

FCC TEST REPORT

Application No.: HR/2020/30021
Applicant: Huawei Technologies Co., Ltd.
Address of Applicant: Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C
Manufacturer: Huawei Technologies Co., Ltd.
Address of Manufacturer: Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C
EUT Description: Smart Phone
Model No.: YAL-L21
Trade Mark: HUAWEI
FCC ID: QISYAL-L21
Standards: 47 CFR FCC Part 2, Subpart J
 47 CFR Part 15, Subpart C
Test Method: ANSI C63.10 (2013)
 KDB558074 D01 15.247 Meas Guidance v05r02
Date of Receipt: 2020/4/3
Date of Test: 2020/4/3 to 2020/4/21
Date of Issue: 2020/4/21

Test Result:	PASS *
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* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Derek Yang
Wireless Laboratory Manager



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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
00		2020/4/21		Original

Authorized for issue by:			
Tested By	<i>Mike Hu</i>		2020/4/21
	_____		_____
	(Mike Hu) /Project Engineer		Date
Checked By	<i>David Chen</i>		2020/4/21
	_____		_____
	(David Chen) /Reviewer		Date



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2 Test Summary

Test Item	Test Requirement	Test method	Test Result	Result
AC Power Line Conducted Emission	15.207	ANSI C63.10 (2013)	Clause 4.3	PASS
Conducted Peak Output Power	15.247 (a)(1)	ANSI C63.10 (2013)	Clause 4.4	PASS
20dB Emission Bandwidth	15.247 (a)(1)	ANSI C63.10 (2013)	Clause 4.5	PASS
Carrier Frequencies Separation	15.247 (a)(1)	ANSI C63.10 (2013)	Clause 4.6	PASS
Hopping Channel Number	15.247 (a)(1)	ANSI C63.10 (2013)	Clause 4.7	PASS
Dwell Time	15.247 (a)(1)	ANSI C63.10 (2013)	Clause 4.8	PASS
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10 (2013)	Clause 4.9	PASS
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10 (2013)	Clause 4.10	PASS
Radiated Spurious emissions	15.247(d); 15.205/15.209	ANSI C63.10 (2013)	Clause 4.11	PASS
Restricted bands around fundamental frequency (Radiated Emission)	15.247(d); 15.205/15.209	ANSI C63.10 (2013)	Clause 4.12	PASS



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3 General Information

3.1 Client Information

Applicant:	Huawei Technologies Co., Ltd.
Address of Applicant:	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C
Manufacturer:	Huawei Technologies Co., Ltd.
Address of Manufacturer:	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

3.2 Test Location

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Address:	No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
Post code:	518057
Telephone:	+86 (0) 755 2601 2053
Fax:	+86 (0) 755 2671 0594
E-mail:	ee.shenzhen@sgs.com

3.3 Test Facility

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

• **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• **A2LA (Certificate No. 3816.01)**

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

• **VCCI**

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

• **FCC –Designation Number: CN1178**

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

Designation Number: CN1178. Test Firm Registration Number: 406779.

• **Industry Canada (IC)**

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.



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3.4 General Description of EUT

EUT Description:	Smart Phone
Model No.:	YAL-L21
Trade Mark:	HUAWEI
Hardware version:	HL2YALEM01
Software version:	10.0.0.100(C900E100R1P1) GPU Yurbo
Operation Frequency:	2400MHz~2483.5MHz
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Hopping Channel Type:	Adaptive Frequency Hopping systems
Sample Type:	<input checked="" type="checkbox"/> Portable Device, <input type="checkbox"/> Module
Antenna Type:	<input type="checkbox"/> External, <input checked="" type="checkbox"/> Integrated
Antenna Gain:	-1.5dBi
Power Supply	<input type="checkbox"/> AC/DC Adapter; <input checked="" type="checkbox"/> Battery <input type="checkbox"/> PoE; <input type="checkbox"/> Other:
Adapter	Model:HW-050450E01;HW-050450B01;HW-050450U01;HW-050450A01; HW-050450E00;HW-050450A00;HW-050450B00;HW-050450U00 Manufacture: Huawei Technologies Co., Ltd.
Battery	Model:HB386589ECW Manufacture: Huawei Technologies Co., Ltd.

the selected channel

Channel	Frequency		
	1MHz	2MHz	4MHz
The Lowest channel	2404MHz	2404MHz	2404MHz
The Middle channel	2440MHz	2440MHz	2440MHz
The Highest channel	2478MHz	2478MHz	2476MHz

3.5 Test Environment

Operating Environment	
Temperature:	24.0 °C
Humidity:	55 % RH
Atmospheric Pressure:	101.30 KPa

3.6 Description of Support Units

The EUT has been tested independent unit.



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4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
<p>15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</p>	
<p>The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -1.5dBi.</p>	



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4.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

4.2.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)

4.2.2 Conclusion

Standard Requirement:

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1):

According to Technical Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.

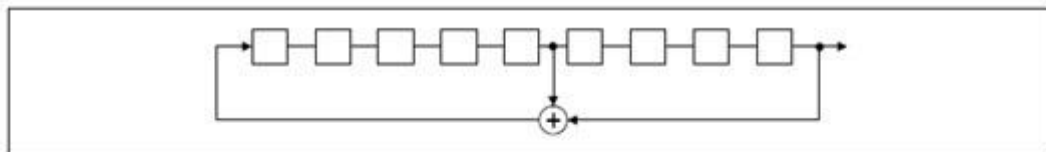
> Number of shift register stages: 9

> Length of pseudo-random sequence: $2^9 - 1 = 511$ bits

> Longest sequence of zeros: 8 (non-inverted signal)

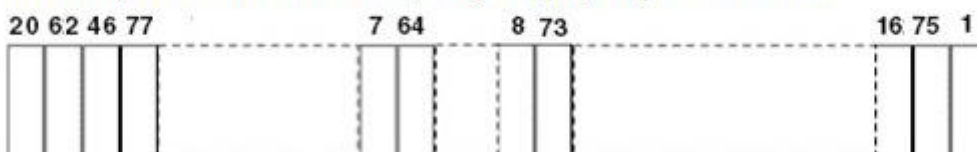
Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.



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According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g):

According to Technical Specification, the system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the RF system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h):

According to Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels. The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.



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4.3 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	150kHz to 30MHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	* Decreases with the logarithm of the frequency.		
Test Procedure:	<p>1) The mains terminal disturbance voltage test was conducted in a shielded room.</p> <p>2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.</p> <p>3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,</p> <p>4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.</p> <p>5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.</p>		



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<p>Test Setup:</p>	
<p>Exploratory Test Mode:</p>	<p>Non-hopping transmitting mode with all kind of modulation and all kind of data type at the lowest, middle, high channel. Charge + Transmitting mode.</p>
<p>Final Test Mode:</p>	<p>Through Pre-scan, find the DH5 of data type and GFSK modulation at the lowest channel is the worst case. Charge + Transmitting mode Only the worst case is recorded in the report.</p>
<p>Instruments Used:</p>	<p>Refer to section 5.10 for details</p>
<p>Test Results:</p>	<p>Pass</p>



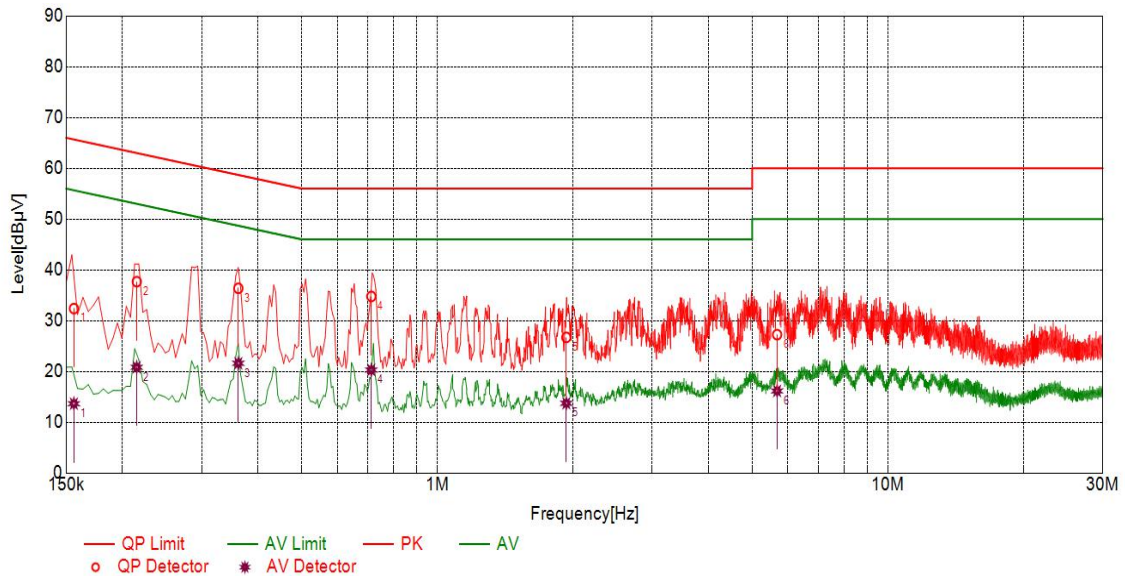
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Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live line:

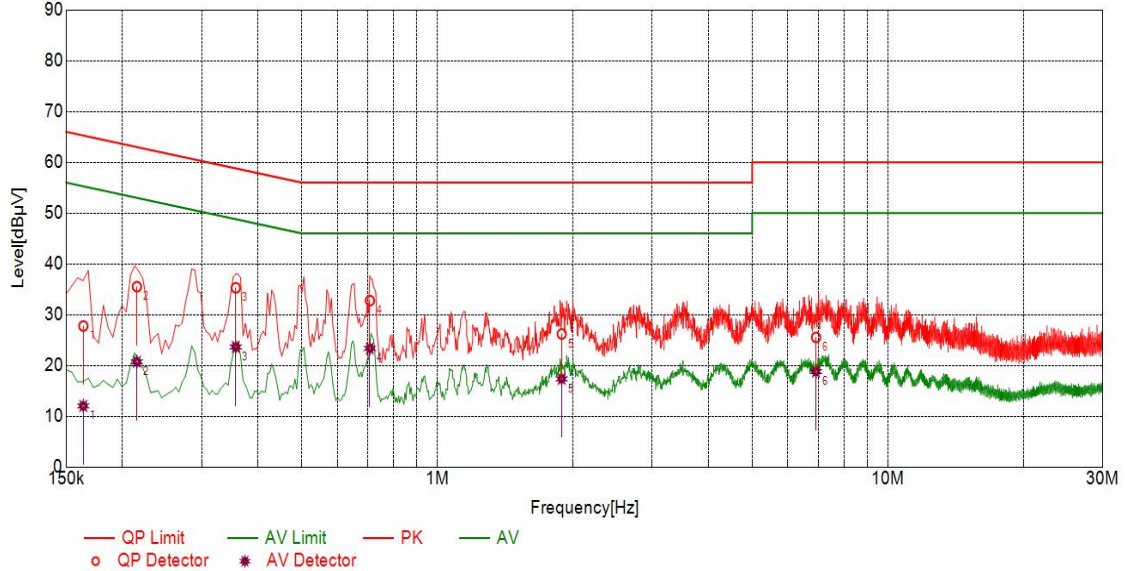


Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Type
1	0.1561	10.10	32.38	65.67	33.29	13.65	55.67	42.02	L
2	0.2152	10.10	37.68	63.00	25.32	20.82	53.00	32.18	L
3	0.3617	10.10	36.37	58.69	22.32	21.60	48.69	27.09	L
4	0.7136	10.10	34.77	56.00	21.23	20.28	46.00	25.72	L
5	1.9336	10.10	26.71	56.00	29.29	13.73	46.00	32.27	L
6	5.6779	10.10	27.25	60.00	32.75	16.16	50.00	33.84	L



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Neutral line:



Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Type
1	0.1638	10.10	27.77	65.27	37.50	12.02	55.27	43.25	N
2	0.2154	10.10	35.52	62.99	27.47	20.72	52.99	32.27	N
3	0.3570	10.10	35.29	58.80	23.51	23.65	48.80	25.15	N
4	0.7084	10.10	32.77	56.00	23.23	23.36	46.00	22.64	N
5	1.8883	10.10	26.20	56.00	29.80	17.36	46.00	28.64	N
6	6.9276	10.10	25.53	60.00	34.47	18.80	50.00	31.20	N

Remarks:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.



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4.4 Conducted Peak Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013 Section 7.8.5
Test Setup:	
Limit:	(20.97dBm) 125mW
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass



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4.4.1 Test Results

Measurement Data of Peak power:

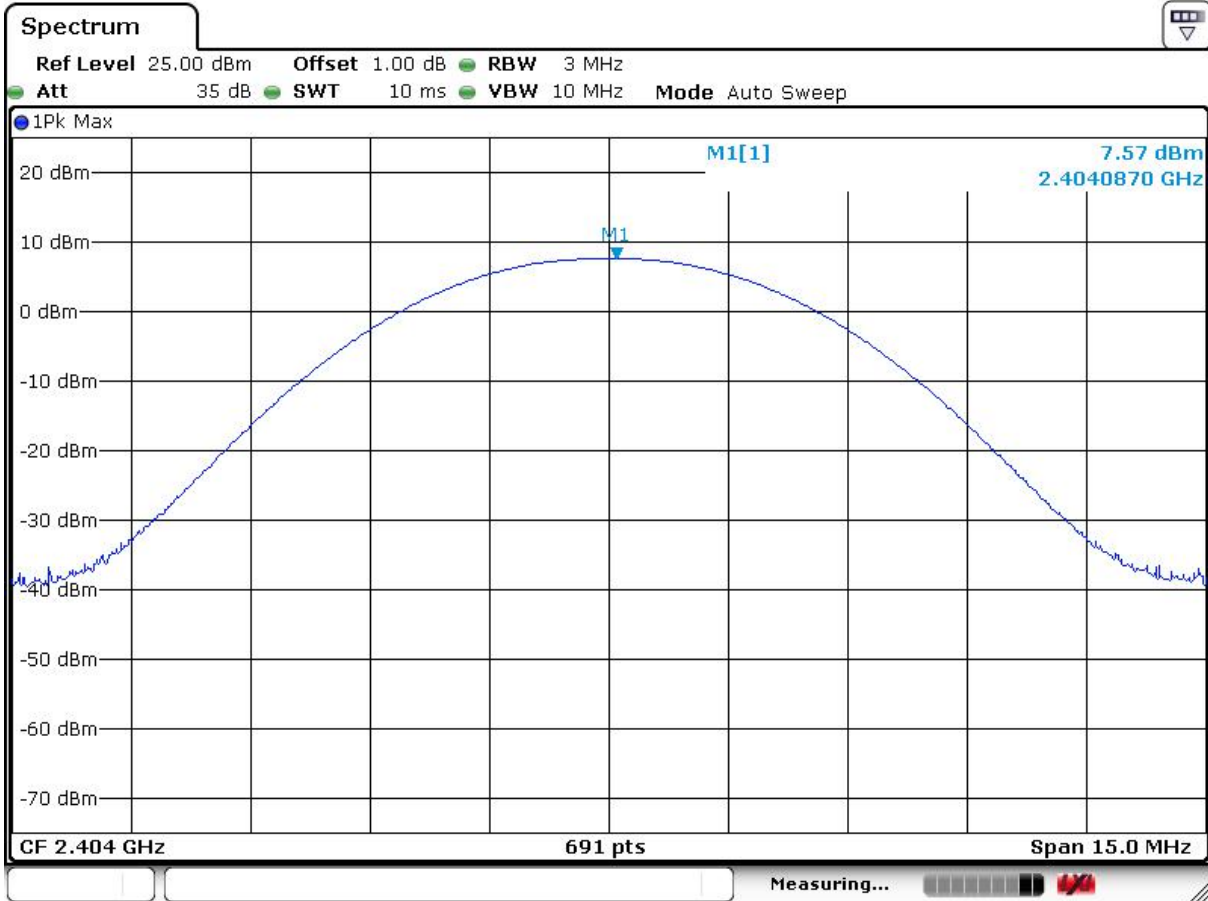
Mode	Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
1MHz	Lowest	7.57	20.97	Pass
	Middle	7.23	20.97	Pass
	Highest	7.25	20.97	Pass
1MHz High Power	Lowest	12.70	20.97	Pass
	Middle	13.34	20.97	Pass
	Highest	11.91	20.97	Pass
2MHz	Lowest	7.34	20.97	Pass
	Middle	7.61	20.97	Pass
	Highest	7.28	20.97	Pass
2MHz High Power	Lowest	13.43	20.97	Pass
	Middle	13.97	20.97	Pass
	Highest	12.52	20.97	Pass
UHD 2MHz	Lowest	10.35	20.97	Pass
	Middle	10.79	20.97	Pass
	Highest	10.38	20.97	Pass
UHD 2MHz High Power	Lowest	15.99	20.97	Pass
	Middle	16.44	20.97	Pass
	Highest	14.96	20.97	Pass
UHD 2MHz 8PSK	Lowest	10.99	20.97	Pass
	Middle	10.99	20.97	Pass
	Highest	10.28	20.97	Pass
UHD 2MHz 8PSK High Power	Lowest	16.50	20.97	Pass
	Middle	16.98	20.97	Pass
	Highest	15.47	20.97	Pass
UHD 4MHz	Lowest	10.04	20.97	Pass
	Middle	10.46	20.97	Pass
	Highest	9.30	20.97	Pass
UHD 4MHz High Power	Lowest	15.64	20.97	Pass
	Middle	16.03	20.97	Pass
	Highest	14.81	20.97	Pass



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4.4.2 Test plots (1MHz)

4.4.2.1 Lowest Channel

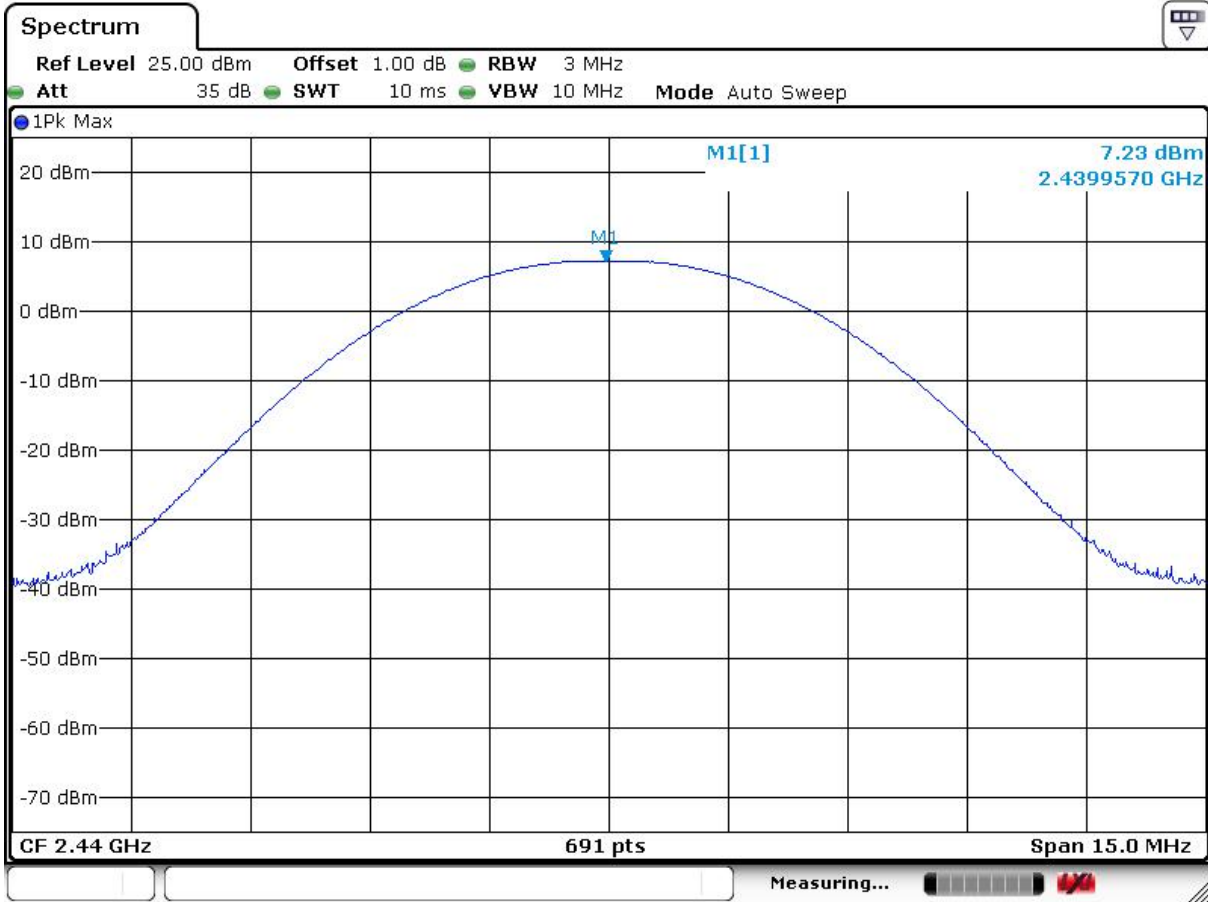


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4.4.2.2 Middle Channel



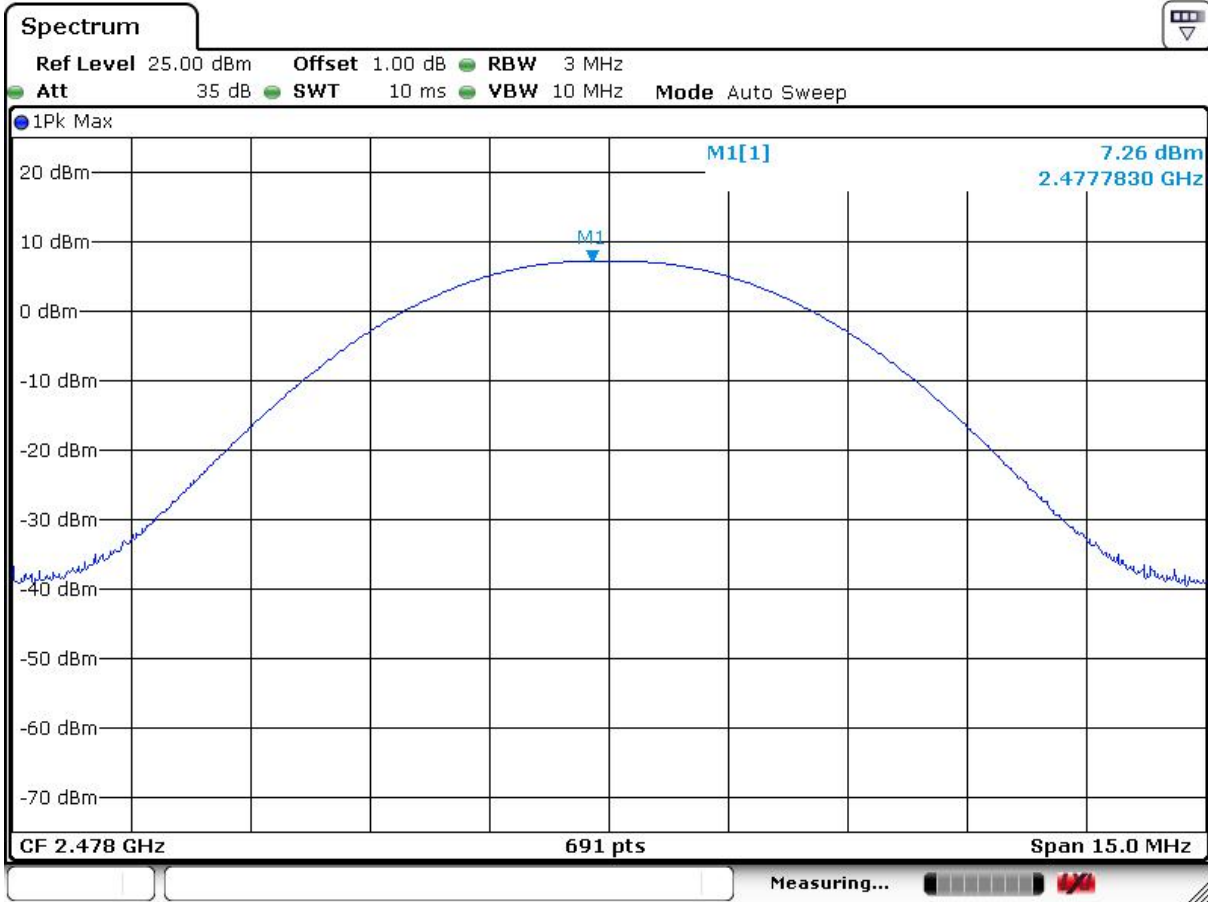
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4.4.2.3 Highest Channel



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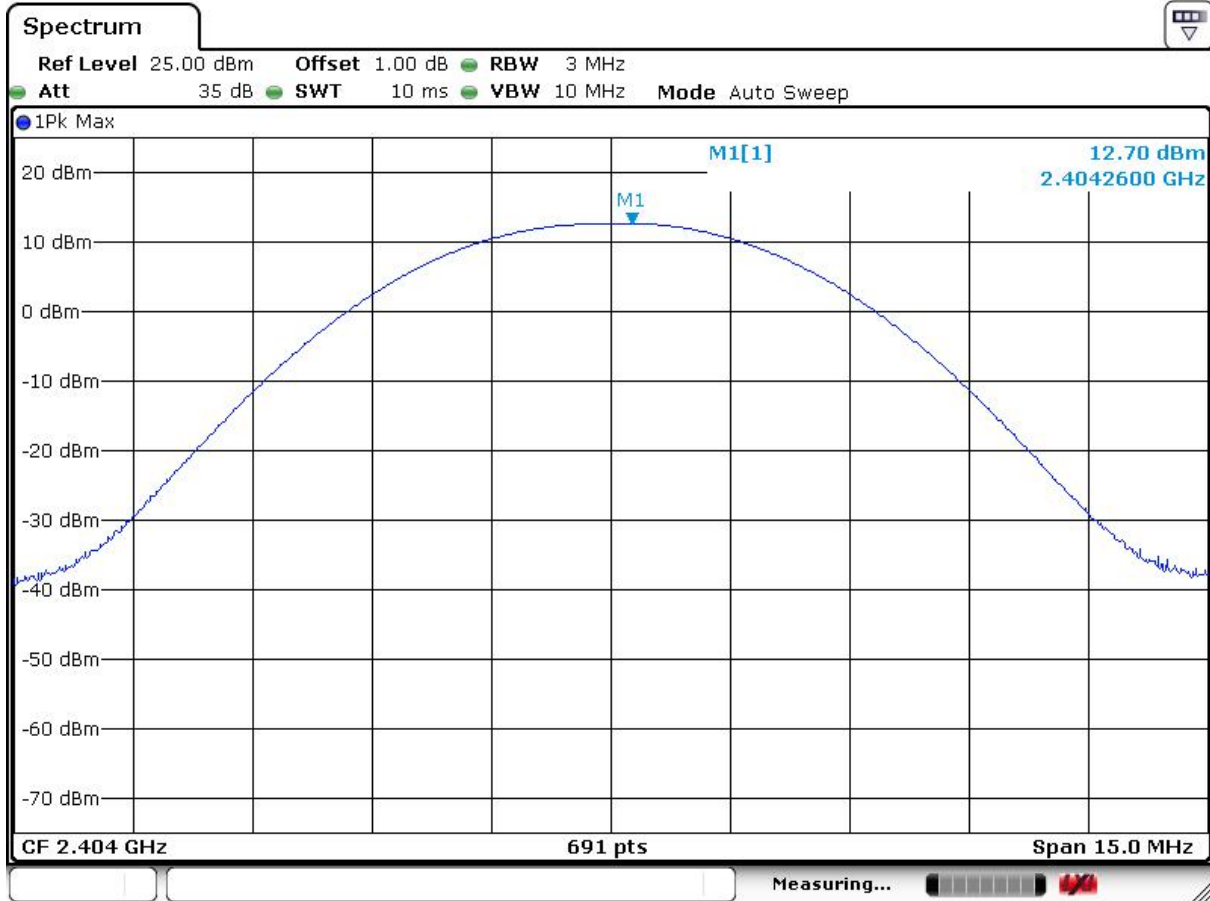
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4.4.3 Test plots (1MHz High Power)

4.4.3.1 Lowest Channel



Date: 8 APR 2020 04:01:00

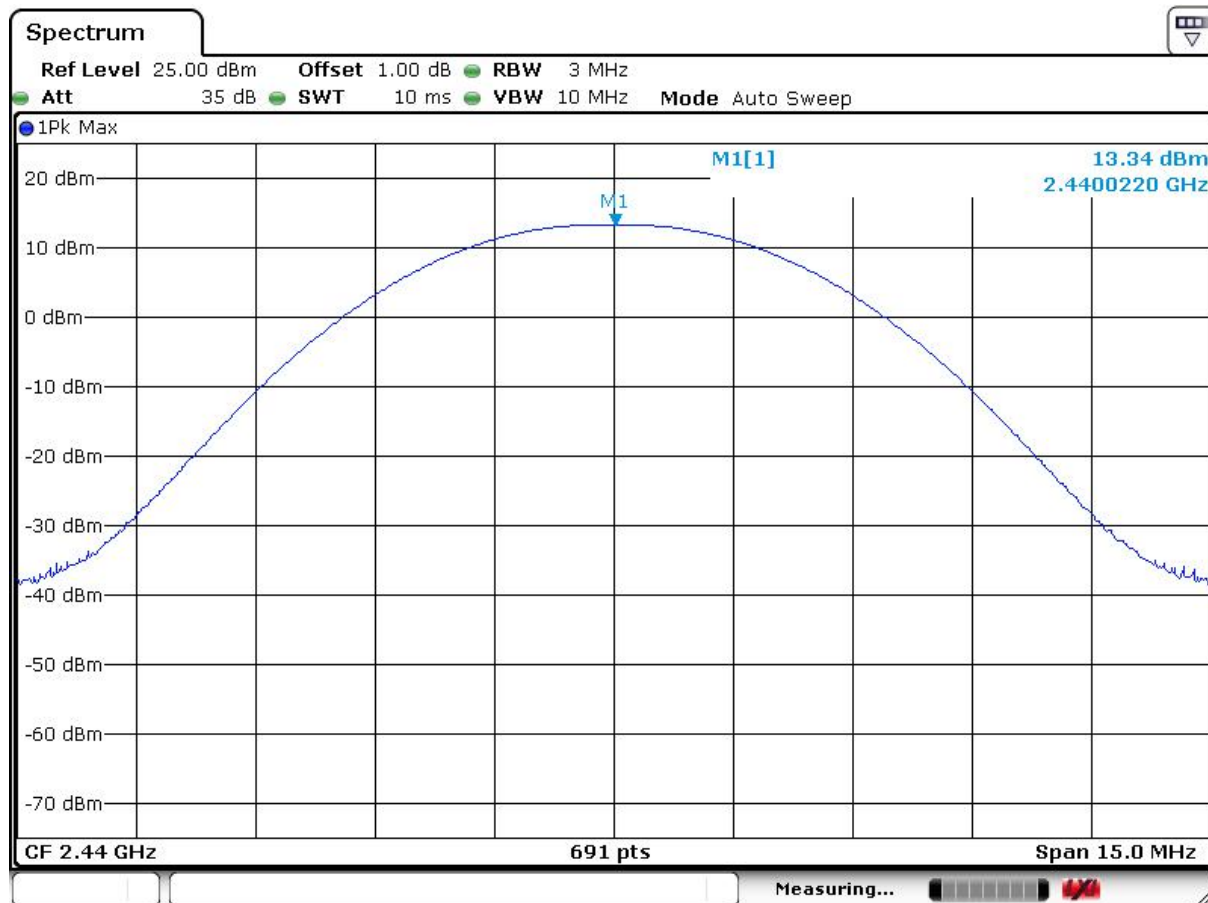


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4.4.3.2 Middle Channel



Date: 8 A.P.R. 2020 04:01:34

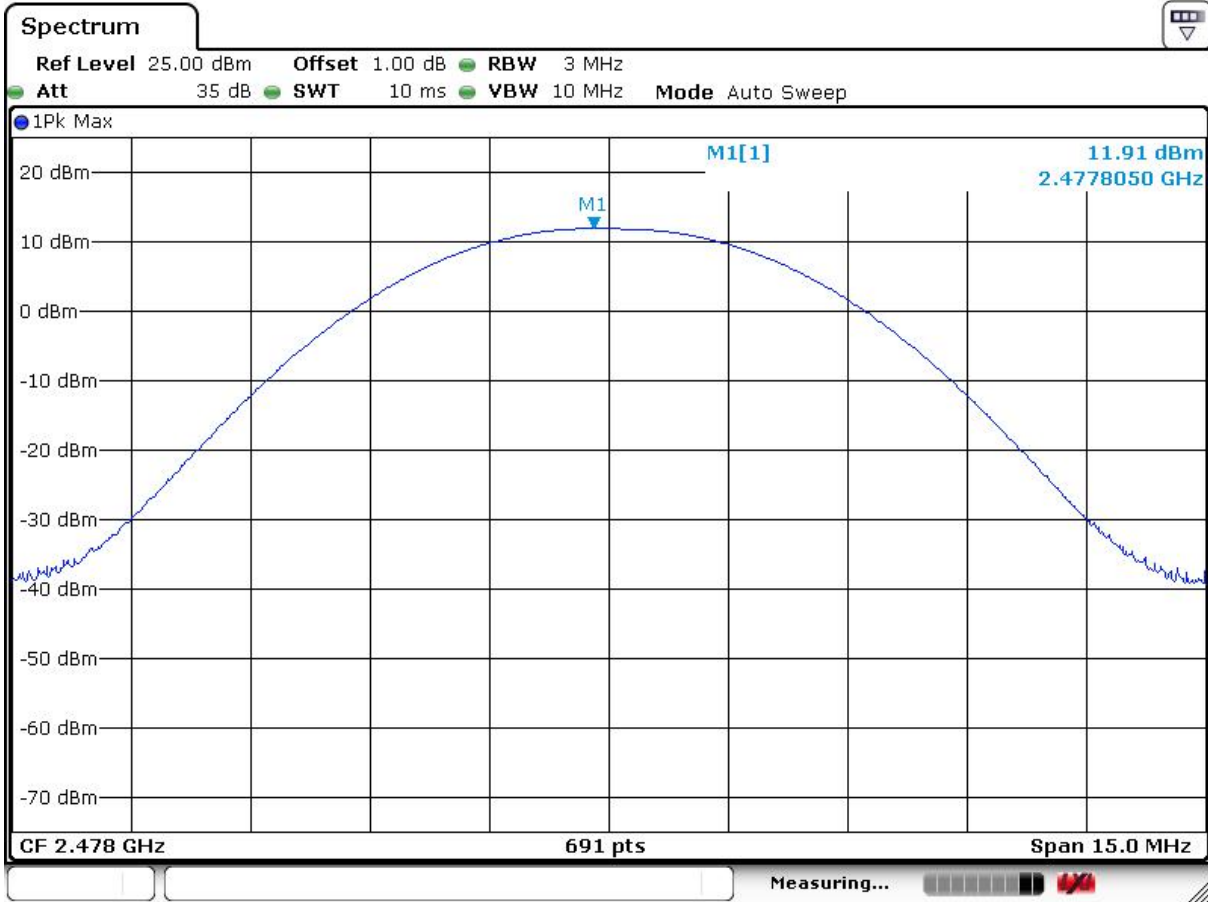


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4.4.3.3 Highest Channel



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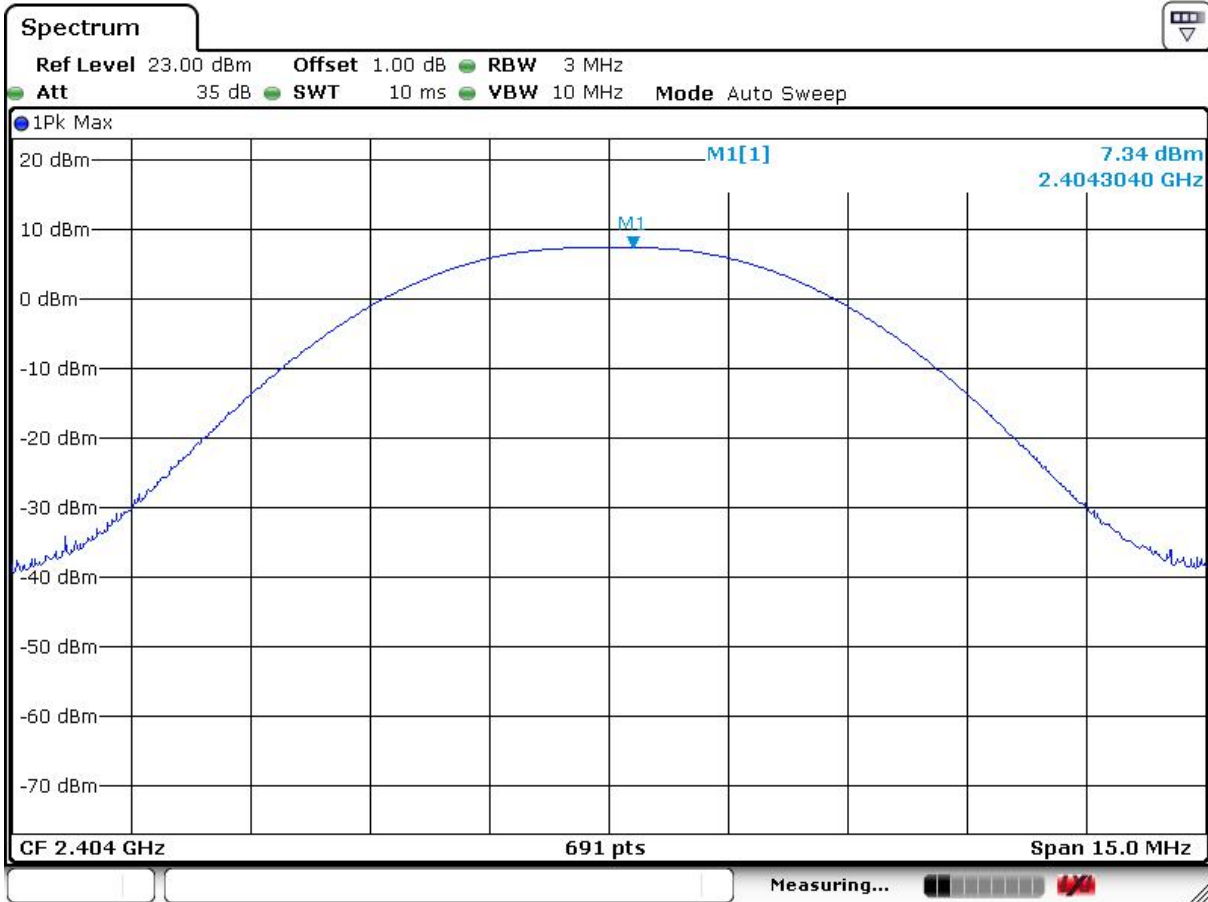
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4.4.4 Test plots (2MHz)

4.4.4.1 Lowest Channel



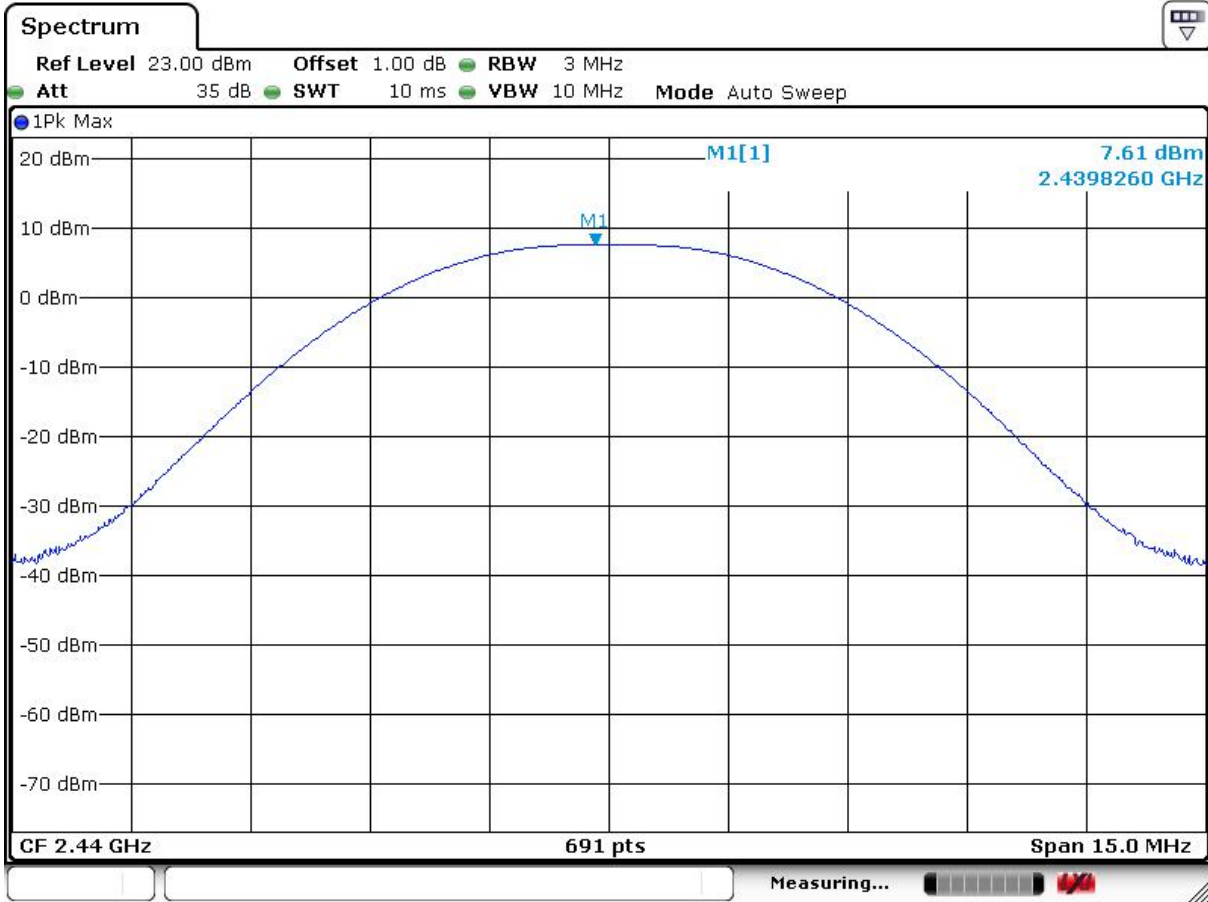
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4.4.4.2 Middle Channel



Date: 8 A.P.R. 2020 07:38:09

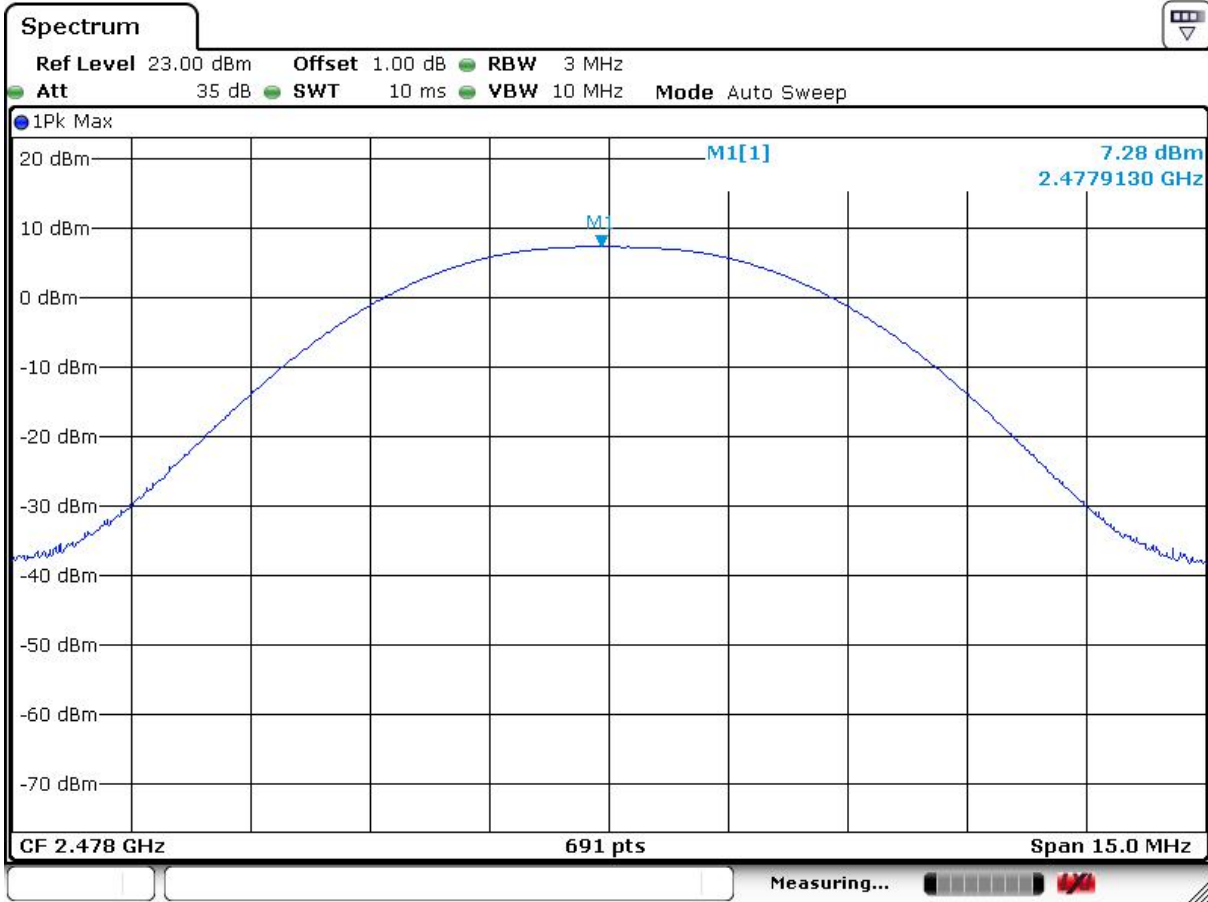


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4.4.4.3 Highest Channel



Date: 8 A.P.R. 2020 07:38:46



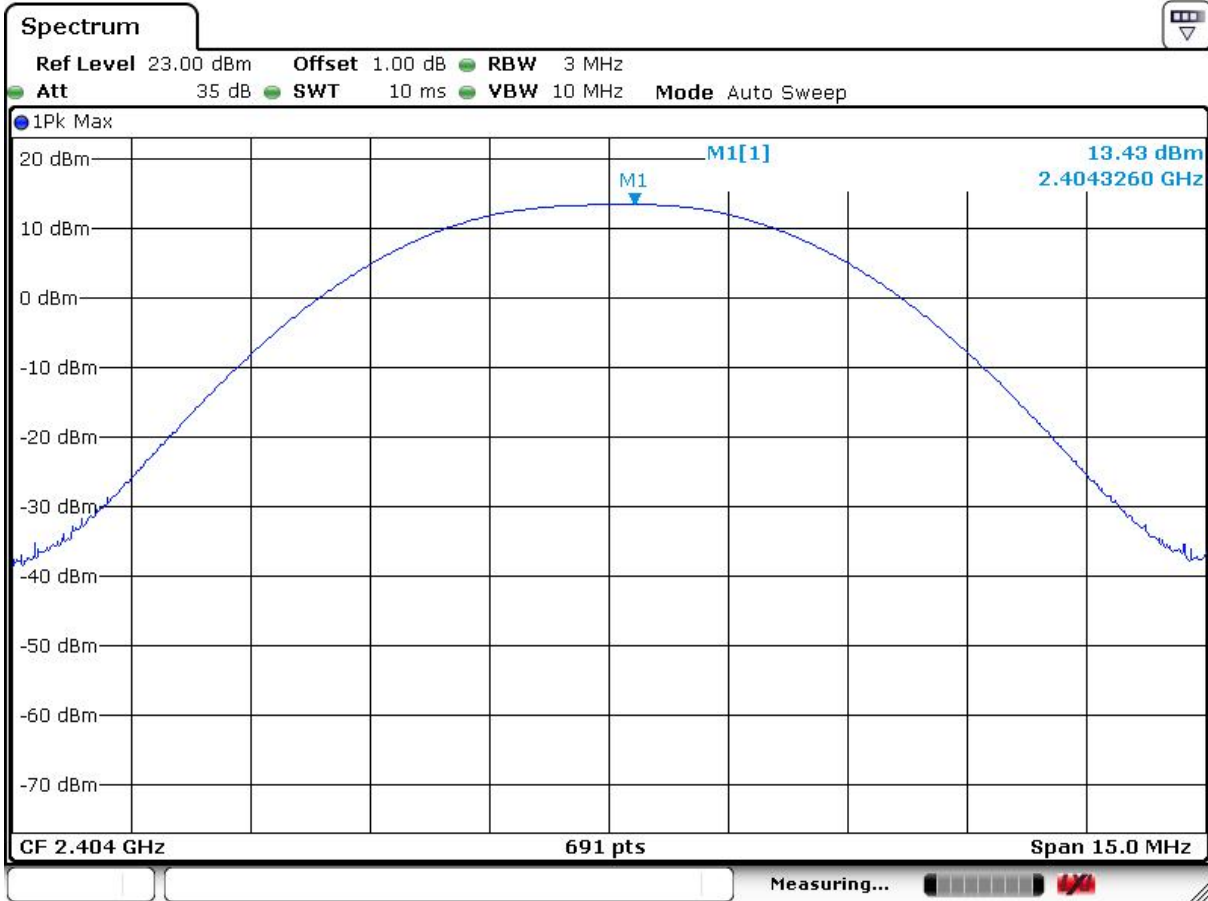
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4.4.5 Test plots (2MHz High Power)

4.4.5.1 Lowest Channel



Date: 8 APR 2020 07:39:55



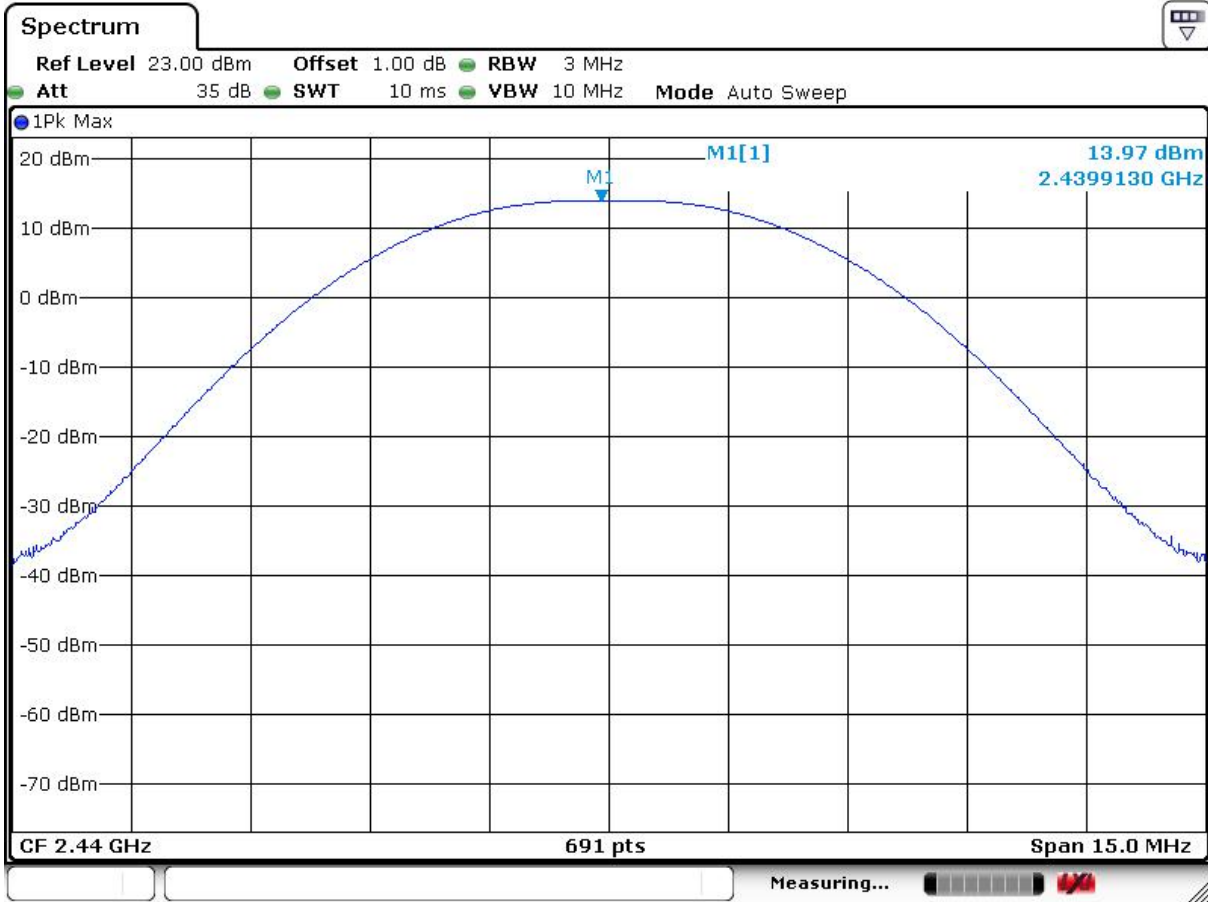
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4.4.5.2 Middle Channel



Date: 8 APR. 2020 07:39:36

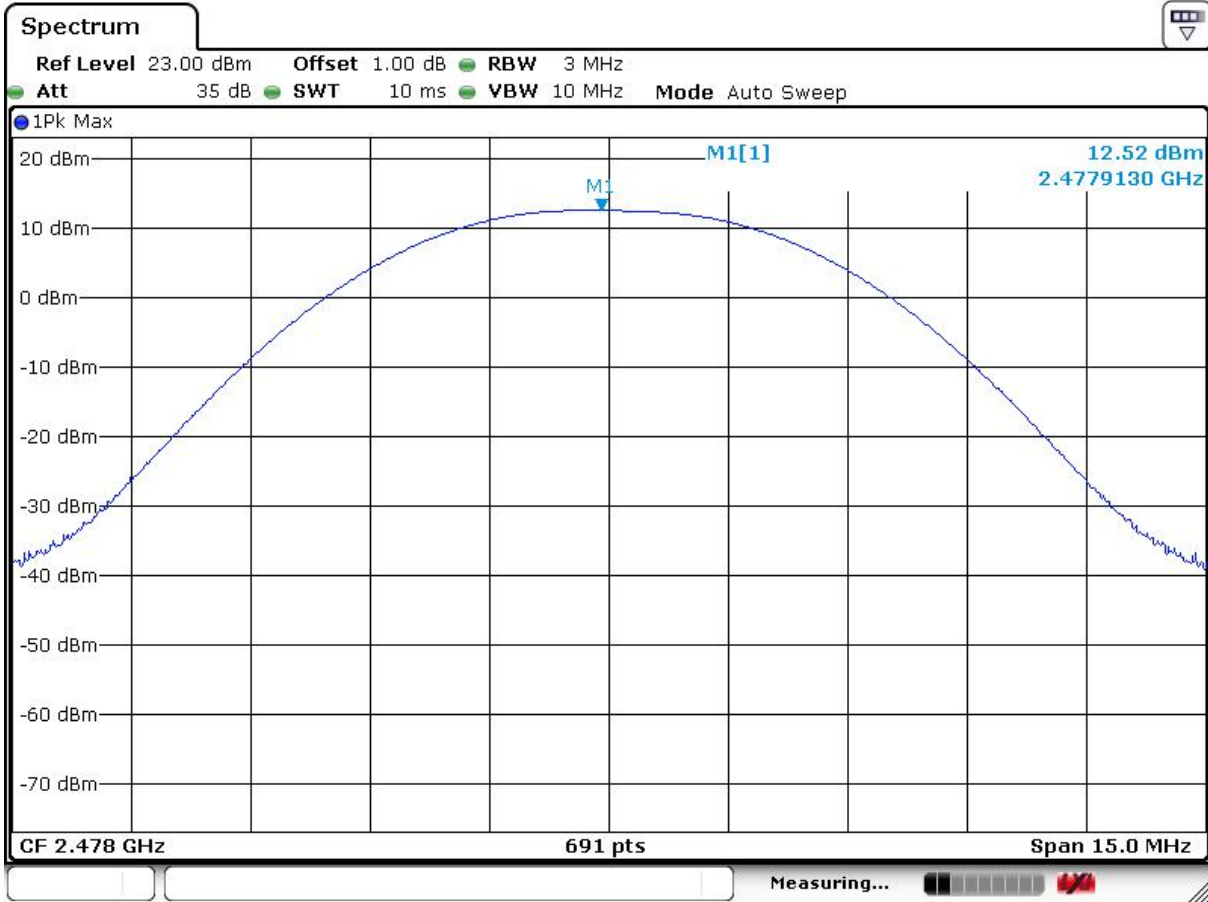


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4.4.5.3 Highest Channel



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