



SGS-CSTC Standards Technical Services Co., Ltd.
Shenzhen Branch

Report No.: HR/2019/B00100103
 Page: 1 of 79

TEST REPORT

Application No.: HR/2019/B0010
Applicant: Quectel Wireless Solutions Co., Ltd.
Address of Applicant: Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
Manufacturer: Quectel Wireless Solutions Co., Ltd.
Address of Manufacturer: Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
EUT Description: Smart Module with Wi-Fi & Bluetooth
Model No.: SC20-WL
Trade Mark: QUECTEL
Standards: Article 2, paragraph 1, item 19 the relevant articles and MIC Notice No.88 of the Ordinance Concerning Technical Regulations Conformity Certification of Specified Radio Equipment
Date of Receipt: 2019/12/09
Date of Test: 2019/12/10 to 2020/01/02
Date of Issue: 2020/01/02

Test Result:	PASS *
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* In the configuration tested, the EUT detailed in this report complied with the standards specified above. Please refer to section 3 of this report for further detail.

Authorized Signature:

Ervin Li
 Regulatory Manager



SGS-CSTC Standards Technical Services Co., Ltd.
 Shenzhen Branch Testing Laboratory

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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2020/01/02		Original
02		2022/12/12		1. Update the Antenna Power and Rated Power; 2. Add the Result on Section 6.1

This report supersedes our previous report HR/2019/B001003, issued on 2020/01/02, which is hereby deemed null and void.

Prepared By	Dee.Zheng
	(Dee Zheng) / Test Engineer
Checked By	Daniel Wang
	(Daniel Wang) / Reviewer

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2 Test Summary

Test	Test Requirement	Limit/Severity	Result
Antenna Requirement	Item 19 of Article 2-1	Notice 88 Appendix 43, B-1 (1) & (2)	PASS
Test frequency	Item 19 of Article 2-1	Notice 88 Appendix 43, A-3	PASS
Frequency Error	Item 19 of Article 2-1	$\leq \pm 50$ ppm	PASS
Occupied Bandwidth	Item 19 of Article 2-1	OFDM: ≤ 40 MHz Others: ≤ 26 MHz	PASS
Spread-spectrum Bandwidth	Item 19 of Article 2-1	≥ 500 kHz (Only Spread Spectrum)	PASS
Spreading Factor	Item 19 of Article 2-1	≥ 5 (Only DS)	PASS
Antenna Power and Tolerance	Item 19 of Article 2-1	DS: ≤ 10 mW/MHz OFDM: a. OBW: ≤ 26 MHz ≤ 10 mW/MHz b. OBW: 26~40 MHz ≤ 5 mW/MHz Others: ≤ 10 mW Tolerance: +20%~-80%	PASS
Spurious Emission of Tx	Item 19 of Article 2-1	< 2387 MHz ≤ 2.5 μ W/MHz 2387 ~ 2400 MHz ≤ 25 μ W/MHz 2483.5 ~ 2496.5 MHz ≤ 25 μ W/MHz >2496.5 MHz ≤ 2.5 μ W/MHz	PASS
Interference prevention capability	Item 19 of Article 2-1	Notice 88 Appendix 43	PASS
Carrier sense capability	Item 19 of Article 2-1	Notice 88 Appendix 43	PASS
RF accessibility	Item 19 of Article 2-1	Notice 88 Appendix 43	PASS
Spurious Emission of Rx	Item 19 of Article 2-1	(1) Below 1 GHz: ≤ 4 nW (2) Above 1 GHz: ≤ 20 nW	PASS
Remark: EUT: In this whole report EUT means Equipment Under Test. Tx: In this whole report Tx (or tx) means Transmitter. Rx: In this whole report Rx (or rx) means Receiver. RF: In this whole report RF means Radio Frequency. Item 19 of Article 2 Paragraph 1 Note: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".			



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Remark:

As the applicant of the below model, [Quectel Wireless Solutions Co., Ltd] declares that the product,

Model name :SC20-WL

SoftWare: SC20WLSAR06A05_BP01.005

AP system: Linux

is the variant of the initial certified product,

Model name : SC20-W

SoftWare: SC20WSAR06A05_BP01.005

AP system : Android

The difference between SC20-WL and SC20-W is that the system is changed from Android to Linux, and the hardware is completely the same, RF parameters remain consistent with SC20-W.

● SOFTWARE MODIFICATIONS:

- Replace AP system

● HARDWARE MODIFICATIONS:

- Band changes: No
- Power Amplifier changes: No
- Antenna changes: No
- PCB Layout changes: No
- Main RF components changes: No

It is exactly the same on hardware, we can flash Android or Linux firmware images to same module, And RF parameters will not change.

	Antenna	AP	Modem	Transceiver	Power Amplifier	Rx SAW Filter	ASM	BaseB and IC	Duplex	Tx SAW Filter
Bluetooth/BLE	No	No	No	No	No	No	No	No	No	No
WiFi	No	No	No	No	No	No	No	No	No	No

- Voltage changes: No
- FM changes: NA
- LCD/ Speaker/ Camera/ Vibrator changes: NA
- Vibrator changes: No
- Bluetooth changes: No

Other changes detailed:

According to the declaration from the applicant, only the maximum power and spurious emission were tested on SC20-WL , other data were copied from the report of SC20-W (Report No.: SZEM170700802403)



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3 General Information

3.1 Client Information

Applicant:	Quectel Wireless Solutions Co., Ltd.
Address of Applicant:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
Manufacturer:	Quectel Wireless Solutions Co., Ltd.
Address of Manufacturer:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233

3.2 General Description of E.U.T.

Product Name:	Smart Module with Wi-Fi & Bluetooth
Model No.:	SC20-WL
Trade Mark:	QUECTEL

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3.3 Details of E.U.T.

Operating Frequency:	IEEE 802.11b: 2412MHz to 2472MHz IEEE 802.11g/n(HT20): 2412 MHz to 2472 MHz IEEE 802.11n(HT40): 2422MHz to 2462MHz
Type of Modulation:	802.11b: DSSS(CCK/QPSK/BPSK) 802.11g: OFDM(BPSK/QPSK/16QAM/64QAM) 802.11n (HT20/40): OFDM (64QAM, 16QAM, QPSK, BPSK)
Transmit Data Rate:	802.11b: 1M/2M/5.5M/11M bps 802.11g: 6M/9M/12M/18M/24M/36M/48M/54M bps 802.11n: 6.5M/13M/19.5M/26M/39M/52M/58.5M/64M bps
Number of Channels:	802.11b: 14Channels 802.11g/n (HT20): 13 Channels 802.11n (HT40): 9 Channels
Channel Separation:	5 MHz
Antenna Type:	☒ External, ☐ Integrated
Antenna Gain*:	☒ Provided by client 3.3dBi
Power supply:	DC 3.8V
AC Adapter:	Model: JS-05020 Input: AC100-240V, 50/60Hz; Output: DC 5V,2A
<p>Note: *Since the above data and/or information is provided by the client relevant results or conclusions of this report are only made for these data and/or information, SGS is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion.</p> <p>Remark:</p> <p>As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.</p>	



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3.4 Description of Support Units

The EUT has been tested independently.

3.5 Deviation from Standards

None.

3.6 Abnormalities from Standard Conditions

None.

3.7 Other Information Requested by the Customer

None.

3.8 Test Location

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Address:	No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
Post code:	518057
Test engineer:	Dee Zheng,

3.9 Test Facility

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

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

Remark: Our test report is under the quality assurance system according to ISO17025.



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4 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 9.84\text{Hz}$
2	Occupied Bandwidth	± 4.19
3	RF conducted power	$\pm 0.42\text{dB}$
4	Conducted Spurious emissions	$\pm 0.42\text{dB}$

Remark:

The Ulab (lab Uncertainty) is less than Ucispr/ETSI (CISPR/ETSI Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

Note: The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.





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5 Equipment Used during Test

Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Due date
				(yyyy-mm-dd)	(yyyy-mm-dd)
Humi/ Temp Indicator	Shanghai Meteorological Industry Factory	HTC-1	W006-14	2019/4/15	2020/4/15
Spectrum Analyzer	Rohde & Schwarz	FSV	W025-05	2019/2/13	2020/2/12
Barometer	ChangChun	DYM3	SEL0088	2019/4/3	2020/4/3
Dual Output Mobile Communication DC Source	Agilent Technologies Inc	66311B	W009-09	2019/7/15	2020/7/14
Digital Multimeter	Fluke	15B+	W055-01	2019/2/13	2020/2/12
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	W005-21	2019/4/9	2020/4/9
Wideband Radio Communication Tester	Anritsu	MT8821C	6201502984	2019/6/25	2020/6/25
Universal Radio Communication Tester	Rohde & Schwarz	CMU200	W005-01	2019/6/25	2020/6/25
Wideband Radio Communication Tester CMW500	Rohde & Schwarz	CMW500	W005-20	2019/11/18	2020/11/17
Wideband Radio Communication Tester CMW500	Rohde & Schwarz	CMW500	W005-19	2019/11/18	2020/11/17
Dual Antenna Combiner	Anite	Dual Antenna Combiner	SN:TC21113	2018/8/26	2020/8/26

Remark:

- Calibration conducted by the National Institute of Information and Communications Technology (NICT) in Japan (hereinafter referred to as "NICT") or a designated calibration agency under Article 102-18 paragraph (1) in JRL.
- Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Act (Act No. 51 of 1992).
- Calibration conducted in countries except Japan, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1).
- Calibration, etc. conducted by using measuring instruments and other equipment listed in the right column of appended table No. 3, which shall have been given any type of calibration, etc. listed above from (a) to (c).

the calibration corresponds to C described above.

From JRL Article 24-2, paragraph 4, Item 2

Notice: Calibration duration for above equipments is 1 year.

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6 Test Results

6.1 Radio Technical Requirements Specification

Tabel 1: Radio Technical Requirements Specification for 2.4 GHz band wide-band low-power data communication system (Item 19 of Article 2-1)

Items	Technical standard	Result
Assigned frequency or designated frequency	2400-2483.5MHz	PASS
Communication method	One-way communication, simplex, semi-duplex, or duplex operation of digital signal transmission including spread spectrum	PASS
Tolerance of frequency ($\times 10^{-6}$)	± 50 ppm	PASS
Tolerance of occupied bandwidth	OFDM: ≤ 40 MHz Others: ≤ 26 MHz	PASS
Antenna power	DS: 10mW/MHz OFDM: (1) $OBW \leq 26$ MHz: ≤ 10 mW/MHz (2) $OBW 26 \sim 40$ MHz: ≤ 5 mW/MHz Others: 10mW Tolerance: +20% , -80%	PASS
Antenna gain	1) 12.14 dBi or less in principle 2) In case of directional antenna (1) FH, FH+DS or FH+OFDM using 2427-2470.75 MHz $EIRP \leq 16.91$ dBm/MHz (2) OFDM or DS other than (1) $EIRP \leq 22.14$ dBm/MHz (3) Other than (1) and (2): 22.14 dBm or less (4) OFDM OBW 26 - 40MHz: 19.14dBm/MHz (5) Half-power angle of directional antenna (e) in case of the item 2): $e \leq 360/A$ (The A is 10 in maximum.)	PASS
Tolerance of spurious emission intensity	< 2387 MHz: 2.5 μ W 2387 to 2400 MHz: 25 μ W 2483.5 through 2496.5 MHz: 25 μ W > 2496.5 MHz: 2.5 μ W	PASS
Spreading bandwidth	DS, FH, FH+DS, FH+OFDM: 500kHz or more	PASS
Spreading rate of spectrum	For DS system; (Spreading bandwidth) / (Frequency corresponding to transmission rate) ≥ 5	PASS
Limit of secondary radiated	(1) Below 1 GHz: 4 nW	PASS

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emissions	(2) Above 1 GHz: 20 nW	
Interference prevention function	Shall have the function of automatic transmission and reception of identification sign.	PASS
Structure	Shall be of the structure that the RF and modulator sections excluding antenna cannot easily be opened.	PASS
Note	DS: Direct spread FH: Frequency hopping OFDM: Orthogonal frequency division multiplexing	

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6.2 E.U.T. test conditions

Power Supply:	DC3.8V		
	The RF unit is supplied DC3.8V. The fluctuation of input voltage to the circuit of RF unit of test equipment is under $\pm 1\%$, when input voltage from DC3.3V to the test equipment is fluctuated $\pm 10\%$, So, all measurement has been conducted by only rated voltage.		
	The measurement result of the voltage fluctuation at RF circuit when DC3.3V $\pm 1\%$.		
	DC Input		input voltage to the circuit
			Deviation
	High Voltage	4.2V	3.33V
Test Frequencies:	Normal Voltage	3.8V	3.30V
	Low Voltage	3.5V	3.27V
	If the EUT can be set to 3 of more different (carrier) frequencies in 1 allocated band, testing shall be performed using the Lowest, Middle and the Highest frequency (L, M and H). If there are 2 or fewer frequencies, testing shall be performed with the available frequencies.		

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6.3 EUT channels and frequencies list:

Channel	Frequency (MHz)
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452
10	2457
11	2462
12	2467
13	2472
14	2484
802.11b/g/n(HT20):	Test frequencies are the lowest channel: 1 channel(2412MHz), middle channel: 7 channel (2442 MHz) and the highest channel: 13 channel (2472 MHz) The last channel: 14 channel(2484MHz)
802.11n (HT40):	Test frequencies are the lowest channel: 3 channel(2422MHz), middle channel: 7 channel (2442 MHz) and the highest channel: 11 channel (2462 MHz)

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6.4 Antenna Requirement

Standard requirement

Applicable for equipment with an antenna terminal, including testing terminals) If an antenna connector is available, all relevant tests will be carried out conducted. If not, tests will be carried out in an anechoic room or with a suitable test-fixture.



The antenna is external antenna on the main PCB and no consideration of replacement. The best case gain of the antenna is 3.3dBi.

Result: An antenna connector is available, all relevant tests will be carried out conducted



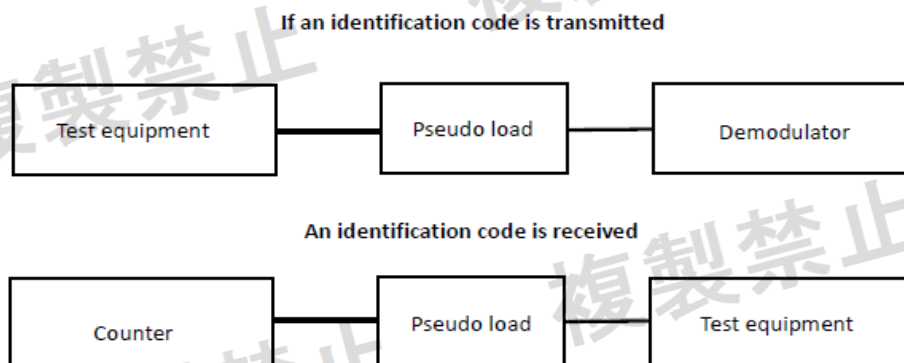
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6.5 Interference prevention function

1) Measurement system diagram

(a) When transmitting identification code



2) Condition of measuring instrument

(b) Demodulator must be able to demodulate the transmitting signal emitted by test equipment and to indicate the identification code.

3) Condition of test equipment The mode of normal use.

4) Measuring operation procedure

(a) When test equipment has the function to transmit identification code automatically:

A) Transmit the predetermined identification code from test equipment.

B) Confirm the transmitted identification code by demodulator.

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5) Test result: The unit does meet the requirements (Good).

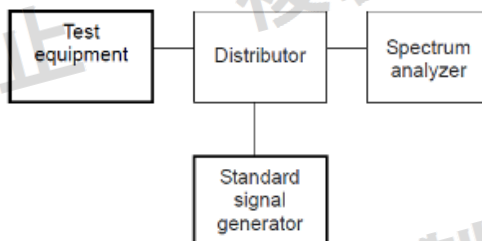
PASS





6.6 Carrier sense capability

- 1) Measurement system diagram
 - (a) Test with test equipment only



- 2) Condition of measuring instrument
 - (a) Set the standard signal generator as follows:

Carrier frequency: Center frequency of receiving frequency band of test equipment

Modulation: No modulation. (note1)

Output level: regulated level on antenna input of test equipment

Note 1: The un-modulated carrier in the center frequency, when the carrier sense function of test equipment is not worked, if necessary, change the frequency or modulate it.
 - (b) Set the spectrum analyzer as follows:

Center frequency: Center frequency of the bandwidth used.(note2)

Sweep frequency band: 50MHz(note2)

Resolution bandwidth: Approximately 1 MHz

Video bandwidth: Comparable level with resolution bandwidth

Trigger condition: Free-run

Detective mode: positive peak

Note 2: Under 26MHz of OFDM or other modulated method that with transmit function, set sweep frequency band as 0Hz, detective mode as sample, center frequency as the carrier frequency from 13MHz to 19MHz.
- 3) Condition of test equipment

Set the test equipment at the test frequency and the test spread code, and set it to the receiving mode in the beginning. When using external test device, connect with the test equipment by line connection.
- 4) Measuring operation procedure
 - (a) Test with test equipment only:
 - (1) Set the spectrum analyzer according to (2) of 2).
 - (2) Set the test equipment to the transmitting operation with the output of standard signal generator OFF, and confirm that it emits over 26MHz occupied frequency bandwidth OFDM radio wave, by using spectrum analyzer.
 - (3) Set the test equipment to the receiving mode.
 - (4) With the output of standard signal generator ON, set the test equipment to the transmitting operation, and confirm that it does not emit over 26MHz occupied frequency bandwidth OFDM radio wave, by using spectrum analyzer.
 - (5) Test result: The unit does meet the requirements (Good).

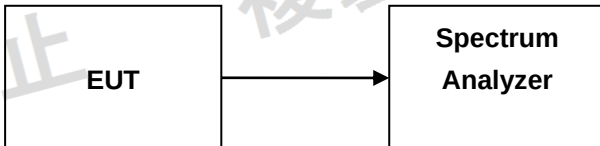




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6.7 Frequency Error

Test Requirement:	Item 19 of Article 2-1
Limit:	Tolerance of frequency: $\pm 50 \times 10^{-6}$
Test Status:	Test the EUT in transmitting mode without modulation.
Temperature:	25.0 °C
Humidity:	53 % RH
Atmospheric Pressure:	1020 mbar
Test Configuration:	 <pre> graph LR EUT[EUT] --> SA[Spectrum Analyzer] </pre>
Test Procedure:	<ol style="list-style-type: none"> Test Conditions: Spectrum Analyzer is used for measurement. EUT conditions: Modulation/Spread/Hopping OFF, CW Tx Spectrum Analyzer conditions: Frequency: Test Frequency Span 1MHz RBW 10 kHz (Modulation OFF), VBW 10 kHz (Modulation OFF), Sweep Time Auto Detector mode Positive peak Indication mode Max hold
The detailed test data see: Appendix	



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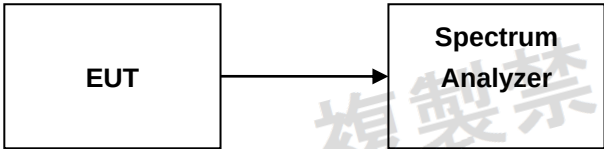


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6.8 Occupied Bandwidth (99%)

Test Requirement:	Item 19 of Article 2-1
Limit:	OFDM: 40 MHz or less DSSS: 26 MHz or less
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.
Temperature:	25.0 °C
Humidity:	53 % RH
Atmospheric Pressure:	1020 mbar
Test Configuration:	 <pre> graph LR EUT[EUT] --> SA[Spectrum Analyzer] </pre>
Test Procedure:	<ol style="list-style-type: none"> Test Conditions: Spectrum Analyzer is used for measurement. EUT conditions: Modulation/Spread/Hopping ON For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal. Spectrum Analyzer conditions: Frequency: Test Frequency Span 40MHz for 20MHz system;80MHz for 40MHz system RBW 300 KHz for 20MHz system;500 KHz for 40MHz system VBW same as RBW Sweep Time Auto detector mode Sample Indication mode Max hold OBW 99%
The detailed test data see: Appendix	



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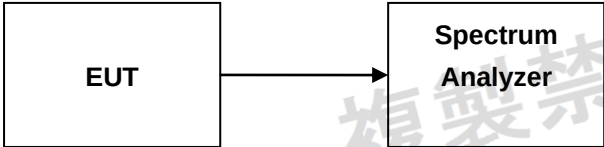


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6.9 Spread spectrum Bandwidth (90%) & Spreading Factor

Test Requirement:	Item 19 of Article 2-1
Limit:	500 kHz or more For DS system Spreading Factor should be more than 5
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.
Temperature:	25.0 °C
Humidity:	53 % RH
Atmospheric Pressure:	1020 mbar
Test Configuration:	 <pre> graph LR EUT[EUT] --> SA[Spectrum Analyzer] </pre>
Test Procedure:	<ol style="list-style-type: none"> Test Conditions: Spectrum Analyzer is used for measurement. EUT conditions: Modulation/Spread ON For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal. Spectrum Analyzer conditions: Frequency: Test Frequency Span 40MHz (DSSS) RBW 300kHz VBW 300kHz Sweep Time Auto Detector mode Positive peak Indication mode Max hold OBW 90%
The detailed test data see: Appendix	



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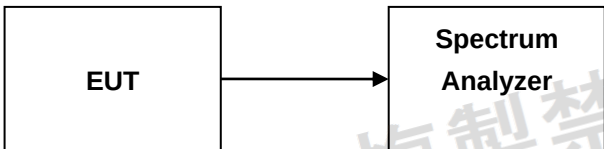


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6.10 Antenna Power

Test Requirement:	Item 19 of Article 2-1
Limit:	10mW/MHz or less
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.
Temperature:	25.0 °C
Humidity:	53 % RH
Atmospheric Pressure:	1020 mbar
Test Configuration:	 <pre> graph LR EUT[EUT] --> SA[Spectrum Analyzer] </pre>
Test Procedure:	<ol style="list-style-type: none"> Test Conditions: Spectrum Analyzer is used for measurement. EUT conditions: Modulation/Spread/Hopping ON For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal. Spectrum Analyzer conditions: Center frequency: Test frequency Sweep frequency width: About twice the occupied frequency bandwidth RBW: 1MHz VBW: 1MHz Sweep time: Auto Sweep mode: Continuous sweep Detection mode: positive peak Display mode: Max hold Center frequency The frequency that gives the maximum power (searched frequency) Sweep frequency width: 0Hz RBW: 1MHz VBW: 1MHz Sweep mode: Continuous sweep
The detailed test data see: Appendix	



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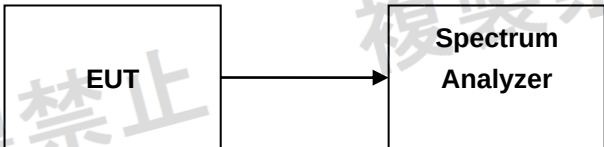


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6.11 Spurious Emissions of Tx

Test Requirement:	Item 19 of Article 2-1
Limit:	$< 2387\text{MHz} \leq 2.5\mu\text{W/MHz}$ $2387 \sim 2400\text{MHz} \leq 25\mu\text{W/MHz}$ $2483.5 \sim 2496.5\text{MHz} \leq 25\mu\text{W/MHz}$ $>2496.5\text{MHz} \leq 2.5\mu\text{W/MHz}$
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.
Temperature:	25.0 °C
Humidity:	53 % RH
Atmospheric Pressure:	1020 mbar
Test Configuration:	 <pre> graph LR EUT[EUT] --> SA[Spectrum Analyzer] </pre>
Test Procedure:	<p>Test Conditions: Spectrum Analyzer is used for measurement.</p> <p>EUT conditions: Modulation/Spread/Hopping ON For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal.</p> <p>Spectrum Analyzer conditions: Step 1: All spurious are measured from 30 MHz to 13 GHz by peak mode. Step 2: IF the value measured by Step1 is 2 dB or less, measure in average mode.</p> <p>Test setup for Step 1: Frequency: 30MHz~2400MHz, 2483.5MHz~13GHz (for 2412-2472MHz) RBW 1 MHz VBW 1 MHz Sweep Time Auto detector mode Positive peak</p>



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	Indication mode Max hold Test setup for Step 2: Frequency: Spurious Frequency RBW 1 MHz VBW 1 MHz Sweep Time Auto detector mode Sample Indication mode Max hold
The detailed test data see: Appendix	

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6.12 RF accessibility

Standard requirement

Article 49-20, paragraph 1 (a)

The EUT shall be constructed in such a way that sensitive RF parts, (like modulation and oscillator parts) cannot be reached easily by the user. These parts shall be covered by soldered metal caps or glue or by other mechanical covers. If the covers are fixed with screws, these shall be not the common type(s) like a Phillips, but special versions like Torx, so that the user cannot open the device with common tools.

RF and Modulation parts are mounted on PCB with surface mount technology, and there is no any adjustable parts on PCB or adjustable parts are not exposed.



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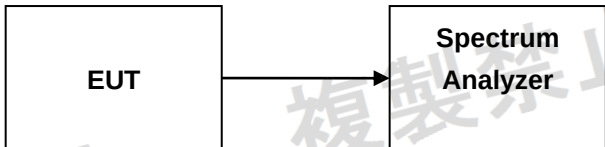


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6.13 Spurious Emissions of Rx

Test Requirement:	Item 19 of Article 2-1
Limit:	(1) Below 1 GHz: 4 nW (2) 1 GHz and over: 20 nW
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.
Temperature:	25.0 °C
Humidity:	53 % RH
Atmospheric Pressure:	1020 mbar
Test Configuration:	 <pre> graph LR EUT[EUT] --> SA[Spectrum Analyzer] </pre>
Test Procedure:	<ol style="list-style-type: none"> Test Conditions: Spectrum Analyzer is used for measurement. EUT conditions: Modulation/Spread/Hopping ON For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal. Spectrum Analyzer conditions: Step 1: All spurious are measured from 30 MHz to 13 GHz by peak mode. Step 2: IF the value measured by Step1 is 2 dB or less, measure in average mode. Test setup for Step 1: Frequency: 30 MHz – 2400 MHz, 2483.5 MHz –13 GHz (for 2412MHz-2472MHz) RBW 100 kHz (30 – 1GHz), 1 MHz (over 1GHz) VBW 100 kHz (30 – 1GHz), 1 MHz (over 1GHz) Sweep Time Auto detector mode Positive peak Indication mode Max hold Test setup for Step 2: Frequency: Spurious Frequency Span 0 Hz RBW 100 kHz (30 – 1GHz) , 1 MHz (over 1GHz) VBW 100 kHz (30 – 1GHz), 1 MHz (over 1GHz) Sweep Time Auto detector mode Sample

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Indication mode Max hold

The detailed test data see: **Appendix**

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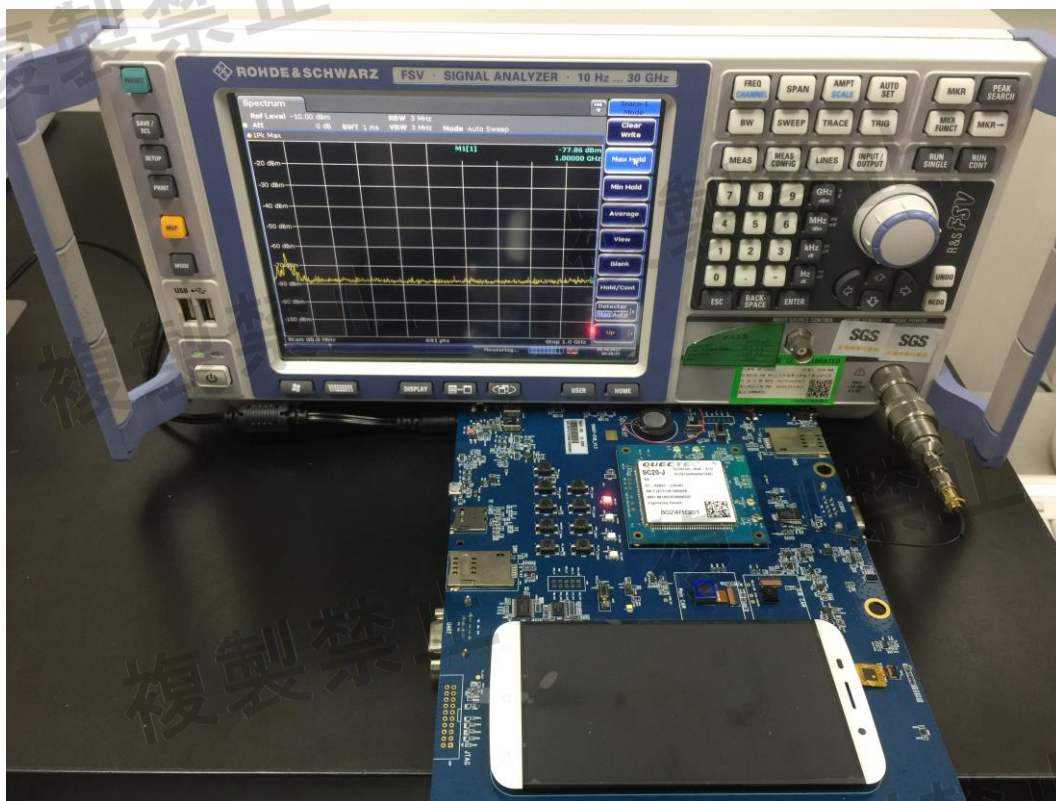


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7 Photographs

7.1 EUT Test Setup



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Appendix



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Frequency Error

Test Result

Test Frequency (MHz)	Test Result			Unit	Limit
	Normal Voltage	High Voltage	Low Voltage		
	3.8V DC	4.2V DC	3.5V DC		
2412.0	-0.007	N/A	N/A	MHz	±50 PPM or less
	-2.90	N/A	N/A	PPM	
2422.0	-0.007	N/A	N/A	MHz	
	-2.87	N/A	N/A	PPM	
2442.0	-0.008	N/A	N/A	MHz	
	-3.28	N/A	N/A	PPM	
2462.0	-0.006	N/A	N/A	MHz	
	-2.44	N/A	N/A	PPM	
2472.0	-0.009	N/A	N/A	MHz	
	-3.64	N/A	N/A	PPM	
2484.0	-0.014	N/A	N/A	MHz	
	-5.64	N/A	N/A	PPM	

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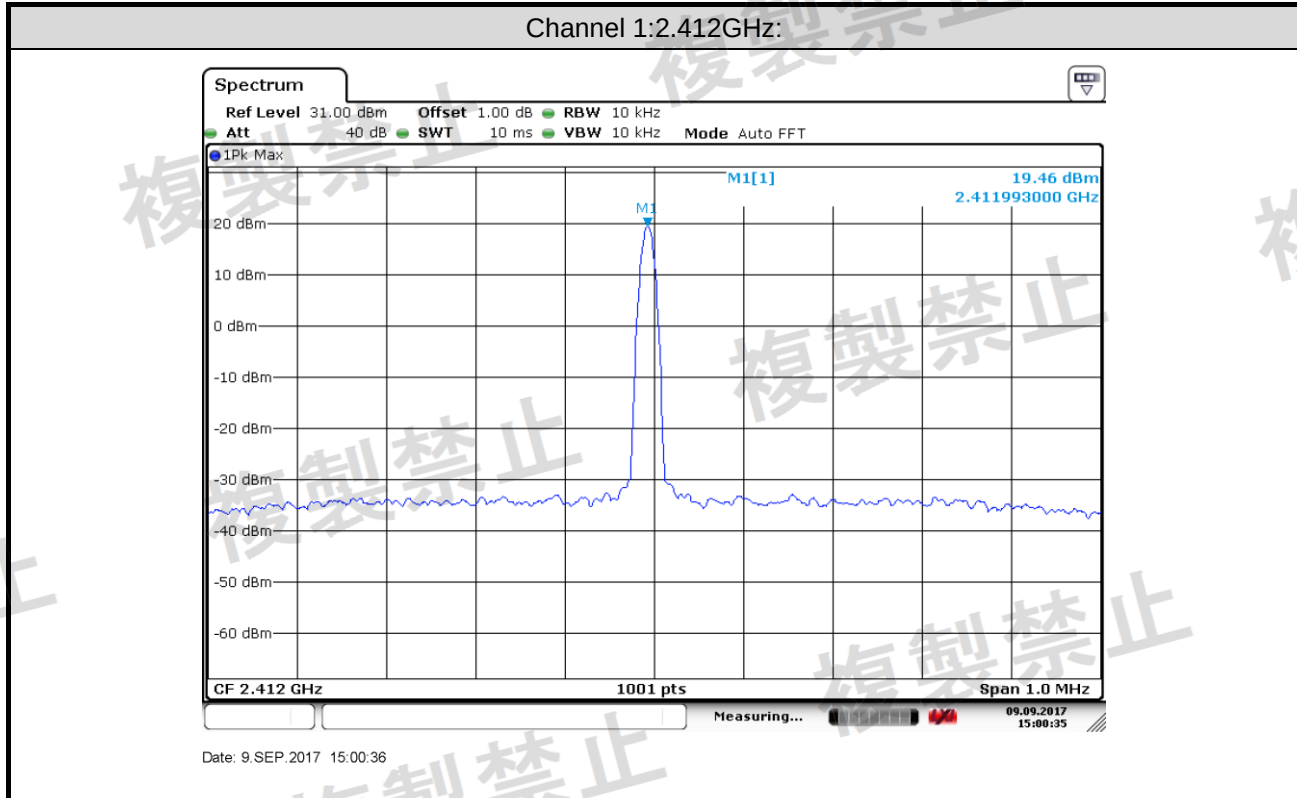


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Test Graphs



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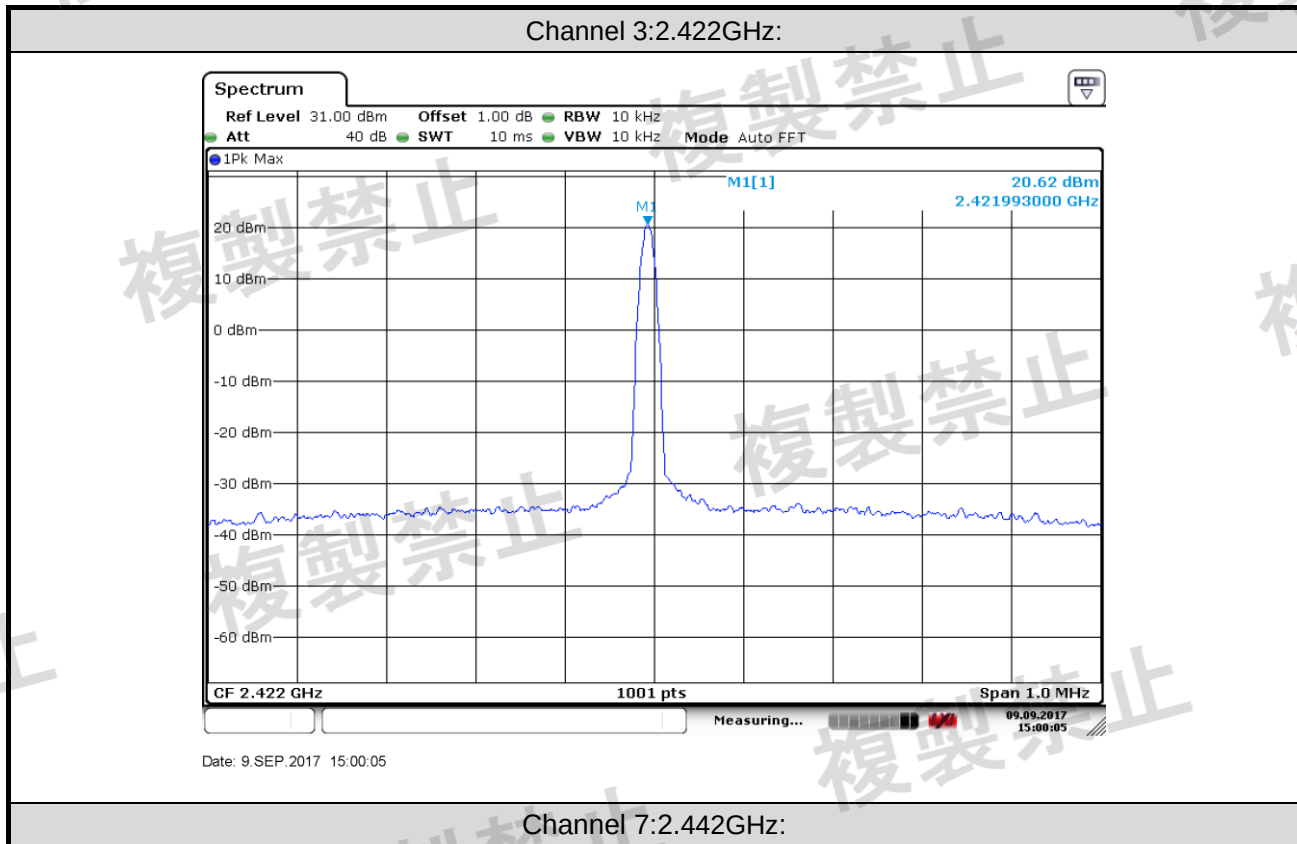
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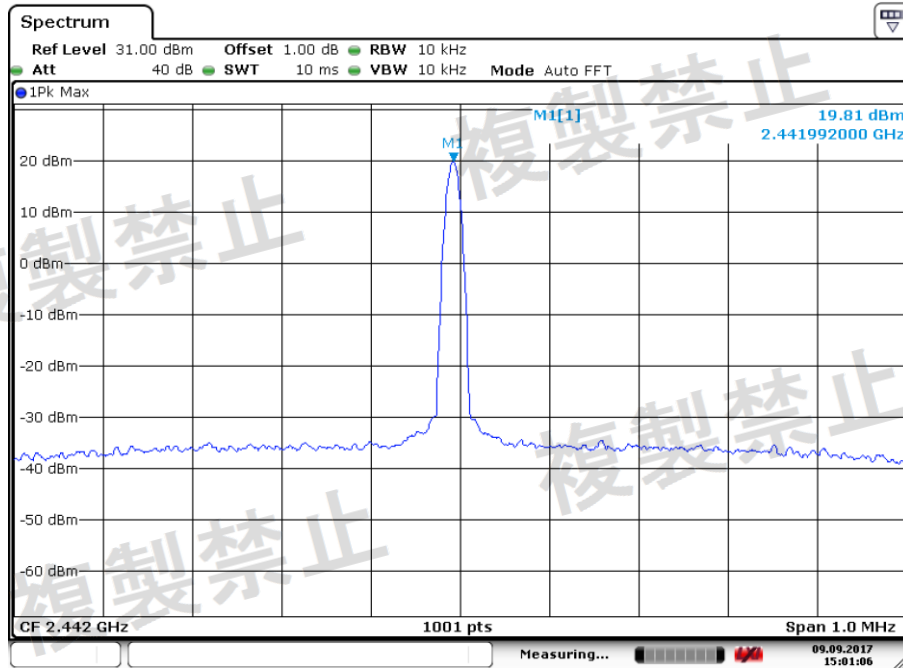
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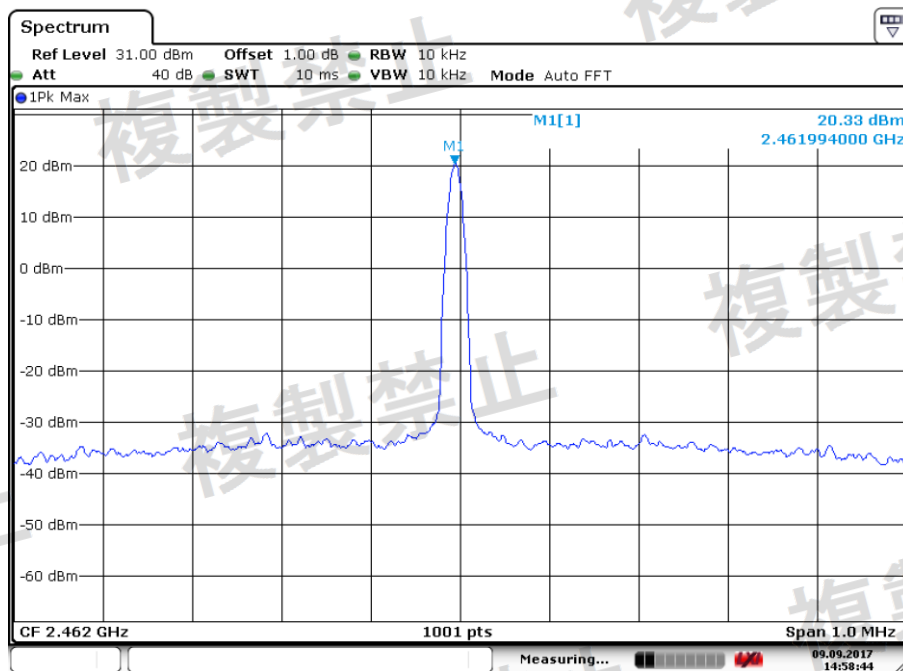
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Date: 9.SEP.2017 15:01:06

Channel 11:2.462GHz:



Date: 9.SEP.2017 14:58:44

Channel 13:2.472GHz

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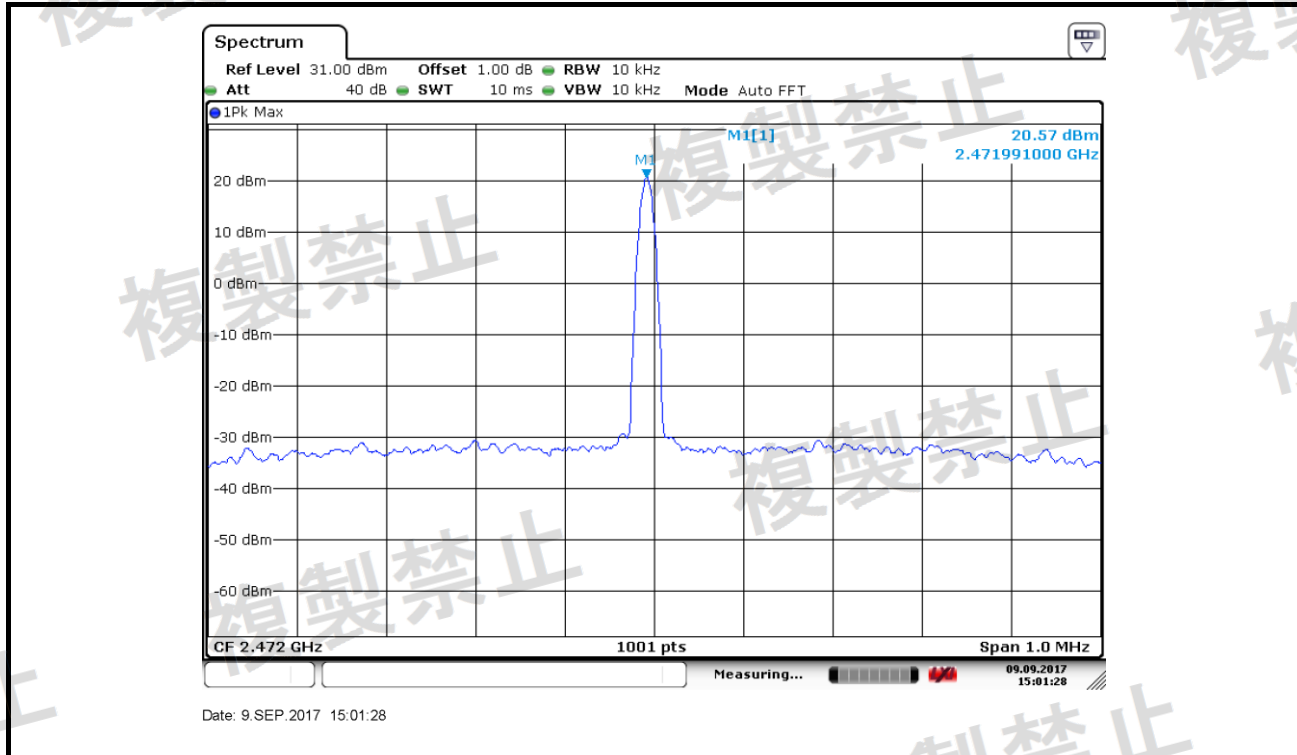
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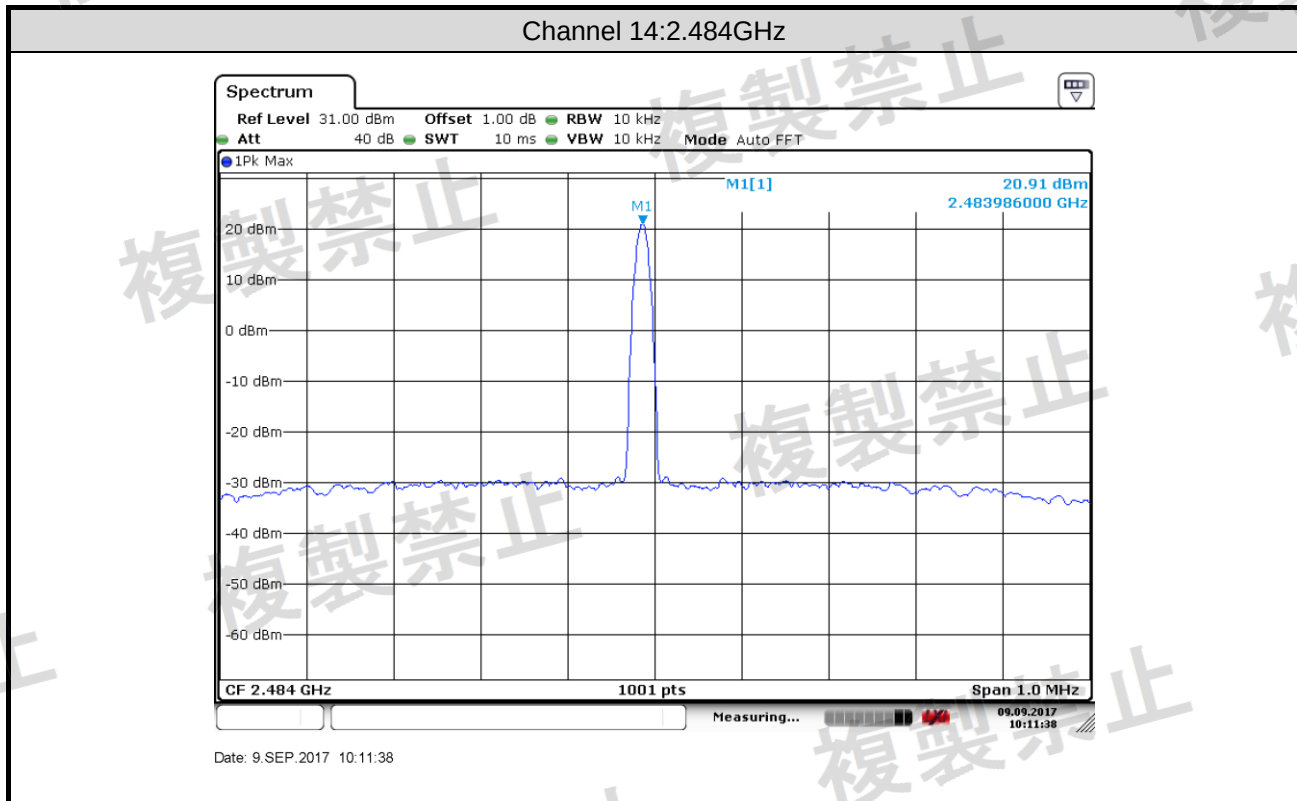
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Antenna Power

Test Result

Antenna Power							
Test Condition	Test Mode	Antenna	Frequency[MHz]	Result[dBm/MHz]	Result[mW /MHz]	Limit[mW /MHz]	Verdict
NTNV	11B	Ant1	2412	2.14	1.6368	≤10	PASS
			2442	4.32	2.7040	≤10	PASS
			2472	5.20	3.3113	≤10	PASS
	11G	Ant1	2412	4.84	3.0479	≤10	PASS
			2442	-2.78	0.5272	≤10	PASS
			2472	-1.23	0.7534	≤10	PASS
	11N20SISO	Ant1	2412	-0.70	0.8511	≤10	PASS
			2442	-2.72	0.5346	≤10	PASS
			2472	-1.82	0.6577	≤10	PASS
	11N40SISO	Ant1	2422	-0.26	0.9419	≤5	PASS
			2442	-5.30	0.2951	≤5	PASS
			2462	-5.20	0.3020	≤5	PASS

Tolerance								
Test Condition	Test Mode	Antenna	Frequency[MHz]	Power (mW)	Rated Power (mW)	Result (%)	Limit (%)	Verdict
NTNV	11B	Ant1	2412	1.6368	6	-72.72	-80 to +20	PASS
			2442	2.7040	6	-54.93	-80 to +20	PASS
			2472	3.3113	6	-44.81	-80 to +20	PASS
	11G	Ant1	2412	3.0479	6	-49.20	-80 to +20	PASS
			2442	0.5272	1	-47.28	-80 to +20	PASS
			2472	0.7534	1	-24.66	-80 to +20	PASS
	11N20SISO	Ant1	2412	0.8511	1	-14.89	-80 to +20	PASS
			2442	0.5346	1	-46.54	-80 to +20	PASS
			2472	0.6577	1	-34.23	-80 to +20	PASS
	11N40SISO	Ant1	2422	0.9419	1	-5.81	-80 to +20	PASS
			2442	0.2951	1	-70.49	-80 to +20	PASS
			2462	0.3020	1	-69.80	-80 to +20	PASS

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EIRP							
Test Condition	Test Mode	Antenna	Frequency [MHz]	Result [dBm/MHz]	EIRP [dBm/MHz]	Limit [dBm/MHz]	Verdict
NTNV	11B	Ant1	2412	2.14	5.44	≤12.14	PASS
			2442	4.32	7.62	≤12.14	PASS
			2472	5.20	8.50	≤12.14	PASS
	11G	Ant1	2412	4.84	8.14	≤12.14	PASS
			2442	-2.78	0.52	≤12.14	PASS
			2472	-1.23	2.07	≤12.14	PASS
	11N20SIS O	Ant1	2412	-0.70	2.60	≤12.14	PASS
			2442	-2.72	0.58	≤12.14	PASS
			2472	-1.82	1.48	≤12.14	PASS
	11N40SIS O	Ant1	2422	-0.26	3.04	≤9.13	PASS
			2442	-5.30	-2.00	≤9.13	PASS
			2462	-5.20	-1.90	≤9.13	PASS

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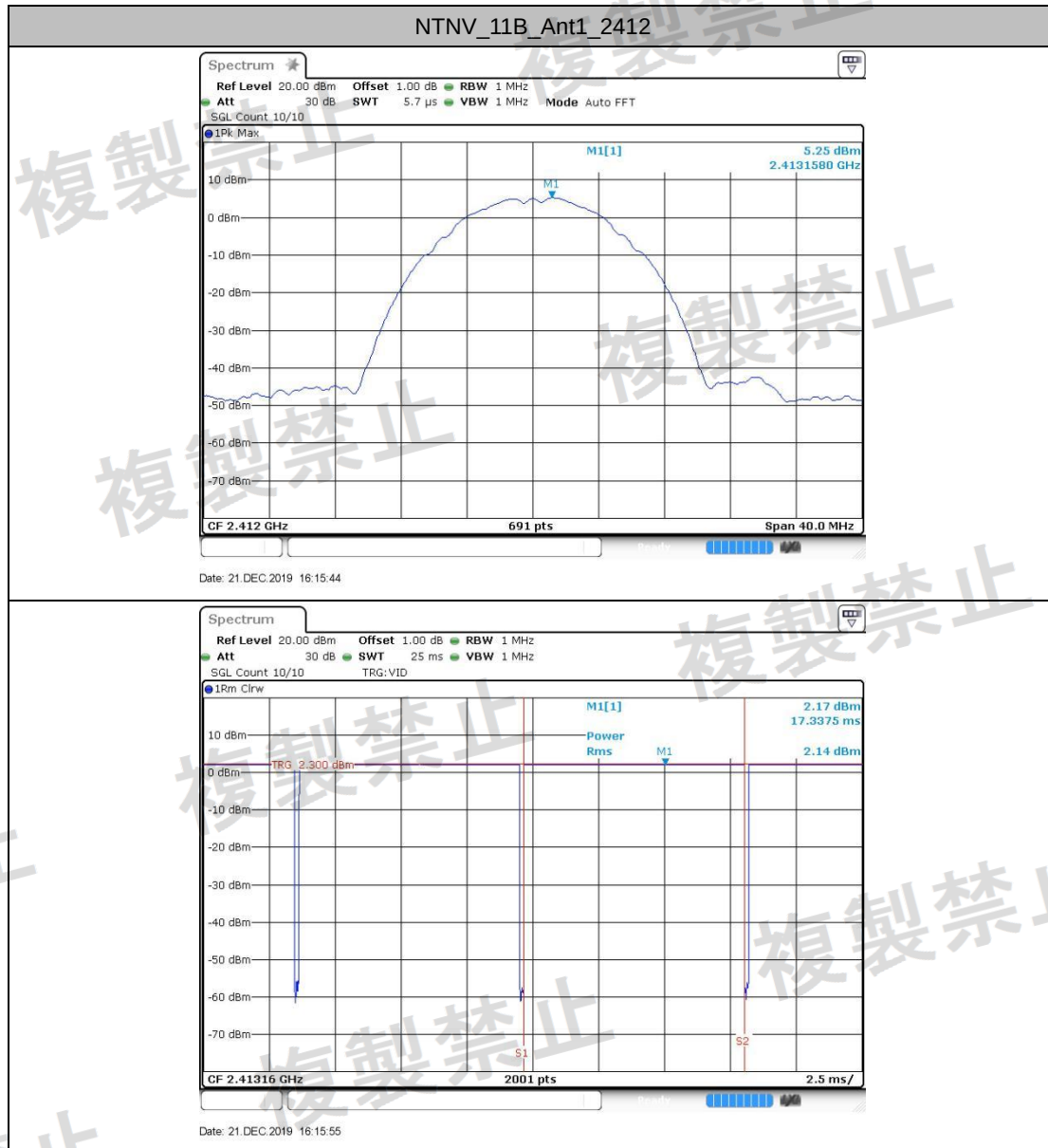


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Test Graphs



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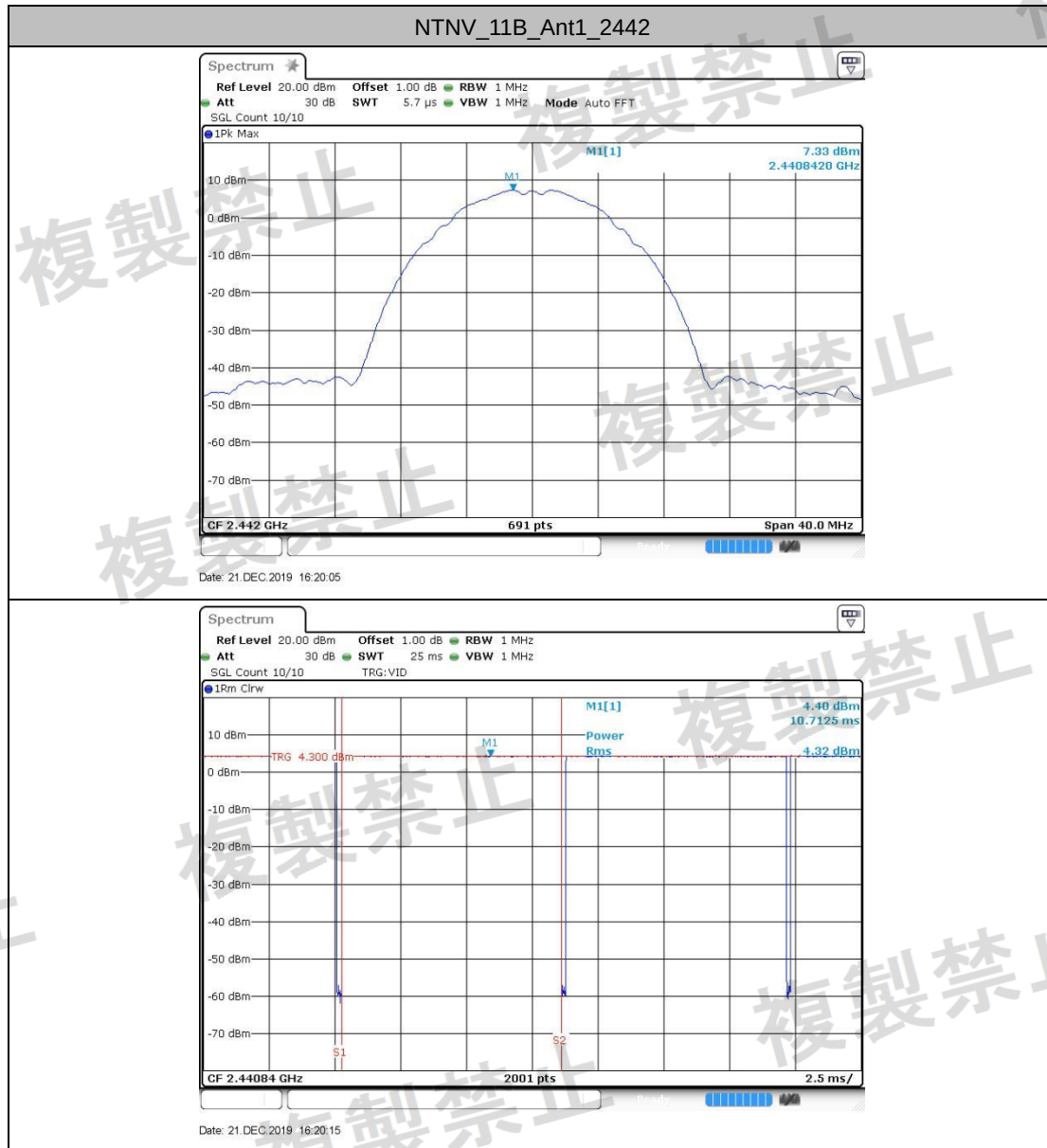
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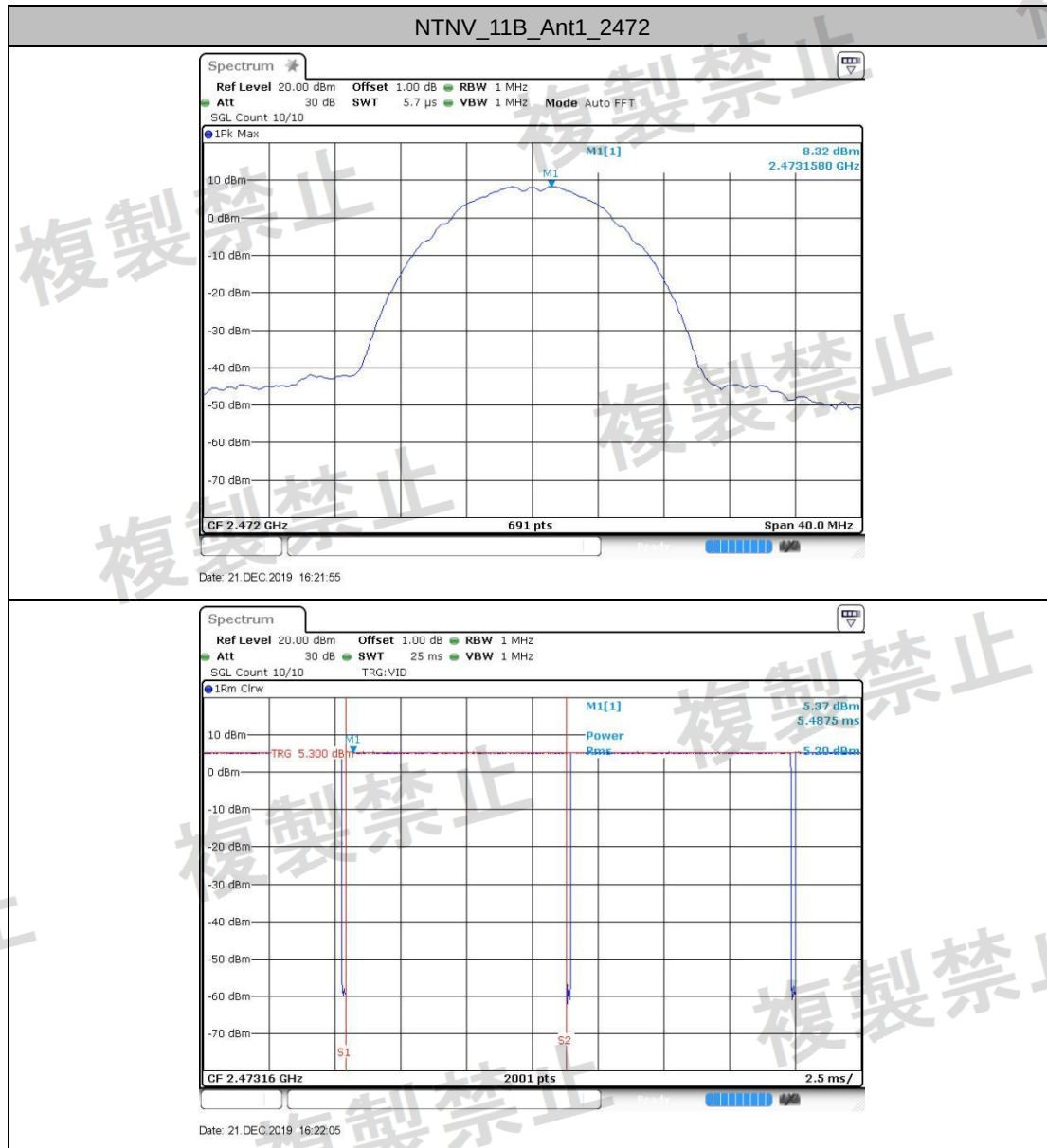
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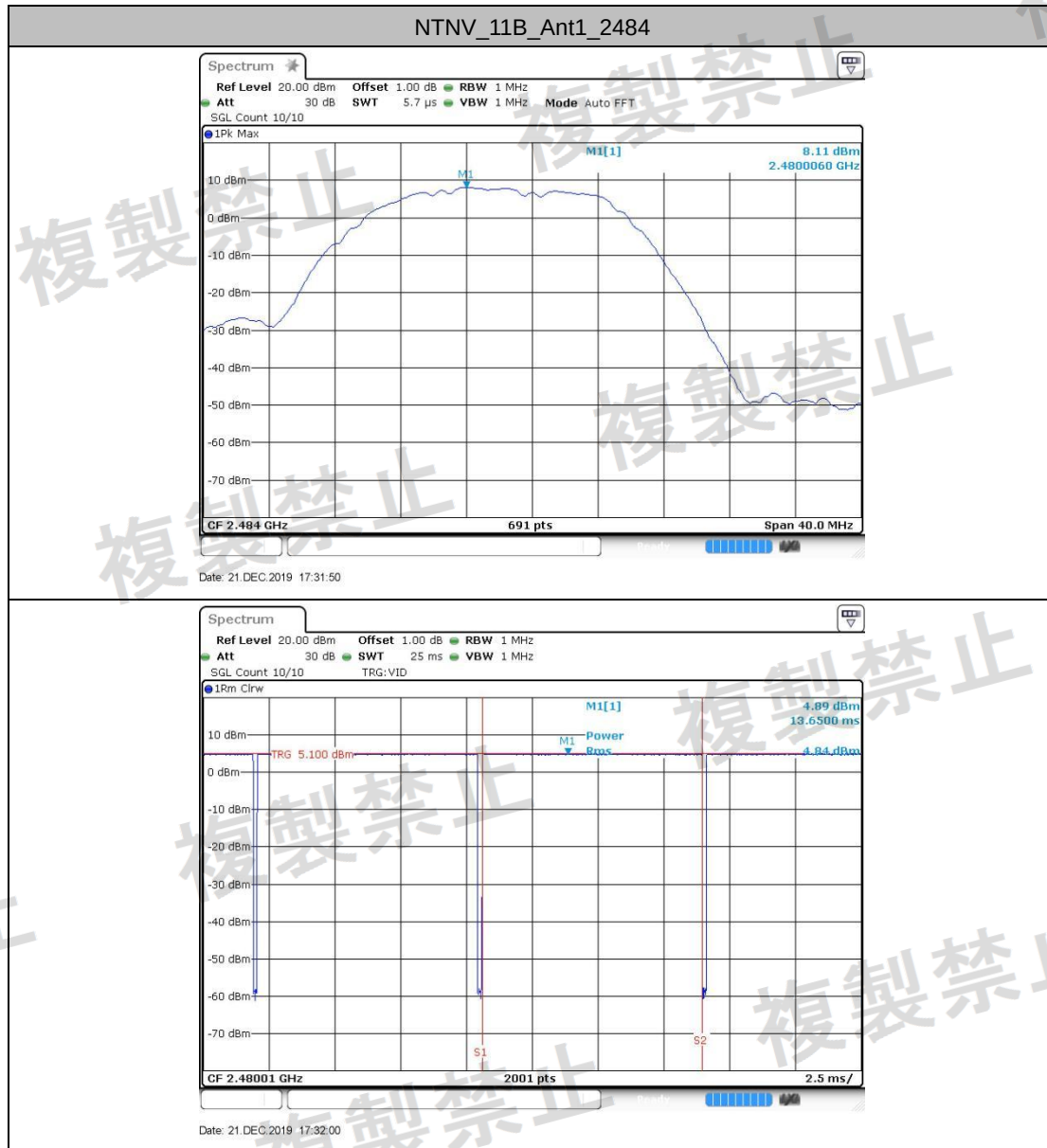
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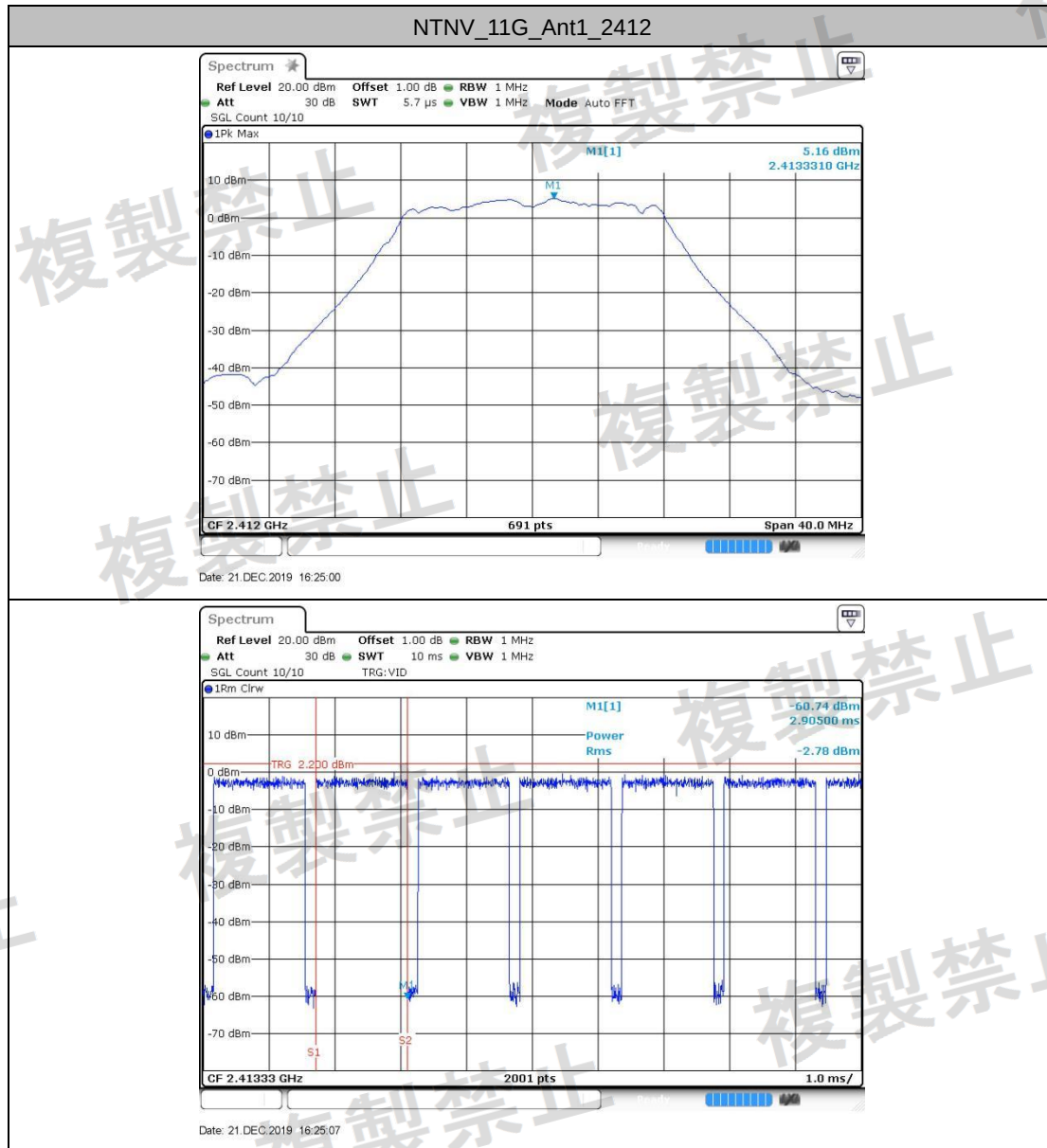
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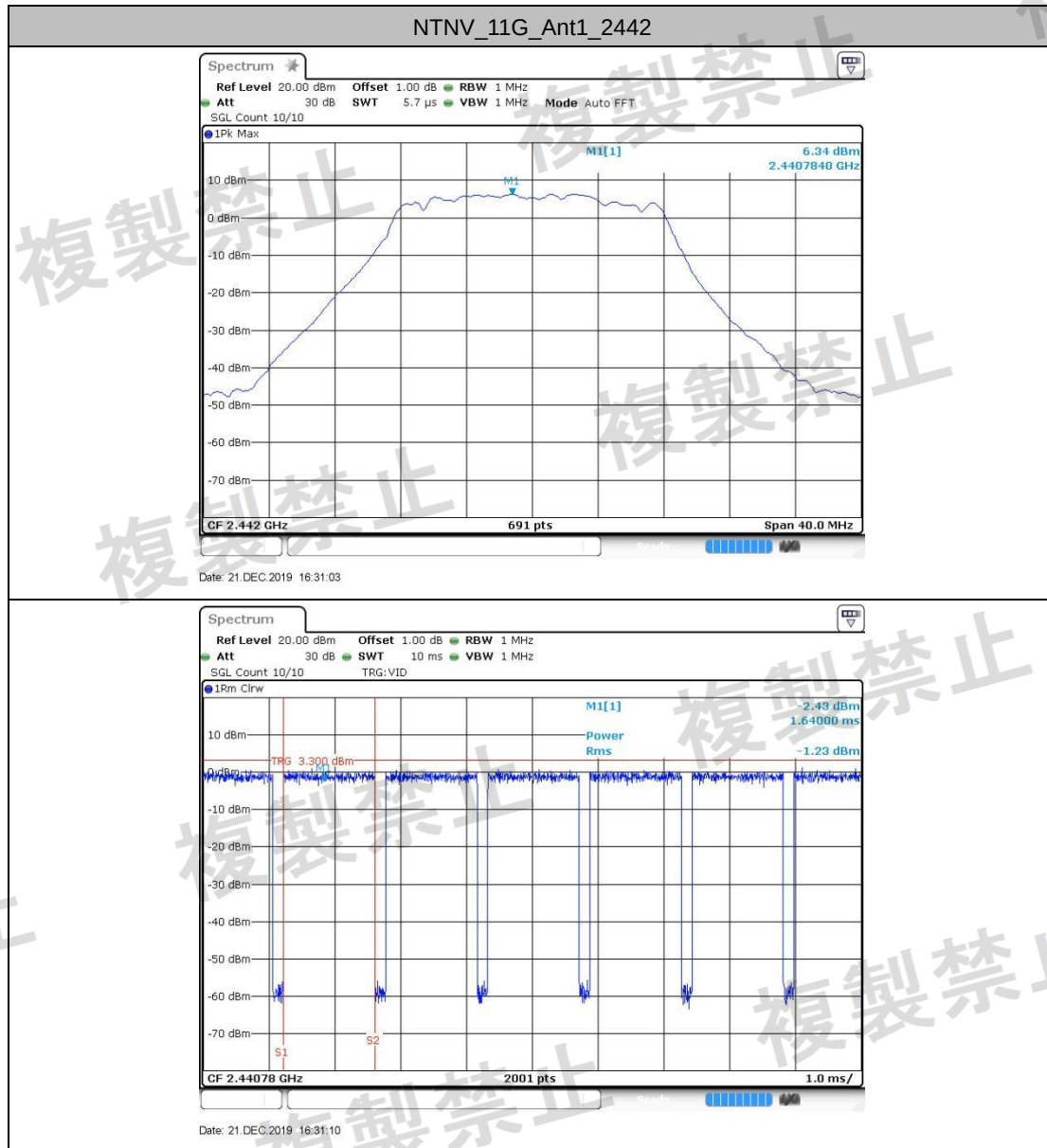
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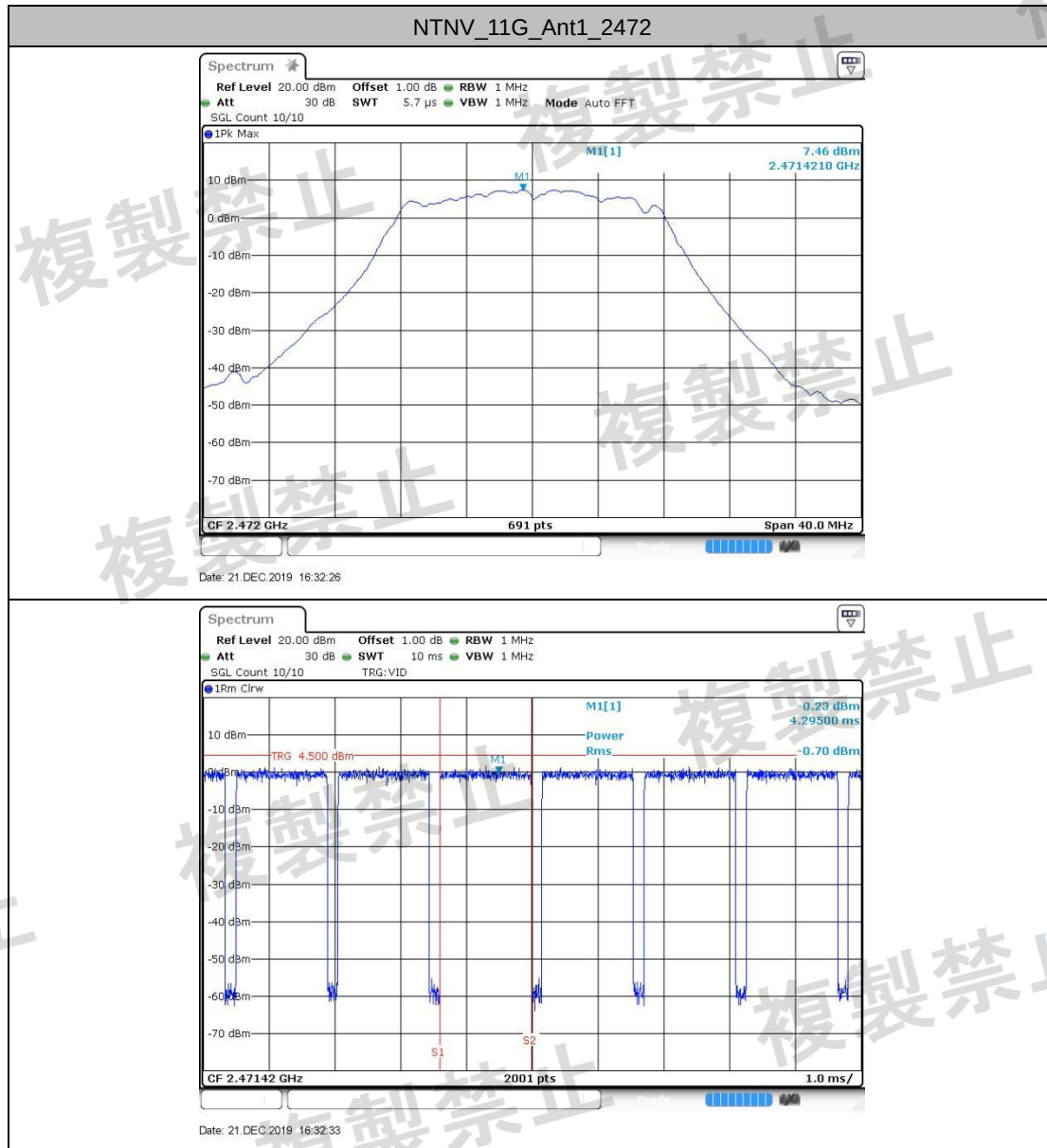
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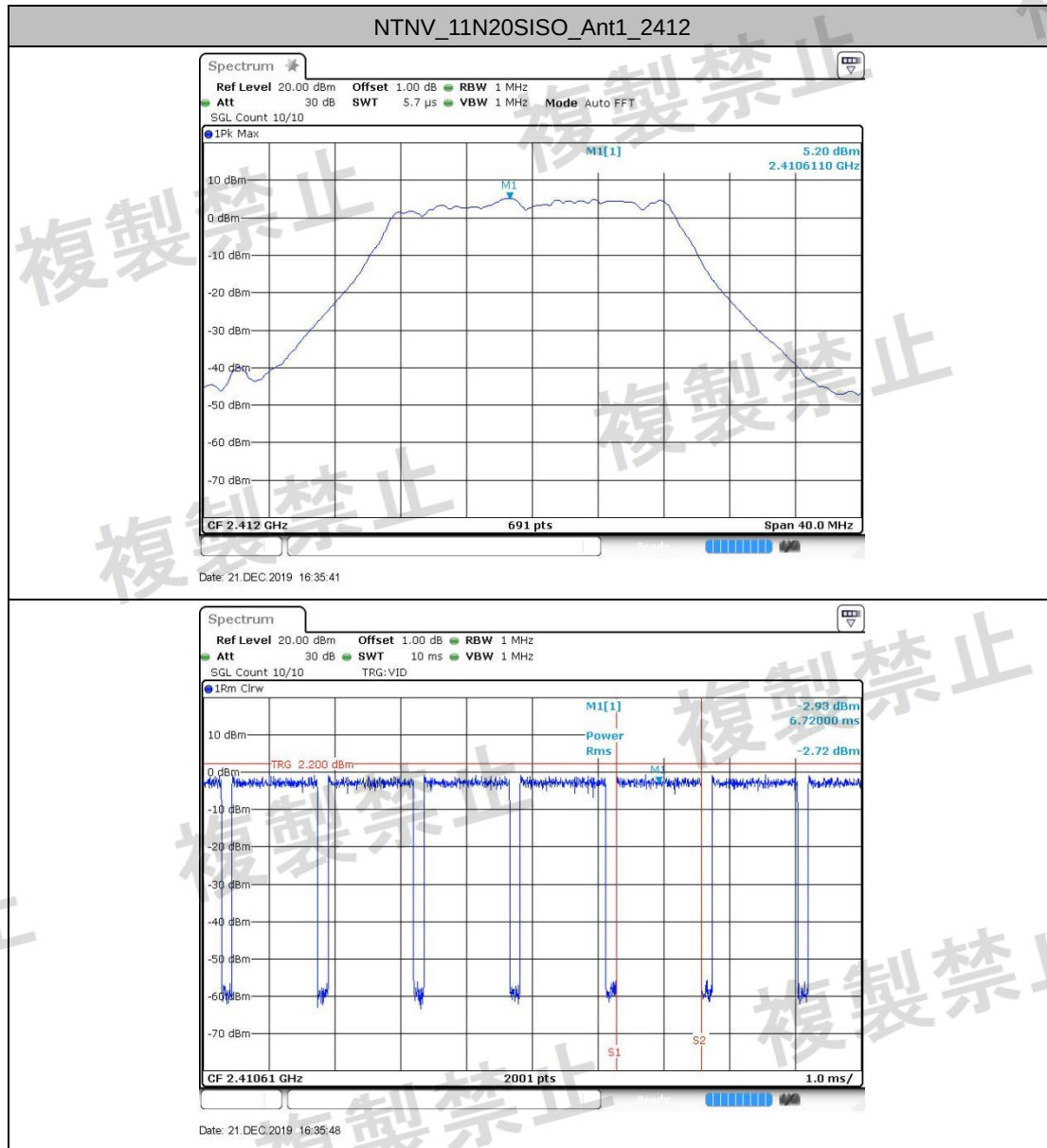
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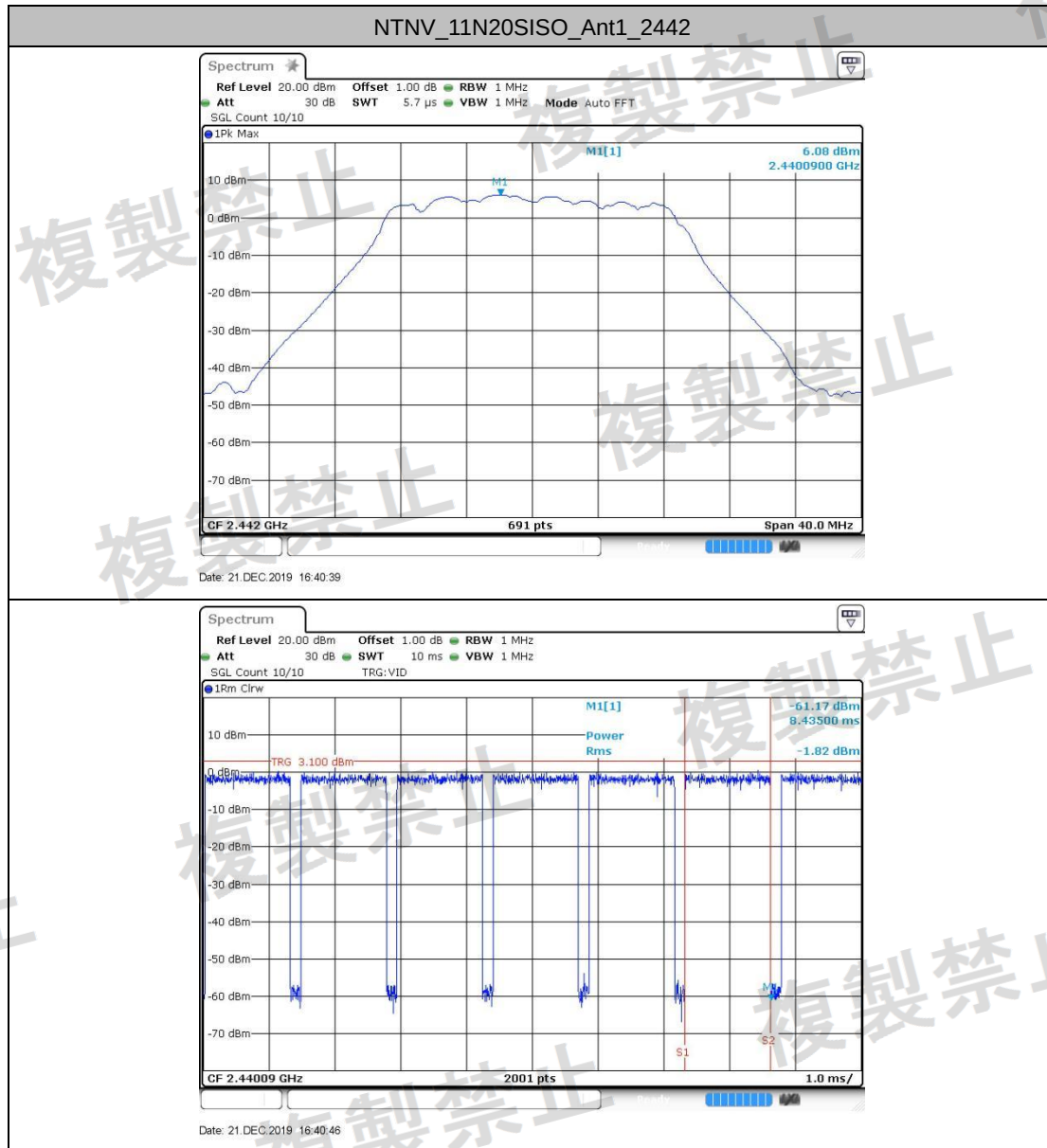
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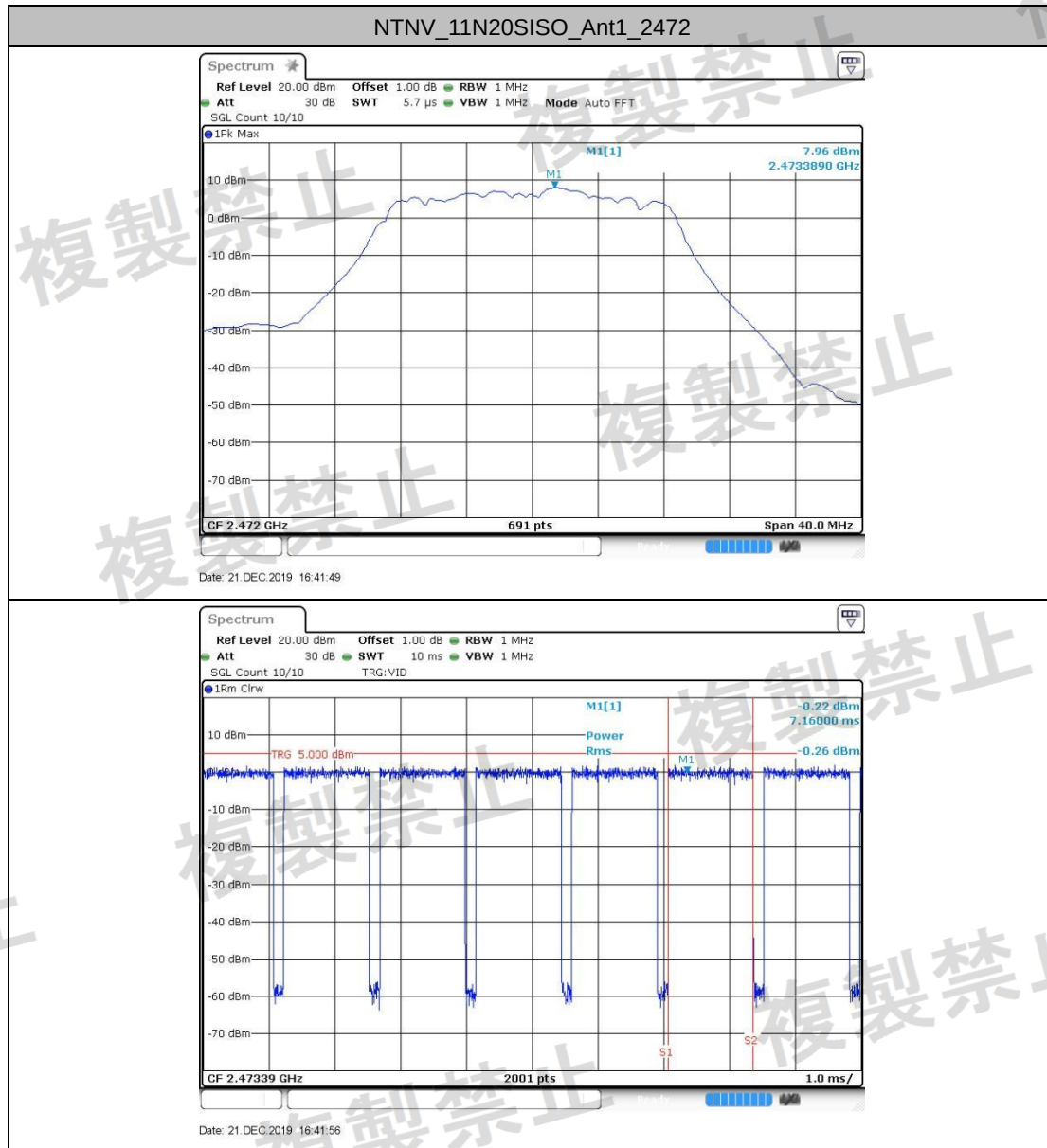
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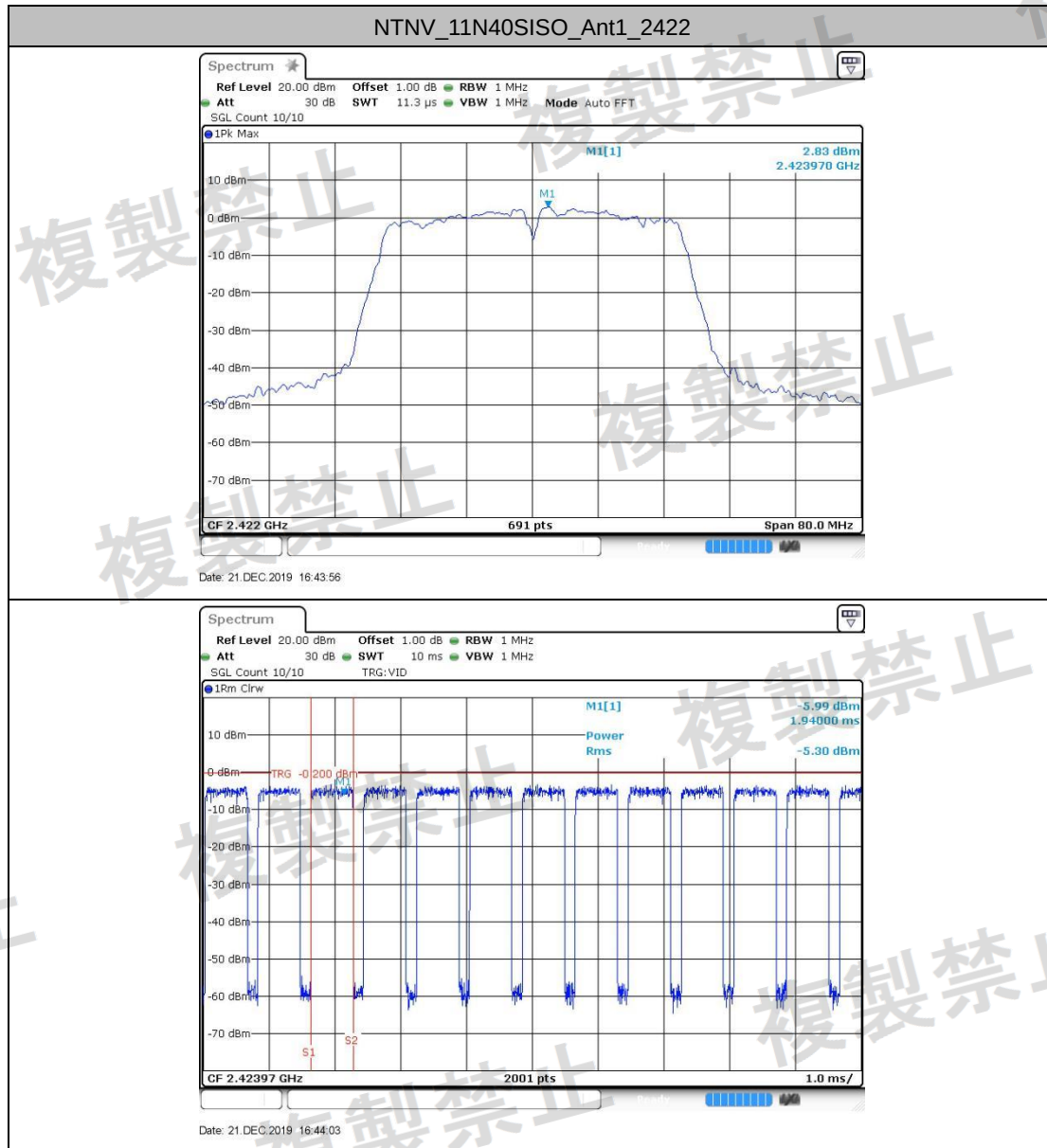
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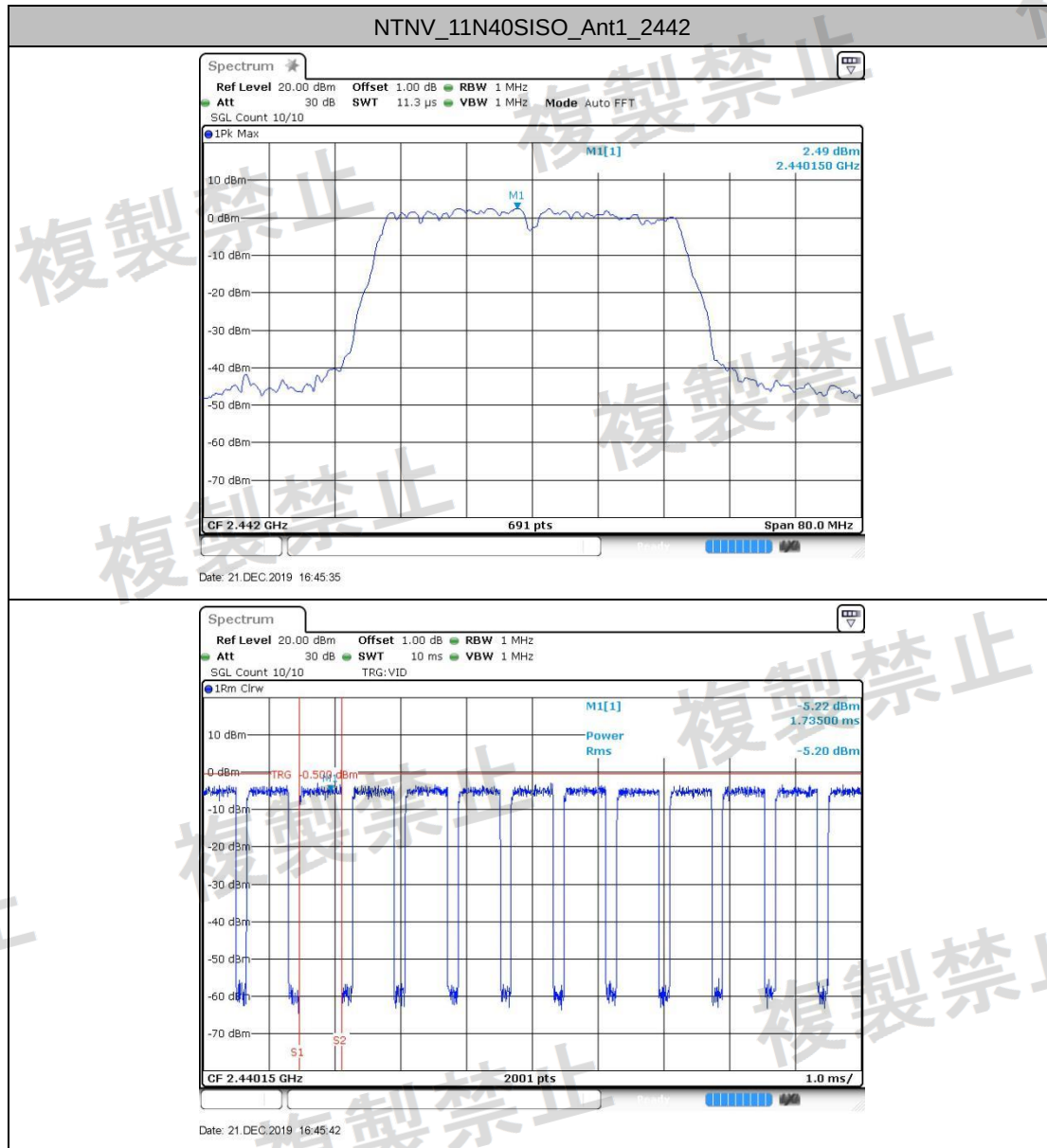
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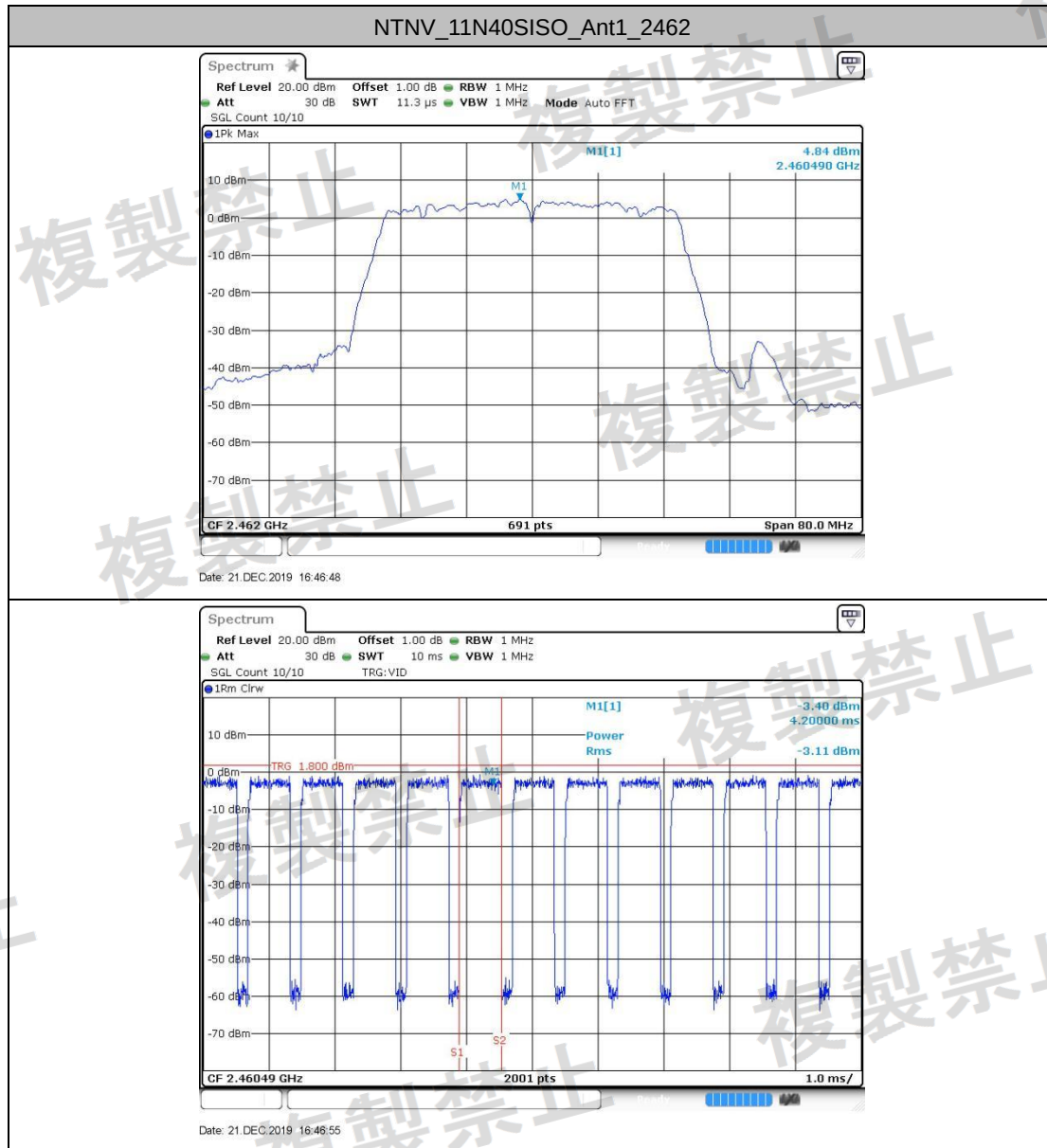
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Occupied Bandwidth

Test Result

TestCondition	TestMode	Frequency[MHz]	Result [MHz]	Limit [MHz]	Verdict
NTNV	11b	2412	12.23	≤26	PASS
		2442	12.23	≤26	PASS
		2472	12.39	≤26	PASS
	11g	2412	17.22	≤40	PASS
		2442	17.18	≤40	PASS
		2472	17.14	≤40	PASS
	11n20MIMO	2412	18.14	≤40	PASS
		2442	18.14	≤40	PASS
		2472	18.06	≤40	PASS
	11n40MIMO	2422	35.90	≤40	PASS
		2442	36.08	≤40	PASS
		2462	35.96	≤40	PASS

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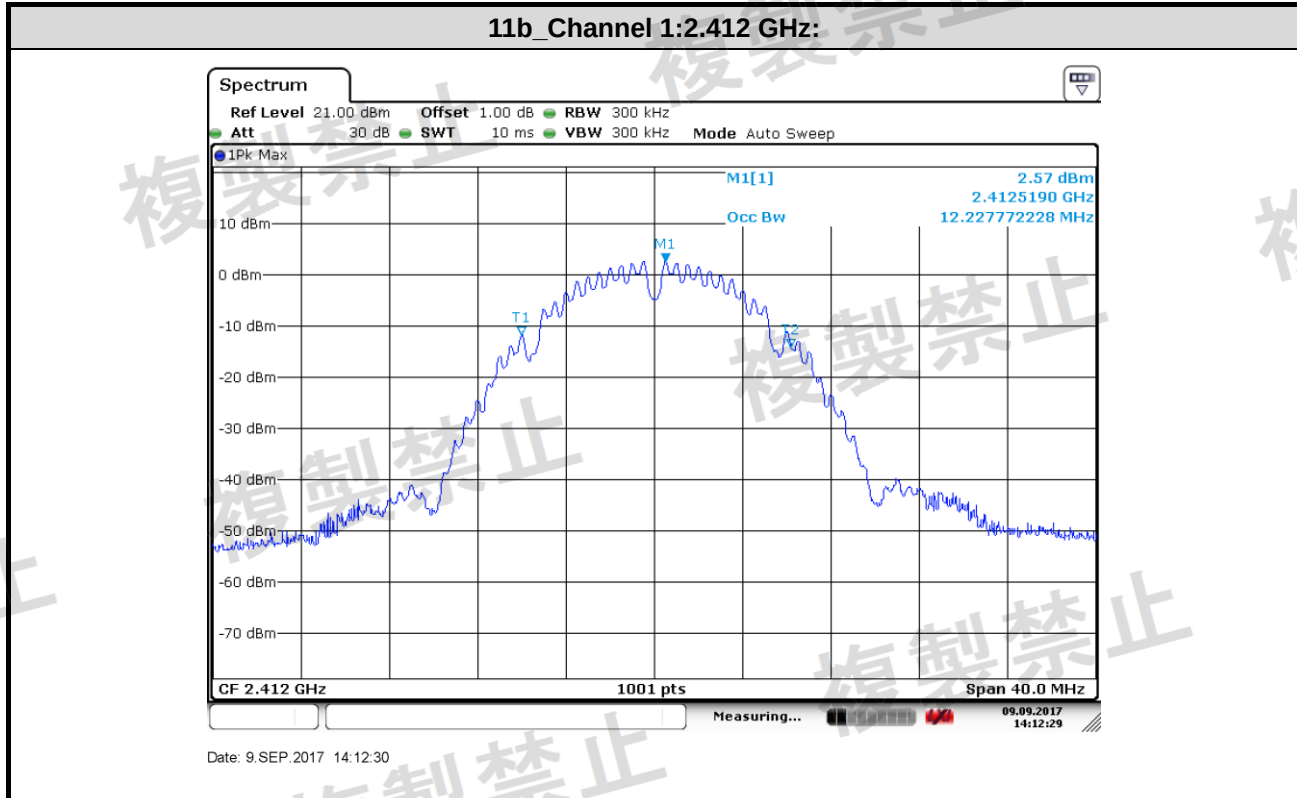


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Test Graphs



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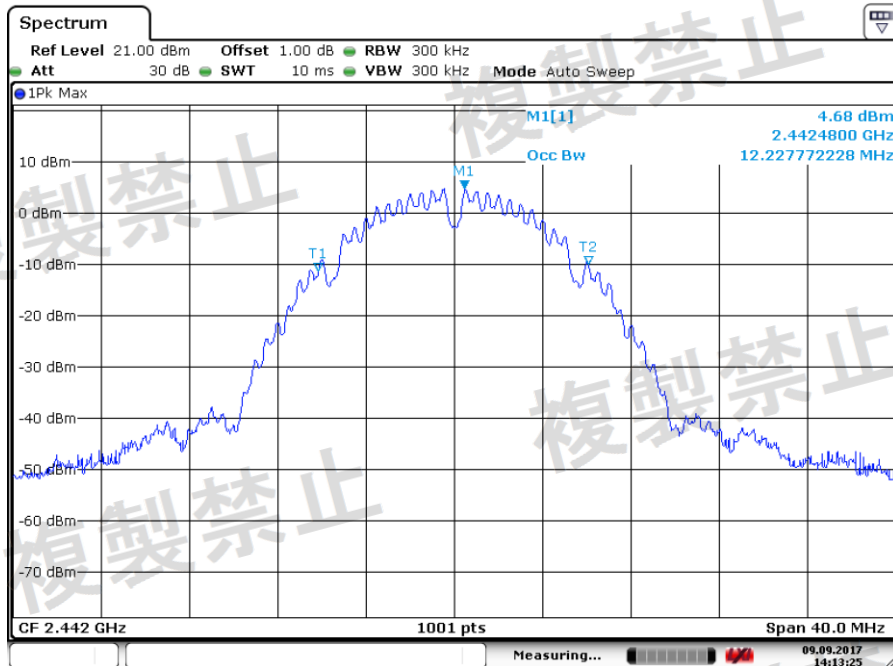


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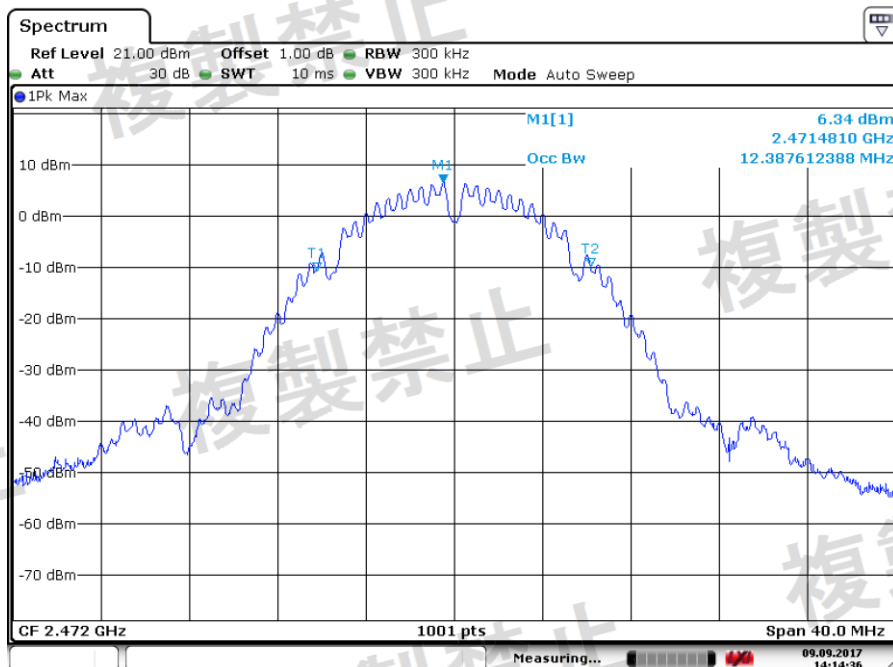
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11b_Channel 7:2.442 GHz:



Date: 9 SEP.2017 14:13:25

11b_Channel 13:2.472GHz:



Date: 9 SEP.2017 14:14:36

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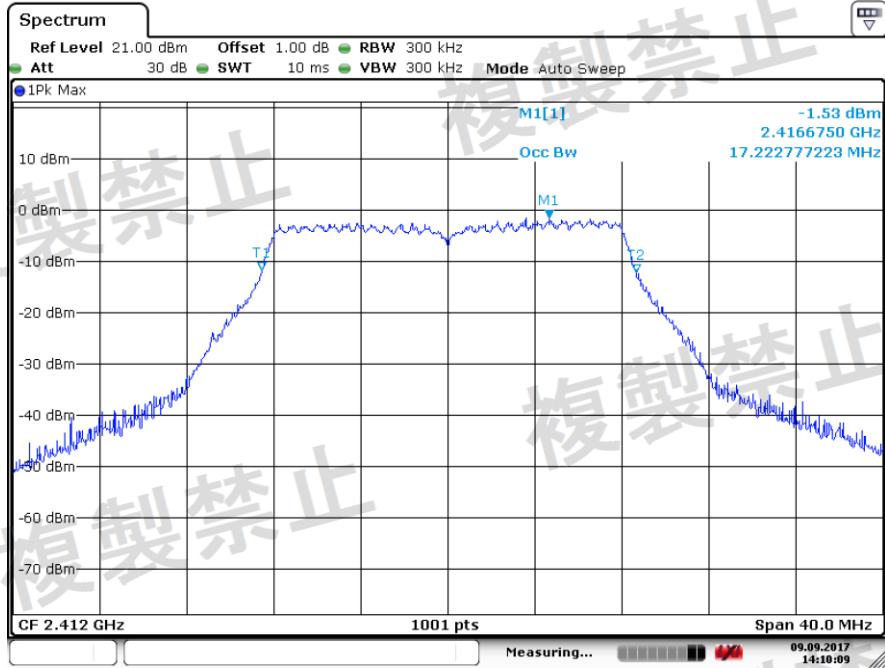


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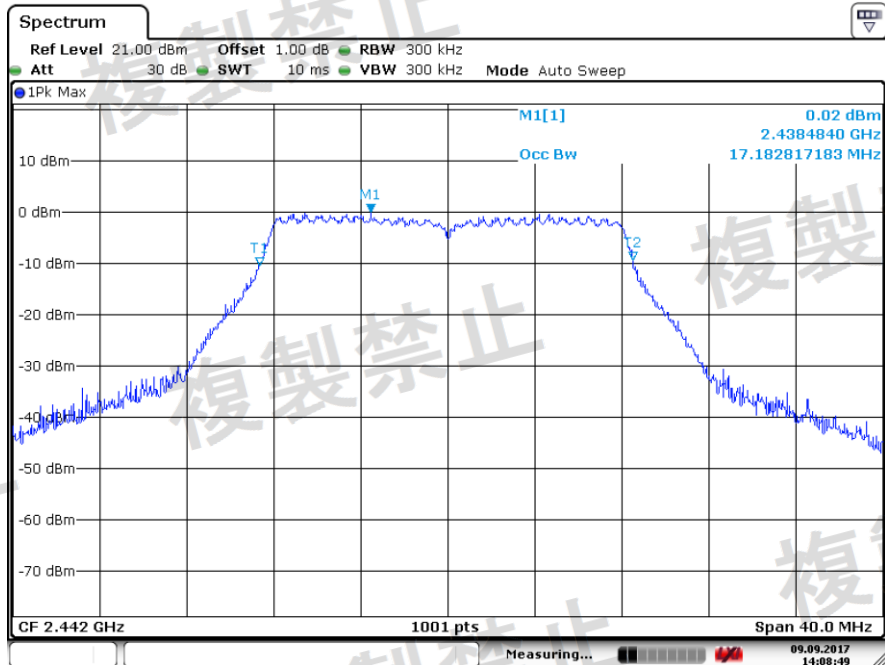
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11g_Channel 1:2.412 GHz:



Date: 9.SEP.2017 14:10:10

11g_Channel 7:2.442 GHz:



Date: 9.SEP.2017 14:08:50

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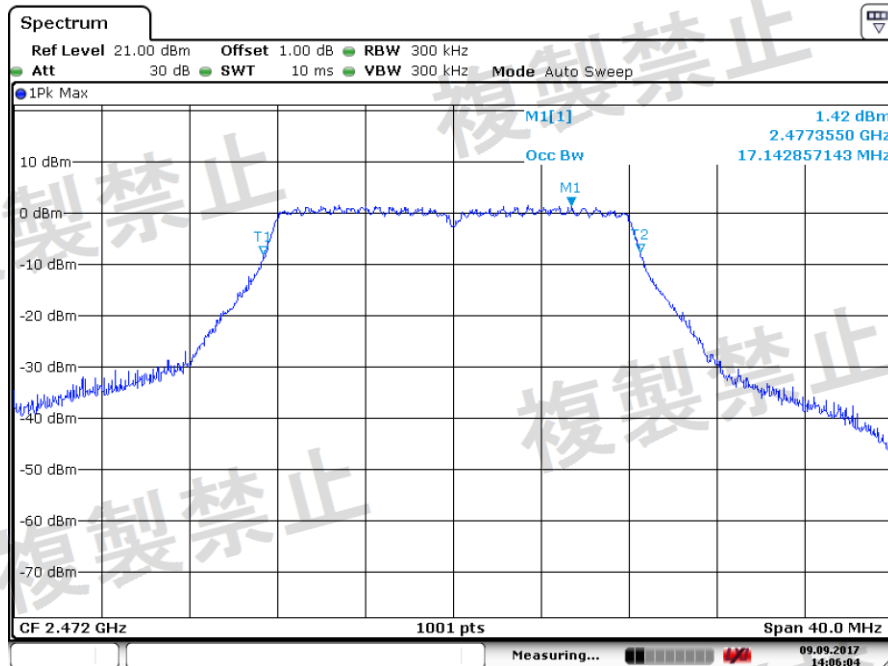


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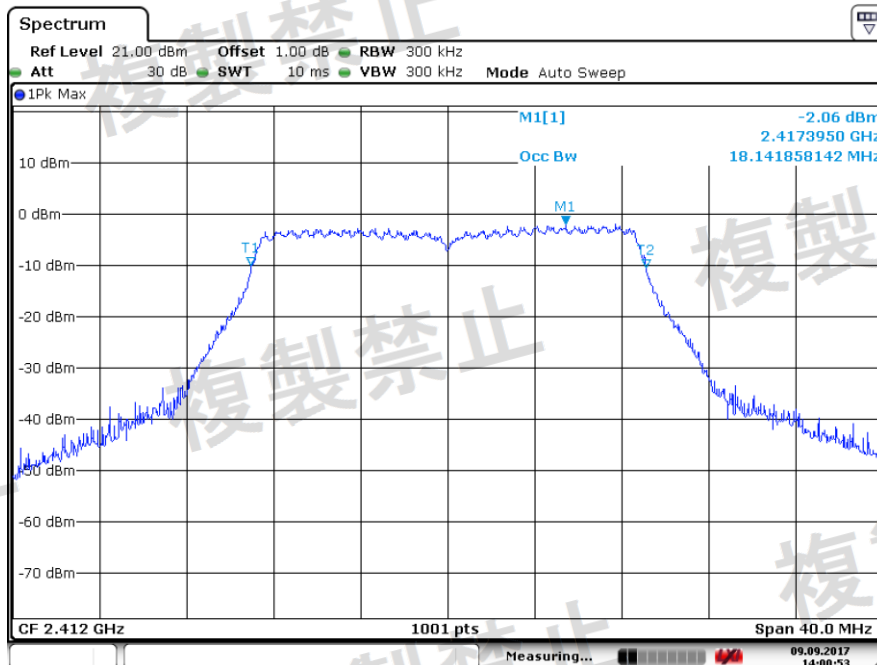
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11g_Channel 13:2.472GHz:



Date: 9.SEP.2017 14:06:05

11n20_Channel 1:2.412 GHz:



Date: 9.SEP.2017 14:00:53

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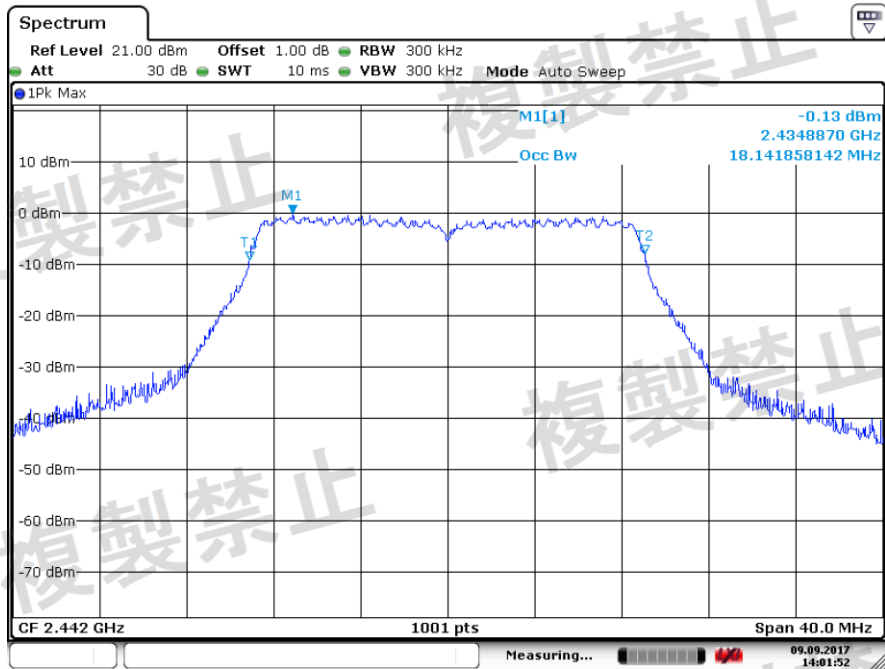


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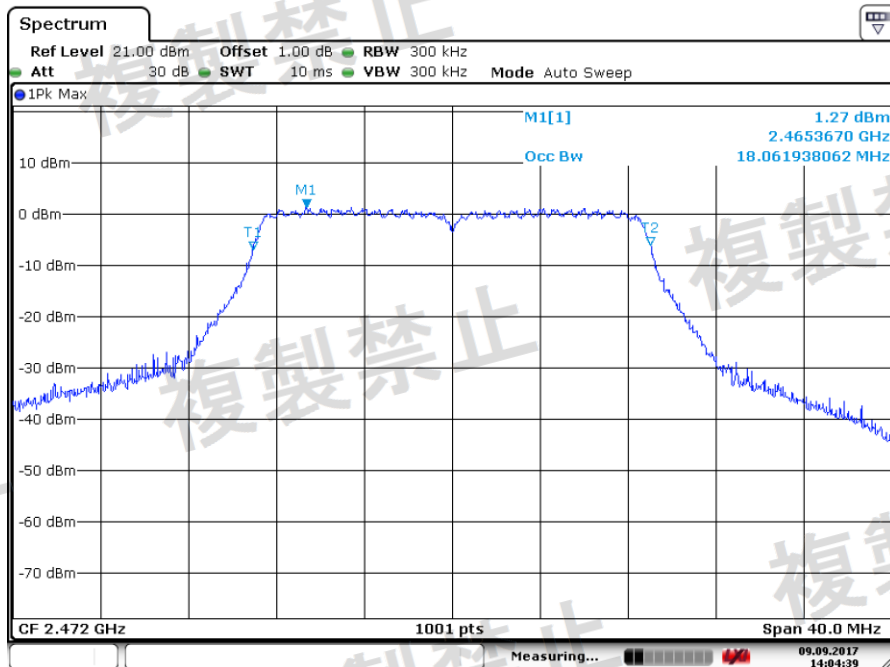
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11n20_Channel 7:2.442 GHz:



Date: 9.SEP.2017 14:01:53

11n20_Channel 13:2.472GHz:



Date: 9.SEP.2017 14:04:40

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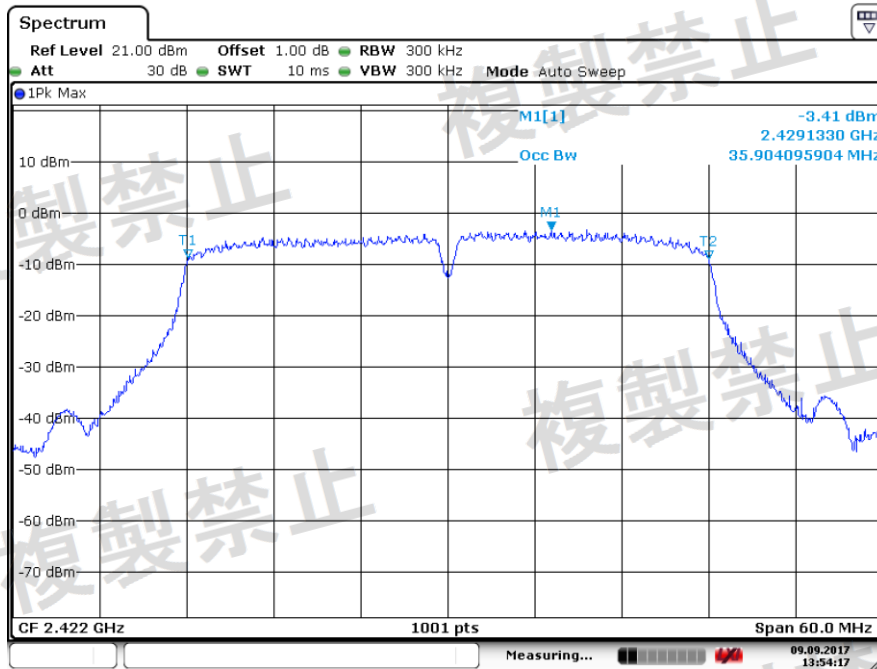


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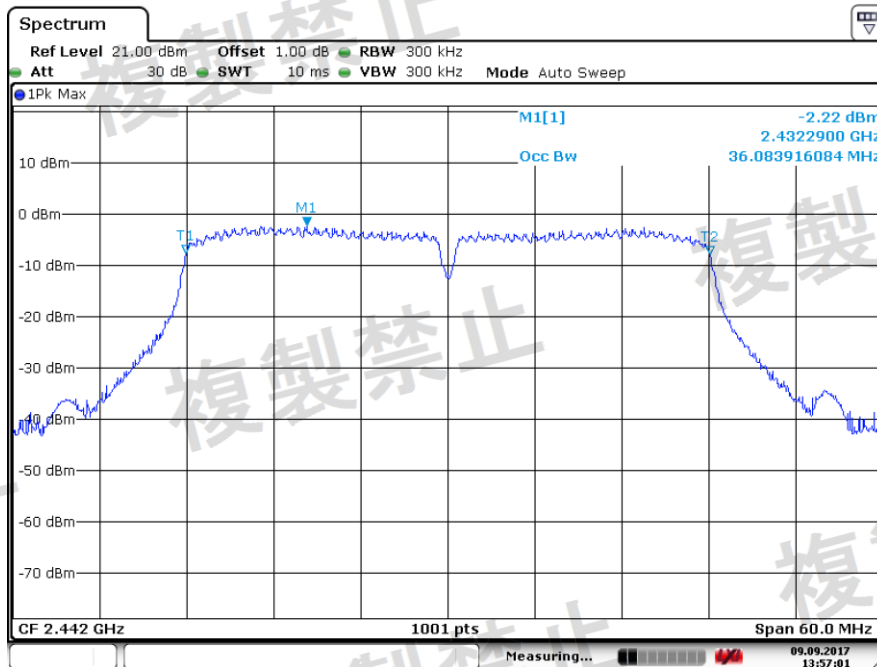
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Date: 9.SEP.2017 13:54:17

11n40_Channel 7:2.442 GHz:



Date: 9.SEP.2017 13:57:02

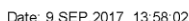
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Spread Bandwidth

Test Result

TestCondition	TestMode	Frequency[MHz]	Result [MHz]	Limit [MHz]	SpreadFactor	Limit	Verdict
NTNV	11b	2412	7.83	≥0.5	5.695	>5	PASS
		2442	7.83	≥0.5	5.695	>5	PASS
		2472	7.87	≥0.5	5.724	>5	PASS
	11g	2412	14.95	≥0.5	---	---	PASS
		2442	14.95	≥0.5	---	---	PASS
		2472	14.83	≥0.5	---	---	PASS
	11n20MIMO	2412	15.94	≥0.5	---	---	PASS
		2442	15.94	≥0.5	---	---	PASS
		2472	15.86	≥0.5	---	---	PASS
	11n40MIMO	2422	31.11	≥0.5	---	---	PASS
		2442	31.95	≥0.5	---	---	PASS
		2462	31.17	≥0.5	---	---	PASS

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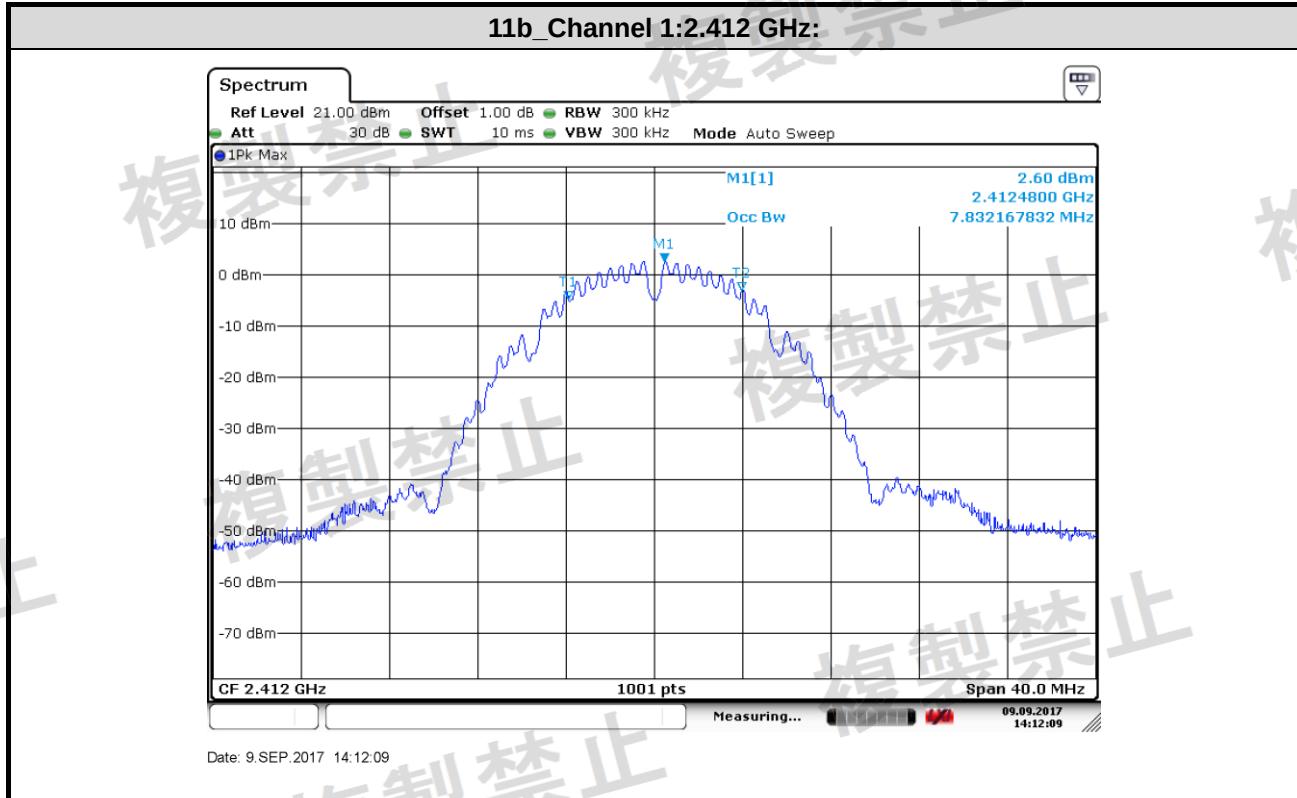


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Test Graphs



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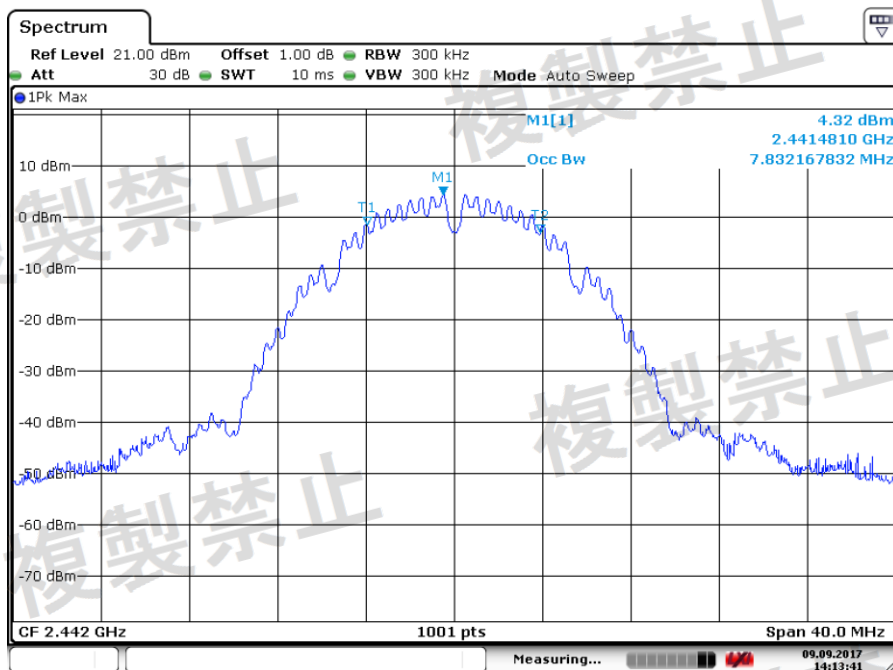


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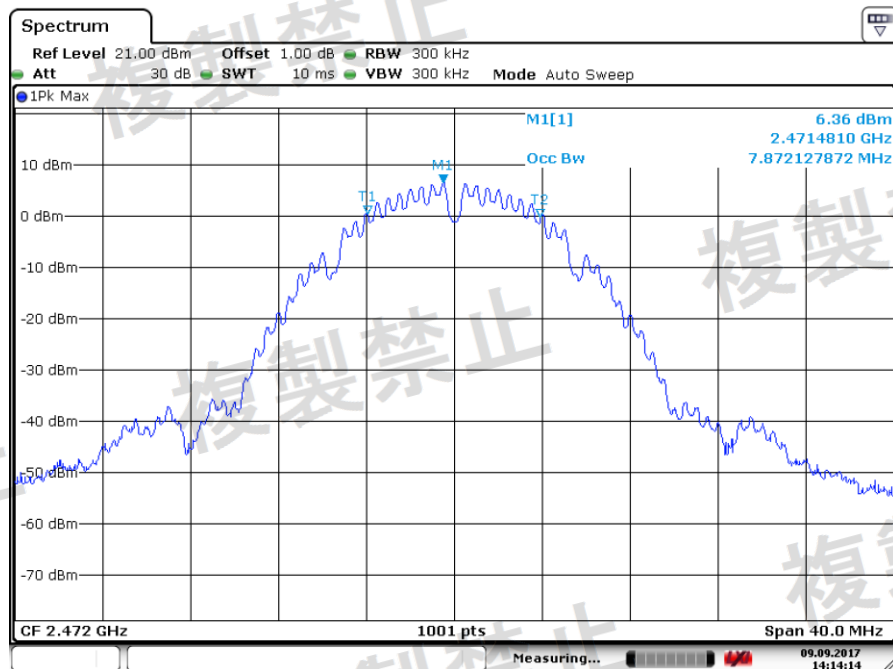
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11b_Channel 7:2.442 GHz:



Date: 9 SEP.2017 14:13:42

11b_Channel 13:2.472GHz:



Date: 9 SEP.2017 14:14:14

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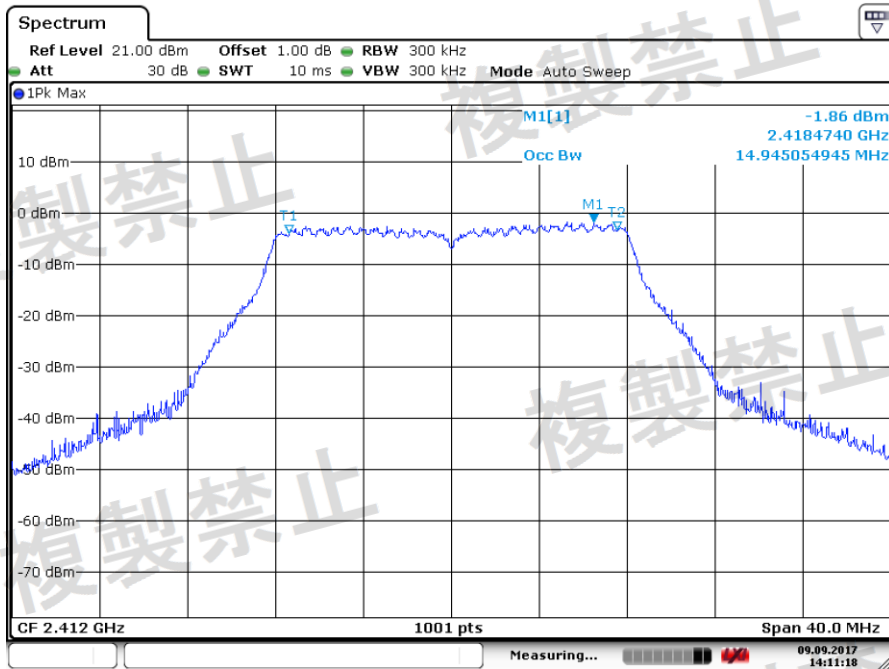


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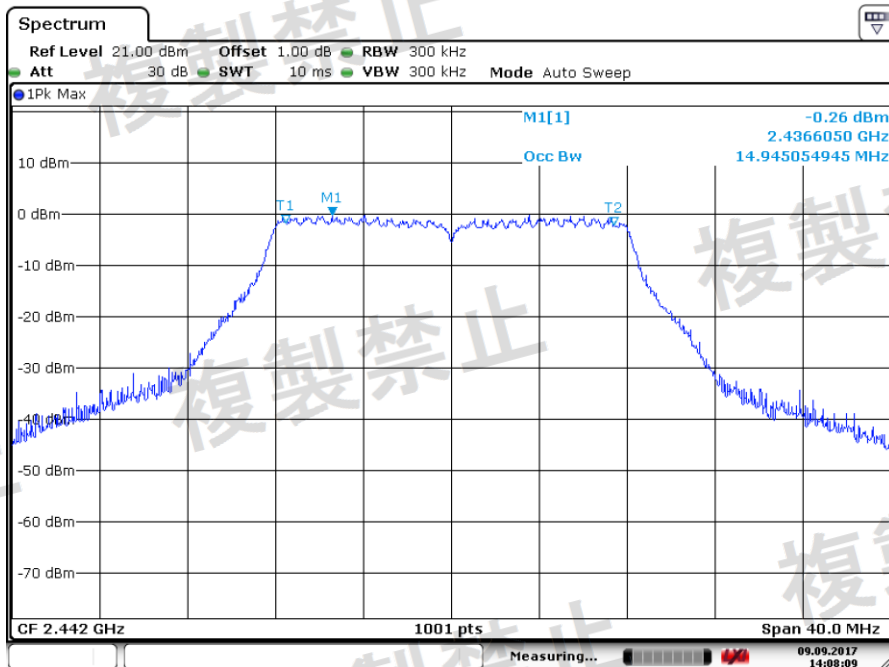
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11g_Channel 1:2.412 GHz:



Date: 9.SEP.2017 14:11:19

11g_Channel 7:2.442 GHz:



Date: 9.SEP.2017 14:08:09

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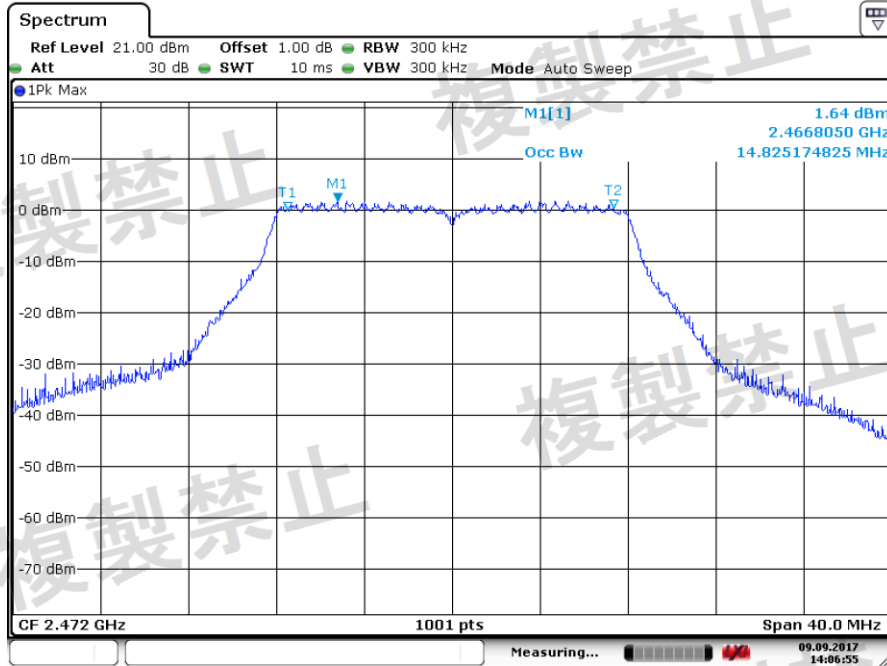


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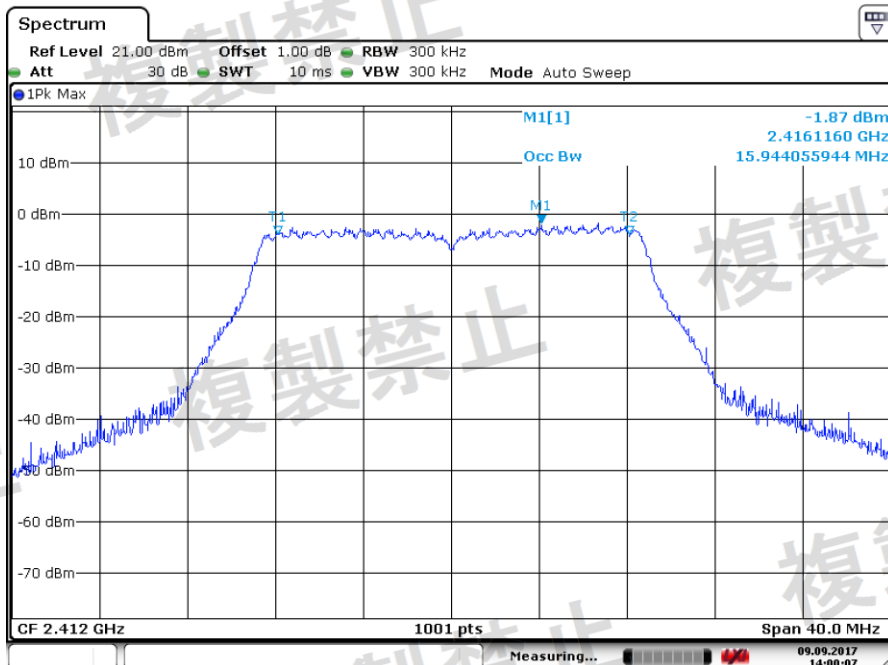
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11g_Channel 13:2.472GHz:



Date: 9.SEP.2017 14:06:55

11n20_Channel 1:2.412 GHz:



Date: 9.SEP.2017 14:00:08

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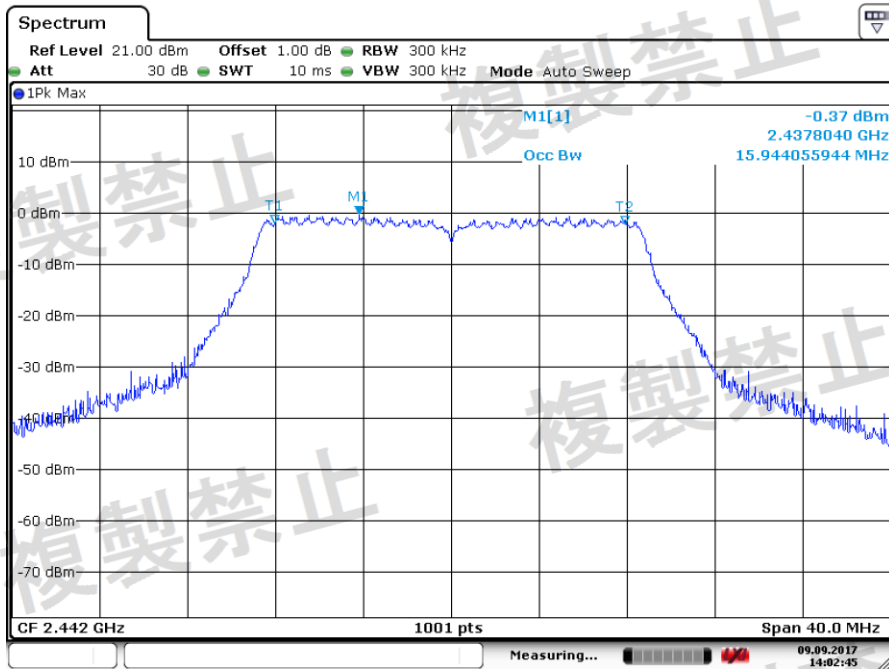


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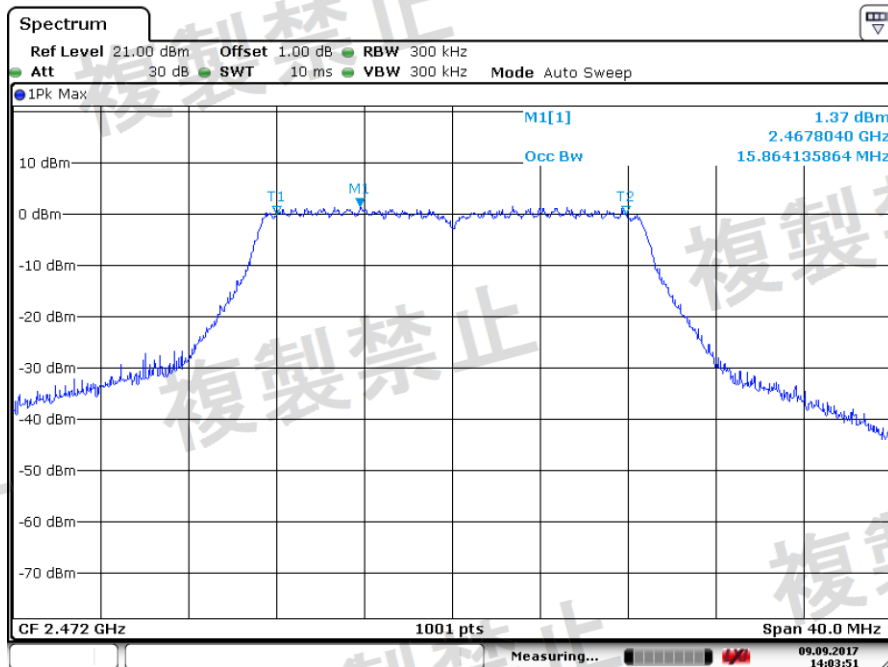
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11n20_Channel 7:2.442 GHz:



Date: 9.SEP.2017 14:02:45

11n20_Channel 13:2.472GHz:



Date: 9.SEP.2017 14:03:51

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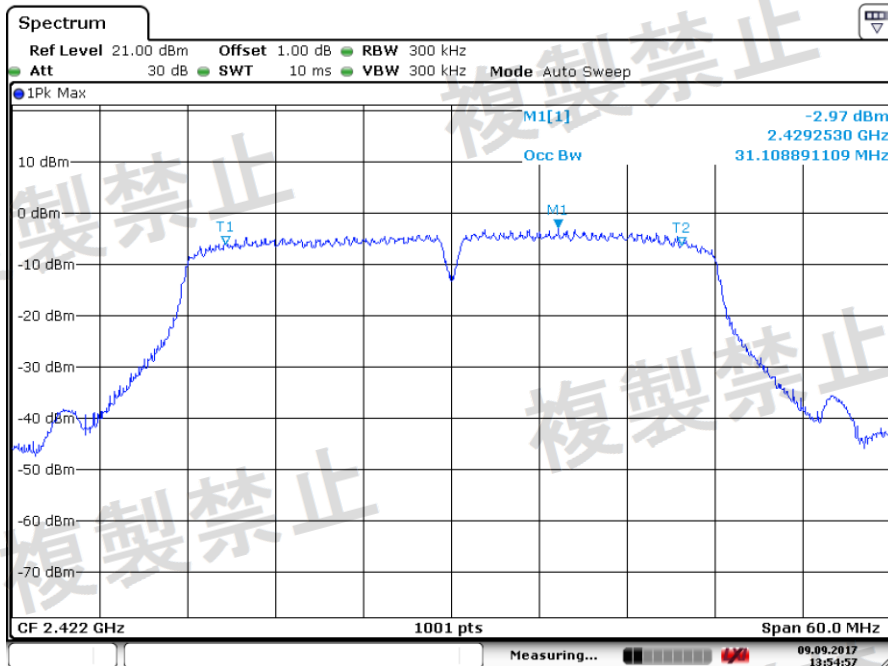


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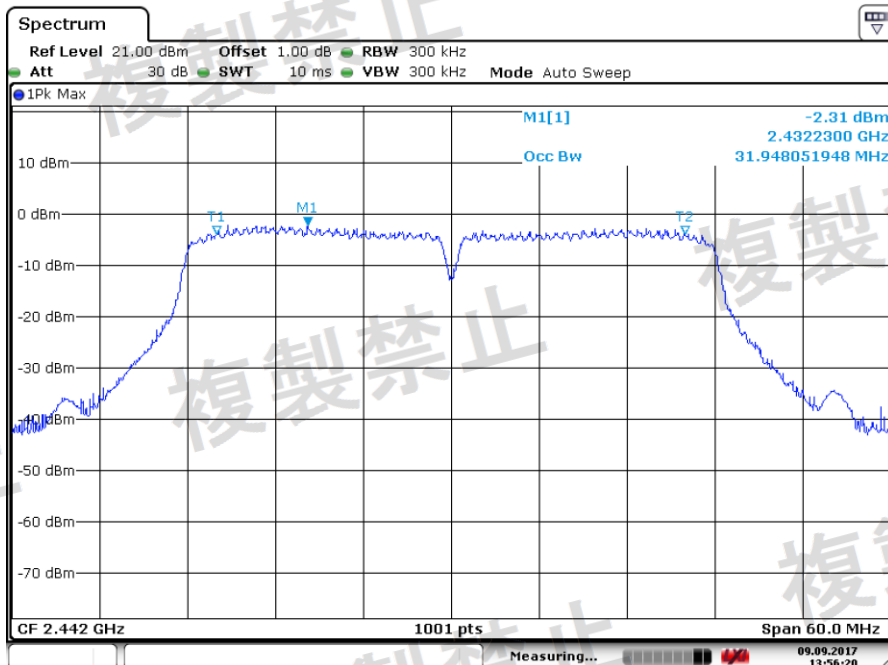
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11n40_Channel 3:2.422 GHz:



Date: 9.SEP.2017 13:54:57

11n40_Channel 7:2.442 GHz:



Date: 9.SEP.2017 13:56:20

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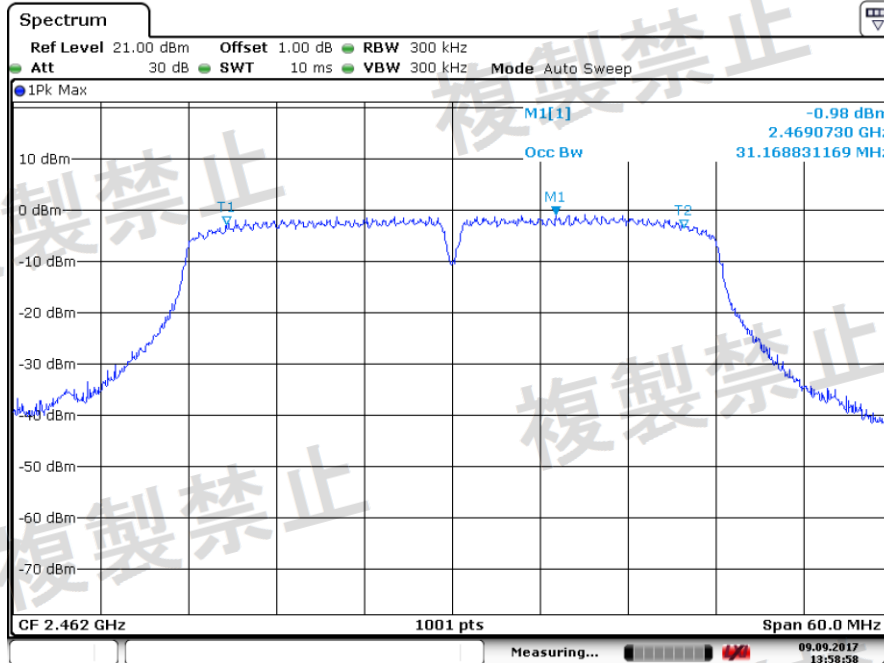


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11n40_Channel 11:2.462GHz:



Date: 9.SEP.2017 13:58:59

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Spurious Emission of TX

Test Result

TestCondition	TestMode	Frequency [MHz]	Freq.Range [MHz]	Freq. [MHz]	Result [dBm/MHz z]	Result [μW/MHz]	Limit [μW/ MHz]	Verdict
NTNV	11b	2412	30~2387	970.50	-54.56	0.0035	≤2.5	PASS
			2387~2400	2399.99	-45.79	0.0264	≤25	PASS
			2483.5~2496.5	2483.90	-56.87	0.0021	≤25	PASS
			2496.5~13000	6898.83	-51.00	0.0079	≤2.5	PASS
		2442	30~2387	1057.69	-54.01	0.0040	≤2.5	PASS
			2387~2400	2399.64	-55.41	0.0029	≤25	PASS
			2483.5~2496.5	2485.97	-55.87	0.0026	≤25	PASS
			2496.5~13000	6880.83	-51.13	0.0077	≤2.5	PASS
		2472	30~2387	903.17	-54.82	0.0033	≤2.5	PASS
			2387~2400	2399.50	-56.74	0.0021	≤25	PASS
			2483.5~2496.5	2483.51	-40.98	0.0798	≤25	PASS
			2496.5~13000	6970.32	-51.21	0.0076	≤2.5	PASS
	11g	2412	30~2387	1759.90	-54.10	0.0039	≤2.5	PASS
			2387~2400	2399.99	-36.75	0.2113	≤25	PASS
			2483.5~2496.5	2484.34	-56.94	0.0020	≤25	PASS
			2496.5~13000	6887.83	-51.35	0.0073	≤2.5	PASS
		2442	30~2387	921.02	-54.35	0.0037	≤2.5	PASS
			2387~2400	2399.93	-55.49	0.0028	≤25	PASS
			2483.5~2496.5	2484.38	-55.71	0.0027	≤25	PASS
			2496.5~13000	6845.34	-50.90	0.0081	≤2.5	PASS
		2472	30~2387	624.11	-54.64	0.0034	≤2.5	PASS
			2387~2400	2399.64	-56.71	0.0021	≤25	PASS
			2483.5~2496.5	2483.53	-31.86	0.6516	≤25	PASS
			2496.5~13000	6709.35	-51.29	0.0074	≤2.5	PASS
	11n20	2412	30~2387	867.41	-53.65	0.0043	≤2.5	PASS
			2387~2400	2399.88	-35.34	0.2924	≤25	PASS
			2483.5~2496.5	2483.88	-56.72	0.0021	≤25	PASS
			2496.5~13000	6874.83	-50.85	0.0082	≤2.5	PASS
		2442	30~2387	667.70	-54.74	0.0034	≤2.5	PASS
			2387~2400	2399.41	-55.51	0.0028	≤25	PASS

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	11n40	2472	2483.5~2496.5	2484.27	-55.78	0.0026	≤25	PASS
			2496.5~13000	6804.34	-51.55	0.0070	≤2.5	PASS
			30~2387	603.49	-53.96	0.0040	≤2.5	PASS
			2387~2400	2397.03	-56.52	0.0022	≤25	PASS
			2483.5~2496.5	2483.51	-30.69	0.8531	≤25	PASS
			2496.5~13000	6928.33	-51.08	0.0078	≤2.5	PASS
		2422	30~2387	1003.49	-54.20	0.0038	≤2.5	PASS
			2387~2400	2399.81	-37.87	0.1633	≤25	PASS
			2483.5~2496.5	2483.52	-55.53	0.0028	≤25	PASS
			2496.5~13000	6969.82	-51.32	0.0074	≤2.5	PASS
		2442	30~2387	925.14	-54.46	0.0036	≤2.5	PASS
			2387~2400	2399.50	-52.97	0.0050	≤25	PASS
			2483.5~2496.5	2484.26	-54.15	0.0038	≤25	PASS
			2496.5~13000	6908.83	-51.03	0.0079	≤2.5	PASS
		2462	30~2387	2021.46	-54.84	0.0033	≤2.5	PASS
			2387~2400	2398.71	-55.29	0.0030	≤25	PASS
			2483.5~2496.5	2483.57	-34.03	0.3954	≤25	PASS
			2496.5~13000	6874.33	-51.19	0.0076	≤2.5	PASS

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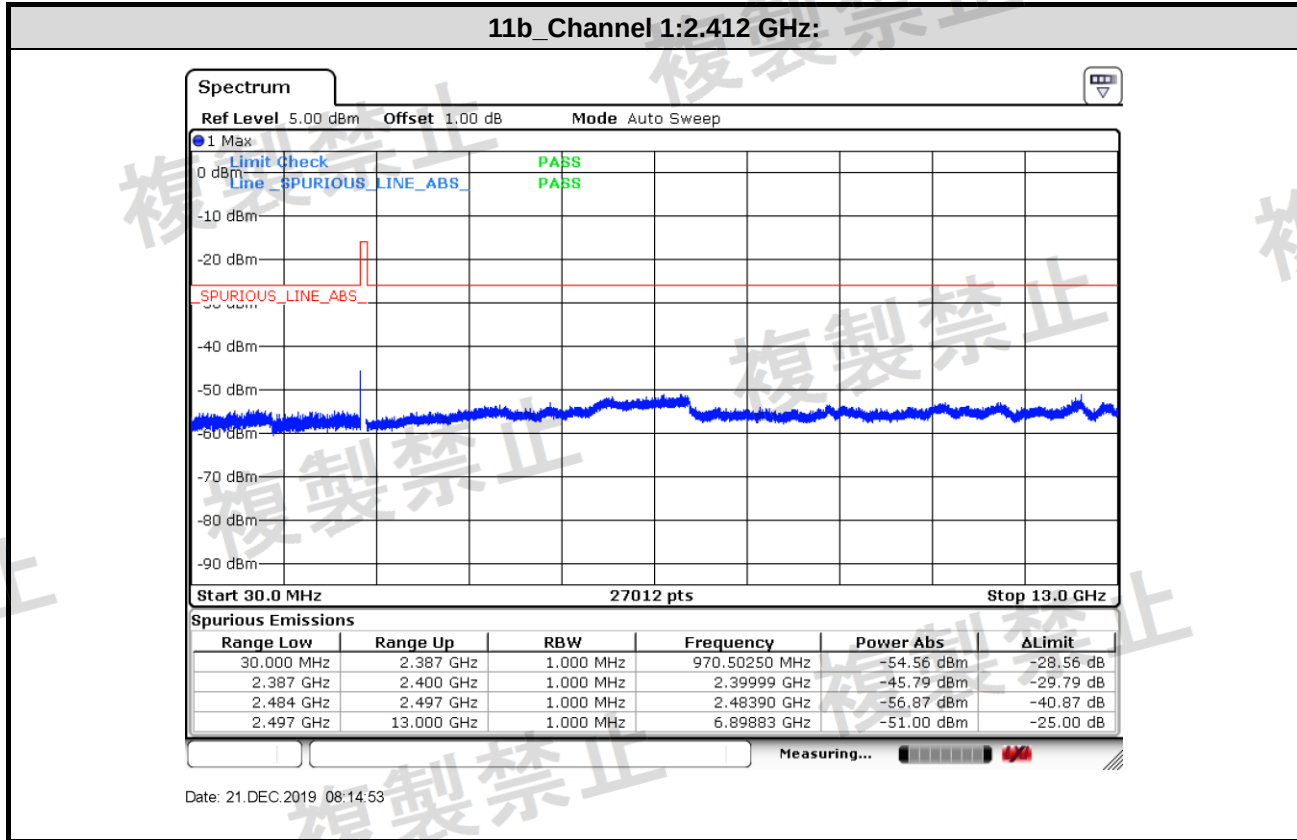


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Test Graphs



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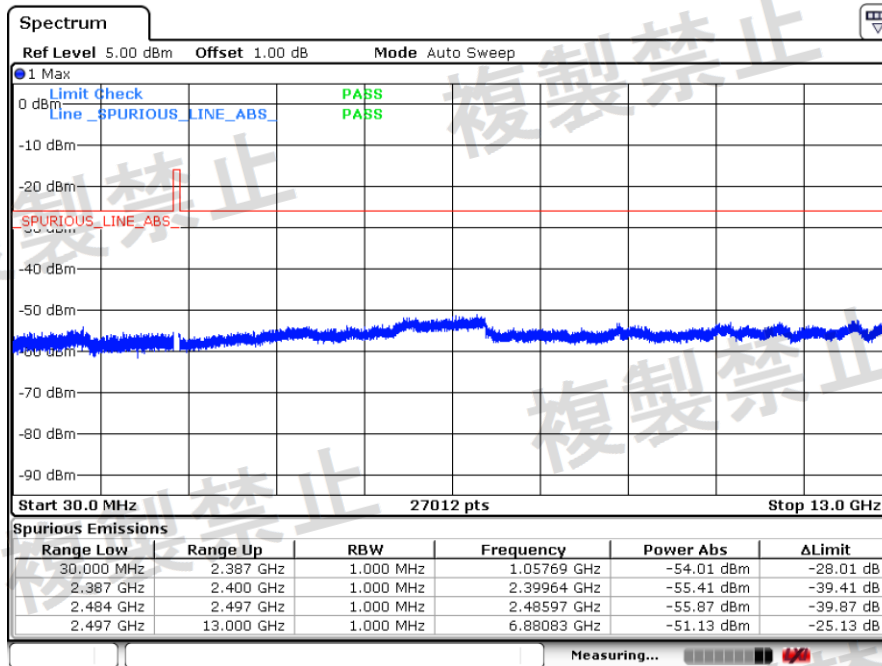


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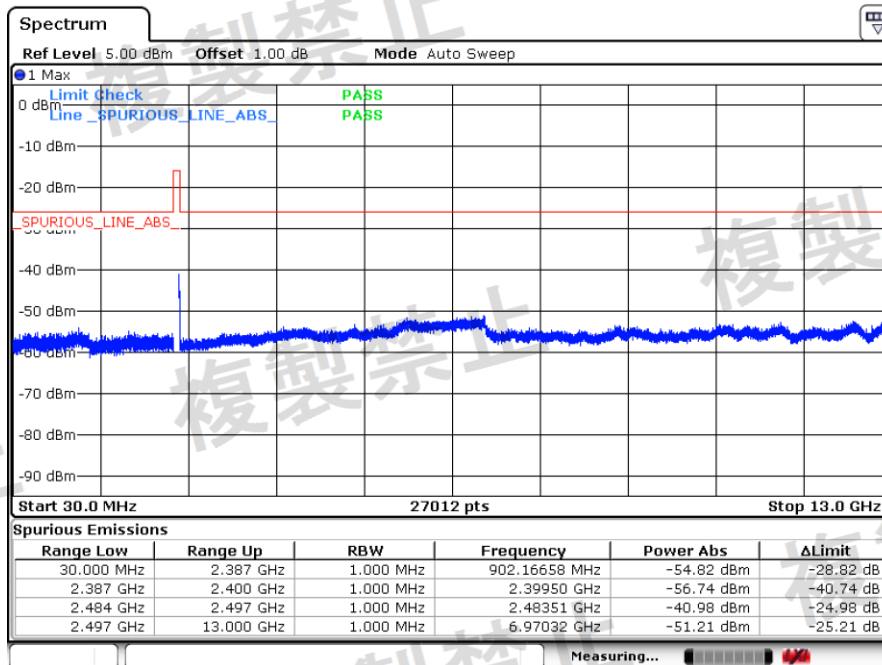
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11b_Channel 7:2.442 GHz:



Date: 21.DEC.2019 08:18:25

11b_Channel 13:2.472GHz:



Date: 21.DEC.2019 08:20:13



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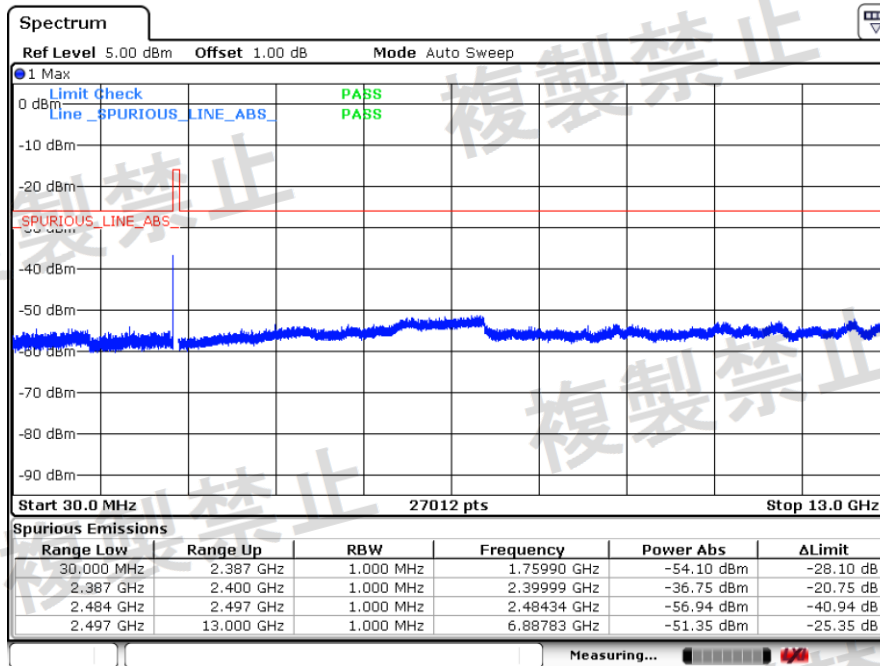


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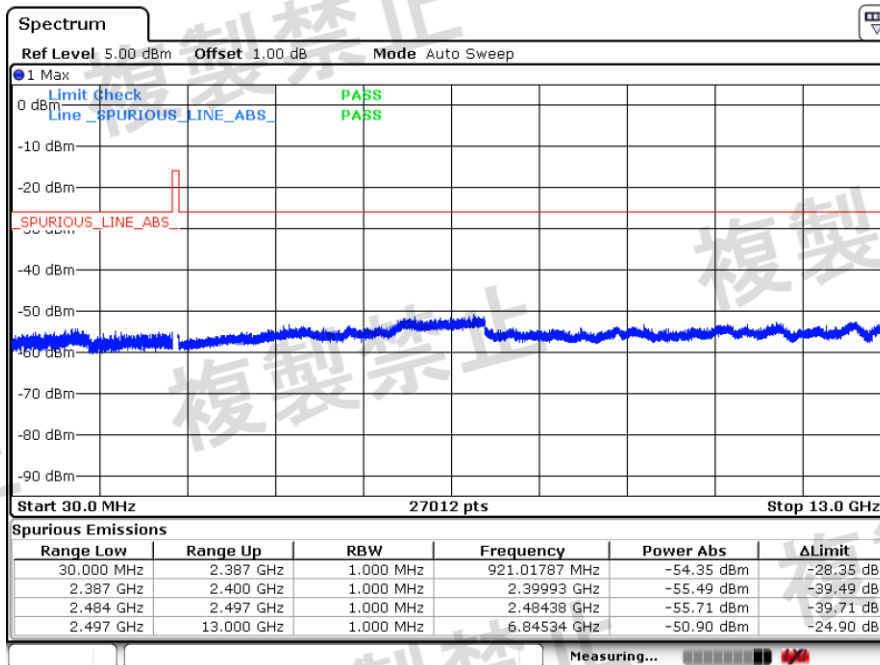
Page: 70 of 79

11g_Channel 1:2.412 GHz:



Date: 21.DEC.2019 08:15:19

11g_Channel 7:2.442 GHz:



Date: 21.DEC.2019 08:18:52



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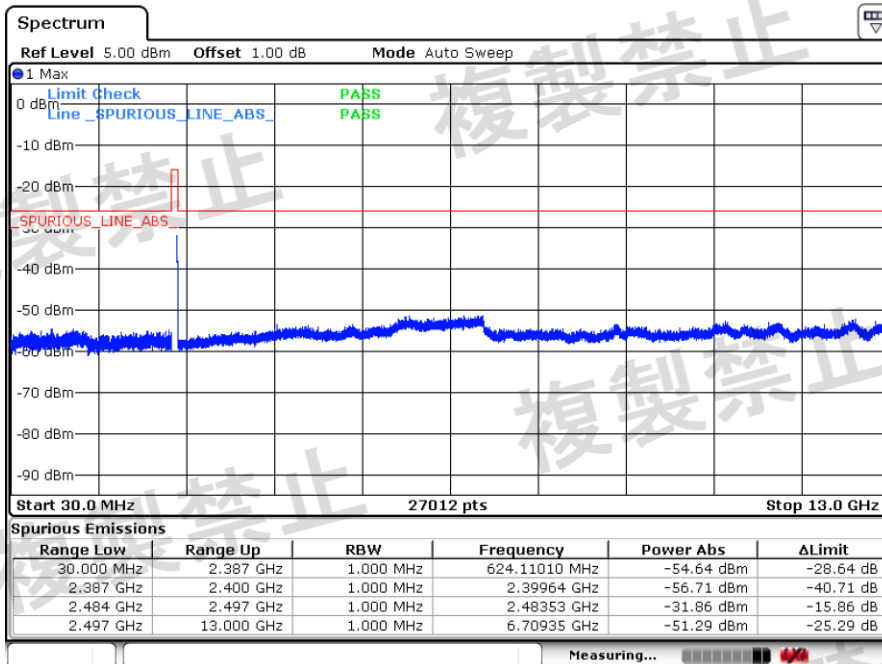


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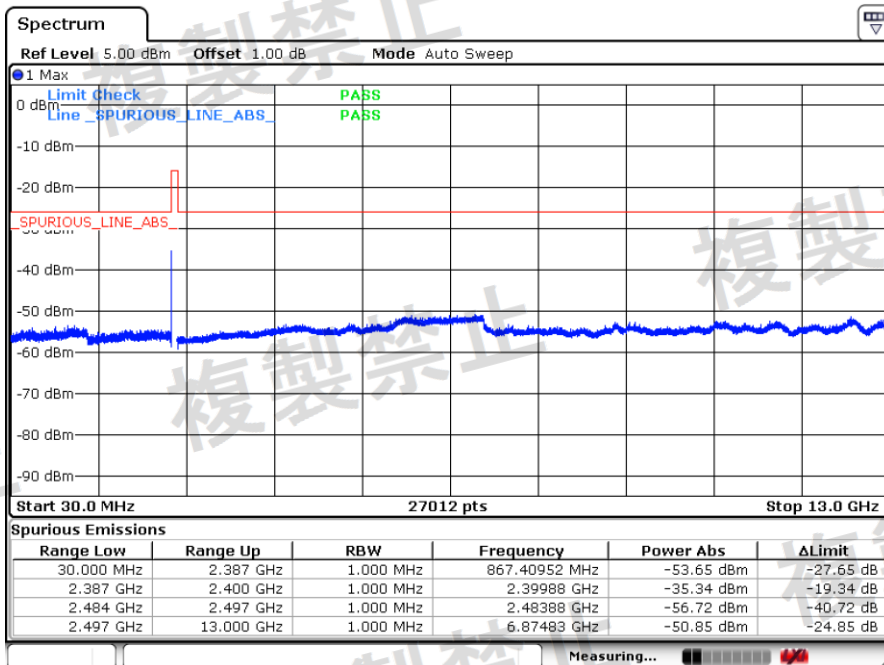
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11g_Channel 13:2.472GHz:



Date: 21.DEC.2019 08:20:40

11n20_Channel 1:2.412 GHz:



Date: 21.DEC.2019 08:17:57



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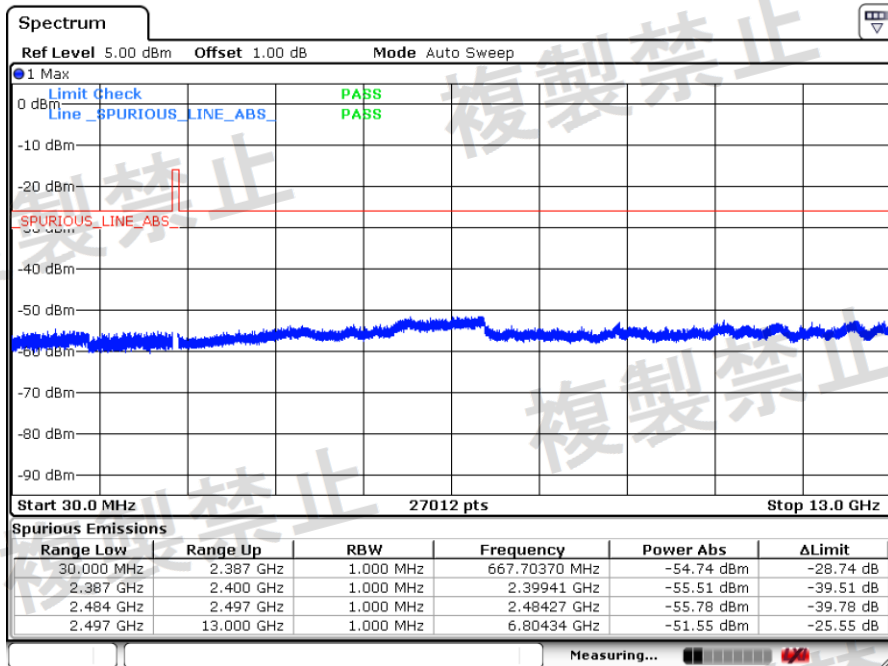


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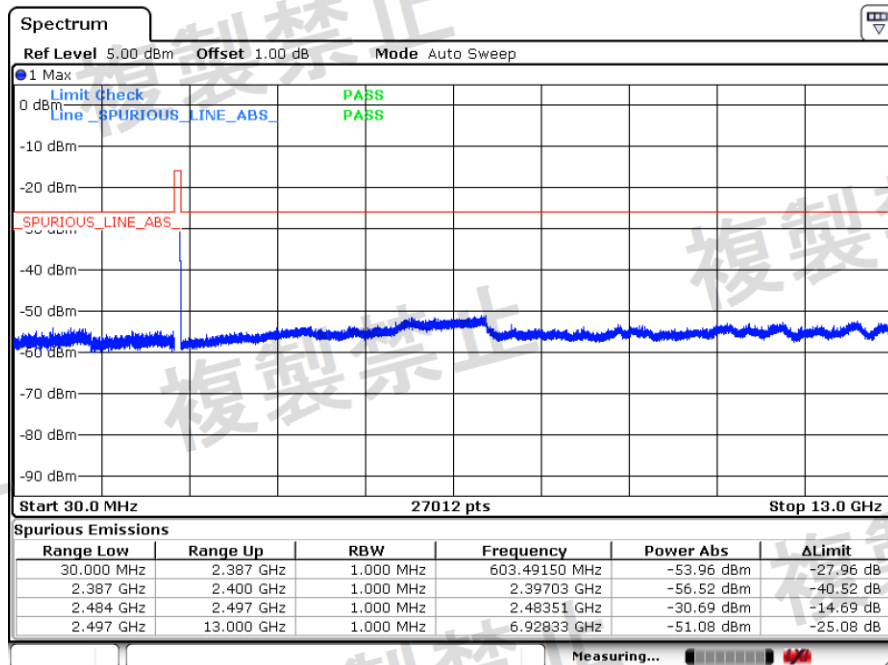
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11n20_Channel 7:2.442 GHz:



Date: 21.DEC.2019 08:19:34

11n20_Channel 13:2.472GHz:



Date: 21.DEC.2019 08:21:12



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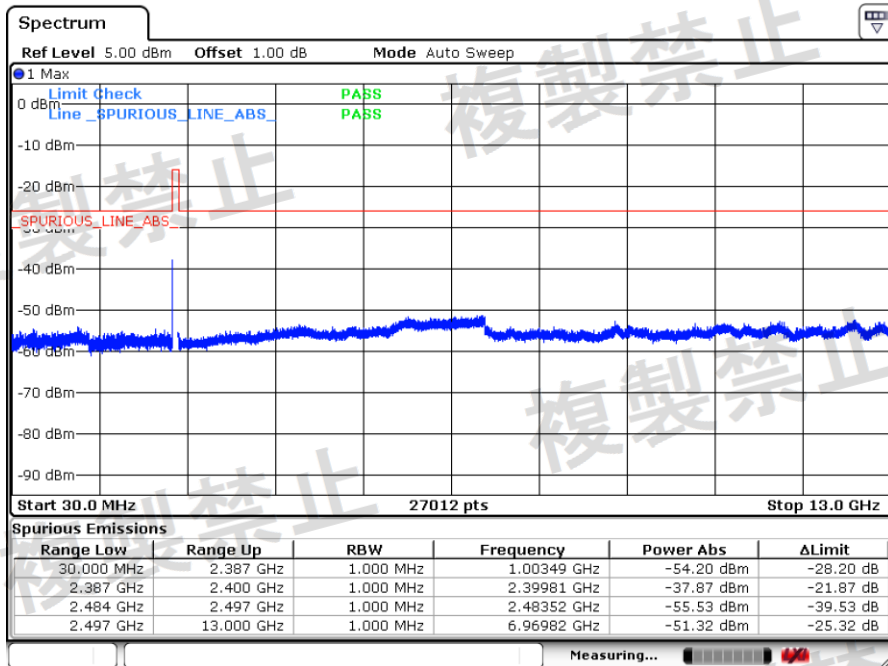


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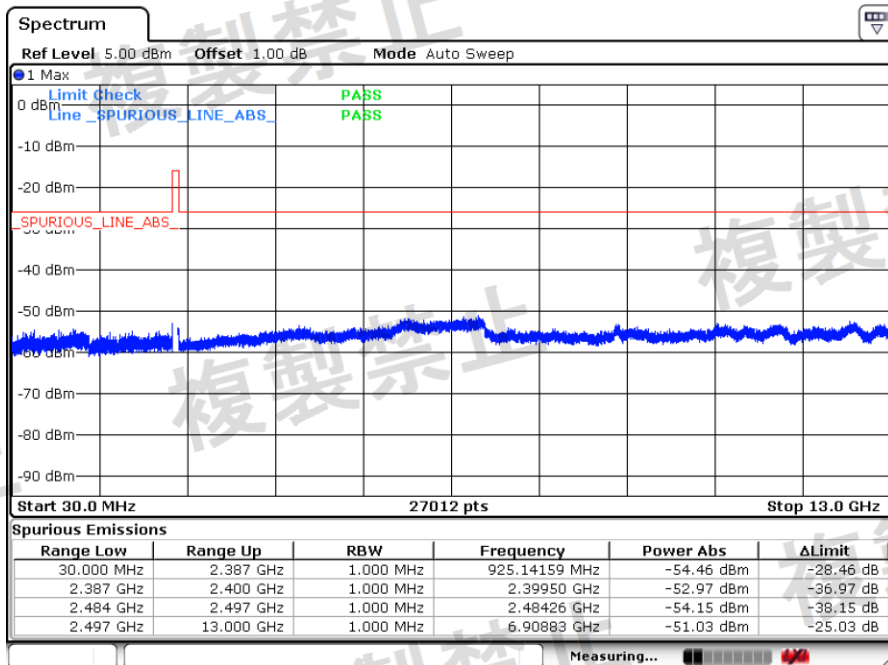
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11n40_Channel 3:2.422 GHz:



Date: 21.DEC.2019 08:14:17

11n40_Channel 7:2.442 GHz:



Date: 21.DEC.2019 08:13:47



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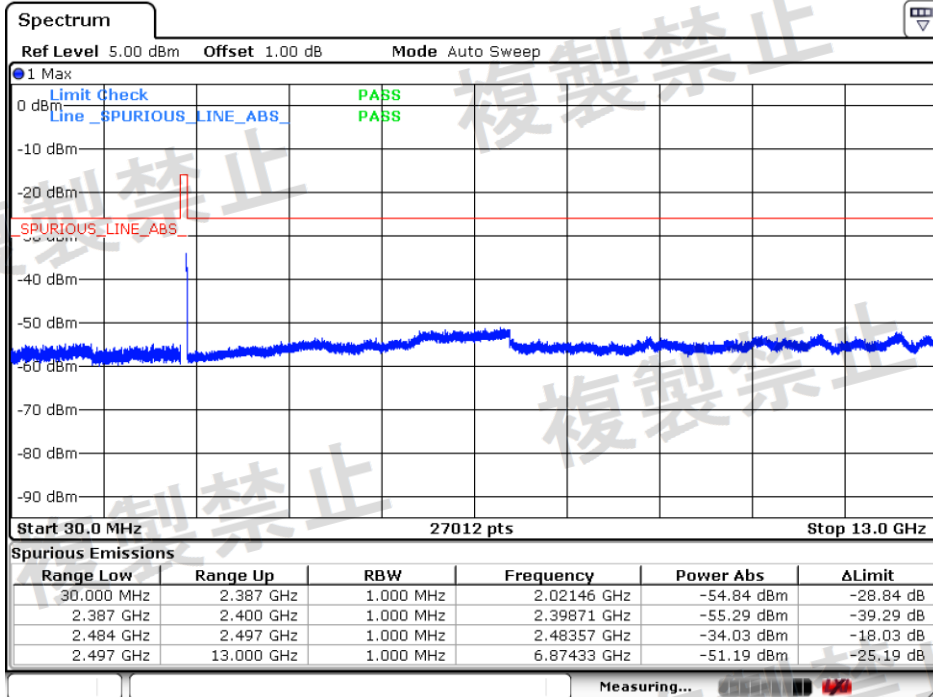


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11n40_Channel 11:2.462GHz:



Date: 21.DEC.2019 08:13:09

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Spurious Emission of RX

Test Result

TestCondition	TestMode	Frequency [MHz]	Freq.Range [MHz]	Freq. [MHz]	Result [dBm]	Result [nW]	Limit [nW]	Verdict
NTNV	11b	2412	30~1000	871.28	-77.94	0.016	≤4	PASS
			1000~13000	6802.51	-62.89	0.514	≤20	PASS
		2442	30~1000	289.96	-78.22	0.015	≤4	PASS
			1000~13000	6214.03	-63.27	0.471	≤20	PASS
		2472	30~1000	909.98	-77.39	0.017	≤4	PASS
			1000~13000	6382.53	-62.66	0.542	≤20	PASS
	11n40	2422	30~1000	908.43	-78.25	0.015	≤4	PASS
			1000~13000	5908.05	-61.84	0.655	≤20	PASS
		2442	30~1000	932.18	-77.62	0.017	≤4	PASS
			1000~13000	6437.52	-62.78	0.527	≤20	PASS
		2462	30~1000	432.95	-77.93	0.016	≤4	PASS
			1000~13000	6137.54	-63.40	0.457	≤20	PASS

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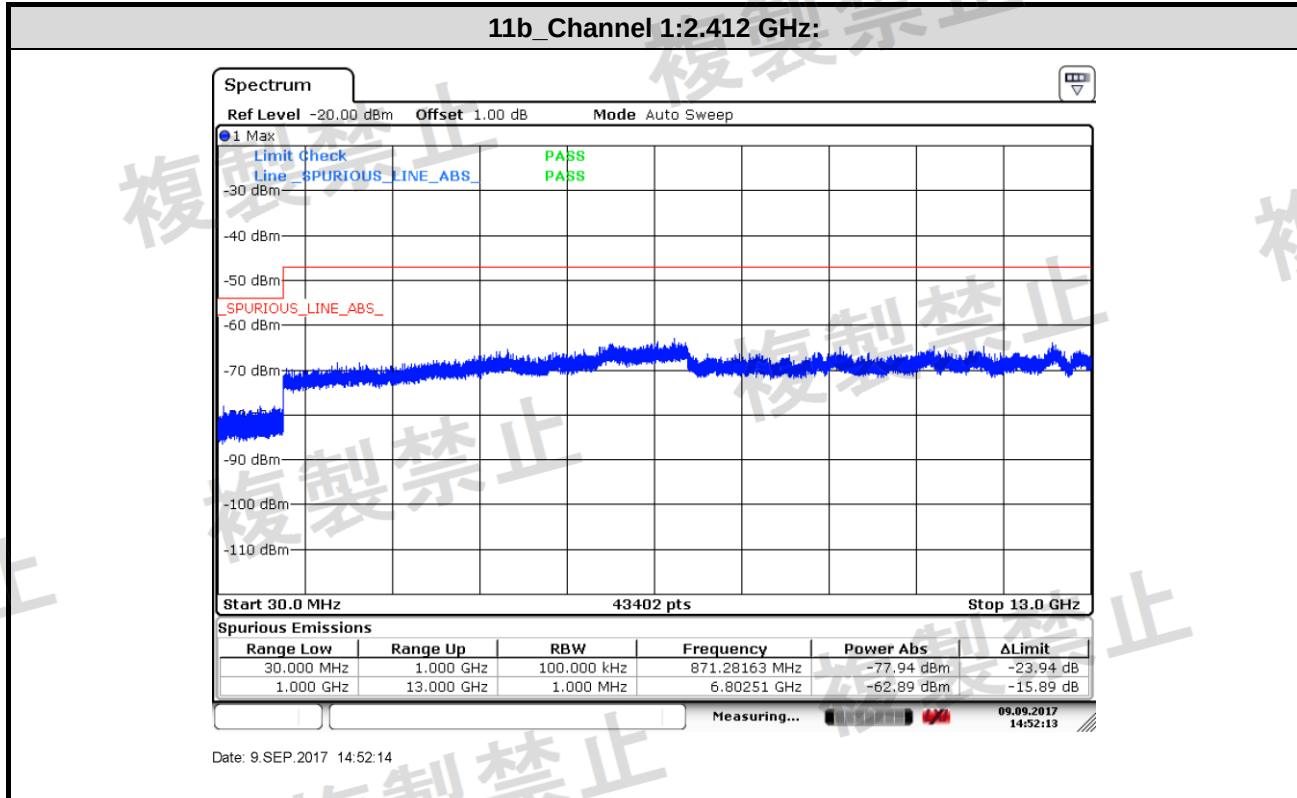


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Test Graphs



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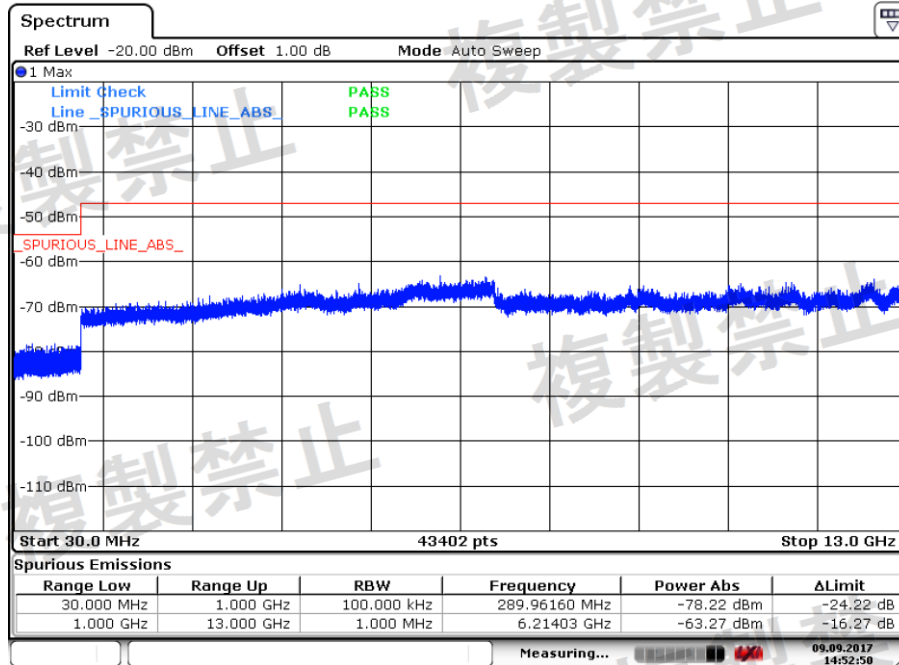
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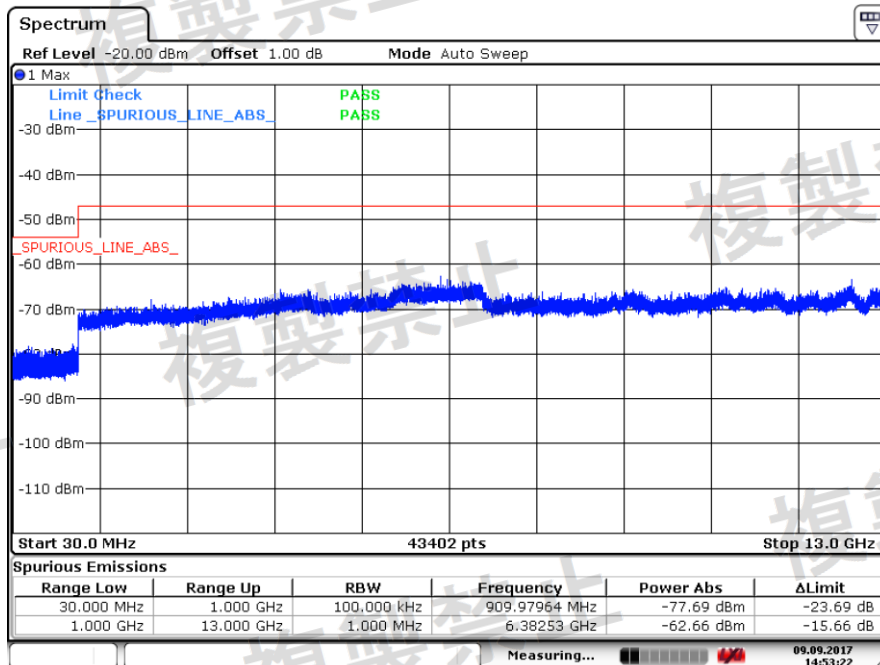
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11b_Channel 7:2.442 GHz:



Date: 9.SEP.2017 14:52:49

11b_Channel 13:2.472GHz:



Date: 9.SEP.2017 14:53:22

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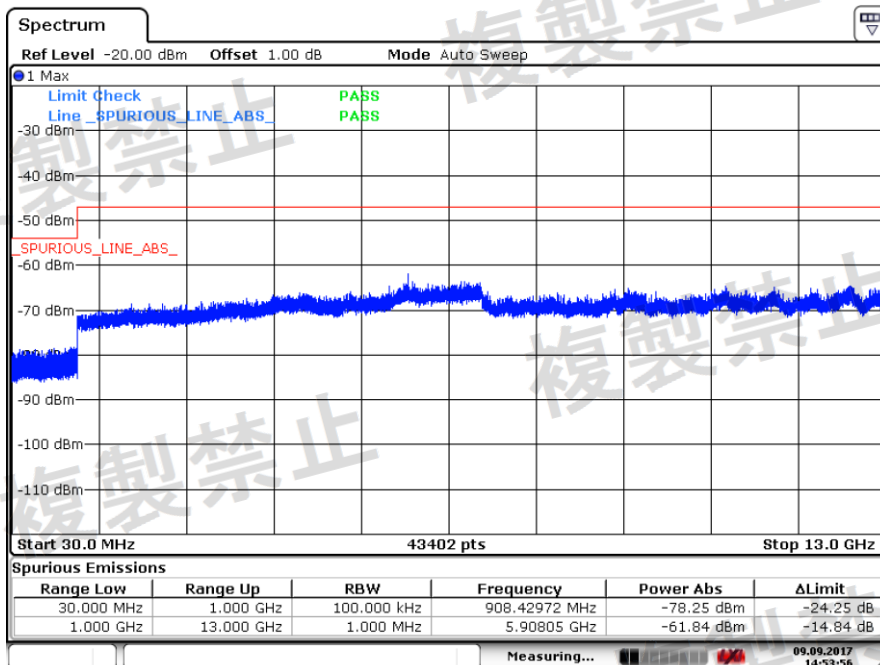


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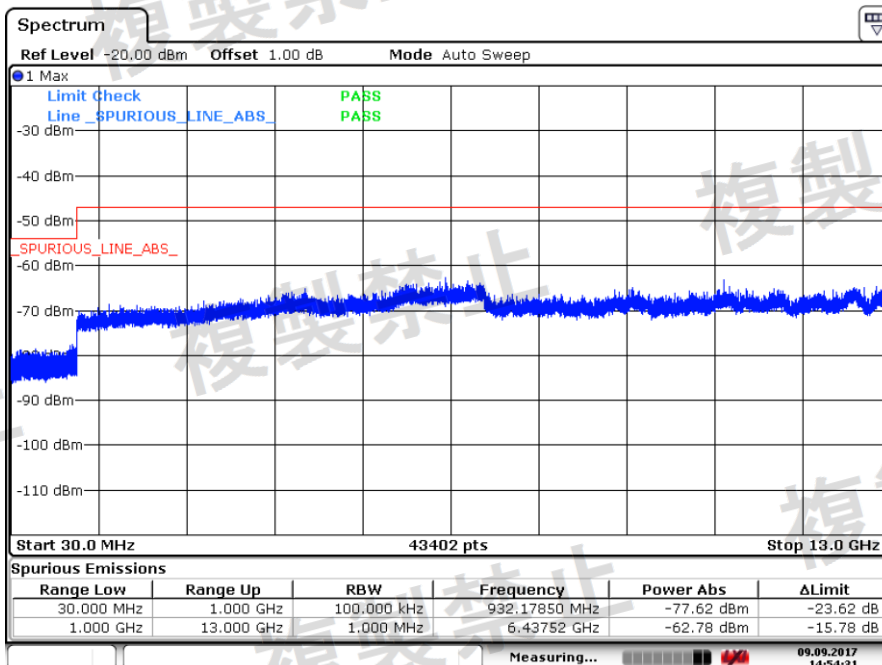
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11n40_Channel 3:2.422 GHz:



Date: 9 SEP.2017 14:53:56

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Date: 9 SEP.2017 14:54:31

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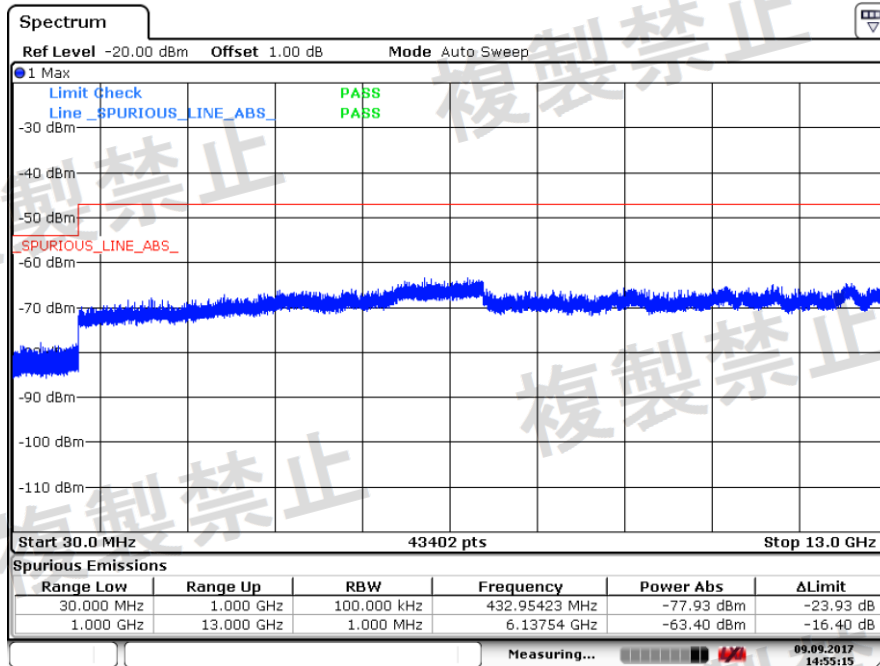
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