

Test Result and Measuring equipment for certification

2.4GHz low-power data communication system

1 Mbps

Radio Equipment for test	Model or type name: WFM60-SFP201	Test environment	Temperature : 21 °C	Type of radio, frequency and antenna power	D1D, G1D, 2412 to 2472 MHz (5 MHz separation 13 carriers)		802.11b	0.00885W/MHz
	Humidity : 51 %		Date : MAR.7.2018 ~AUG.14.2018	Location : HCT 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea				
	Serial number: #0		Test method : TELEC-T401, Ver8.2		Remark: Engineer: N.H.KIM Reviewer: Y.H.LEE			

Equipment	Model and type name	Serial number	Manufacturer	Last Calibrated date	Calibration Company	Note
	Signal Analyzer(N9020A)	US46220219	AGILENT Technologies	2018-04-24	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	DC Power Supply(E3632A)	KR75306225	AGILENT Technologies	2018-04-11	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	POWER METER(N1911A)	MY45100523	AGILENT Technologies	2018-04-16	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	Power Sensor (N1921A)	MY52260025	AGILENT Technologies	2018-04-16	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	Fixed Attenuator (8493C)	10342	HEWLETT PACKARD	2018-05-18	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	DIGITAL MULTIMETER(34401A)	US36010057	AGILENT Technologies	2017-10-30	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-3-ha

Test result	Electric performance	Voltage		V	Limit	DC 3.30 V (normal)			DC 3.63 V (high)			DC 2.97 V (low)			Note	
		Test Frequency		MHz		2412	2442	2472	2412	2442	2472	2412	2442	2472		
		Frequency error(measured frequency)			MHz	2411.9856	2441.9858	2471.9867				2411.9857	2441.9858	2471.9867		
		Frequency error			ppm	50	-5.95	-5.83	-5.38				-5.91	-5.81	-5.40	
	Occupied bandwidth	1Mbps	MHz	26	12.27	12.32	12.27		12.26	12.32	12.27		12.28	12.35	12.28	1Mbps
		2Mbps	MHz	26	12.31	12.38	12.33		12.32	12.37	12.33		12.32	12.40	12.33	2Mbps
		5.5Mbps	MHz	26	12.07	12.10	12.09		12.13	12.04	12.11		12.14	12.11	12.12	5.5Mbps
		11Mbps	MHz	26	12.14	12.18	12.11		12.15	12.12	12.15		12.15	12.20	12.16	11Mbps
	Spreading bandwidth		MHz	0.5	8.37	8.38	8.32		8.37	8.37	8.32		8.39	8.39	8.34	bit rate 1Mbps
	Spreading Factor		-	5	8.37	8.38	8.32		8.37	8.37	8.32		8.39	8.39	8.34	
	Spreading bandwidth		MHz	0.5	8.28	8.25	8.33		-	-	-		-	-	-	11Mbps
	Spreading Factor		-	5	6.02	6.00	6.05		-	-	-		-	-	-	
	Spurious	(measured frequency)	-	MHz	2384.57	2284.33	2313.01		2386.76	2362.94	2353.83		2379.95	2281.78	2310.70	
		30 ~ 2387 MHz	μW/MHz	2.5	0.060	0.042	0.042		0.040	0.042	0.048		0.034	0.048	0.040	
		(measured frequency)	-	MHz	2399.92	2399.75	2394.38		2399.94	2399.34	2390.39		2399.91	2398.27	2393.16	
		2387 ~ 2400 MHz	μW/MHz	25	2.165	0.051	0.047		2.743	0.057	0.049		1.505	0.058	0.042	
		(measured frequency)	-	MHz	2491.07	2483.97	2483.50		2489.31	2484.33	2483.50		2495.81	2483.68	2483.51	
		2483.5 ~ 2496.5 MHz	μW/MHz	25	0.032	0.048	3.136		0.035	0.046	4.000		0.030	0.046	2.200	
		(measured frequency)	-	MHz	12322.44	11960.81	6355.60		12402.97	12289.93	2497.00		6438.38	5899.19	2497.75	
		2496.5 ~ 12500 MHz	μW/MHz	2.5	0.028	0.025	0.033		0.026	0.027	0.044		0.034	0.027	0.037	
	Antenna power deviation		mW/MHz	8.85	8.672	9.013	8.144		8.348	8.498	8.059		8.296	8.617	8.042	
	Collateral Emission	(measured frequency)	-	MHz	846.99	920.65	781.79		944.80	862.64	972.90		924.85	846.64	804.44	
		30 ~ 1000 MHz	nW	4	0.0006	0.0009	0.0006		0.0007	0.0007	0.0006		0.0007	0.0007	0.0007	
		(measured frequency)	-	MHz	12436.18	5600.58	5826.55		12359.70	5764.45	12429.28		5581.03	4848.48	6930.55	
		1000 ~ 12500 MHz	nW	20	0.0140	0.0176	0.0150		0.0142	0.0146	0.0153		0.0180	0.0163	0.0145	
	E.I.R.P.		mW/MHz	NA												
	Hopping Frequency staying time		sec	NA												
	Interference Protection (Deveice ID)			yes	Complies	Complies	Complies		Complies	Complies	Complies		Complies	Complies	Complies	
	Carrier Sense			NA												
	Antenna power	1Mbps	mW/MHz	8.85	8.672	9.013	8.144									
			%		-2.01	1.84	-7.98									
	Antenna power	2Mbps	mW/MHz	8.85	8.365	8.493	8.177									
			%		-5.48	-4.04	-7.61									
	Antenna power	5.5Mbps	mW/MHz	8.85	8.100	8.223	7.900									
			%		-8.47	-7.08	-10.73									
	Antenna power	11Mbps	mW/MHz	8.85	7.963	8.114	7.861									
			%		-10.02	-8.32	-11.18									

Antenna Gain: 2.71 dBi

NA = Not Applicable

Engineer: N.H.KIM Reviewer: Y.H.LEE Date: MAR.7.2018 ~ AUG.14.2018 Test location: HCT

Allowed Maximum E.I.R.P.:

* Note: TX Power was set-up as 'b: 18' in test mode.

Test Result and Measuring equipment for certification

2.4GHz low-power data communication system

6 Mbps

Radio Equipment for test	Model or type name: WFM60-SFP201	Test environment	Temperature : 21 °C	Type of radio, frequency and antenna power	G1D, 2412 to 2472 MHz (5 MHz separation 13 carriers)		802.11g(1TX1RX)	0.005W/MHz
	Humidity : 51 %		Date : MAR.7.2018 ~AUG.14.2018	Location : HCT 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea				
	Serial number: #0		Test method : TELEC-T401, Ver8.2		Remark: Engineer: N.H.KIM Reviewer: Y.H.LEE			

Equipment	Model and type name	Serial number	Manufacturer	Last Calibrated date	Calibration Company	Note
	Signal Analyzer(N9020A)	US46220219	AGILENT Technologies	2018-04-24	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	DC Power Supply(E3632A)	KR75306225	AGILENT Technologies	2018-04-11	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	POWER METER(N1911A)	MY45100523	AGILENT Technologies	2018-04-16	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	Power Sensor (N1921A)	MY52260025	AGILENT Technologies	2018-04-16	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	Fixed Attenuator (8493C)	10342	HEWLETT PACKARD	2018-05-18	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	DIGITAL MULTIMETER(34401A)	US36010057	AGILENT Technologies	2017-10-30	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-3-ha

Test result	Electric performance	Voltage		Limit	DC 3.30 V (normal)			DC 3.63 V (high)			DC 2.97 V (low)			Note
		Test Frequency	MHz		2412	2442	2472	2412	2442	2472	2412	2442	2472	
		Frequency error(measured frequency)	MHz		2411.9871	2441.9869	2471.9867	2411.9871	2441.9869	2471.9867	2411.9871	2441.9869	2471.9868	
		Frequency error	ppm		-5.34	-5.36	-5.37	-5.34	-5.37	-5.38	-5.35	-5.36	-5.35	
	Occupied bandwidth	6Mbps	MHz	26	17.53	17.32	17.34	17.44	17.43	17.38	17.52	17.38	17.42	6 Mbps
		9Mbps	MHz	26	17.41	17.33	17.37	17.38	17.34	17.39	17.35	17.31	17.30	9 Mbps
		12Mbps	MHz	26	17.16	17.25	17.29	17.28	17.24	17.26	17.23	17.19	17.23	12 Mbps
		18Mbps	MHz	26	17.23	17.20	17.19	17.15	17.28	17.26	17.21	17.12	17.28	18 Mbps
		24Mbps	MHz	26	17.06	17.17	17.14	17.15	17.15	17.19	17.20	17.17	17.16	24 Mbps
		36Mbps	MHz	26	17.04	17.07	17.12	17.06	17.05	17.09	16.98	17.05	17.03	36 Mbps
		48Mbps	MHz	26	16.94	16.93	16.94	16.99	17.03	17.04	16.97	17.04	17.00	48 Mbps
		54Mbps	MHz	26	16.99	16.91	16.95	16.95	17.02	16.94	16.95	16.97	16.94	54 Mbps
	Spurious (measured frequency)	30 ~ 2387 MHz	μW/MHz	2.5	0.172	0.488	0.058	0.113	0.071	0.059	0.142	0.051	0.052	
		2387 ~ 2400 MHz	μW/MHz	25	2.183	7.192	0.076	1.851	7.483	0.045	2.115	6.182	0.055	
		2400 ~ 2483.5 MHz	μW/MHz	25	2490.30	2486.56	2484.01	2484.66	2492.26	2484.25	2485.22	2490.38	2484.06	
		2483.5 ~ 2496.5 MHz	μW/MHz	25	0.088	2.781	1.431	0.064	3.980	2.446	0.121	3.906	1.598	
		2496.5 ~ 12500 MHz	μW/MHz	2.5	0.029	0.036	0.182	0.028	0.060	0.285	0.027	0.032	0.207	
		Antenna power deviation	mW/MHz	8.77	5.124	5.100	4.363	5.046	5.051	4.366	4.975	4.968	4.303	
			%	-80	2.48	1.99	-12.74	0.93	1.03	-12.68	-0.50	-0.64	-13.93	
	Collateral Emission	(measured frequency)	MHz		855.94	983.95	986.15	881.79	448.42	987.20	797.24	780.29	947.70	
		30 ~ 1000 MHz	nW	4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
		(measured frequency)	MHz		6459.05	4896.20	12277.48	7178.95	6910.43	5839.78	5953.05	6417.65	7657.35	
	E.I.R.P.	1000 ~ 12500 MHz	nW	20	0.014	0.015	0.015	0.015	0.012	0.015	0.016	0.018	0.018	
		Hopping Frequency staying time	sec	NA										
		Interference Protection (Device ID)	yes	Complies	Complies	Complies		Complies	Complies	Complies	Complies	Complies	Complies	
		Carrier Sense	NA											
	Antenna power 6Mbps	mW/MHz	8.77	5.124	5.100	4.363								
		%		2.48	1.99	-12.74								
	Antenna power 9Mbps	mW/MHz	8.77	4.756	4.778	4.227								
		%		-4.87	-4.45	-15.47								
	Antenna power 12Mbps	mW/MHz	8.77	4.868	4.934	4.485								
		%		-2.63	-1.33	-10.30								
	Antenna power 18Mbps	mW/MHz	8.77	4.841	4.876	4.501								
		%		-3.19	-2.48	-9.97								
	Antenna power 24Mbps	mW/MHz	8.77	4.867	4.880	4.608								
		%		-2.66	-2.39	-7.84								
	Antenna power 36Mbps	mW/MHz	8.77	4.110	4.083	3.790								
		%		-17.80	-18.35	-24.20								
	Antenna power 48Mbps	mW/MHz	8.77	3.365	3.456	3.320								
		%		-32.70	-30.87	-33.60								
	Antenna power 54Mbps	mW/MHz	8.77	3.230	3.102	2.857								
		%		-35.39	-37.96	-42.86								

Antenna Gain: 2.71 dBi

NA = Not Applicable

Engineer: N.H.KIM Reviewer: Y.H.LEE Date: MAR.7.2018 ~ AUG.14.2018 Test location: HCT

Allowed Maximum E.I.R.P. :

* Note: Test program : Mtool. TX Power was set-up as 'g: 16'

Test Result and Measuring equipment for certification

2.4GHz low-power data communication system

MCS0

Radio Equipment for test	Model or type name: WFM60-SFP201	Test environment	Temperature : 21 °C	Type of radio, frequency and antenna power	G1D, 2412 to 2472 MHz (5 MHz separation 13 carriers)	802.11n(1Tx1Rx)	0.005W/MHz
	Humidity : 51 %		Date : MAR.7.2018 ~AUG.14.2018	Location : HCT 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea			
	Serial number: #0		Test method : TELEC-T401, Ver8.2	Remark: Engineer: N.H.KIM Reviewer: Y.H.LEE			

Equipment	Model and type name	Serial number	Manufacturer	Last Calibrated date	Calibration Company	Note
	Signal Analyzer(N9020A)	US46220219	AGILENT Technologies	2018-04-24	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	DC Power Supply(E3632A)	KR75306225	AGILENT Technologies	2018-04-11	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	POWER METER(N1911A)	MY45100523	AGILENT Technologies	2018-04-16	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	Power Sensor (N1921A)	MY52260025	AGILENT Technologies	2018-04-16	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	Fixed Attenuator (8493C)	10342	HEWLETT PACKARD	2018-05-18	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-2-ha
	DIGITAL MULTIMETER(34401A)	US36010057	AGILENT Technologies	2017-10-30	HCT Co., Ltd.	Based on Japanese Radio Law 24-2-4-3-ha

Test result	Electric performance	Voltage		V	Limit	DC 3.30 V (normal)			DC 3.63 V (high)			DC 2.97 V (low)			Note	
		Test Frequency			MHz		2412	2442	2472	2412	2442	2472	2412	2442	2472	
		Frequency error(measured frequency)			MHz	-	-	-	-	-	-	-	-	-	-	
		Frequency error			ppm	50	-	-	-	-	-	-	-	-	-	
		6.5Mbps 13Mbps 19.5Mbps 26Mbps 39Mbps 52Mbps 58.5Mbps 65Mbps	6.5Mbps	MHz	26	17.99	18.02	18.06	17.99	17.95	18.04	17.98	18.05	18.04	MCS0	6.5 Mbps
			13Mbps	MHz	26	17.98	17.95	17.96	17.95	17.95	17.96	17.98	17.91	17.96	MCS1	13 Mbps
			19.5Mbps	MHz	26	17.93	17.92	17.96	17.91	17.87	17.90	17.95	17.90	17.94	MCS2	19.5 Mbps
			26Mbps	MHz	26	17.88	17.89	17.86	17.87	17.86	17.85	17.92	17.88	17.97	MCS3	26 Mbps
			39Mbps	MHz	26	17.88	17.90	17.88	17.90	17.90	17.87	17.90	17.88	17.87	MCS4	39 Mbps
			52Mbps	MHz	26	17.84	17.83	17.88	17.82	17.80	17.85	17.82	17.77	17.81	MCS5	52 Mbps
			58.5Mbps	MHz	26	17.85	17.82	17.81	17.84	17.80	17.81	17.86	17.81	17.85	MCS6	58.5 Mbps
			65Mbps	MHz	26	17.87	17.87	17.88	17.80	17.81	17.86	17.83	17.83	17.84	MCS7	65 Mbps
		Spreading bandwidth			MHz	0.5	-	-	-	-	-	-	-	-		
		Spurious (measured frequency) 30 ~ 2387 MHz (measured frequency) 2387 ~ 2400 MHz (measured frequency) 2483.5 ~ 2496.5 MHz (measured frequency) 2496.5 ~ 12500 MHz	-	MHz	2.5	2385.66	2287.37	2315.31	2385.42	2283.48	2317.74	2387.00	2285.79	2315.31	MCS0	
			μW/MHz	2.5	0.045	0.064	0.069	0.056	0.077	0.066	0.126	0.057	0.063			
			-	MHz	25	2397.18	2398.22	2398.08	2399.74	2397.86	2392.55	2397.34	2394.28	2396.30		
			μW/MHz	25	1.754	1.112	0.063	3.378	1.469	0.071	5.590	0.725	0.057			
			-	MHz	25	2491.39	2483.67	2484.06	2490.22	2484.33	2486.13	2487.28	2483.51	2483.94		
			μW/MHz	25	0.037	1.041	2.070	0.044	1.136	2.421	0.038	0.869	2.162			
			-	MHz	2.5	2496.50	6407.12	2501.25	11659.96	2523.51	2501.25	6254.31	5453.53	2496.50		
			μW/MHz	2.5	0.029	0.028	0.840	0.030	0.028	0.032	0.031	0.027	0.084			
		Antenna power deviation			mW/MHz	8.77	4.063	4.077	3.753	4.054	4.065	3.761	4.053	4.075	3.771	MCS0
					%	-80	-18.74	-18.46	-24.95	-18.92	-18.70	-24.78	-18.94	-18.50	-24.58	
					20	-	-	-	-	-	-	-	-	-		
		Collateral Emission	(measured frequency)	-	MHz	-	-	-	-	-	-	-	-	-		
			30 ~ 1000 MHz	nW	4	-	-	-	-	-	-	-	-	-		
			(measured frequency)	-	MHz	-	-	-	-	-	-	-	-	-		
			1000 ~ 12500 MHz	nW	20	-	-	-	-	-	-	-	-	-		
		E.I.R.P.			mW/MHz	NA										
		Hopping Frequency staying time			sec	NA										
		Interference Protection (Deveice ID)			yes	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies		
		Carrier Sense			NA											
		Antenna power 6.5Mbps MCS0			mW/MHz	8.77	4.063	4.077	3.753							
					%		-18.74	-18.46	-24.95							
		Antenna power 13Mbps MCS1			mW/MHz	8.77	3.981	3.958	3.601							
					%		-20.37	-20.85	-27.98							
		Antenna power 19.5Mbps MCS2			mW/MHz	8.77	3.817	3.885	3.546							
					%		-23.66	-22.29	-29.08							
		Antenna power 26Mbps MCS3			mW/MHz	8.77	3.785	3.849	3.436							
					%		-24.31	-23.03	-31.27							
		Antenna power 39Mbps MCS4			mW/MHz	8.77	3.672	3.695	3.323							
					%		-26.57	-26.09	-33.54							
		Antenna power 52Mbps MCS5			mW/MHz	8.77	3.436	3.313	2.782							
					%		-31.28	-33.73	-44.35							
		Antenna power 58.5Mbps MCS6			mW/MHz	8.77	2.926	2.887	2.418							
					%		-41.48	-42.27	-51.64							
		Antenna power 65Mbps MCS7			mW/MHz	8.77	2.335	2.401	2.017							
					%		-53.29	-51.98	-59.65							

Antenna Gain: 2.71 dBi

NA = Not Applicable

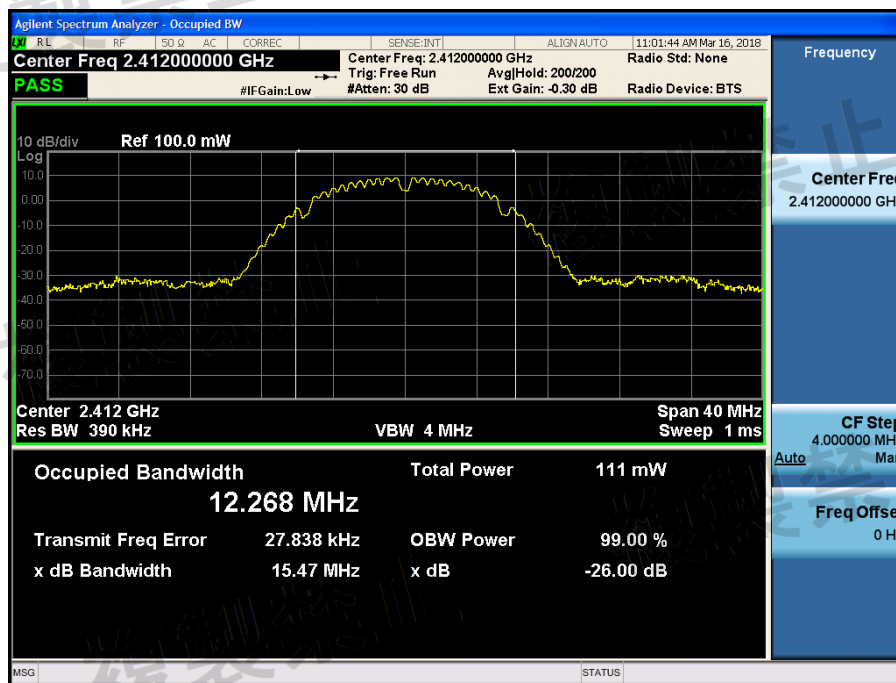
Engineer: N.H.KIM Reviewer: Y.H.LEE Date: MAR.7.2018 ~ AUG.14.2018 Test location: HCT

Allowed Maximum E.I.R.P.:

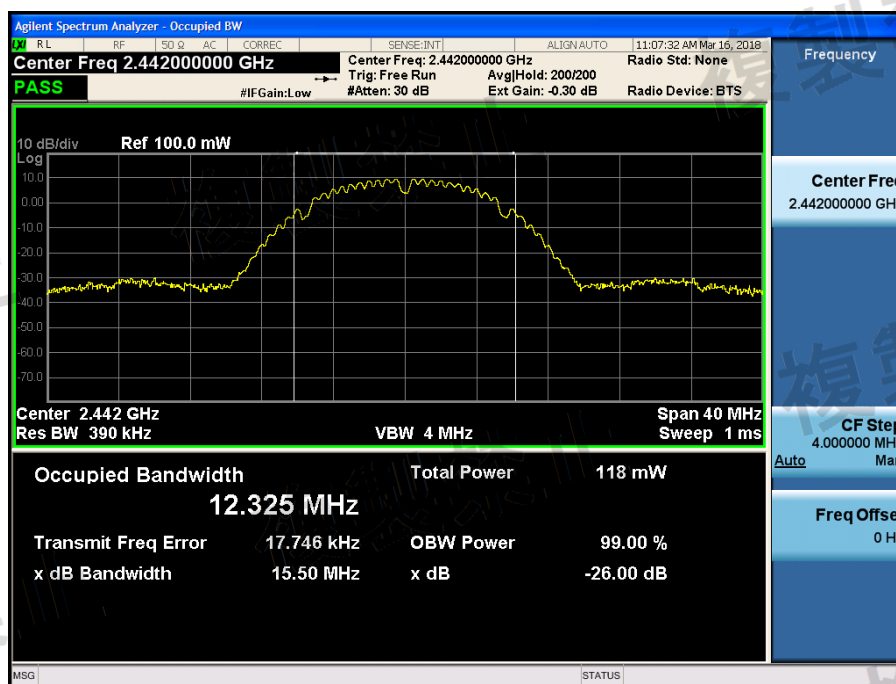
Other 2.4 GHz Radio Equipment

Occupied Bandwidth (802.11b)

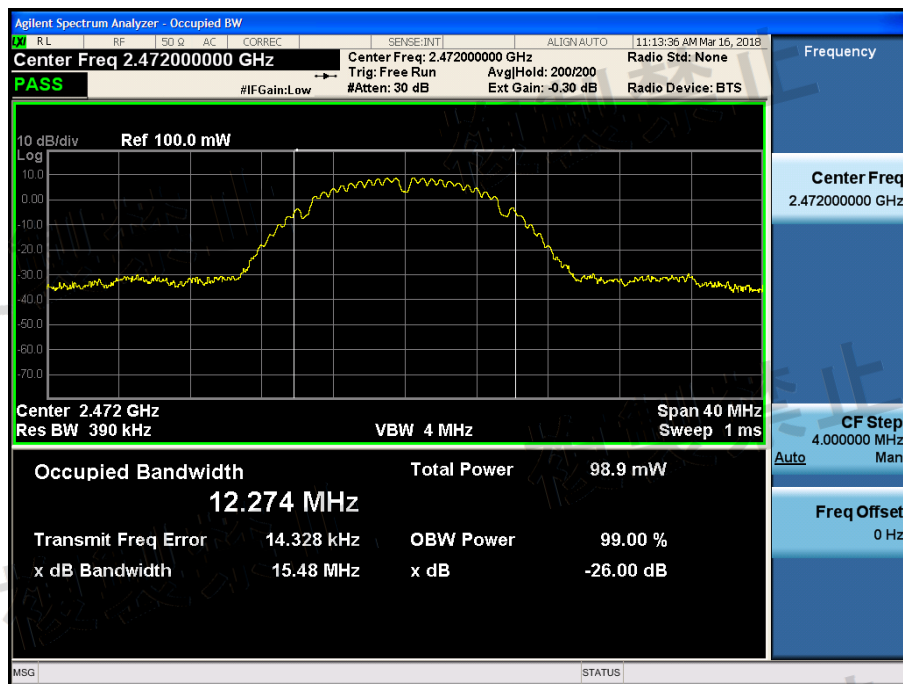
Normal Voltage_2 412 MHz



Normal Voltage_2 442 MHz

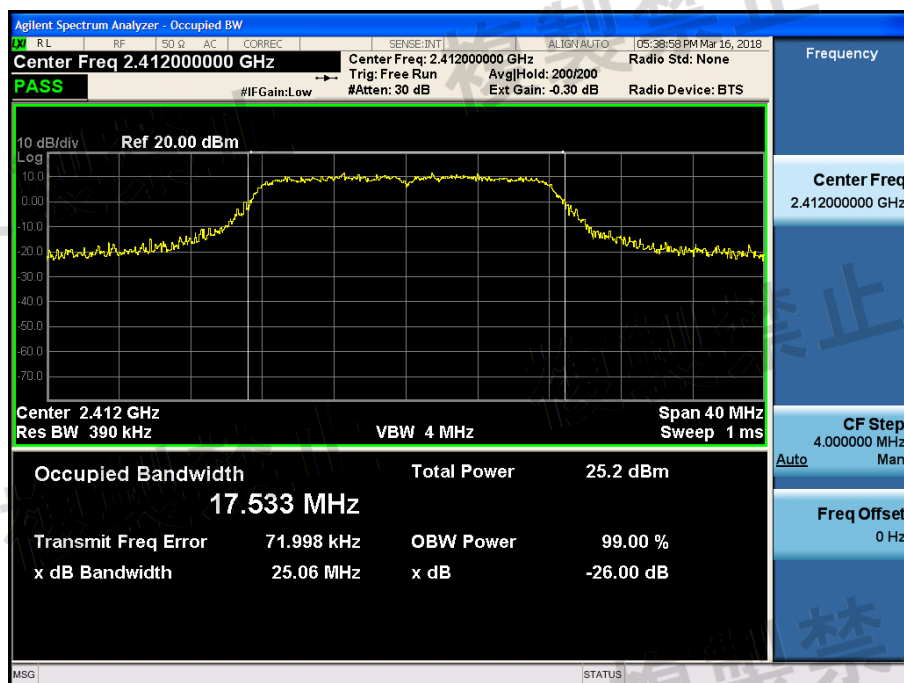


Normal Voltage_2 472 MHz

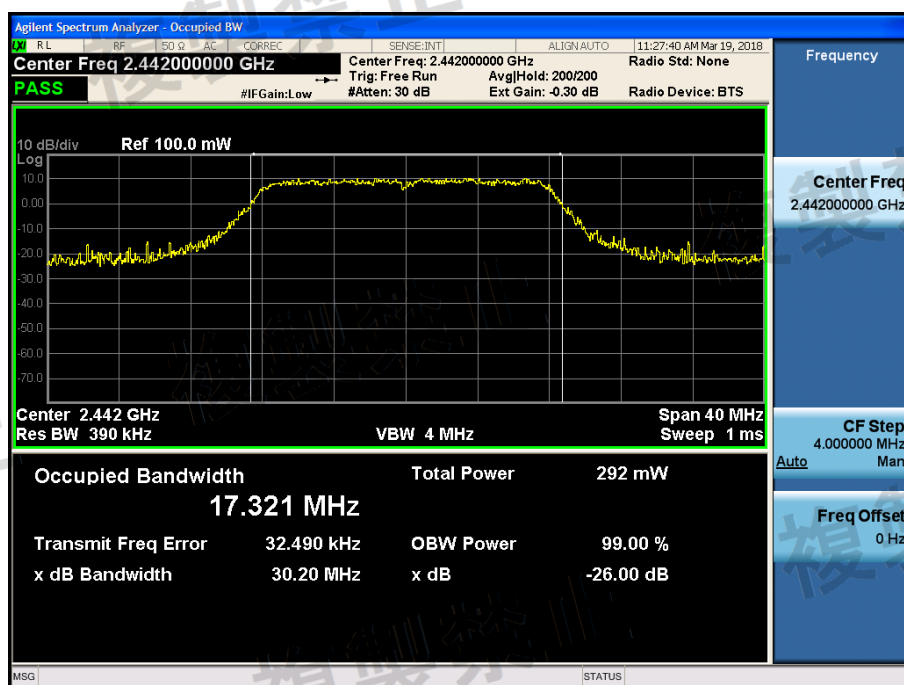


Occupied Bandwidth (802.11g)

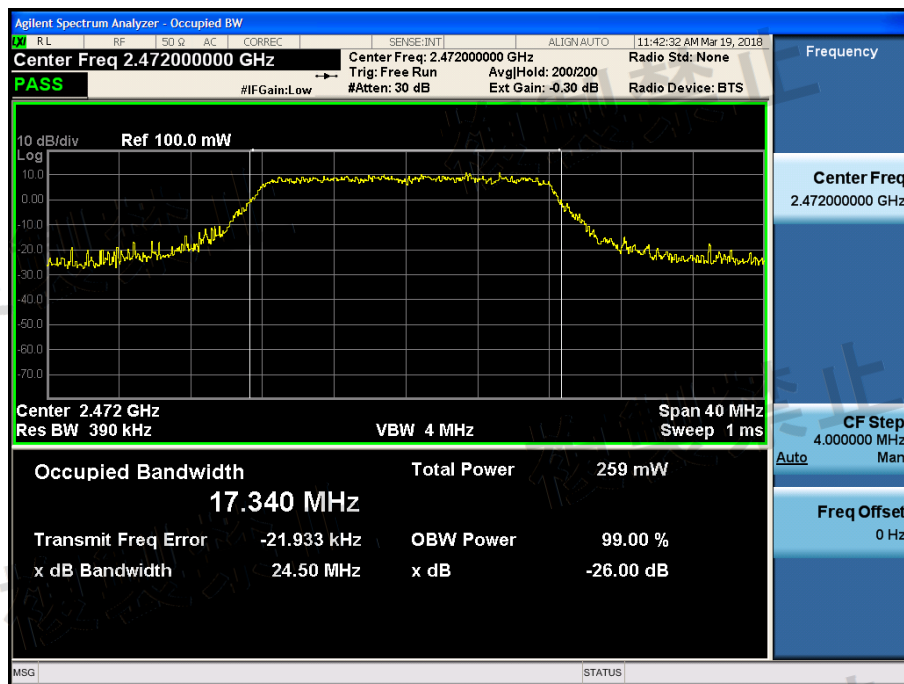
Normal Voltage_2 412 MHz



Normal Voltage_2 442 MHz

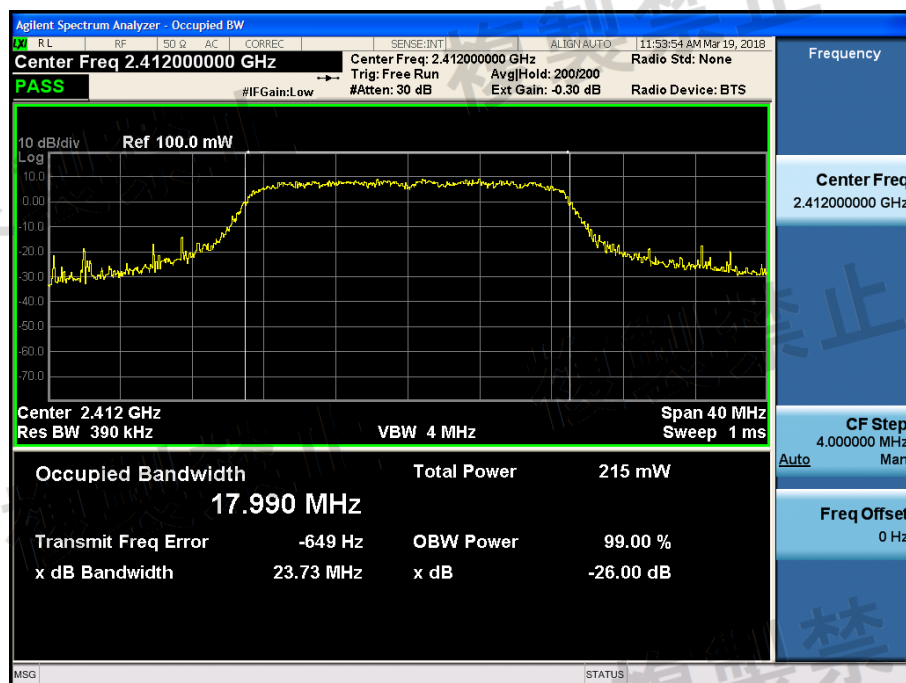


Normal Voltage_2 472 MHz

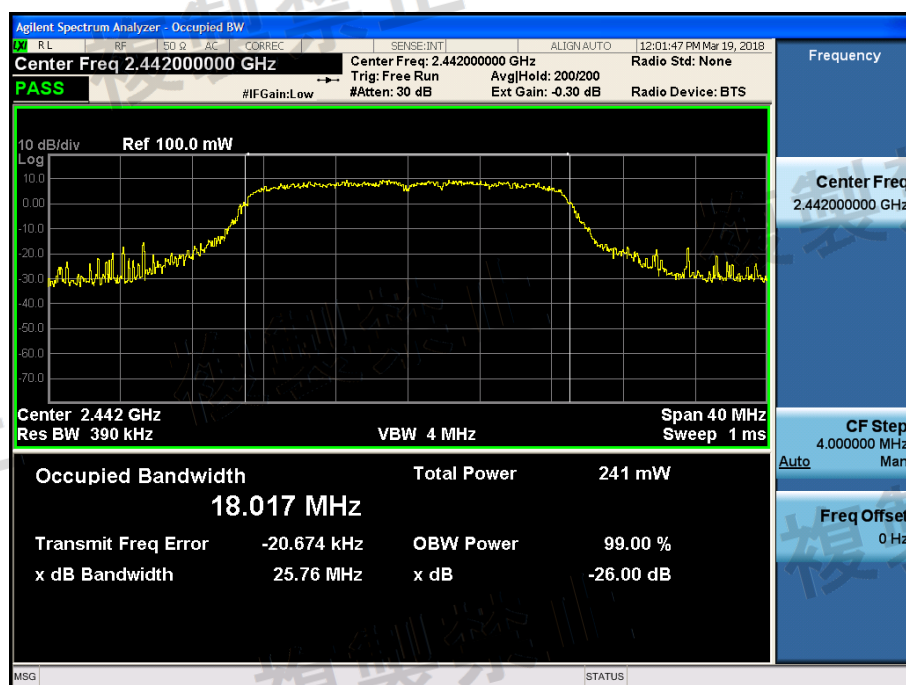


Occupied Bandwidth (802.11n)

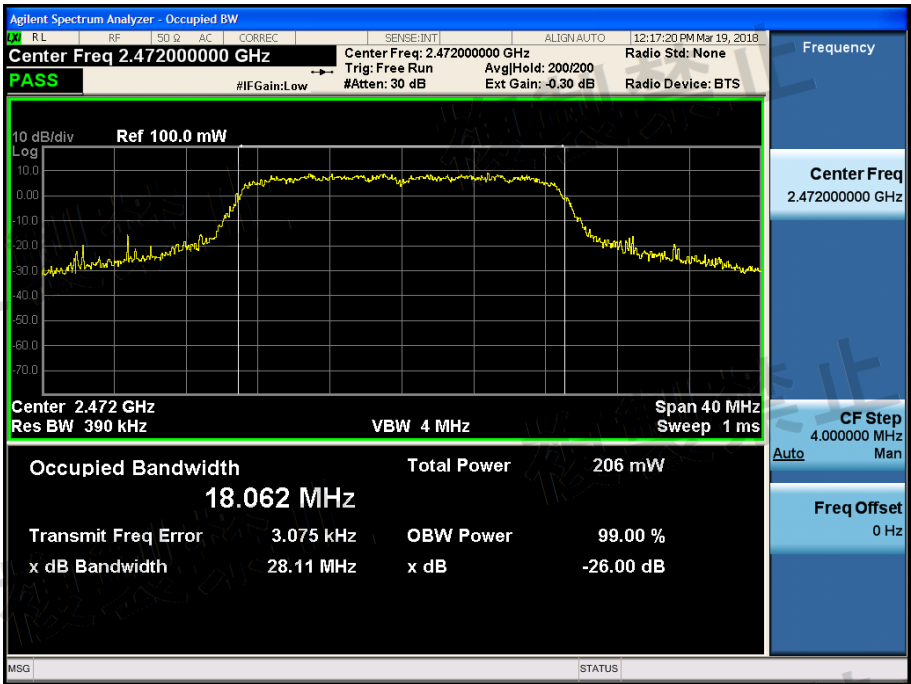
Normal Voltage_2 412 MHz



Normal Voltage_2 442 MHz



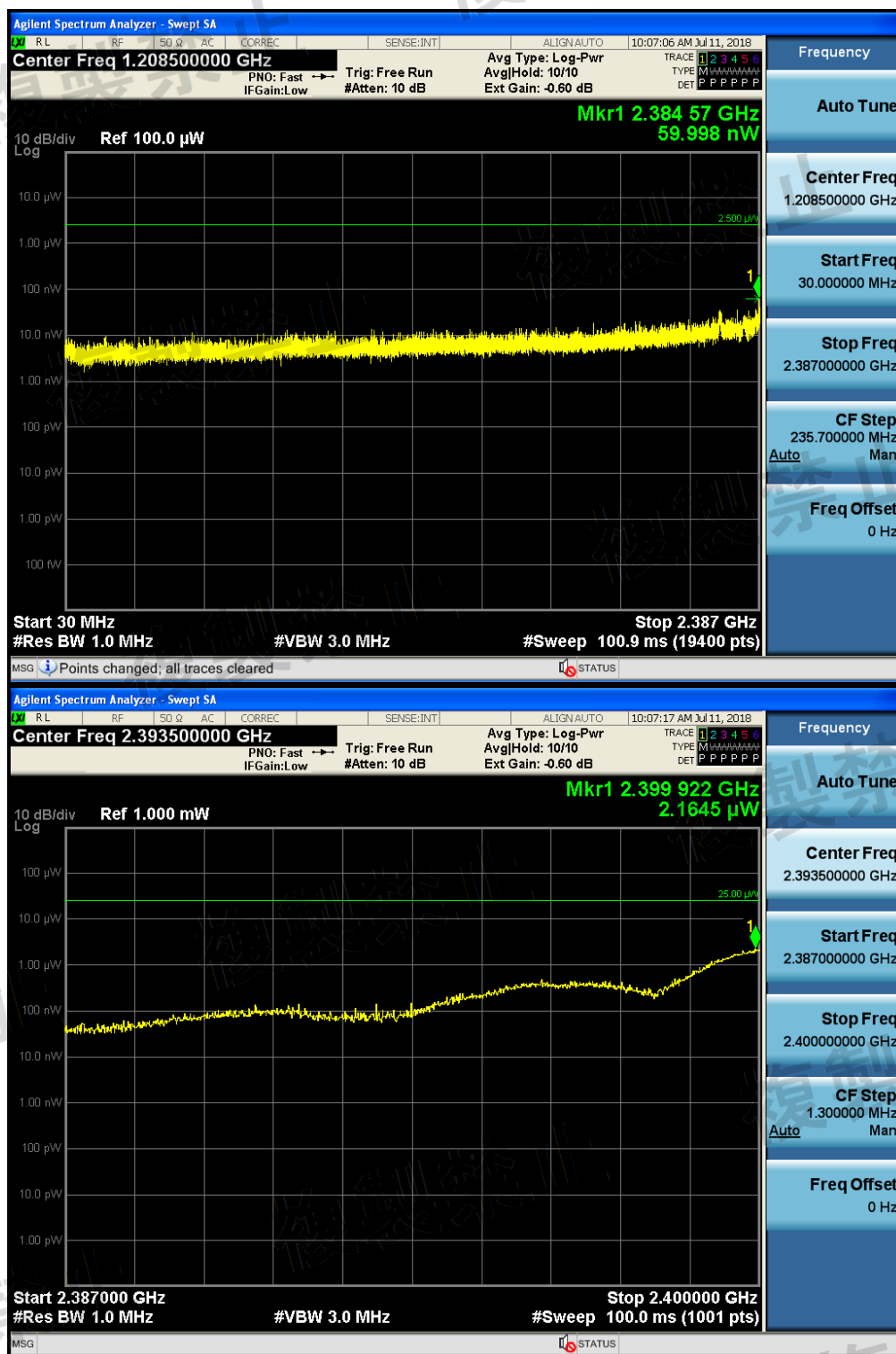
Normal Voltage_2 472 MHz

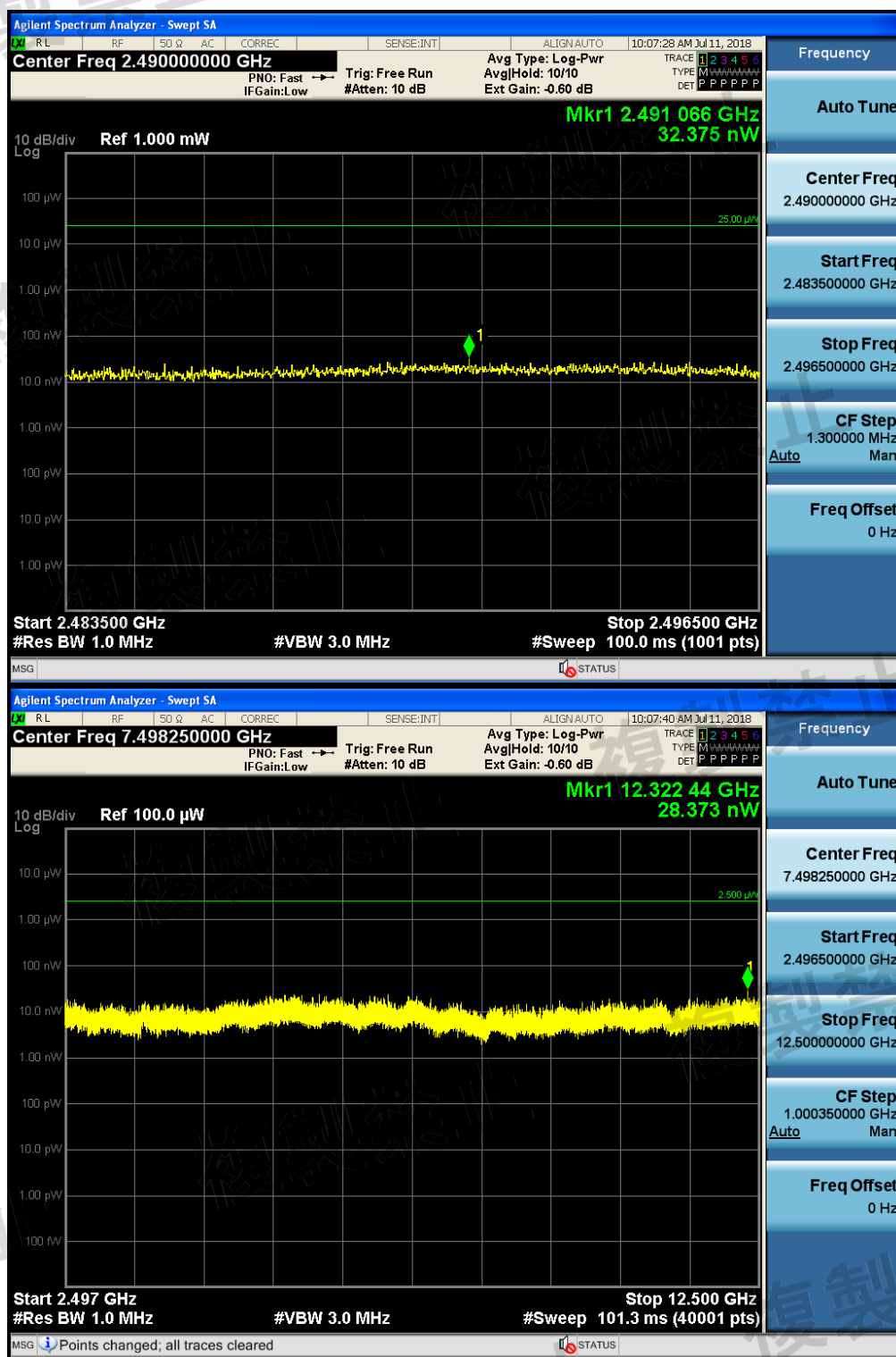


The Strength of Unwanted Emissions

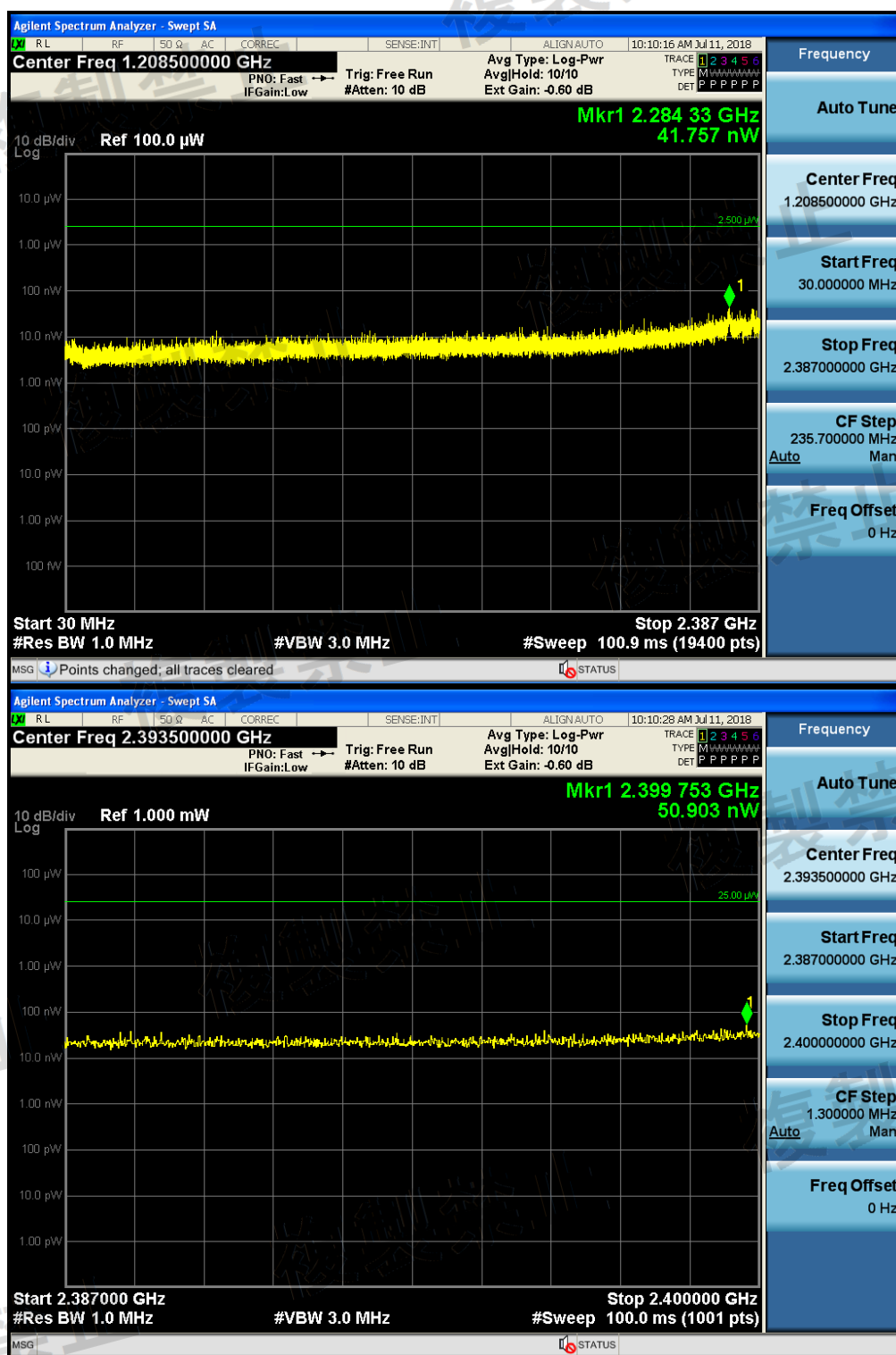
The Strength of Unwanted Emissions (802.11b)

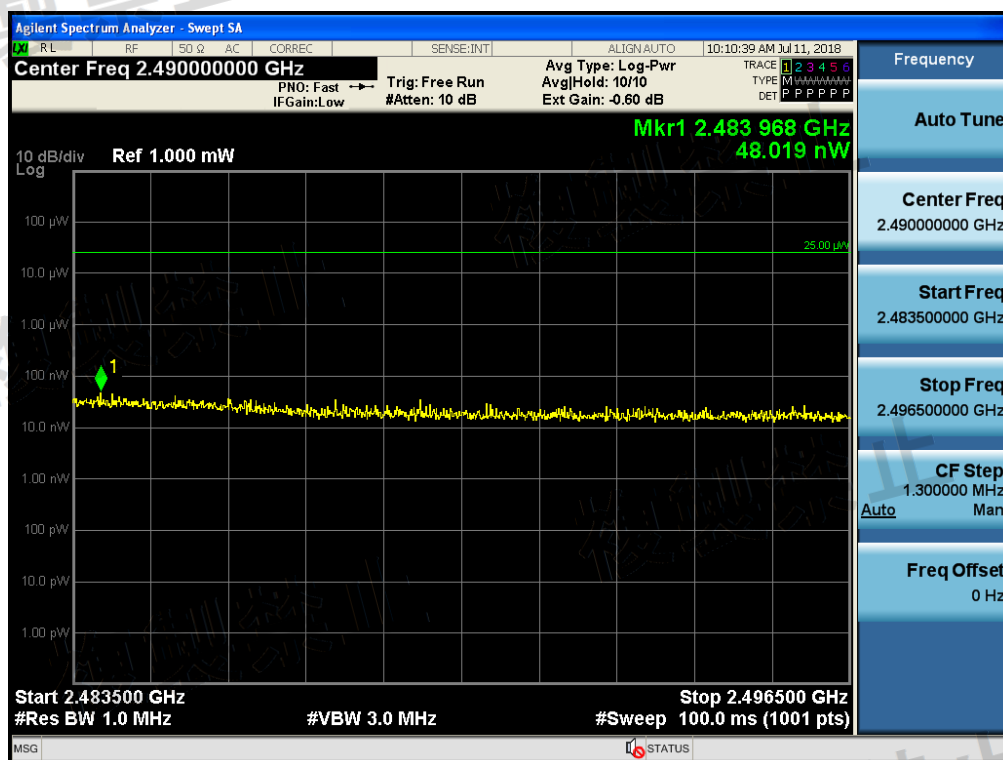
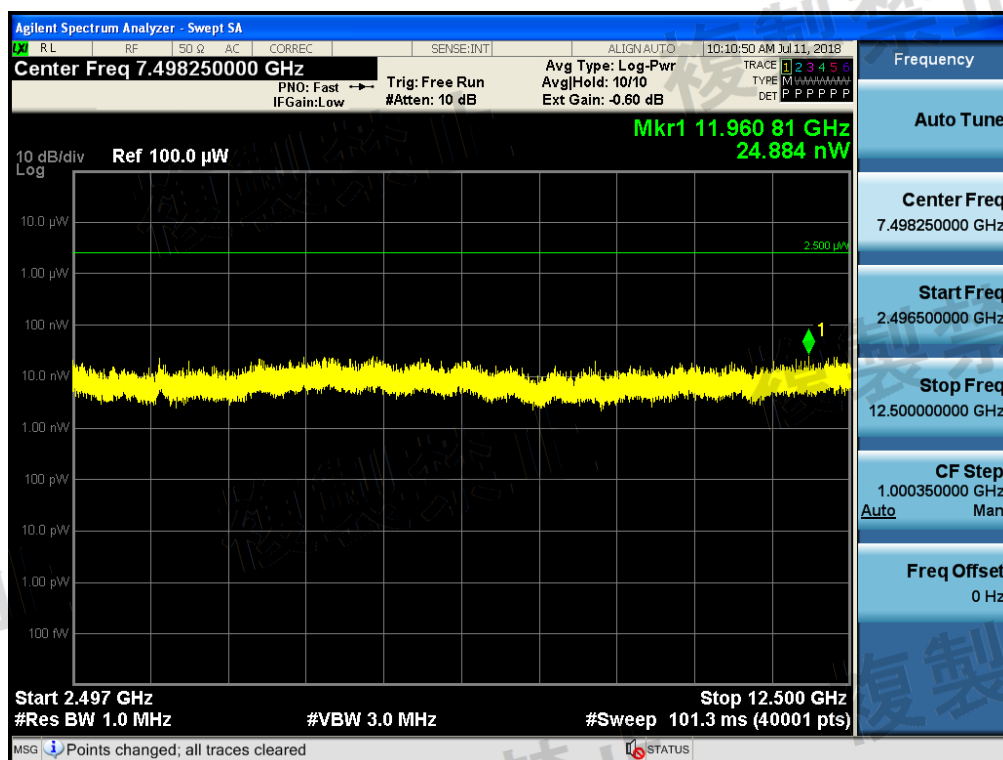
Normal Voltage_2 412 MHz





Normal Voltage_2 442 MHz

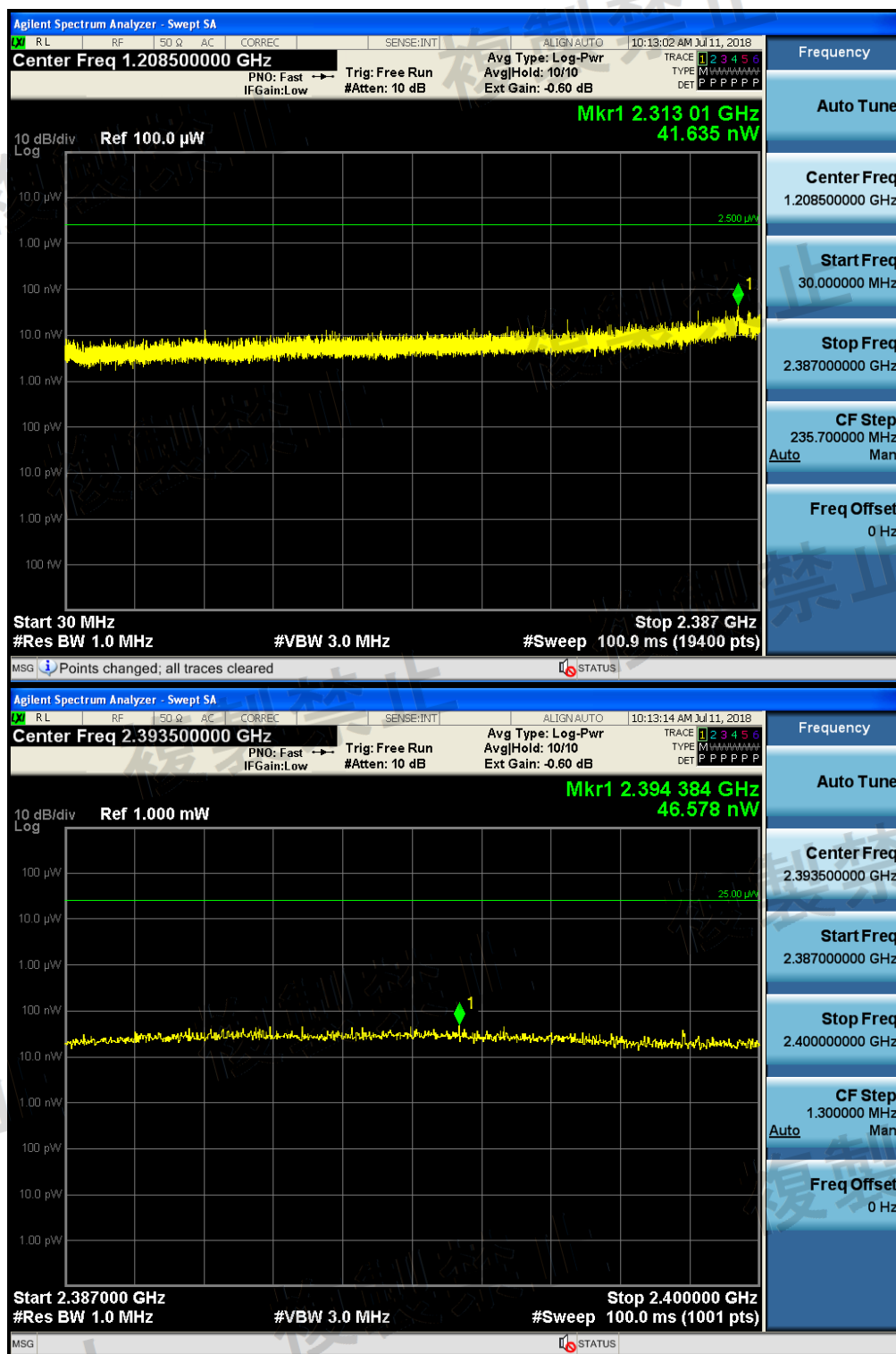


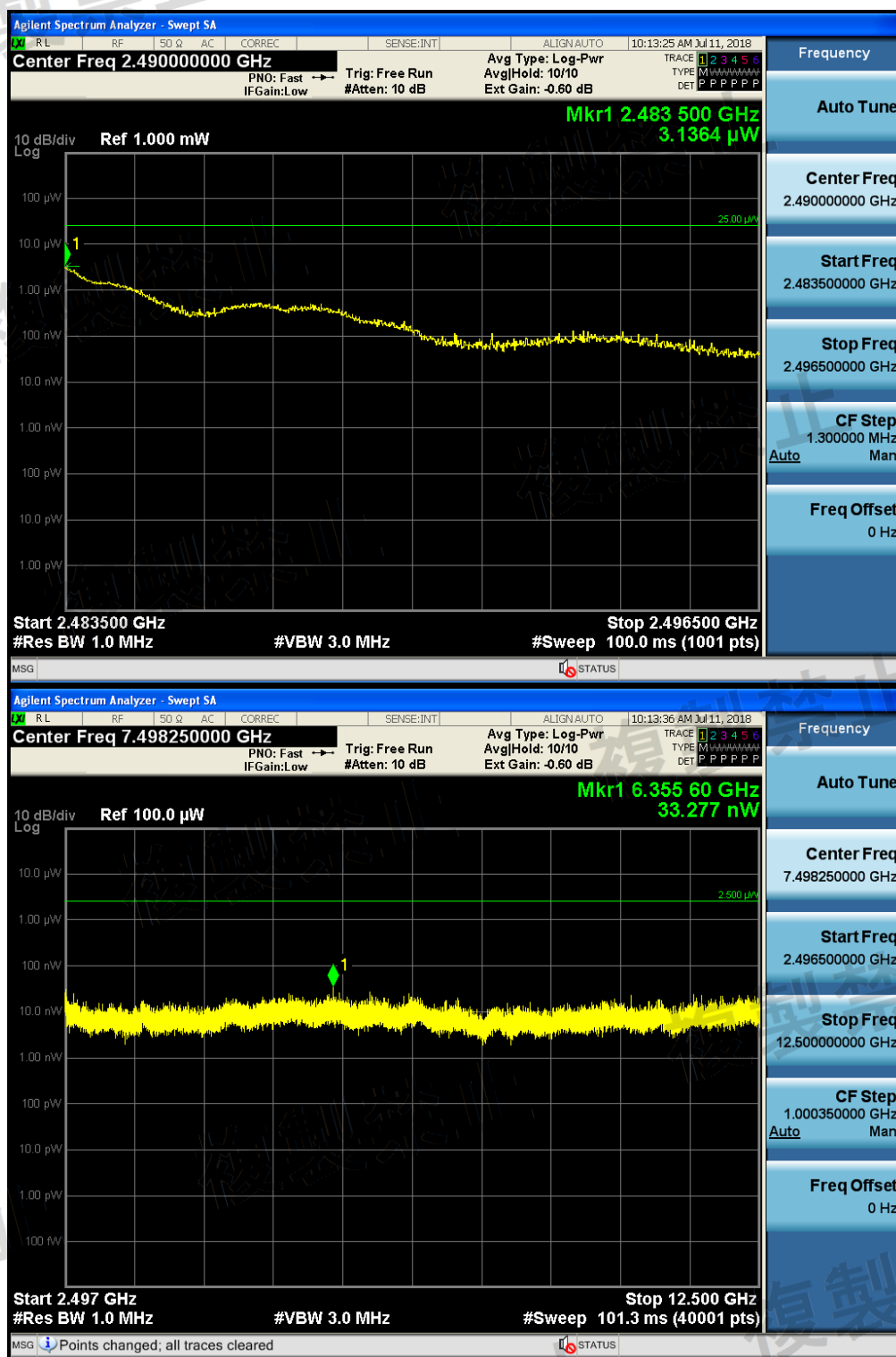


Model: WFM60-SFP201



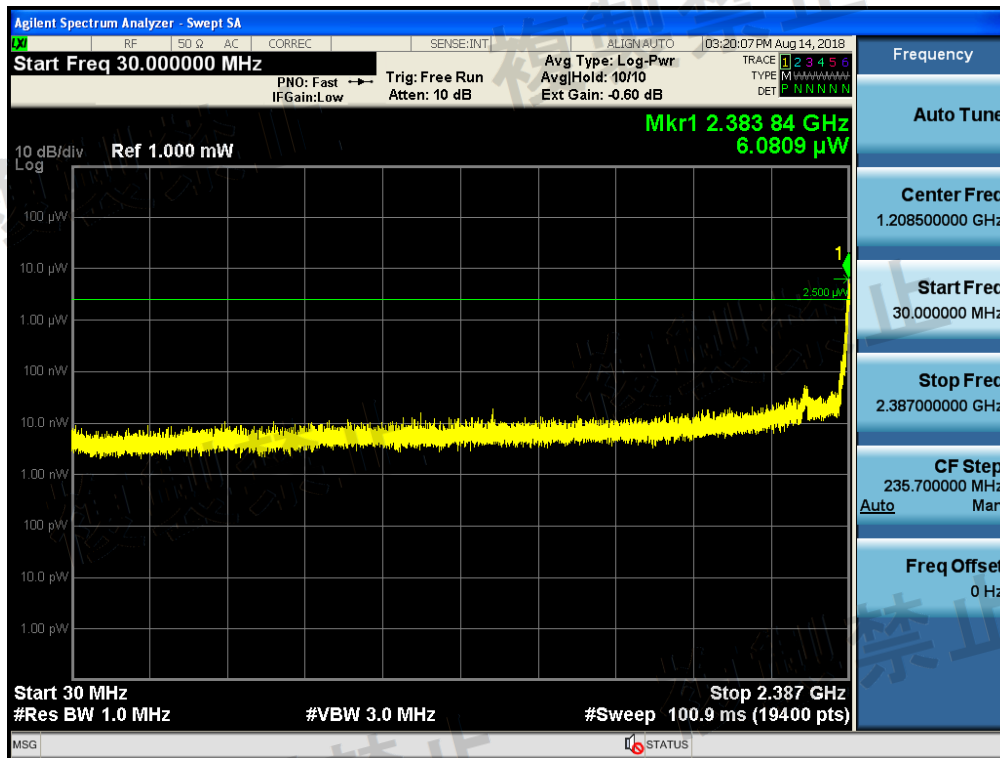
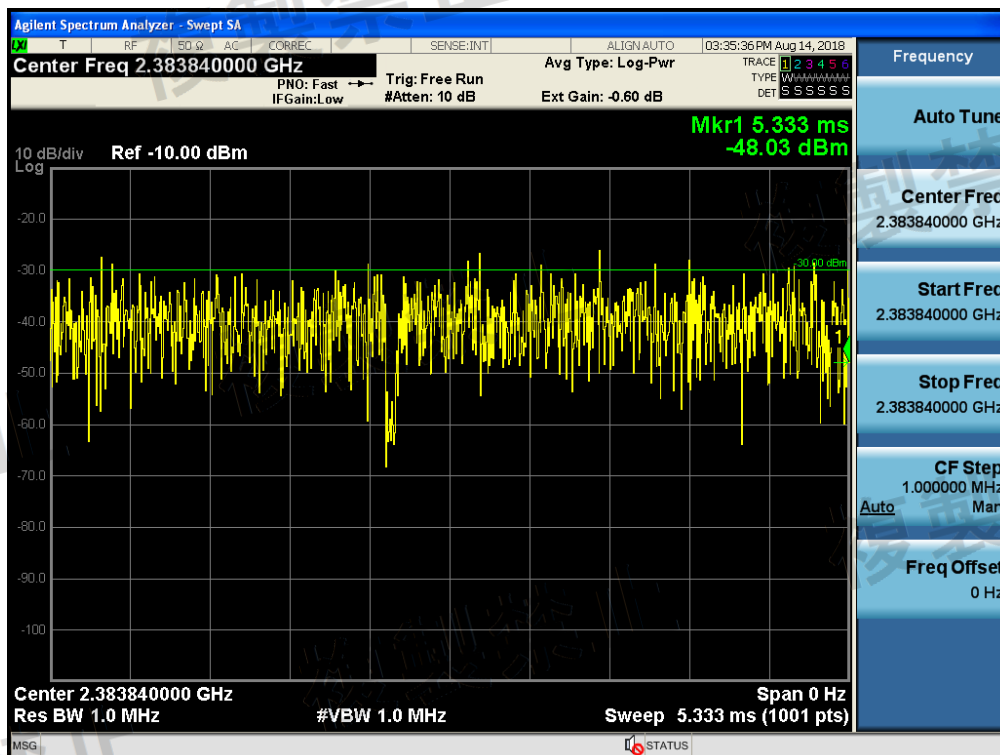
Normal Voltage_2 472 MHz

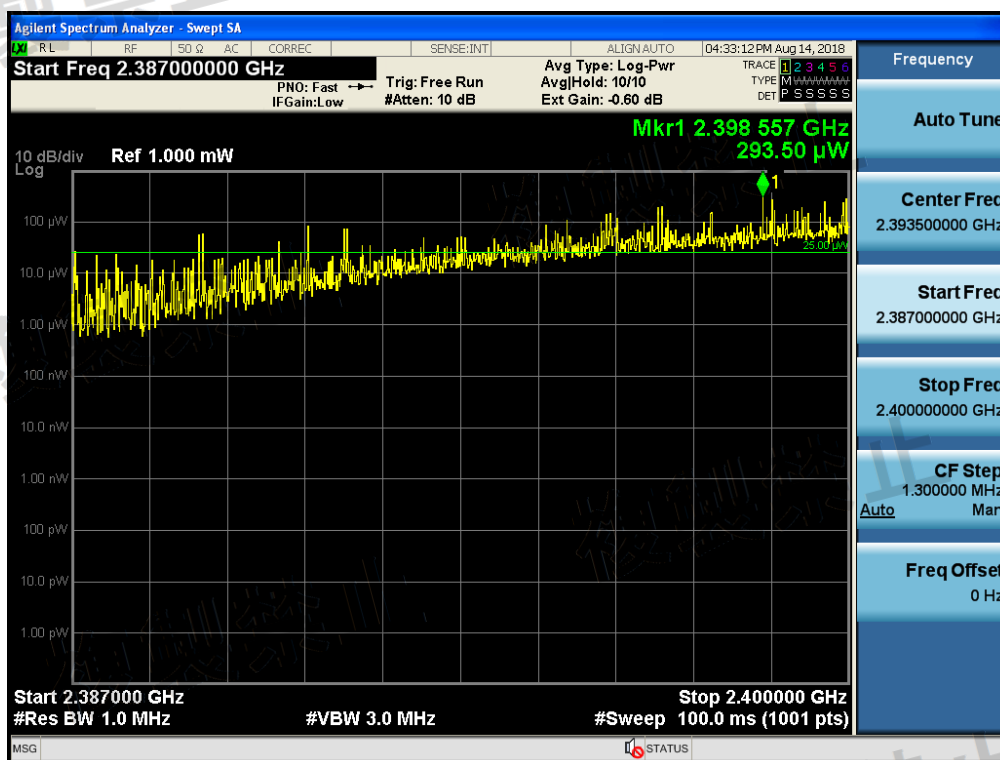
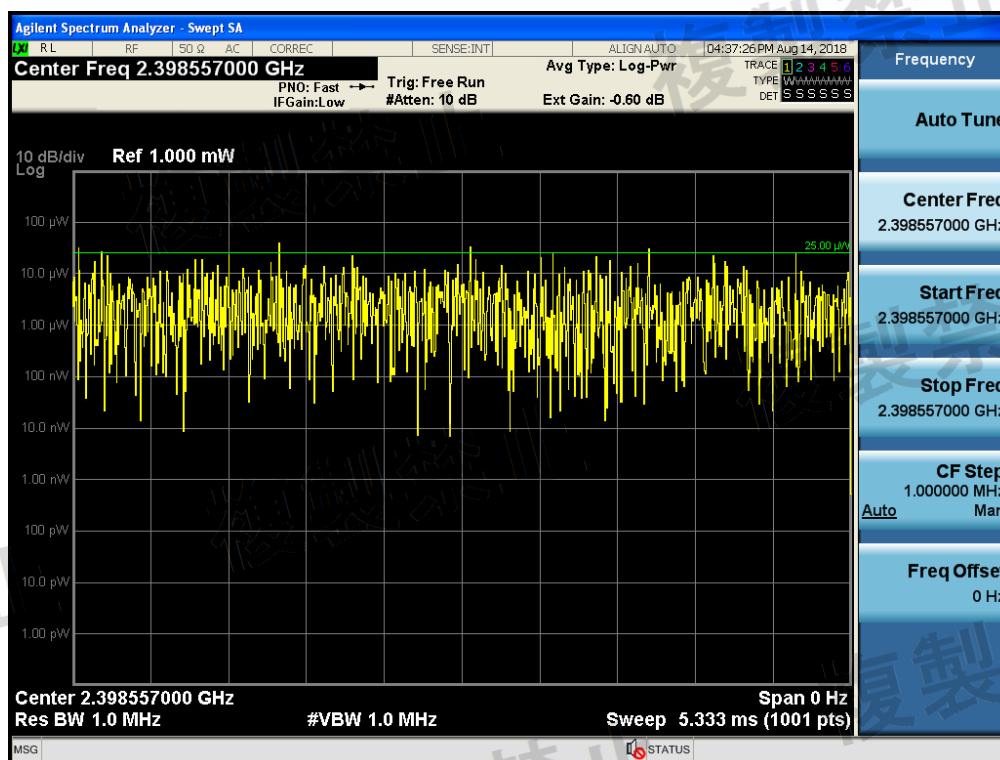


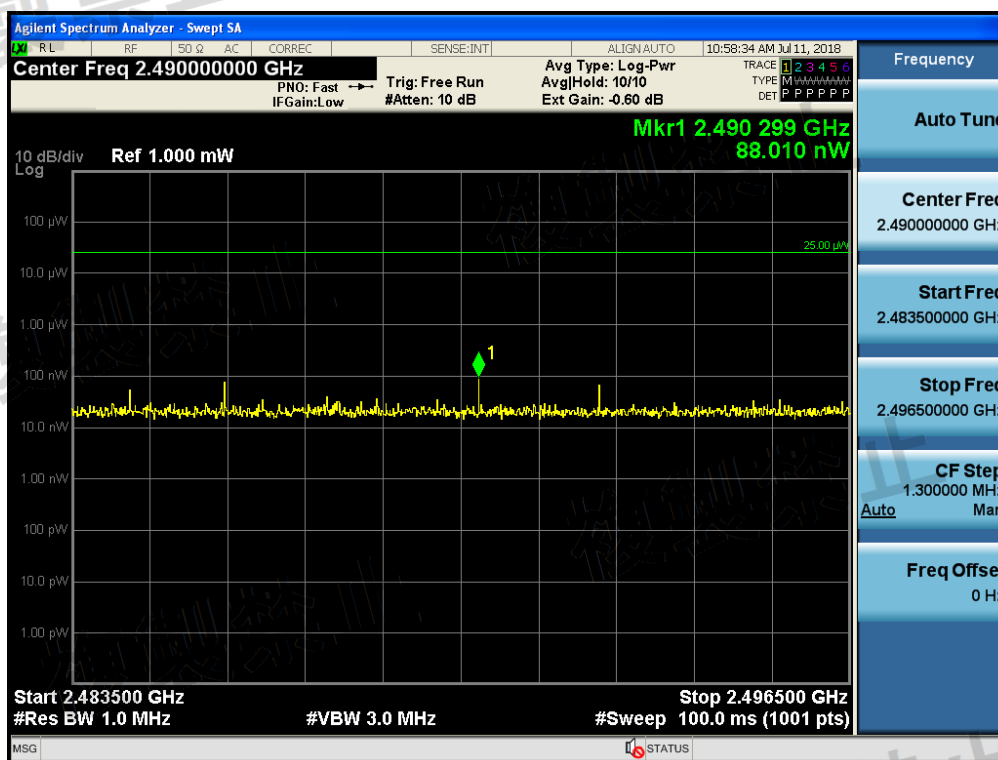
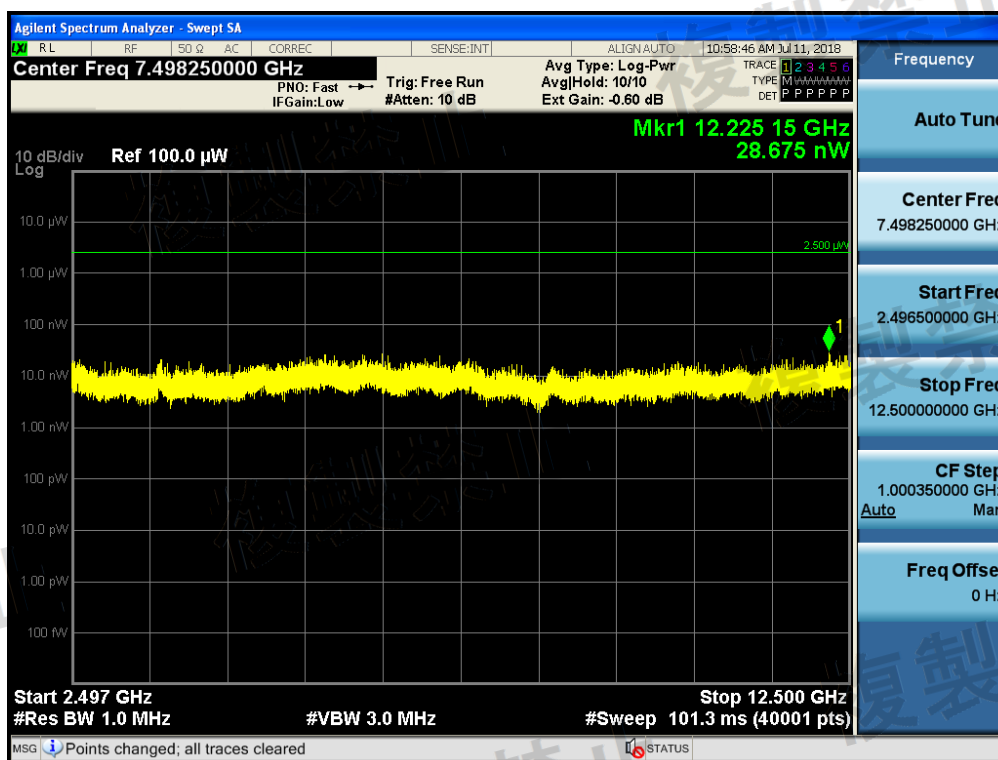


The Strength of Unwanted Emissions (802.11g)

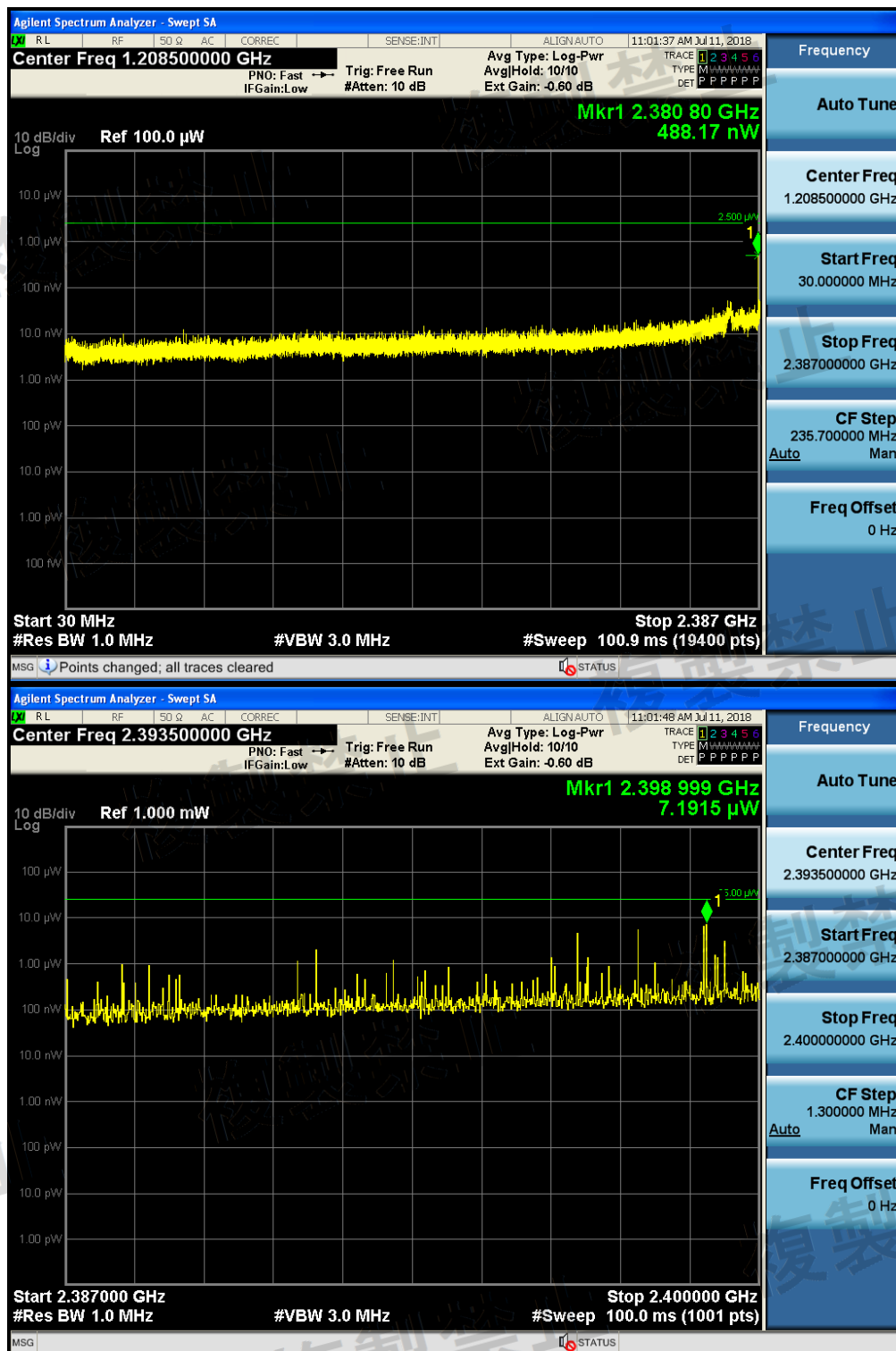
Normal Voltage_2 412 MHz

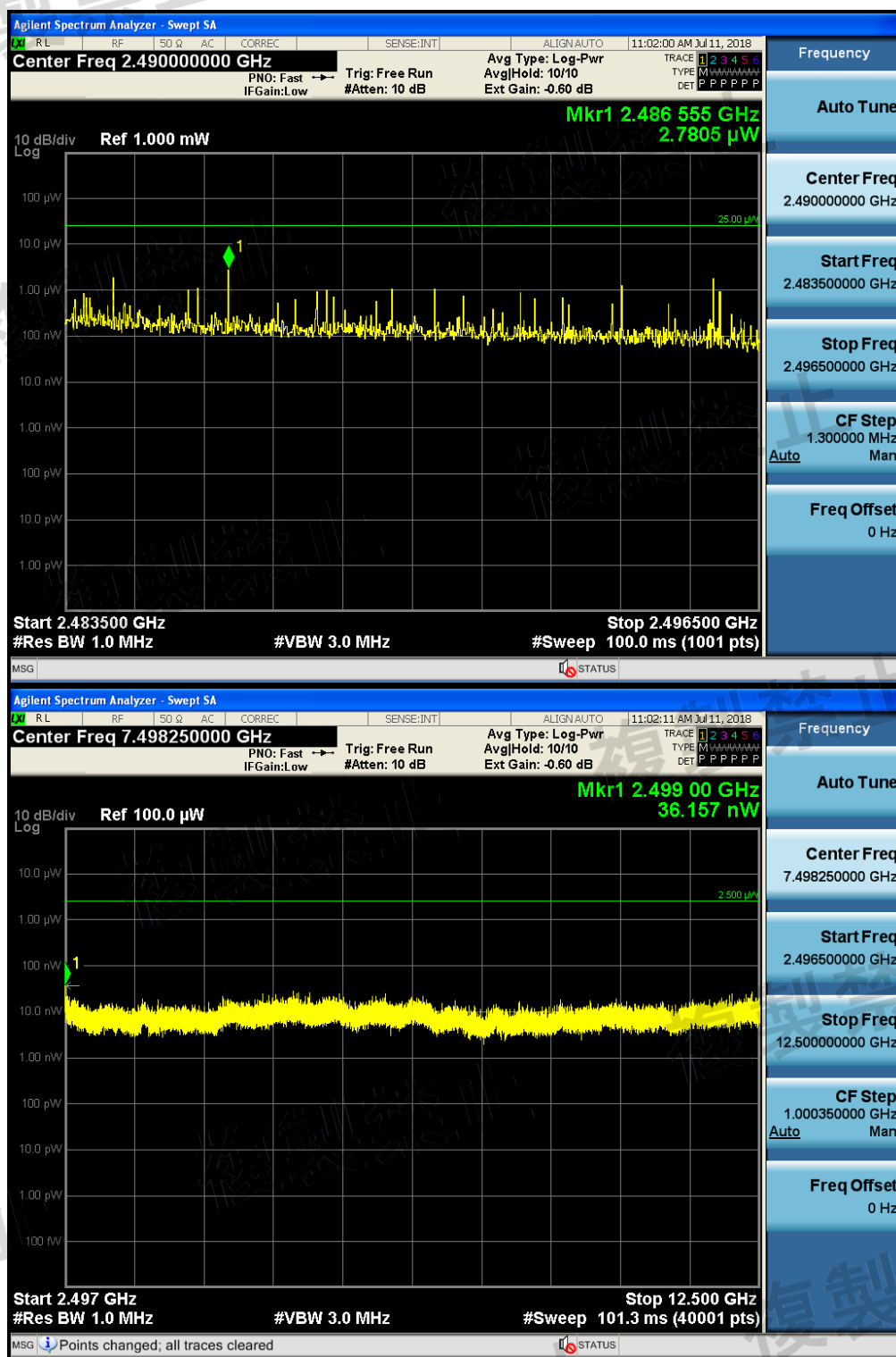




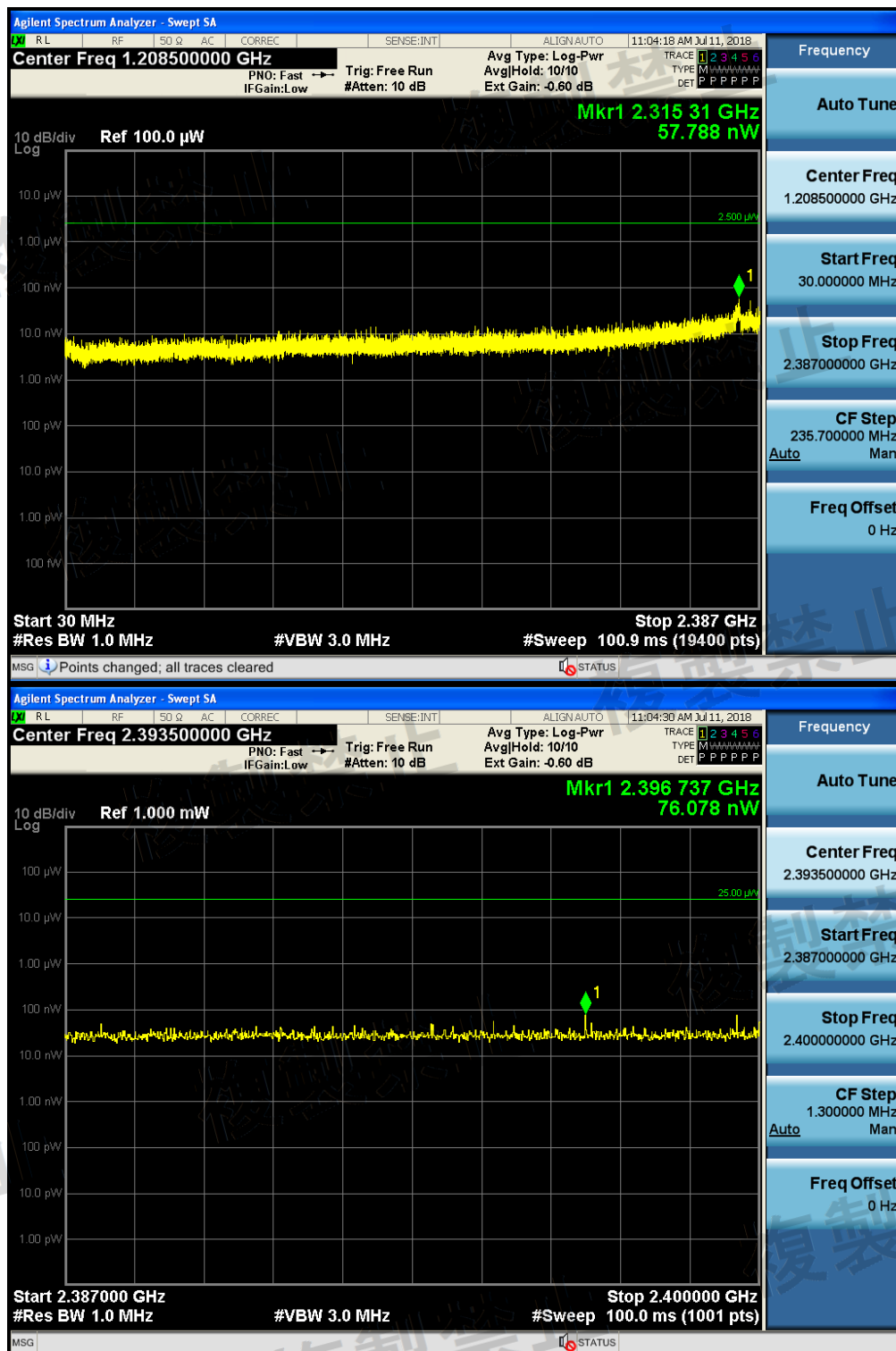


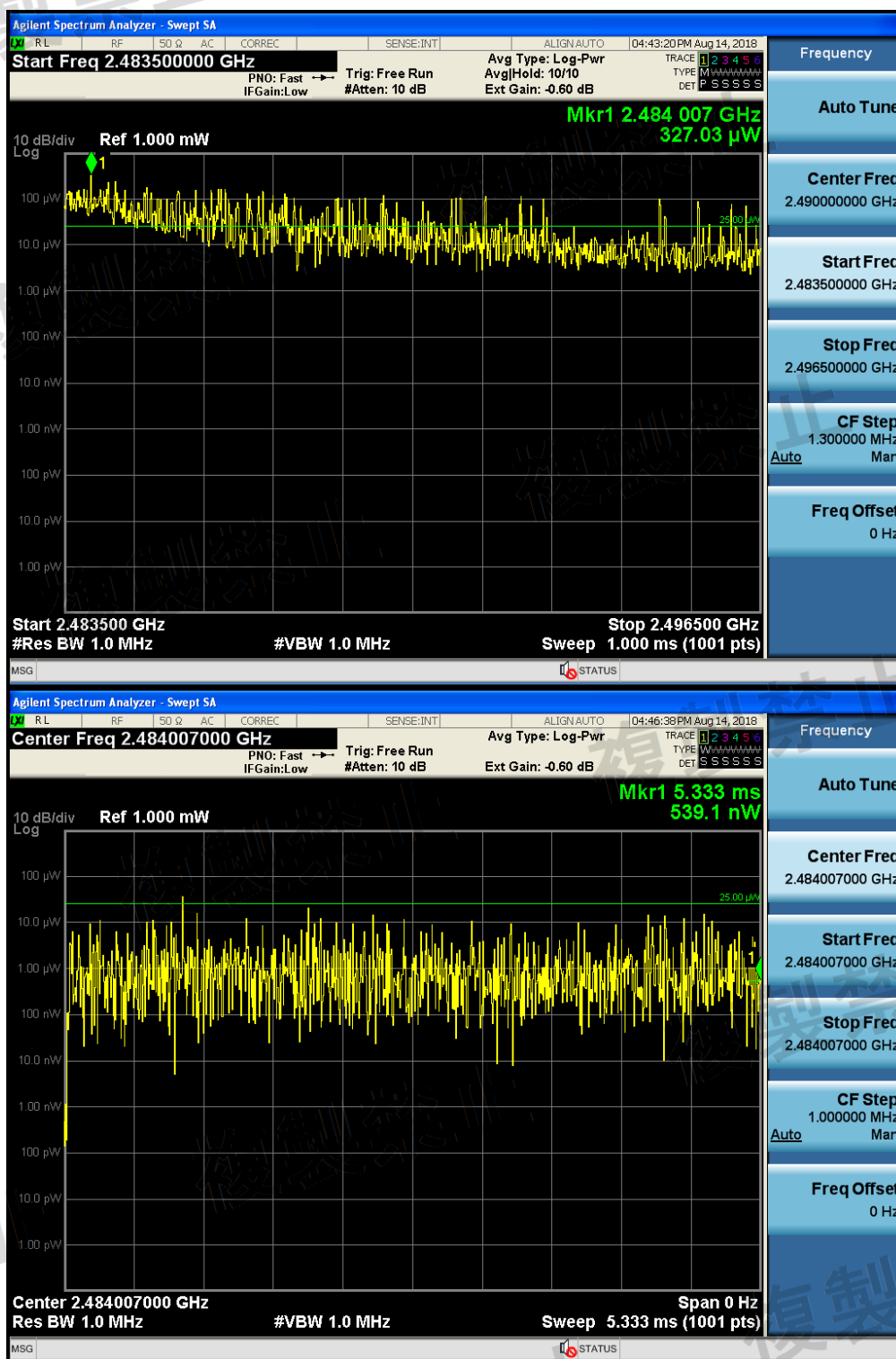
Normal Voltage_2 442 MHz

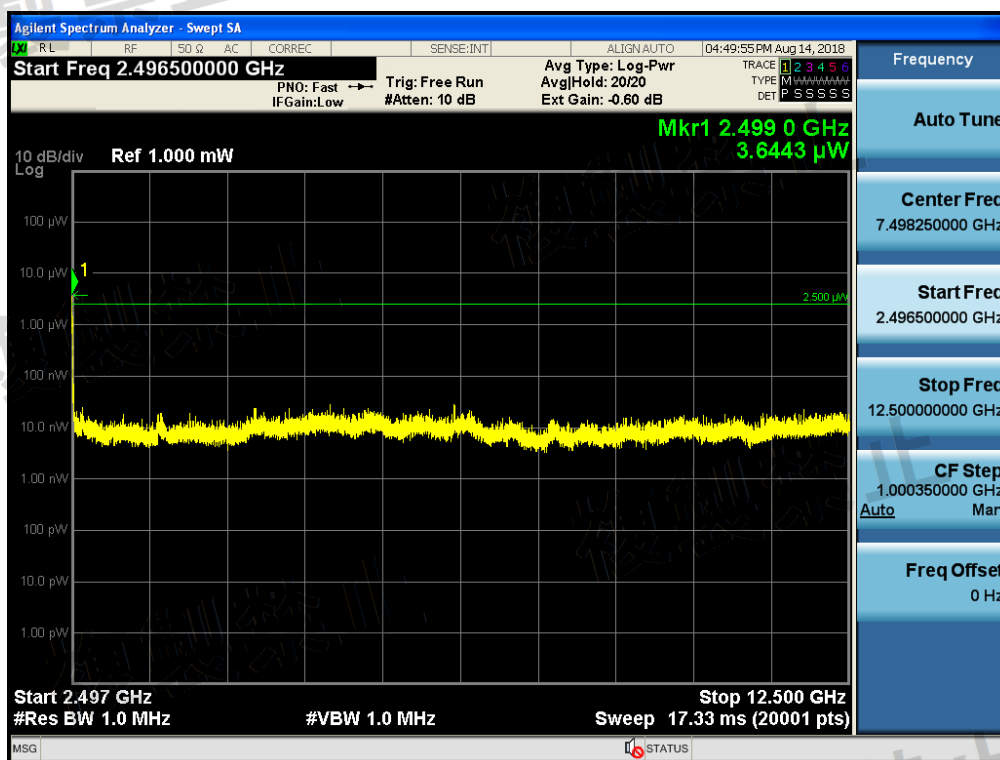
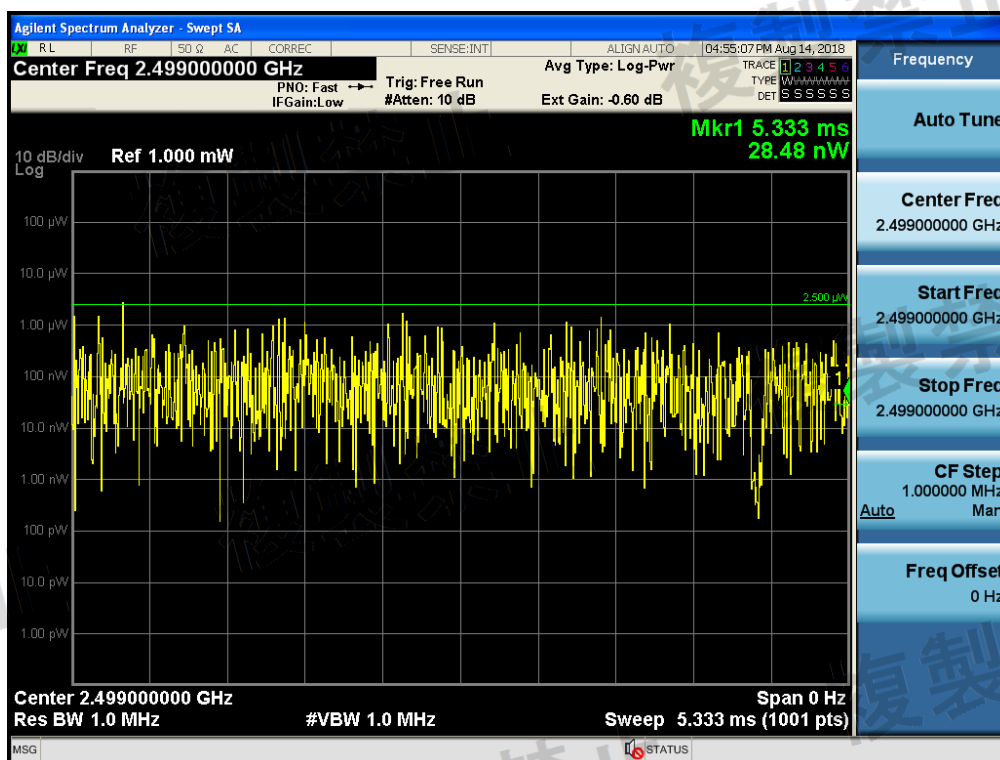




Normal Voltage_2 472 MHz

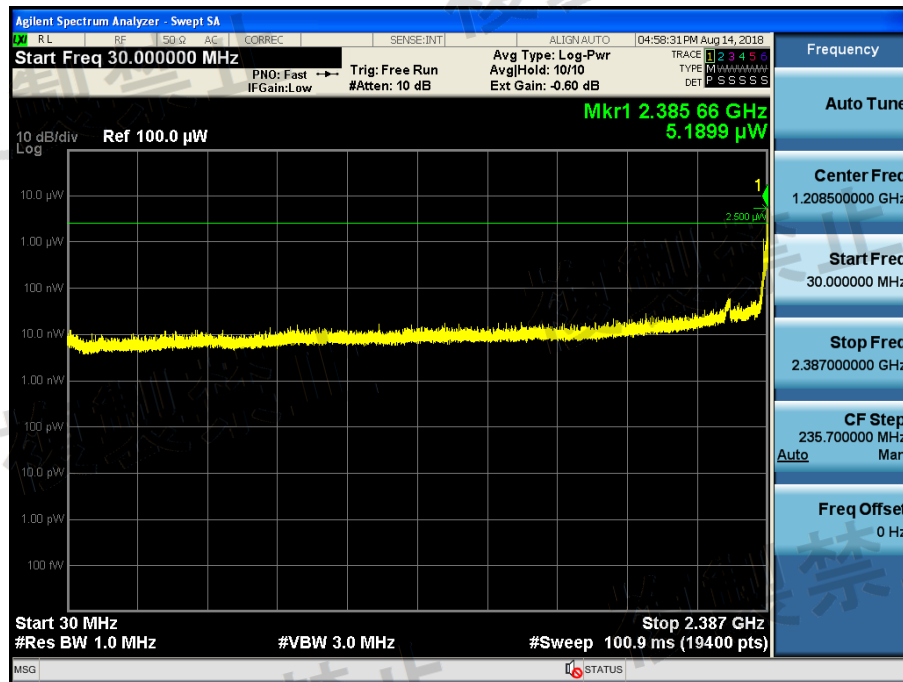
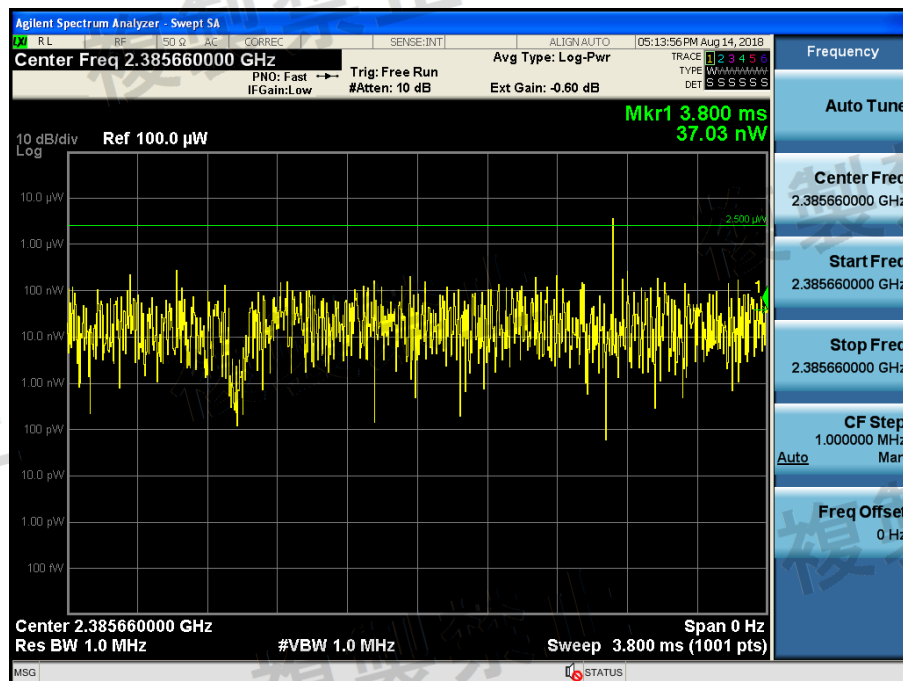


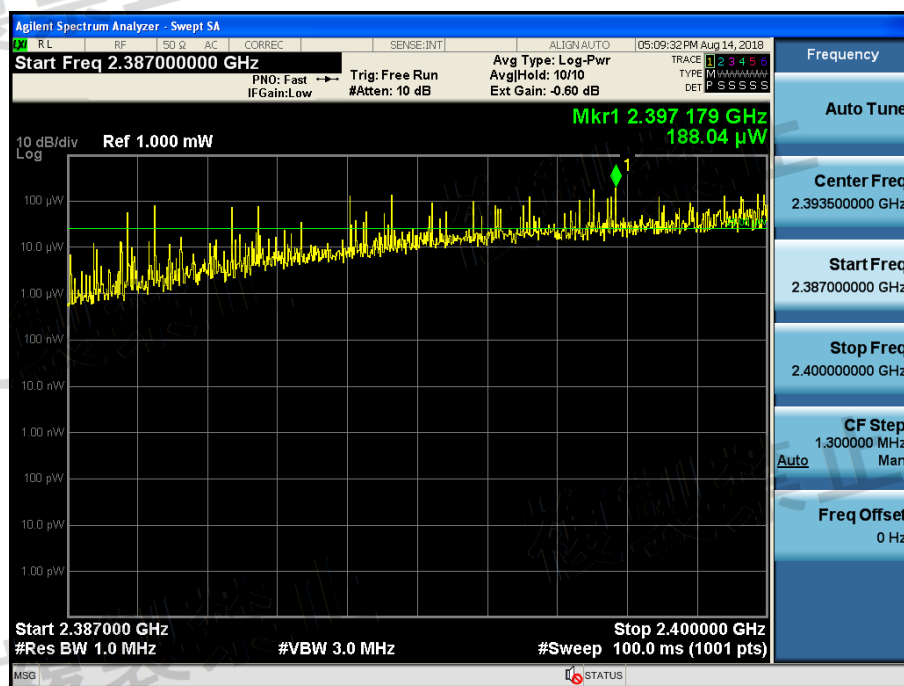
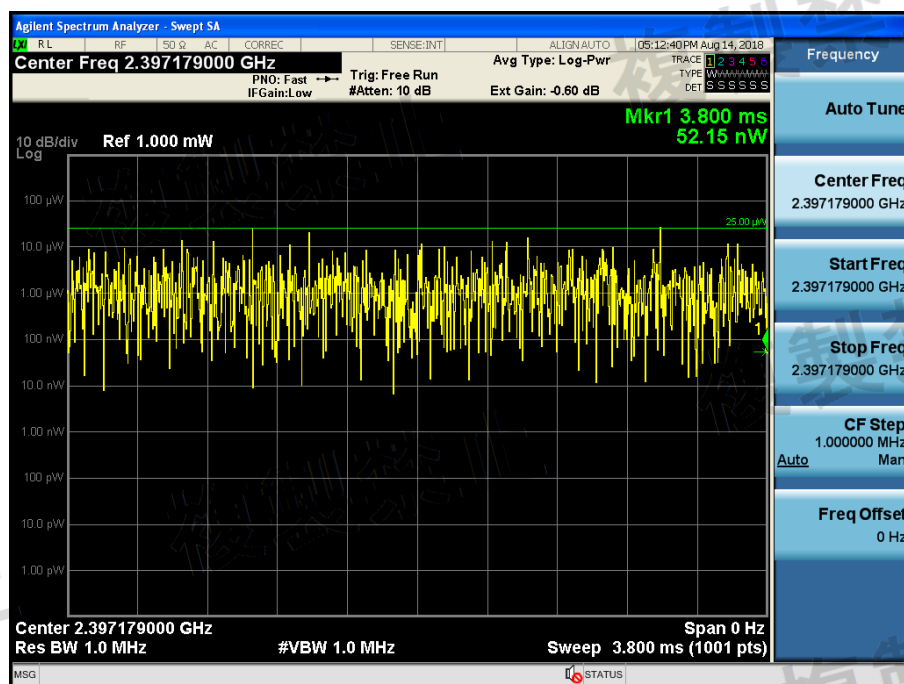


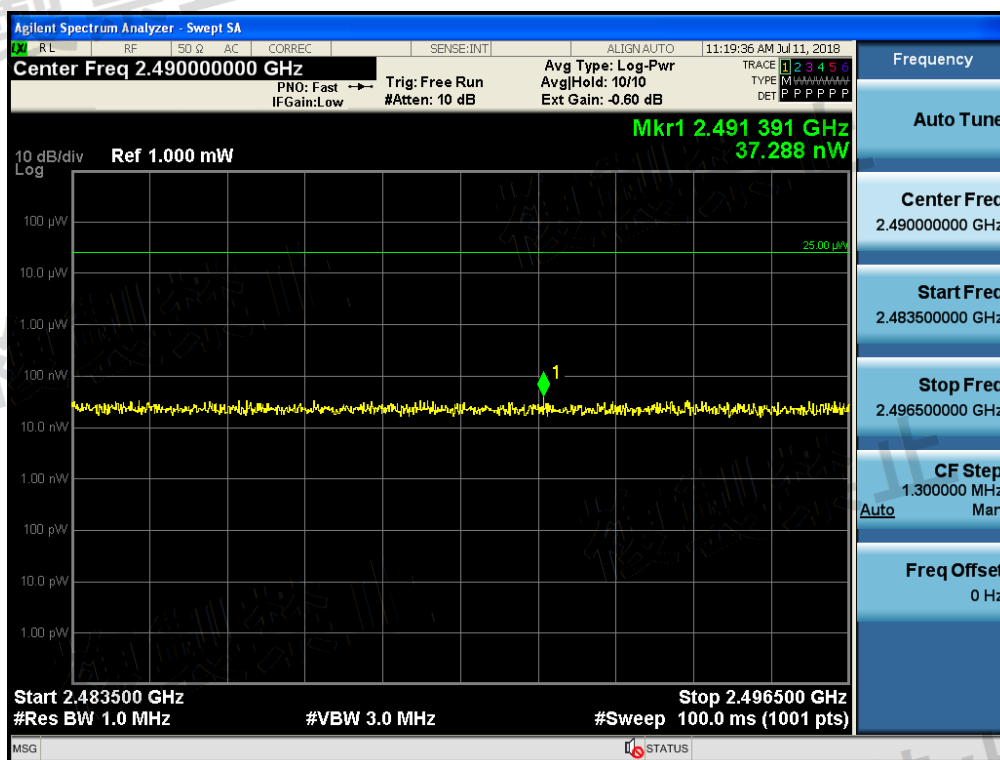
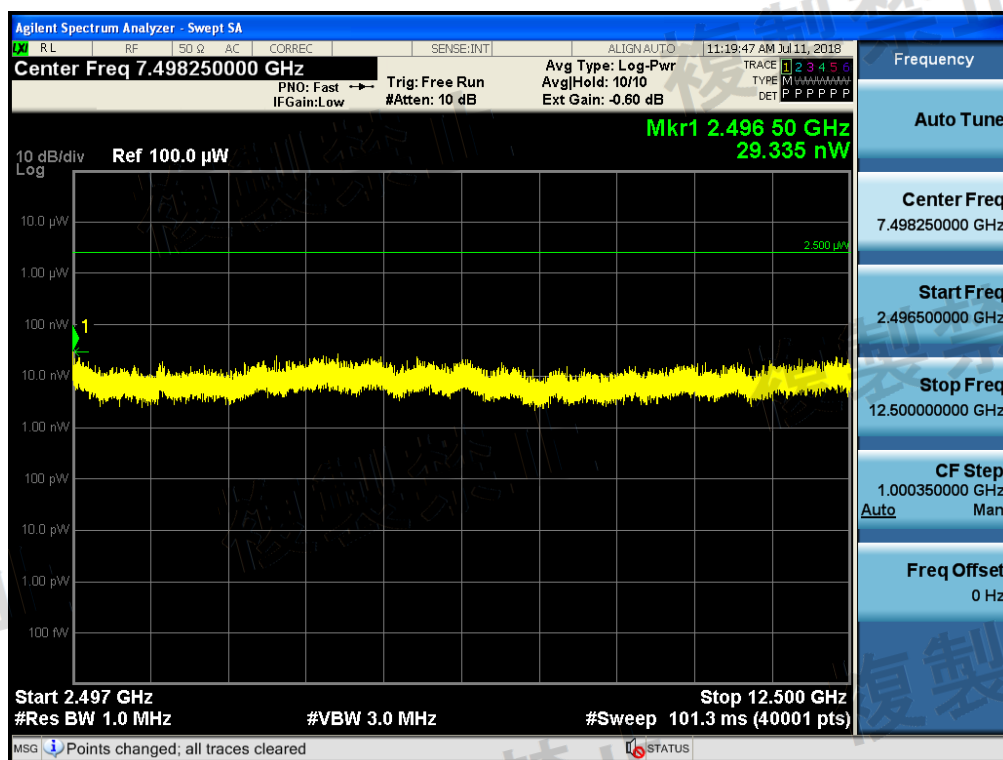


The Strength of Unwanted Emissions (802.11n)

Normal Voltage_2 412 MHz



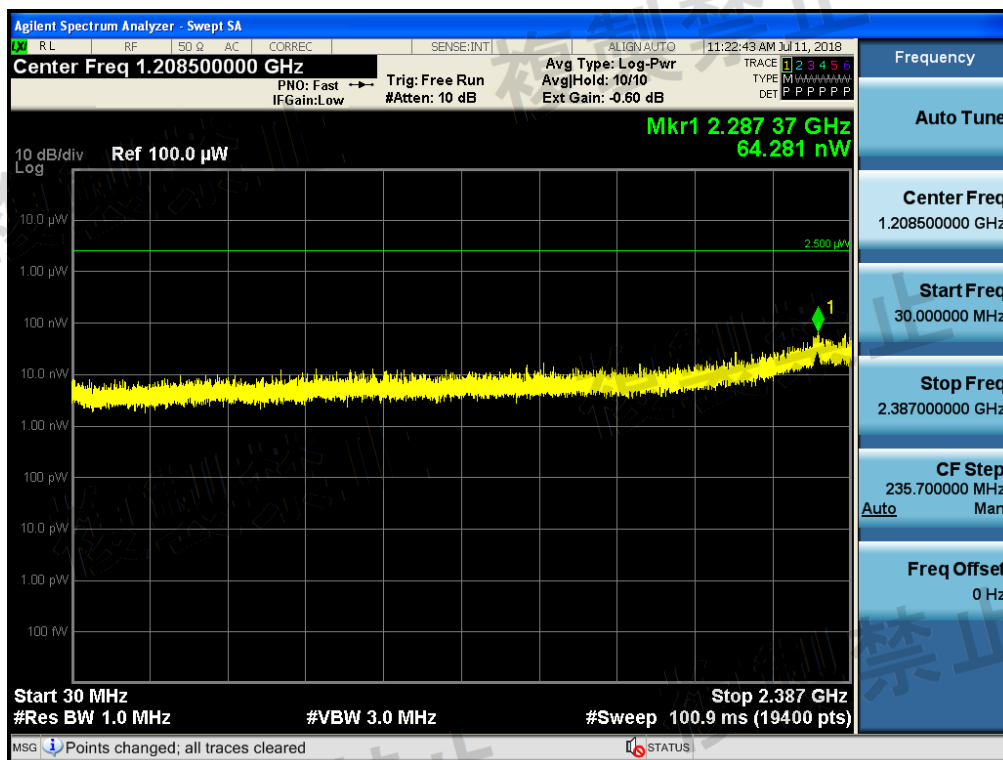
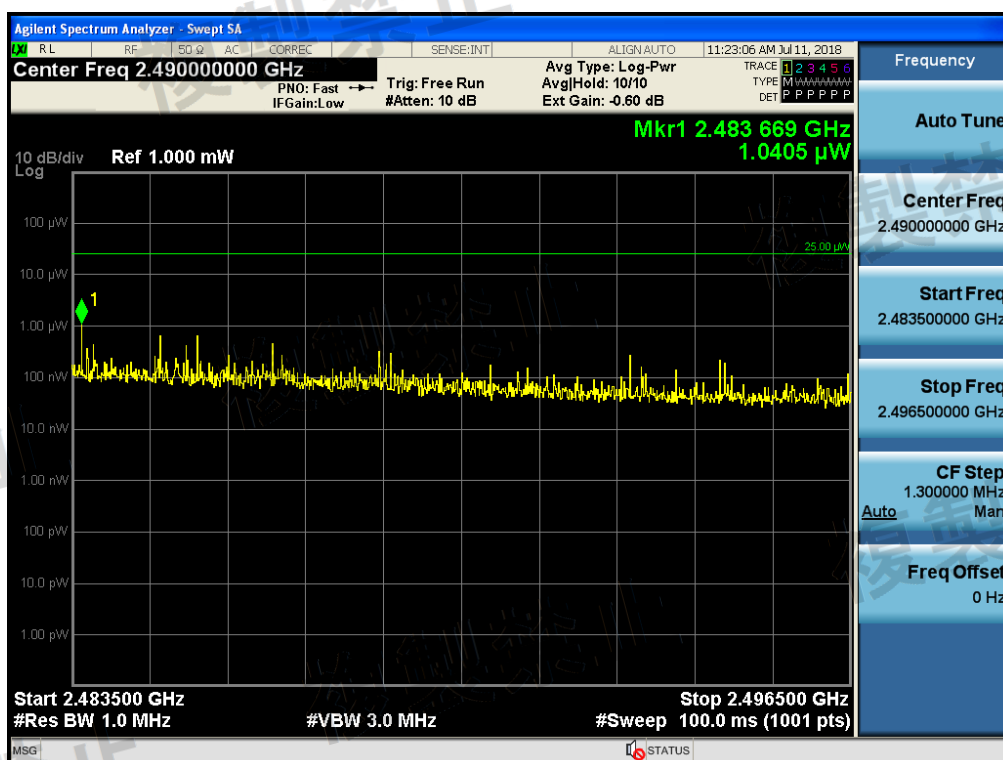


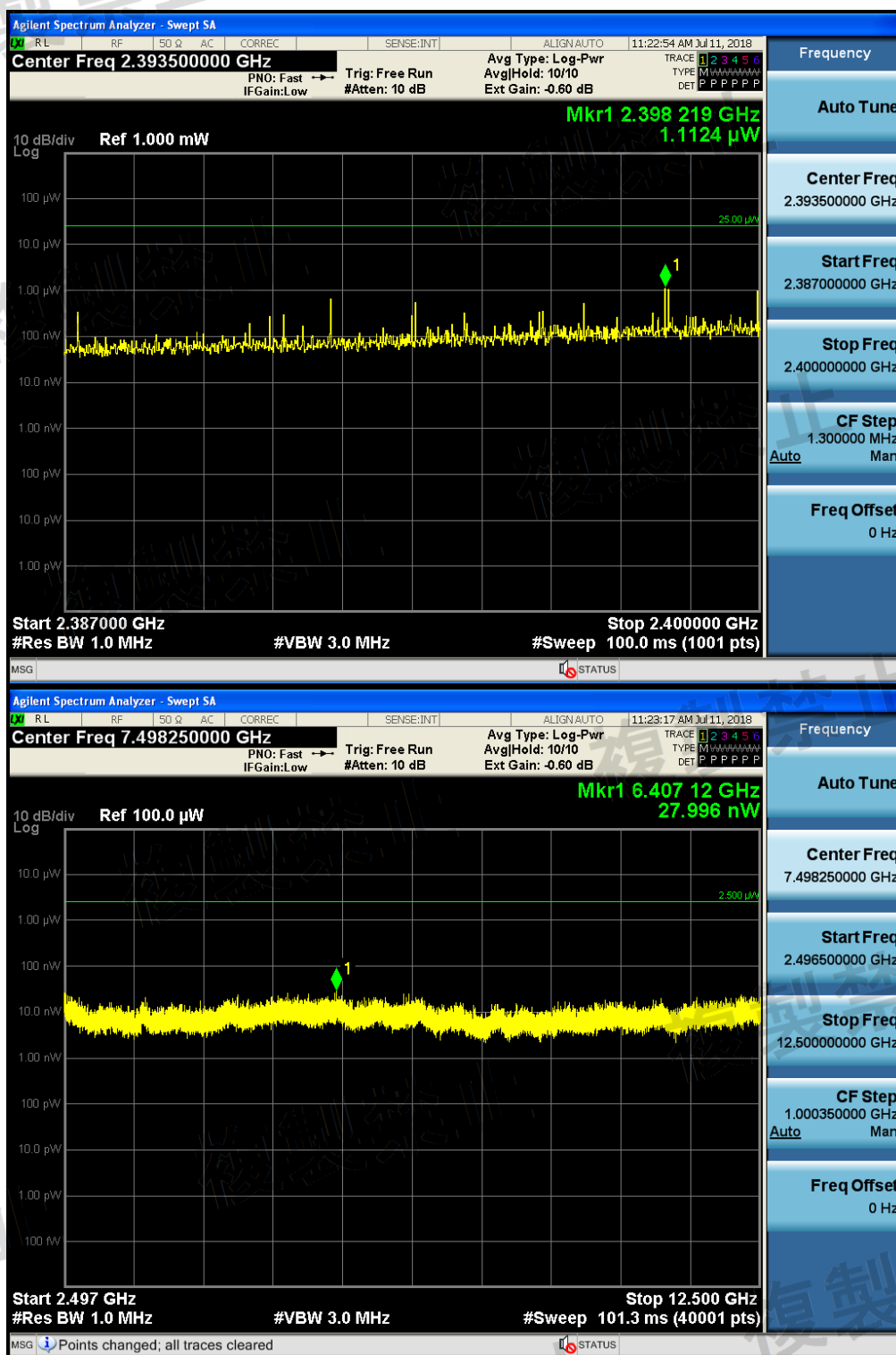


Model: WFM60-SFP201



Normal Voltage_2 442 MHz

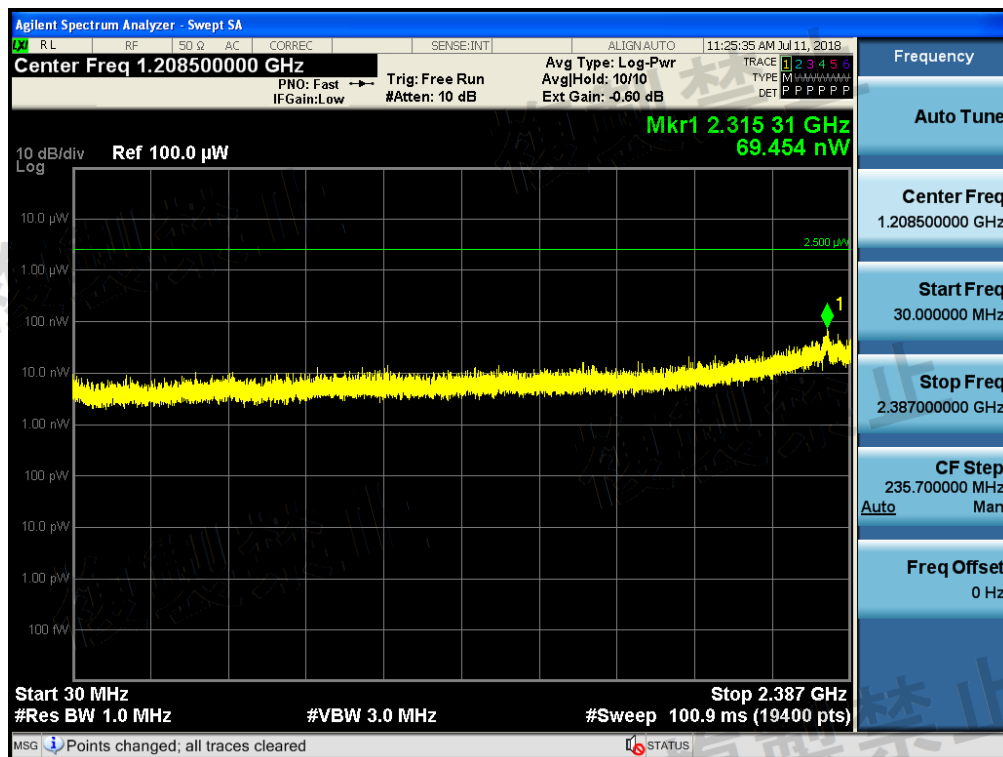
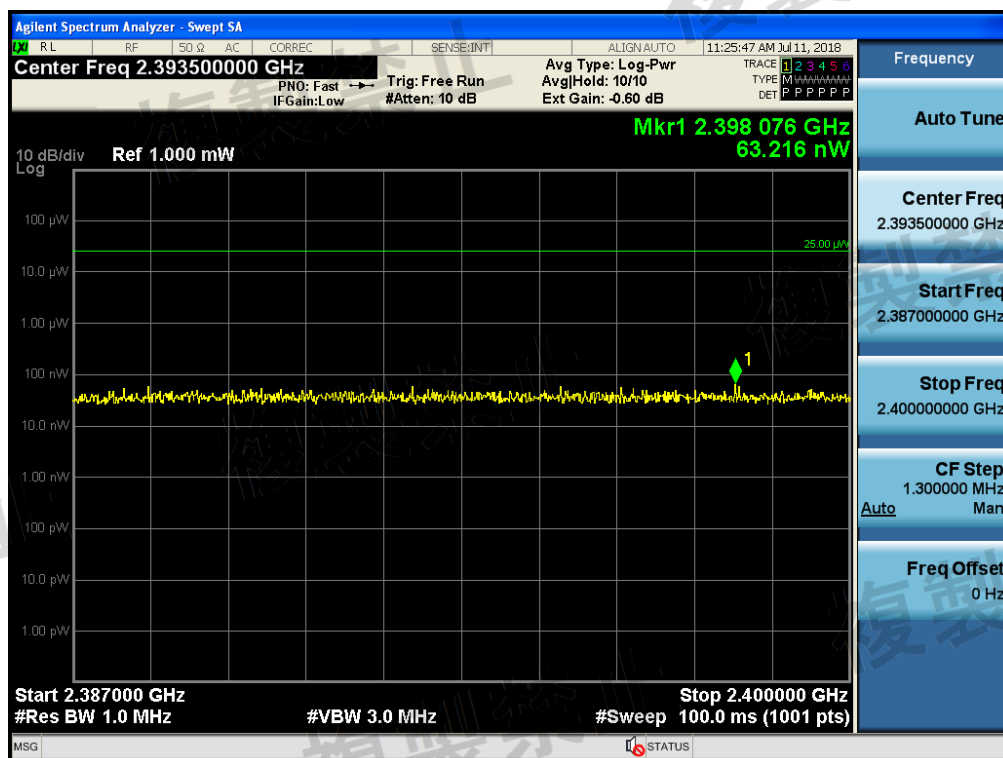


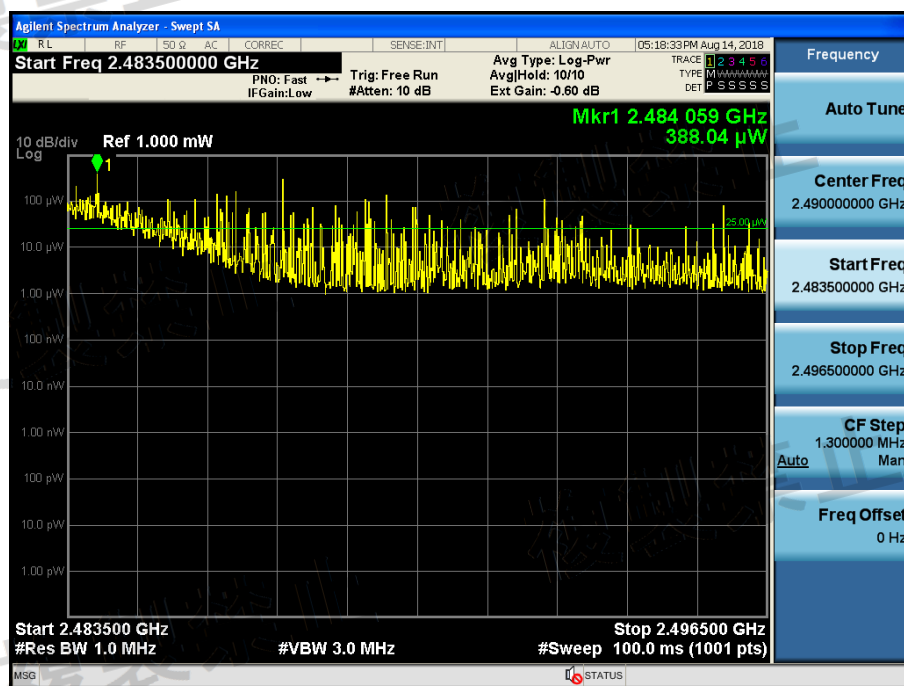
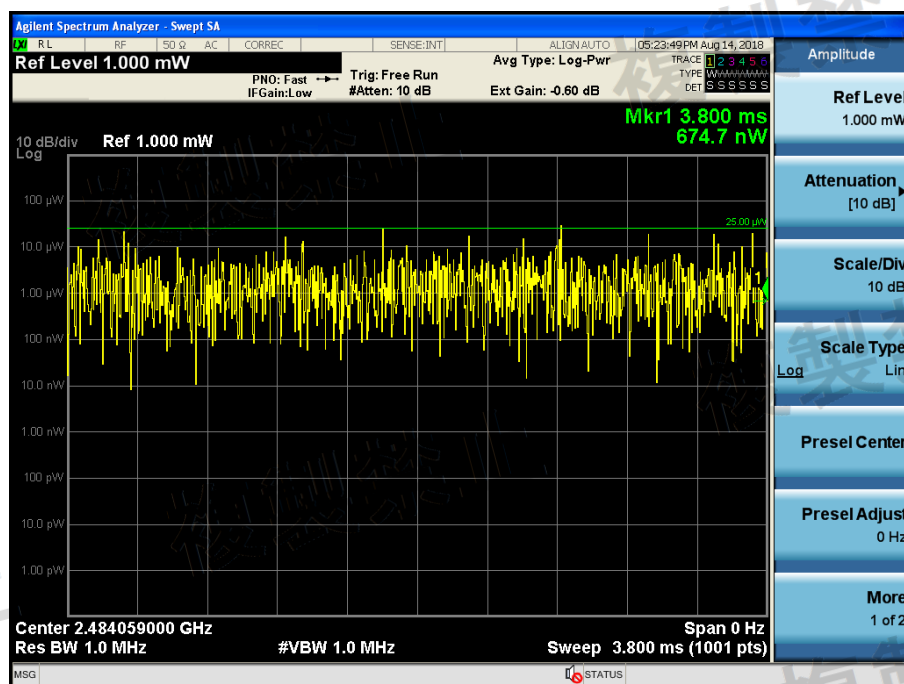


Model: WFM60-SFP201



Normal Voltage_2 472 MHz





Model: WFM60-SFP201

