RF TEST REPORT

Applicant	Quectel Wireless Solutions Co., Ltd.
FCC ID	XMR202303AF20
Product	Wi-Fi & Bluetooth Module
Brand	Quectel
Model	AF20
Report No.	R2212A1318-R1V1
Issue Date	June 6, 2023

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15C (2022)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Prepared by: Xu Ying

Approved by: Xu Kai

TA Technology (Shanghai) Co., Ltd.

Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China

TEL: +86-021-50791141/2/3

FAX: +86-021-50791141/2/3-8000

TABLE OF CONTENT

1. Test Laboratory 5
1.1. Notes of the Test Report 5
1.2. Test Facility 5
1.3. Testing Location 5
2. General Description of Equipment Under Test 6
2.1. Applicant and Manufacturer Information 6
2.2. General Information 6
3. Applied Standards 7
4. Test Configuration 8
5. Test Case Results 9
5.1. Maximum output power 9
5.2. 99% Bandwidth and 6dB Bandwidth 12
5.3. Band Edge 38
5.4. Power Spectral Density 57
5.5. Spurious RF Conducted Emissions 72
5.6. Unwanted Emission 97
5.7. Conducted Emission 155
6. Main Test Instruments 160
ANNEX A: The EUT Appearance 161
ANNEX B: Test Setup Photos 162

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Version	Revision description	Issue Date
Rev.0	Initial issue of report.	June 1, 2023
Rev.1	Update information in page 6.	June 6, 2023
Note: This revised report (Report No.: R2212A1318-R1V1) supersedes and replaces the previously issued report (Report No.: R2212A1318-R1). Please discard or destroy the previously issued report and dispose of it accordingly.		

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Summary of Measurement Results

Number	Test Case	Clause in FCC rules	Verdict
1	Maximum output power	15.247(b)(3)	PASS
2	99% Bandwidth and 6dB Bandwidth	15.247(a)(2) C63.10 6.9	PASS
3	Power spectral density	15.247(e)	PASS
4	Band Edge	15.247(d)	PASS
5	Spurious RF Conducted Emissions	15.247(d)	PASS
6	Unwanted Emissions	15.247(d),15.205,15.209	PASS
7	Conducted Emissions	15.207	PASS
Date of Testing: March 16, 2023 ~ May 8, 2023 Date of Sample Received: March 15, 2023			
Note: All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

1. Test Laboratory

1.1. Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA Technology (Shanghai) Co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein .Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test Facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform measurement.

1.3. Testing Location

Company:	TA Technology (Shanghai) Co., Ltd.
Address:	Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China
City:	Shanghai
Post code:	201201
Country:	P. R. China
Contact:	Xu Kai
Telephone:	+86-021-50791141/2/3
Fax:	+86-021-50791141/2/3-8000
Website:	http://www.ta-shanghai.com
E-mail:	xukai@ta-shanghai.com

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

2. General Description of Equipment Under Test

2.1. Applicant and Manufacturer Information

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

2.2. General Information

EUT Description	
Model	AF20
SN	D1A20JK20000024
Hardware Version	R1.0
Software Version	NA
Power Supply	External power supply
Antenna Type	External Antenna
Antenna Connector	SMA Male (Center Pin) (module use unique antenna connector meet with the standard FCC Part 15.203 unique antenna connector requirement)
Operating Frequency Range(s)	802.11b/g/n(HT20): 2412 ~ 2462 MHz 802.11n(HT40): 2422 ~ 2452 MHz Bluetooth LE V5.0: 2402 ~2480 MHz
Modulation Type	802.11b: DSSS 802.11g/n(HT20/HT40): OFDM Bluetooth LE: GFSK
Max. Output Power	Wi-Fi 2.4G: 17.65 dBm Bluetooth LE: 3.25 dBm
Auxiliary test equipment	
Antenna	Manufacturer: Quectel Wireless Solutions Co., Ltd. Brand: Quectel Model: YE0038AA . Antenna Gain: Bluetooth: 0.73 dBi Wi-Fi 2.4G: 0.73 dBi
Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.	

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

3. Applied Standards

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

Test standards:

FCC CFR47 Part 15C (2022) Radio Frequency Devices

ANSI C63.10-2013

Reference standard:

KDB 558074 D01 15.247 Meas Guidance v05r02

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

4. Test Configuration

Test Mode

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

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the loop antenna is vertical, the others are vertical and horizontal. and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate. Preliminary tests have been done on all the configuration for confirming worst case. Data rate below means worst-case rate of each test item.

Worst-case data rates are shown as following table.

Test Mode	Data Rate
Bluetooth (Low Energy)	1Mbps
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

5. Test Case Results

5.1. Maximum output power

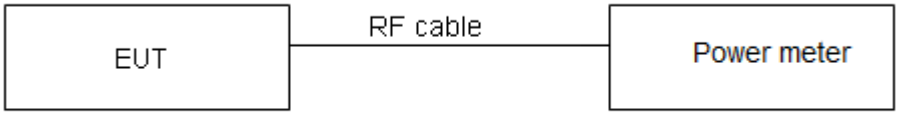
Ambient Condition

Temperature	Relative humidity
20°C ~ 25°C	45% ~ 50%

Methods of Measurement

During the process of the testing, The EUT was connected to Power meter with a known loss. The EUT is max power transmission with proper modulation.

Test Setup



Limits

Rule Part 15.247 (b) (3) specifies that " For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz: 1 Watt."

Average Output Power	≤ 1W (30dBm)

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.44 dB.

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Test Results

Power Index					
Channel	**802.11b**	**802.11g**	**802.11n HT20**	**Channel**	**802.11n HT40**
CH1	16	15	15	**CH3**	15
CH4	16	N/A	N/A	**CH6**	15
CH5	16	N/A	N/A	**CH9**	15
CH6	16	15	15	/	N/A
CH7	16	N/A	15	/	N/A
CH8	16	N/A	15	/	N/A
CH9	N/A	N/A	15	/	N/A
CH10	N/A	N/A	15	/	N/A
CH11	16	15	15	/	N/A

Test Mode	Duty cycle	Duty cycle correction Factor(dB)
802.11b	0.990	0.000
802.11g	0.950	0.220
802.11n HT20	0.980	0.000
802.11n HT40	0.950	0.200
Bluetooth LE (1M)	0.653	1.850
Note: when Duty cycle⩾0.98, Duty cycle correction Factor not required.		

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Test Mode	Carrier frequency (MHz)) / Channel	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11b	2412/CH 1	16.24	16.24	30	PASS
	2427/CH 4	16.68	16.68	30	PASS
	2432/CH 5	17.50	17.50	30	PASS
	2437/CH 6	17.65	17.65	30	PASS
	2442/CH 7	16.96	16.96	30	PASS
	2447/CH 8	15.61	15.61	30	PASS
	2462/CH 11	15.47	15.47	30	PASS
802.11g	2412/CH 1	14.81	15.03	30	PASS
	2437/CH 6	15.06	15.28	30	PASS
	2462/CH 11	14.11	14.33	30	PASS
802.11n HT20	2412/CH 1	14.83	14.83	30	PASS
	2437/CH 6	15.42	15.42	30	PASS
	2442/CH 7	14.97	14.97	30	PASS
	2447/CH 8	14.00	14.00	30	PASS
	2452/CH 9	13.75	13.75	30	PASS
	2457/CH 10	13.72	13.72	30	PASS
	2462/CH 11	13.82	13.82	30	PASS
802.11n HT40	2422/CH 3	15.35	15.55	30	PASS
	2437/CH 6	14.34	14.54	30	PASS
	2452/CH 9	13.51	13.71	30	PASS
Bluetooth (Low Energy)	2402/CH 0	0.28	2.13	30	PASS
	2440/CH 19	1.40	3.25	30	PASS
	2480/CH 39	1.20	3.05	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

5.2. 99% Bandwidth and 6dB Bandwidth

Ambient Condition

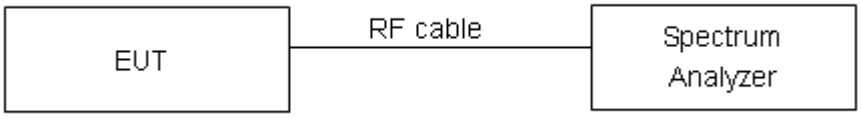
Temperature	Relative humidity
20°C ~ 25°C	45% ~ 50%

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable. RBW is set to 100 kHz; VBW is set to 300 kHz on spectrum analyzer.
Dector=Peak, Trace mode=max hold.

The EUT was connected to the spectrum analyzer through a known loss cable. The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value.

Test Setup



Limits

Rule Part 15.247 (a) (2) specifies that “Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.”

minimum 6 dB bandwidth	≥ 500 kHz

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 936 Hz.

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

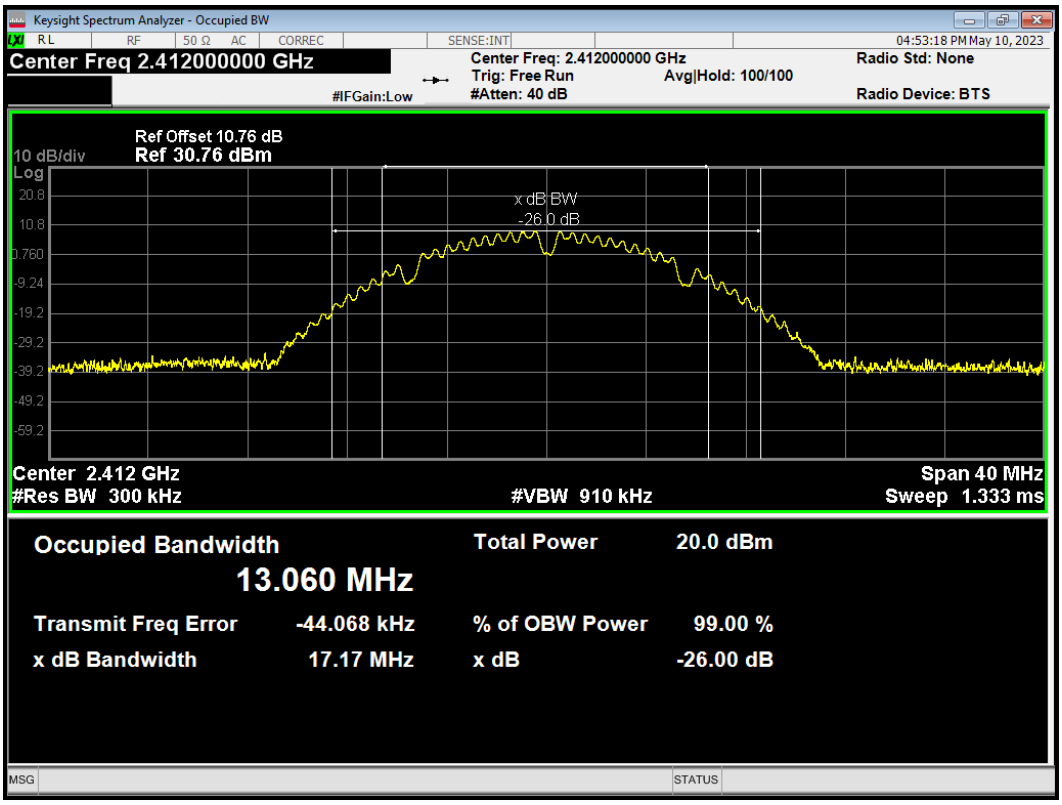
Test Results:

Test Mode	Carrier frequency (MHz)) / Channel	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11b	2412/CH 1	13.060	7.588	500	PASS
	2427/CH 4	12.807	7.536	500	PASS
	2432/CH 5	12.702	7.112	500	PASS
	2437/CH 6	12.808	7.068	500	PASS
	2442/CH 7	13.122	7.532	500	PASS
	2447/CH 8	13.290	7.576	500	PASS
	2462/CH 11	12.974	8.051	500	PASS
802.11g	2412/CH 1	16.491	15.950	500	PASS
	2437/CH 6	16.403	13.778	500	PASS
	2462/CH 11	16.432	16.114	500	PASS
802.11n HT20	2412/CH 1	17.652	17.181	500	PASS
	2437/CH 6	17.567	16.055	500	PASS
	2442/CH 7	17.634	17.431	500	PASS
	2447/CH 8	17.713	16.945	500	PASS
	2452/CH 9	17.725	17.543	500	PASS
	2457/CH 10	17.721	16.212	500	PASS
	2462/CH 11	17.570	17.584	500	PASS
802.11n HT40	2422/CH 3	36.136	35.058	500	PASS
	2437/CH 6	36.010	33.786	500	PASS
	2452/CH 9	36.483	36.067	500	PASS
Bluetooth (Low Energy)	2402/CH 0	1.057	0.653	500	PASS
	2440/CH 19	1.062	0.657	500	PASS
	2480/CH 39	1.065	0.672	500	PASS

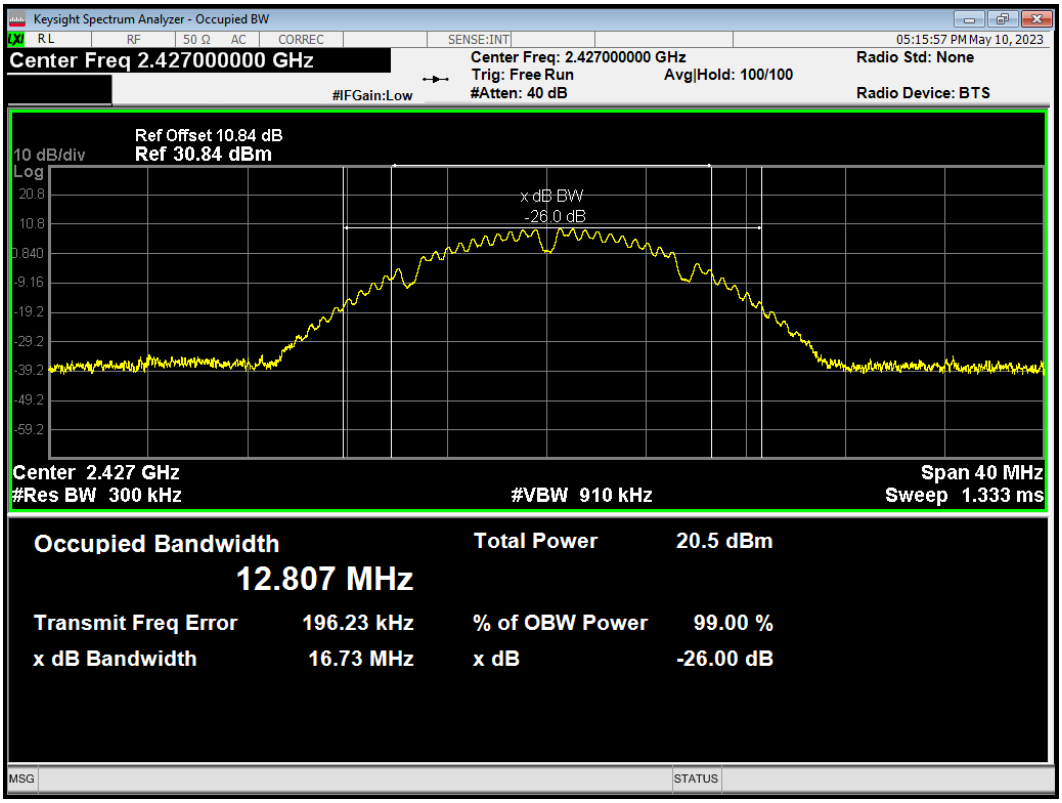
This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

99% bandwidth

OBW 802.11b 2412MHz

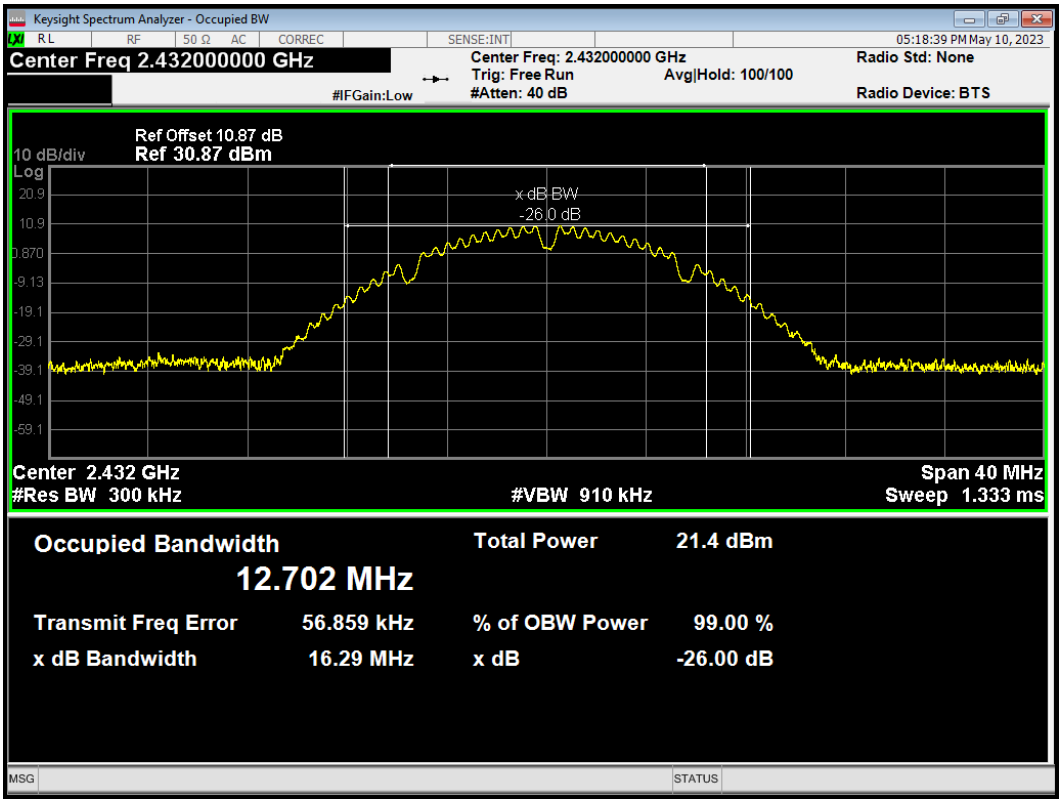


OBW 802.11b 2427MHz

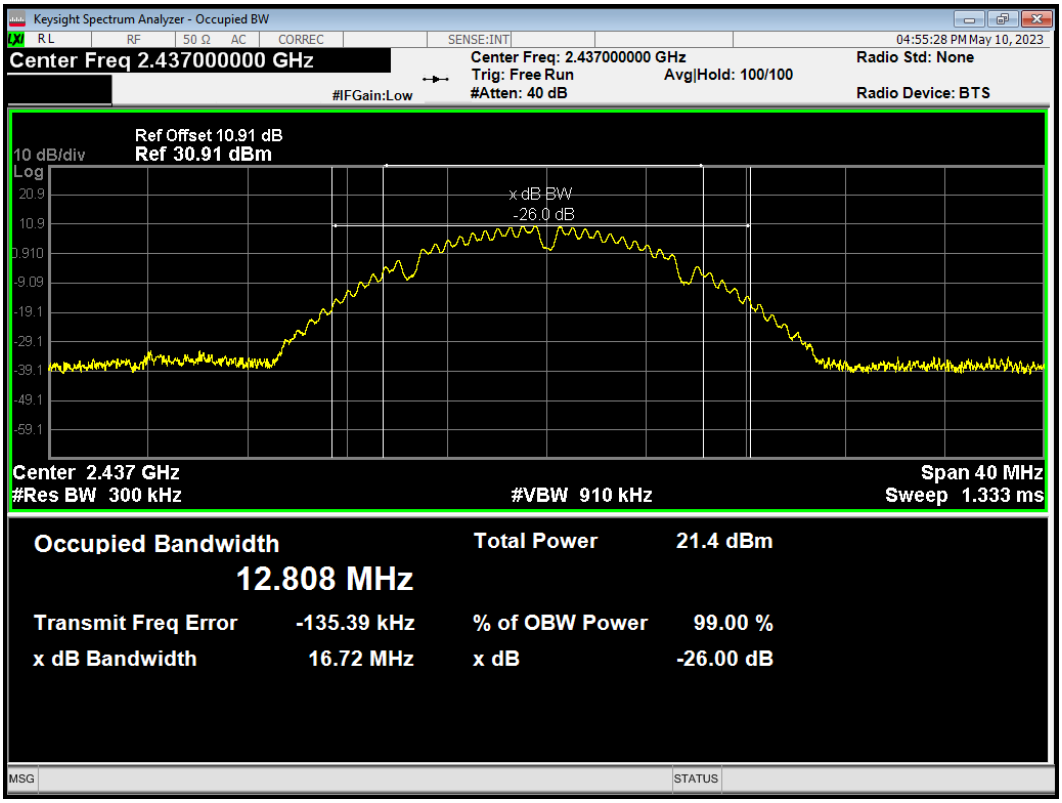


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

OBW 802.11b 2432MHz

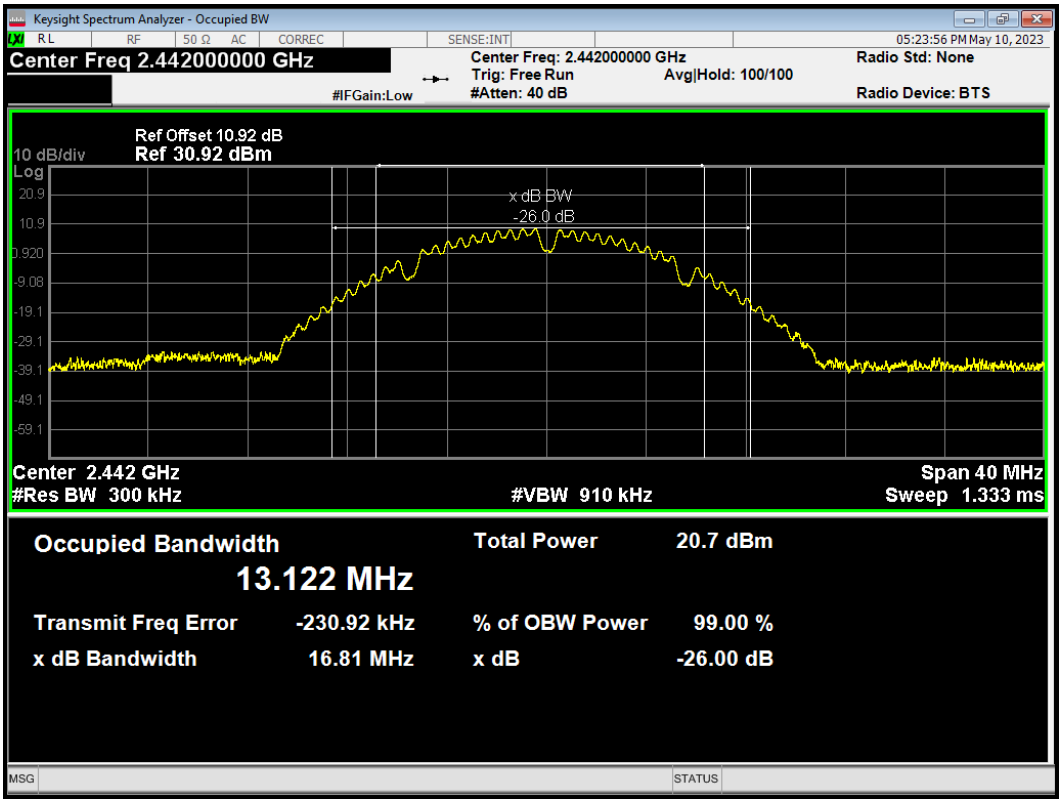


OBW 802.11b 2437MHz

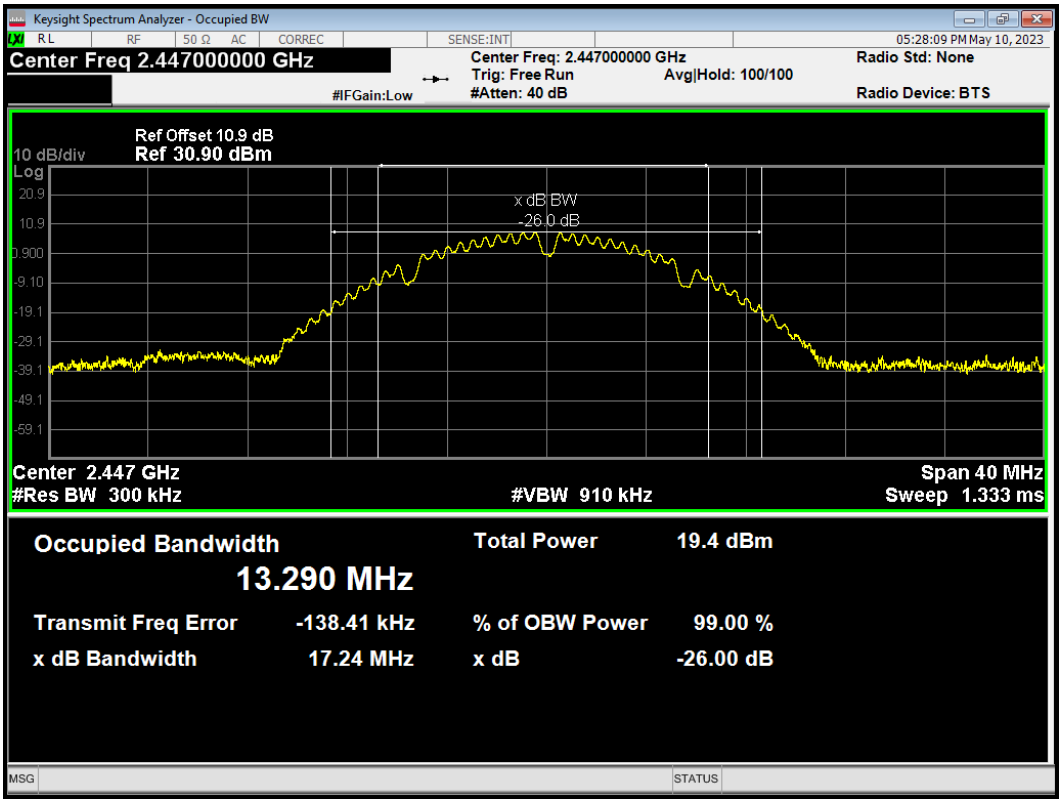


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

OBW 802.11b 2442MHz

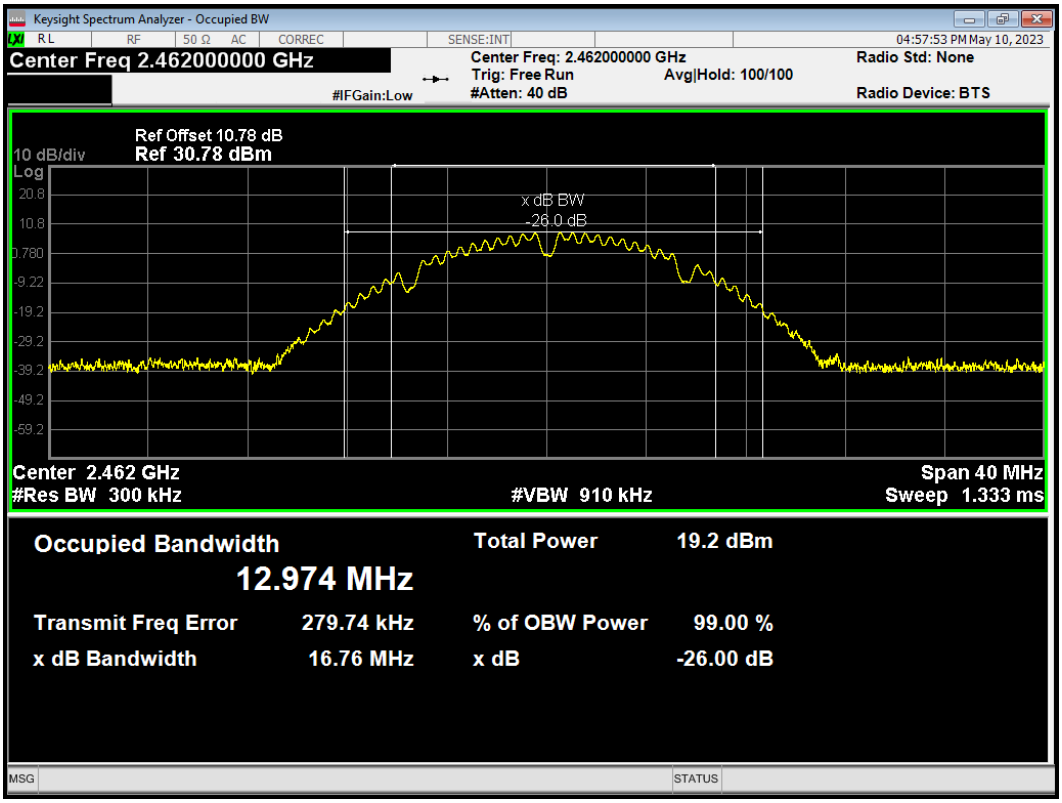


OBW 802.11b 2447MHz

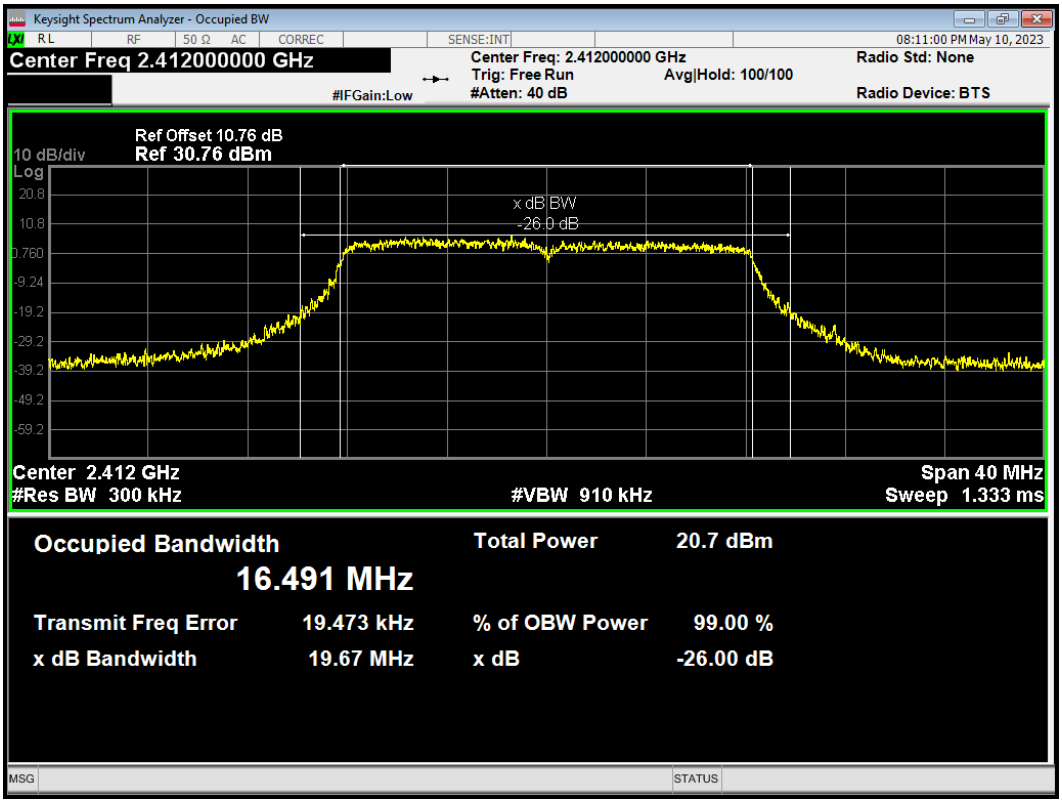


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

OBW 802.11b 2462MHz

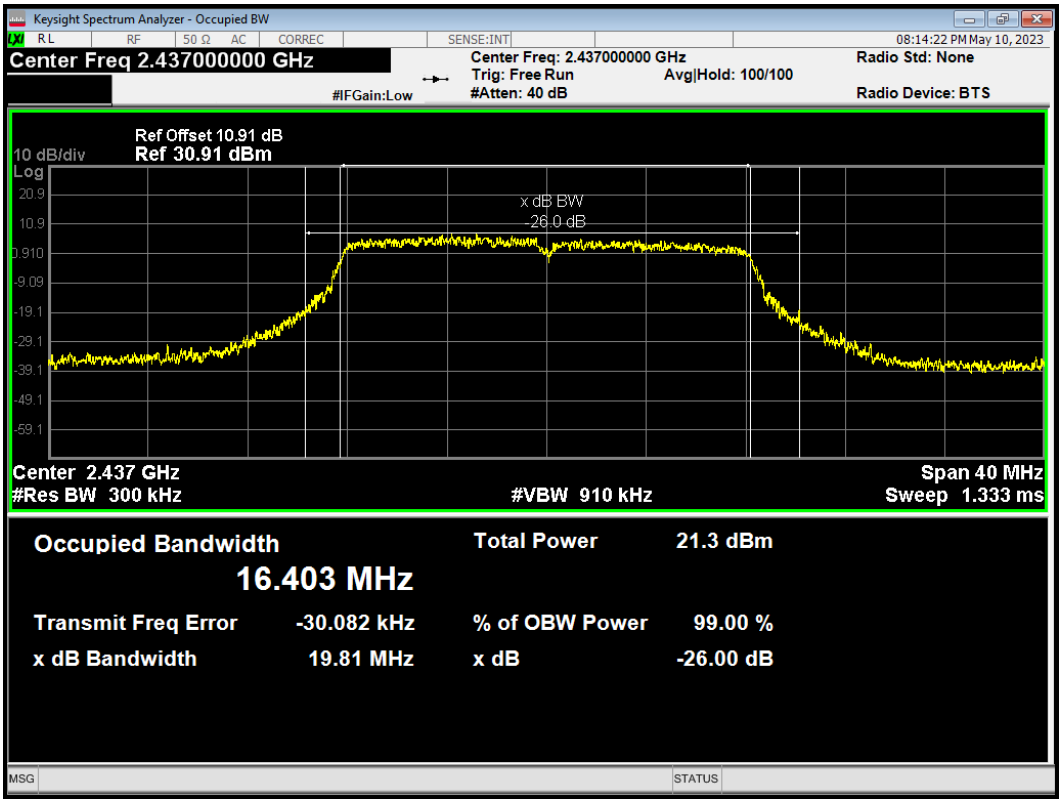


OBW 802.11g 2412MHz

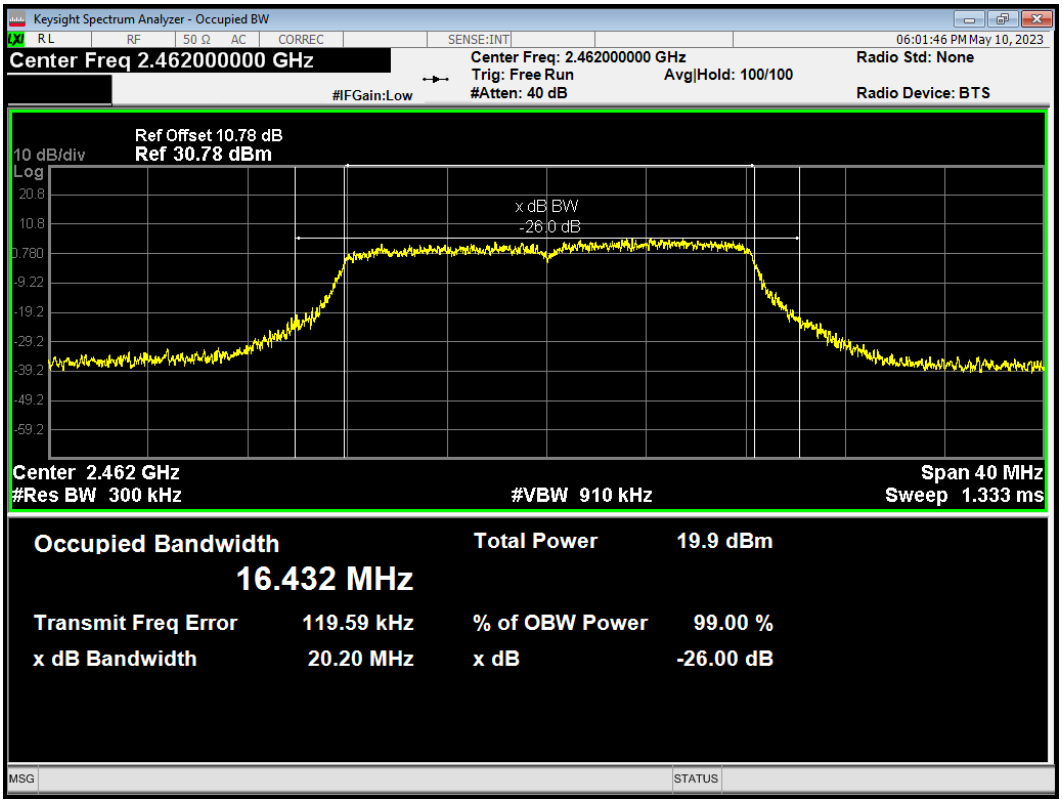


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

OBW 802.11g 2437MHz

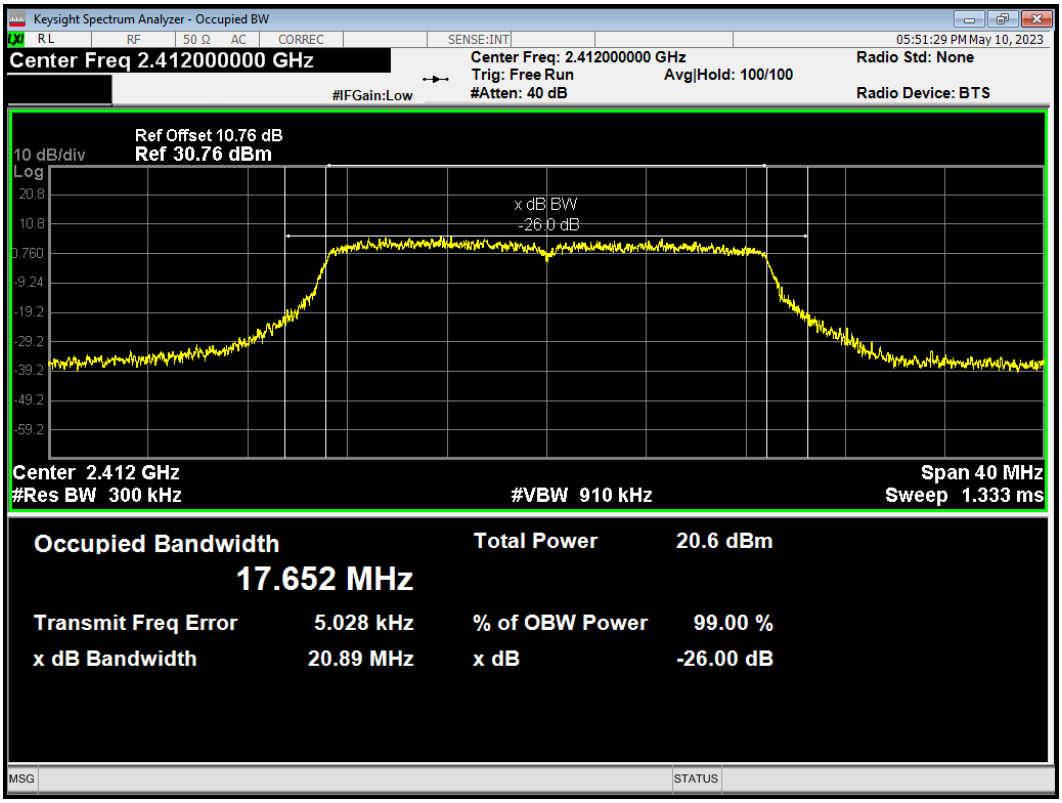


OBW 802.11g 2462MHz

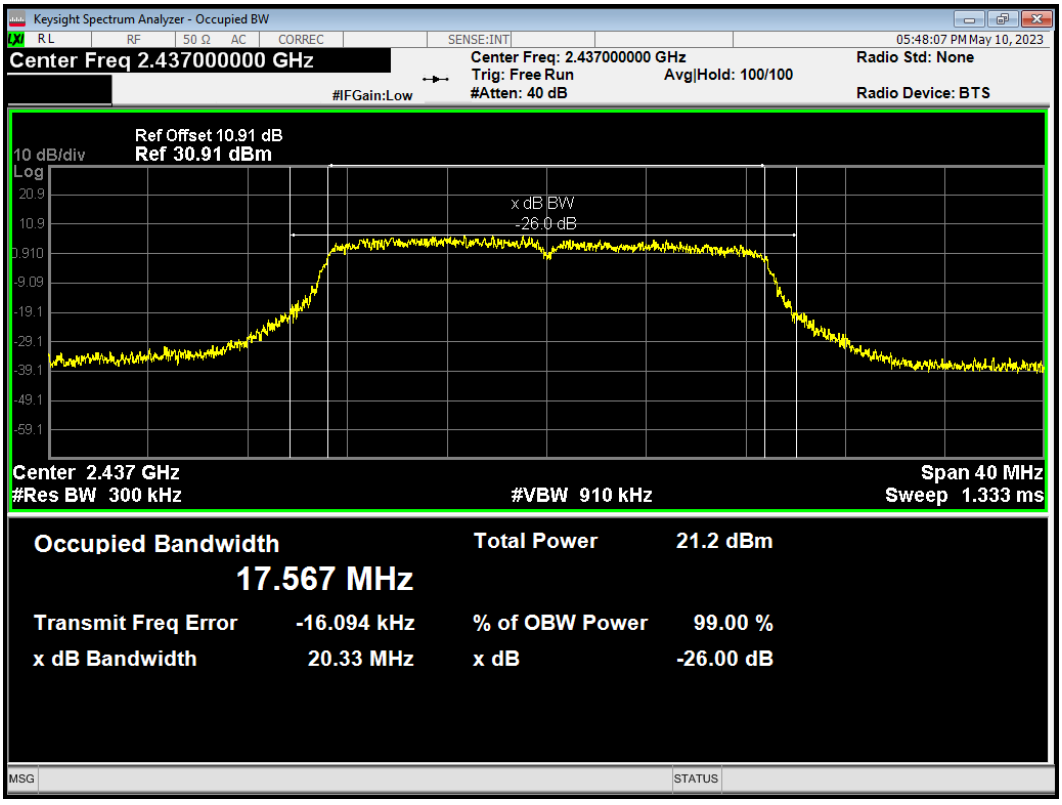


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

OBW 802.11n(HT20) 2412MHz

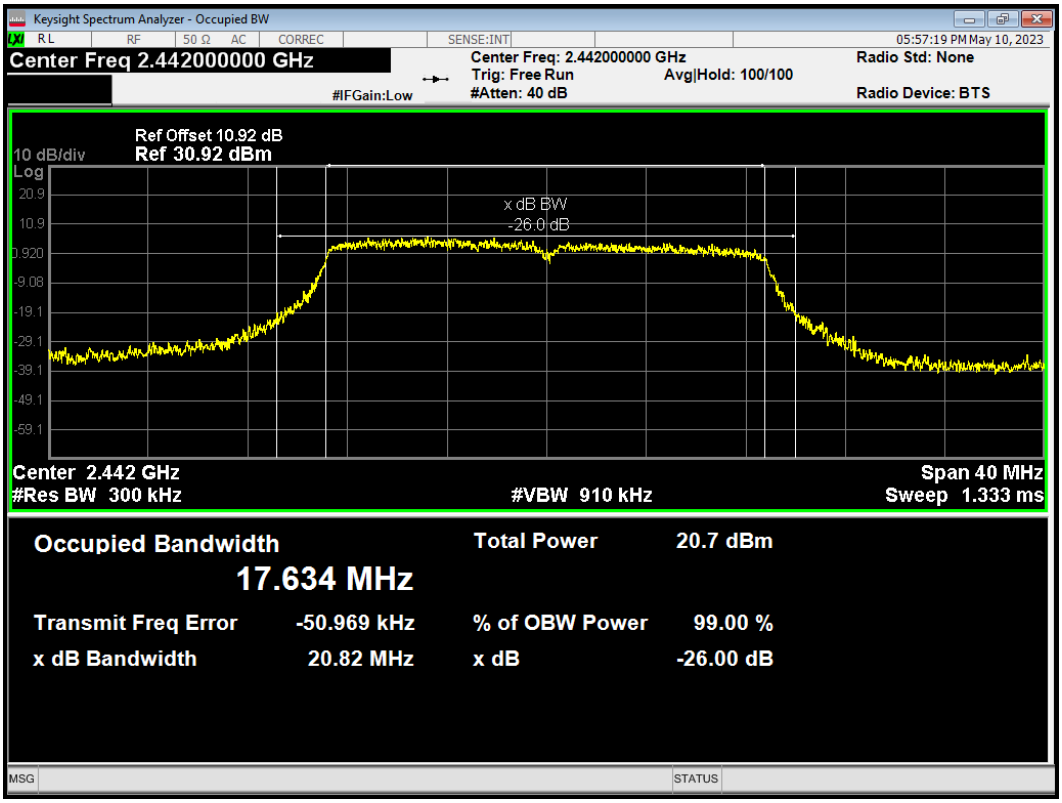


OBW 802.11n(HT20) 2437MHz

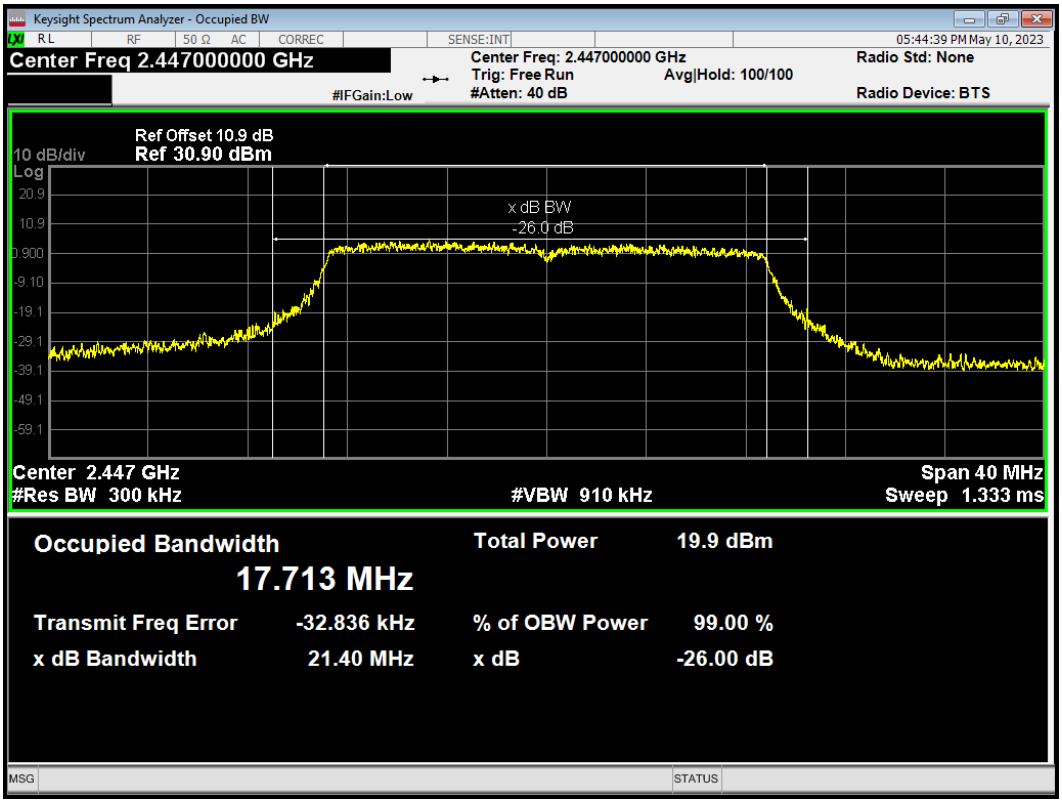


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

OBW 802.11n(HT20) 2442MHz

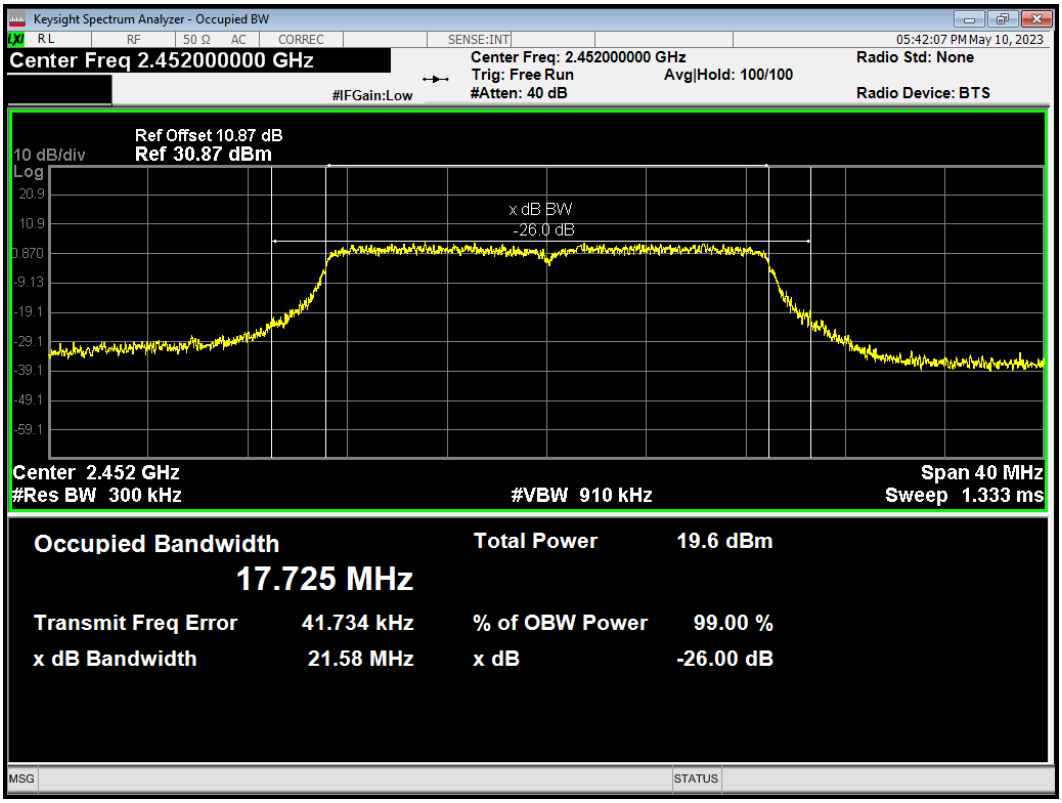


OBW 802.11n(HT20) 2447MHz

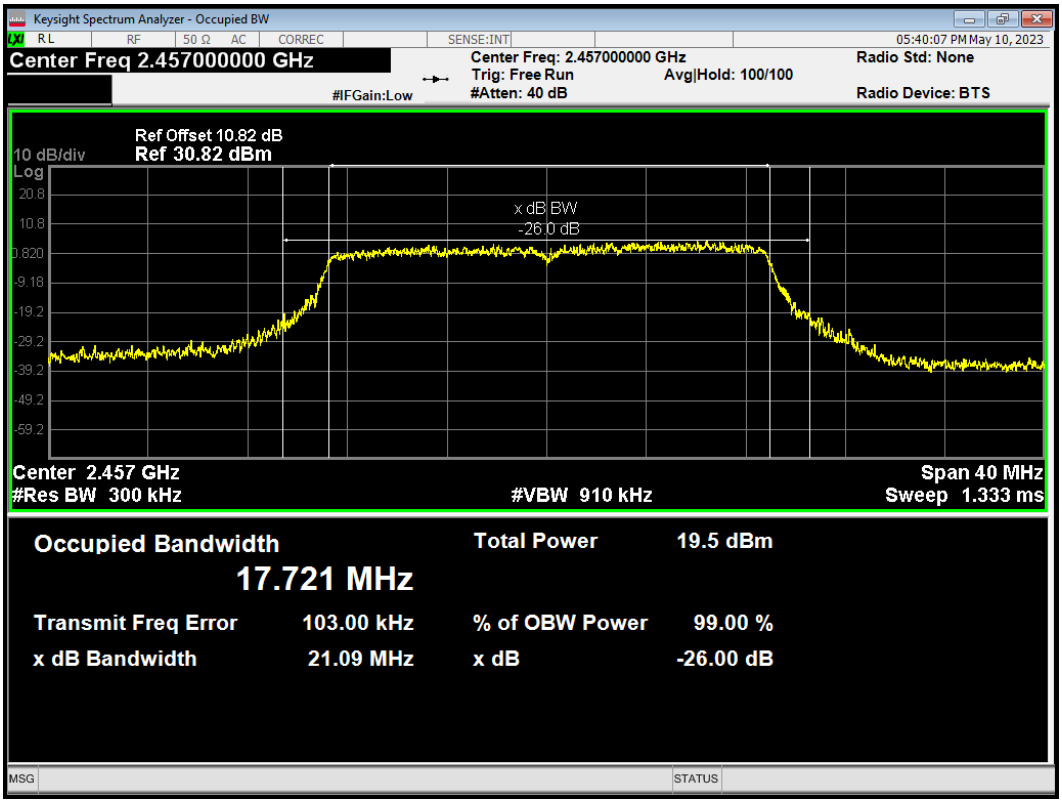


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

OBW 802.11n(HT20) 2452MHz

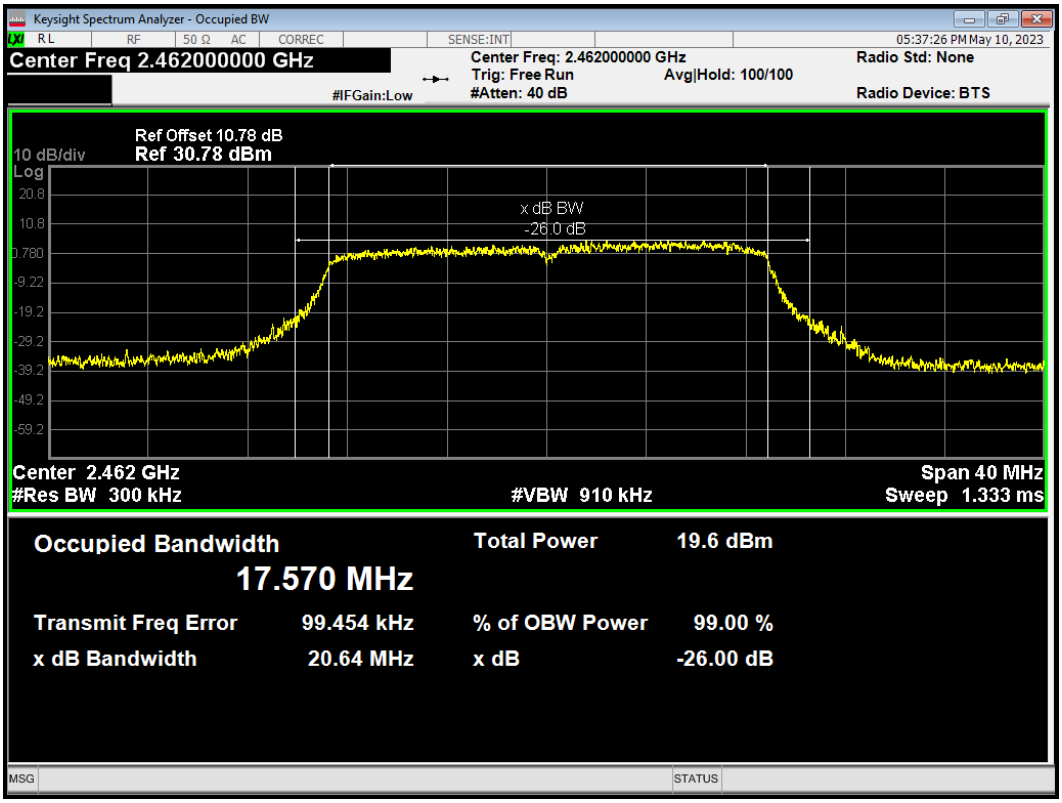


OBW 802.11n(HT20) 2457MHz

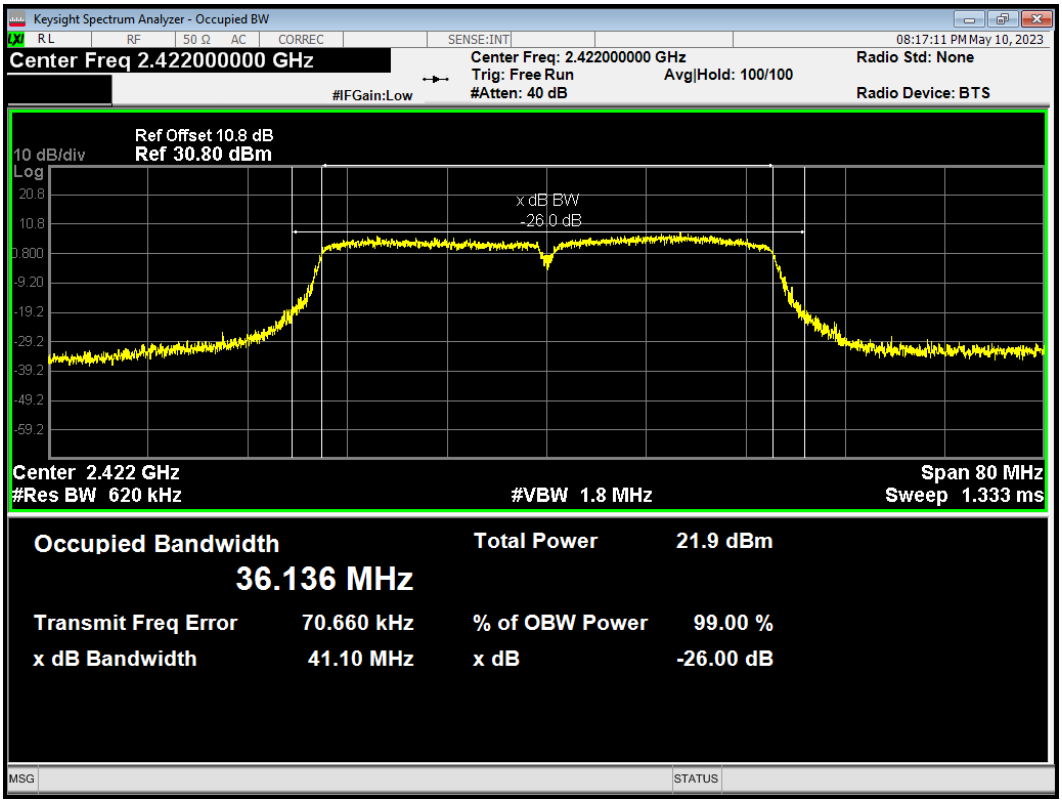


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

OBW 802.11n(HT20) 2462MHz

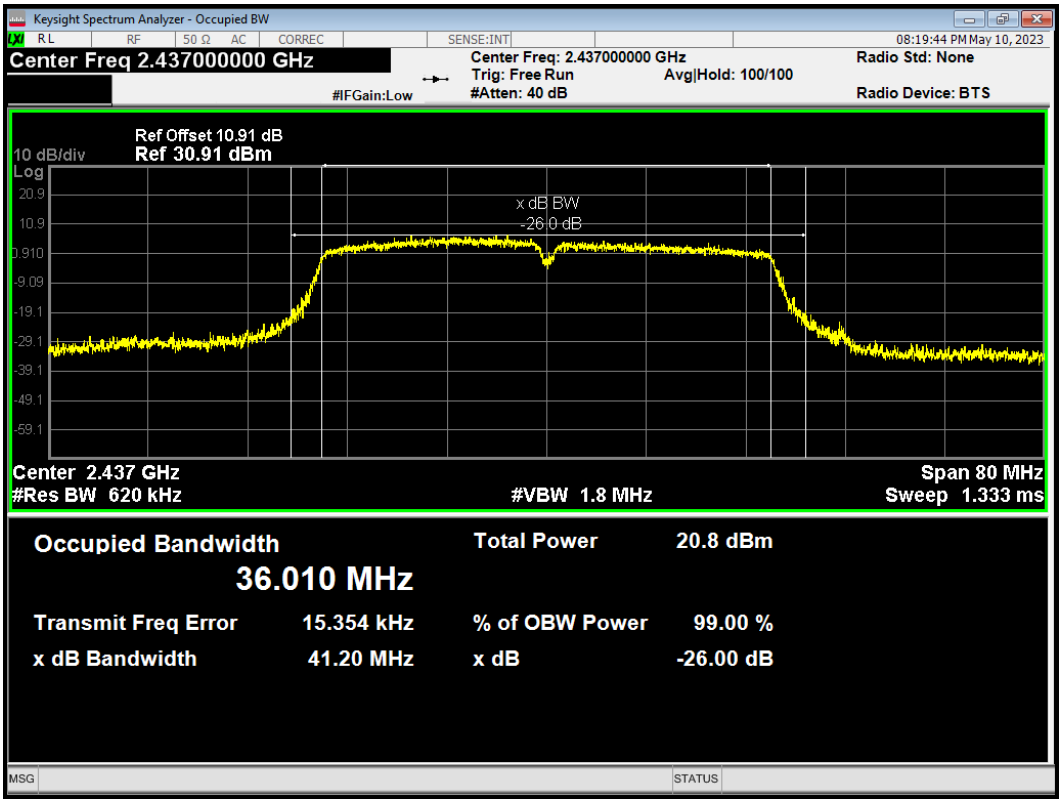


OBW 802.11n(HT40) 2422MHz

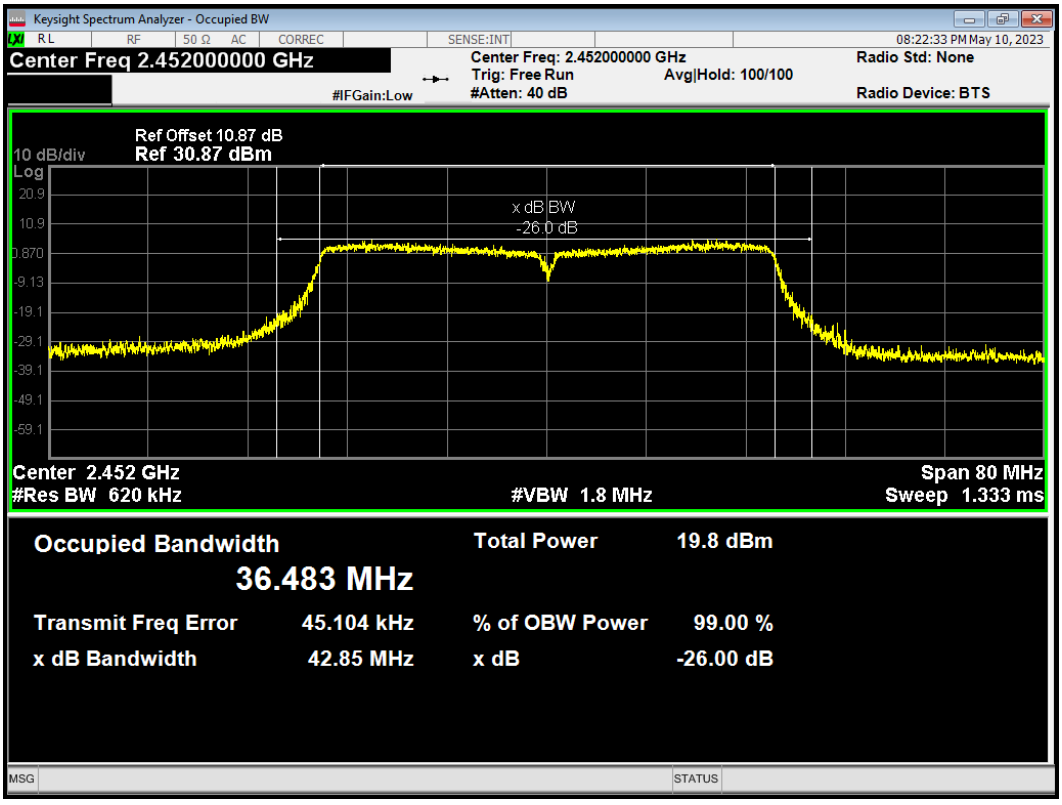


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

OBW 802.11n(HT40) 2437MHz

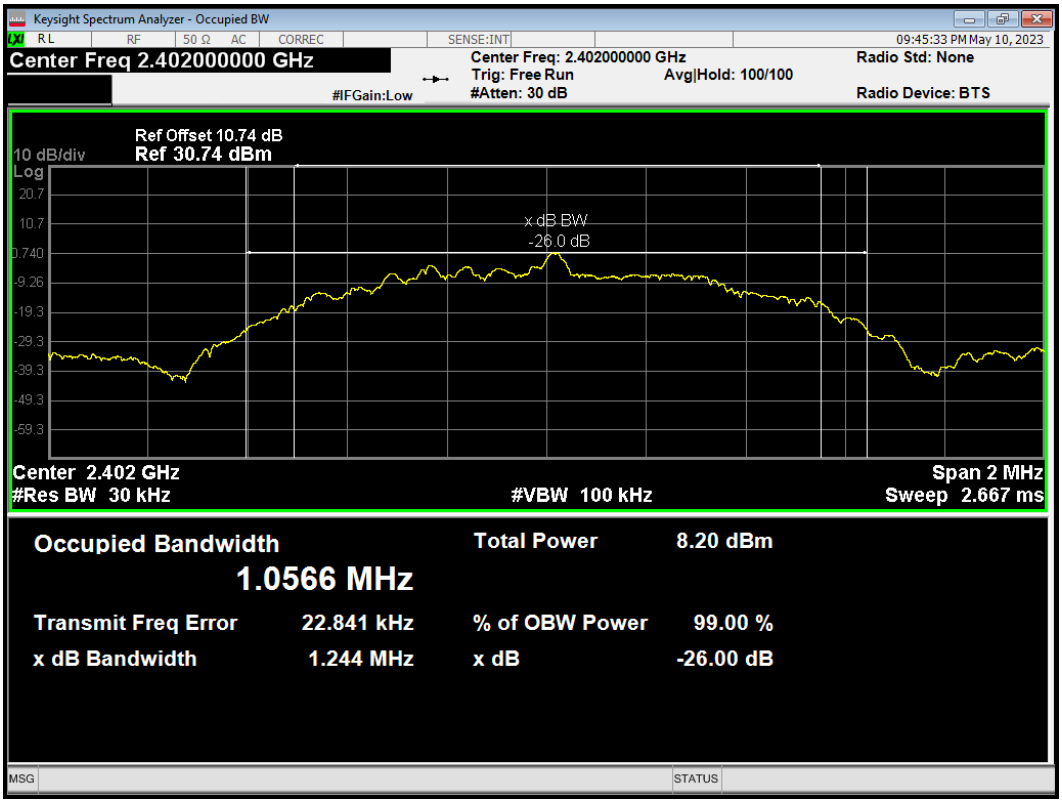


OBW 802.11n(HT40) 2452MHz

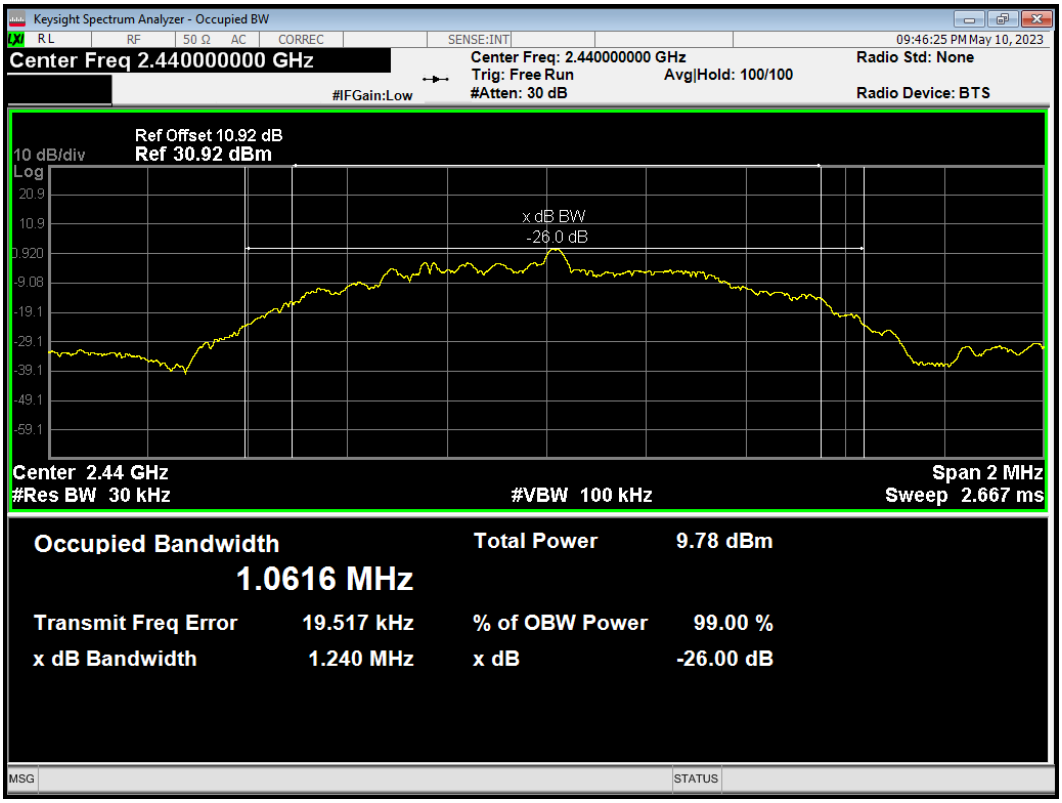


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

OBW BLE 2402MHz

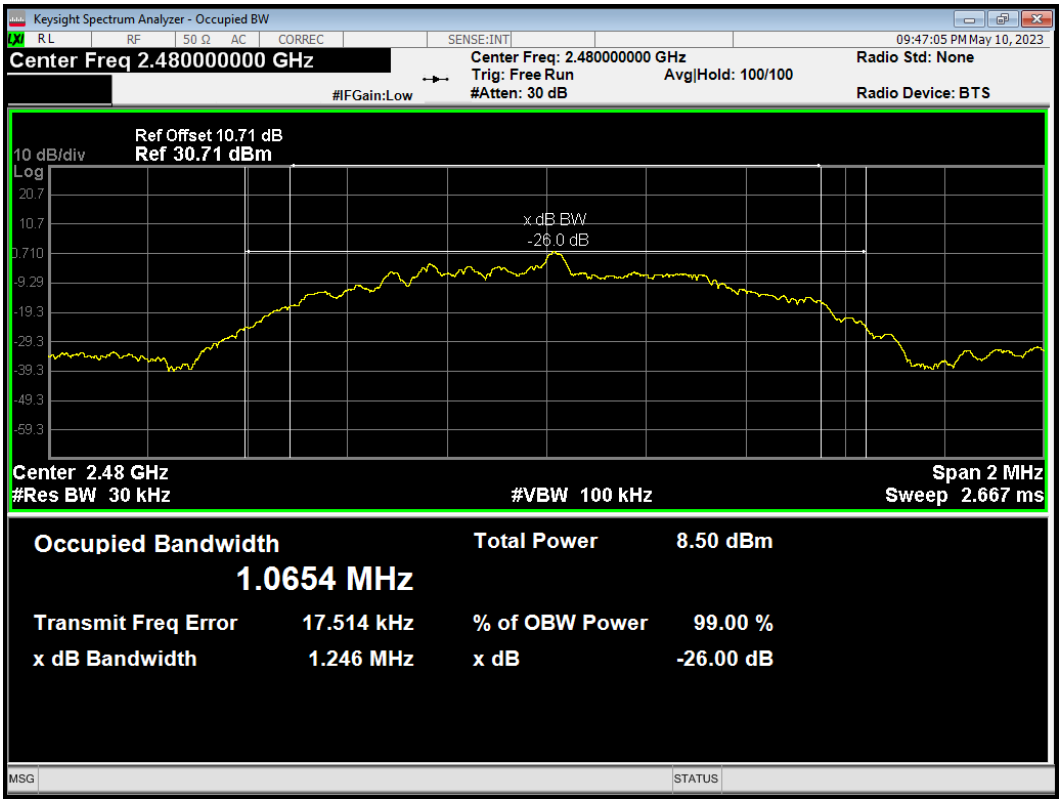


OBW BLE 2440MHz



This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

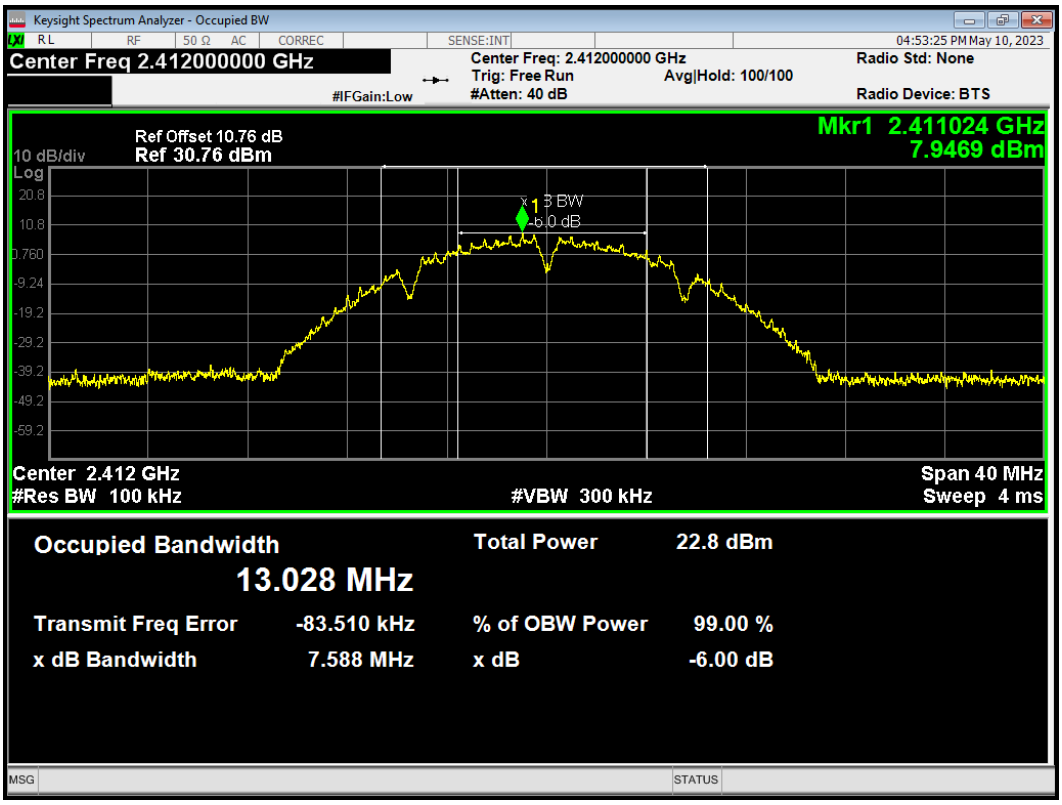
OBW BLE 2480MHz



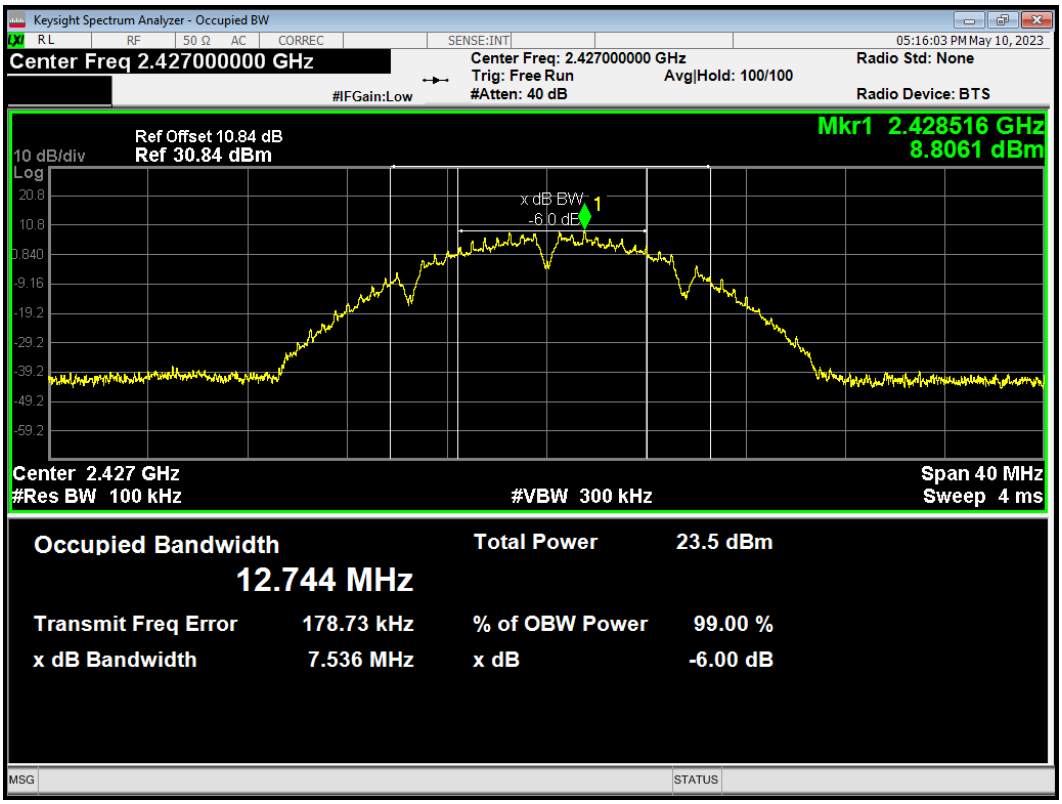
This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

6 dB bandwidth

-6dB Bandwidth 802.11b 2412MHz

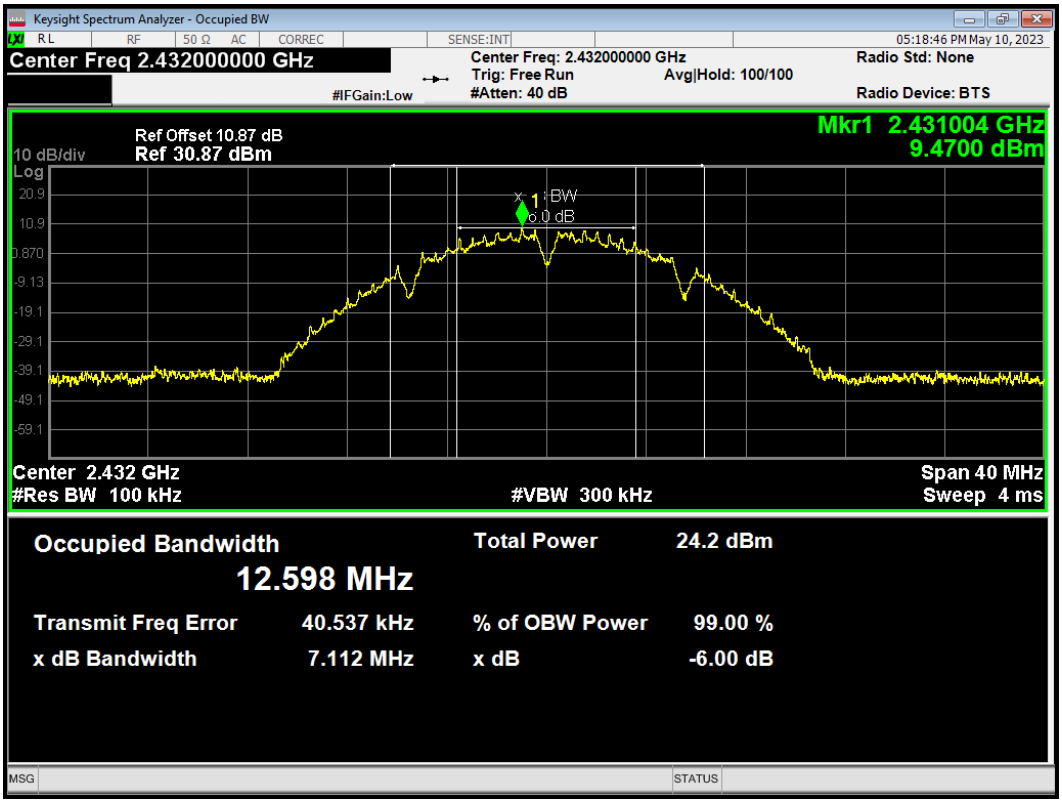


-6dB Bandwidth 802.11b 2427MHz

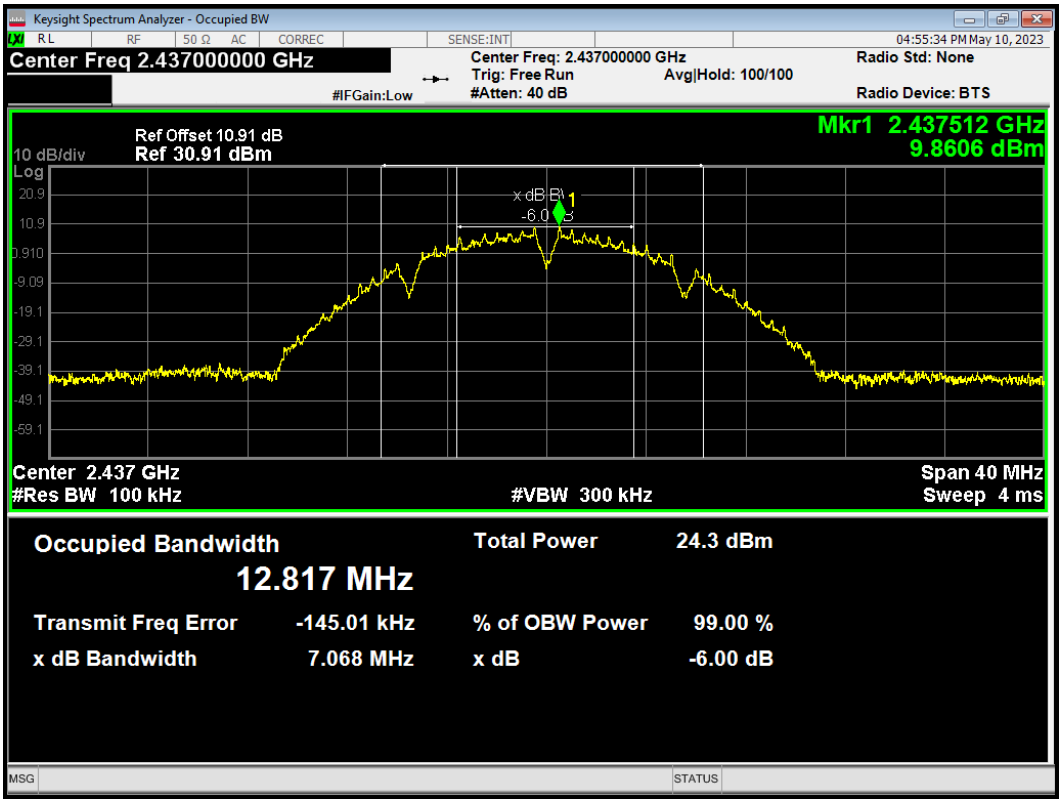


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

-6dB Bandwidth 802.11b 2432MHz

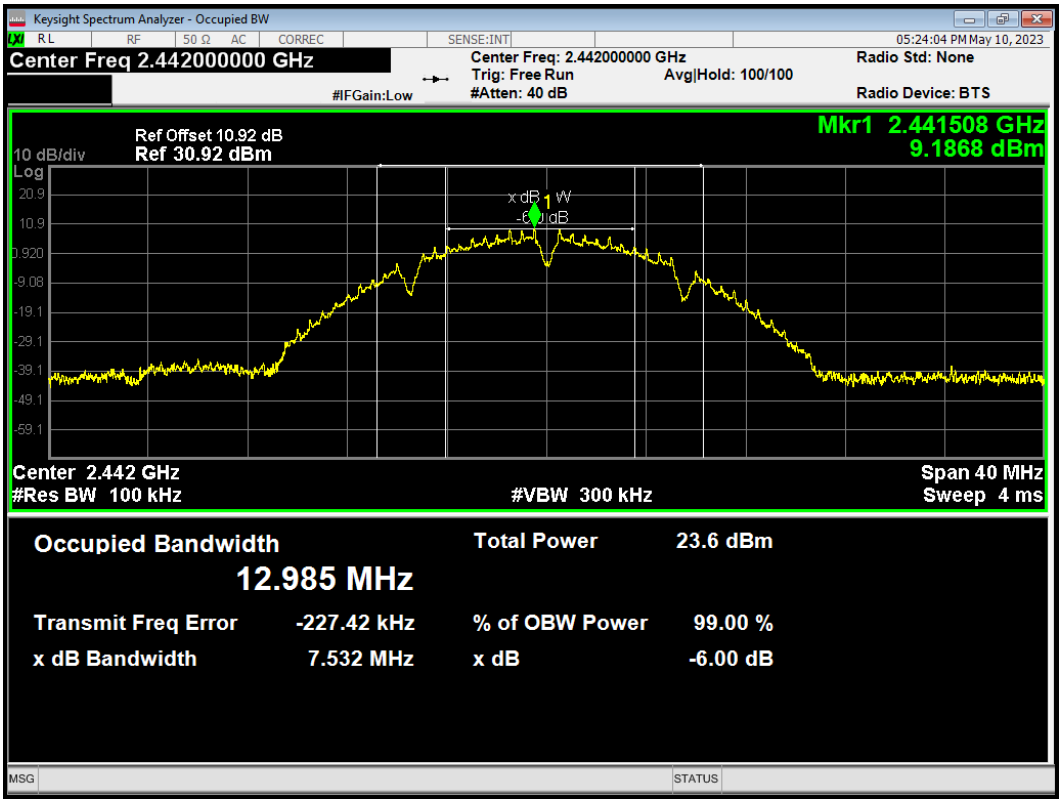


-6dB Bandwidth 802.11b 2437MHz

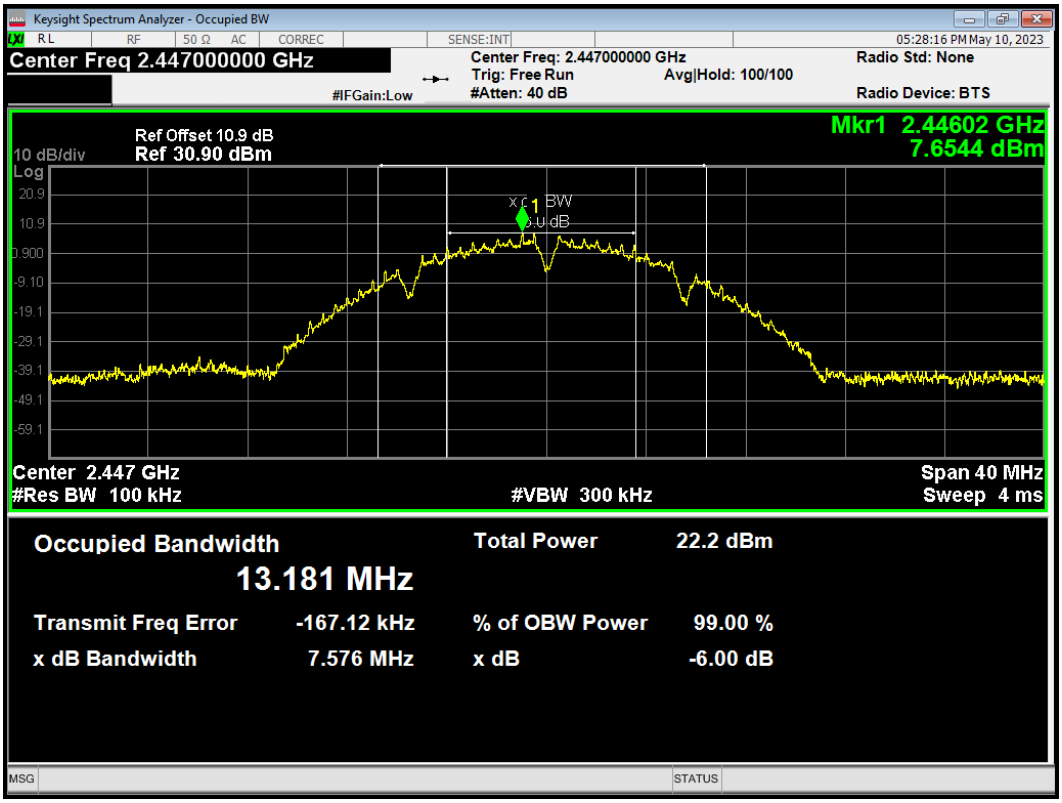


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

-6dB Bandwidth 802.11b 2442MHz

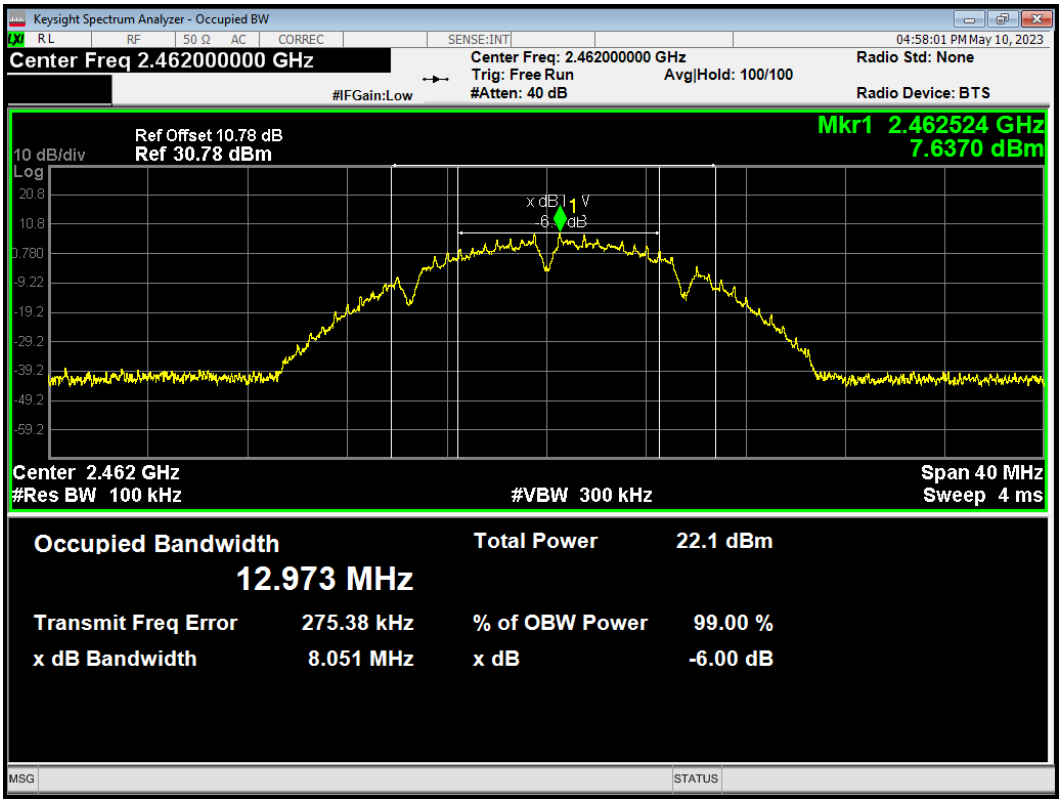


-6dB Bandwidth 802.11b 2447MHz

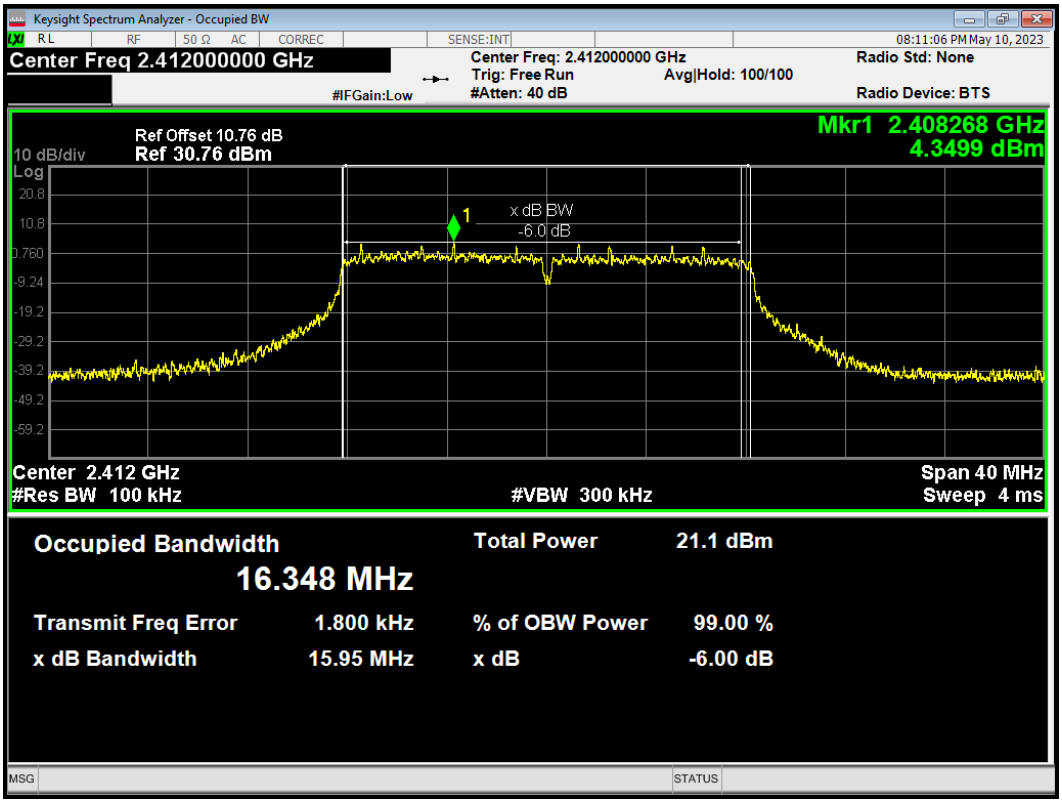


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

-6dB Bandwidth 802.11b 2462MHz

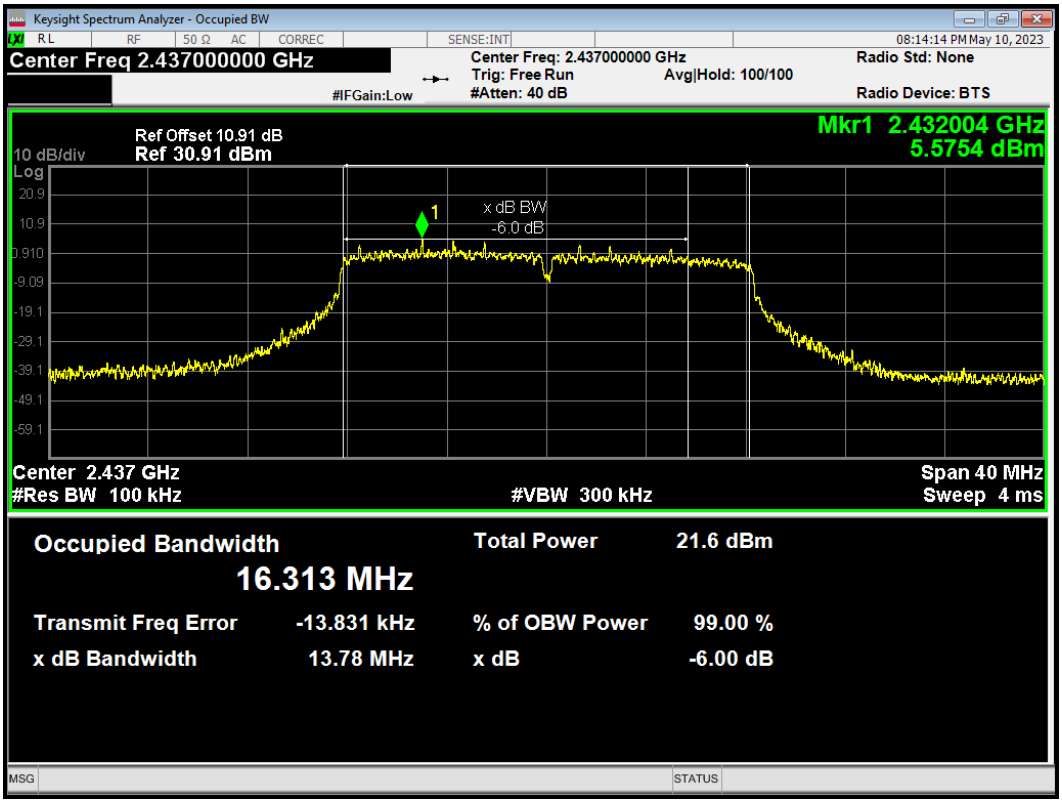


-6dB Bandwidth 802.11g 2412MHz

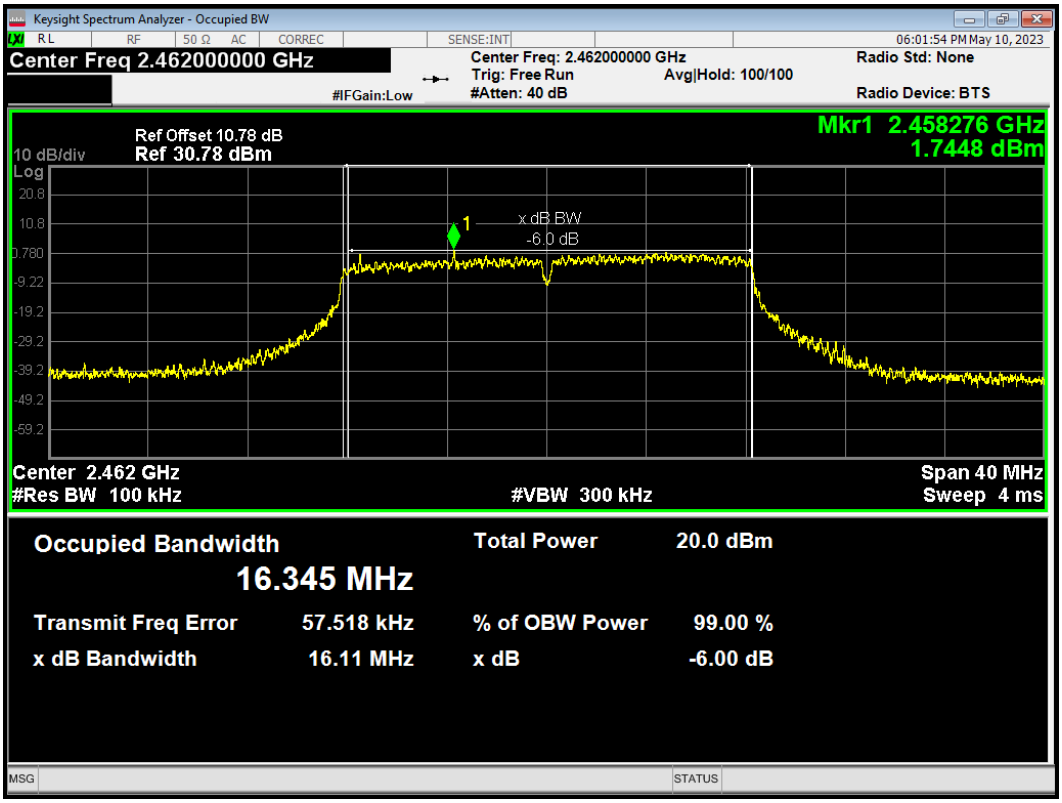


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

-6dB Bandwidth 802.11g 2437MHz

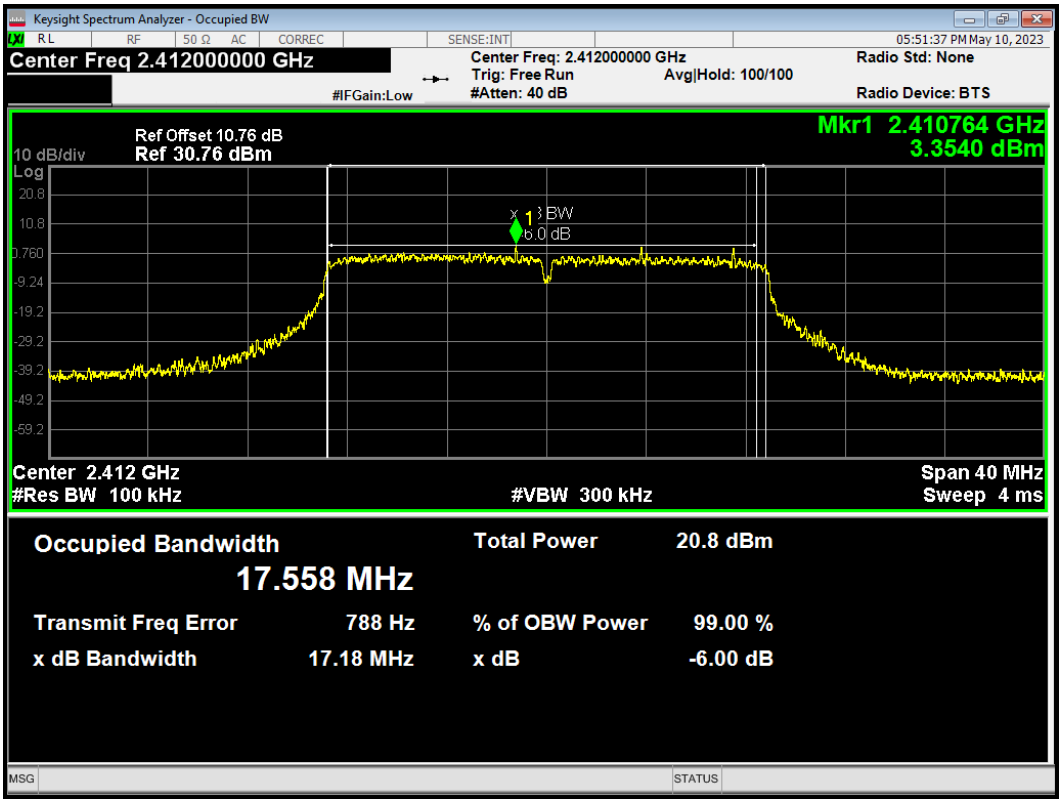


-6dB Bandwidth 802.11g 2462MHz

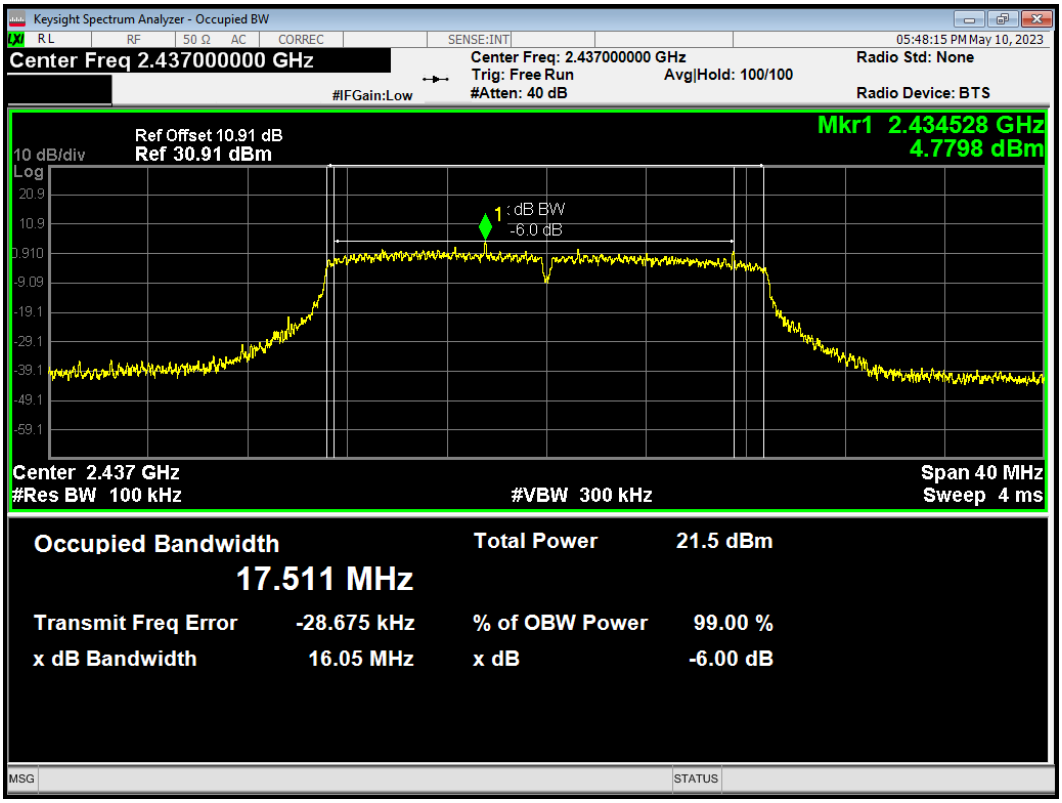


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

-6dB Bandwidth 802.11n(HT20) 2412MHz

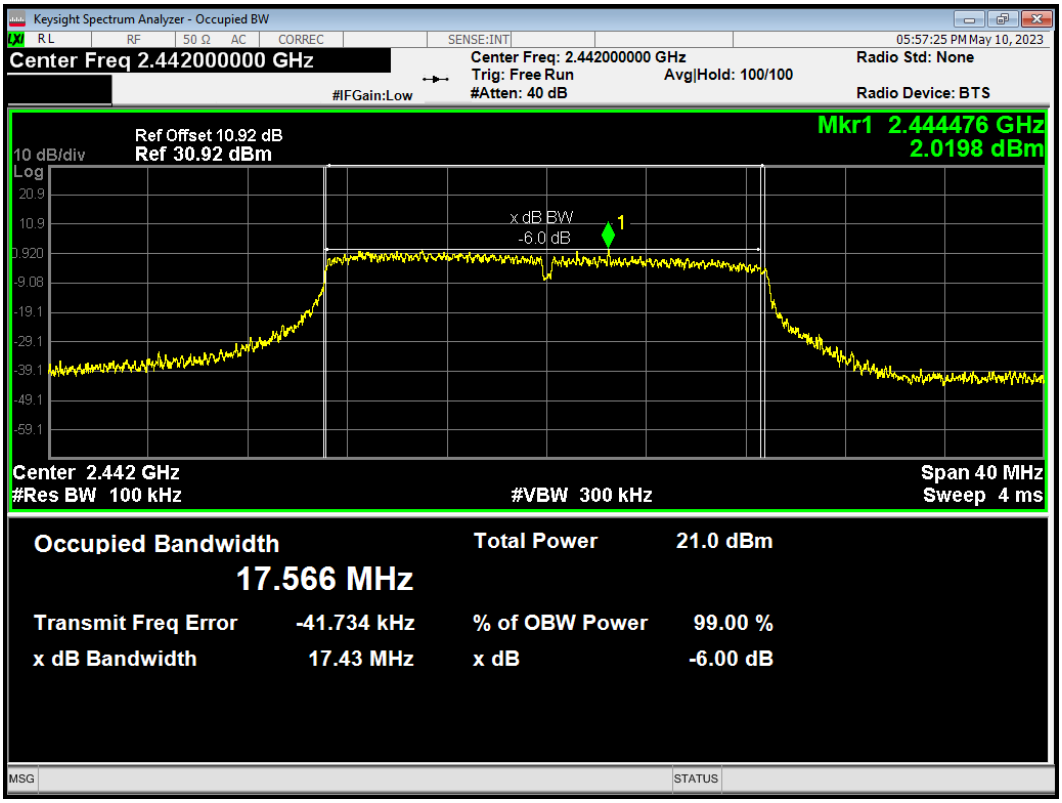


-6dB Bandwidth 802.11n(HT20) 2437MHz

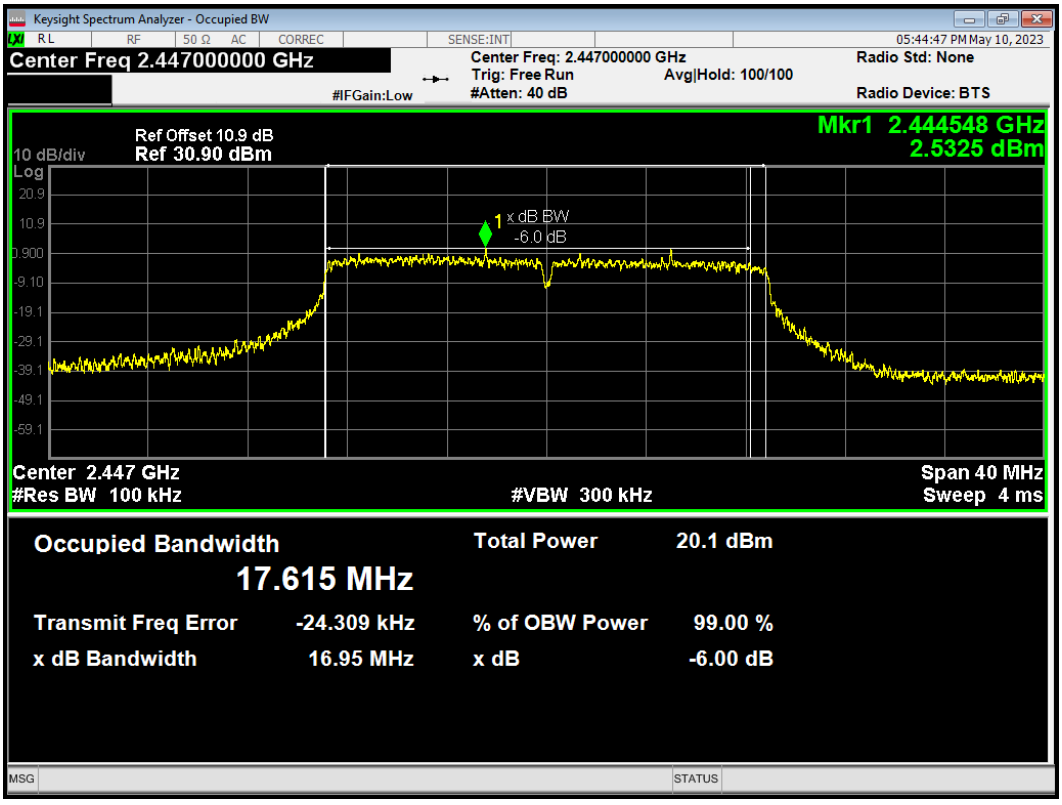


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

-6dB Bandwidth 802.11n(HT20) 2442MHz

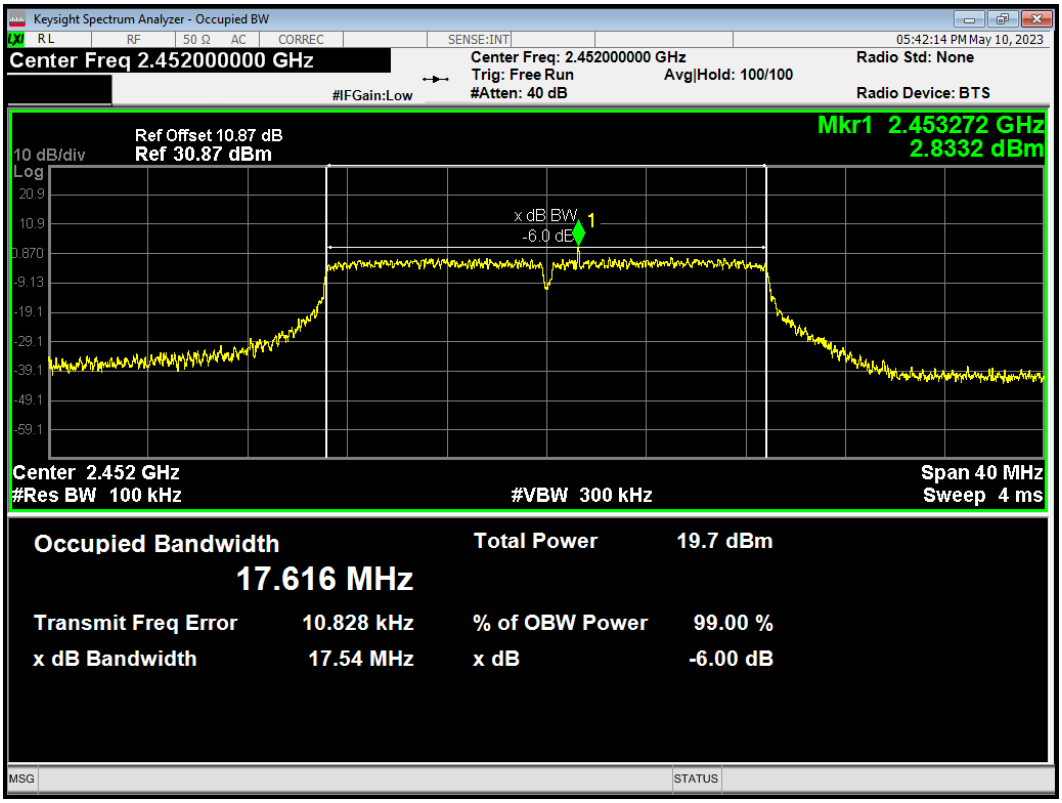


-6dB Bandwidth 802.11n(HT20) 2447MHz

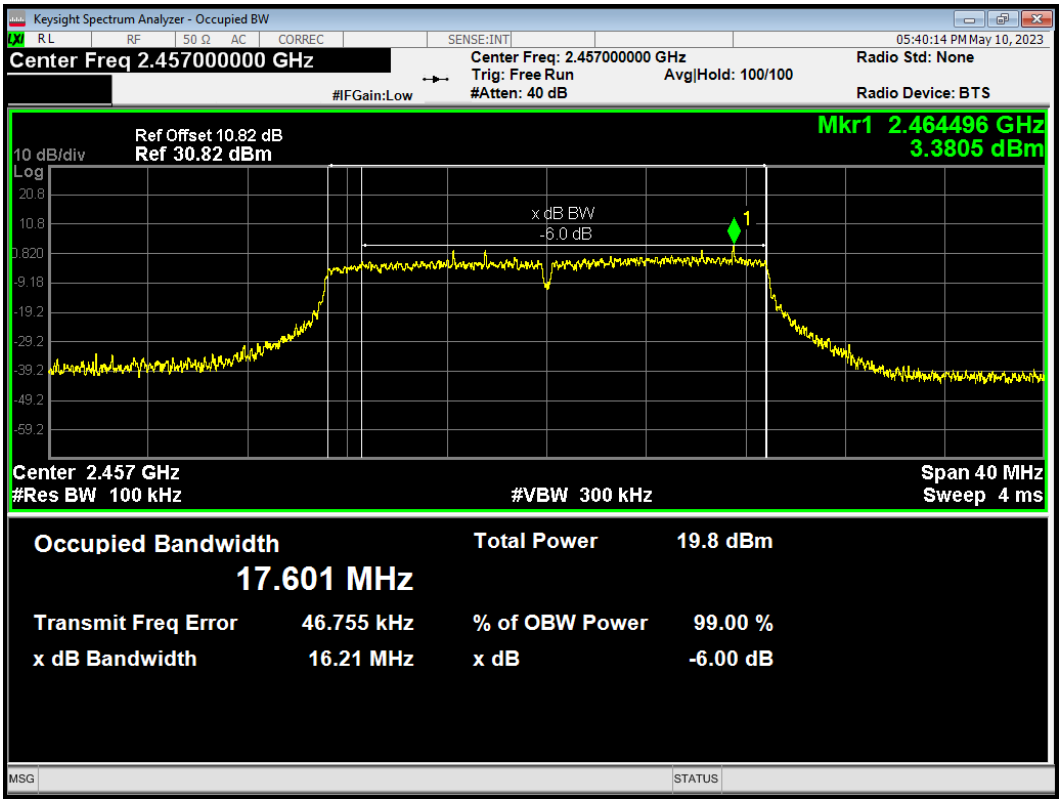


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

-6dB Bandwidth 802.11n(HT20) 2452MHz

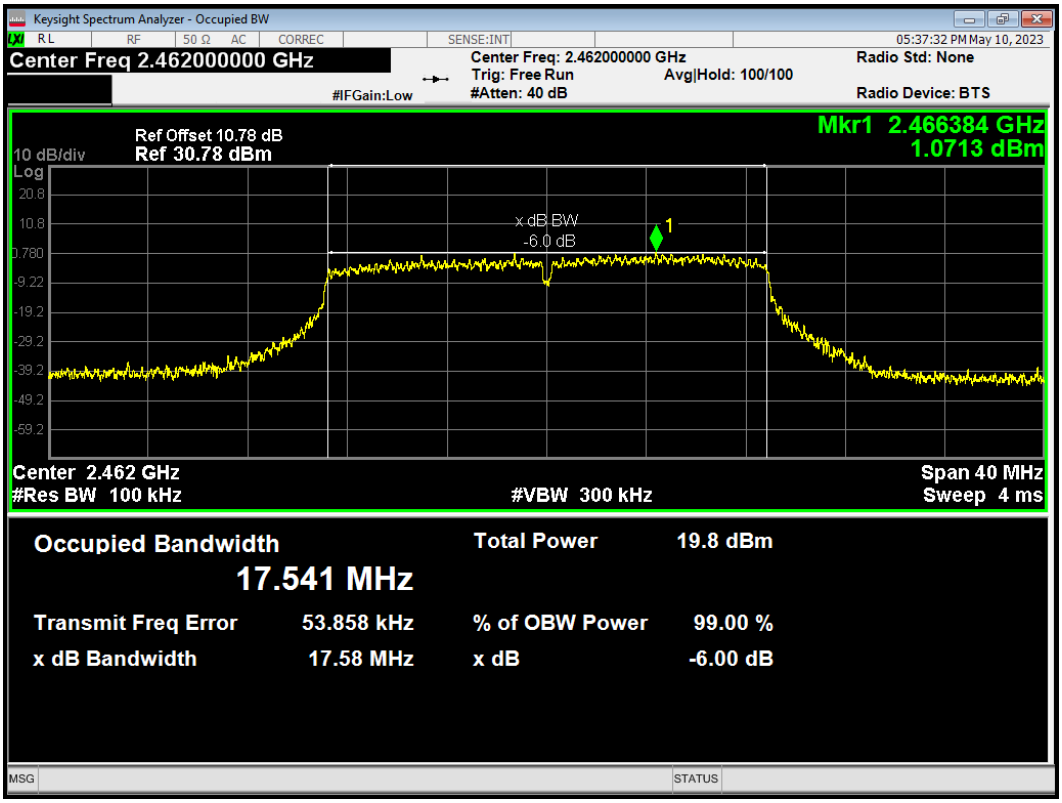


-6dB Bandwidth 802.11n(HT20) 2457MHz

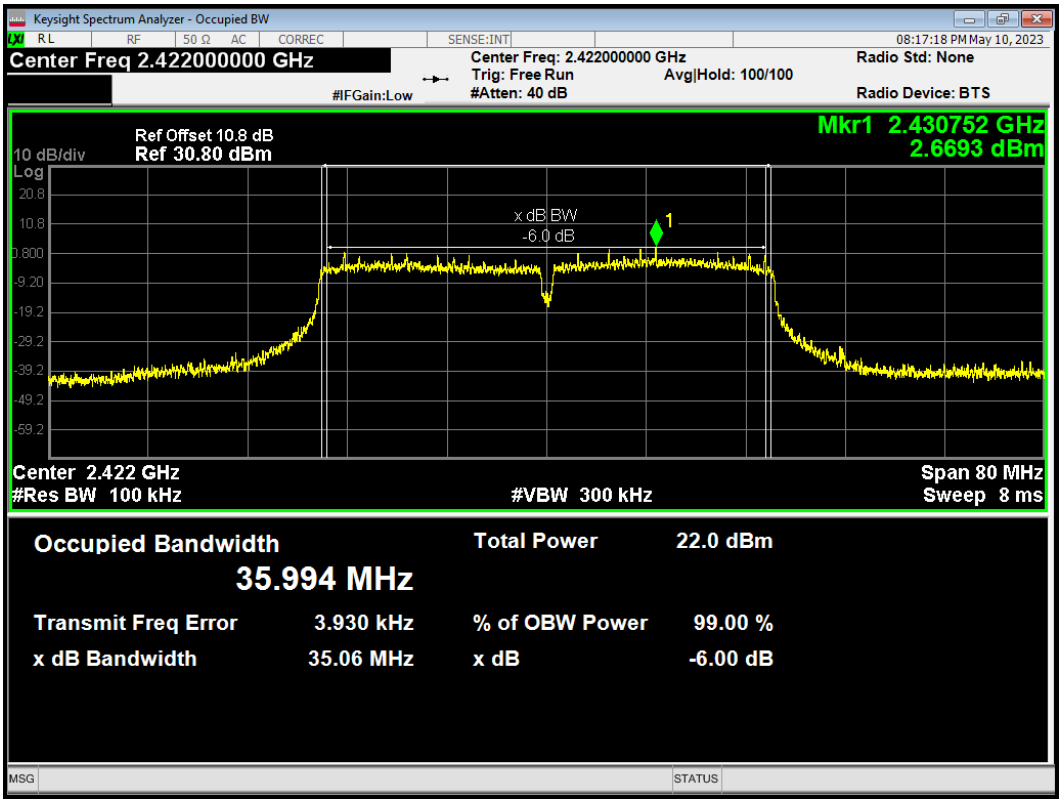


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

-6dB Bandwidth 802.11n(HT20) 2462MHz

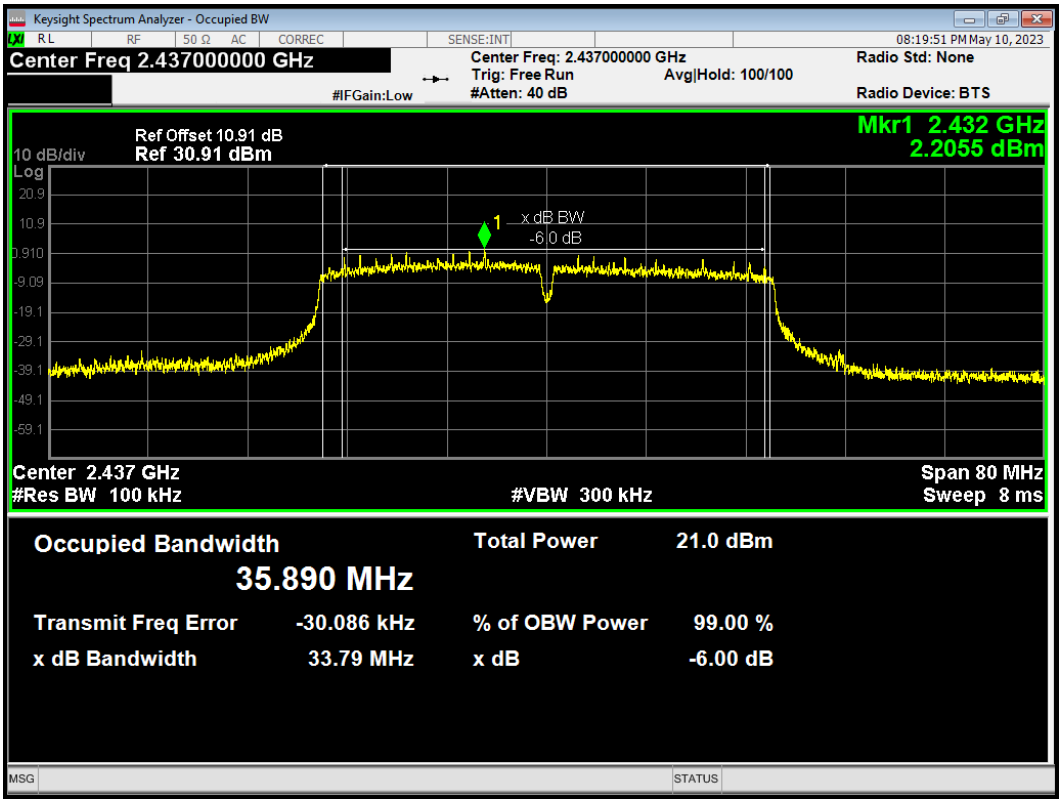


-6dB Bandwidth 802.11n(HT40) 2422MHz

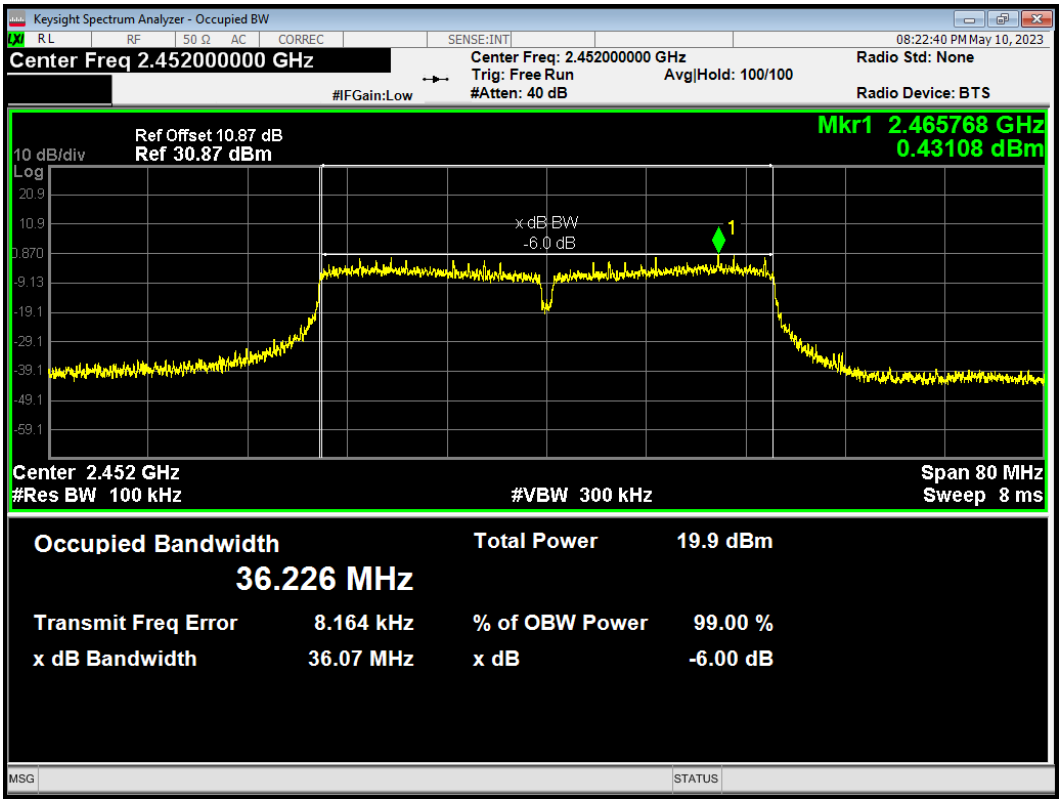


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

-6dB Bandwidth 802.11n(HT40) 2437MHz

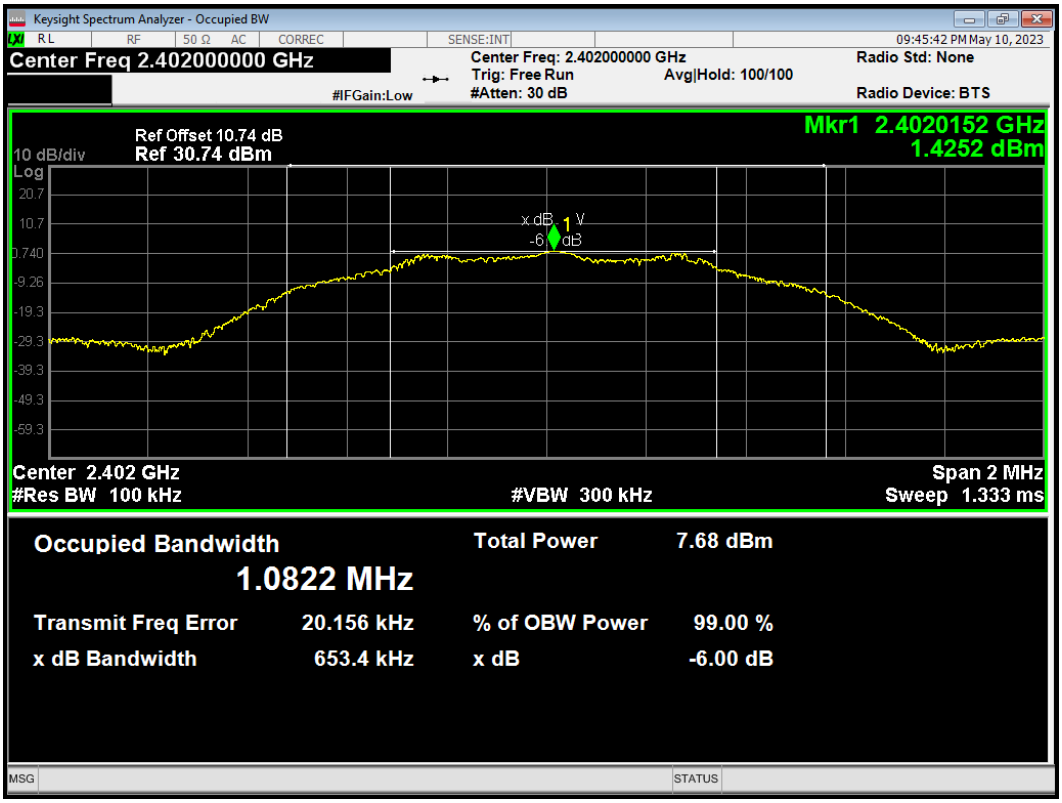


-6dB Bandwidth 802.11n(HT40) 2452MHz

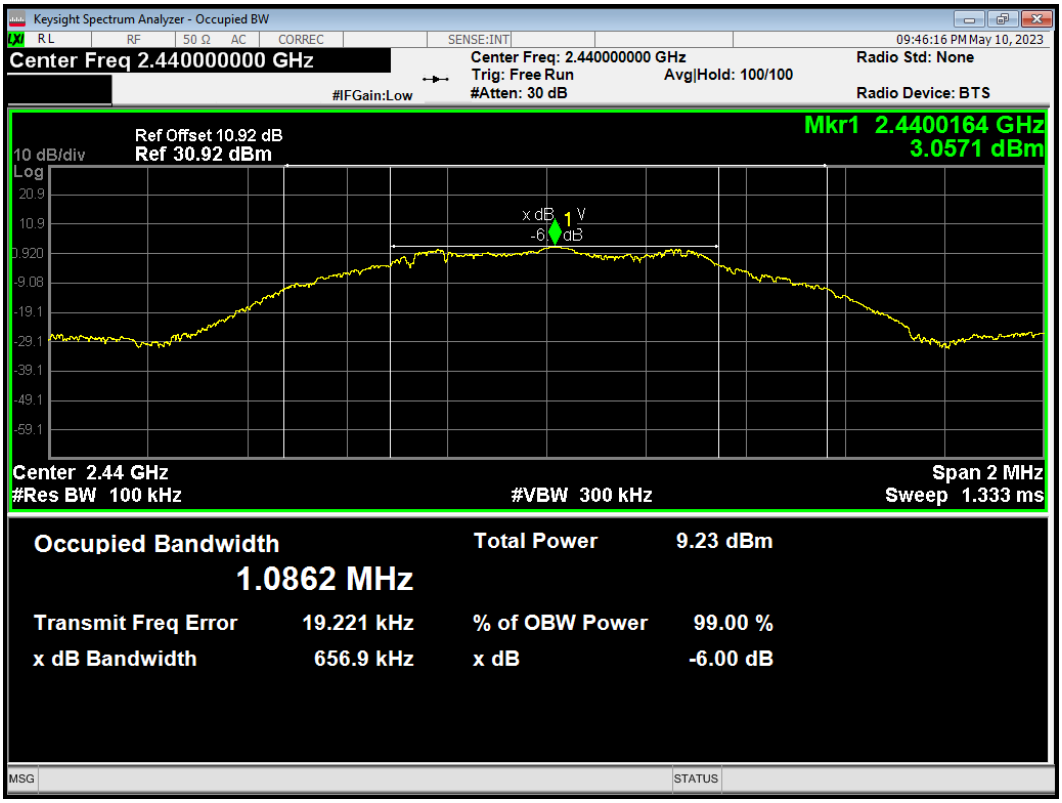


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

-6dB Bandwidth BLE 2402MHz

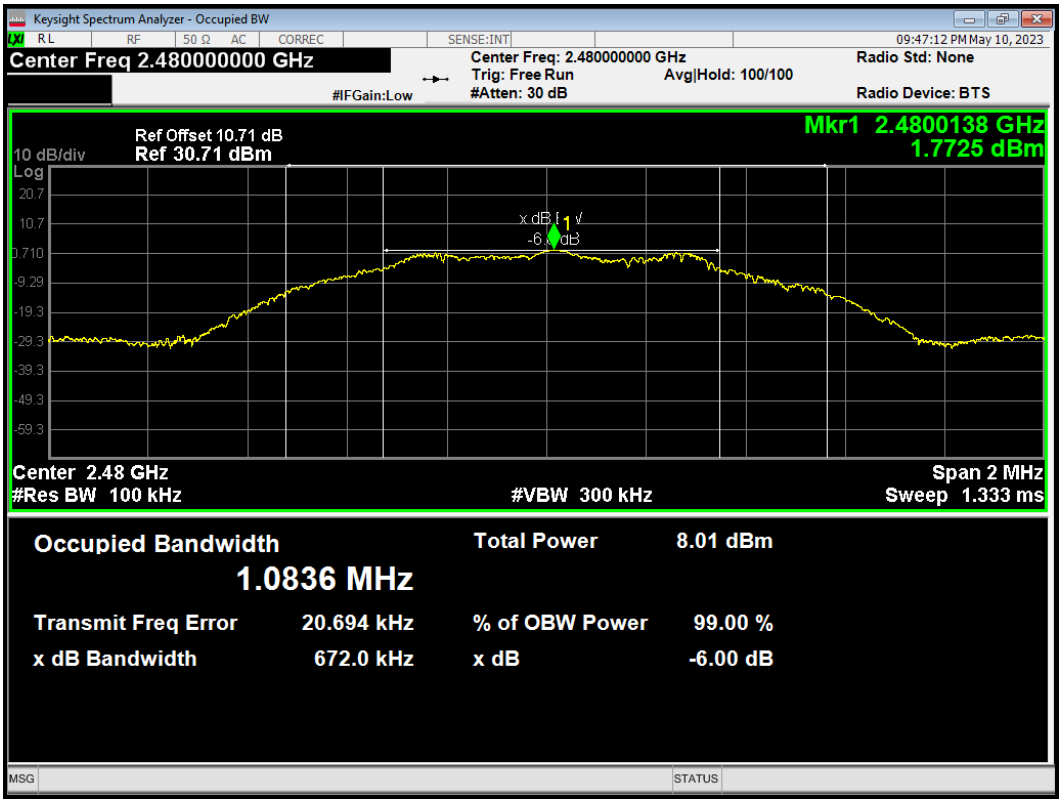


-6dB Bandwidth BLE 2440MHz



This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

-6dB Bandwidth BLE 2480MHz



This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

5.3. Band Edge

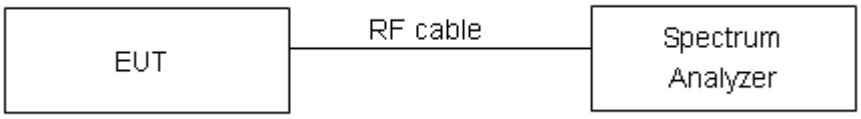
Ambient Condition

Temperature	Relative humidity
20°C ~ 25°C	45% ~ 50%

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable the band edge of the lowest and highest channels were measured. The peak detector is used and RBW is set to 100 kHz and VBW is set to 300 kHz on spectrum analyzer. Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

Rule Part 15.247(d) specifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.” If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.”

Measurement Uncertainty

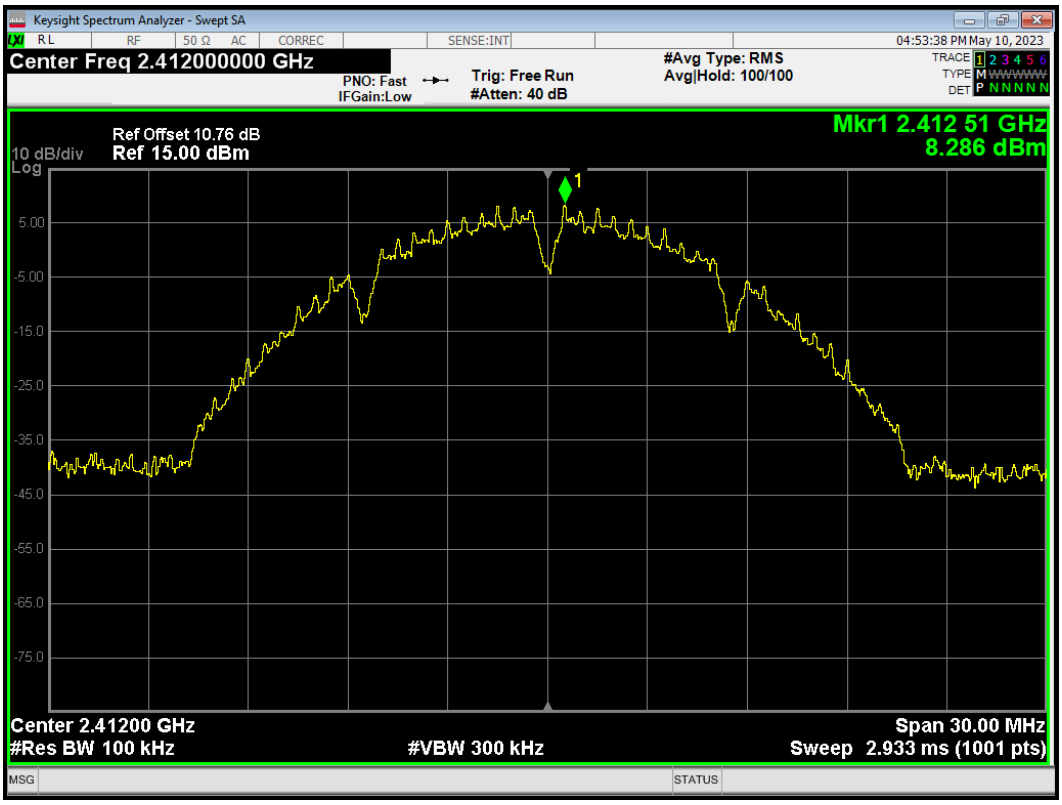
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor *k* = 1.96.

Frequency	Uncertainty
2GHz-3GHz	1.407 dB

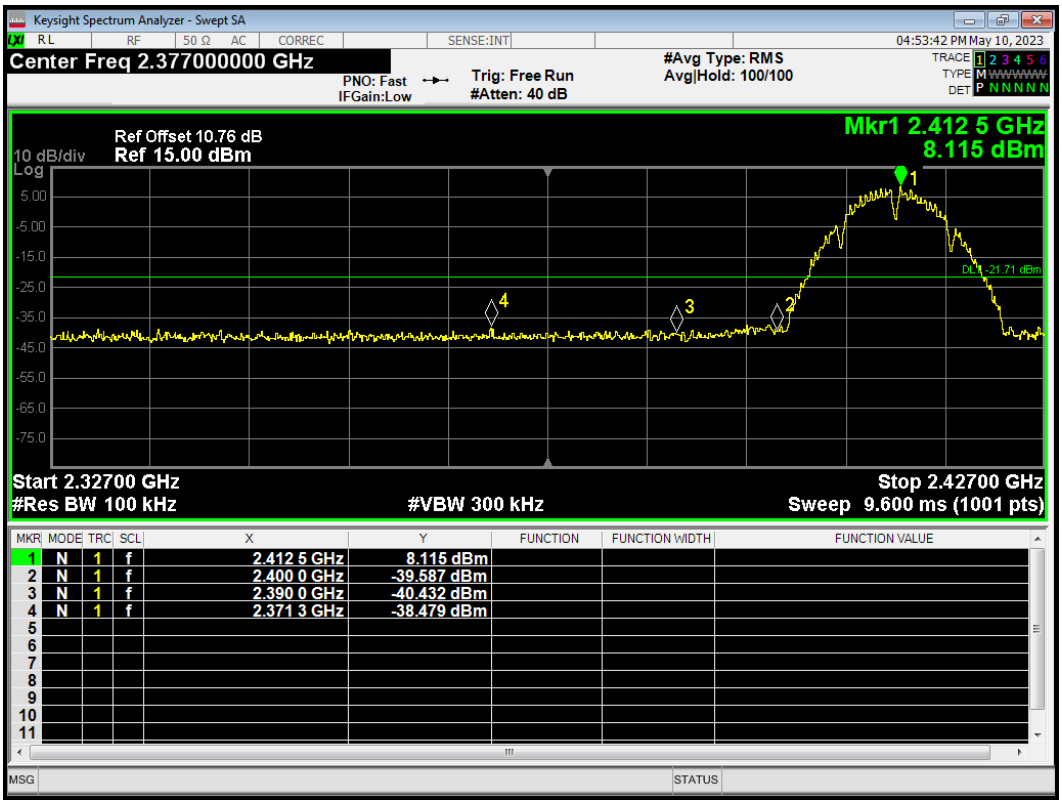
This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Test Results: PASS

Band Edge 802.11b 2412MHz Ref

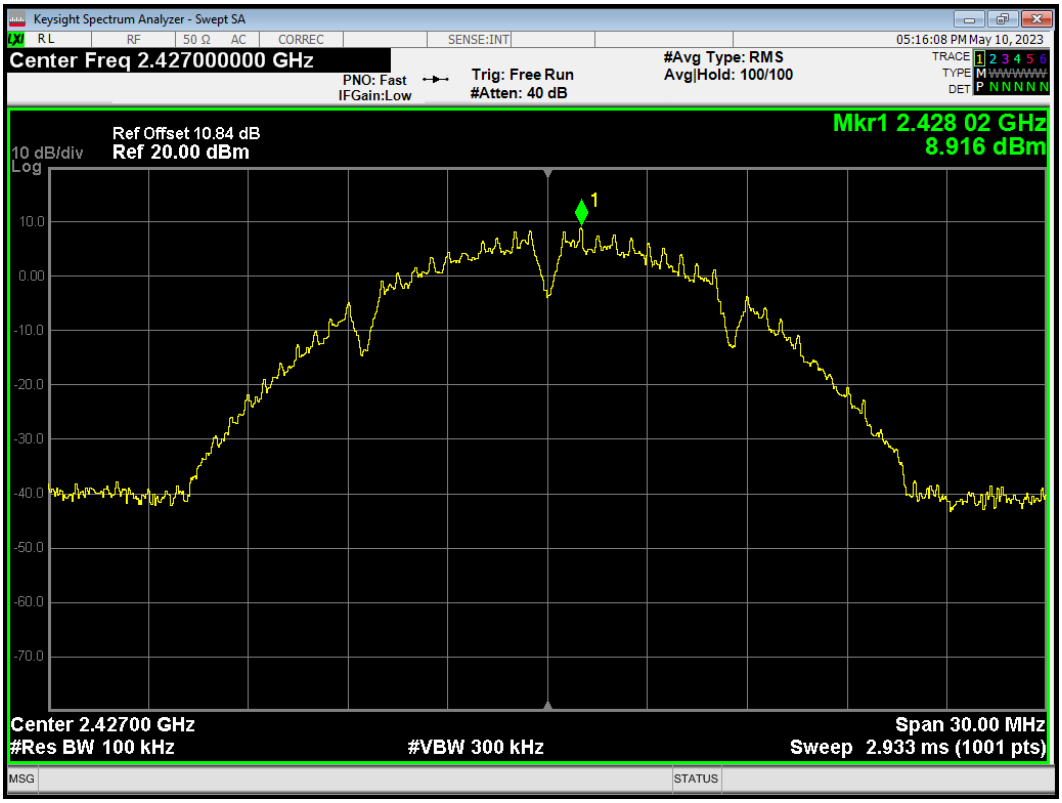


Band Edge 802.11b 2412MHz Emission

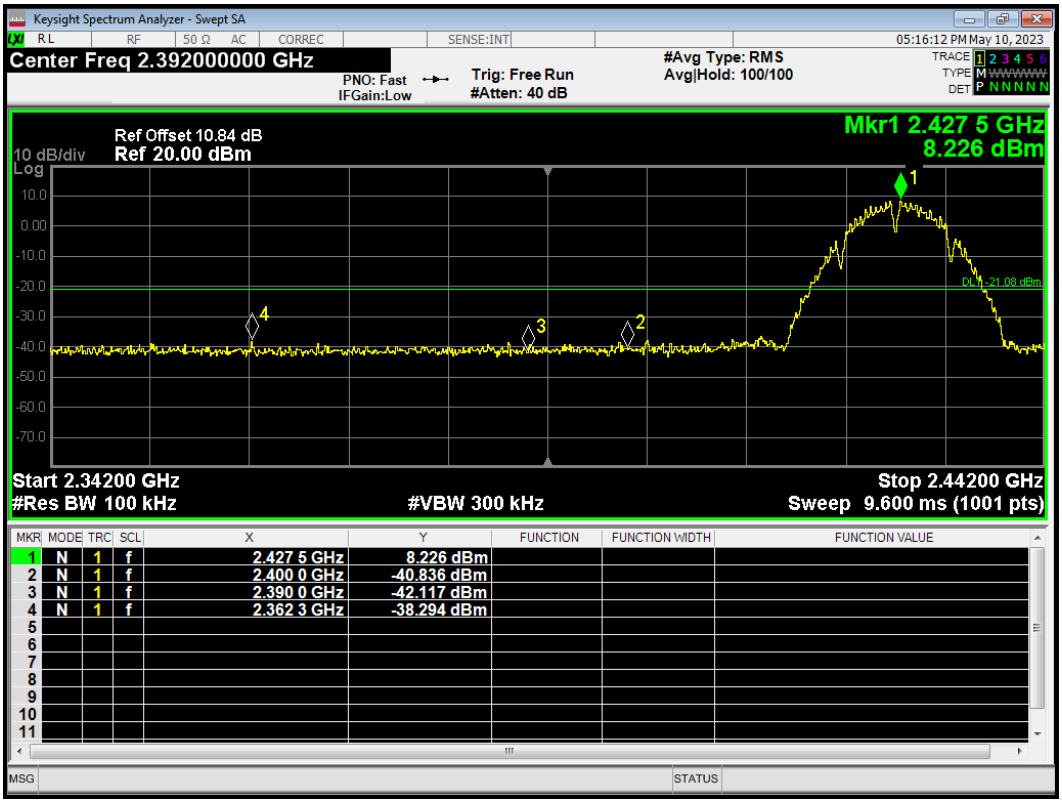


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11b 2427MHz Ref

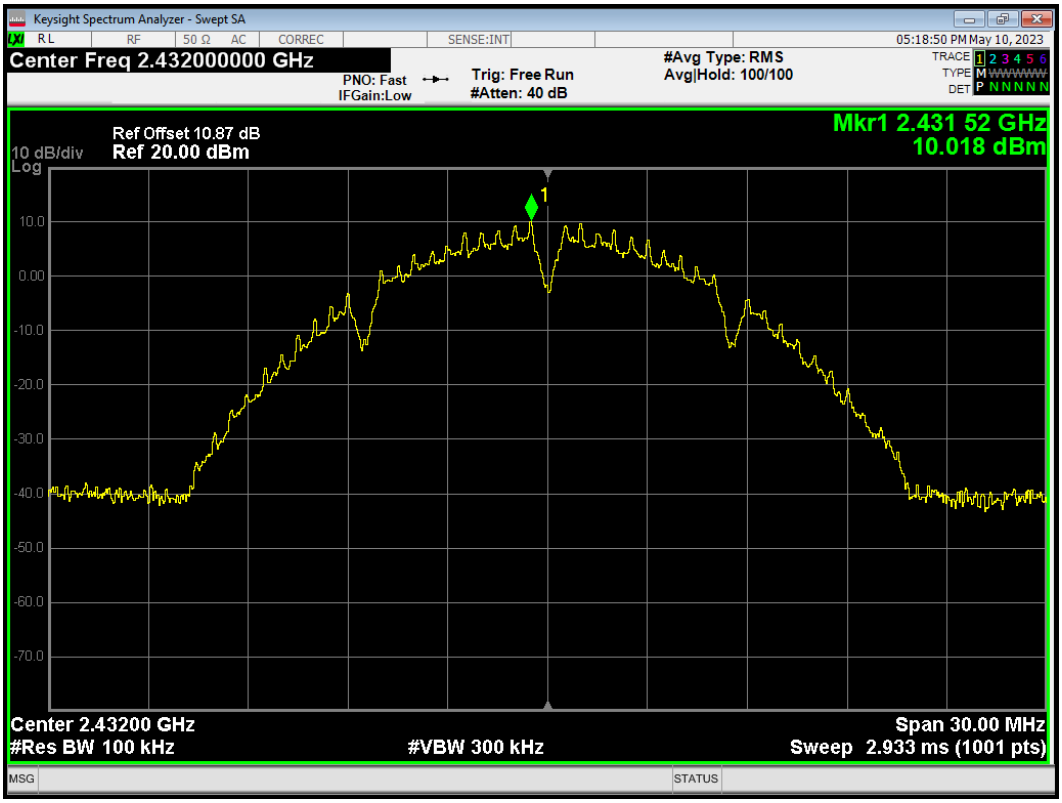


Band Edge 802.11b 2427MHz Emission

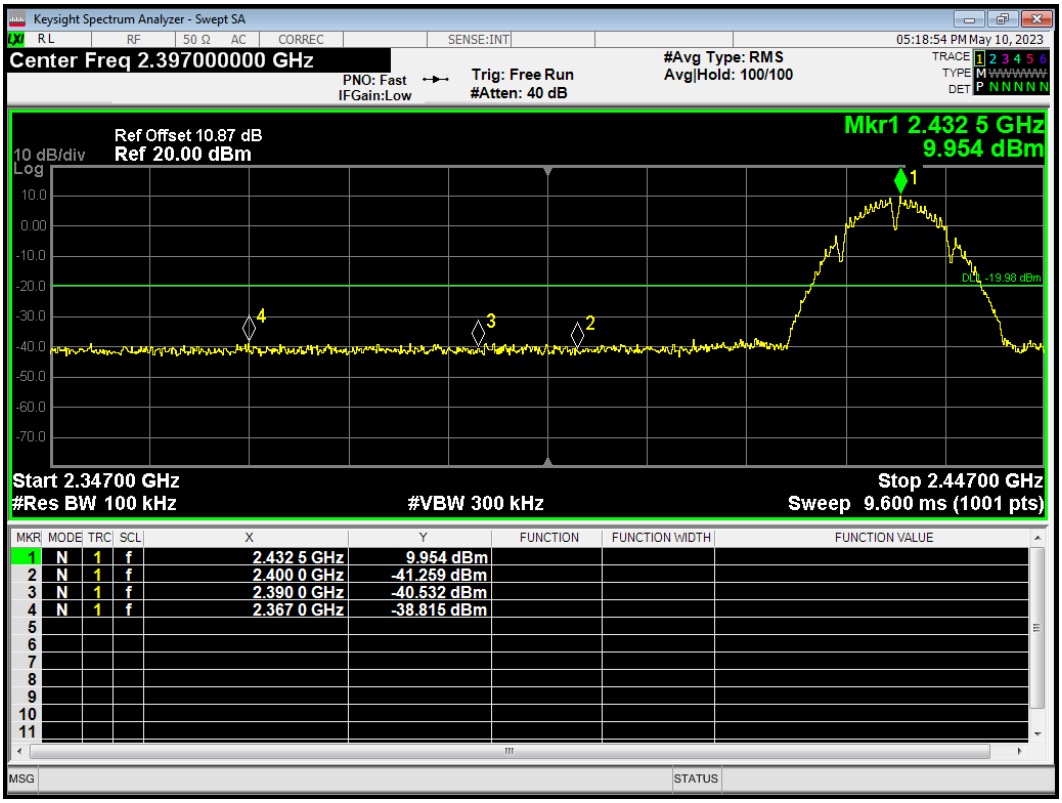


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11b 2432MHz Ref

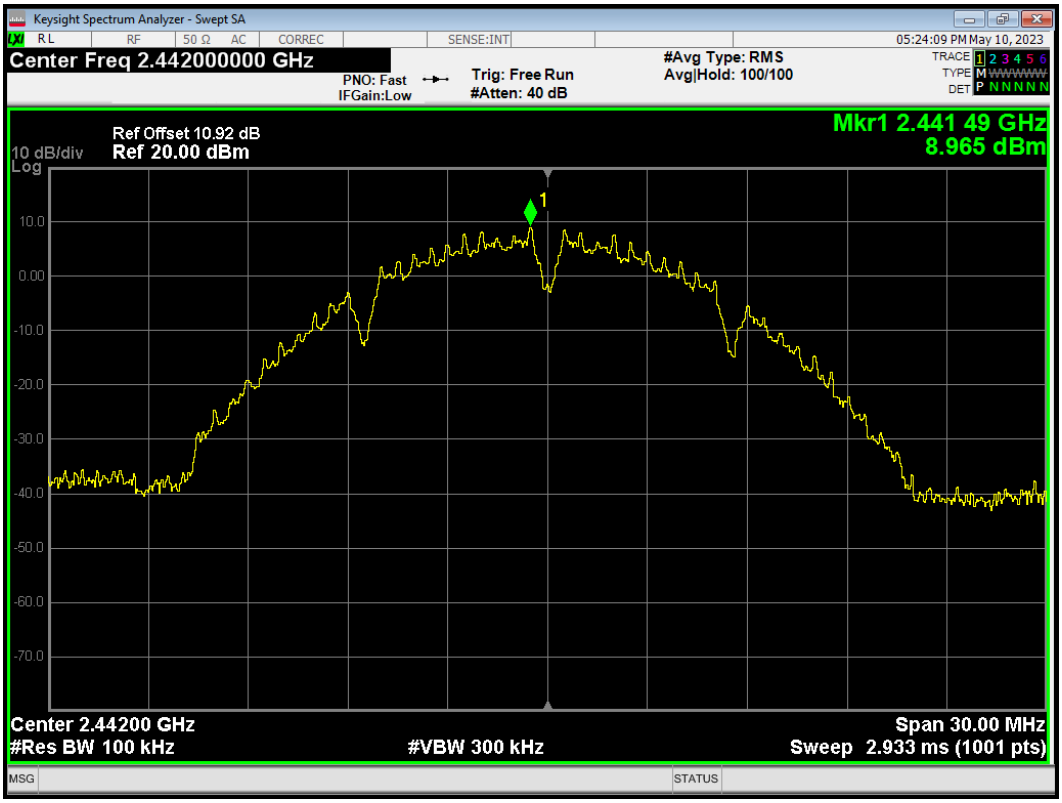


Band Edge 802.11b 2432MHz Emission

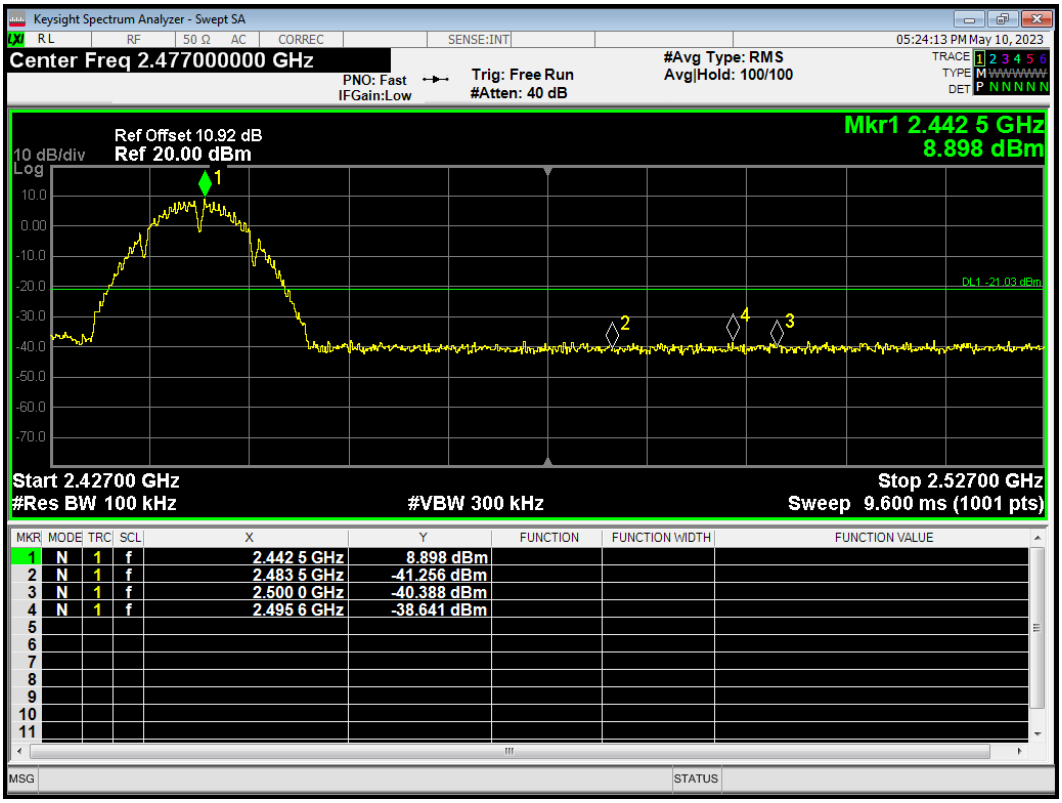


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11b 2442MHz Ref

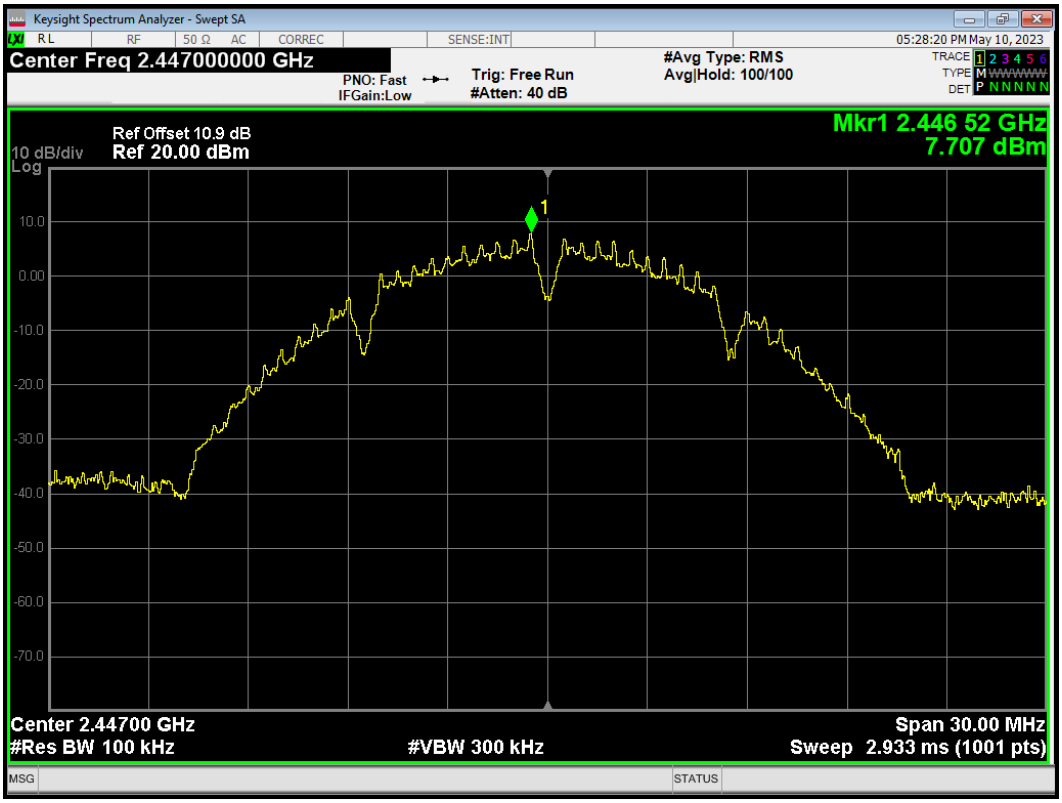


Band Edge 802.11b 2442MHz Emission

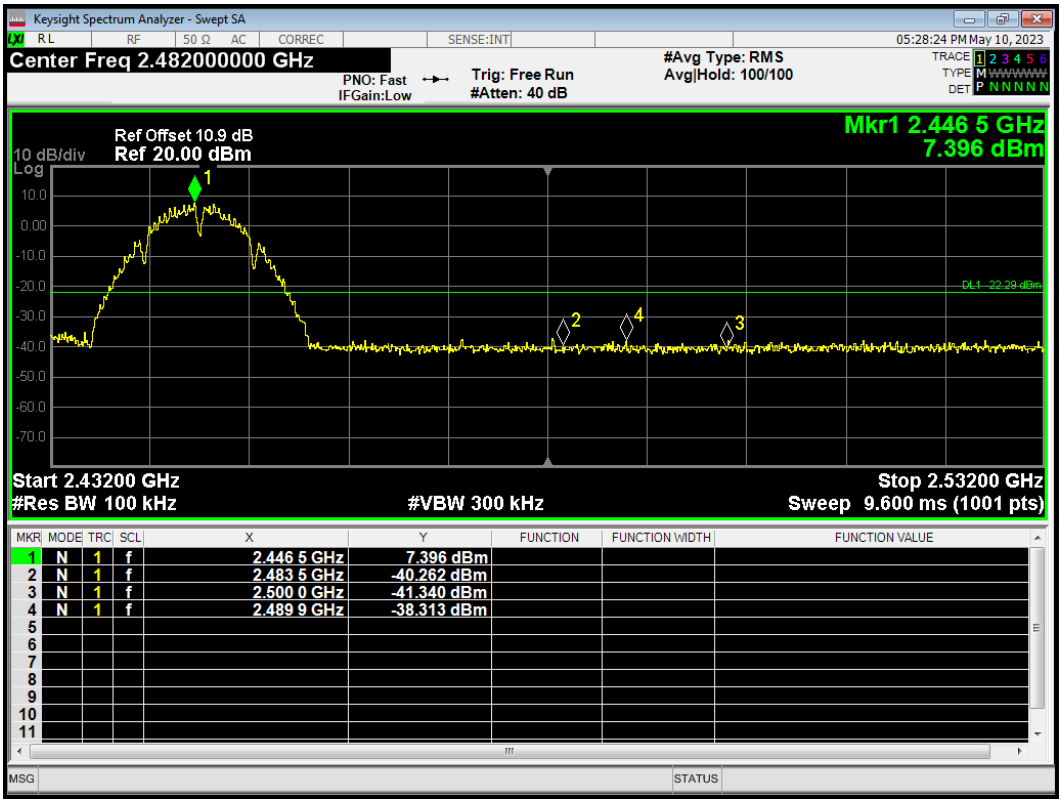


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11b 2447MHz Ref

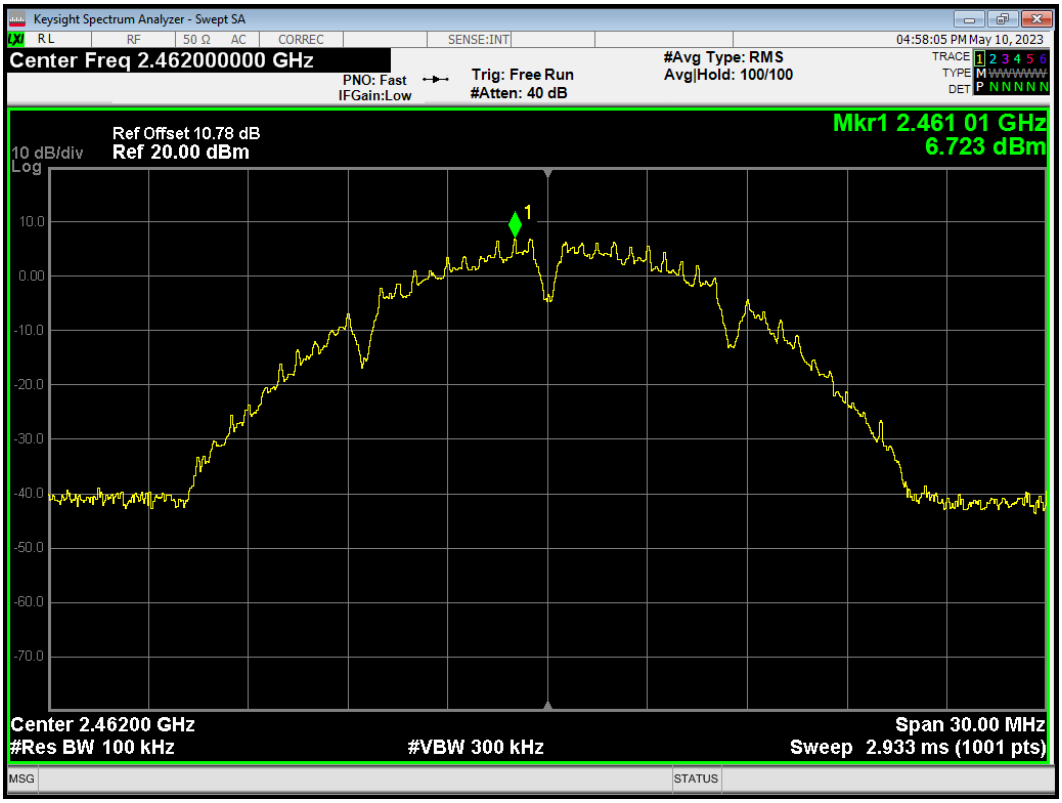


Band Edge 802.11b 2447MHz Emission

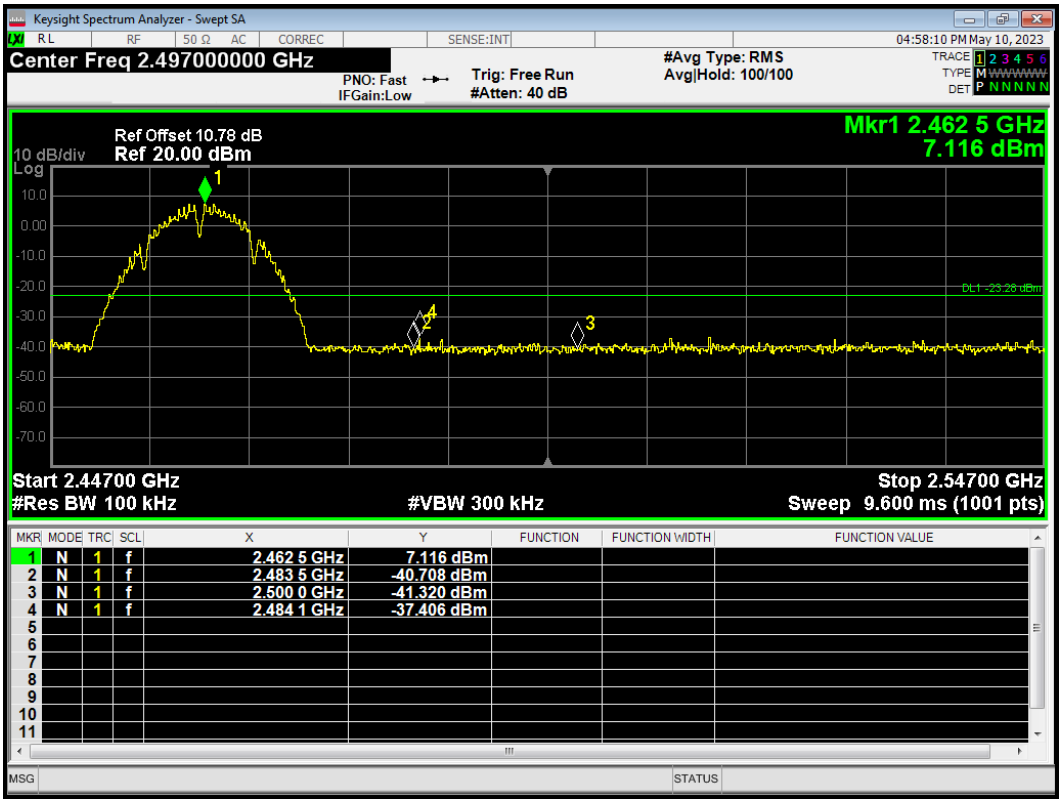


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11b 2462MHz Ref

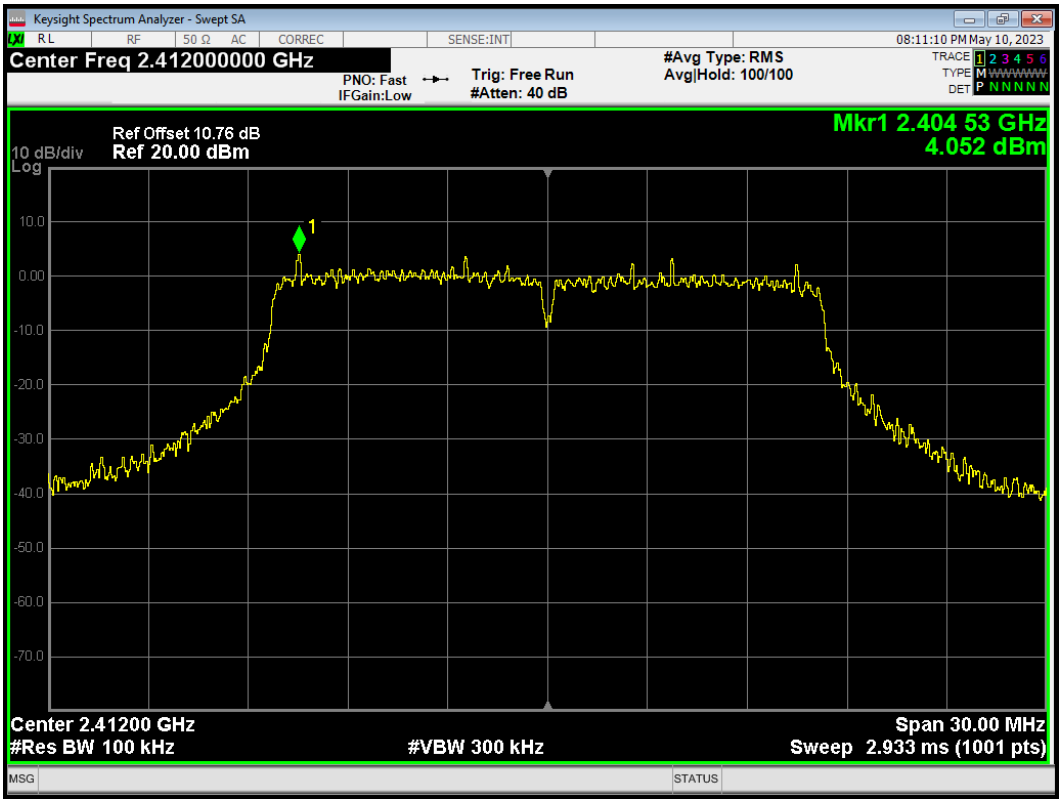


Band Edge 802.11b 2462MHz Emission

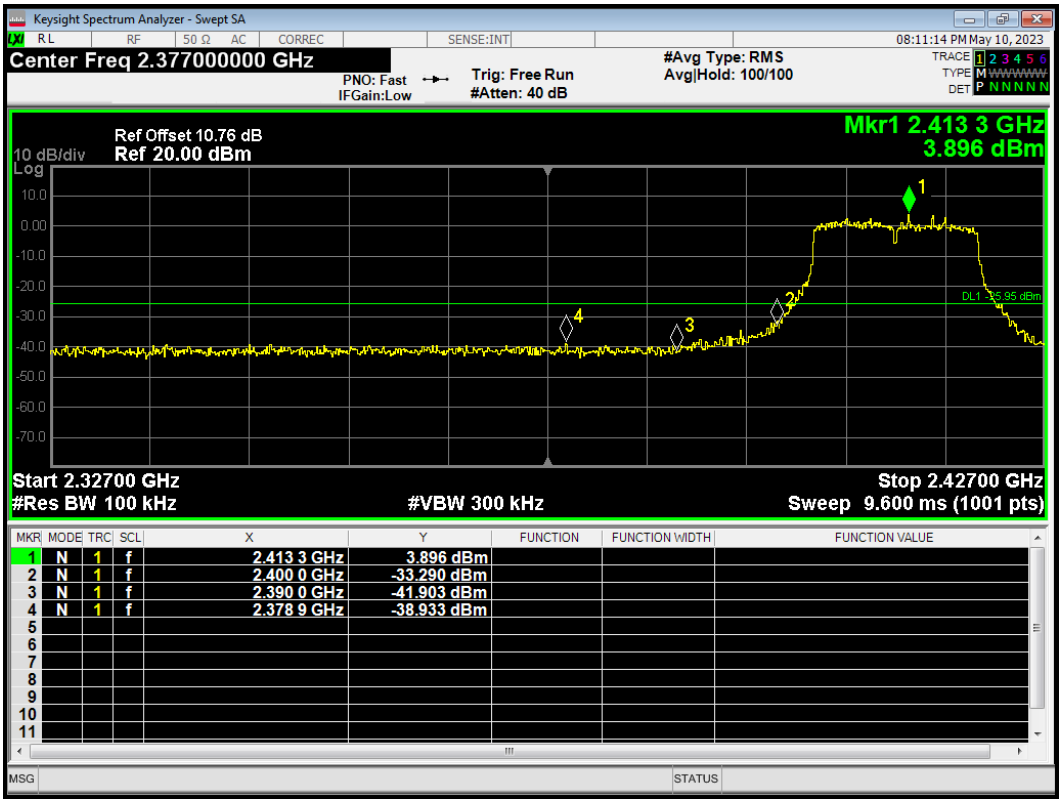


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11g 2412MHz Ref

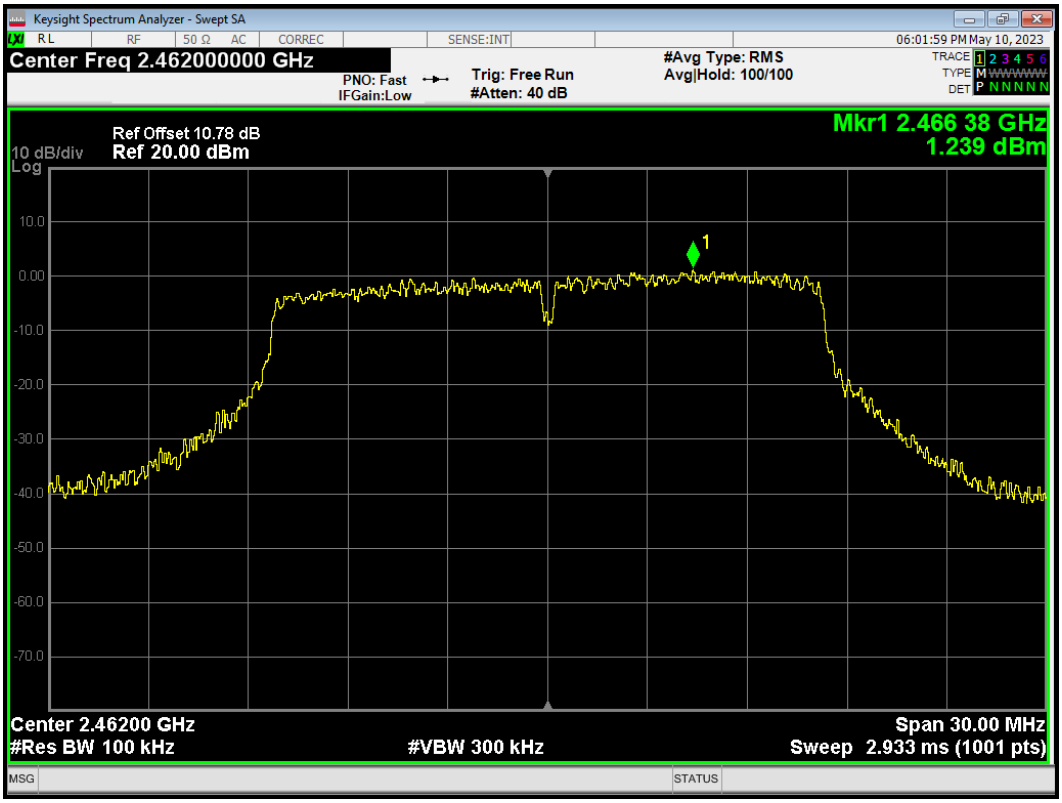


Band Edge 802.11g 2412MHz Emission

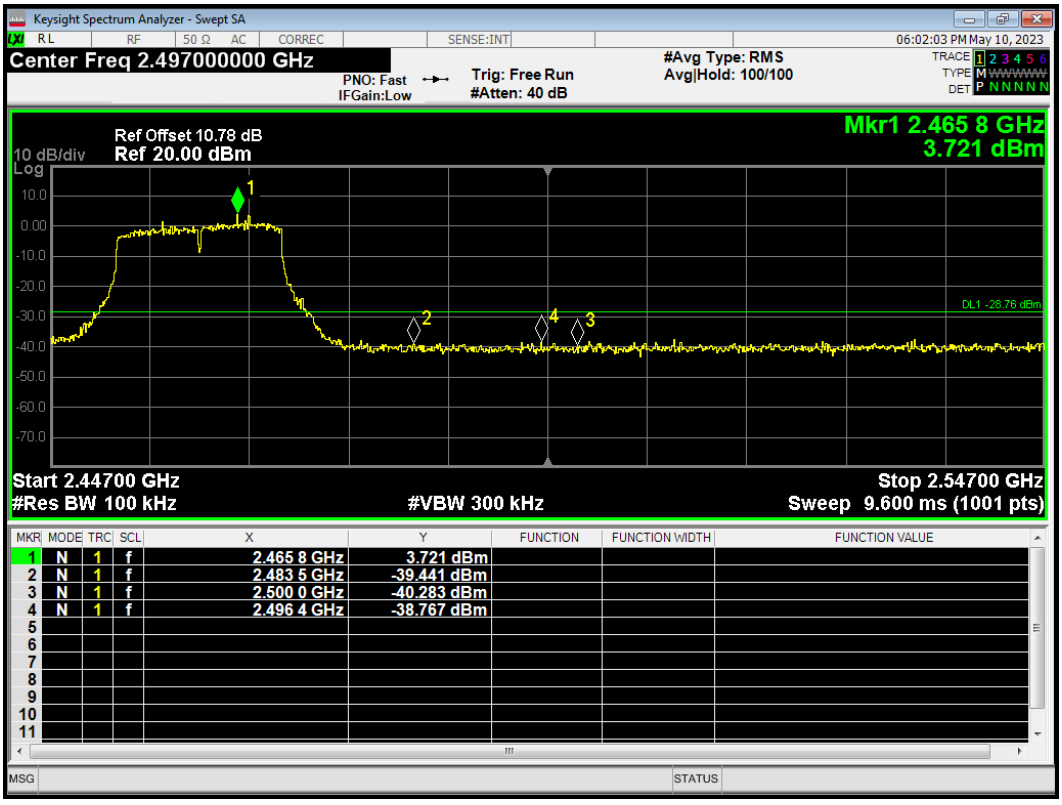


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11g 2462MHz Ref

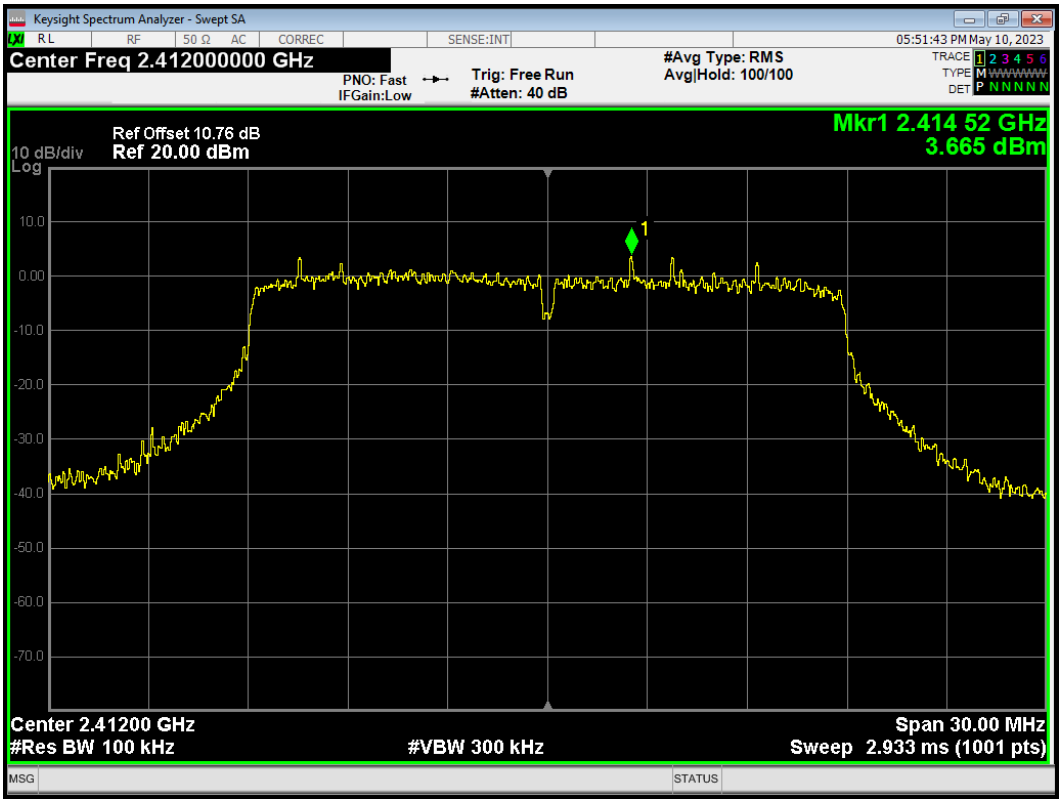


Band Edge 802.11g 2462MHz Emission

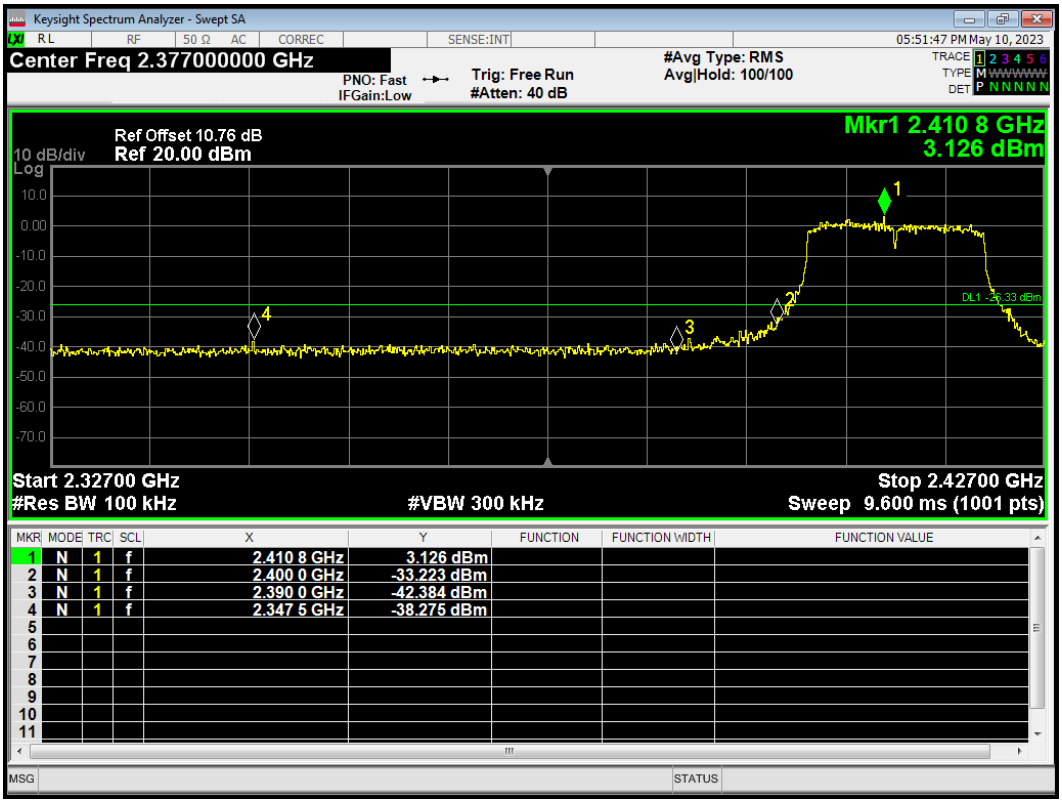


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11n(HT20) 2412MHz Ref

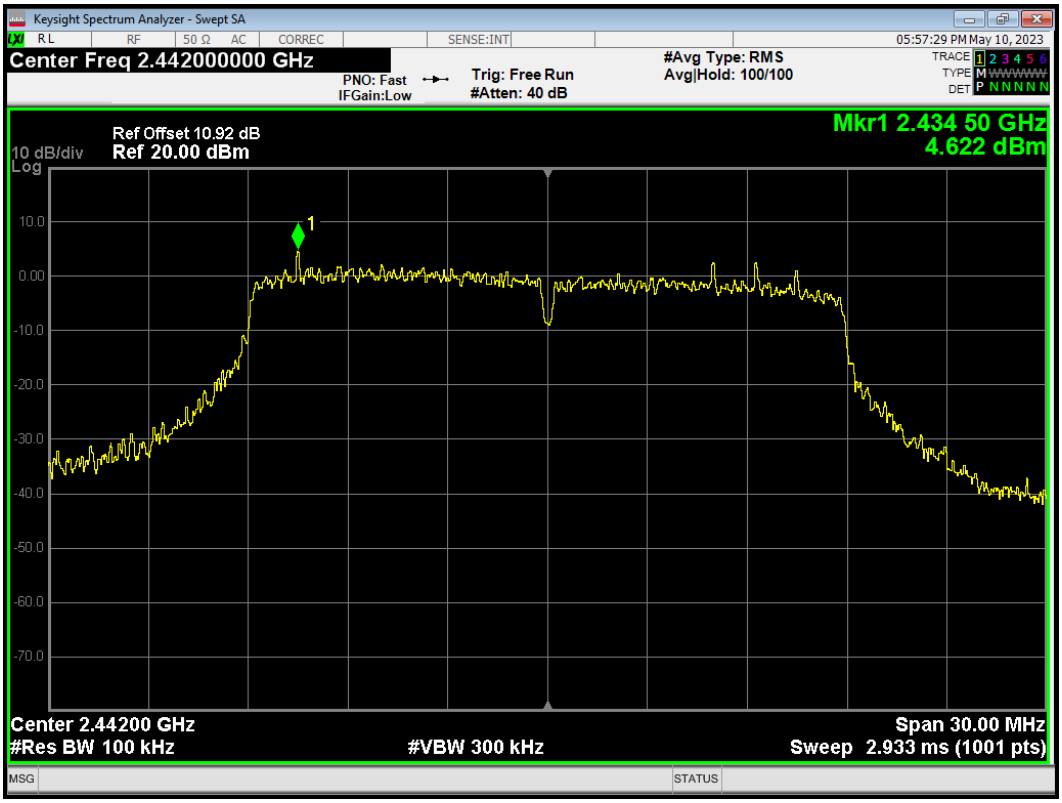


Band Edge 802.11n(HT20) 2412MHz Emission

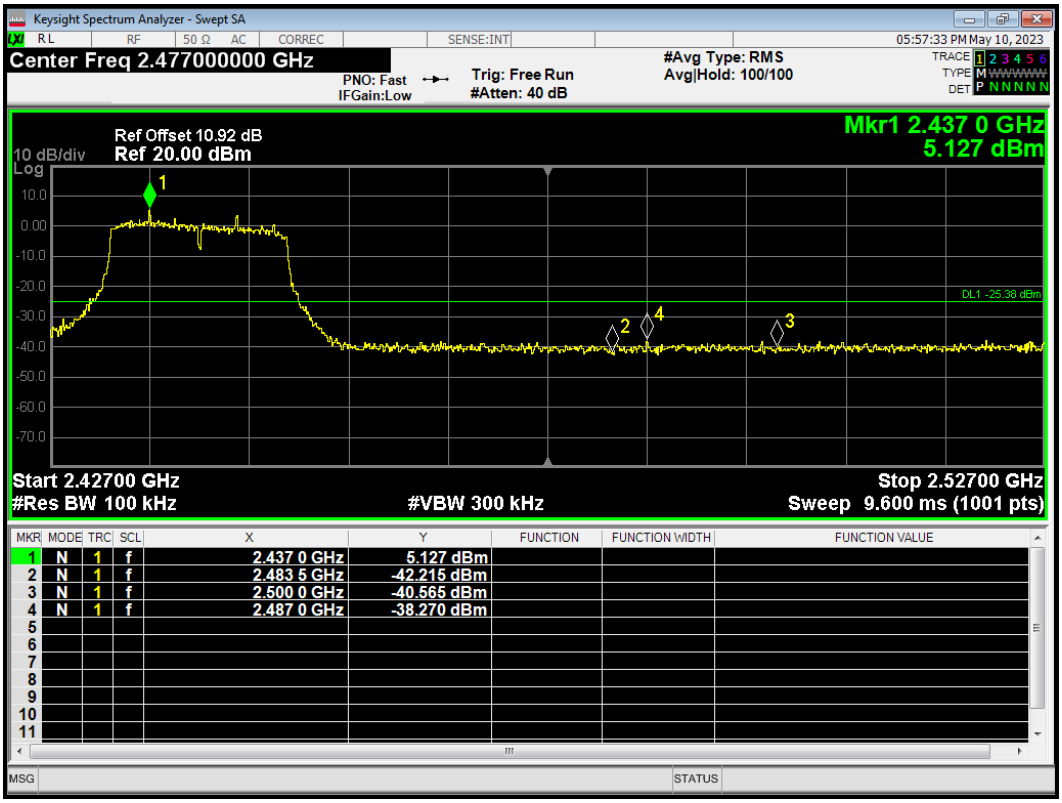


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11n(HT20) 2442MHz Ref

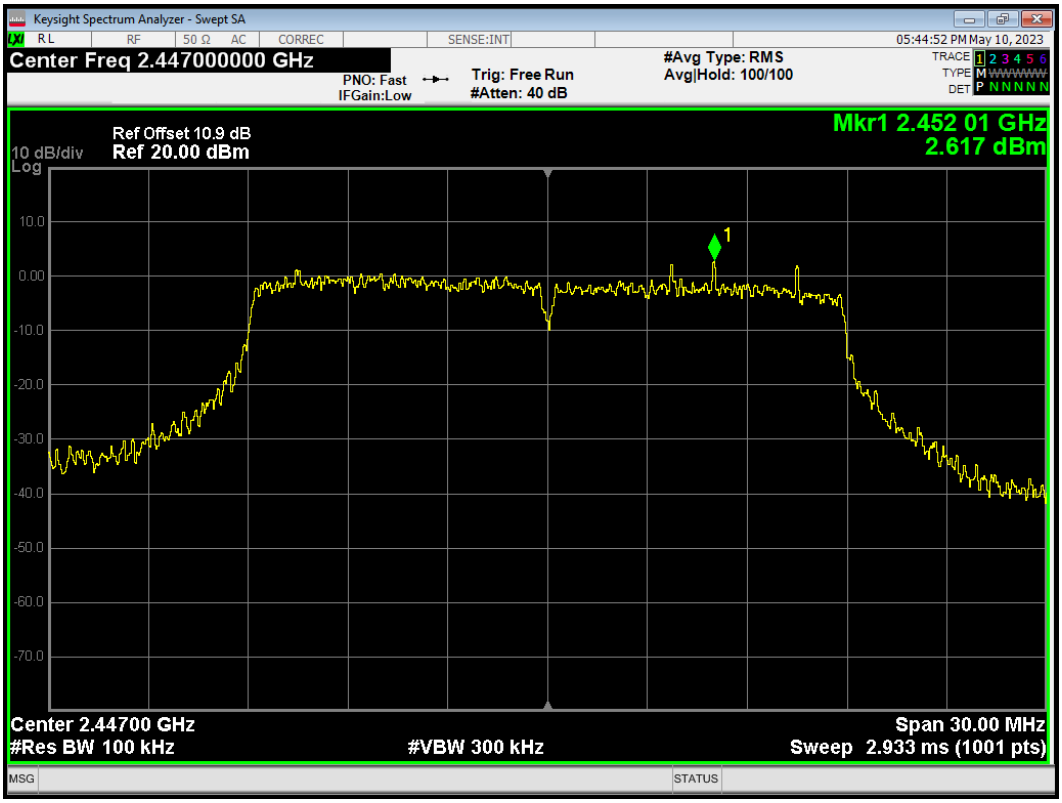


Band Edge 802.11n(HT20) 2442MHz Emission

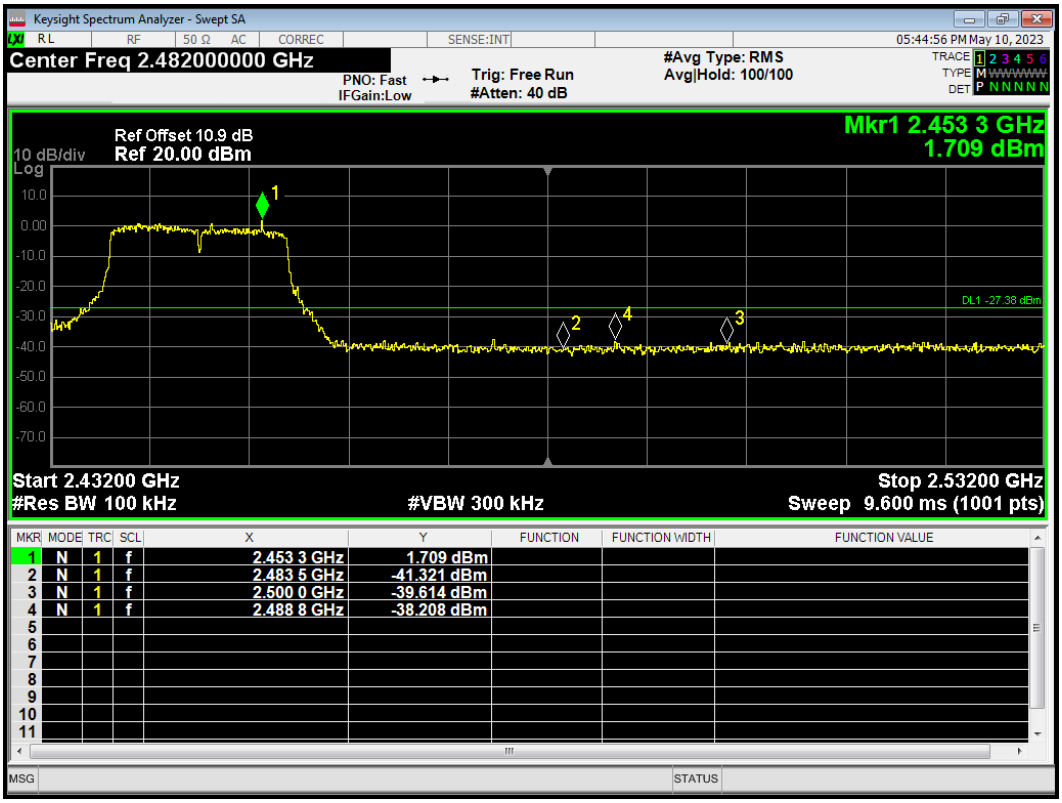


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11n(HT20) 2447MHz Ref

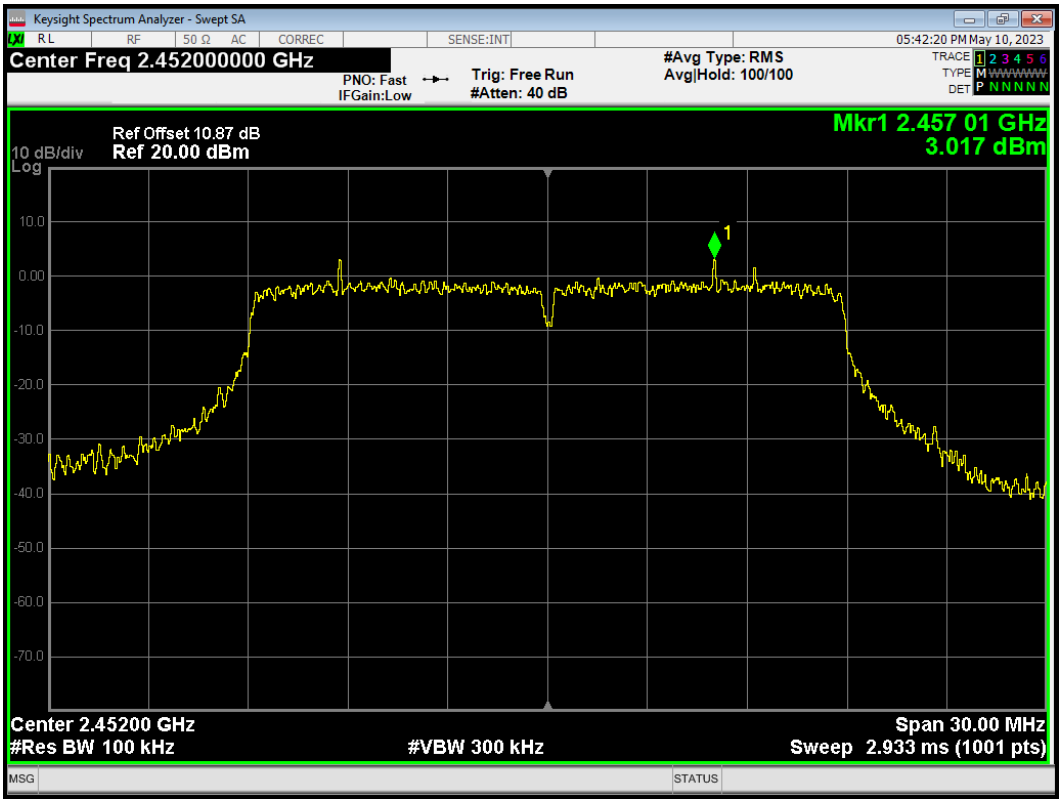


Band Edge 802.11n(HT20) 2447MHz Emission

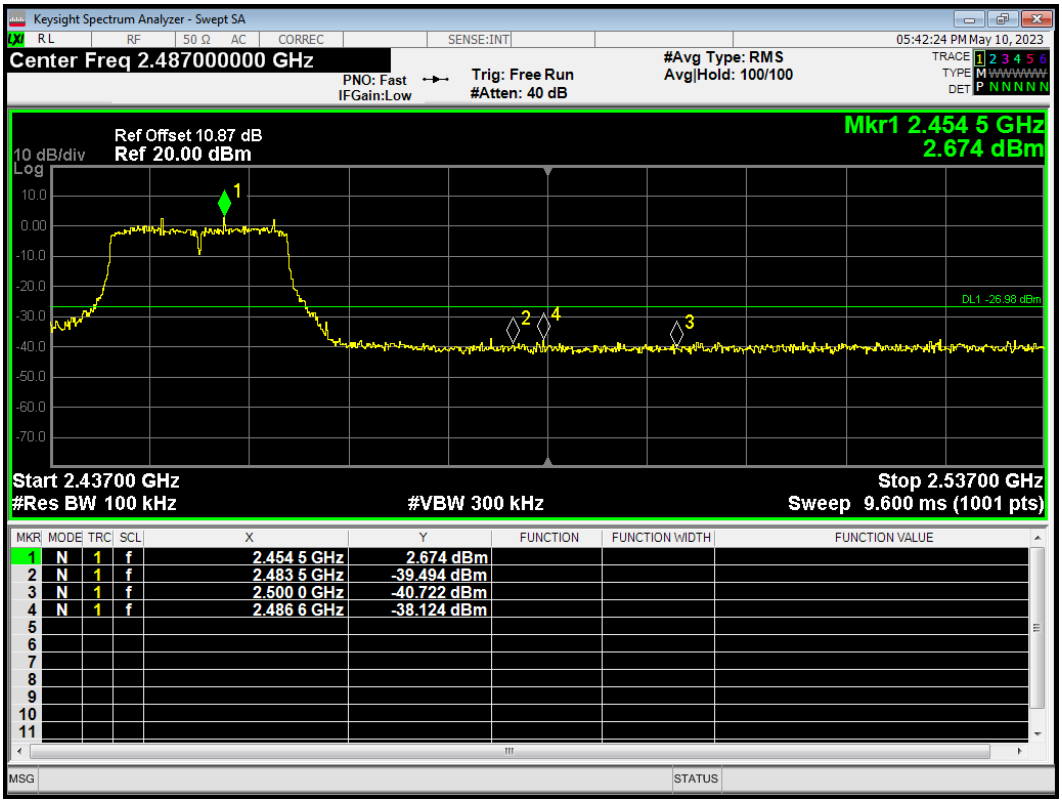


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11n(HT20) 2452MHz Ref

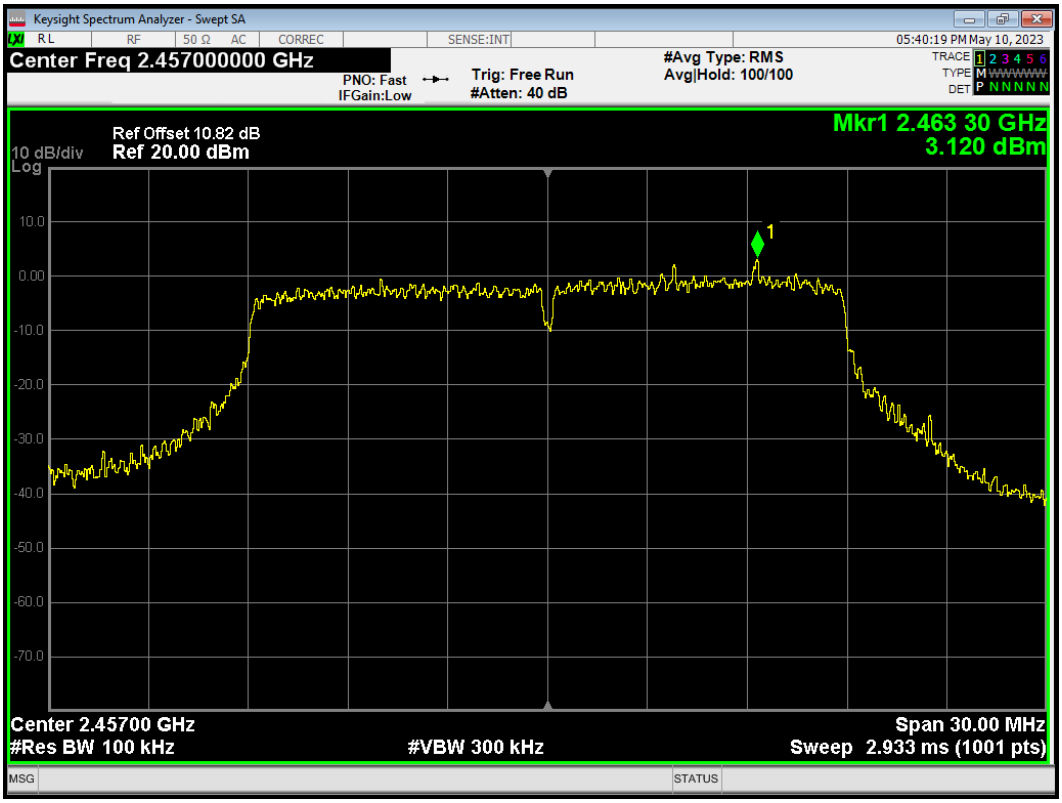


Band Edge 802.11n(HT20) 2452MHz Emission

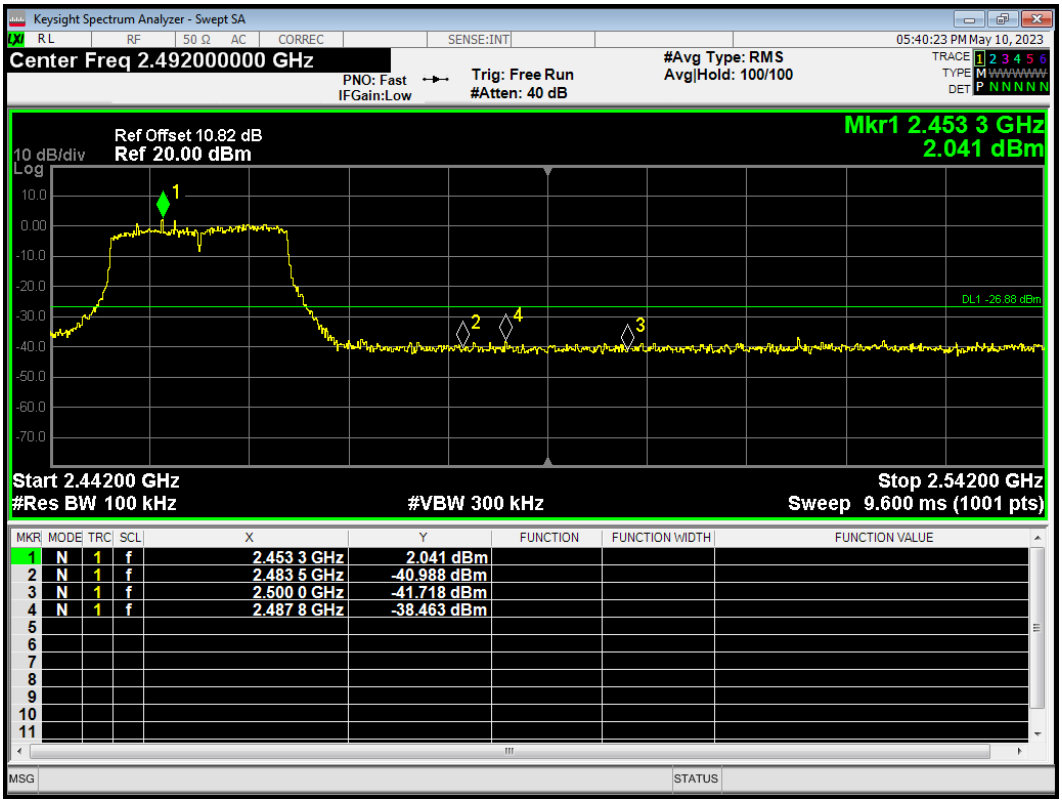


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11n(HT20) 2457MHz Ref

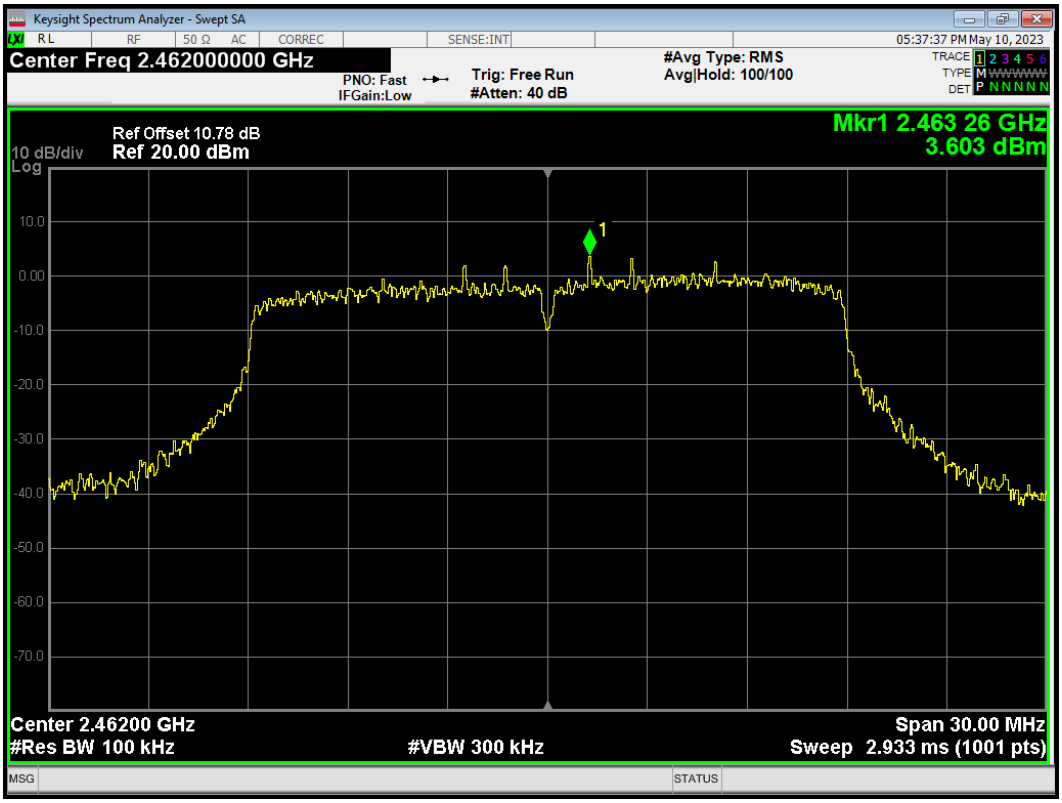


Band Edge 802.11n(HT20) 2457MHz Emission

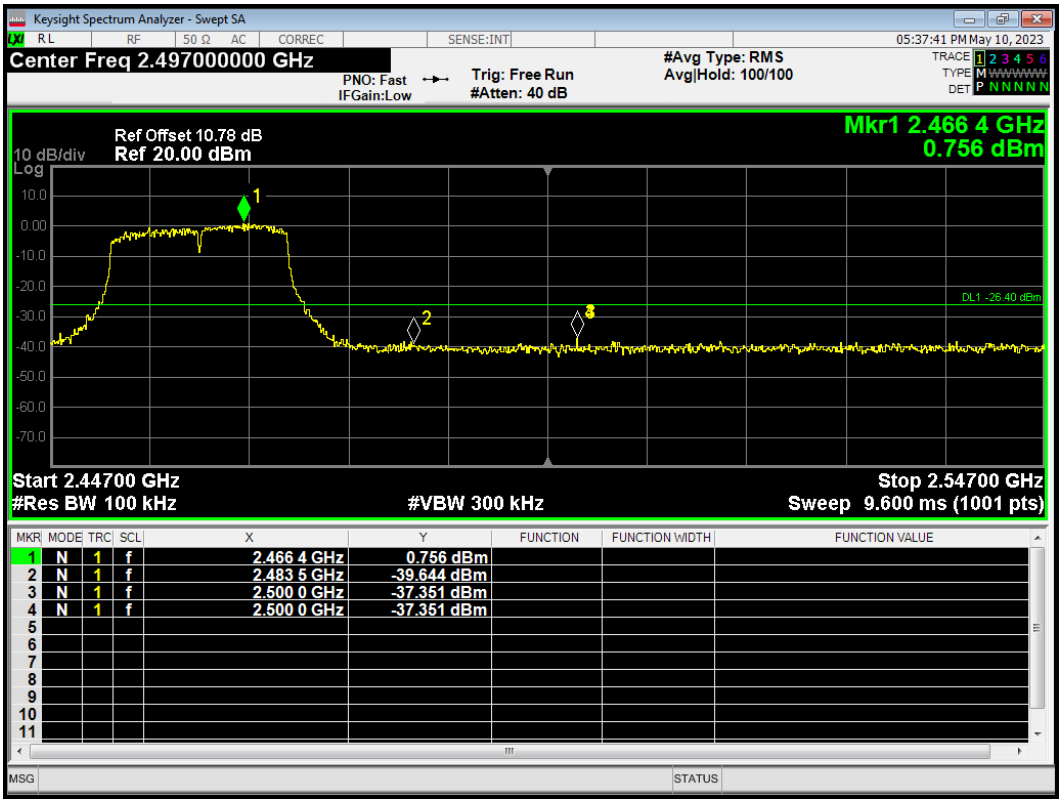


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11n(HT20) 2462MHz Ref

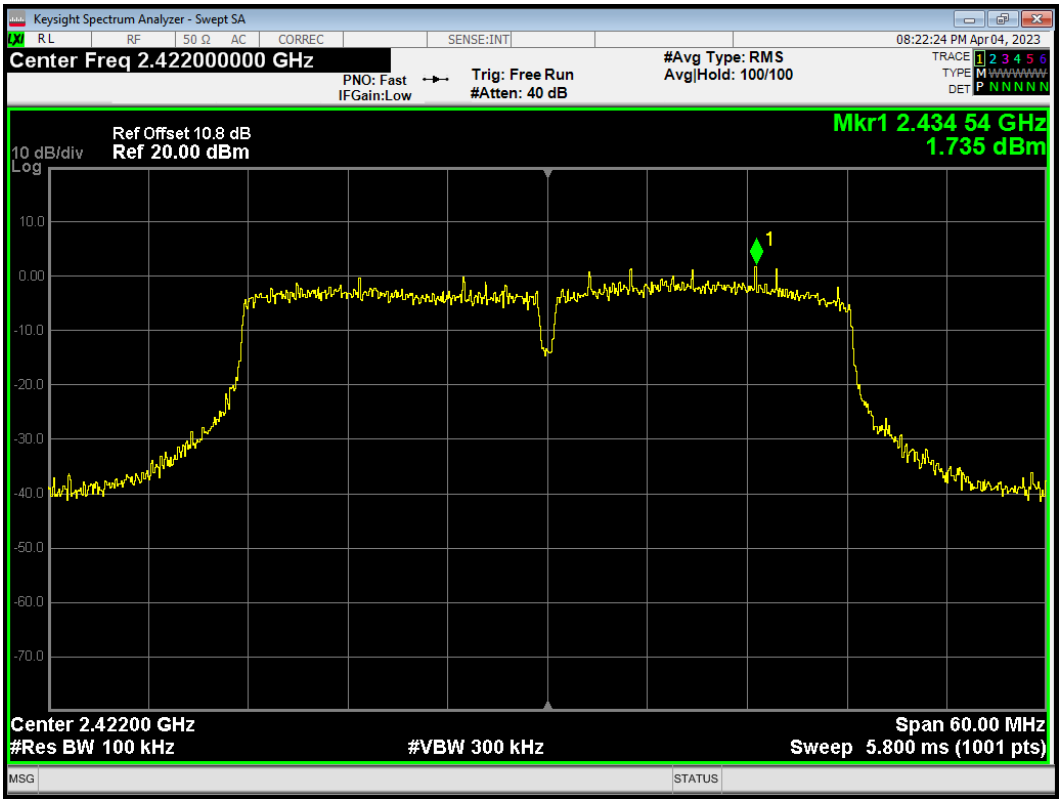


Band Edge 802.11n(HT20) 2462MHz Emission

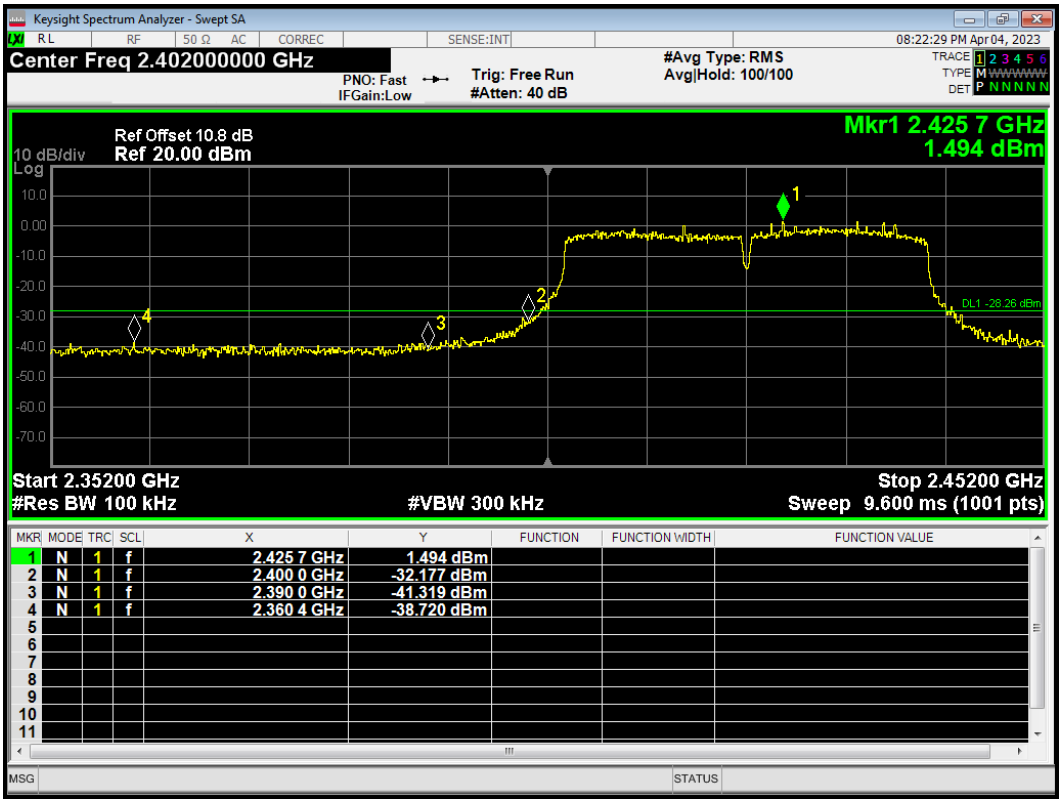


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11n(HT40) 2422MHz Ref

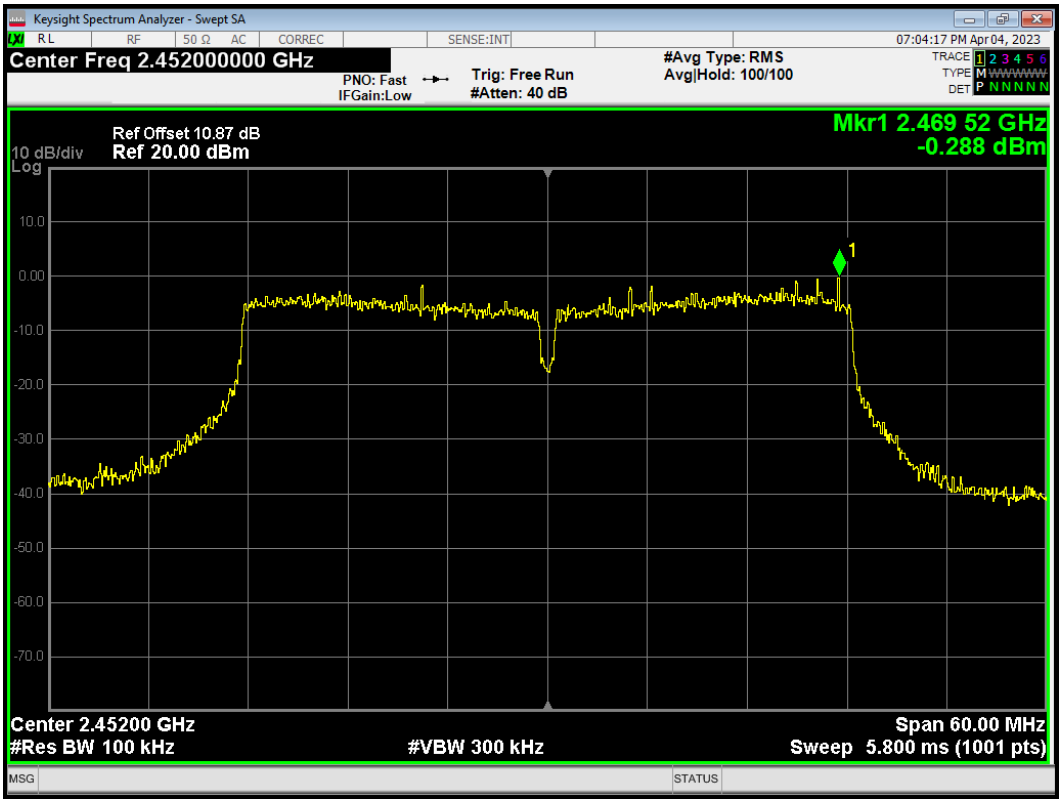


Band Edge 802.11n(HT40) 2422MHz Emission

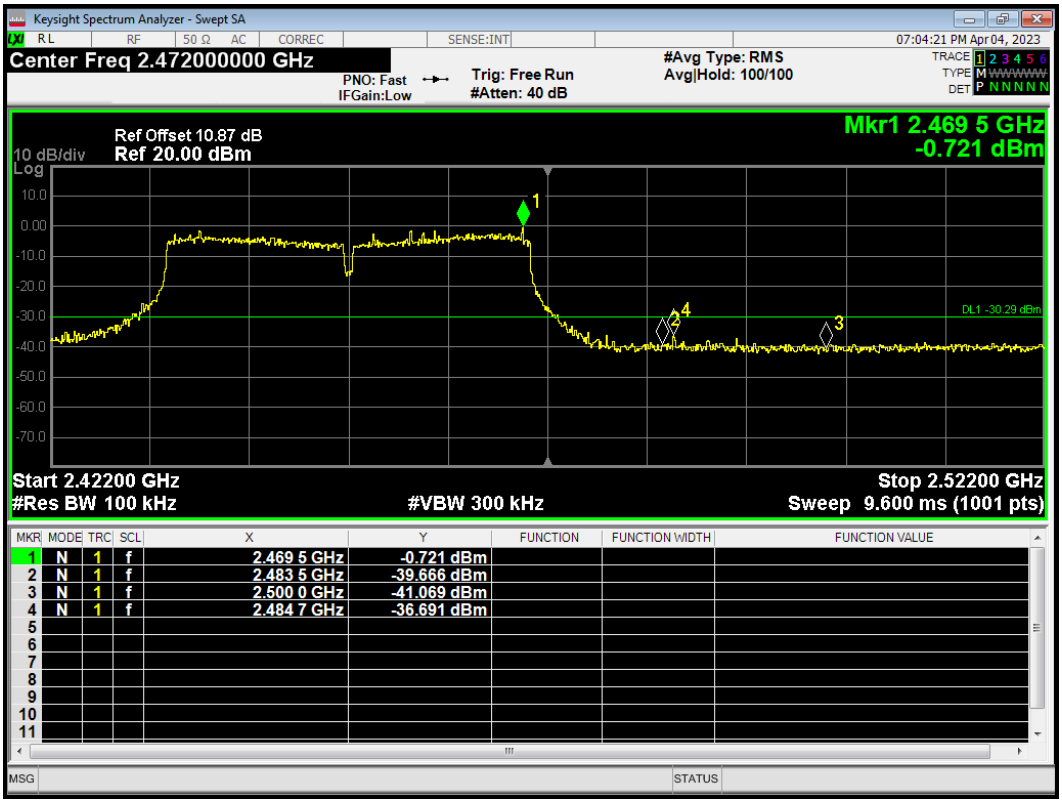


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge 802.11n(HT40) 2452MHz Ref

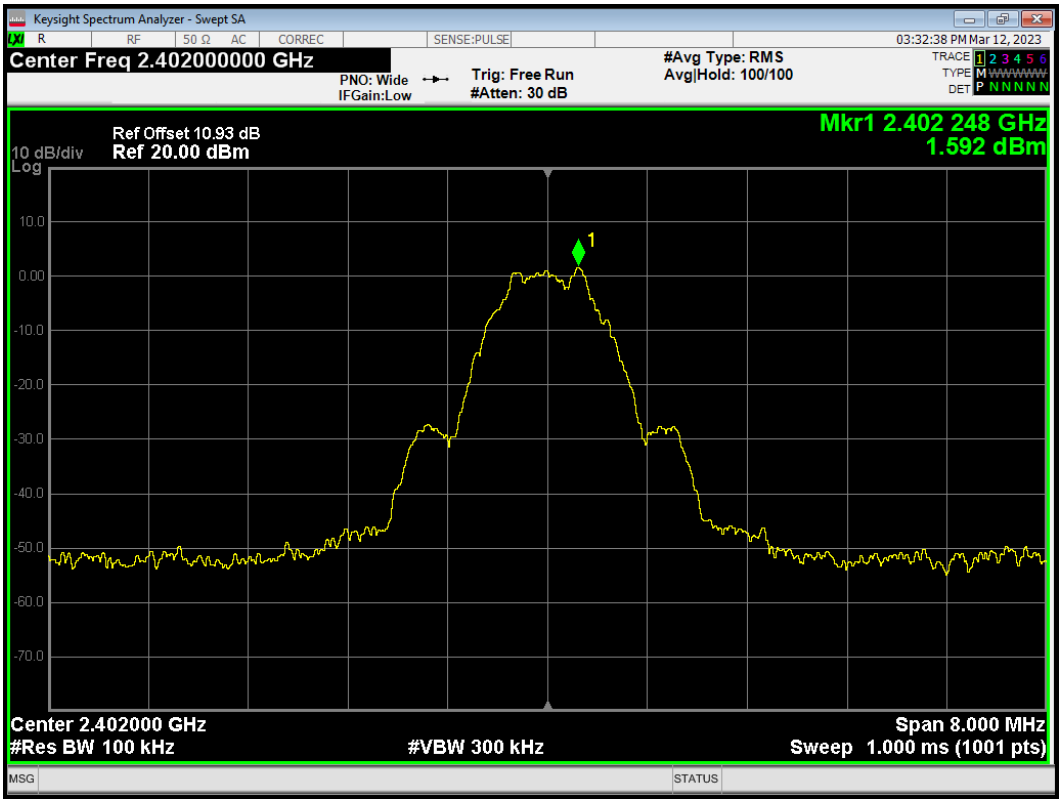


Band Edge 802.11n(HT40) 2452MHz Emission

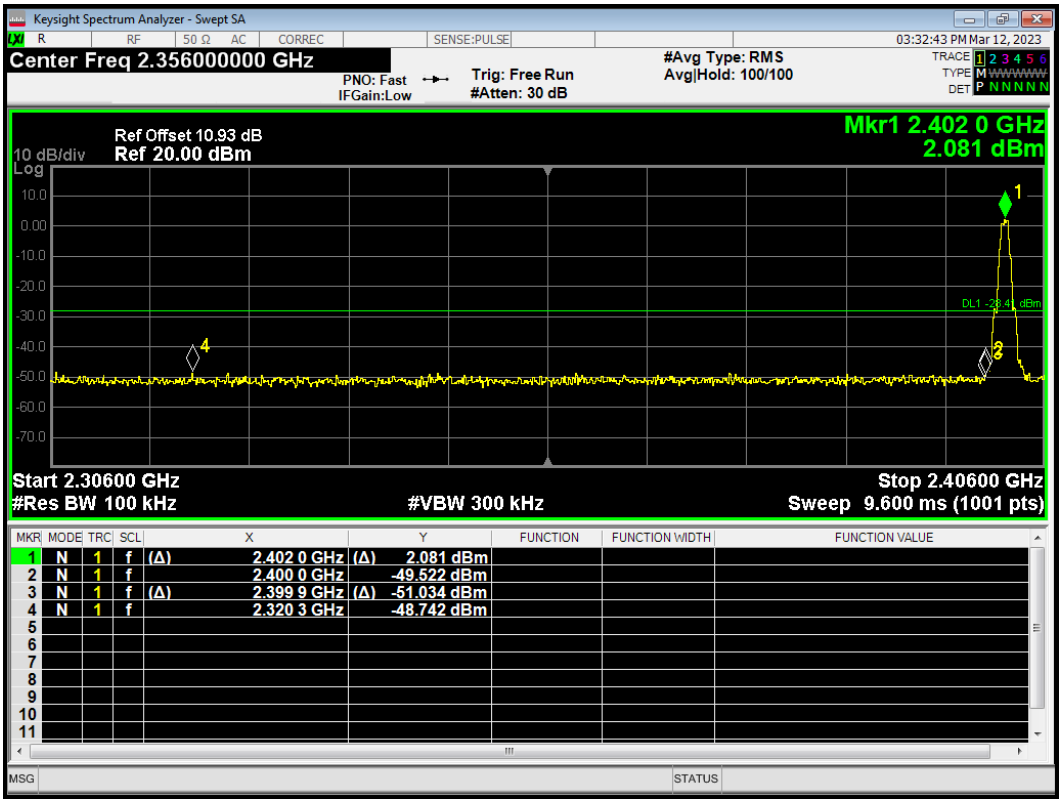


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge BLE 2402MHz Ref

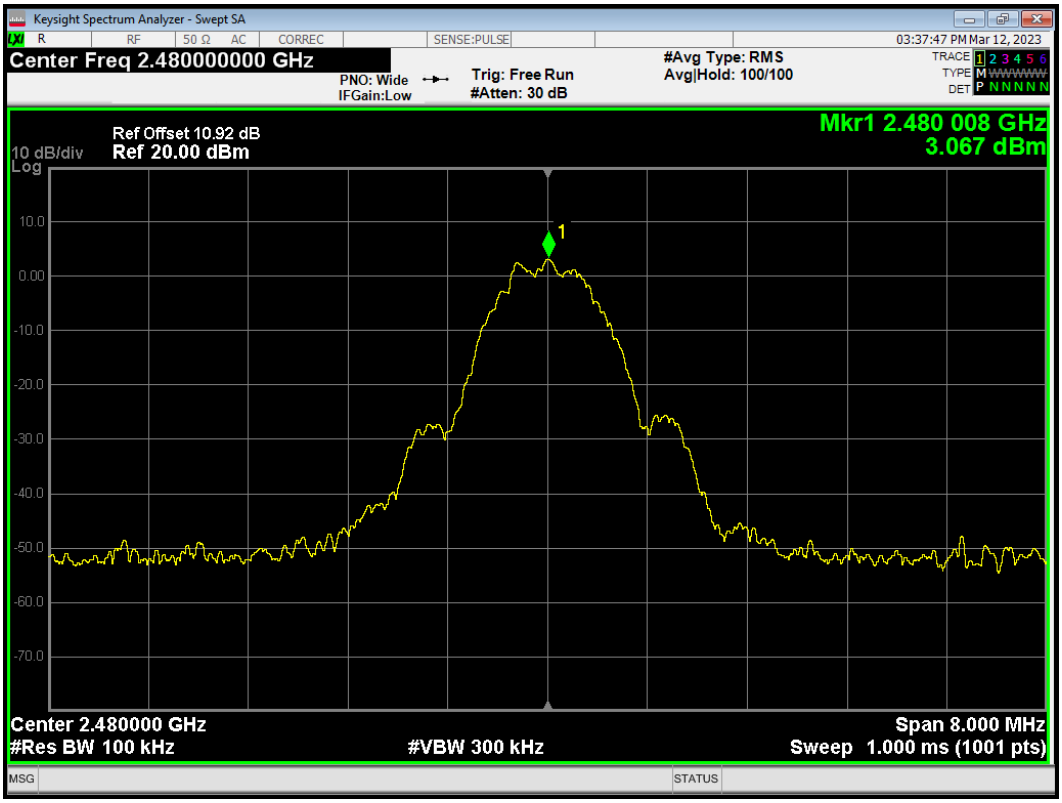


Band Edge BLE 2402MHz Emission

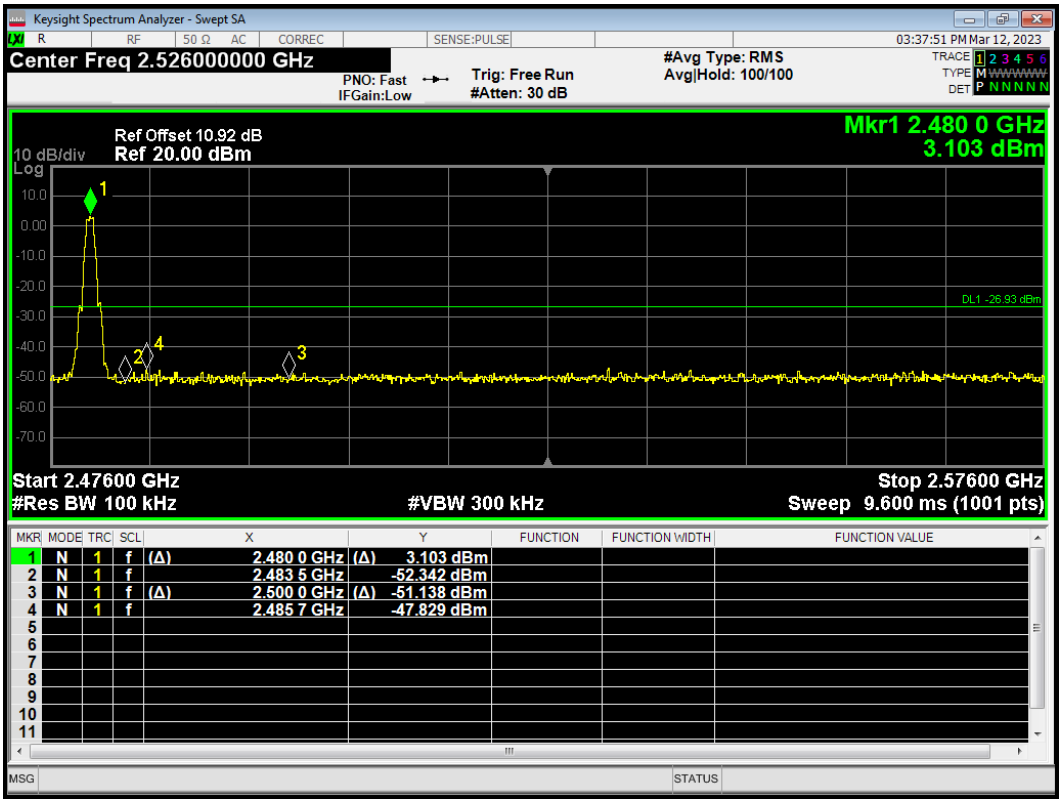


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Band Edge BLE 2480MHz Ref



Band Edge BLE 2480MHz Emission



This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

5.4. Power Spectral Density

Ambient Condition

Temperature	Relative humidity
20°C ~ 25°C	45% ~ 50%

Method of Measurement

During the process of the testing, The EUT was connected to Spectrum Analyzer with a known loss. The EUT is max power transmission with proper modulation.

Method AVGPSD-1 was used for this test.

a) Set instrument center frequency to DTS channel center frequency

b) Set span to at least 1.5 times the OBW

c) Set RBW to:3kHz⩽RBW⩽100kHz

d) Set VBW⩾[3x RBW]

e) Detector=power averaging (rms) or sample detector (when rms not available)

f) Ensure that the number of measurement points in the sweep ≥ [2 X span/RBW]

g) Sweep time auto couple

h) Employ trace averaging (rms) mode over a minimum of 100 traces

i) Use the peak marker function to determine the maximum amplitude level.

j) If the measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced)

Method AVGPSD-2 was used for this test.

a) Measure the duty cycle (D)of the transmitter output signal as described in 11.6

b) Set instrument center frequency to DTS channel center frequency

c) Set span to at least 1.5 times the OBW

d) Set RBW to:3kHz⩽RBW⩽100kHz

e) Set VBW⩾[3x RBW]

f) Detector= power averaging (rms) or sample detector (when rms not available)

g) Ensure that the number of measurement points in the sweep ≥ [2 X span/RBW]

h) Sweep time =auto couple

i) Do not use sweep triggering; allow sweep to "free run”

j) Employ trace averaging (rms) mode over a minimum of 100 traces

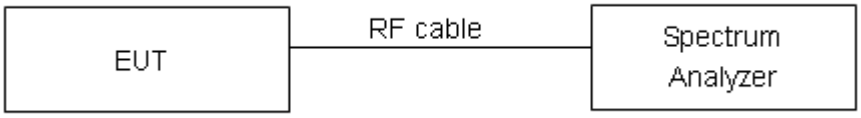
k) Use the peak marker function to determine the maximum amplitude level

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

l) Add [10 log(1/ D)], where D is the duty cycle measured in step a), to the measured PSD to compute the average PSD during the actual transmission time

m) If measured value exceeds requirement specified by regulatory agency then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced)

Test setup



Limits

Rule Part 15.247(e) specifies that" For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. ''

Limits	≤ 8 dBm / 3kHz

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor *k* = 2, *U*= 0.75dB.

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

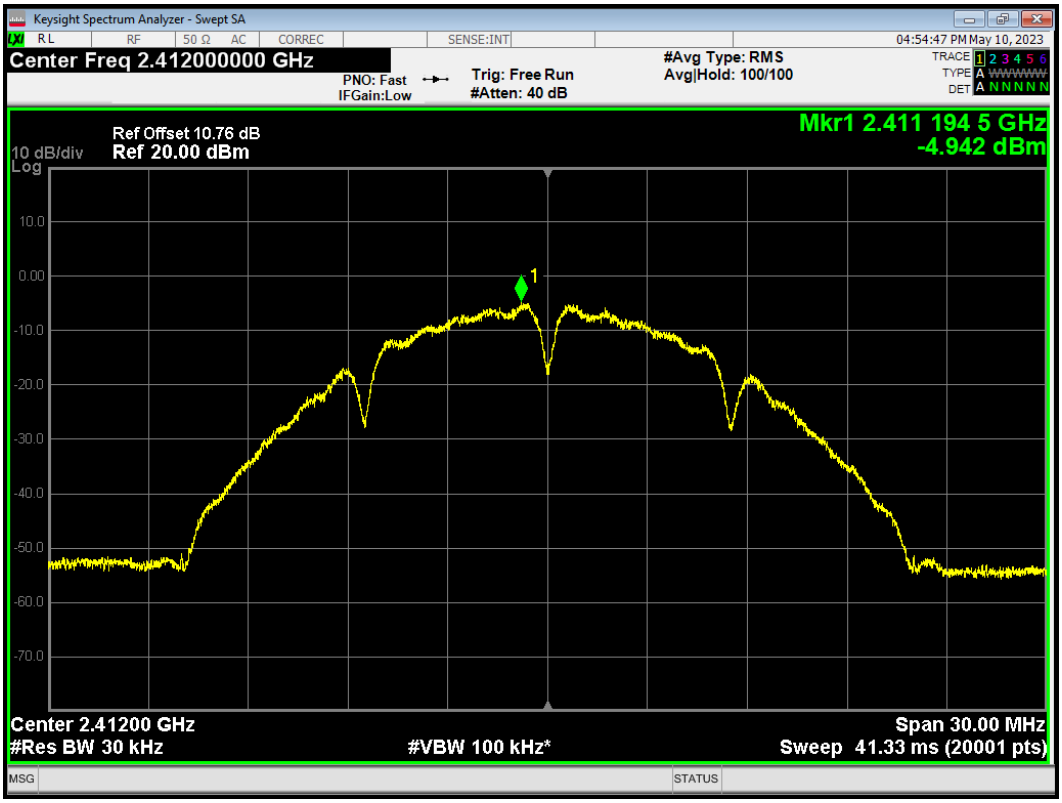
Test Results:

Test Mode	Carrier frequency (MHz))/ Channel	Read Value (dBm / 30kHz)	Power Spectral Density (dBm / 3kHz)	Limit (dBm / 3kHz)	Conclusion
802.11b	2412/CH 1	-4.94	-14.94	8	PASS
	2427/CH 4	-4.31	-14.31	8	PASS
	2432/CH 5	-3.50	-13.50	8	PASS
	2437/CH 6	-3.54	-13.54	8	PASS
	2442/CH 7	-4.22	-14.22	8	PASS
	2447/CH 8	-5.58	-15.58	8	PASS
	2462/CH 11	-5.53	-15.53	8	PASS
802.11g	2412/CH 1	-9.06	-18.84	8	PASS
	2437/CH 6	-8.41	-18.19	8	PASS
	2462/CH 11	-9.15	-18.93	8	PASS
802.11n HT20	2412/CH 1	-9.30	-19.30	8	PASS
	2437/CH 6	-8.40	-18.40	8	PASS
	2442/CH 7	-8.95	-18.95	8	PASS
	2447/CH 8	-10.50	-20.50	8	PASS
	2452/CH 9	-10.80	-20.80	8	PASS
	2457/CH 10	-10.36	-20.36	8	PASS
	2462/CH 11	-9.84	-19.84	8	PASS
802.11n HT40	2422/CH 3	-11.14	-20.94	8	PASS
	2437/CH 6	-12.03	-21.83	8	PASS
	2452/CH 9	-13.36	-23.16	8	PASS
Note: Power Spectral Density (dBm/3kHz) =Read Value+Duty cycle correction factor + 10*log10(3 / 30)					

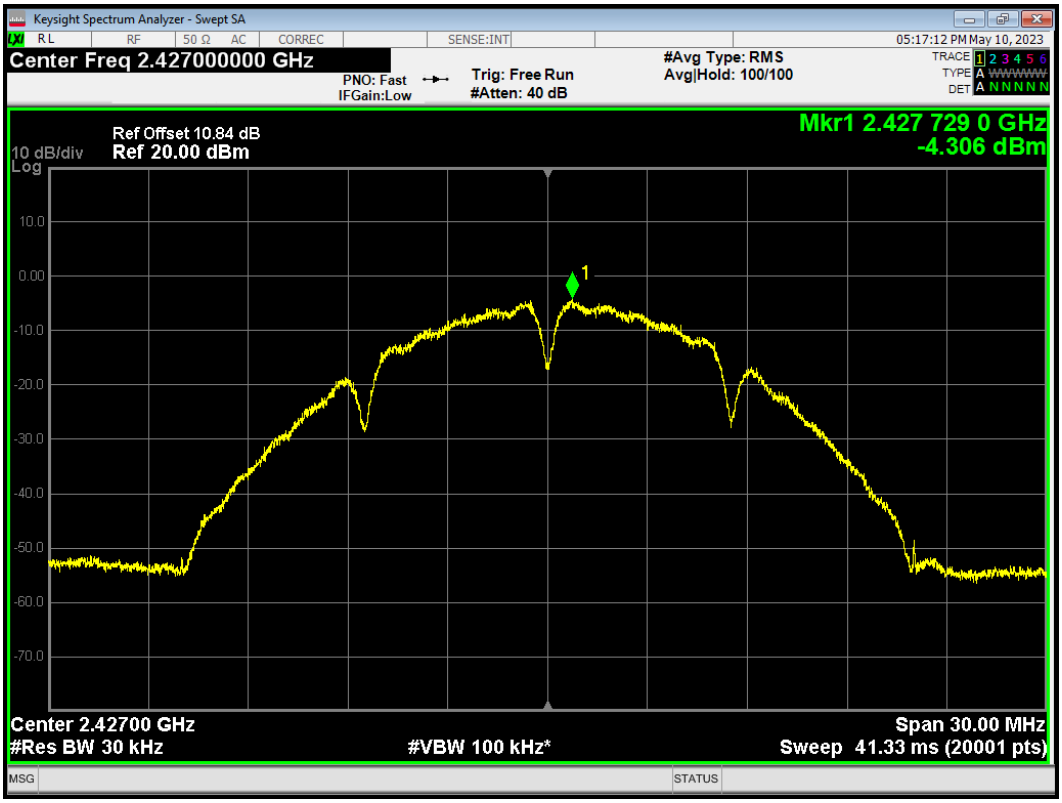
Test Mode	Carrier frequency (MHz))/ Channel	Read Value (dBm / 3kHz)	Power Spectral Density (dBm / 3kHz)	Limit (dBm / 3kHz)	Conclusion
Bluetooth (Low Energy)	2402/CH 0	-17.14	-15.29	8	PASS
	2440/CH 19	-15.70	-13.85	8	PASS
	2480/CH 39	-15.73	-13.88	8	PASS
Note: Power Spectral Density =Read Value+Duty cycle correction factor					

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

PSD 802.11b 2412MHz

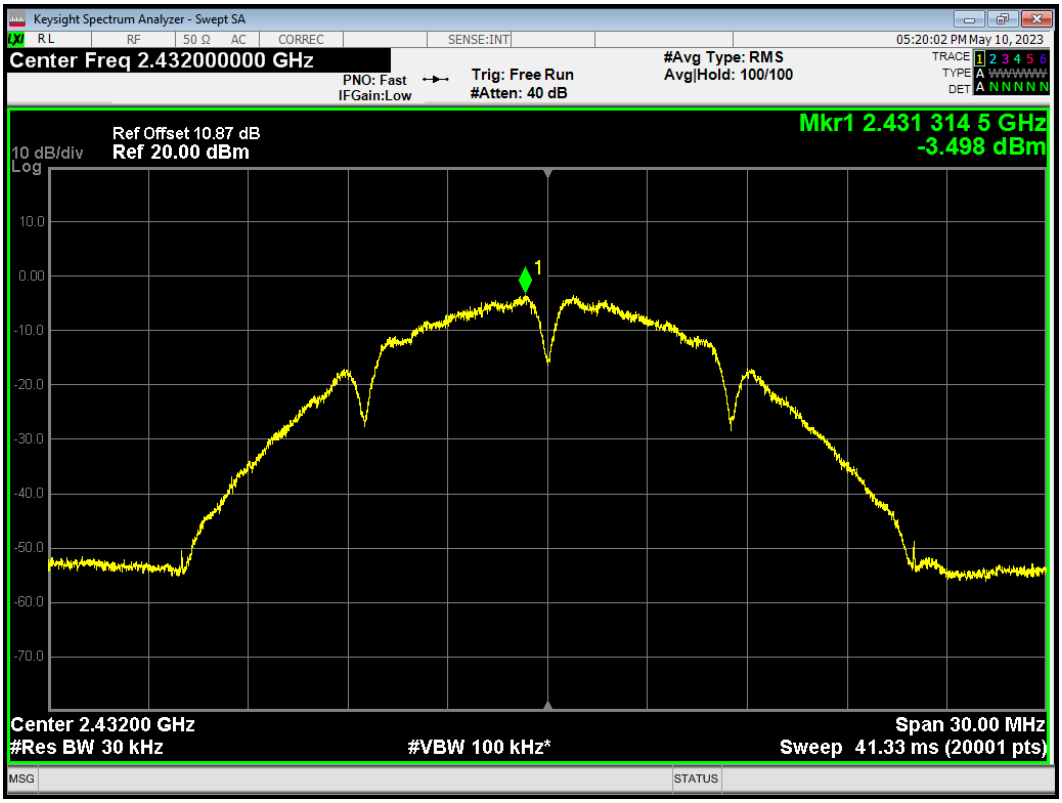


PSD 802.11b 2427MHz

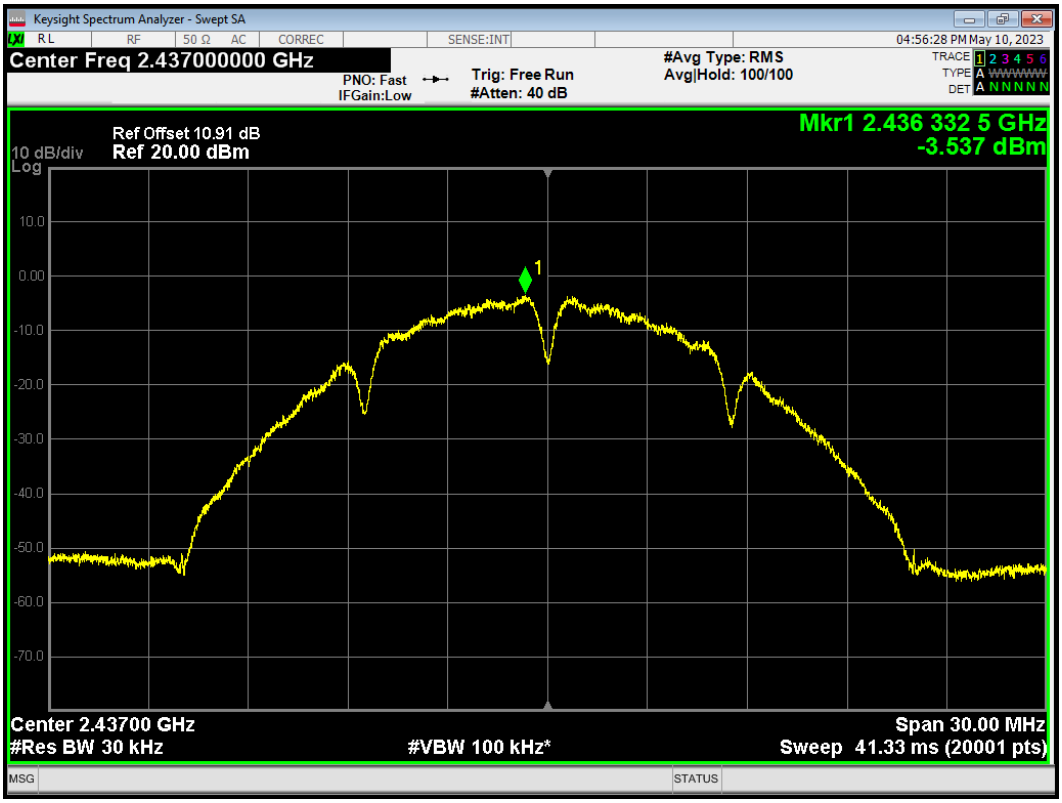


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

PSD 802.11b 2432MHz

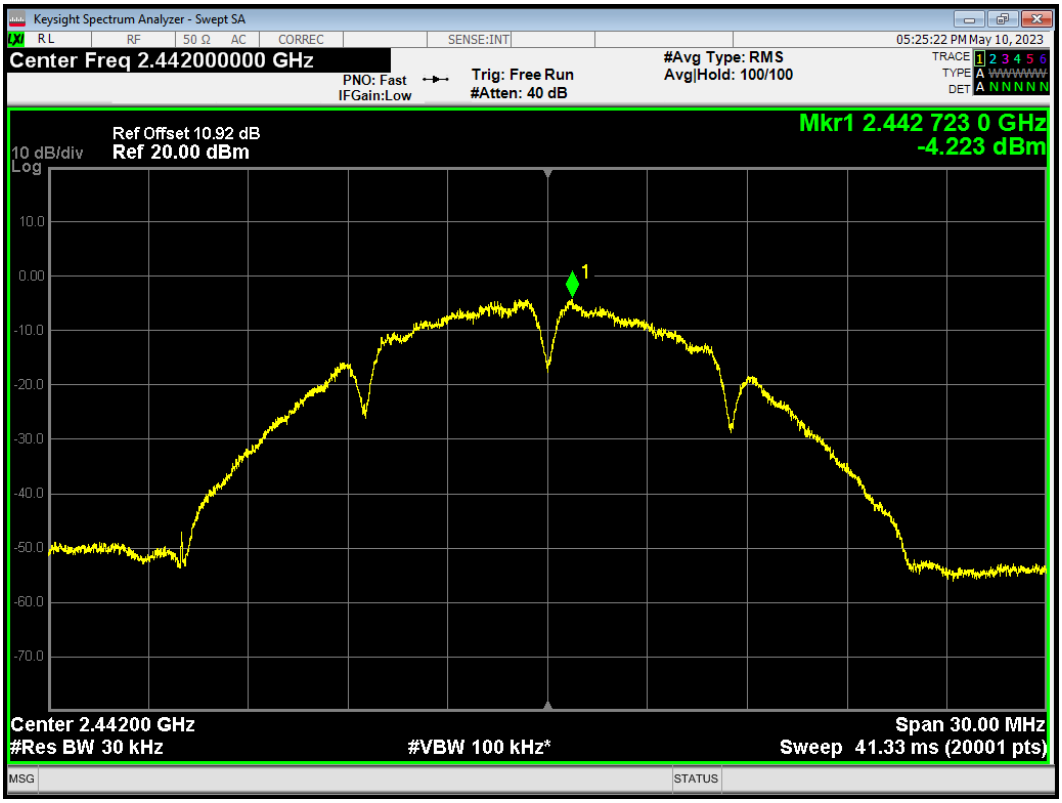


PSD 802.11b 2437MHz

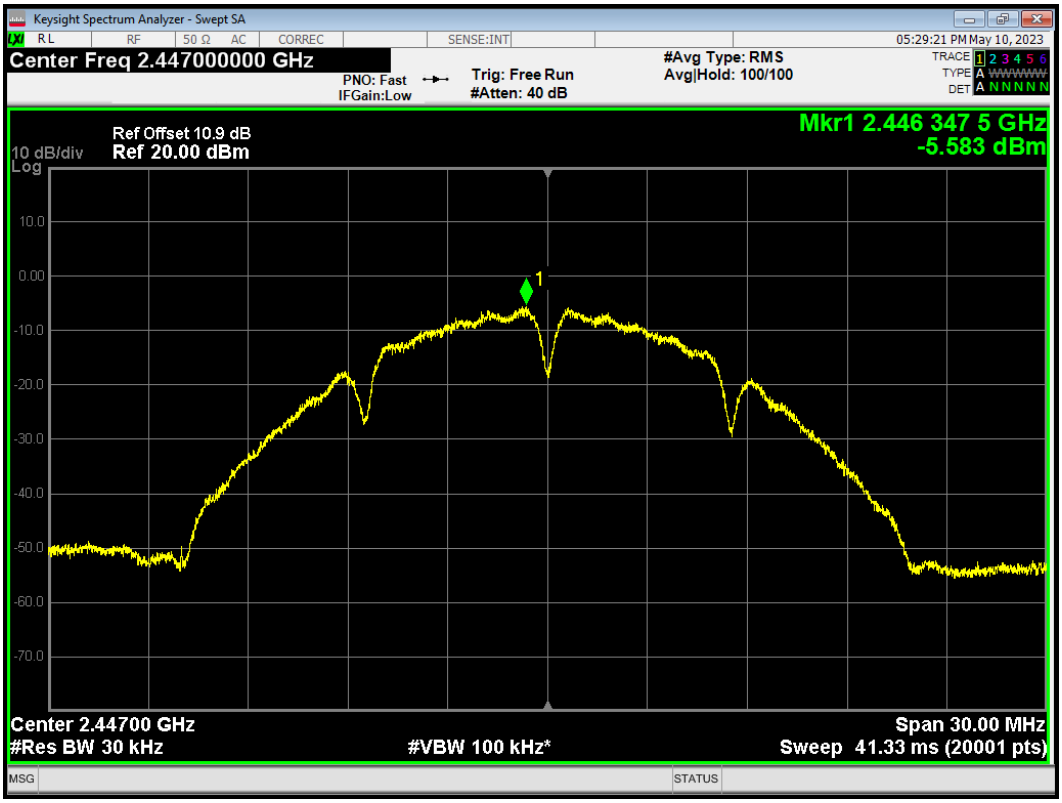


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

PSD 802.11b 2442MHz

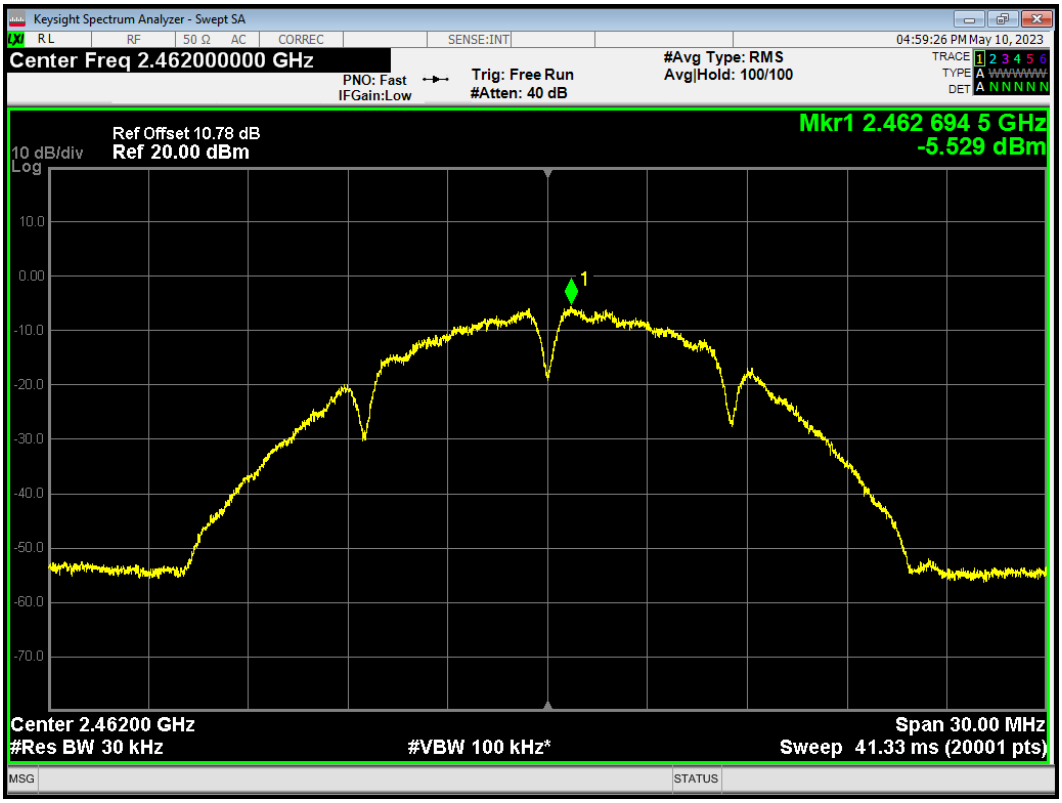


PSD 802.11b 2447MHz

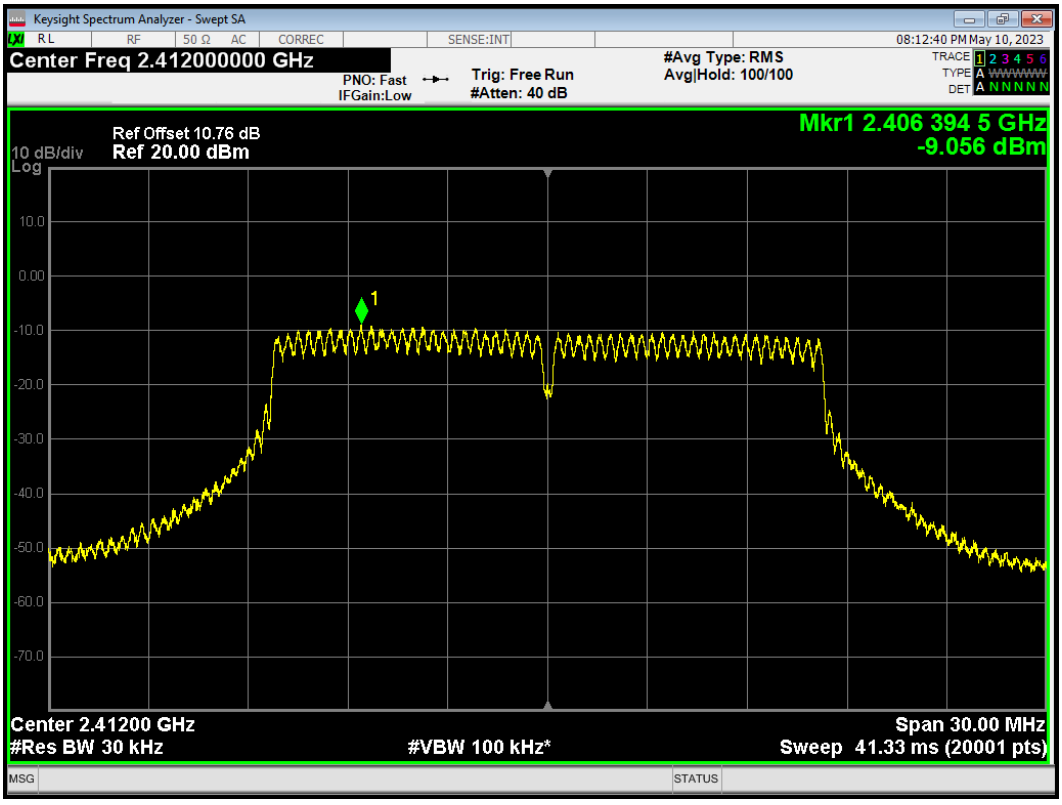


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

PSD 802.11b 2462MHz

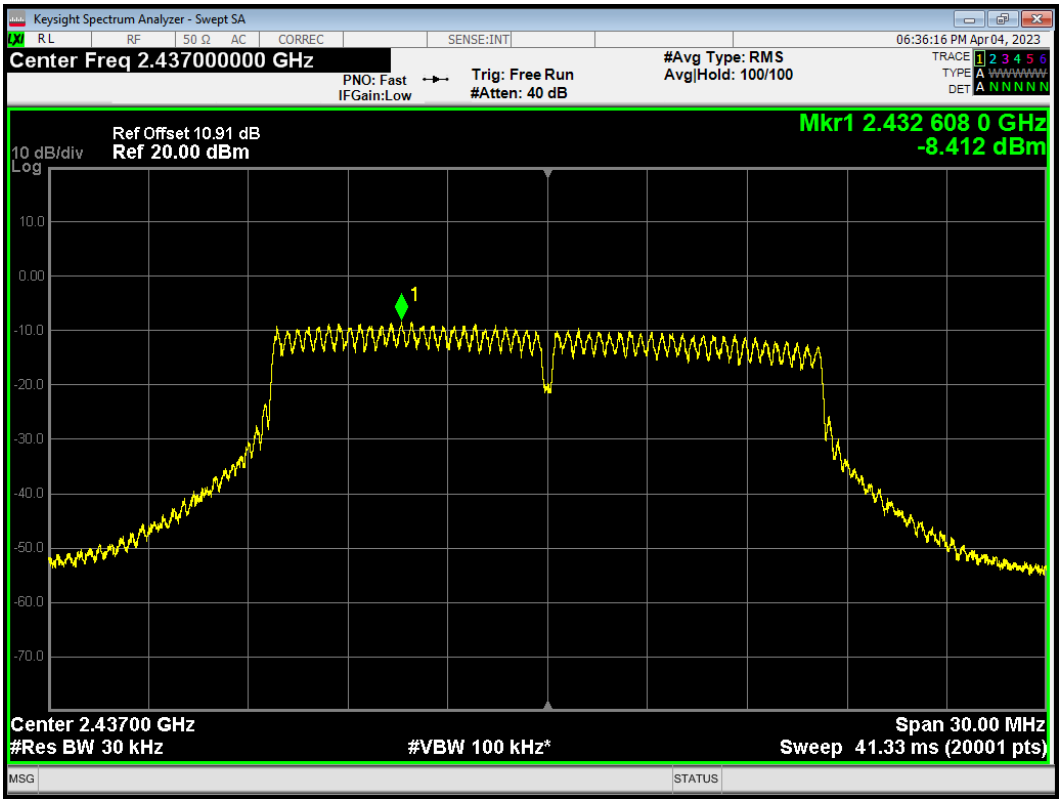


PSD 802.11g 2412MHz

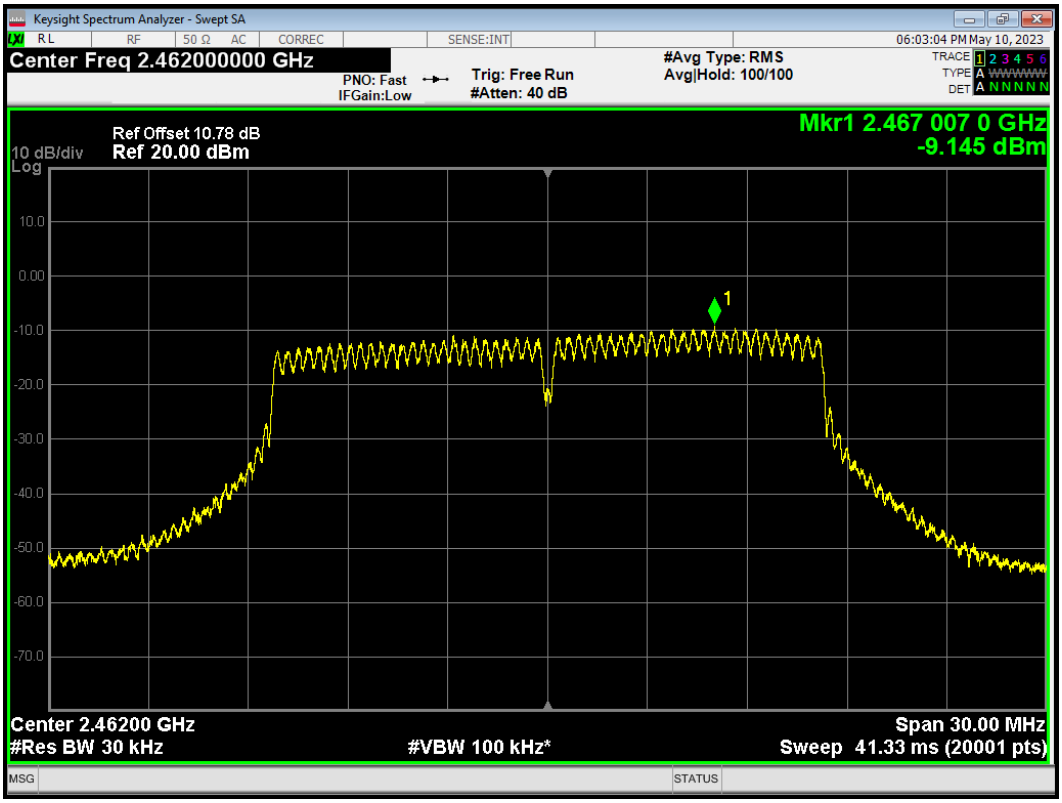


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

PSD 802.11g 2437MHz

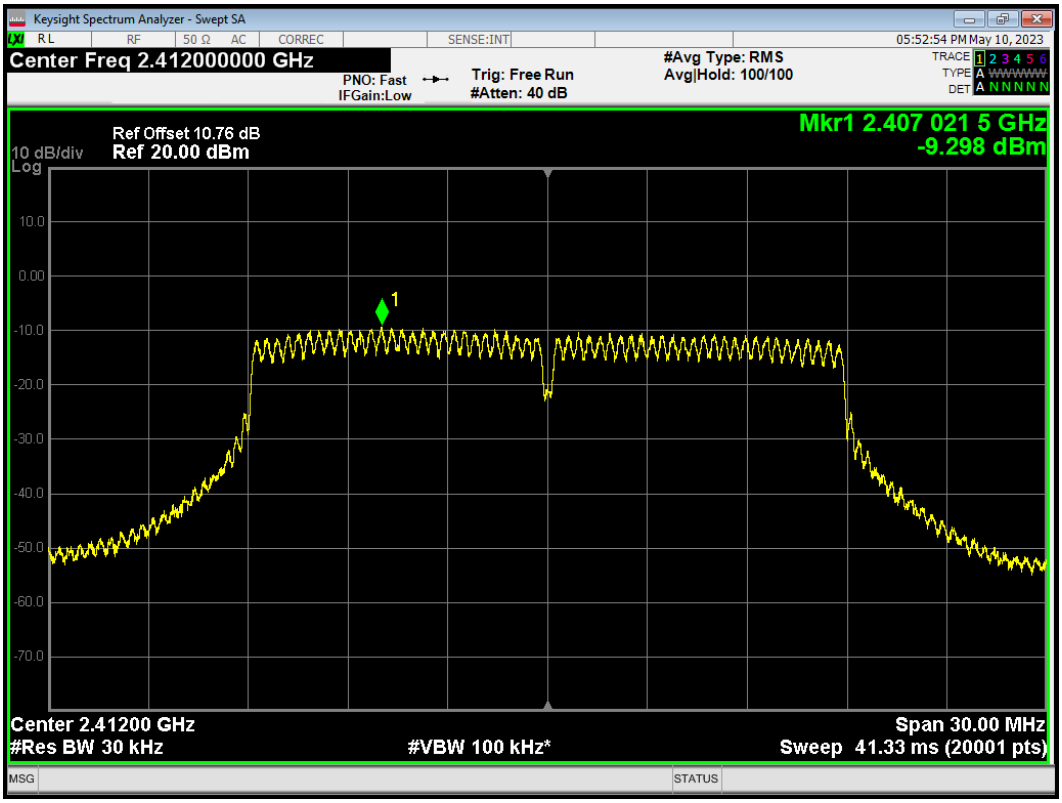


PSD 802.11g 2462MHz

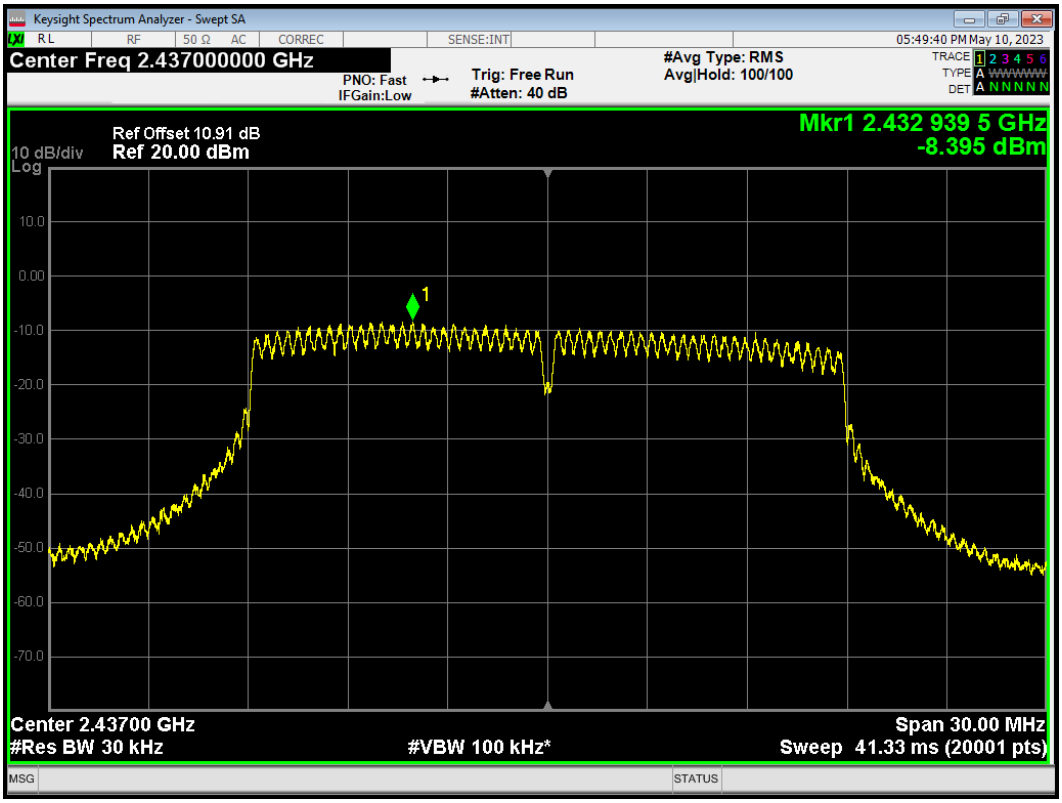


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

PSD 802.11n(HT20) 2412MHz

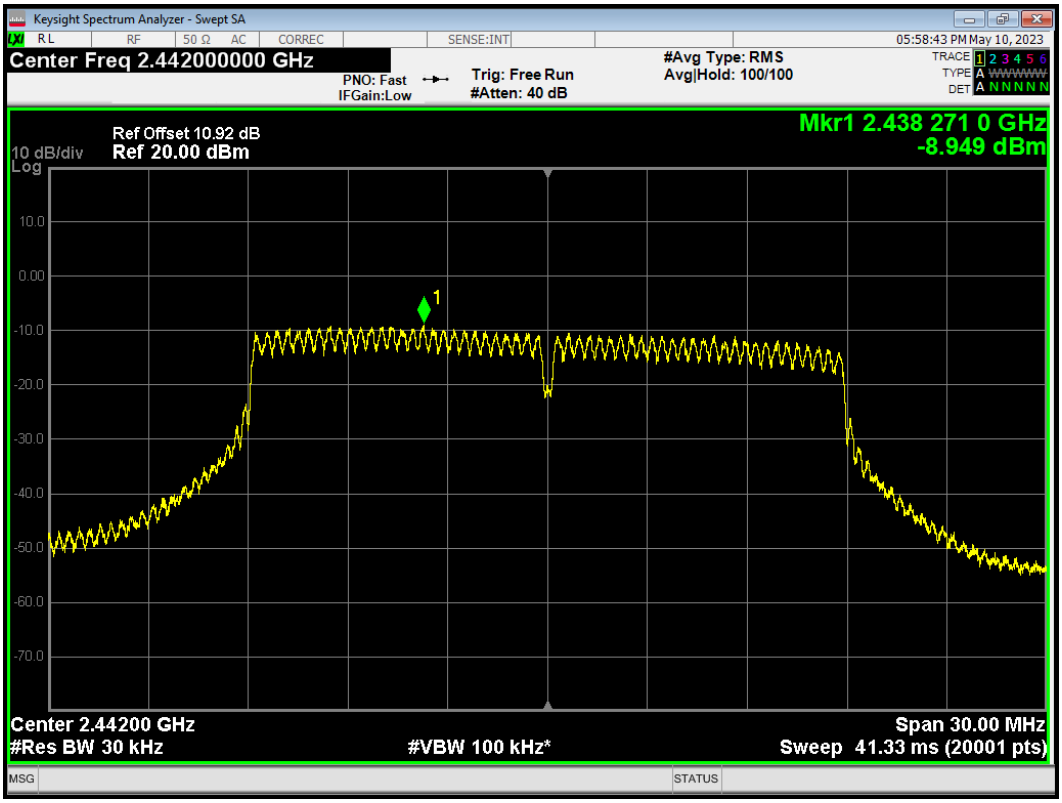


PSD 802.11n(HT20) 2437MHz

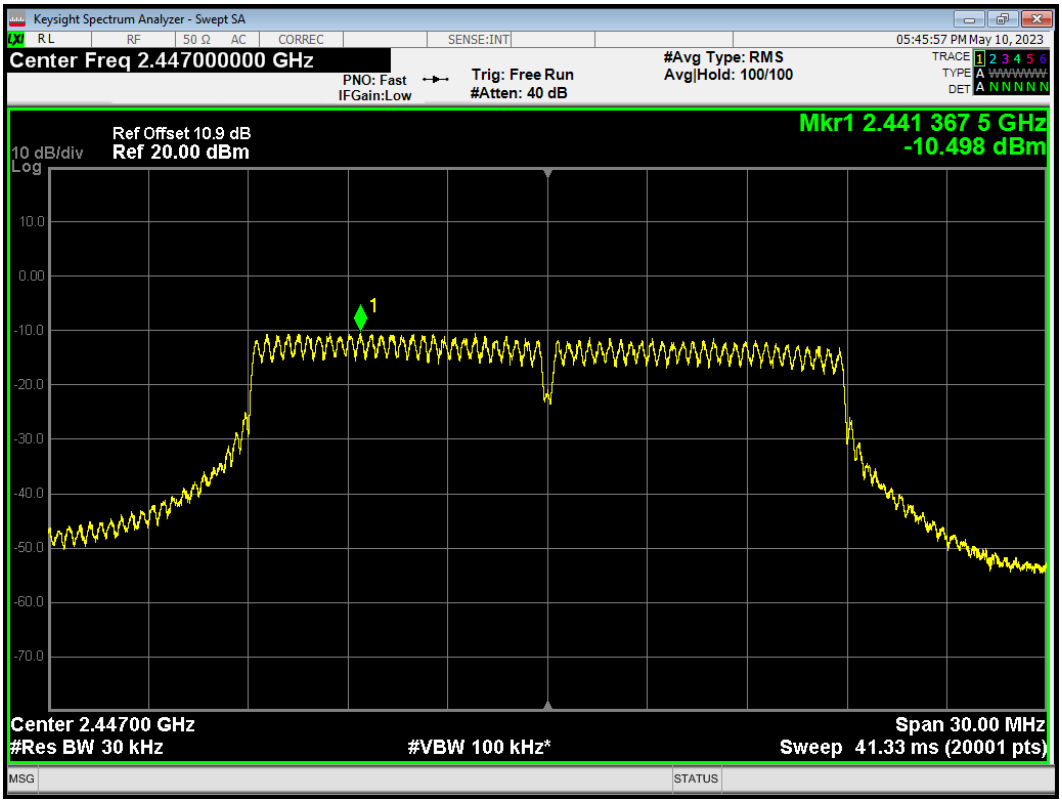


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

PSD 802.11n(HT20) 2442MHz

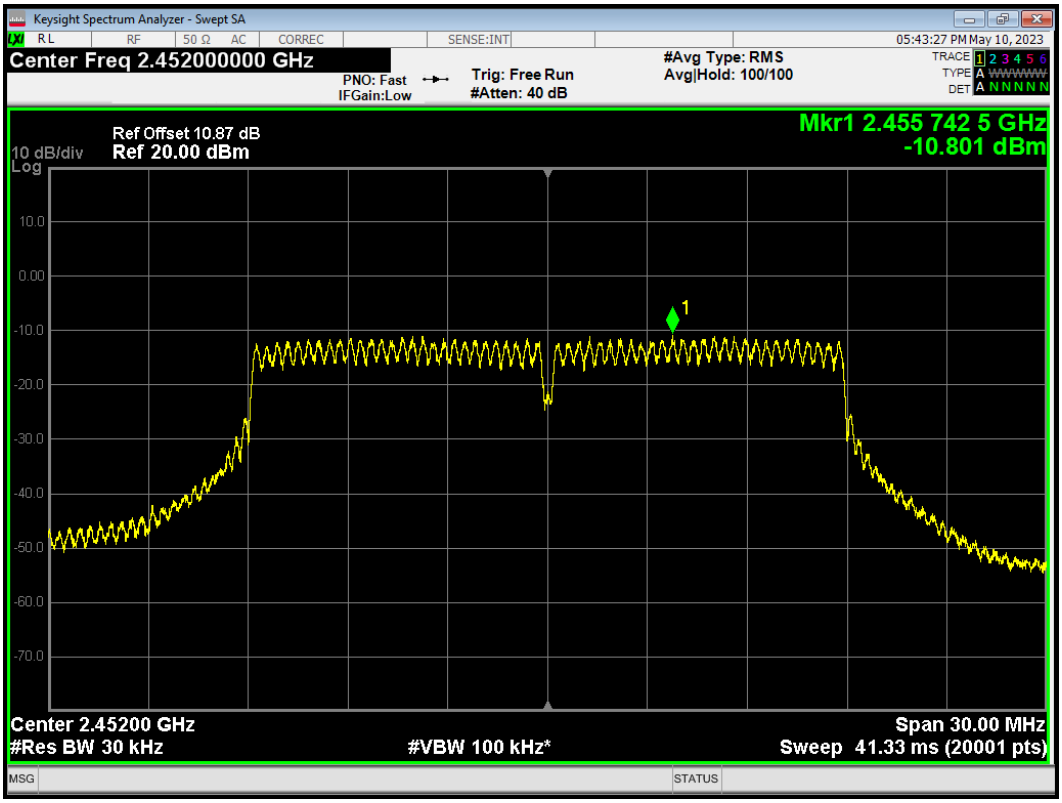


PSD 802.11n(HT20) 2447MHz

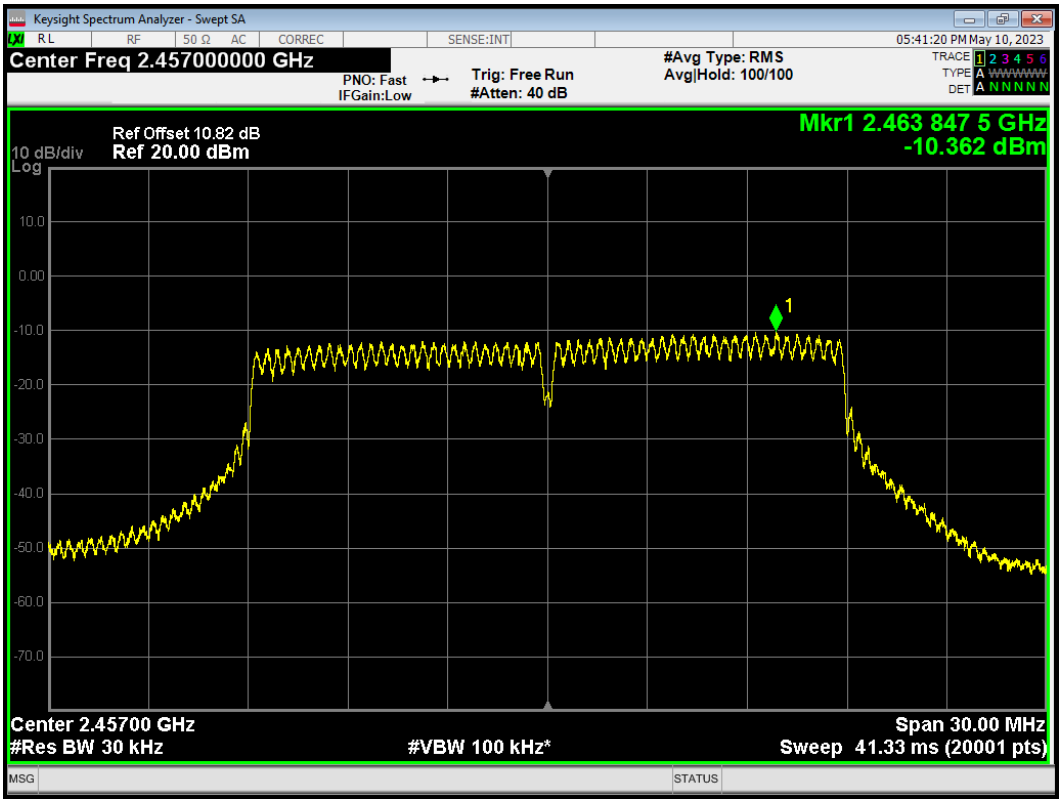


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

PSD 802.11n(HT20) 2452MHz

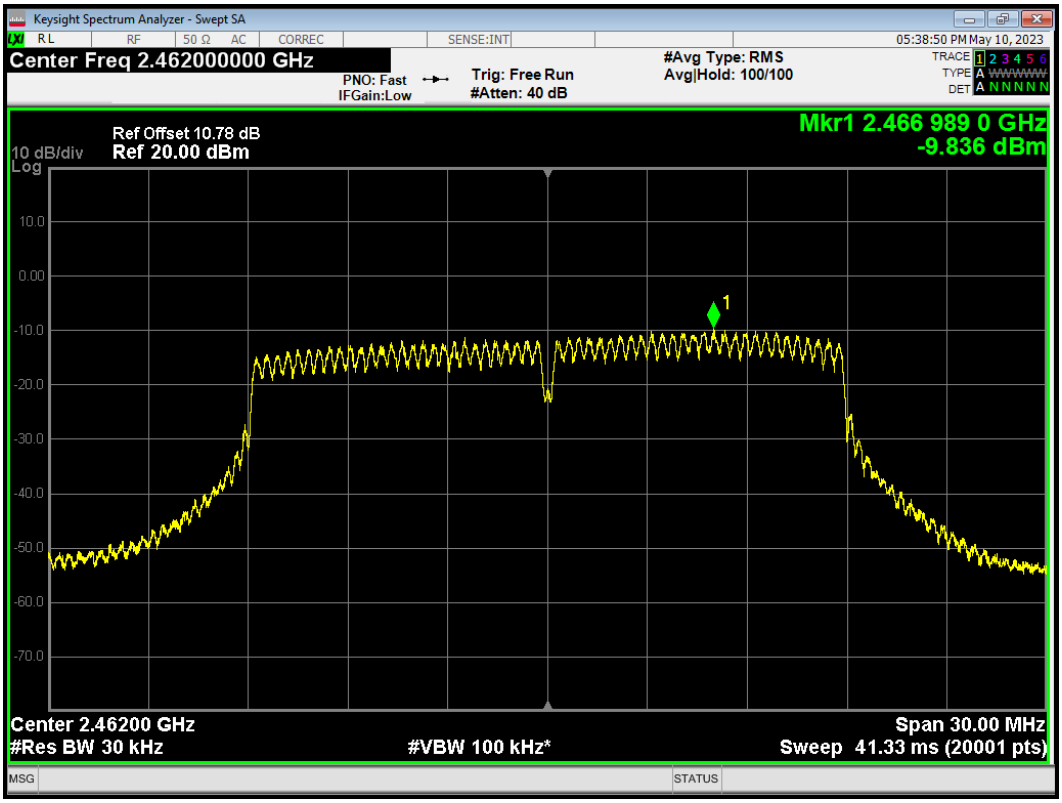


PSD 802.11n(HT20) 2457MHz

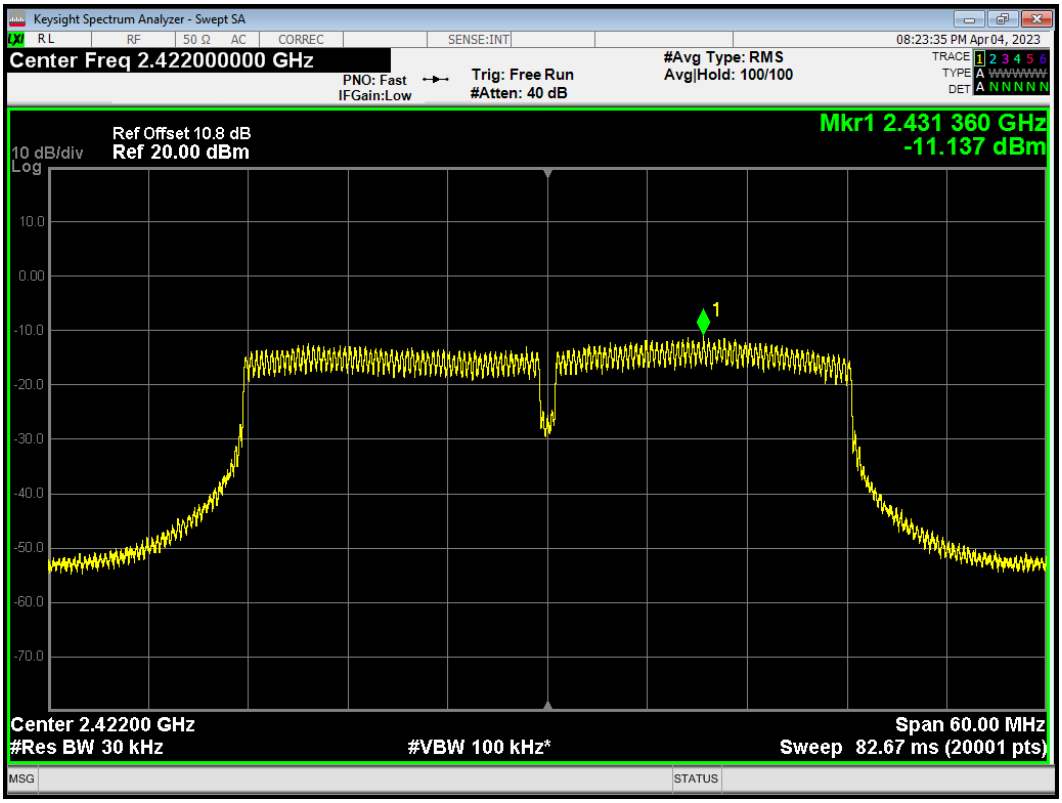


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

PSD 802.11n(HT20) 2462MHz

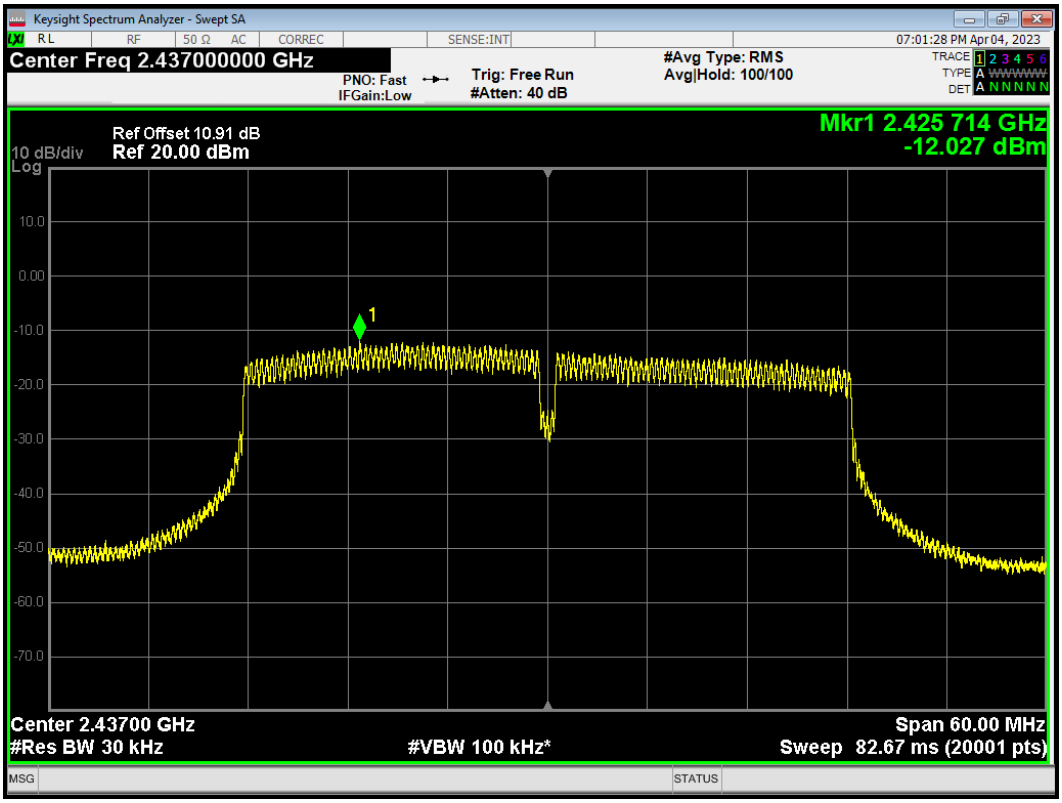


PSD 802.11n(HT40) 2422MHz

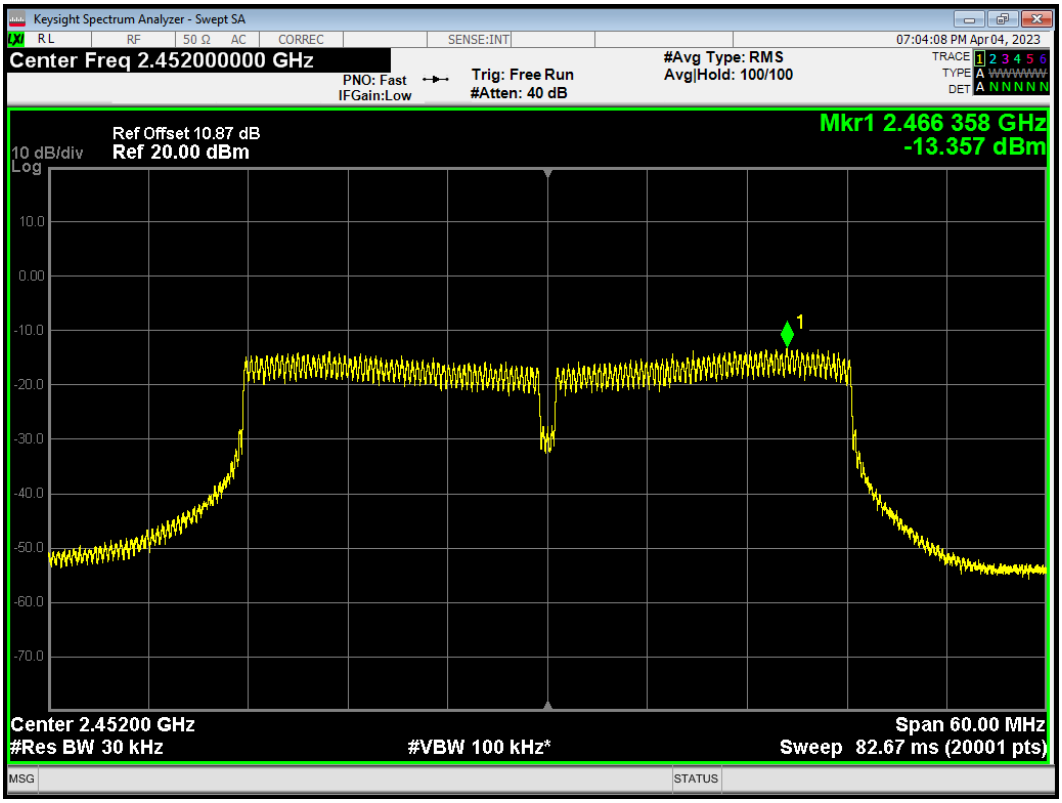


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

PSD 802.11n(HT40) 2437MHz

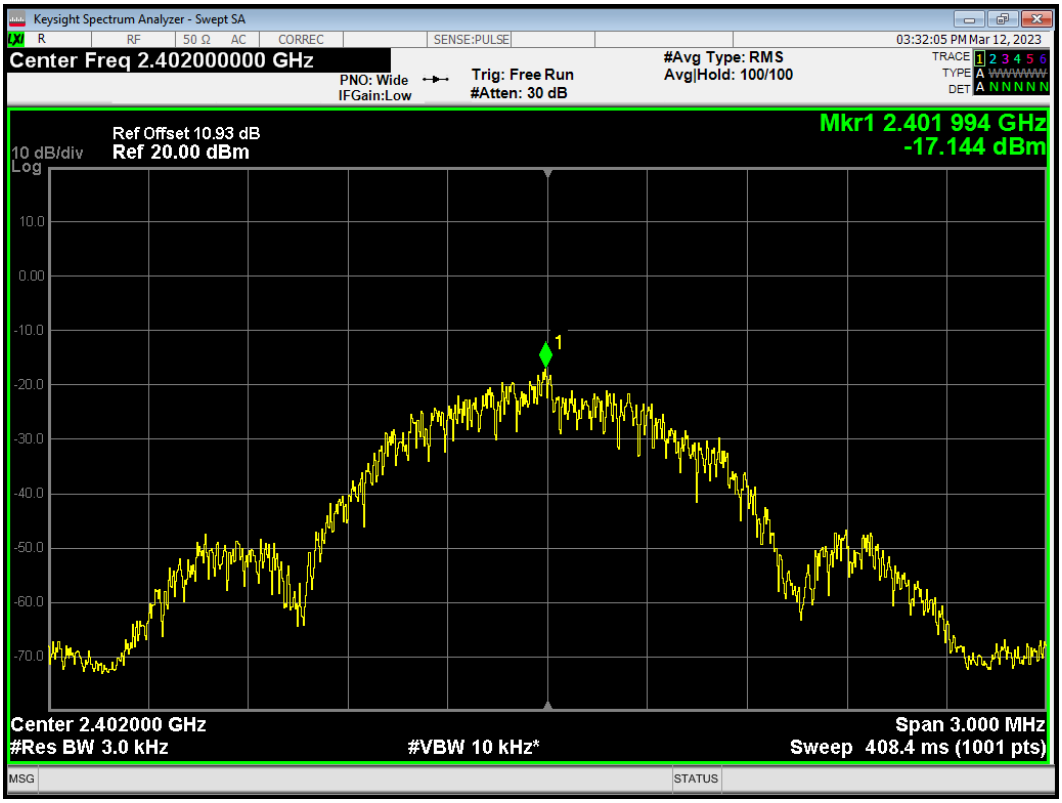


PSD 802.11n(HT40) 2452MHz

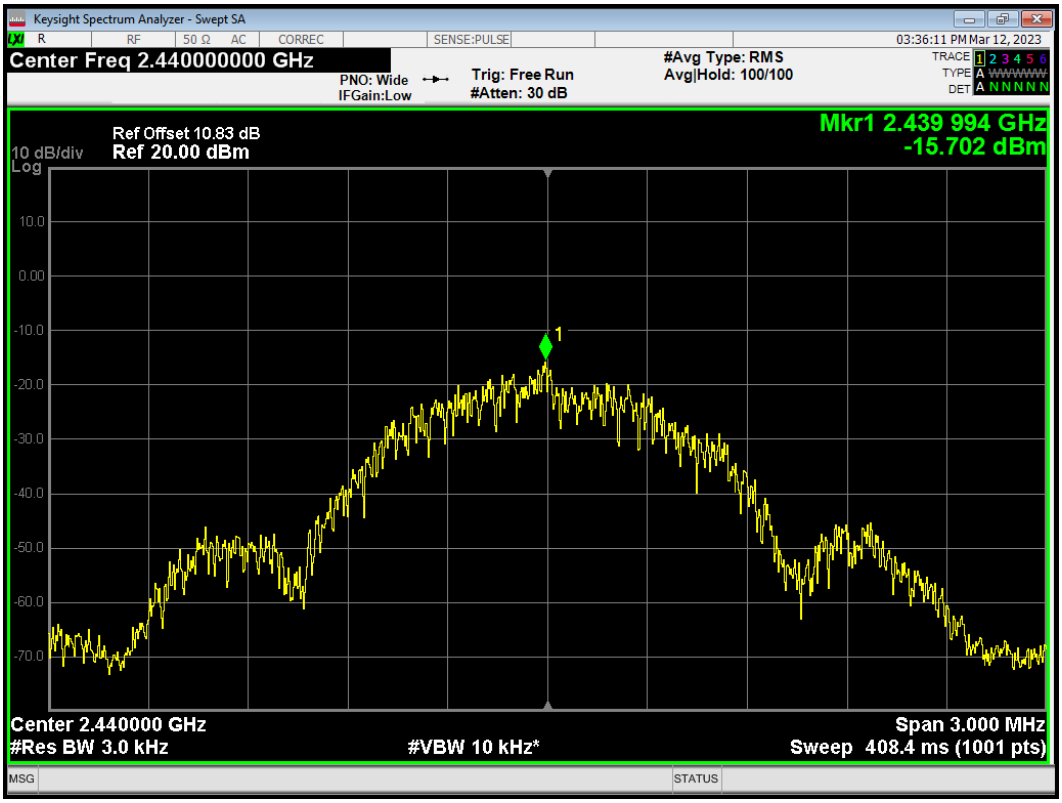


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

PSD BLE 2402MHz

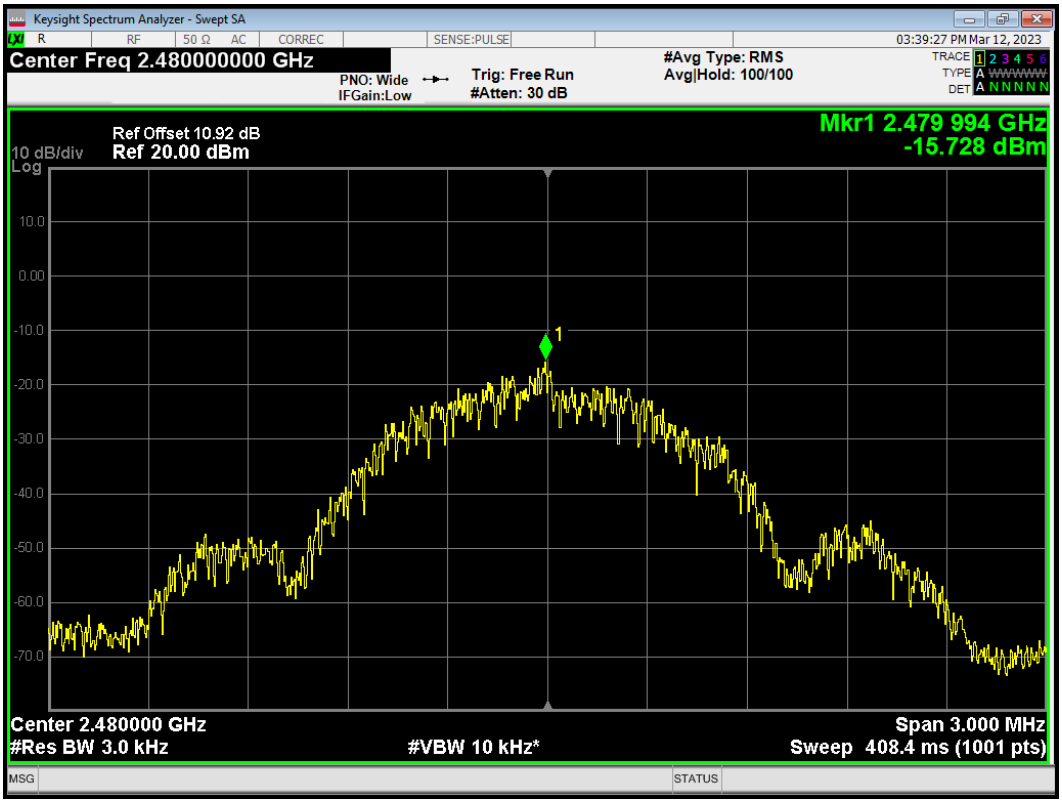


PSD BLE 2440MHz



This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

PSD BLE 2480MHz



This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

5.5. Spurious RF Conducted Emissions

Ambient Condition

Temperature	Relative humidity
20°C ~ 25°C	45% ~ 50%

Method of Measurement

The EUT was connected to the spectrum analyzer with a known loss. The spectrum analyzer scans from 30MHz to the 10th harmonic of the carrier. The peak detector is used. Set RBW to 100 kHz and VBW to 300 kHz, Sweep is set to ATUO.
The test is in transmitting mode.

Test Setup

Limits

Rule Part 15.247(d) pacifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. ”

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Test Mode	Carrier frequency (MHz) / Channel	Reference value (dBm)	Limit
802.11b	2412/CH 1	7.890	-22.11
	2427/CH 4	8.550	-21.45
	2432/CH 5	9.660	-20.34
	2437/CH 6	10.190	-19.81
	2442/CH 7	9.380	-20.62
	2447/CH 8	7.650	-22.35
	2462/CH 11	7.560	-22.44
802.11g	2412/CH 1	4.760	-25.24
	2437/CH 6	5.000	-25.00
	2462/CH 11	2.060	-27.94
802.11n HT20	2412/CH 1	4.260	-25.74
	2437/CH 6	4.670	-25.33
	2442/CH 7	5.300	-24.70
	2447/CH 8	3.040	-26.96
	2452/CH 9	3.150	-26.85
	2457/CH 10	2.090	-27.91
	2462/CH 11	2.800	-27.20
802.11n HT40	2422/CH 3	2.010	-27.99
	2437/CH 6	1.550	-28.45
	2452/CH 9	-1.320	-31.32
Bluetooth (Low Energy)	2402/CH 0	2.010	-27.99
	2440/CH 19	3.240	-26.76
	2480/CH 39	3.040	-26.96

Measurement Uncertainty

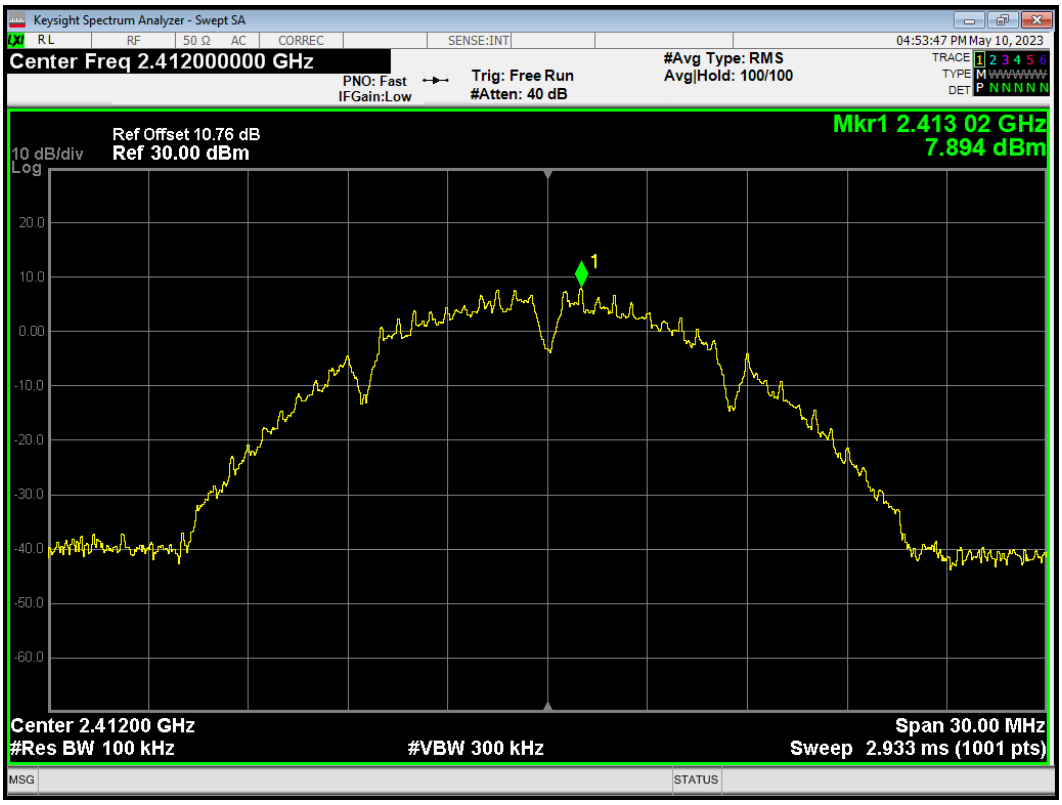
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96.

Frequency	Uncertainty
100kHz-2GHz	0.684 dB
2GHz-26GHz	1.407 dB

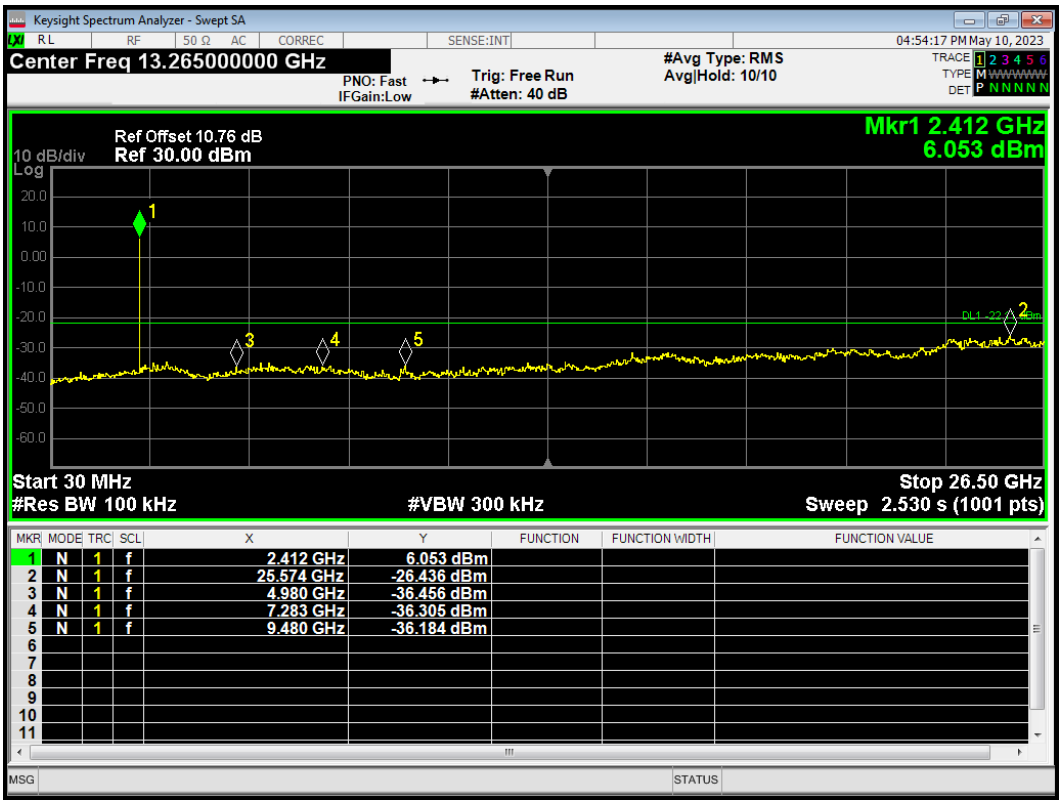
This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Test Results:

Tx. Spurious 802.11b 2412MHz Ref



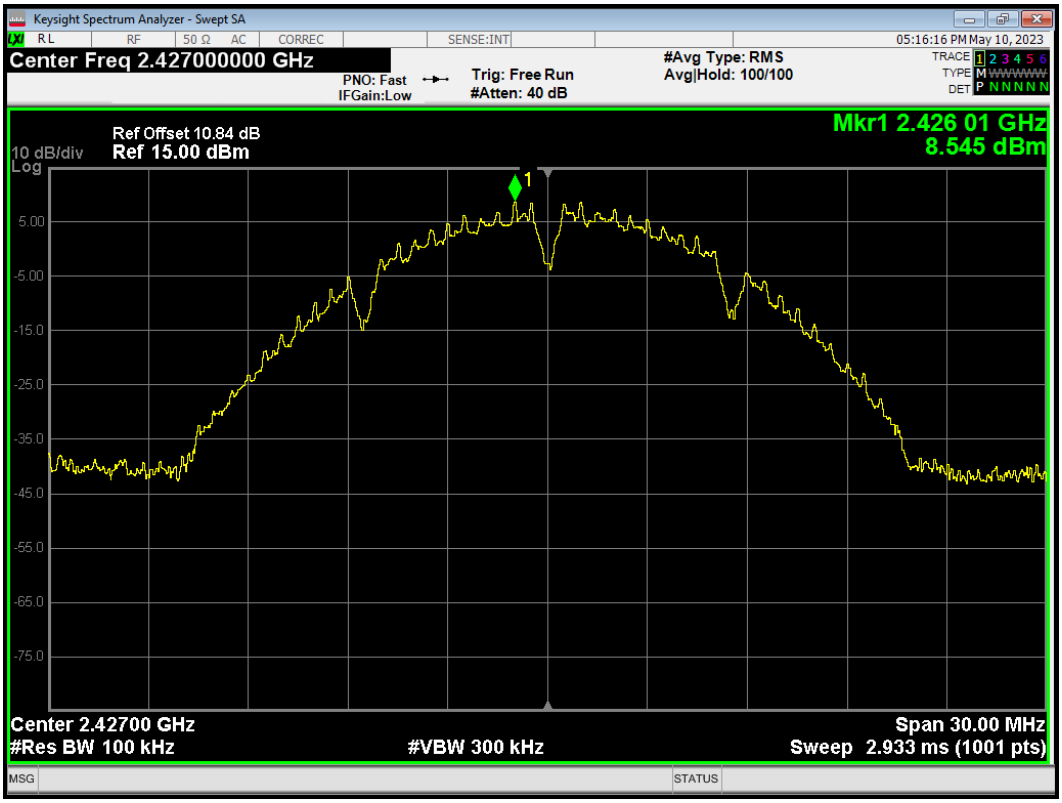
Tx. Spurious 802.11b 2412MHz Emission



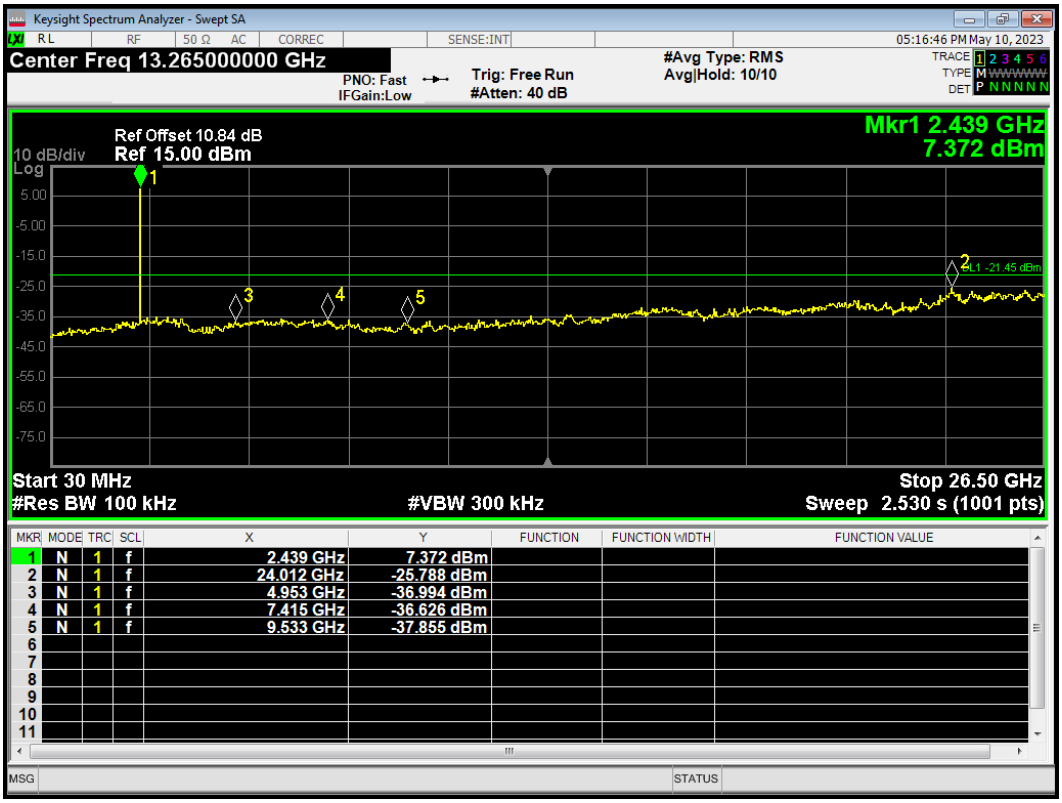
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.412 GHz	6.053 dBm			
2	N	1	f	25.574 GHz	-26.436 dBm			
3	N	1	f	4.980 GHz	-36.456 dBm			
4	N	1	f	7.283 GHz	-36.305 dBm			
5	N	1	f	9.480 GHz	-36.184 dBm			
6								
7								
8								
9								
10								
11								

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11b 2427MHz Ref



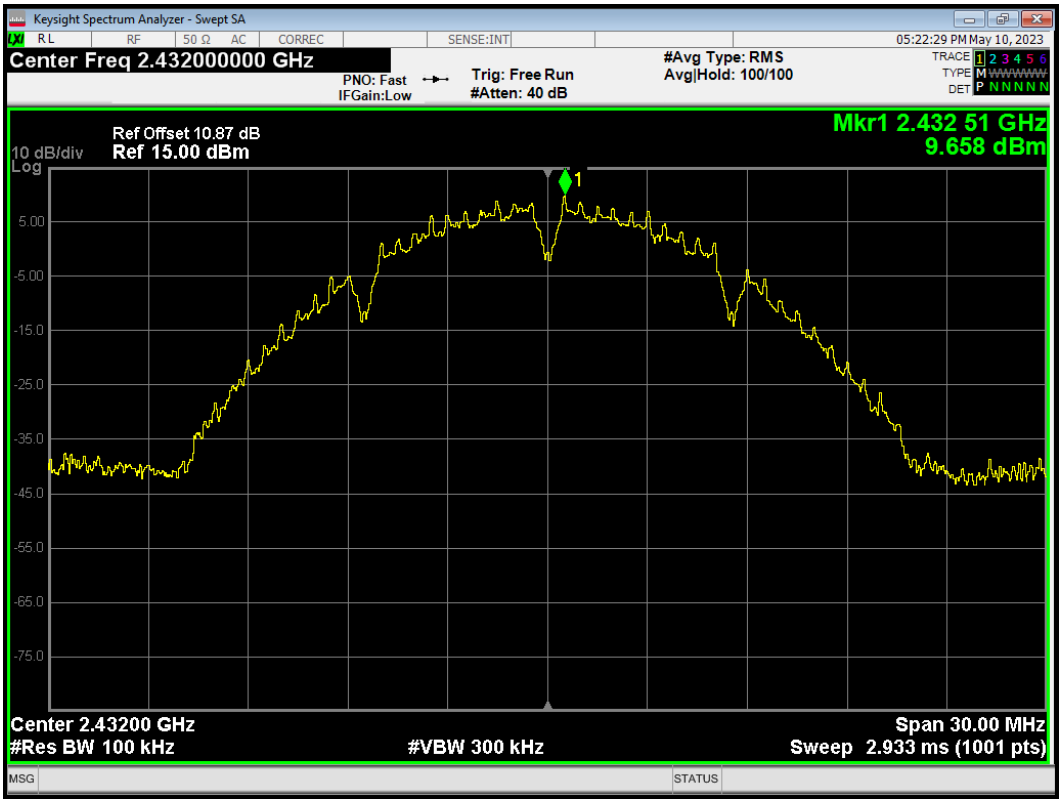
Tx. Spurious 802.11b 2427MHz Emission



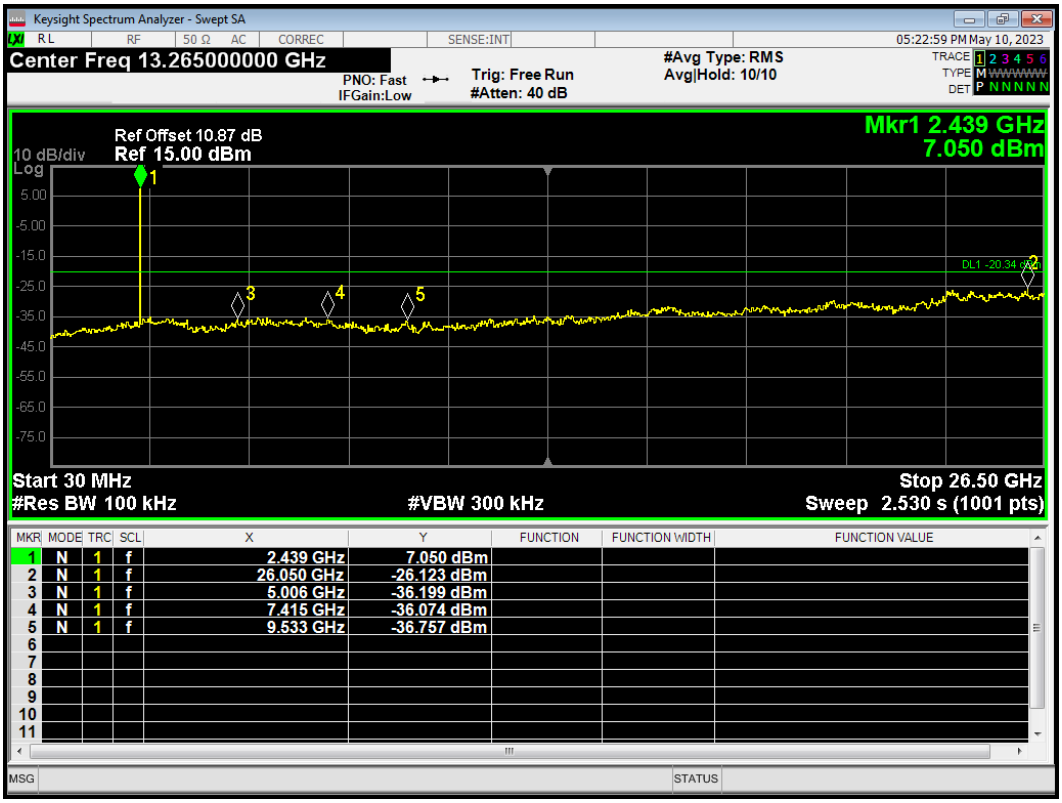
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.439 GHz	7.372 dBm			
2	N	1	f	24.012 GHz	-25.788 dBm			
3	N	1	f	4.953 GHz	-36.994 dBm			
4	N	1	f	7.415 GHz	-36.626 dBm			
5	N	1	f	9.533 GHz	-37.855 dBm			
6								
7								
8								
9								
10								
11								

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11b 2432MHz Ref

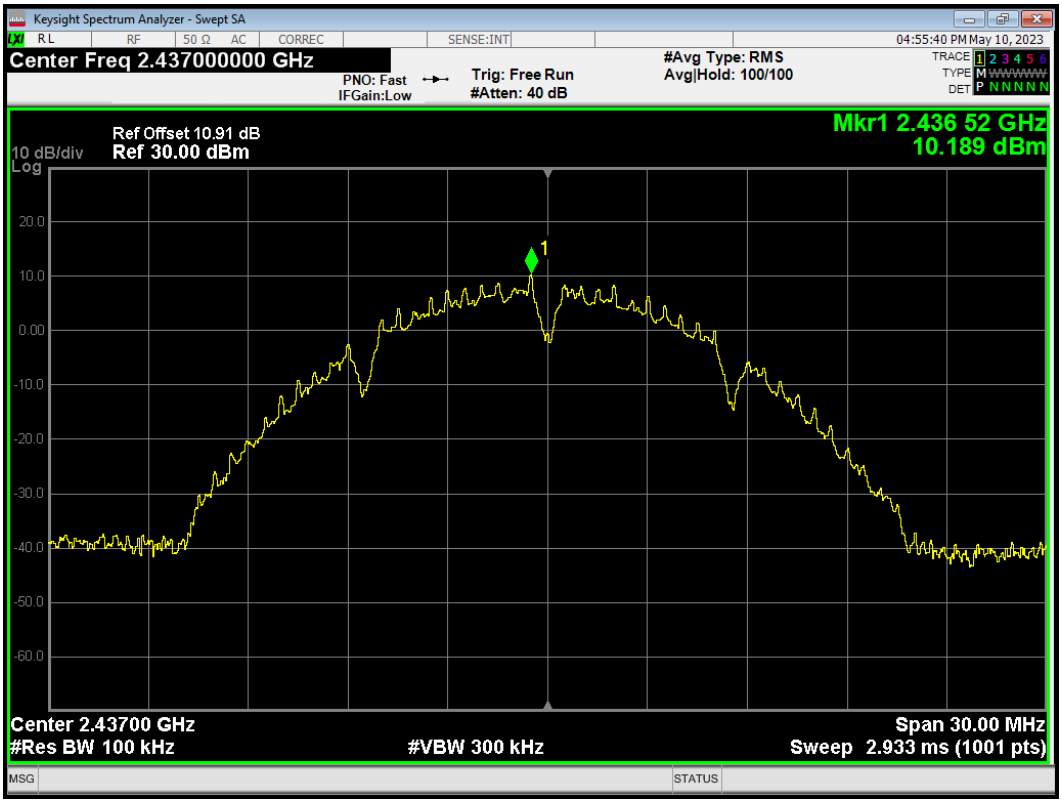


Tx. Spurious 802.11b 2432MHz Emission

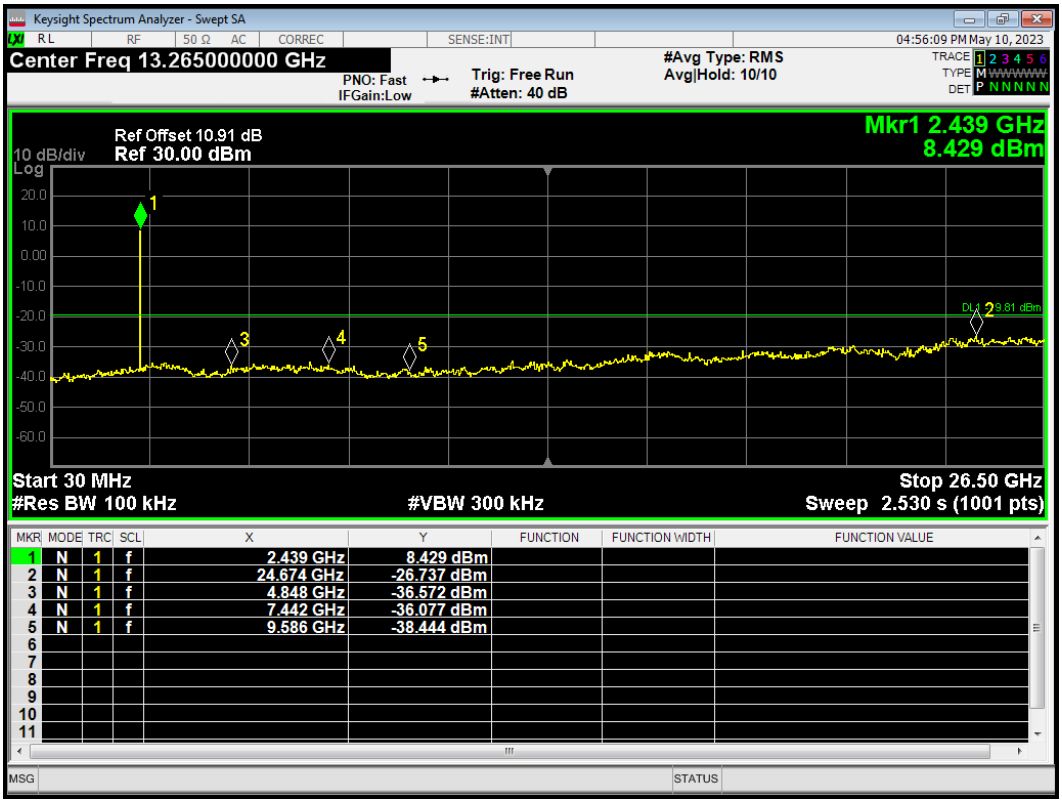


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11b 2437MHz Ref



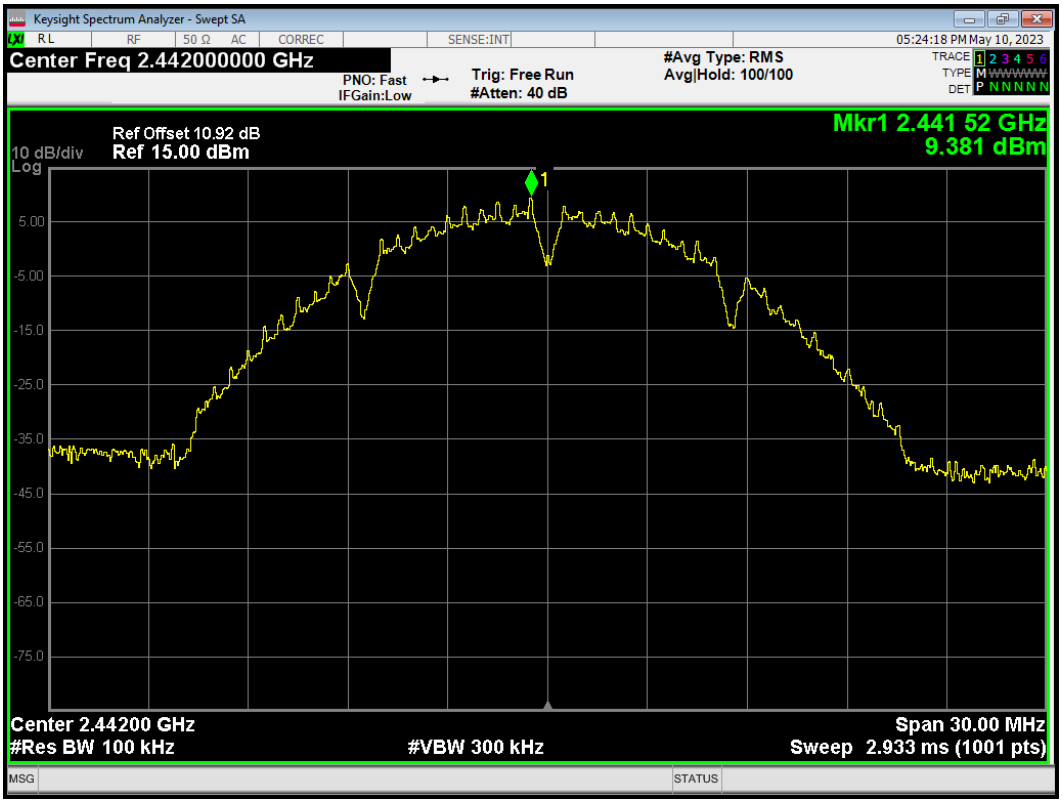
Tx. Spurious 802.11b 2437MHz Emission



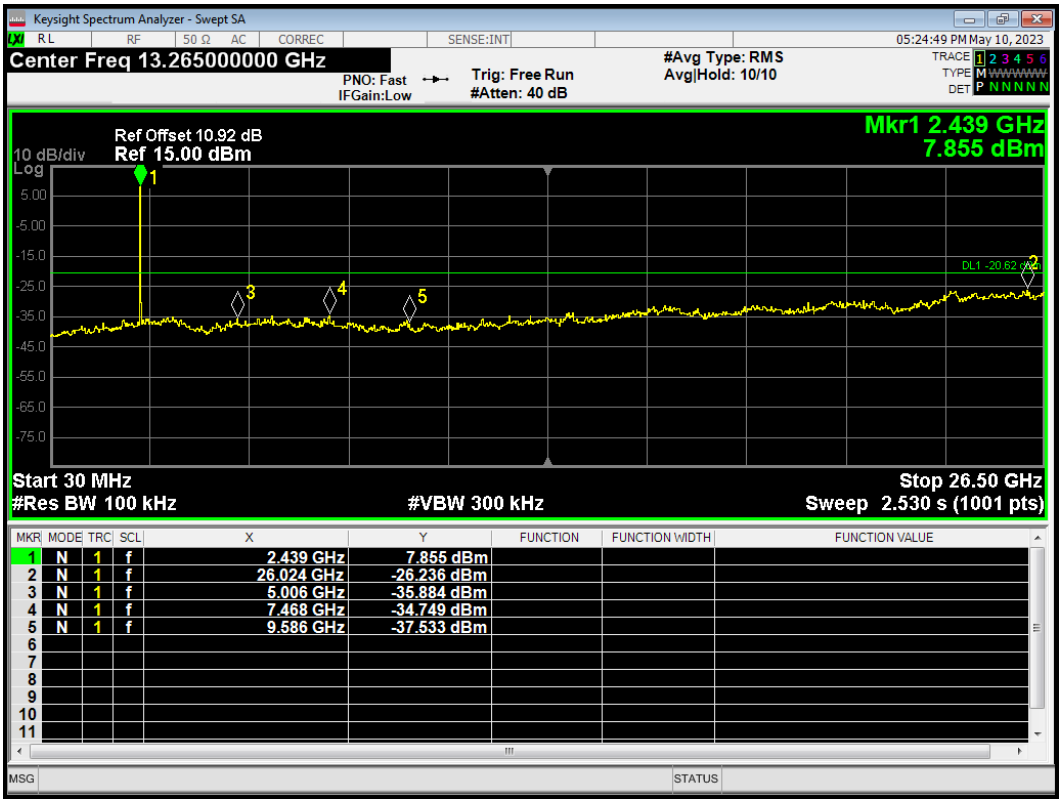
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.439 GHz	8.429 dBm			
2	N	1	f	24.674 GHz	-26.737 dBm			
3	N	1	f	4.848 GHz	-36.572 dBm			
4	N	1	f	7.442 GHz	-36.077 dBm			
5	N	1	f	9.586 GHz	-38.444 dBm			
6								
7								
8								
9								
10								
11								

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11b 2442MHz Ref

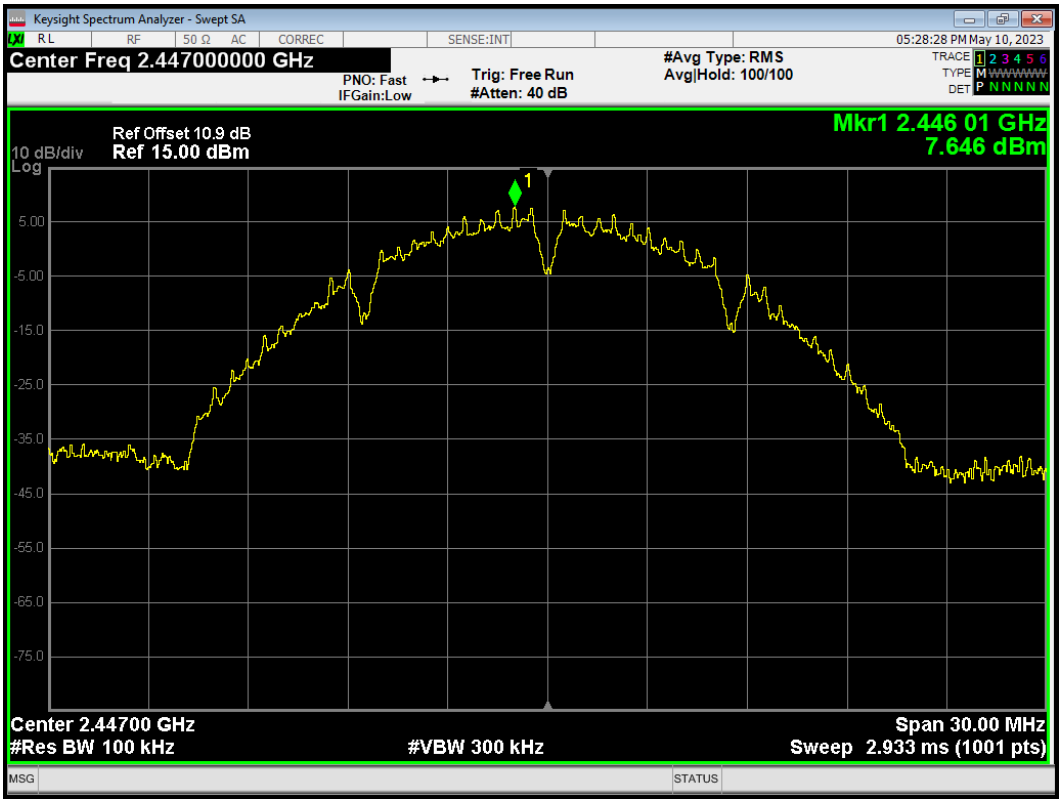


Tx. Spurious 802.11b 2442MHz Emission

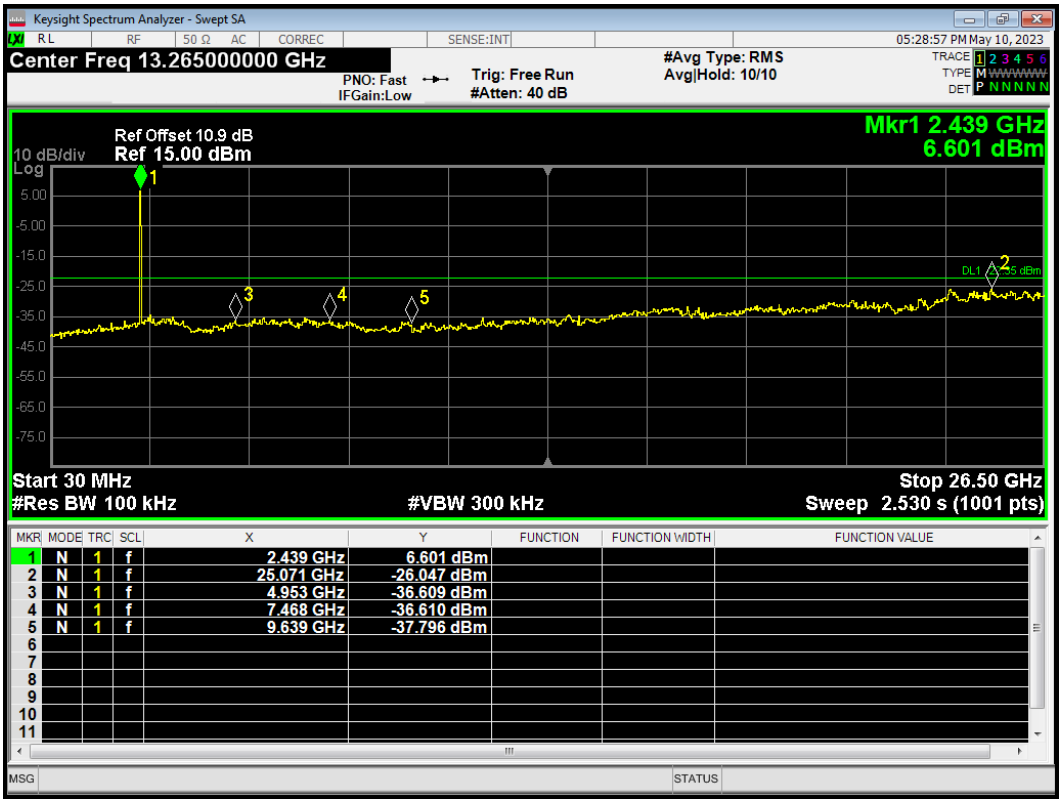


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11b 2447MHz Ref

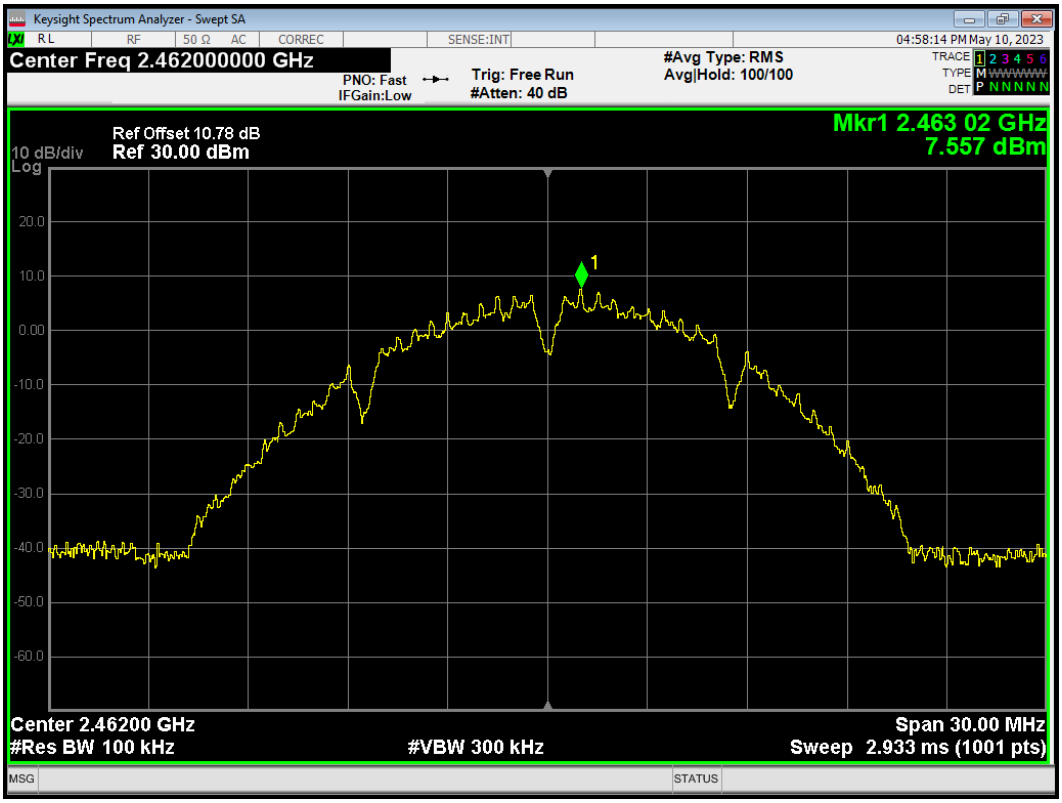


Tx. Spurious 802.11b 2447MHz Emission

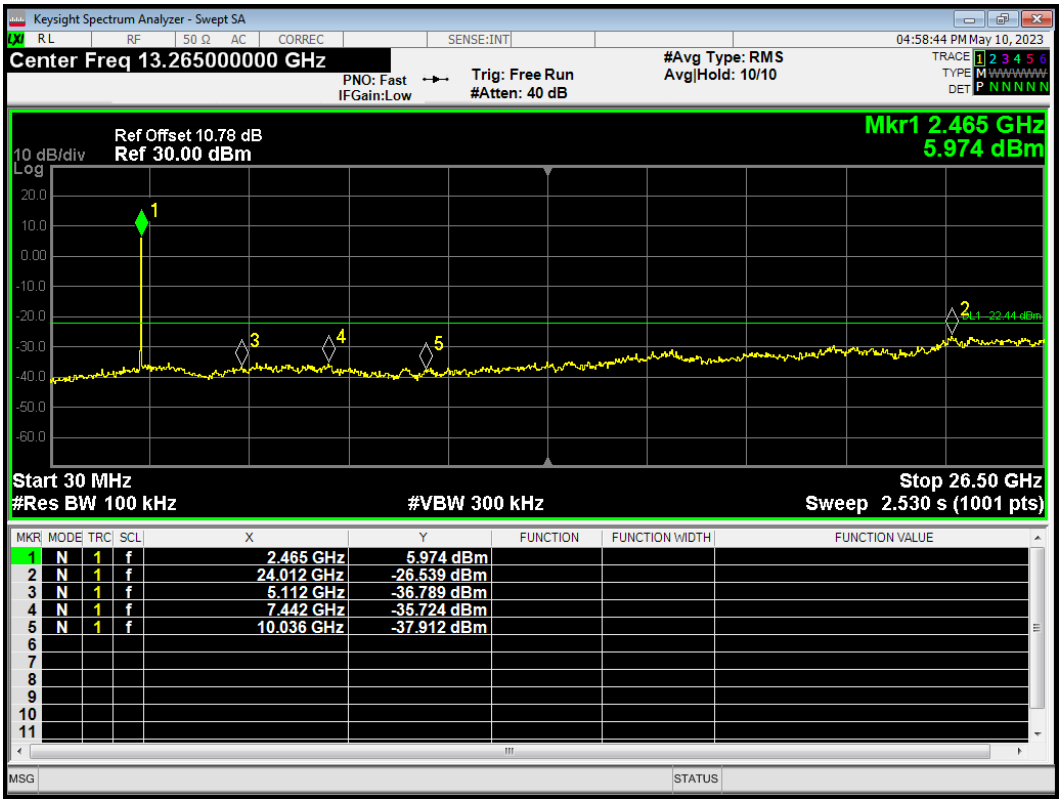


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11b 2462MHz Ref



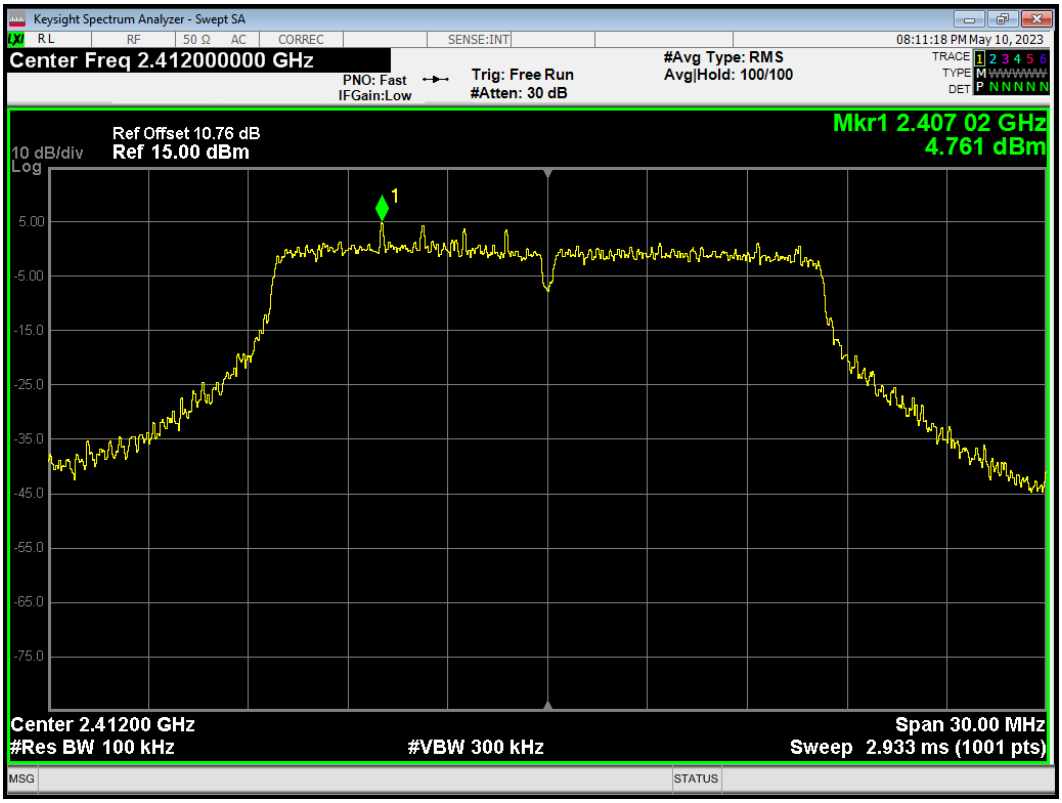
Tx. Spurious 802.11b 2462MHz Emission



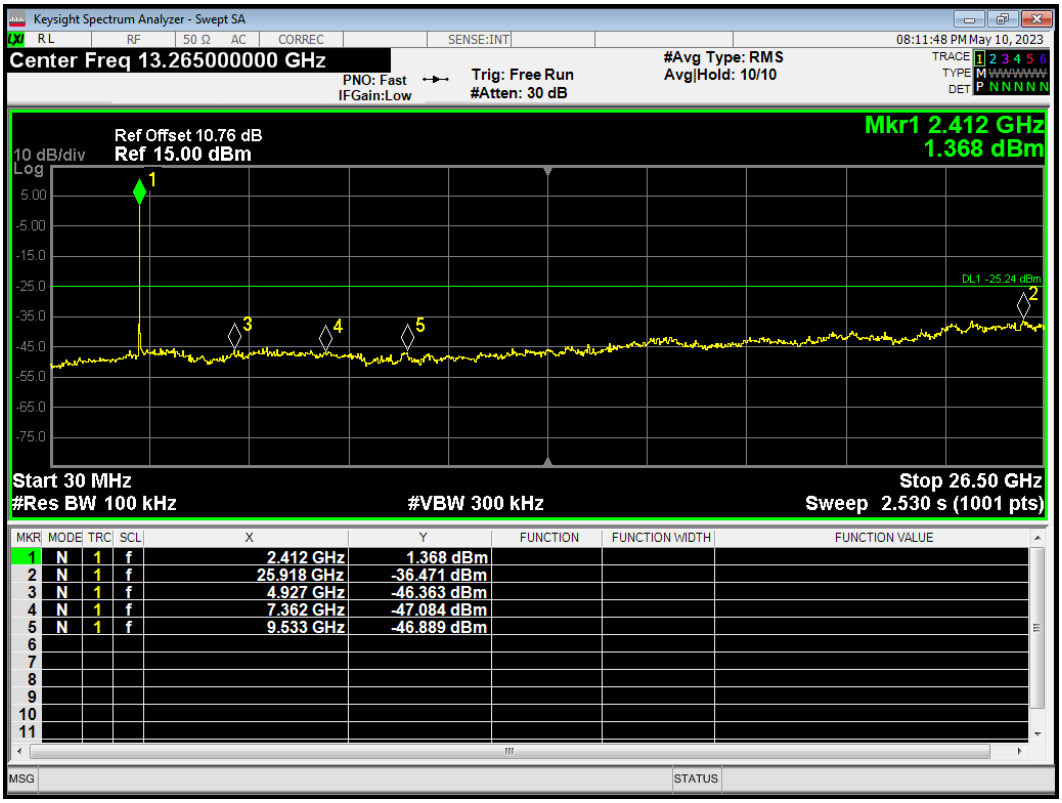
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.465 GHz	5.974 dBm			
2	N	1	f	24.012 GHz	-26.539 dBm			
3	N	1	f	5.112 GHz	-36.789 dBm			
4	N	1	f	7.442 GHz	-35.724 dBm			
5	N	1	f	10.036 GHz	-37.912 dBm			
6								
7								
8								
9								
10								
11								

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11g 2412MHz Ref

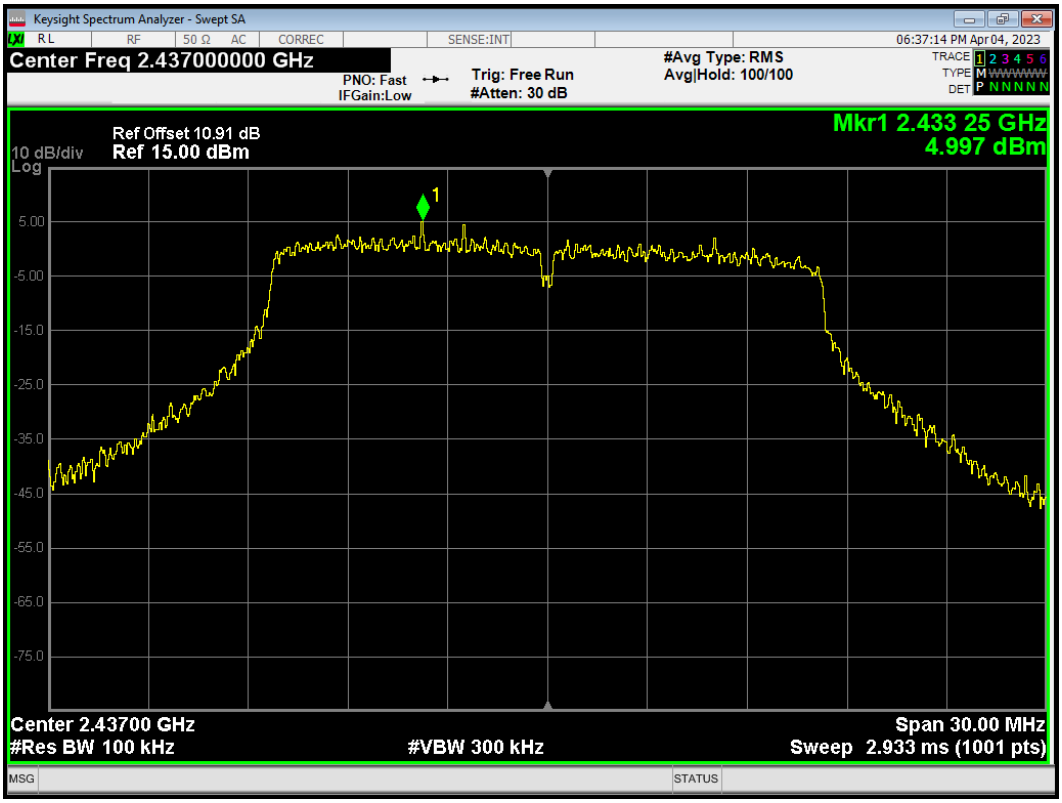


Tx. Spurious 802.11g 2412MHz Emission

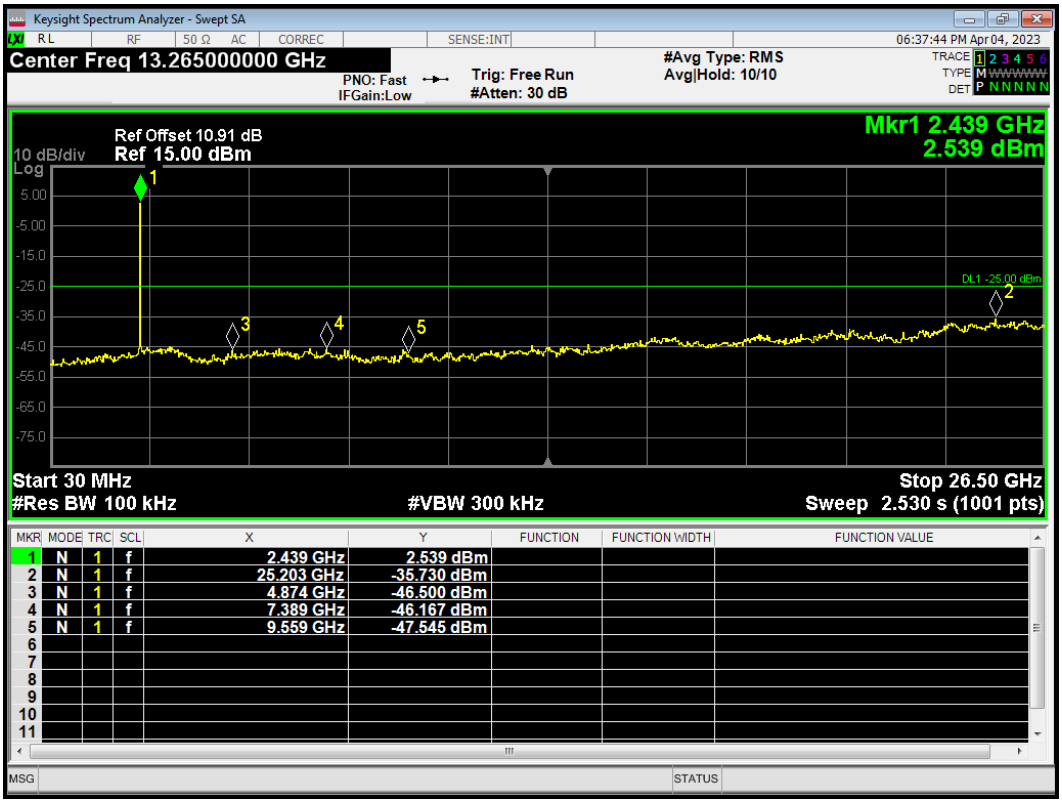


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11g 2437MHz Ref

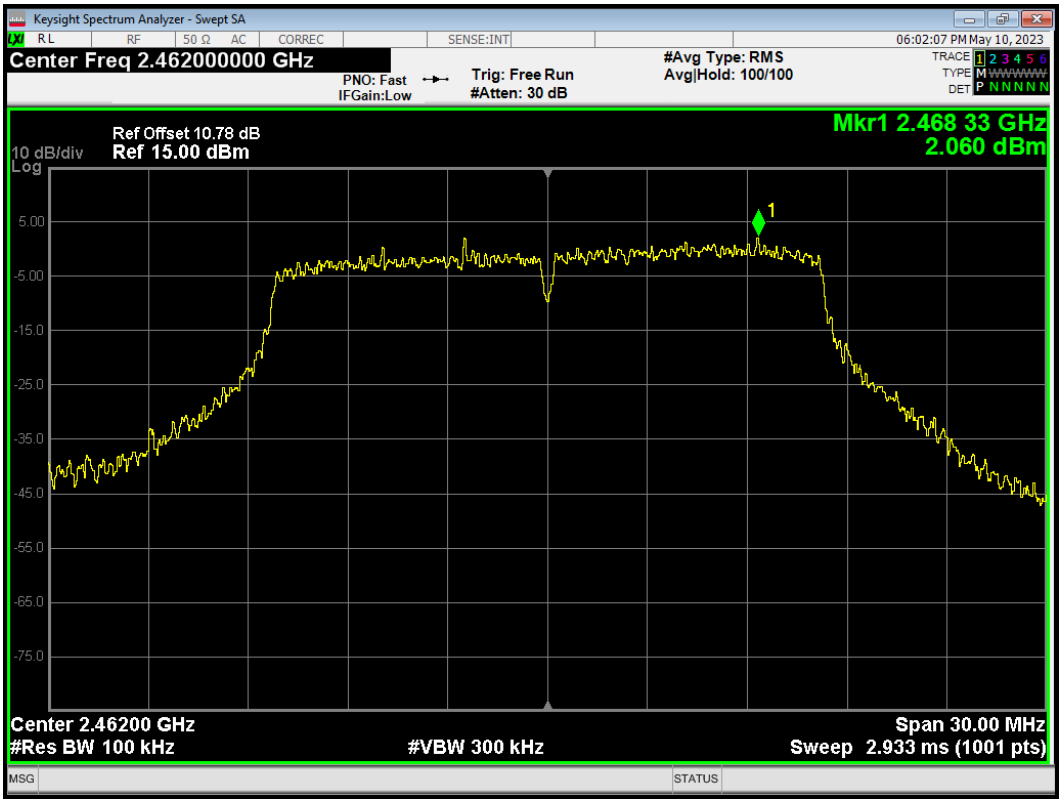


Tx. Spurious 802.11g 2437MHz Emission

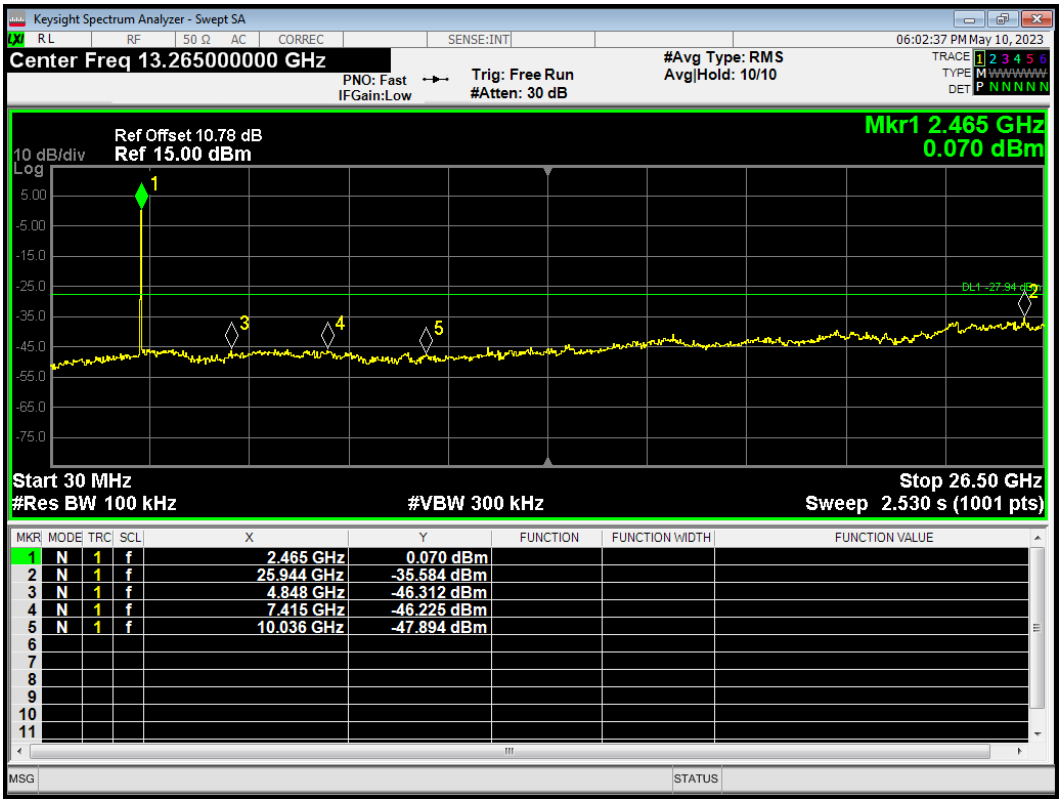


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11g 2462MHz Ref



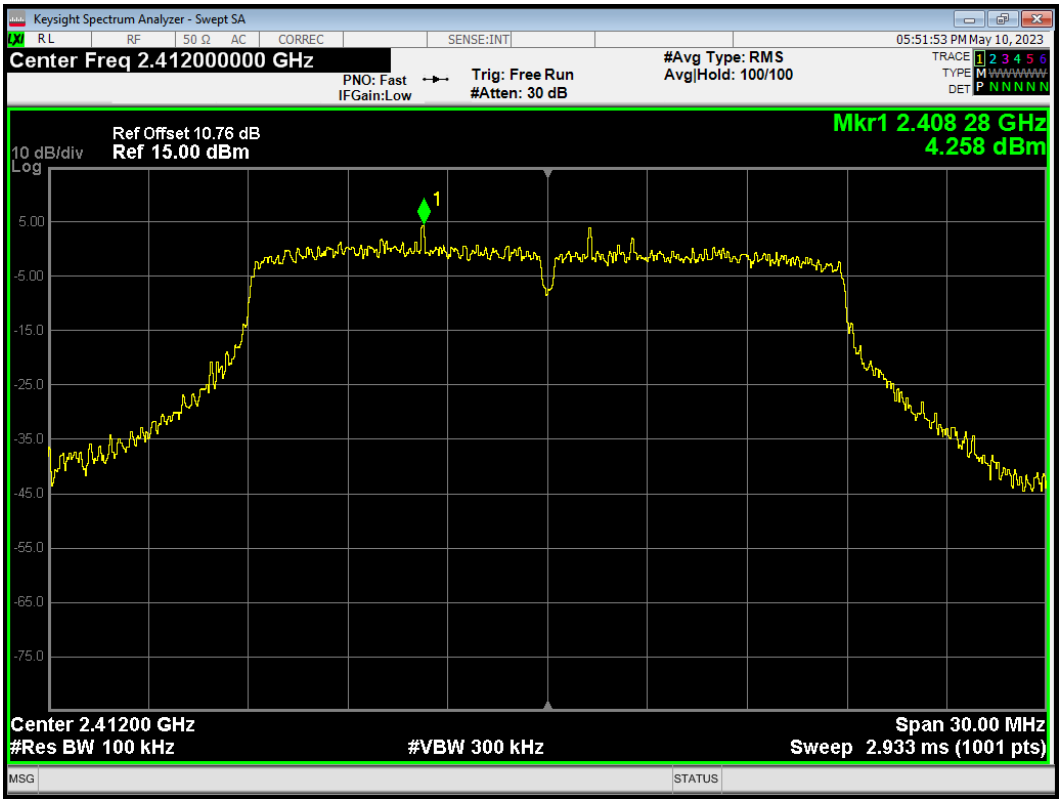
Tx. Spurious 802.11g 2462MHz Emission



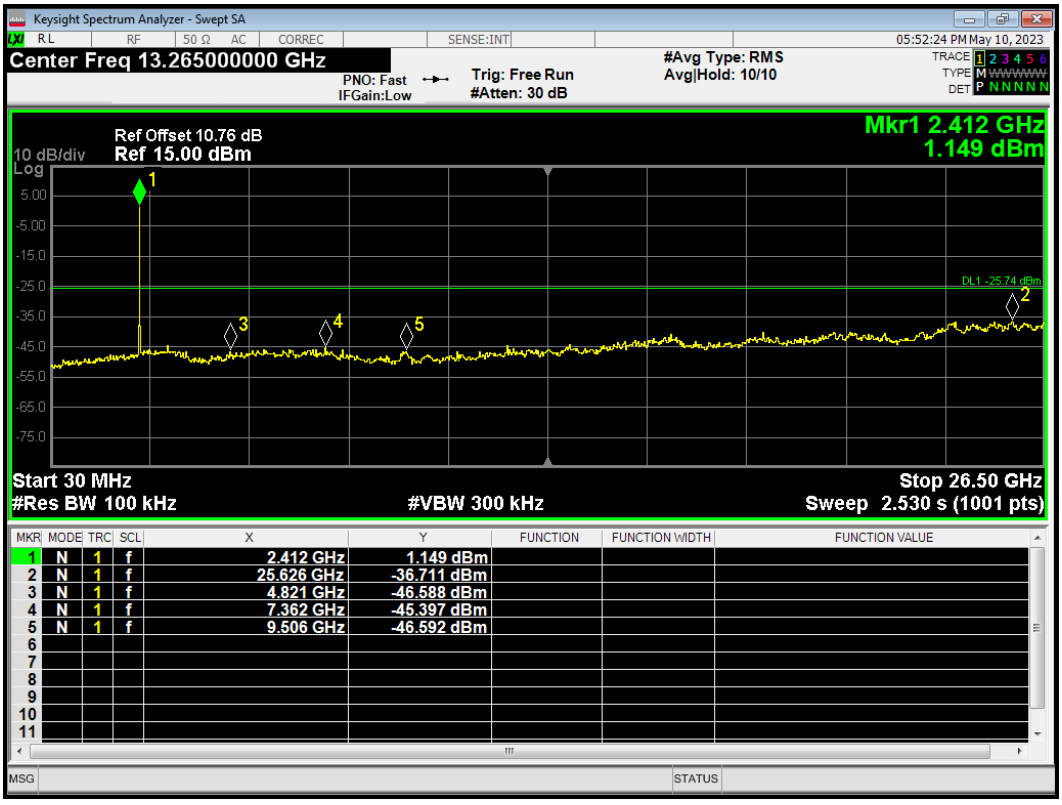
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.465 GHz	0.070 dBm			
2	N	1	f	25.944 GHz	-35.584 dBm			
3	N	1	f	4.848 GHz	-46.312 dBm			
4	N	1	f	7.415 GHz	-46.225 dBm			
5	N	1	f	10.036 GHz	-47.894 dBm			
6								
7								
8								
9								
10								
11								

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11n(HT20) 2412MHz Ref

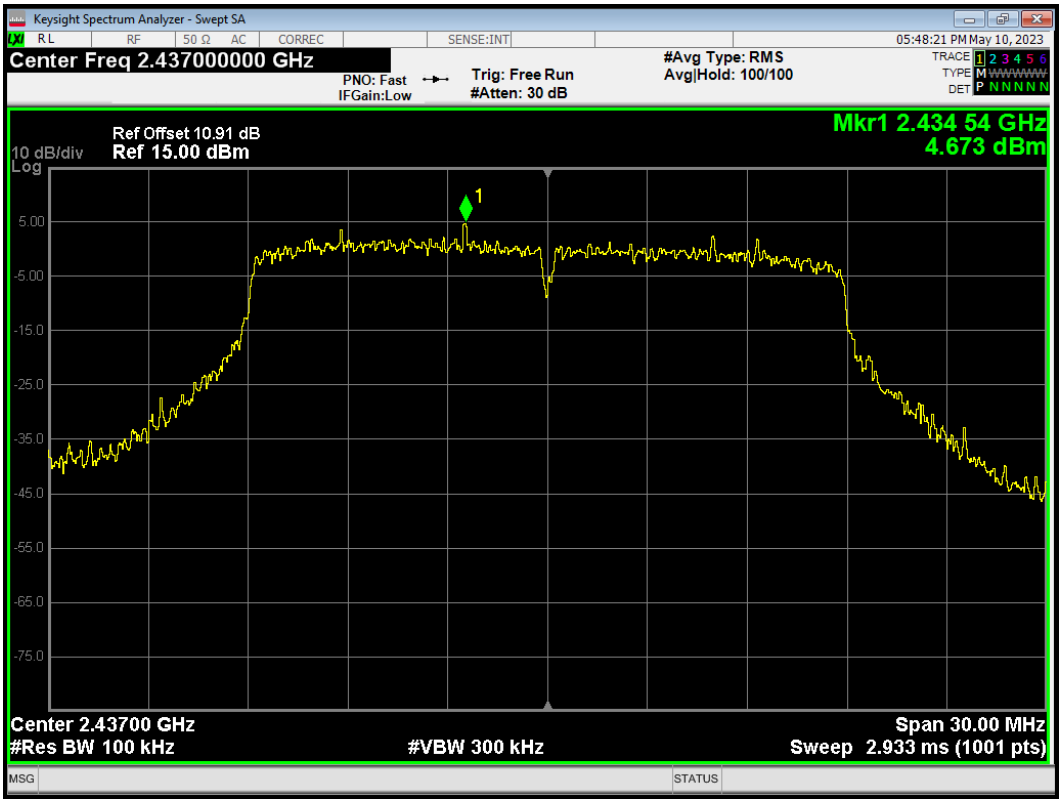


Tx. Spurious 802.11n(HT20) 2412MHz Emission

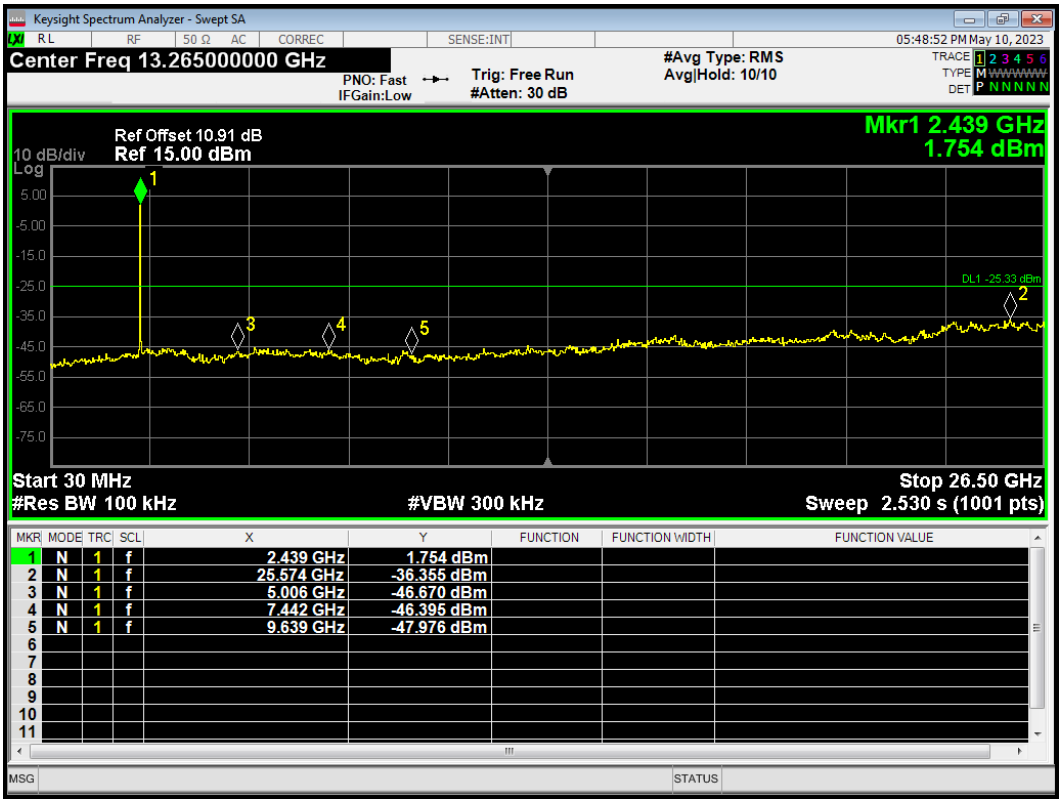


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11n(HT20) 2437MHz Ref

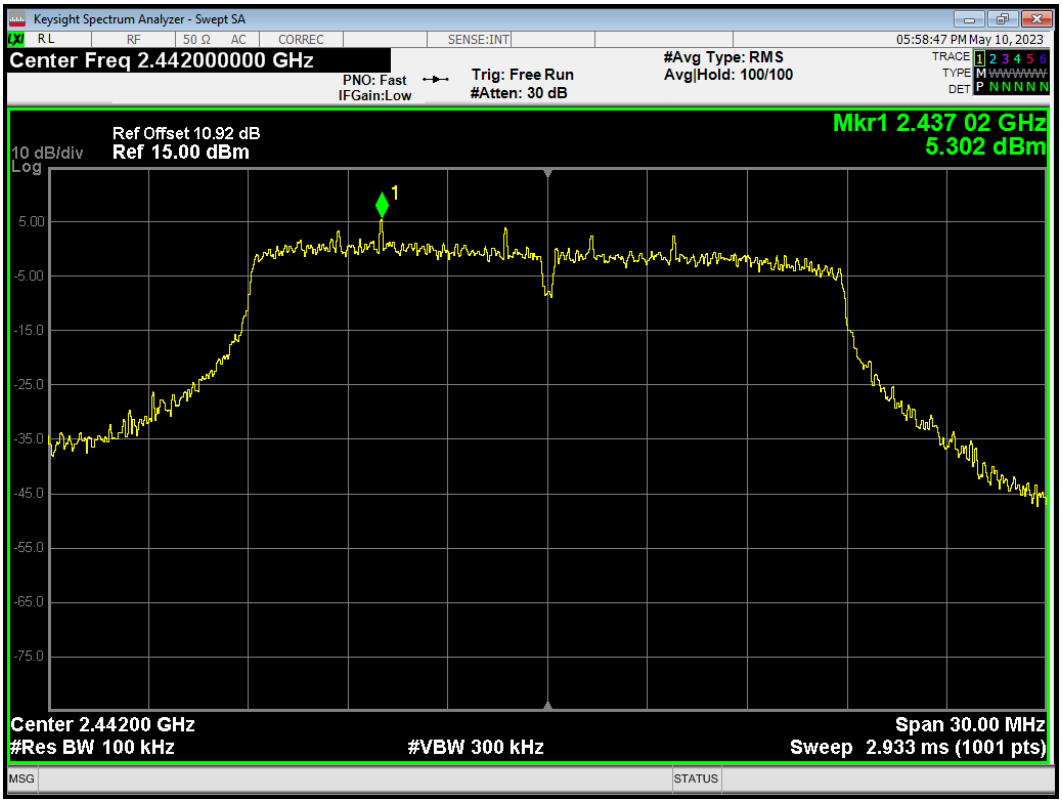


Tx. Spurious 802.11n(HT20) 2437MHz Emission

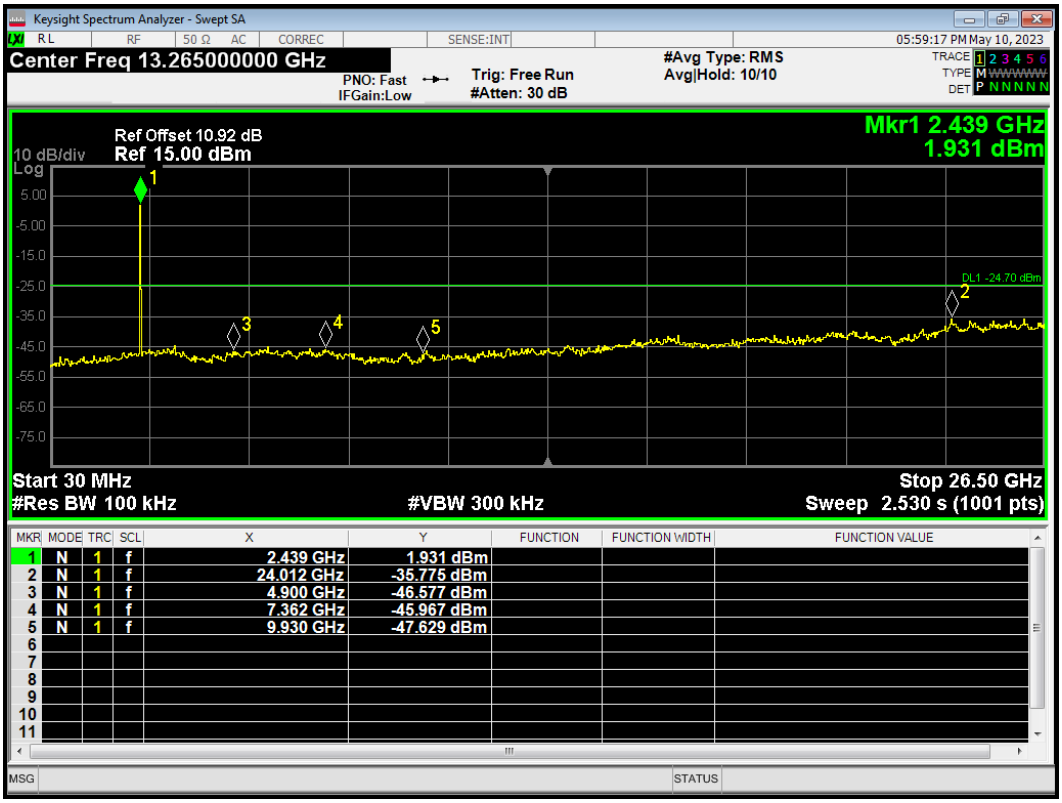


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11n(HT20) 2442MHz Ref

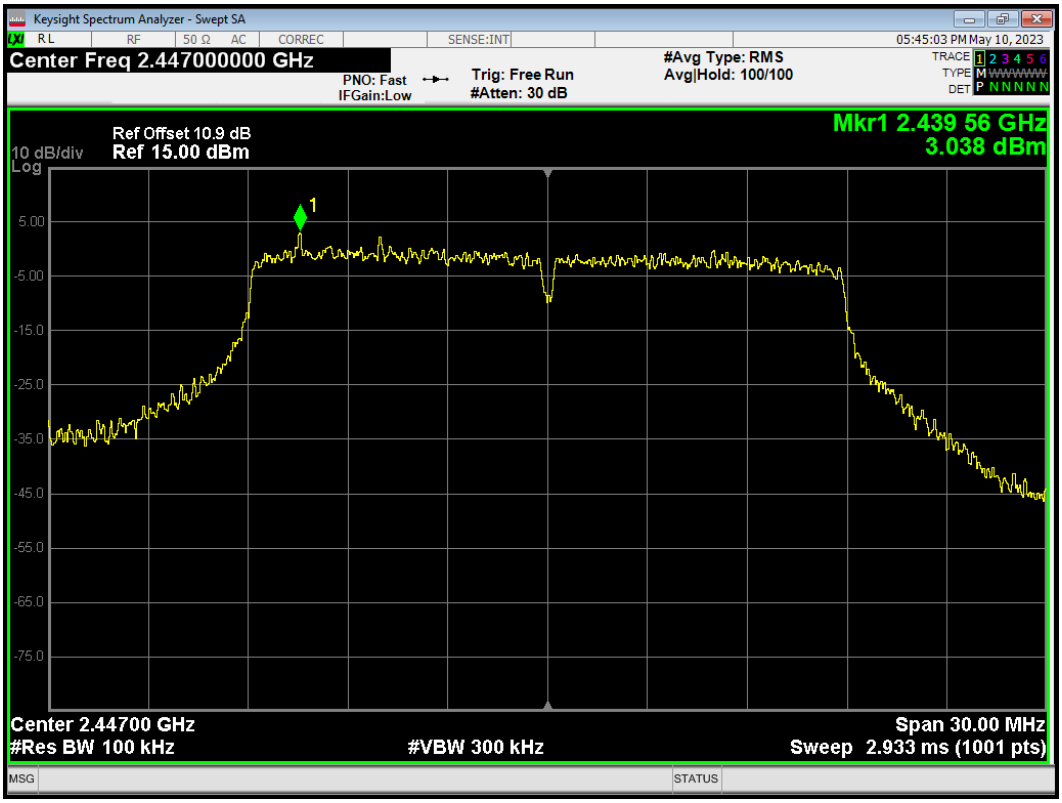


Tx. Spurious 802.11n(HT20) 2442MHz Emission

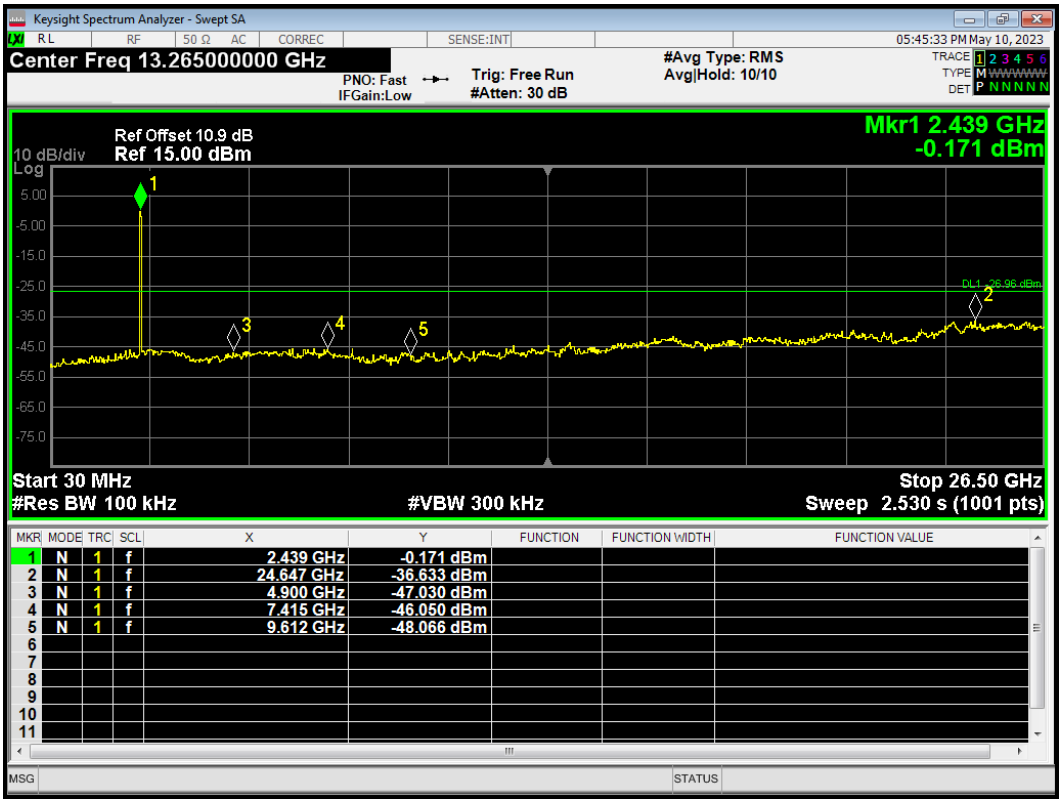


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11n(HT20) 2447MHz Ref



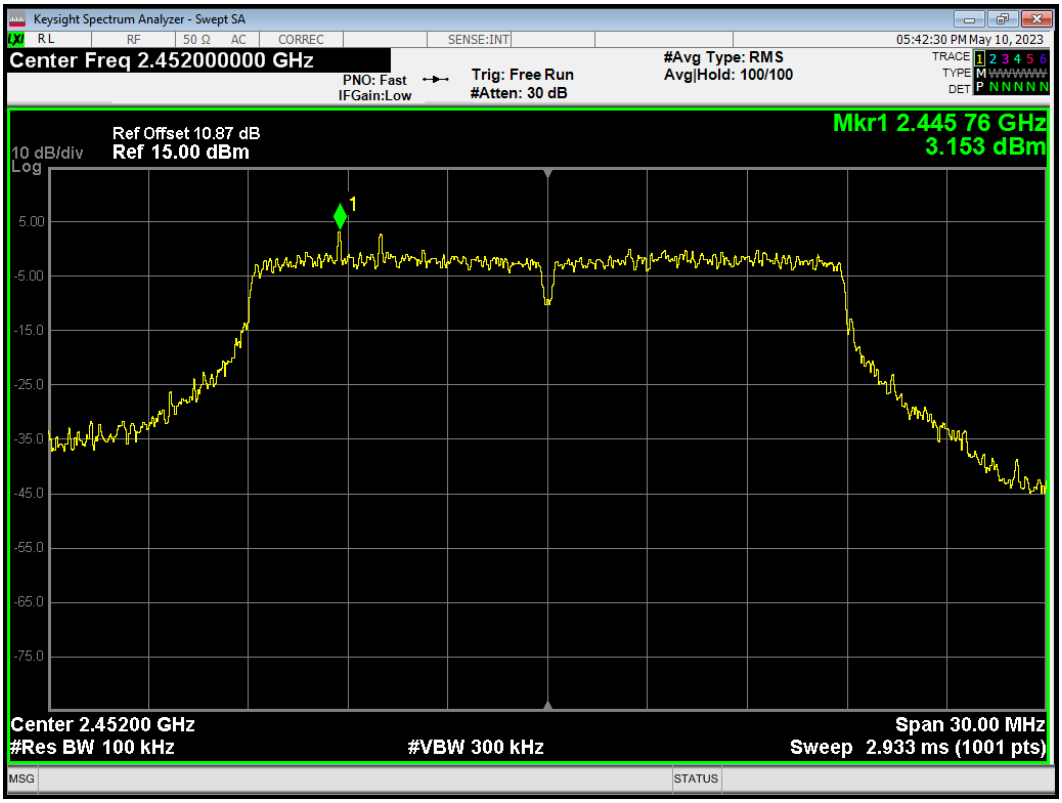
Tx. Spurious 802.11n(HT20) 2447MHz Emission



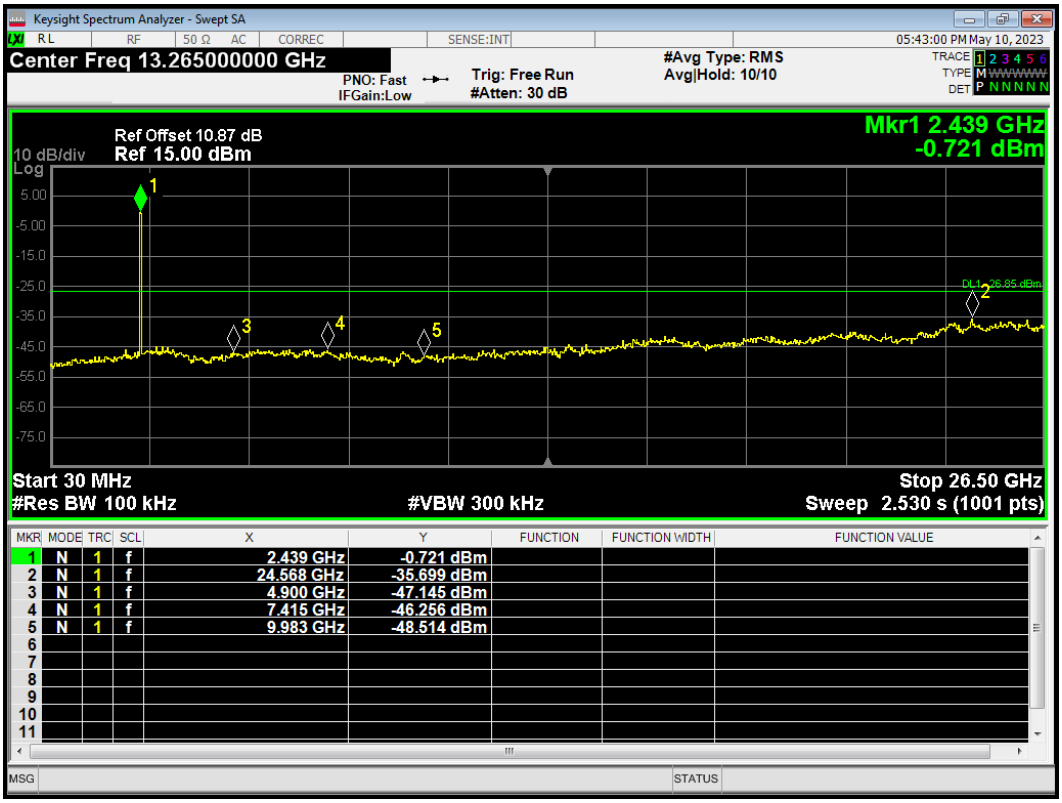
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.439 GHz	-0.171 dBm			
2	N	1	f	24.647 GHz	-36.633 dBm			
3	N	1	f	4.900 GHz	-47.030 dBm			
4	N	1	f	7.415 GHz	-46.050 dBm			
5	N	1	f	9.612 GHz	-48.066 dBm			
6								
7								
8								
9								
10								
11								

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11n(HT20) 2452MHz Ref



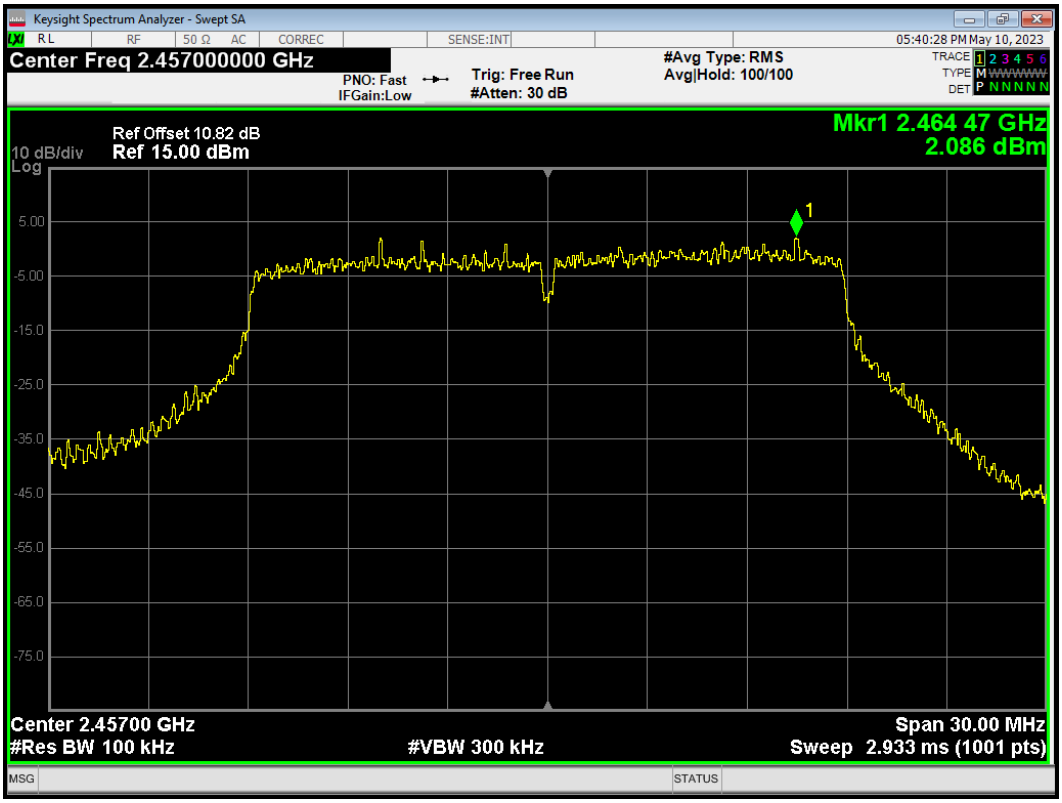
Tx. Spurious 802.11n(HT20) 2452MHz Emission



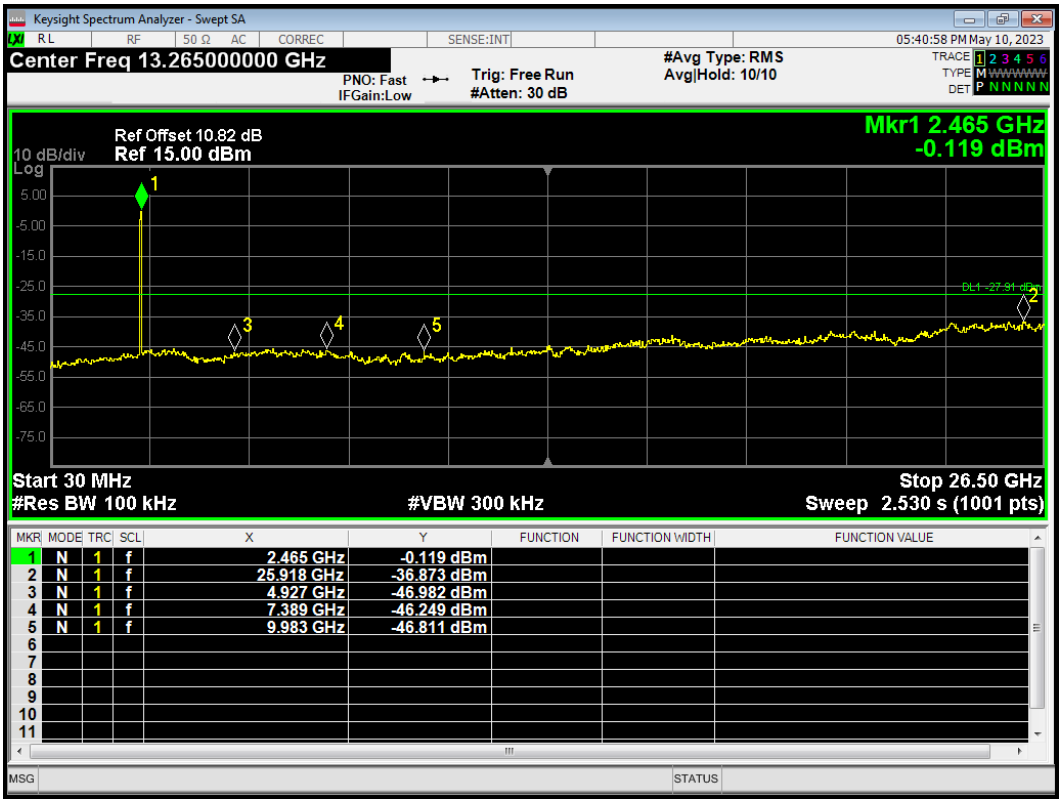
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.439 GHz	-0.721 dBm			
2	N	1	f	24.568 GHz	-35.699 dBm			
3	N	1	f	4.900 GHz	-47.145 dBm			
4	N	1	f	7.415 GHz	-46.256 dBm			
5	N	1	f	9.983 GHz	-48.514 dBm			
6								
7								
8								
9								
10								
11								

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11n(HT20) 2457MHz Ref



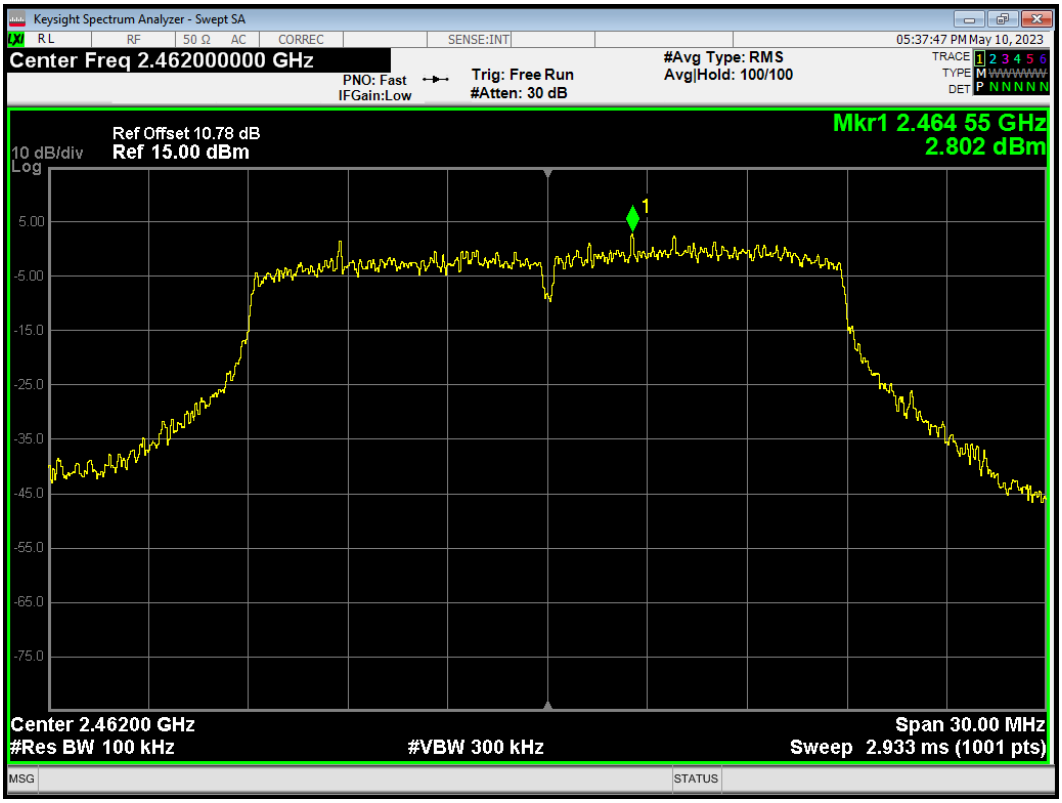
Tx. Spurious 802.11n(HT20) 2457MHz Emission



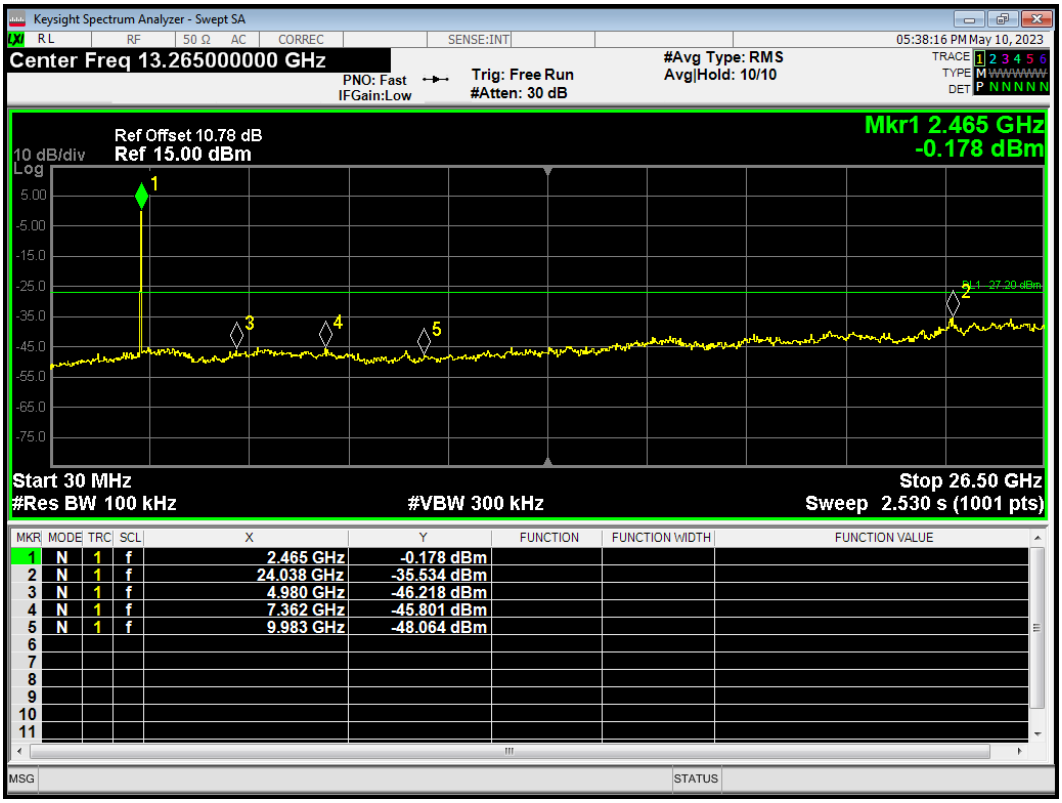
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.465 GHz	-0.119 dBm			
2	N	1	f	25.918 GHz	-36.873 dBm			
3	N	1	f	4.927 GHz	-46.982 dBm			
4	N	1	f	7.389 GHz	-46.249 dBm			
5	N	1	f	9.983 GHz	-46.811 dBm			
6								
7								
8								
9								
10								
11								

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11n(HT20) 2462MHz Ref



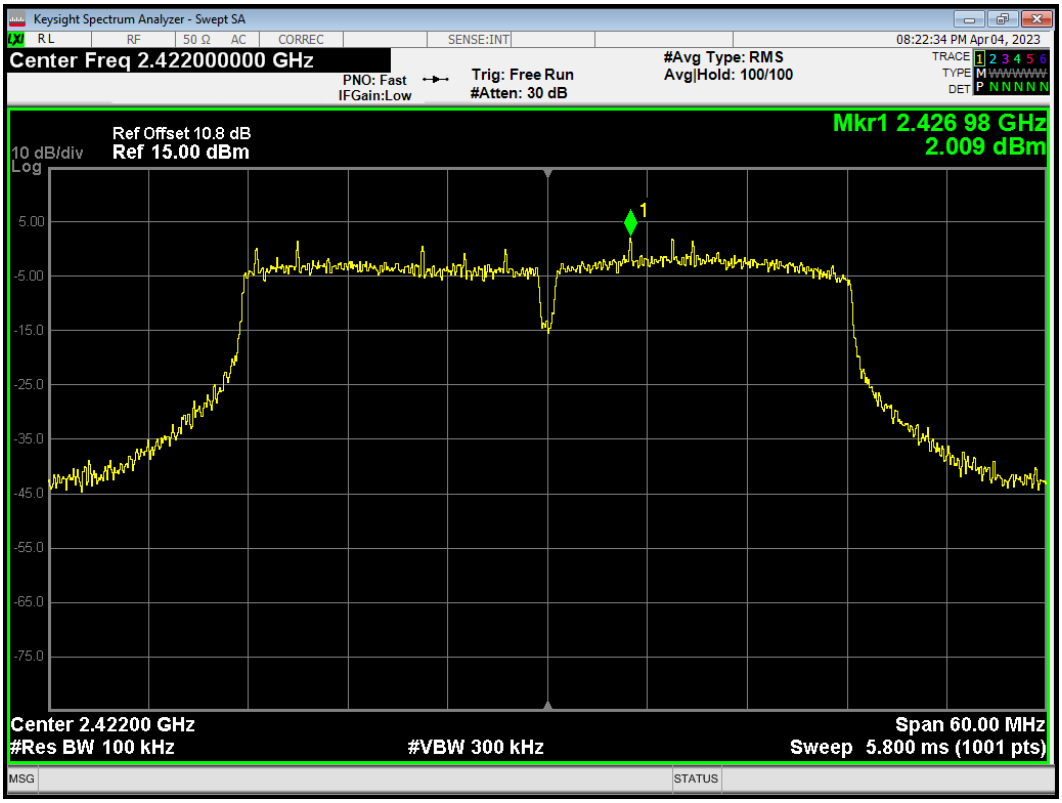
Tx. Spurious 802.11n(HT20) 2462MHz Emission



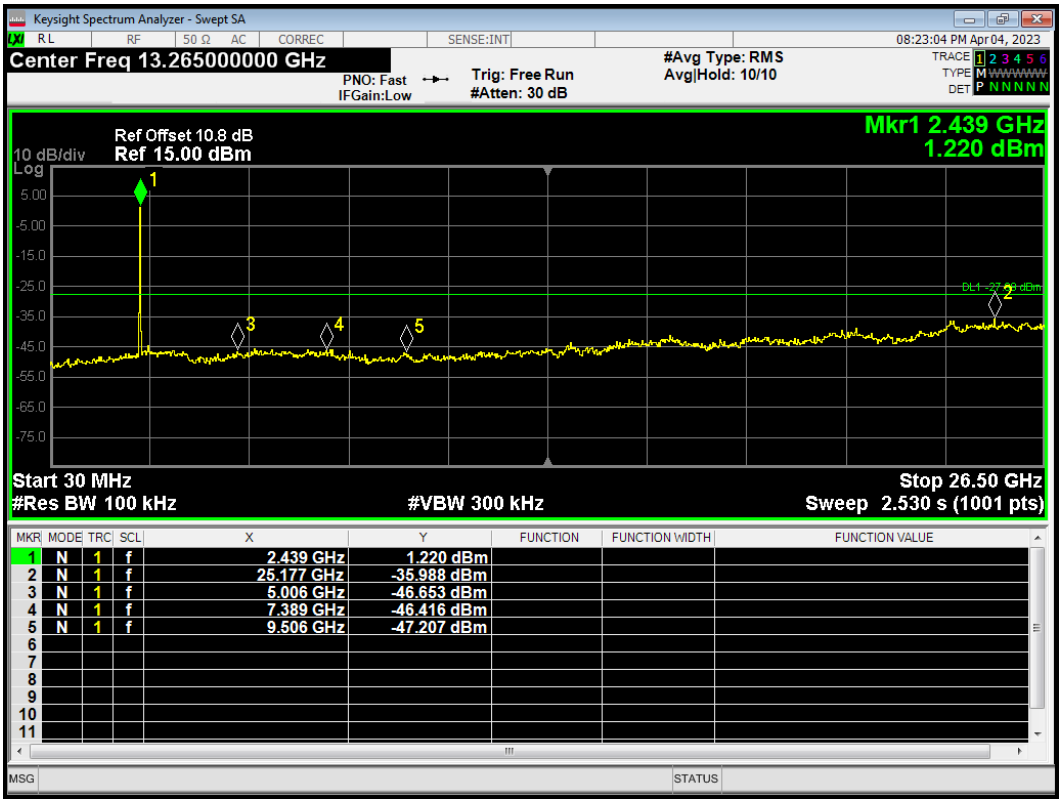
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.465 GHz	-0.178 dBm			
2	N	1	f	24.038 GHz	-35.534 dBm			
3	N	1	f	4.980 GHz	-46.218 dBm			
4	N	1	f	7.362 GHz	-45.801 dBm			
5	N	1	f	9.983 GHz	-48.064 dBm			
6								
7								
8								
9								
10								
11								

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11n(HT40) 2422MHz Ref

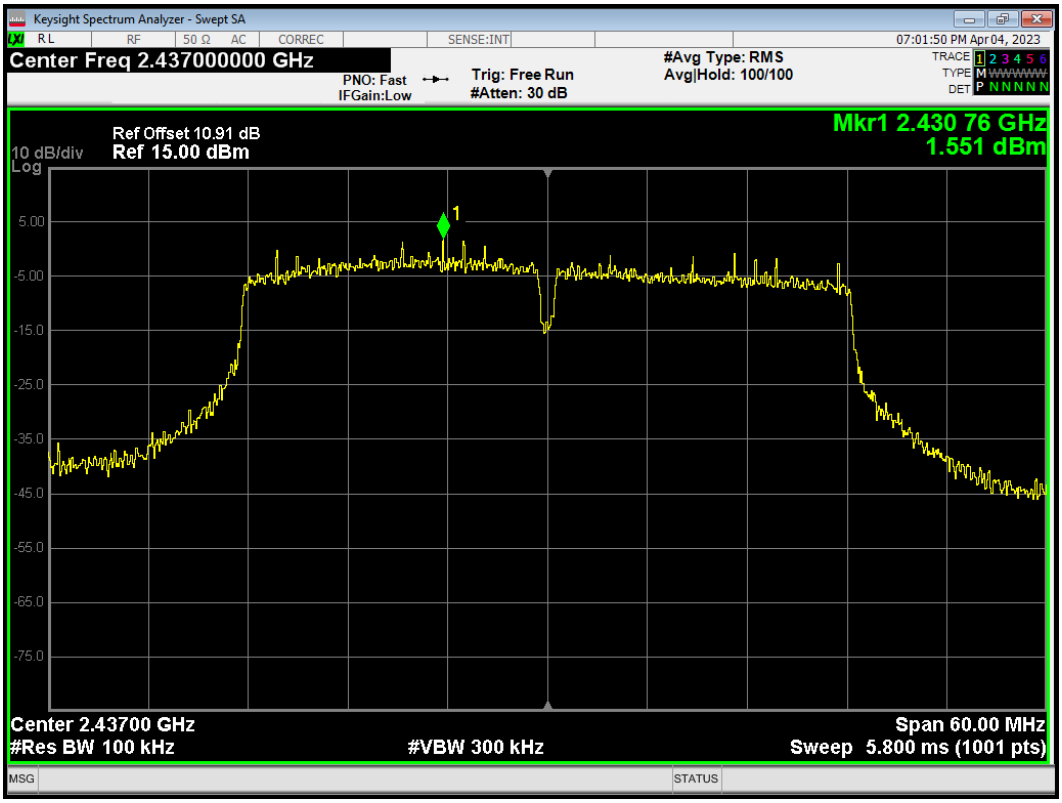


Tx. Spurious 802.11n(HT40) 2422MHz Emission

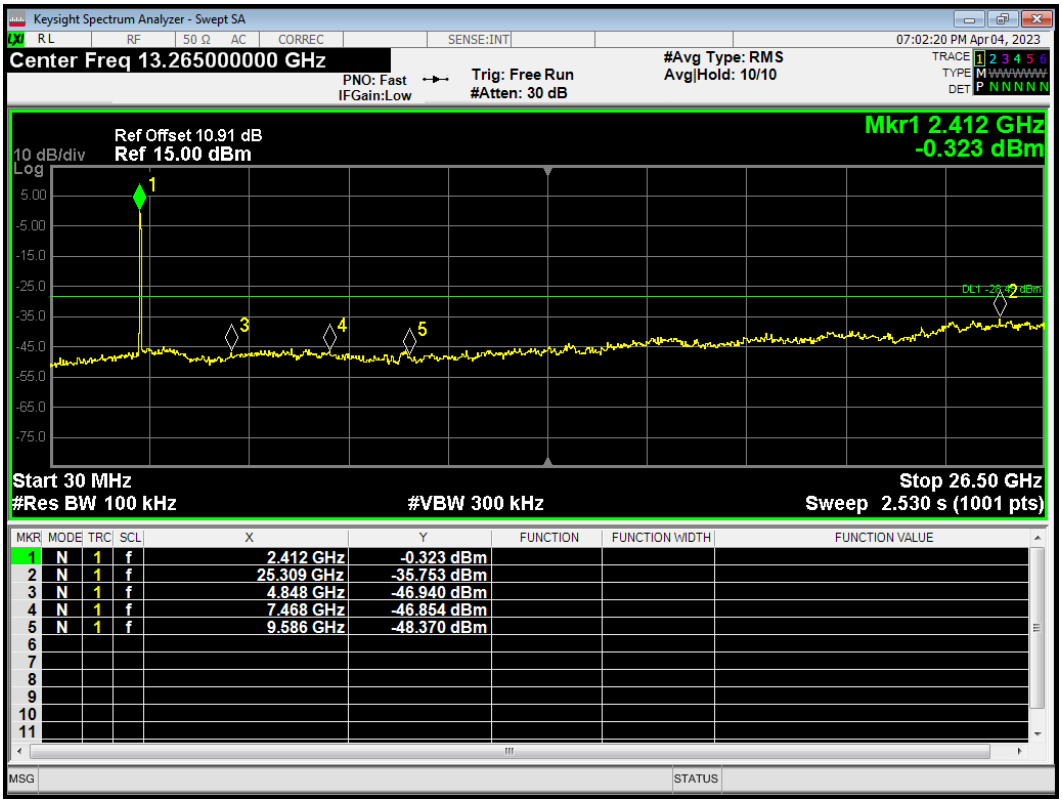


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11n(HT40) 2437MHz Ref

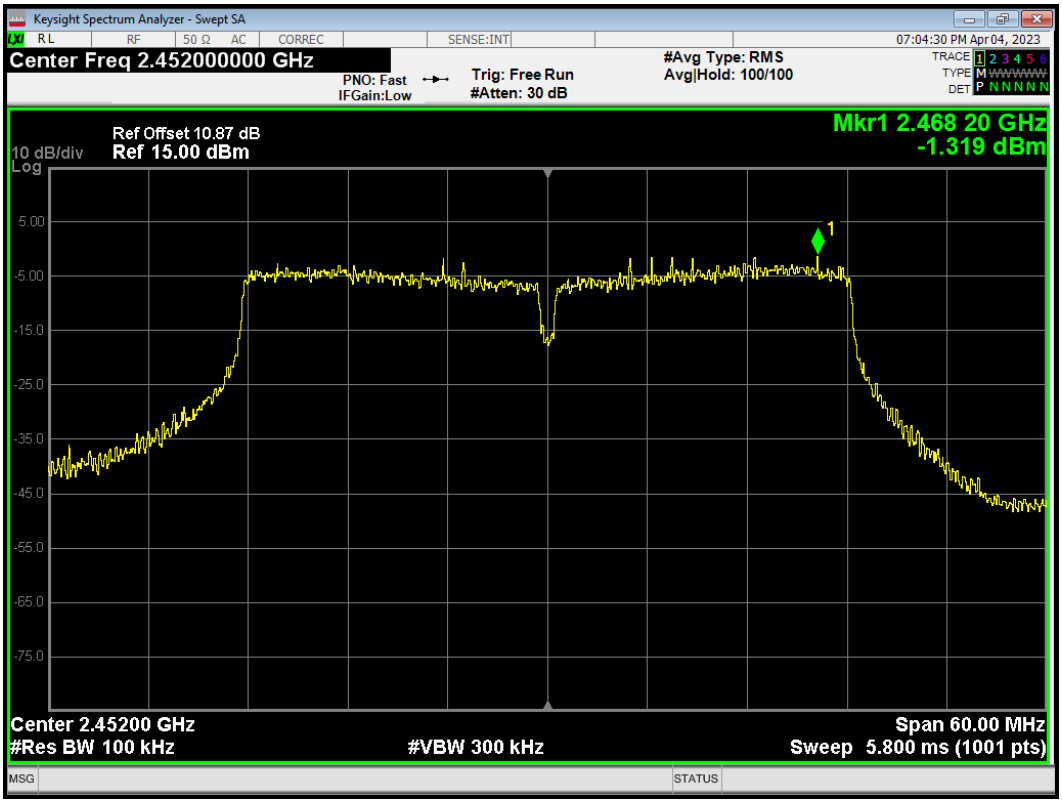


Tx. Spurious 802.11n(HT40) 2437MHz Emission

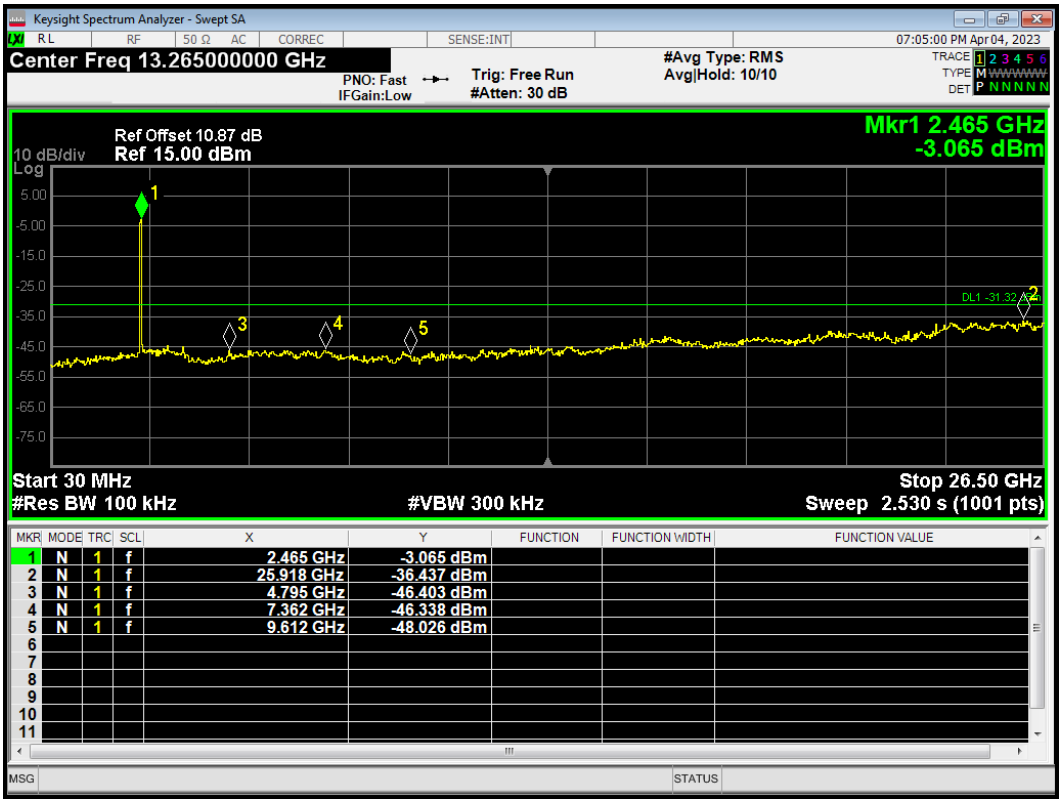


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious 802.11n(HT40) 2452MHz Ref



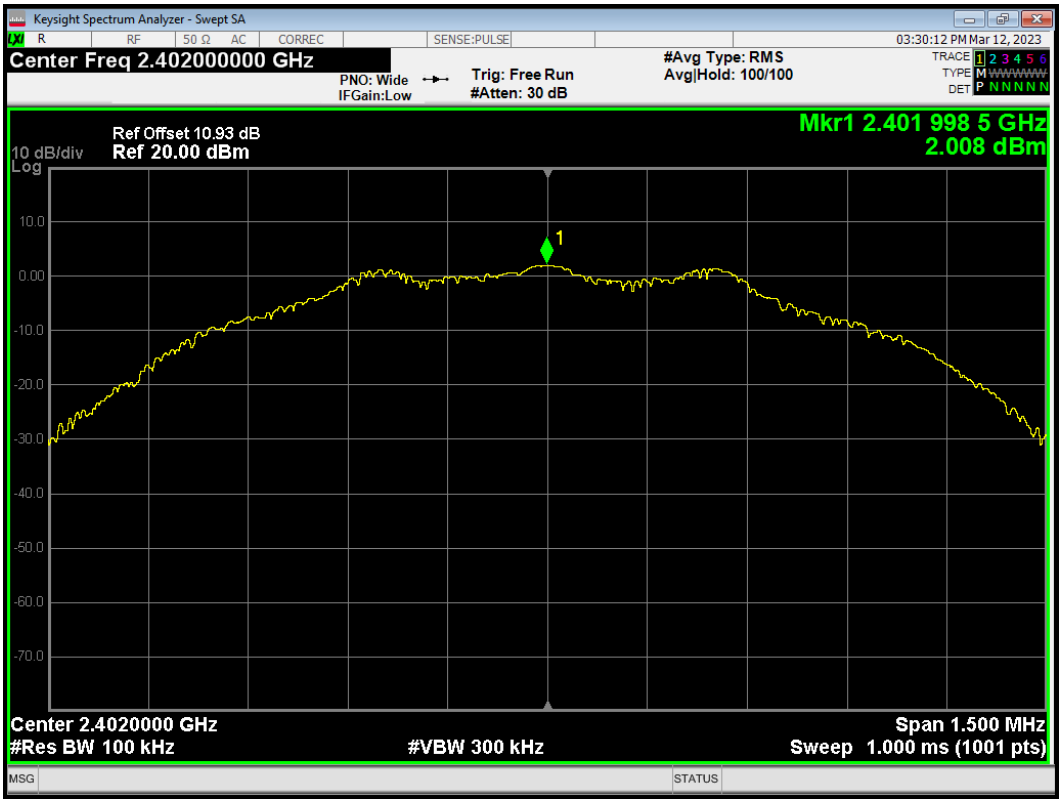
Tx. Spurious 802.11n(HT40) 2452MHz Emission



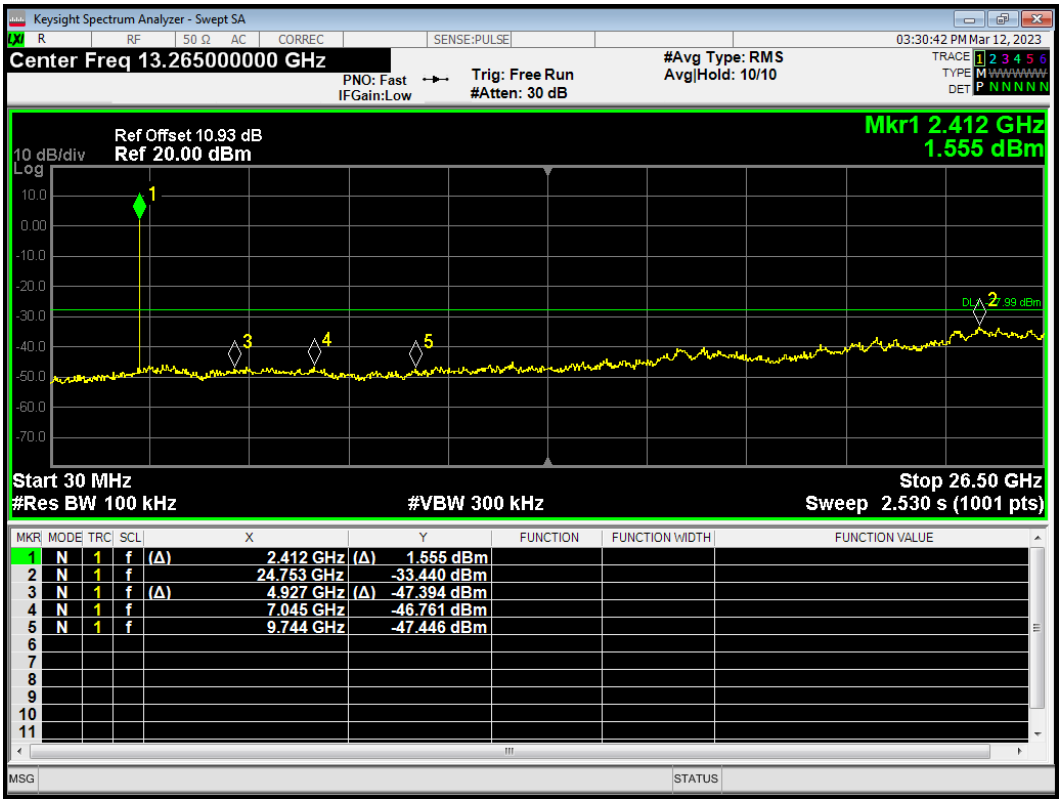
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.465 GHz	-3.065 dBm			
2	N	1	f	25.918 GHz	-36.437 dBm			
3	N	1	f	4.795 GHz	-46.403 dBm			
4	N	1	f	7.362 GHz	-46.338 dBm			
5	N	1	f	9.612 GHz	-48.026 dBm			
6								
7								
8								
9								
10								
11								

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious BLE 2402MHz Ref

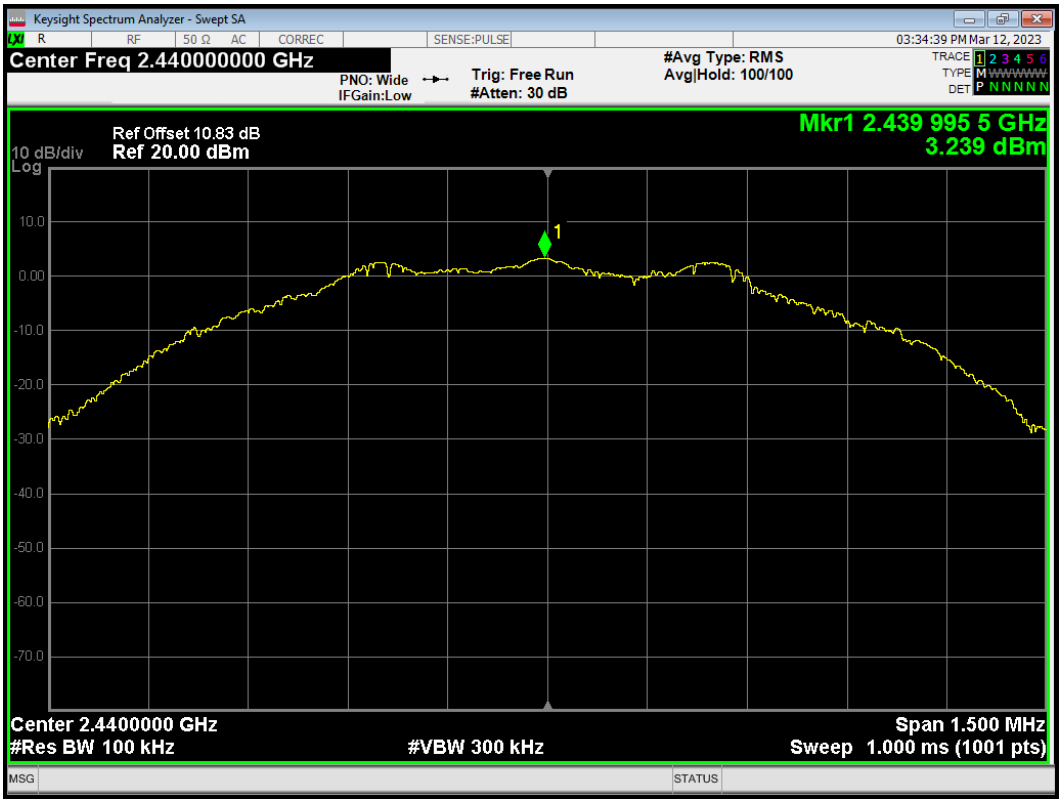


Tx. Spurious BLE 2402MHz Emission

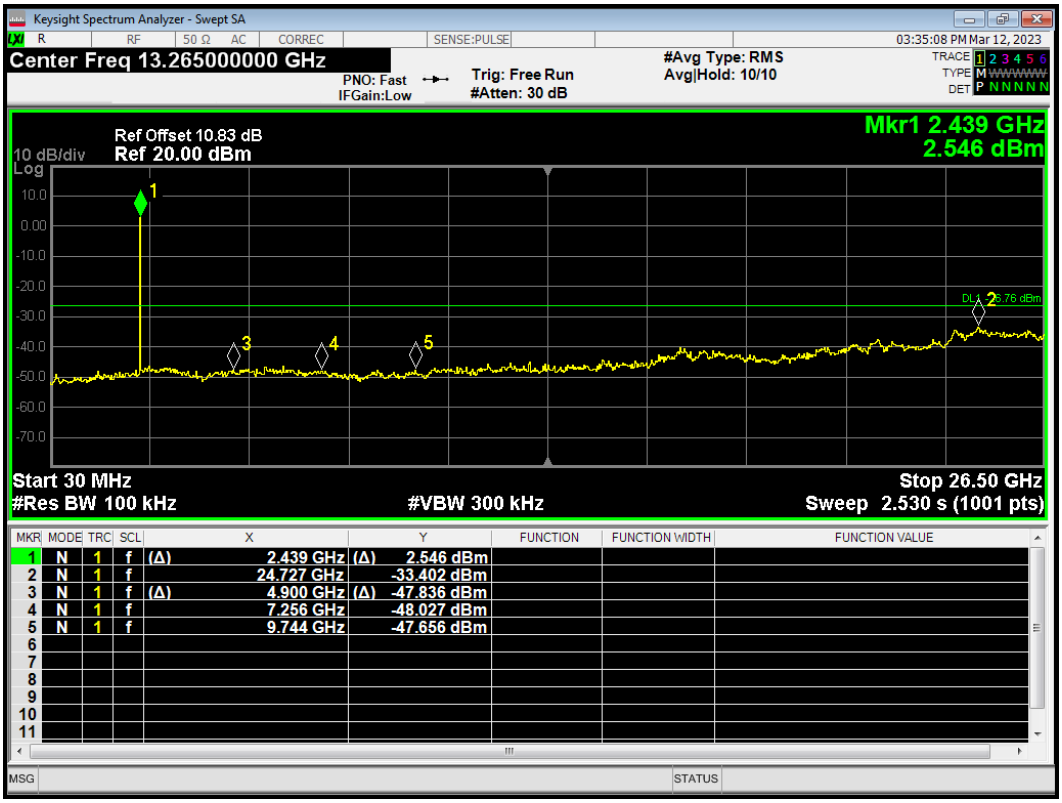


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious BLE 2440MHz Ref

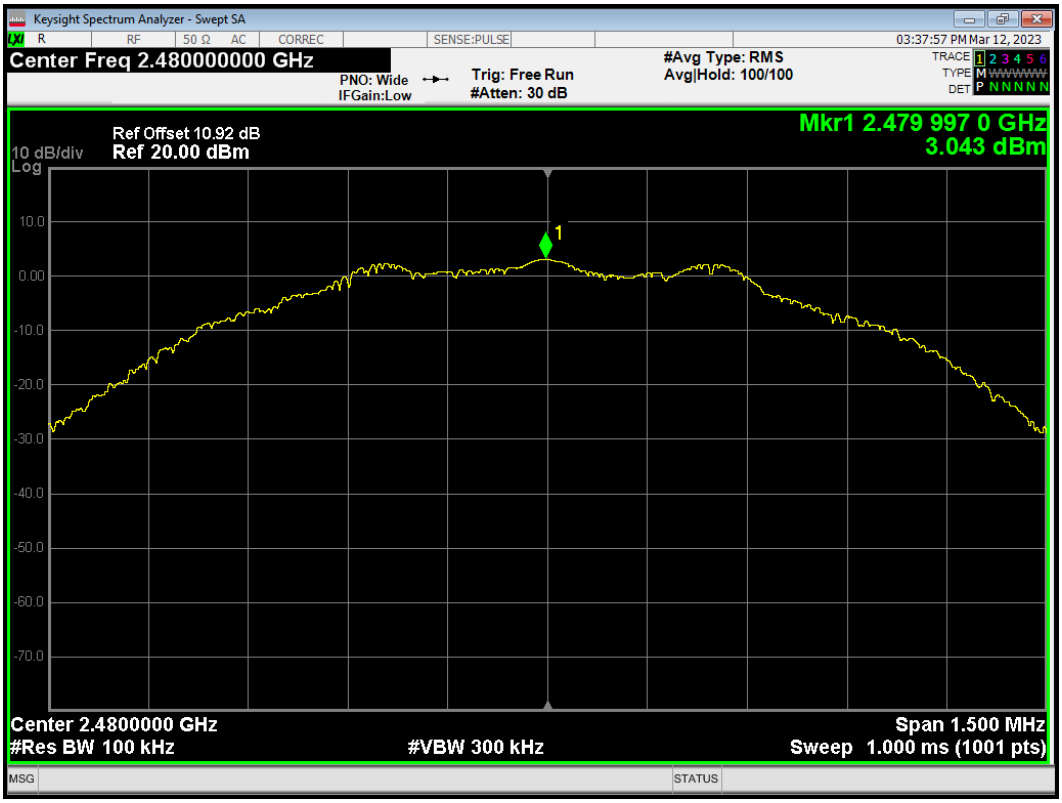


Tx. Spurious BLE 2440MHz Emission

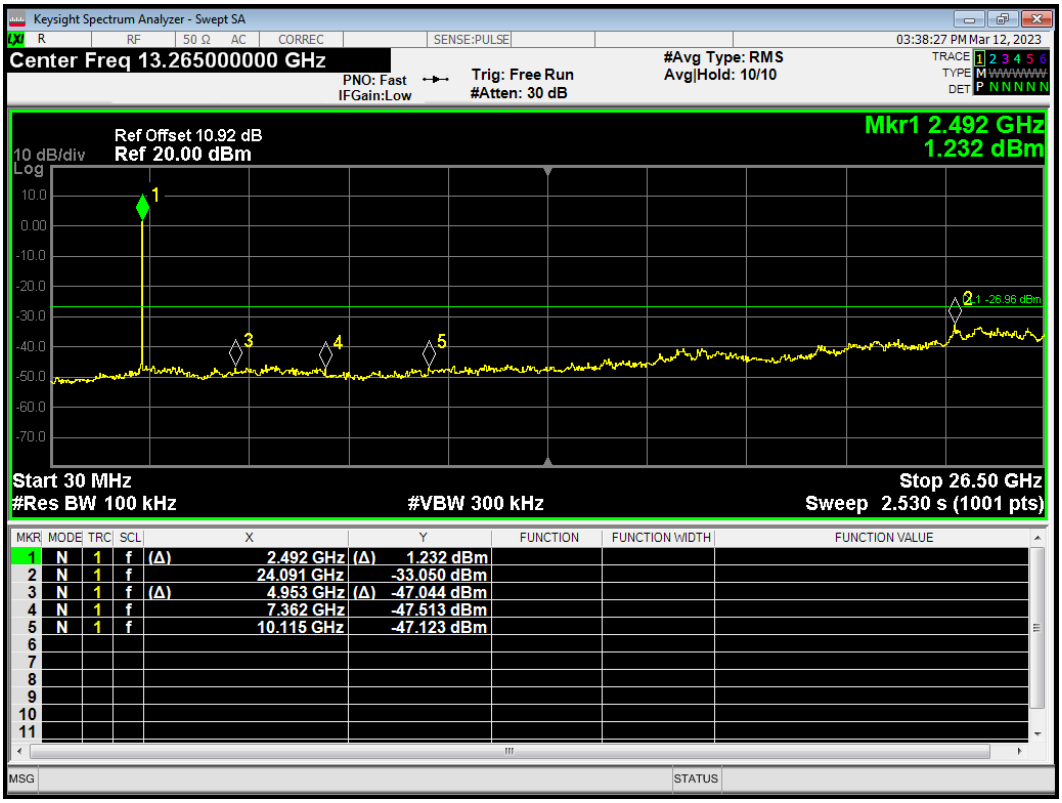


This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Tx. Spurious BLE 2480MHz Ref



Tx. Spurious BLE 2480MHz Emission



This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

5.6. Unwanted Emission

Ambient Condition

Temperature	Relative humidity
20°C ~ 25°C	45% ~ 50%

Method of Measurement

The test set-up was made in accordance to the general provisions of ANSI C63.10.
The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna.The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing. Sweep the Restricted Band and the emissions less than 20 dB below the permissible value are reported.
The radiated emissions measurements were made in a typical installation configuration.
Sweep the whole frequency band through the range from 9 kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

This method refer to ANSI C63.10.
The procedure for peak unwanted emissions measurements above 1000 MHz is as follows:
Set the spectrum analyzer in the following:
9kHz~150 kHz
RBW=200Hz, VBW=1kHz/ Sweep=AUTO
150 kHz~30MHz
RBW=9KHz, VBW=30KHz,/ Sweep=AUTO
Below 1GHz
RBW=100kHz / VBW=300kHz / Sweep=AUTO
a) Peak emission levels are measured by setting the instrument as follows:
Above 1GHz
PEAK: RBW=1MHz VBW=3MHz/ Sweep=AUTO
b) Average emission levels are measured by setting the instrument as follows:
Above 1GHz
AVERAGE: RBW=1MHz / VBW=3MHz / Sweep=AUTO
c) Detector: The measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

averaging. Log or dB averaging shall not be used.)

e) Sweep time = auto.

f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

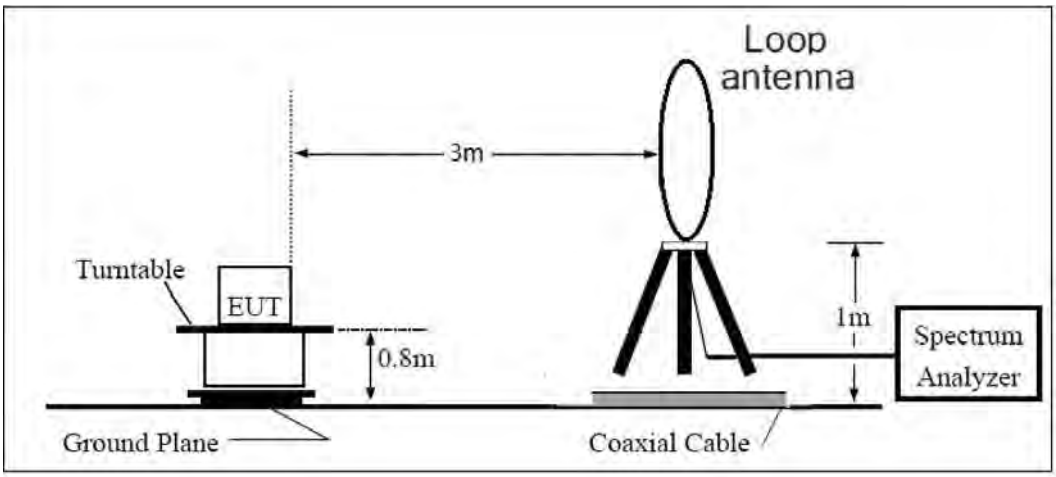
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

The test is in transmitting mode.

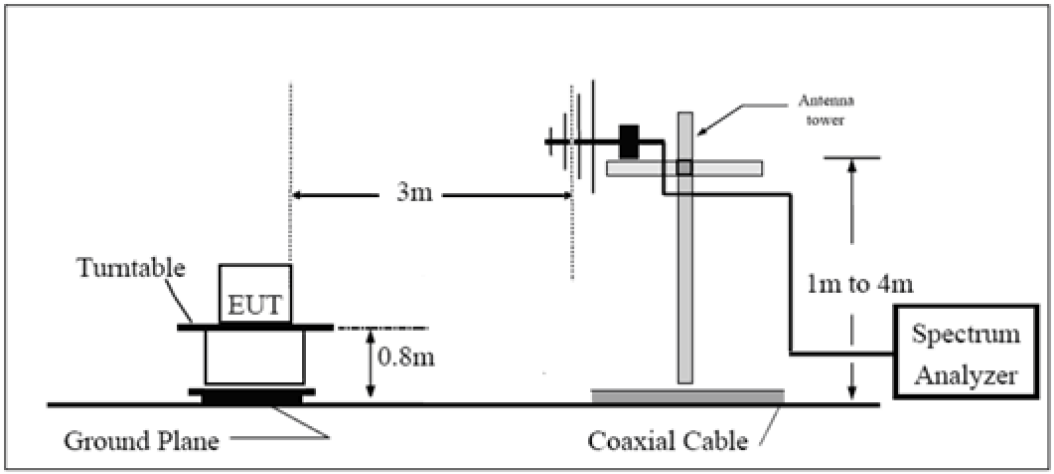
This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Test Setup

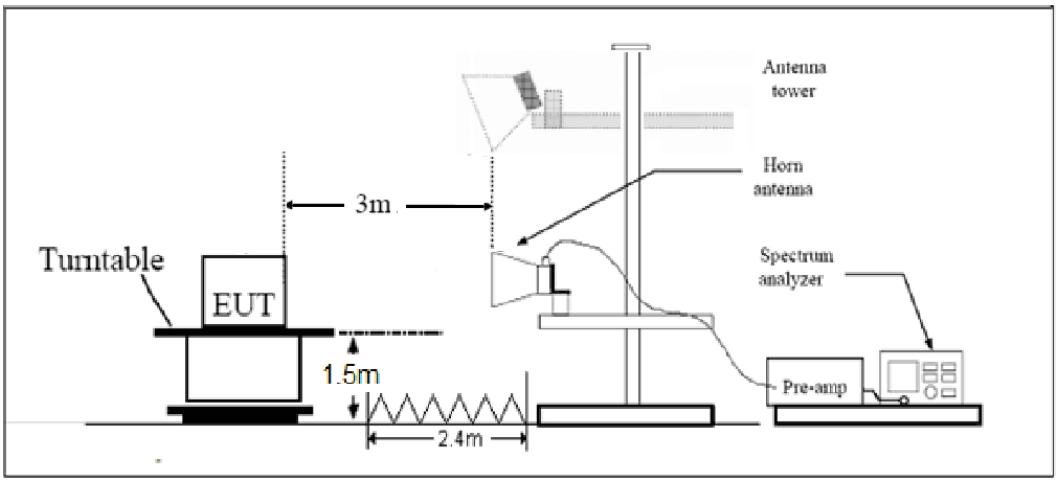
9KHz~ 30MHz



30MHz~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Limits

Rule Part 15.247(d) specifies that "In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c))."

Limit in restricted band

Frequency of emission (MHz)	Field strength(μV/m)	Field strength(dBμV/m)
0.009–0.490	2400/F(kHz)	/
0.490–1.705	24000/F(kHz)	/
1.705–30.0	30	/
30-88	100	40
88-216	150	43.5
216-960	200	46
Above960	500	54

§15.35(b)

There is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

Peak Limit=74 dBμV/m

Average Limit=54 dBμV/m

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Spurious Radiated Emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1] 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41			

Measurement Uncertainty

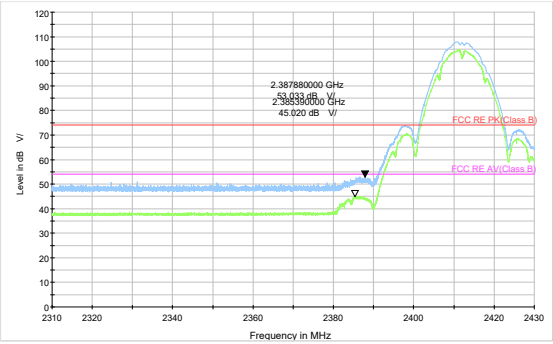
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor *k* = 1.96.

Frequency	Uncertainty
9KHz-30MHz	3.55 dB
30MHz-200MHz	4.17 dB
200MHz-1GHz	4.84 dB
1-18GHz	4.35 dB
18-26.5GHz	5.90 dB
26.5GHz~40GHz	5.92 dB

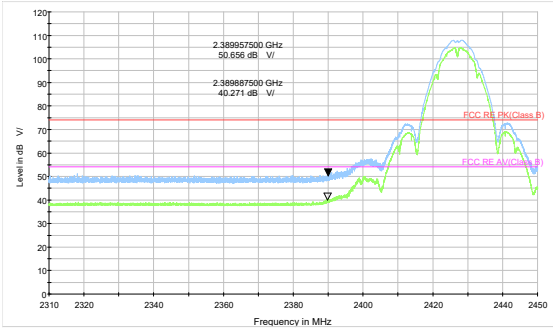
This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Test Results:

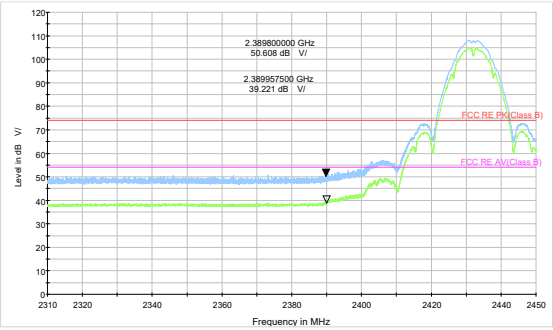
A symbol (dB V/) in the test plot below means (dBμV/m)



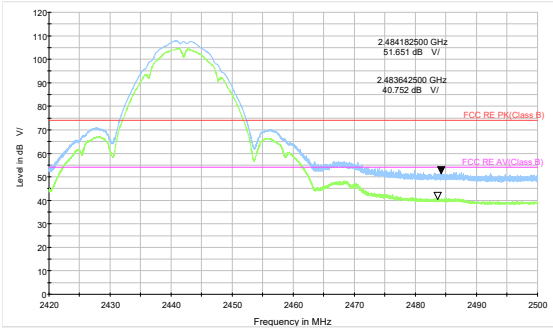
802.11b-Channel 1 Peak+ Average



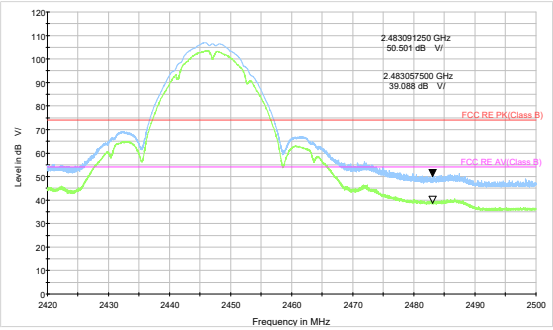
802.11b-Channel 4 Peak+ Average



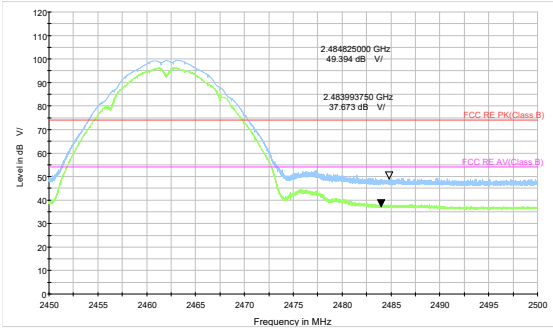
802.11b-Channel 5 Peak+ Average



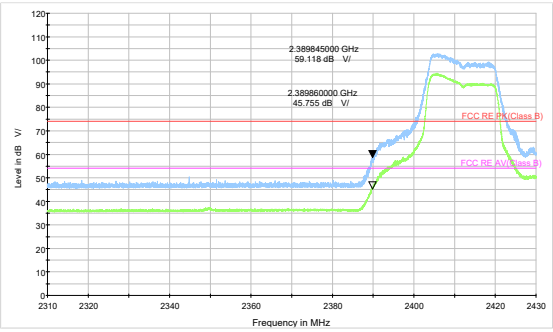
802.11b-Channel 7 Peak+ Average



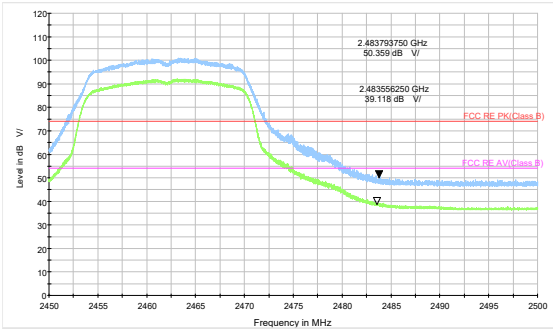
802.11b-Channel 8 Peak+ Average



802.11b-Channel 11 Peak+ Average

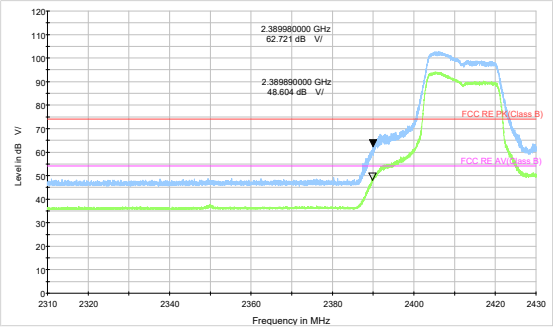


802.11g-Channel 1 Peak+ Average

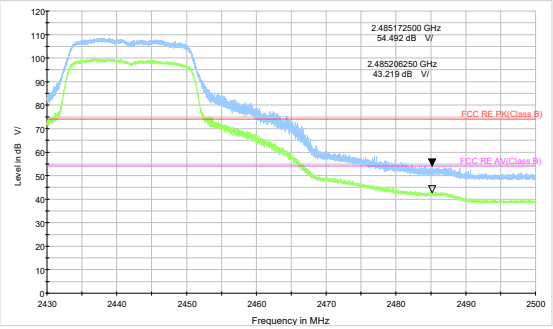


802.11g-Channel 11 Peak+ Average

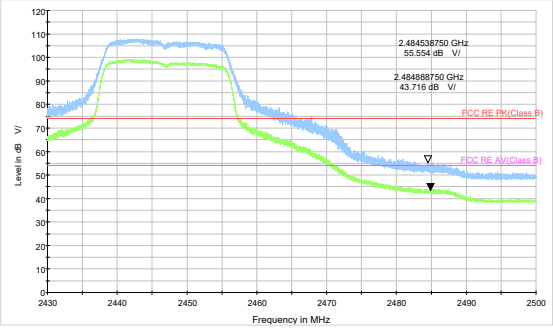
This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.



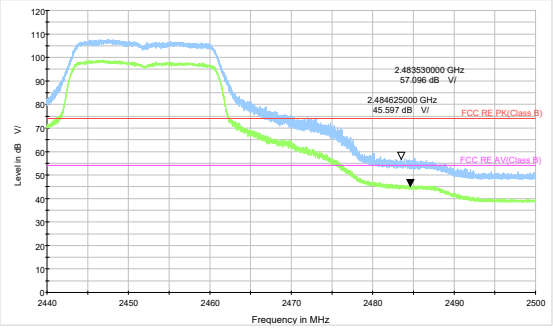
802.11n HT20 -Channel 1 Peak+ Average



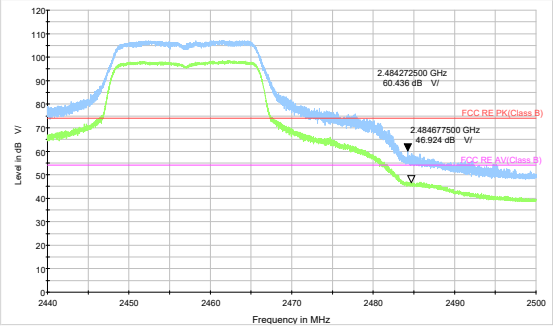
802.11n HT20 -Channel 7 Peak+ Average



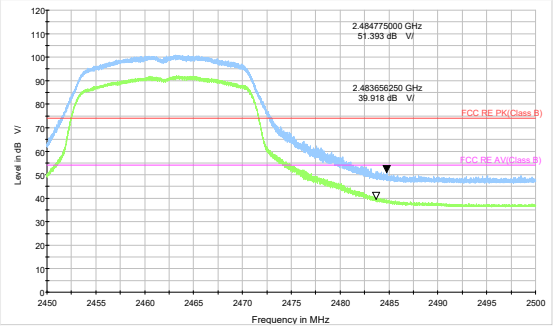
802.11n HT20 -Channel 8 Peak+ Average



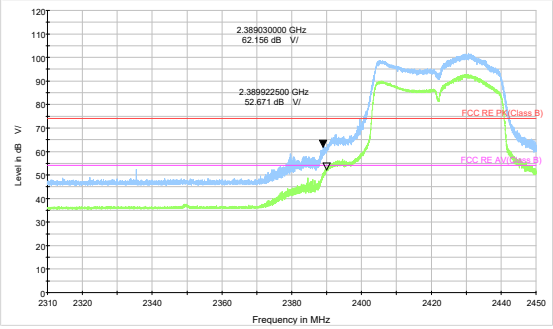
802.11n HT20 -Channel 9 Peak+ Average



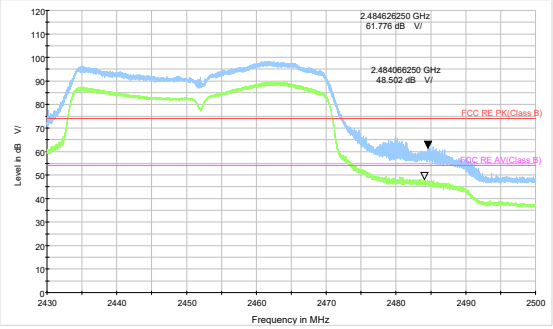
802.11n HT20 -Channel 10 Peak+ Average



802.11n HT20 -Channel 11 Peak+ Average



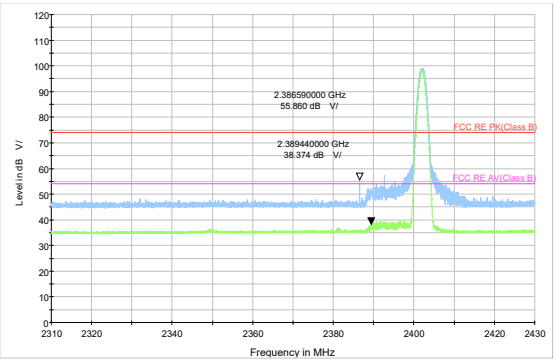
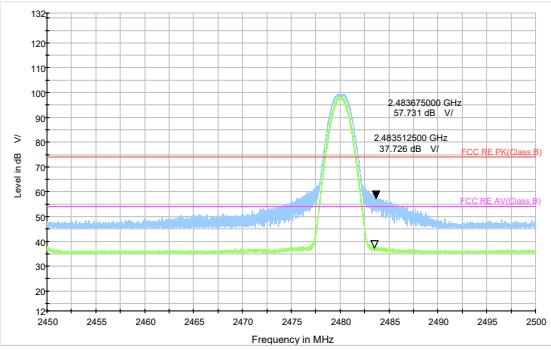
802.11n HT40 –Channel 3 Peak+ Average



802.11n HT40 –Channel 9 Peak+ Average

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

After the pretest, Bluetooth LE (1M) was selected as the worst Mode for Bluetooth LE.

	
Bluetooth LE (1M) Channel 0 Peak+ Average	Bluetooth LE (1M) Channel 39 Peak+Average

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Result of RE

Test result

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the Emissions in the frequency band 9kHz-30MHz and 18GHz-26.5GHz are more than 20dB below the limit are not reported.

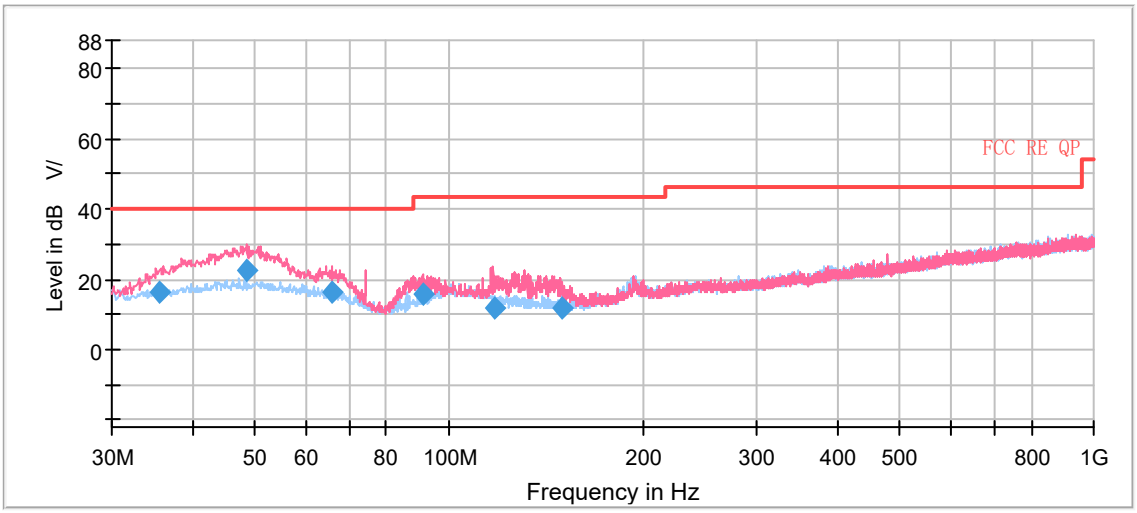
The following graphs display the maximum values of horizontal and vertical by software.
For above 1GHz, Blue trace uses the peak detection, Green trace uses the average detection.

Continuous TX mode:

Wi-Fi 2.4G

During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes with all channels, **802.11b, Channel 5** are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

A symbol (dB V/) in the test plot below means (dBμV/m)



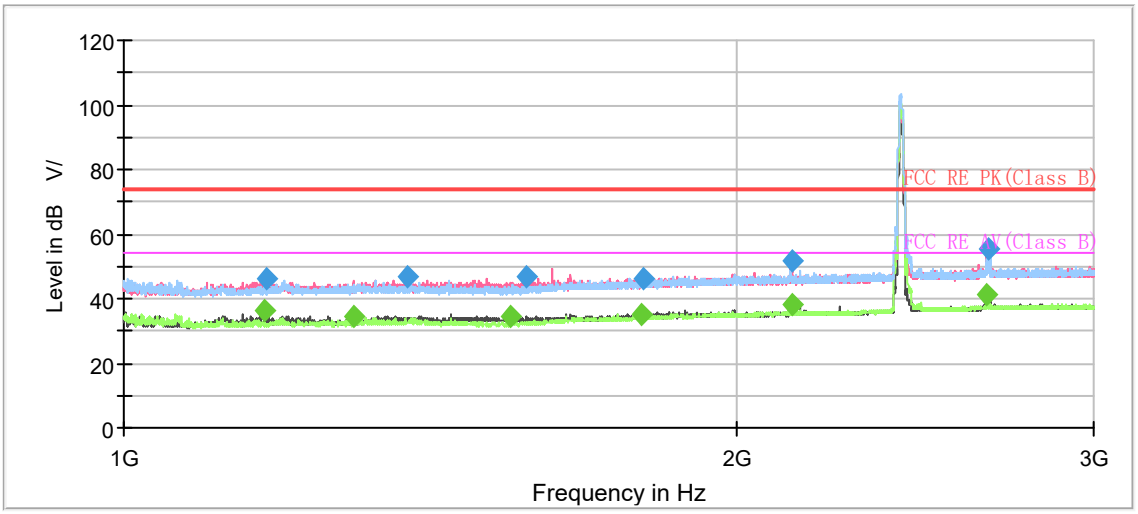
Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
35.479613	16.23	40.00	23.77	100.0	V	240.0	17.9
48.428494	22.64	40.00	17.36	100.0	V	144.0	20.5
65.879906	16.56	40.00	23.44	100.0	V	85.0	17.7
91.213806	15.61	43.50	27.89	109.0	V	178.0	16.7
117.886500	11.57	43.50	31.93	100.0	V	272.0	16.8
149.279500	12.01	43.50	31.49	100.0	V	149.0	14.7

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)
2. Margin = Limit – Quasi-Peak

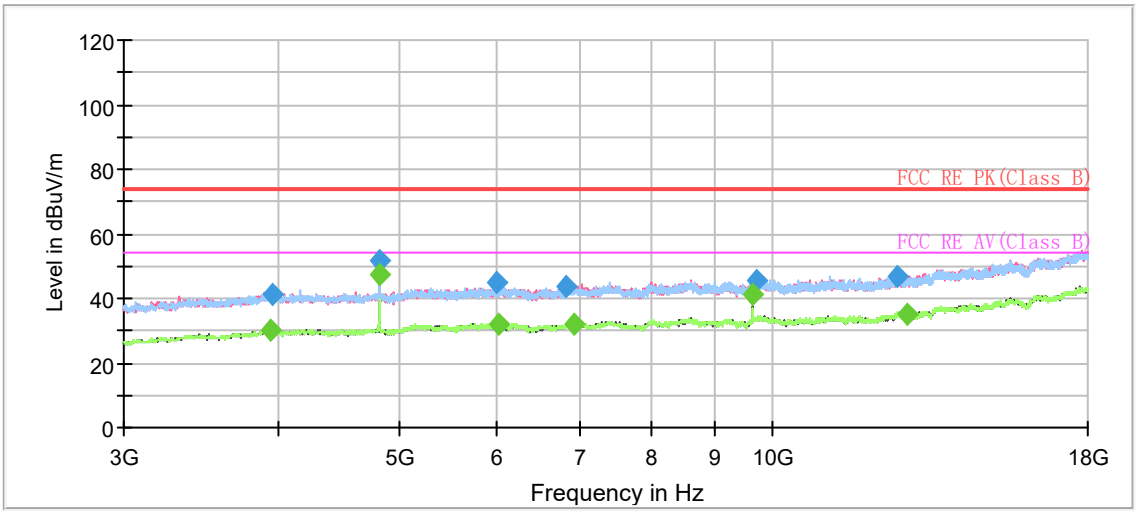
This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

802.11b CH1



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz



Radiates Emission from 3GHz to 18GHz

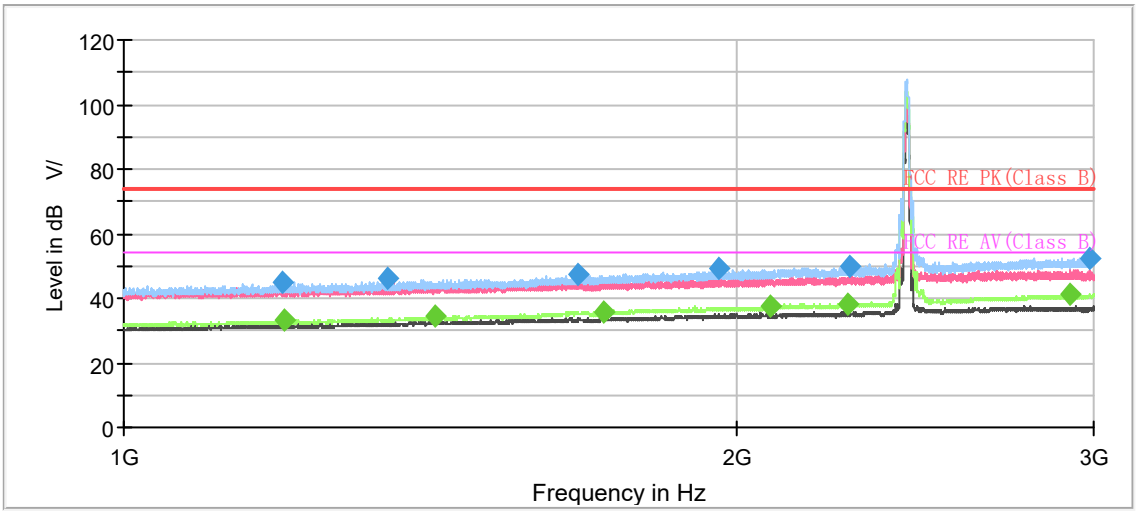
This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1174.000000	---	36.13	54.00	17.87	500.0	100.0	V	160.0	-7.9
1174.500000	46.23	---	74.00	27.77	500.0	100.0	V	160.0	-7.9
1296.750000	---	34.70	54.00	19.30	500.0	100.0	V	110.0	-7.2
1378.500000	46.62	---	74.00	27.38	500.0	100.0	V	275.0	-6.6
1549.750000	---	34.72	54.00	19.28	500.0	100.0	V	289.0	-5.7
1578.500000	46.77	---	74.00	27.23	500.0	100.0	V	6.0	-5.6
1797.750000	---	35.02	54.00	18.98	500.0	100.0	V	303.0	-4.4
1803.250000	46.15	---	74.00	27.85	500.0	100.0	V	105.0	-4.4
2131.500000	51.98	---	74.00	22.02	500.0	200.0	V	41.0	-2.9
2131.750000	---	38.26	54.00	15.74	500.0	200.0	V	41.0	-2.9
2658.500000	---	41.37	54.00	12.63	500.0	100.0	V	119.0	-0.3
2663.000000	55.44	---	74.00	18.56	500.0	100.0	V	119.0	-0.3
4824.058750	51.43	---	74.00	22.57	500.0	100.0	H	99.0	-4.2
4824.066250	---	47.66	54.00	6.34	500.0	100.0	H	99.0	-4.2

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)
2. Margin = Limit –MAX Peak/ Average

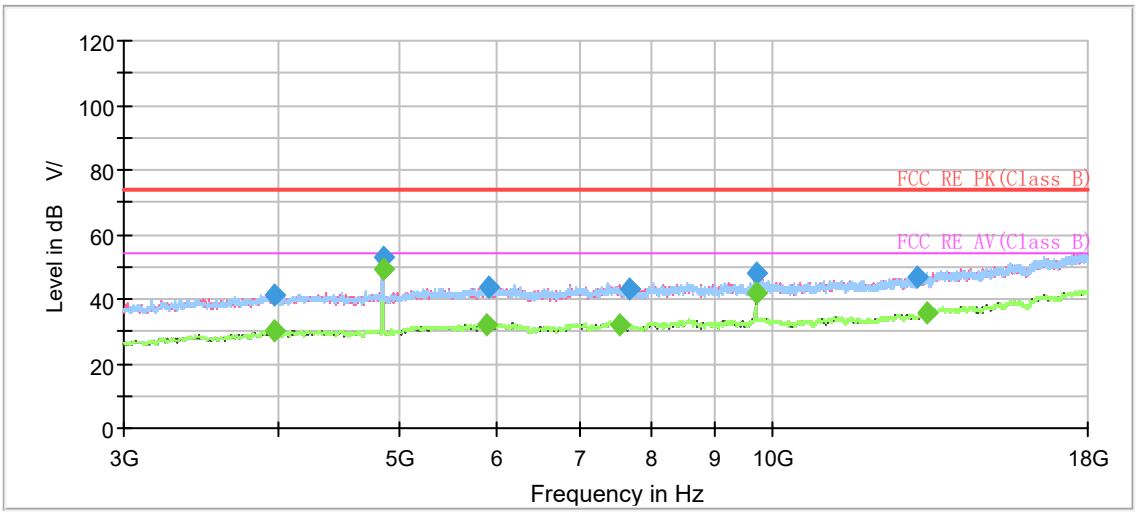
This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

802.11b CH4



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz



Radiates Emission from 3GHz to 18GHz

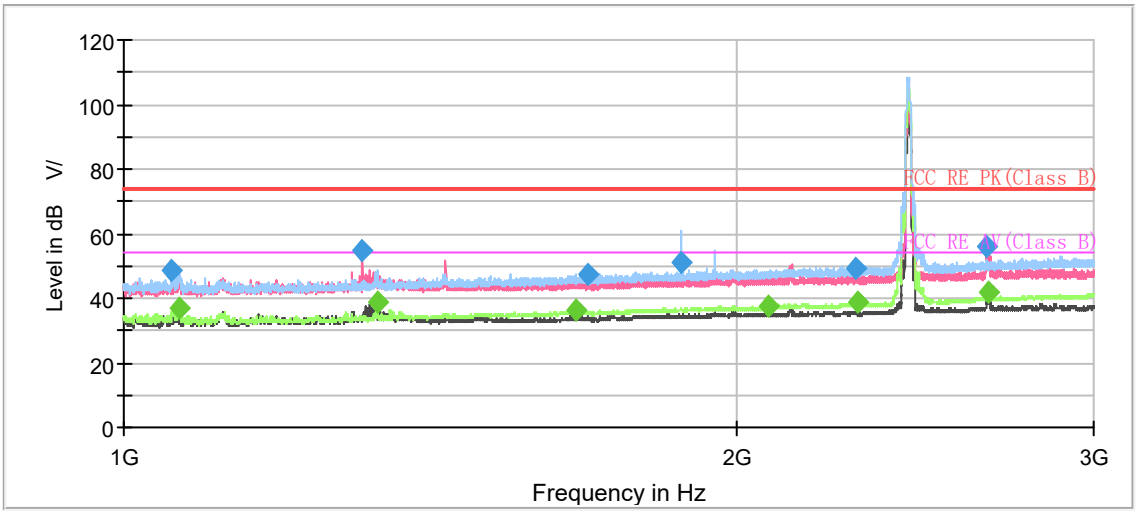
This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1197.750000	44.62	---	74.00	29.38	500.0	200.0	H	289.0	-7.7
1199.000000	---	33.00	54.00	21.00	500.0	200.0	H	321.0	-7.7
1347.250000	45.94	---	74.00	28.06	500.0	200.0	H	289.0	-6.8
1424.000000	---	34.32	54.00	19.68	500.0	200.0	H	84.0	-6.3
1672.750000	47.55	---	74.00	26.45	500.0	200.0	H	144.0	-5.0
1722.500000	---	35.81	54.00	18.19	500.0	100.0	H	0.0	-4.8
1964.000000	48.97	---	74.00	25.03	500.0	200.0	H	331.0	-3.6
2079.500000	---	37.46	54.00	16.54	500.0	200.0	H	118.0	-3.1
2271.500000	---	38.33	54.00	15.67	500.0	200.0	H	316.0	-2.3
2273.500000	49.95	---	74.00	24.05	500.0	200.0	H	311.0	-2.3
2920.250000	---	41.19	54.00	12.81	500.0	200.0	H	302.0	0.3
2986.250000	52.58	---	74.00	21.42	500.0	200.0	H	79.0	0.4
4854.037500	---	49.51	54.00	4.49	500.0	100.0	H	45.0	-4.1
4854.193750	52.83	---	74.00	21.17	500.0	100.0	H	45.0	-4.1

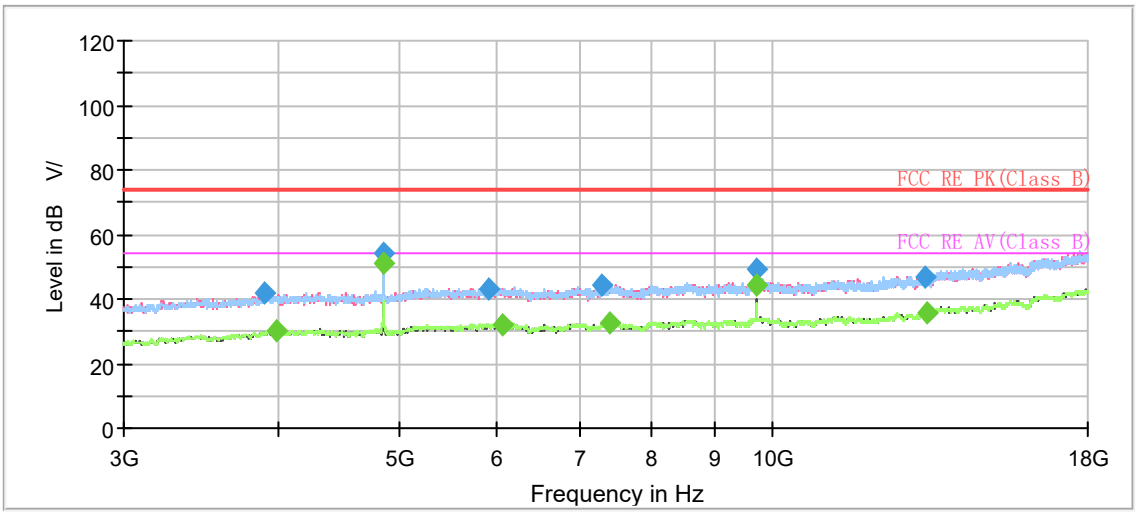
Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)
2. Margin = Limit –MAX Peak/ Average

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.

802.11b CH5



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz



Radiates Emission from 3GHz to 18GHz

This report shall not be reproduced except in full, without the written approval of TA Technology (Shanghai) Co., Ltd.