RF TEST REPORT

Report No.:	SET2019-10796
Product Name:	OverHeadProjector
Model No. :	MA-1
Applicant:	ELMO COMPANY, LIMITED
Address:	1-3-4, Shioya-cho, Minami-ku, Nagoya-Shi, Aichi Pref., Japan
Dates of Testing:	12/01/2018 — 03/01/2019
Issued by:	CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd.
Lab Location:	Building 28/29, East of Shigu, Xili Industrial Zone, Xili Road, Nanshan District, Shenzhen, Guangdong, China **Tel:** 86 755 26627338 **Fax:** 86 755 26627238

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Test Report

Product Name.....:	OverHeadProjector
Trade Name.....:	ELMO
Brand Name.....:	ELMO
Applicant.....:	ELMO COMPANY, LIMITED
Applicant Address.....:	1-3-4, Shioya-cho, Minami-ku, Nagoya-Shi, Aichi Pref., Japan
Manufacturer .....:	ELMO COMPANY, LIMITED
Manufacturer Address .....:	1-3-4, Shioya-cho, Minami-ku, Nagoya-Shi, Aichi Pref., Japan
Test Standards.....:	MIC Notice No.88 Appendix No.43 MIC Ordinance Regulating Radio Equipment Article 49.20.
Test Result.....:	PASS
Tested by .....:	Robin Luo 2019.05.21 Robin Luo, Test Engineer
Reviewed by .....:	Chris You 2019.05.21 Chris You, Senior Engineer
Approved by .....:	Shuangwen Zhang 2019.05.21 Shuangwen Zhang, Manager

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Change History		
Issue	Date	Reason for change
1.0	2019.05.21	First edition

1. General Information

1.1. EUT Description

EUT Type	OverHeadProjector
Hardware Version	MA-1
Software Version	0.5.1
Power Supply	3.3Vdc
EUT supports Radios application	WLAN2.4GHz 802.11b/g/n (HT20/HT40) WLAN5.0GHz 802.11a/n (HT20/40)/ac(VHT20/40/80)
Modulation technology	DSSS, OFDM
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM,16QAM, QPSK, BPSK for OFDM
Transfer Rate	2.4GHz: 802.11b: 11/5.5/2/1 Mbps 802.11g: 54/48/36/24/18/12/9/6 Mbps 802.11n: up to 150 Mbps
Frequency Range	2.4GHz: 802.11b:2412-2484MHz 802.11g, 802.11n(20MHz): 2412~2472MHz 802.11n(40MHz): 2422~2462MHz
Channel Number	2.4GHz: 802.11b:14 802.11g/n-20MHz: 13 802.11n-40MHz: 9
Antenna Type	Internal Antenna
Antenna Gain	5.22dBi
Product Type	Refer to note

The test data refers to SET2019-01796, the model MA-1 have the same RF module with MO-2.

1.2. Test Summary

Test detailed items/section required by MIC rules and results are as below:

Applied Standard: MIC Notice No.88 Appendix No.43			
Part	Rule Section	Description of Test	Result
3.1	3	Frequency Error	Complies
3.2	4	Occupied Bandwidth and Spread-spectrum Bandwidth / Factor	Complies
3.3	5	Unwanted Emission Intensity	Complies
3.4	6	Antenna Power Error	Complies
3.5	7	Limitation of Collateral Emission of Receiver	Complies
3.6	8	Transmission Antenna Gain (EIRP Antenna Power)	Complies
3.7	9	Transmission Radiation Angle Width (3dB Beamwidth)	Complies
3.8	10	Radio Interference Prevention Capability	Complies
3.9	Note 1	Carrier Sense Capability	N.A
3.10	Note 2	Construction Protection Confirmation	Complies

Note 1: Testing is only required OFDM system with occupied frequency bandwidth below 38MHz and exceed 26MHz.

1.3. Channel List

WLAN 2.4GHz

13 channels are provided for 802.11b, 802.11g, and 802.11n (20MHz)

Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432	12	2467
6	2437	13	2472
7	2442		

9 channels are provided for 802.11n (40MHz)

Channel	Frequency(MHz)	Channel	Frequency(MHz)
3	2422	8	2447
4	2427	9	2452
5	2432	10	2457
6	2437	11	2462
7	2442		

Note: The 802.11b/802.11g/802.11n (HT20) were selected 1/7/13 channel to perform the test, the 802.11n (HT40) selected 3/7/11 channel to perform the test.

1.4. Test environment and mode

Operating Environment	
Temperature	24℃
Humidity	57 % RH
Atmospheric Pressure	1010 mbar
Test mode：	
Continuously transmitting mode	Keeps the EUT in 100% duty cycle transmitting with modulation in SISO mode, duty cycle factor is not required.

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

Test Items	Mode	Data Rate	Channel
Frequency Error	Un-modulation	1 Mbps for 802.11b / 6 Mbps for 802.11g / MCS 0 for 802.11n	L/M/H
Occupied Bandwidth and Spread-spectrum Bandwidth / Factor	11b/11g/11n		L/M/H
Unwanted Emission Intensity	11b/11g/11n		L/M/H
Antenna Power Error	11b/11g/11n		L/M/H
Limitation of Collateral Emission of Receiver	11b/11g/11n		L/M/H
Transmission Antenna Gain	11b/11g/11n		L/M/H
Transmission Radiation Angle Width	11b/11g/11n		L/M/H
Radio Interference Prevention Capability	11b/11g/11n		L/M/H
Carrier Sense Capability	11b/11g/11n		L/M/H

1.5. Measurement Uncertainty

Test Items	Uncertainty	Remark
Frequency Error / 99% & 90% Bandwidth	±1.75×10-6	Confidence levels of 95%
Antenna Power	±0.849dB	Confidence levels of 95%
TX-RX Spurious Emissions	±0.614dB	Confidence levels of 95%
Transmission Antenna Gain	±2.49dB	Confidence levels of 95%
Temperature	±0.8℃	Confidence levels of 95%
Humidity	±4.1%	Confidence levels of 95%
DC / AC Power Source	±0.04%	Confidence levels of 95%

1.6. Test Facility

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. CCIC is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659.

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2. Test Results

2.1. Frequency Error Measurement

2.1.1. Limit

Item	Limits
Frequency Tolerance	≤±50ppm

2.1.2. Measuring Instruments and setting

Please refer to section 4 in this report. The following table is the setting of the spectrum.

Spectrum Parameter	Setting
Span Frequency	50 KHz
RB/VB	10 kHz / 10 kHz

2.1.3. Test Procedures

1 Frequency accuracy of SA shall be less than 10% of limits tolerance (5ppm)

2 Setting of SA is following as: RB:10kHz / VB:10kHz / SPAN: 100KHz

3 Center Frequency: The center frequency of testing for EUT

4 Sweep time: Auto

5 Detect mode: Positive peak

6 EUT have transmitted absence of modulation signal and fixed channelize. f is using the mark cursor to mark the peak frequency value, fc is declaring of channel frequency. Then the frequency error formula is $(fc-f)/fc\times10^{6}$ppm and the limit is less than ±50ppm

2.1.4. Test Setup Layout

2.1.5. Test Deviation

There is no deviation with the original standard.

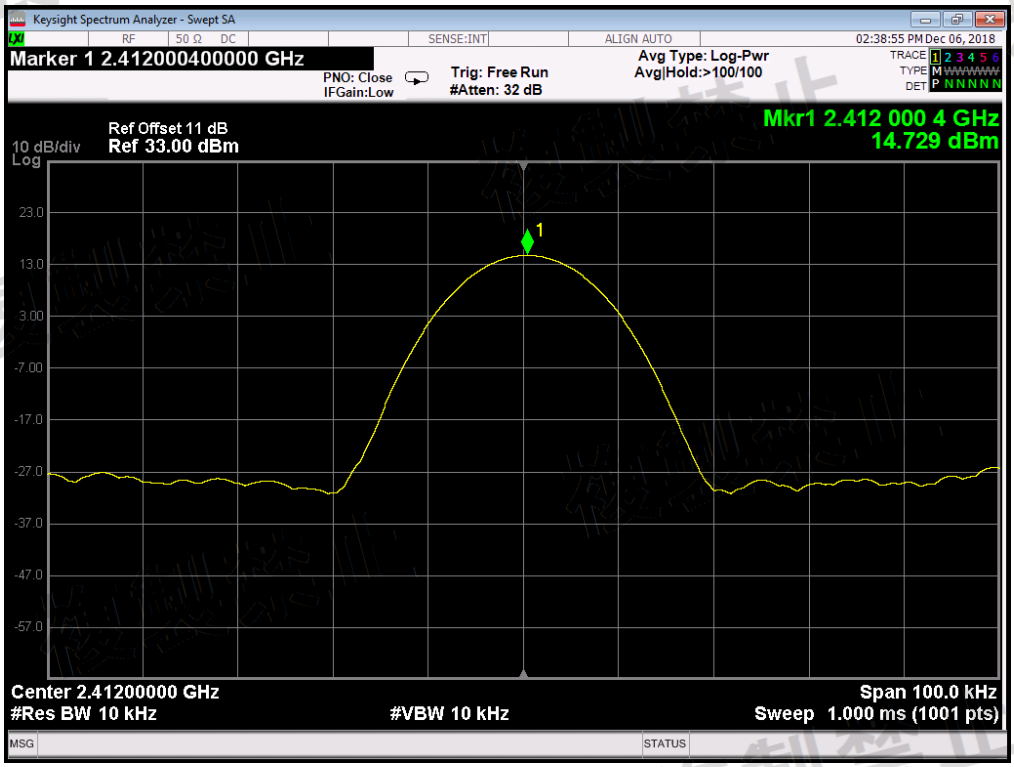
2.1.6. EUT Operation during Test

The EUT was placed on the test table and programmed in un-modulation function.

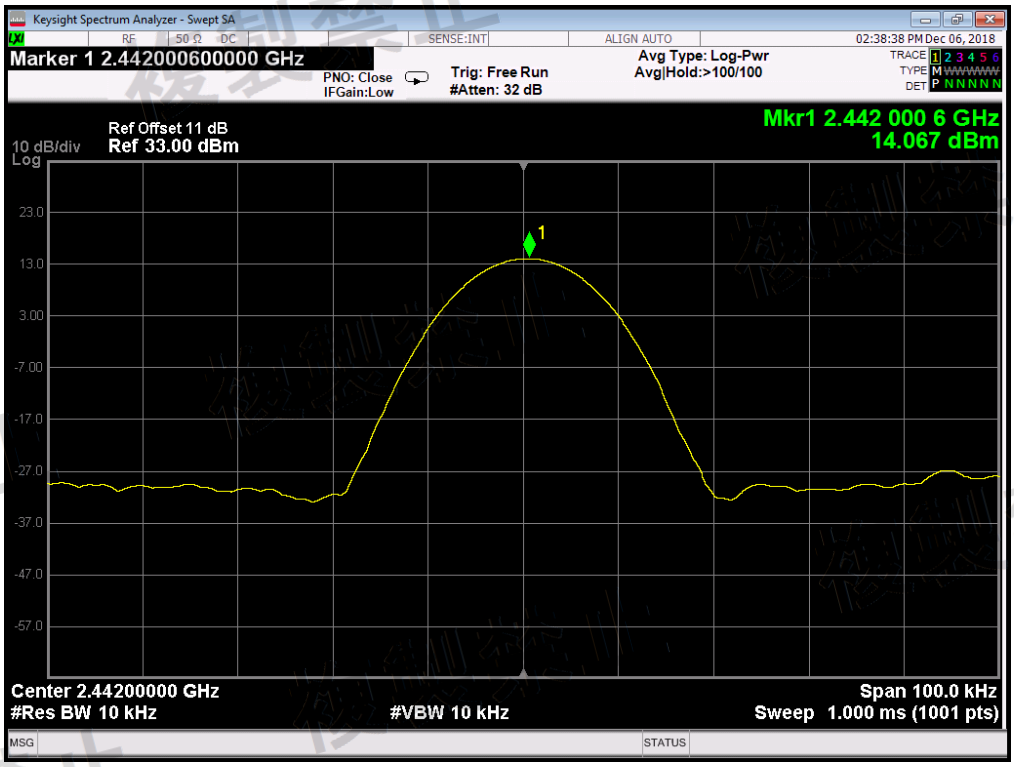
2.1.7. Results of Frequency Error

Test Voltage	Channel	Frequency fc (MHz)	Test Frequency f (MHz)	Frequency Error ppm	Refer to Plot	Verdict
20MHz BW	1	2412	2412.0004	-0.17	Plot A1	PASS
	7	2442	2442.0006	-0.25	Plot A2	PASS
	13	2472	2472.0006	-0.24	Plot A3	PASS
40MHz BW	2	2422	2422.0005	-0.21	Plot B1	PASS
	7	2442	2442.0005	-0.20	Plot B2	PASS
	11	2462	2462.0005	-0.20	Plot B3	PASS

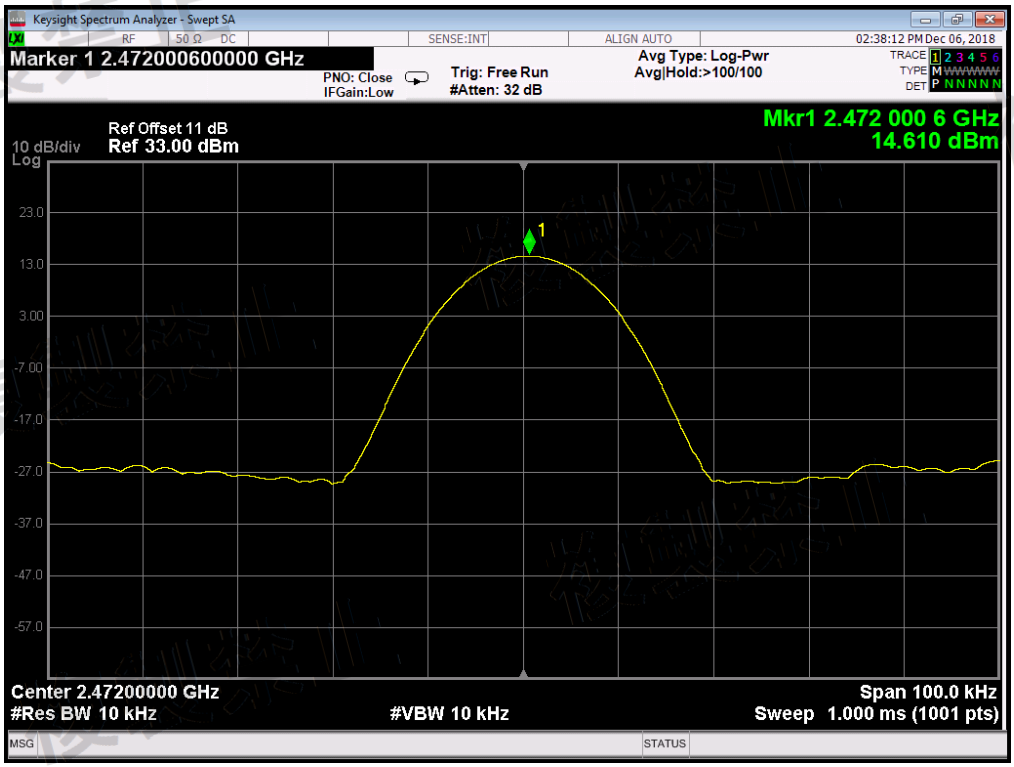
2.1.8. Test Plots



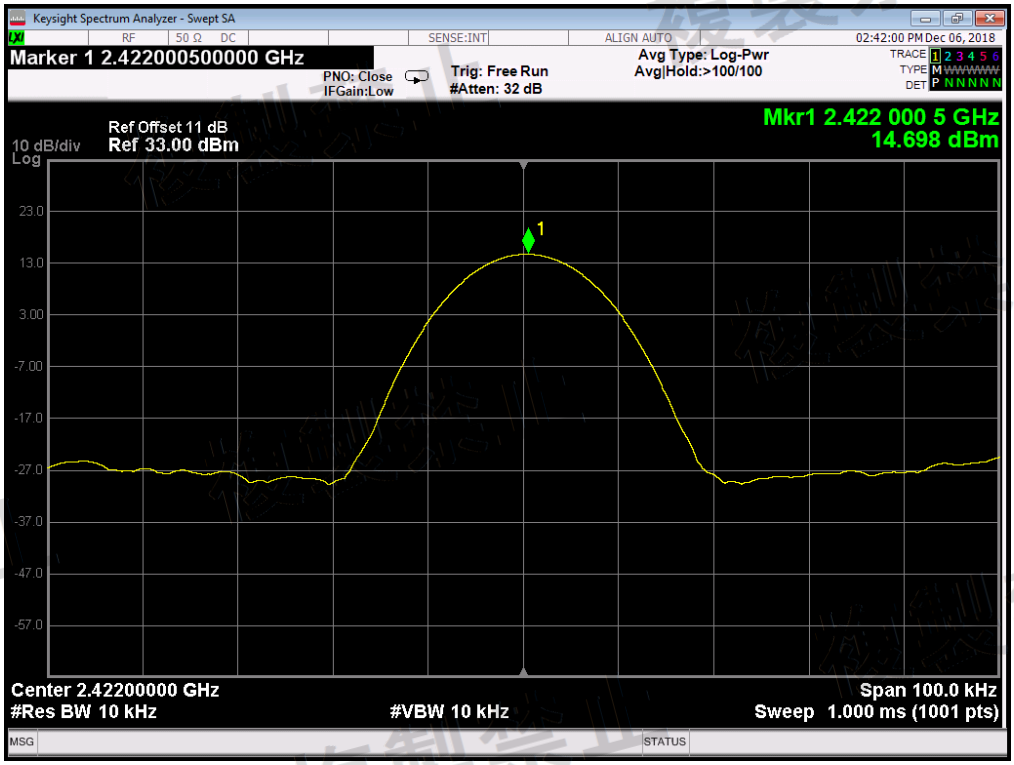
(Plot A1: Channel 1)



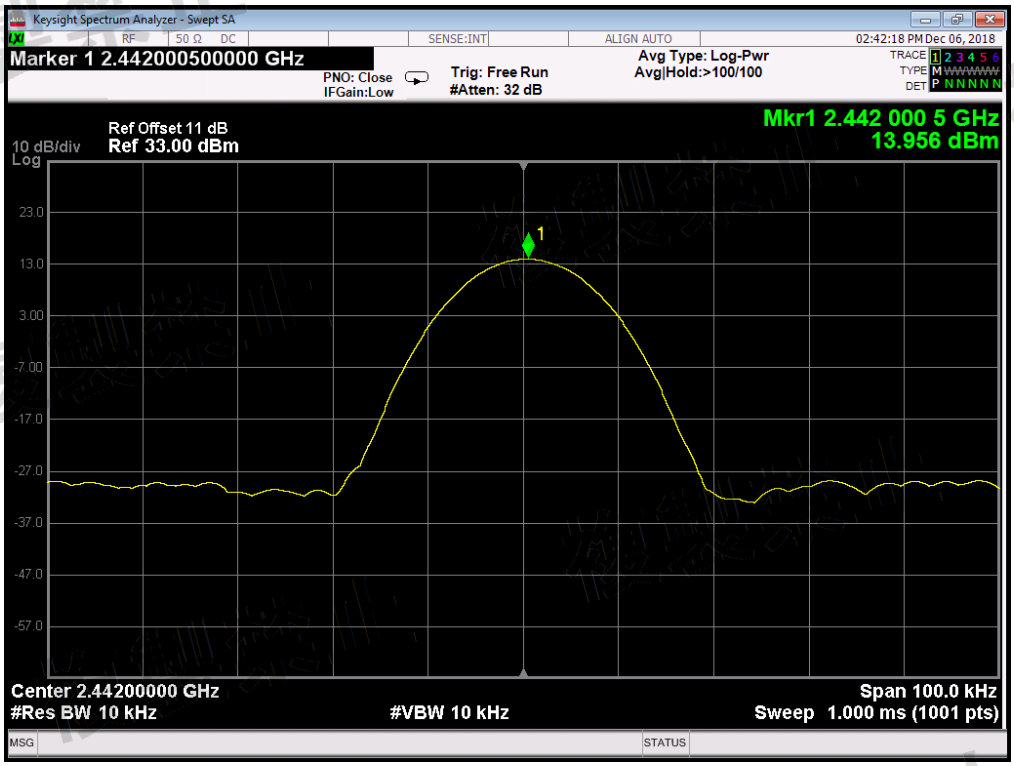
(Plot A2: Channel 7)



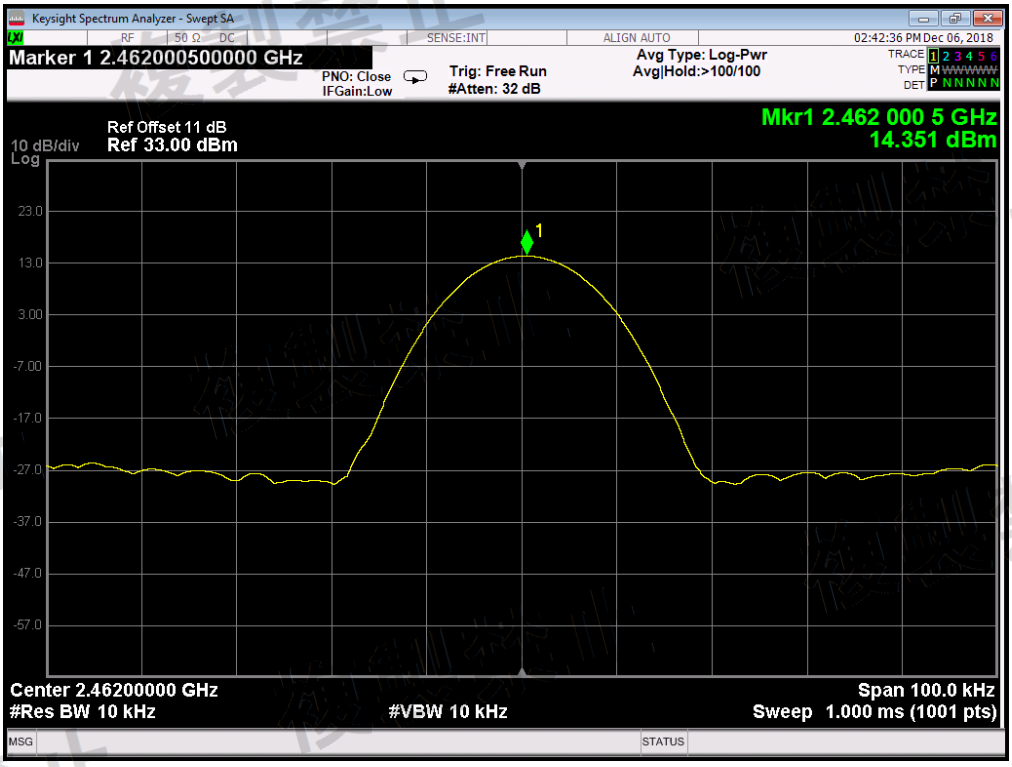
(Plot A3: Channel 13)



(Plot B1: Channel 2)



(Plot B2: Channel 7)



(Plot B3: Channel 11)

2.2. Occupied Bandwidth and Spread-spectrum Bandwidth / Factor

2.2.1. Limit

Item	Limits
Occupied Band Width	FH≤83.5MHz; OFDM, DS≤26MHz; Others≤26MHz;
Spread-spectrum Bandwidth	≥500KHz (FH, DS)

2.2.2. Measuring Instruments and setting

Please refer to section 4 in this report. The following table is the setting of the spectrum.

Spectrum Parameter	Setting
Span Frequency	50MHz
RB/VB	300 kHz

2.2.3. Test Procedures

1 Setting of SA is following as: RB:300kHz / VB:300kHz / SPAN: 50MHz / Sweep time: Auto /Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold

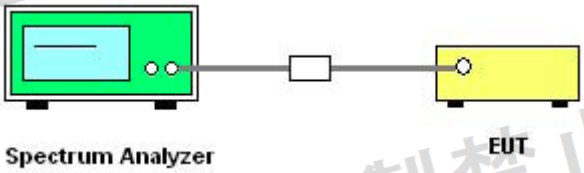
2 EUT have transmitted the maximum modulation signal and fixed channelize (For DSSS or OFDM Device) or continuous maximum power of hopping mode (For FHSS Device). SA set to 99% of occupied bandwidth to measure occupied bandwidth. The limit is less than 26MHz (For DSSS or OFDM Device) or 83.5MHz (For FHSS Device).

3 SA set to 90% of occupied bandwidth to measure Spread Spectrum Bandwidth and must greater than 500kHz.

4 Spread Spectrum Factor = Spread Spectrum Bandwidth / modulation rate of EUT.

5 Spread Spectrum Factor limit is greater than 5

2.2.4. Test Setup Layout



2.2.5. Test Deviation

There is no deviation with the original standard.

2.2.6. EUT Operation during Test

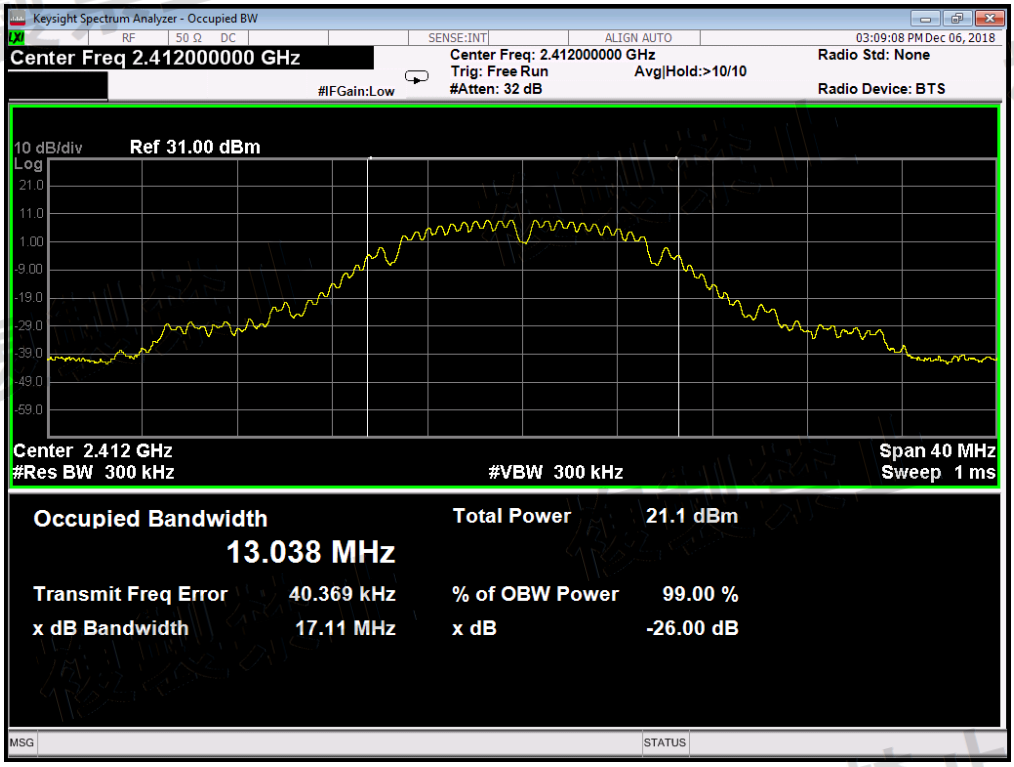
The EUT was programmed to be in continuously transmitting mode.

2.2.7. Results of Occupied Bandwidth

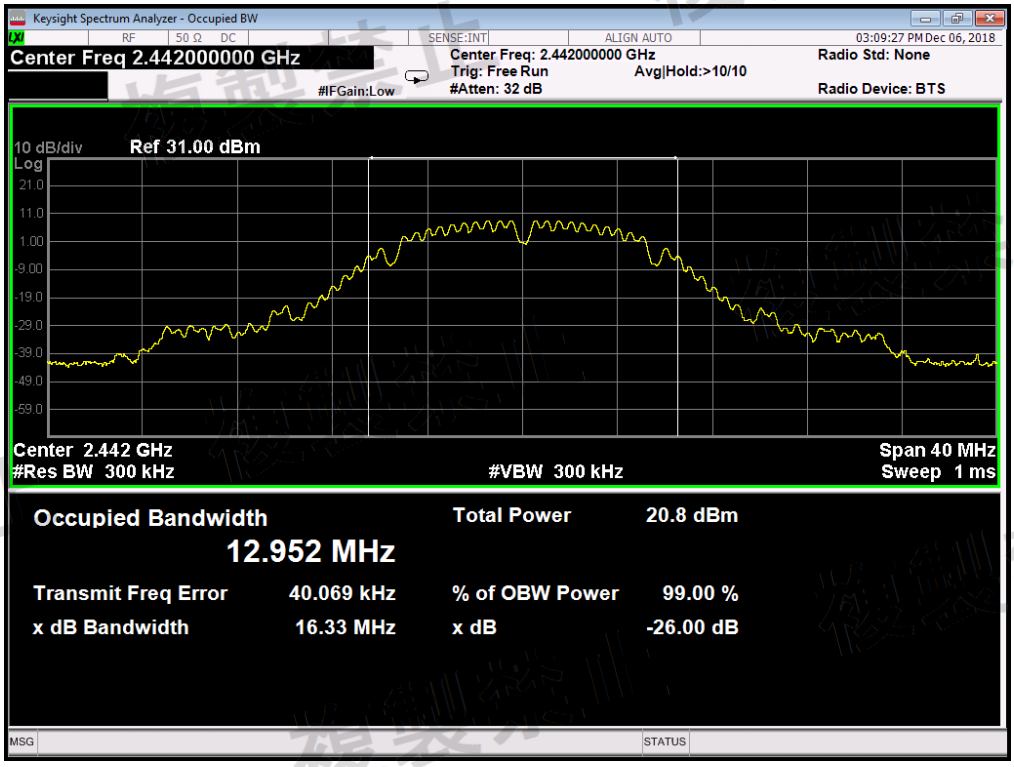
Test Voltage	Channel	Frequency (MHz)	99% OBW (MHz)	Refer to Plot	Verdict
802.11b	1	2412	13.04	Plot A1	PASS
	7	2442	12.95	Plot A2	PASS
	13	2472	12.78	Plot A3	PASS
802.11g	1	2412	16.98	Plot A4	PASS
	7	2442	17.01	Plot A5	PASS
	13	2472	16.95	Plot A6	PASS
802.11n20	1	2412	17.92	Plot A7	PASS
	7	2442	17.92	Plot A8	PASS
	13	2472	17.89	Plot A9	PASS
802.11n40	2	2422	36.15	Plot A10	PASS
	7	2442	36.20	Plot A11	PASS
	11	2462	35.94	Plot A12	PASS

Test Voltage	Channel	Frequency (MHz)	Spread-spectrum Bandwidth (MHz)	Refer to Plot	Verdict
802.11b	1	2412	8.92	Plot B1	PASS
	7	2442	8.92	Plot B2	PASS
	13	2472	8.89	Plot B3	PASS
802.11g	1	2412	14.23	Plot B4	PASS
	7	2442	14.25	Plot B5	PASS
	13	2472	14.14	Plot B6	PASS
802.11n20	1	2412	15.16	Plot B7	PASS
	7	2442	15.17	Plot B8	PASS
	13	2472	15.11	Plot B9	PASS
802.11n40	2	2422	31.21	Plot B10	PASS
	7	2442	31.60	Plot B11	PASS
	11	2462	31.36	Plot B12	PASS

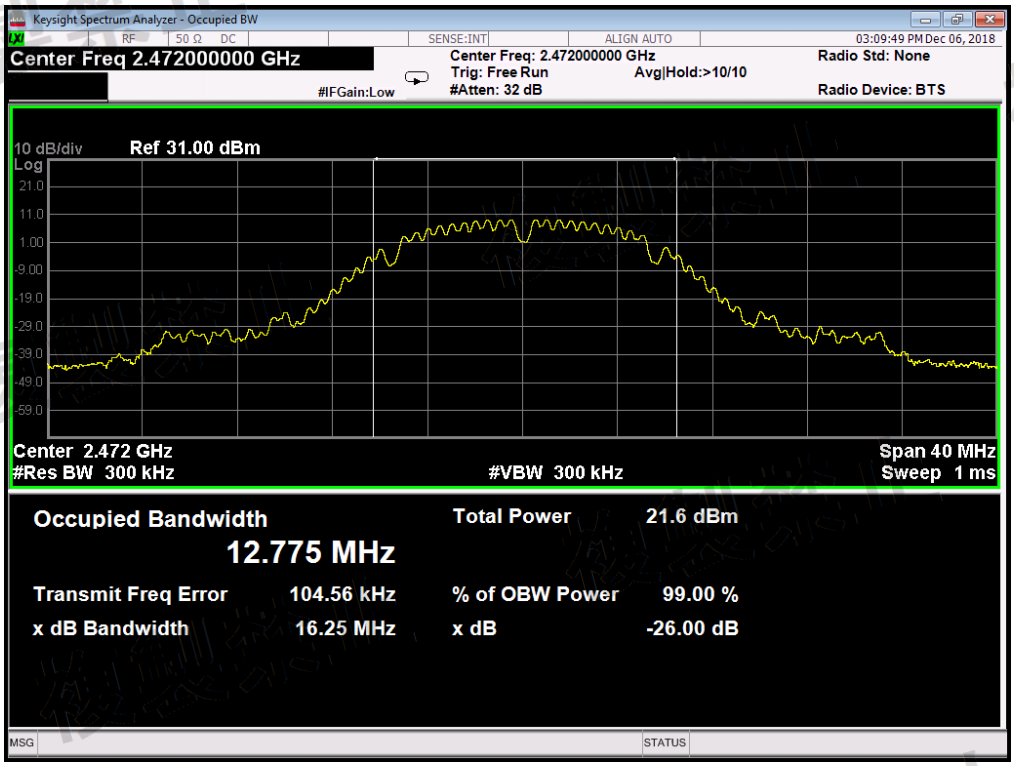
Test Plots



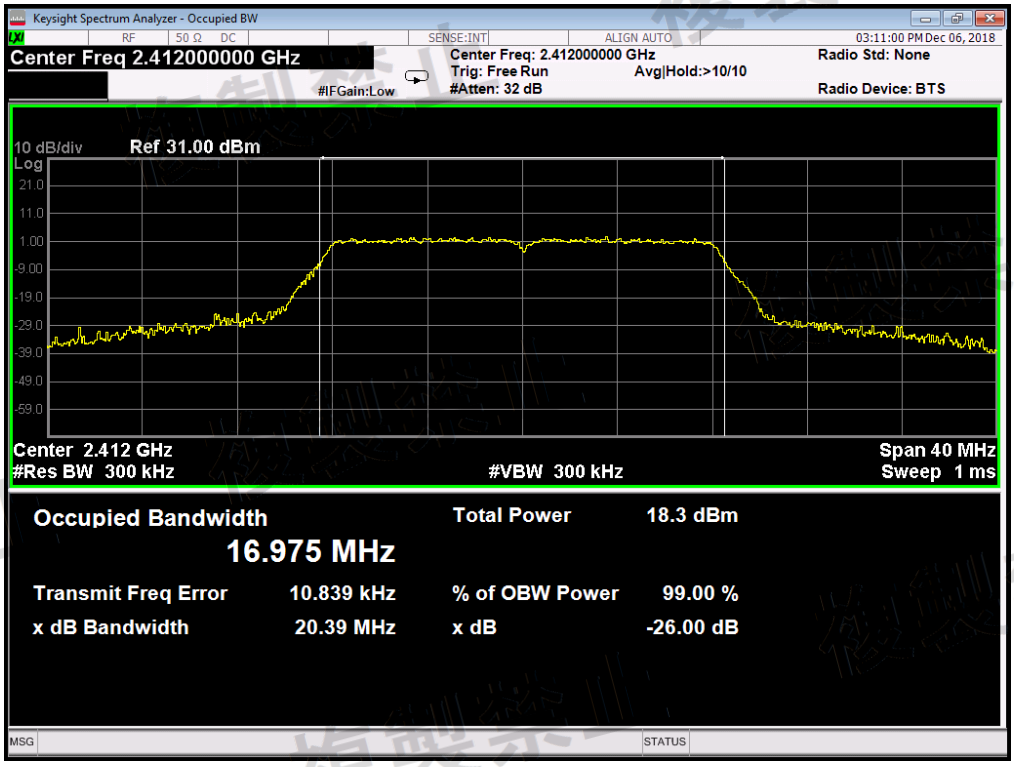
(Plot A1: Channel 1)



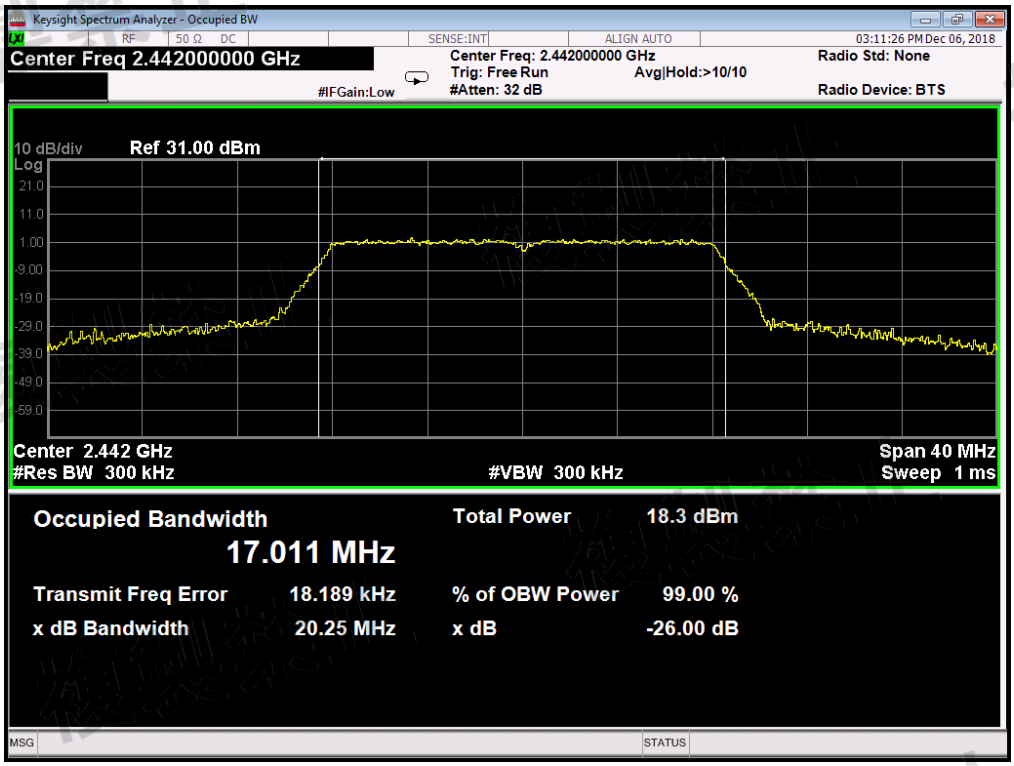
(Plot A2: Channel 7)



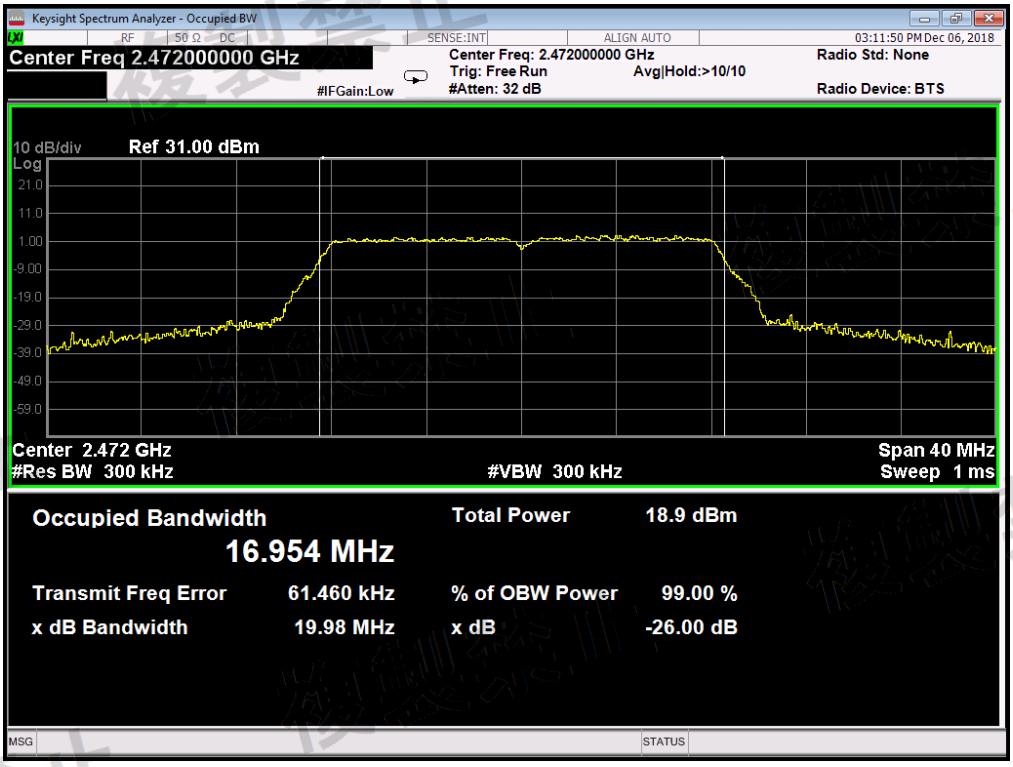
(Plot A3: Channel 13)



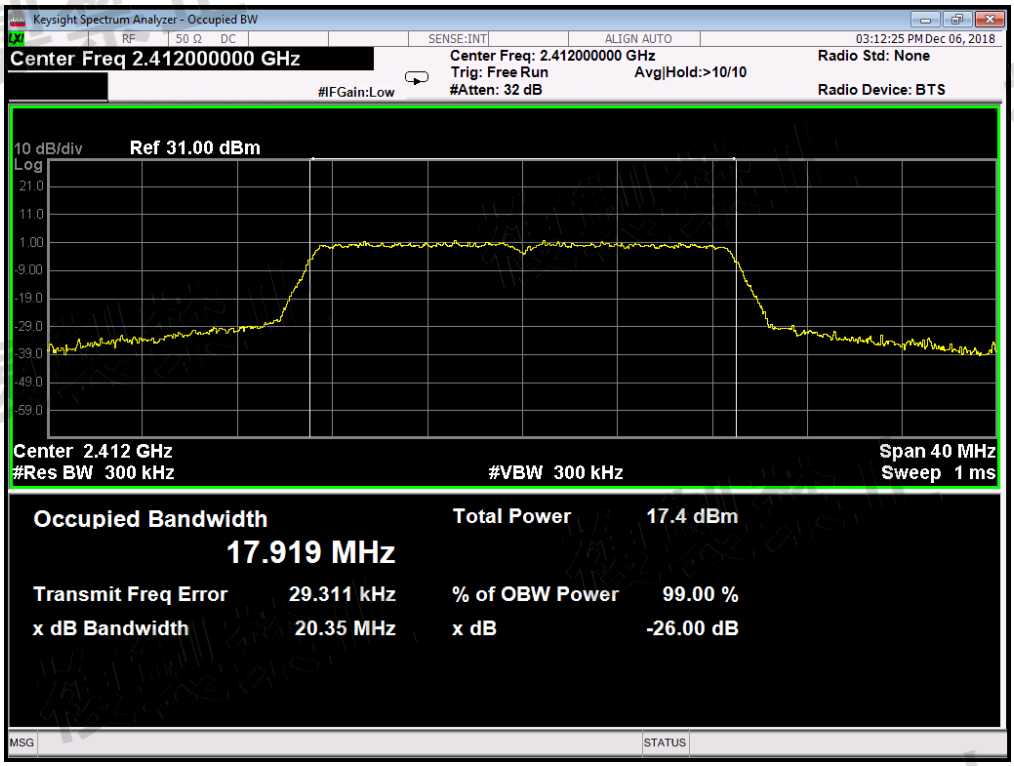
(Plot A4: Channel 1)



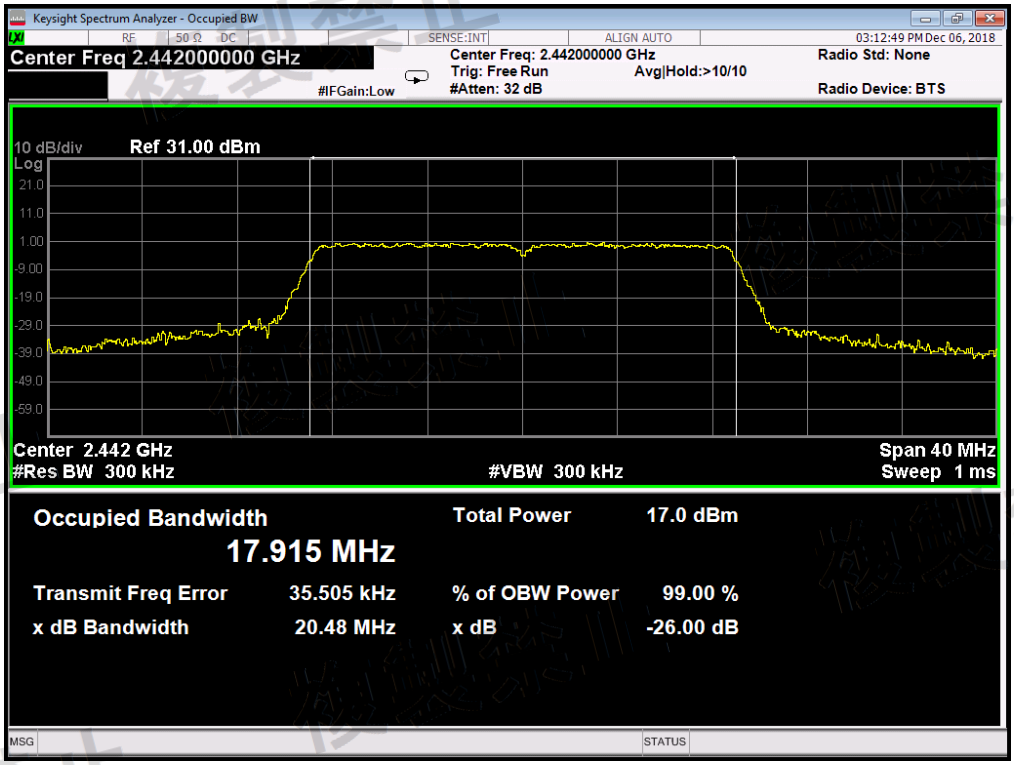
(Plot A5: Channel 7)



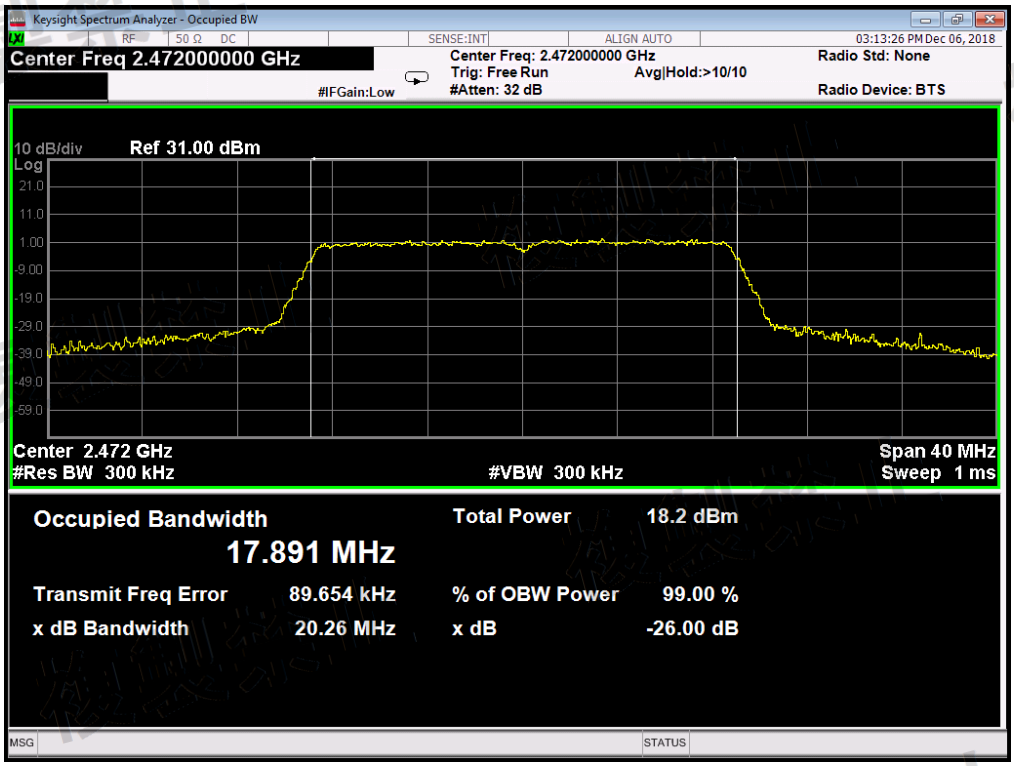
(Plot A6: Channel 13)



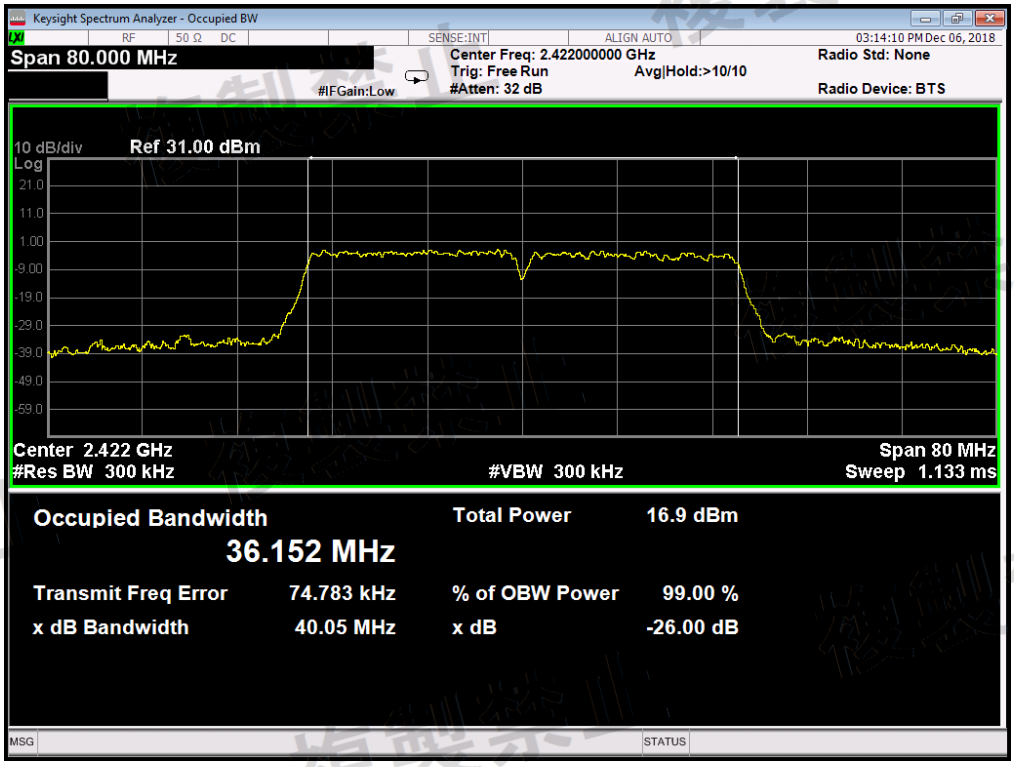
(Plot A7: Channel 1)



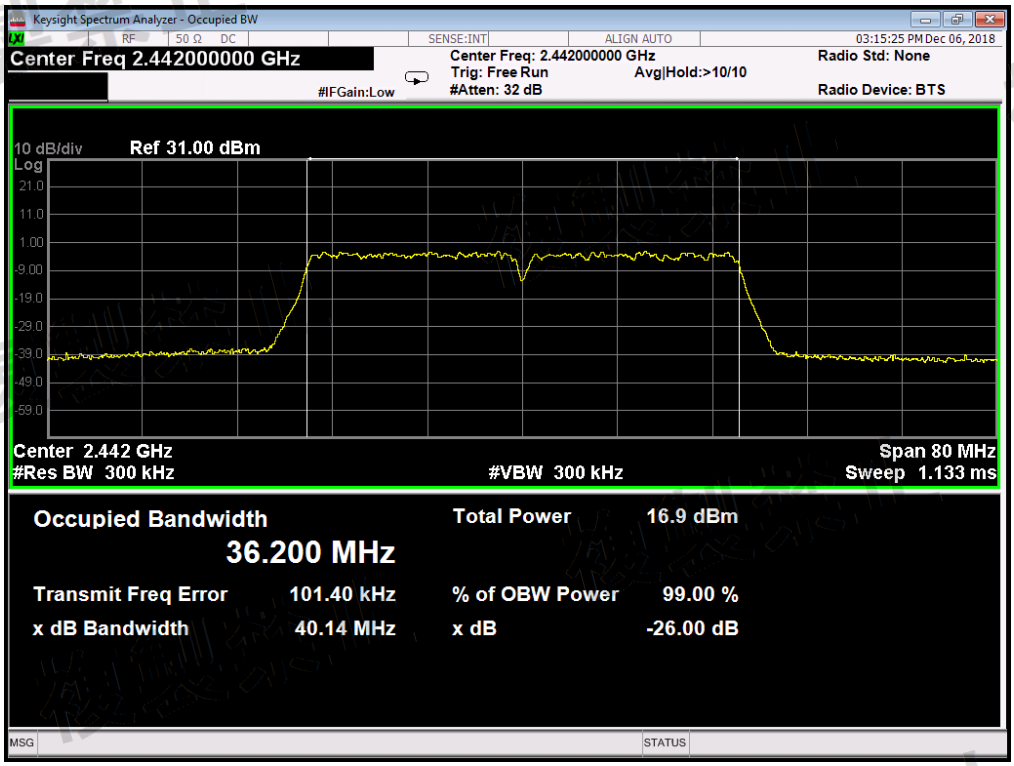
(Plot A8: Channel 7)



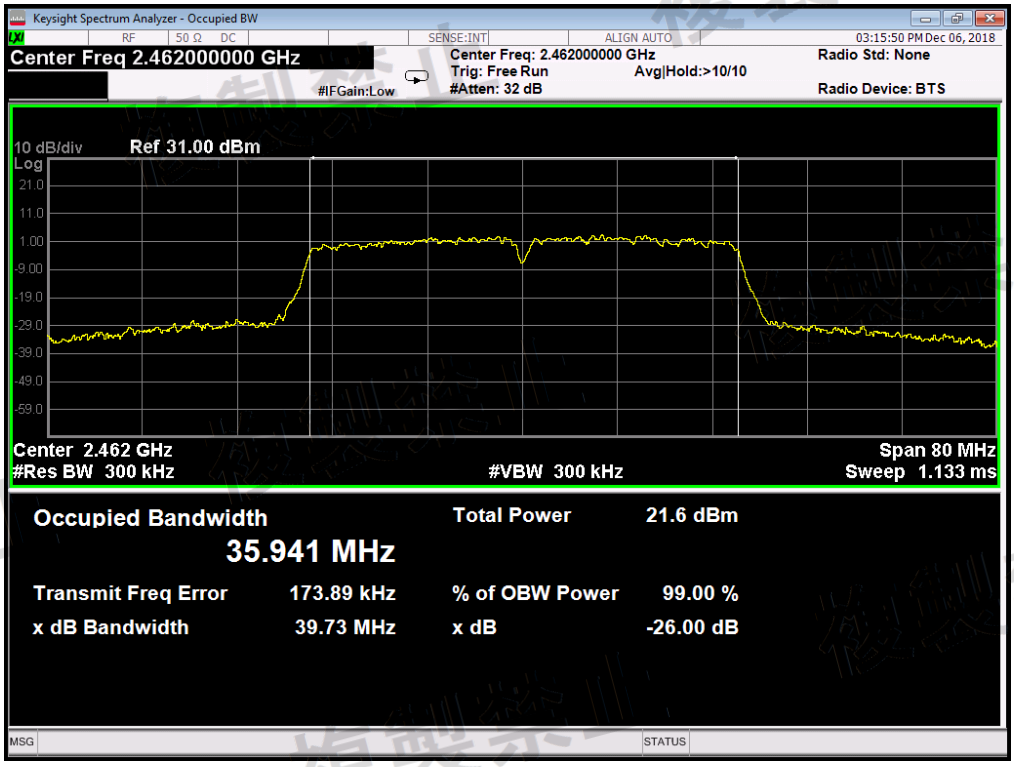
(Plot A9: Channel 13)



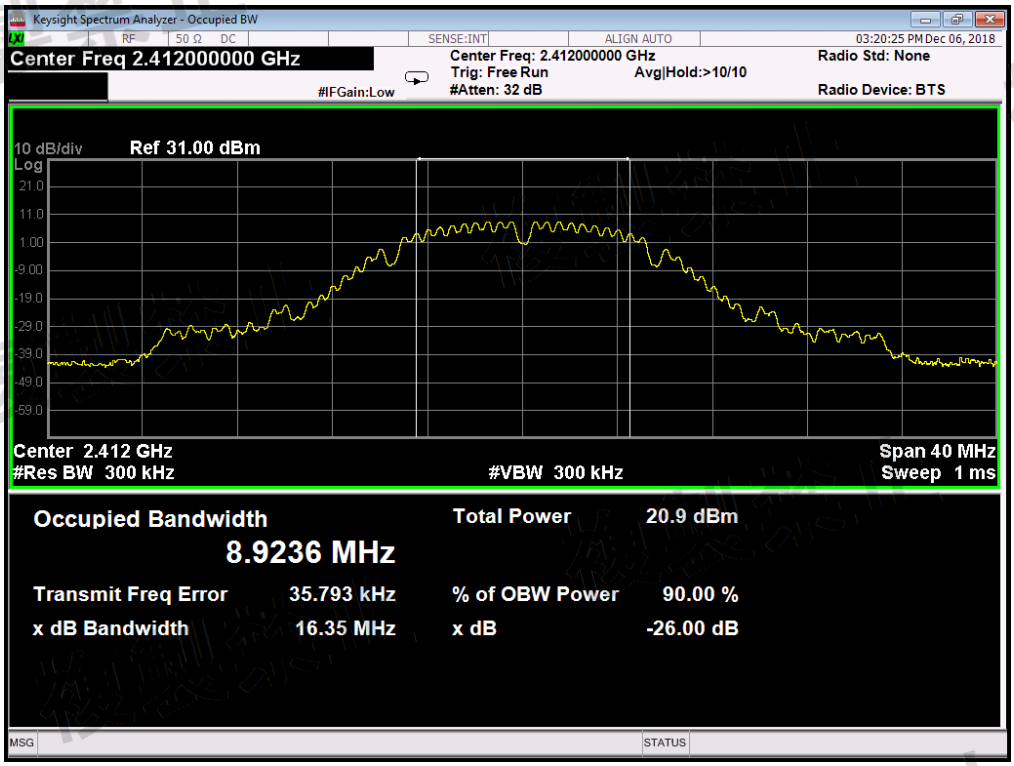
(Plot A10: Channel 2)



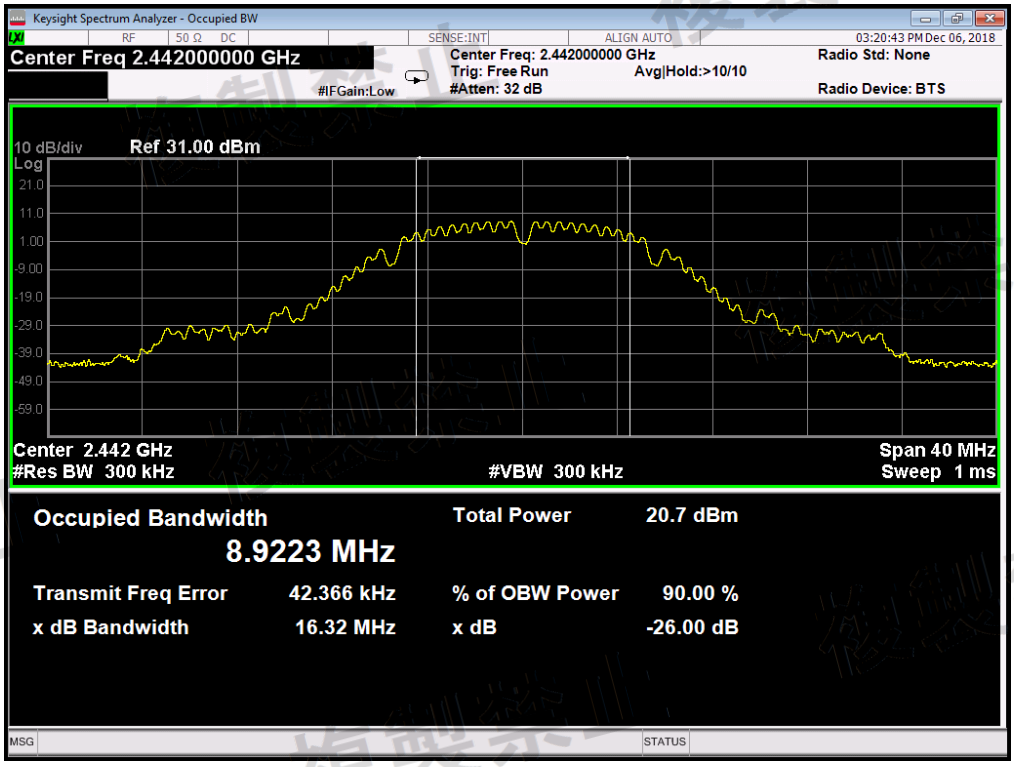
(Plot A11: Channel 7)



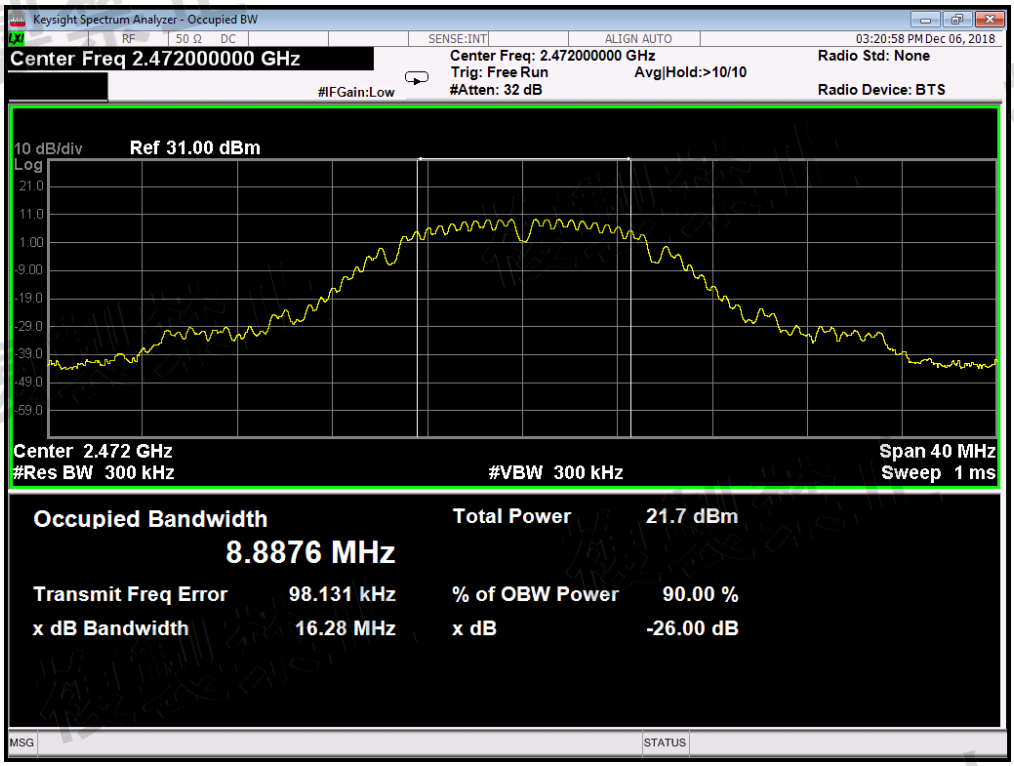
(Plot A12: Channel 11)



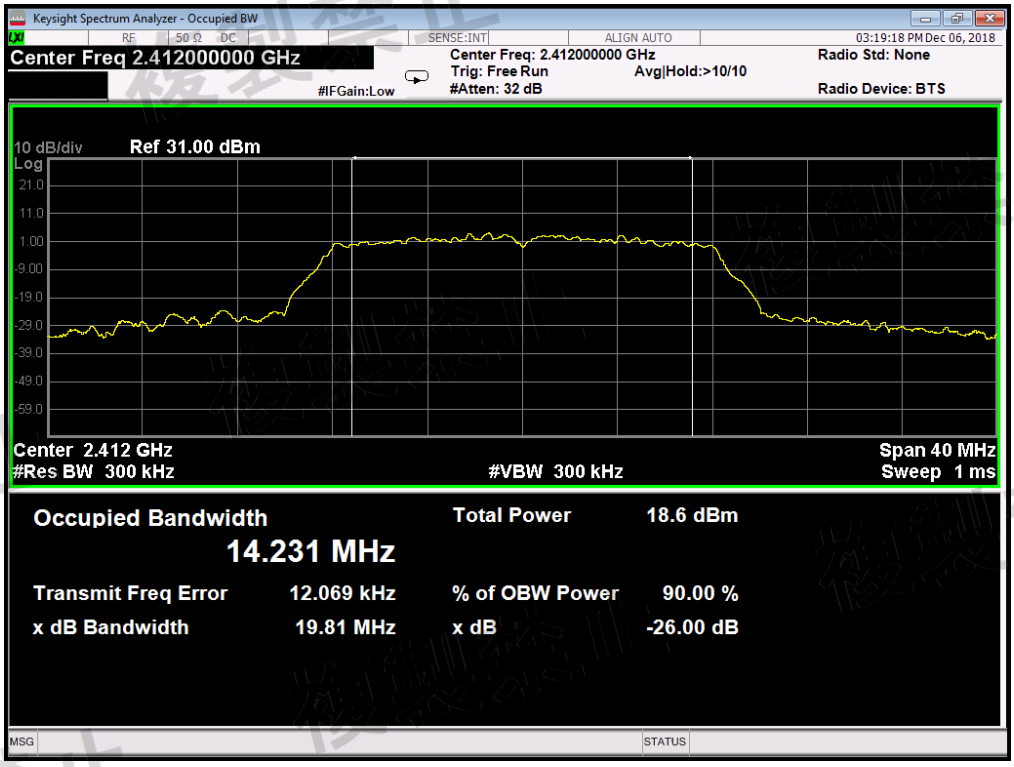
(Plot B1: Channel 1)



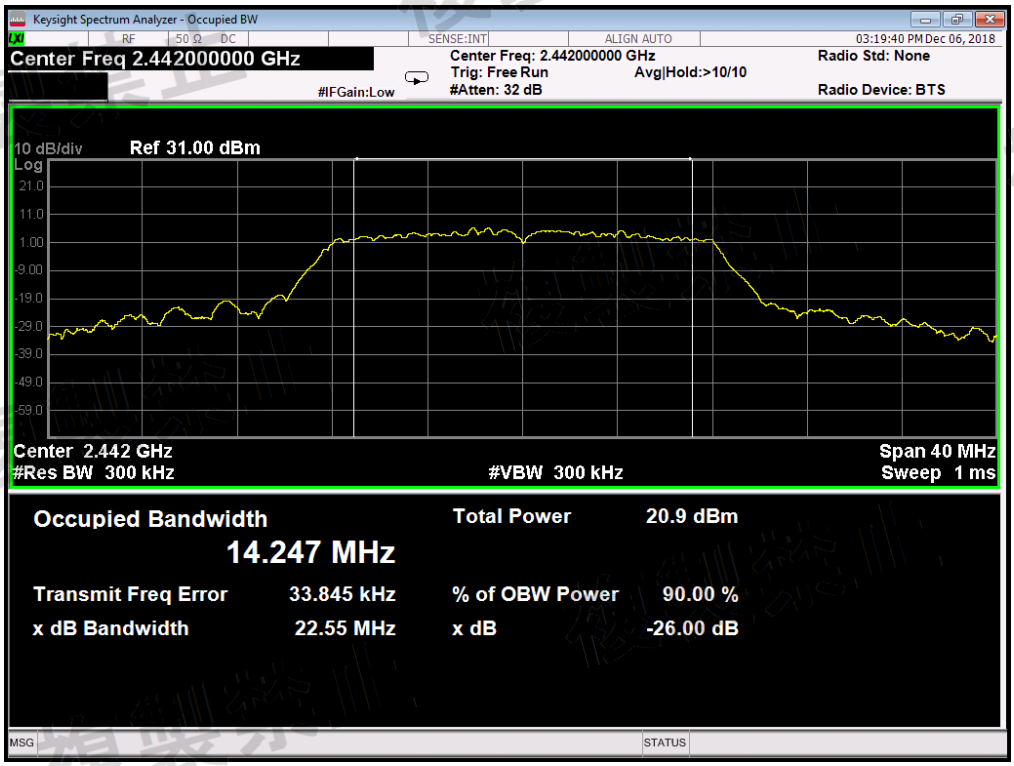
(Plot B2: Channel 7)



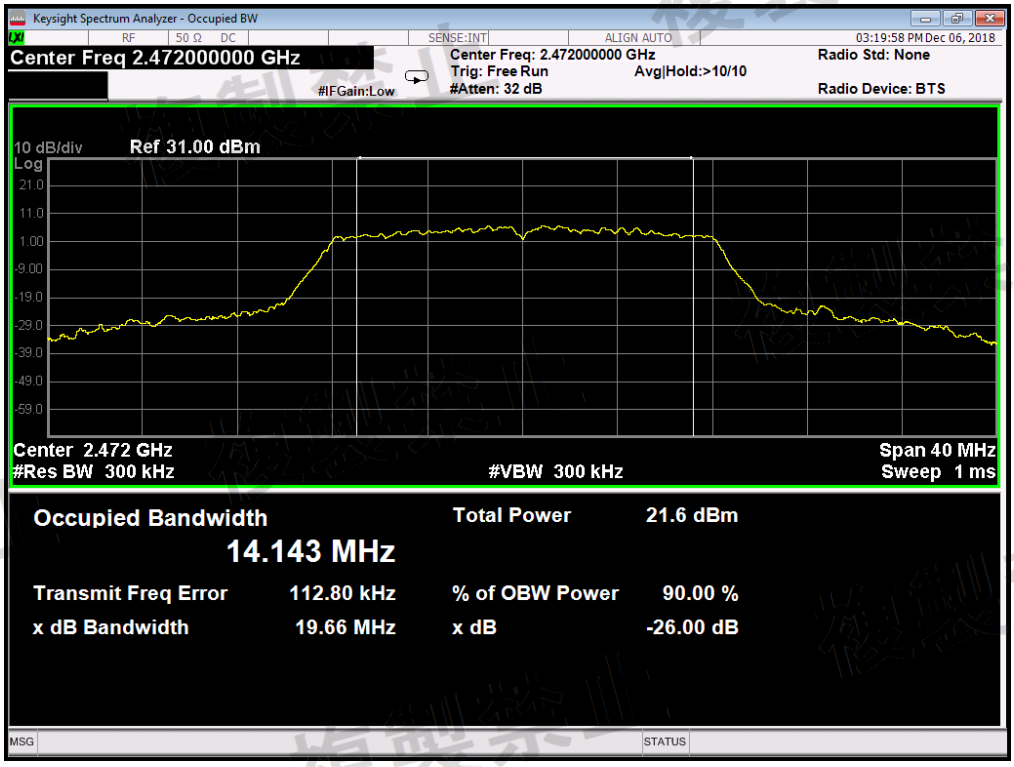
(Plot B3: Channel 13)



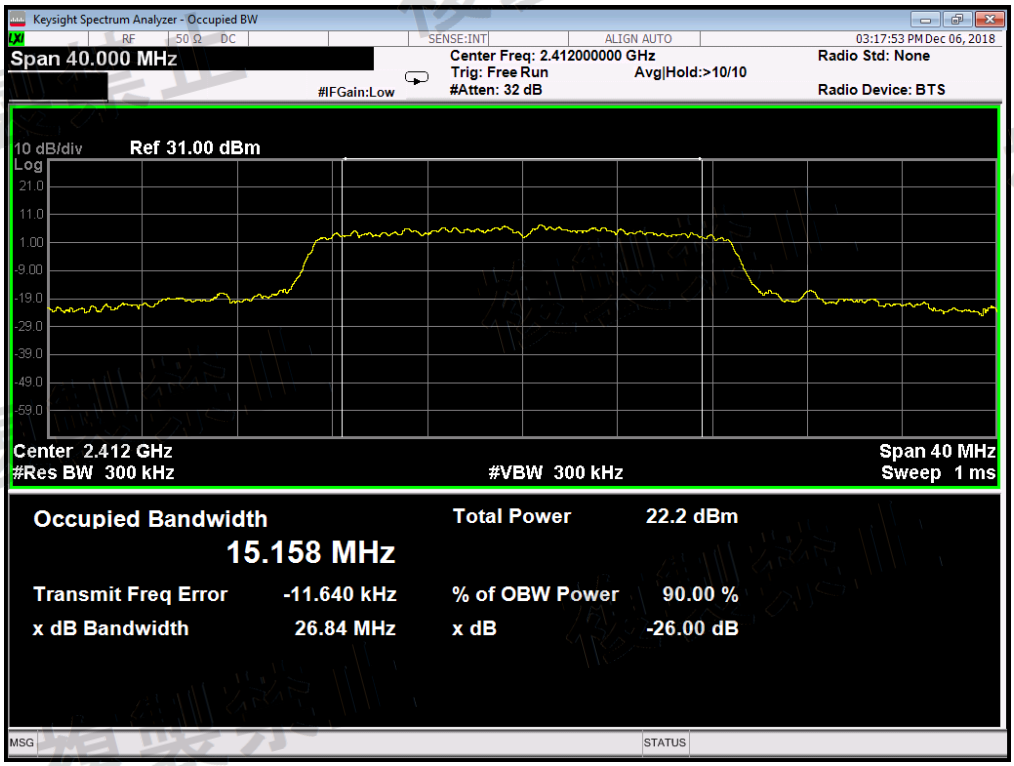
(Plot B4: Channel 11)



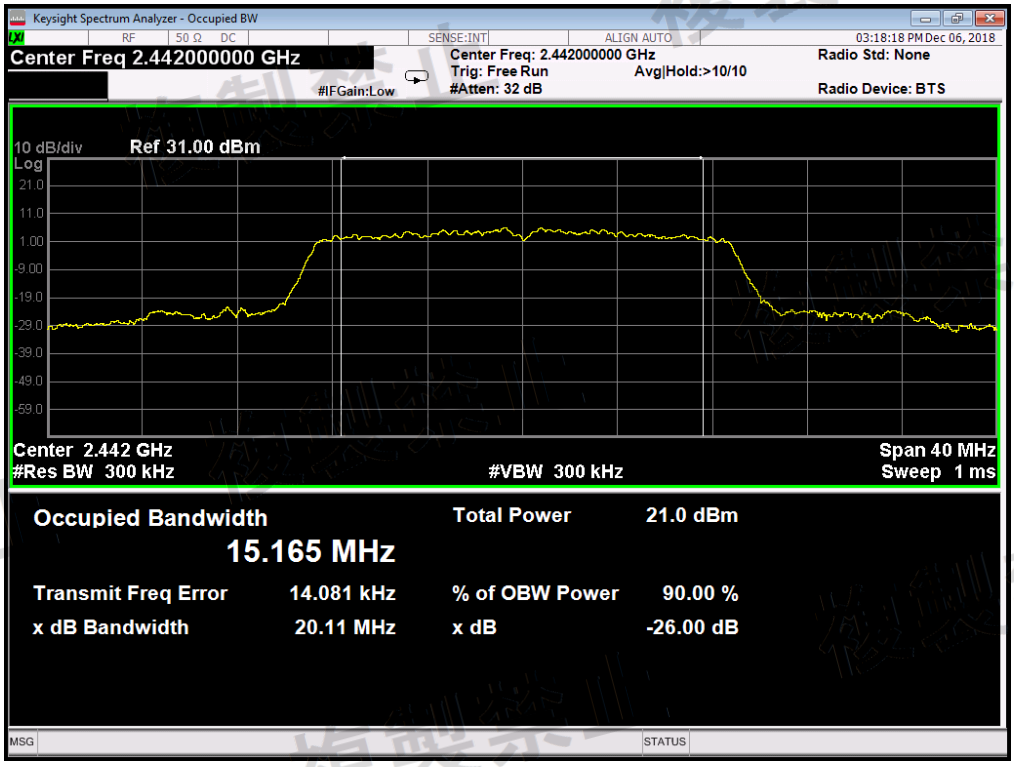
(Plot B5: Channel 7)



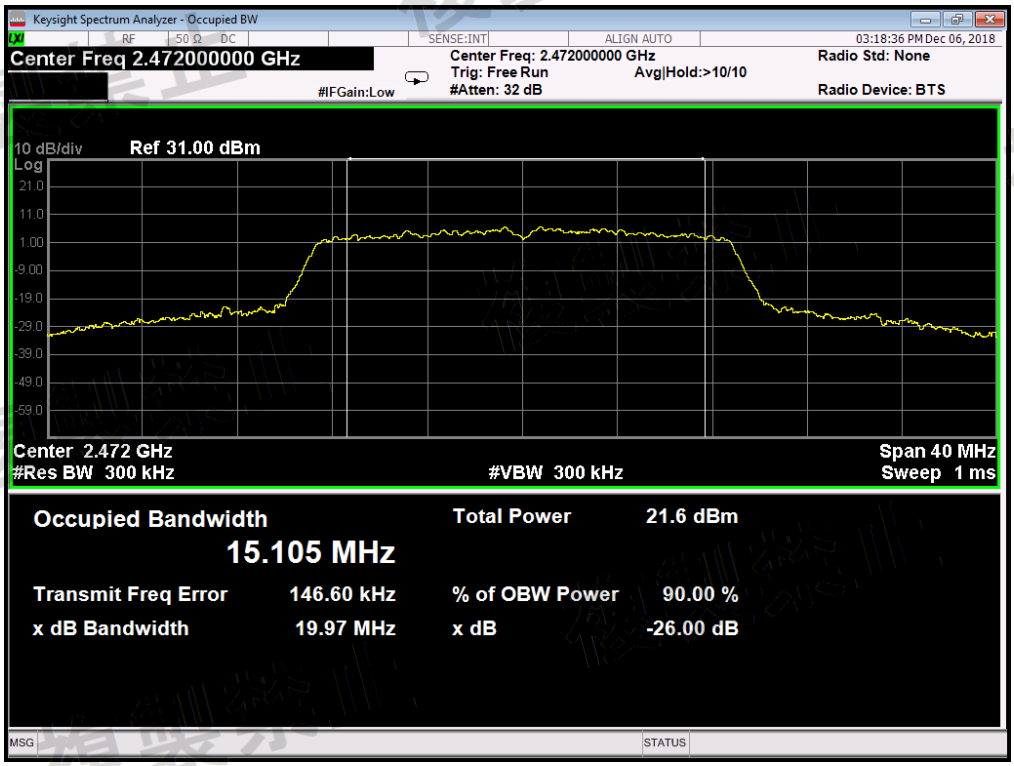
(Plot B6: Channel 13)



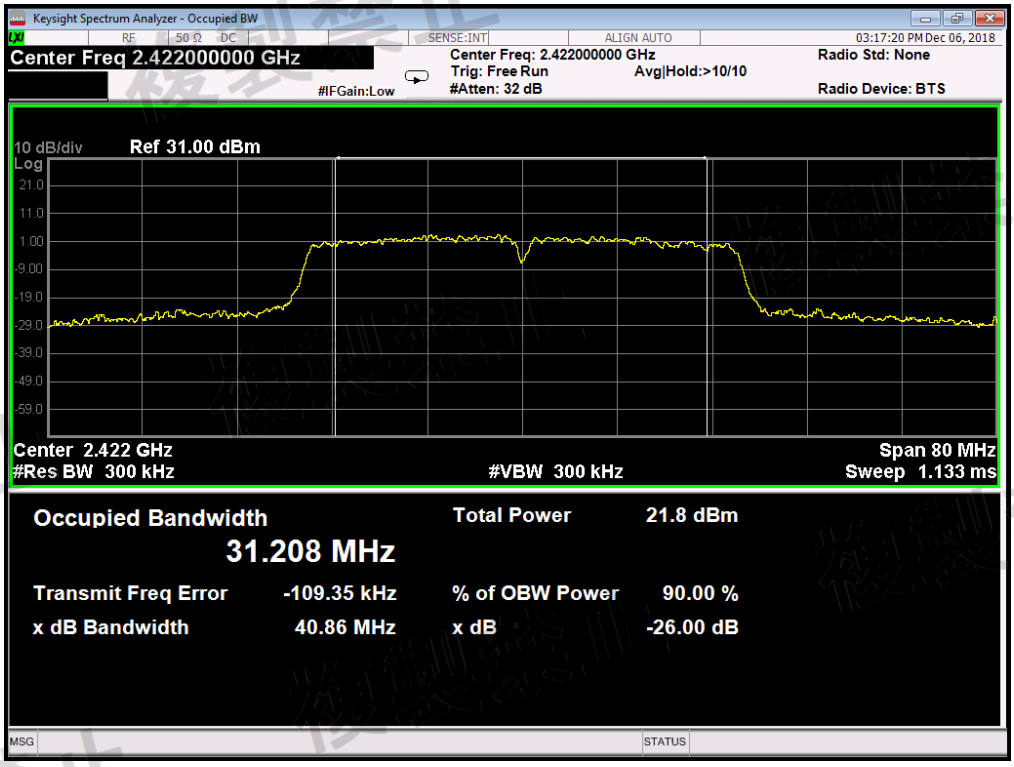
(Plot B7: Channel 1)



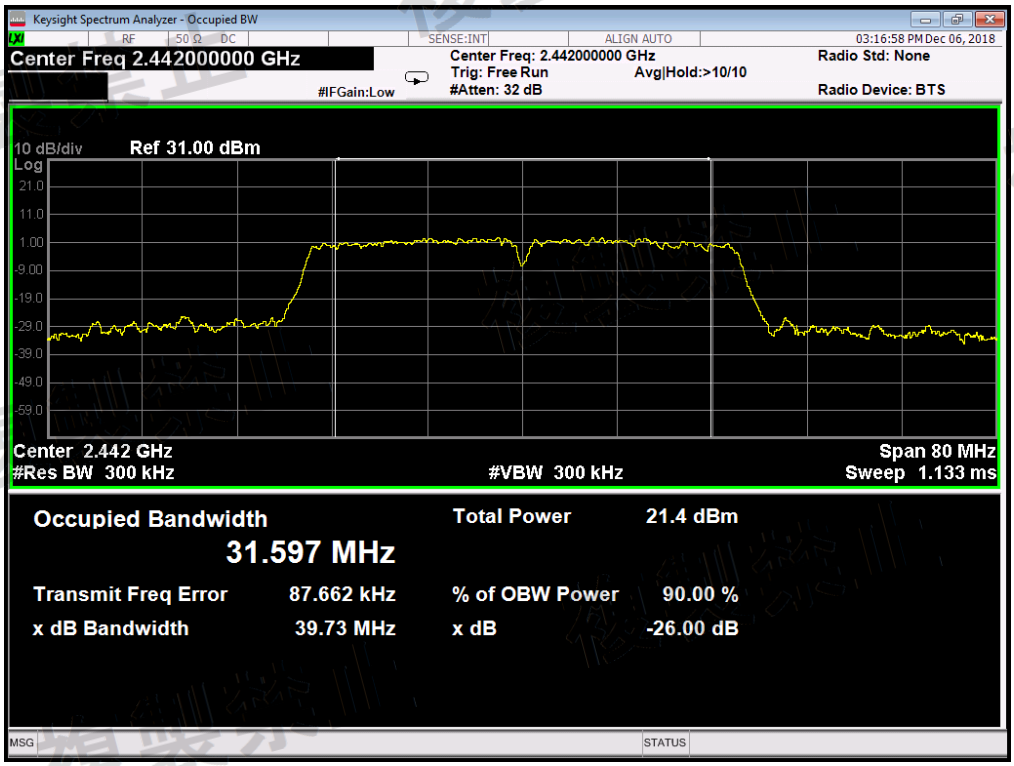
(Plot B8: Channel 7)



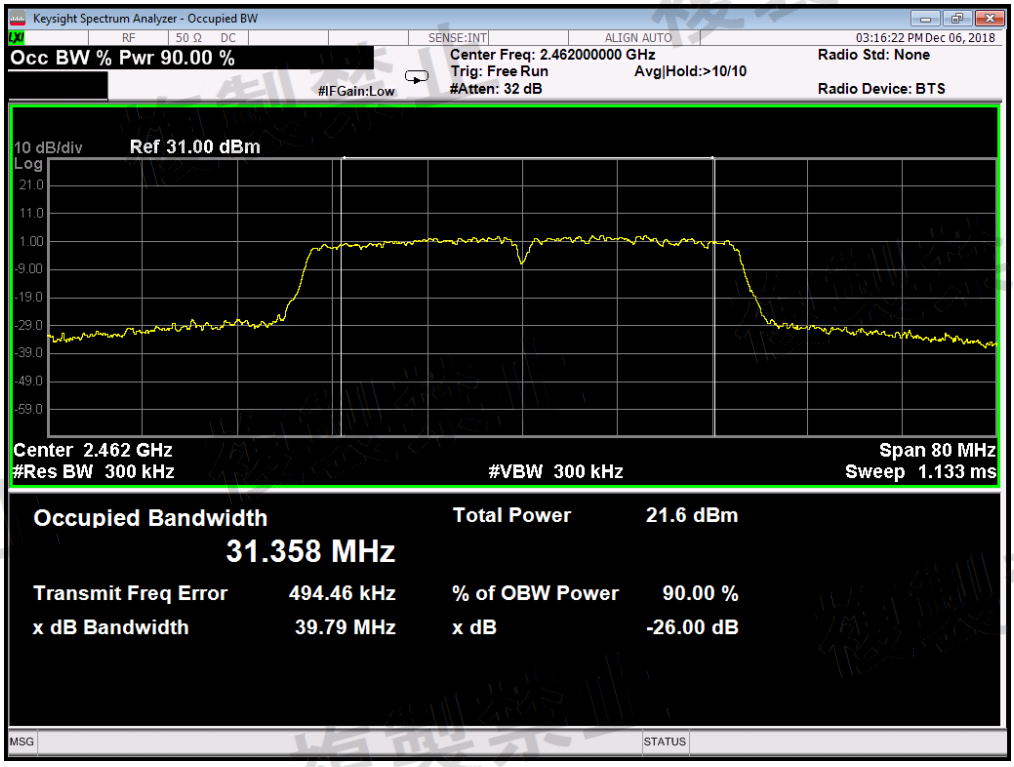
(Plot B9: Channel 13)



(Plot B10: Channel 2)



(Plot B11: Channel 7)



(Plot B12: Channel 11)

2.3. Unwanted Emission Intensity Measurement

2.3.1. Limit

Item	Limits
TX Spurious Emission	≦2.5 μW (2387MHz>f ; 2496.5MHz<f)
	≦25 μW (2387MHz≦f<2400MHz) and (2483.5MHz<f≦2496.5MHz)

2.3.2. Measuring Instruments and setting

Please refer to section 4 in this report. The following table is the setting of the spectrum.

Spectrum Parameter	Setting
Attenuation	Auto
RB/VB	1MHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

2.3.3. Test Procedures

1 EUT have transmitted the maximum modulation signal and fixed channelize.

2 Setting of SA is following as: RB:1MHz / VB:1MHz / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold

3 Setting of SA is following as 30MHz and stop frequency 2387MHz Then to mark peak reading value + cable loss shall be less than 2.5μW.

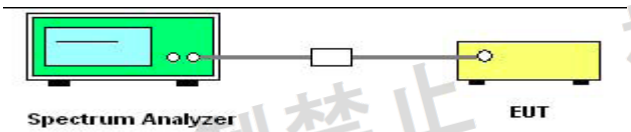
4 SA adjusted to start frequency 2387MHz and stop frequency 2400MHz. Then to mark peak reading value + cable loss shall be less than 25μW.

5 SA adjusted to start frequency 2483.5MHz and stop frequency 2496.5MHz Then to mark peak reading value + cable loss shall be less than 25μW

6 SA adjusted to start frequency 2496.5MHz and stop frequency 12500MHz Then to mark peak reading value + cable loss shall be less than 2.5μW

7 If the Result_Value is over the requirement, take total sum of 1MHz band centered at the spur frequency like ACLP measurement as Result_Value.

2.3.4. Test Setup Layout



2.3.5. Test Deviation

There is no deviation with the original standard.

2.3.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.3.7. Test Result of Unwanted Emission Intensity

2.3.7.1. 802.11b Test Resul

Channel	Test Frequency (MHz)	Max Unwanted Emission Value	Refer to Plot	Limit (dBm)	Verdict
		Max Value (dBm)			
1	30～2387	< -30	Plot B1/4	-26	PASS
	2496.5～12500	< -30		-26	PASS
	2387～2400	< -30		-16	PASS
	2483.5～2496.5	< -30		-16	PASS
7	30～2387	< -30	Plot B5/8	-26	PASS
	2496.5～12500	< -30		-26	PASS
	2387～2400	< -30		-16	PASS
	2483.5～2496.5	< -30		-16	PASS
13	30～2387	< -30	Plot B9/12	-26	PASS
	2496.5～12500	< -30		-26	PASS
	2387～2400	< -30		-16	PASS
	2483.5～2496.5	< -30		-16	PASS

2.3.7.2. 802.11g Test Result

Channel	Test Frequency (MHz)	Max Unwanted Emission Value	Refer to Plot	Limit (dBm)	Verdict
		Max Value (dBm)			
1	30～2387	< -30	Plot E1/4	-26	PASS
	2496.5～12500	< -30		-26	PASS
	2387～2400	< -30		-16	PASS
	2483.5～2496.5	< -30		-16	PASS
7	30～2387	< -30	Plot E5/8	-26	PASS
	2496.5～12500	< -30		-26	PASS
	2387～2400	< -30		-16	PASS
	2483.5～2496.5	< -30		-16	PASS
13	30～2387	< -30	Plot E9/12	-26	PASS
	2496.5～12500	< -30		-26	PASS
	2387～2400	< -30		-16	PASS
	2483.5～2496.5	< -30		-16	PASS

2.3.7.3. 802.11n20 Test Result

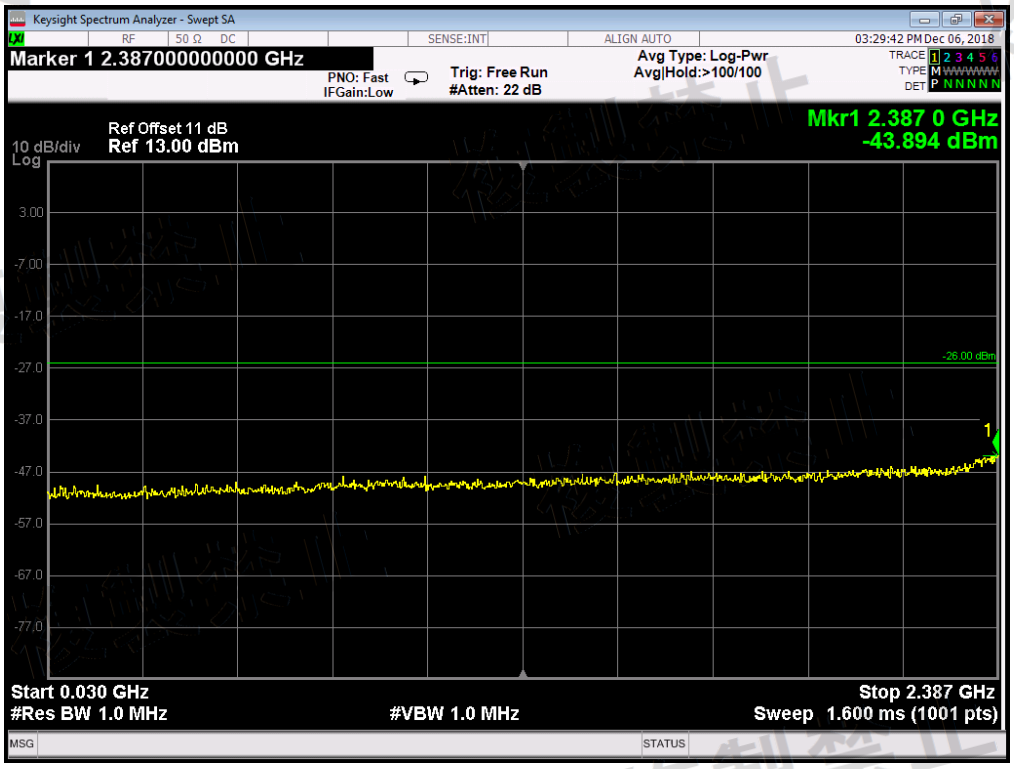
Channel	Test Frequency (MHz)	Max Unwanted Emission Value	Refer to Plot	Limit (dBm)	Verdict
		Max Value (dBm)			
1	30～2387	< -30	Plot H1/4	-26	PASS
	2496.5～12500	< -30		-26	PASS
	2387～2400	< -30		-16	PASS
	2483.5～2496.5	< -30		-16	PASS
7	30～2387	< -30	Plot H5/8	-26	PASS
	2496.5～12500	< -30		-26	PASS
	2387～2400	< -30		-16	PASS
	2483.5～2496.5	< -30		-16	PASS
13	30～2387	< -30	Plot H9/12	-26	PASS
	2496.5～12500	< -30		-26	PASS
	2387～2400	< -30		-16	PASS
	2483.5～2496.5	< -30		-16	PASS

2.3.7.4.802.11n40 Test Result

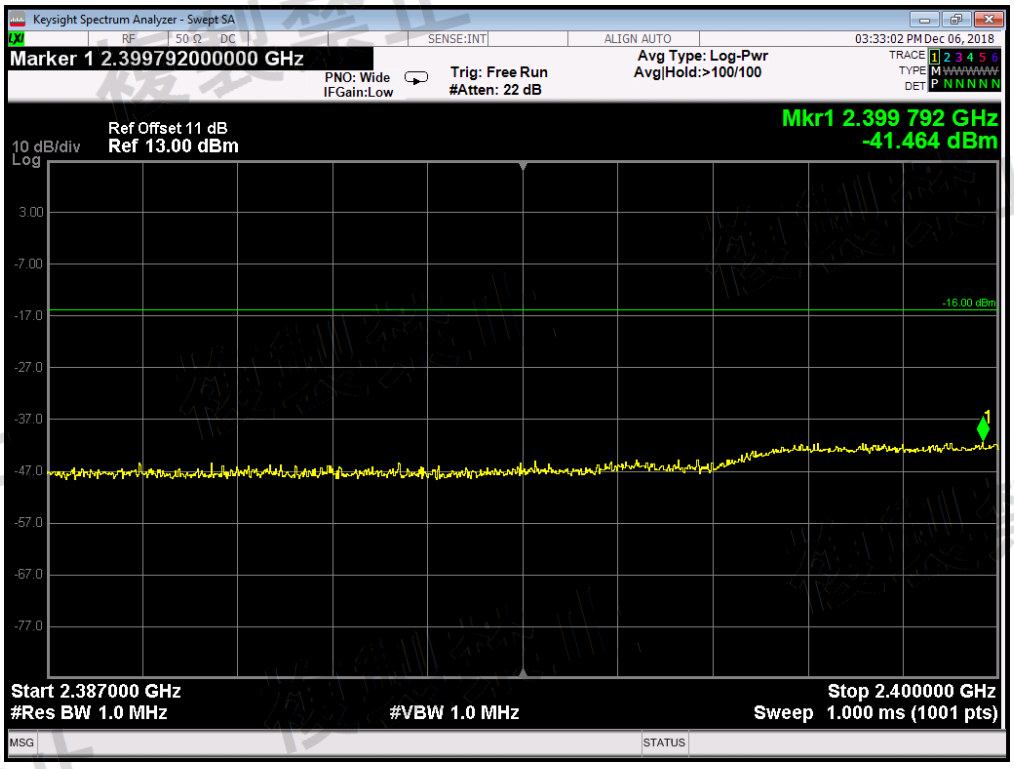
Channel	Test Frequency (MHz)	Max Unwanted Emission Value	Refer to Plot	Limit (dBm)	Verdict
		Max Value (dBm)			
1	30～2387	< -30	Plot G1/4	-26	PASS
	2496.5～12500	< -30		-26	PASS
	2387～2400	< -30		-16	PASS
	2483.5～2496.5	< -30		-16	PASS
7	30～2387	< -30	Plot G5/8	-26	PASS
	2496.5～12500	< -30		-26	PASS
	2387～2400	< -30		-16	PASS
	2483.5～2496.5	< -30		-16	PASS
13	30～2387	< -30	Plot G9/12	-26	PASS
	2496.5～12500	< -30		-26	PASS
	2387～2400	< -30		-16	PASS
	2483.5～2496.5	< -30		-16	PASS

2.3.8. Test Plots

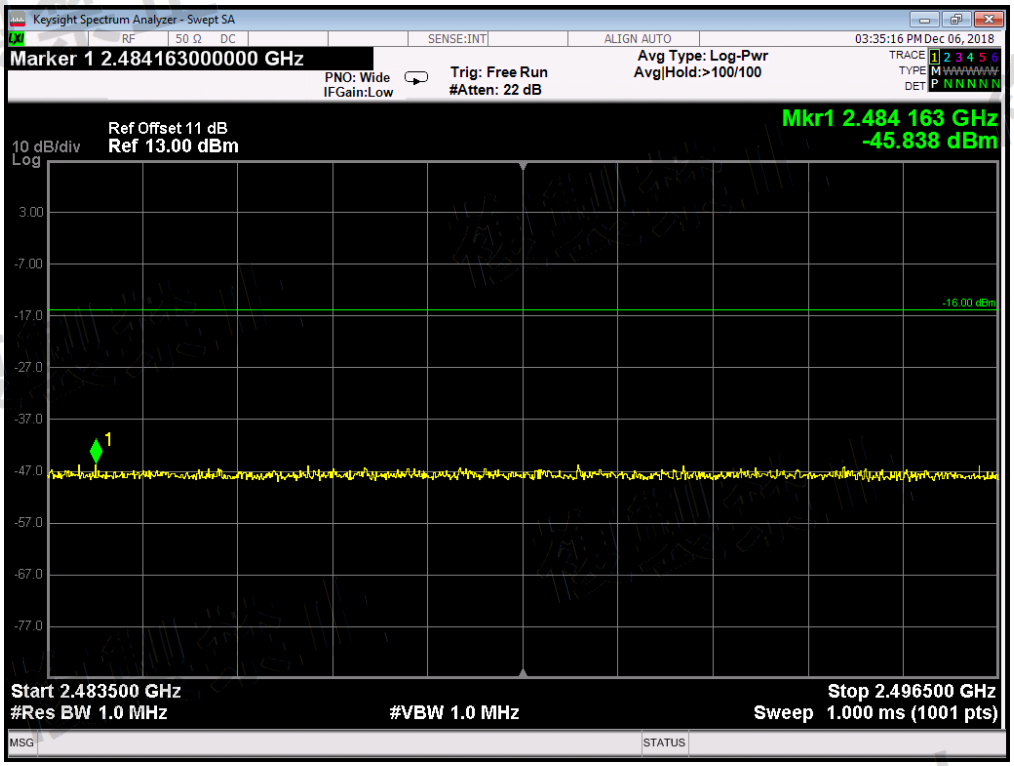
2.3.8.1. 802.11b



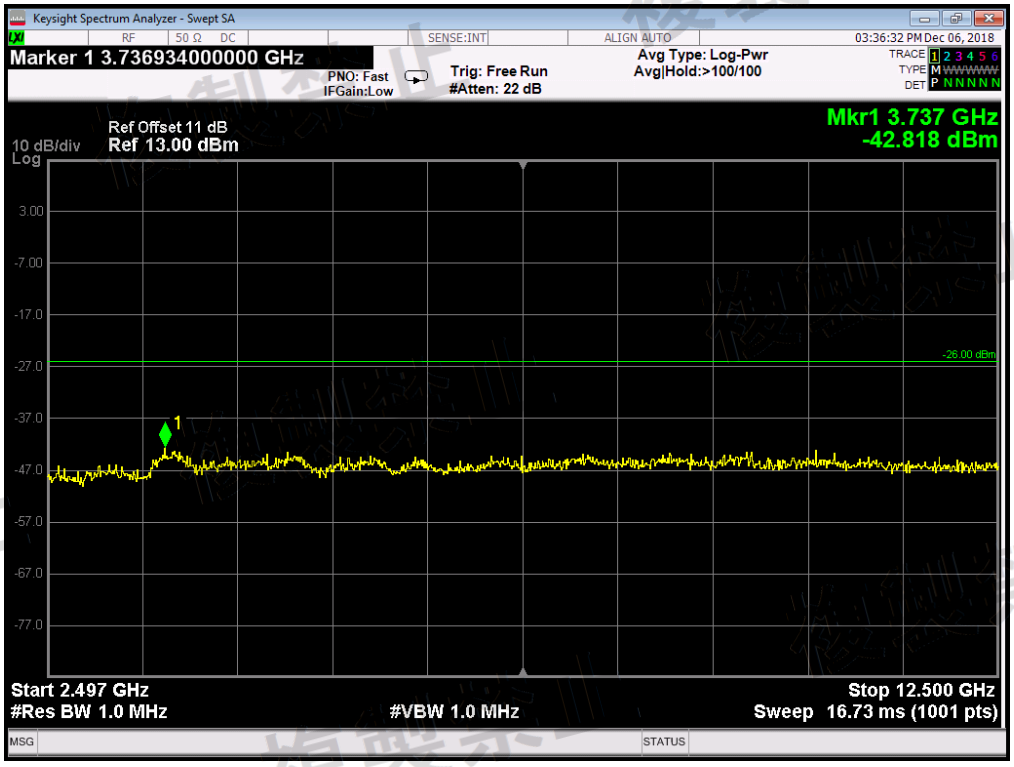
(Plot B1: Channel 1_30MHz – 2387MHz)



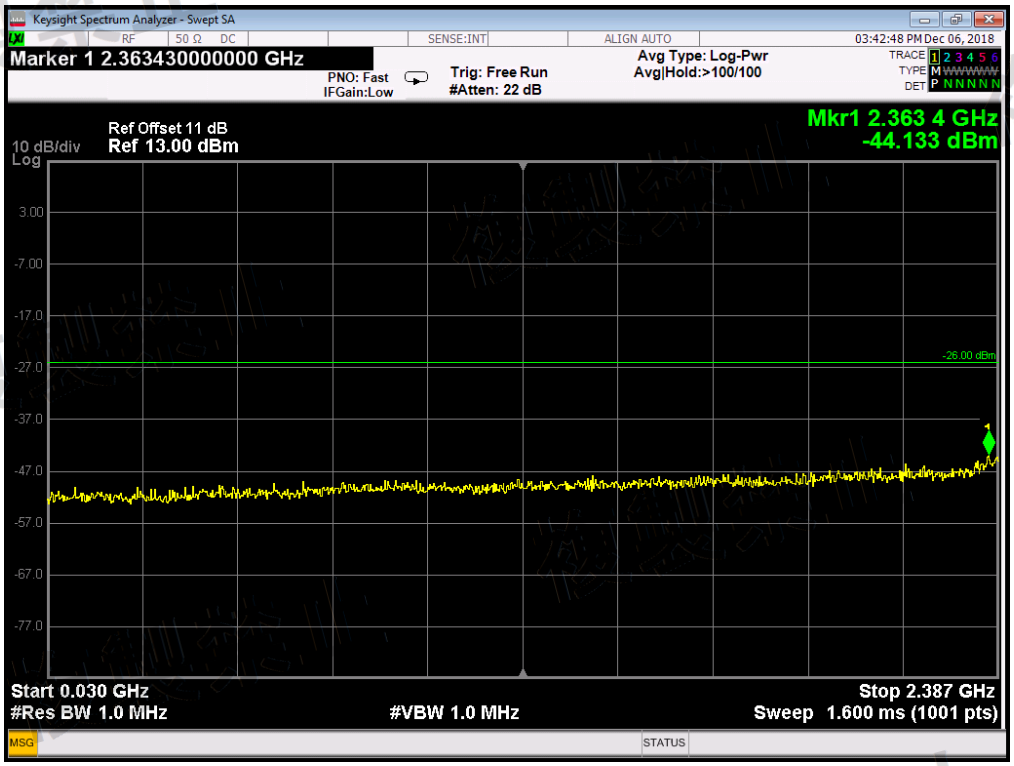
(Plot B2: Channel 1_2387MHz –2400MHz)



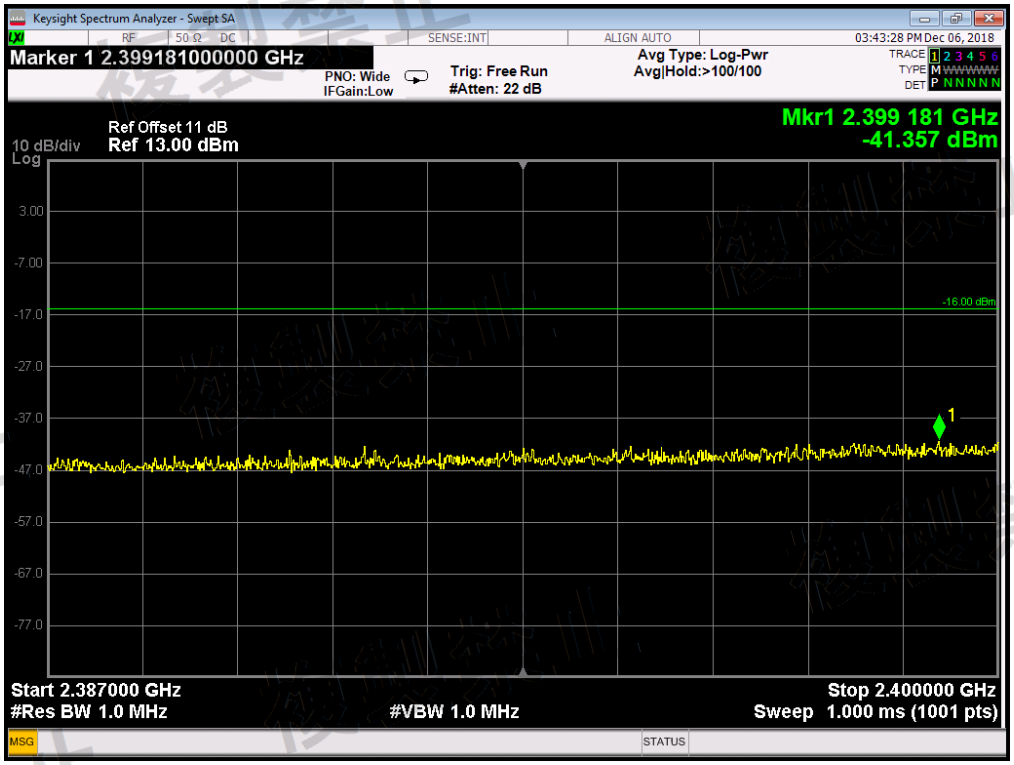
(Plot B3: Channel 1_2483.5 MHz –2496.5 MHz)



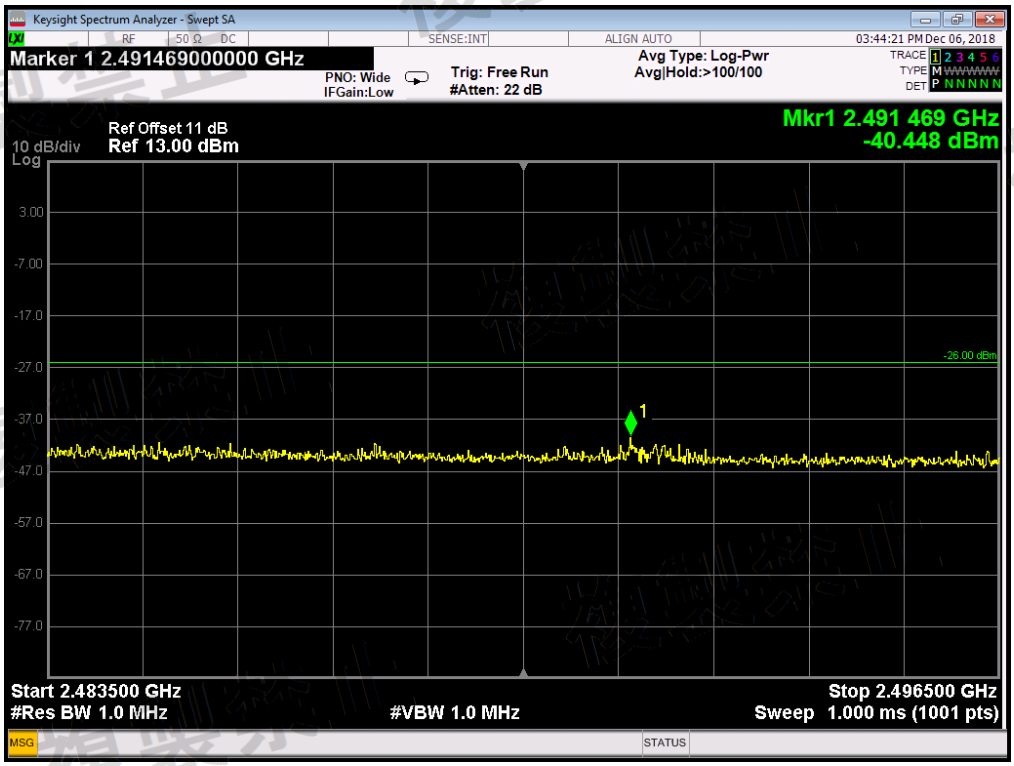
(Plot B4: Channel 1_ 2496.5 MHz – 12500 MHz)



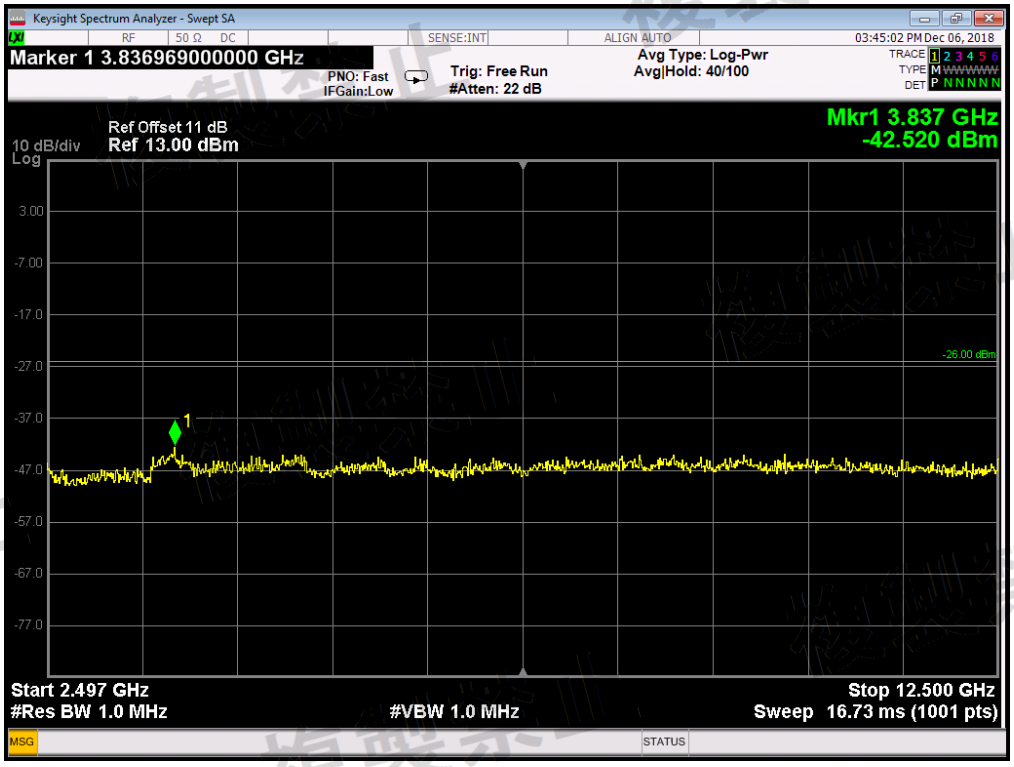
(Plot B5: Channel 7_ 30MHz – 2387MHz)



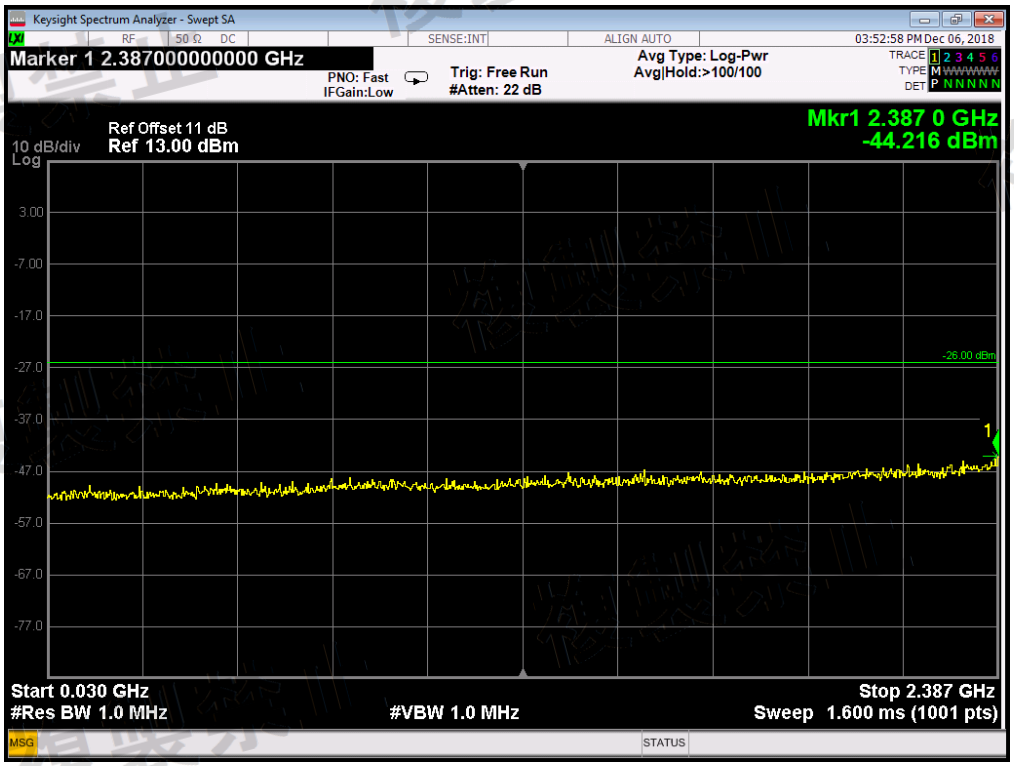
(Plot B6: Channel 7_2387MHz –2400MHz)



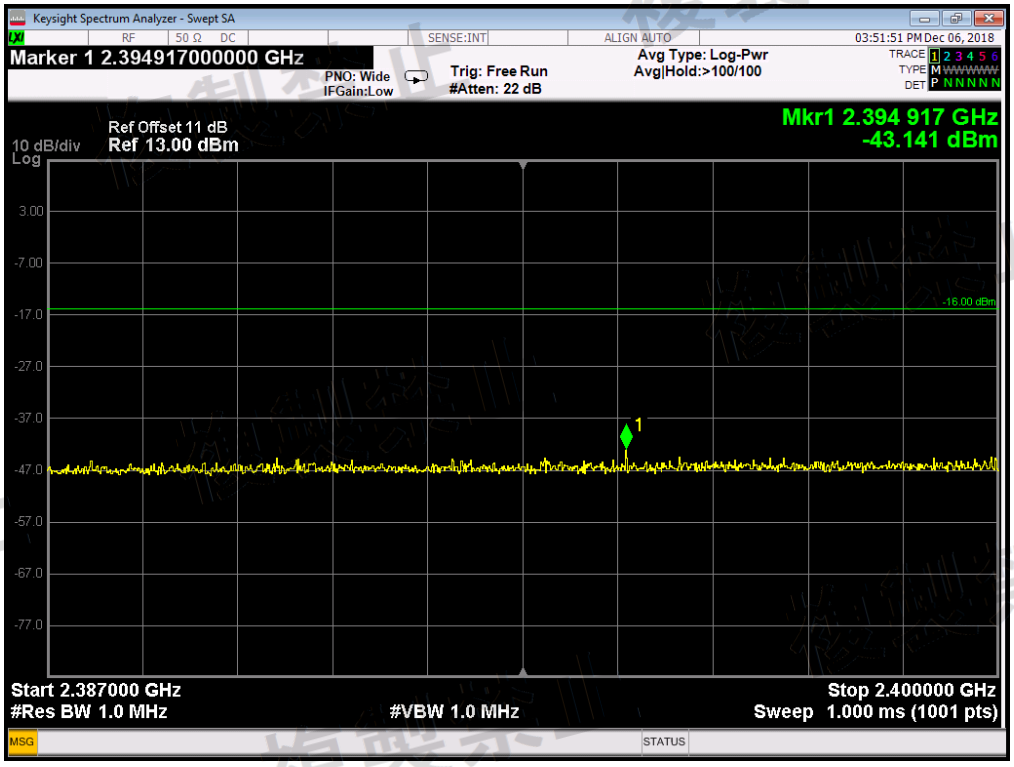
(Plot B7: Channel 7_2483.5 MHz –2496.5 MHz)



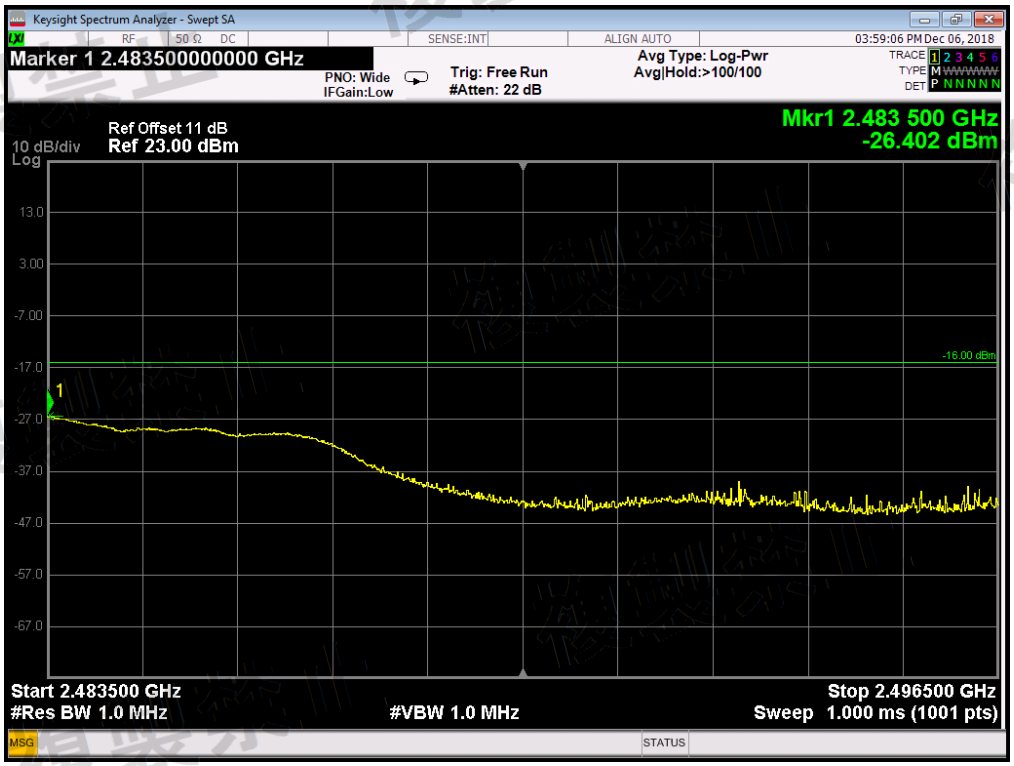
(Plot B8: Channel 7_2496.5 MHz – 12500 MHz)



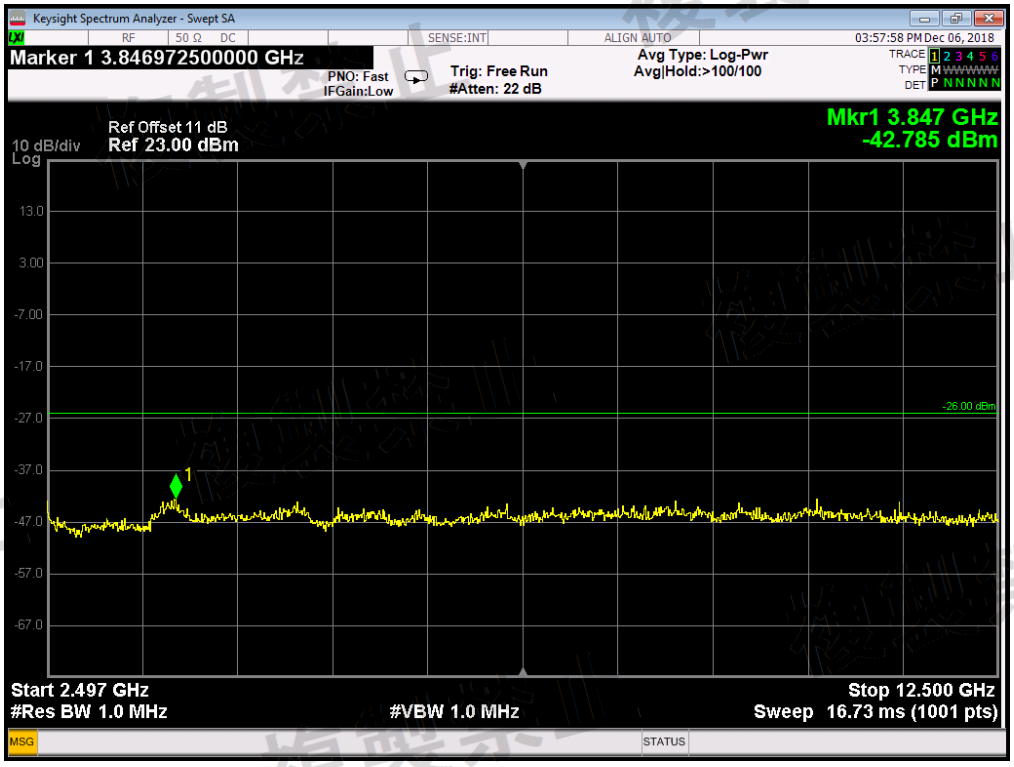
(Plot B9: Channel 13_ 30MHz – 2387MHz)



(Plot B10: Channel 13_2387MHz –2400MHz)

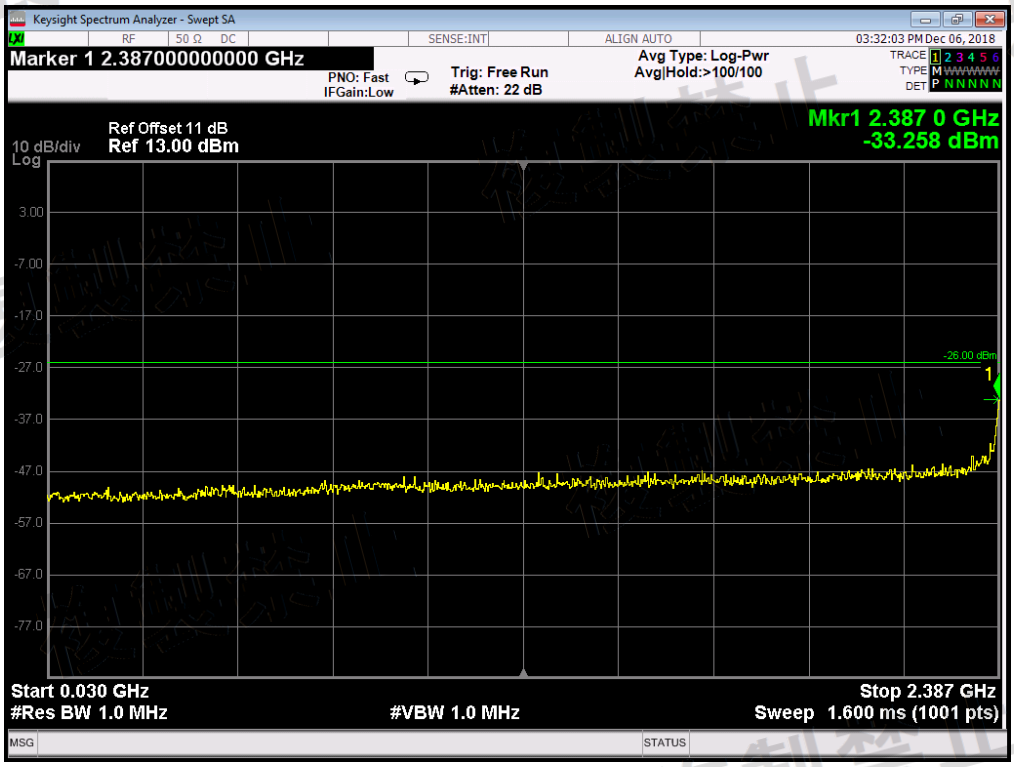


(Plot B11: Channel 13_2483.5 MHz –2496.5 MHz)

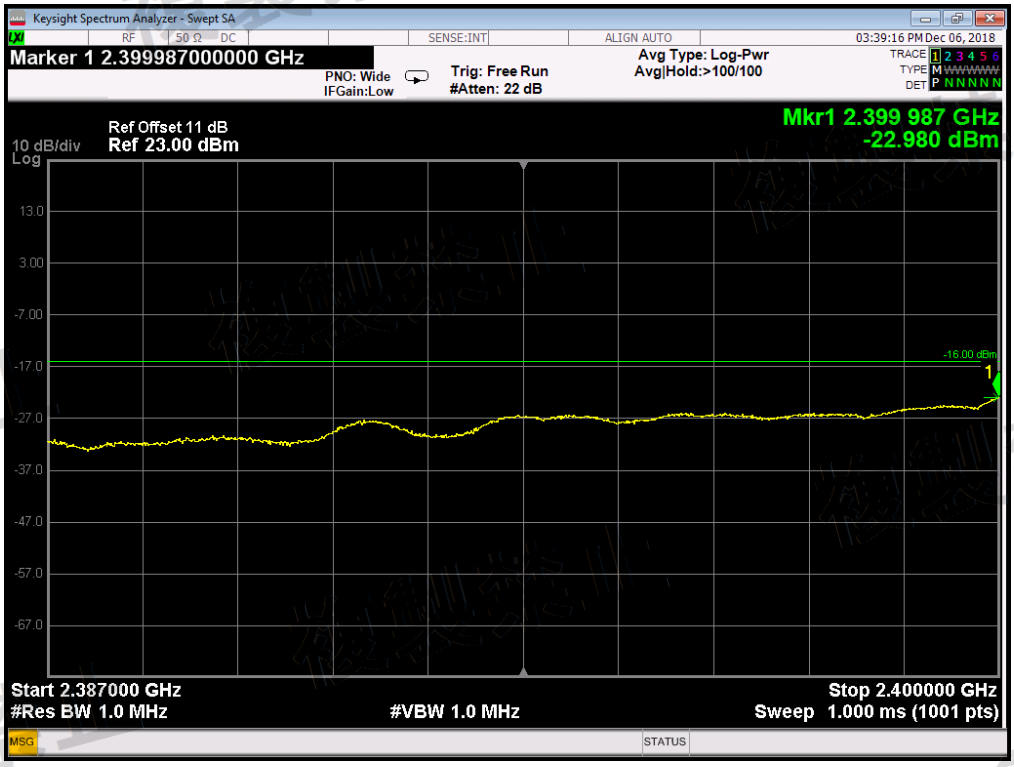


(Plot B12: Channel 13_2496.5 MHz – 12500 MHz)

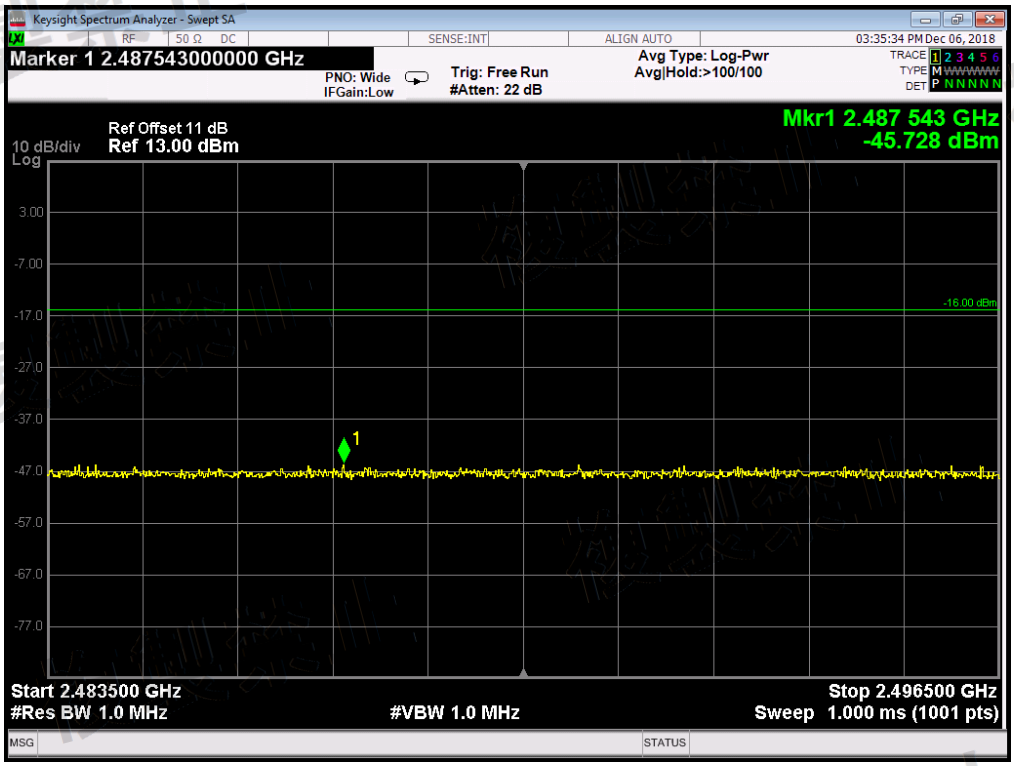
2.3.8.2.802.11g



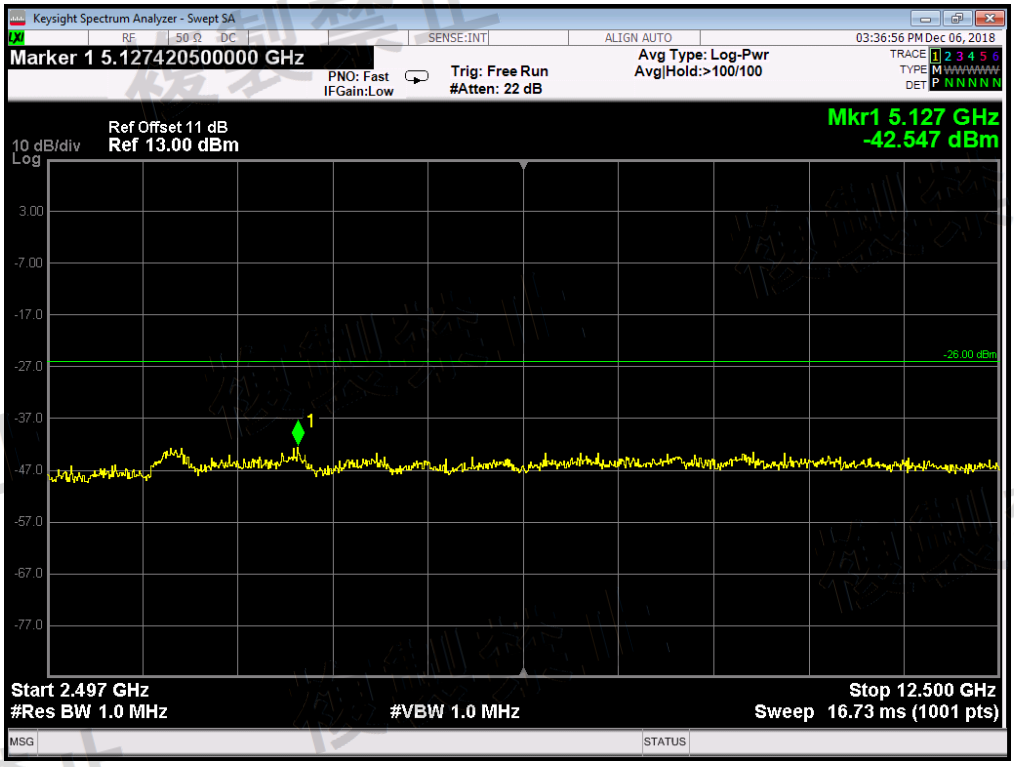
(Plot E1: Channel 1_30MHz – 2387MHz)



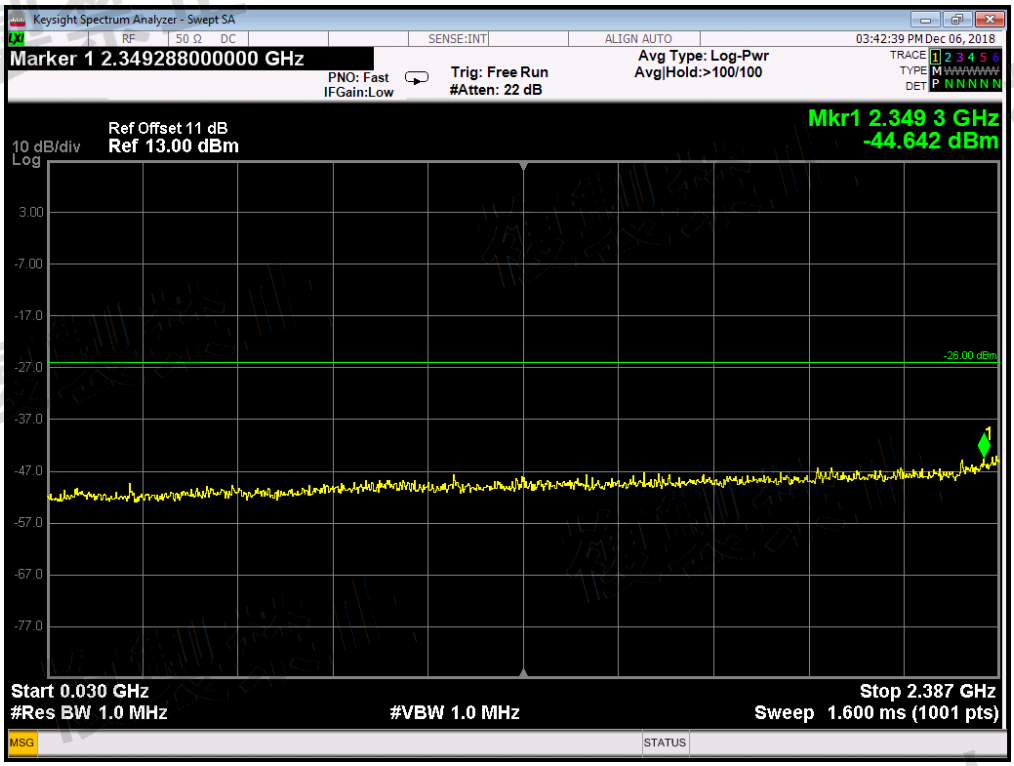
(Plot E2: Channel 1_2387MHz –2400MHz)



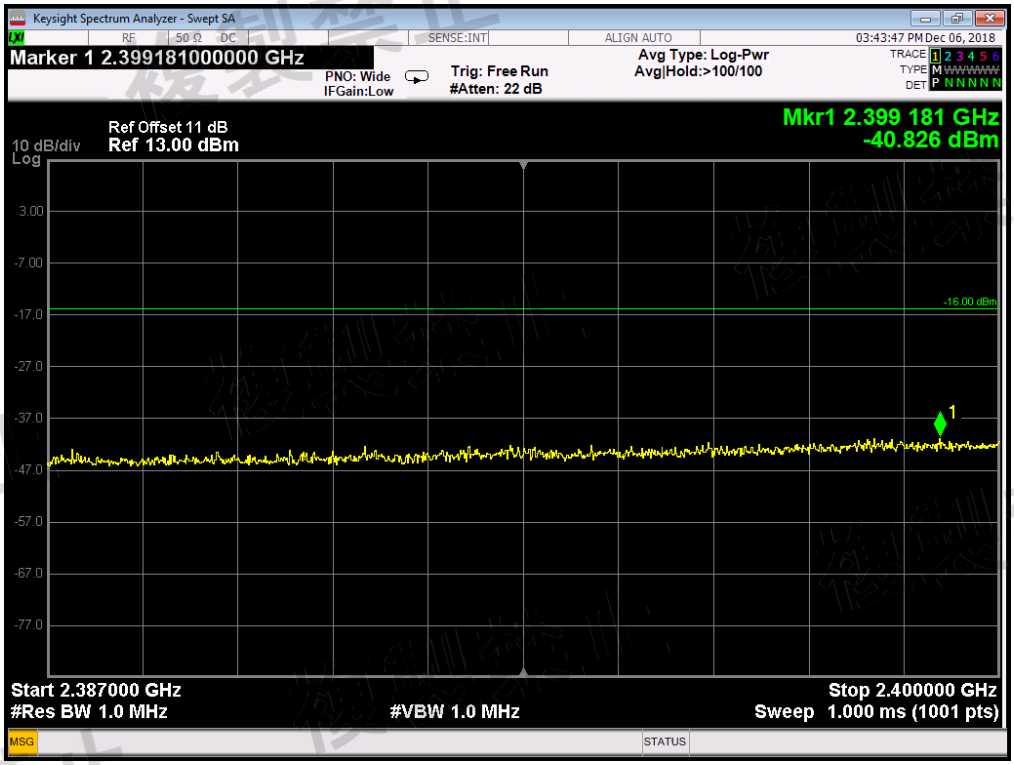
(Plot E3: Channel 1_2483.5 MHz –2496.5 MHz)



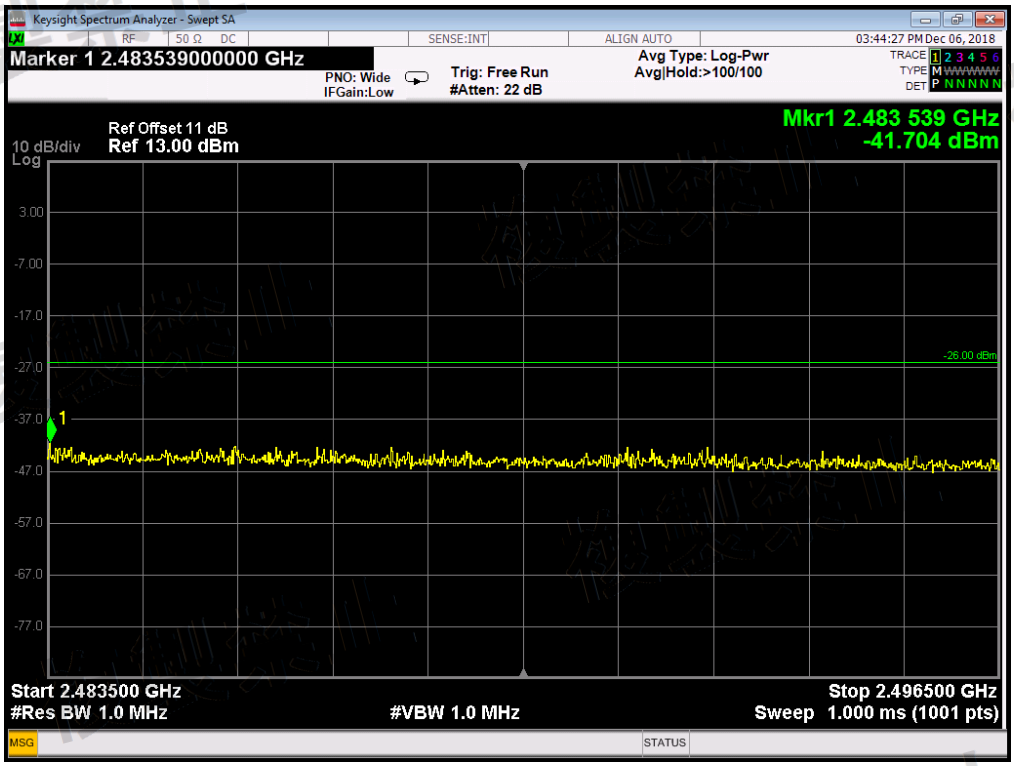
(Plot E4: Channel 1_ 2496.5 MHz – 12500 MHz)



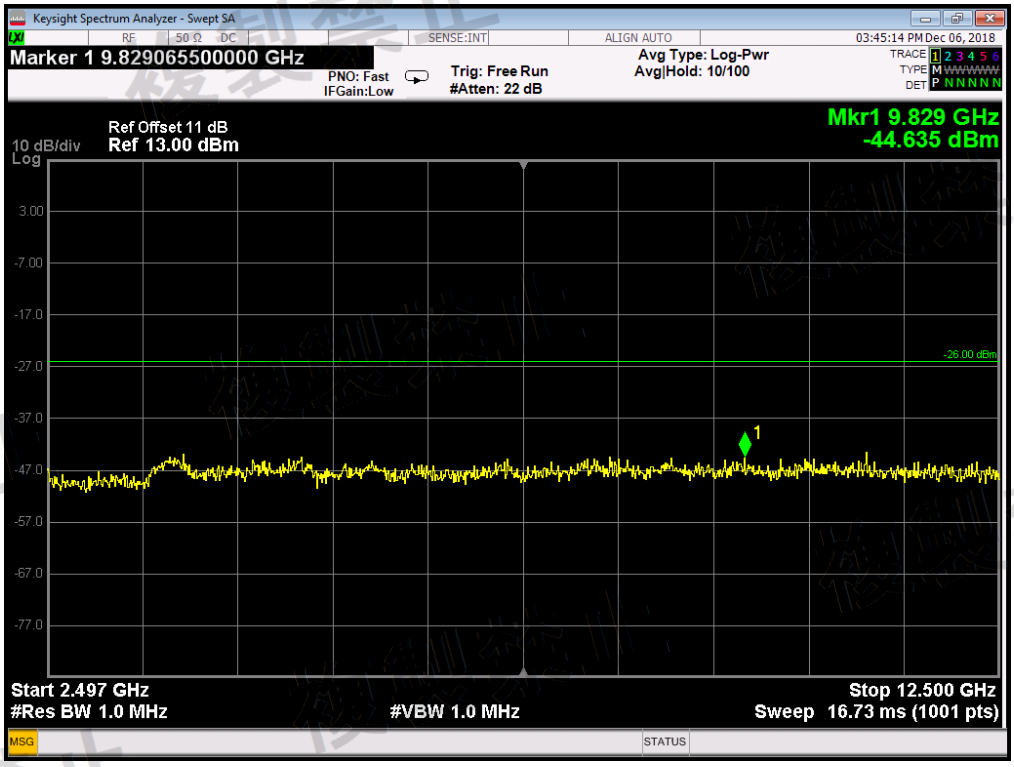
(Plot E5: Channel 7_ 30MHz – 2387MHz)



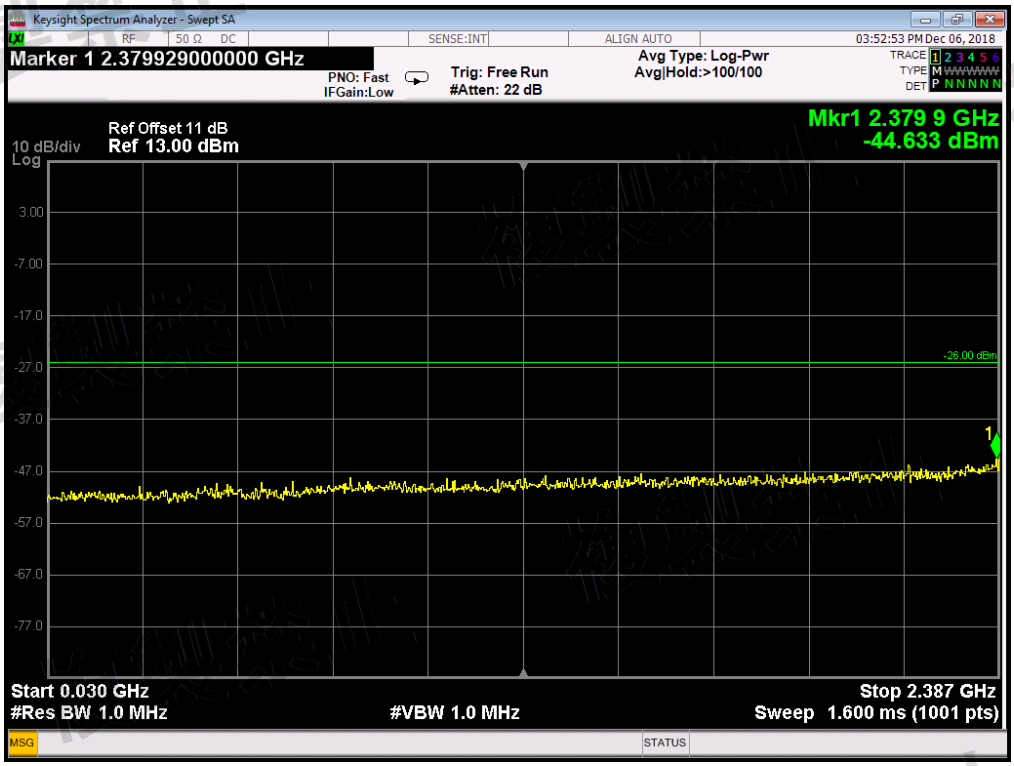
(Plot E6: Channel 7_2387MHz –2400MHz)



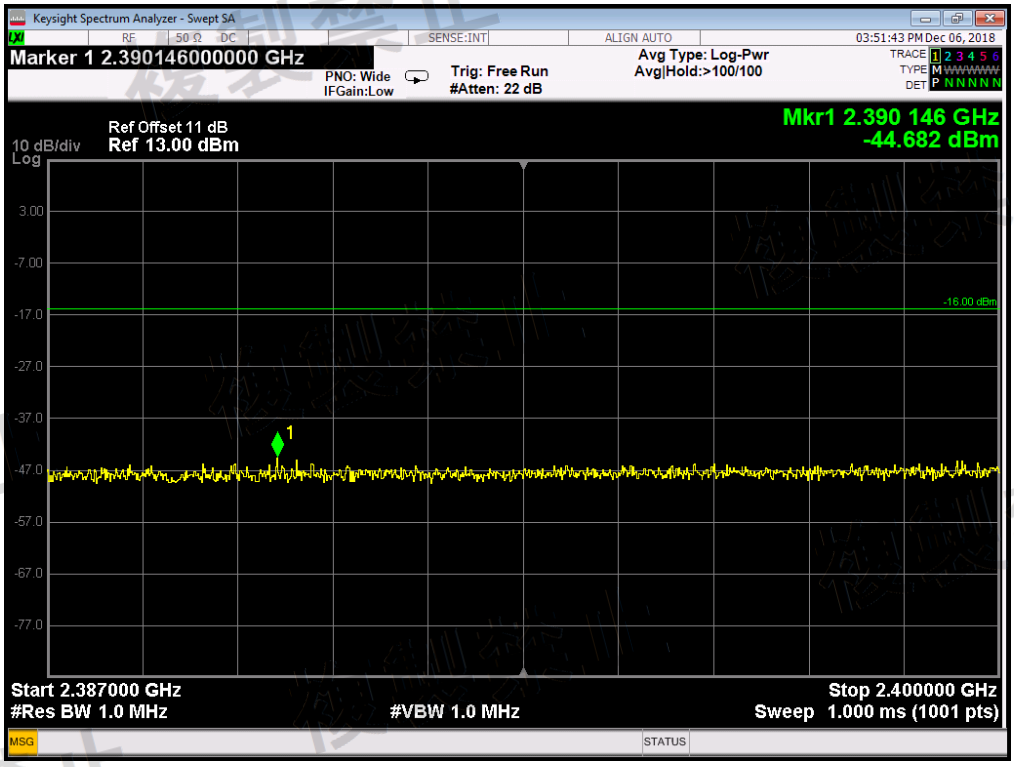
(Plot E7: Channel 7_2483.5 MHz –2496.5 MHz)



(Plot E8: Channel 7_2496.5 MHz – 12500 MHz)

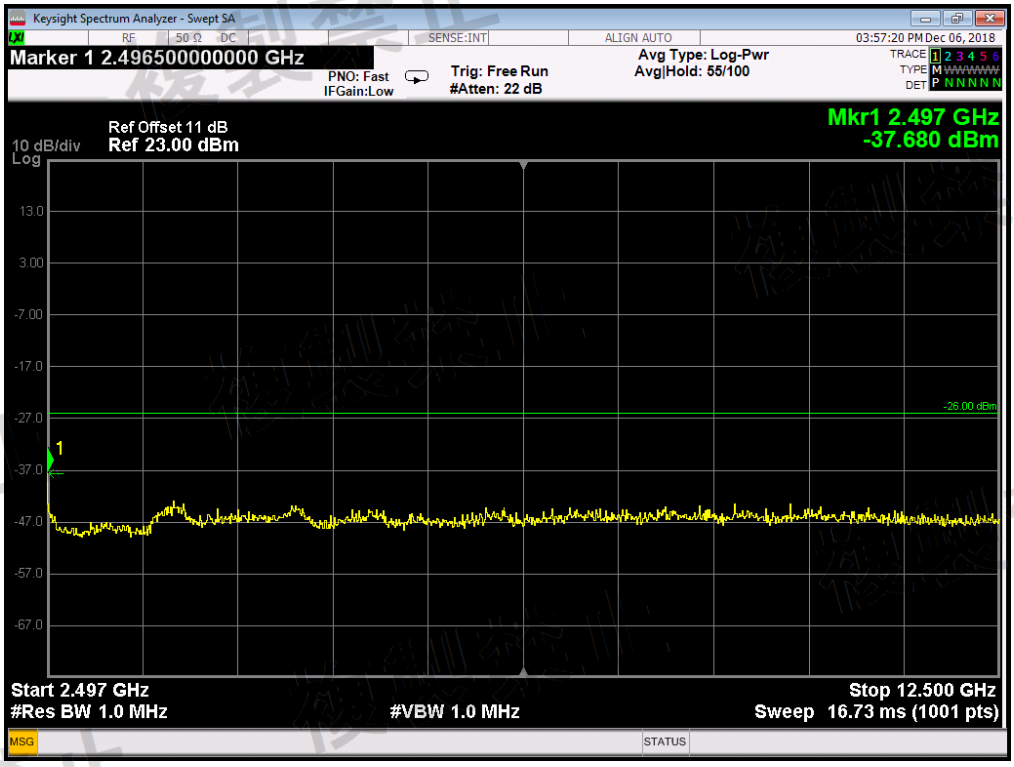


(Plot E9: Channel 13_ 30MHz – 2387MHz)



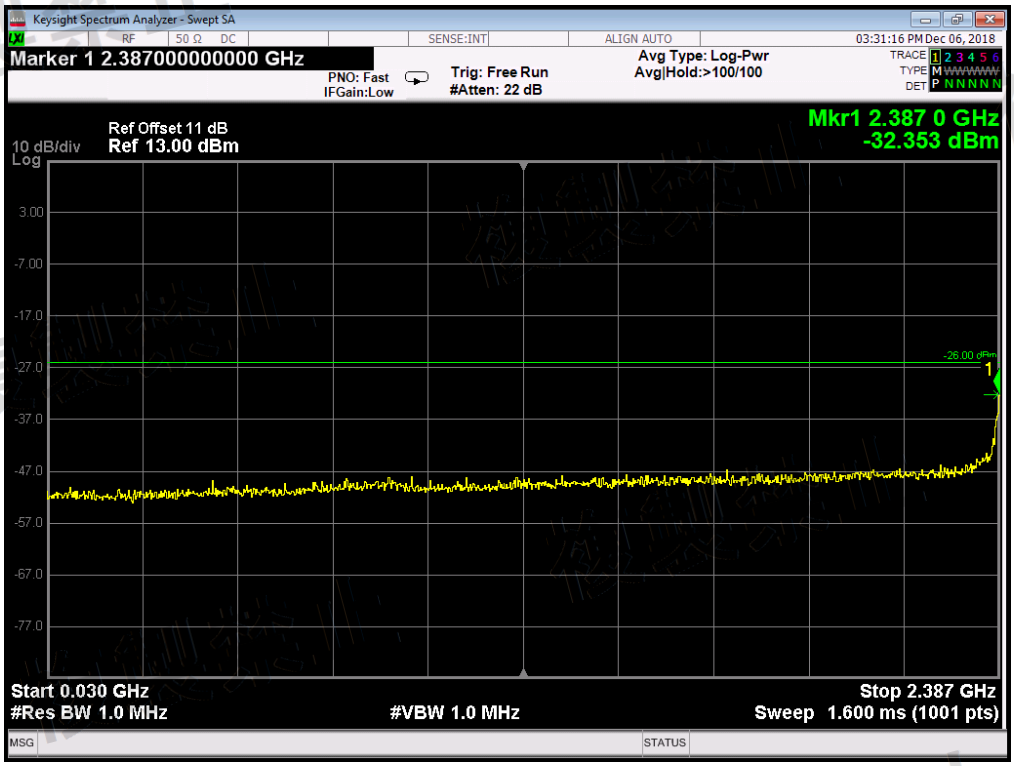
(Plot E10: Channel 13_2387MHz –2400MHz)

(Plot E11: Channel 13_2483.5 MHz –2496.5 MHz)

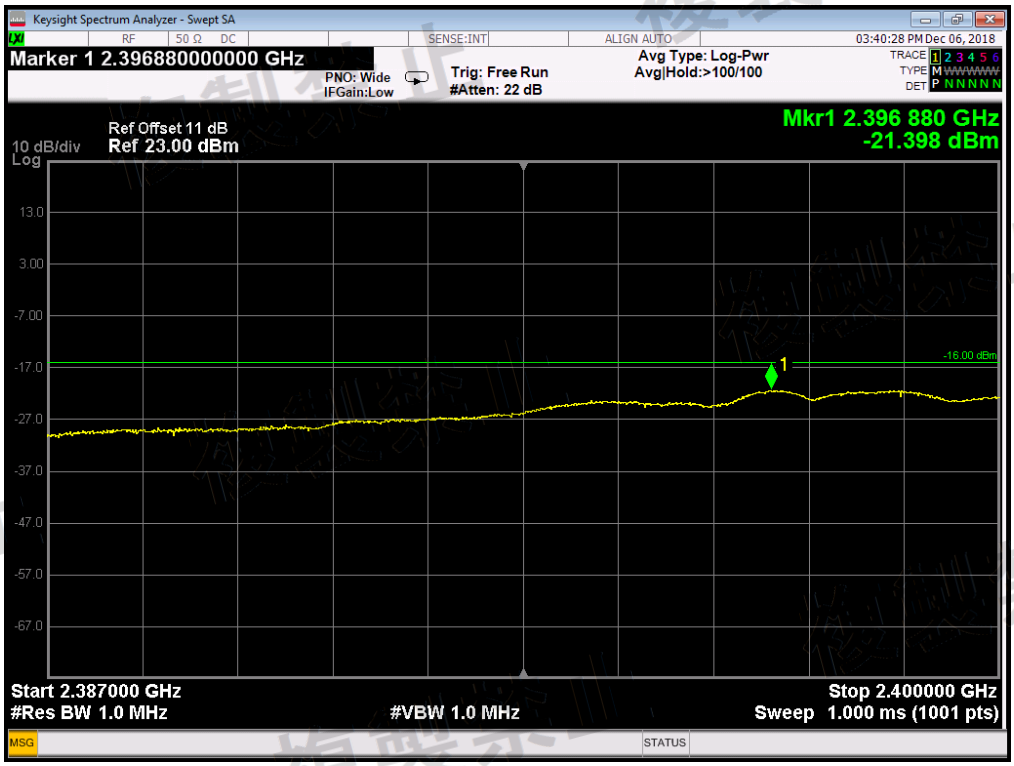


(Plot E12: Channel 13_2496.5 MHz – 12500 MHz)

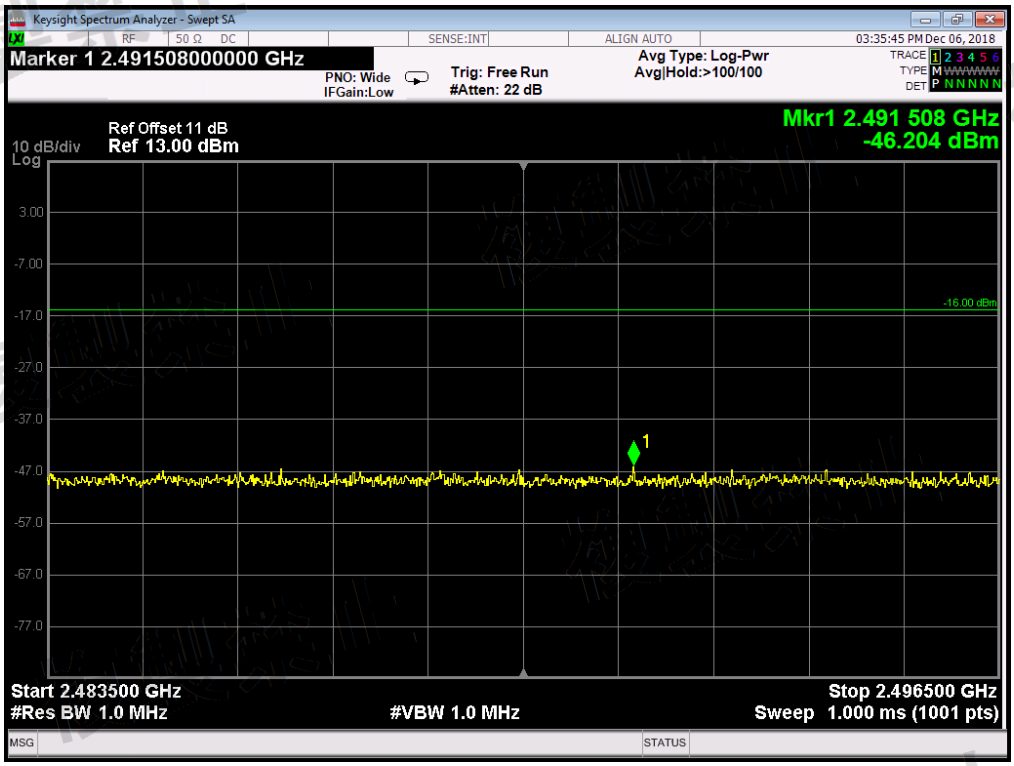
2.3.8.3.802.11n20



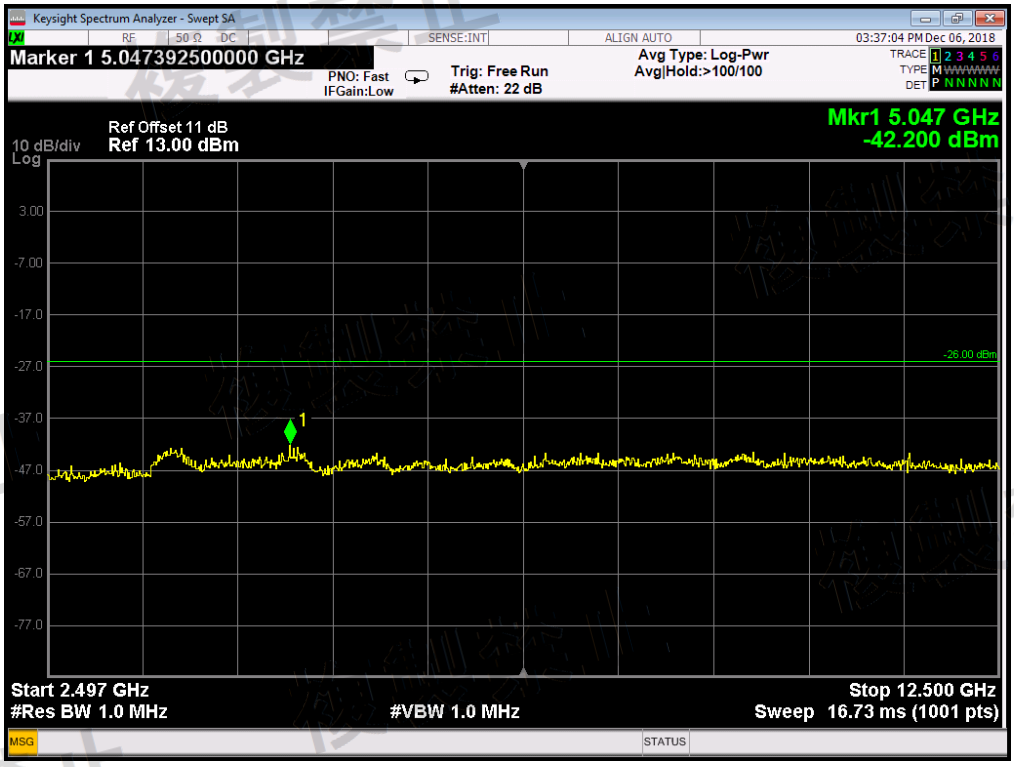
(Plot H1: Channel 1_30MHz – 2387MHz)



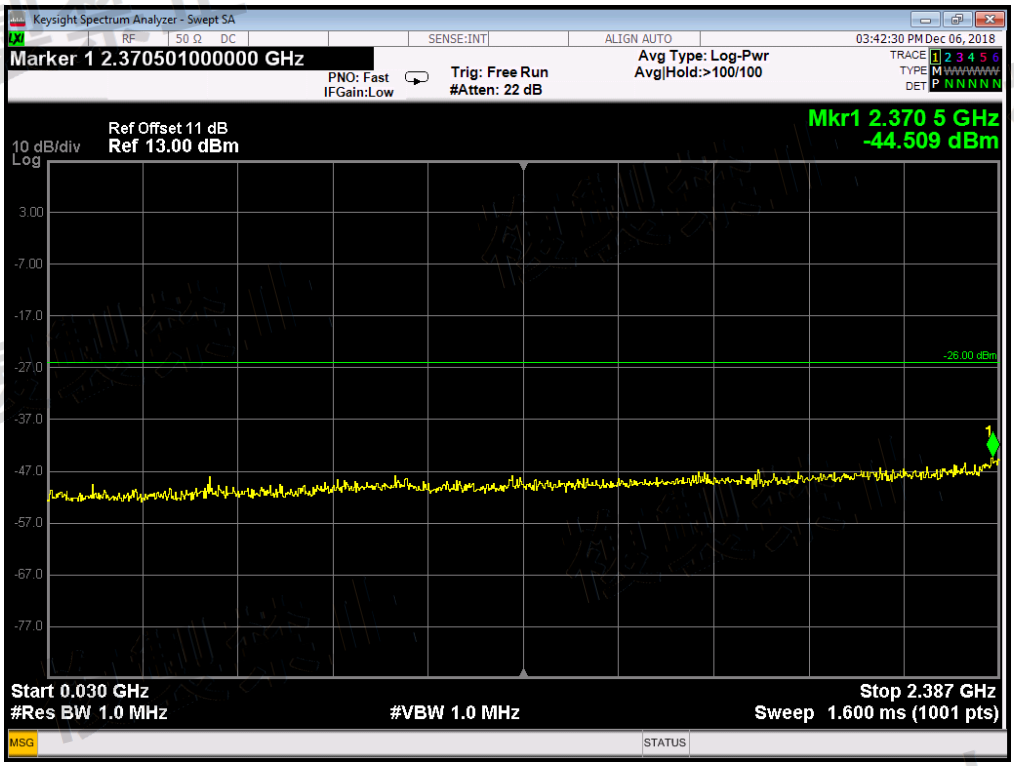
(Plot H2: Channel 1_2387MHz –2400MHz)



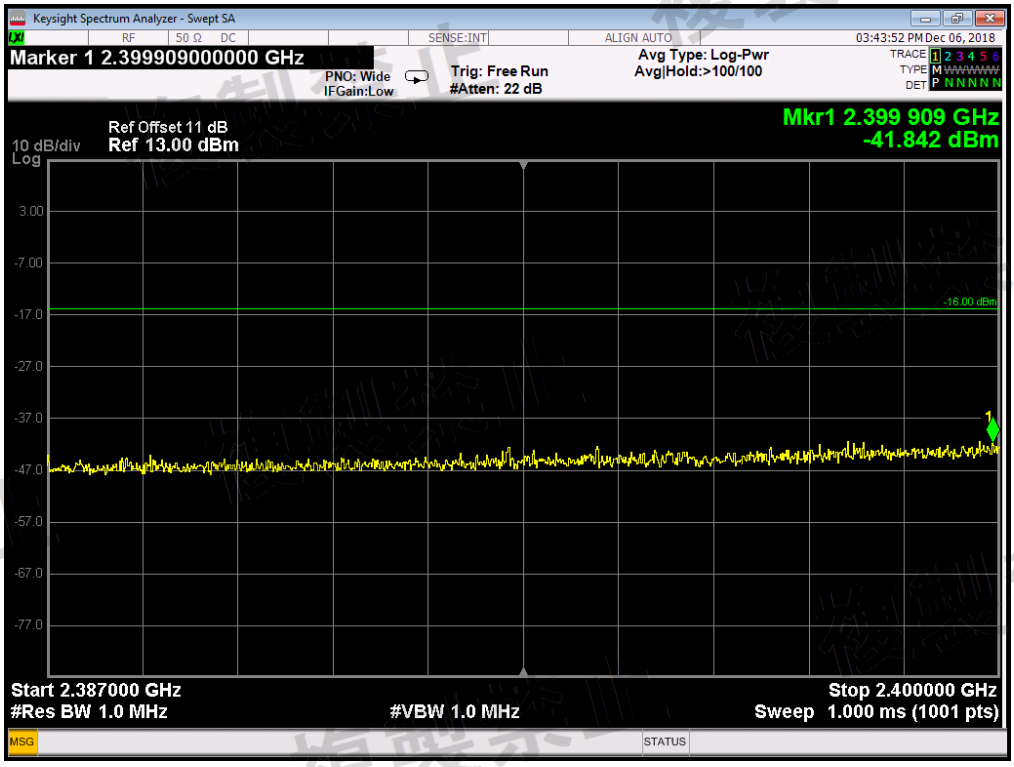
(Plot H3: Channel 1_2483.5 MHz –2496.5 MHz)



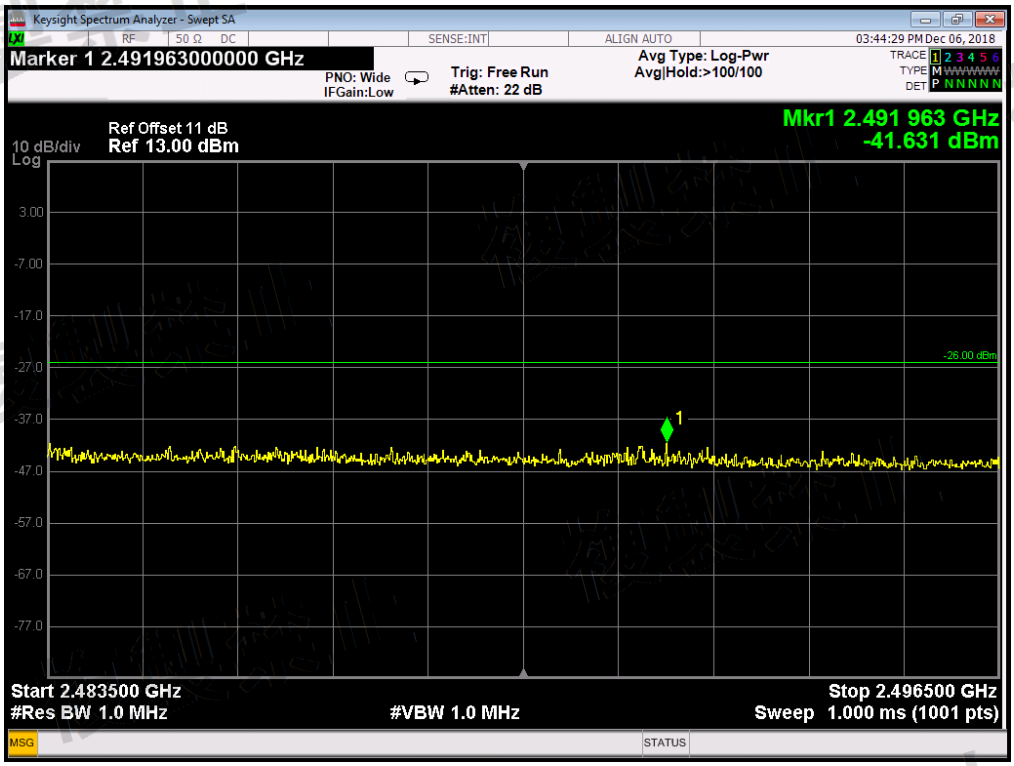
(Plot H4: Channel 1_ 2496.5 MHz – 12500 MHz)



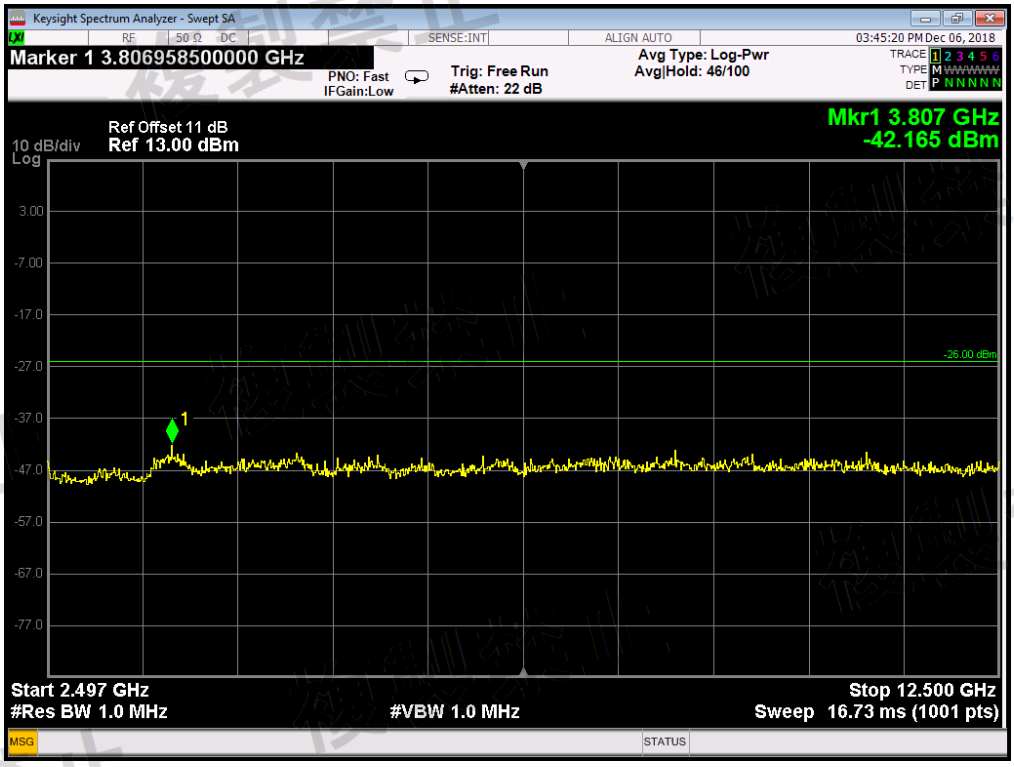
(Plot H5: Channel 7_ 30MHz – 2387MHz)



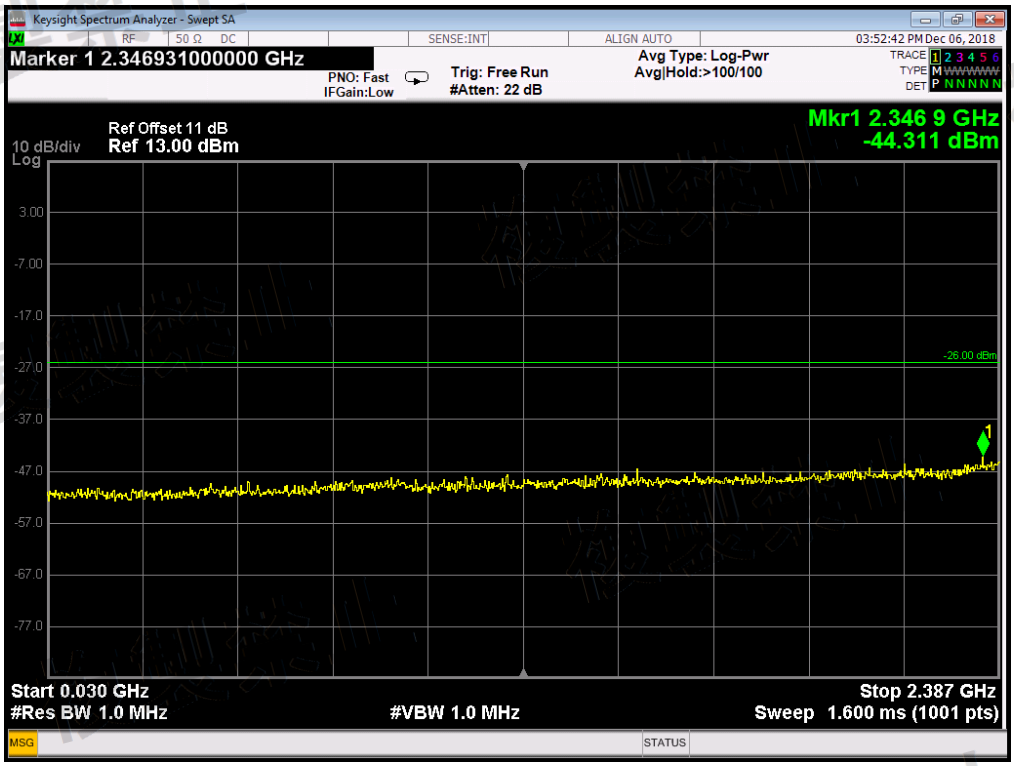
(Plot H6: Channel 7_2387MHz –2400MHz)



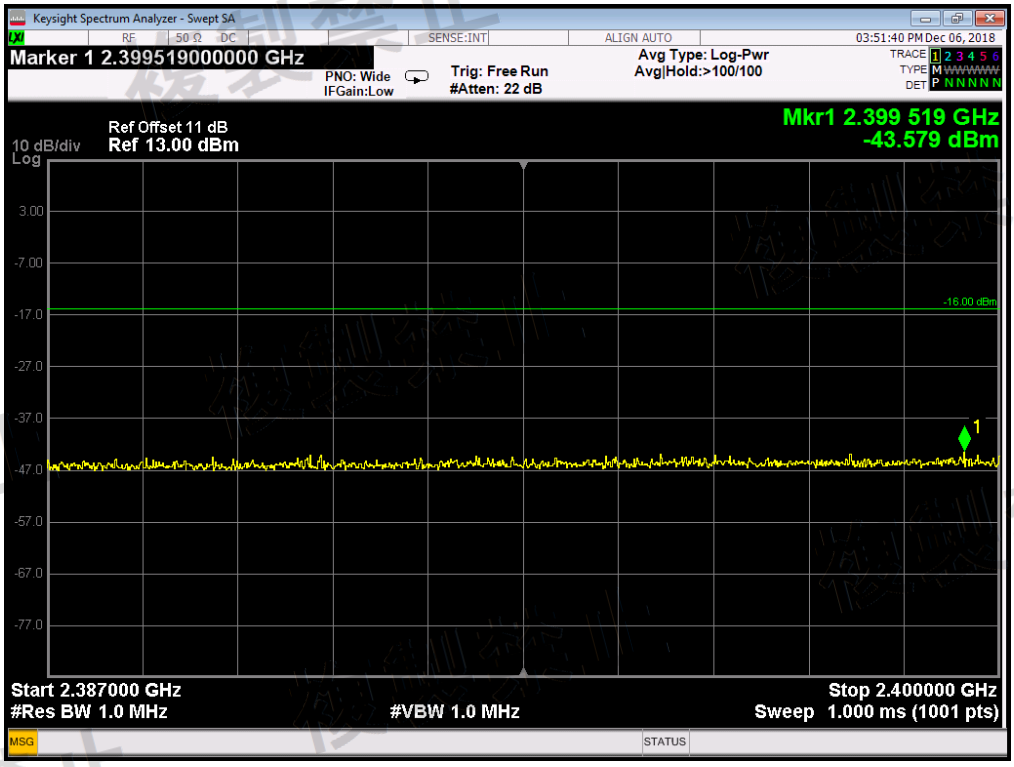
(Plot H7: Channel 7_2483.5 MHz –2496.5 MHz)



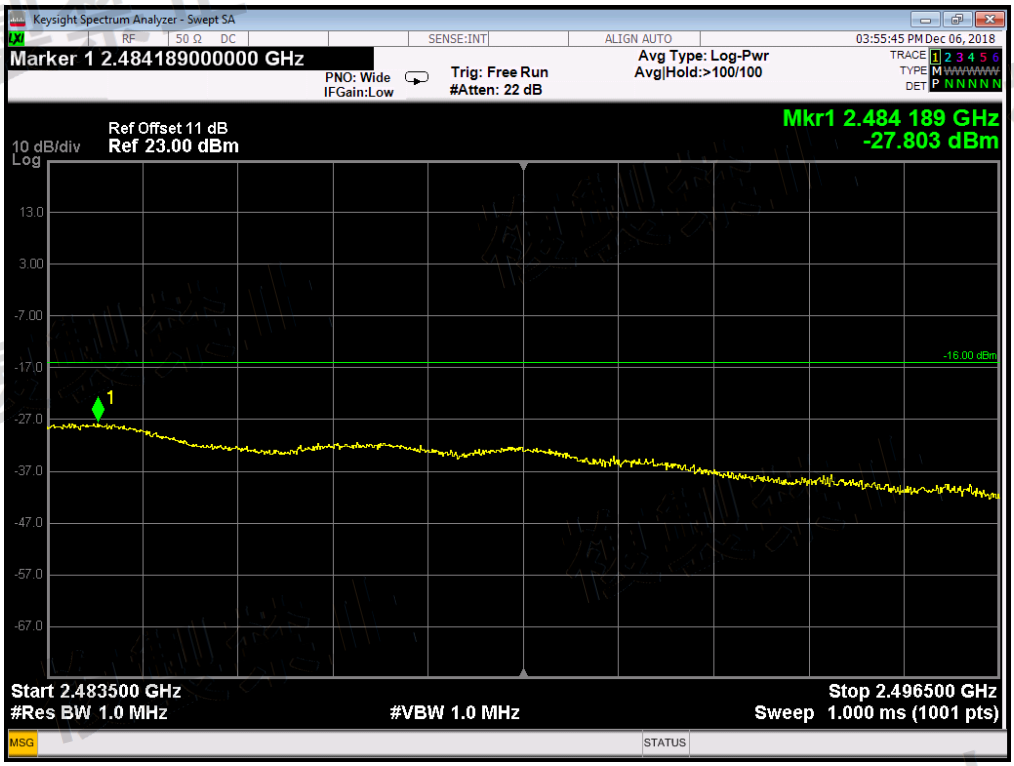
(Plot H8: Channel 7_2496.5 MHz – 12500 MHz)



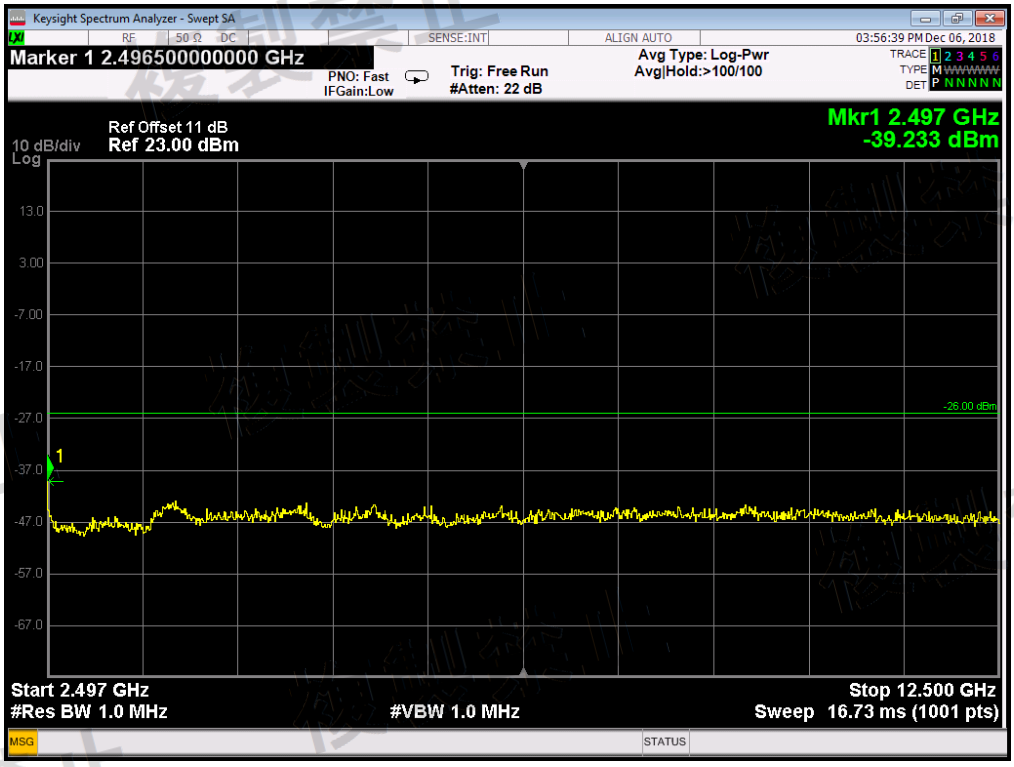
(Plot H9: Channel 13_ 30MHz – 2387MHz)



(Plot H10: Channel 13_2387MHz –2400MHz)

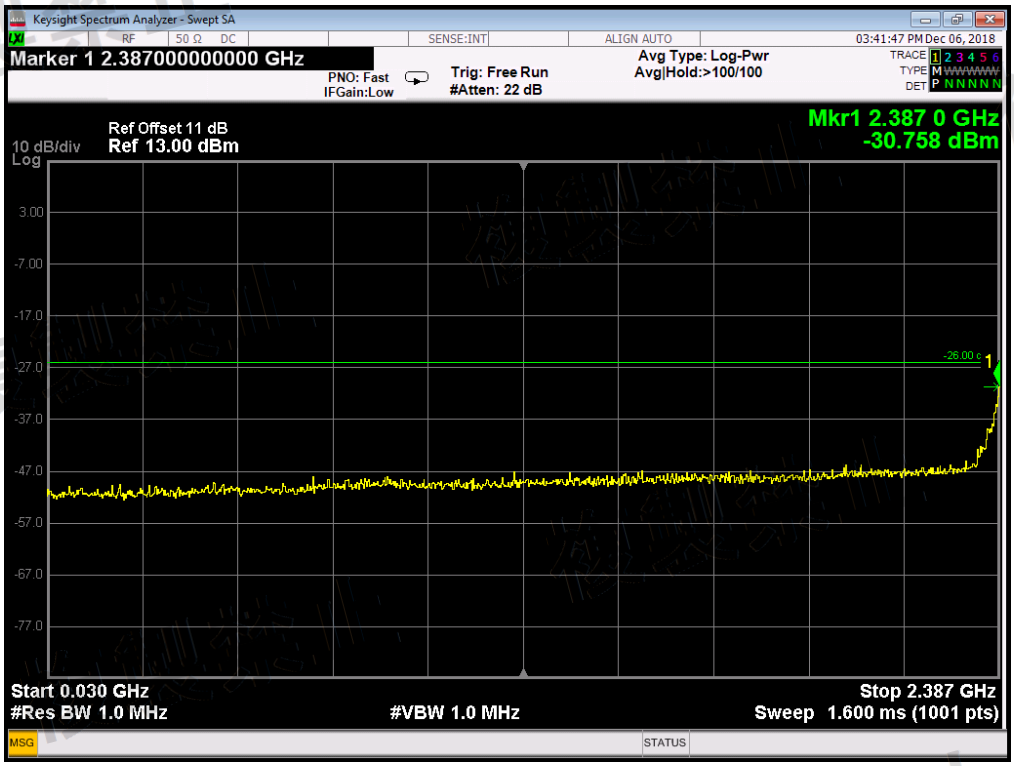


(Plot H11: Channel 13_2483.5 MHz –2496.5 MHz)

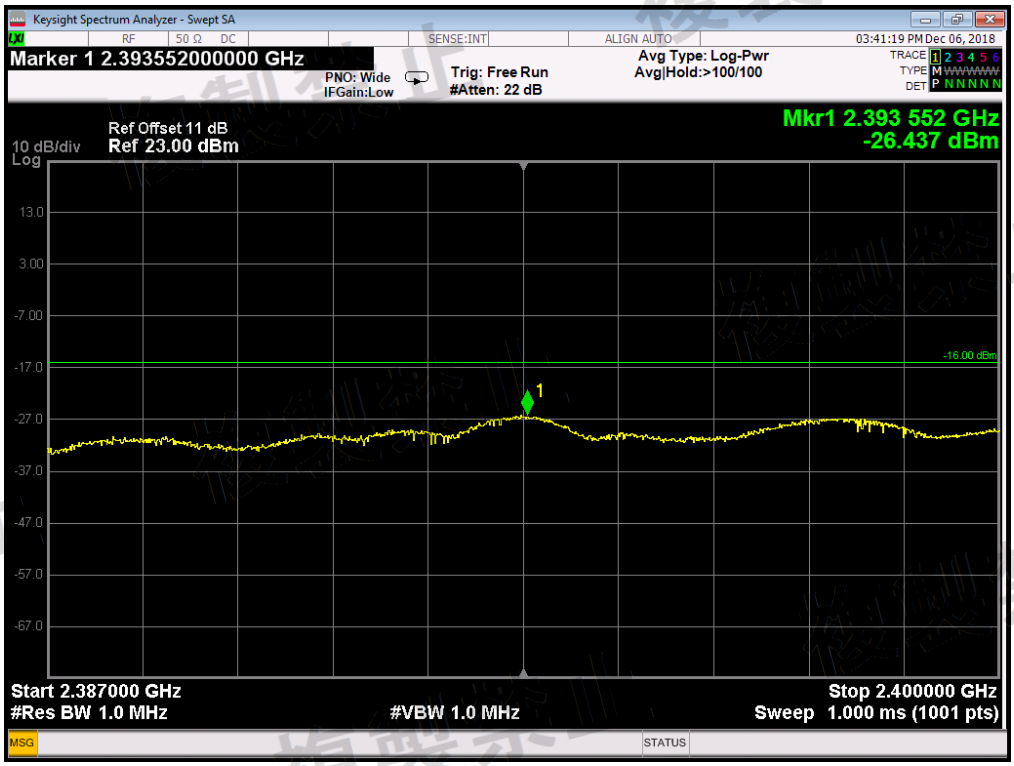


(Plot H12: Channel 13_2496.5 MHz – 12500 MHz)

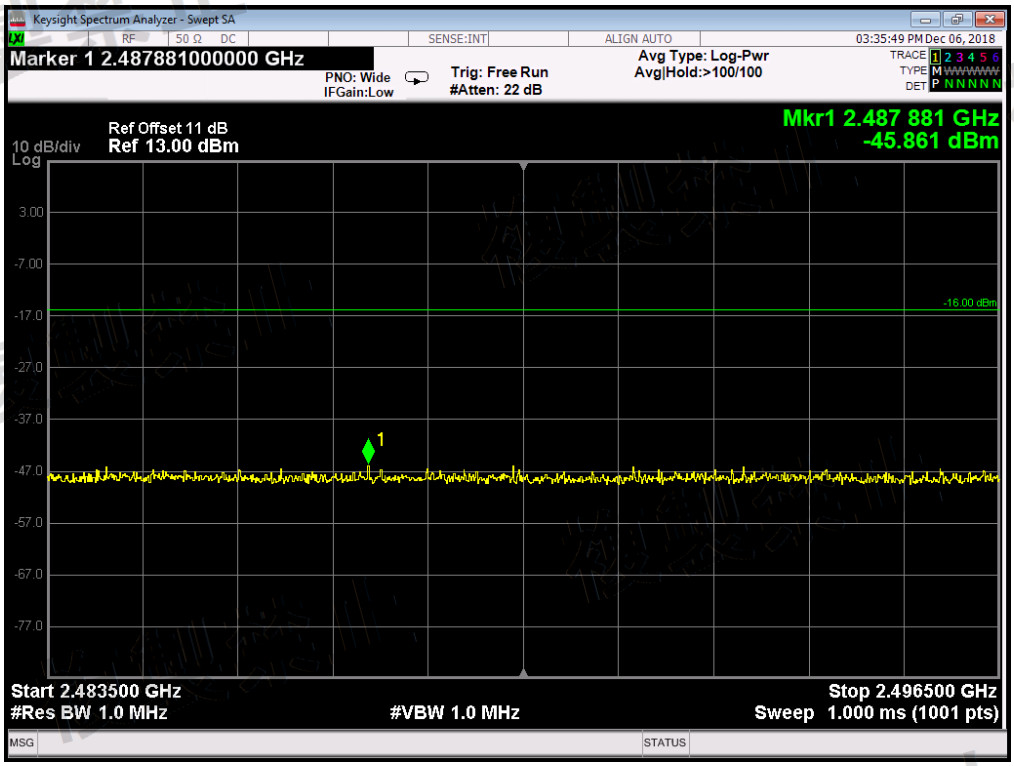
2.3.8.4.802.11n40



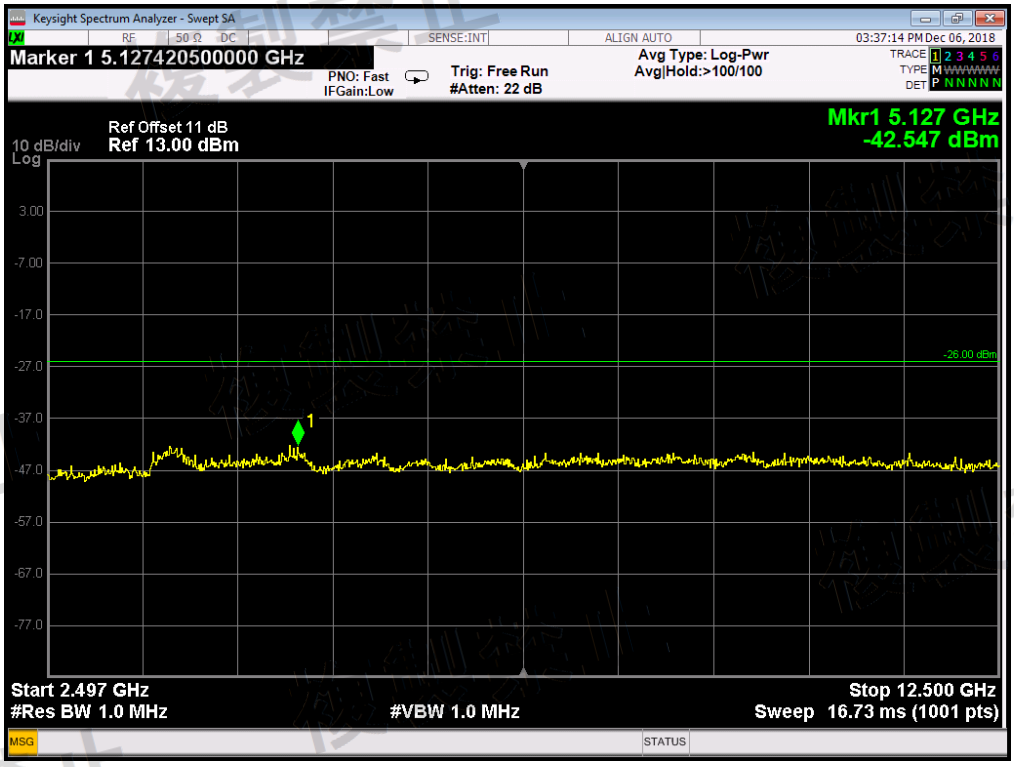
(Plot G1: Channel 1_30MHz – 2387MHz)



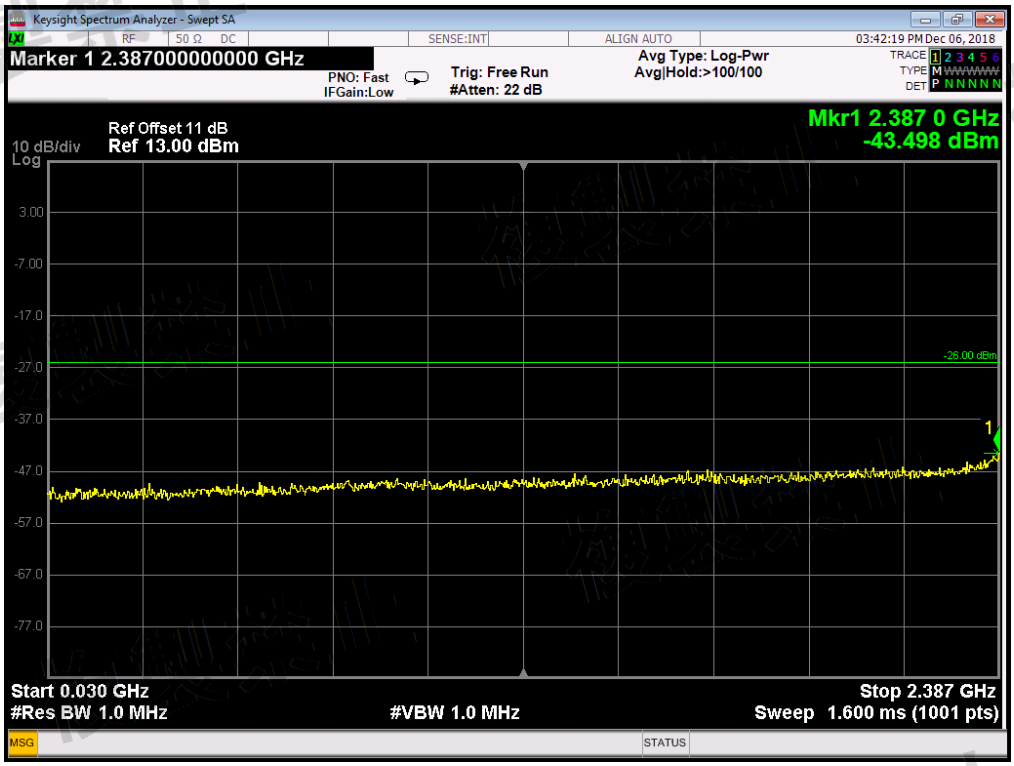
(Plot G2: Channel 1_2387MHz –2400MHz)



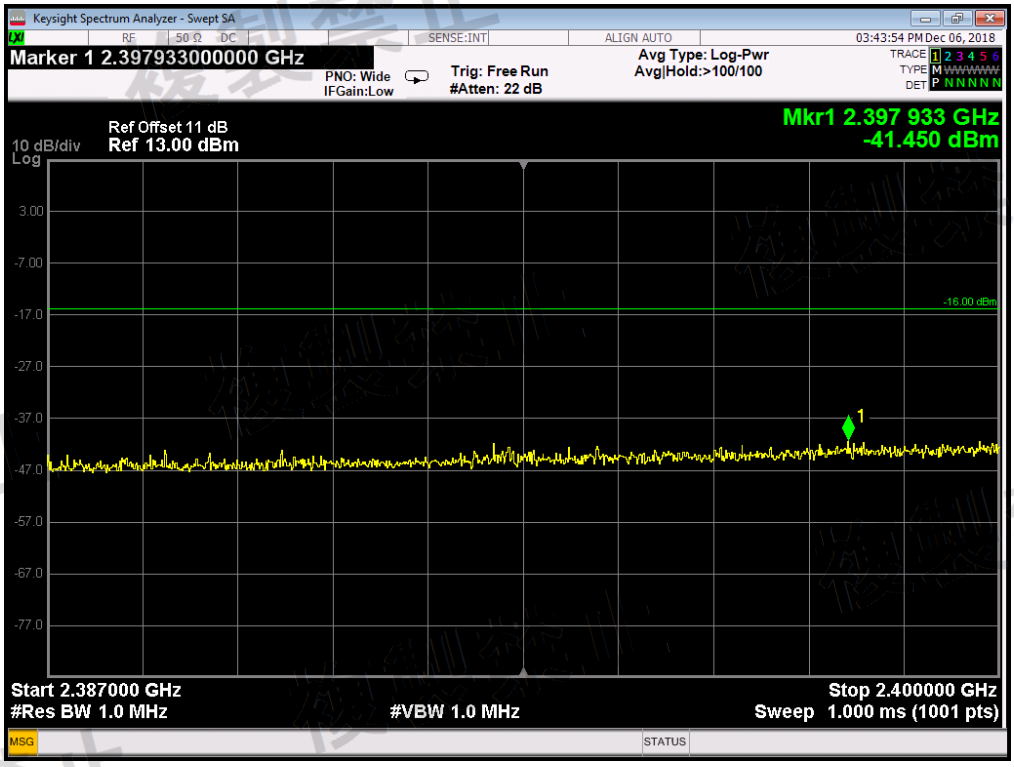
(Plot G3: Channel 1_2483.5 MHz –2496.5 MHz)



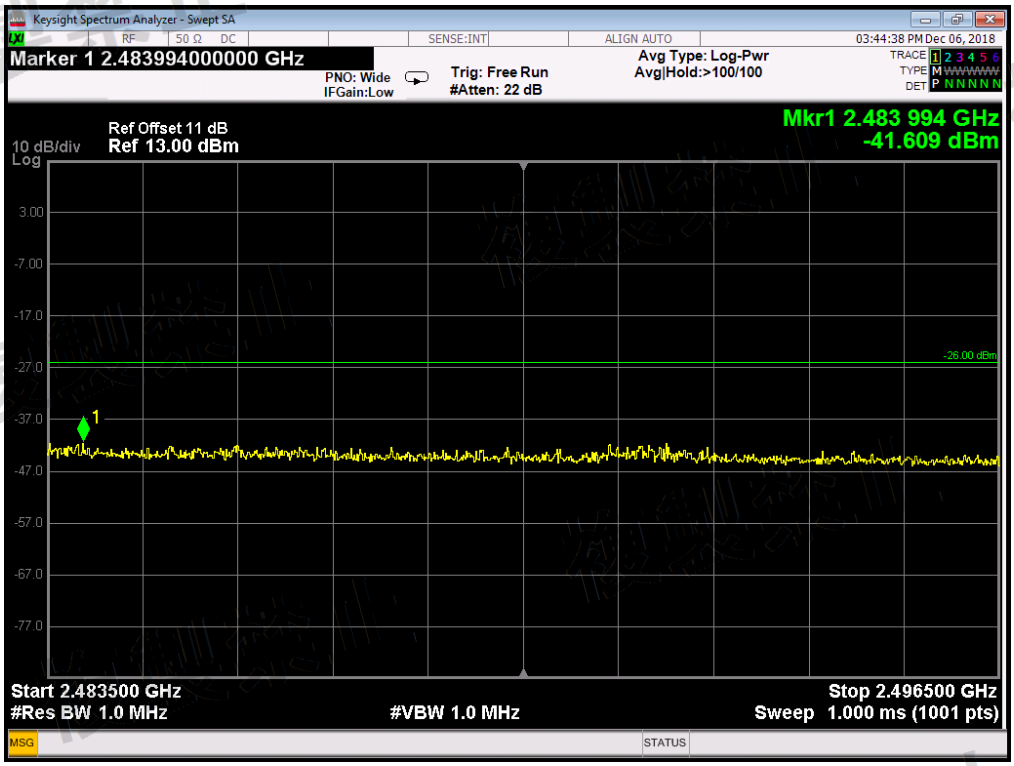
(Plot G4: Channel 1_ 2496.5 MHz – 12500 MHz)



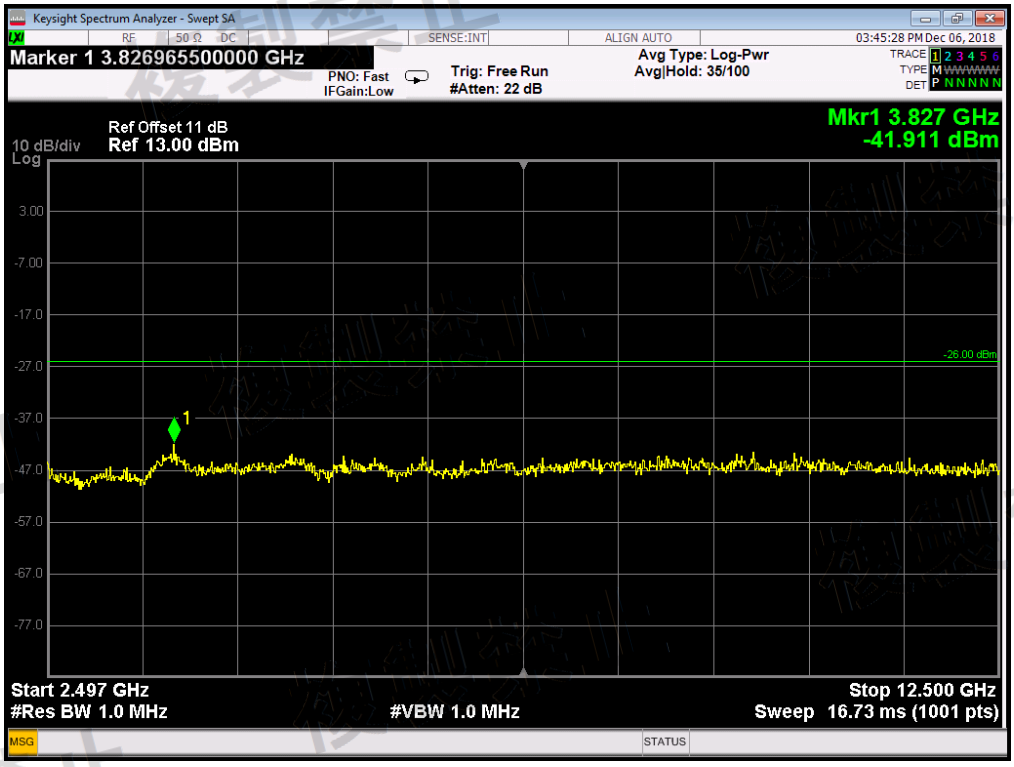
(Plot G5: Channel 7_ 30MHz – 2387MHz)



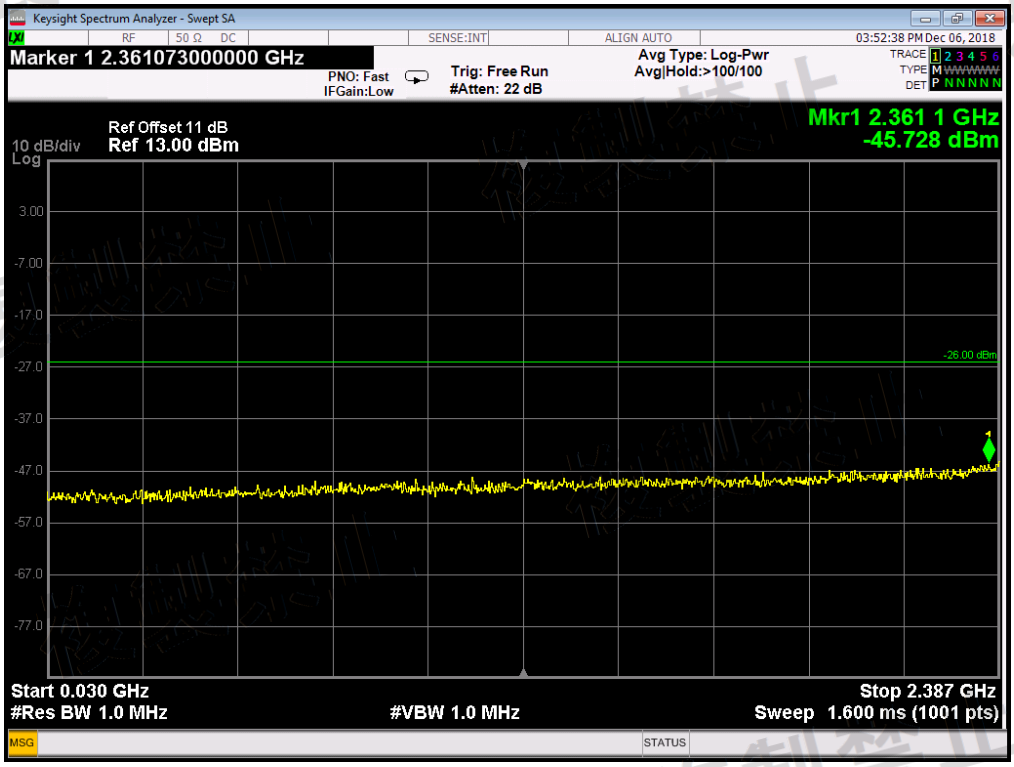
(Plot G6: Channel 7_2387MHz –2400MHz)



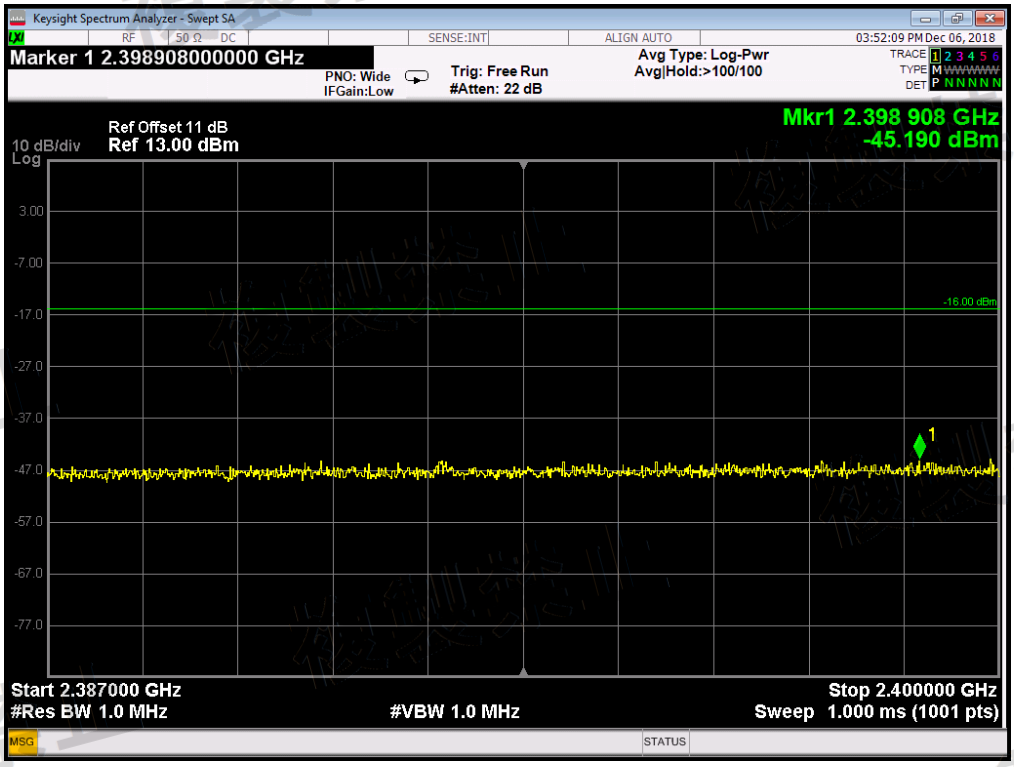
(Plot G7: Channel 7_2483.5 MHz –2496.5 MHz)



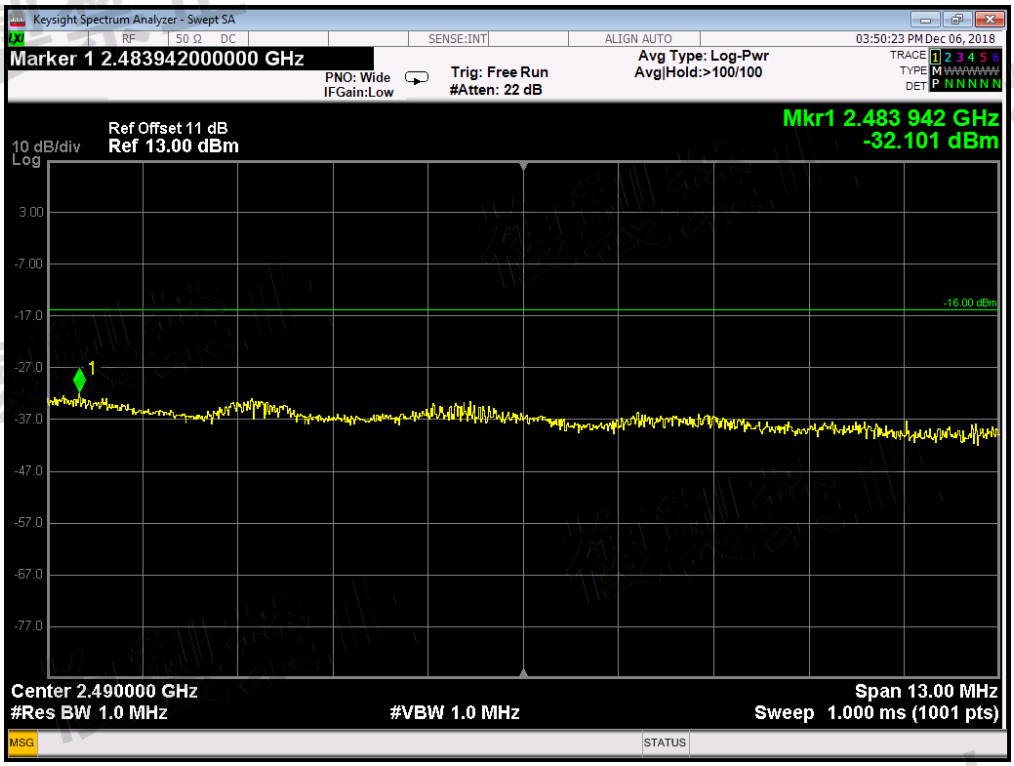
(Plot G8: Channel 7_2496.5 MHz – 12500 MHz)



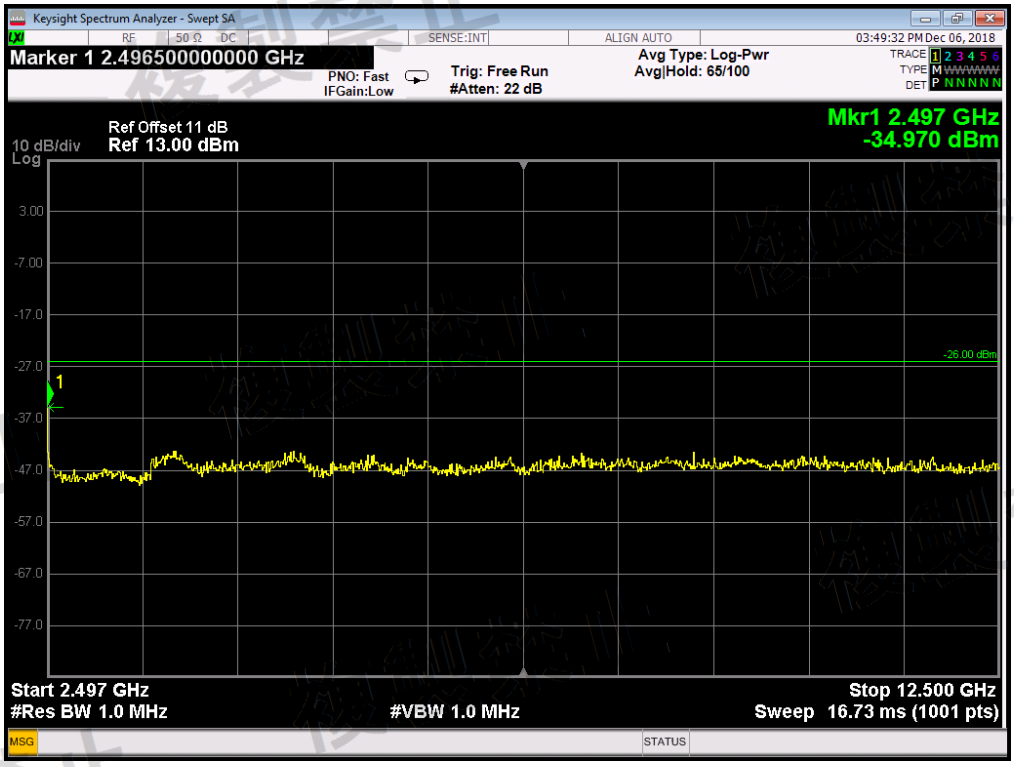
(Plot G9: Channel 13_ 30MHz – 2387MHz)



(Plot G10: Channel 13_2387MHz –2400MHz)



(Plot G11: Channel 13_2483.5 MHz –2496.5 MHz)



(Plot G12: Channel 13_2496.5 MHz – 12500 MHz)

2.4. Antenna Power Error Measurement

2.4.1. Limit

Item	Limits
Antenna Power Density	≦3mW/MHz (FH form 2427 - 2470.75 MHz) ≦10mW/MHz (OFDM, DS from 2400~2483.5MHz) ≦10 mW (Other from 2400~2483.5MHz)
Antenna Power Error	+20%, -80% (Base on manufacturer declare antenna power density)

2.4.2. Measuring Instruments and setting

Please refer to section 4 in this report. The following table is the setting of the spectrum.

2.4.3. Test Procedures

1 A power meter is connected on the IF output port of the spectrum analyzer.

2 Adjust the spectrum analyzer to have the center frequency the same with the measured carrier. RBW=VBW=1MHz, detector mode is positive peak. Turn off the averaging function and use zero span.

3 The calibrating signal power shall be reduced to 0 dBm and it shall be verified that the power meter reading also reduces by 10 dB.

4 Connect the equipment to be measured. Using the following settings of the spectrum analyzer in combination with "max hold" function, find the frequency of highest power output in the power envelope: center frequency equal to operating frequency; RBW & VBW: 1 MHz; detector mode: positive peak; averaging: off; span: 3 times the spectrum width; amplitude: adjust for middle of the instrument's range. The frequency found shall be recorded.

5 Set the center frequency of the spectrum analyzer to the found frequency and switch to zero span. The power meter indicates the measured power density “Pt”.

6 Calculate antenna power density by the formula below PD = Pt + 10*log(1/x). x: The duty cycle of the EUT in continuously transmitting mode

7 Antenna Power Error is definition that actual measure antenna power tolerance between + 20% to - 80% power range that base on manufacturer declare the conducted power density.

2.4.4. Test Setup Layout

2.4.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.4.6. Results of Antenna Power Error

Test Voltage	Channel	Frequency (MHz)	ANT Power (dBm/ MHz)	ANT Power (mW/ MHz)	Rate Power (mW / MHz)	Limit (mW/ MHz)	Antenna Power Error	Verdict
802.11b	1	2412	6.55	4.52	5.0	10	-9.60	PASS
	7	2442	6.51	4.48	5.0	10	-10.40	PASS
	13	2472	7.17	5.21	5.0	10	4.20	PASS
802.11g	1	2412	6.60	4.57	4.5	10	1.56	PASS
	7	2442	6.49	4.45	4.5	10	-1.11	PASS
	13	2472	6.59	4.56	4.5	10	1.33	PASS
802.11n20	1	2412	6.06	4.04	4.0	10	1.00	PASS
	7	2442	6.02	3.99	4.0	10	-0.25	PASS
	13	2472	6.04	4.02	4.0	10	0.50	PASS
802.11n40	2	2422	3.54	2.26	2.5	5	-9.60	PASS
	7	2442	3.83	2.41	2.5	5	-3.60	PASS
	11	2462	3.77	2.38	2.5	5	-4.80	PASS

2.5. Limitation of Collateral Emission of Receiver Measurement

2.5.1. Limit

Item	Limits
RX Spurious Emission:	≦4nW (f<1GHz)
	≦20nW (1GHz≦f)

2.5.2. Measuring Instruments and setting

Please refer to section 4 in this report. The following table is the setting of the spectrum.

Spectrum Parameter	Setting
Attenuation	Auto
RB/VB	100 kHz (below 1GHz emissions) / 1 MHz (above 1GHz emissions)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

2.5.3. Test Procedures

1 EUT has the continuous reception mode and fixed only one channelize.

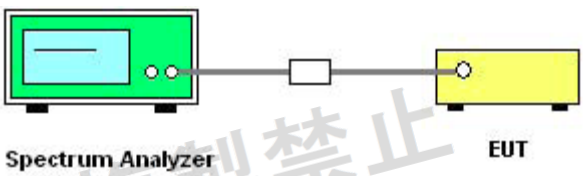
2 Setting of SA is following as RB / VB: 100 kHz (below 1GHz emissions) / 1 MHz (above 1GHz emissions) / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold

3 SA set RB: 100kHz and VB: 100kHz. Then adjust to start frequency 30MHz and stop frequency 1000MHz. Search to mark peak reading value + cable loss shall be less than 4nW

4 SA set RB: 1MHz and VB: 1MHz. Then adjust to start frequency 1000MHz and stop frequency 12500MHz. Search to mark peak reading value + cable loss shall be less than 20nW

5 If power level of lower emissions are more than 1/10 of limit (0.4nW for f < 1GHz, 2nW for f≥ 1GHz), all those are to be indicated in the 2nd and 3rd lines. If others are 1/10 or less more of the limit, no necessary to be indicated

2.5.4. Test Setup Layout



2.5.5. Test Deviation

There is no deviation with the original standard.

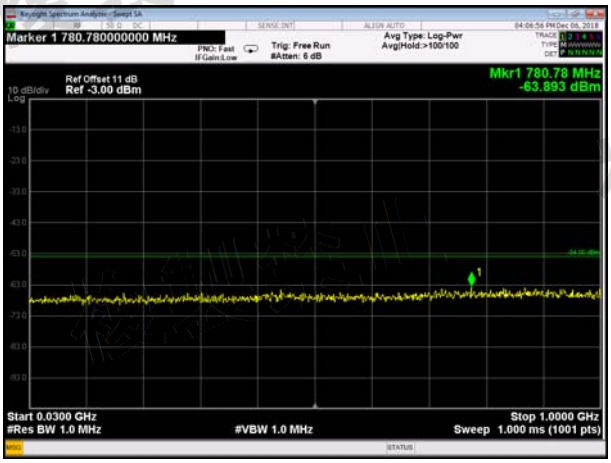
2.5.6. EUT Operation during Test

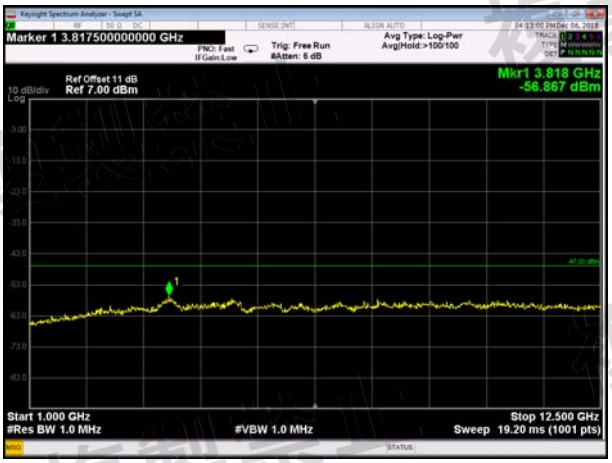
The EUT was programmed to be in continuously transmitting mode.

2.5.7. Test Result Limitation of Collateral Emission of Receiver

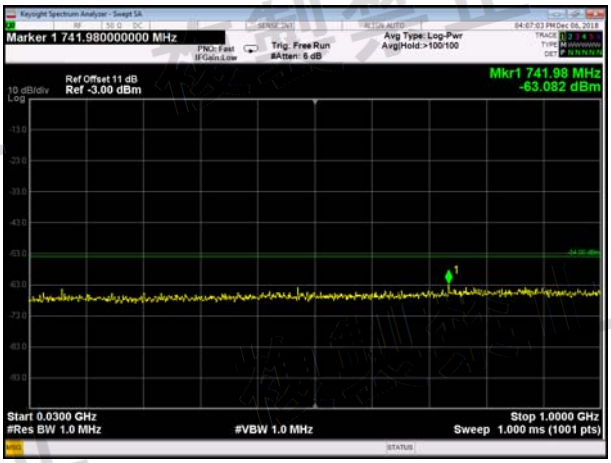
Test Voltage	Frequency	Measured Max. Emission (dBm)	Limit (dBm)	Verdict
802.11b	2412MHz	< -55	≦-54 (f<1GHz); ≦-47 (1GHz≦f)	PASS
	2442MHz	< -55		PASS
	2472MHz	< -55		PASS
802.11g	2412MHz	< -55		PASS
	2442MHz	< -55		PASS
	2472MHz	< -55		PASS
802.11N20	2412MHz	< -55		PASS
	2442MHz	< -55		PASS
	2472MHz	< -55		PASS
802.11N40	2422 MHz	< -55		PASS
	2442 MHz	< -55		PASS
	2462 MHz	< -55		PASS

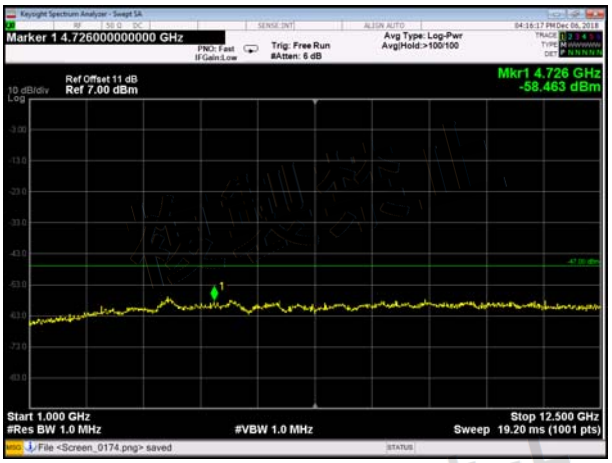
2.5.8. Test Plots



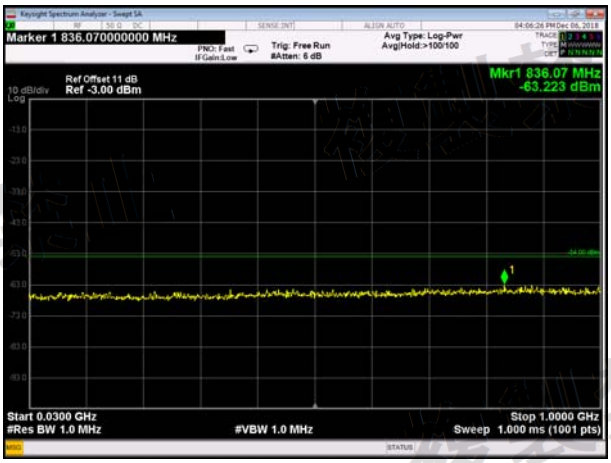


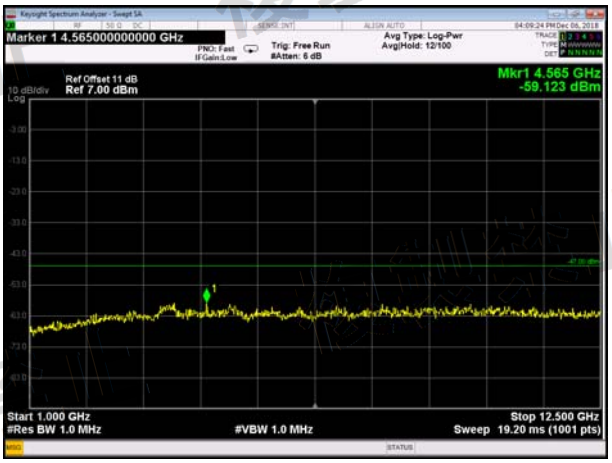
(Plot D: Channel 1_30M-12.5G)



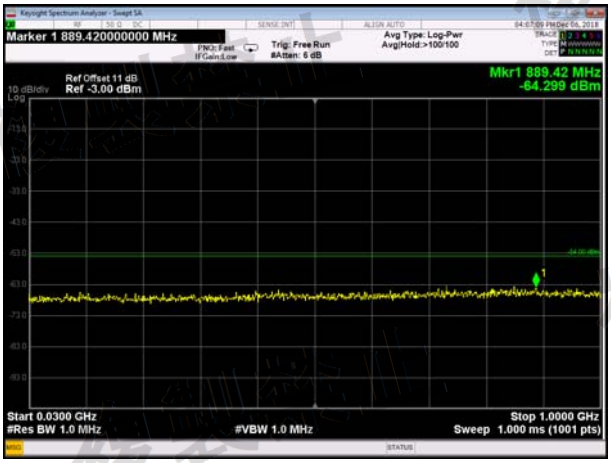


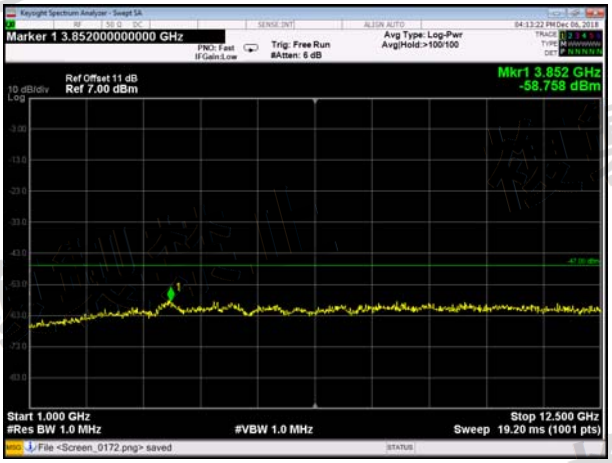
(Plot E: Channel 7_30M-12.5G)



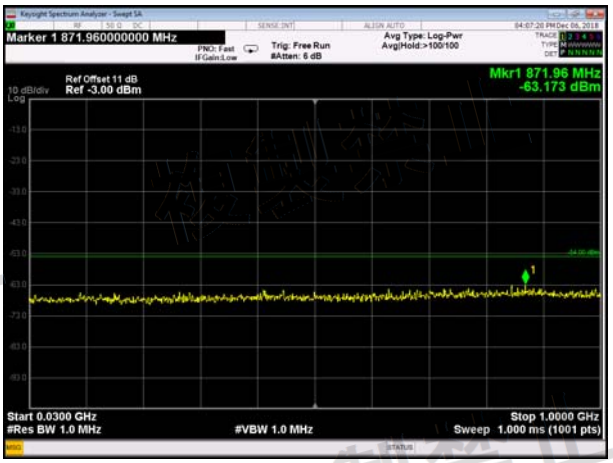


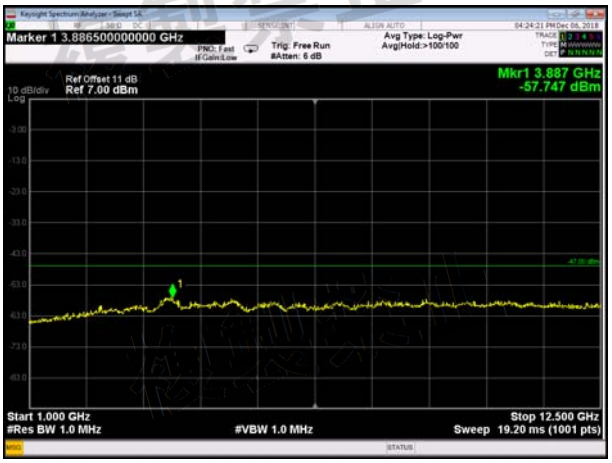
(Plot F: Channel 13_30M-12.5G)



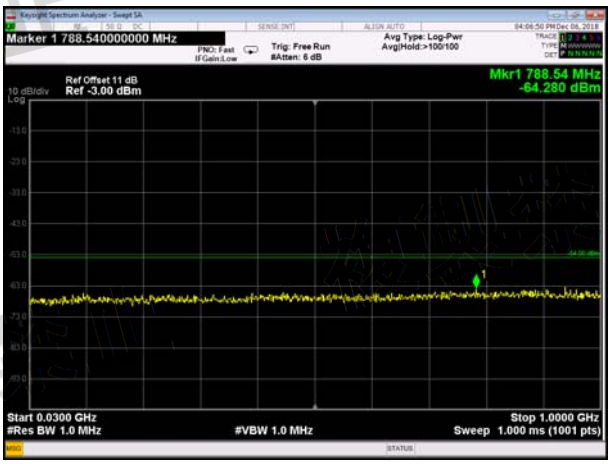


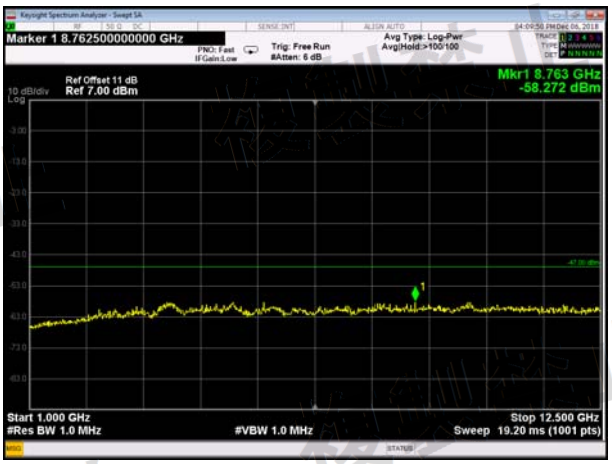
(Plot D: Channel 1_30M-12.5G)



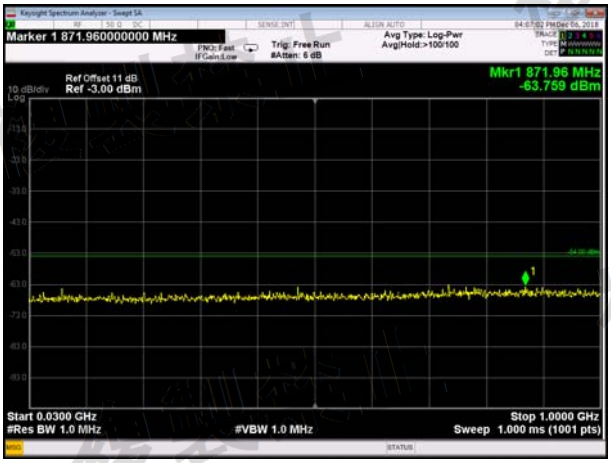


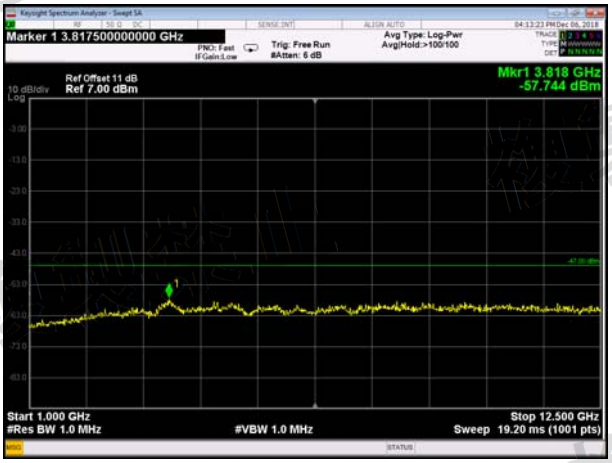
(Plot E: Channel 7_30M-12.5G)



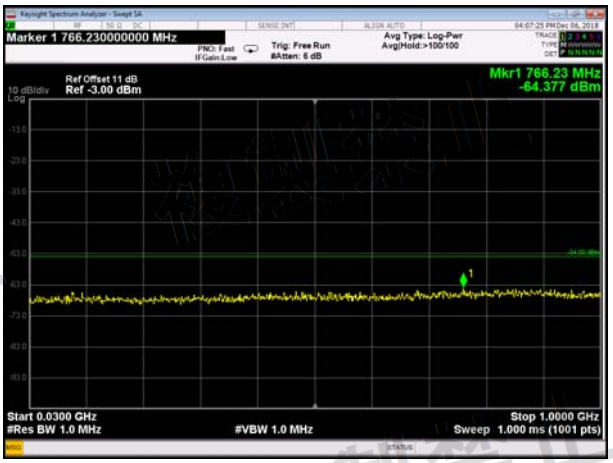


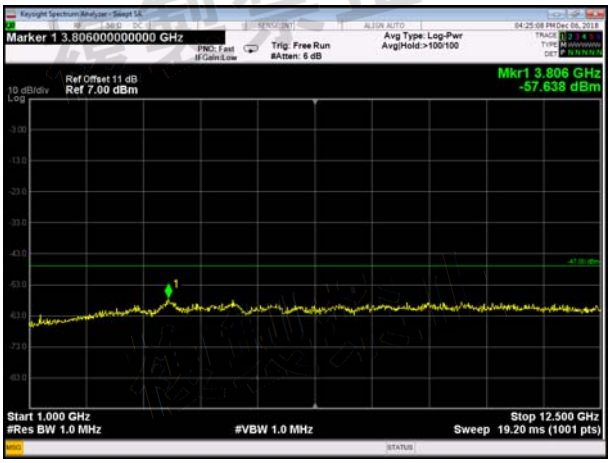
(Plot F: Channel 13_30M-12.5G)



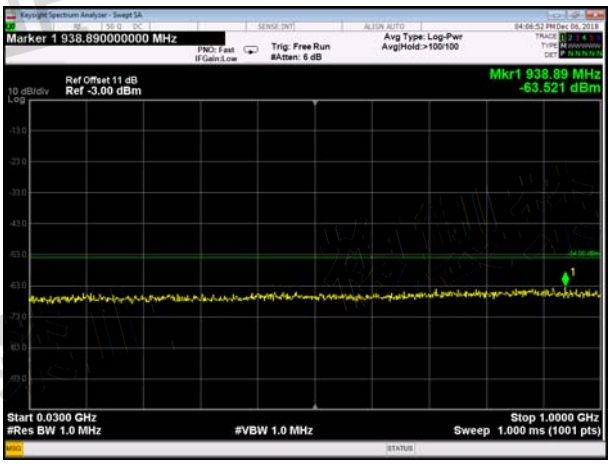


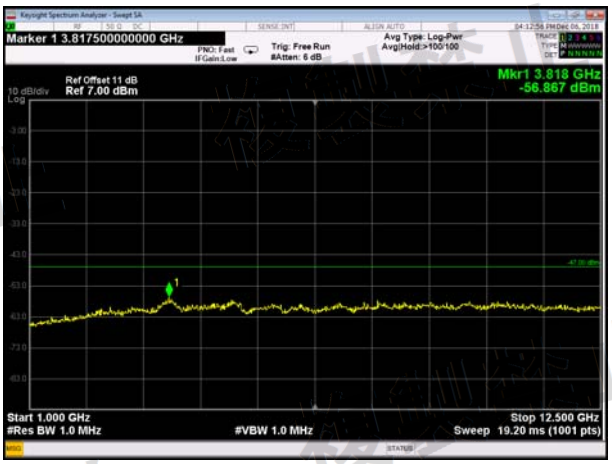
(Plot D: Channel 1_30M-12.5G)



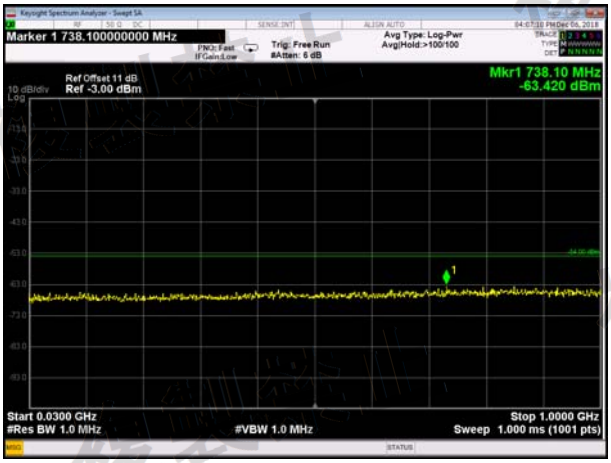


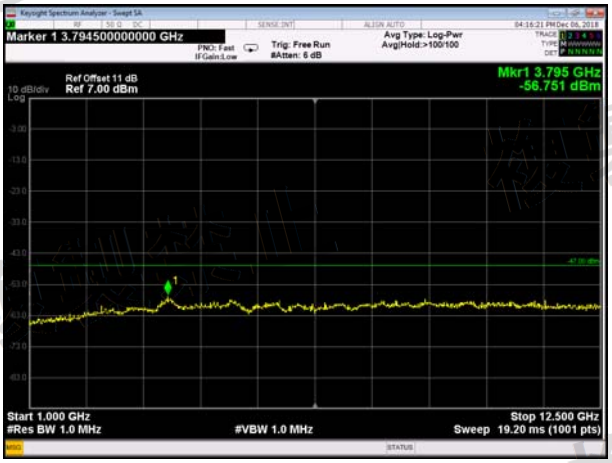
(Plot E: Channel 7_30M-12.5G)



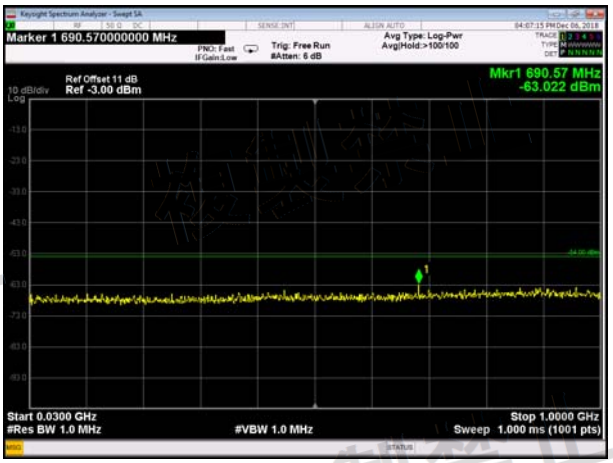


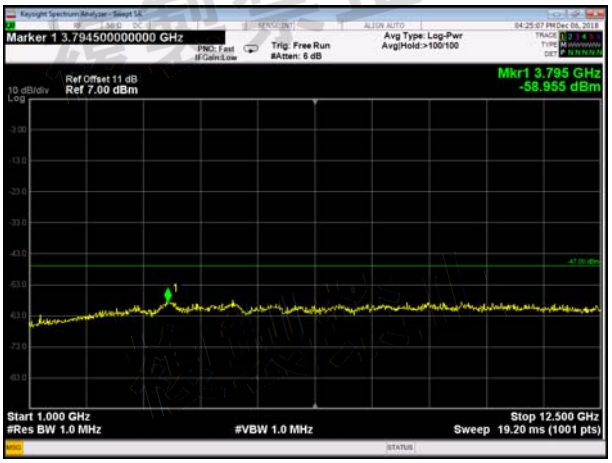
(Plot F: Channel 13_30M-12.5G)



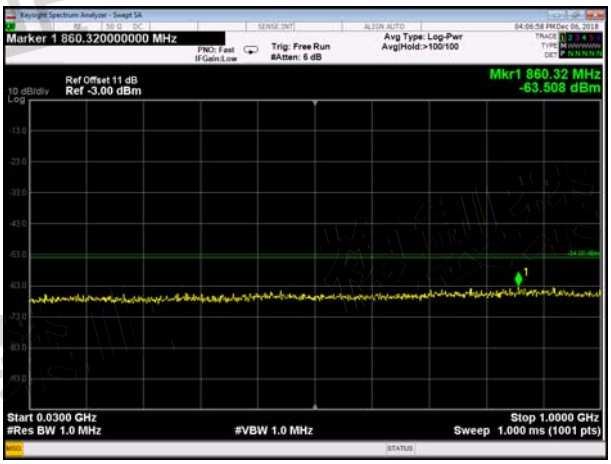


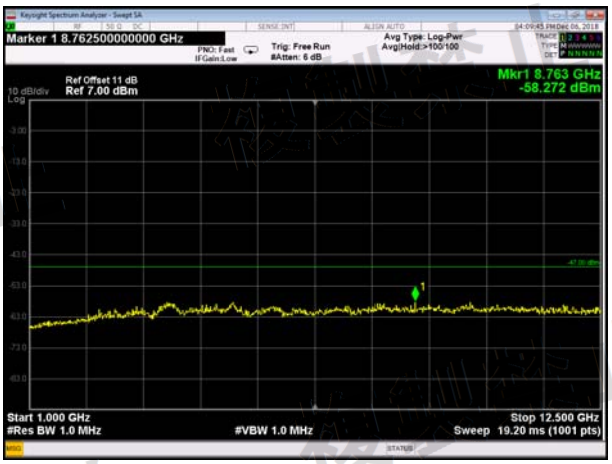
(Plot G: Channel 2_30M-12.5G)





(Plot H: Channel 7_30M-12.5G)





(Plot I: Channel 11_30M-12.5G)

2.6. Transmission Antenna Gain (EIRP Antenna Power) Measurement

2.6.1. Limit

Item	Limits
EIRP Power Density	≦16.91dBm/MHz (FH form 2427 - 2470.75 MHz) ≦22.14dBm/MHz (OFDM,DS from 2400~2483.5MHz, OBW<26MHz) ≦19.14dBm/MHz (OFDM, from 2400~2483.5MHz, OBW=26~38MHz) ≦22.14dBm (Other from 2400~2483.5MHz)
E.i.r.p: ≤12.14dBi (OFDM,DS form 2400-2483.5MHz) Note: E.I.R.P will not be applied to the transmission antenna which has a gain of 2.14dBi or less.	

2.6.2. Measuring Instruments and setting

Please refer to section 4 in this report. The following table is the setting of the spectrum.

Spectrum Parameter	Setting
RB/VB	1MHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

2.6.3. Test Procedures

1 Set EUT ad measuring antenna at the same height and roughly facing each other.

2 Move the measuring antenna height up and down within ± 50cm of EUT height and swing it to find the maximum output of the measuring antenna. The output level at the spectrum analyzer is read sa “E“.

3 Remove the EUT from the turn table and put the replacing antenna facing to measuring antenna at same height. Set the standard signal generator (SSG) at same frequency and transmit on then receive the signal

4 Swing the replacing antenna give a maximum receiving level.

5 Move the measuring antenna height up and down within ± 50cm of replacing antenna height and swing it to find the maximum receiving level.

6 Set SSG output power at Pt to give the equivalent output level of “E” or caluate Pt with SSG output which gives the nearest of “E” and difference (± 1dB). Record the Pt.

7 Calculate EIRP by the formula below EIRP = Gt – L + Pt.

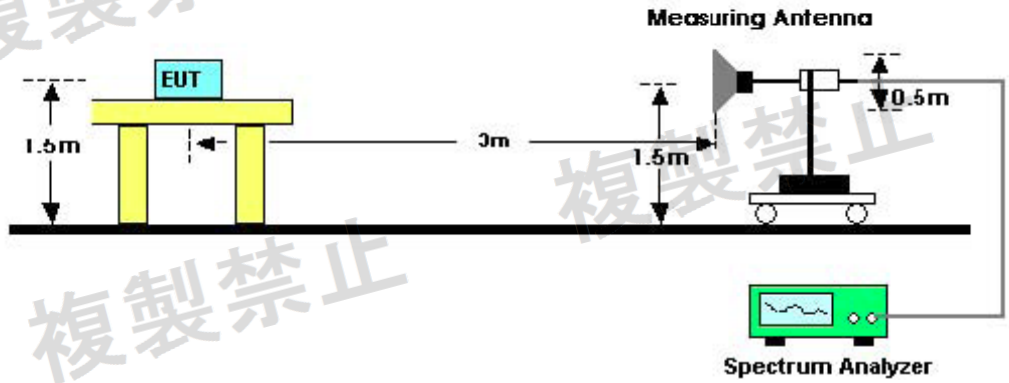
Gt: gain of replacing antenna (dBi)

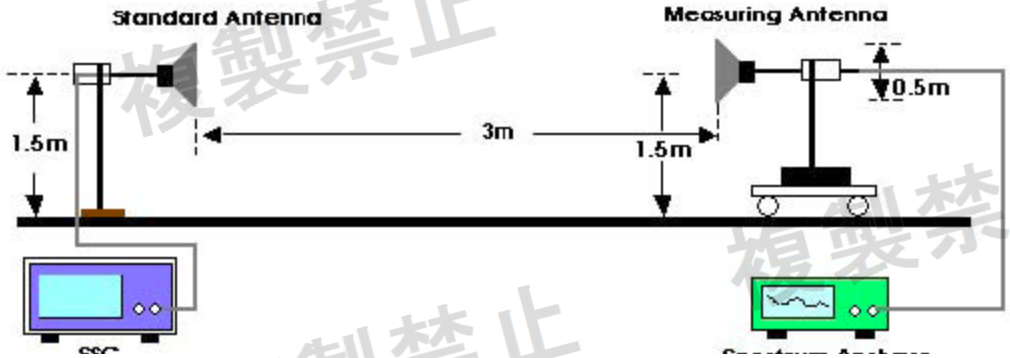
L: feeder loss between SSG and replacing antenna

Pt: Output power of the SSG

7 If the antenna for the EUT has circular polarization, sum of V-field and H-field will be result if measuring antenna is linear polarization.

2.6.4. Test Setup Layout





2.6.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.6.6. Test Result EIRP Antenna Power

Mode	Channel	Fre.(MHz)	EIRP (dBm/ MHz)	Limit(dBm/MHz)
20MHzBW	1	2412	8.42	22.14
	7	2442	8.35	22.14
	13	2472	8.33	22.14
40MHz BW	2	2422	4.32	19.14
	7	2442	4.38	19.14
	11	2462	4.41	19.14

2.7. Transmission Radiation Angle Width (3dB Beamwidth) Measurement

2.7.1. Limit

Item	Limits
3dB antenna beam width	360/A (If A<1; then A=1) A = {EIRP Power [mW] / 16.36 for DS, OFDM} or A = {EIRP Power [mW] / 4.9 for FH}
Note: This test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less	

2.7.2. Measuring Instruments and setting

Please refer to section 4 in this report. The following table is the setting of the spectrum.

Spectrum Parameter	Setting
RB	1 MHz
VB	1 KHz
Y scale	5 dB
Detector	Peak
Trace	Max Hold

2.7.3. Test Procedures

1 Set EUT and measuring antenna at the same height and roughly facing each other.

2 Set spectrum analyzer with condition in section 3.7.2 and tune reference level to observe receving signal position.

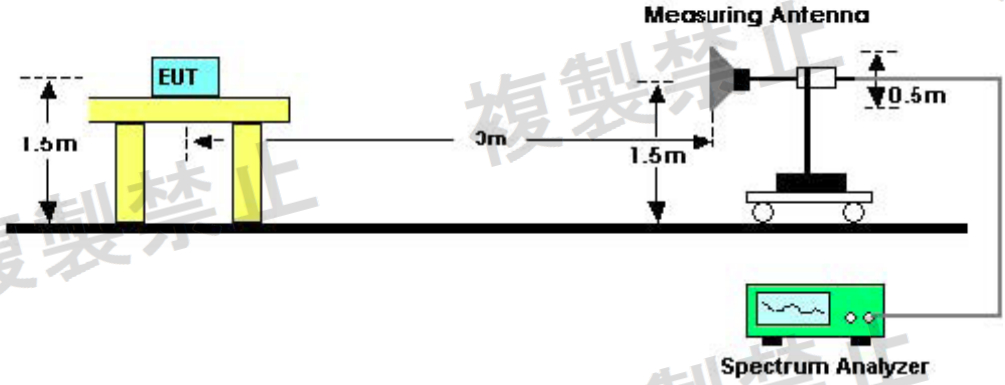
3 Rotate directions of the EUT horizontally and ertically to find the maximum receiving power.

4 Move the measuring antenna height up and down within ± 50cm of EUT height and swing it to find the maximum output of measuring antenna. The output level at the spectrum analyzer is read as "E"

5 Calculate permitted radiation angle in horizontal and vertical using EIRP measured in another test method.

6 Calculate 3dB antenna beam width by the formula below 360/A (If A<1; then A=1). A = {EIRP Power [mW] / 16.36 for DS, OFDM} or A = {EIRP Power [mW] / 4.9 for FH}

2.7.4. Test Setup Layout



2.7.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.7.6. Test Result of Transmission Radiation Angle Width (3dB Beamwidth)

Calculate Result:

Mode	Channel	Fre.(MHz)	EIRP (dBm/ MHz)	EIRP (mW/ MHz)	3dB Beamwidth
20MHz BW	1	2412	8.42	6.95	10.05
	7	2442	8.35	6.84	10.14
	13	2472	8.33	6.81	10.53
40MHz BW	2	2422	4.32	2.70	20.37
	7	2442	4.38	2.74	20.19
	11	2462	4.41	2.76	20.37

2.8. Radio Interference Prevention Capability Measurement

2.8.1. Limit

Item	Limits
Identification	≥ 48 bits

2.8.2. Measuring Instruments and Setting

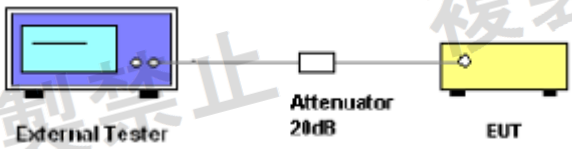
N/A

2.8.3. Test Procedures

1 In the case that the EUT has the function of automatically transmitting the identification code: a. Transmit the predetermined identification codes form EUT. b. Check the transmitted identification codes with the demodulator.

2 In the case of receiving the identification code: a. Transmit the predetermined identification codes form the counterpart. b. Check if communication is normal. c. Transmit the signals other than predetermined ID codes form the counterpart. d. check if the EUT stops the transmission, or if it displays that identification codes are different from the predetermined ones.

2.8.4. Test Setup Layout



2.8.5. Test Deviation

There is no deviation with the original standard.

2.8.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.8.7. Test Result of Radio Interference Prevention Capability

2.8.7.1. 802.11b Test Result:

Channel	Test Result (ID Code)	Verdict
1	GOOD	PASS
7	GOOD	PASS
13	GOOD	PASS

2.8.7.2. 802.11g Test Result:

Channel	Radio Interference Prevention Capability (bits)	Verdict
1	GOOD	PASS
7	GOOD	PASS
13	GOOD	PASS

2.8.7.3. 802.11n20 Test Result:

Channel	Radio Interference Prevention Capability (bits)	Verdict
1	GOOD	PASS
7	GOOD	PASS
13	GOOD	PASS

2.8.7.4.802.11n40 Test Result:

Channel	Radio Interference Prevention Capability (bits)	Verdict
3	GOOD	PASS
6	GOOD	PASS
9	GOOD	PASS

2.9. Carrier Sense Capability Measurement

2.9.1. Limit

Item	Limits
Carrier Sense	Good – EUT stop RF transmission signal after carrier inject to EUT. (On 22.79 +Gr-20*log(f)dBm) (Gr:dBi; f:MHz) or 100mV/m)

2.9.2. Measuring Instruments and Setting

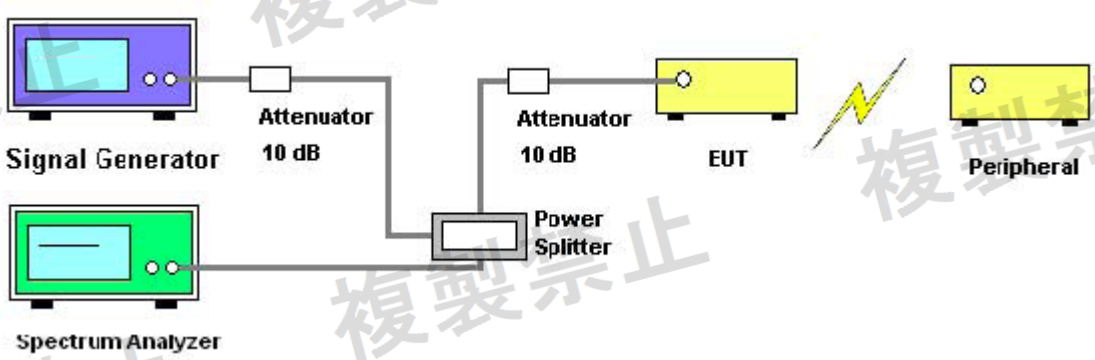
Please refer to section 4 in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
RB/VB	1MHz
Span	0MHz
Sweep	Continuous
Detector	Peak
Trigger mode	Video

2.9.3. Test Procedures

1 SSG adjusted the frequency as same as the EUT transmitted signal and emitted the absence of modulation from SSG and power level is (On 22.79+Gr-20*log(f)[dBm] (Gr: dBi; f: MHz). Then turn off the RF signal of SSG.
2 EUT have transmitted the maximum modulation signal and fixed channelize.
3 Setting of SA is following as: RB:1MHz / VB:1MHz / SPAN: 50MHz / AT: 10dB /Ref: 0dBm / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak.
4 SSG RF Signal On.
5 EUT shall be stop the transmitted any signal and SSG RF Signal Off. Then EUT will be continuous transmitted signal.

2.9.4. Test Setup Layout



2.9.5. Test Deviation

There is no deviation with the original standard.

2.9.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.9.7. Test Result of Carrier Sense Capability

2.9.7.1. 802.11b Test Result:

Channel	Verdict
1	GOOD
7	GOOD
13	GOOD

2.9.7.2. 802.11g Test Result:

Channel	Verdict
1	GOOD
7	GOOD
13	GOOD

2.9.7.3. 802.11n20 Test Result:

Channel	Verdict
1	GOOD
7	GOOD
13	GOOD

2.9.7.4.802.11n40 Test Result:

Channel	Verdict
3	GOOD
6	GOOD
9	GOOD

2.10. Construction Protection Confirmation Method

2.10.1. Limit

The high-frequency section and modulation section of the radio equipment except for the antenna system shall not be capable of being opened easily.

2.10.2. Confirmation Method

The RF and modulation portions are protected against illegal modification as following method:

Protected Method	Description
Special RF Module case	Use special Screw to fixed the house and cannot easy open. Please refer the following photo.

複製禁止

3. Test Equipments Use

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due Date
Spectrum Analyzer	KEYSIGHT	N9030A	A160702554	2018.11.15	2019.11.14
Vector Signal Generator	R&S	SMU200A	105328	2019.04.01	2020.03.31
Signal Generator	R&S	SMB100A	177649	2019.04.01	2020.03.31
Anechoic Chamber	Albatross	SAC-5MAC(EMC12.8*6.8*6.4m)	A0304210	2016.03.08	2020.03.07
Double ridge horn antenna	R&S	HF906	100150	2019.04.27	2022.04.26
Power Meter	R&S	NRP-Z31	102872	2018/5/5	2019/5/5

Note 1: Equipments listed above have been calibrated and are in the period of validation.

** END OF REPORT **