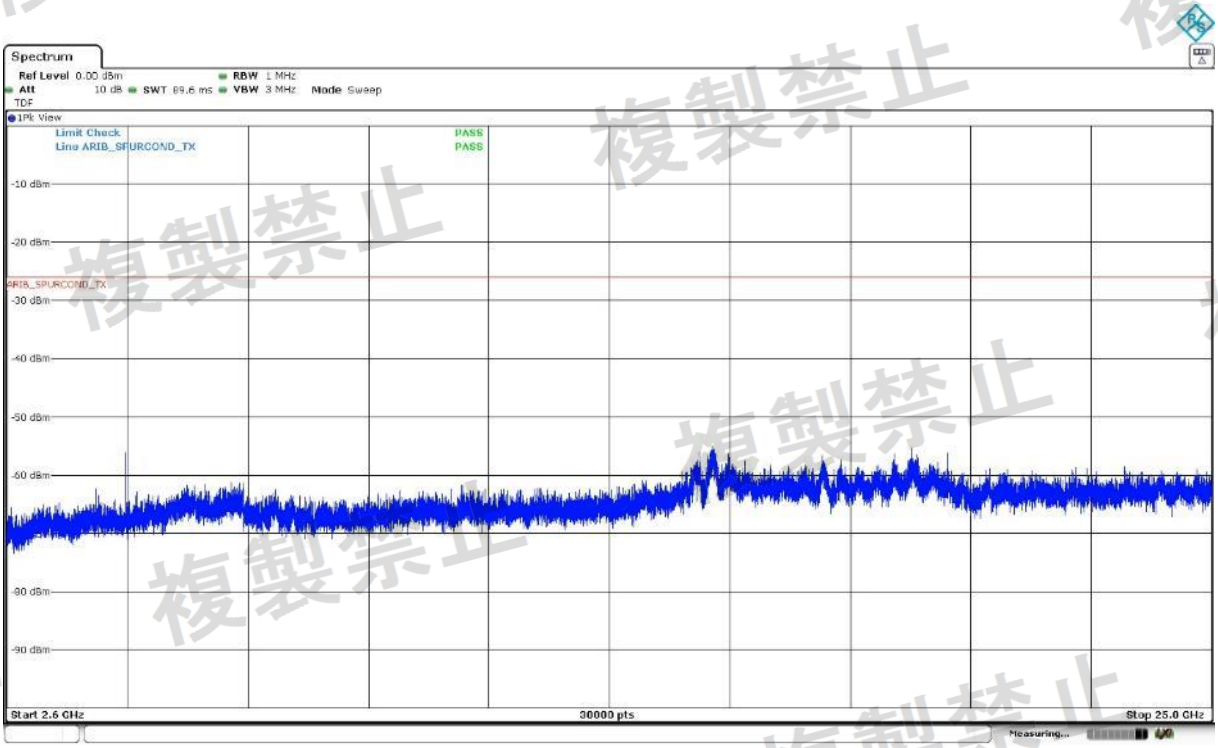
Vmax:

- LOW CHANNEL:

Frequency range 9 kHz - 25 GHz:

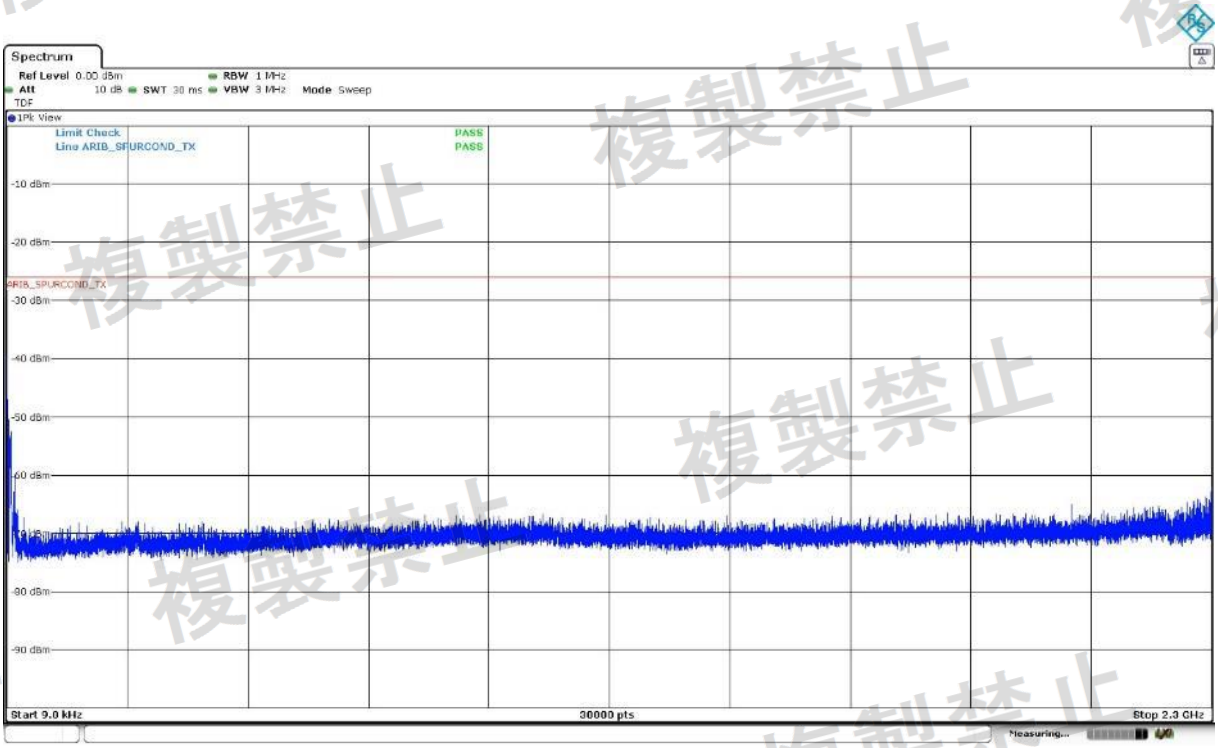


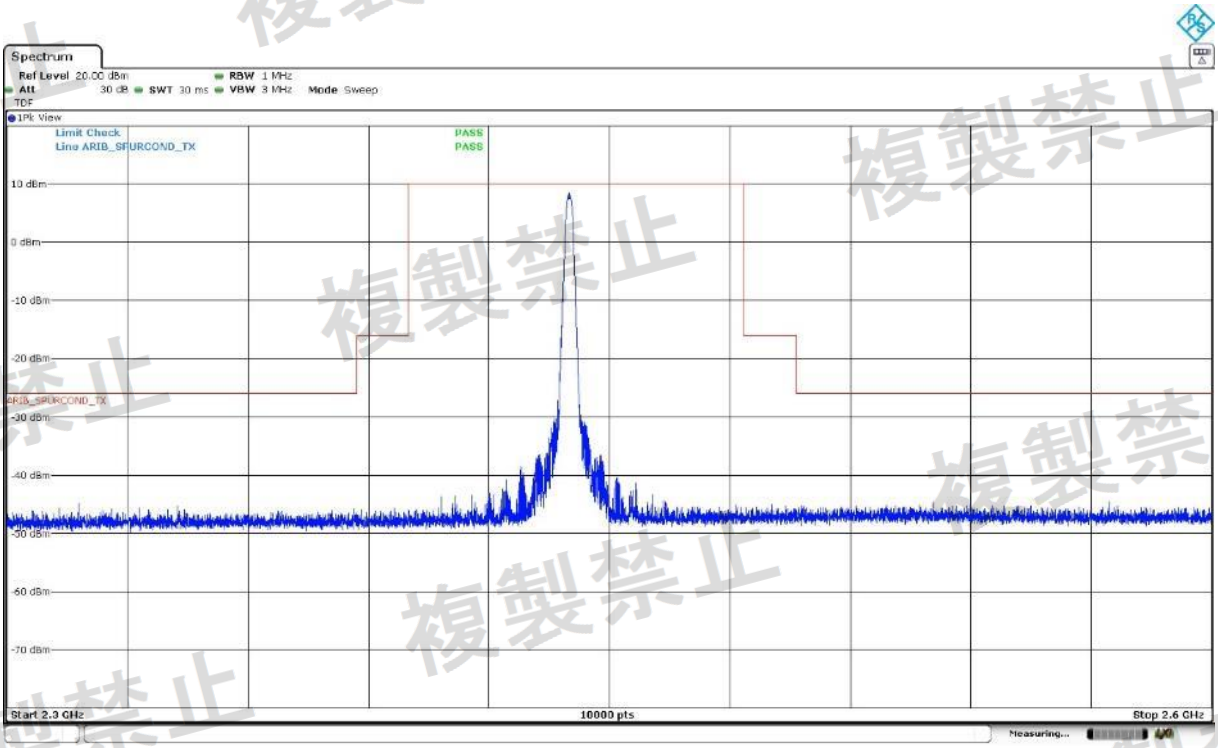


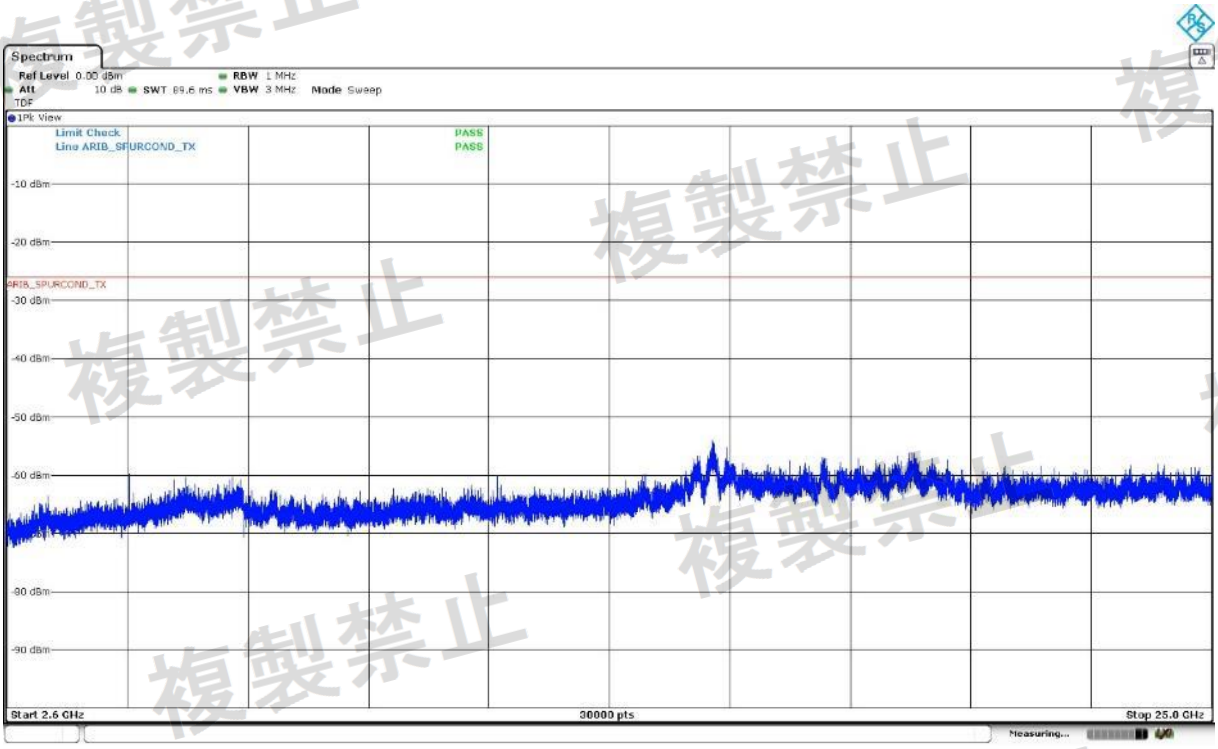

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB
SWT 88.6 ms
VBW 3 MHz
Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- MIDDLE CHANNEL:

Frequency range 9 kHz - 25 GHz:

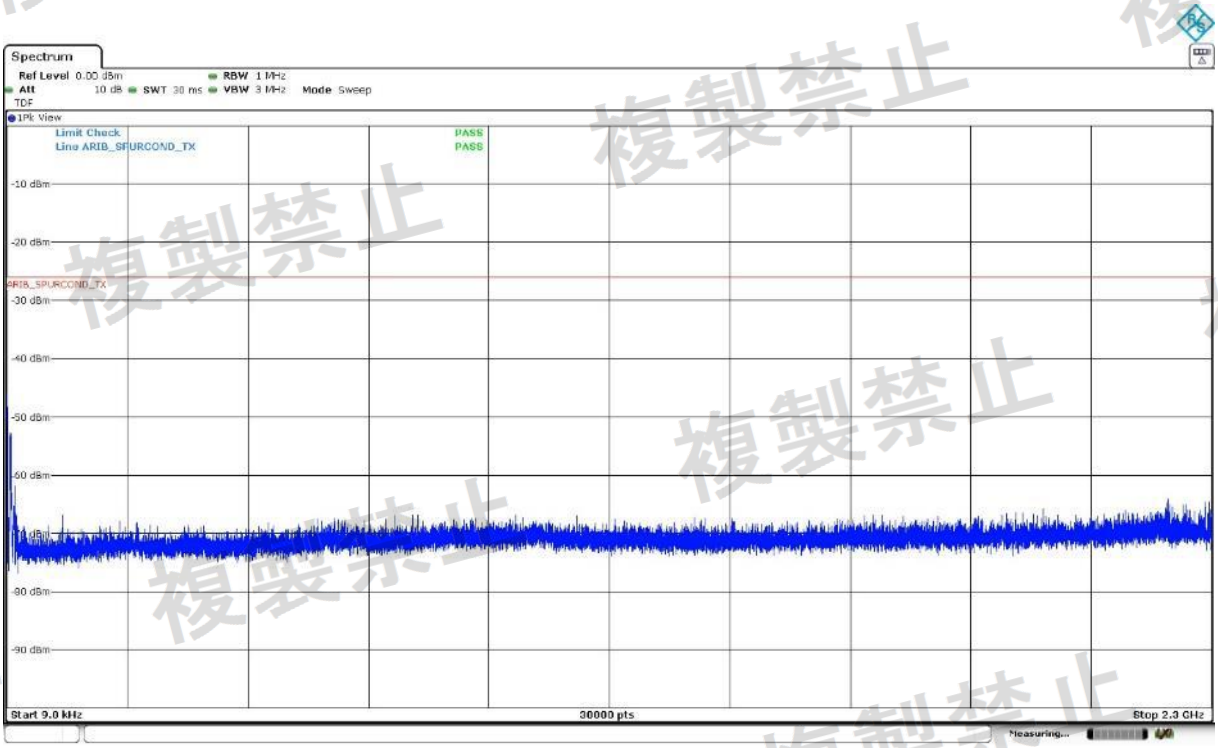


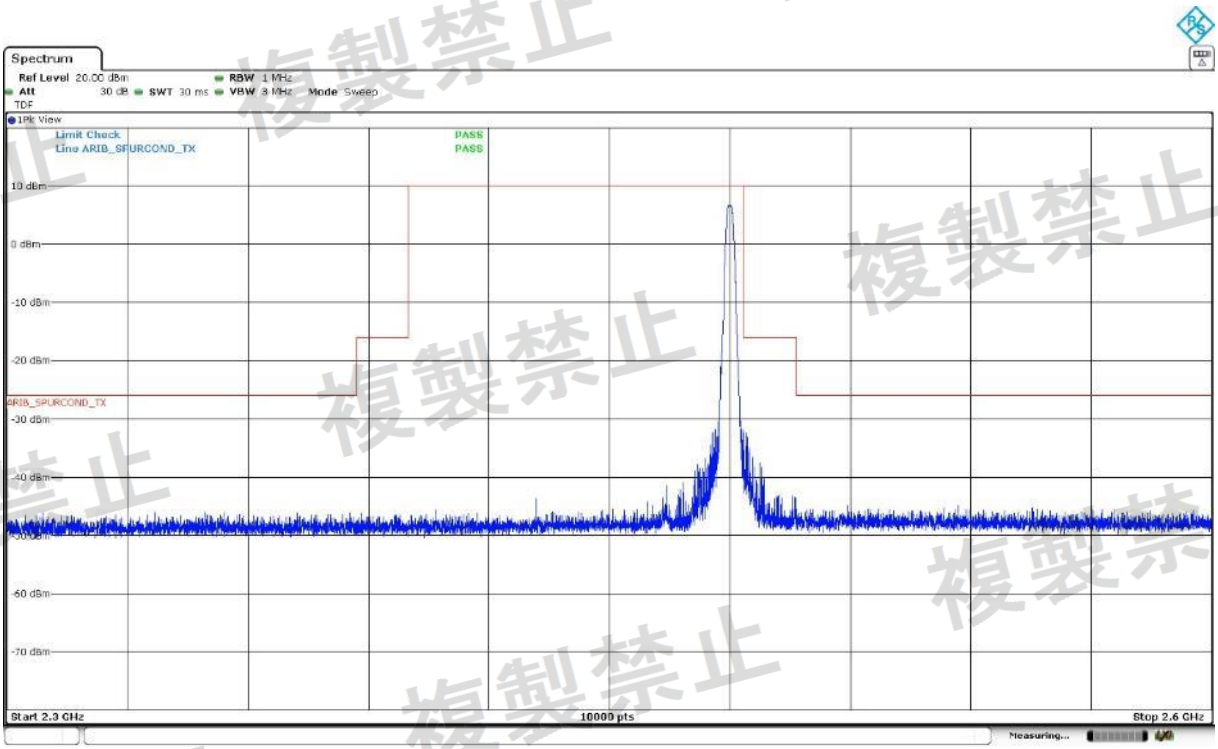


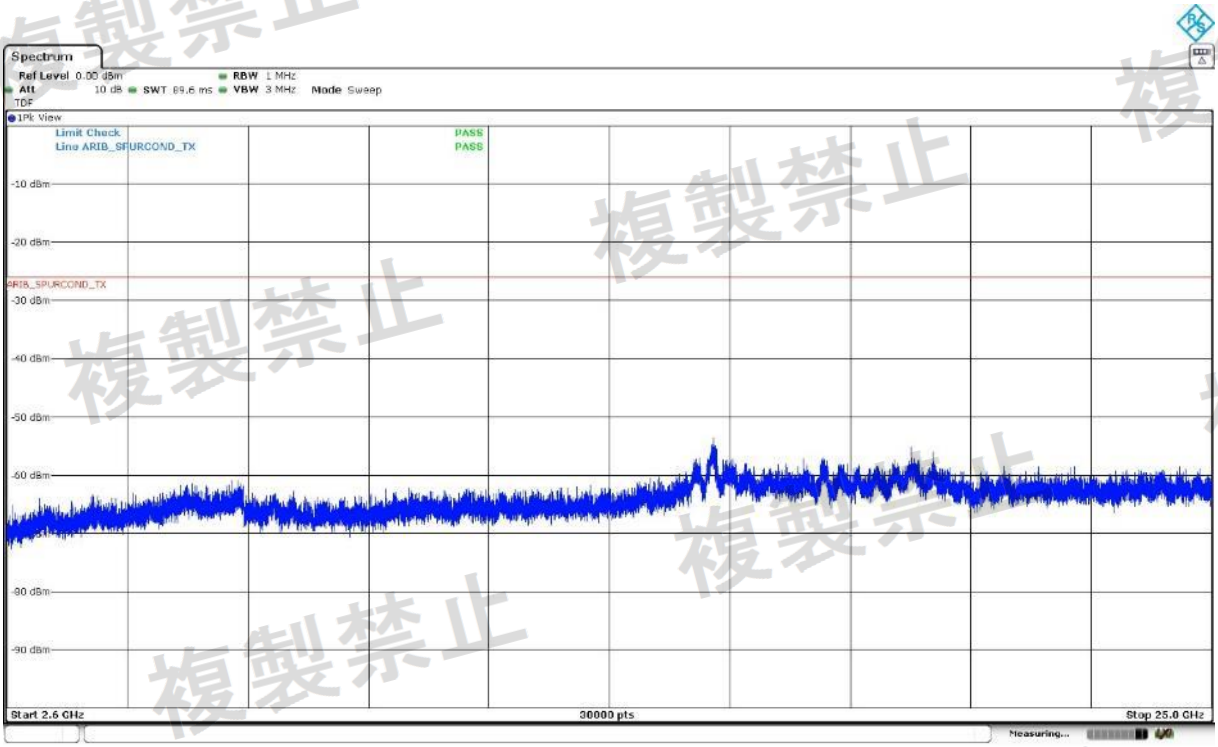

Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

- HIGH CHANNEL:

Frequency range 9 kHz - 25 GHz:






Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 89.6 ms VBW 3 MHz Mode Sweep
TDF
1Pk View
Limit Check PASS
Line ARIB_SPURCOND_TX PASS
-10 dBm
-20 dBm
ARIB_SPURCOND_TX
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
Start 2.6 GHz
30000 pts
Stop 25.0 GHz
Measuring...

Article 24.2. Receiving equipment. Limit on secondary radiated emissions

Limits:

The limit on secondary emissions radiated from the receiving equipment within which the function of other radio equipment will not be impaired shall be, in terms of the power of a dummy antenna circuit that has the same electrical constant as the receiving antenna, 4 nW (-54 dBm) or less at a frequency below 1 GHz and 20 nW (-47 dBm) or less at a frequency of 1 GHz or higher as measured using the circuit.

Results:

Vnom:

- LOW CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty <± 2.94 dB

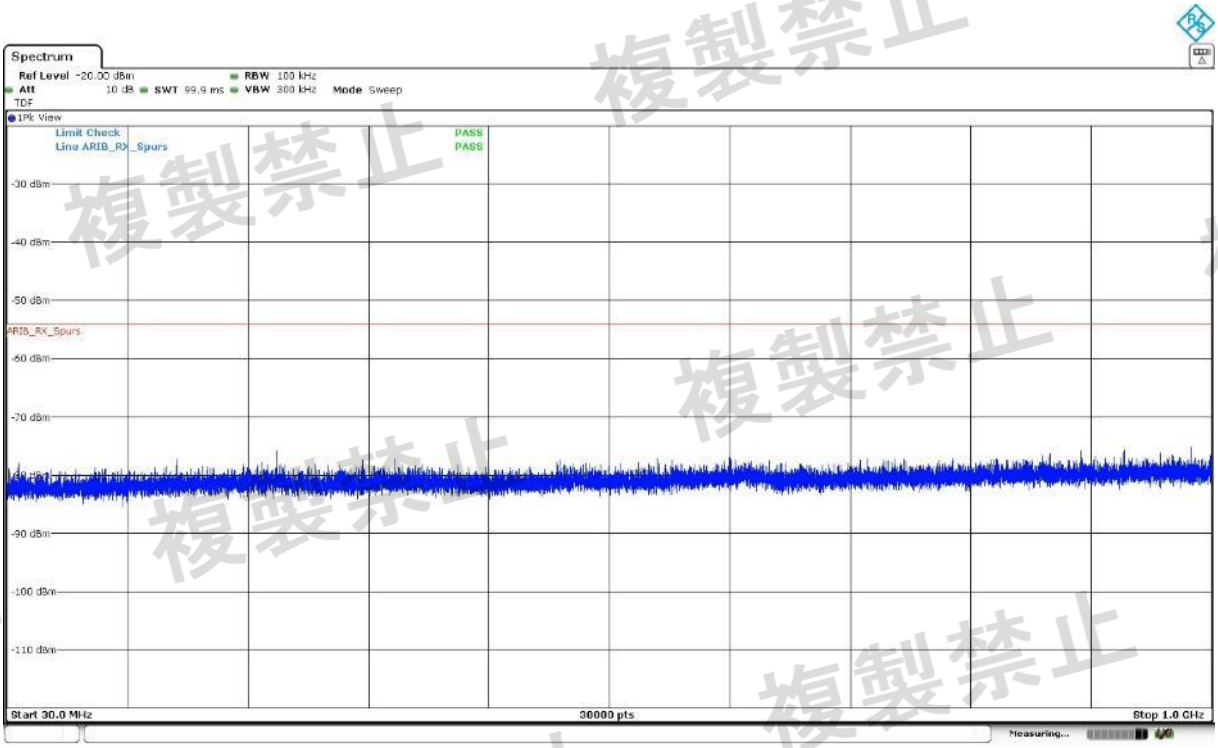
Verdict:

PASS

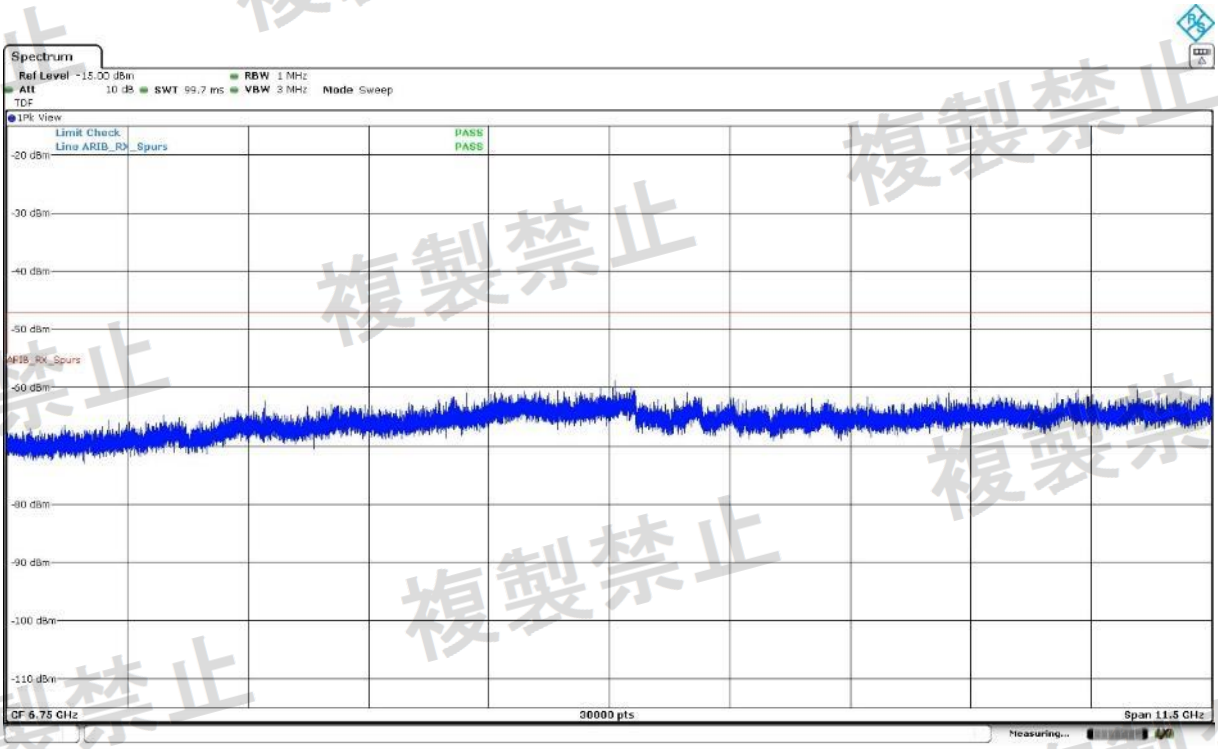
Vnom:

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

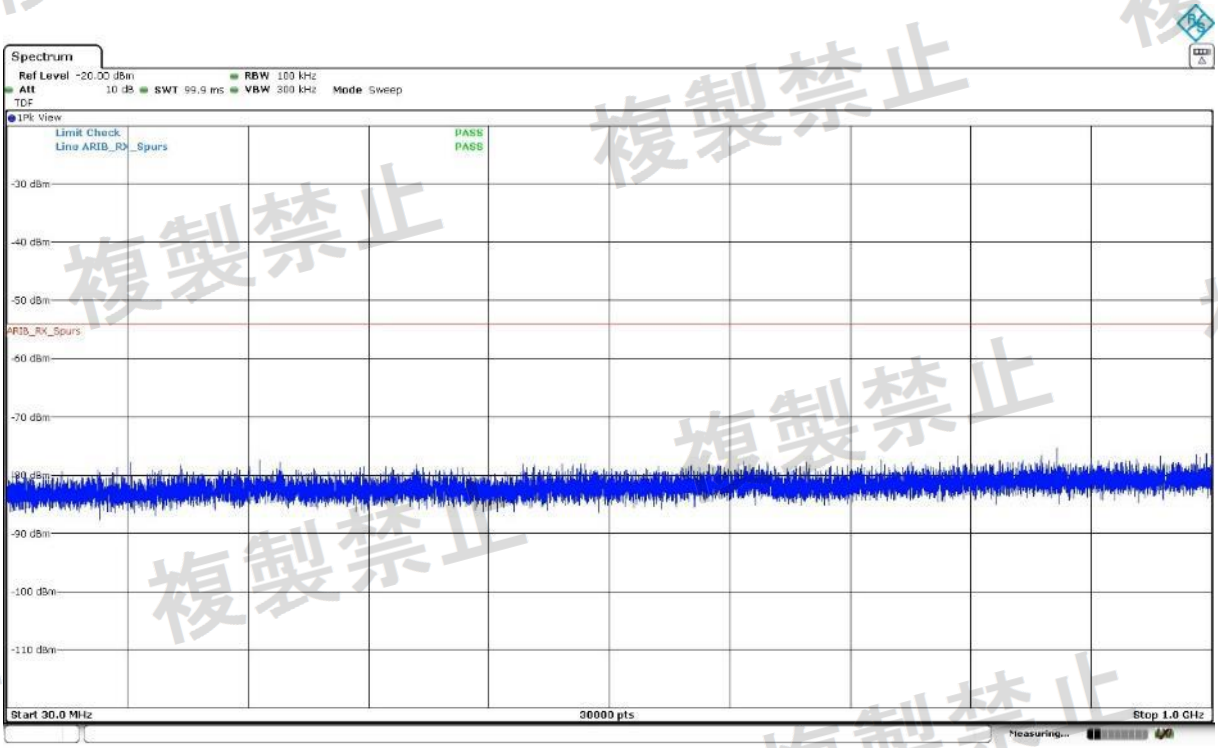


Frequency range 1 – 12.75 GHz:

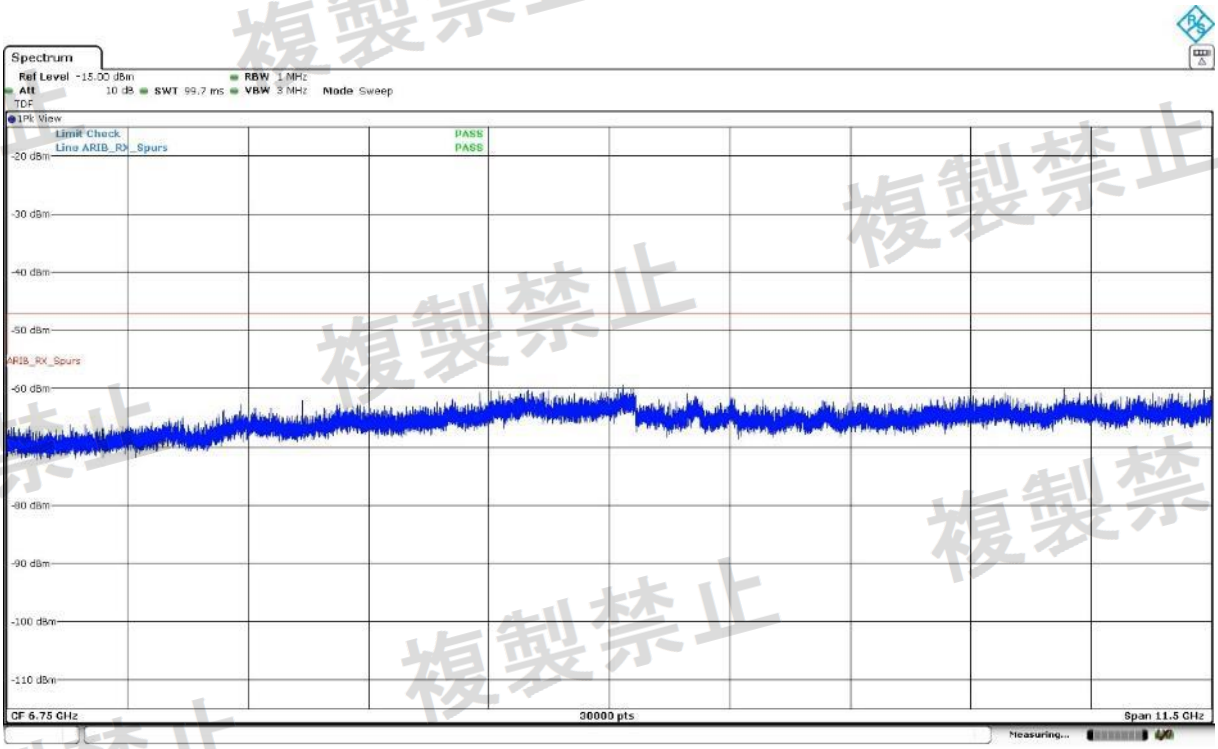


- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

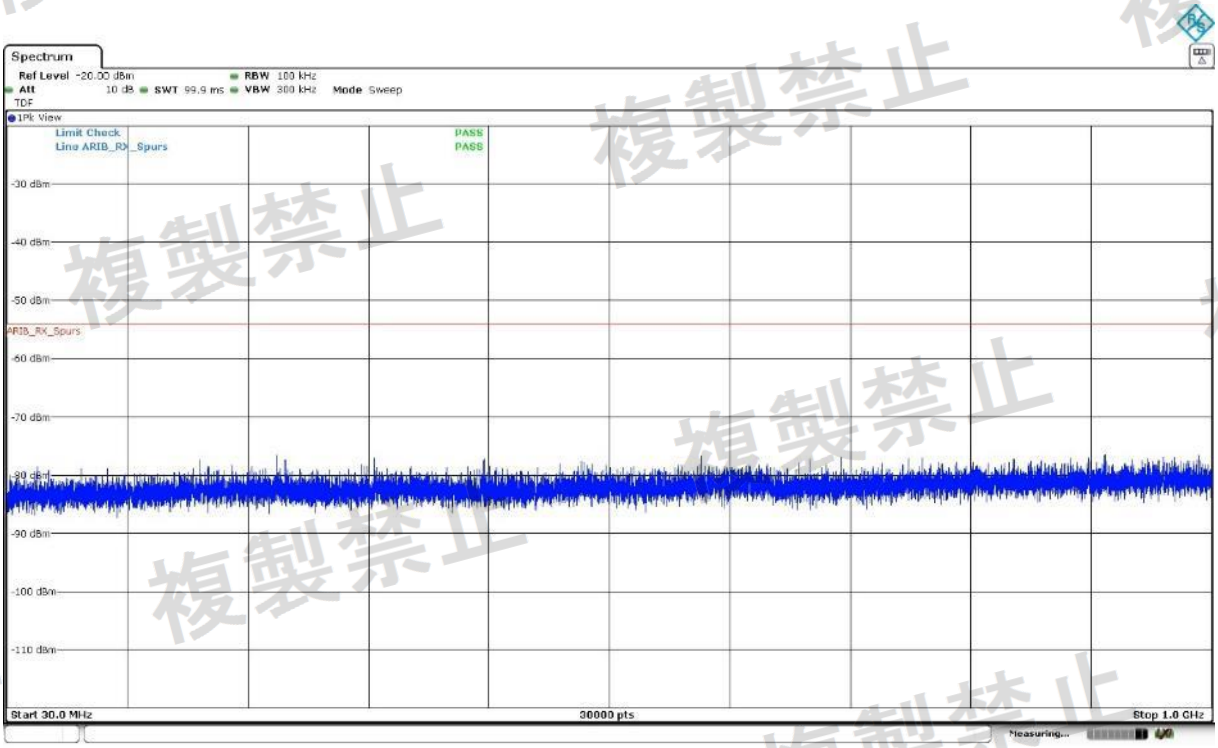


Frequency range 1 – 12.75 GHz:

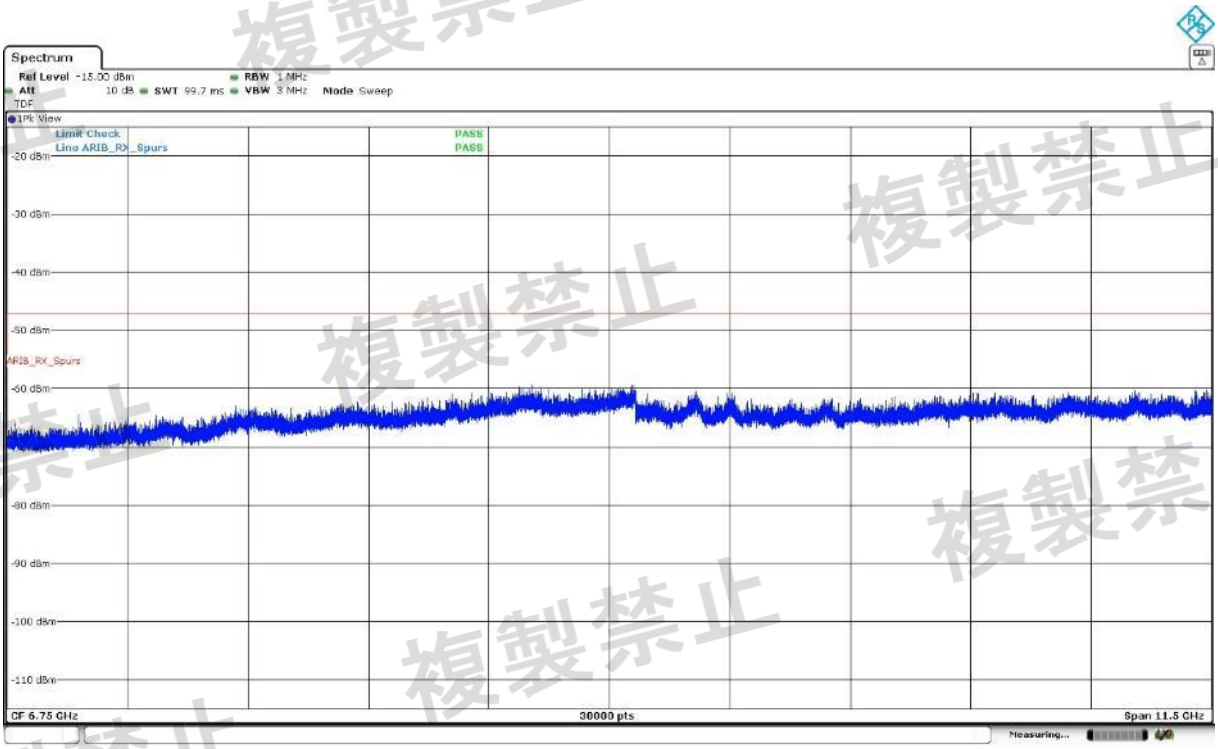


- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:



Frequency range 1 – 12.75 GHz:



Vmin:

- LOW CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty <± 2.94 dB

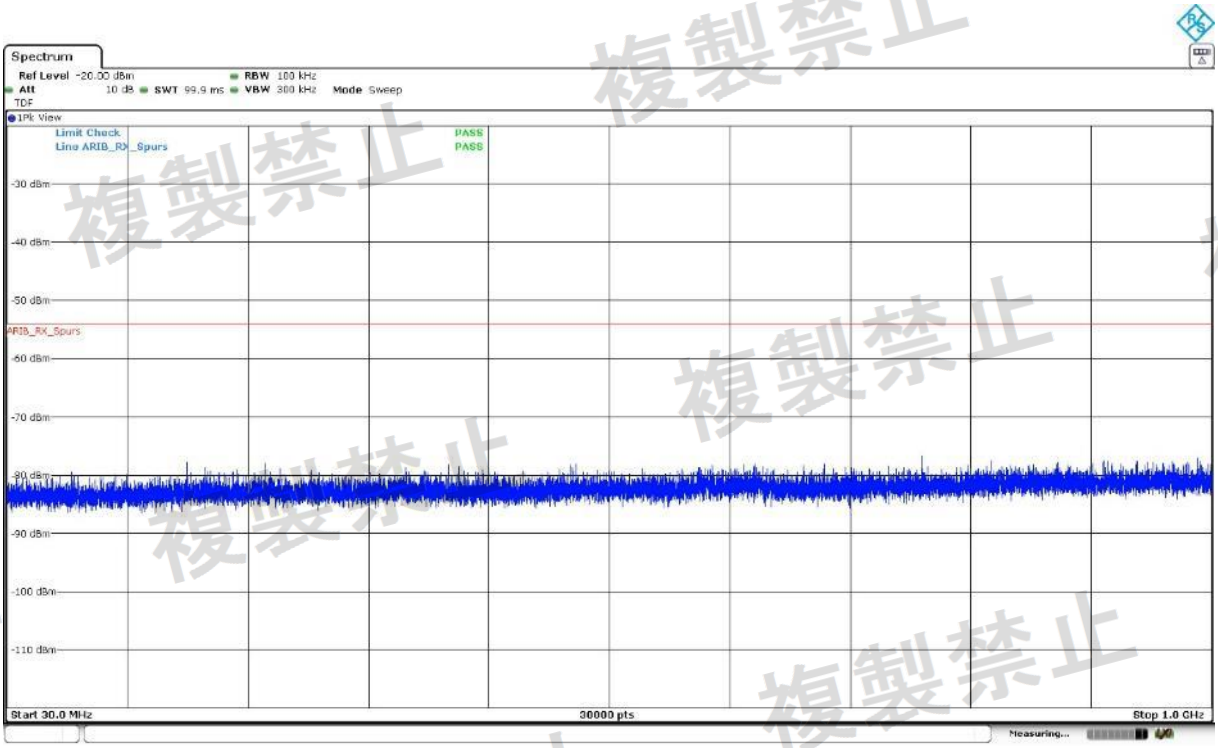
Verdict:

PASS

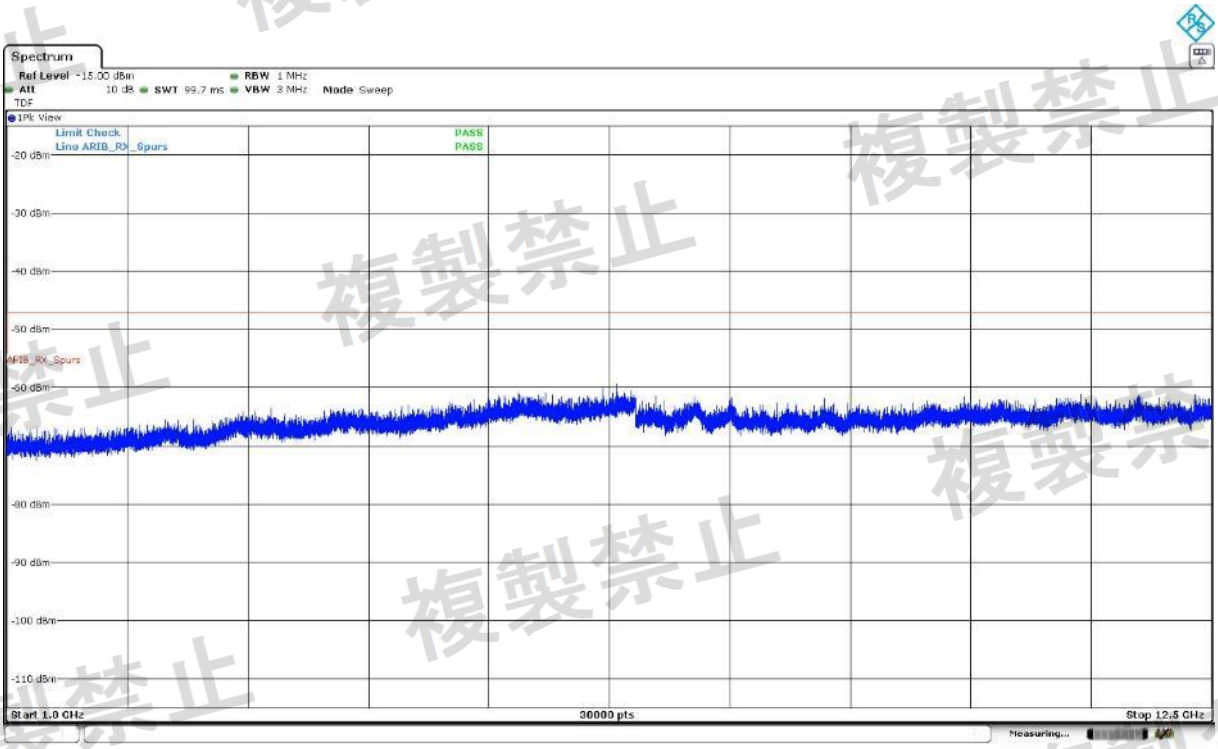
Vmin:

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

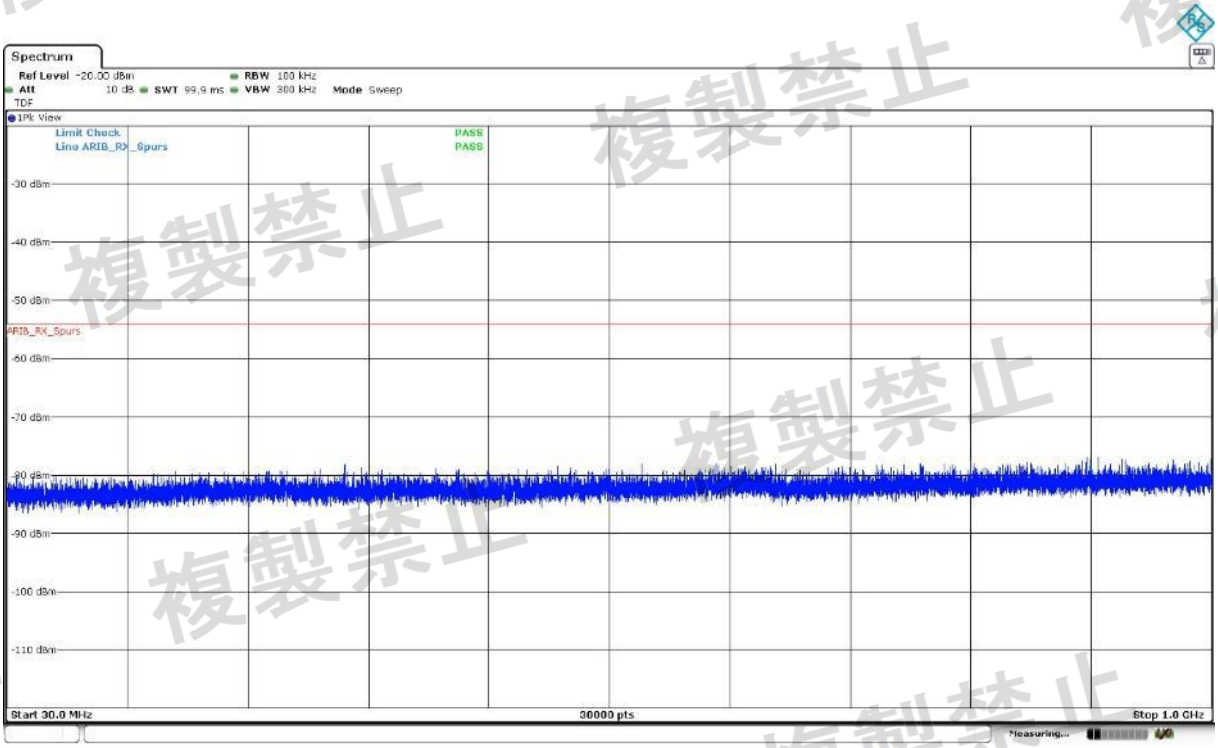


Frequency range 1 – 12.75 GHz:

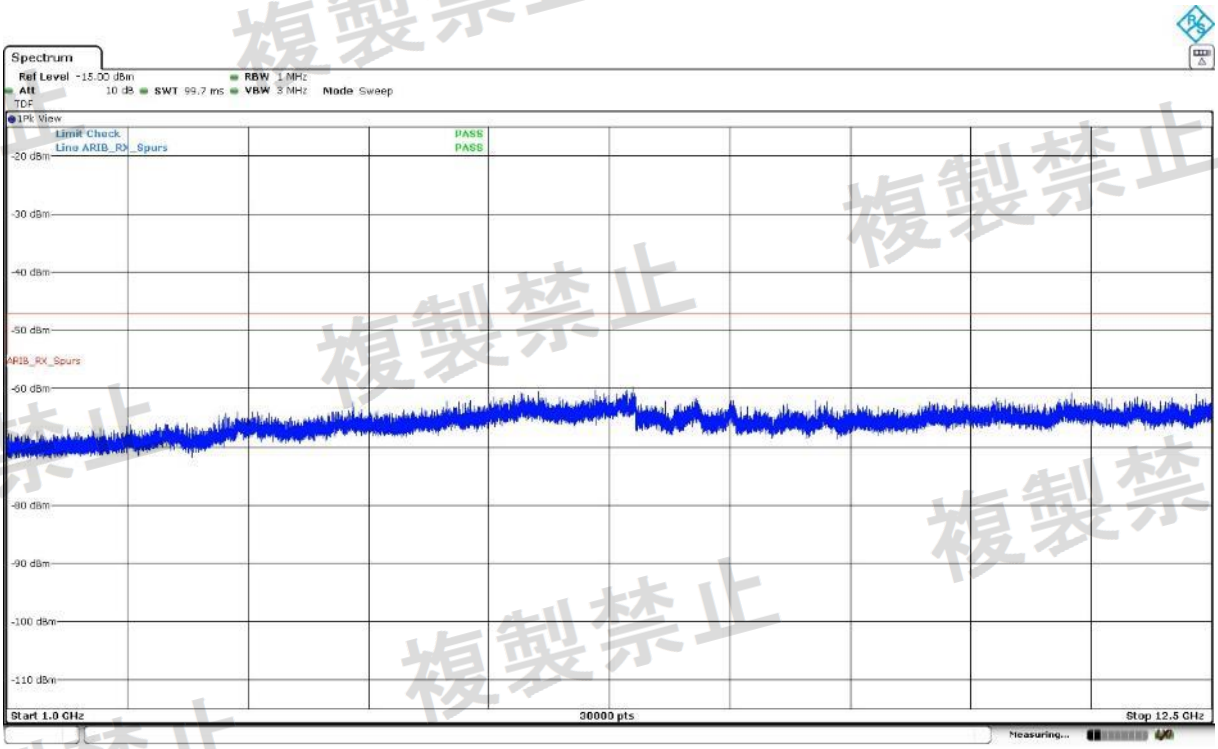


- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

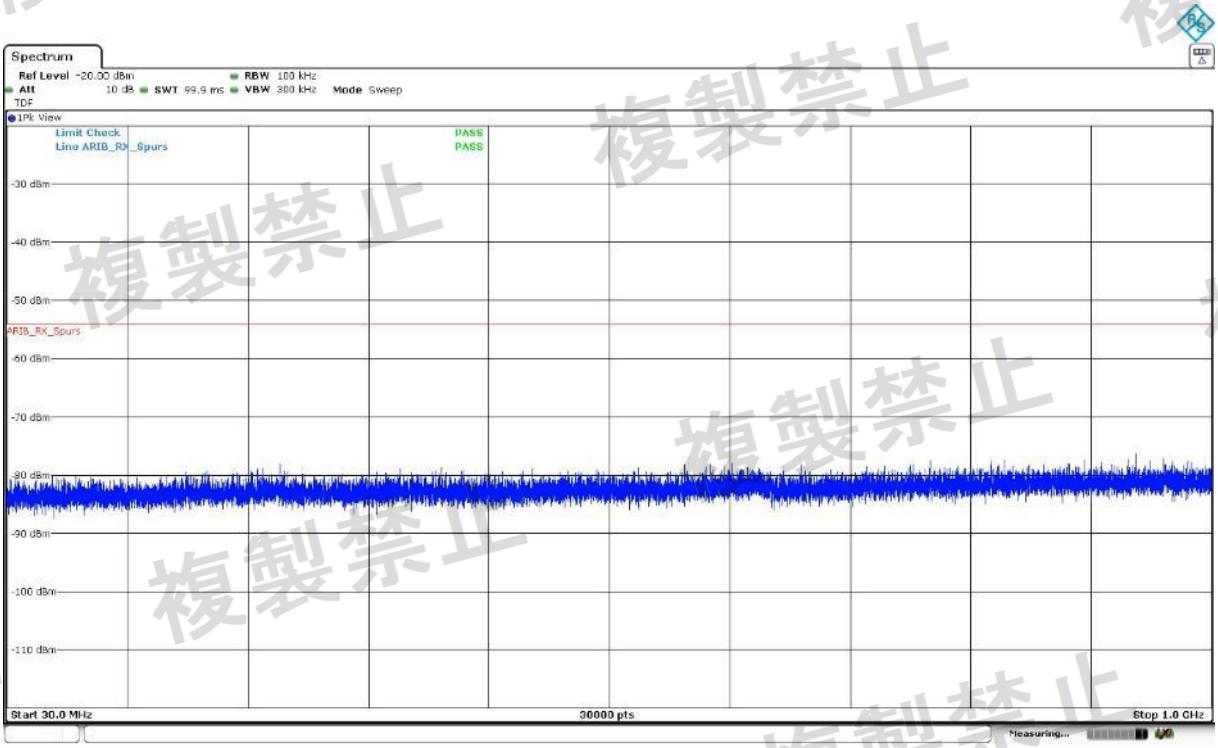


Frequency range 1 – 12.75 GHz:

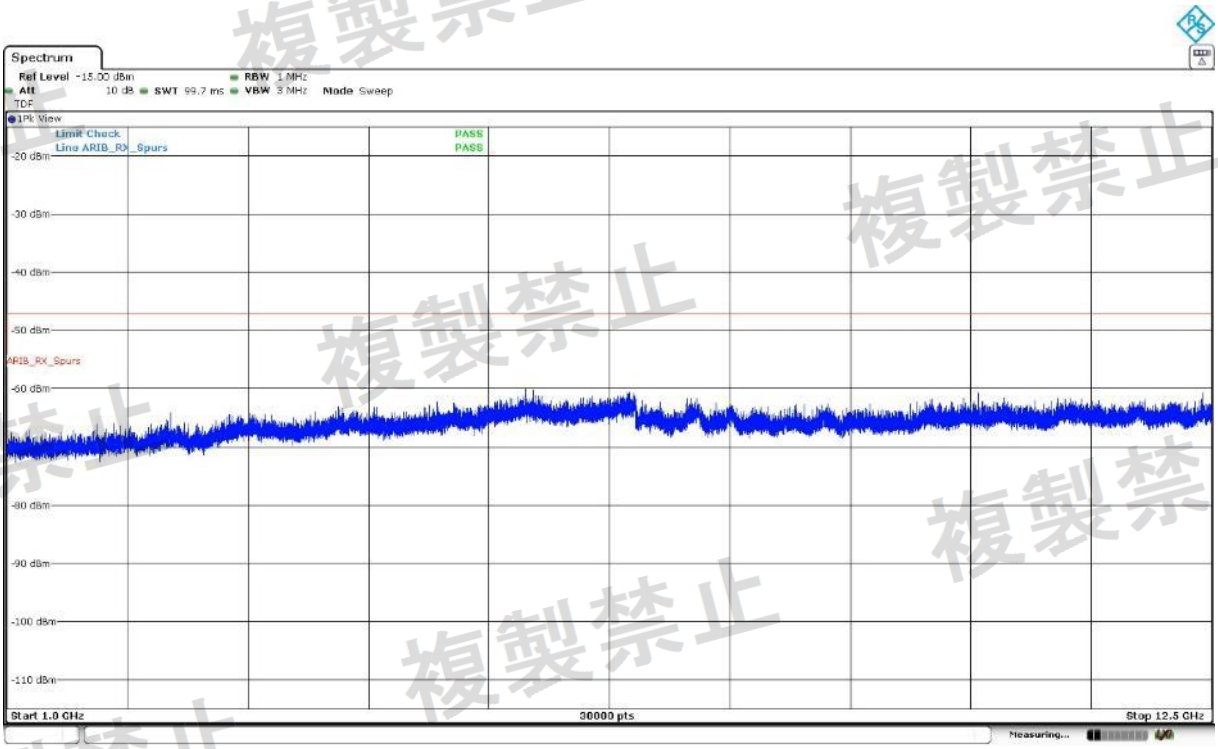


- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:



Frequency range 1 – 12.75 GHz:



Vmax:

- LOW CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- MIDDLE CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

- HIGH CHANNEL:

  No spurious frequencies detected at less than 10 dB below the limit.

Measurement uncertainty <± 2.94 dB

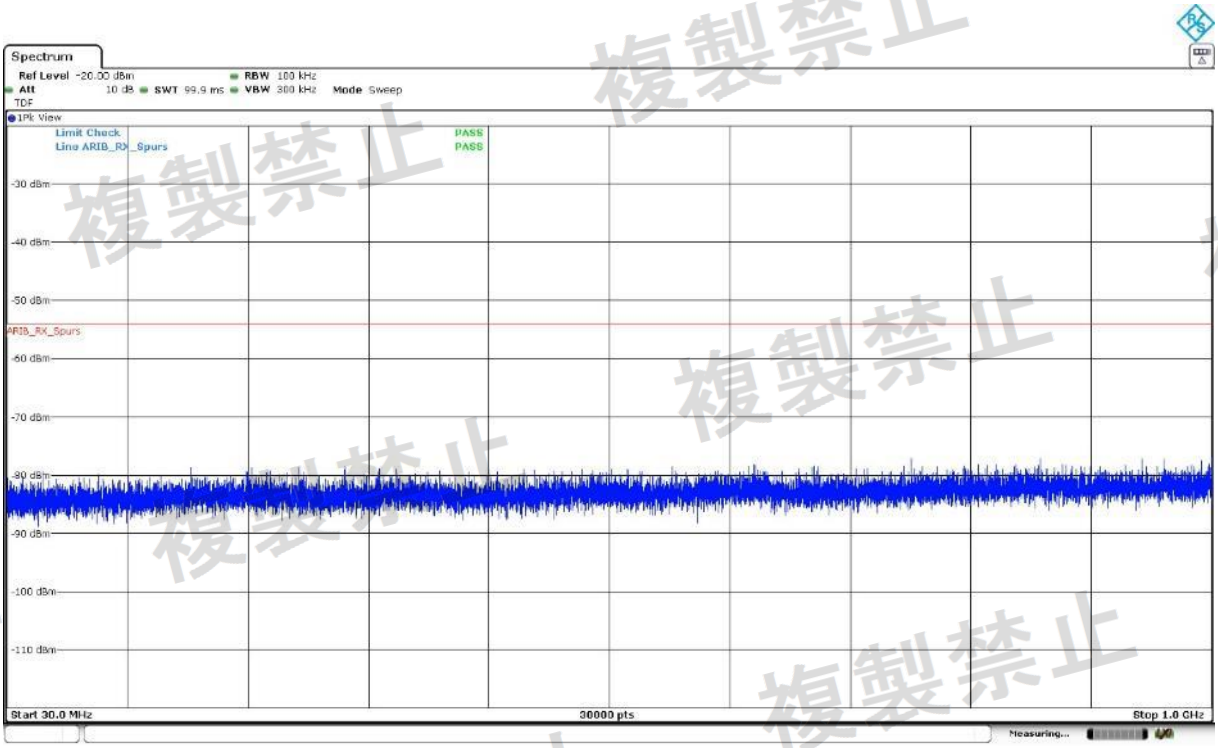
Verdict:

PASS

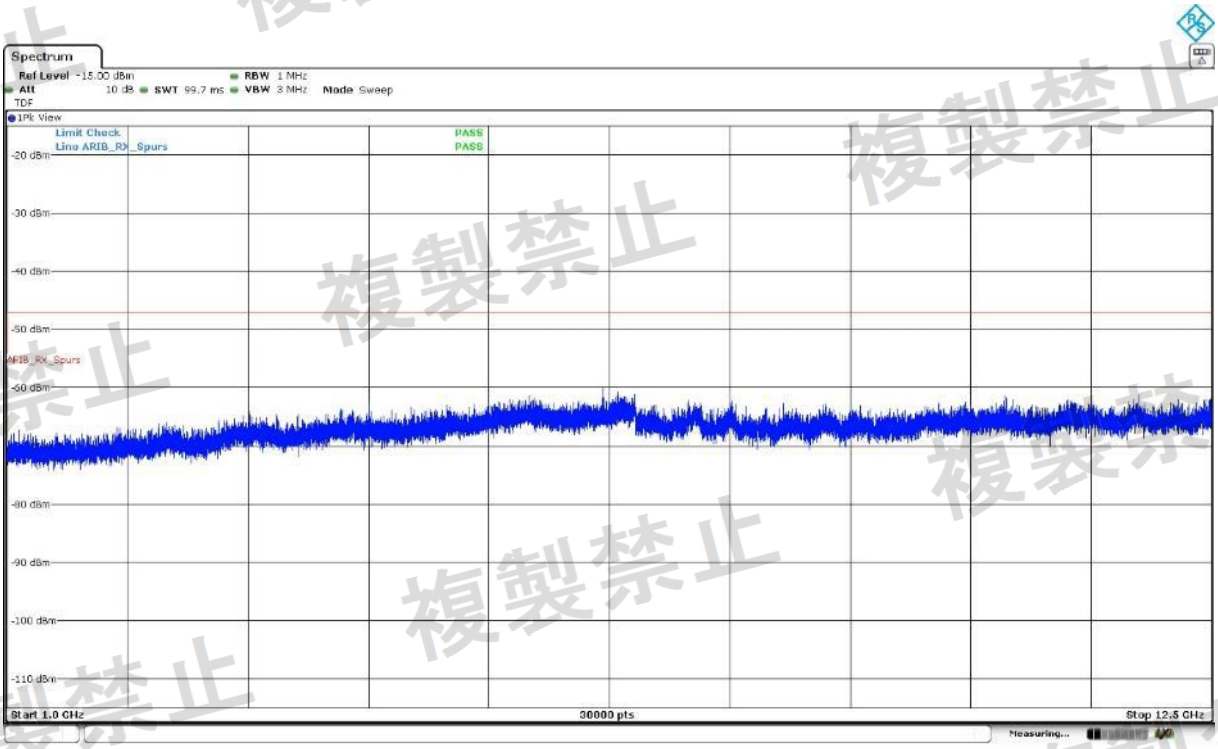
Vmax:

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

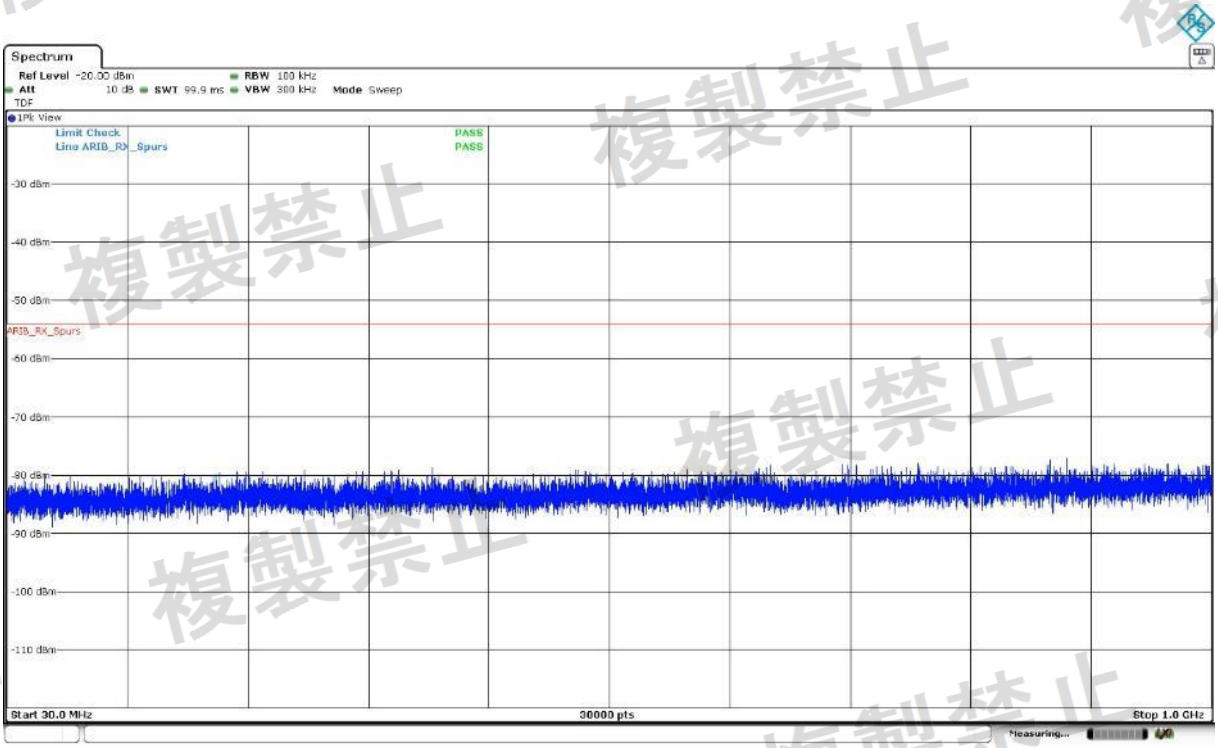


Frequency range 1 – 12.75 GHz:

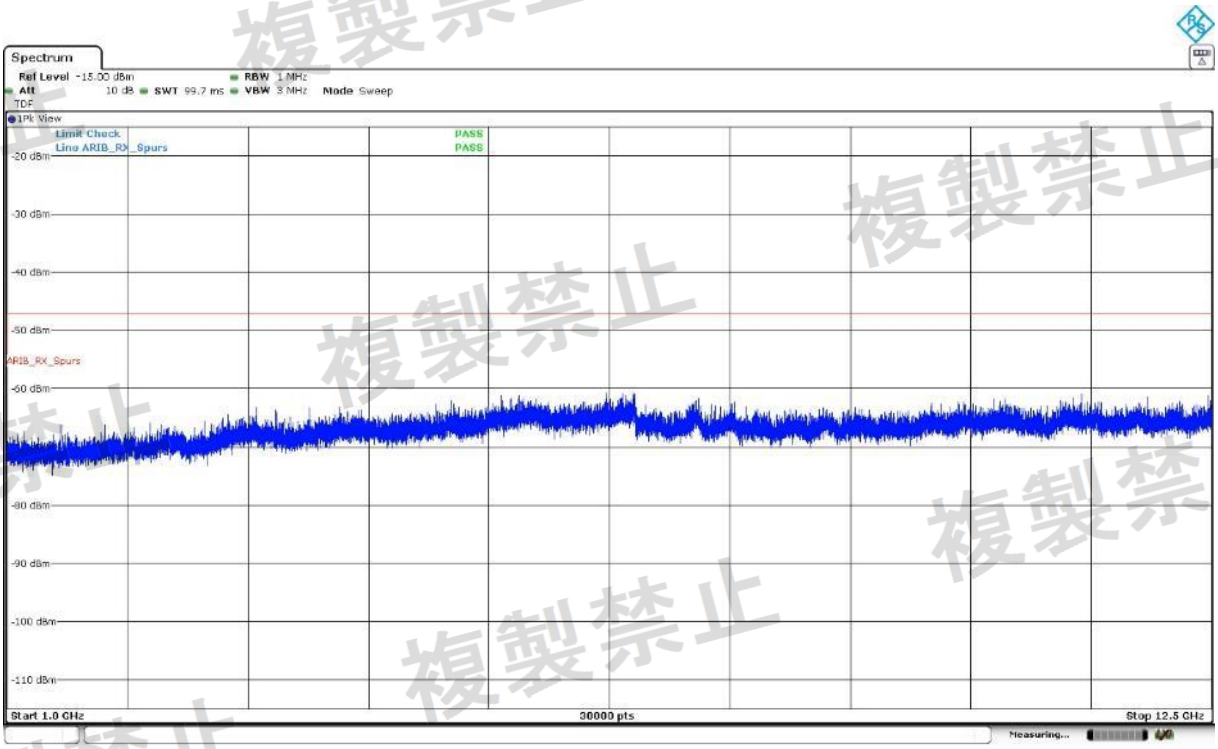


- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

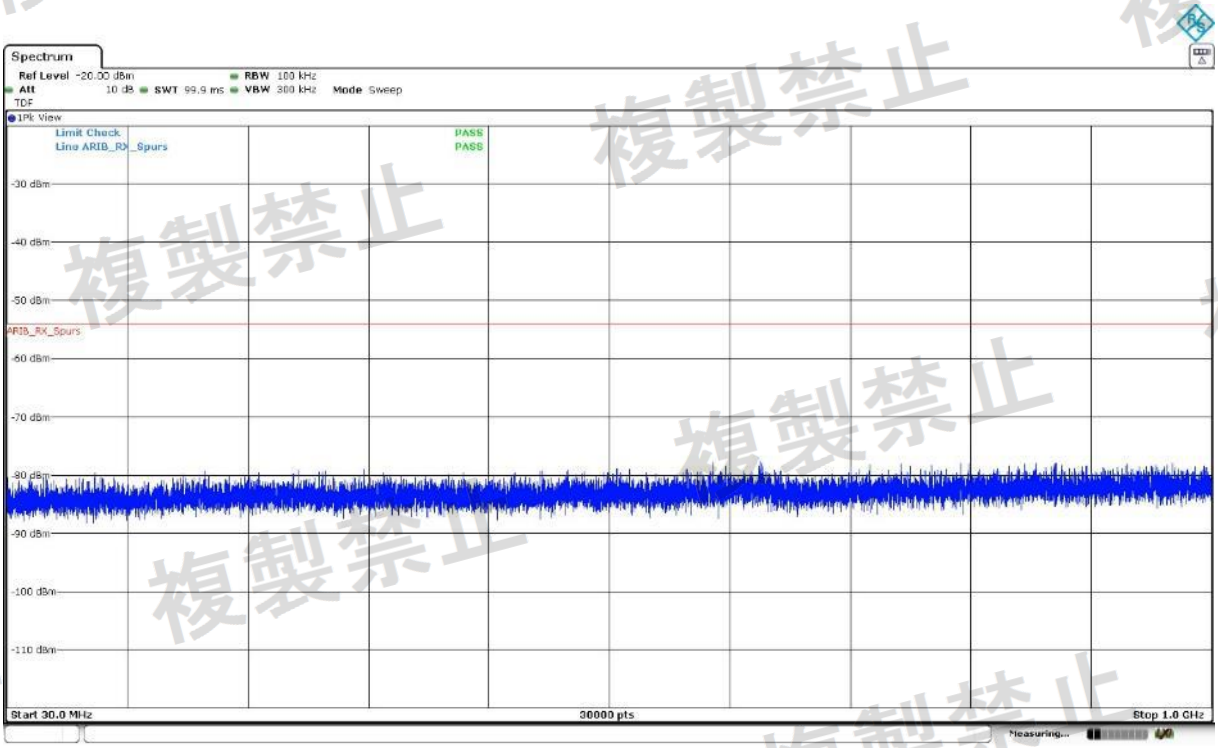


Frequency range 1 – 12.75 GHz:

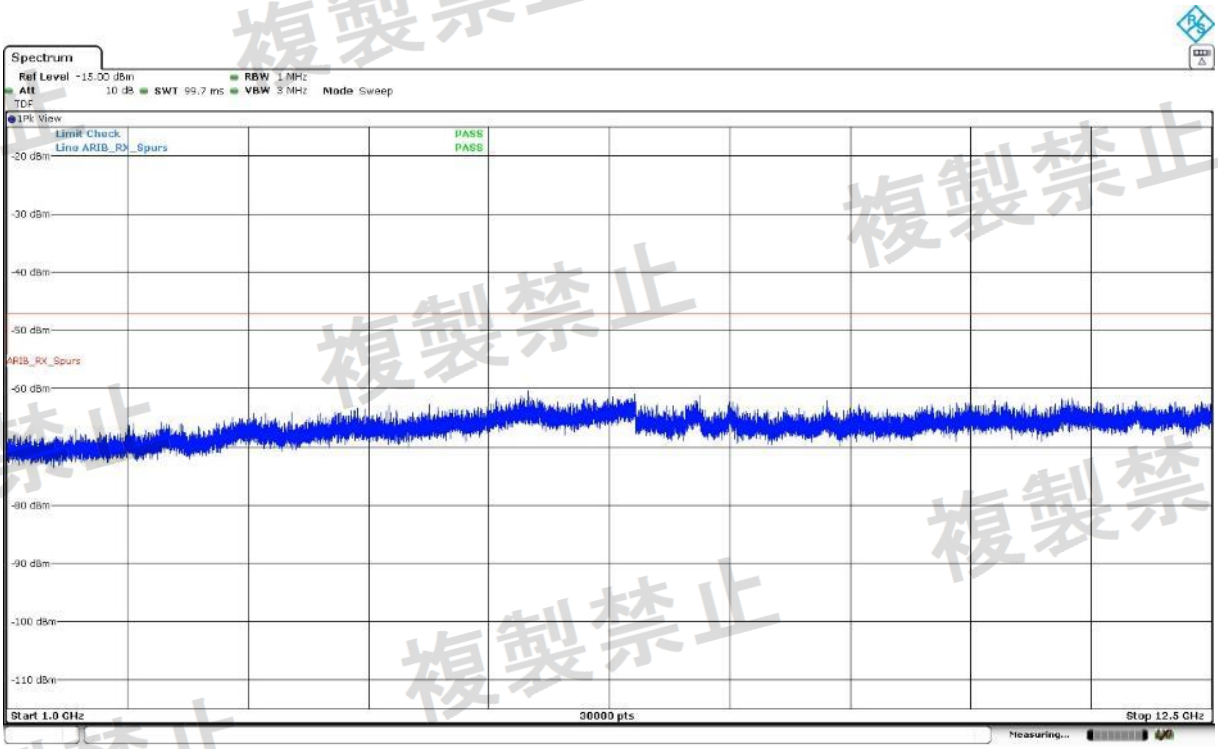


- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:



Frequency range 1 – 12.75 GHz:



Article 49-20. Antenna. Antenna gain

Limits:

a: The absolute gain of the transmitting antenna shall be 12.14 dB or less. However, when the equivalent isotropic radiated power EIRP (equivalent isotropic radiated power in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems) is equal to or less than the value obtained by applying an antenna power with the mean power of 10 mW with its absolute gain being 12.14 dB, the shortage shall be compensated for by the gain of the transmitting antenna (Note that mean power is 10 mW in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems; however, mean power of 3 mW in the 1 MHz bandwidth is applied if the FH system, a hybrid system combining DS and FH systems, or a hybrid system combining FH and OFDM systems is employed and the frequency band of 2,427 - 2,470.75 MHz is used).

b: The Half-Power Beam width Angle HPBA (angle between two points at which radiated power becomes 1/2) of the transmitting antenna's horizontal and vertical planes shall not exceed the value as determined by the following formula:

$$HPBA \leq 360 / A \text{ [degrees]}$$

where constant A is equal to the value obtained by dividing the equivalent isotropic radiated power EIRP (equivalent isotropic radiated power in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems) by the value obtained by applying an antenna power with the mean power of 10 mW with its absolute gain being 2.14 dB, and shall be assumed to be 1 if it is less than 1 (Note that mean power is 10 mW in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems; however, mean power of 3 mW in the 1 MHz bandwidth is applied if the FH system, a hybrid system combining DS and FH systems, or a hybrid system combining the FH and OFDM systems is employed and the frequency band of 2,427 - 2,470.75 MHz is used).

Therefore

$$A = EIRP (mW) / (10 mW \times \text{absolute gain}) = EIRP (mW) / 16.37$$

Where absolute gain is the linear value corresponding to 2.14 dB = 1.637.

Results:

Maximum Declared Antenna Gain: -16 dBi

Vnom:

Channel	Radiated power EIRP (mW)	A = EIRP (mW) /16.37
Low (2402 MHz)	1.11	< 1
Middle (2440 MHz)	1.00	< 1
High (2480 MHz)	0.94	< 1

Since A is < 1, it is assumed to be 1, and therefore the half-power beam width must be 360º or less.

Vmin:

Channel	Radiated power EIRP (mW)	A = EIRP (mW) /16.37
Low (2402 MHz)	1.06	< 1
Middle (2440 MHz)	1.08	< 1
High (2480 MHz)	0.93	< 1

Since A is < 1, it is assumed to be 1, and therefore the half-power beam width must be 360º or less.

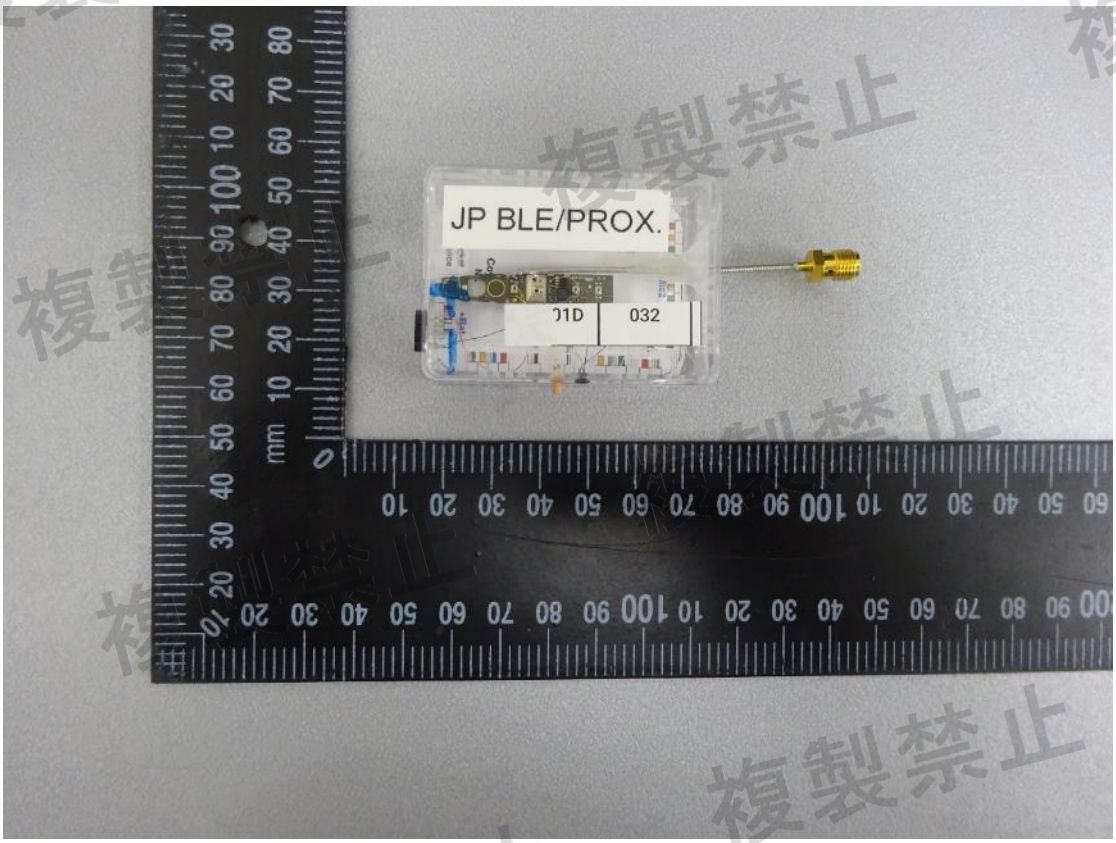
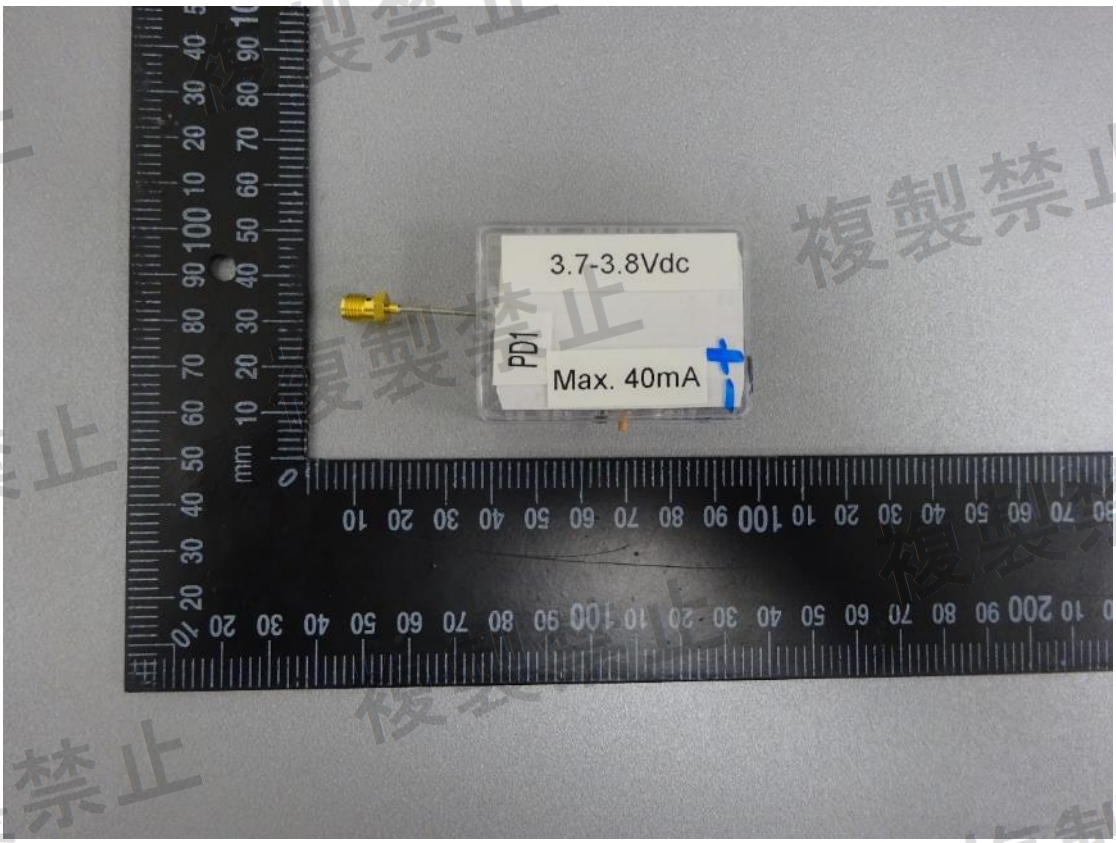
Vmax:

Channel	Radiated power EIRP (mW)	A = EIRP (mW) /16.37
Low (2402 MHz)	1.08	< 1
Middle (2440 MHz)	1.01	< 1
High (2480 MHz)	0.95	< 1

Since A is < 1, it is assumed to be 1, and therefore the half-power beam width must be 360º or less.

Verdict:

PASS

Appendix D: Photographs

EQUIPMENT VIEW FOR THE TESTS