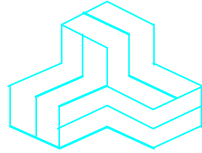


ENGINEERING TEST REPORT



MF/HF MARINE TRANSCEIVER

Model No.: IC-M803

FCC ID: AFJ410000

Applicant:

ICOM Incorporated
1-1-32, Kamiminami, Hirano-ku
Osaka, Japan, 547-0003

Tested in Accordance With

Federal Communications Commission (FCC)
47 CFR, Parts 80 and 90 (Subpart I)

UltraTech's File No.: 19ICOM515_FCC80

This Test report is Issued under the Authority of
Tri M. Luu, BASc,
Vice President of Engineering
UltraTech Group of Labs

Date: November 14, 2019

Report Prepared by: Santhosh Fernandez

Tested by: Nimisha Desai

Issued Date: November 14, 2019

Test Dates: October 10, November 12, 2019

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Parts 80 and 90 (Subpart I)
Title:	Code of Federal Regulations (CFR), Title 47 Telecommunication – Parts 80 and 90 (Subpart I)
Purpose of Test:	To obtain FCC Certification Authorization for Radio operating in the Frequency Band 1.6-27.5 MHz
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with TIA/EIA Standard TIA/EIA-603-E – Land Mobile FM or PM Communications Equipment Measurement and performance Standards.

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	2018	Code of Federal Regulations – Telecommunication
ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
TIA/EIA 603, Edition E	2016	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ANSI C63.26	2015	American National Standard for Compliance Testing of Transmitters used in Licensed Radio Services
CISPR 16-1-1 +A1 +A2	2006 2006 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-1-2 +A1 +A2	2003 2004 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances

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EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	Icom Incorporated
Address:	1-1-32, Kamiminami Hirano-ku, Osaka Japan, 547-0003
Contact Person:	Mr. Atsushi Tomiyama Phone #: +81 6 6793 5302 Fax #: +81 6 6793 0013 Email Address: world_support@icom.co.jp

MANUFACTURER	
Name:	Icom Incorporated
Address:	1-1-32, Kamiminami Hirano-ku, Osaka Japan, 547-0003
Contact Person:	Mr. Atsushi Tomiyama Phone #: +81 6 6793 5302 Fax #: +81 6 6793 0013 Email Address: world_support@icom.co.jp

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The applicant has supplied the following information (with the exception of the Date of Receipt).

Brand Name:	ICOM Incorporated
Product Name:	MF/HF MARINE TRANSCEIVER
Model Name or Number:	IC-M803
Serial Number:	00000017
Type of Equipment:	Licensed Non-Broadcast Transceiver
Power Supply Requirement:	13.6 VDC nominal
Transmitting/Receiving Antenna Type:	Non-integral
Primary User Functions of EUT:	2-Way Wireless Communication

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2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Mobile
Intended Operating Environment:	Marine
Power Supply Requirement:	13.6 VDC nominal
RF Output Power Rating:	150 Watt (High); 20 Watt (Low)
Operating Frequency Range:	16-27.5 MHz
RF Output Impedance:	50 Ω
Occupied Bandwidth (99%):	240Hz (A1A) 2.04 kHz (J3E) 0.86 kHz (J2B) 260 Hz (F1B) 1.5 kHz (F1B)
Emission Designation:	2K80J3E; 2K80J2B; 2K80F1B*; 300HF1B; 160HA1A
*Part 90 only	

2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type
1	Microphone connector (Front panel remote)	1	8 Pin Connector
2	RF Antenna (Tx/Rx)	1	UHF
3	Controller Jack	1	10 Pin Connector
4	Accessory	1	8 pin connector
5	GPS-Data	1	BNC
6	Remote	1	DB9
7	AF/MOD	1	DB9
8	GPS-ANT	1	SMA
9	Ext Speaker	1	1/8 mini jack
10	Tuner control Socket	1	4 pin socket
11	Ground terminal	1	terminal
12	DC Power Socket	1	6 pin socket
13	DSC Antenna Connector (Rx)	1	UHF

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2.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	Speaker Microphone
Brand Name:	Icom Inc.

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C - 24°C
Humidity:	45% to 58%
Pressure:	102 kPa
Power Input Source:	13.6 VDC Nominal

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
Special Test Software:	N/A
Special Hardware Used:	N/A
Transmitter Test Antenna:	The EUT is tested with the antenna port terminated to a 50 Ohm RF Load.

Transmitter Test Signals		
Frequency Band(s):	Part 80	1.6-2.9999 MHz, 4-4.9999 MHz 6-6.9999 MHz, 8-8.9999 MHz 12-13.9999 MHz, 16-17.9999 MHz 18-19.9999 MHz, 22-22.9999 MHz 25-27.5 MHz
	Part 90	1.6-27.5 MHz
Test Frequencies: (MHz) (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	1.605; 2.182; 4.065; 6.2; 8.195; 12.23; 16.36; 18.78; 22.05; 25.07; 27.5 MHz	
Transmitter Wanted Output Test Signals: Transmitter Power (measured maximum output power): Normal Test Modulation: Modulating signal source:	160.32W High and 19.50 W Low A1A, F1B, J2B, J3E External	

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with ANAB File No.: AT-1945.

4.2. APPLICABILITY & SUMMARY OF EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Applicability (Yes/No)
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes.
2.1046, 22.565, 74.461, 80.215 & 90.205	RF Power Output	Yes
2.1047(a), 80.213(e) & 90.242(b)(8)	Audio Frequency Response	Yes.
2.1047(b), 74.463, 80.213 & 90.210	Modulation Limiting	Yes
2.1049, 74.462, 80.211(f), 90.209 & 90.210	Emission Limitation & Emission Mask	Yes
2.1051, 2.1057, 80.211(f)(3), & 90.210	Emission Limits - Spurious Emissions at Antenna Terminal	Yes
2.1053, 2.1057, 22.359, 80.211(f)(3), & 90.210	Emission Limits - Field Strength of Spurious Emissions	Yes
2.1055, 22.355, 74.464 80.209 & 90.213	Frequency Stability	Yes
MF/HF MARINE TRANSCEIVER, Model No.: IC-M803, by ICOM Incorporated has also been tested and found to comply with FCC Part 15, Subpart B - Radio Receivers and Class A Digital Devices. The engineering test report has been documented and kept on file and is available upon request.		

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

4.3.1. DEVIATION OF STANDARD TEST PROCEDURES

None

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EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in EXHIBIT 8 of this report.

5.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement. Refer to Exhibit 7 for Measurement Uncertainties.

5.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4 and CISPR 16-1-1.

5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER

The essential function of the EUT is to communicate to and from radios over RF link.

5.5. RF POWER OUTPUT [§§ 2.1046, 80.215 & 90.205]

5.5.1. Limits

Please refer to FCC 47 CFR 90.205, 74.461, 80.215 & 22.565 for specification details.

RSS 181 Section 11.4

Equipment employing single sideband emission shall have the carrier power: at 40 dB below PEP, for suppressed carrier transmitters;

5.5.2. Method of Measurements

Refer to Section 8.1 (Conducted) and 8.2 (Radiated) of this report for measurement details

5.5.3. Test Data

5.5.3.1. Mode A1A

Frequencies MHz	Power Level	Power Rating dBm	Measured dBm	Actual Power Watts	Power Rating Watts
1.605	High	51.76	51.67	146.89	150.0
1.605	Mid-H	50.00	50.28	106.66	100.0
1.605	Mid-L	47.78	48.66	73.45	60.0
1.605	Low	43.01	43.10	20.42	20.0
2.182	High	51.76	51.57	143.55	150.0
2.182	Mid-H	50.00	50.21	104.95	100.0
2.182	Mid-L	47.78	48.56	71.78	60.0
2.182	Low	43.01	42.97	19.82	20.0
4.065	High	51.76	51.59	144.21	150.0
4.065	Mid-H	50.00	50.15	103.51	100.0
4.065	Mid-L	47.78	48.53	71.29	60.0
4.065	Low	43.01	43.03	20.09	20.0
6.2	High	51.76	51.56	143.22	150.0
6.2	Mid-H	50.00	50.11	102.57	100.0
6.2	Mid-L	47.78	48.50	70.79	60.0
6.2	Low	43.01	43.02	20.04	20.0
8.195	High	51.76	51.49	140.93	150.0
8.195	Mid-H	50.00	50.05	101.16	100.0
8.195	Mid-L	47.78	48.44	69.82	60.0
8.195	Low	43.01	42.98	19.86	20.0
12.23	High	51.76	51.48	140.60	150.0
12.23	Mid-H	50.00	50.13	103.04	100.0
12.23	Mid-L	47.78	48.44	69.82	60.0
12.23	Low	43.01	42.97	19.82	20.0
16.36	High	51.76	51.56	143.22	150.0
16.36	Mid-H	50.00	50.15	103.51	100.0
16.36	Mid-L	47.78	48.52	71.12	60.0
16.36	Low	43.01	43.04	20.14	20.0

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Frequencies MHz	Power Level	Power Rating dBm	Measured dBm	Actual Power Watts	Power Rating Watts
18.78	High	51.76	51.48	140.60	150.0
18.78	Mid-H	50.00	50.15	103.51	100.0
18.78	Mid-L	47.78	48.50	70.79	60.0
18.78	Low	43.01	42.99	19.91	20.0
22.05	High	51.76	51.50	141.25	150.0
22.05	Mid-H	50.00	50.09	102.09	100.0
22.05	Mid-L	47.78	48.45	69.98	60.0
22.05	Low	43.01	42.92	19.59	20.0
25.07	High	51.76	51.46	139.96	150.0
25.07	Mid-H	50.00	50.06	101.39	100.0
25.07	Mid-L	47.78	48.42	69.50	60.0
25.07	Low	43.01	42.90	19.50	20.0
27.5	High	51.76	51.24	133.05	150.0
27.5	Mid-H	50.00	49.88	97.27	100.0
27.5	Mid-L	47.78	48.29	67.45	60.0
27.5	Low	43.01	42.94	19.68	20.0

5.5.3.2. Mode F1B

Frequencies MHz	Power Level	Power Rating dBm	Measured dBm	Actual Power Watts	Power Rating Watts
1.605	High	51.76	51.71	148.25	150.0
1.605	Mid-H	50.00	50.22	105.20	100.0
1.605	Mid-L	47.78	48.67	73.62	60.0
1.605	Low	43.01	43.21	20.94	20.0
2.182	High	51.76	51.62	145.21	150.0
2.182	Mid-H	50.00	50.15	103.51	100.0
2.182	Mid-L	47.78	48.56	71.78	60.0
2.182	Low	43.01	43.09	20.37	20.0
4.065	High	51.76	51.65	146.22	150.0
4.065	Mid-H	50.00	50.09	102.09	100.0
4.065	Mid-L	47.78	48.59	72.28	60.0
4.065	Low	43.01	43.15	20.65	20.0
6.2	High	51.76	51.61	144.88	150.0
6.2	Mid-H	50.00	50.05	101.16	100.0
6.2	Mid-L	47.78	48.57	71.94	60.0
6.2	Low	43.01	43.12	20.51	20.0
8.195	High	51.76	51.55	142.89	150.0
8.195	Mid-H	50.00	49.98	99.54	100.0
8.195	Mid-L	47.78	48.51	70.96	60.0
8.195	Low	43.01	43.07	20.28	20.0
12.23	High	51.76	51.55	142.89	150.0
12.23	Mid-H	50.00	50.07	101.62	100.0
12.23	Mid-L	47.78	48.50	70.79	60.0
12.23	Low	43.01	43.07	20.28	20.0

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Frequencies MHz	Power Level	Power Rating dBm	Measured dBm	Actual Power Watts	Power Rating Watts
16.36	High	51.76	51.63	145.55	150.0
16.36	Mid-H	50.00	50.15	103.51	100.0
16.36	Mid-L	47.78	48.58	72.11	60.0
16.36	Low	43.01	43.15	20.65	20.0
18.78	High	51.76	51.56	143.22	150.0
18.78	Mid-H	50.00	50.08	101.86	100.0
18.78	Mid-L	47.78	48.52	71.12	60.0
18.78	Low	43.01	43.09	20.37	20.0
22.05	High	51.76	51.58	143.88	150.0
22.05	Mid-H	50.00	50.03	100.69	100.0
22.05	Mid-L	47.78	48.47	70.31	60.0
22.05	Low	43.01	43.03	20.09	20.0
25.07	High	51.76	51.55	142.89	150.0
25.07	Mid-H	50.00	50.00	100.00	100.0
25.07	Mid-L	47.78	48.45	69.98	60.0
25.07	Low	43.01	43.00	19.95	20.0
27.5	High	51.76	51.33	135.83	150.0
27.5	Mid-H	50.00	49.83	96.16	100.0
27.5	Mid-L	47.78	48.32	67.92	60.0
27.5	Low	43.01	43.03	20.09	20.0

5.5.3.3. Mode J2B

Frequencies MHz	Power Level	Power Rating dBm	Measured dBm	Actual Power Watts	Power Rating Watts
1.605	High	51.76	51.70	147.91	150.0
1.605	Mid-H	50.00	50.23	105.44	100.0
1.605	Mid-L	47.78	48.66	73.45	60.0
1.605	Low	43.01	43.14	20.61	20.0
2.182	High	51.76	51.61	144.88	150.0
2.182	Mid-H	50.00	50.15	103.51	100.0
2.182	Mid-L	47.78	48.61	72.61	60.0
2.182	Low	43.01	43.02	20.04	20.0
4.065	High	51.76	51.63	145.55	150.0
4.065	Mid-H	50.00	50.09	102.09	100.0
4.065	Mid-L	47.78	48.59	72.28	60.0
4.065	Low	43.01	43.11	20.46	20.0
6.2	High	51.76	51.58	143.88	150.0
6.2	Mid-H	50.00	50.05	101.16	100.0
6.2	Mid-L	47.78	48.55	71.61	60.0
6.2	Low	43.01	43.08	20.32	20.0

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Frequencies MHz	Power Level	Power Rating dBm	Measured dBm	Actual Power Watts	Power Rating Watts
8.195	High	51.76	51.52	141.91	150.0
8.195	Mid-H	50.00	49.99	99.77	100.0
8.195	Mid-L	47.78	48.49	70.63	60.0
8.195	Low	43.01	43.03	20.09	20.0
12.23	High	51.76	51.52	141.91	150.0
12.23	Mid-H	50.00	50.08	101.86	100.0
12.23	Mid-L	47.78	48.49	70.63	60.0
12.23	Low	43.01	43.03	20.09	20.0
16.36	High	51.76	51.59	144.21	150.0
16.36	Mid-H	50.00	50.15	103.51	100.0
16.36	Mid-L	47.78	48.57	71.94	60.0
16.36	Low	43.01	43.10	20.42	20.0
18.78	High	51.76	51.53	142.23	150.0
18.78	Mid-H	50.00	50.09	102.09	100.0
18.78	Mid-L	47.78	48.51	70.96	60.0
18.78	Low	43.01	43.04	20.14	20.0
22.05	High	51.76	51.55	142.89	150.0
22.05	Mid-H	50.00	50.03	100.69	100.0
22.05	Mid-L	47.78	48.46	70.15	60.0
22.05	Low	43.01	43.00	19.95	20.0
25.07	High	51.76	51.52	141.91	150.0
25.07	Mid-H	50.00	50.01	100.23	100.0
25.07	Mid-L	47.78	48.44	69.82	60.0
25.07	Low	43.01	42.97	19.82	20.0
27.5	High	51.76	51.30	134.90	150.0
27.5	Mid-H	50.00	49.82	95.94	100.0
27.5	Mid-L	47.78	48.32	67.92	60.0
27.5	Low	43.01	43.00	19.95	20.0

5.5.3.4. Mode J3E

Frequencies MHz	Power Level	Power Rating dBm	Measured dBm	Actual Power Watts	Power Rating Watts
1.605	High	51.76	52.05	160.32	150.0
1.605	Mid-H	50.00	50.61	115.08	100.0
1.605	Mid-L	47.78	49.18	82.79	60.0
1.605	Low	43.01	43.60	22.91	20.0
2.182	High	51.76	51.90	154.88	150.0
2.182	Mid-H	50.00	50.51	112.46	100.0
2.182	Mid-L	47.78	48.97	78.89	60.0
2.182	Low	43.01	43.42	21.98	20.0
4.065	High	51.76	51.97	157.40	150.0
4.065	Mid-H	50.00	50.45	110.92	100.0
4.065	Mid-L	47.78	49.03	79.98	60.0
4.065	Low	43.01	43.49	22.34	20.0

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Frequencies MHz	Power Level	Power Rating dBm	Measured dBm	Actual Power Watts	Power Rating Watts
6.2	High	51.76	51.89	154.53	150.0
6.2	Mid-H	50.00	50.43	110.41	100.0
6.2	Mid-L	47.78	49.01	79.62	60.0
6.2	Low	43.01	43.47	22.23	20.0
8.195	High	51.76	51.89	154.53	150.0
8.195	Mid-H	50.00	50.42	110.15	100.0
8.195	Mid-L	47.78	48.96	78.70	60.0
8.195	Low	43.01	43.48	22.28	20.0
12.23	High	51.76	51.89	154.53	150.0
12.23	Mid-H	50.00	50.45	110.92	100.0
12.23	Mid-L	47.78	48.91	77.80	60.0
12.23	Low	43.01	43.44	22.08	20.0
16.36	High	51.76	51.97	157.40	150.0
16.36	Mid-H	50.00	50.51	112.46	100.0
16.36	Mid-L	47.78	49.02	79.80	60.0
16.36	Low	43.01	43.49	22.34	20.0
18.78	High	51.76	51.94	156.31	150.0
18.78	Mid-H	50.00	50.53	112.98	100.0
18.78	Mid-L	47.78	49.00	79.43	60.0
18.78	Low	43.01	43.50	22.39	20.0
22.05	High	51.76	51.84	152.76	150.0
22.05	Mid-H	50.00	50.42	110.15	100.0
22.05	Mid-L	47.78	48.91	77.80	60.0
22.05	Low	43.01	43.36	21.68	20.0
25.07	High	51.76	51.86	153.46	150.0
25.07	Mid-H	50.00	50.39	109.40	100.0
25.07	Mid-L	47.78	48.89	77.45	60.0
25.07	Low	43.01	43.34	21.58	20.0
27.5	High	51.76	51.64	145.88	150.0
27.5	Mid-H	50.00	50.21	104.95	100.0
27.5	Mid-L	47.78	48.72	74.47	60.0
27.5	Low	43.01	43.39	21.83	20.0

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5.5.3.5. Carrier Suppression- J2B

Frequencies MHz	Carrier Suppression Level (dB)	Limit (dB)
1.605	50.16	40.0
2.182	50.74	40.0
4.065	54.86	40.0
6.2	53.90	40.0
8.195	54.83	40.0
12.23	54.51	40.0
16.36	53.35	40.0
18.78	54.54	40.0
22.05	53.80	40.0
25.07	54.49	40.0
27.5	55.46	40.0

5.5.3.6. Carrier Suppression- J3E

Frequencies MHz	Carrier Suppression Level (dB)	Limit (dB)
1.605	45.50	40.0
2.182	47.96	40.0
4.065	47.42	40.0
6.2	46.03	40.0
8.195	48.88	40.0
12.23	45.26	40.0
16.36	45.95	40.0
18.78	48.17	40.0
22.05	47.40	40.0
25.07	47.08	40.0
27.5	47.97	40.0

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5.6. Modulation Characteristics and Modulation Limiting [§ 2.1047(a), 80.213(3)]

5.6.1. Limits

§ 2.1047(a): Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

5.6.2. Method of Measurements

The rated audio input signal was applied to the input of the audio low-pass filter (or of all modulation stages) using an audio oscillator, this input signal level and its corresponding output signal were then measured and recorded using the Spectrum Analyzer.

5.6.3. Test Data

5.6.3.1. Audio Frequency response

J3E Upper side band (Test frequency @ 12.23 MHz)

Input level Used for 0dB reference at 1 KHz: 10 mV

Input Audio Frequency (Hz)	Attenuation (dB)	Attenuation Rel. to 1 KHz
60	6.20	-45.44
70	6.23	-45.41
80	6.38	-45.26
90	7.11	-44.53
100	7.20	-44.44
150	7.94	-43.70
200	22.59	-29.05
300	51.58	-0.06
400	51.59	-0.05
500	51.59	-0.05
750	51.60	-0.04
1000	51.64	0.00
1500	51.64	0.00
2000	51.63	-0.01
2500	51.63	0.00
2700	42.32	-9.32
3000	7.62	-44.02
4000	6.86	-44.78
5000	6.29	-45.35

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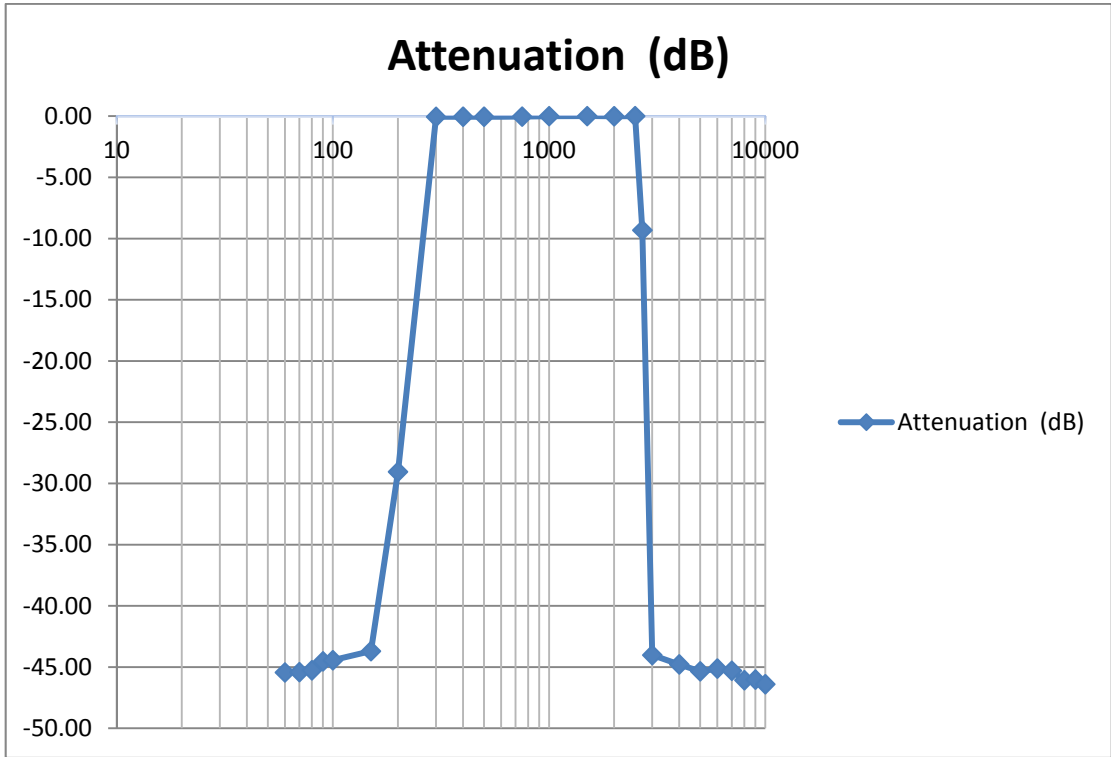
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Input Audio Frequency (Hz)	Attenuation (dB)	Attenuation Rel. to 1 KHz
6000	6.52	-45.12
7000	6.34	-45.30
8000	5.57	-46.07
9000	5.62	-46.02
10000	5.24	-46.40



5.7. MODULATION LIMITING [§§ 2.1047 (b), 80.213 & 90.210]

5.7.1. Limits

§ 2.1047(b): Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

Recommended frequency deviation characteristics are given below:

- 1.25 KHz for 6.25 kHz Channel Spacing System
- 2.5 KHz for 12.5 kHz Channel Spacing System

80.213 (3) In single sideband operation the upper sideband must be transmitted. Single sideband transmitters must automatically limit the peak envelope power to their authorized operating power and meet the requirements in §80.207(c).

5.7.2. Method of Measurements

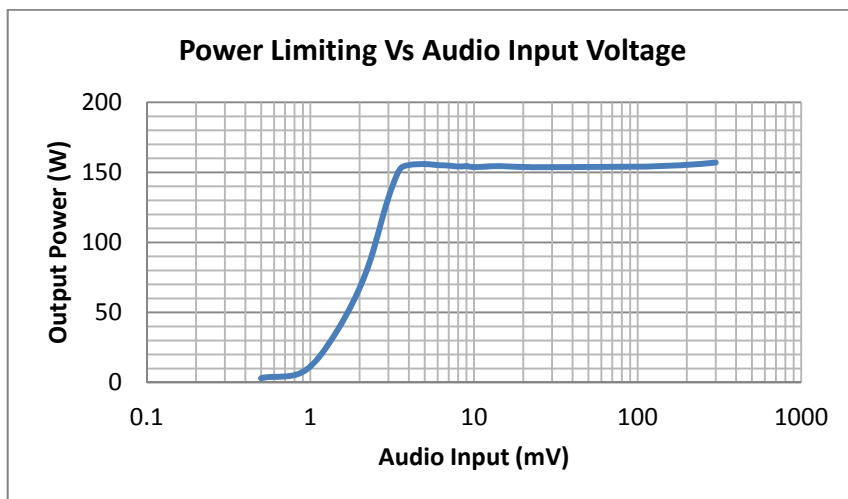
For J3 E two audio tones of 400 Hz and 1800 Hz were applied to transmitter in equal level. The input level was varied and the PEP was measured.

For J2B a single tone of 1.7 kHz was applied and the Power output was measured.

5.7.3. Test Data

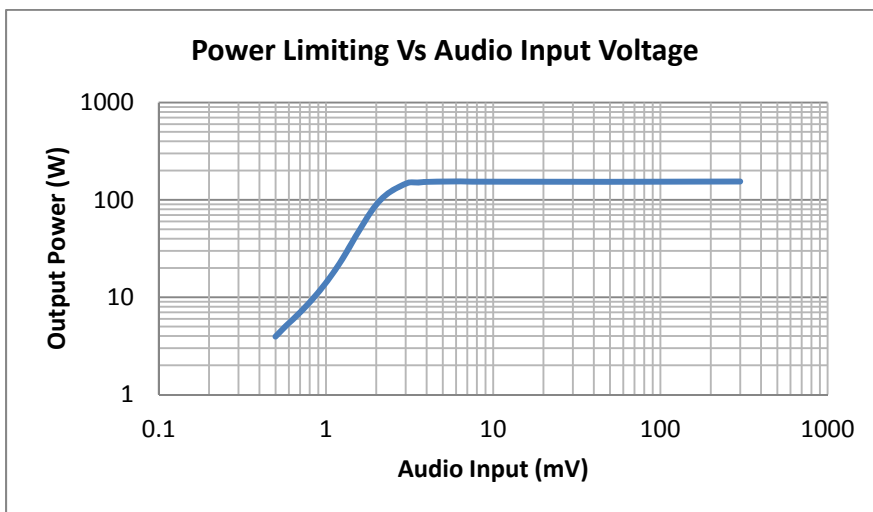
5.7.3.1. J3E - Power Limiting @ 1.605 MHz

Input audio signal level (mV)	Measured Power PEP (W)
0.5	3.01
1	11.43
2	67.3
3	132.13
3.5	151.71
4	155.24
5	155.96
6	155.24
7	154.88
8	154.17
9	154.53
10	153.82
15	154.53
20	153.82
50	153.82
100	154.17
200	155.24
300	157.04



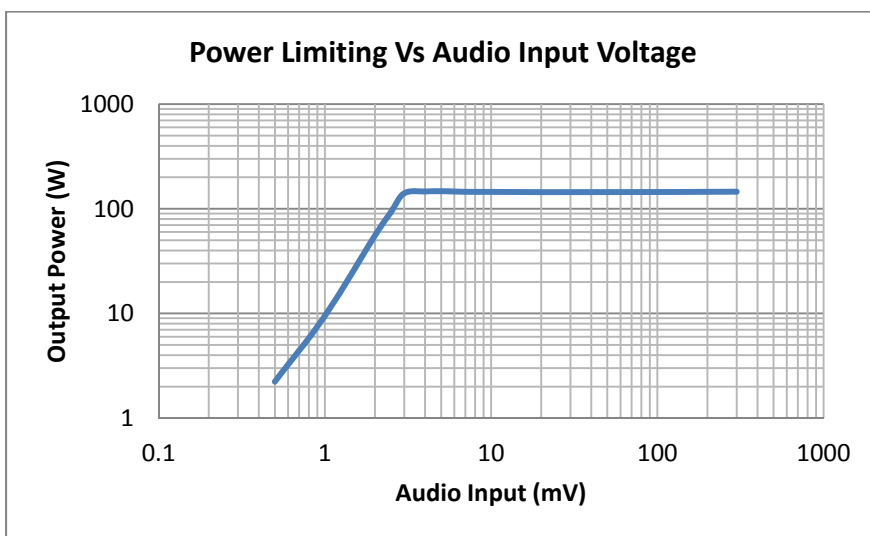
5.7.3.2. J3E - Power Limiting @ 2.182 MHz

Input audio signal level (mV)	Measured Power PEP (W)
0.5	3.94
1	13.93
2	89.33
3	146.89
3.5	150.66
4	153.46
5	154.53
6	155.24
7	154.53
8	154.17
9	154.17
10	153.82
15	153.82
20	154.17
50	153.46
100	154.17
200	154.88
300	154.88



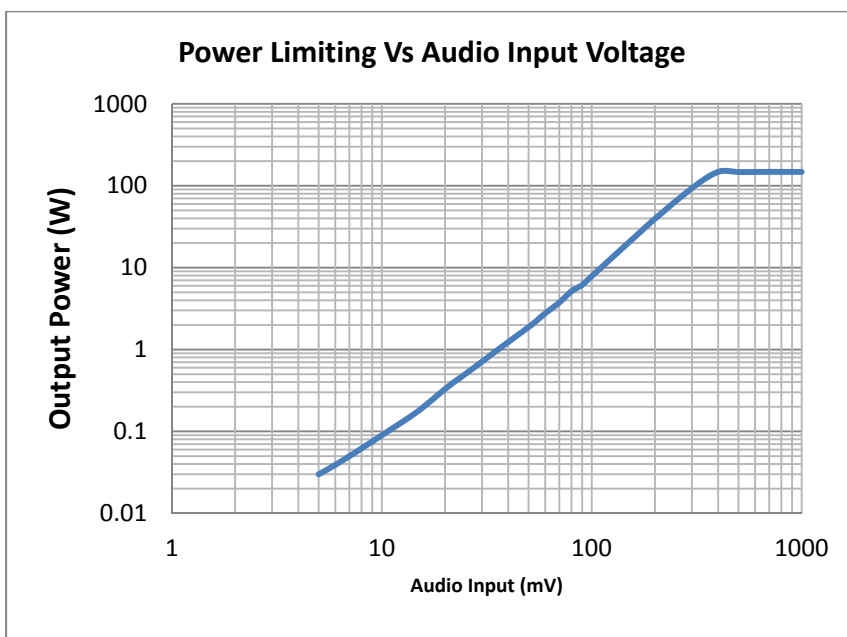
5.7.3.3. J3E - Power Limiting @ 27.5 MHz

Input audio signal level (mV)	Measured Power PEP (W)
0.5	2.23
1	9.48
2	55.59
2.5	93.33
3	140.93
4	146.55
5	147.23
6	146.55
7	145.21
8	145.21
9	145.21
10	144.54
15	144.54
20	144.54
50	143.88
100	145.21
200	144.88
300	145.55



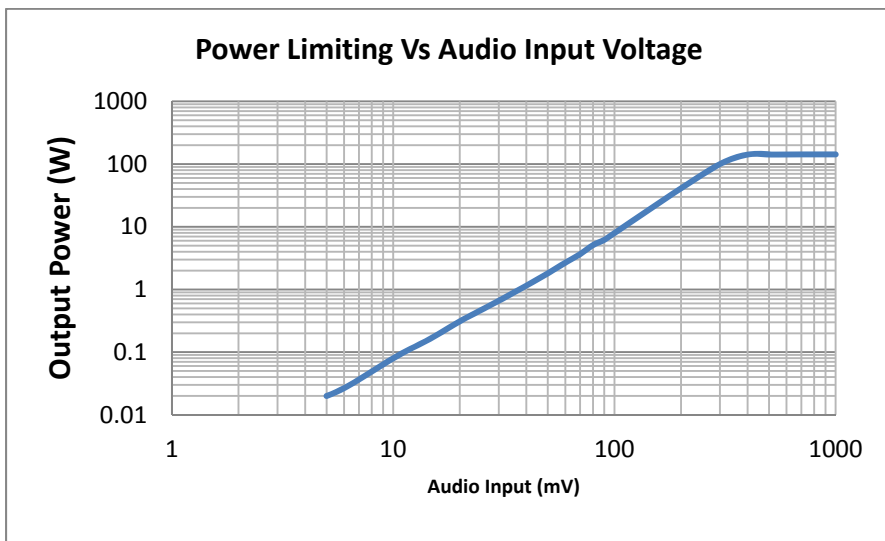
5.7.3.4. J2B- Power Limiting @ 1.605 MHz

Input audio signal level (mV)	Measured Power (W)
1	0
2	0.01
5	0.03
10	0.09
15	0.18
20	0.33
30	0.71
40	1.24
50	1.87
60	2.76
70	3.74
80	5.14
90	6.14
100	7.87
200	39.36
300	93.33
400	147.57
500	146.89
600	147.57
700	147.57
800	147.57
1000	147.57



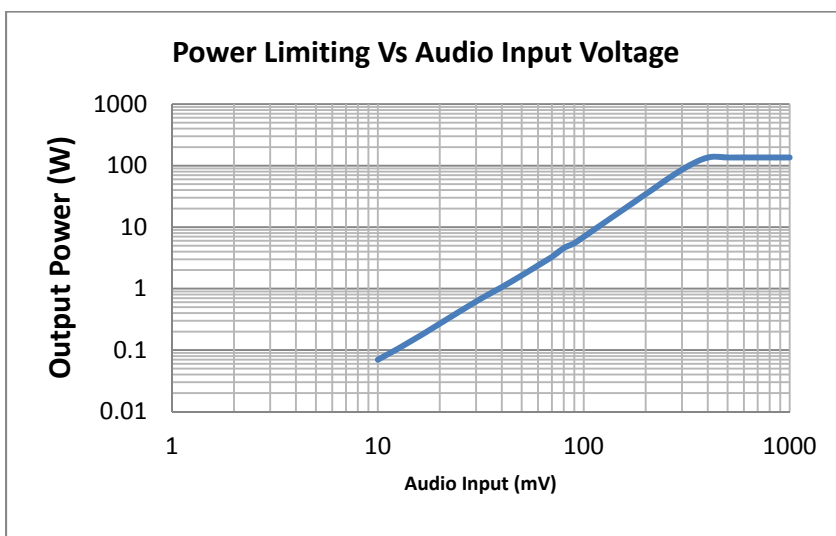
5.7.3.5. J2B- Power Limiting @ 2.182 MHz

Input audio signal level (mV)	Measured Power (W)
1	0
2	0.01
5	0.02
10	0.08
15	0.17
20	0.31
30	0.66
40	1.15
50	1.81
60	2.67
70	3.66
80	5.09
90	6.17
100	7.93
200	40.93
300	99.77
400	141.58
500	141.91
600	141.91
700	142.23
800	142.23
1000	142.23



5.7.3.6. J2B- Power Limiting @ 27.5 MHz

Input audio signal level (mV)	Measured Power (W)
1	0
2	0
5	0.02
10	0.07
15	0.15
20	0.27
30	0.62
40	1.06
50	1.64
60	2.39
70	3.28
80	4.56
90	5.47
100	6.95
200	34.36
300	85.9
400	134.9
500	135.21
600	135.52
700	135.52
800	135.52
1000	135.52



5.8. OCCUPIED BANDWIDTH & EMISSION MASK [§§ 2.1049, 80.205 80.211(f), 90.209 & 90.210]

5.8.1. Limits

Emissions shall be attenuated below the mean output power of the transmitter as follows:

Class Of Emission	Maximum Authorized BW (KHz)
A1A	0.4(0.25**)
F1B*	0.5
F1B**	3
J2B	3
J3E	3

*NB-DP radiotelegraph and data transmissions for communications with public coast stations.

** For Part 90 only

§80.211 Emission limitations

(a) The mean power when using emissions H3E, J3E and R3E:

- (1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 150 percent of the authorized bandwidth: at least 28 dB for transmitters installed on or after February 1, 1992;
- (2) On any frequency removed from the assigned frequency by more than 150 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.

(f) other type emissions designators; emissions shall be attenuated below the mean output power of the transmitter as follows:

- (1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;
- (2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.

§90.210 Emission Masks

Frequency Band MHz	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25*	A or B	A or C
25-50	B	C

* Equipment using single sideband J3E emission must meet the requirements of Emission Mask A. Equipment using other emissions must meet the requirements of Emission Mask B or C, as applicable.

5.8.2. Method of Measurements

For J3 E two audio tones of 400 Hz and 1800 Hz were applied to transmitter in equal level.

For J2B a single tone of 1.7 kHz was applied.

For A1A 16 dots per second were keyed through the transmitter

For F1B a Mark frequency 1615 Hz and shift frequency of 170 Hz were used for 0.5kHz Bandwidth and a Mark frequency 1200 Hz and shift frequency of 850 Hz were used for 3 kHz Bandwidth

5.8.3. Test Data

5.8.3.1. 99% Occupied Bandwidth

Frequency MHz	A1A		F1B		F1B Part 90 only		J2B		J3E	
	Measured 99% OBW (Hz)	Maximum Authorized Bandwidth (kHz)	Measured 99% OBW (Hz)	Maximum Authorized Bandwidth (kHz)	Measured 99% OBW (kHz)	Maximum Authorized Bandwidth (kHz)	Measured 99% OBW (kHz)	Maximum Authorized Bandwidth (kHz)	Measured 99% OBW (kHz)	Maximum Authorized Bandwidth (kHz)
1.605	228	0.25	260	0.5	1.44	3	0.86	3	2.04	3
2.182	220	0.25	260	0.5	1.5	3	0.86	3	2.04	3
4.065	236	0.25	260	0.5	1.44	3	0.86	3	2.04	3
6.2	216	0.25	260	0.5	1.47	3	0.86	3	2.04	3
8.195	224	0.25	260	0.5	1.47	3	0.86	3	2.04	3
12.23	220	0.25	260	0.5	1.47	3	0.86	3	2.04	3
16.36	228	0.25	260	0.5	1.47	3	0.86	3	2.04	3
18.78	212	0.25	260	0.5	1.44	3	0.86	3	2.04	3
22.05	240	0.25	260	0.5	1.47	3	0.86	3	2.04	3
25.07	224	0.25	260	0.5	1.5	3	0.86	3	2.04	3
27.5	232	0.25	260	0.5	1.47	3	0.86	3	2.04	3

Note: 99% Occupied Bandwidth measurements were done using the built-in auto function of the analyzer.

Refer to the following test data plots for details.

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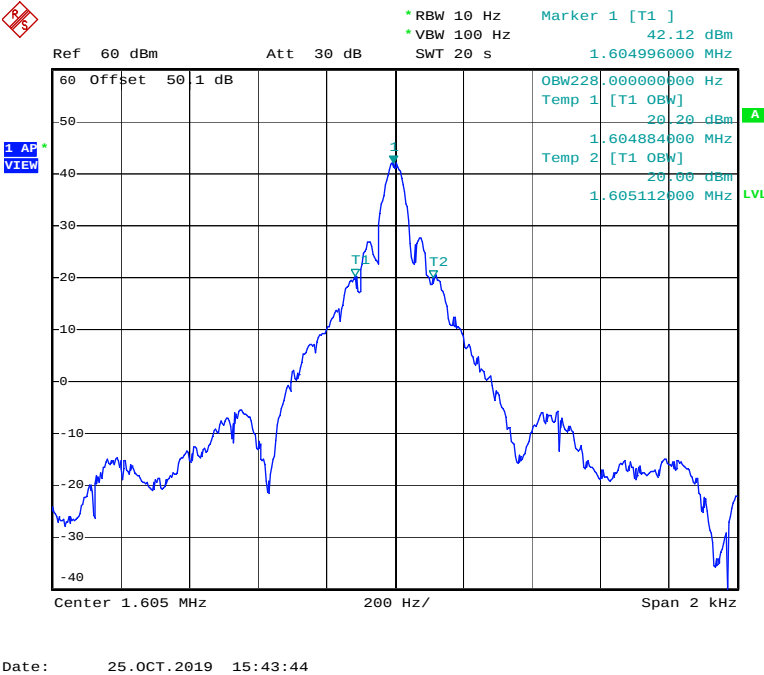
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5.8.3.2. OBW Plots- A1A

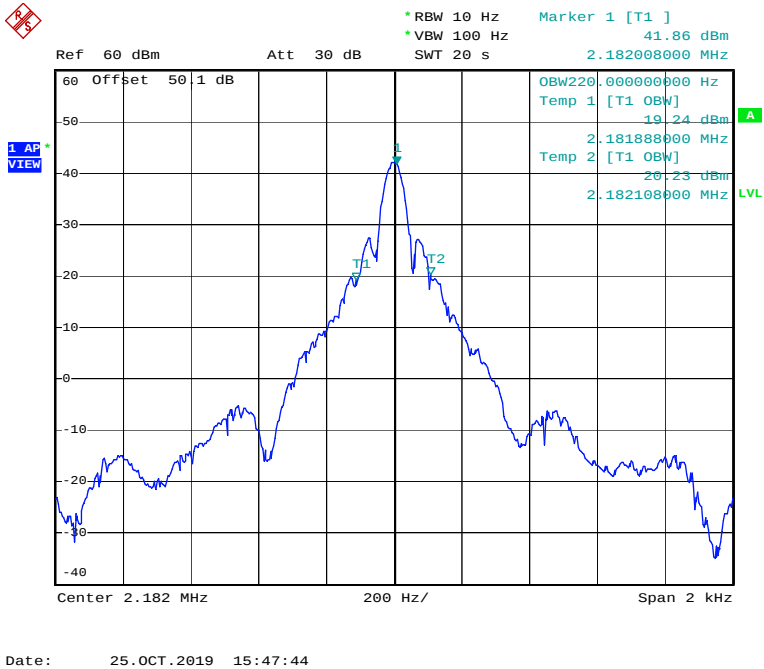
Configuration: A1A (CW), 1.605MHz, High power, 16 dots/ second

OBW: 228Hz



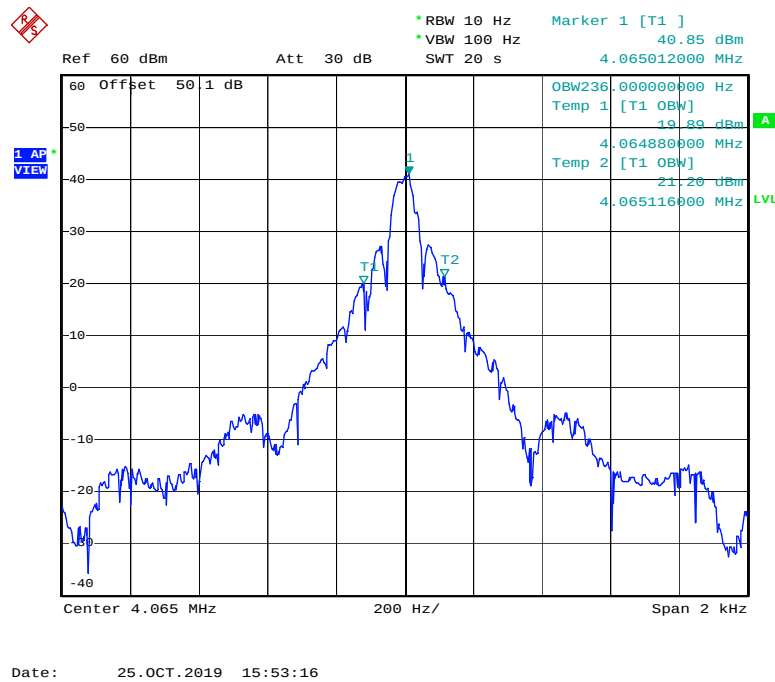
Configuration: A1A (CW), 2.182MHz, High power, 16 dots/ second

OBW: 220Hz



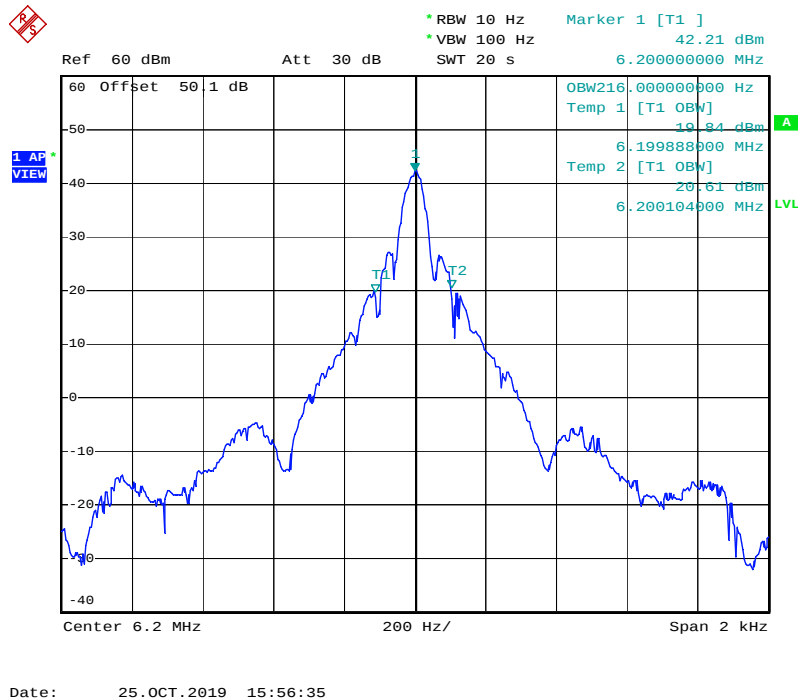
Configuration: A1A (CW), 4.065MHz, High power, 16 dots/ second

OBW: 236Hz



Configuration: A1A (CW), 6.2MHz, High power, 16 dots/ second

OBW: 216Hz



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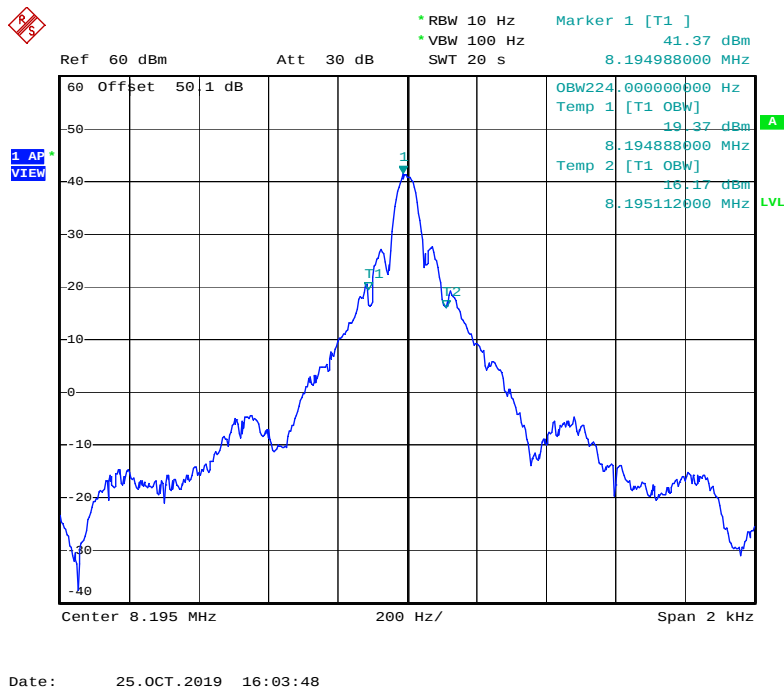
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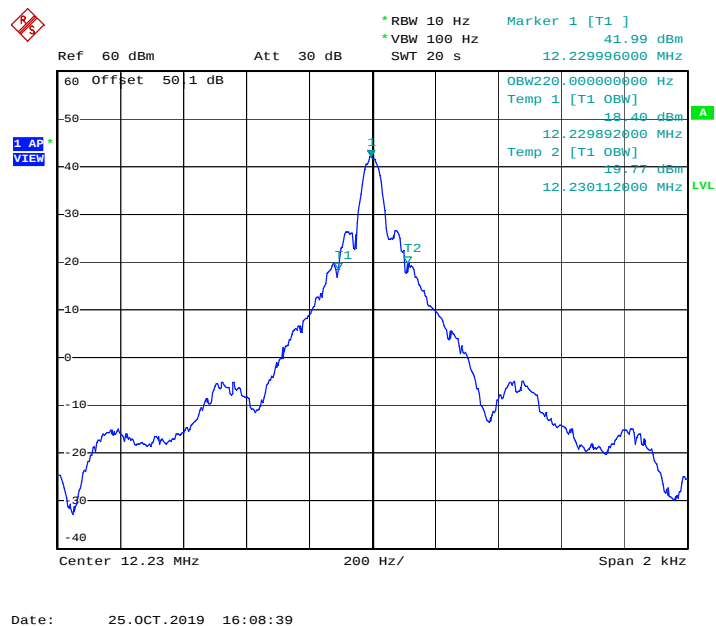
Configuration: A1A (CW), 8.195MHz, High power, 16 dots/ second

OBW: 224Hz



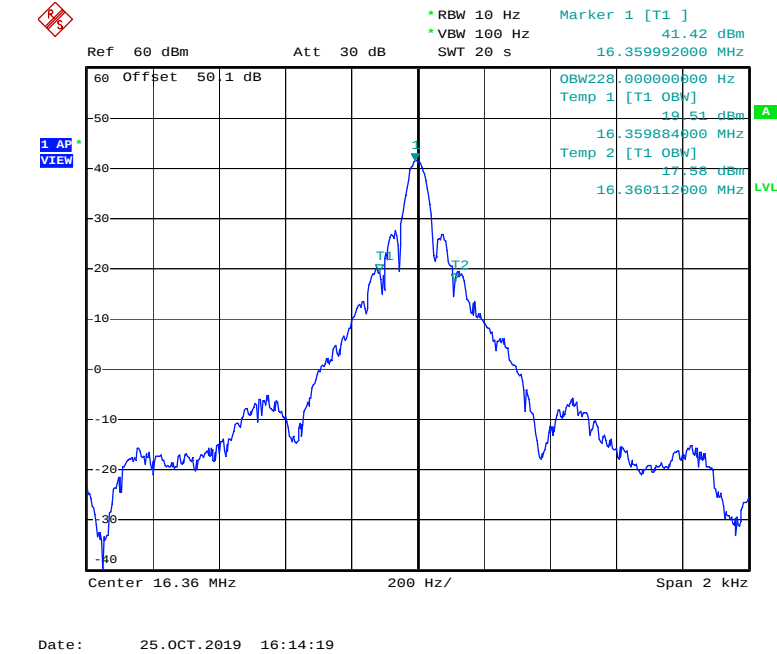
Configuration: A1A (CW), 12.230MHz, High power, 16 dots/ second

OBW: 220Hz



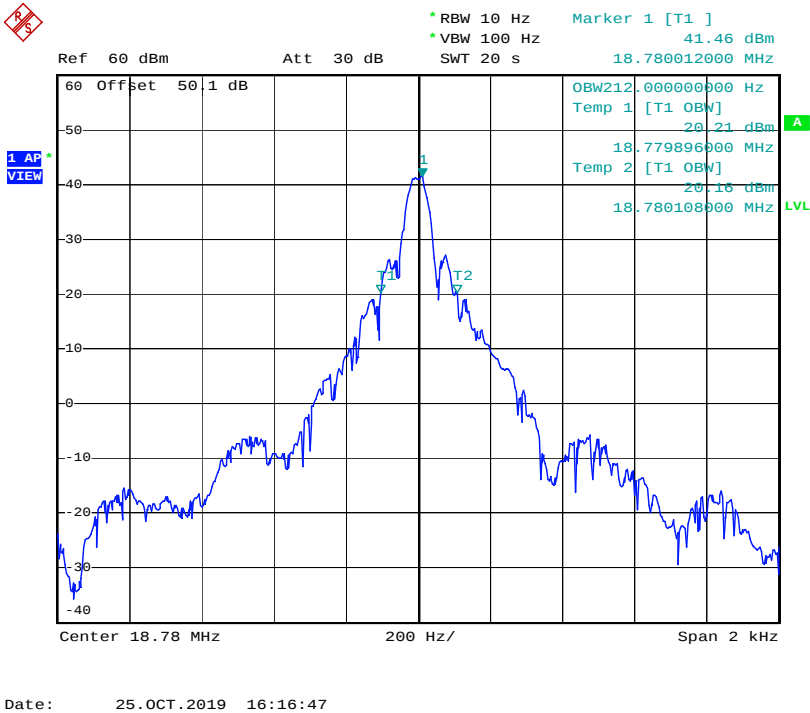
Configuration: A1A (CW), 16.360MHz, High power, 16 dots/ second

OBW: 228Hz



Configuration: A1A (CW), 18.780MHz, High power, 16 dots/ second

OBW: 212Hz



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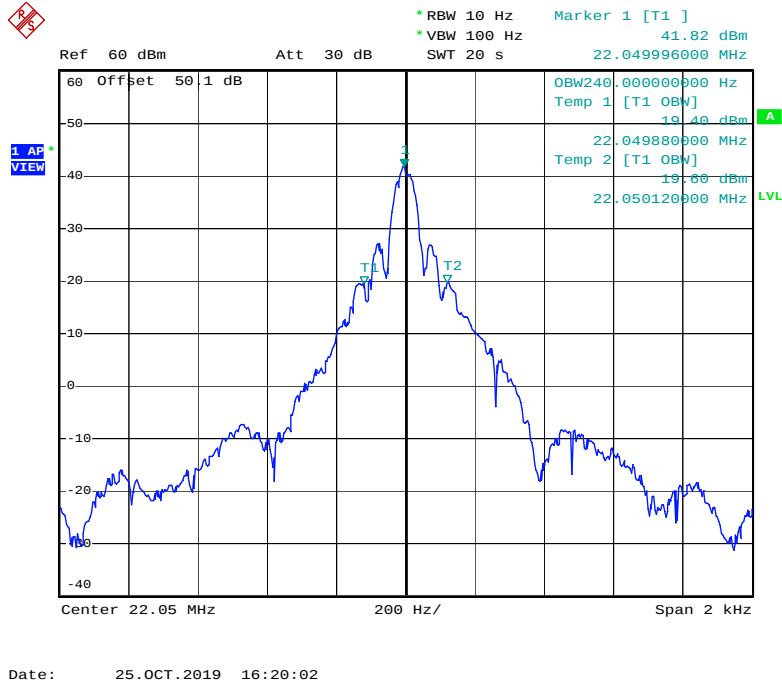
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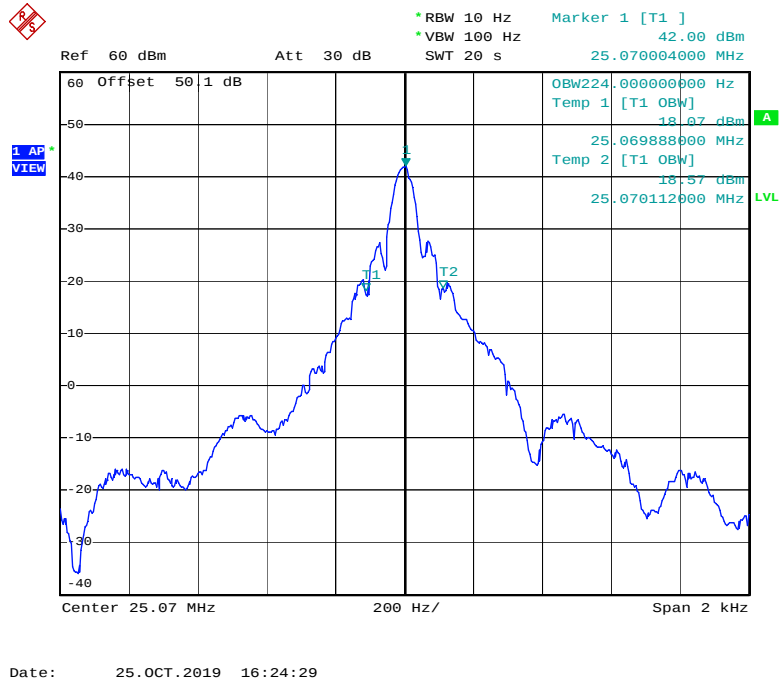
Configuration: A1A (CW), 22.050MHz, High power, 16 dots/ second

OBW: 240Hz



Configuration: A1A (CW), 25.070MHz, High power, 16 dots/ second

OBW: 224Hz



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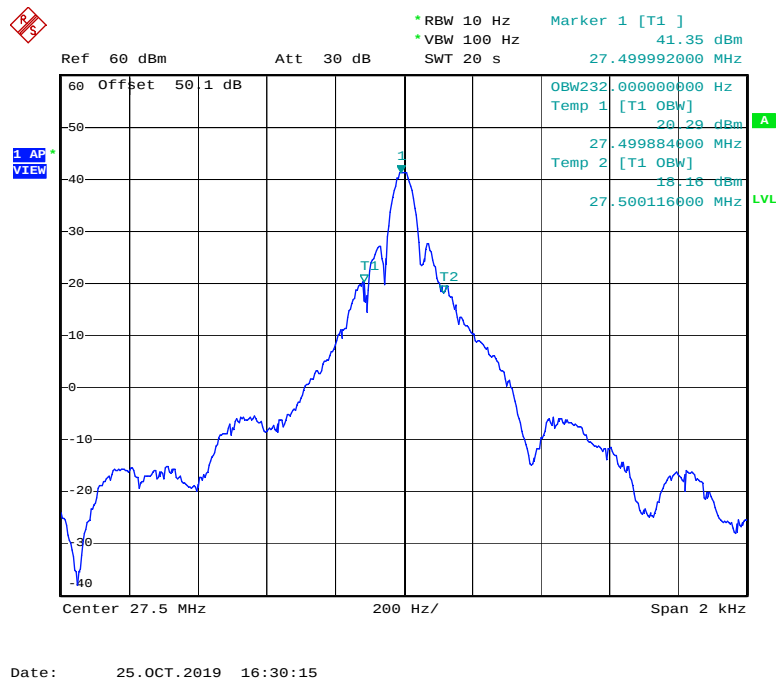
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Configuration: A1A (CW), 27.5MHz, High power, 16 dots/ second

OBW: 232 KHz



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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

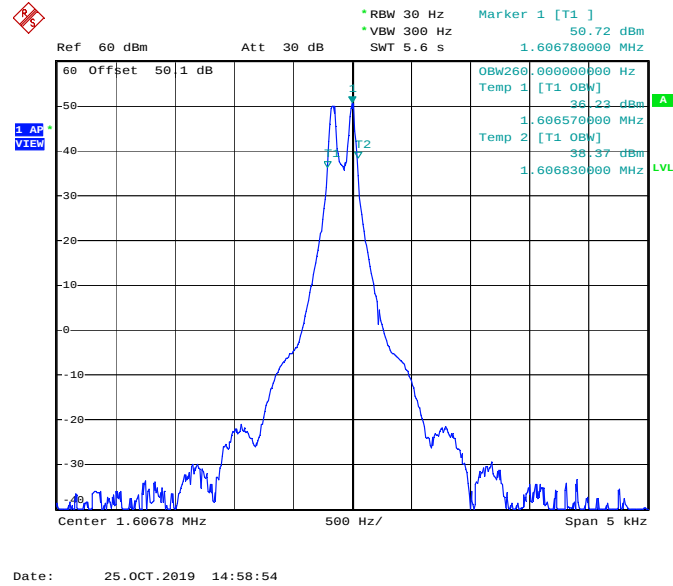
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

OBW Plots- F1B 0.5 kHz

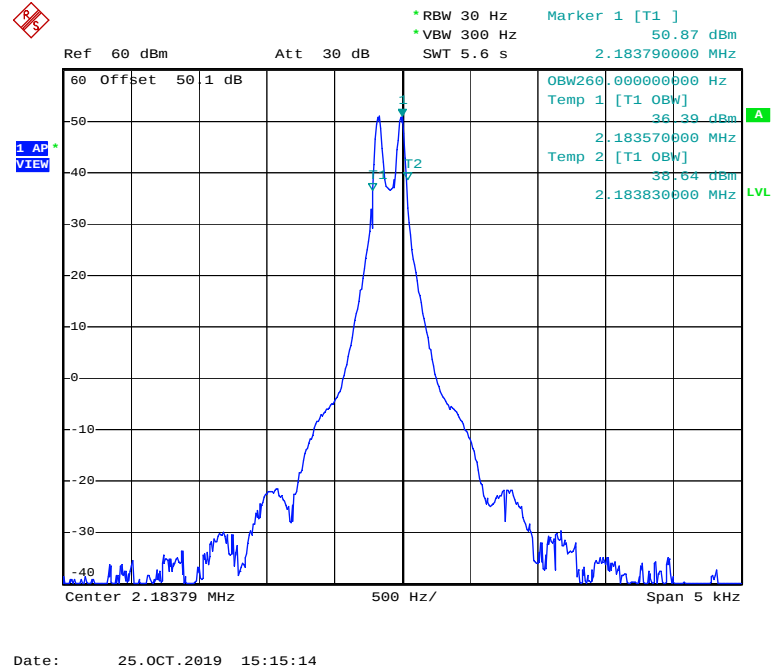
Configuration: F1B (FSK), 1.605MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz

OBW: 260 Hz



Configuration: F1B (FSK), 2.182MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz

OBW: 260 Hz



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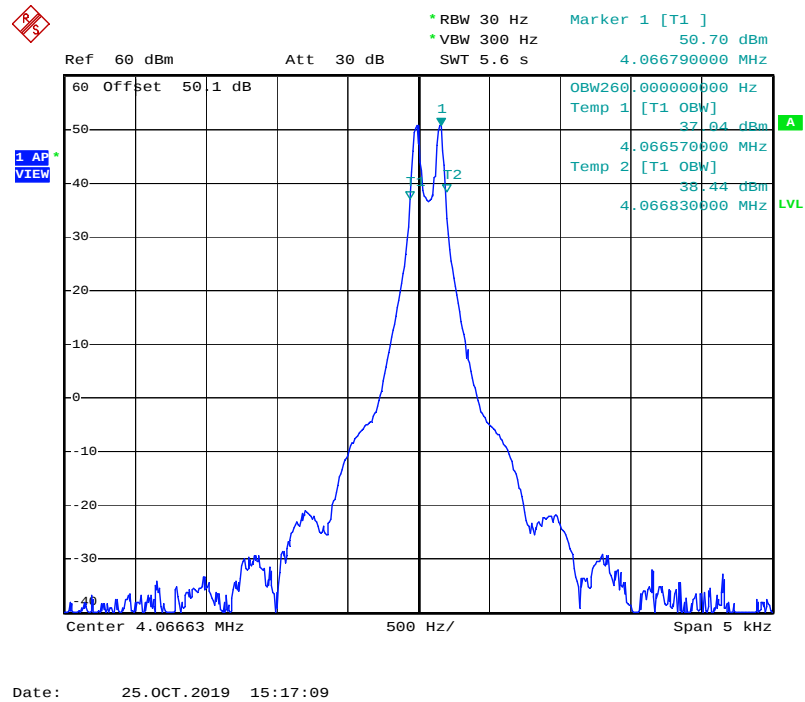
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

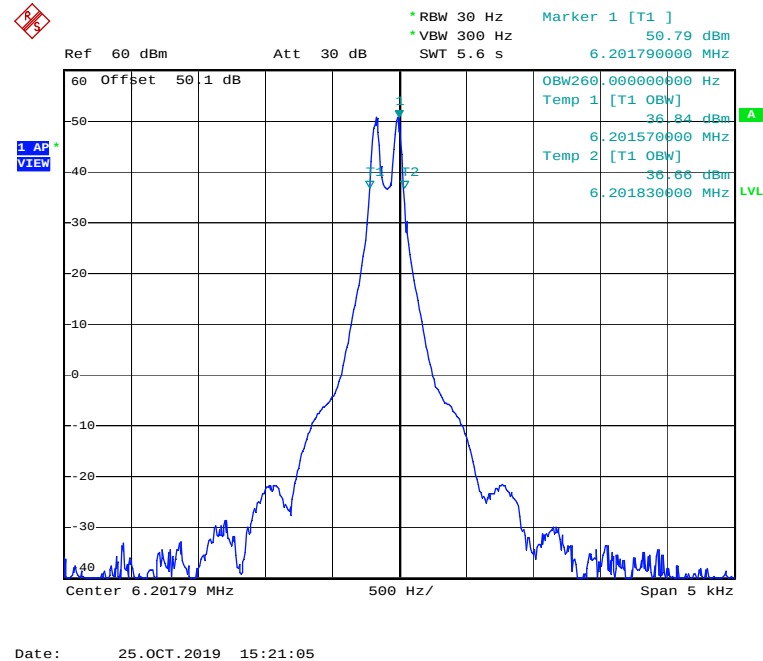
Configuration: F1B (FSK), 4.065MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz

OBW: 260Hz



Configuration: F1B (FSK), 6.2MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz

OBW: 260Hz



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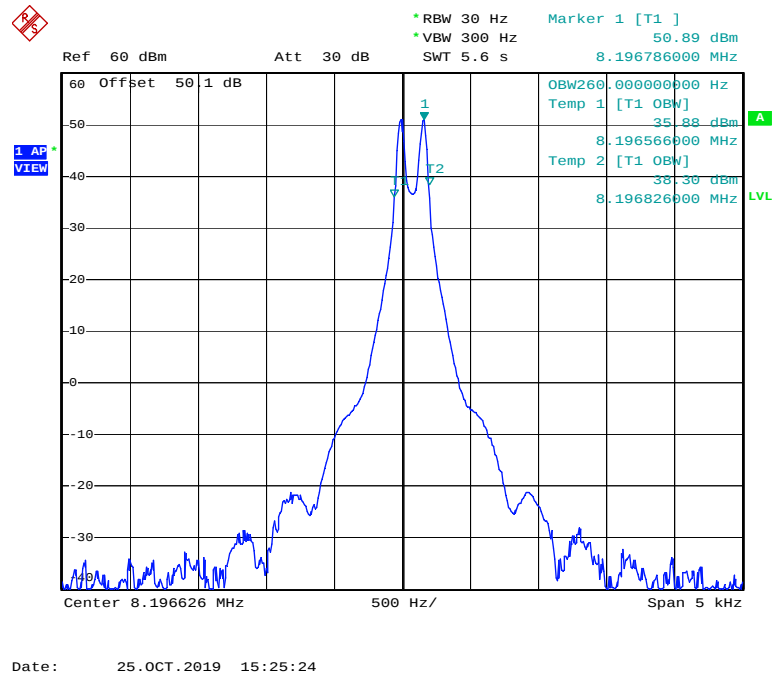
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

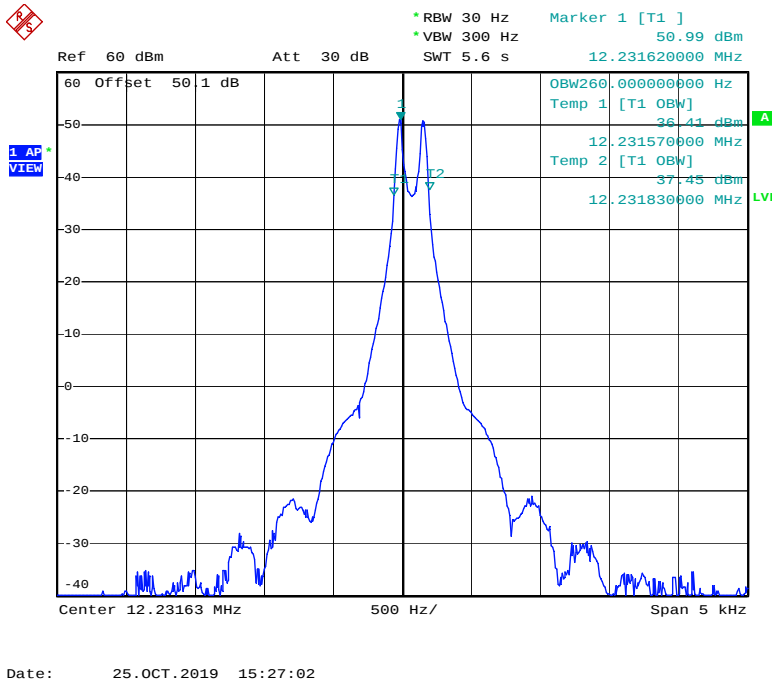
Configuration: F1B (FSK), 8.195MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz

OBW: 260Hz



Configuration: F1B (FSK), 12.230MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz

OBW: 260Hz



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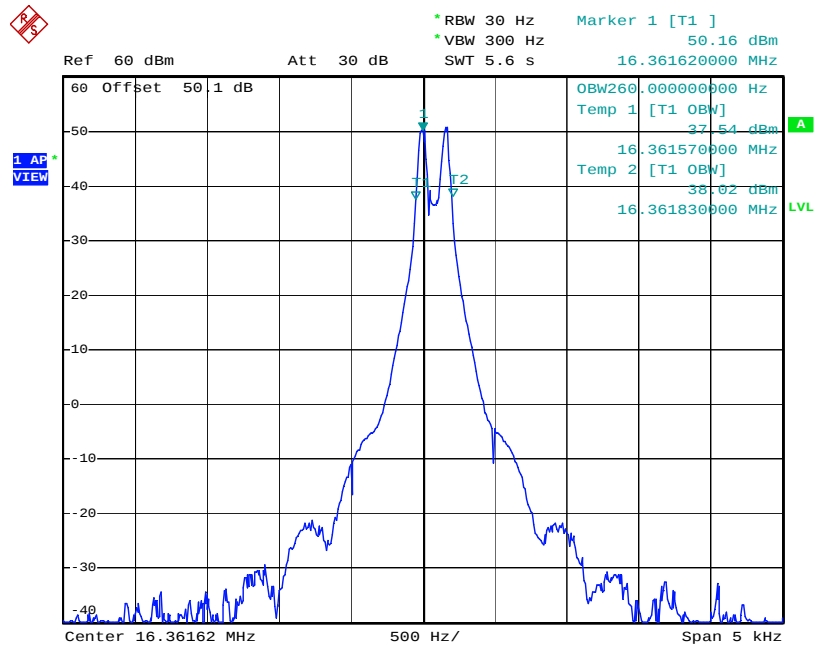
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 16.360MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz

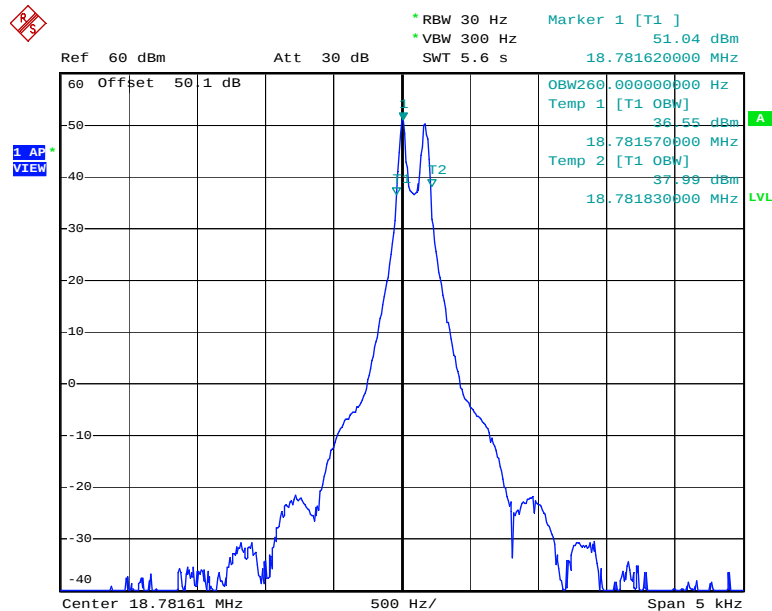
OBW: 260Hz



Date: 25.OCT.2019 15:28:51

Configuration: F1B (FSK), 18.780MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz

OBW: 260Hz



Date: 25.OCT.2019 15:30:24

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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

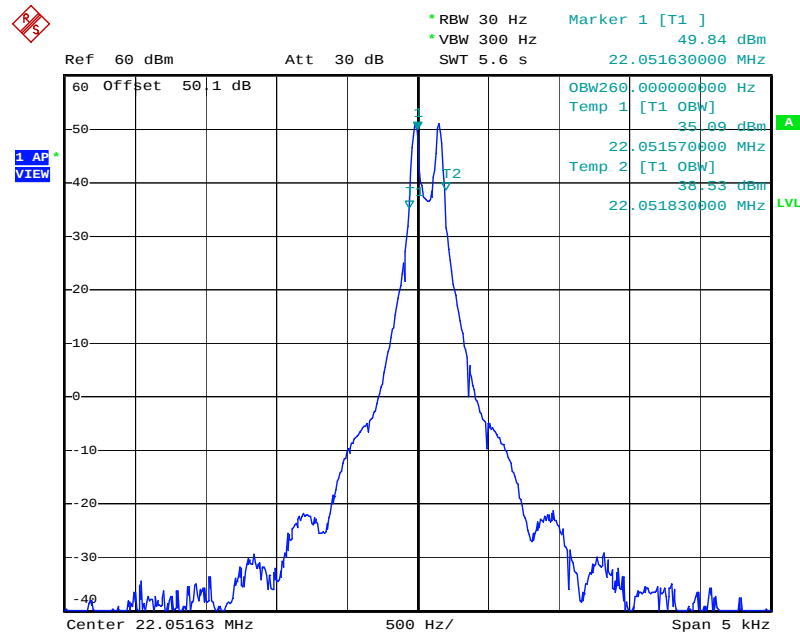
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

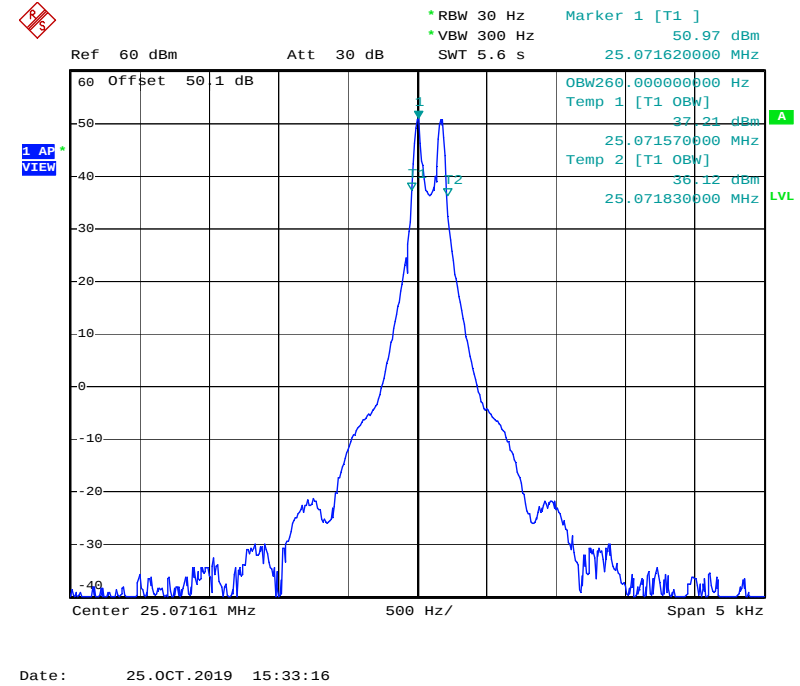
Configuration: F1B (FSK), 22.050MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz

OBW: 260Hz



Configuration: F1B (FSK), 25.070MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz

OBW: 260Hz



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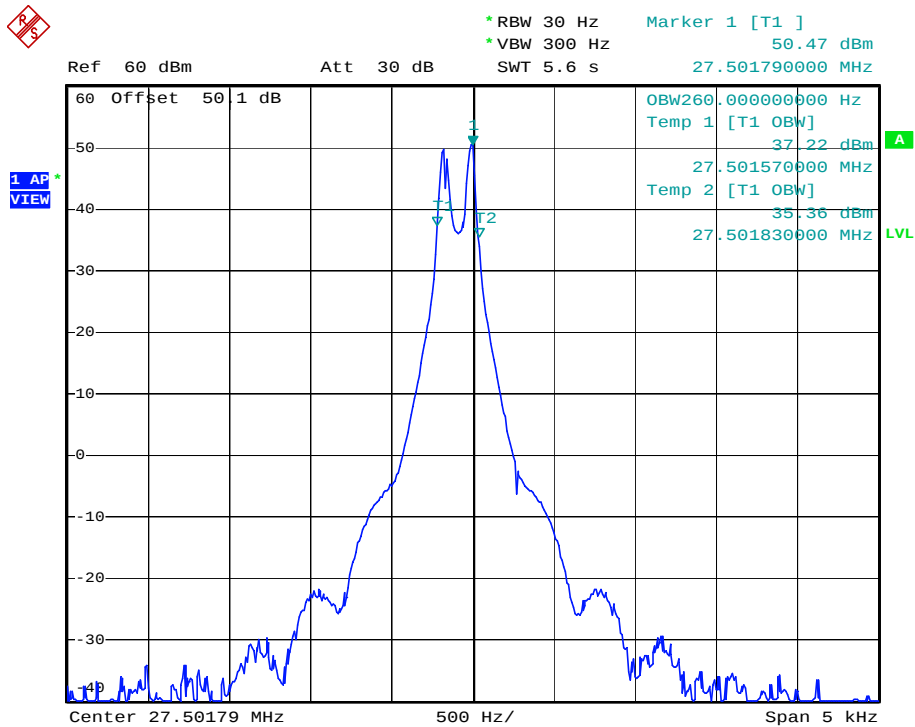
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 27.5MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz

OBW: 260Hz



Date: 25.OCT.2019 15:34:50

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File #: 19ICOM515_FCC80

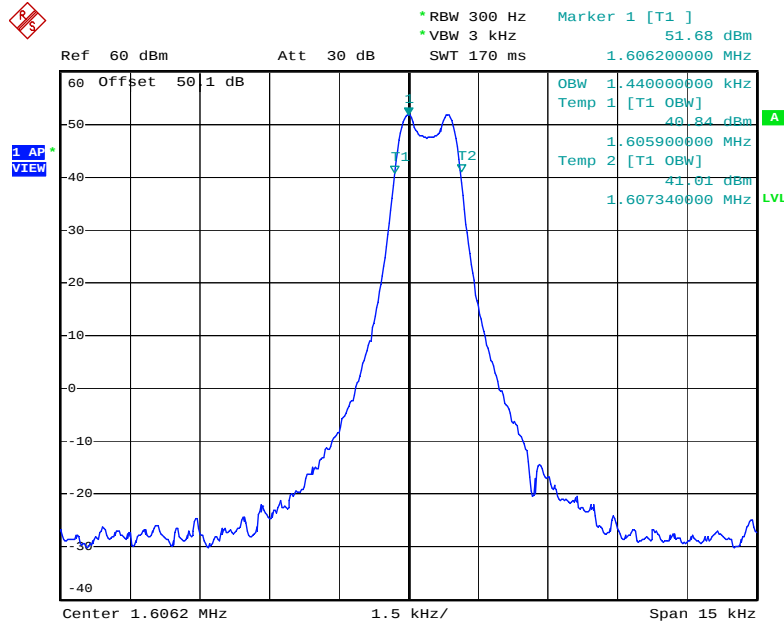
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

OBW Plots- F1B 3 kHz

Configuration: F1B (FSK), 1.605MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz

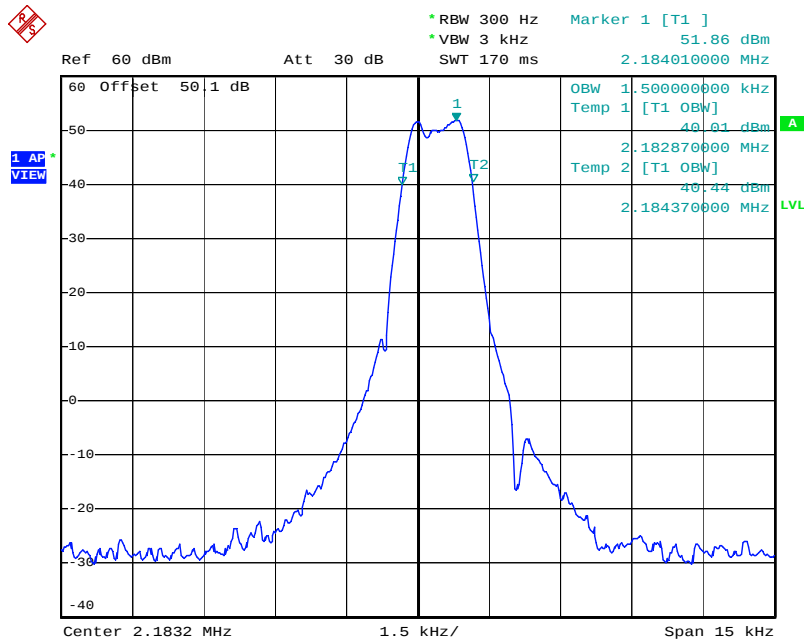
OBW: 1.44 KHz



Date: 25.OCT.2019 10:25:01

Configuration: F1B (FSK), 2.182MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz

OBW: 1.5 KHz



Date: 25.OCT.2019 10:27:09

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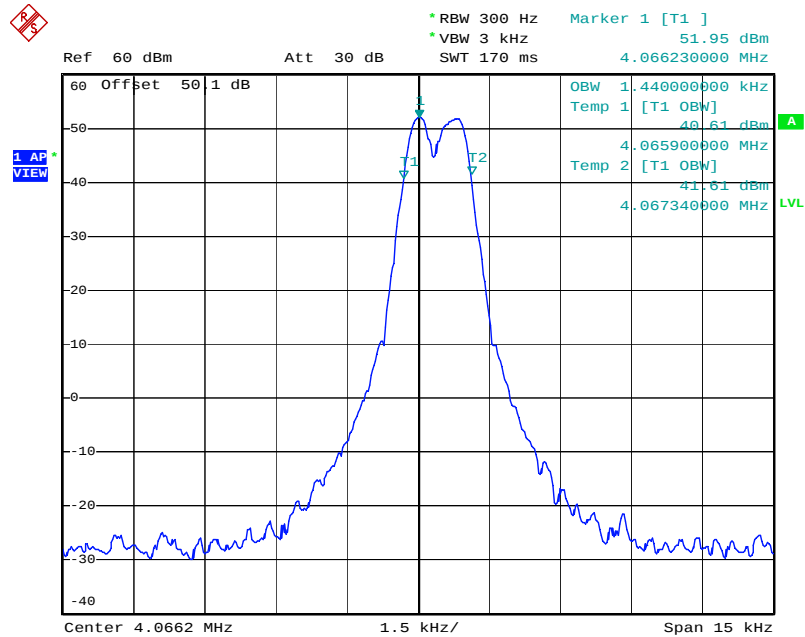
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 4.065MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz

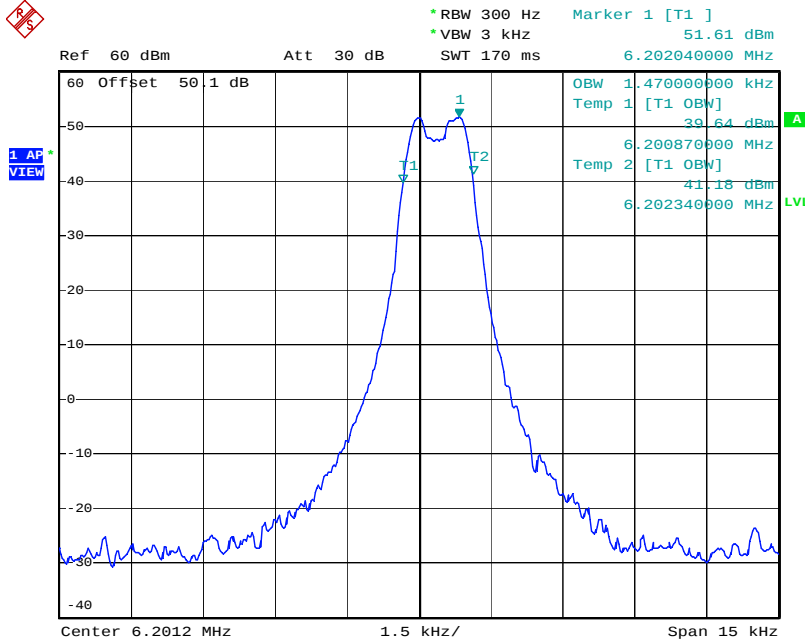
OBW: 1.44 KHz



Date: 25.OCT.2019 10:28:49

Configuration: F1B (FSK), 6.2MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz

OBW: 1.47 KHz



Date: 25.OCT.2019 10:29:58

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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

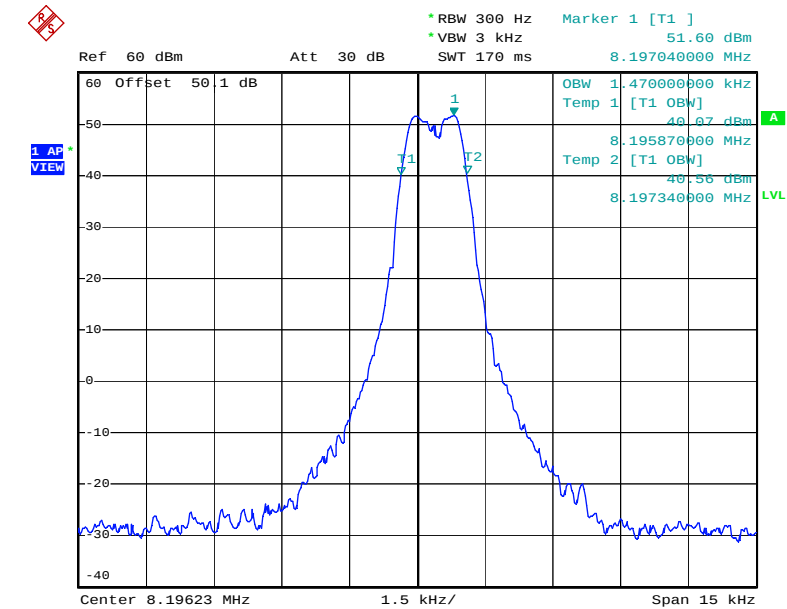
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 8.195MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz

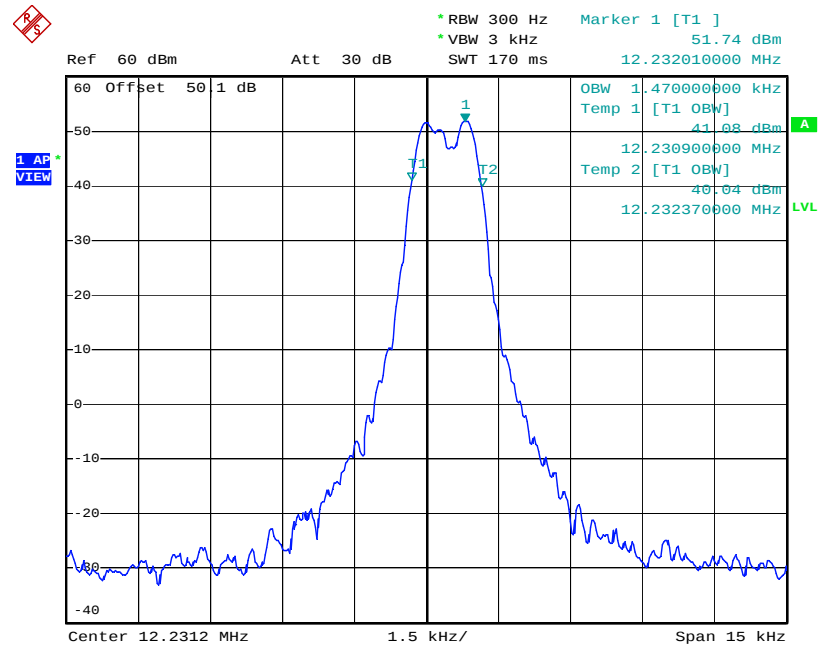
OBW: 1.47 KHz



Date: 25.OCT.2019 10:31:11

Configuration: F1B (FSK), 12.230MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz

OBW: 1.47 KHz



Date: 25.OCT.2019 10:32:11

ULTRATECH GROUP OF LABS

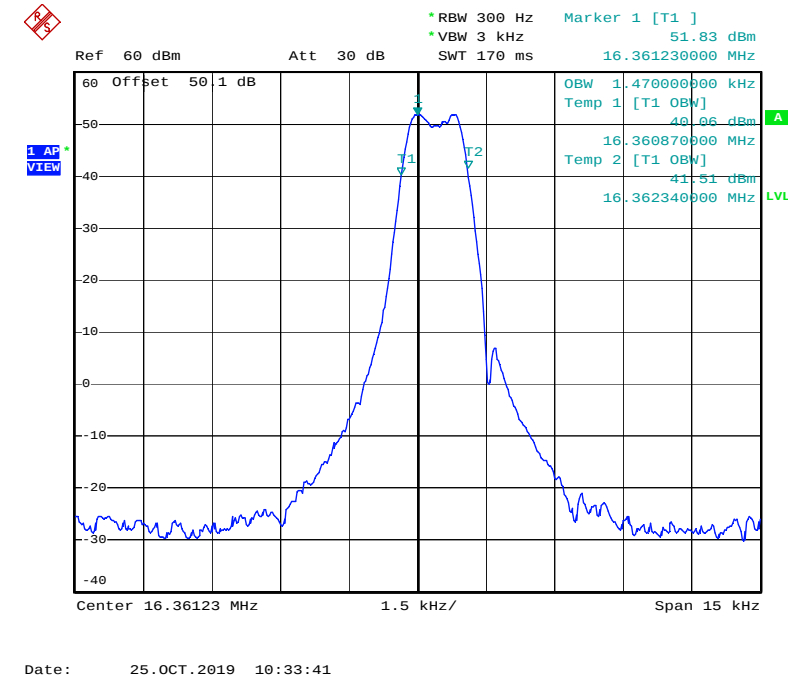
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

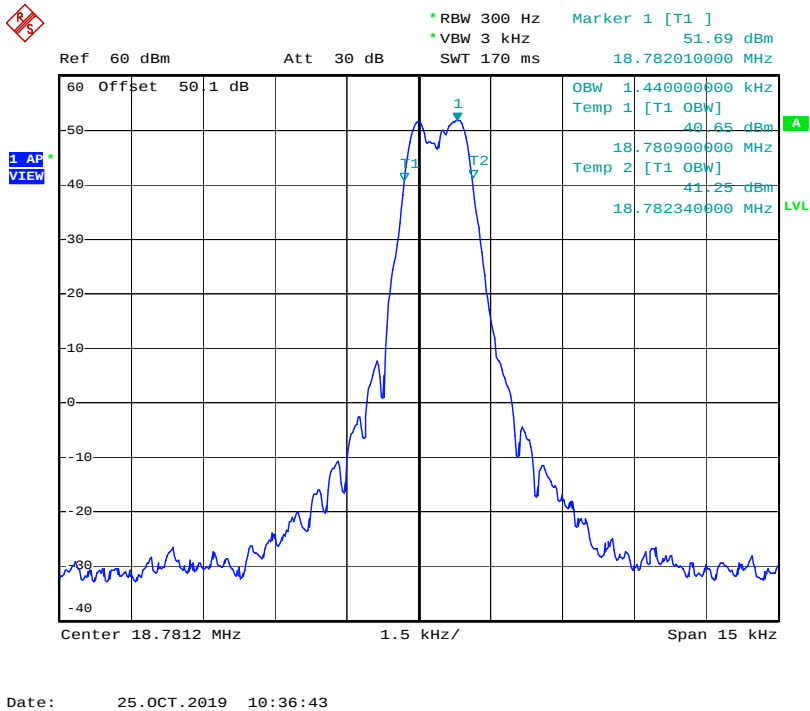
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 16.360MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz
OBW: 1.47 KHz



Configuration: F1B (FSK), 18.780MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz
OBW: 1.44 KHz



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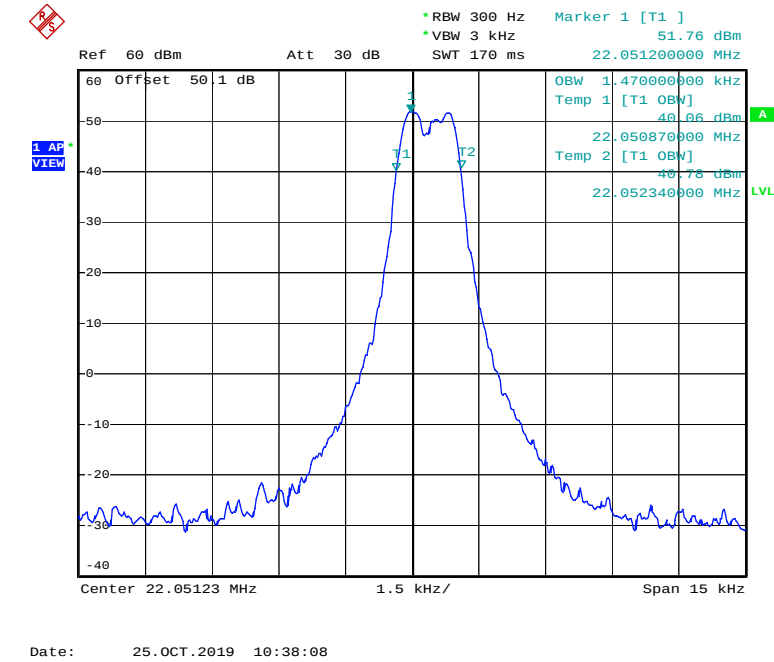
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

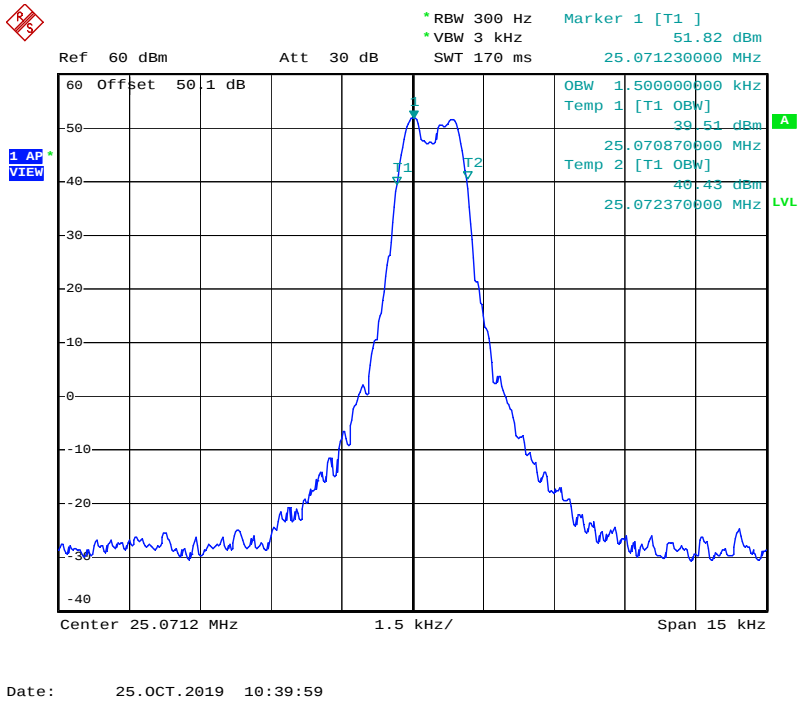
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 22.050MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz
OBW: 1.47 KHz



Configuration: F1B (FSK), 25.070MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz
OBW: 1.5 KHz



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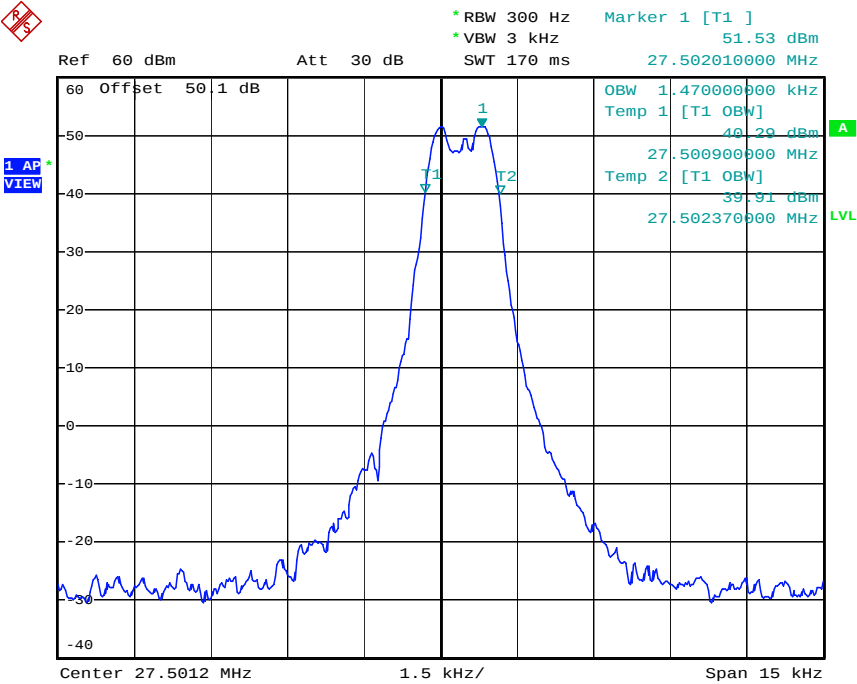
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 27.5MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz

OBW: 1.47 KHz



Date: 25.OCT.2019 10:41:35

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File #: 19ICOM515_FCC80

November 14, 2019

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OBW: 0.860 KHz

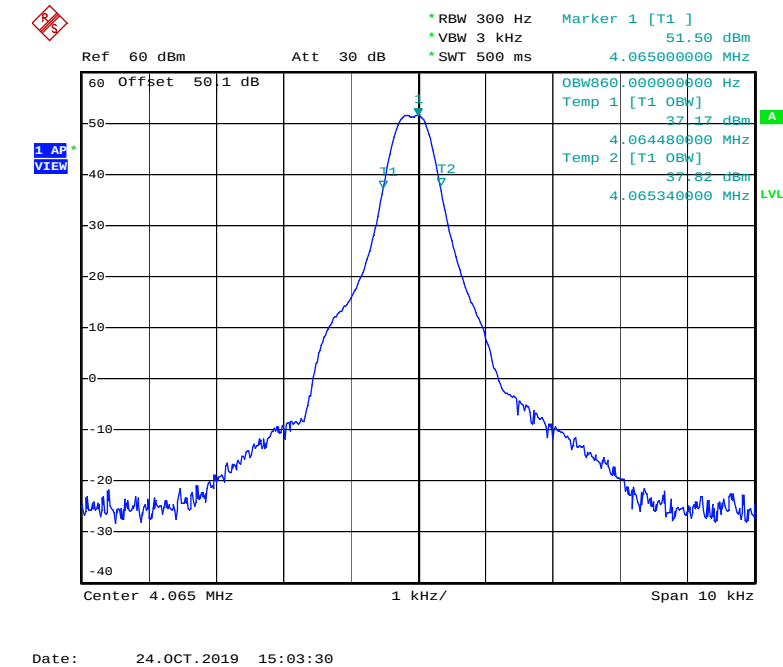


OBW: 0.860 KHz



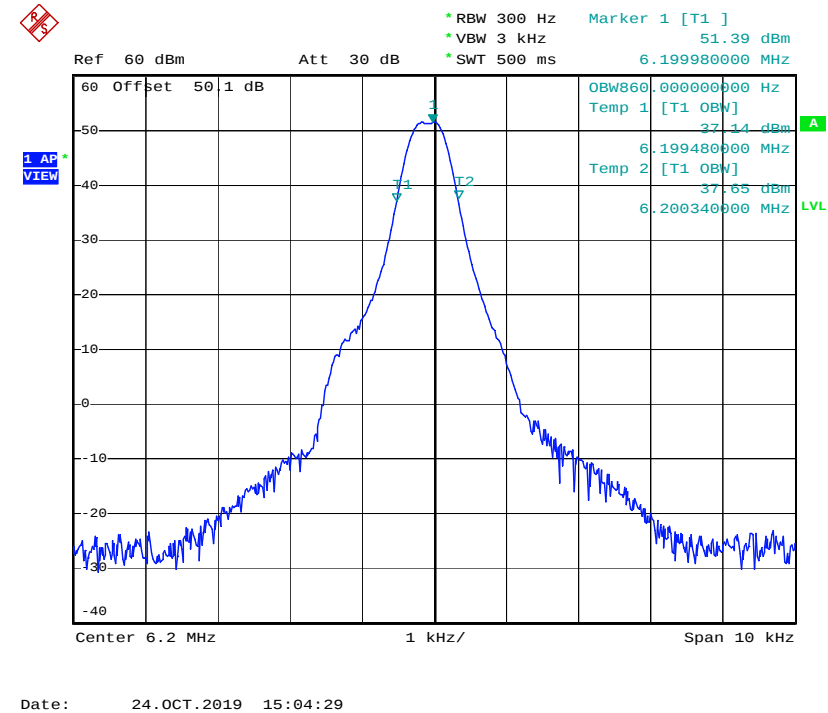
Configuration: J2B (AFSK), 4.065MHz, High power, Modulation: 1.7 KHz

OBW: 0.860 KHz



Configuration: J2B (AFSK), 6.2MHz, High power, Modulation: 1.7 KHz

OBW: 0.860 KHz



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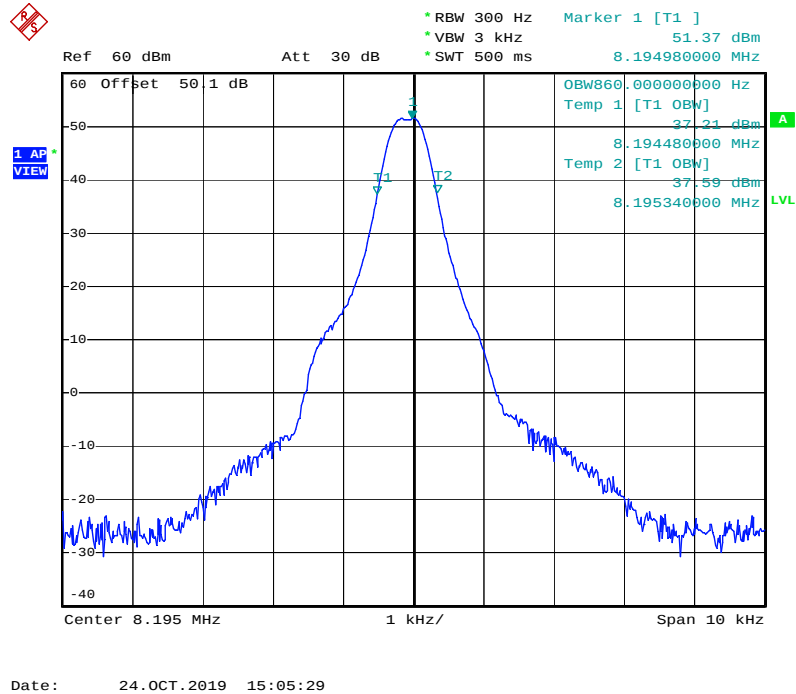
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

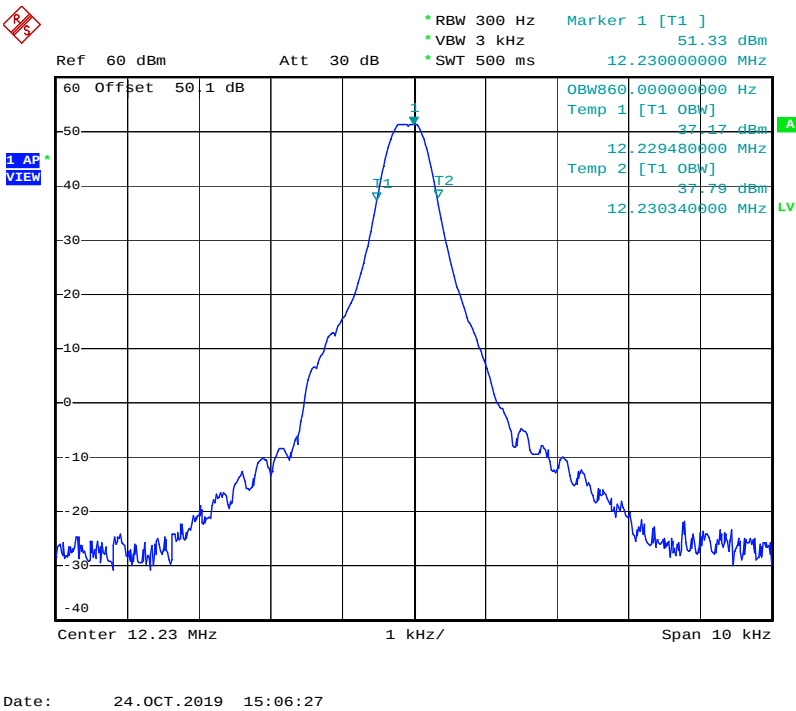
Configuration: J2B (AFSK), 8.195MHz, High power, Modulation: 1.7 KHz

OBW: 0.860 KHz



Configuration: J2B (AFSK), 12.230MHz, High power, Modulation: 1.7 KHz

OBW: 0.860 KHz



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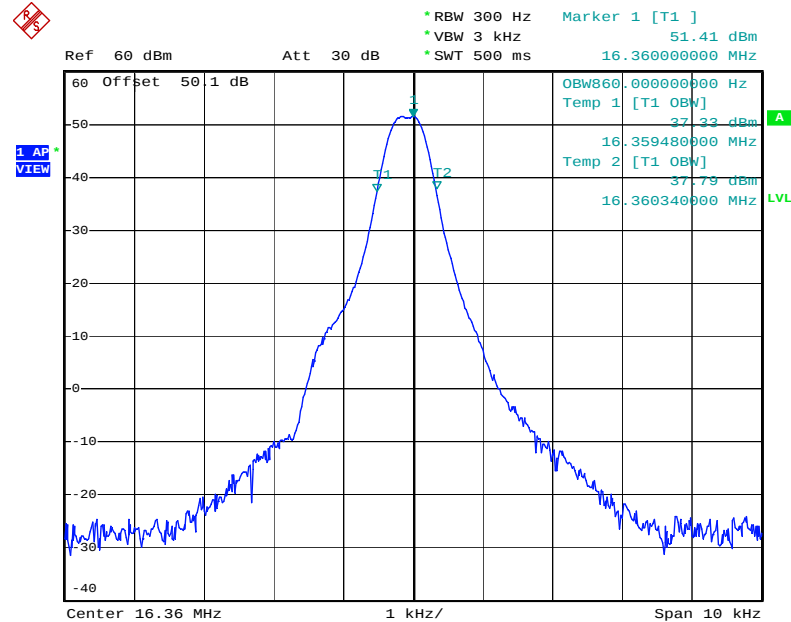
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 16.360MHz, High power, Modulation: 1.7 KHz

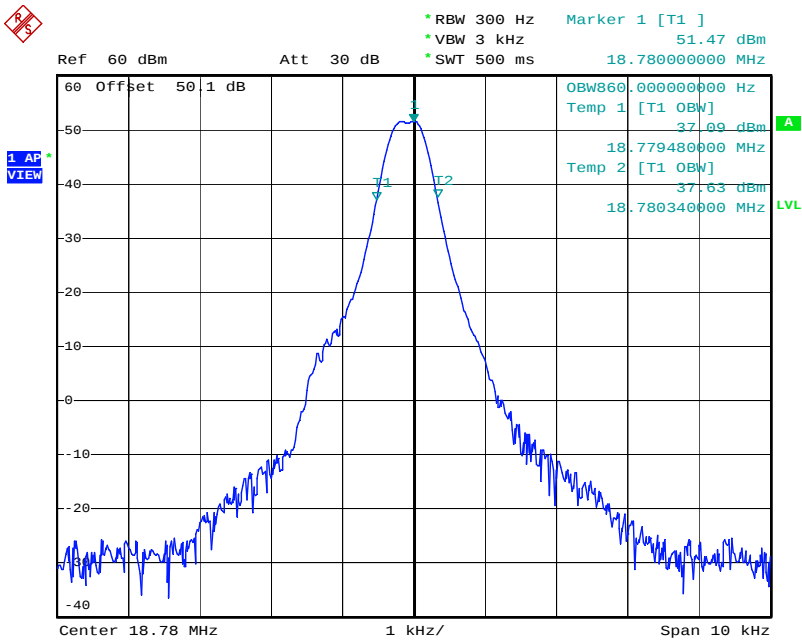
OBW: 0.860 KHz



Date: 24.OCT.2019 15:07:28

Configuration: J2B (AFSK), 18.780MHz, High power, Modulation: 1.7 KHz

OBW: 0.860 KHz



Date: 24.OCT.2019 15:28:09

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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

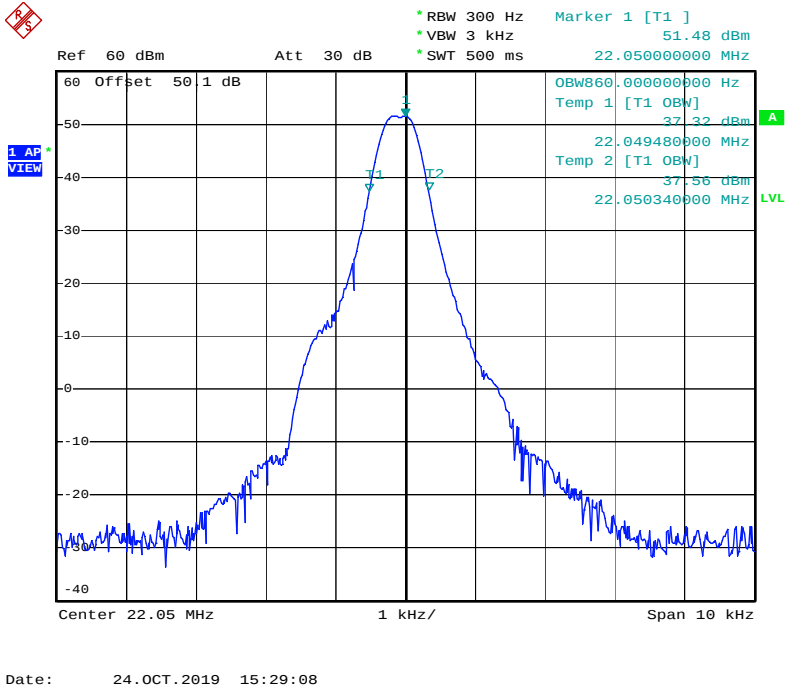
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

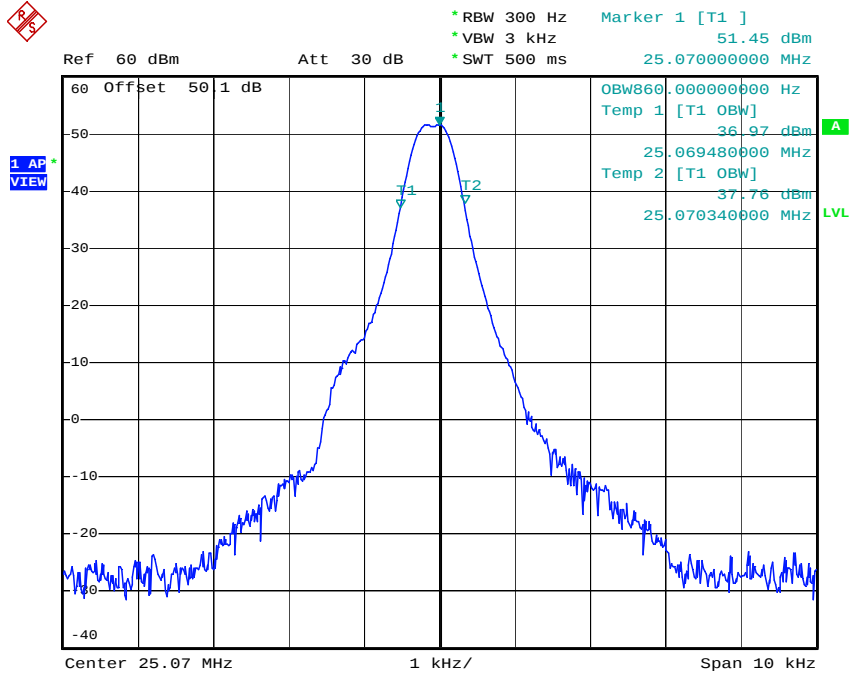
Configuration: J2B (AFSK), 22.050MHz, High power, Modulation: 1.7 KHz

OBW: 0.860 KHz



Configuration: J2B (AFSK), 25.070MHz, High power, Modulation: 1.7 KHz

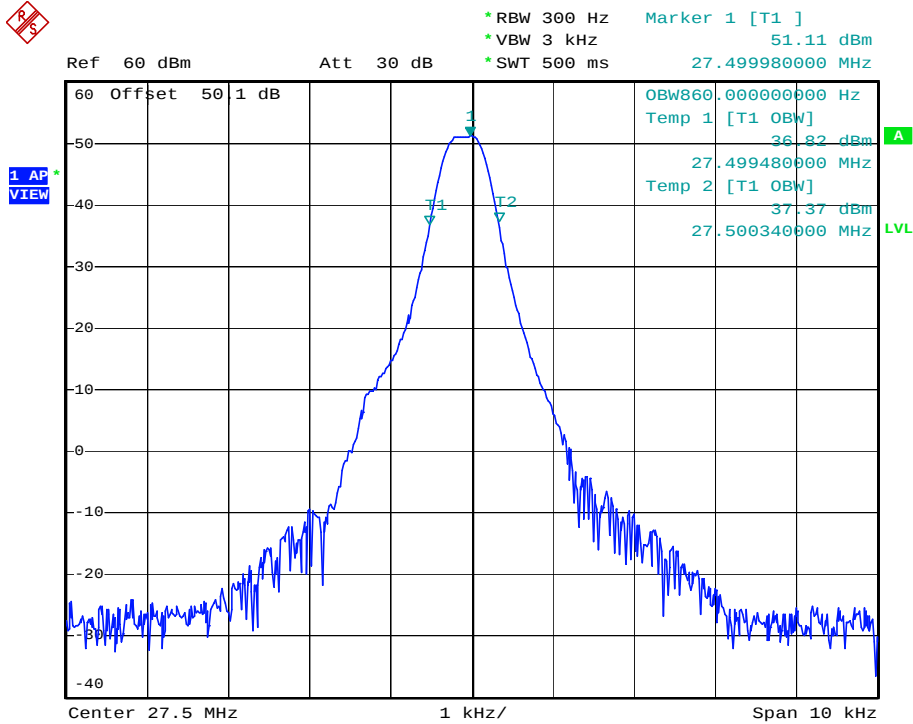
OBW: 0.860 KHz



Date: 24.OCT.2019 15:34:37

Configuration: J2B (AFSK), 27.5MHz, High power, Modulation: 1.7 KHz

OBW: 0.860 KHz



Date: 24.OCT.2019 15:35:37

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File #: 19ICOM515_FCC80

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File #: 19ICOM515_FCC80

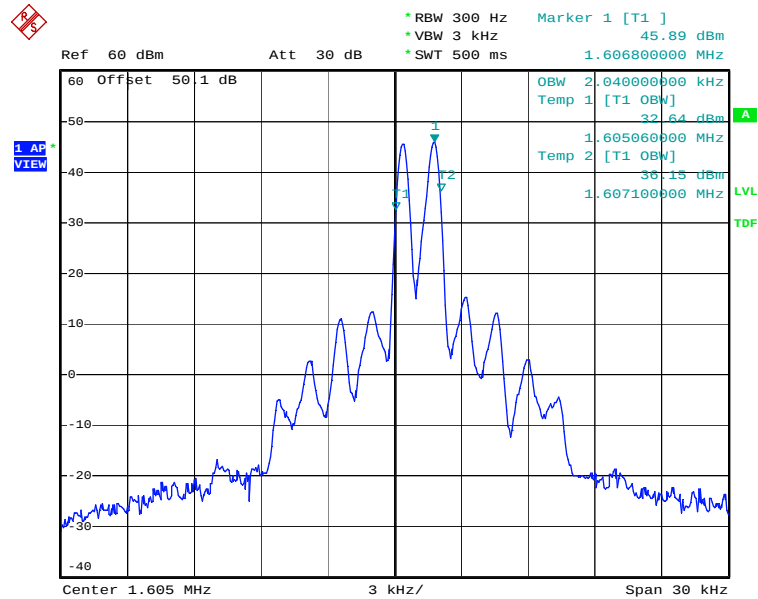
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

OBW Plots- J3E

Configuration: J3E (USB), 1.605MHz, High power, Modulation: 400+1800Hz

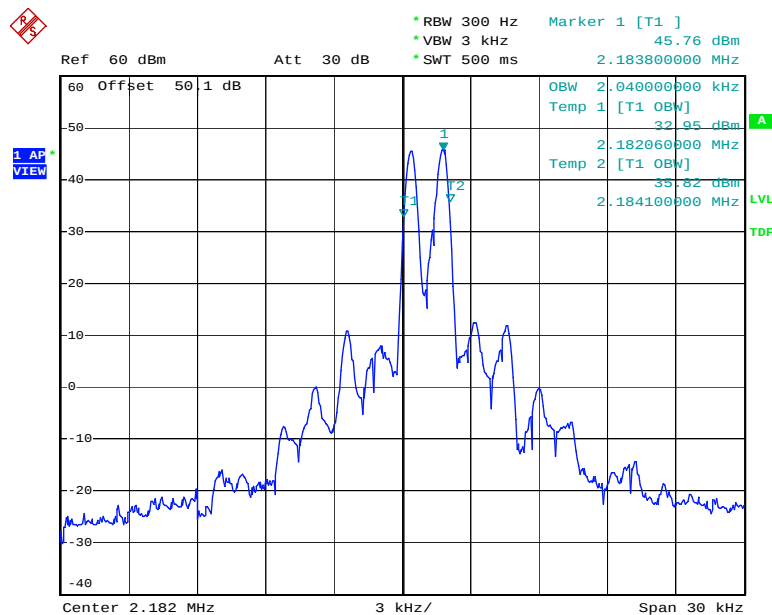
OBW: 2.04 KHz



Date: 1.NOV.2019 14:55:41

Configuration: J3E (USB), 2.182MHz, High power, Modulation: 400+1800Hz

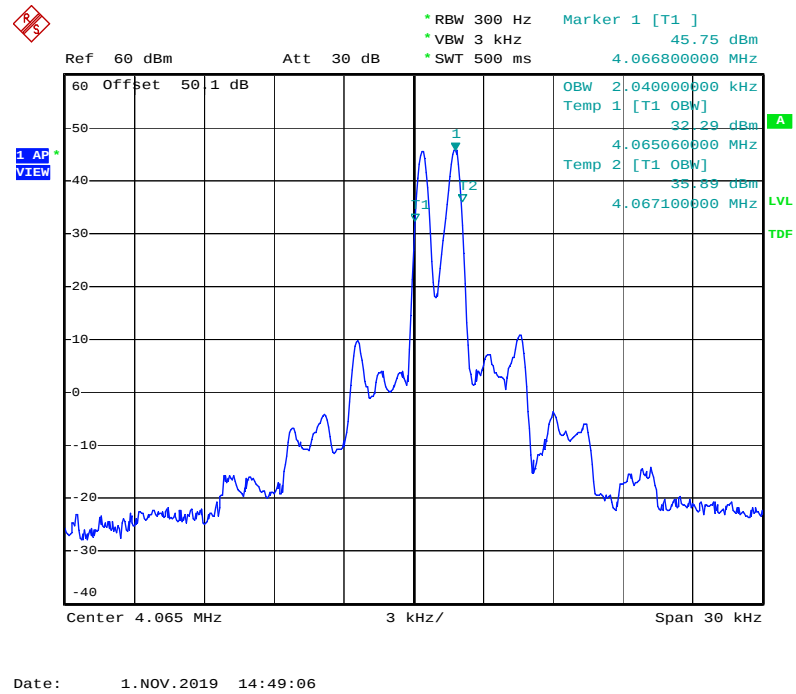
OBW: 2.04 KHz



Date: 1.NOV.2019 14:56:44

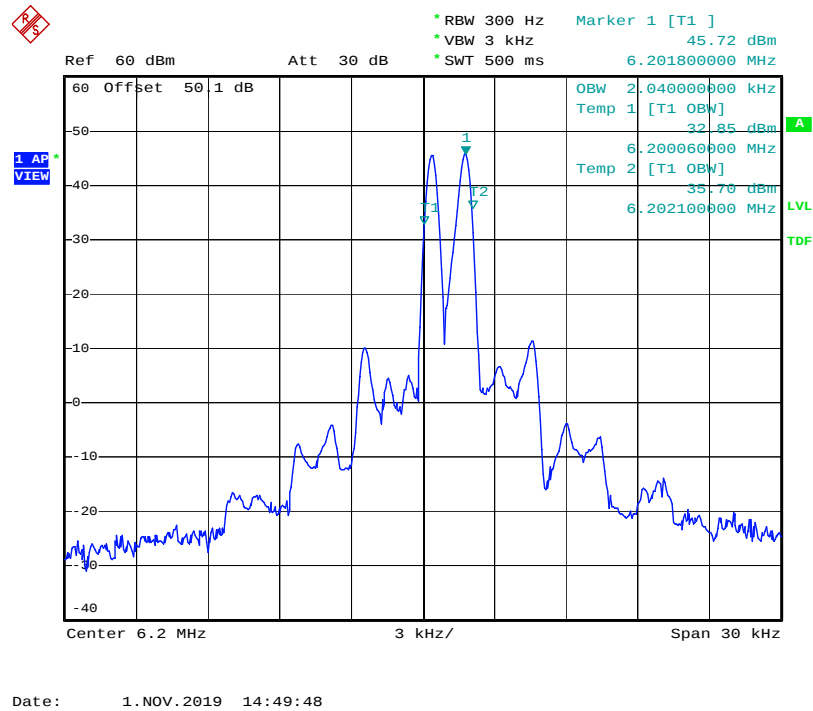
Configuration: J3E (USB), 4.065MHz, High power, Modulation: 400+1800Hz

OBW: 2.04 KHz



Configuration: J3E (USB), 6.2MHz, High power, Modulation: 400+1800Hz

OBW: 2.04 KHz



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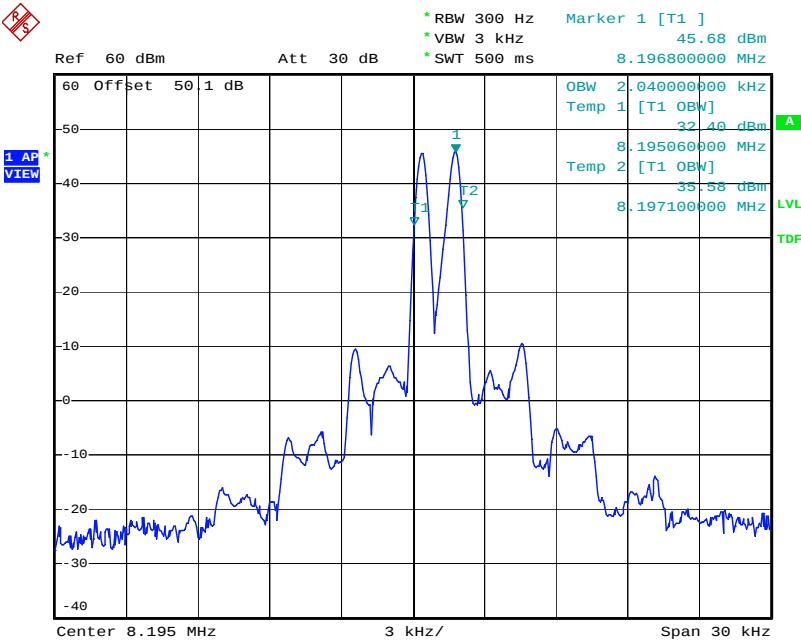
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J3E (USB), 8.195MHz, High power, Modulation: 400+1800Hz

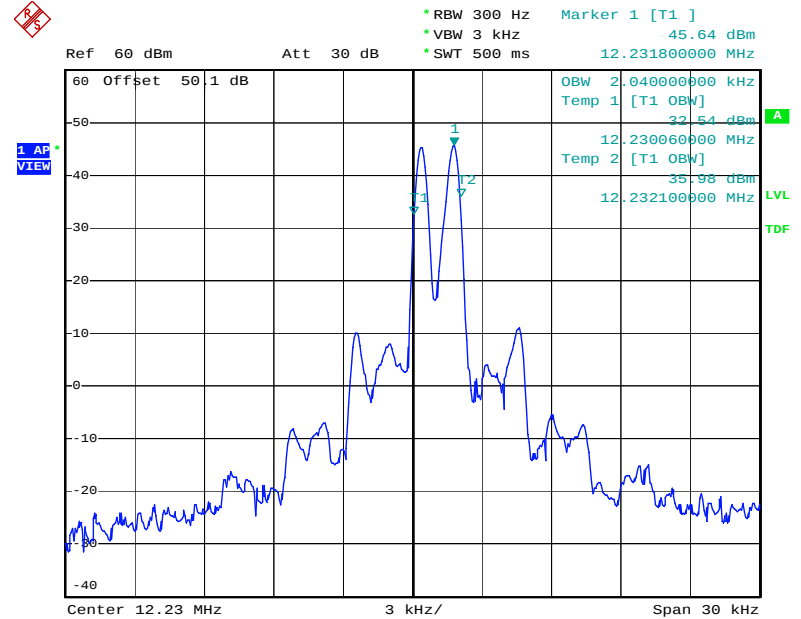
OBW: 2.04 KHz



Date: 1.NOV.2019 14:50:32

Configuration: J3E (USB), 12.230MHz, High power, Modulation: 400+1800Hz

OBW: 2.04 KHz



Date: 1.NOV.2019 14:51:12

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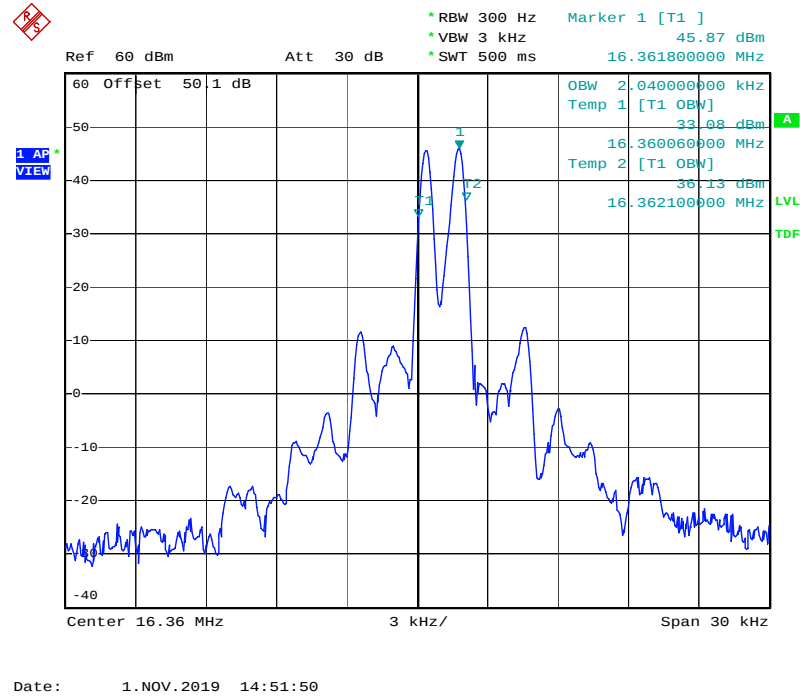
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

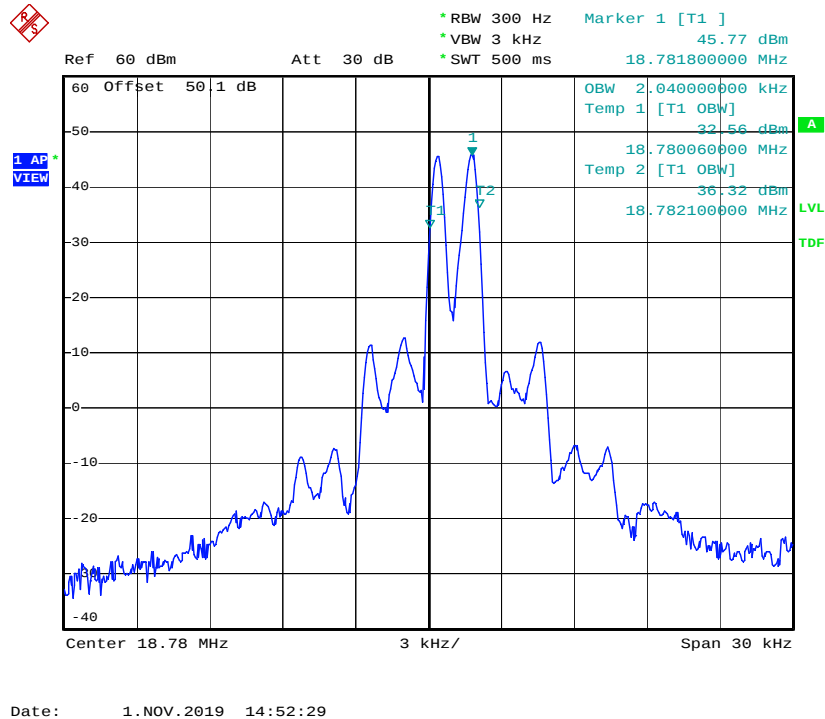
Configuration: J3E (USB), 16.360MHz, High power, Modulation: 400+1800Hz

OBW: 2.04 KHz



Configuration: J3E (USB), 18.780MHz, High power, Modulation: 400+1800Hz

OBW: 2.04 KHz



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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

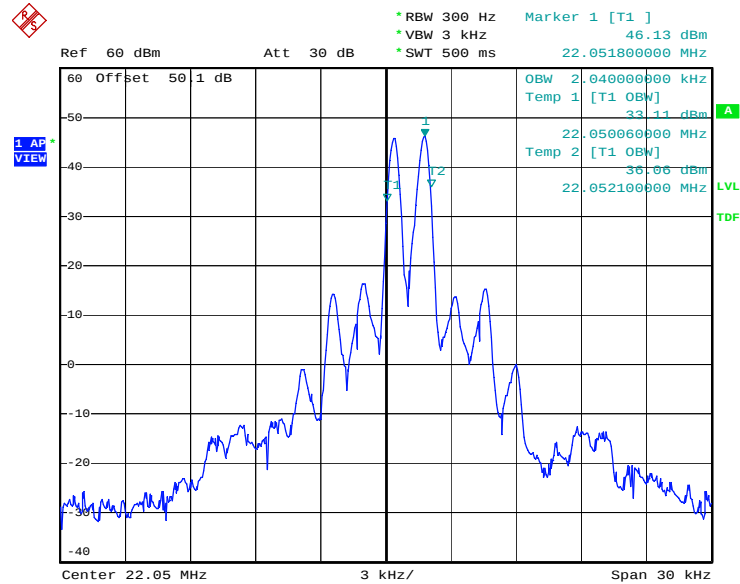
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J3E (USB), 22.050MHz, High power, Modulation: 400+1800Hz

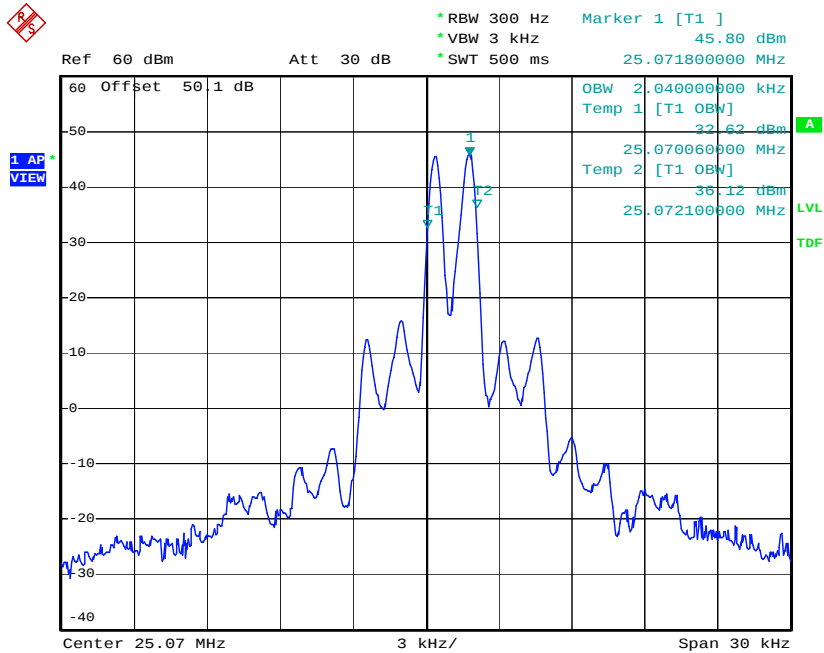
OBW: 2.04 KHz



Date: 1.NOV.2019 14:53:15

Configuration: J3E (USB), 25.070MHz, High power, Modulation: 400+1800Hz

OBW: 2.04 KHz



Date: 1.NOV.2019 14:53:55

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

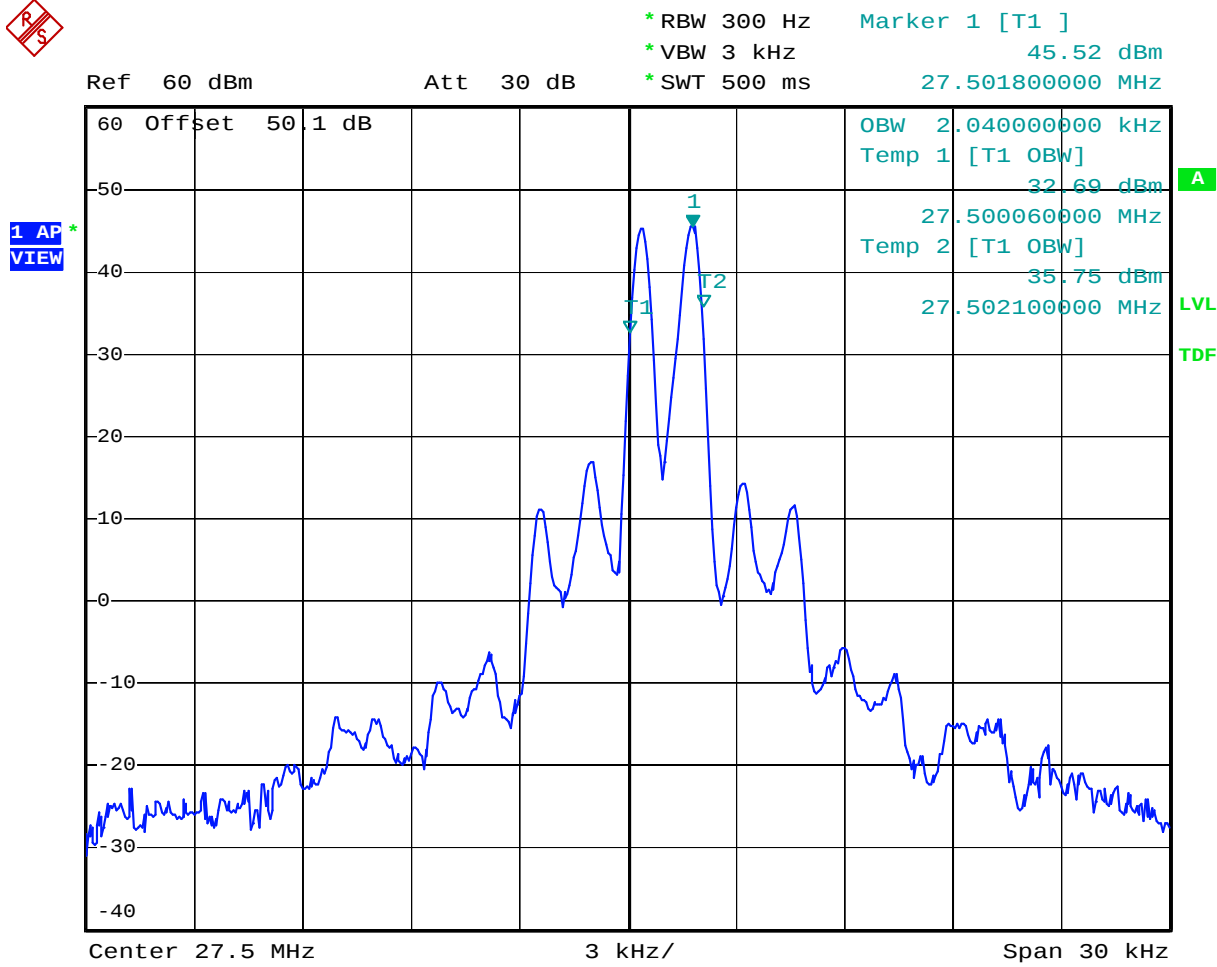
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J3E (USB), 27.5MHz, High power, Modulation: 400+1800Hz

OBW: 2.04 KHz



Date: 1.NOV.2019 14:54:35

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

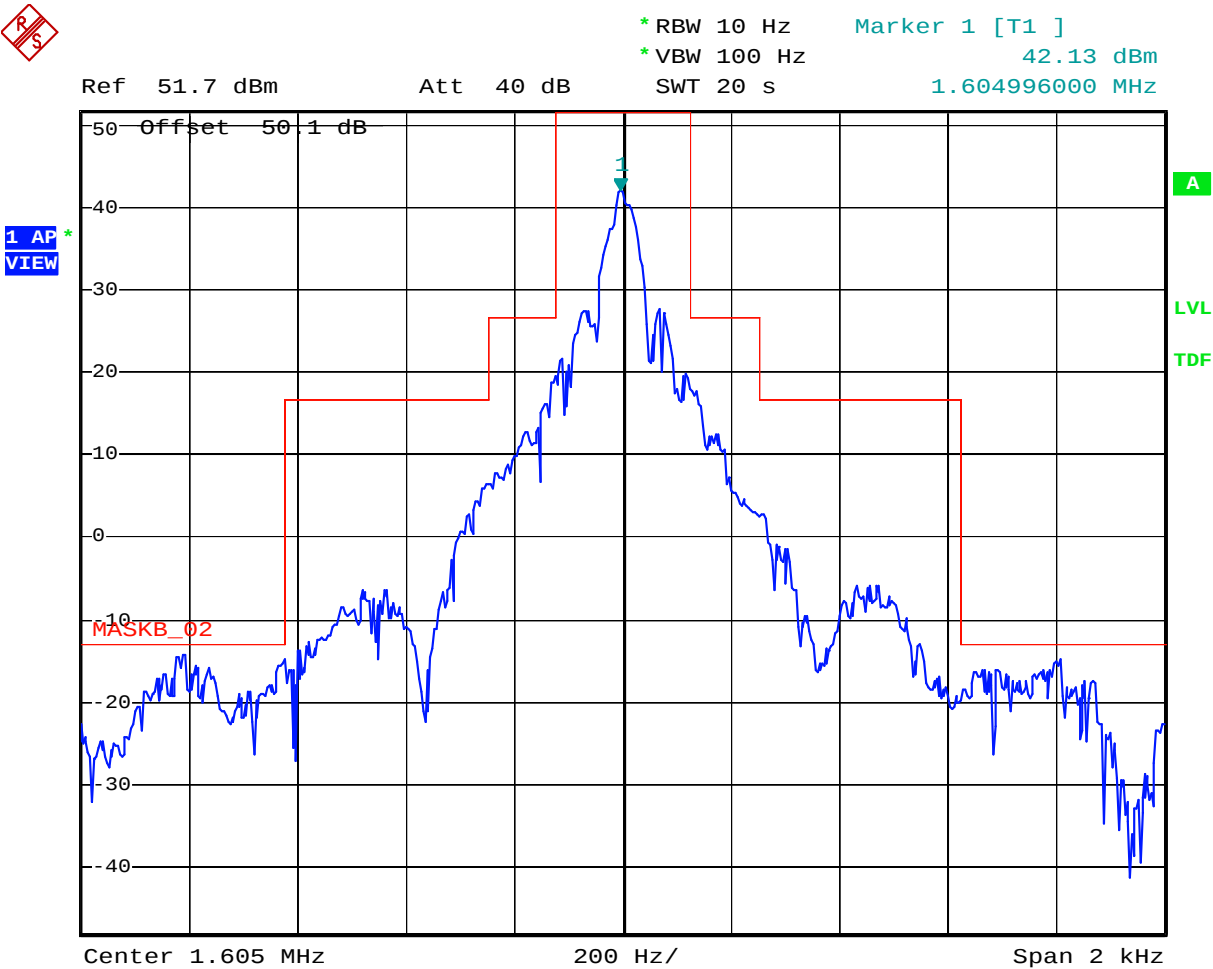
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

MASK FOR A1A
Part 90 Mask B

Configuration: A1A (CW), 1.605MHz, High power, 16 dots/ second



Date: 30.OCT.2019 12:39:24

ULTRATECH GROUP OF LABS

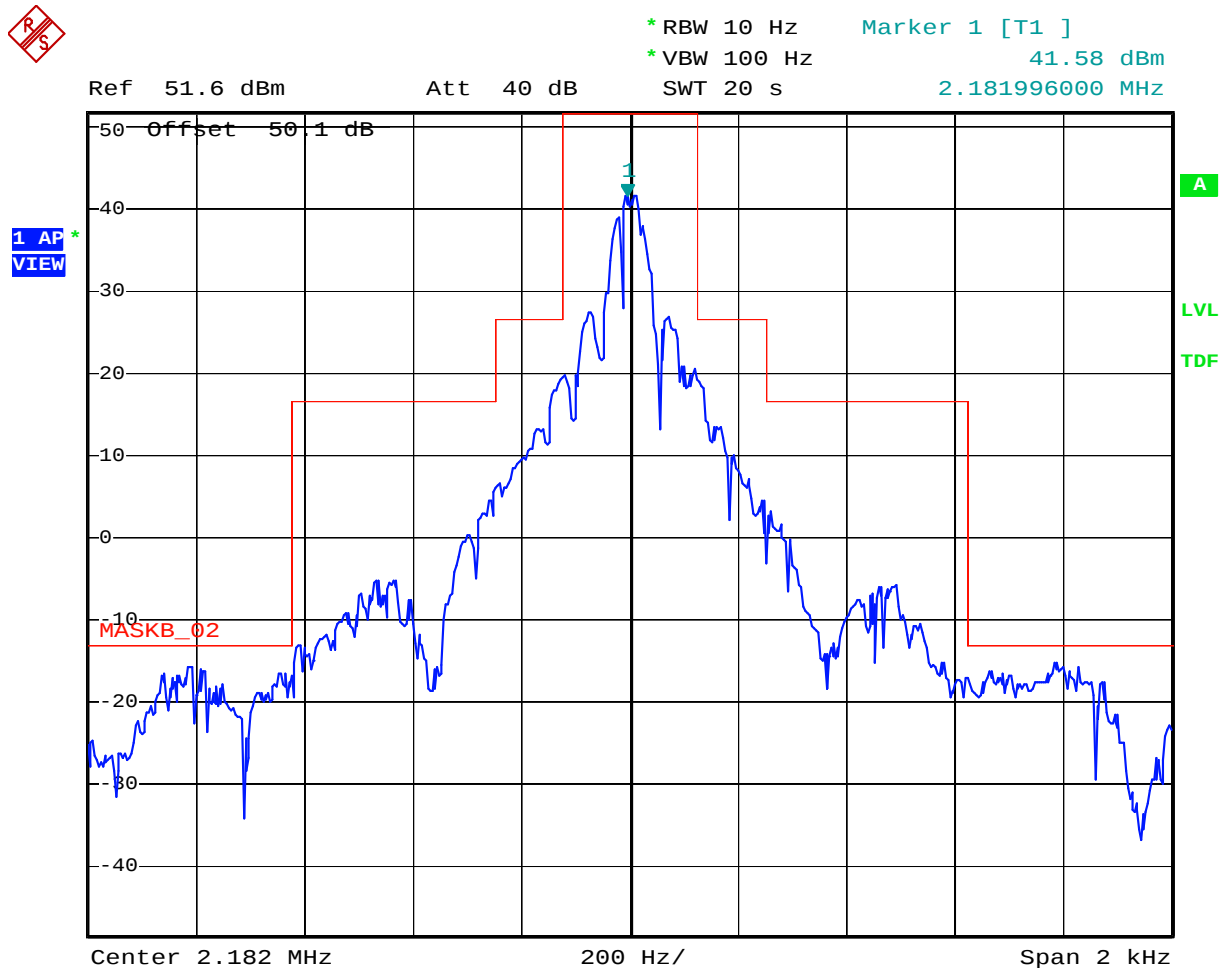
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 2.182MHz, High power, 16 dots/ second



Date: 30.OCT.2019 12:42:21

ULTRATECH GROUP OF LABS

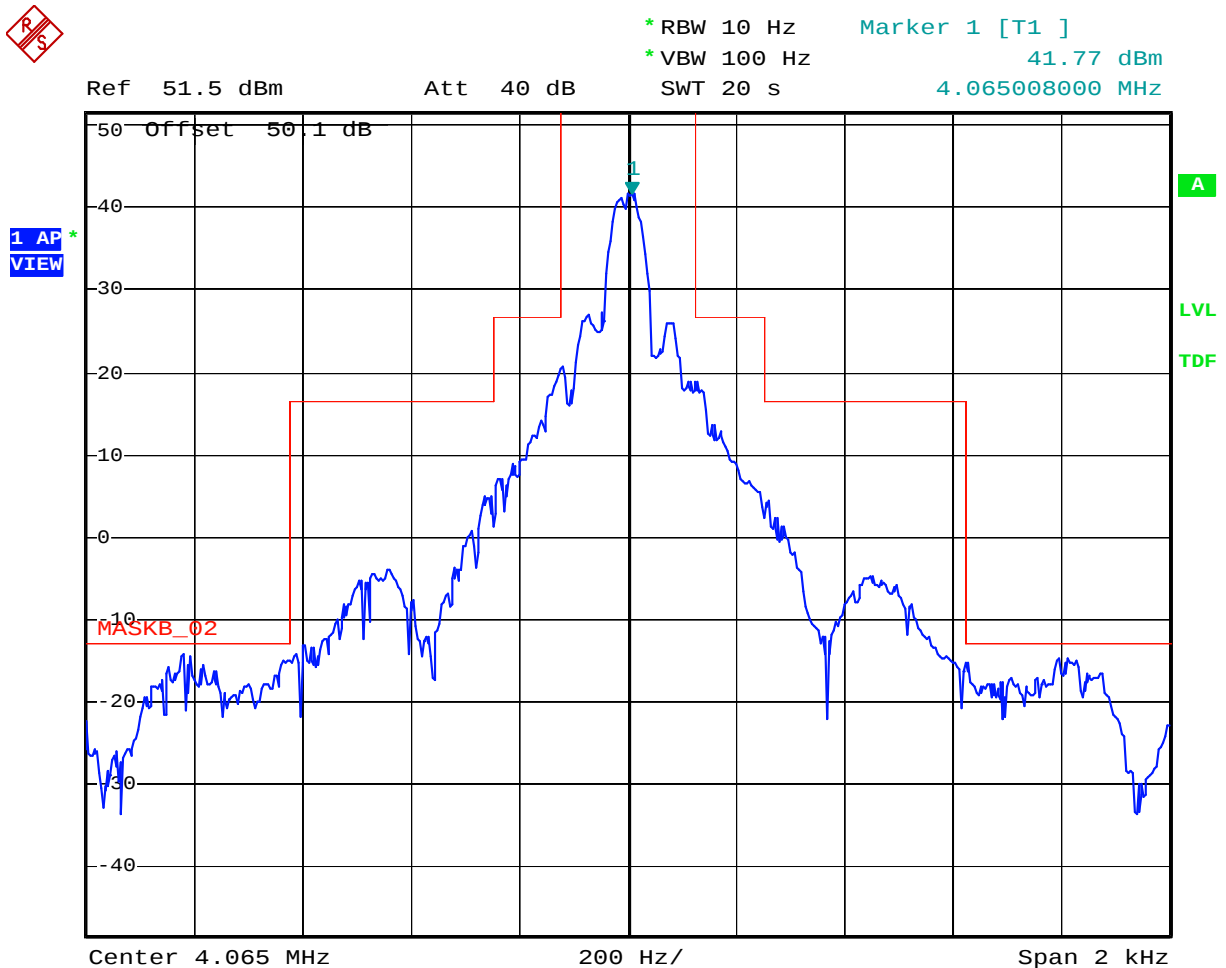
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 4.065MHz, High power, 16 dots/ second



Date: 30.OCT.2019 12:45:10

ULTRATECH GROUP OF LABS

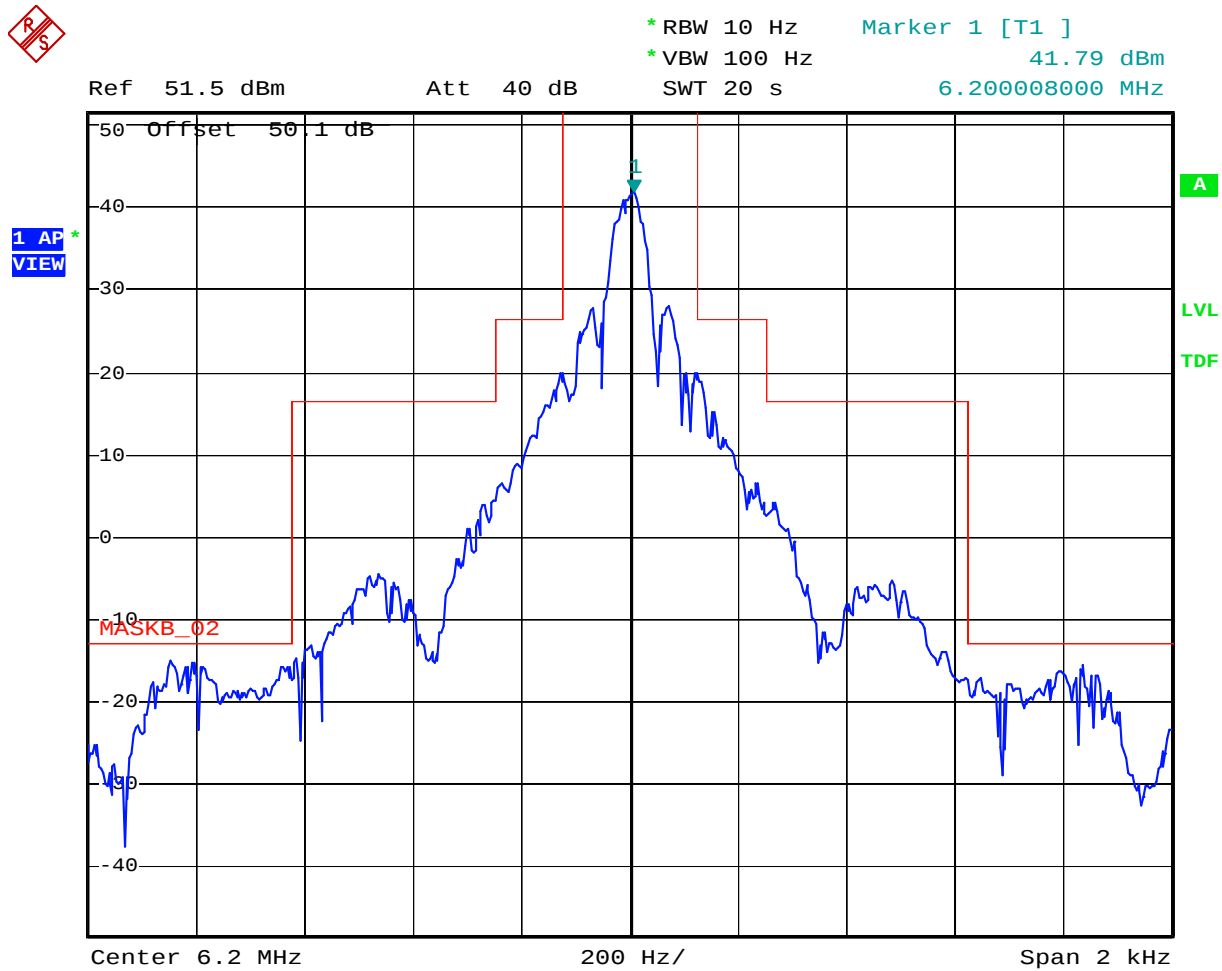
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 6.2MHz, High power, 16 dots/ second



Date: 30.OCT.2019 12:48:04

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 8.195MHz, High power, 16 dots/second



Date: 30.OCT.2019 12:51:02

ULTRATECH GROUP OF LABS

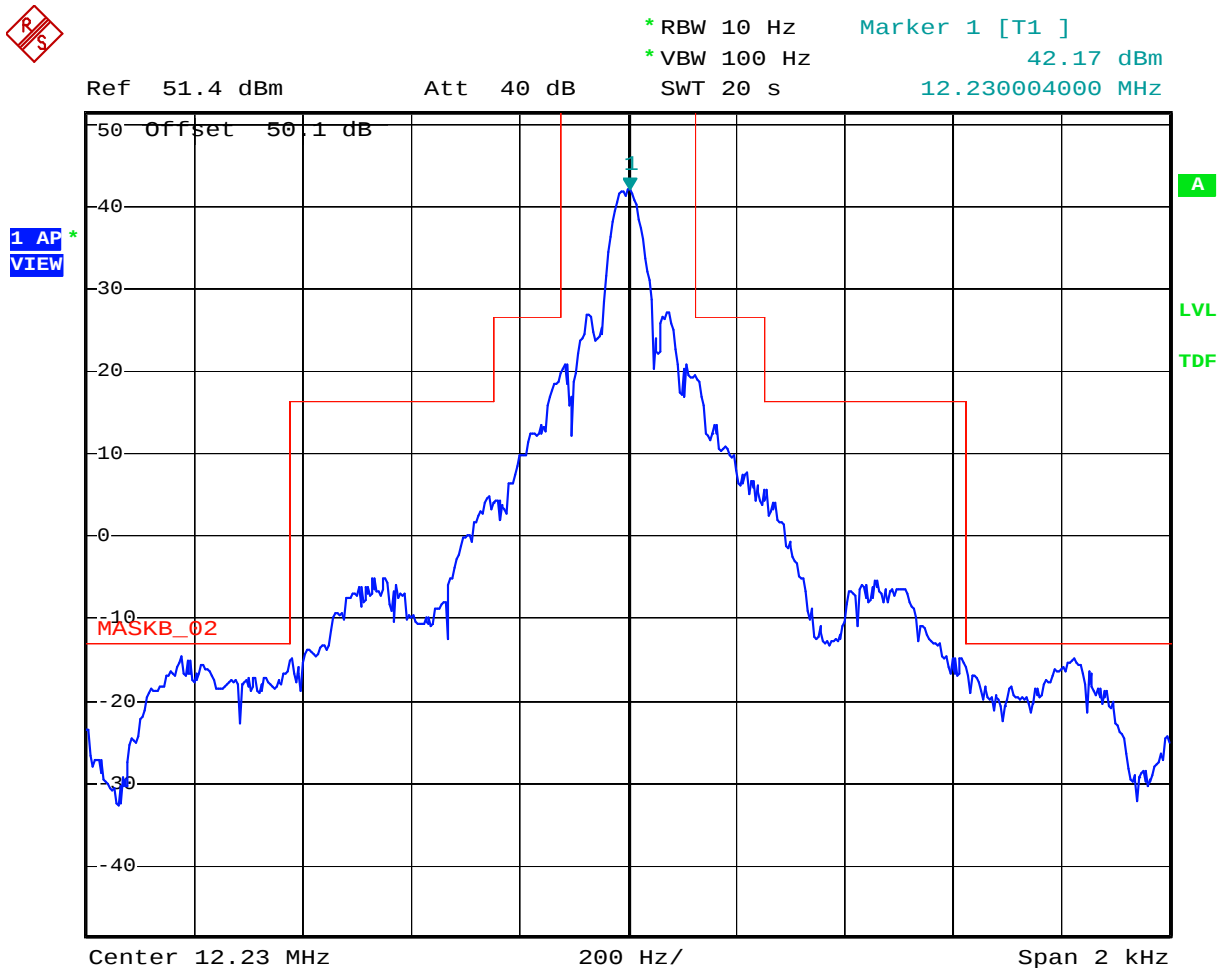
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 12.230MHz, High power, 16 dots/ second



Date: 30.OCT.2019 12:54:21

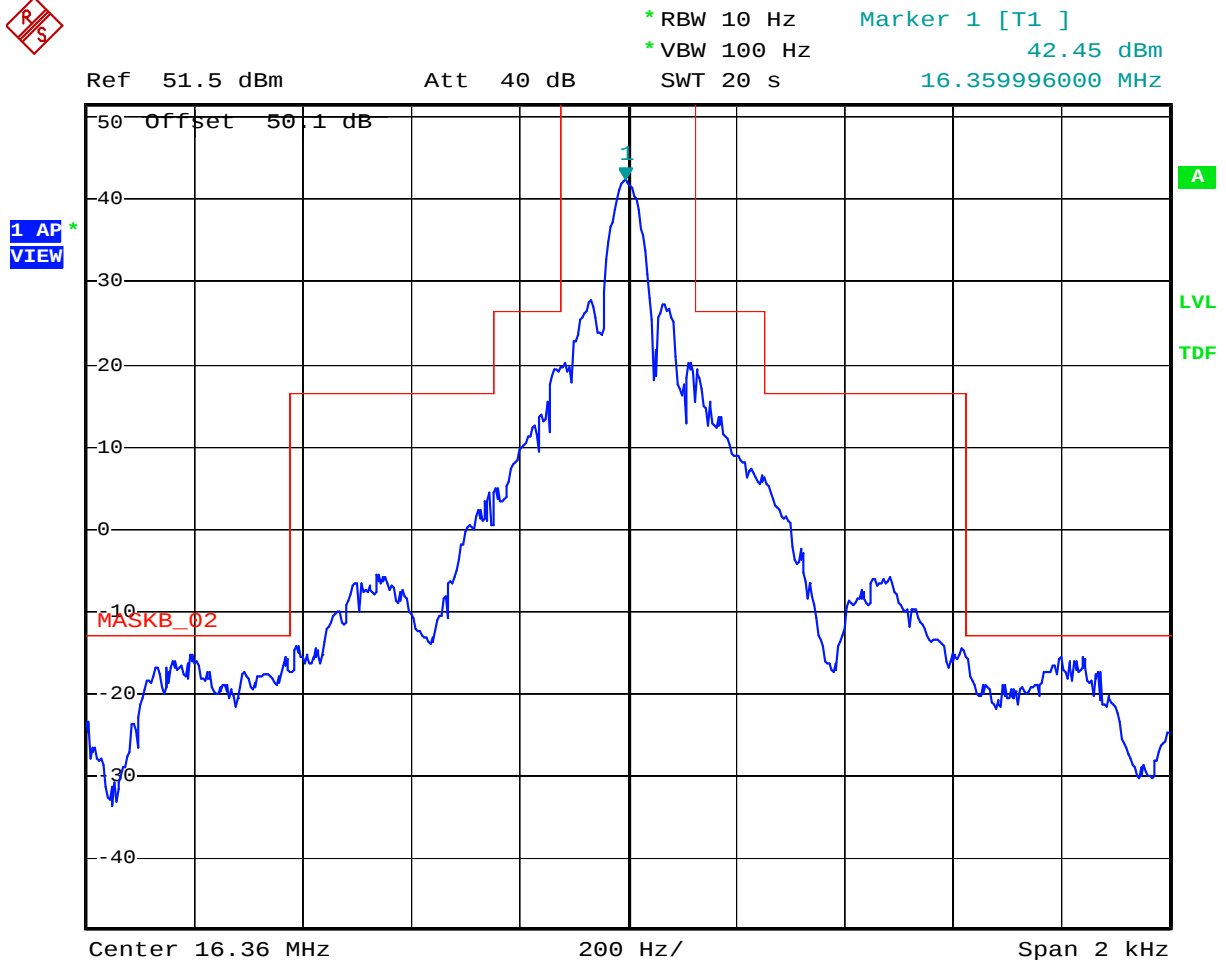
ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 16.360MHz, High power, 16 dots/ second



Date: 30.OCT.2019 12:58:49

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 18.780MHz, High power, 16 dots/ second



Date: 30.OCT.2019 13:02:13

ULTRATECH GROUP OF LABS

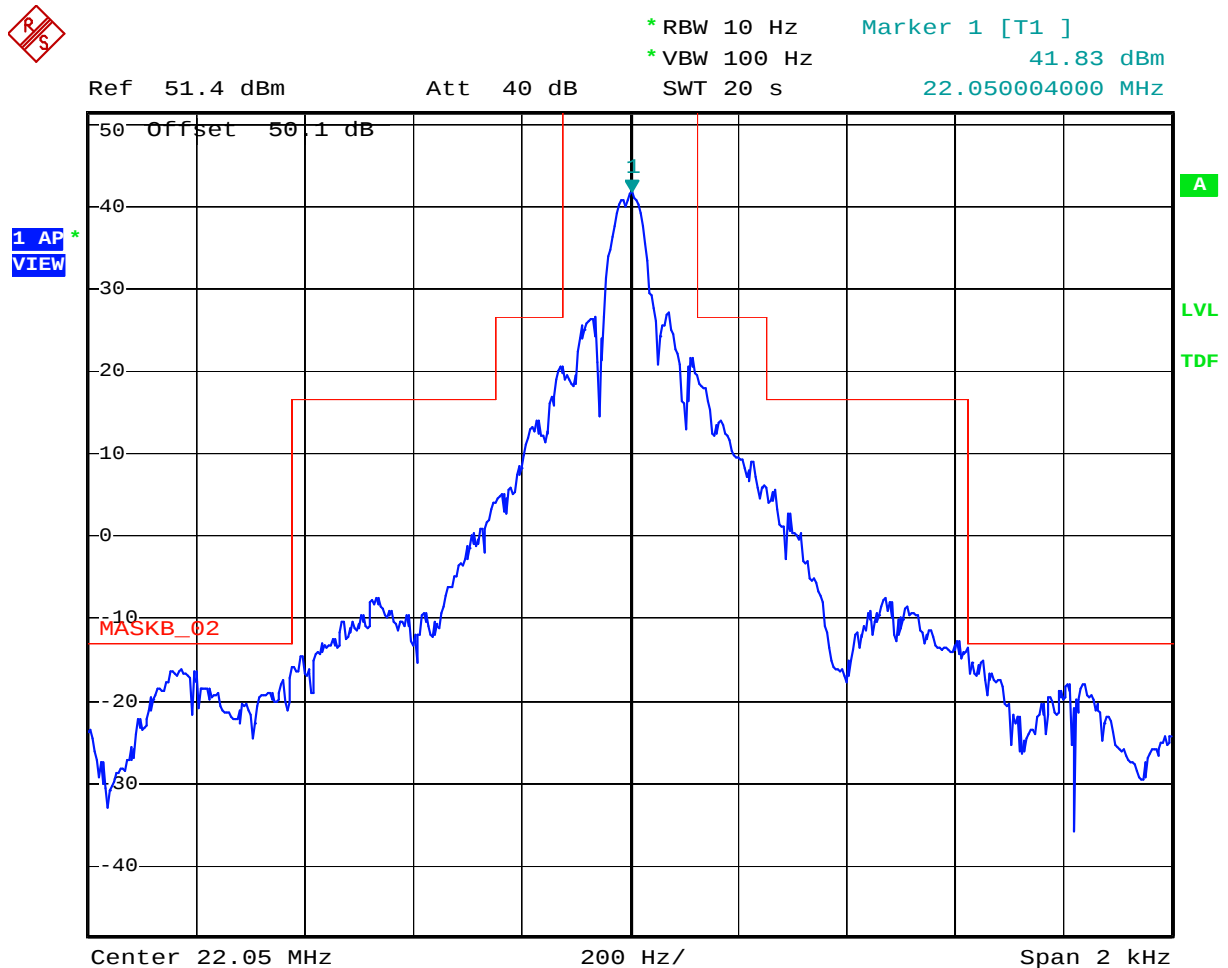
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 22.050MHz, High power, 16 dots/ second



Date: 30.OCT.2019 13:05:11

ULTRATECH GROUP OF LABS

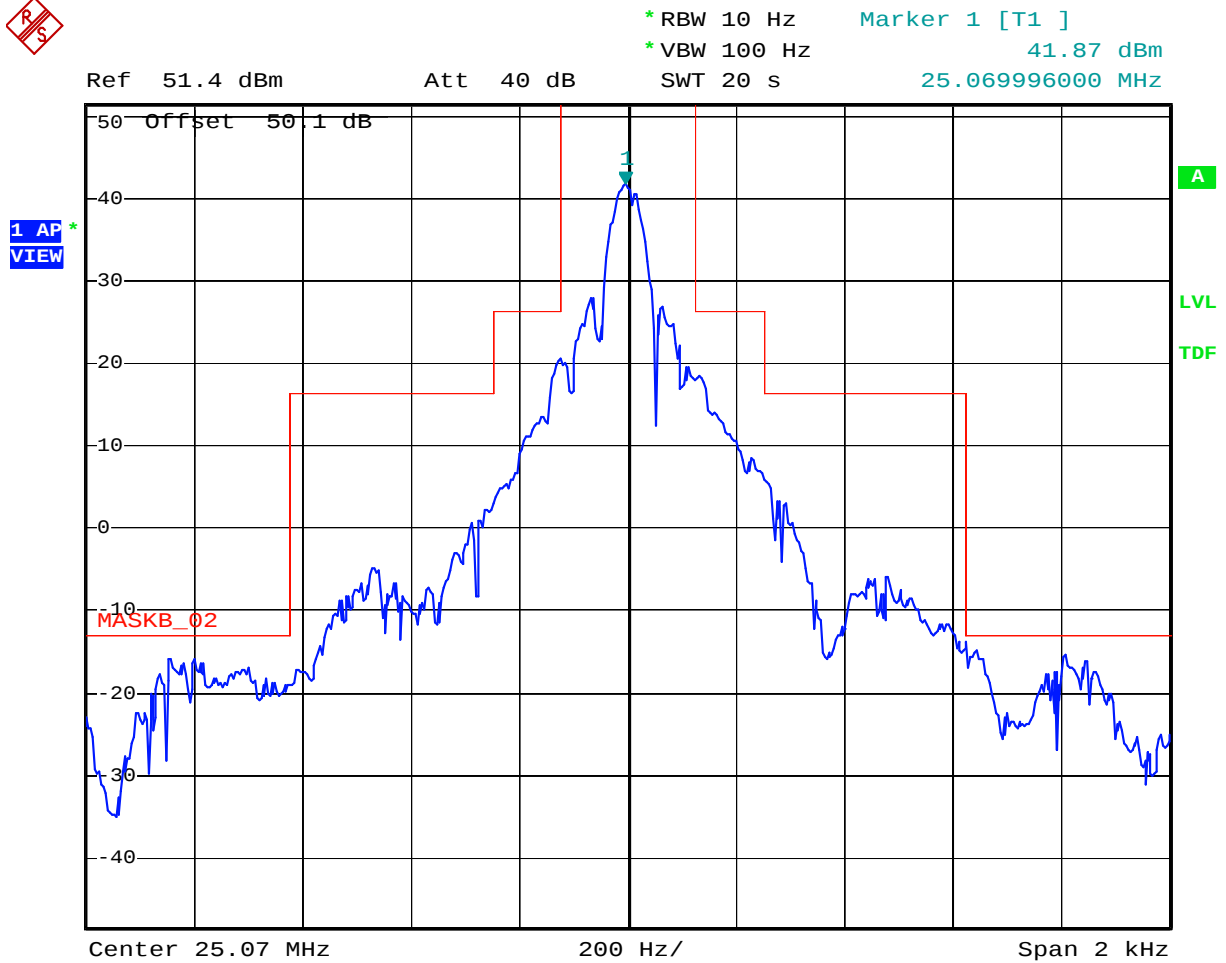
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 25.070MHz, High power, 16 dots/ second



Date: 30.OCT.2019 13:12:48

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)



Ref 51.2 dBm Att 40 dB SWT 20 s 27.500004000 MHz

Offset 50 1 dB

MASKB_02

Center 27.5 MHz 200 Hz/ Span 2 kHz

Date: 30.OCT.2019 13:16:35

Low Power

Configuration: A1A (CW), 1.605MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 13:19:59

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 2.182MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 13:22:49

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 4.065MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 13:25:33

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 6.2MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 13:28:53

ULTRATECH GROUP OF LABS

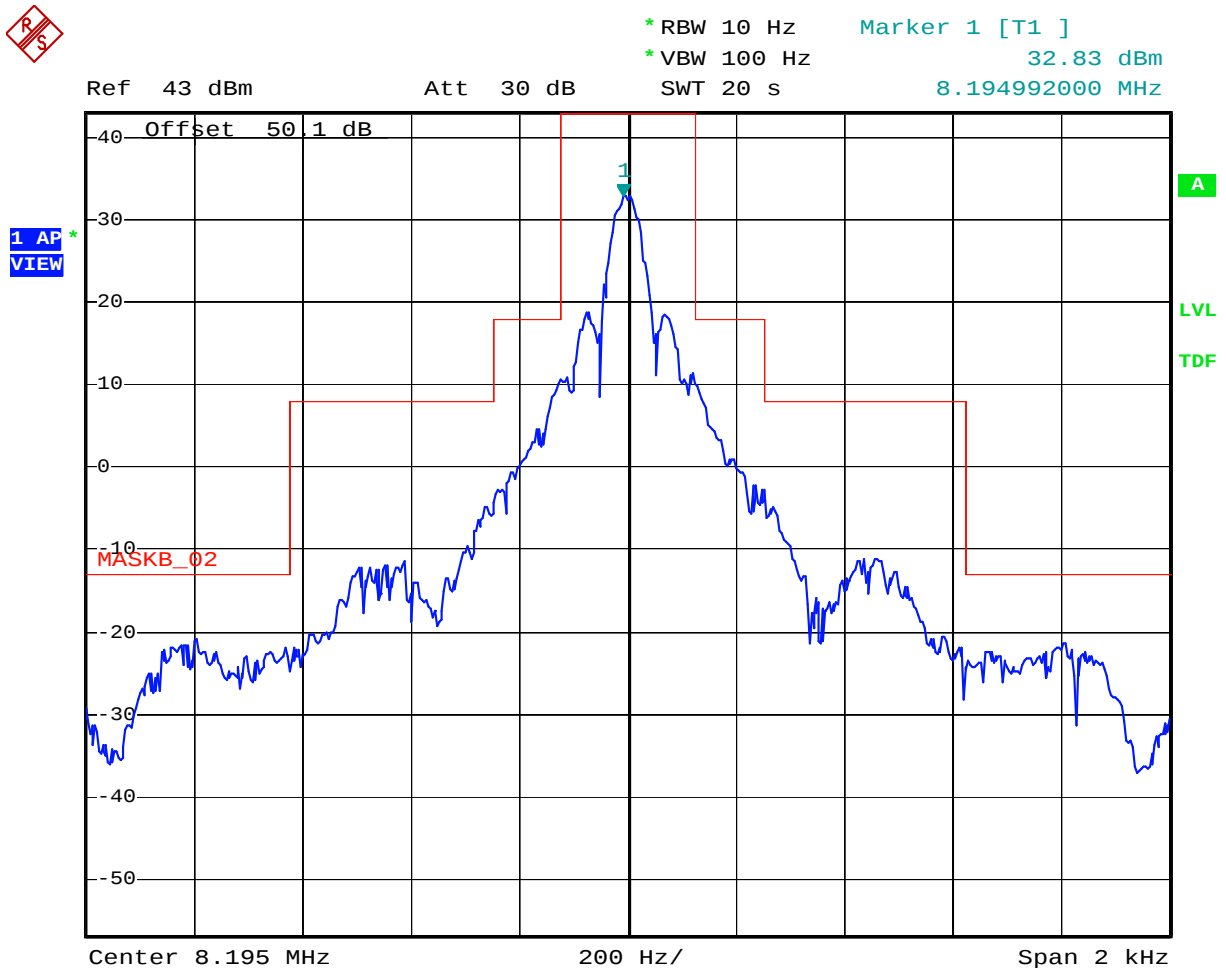
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 8.195MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 13:32:05

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 12.230MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 13:35:09

ULTRATECH GROUP OF LABS

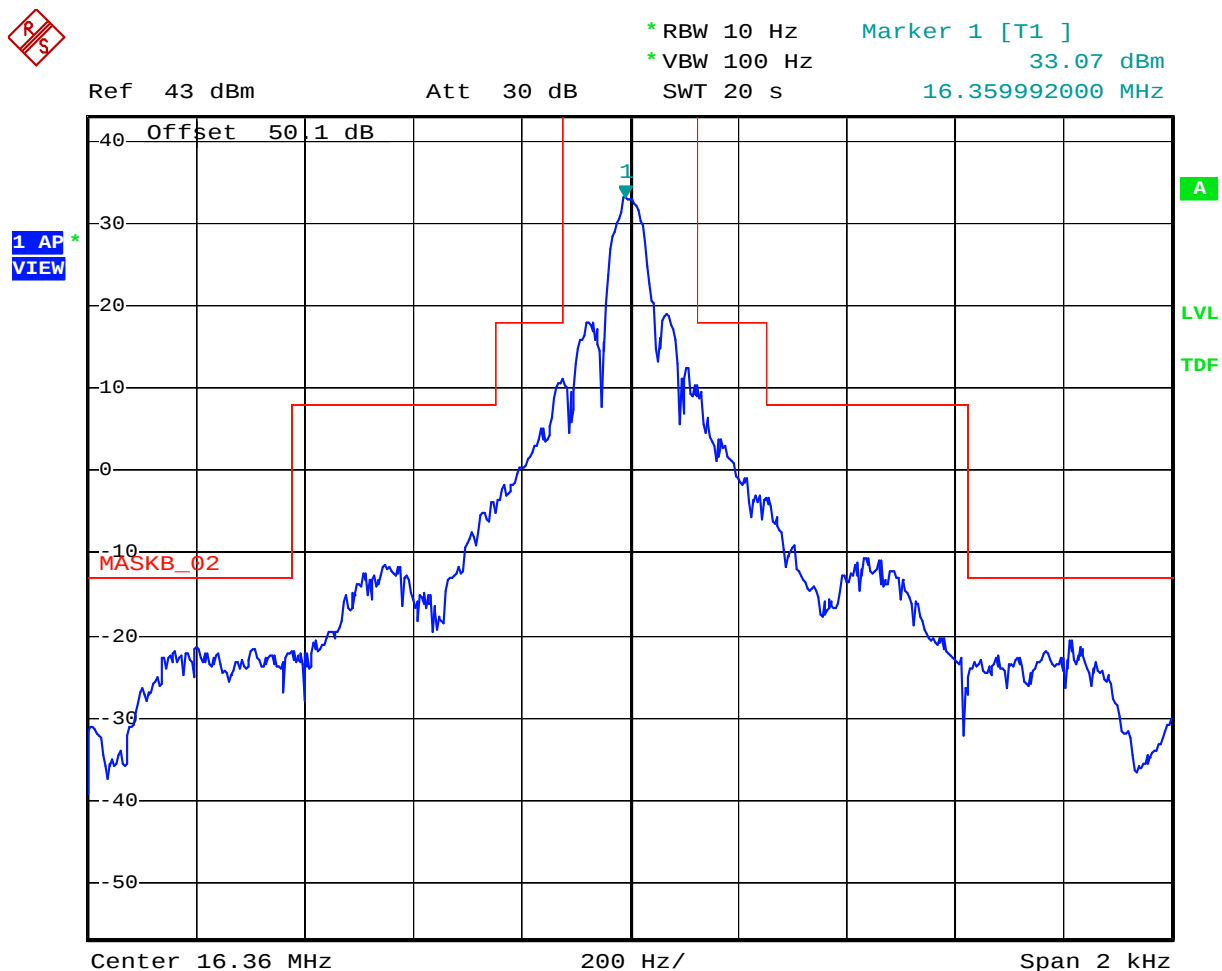
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 16.360MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 13:37:57

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 18.780MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 13:40:44

ULTRATECH GROUP OF LABS

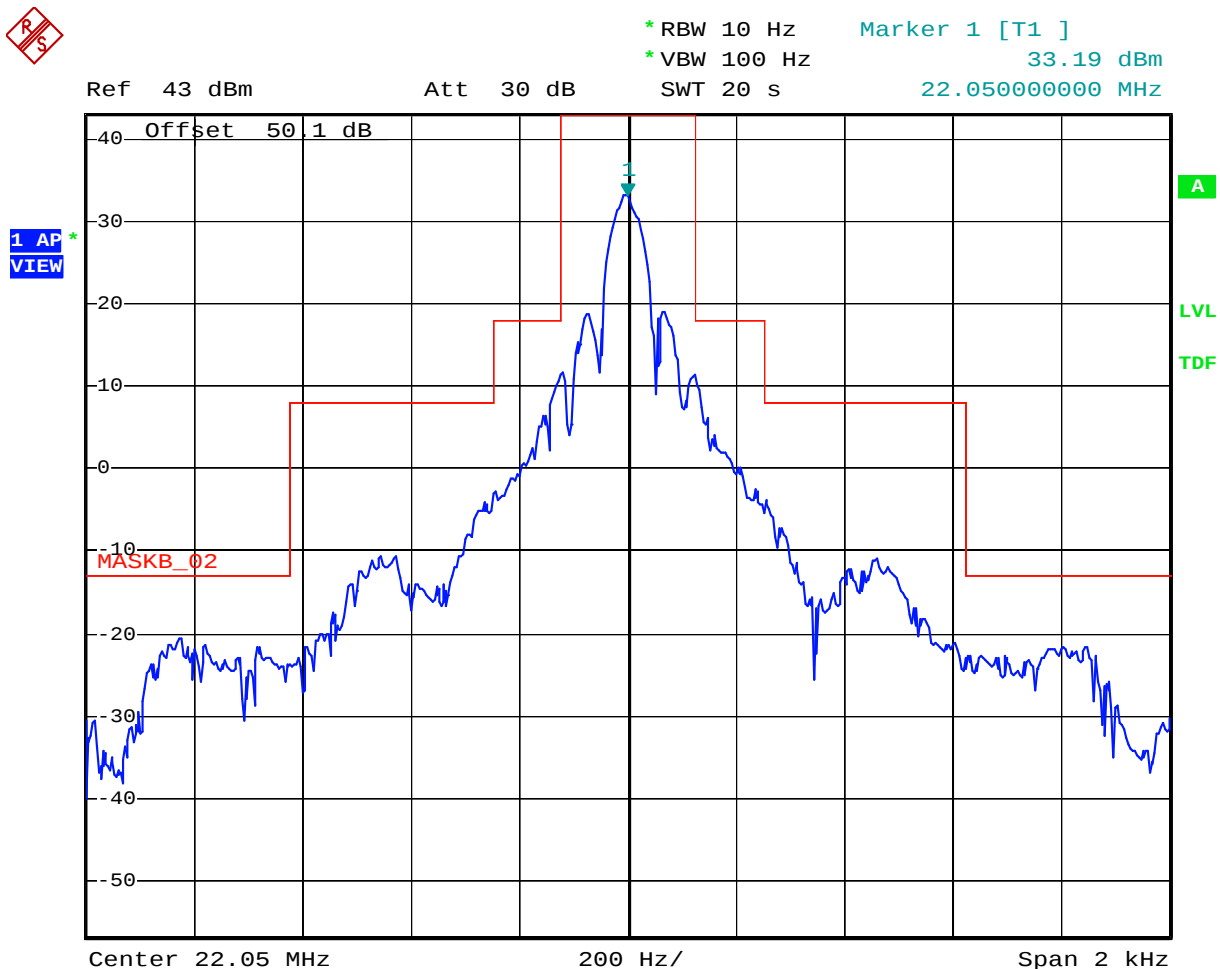
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 22.050MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 13:46:31

ULTRATECH GROUP OF LABS

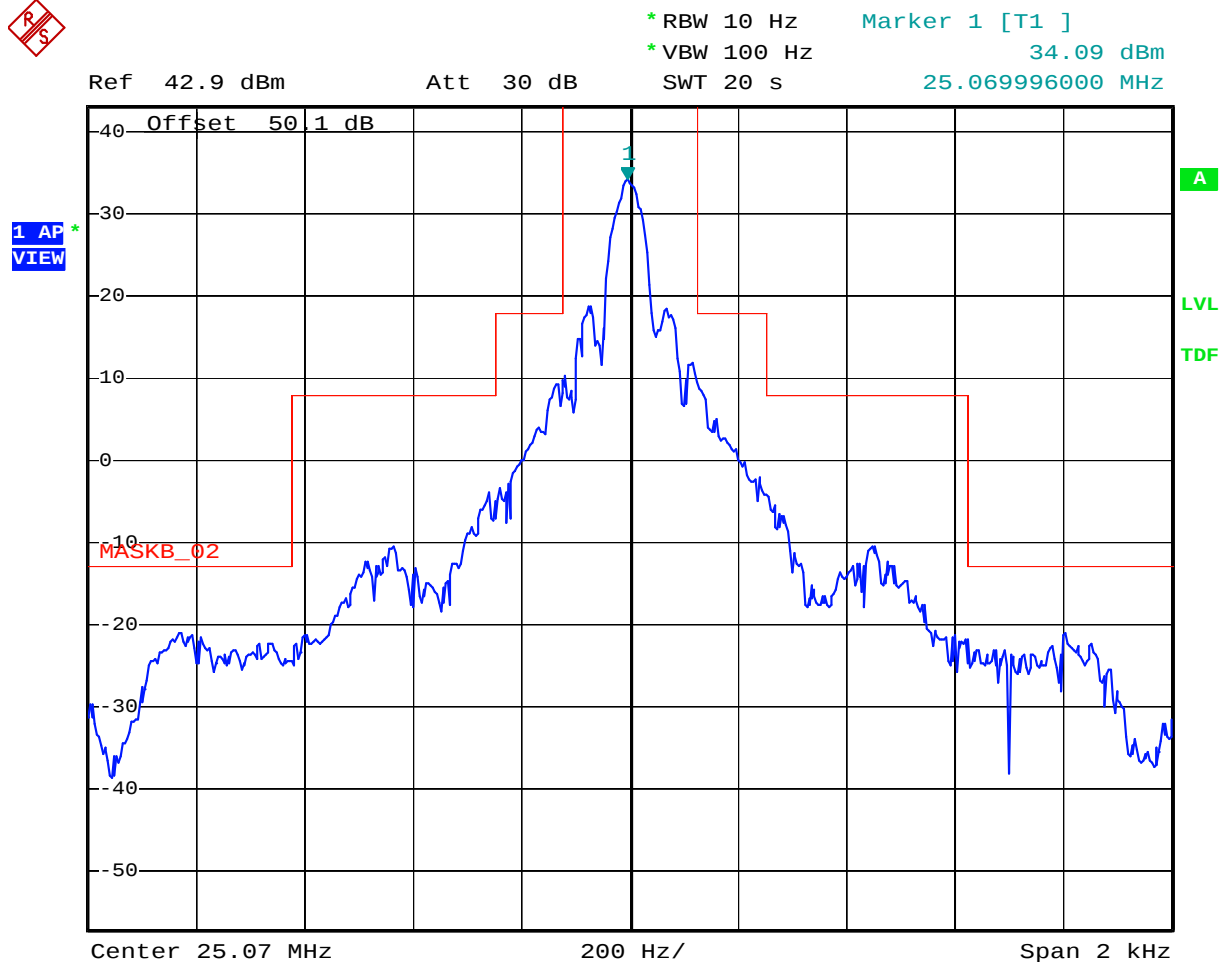
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 25.070MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 13:49:23

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 27.5MHz, Low power, 16 dots/second



Date: 30.OCT.2019 13:53:17

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

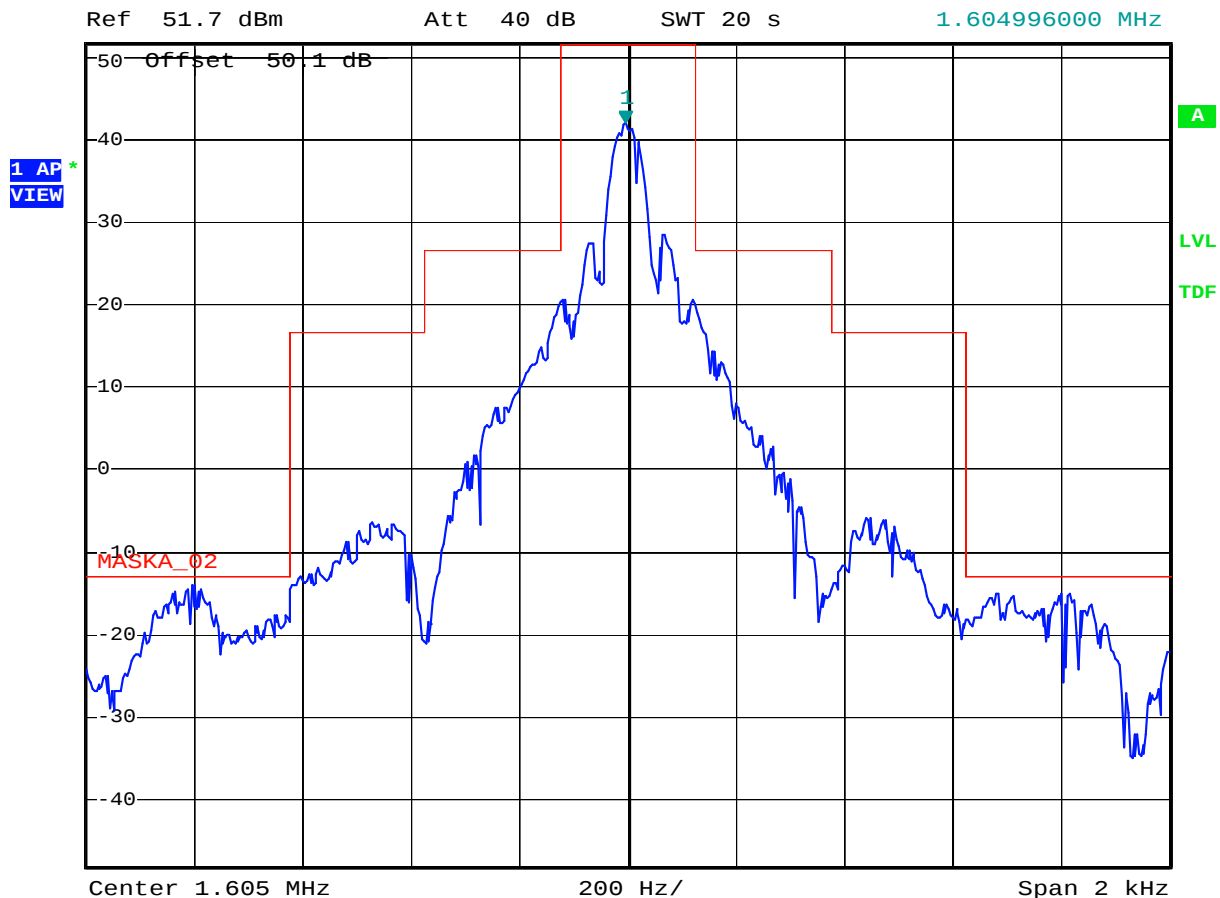
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Part 80

Configuration: A1A (CW), 1.605MHz, High power, 16 dots/ second



* RBW 10 Hz Marker 1 [T1]
* VBW 100 Hz 42.02 dBm
SWT 20 s 1.604996000 MHz



Date: 30.OCT.2019 10:21:36

ULTRATECH GROUP OF LABS

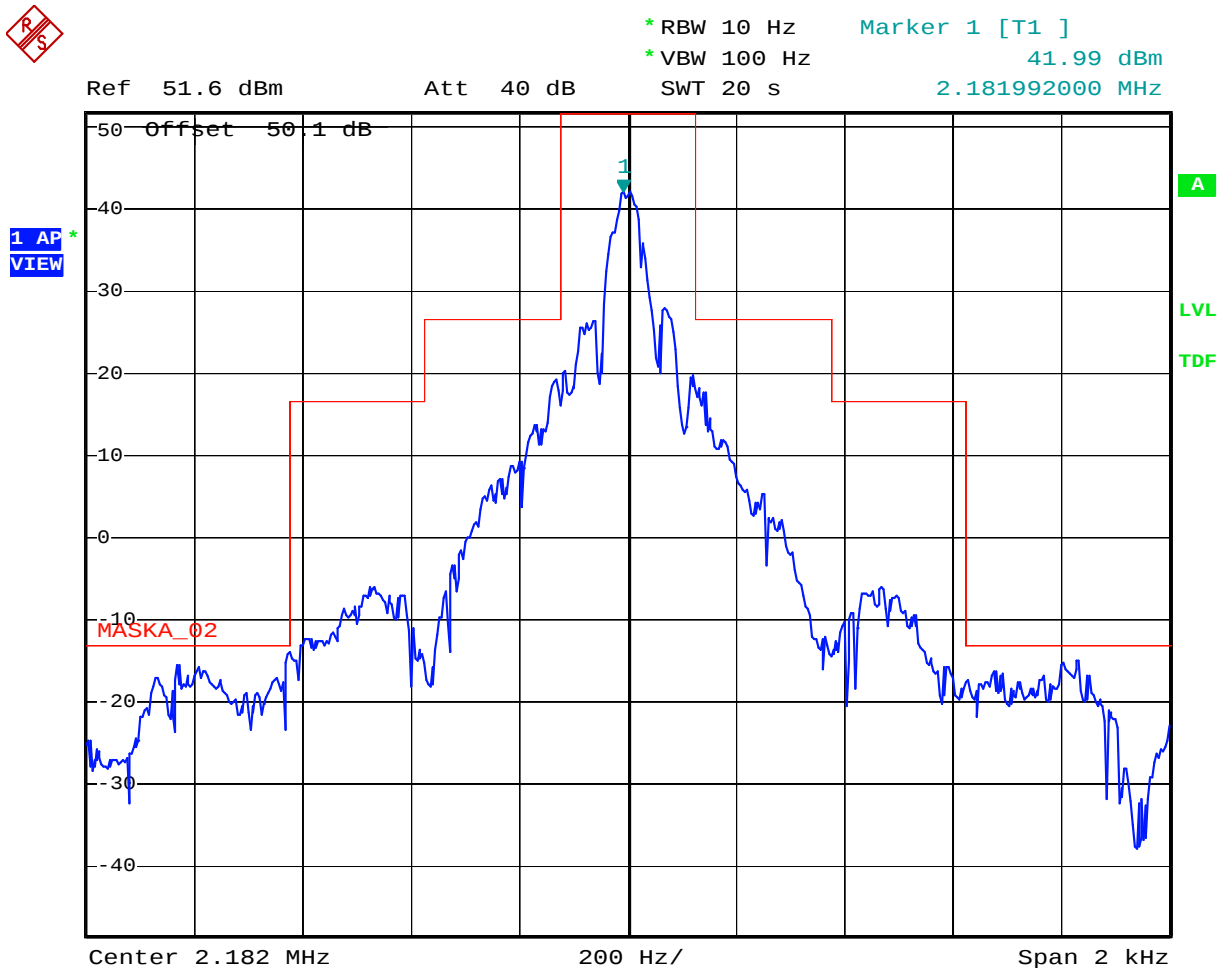
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 2.182MHz, High power, 16 dots/second



Date: 30.OCT.2019 10:27:00

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 4.065MHz, High power, 16 dots/ second



Date: 30.OCT.2019 10:30:17

ULTRATECH GROUP OF LABS

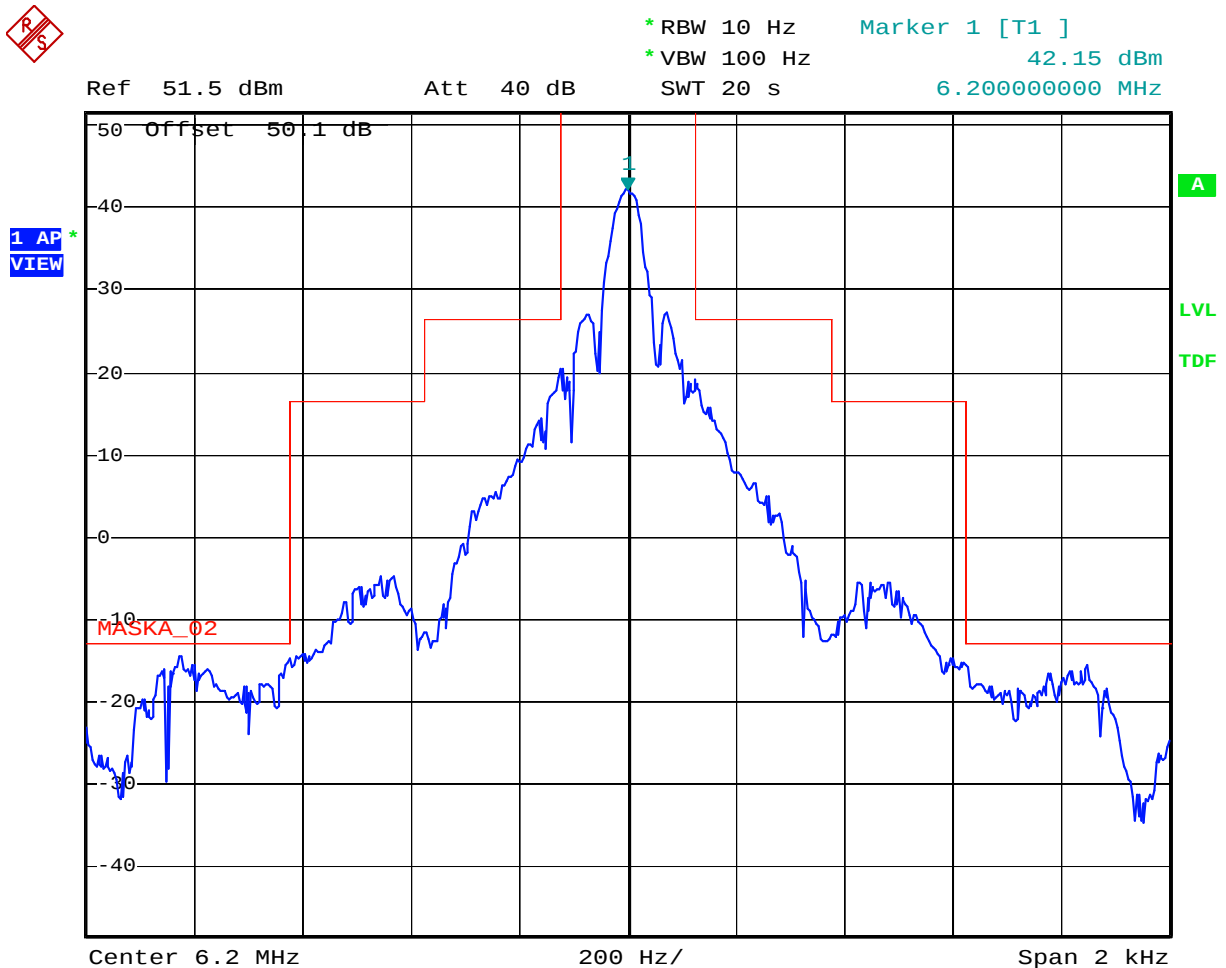
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 6.2MHz, High power, 16 dots/ second



Date: 30.OCT.2019 10:36:20

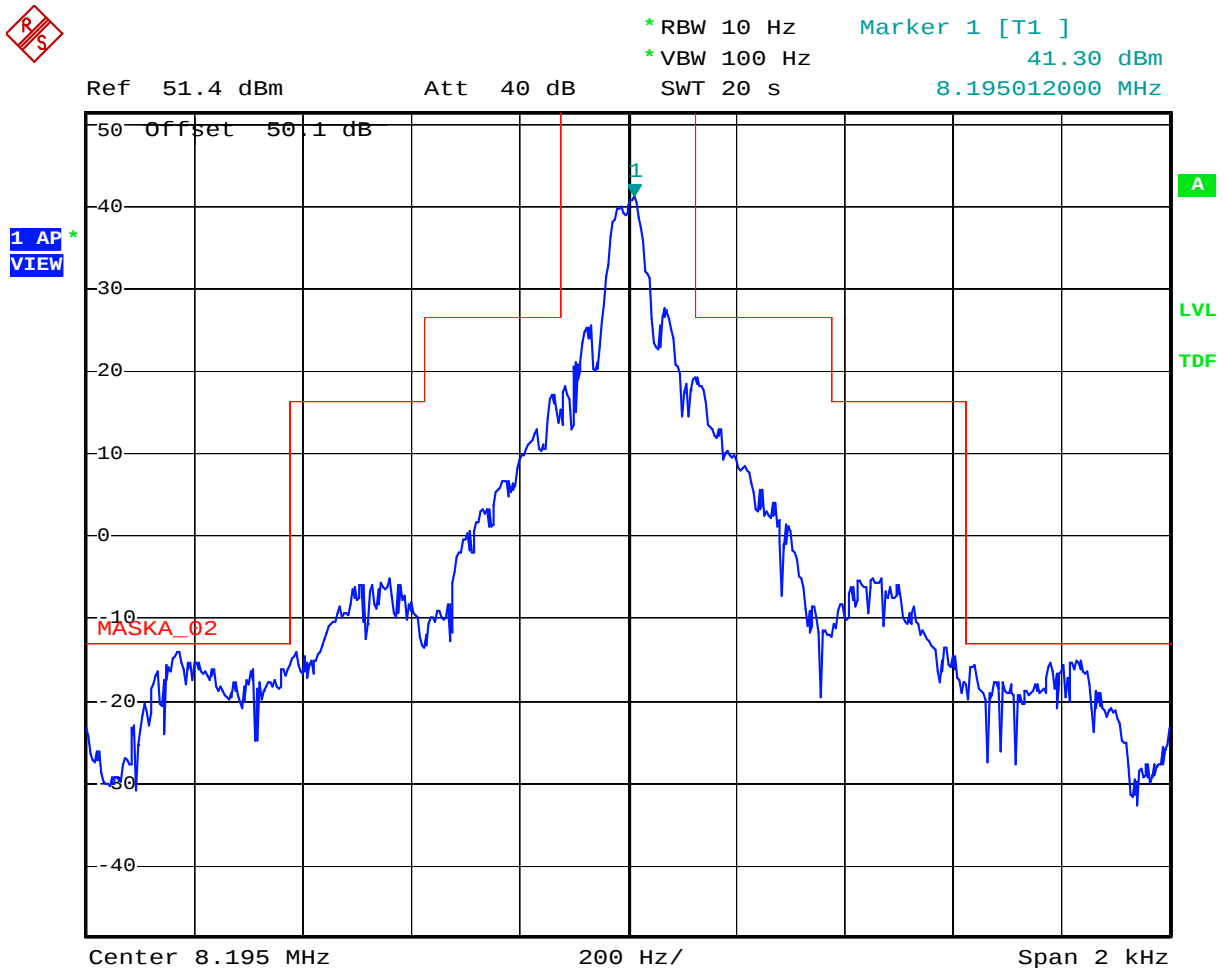
ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 8.195MHz, High power, 16 dots/second



Date: 30.OCT.2019 10:39:12

ULTRATECH GROUP OF LABS

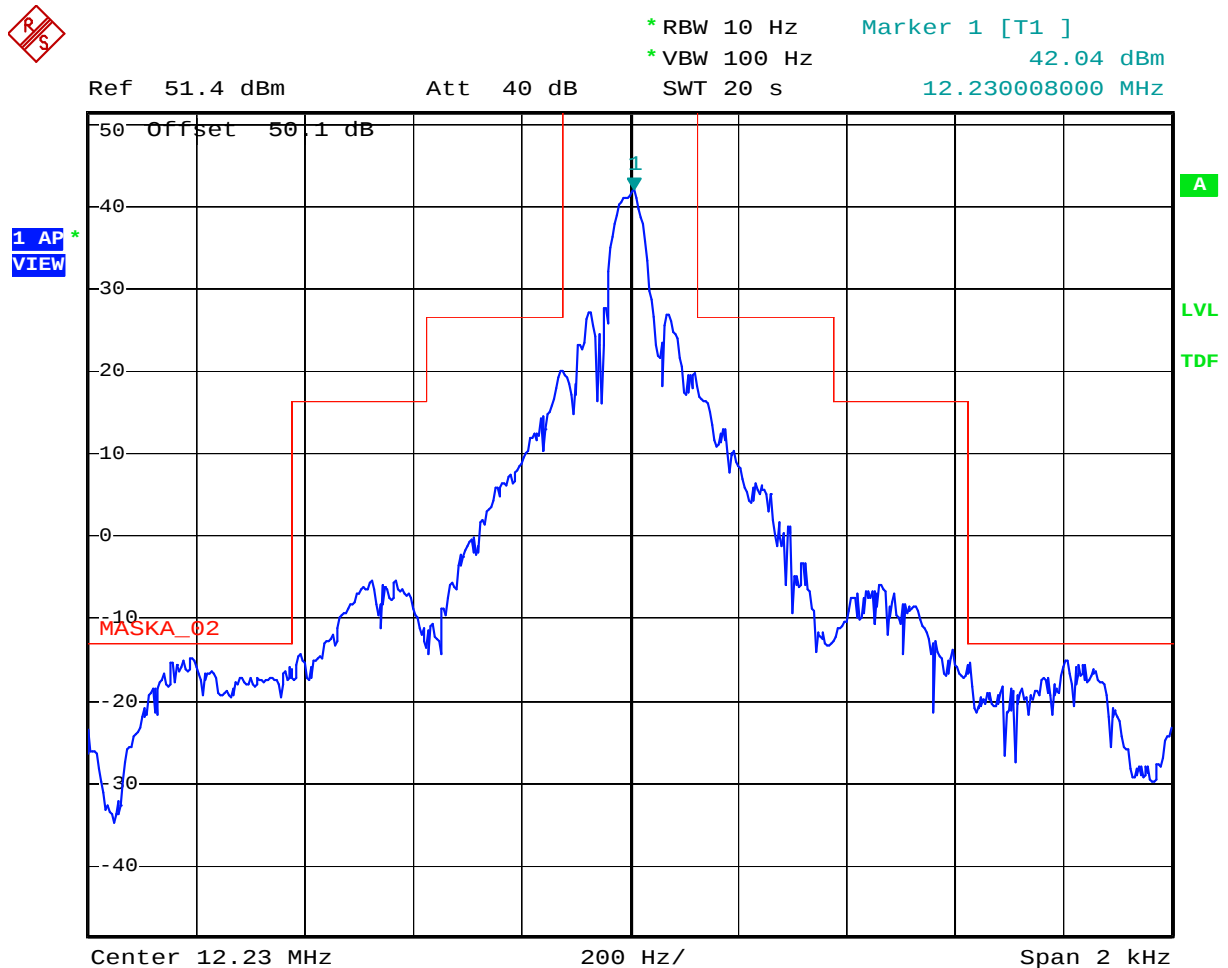
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 12.230MHz, High power, 16 dots/ second



Date: 30.OCT.2019 10:41:52

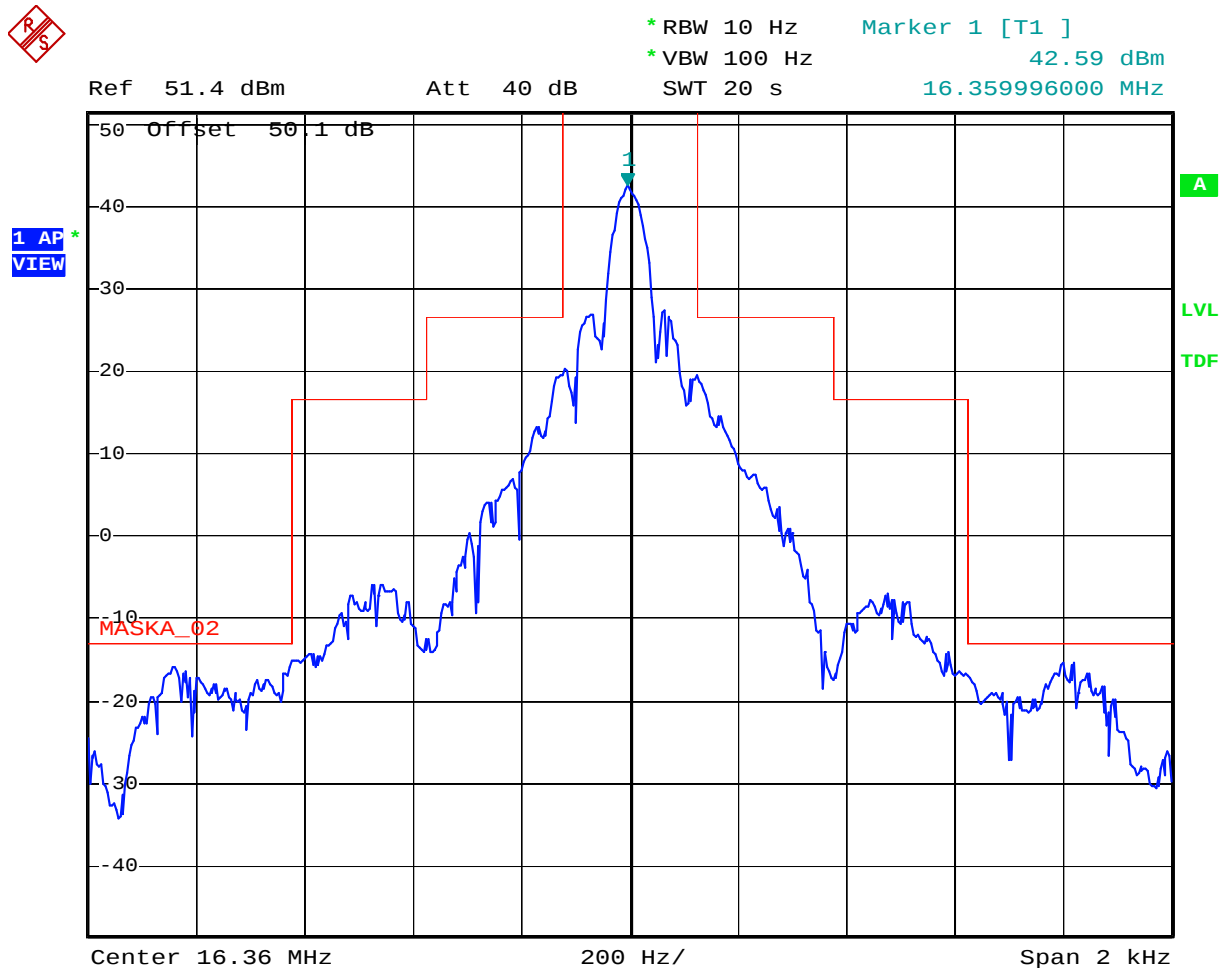
ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 16.360MHz, High power, 16 dots/ second



Date: 30.OCT.2019 10:44:50

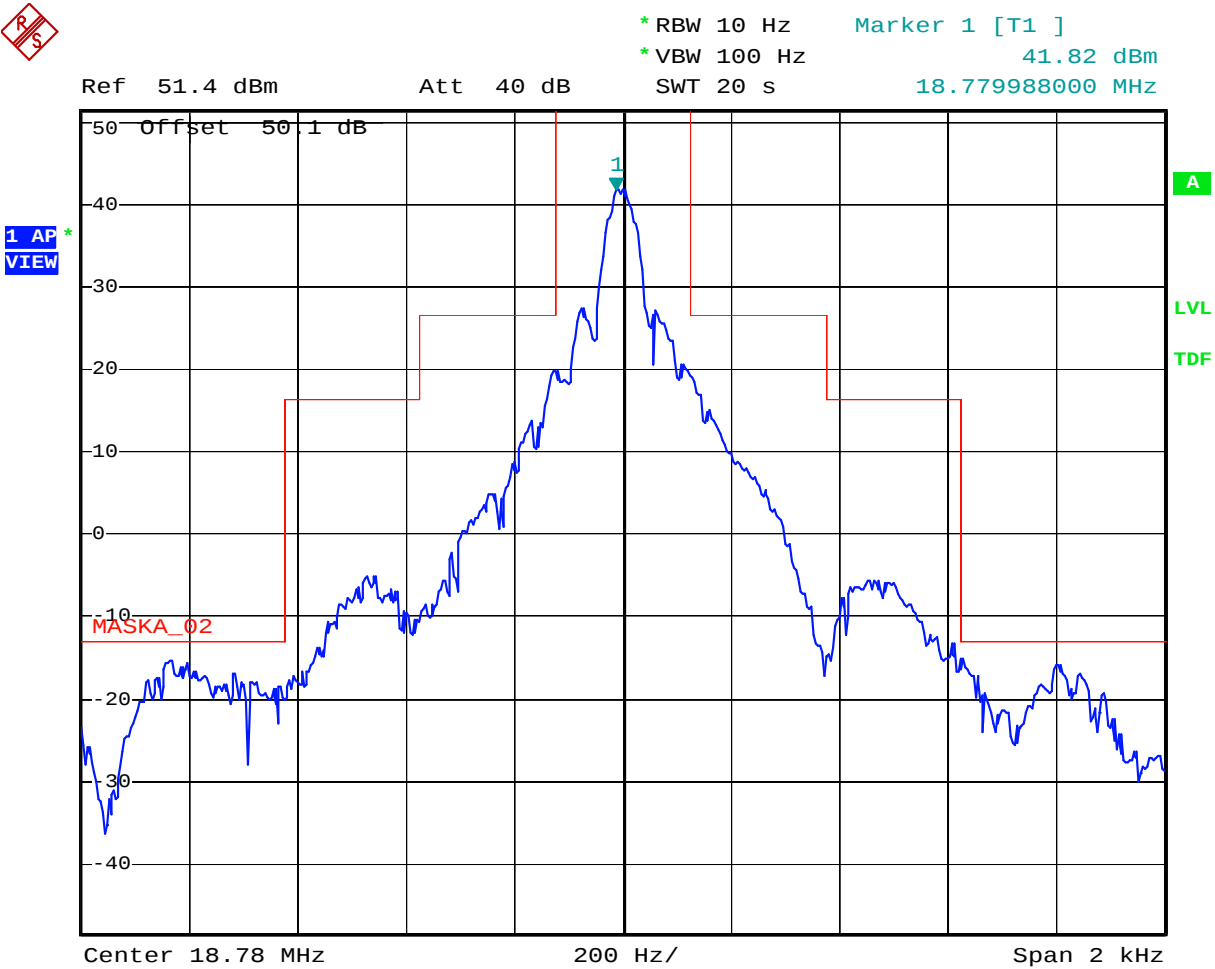
ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 18.780MHz, High power, 16 dots/ second



Date: 30.OCT.2019 10:48:01

ULTRATECH GROUP OF LABS

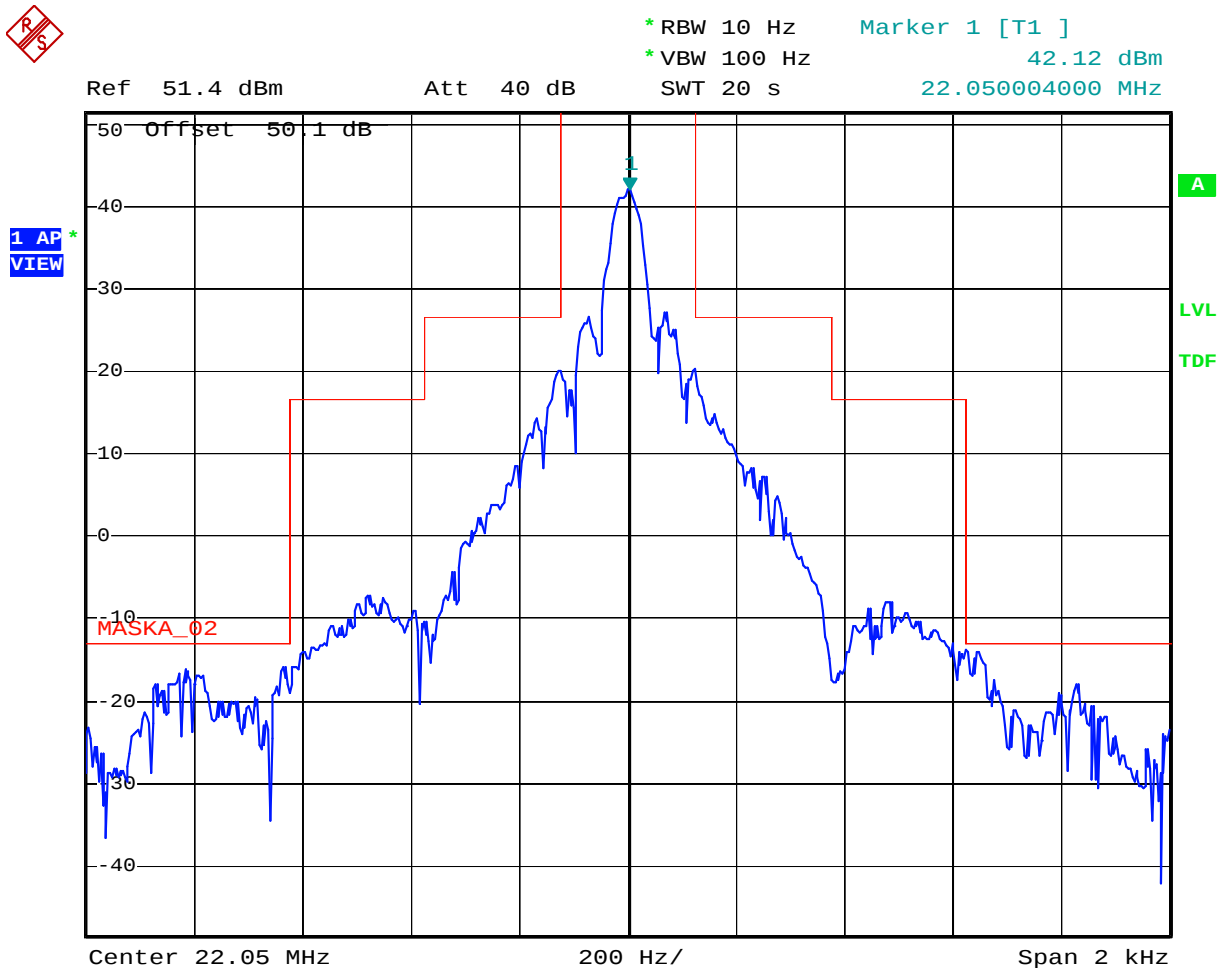
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 22.050MHz, High power, 16 dots/ second



Date: 30.OCT.2019 10:50:30

ULTRATECH GROUP OF LABS

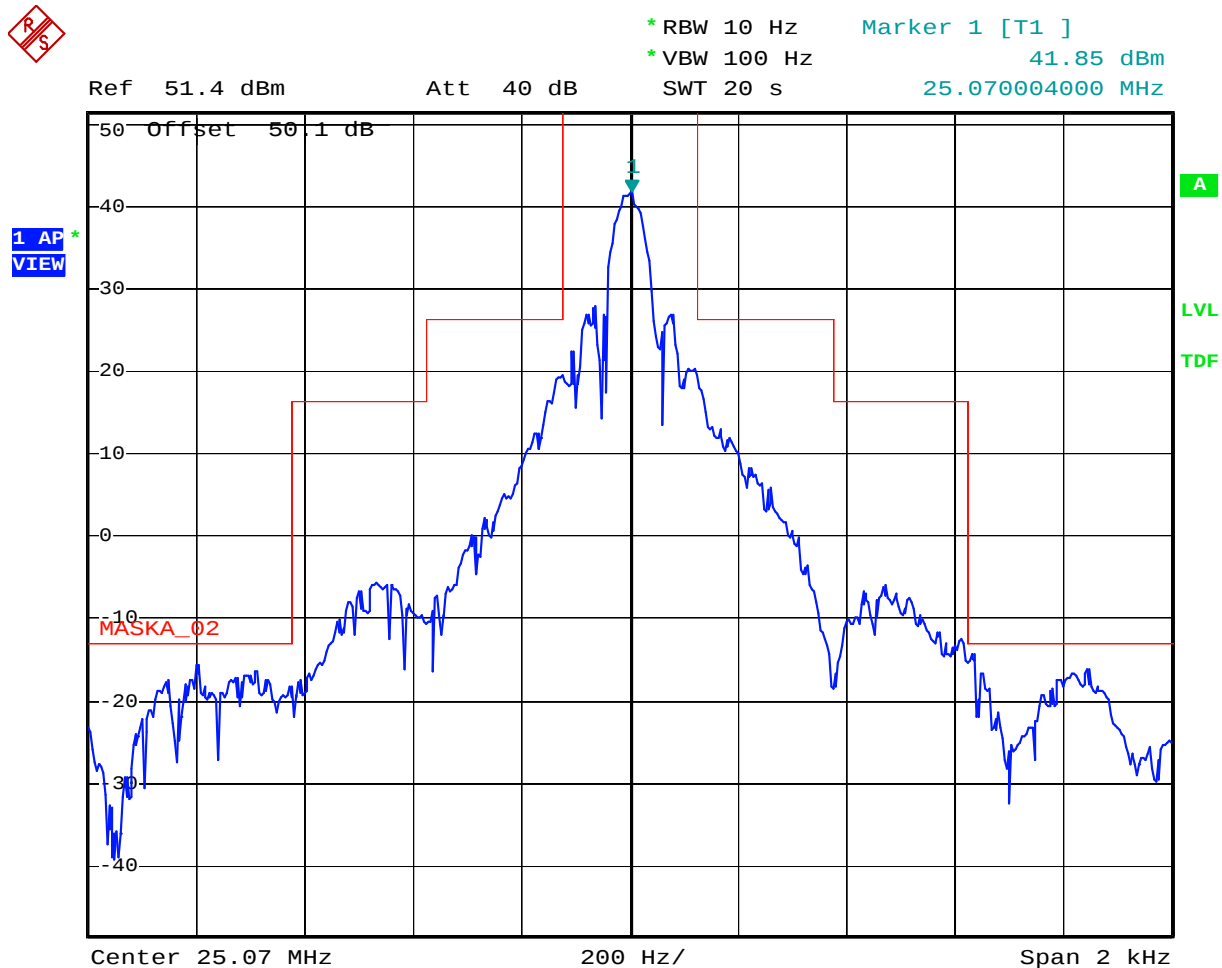
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 25.070MHz, High power, 16 dots/ second



Date: 30.OCT.2019 10:53:01

ULTRATECH GROUP OF LABS

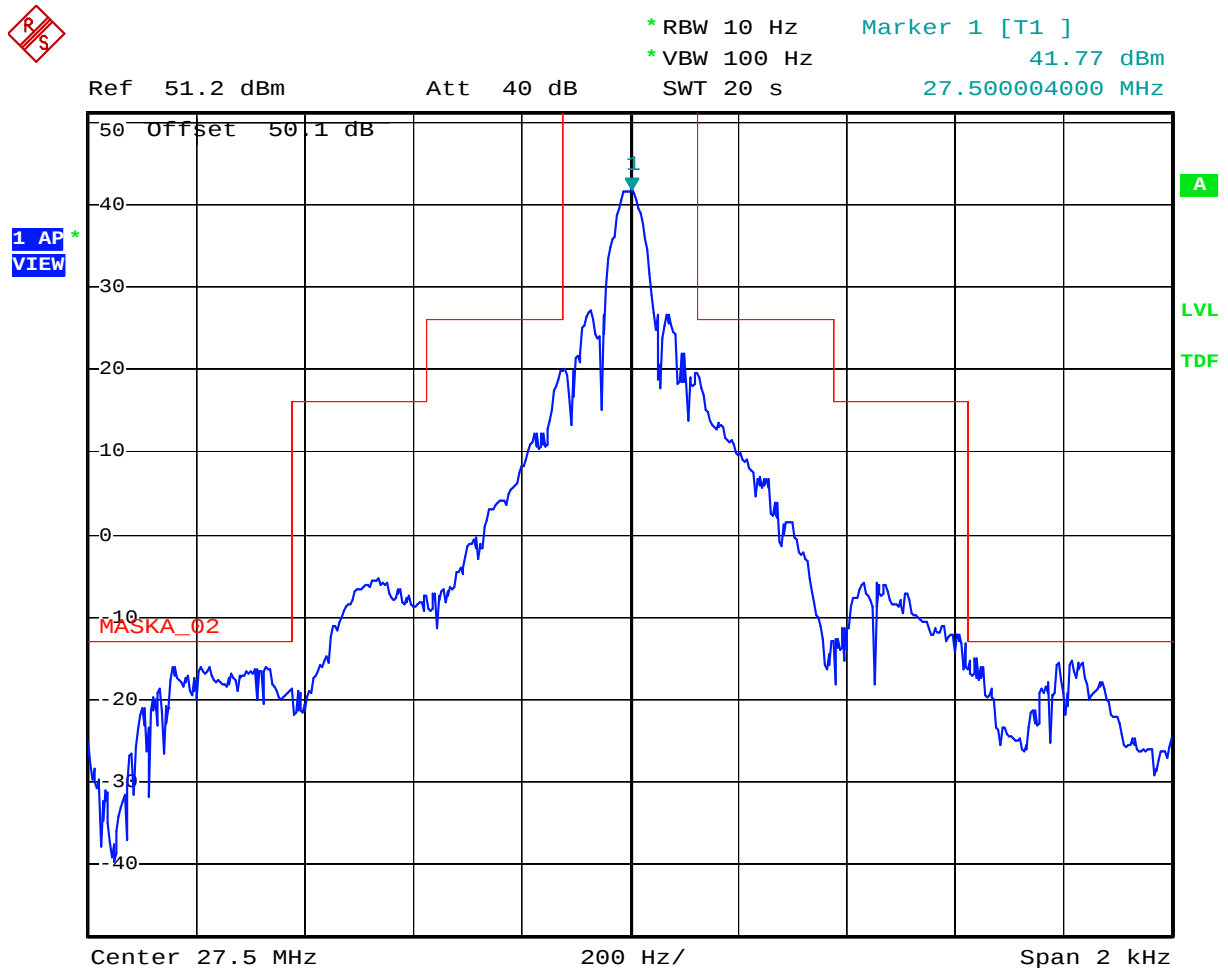
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 27.5MHz, High power, 16 dots/ second



Date: 30.OCT.2019 10:56:03

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Low Power

Configuration: A1A (CW), 1.605MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 11:03:48

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 2.182MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 11:07:27

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 4.065MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 11:10:46

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 6.2MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 11:14:18

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 8.195MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 11:17:32

ULTRATECH GROUP OF LABS

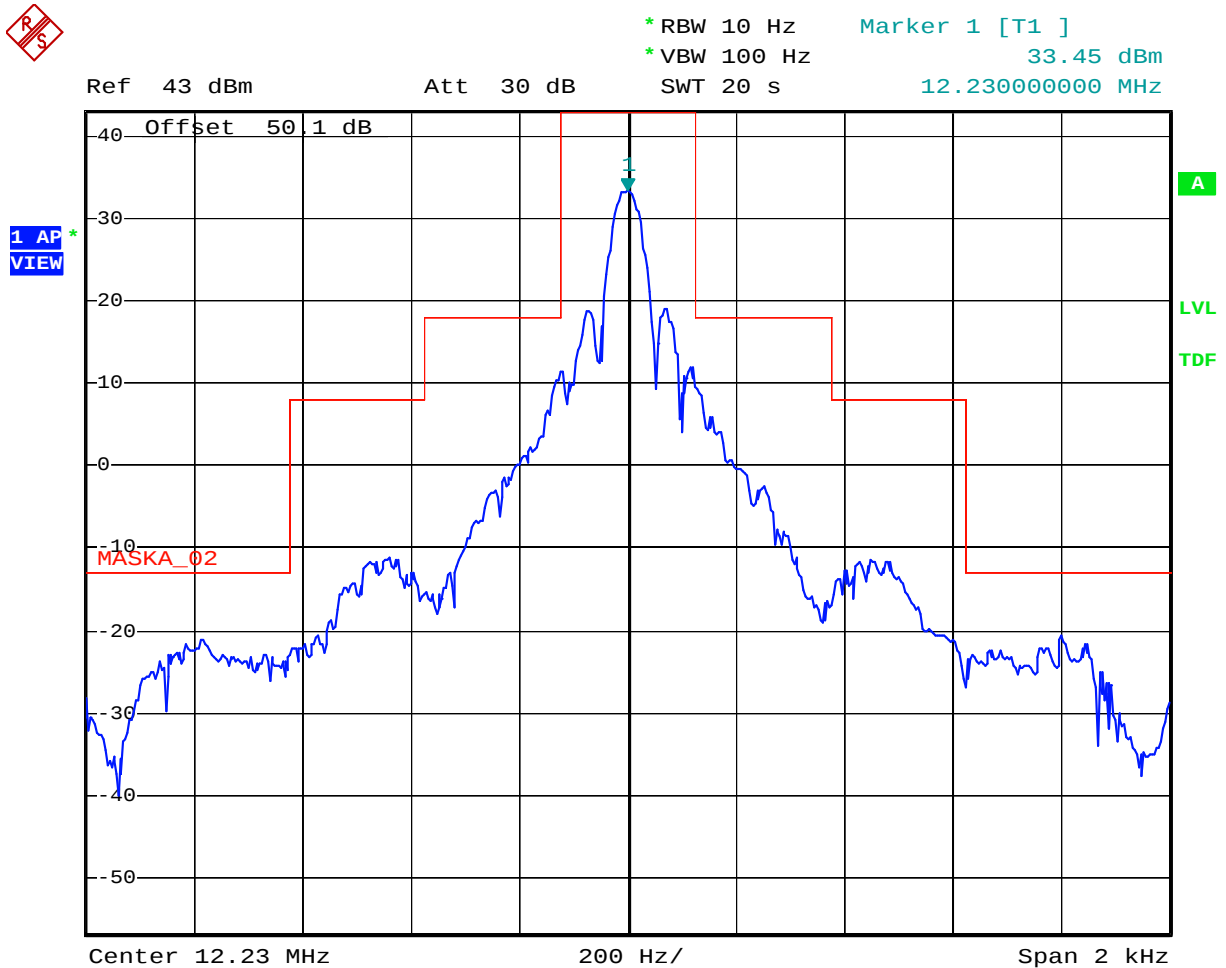
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 12.230MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 11:20:44

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 16.360MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 11:24:13

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 18.780MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 11:27:06

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 22.050MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 11:30:32

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 25.070MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 11:33:43

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: A1A (CW), 27.5MHz, Low power, 16 dots/ second



Date: 30.OCT.2019 11:37:10

ULTRATECH GROUP OF LABS

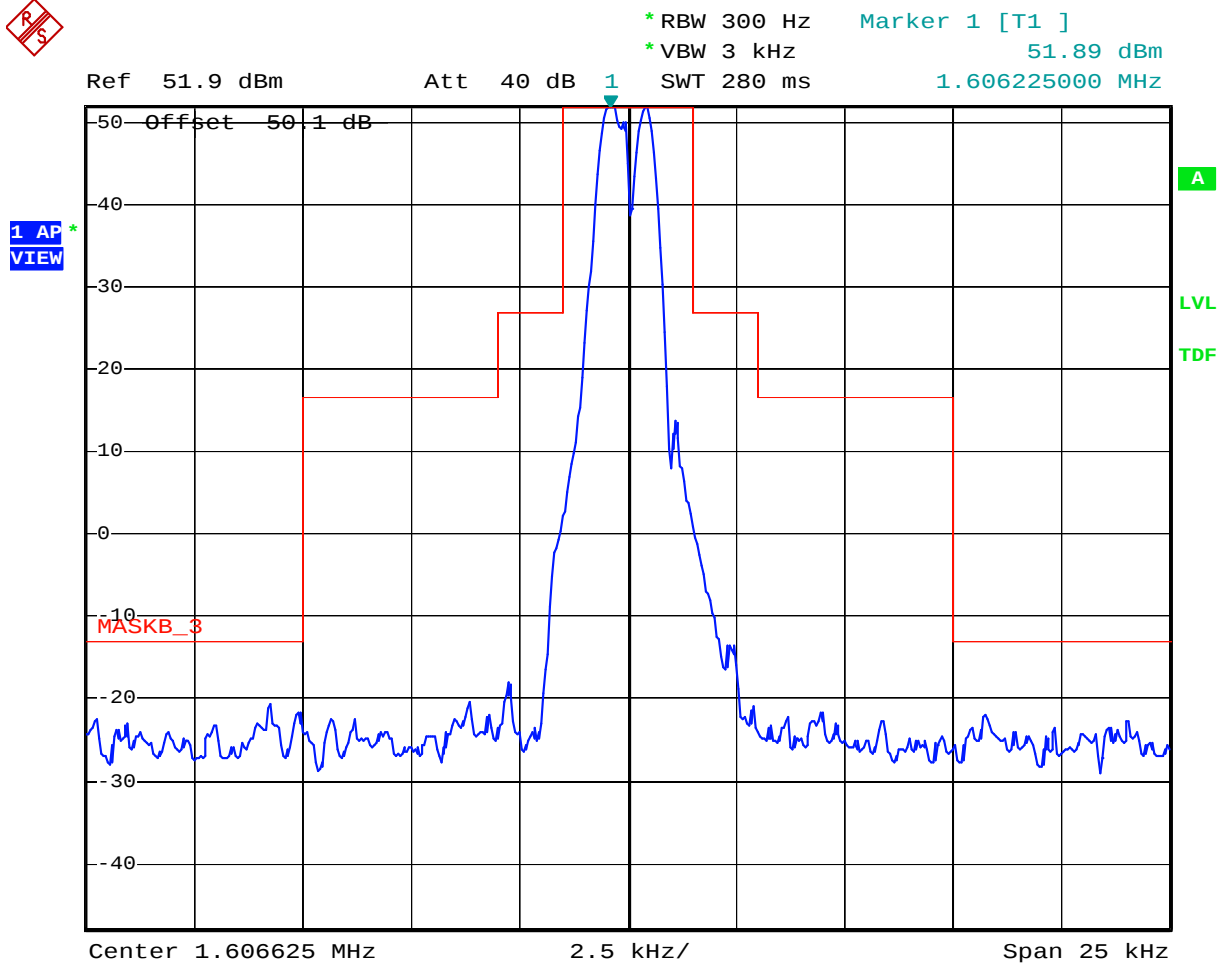
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

MASK FOR F1B
Part 90

Configuration: F1B (FSK), 1.605MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850 Hz, AB: 3 KHz



Date: 30.OCT.2019 14:19:11

ULTRATECH GROUP OF LABS

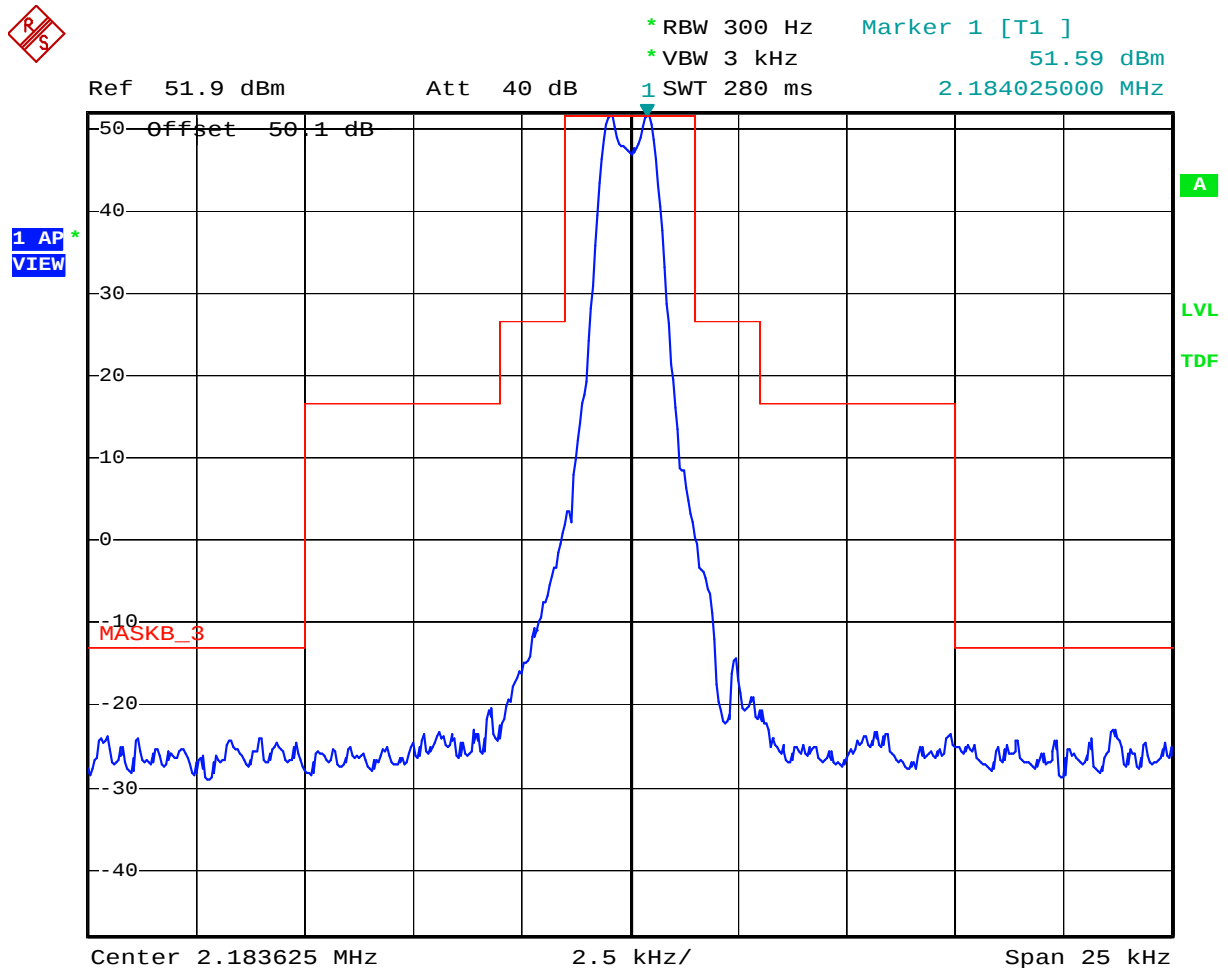
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 2.182MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:20:37

ULTRATECH GROUP OF LABS

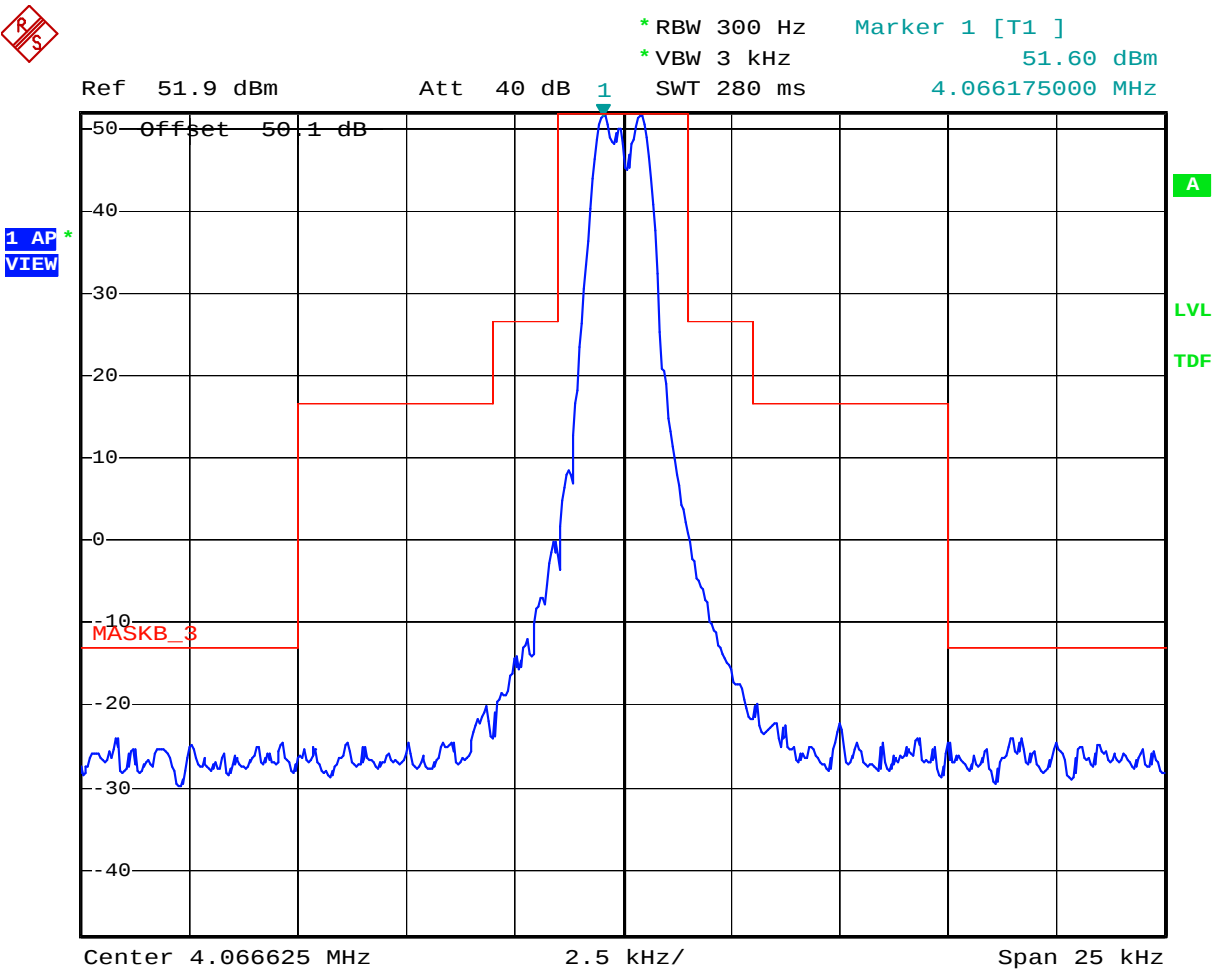
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 4.065MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:22:14

ULTRATECH GROUP OF LABS

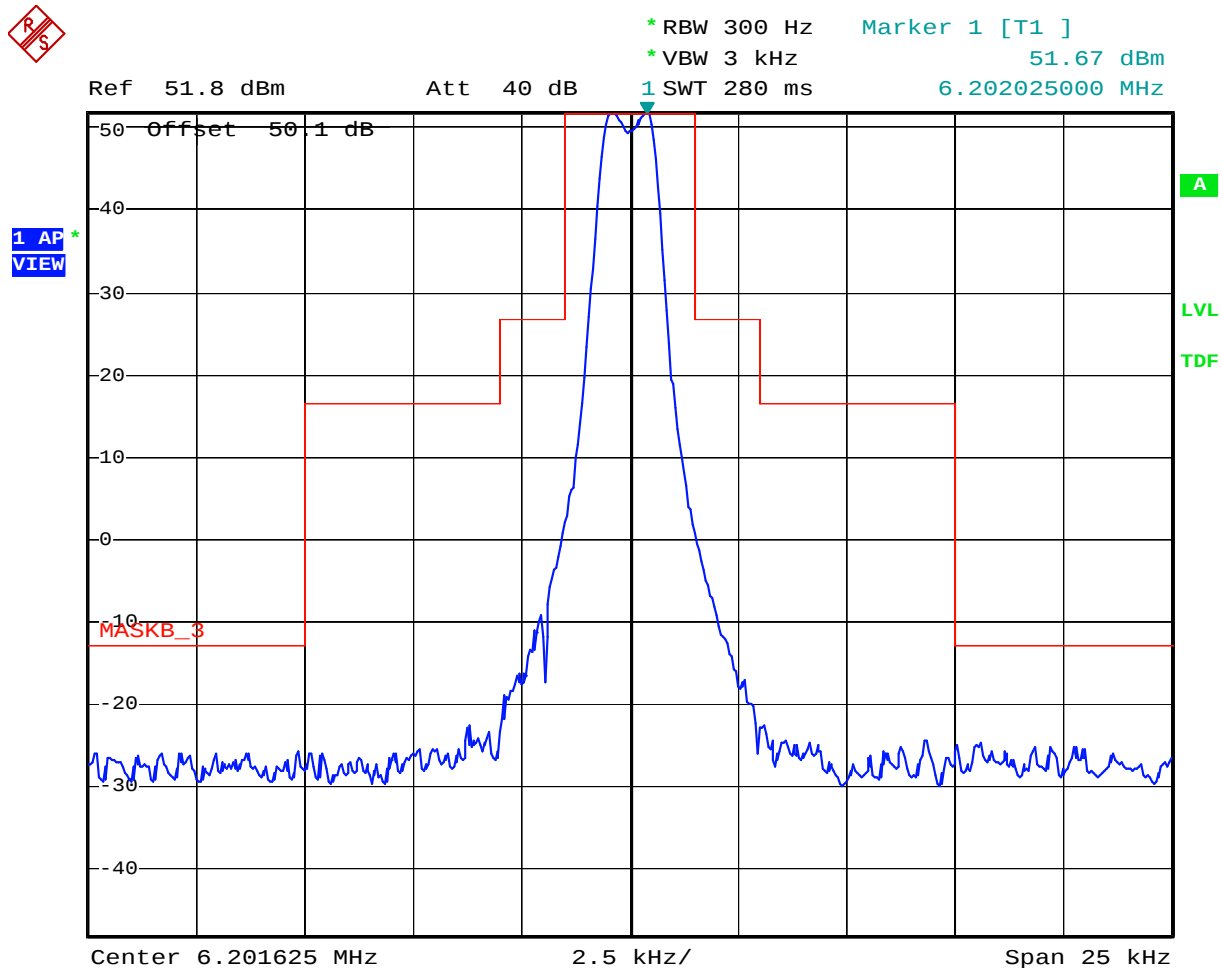
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 6.2MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:23:45

ULTRATECH GROUP OF LABS

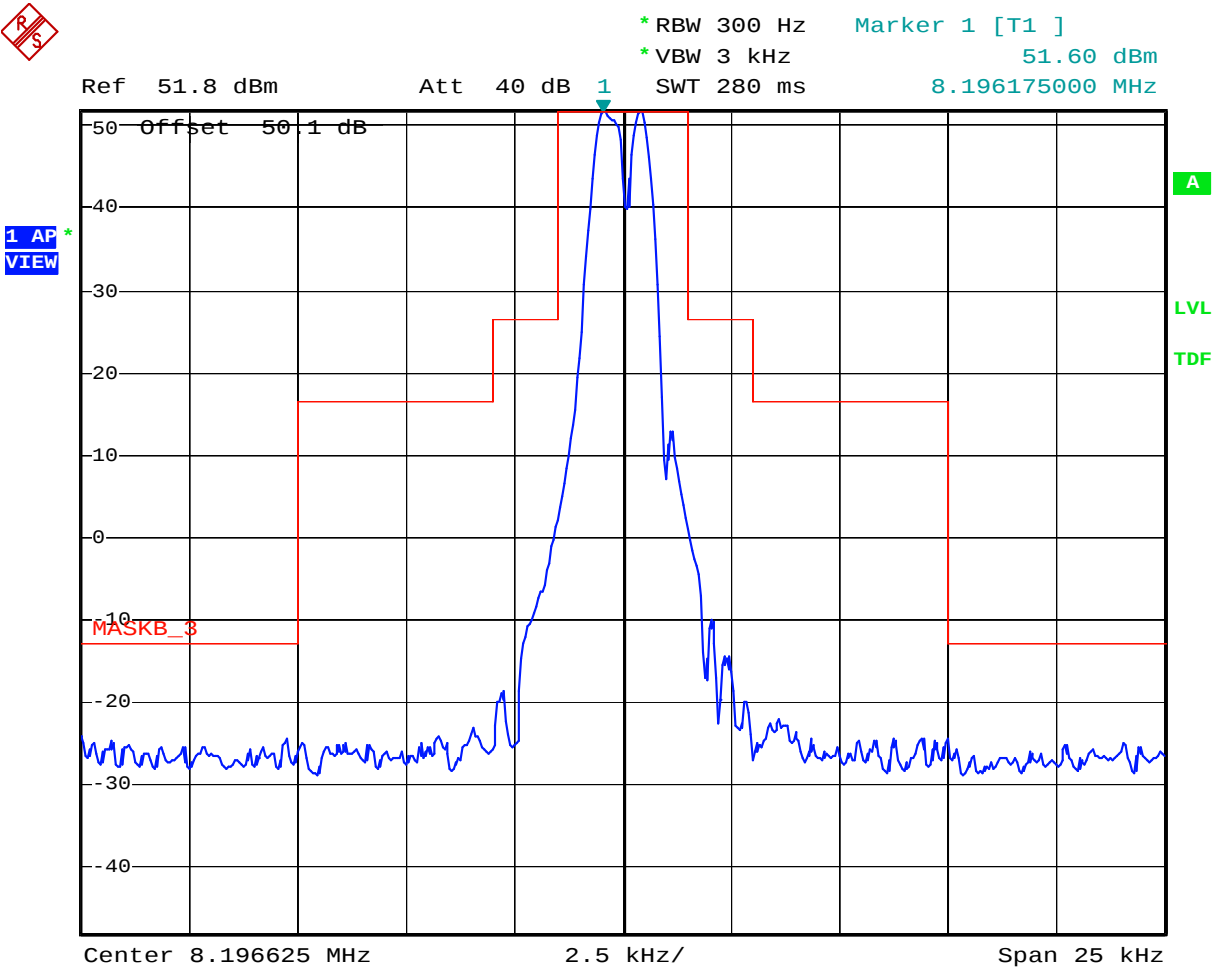
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 8.195MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:25:35

ULTRATECH GROUP OF LABS

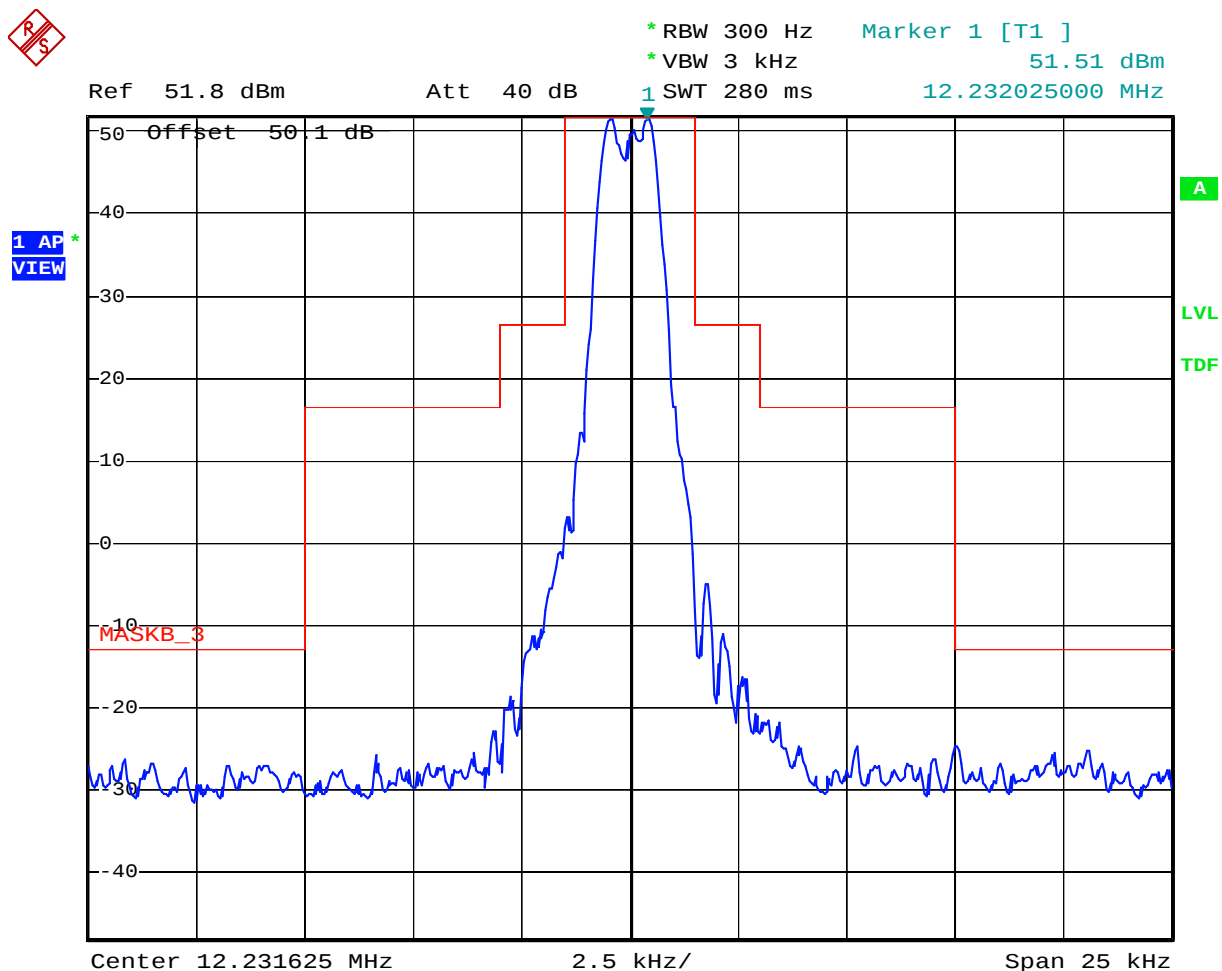
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 12.230MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:27:10

ULTRATECH GROUP OF LABS

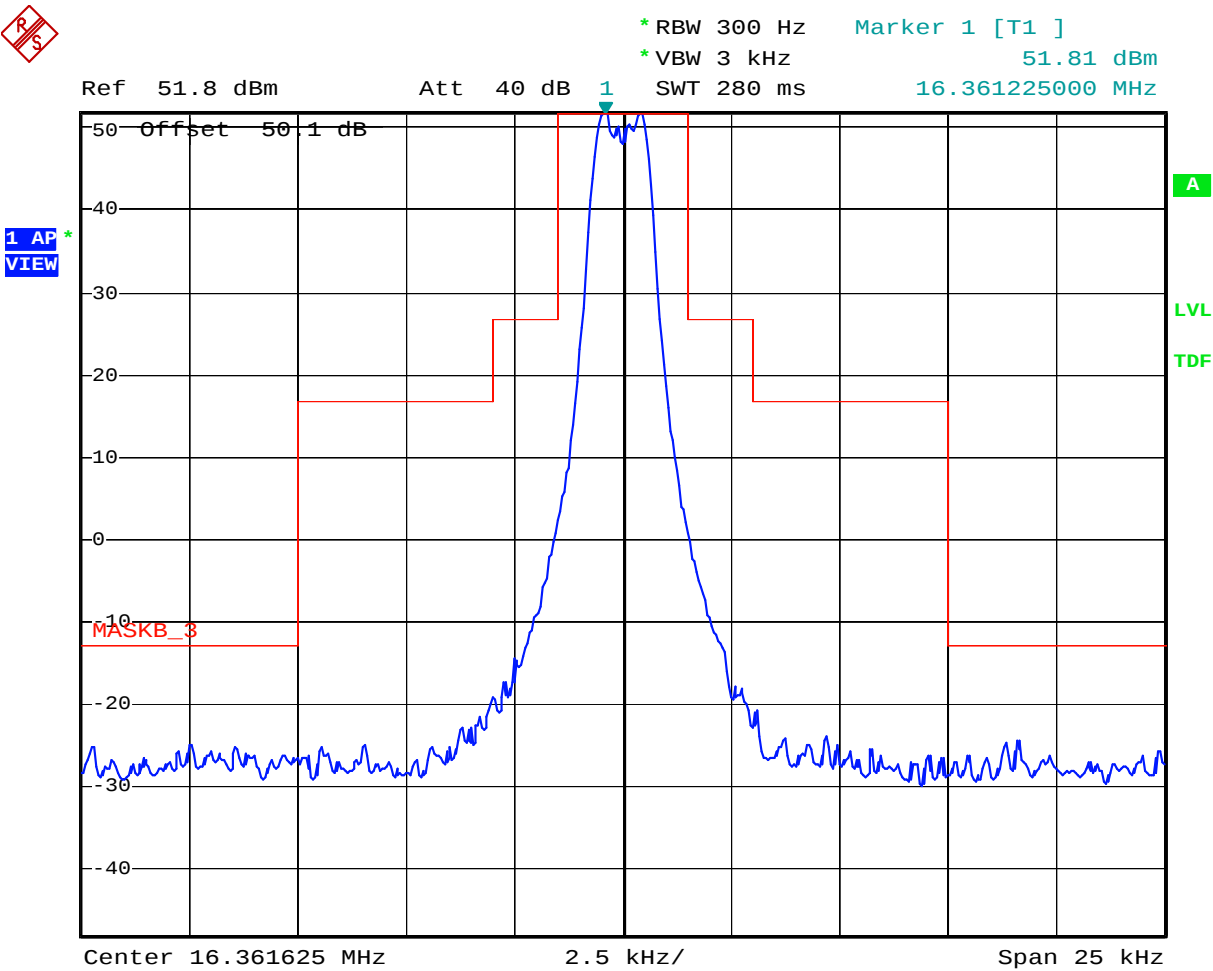
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 16.360MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:28:31

ULTRATECH GROUP OF LABS

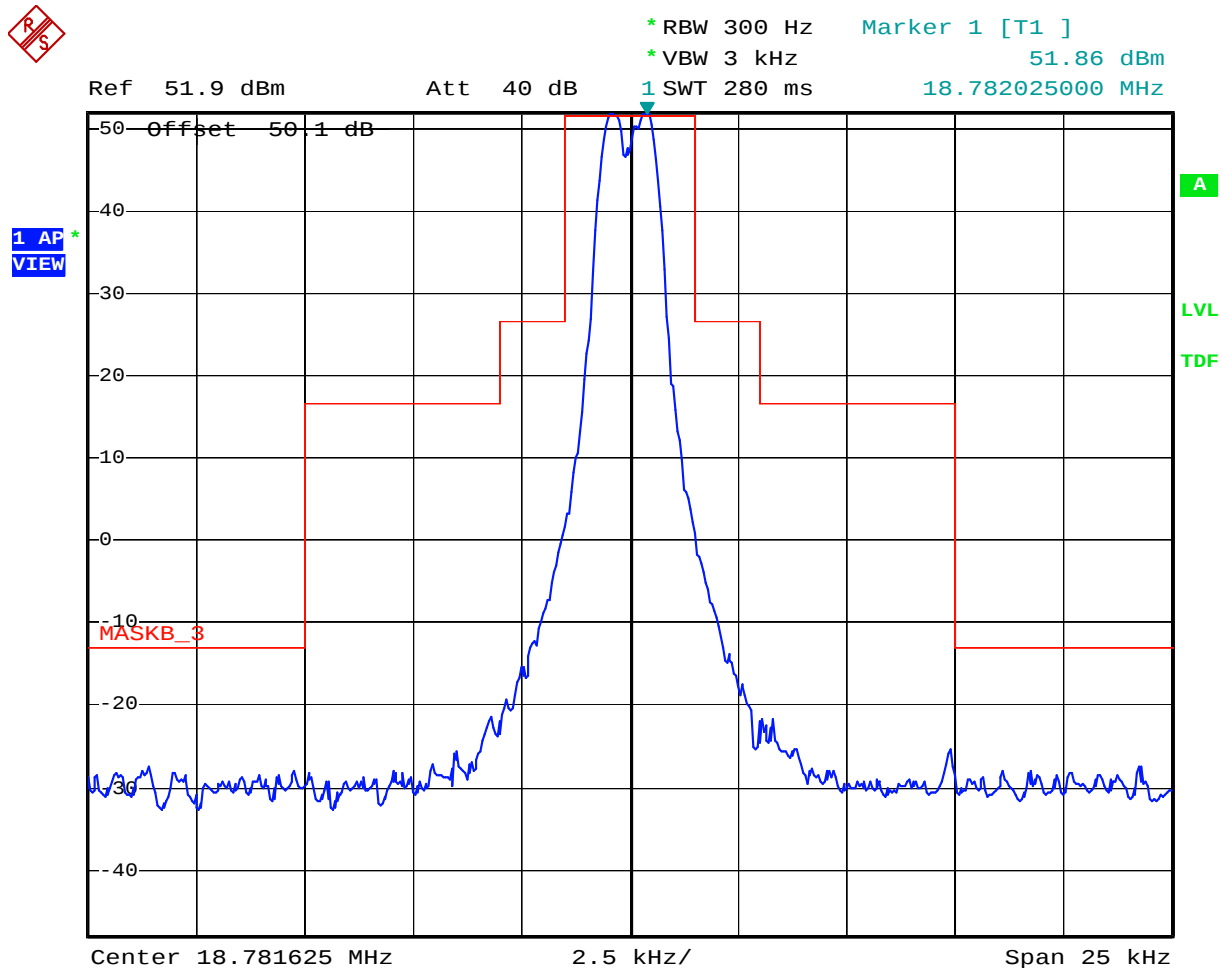
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 18.780MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:30:09

ULTRATECH GROUP OF LABS

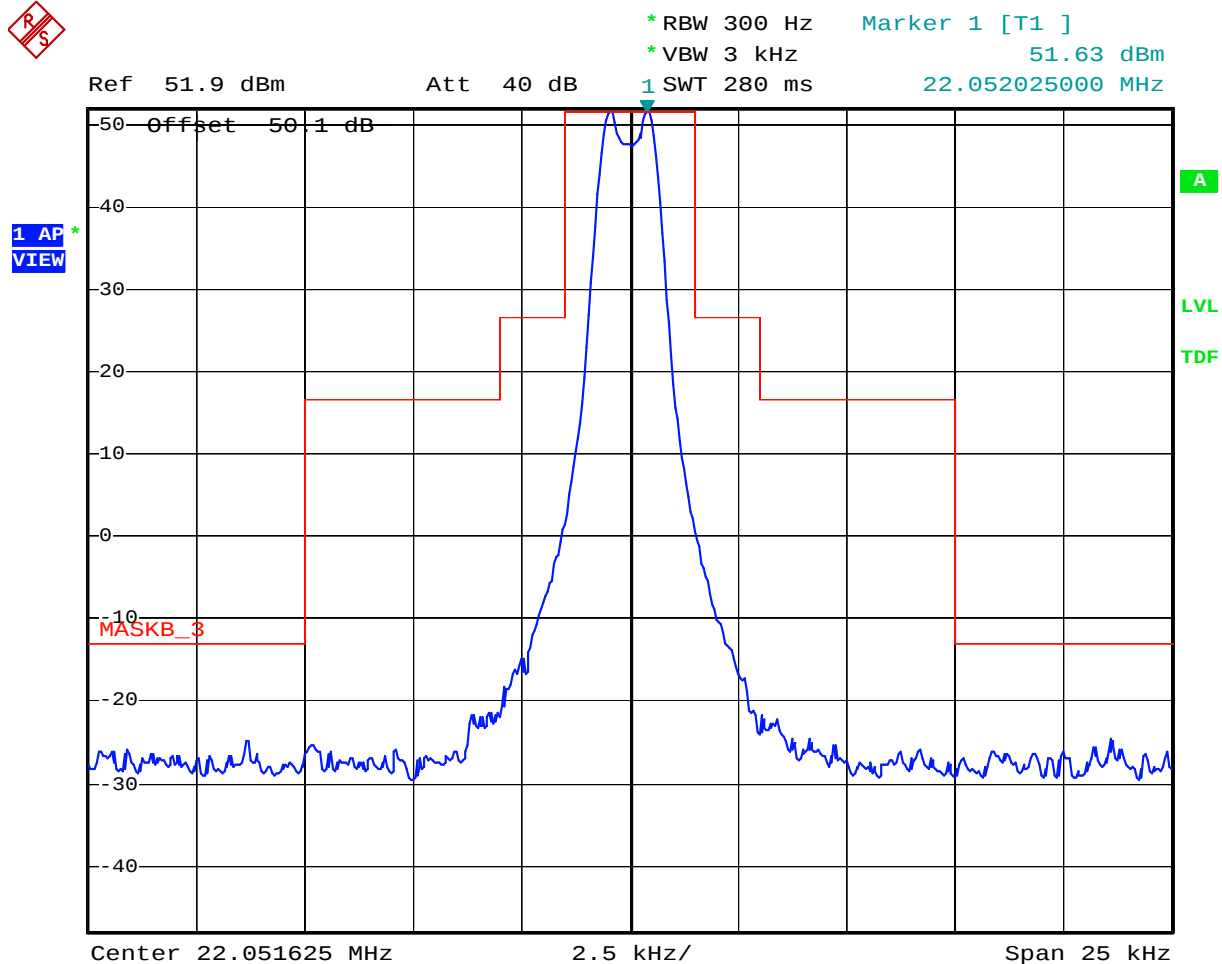
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 22.050MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:31:42

ULTRATECH GROUP OF LABS

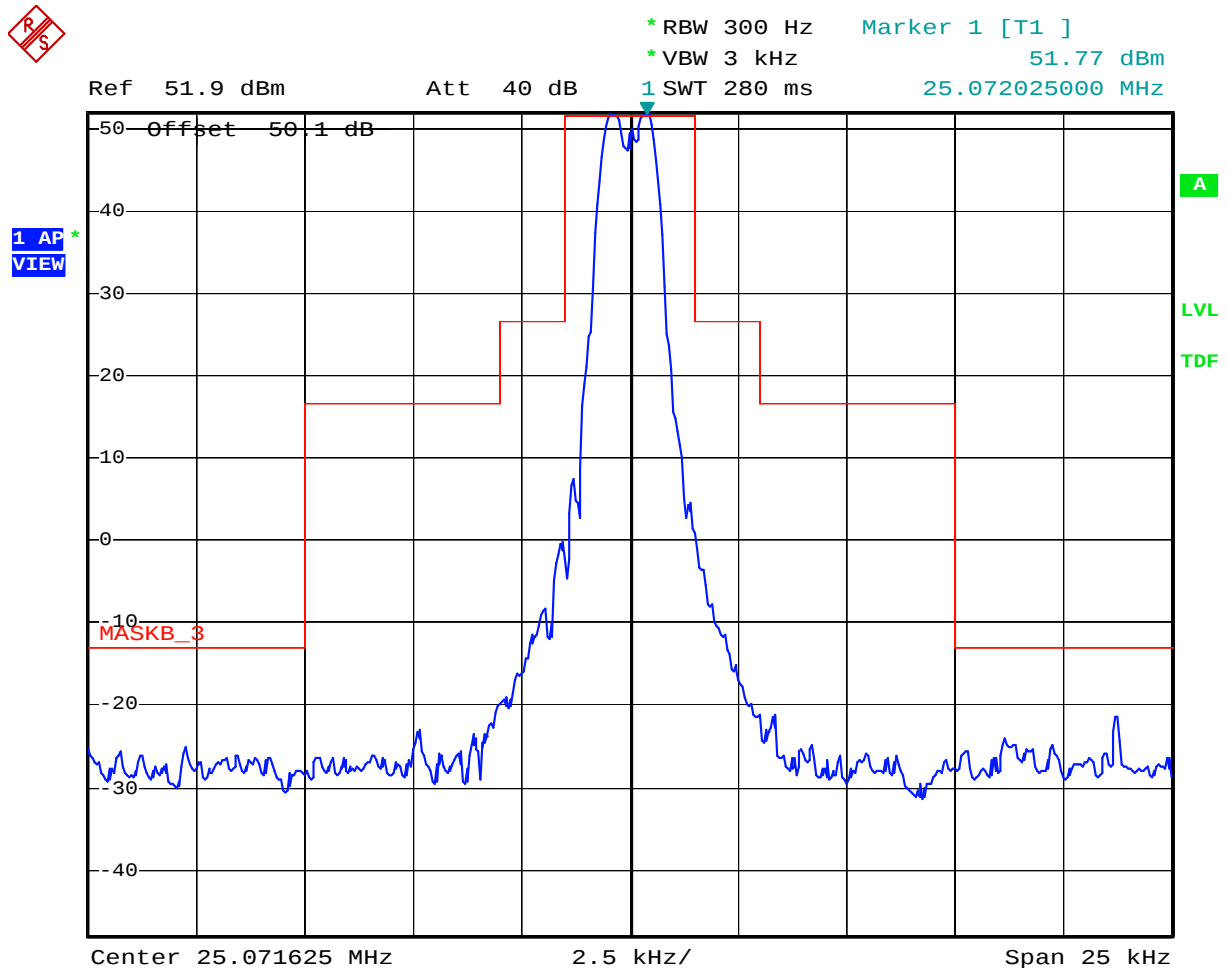
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 25.070MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:33:04

ULTRATECH GROUP OF LABS

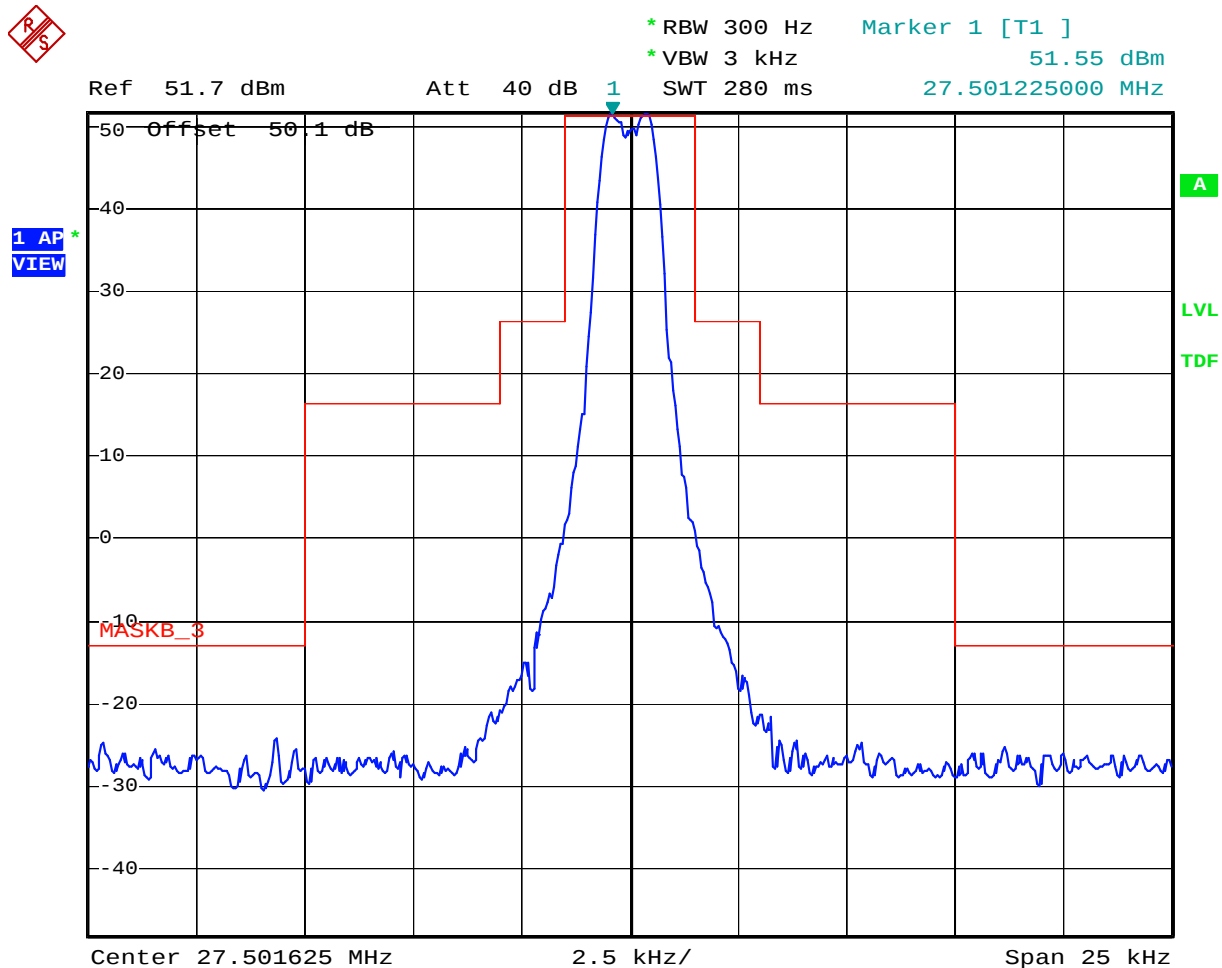
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 27.5MHz, High power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:34:33

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

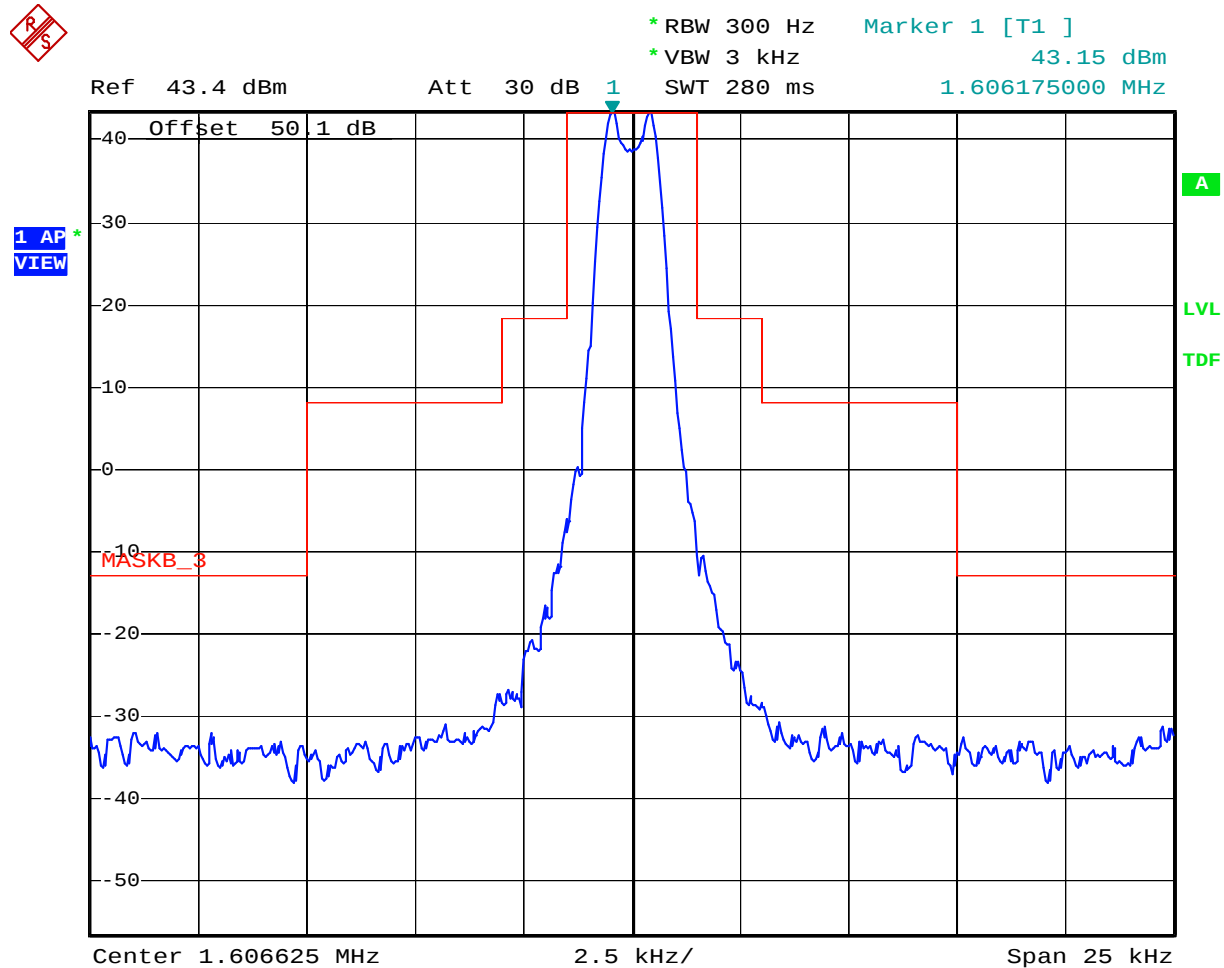
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Low Power

Configuration: F1B (FSK), 1.605MHz, Low power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:00:02

ULTRATECH GROUP OF LABS

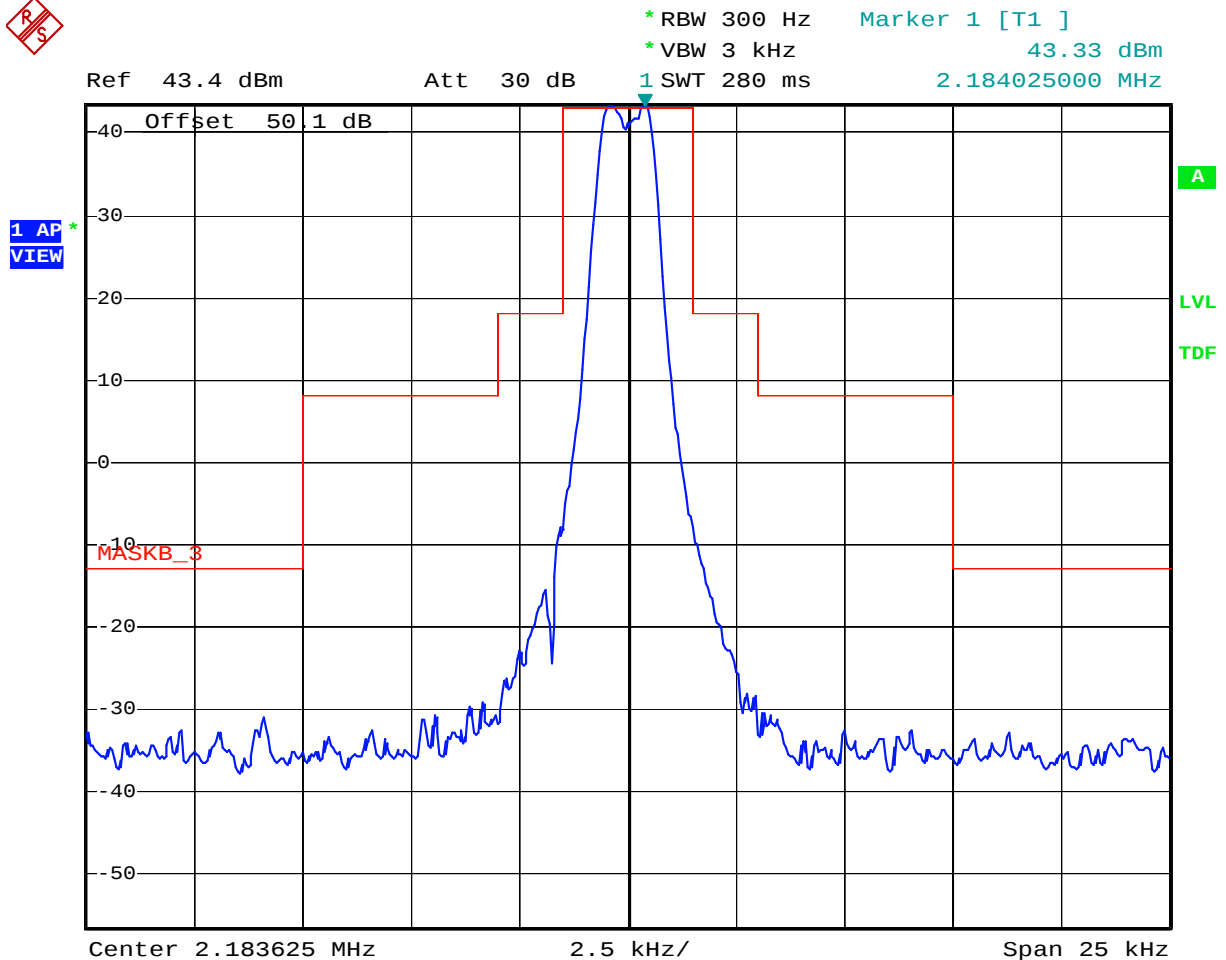
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 2.182MHz, Low power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:01:39

ULTRATECH GROUP OF LABS

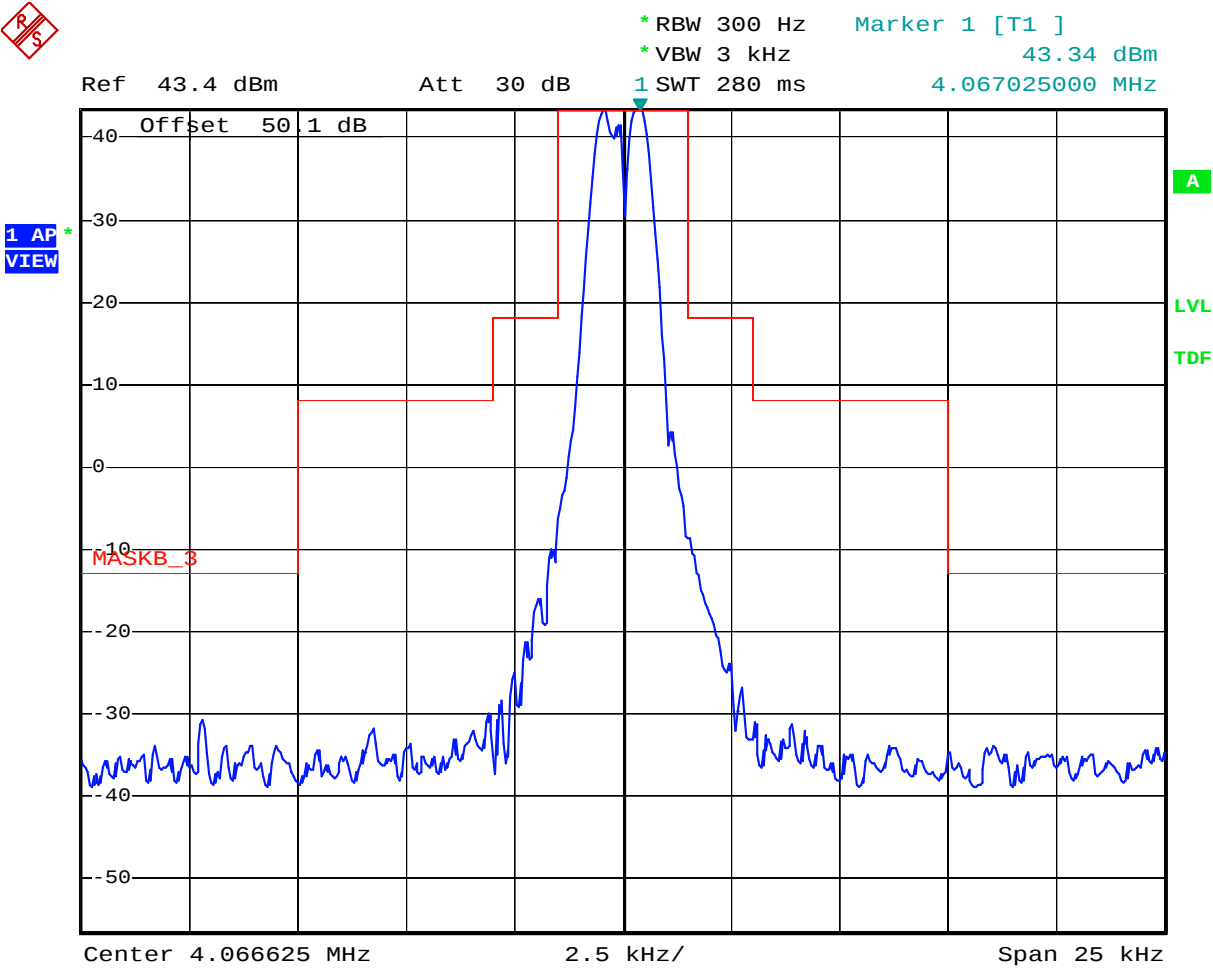
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 4.065MHz, Low power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:03:08

ULTRATECH GROUP OF LABS

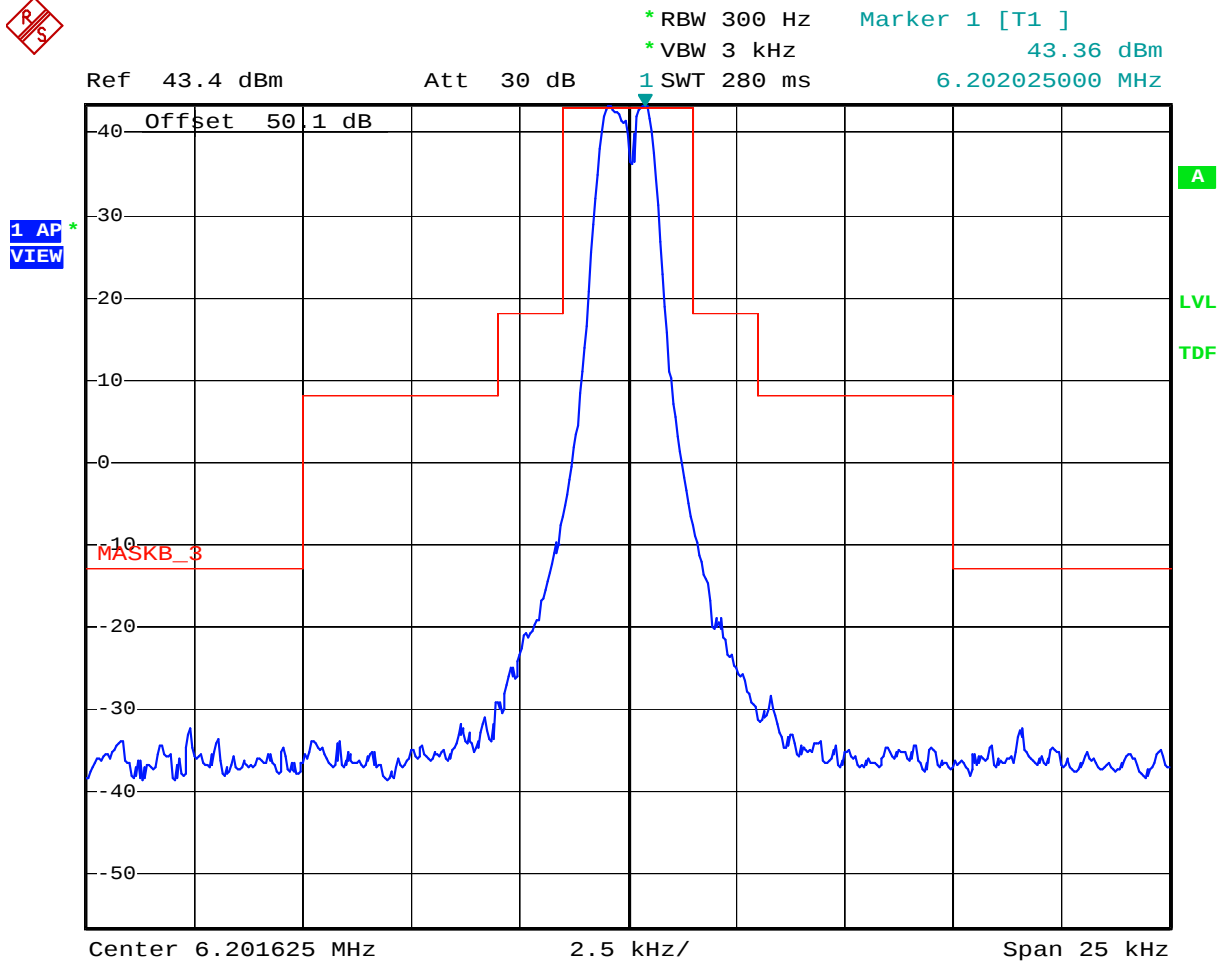
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 6.2MHz, Low power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:04:41

ULTRATECH GROUP OF LABS

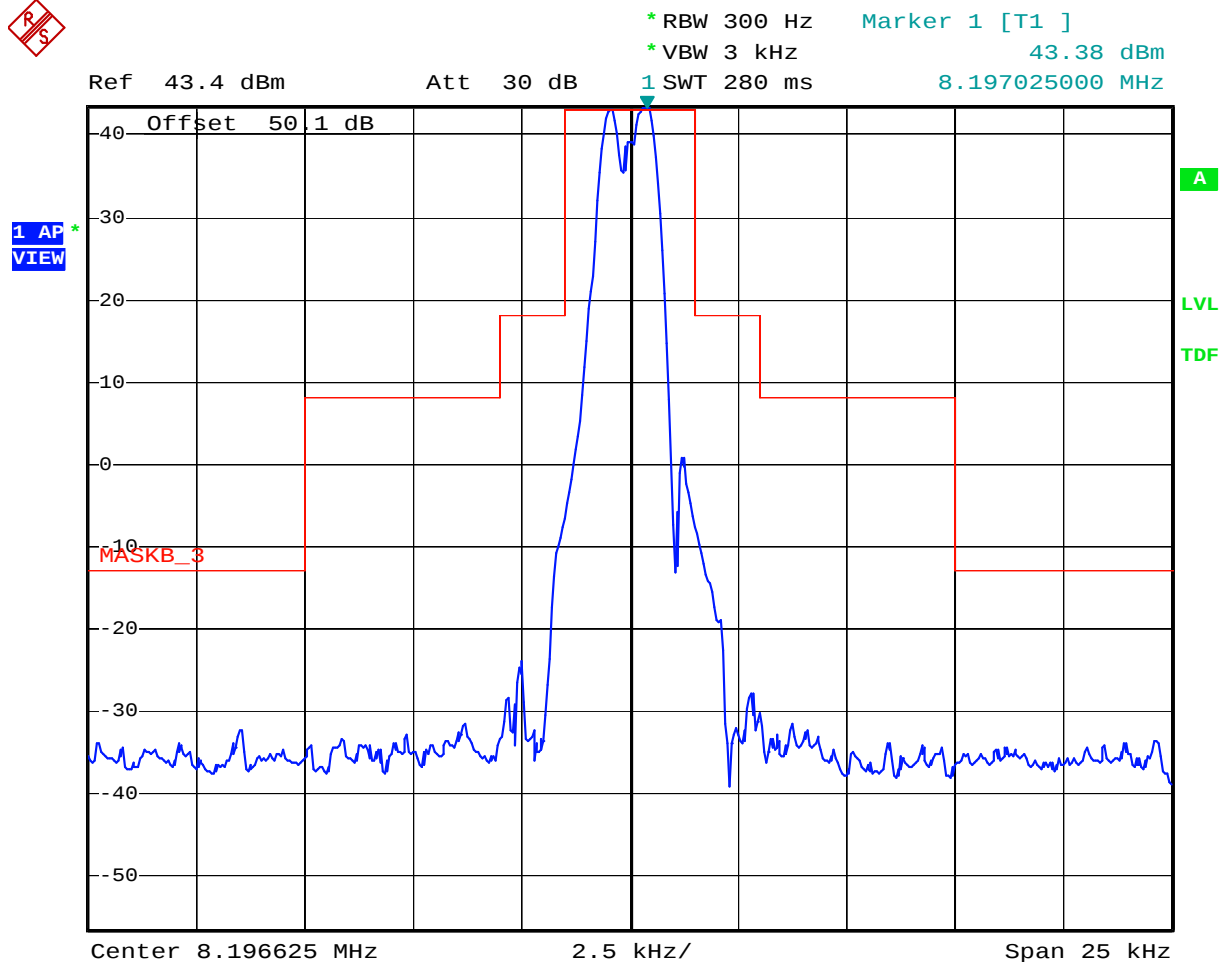
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 8.195MHz, Low power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:06:09

ULTRATECH GROUP OF LABS

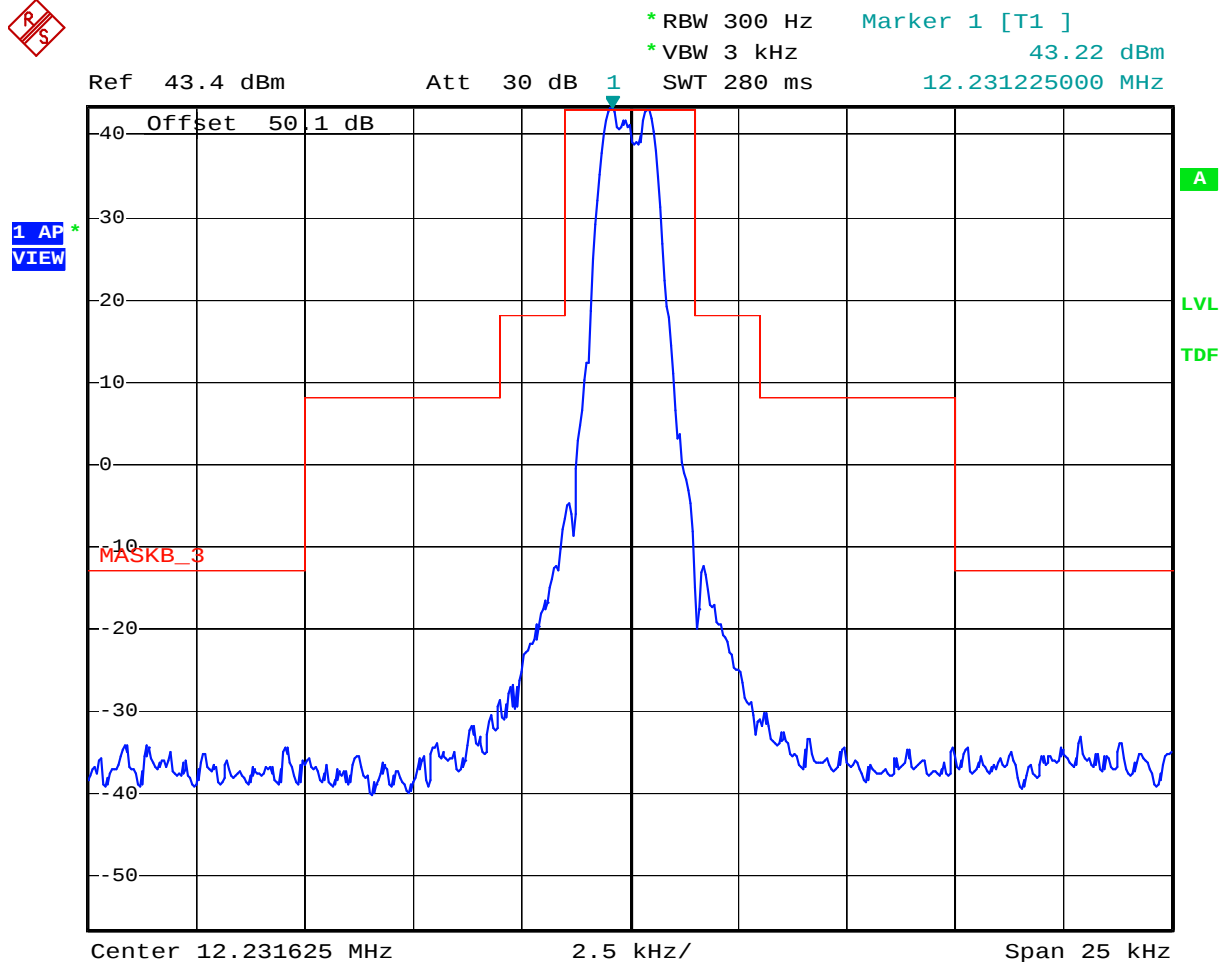
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 12.230MHz, Low power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:08:59

ULTRATECH GROUP OF LABS

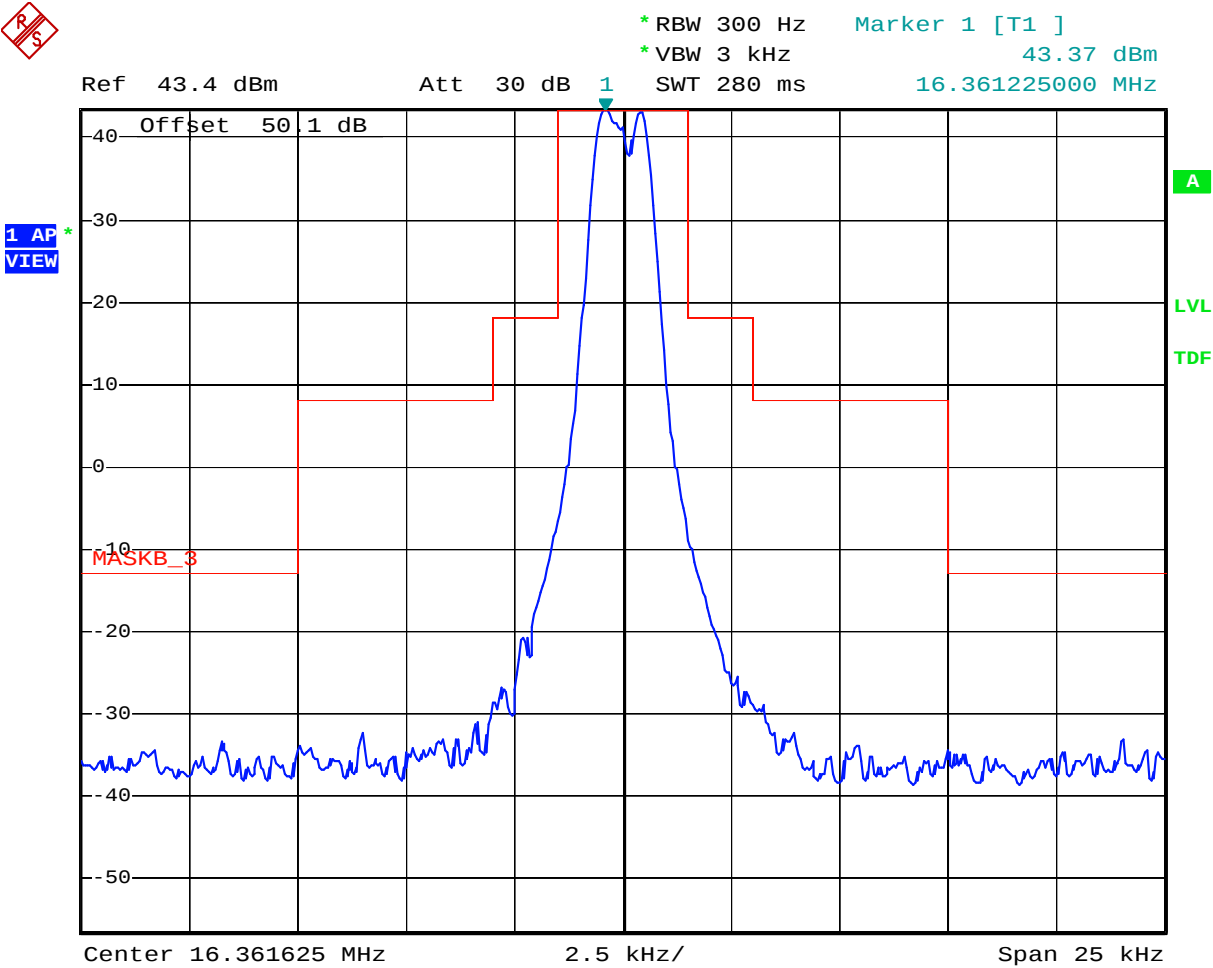
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 16.360MHz, Low power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:10:22

ULTRATECH GROUP OF LABS

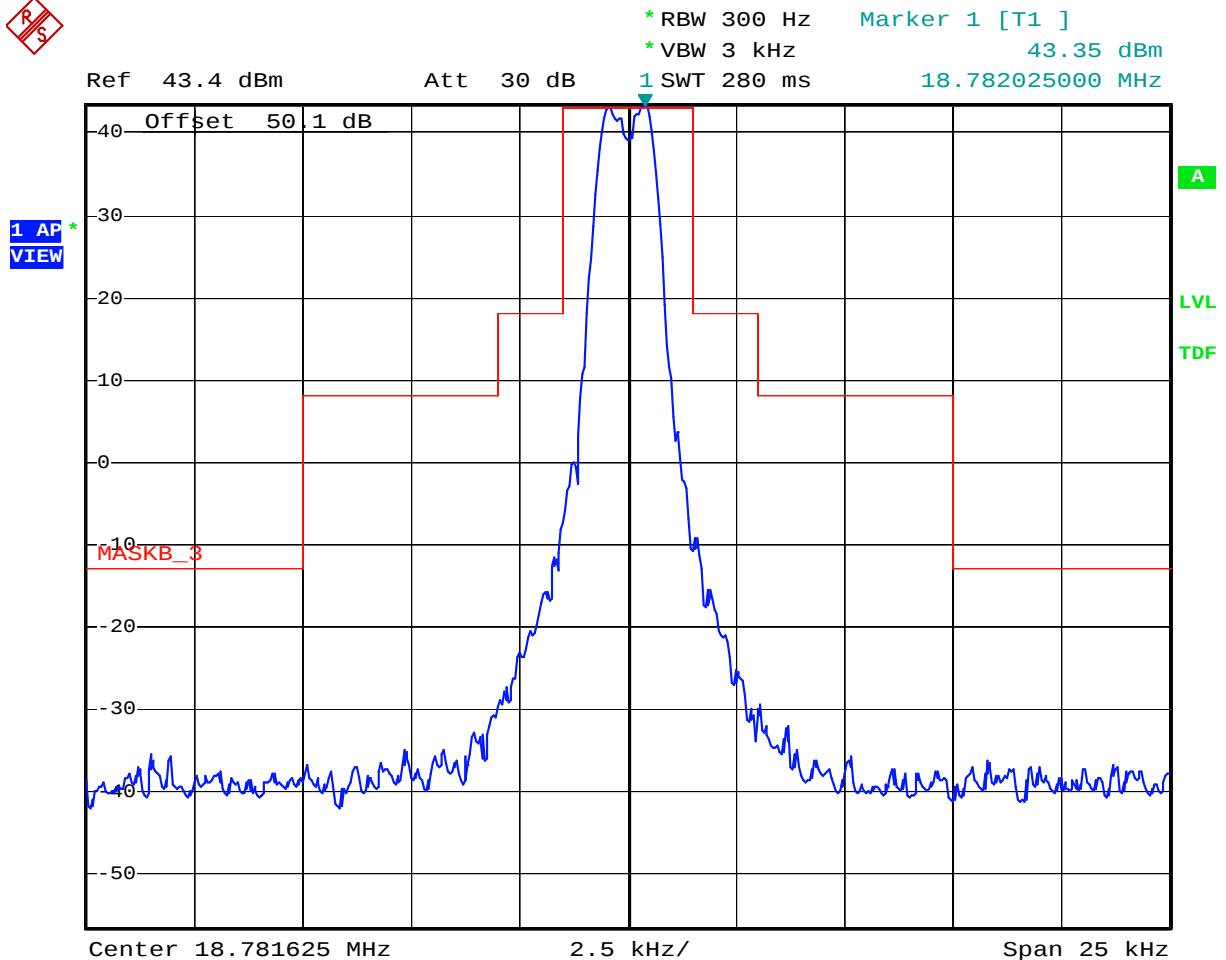
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 18.780MHz, Low power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:12:03

ULTRATECH GROUP OF LABS

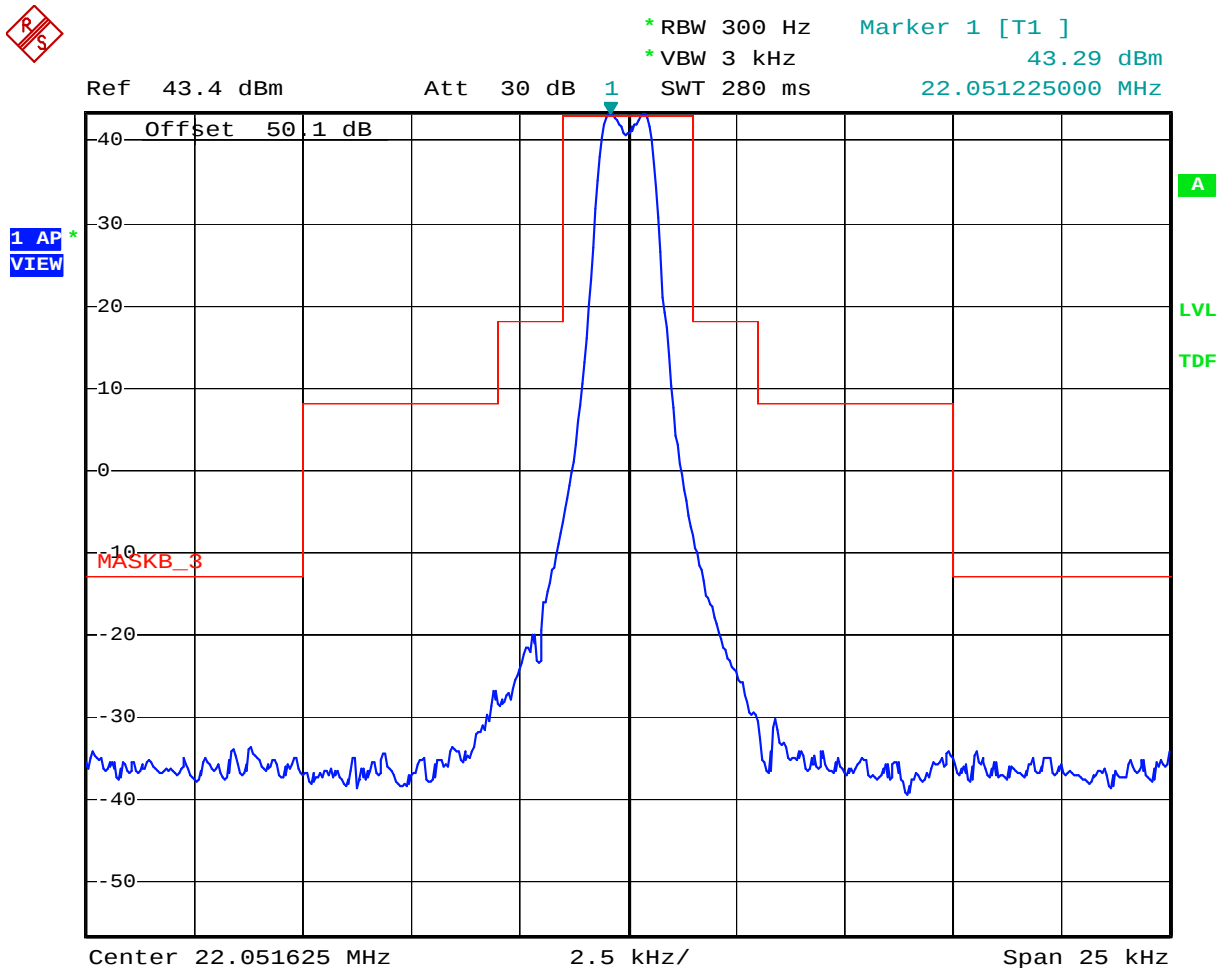
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 22.050MHz, Low power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:13:31

ULTRATECH GROUP OF LABS

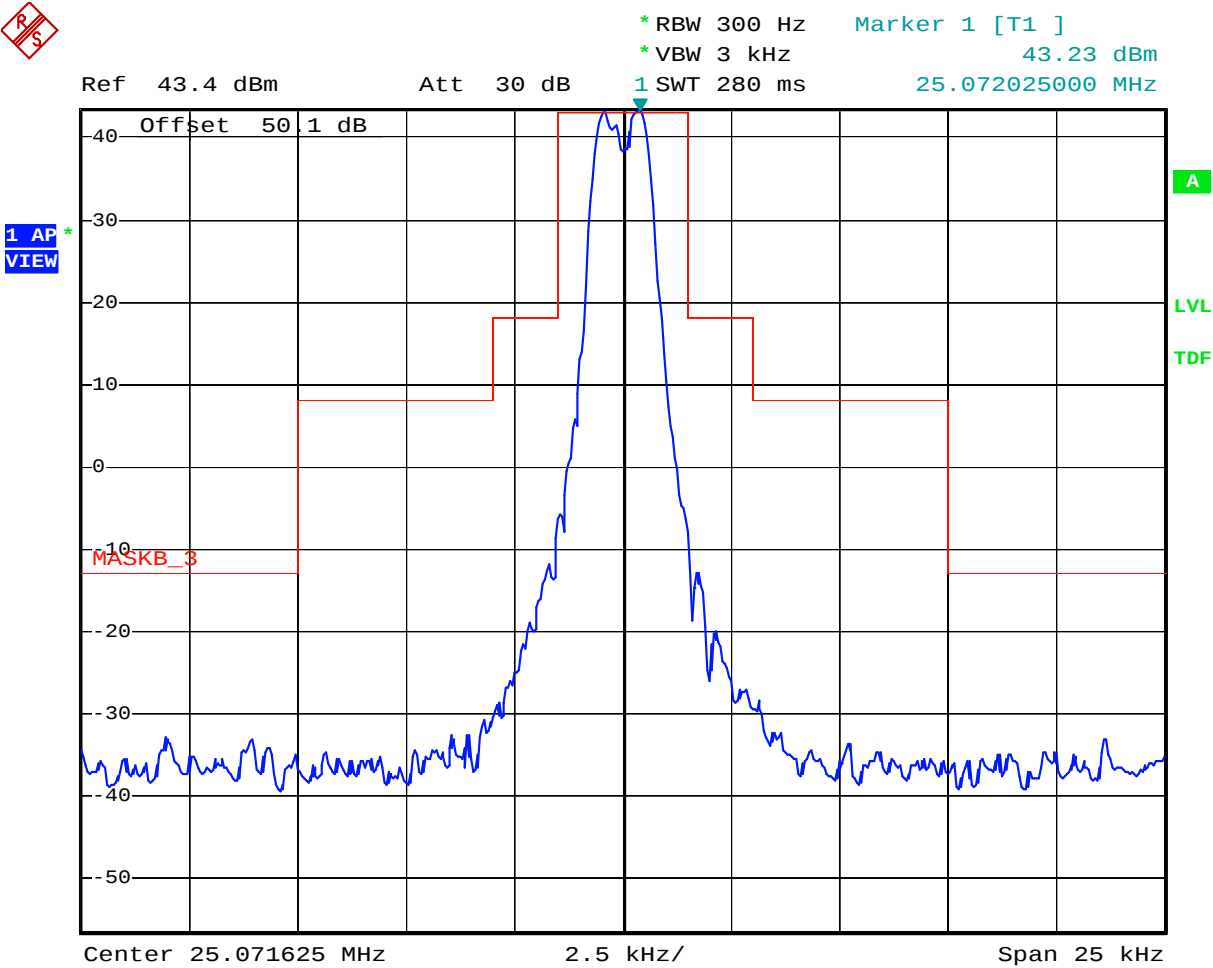
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 25.070MHz, Low power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:14:40

ULTRATECH GROUP OF LABS

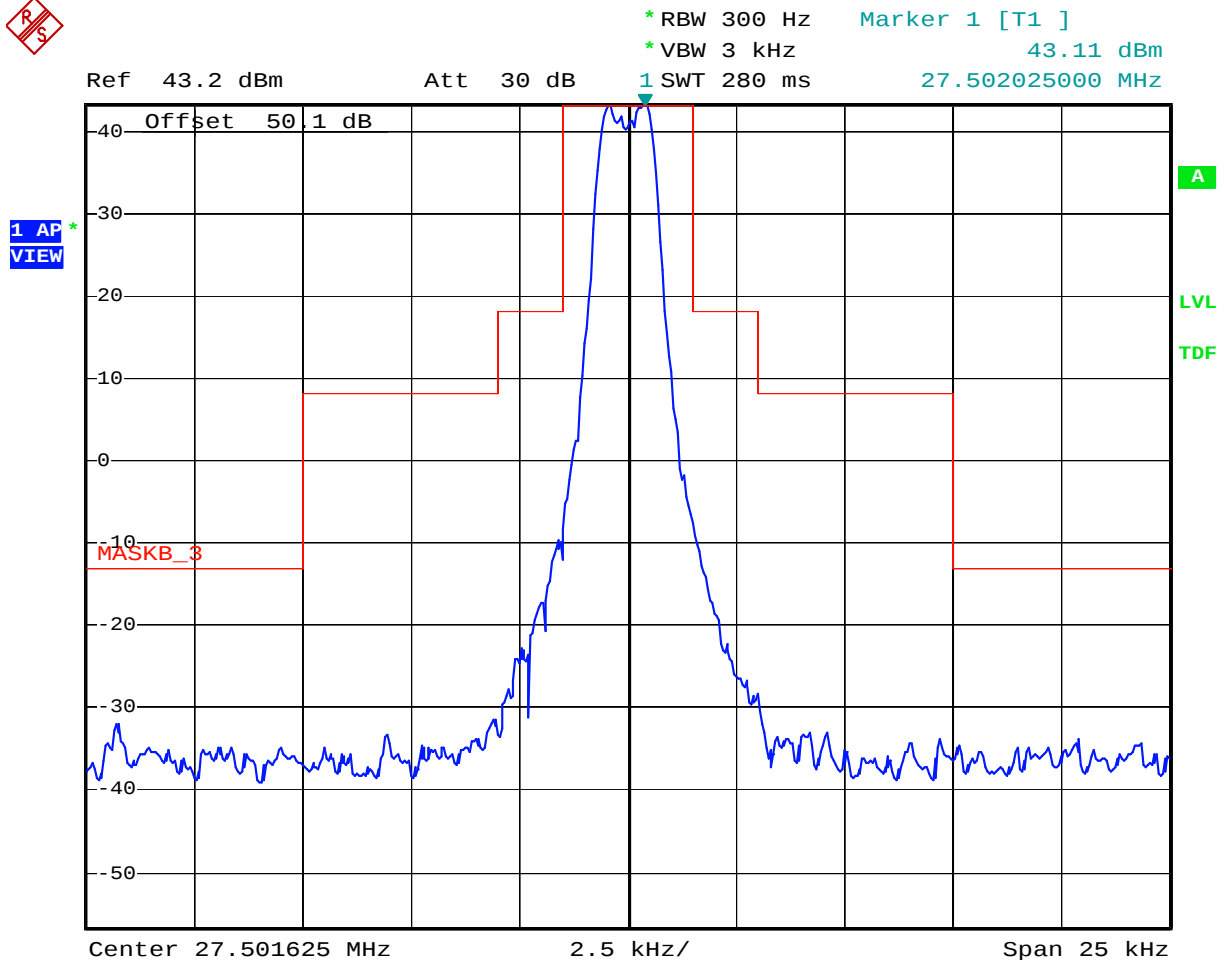
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 27.5MHz, Low power, Mark Frequency: 1200Hz, Shift Frequency: 850Hz



Date: 30.OCT.2019 14:16:16

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

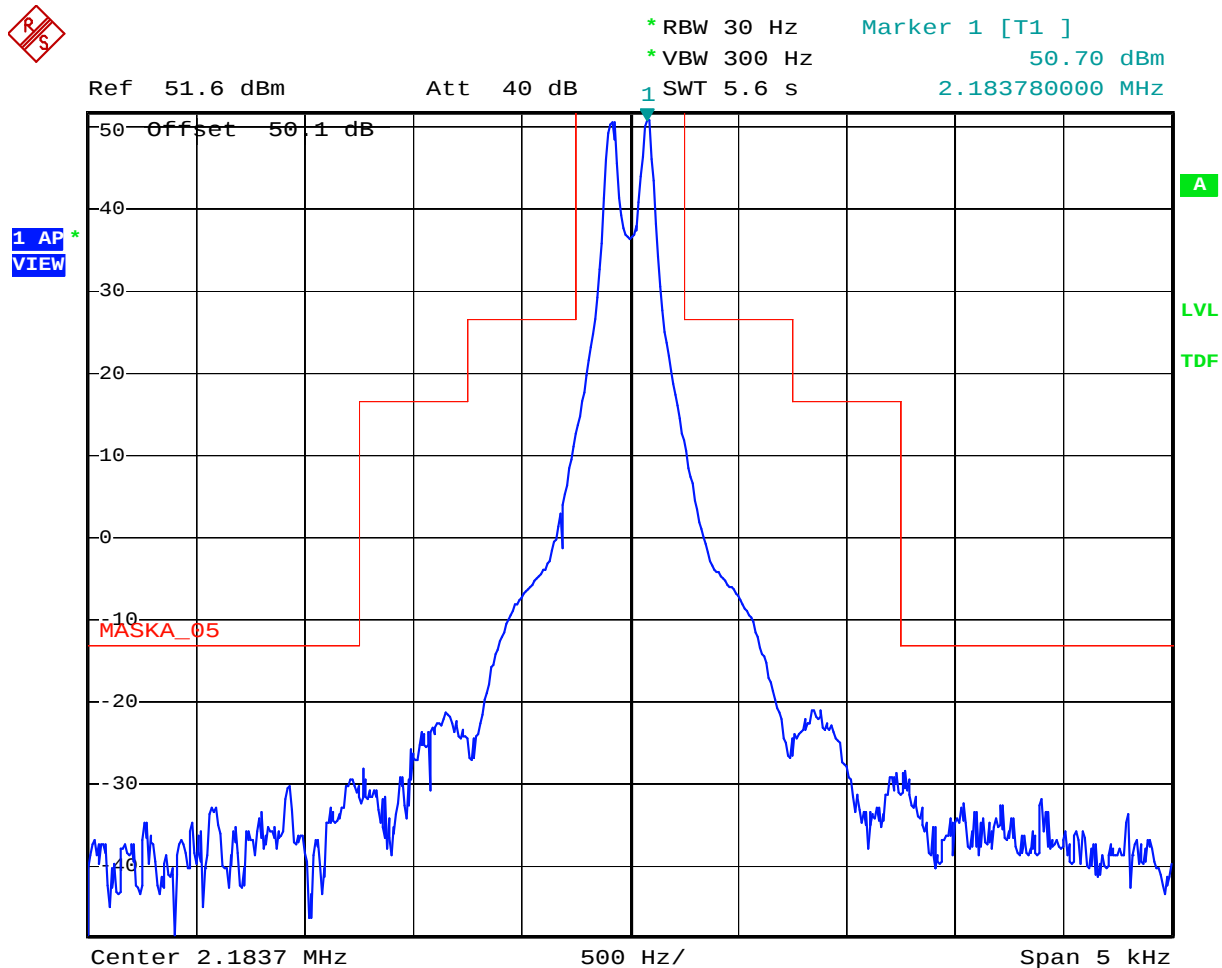
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 1.605MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170 Hz, AB: 0.5 KHz



Configuration: F1B (FSK), 2.182MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 08:45:49

ULTRATECH GROUP OF LABS

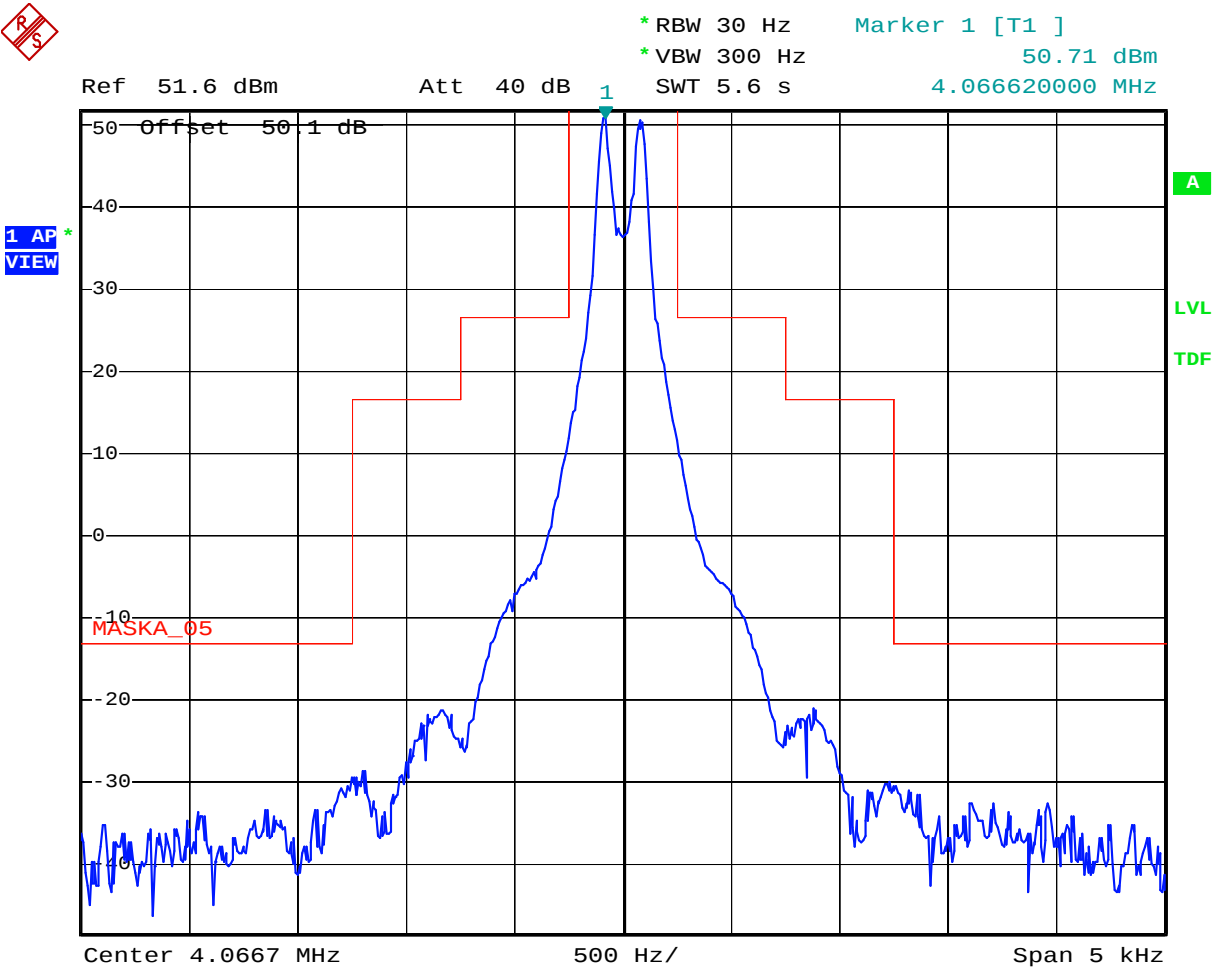
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 4.065MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 08:49:51

ULTRATECH GROUP OF LABS

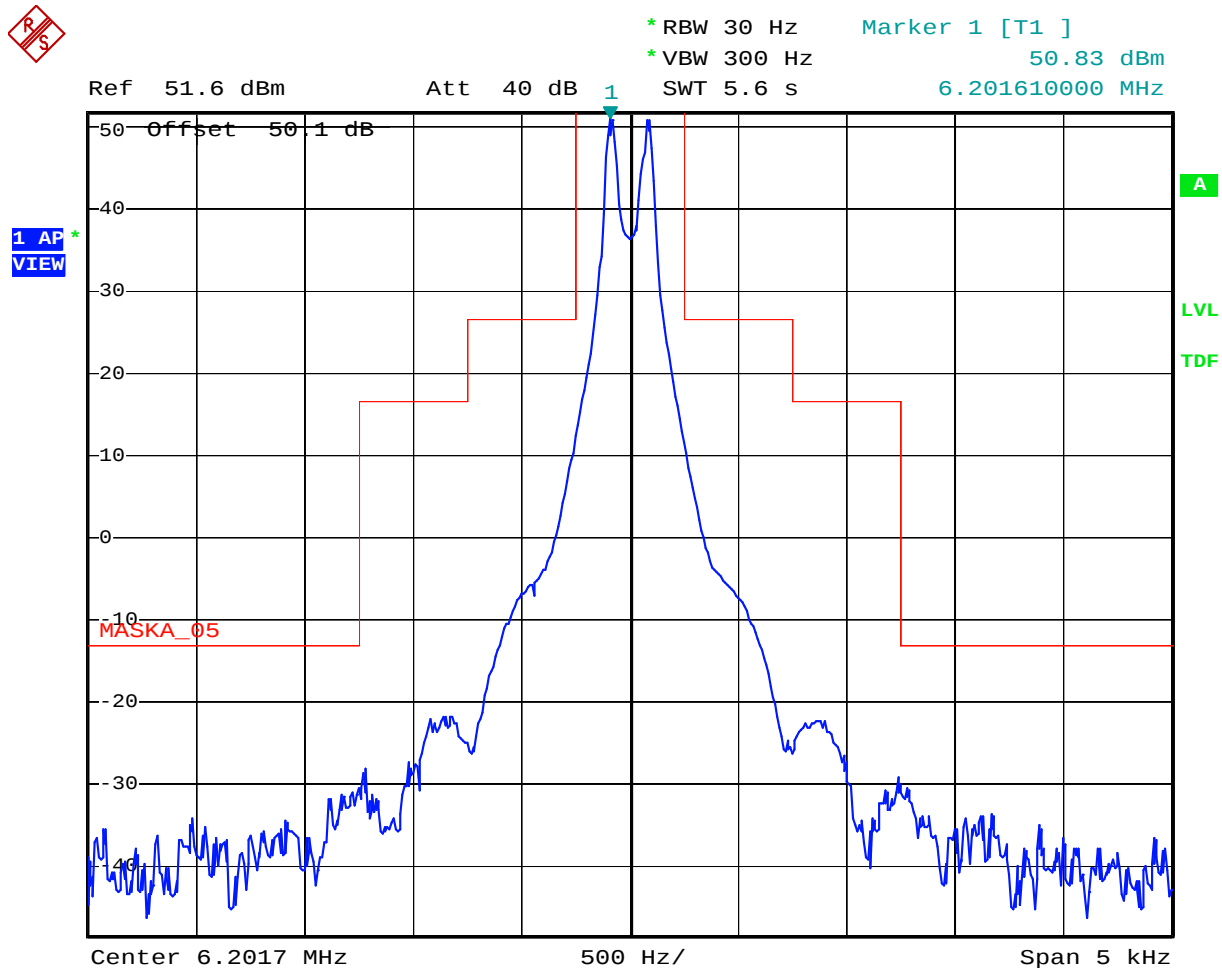
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 6.2MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 08:51:38

ULTRATECH GROUP OF LABS

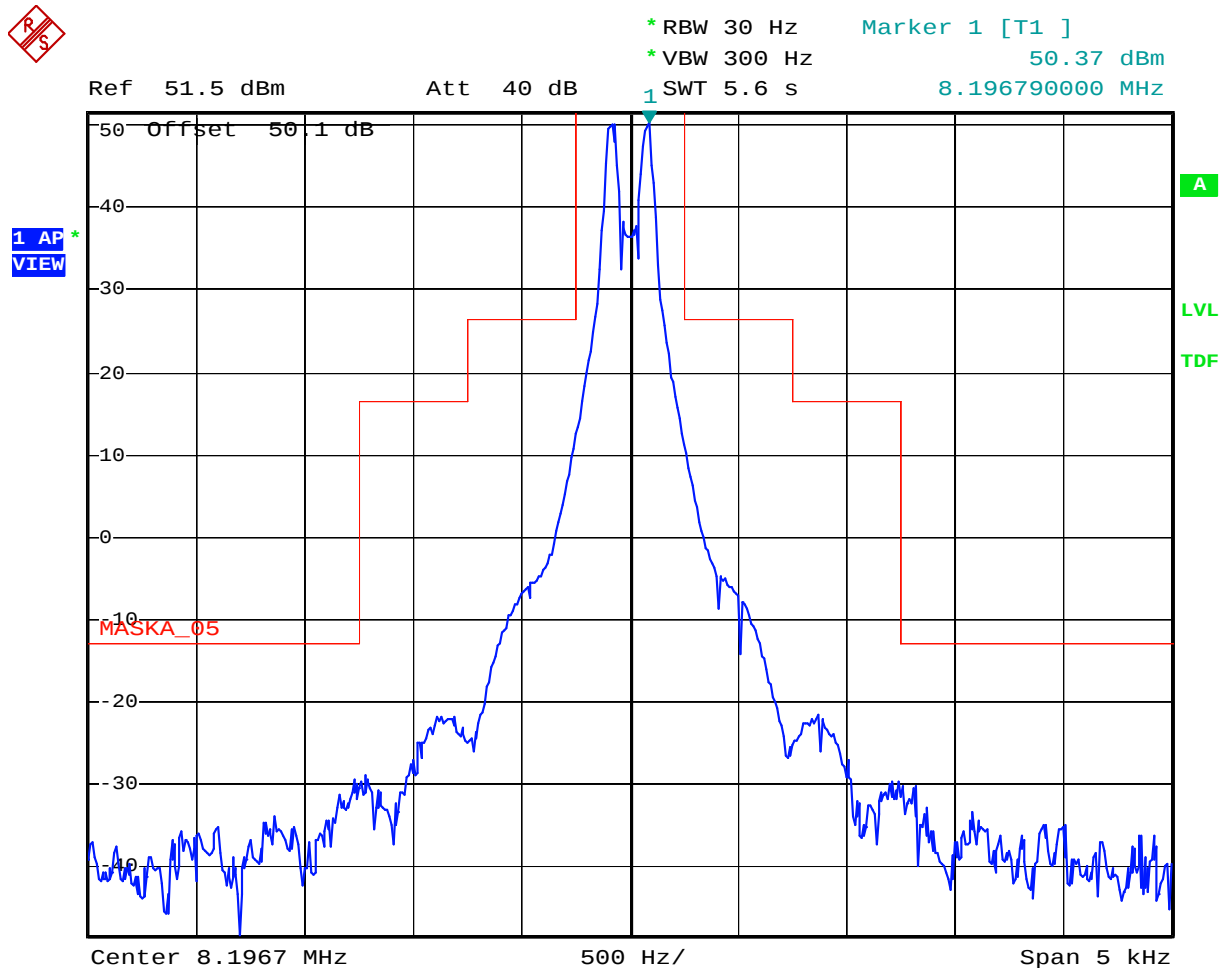
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 8.195MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 08:53:37

ULTRATECH GROUP OF LABS

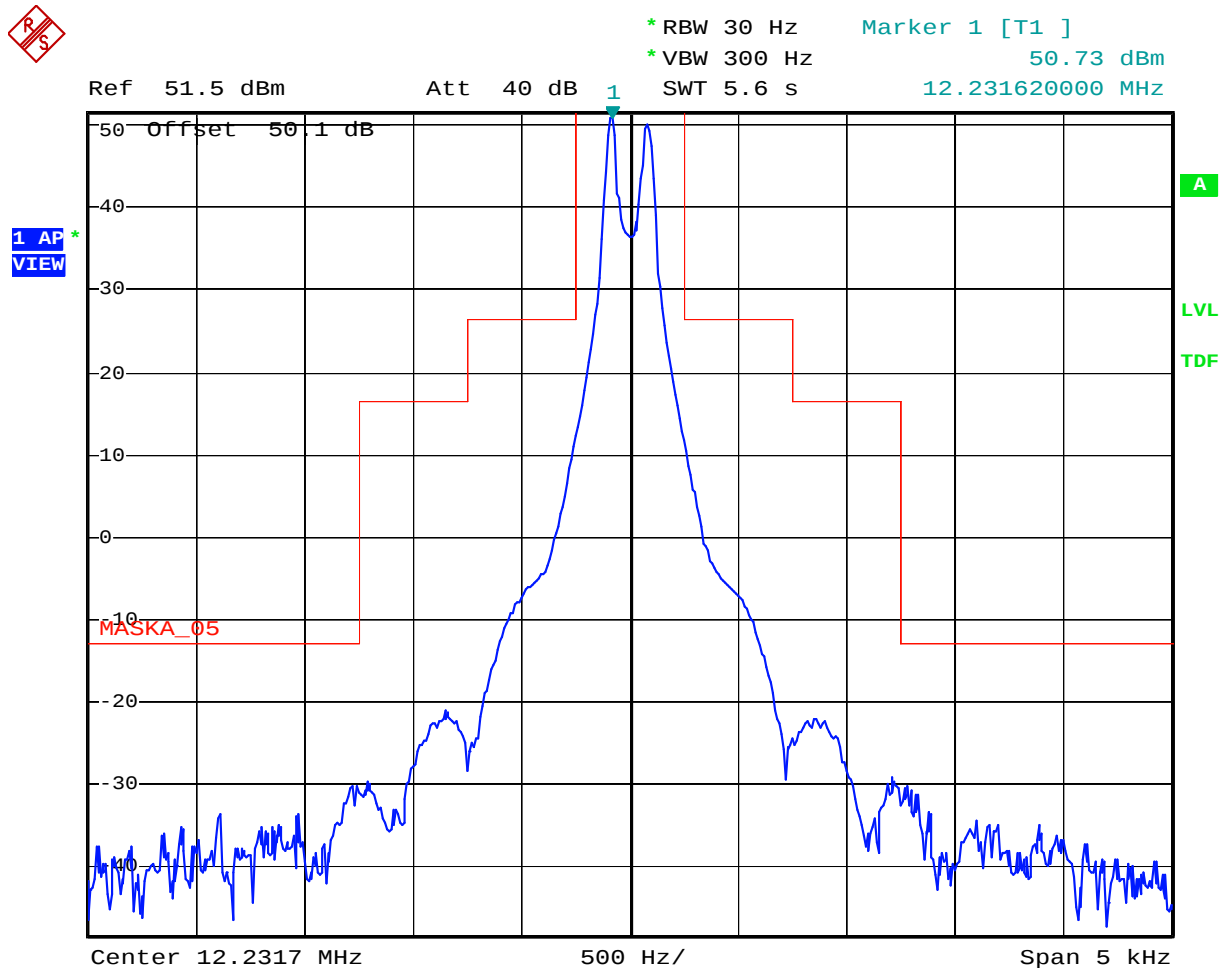
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 12.230MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 08:55:08

ULTRATECH GROUP OF LABS

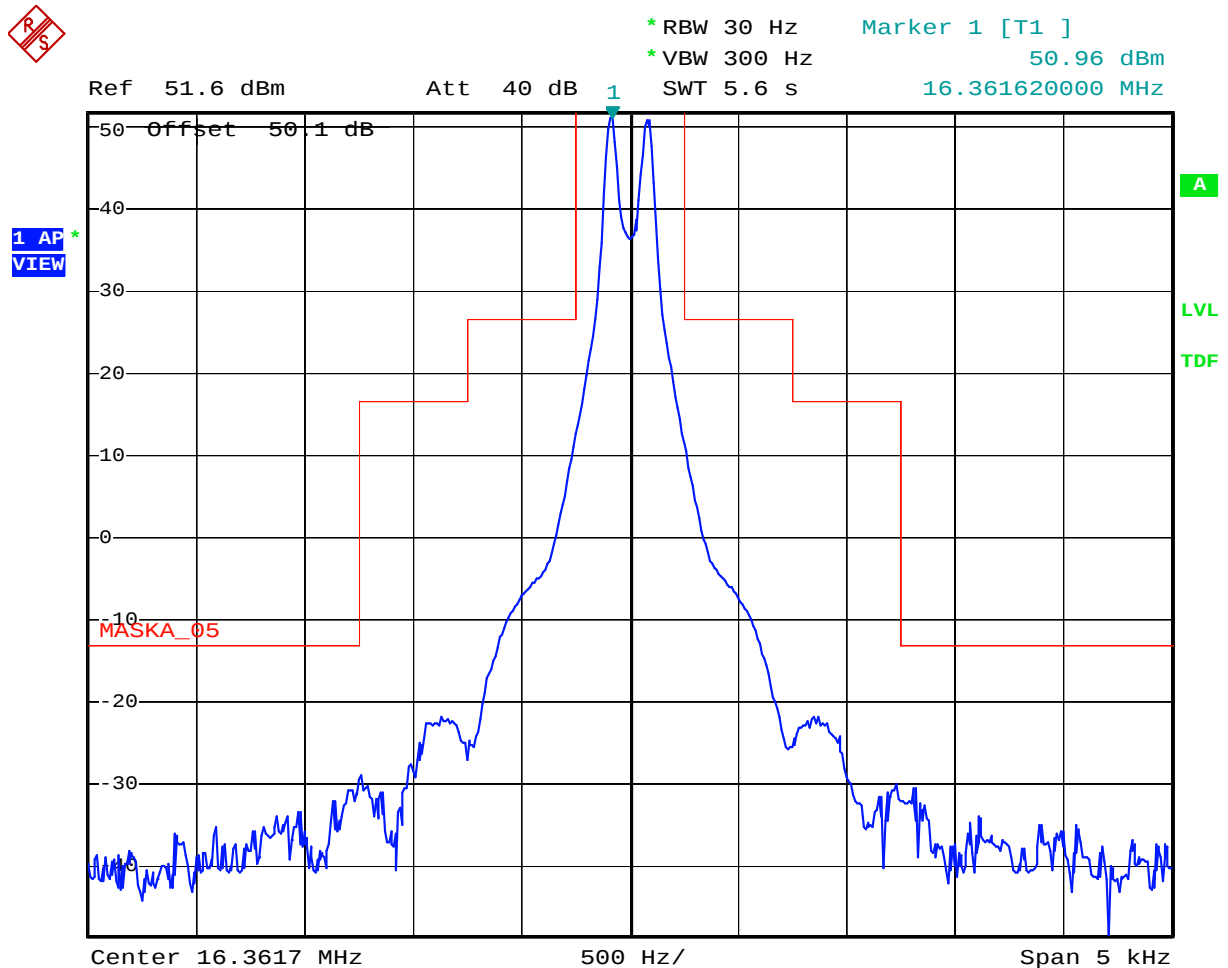
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 16.360MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 08:57:26

ULTRATECH GROUP OF LABS

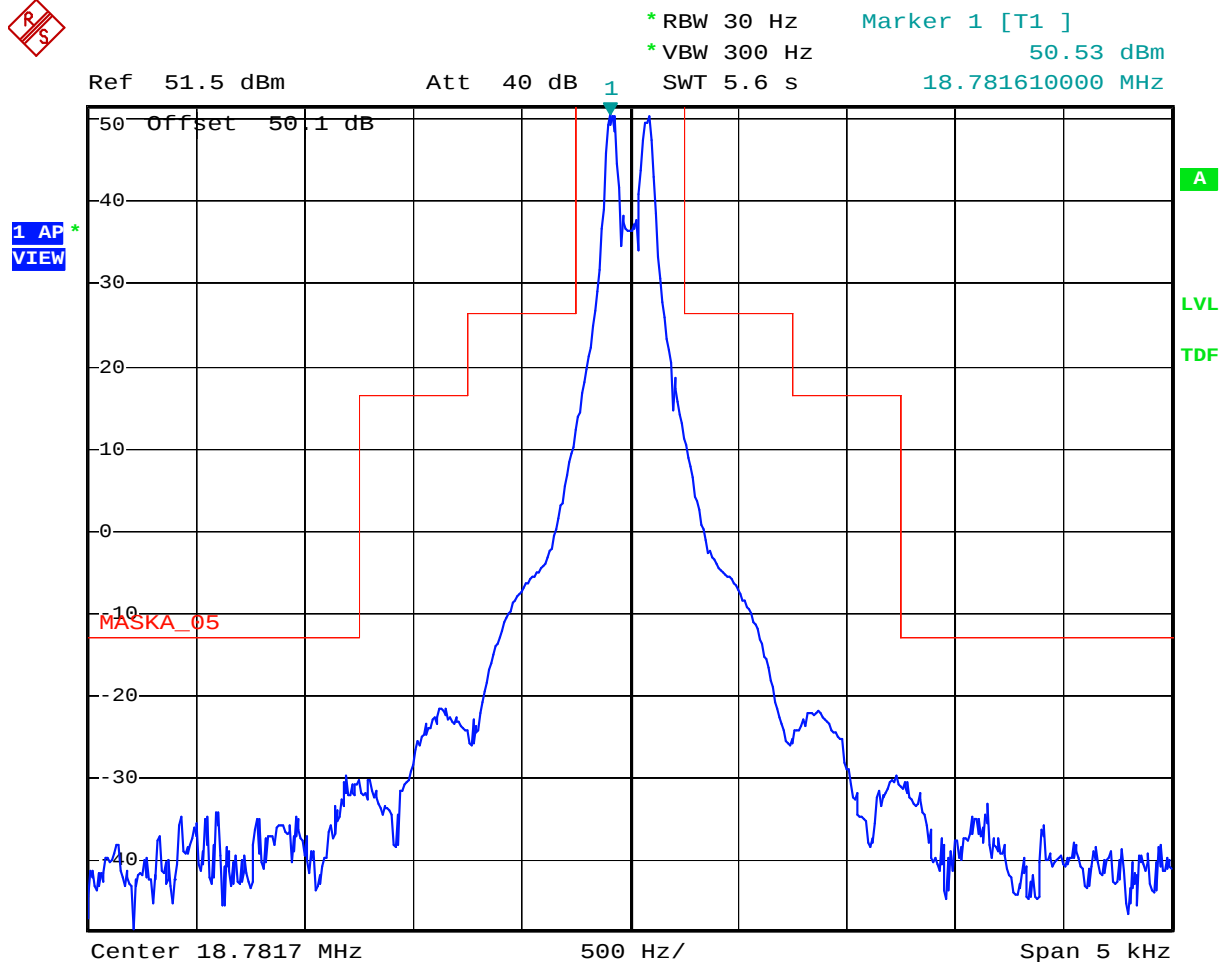
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 18.780MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:00:13

ULTRATECH GROUP OF LABS

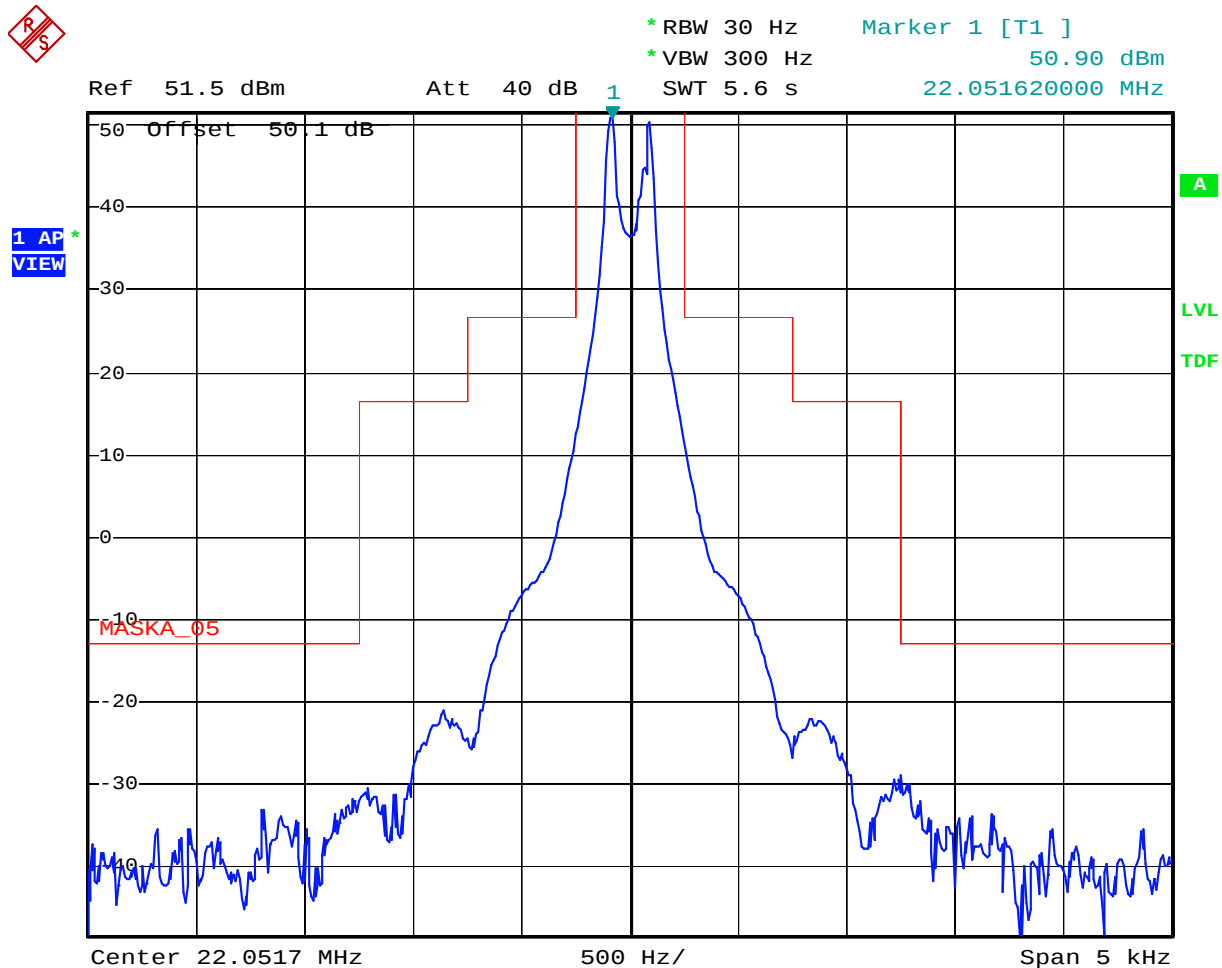
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 22.050MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:02:13

ULTRATECH GROUP OF LABS

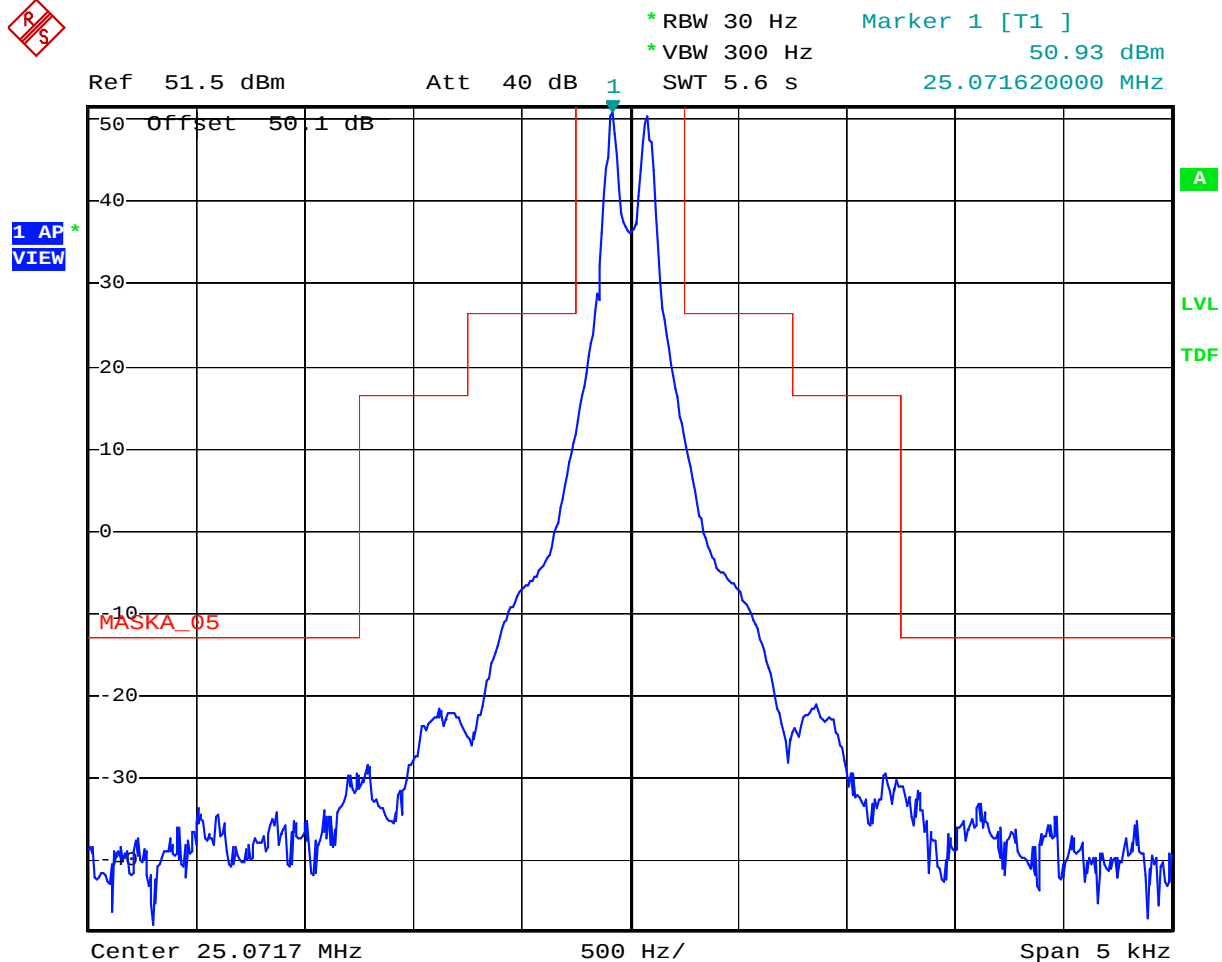
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 25.070MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:04:09

ULTRATECH GROUP OF LABS

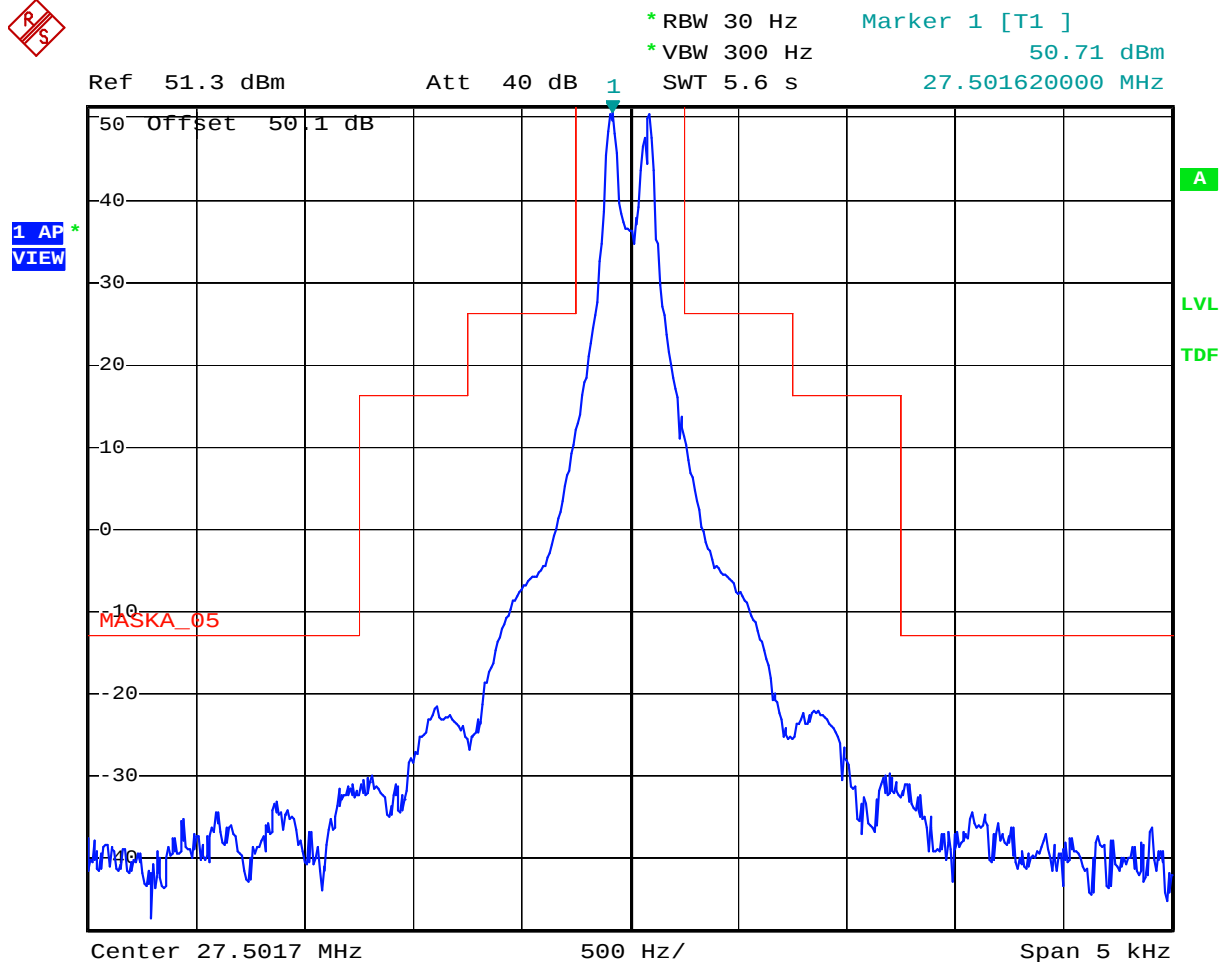
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 27.5MHz, High power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:06:16

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

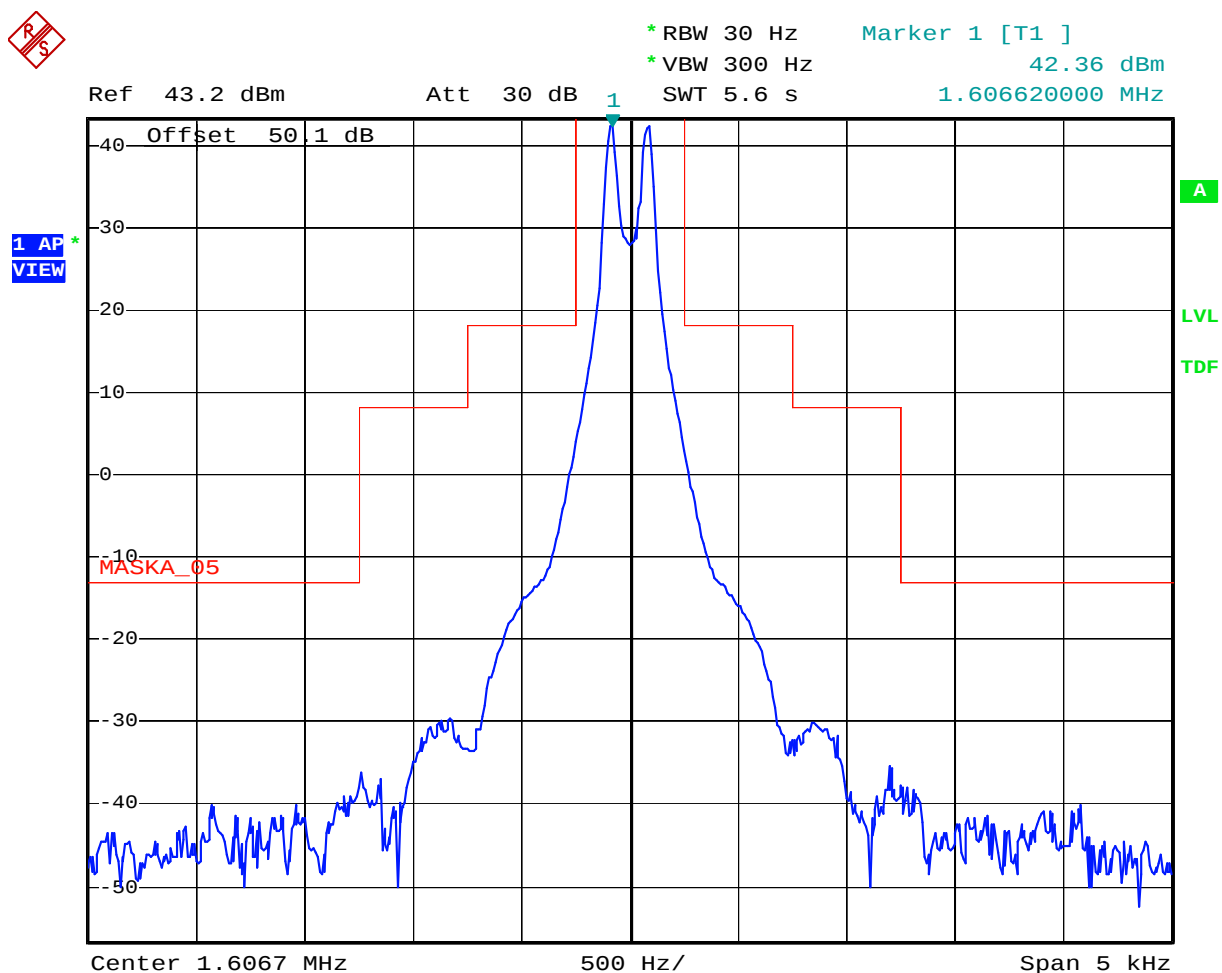
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Low Power

Configuration: F1B (FSK), 1.605MHz, Low power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:09:02

ULTRATECH GROUP OF LABS

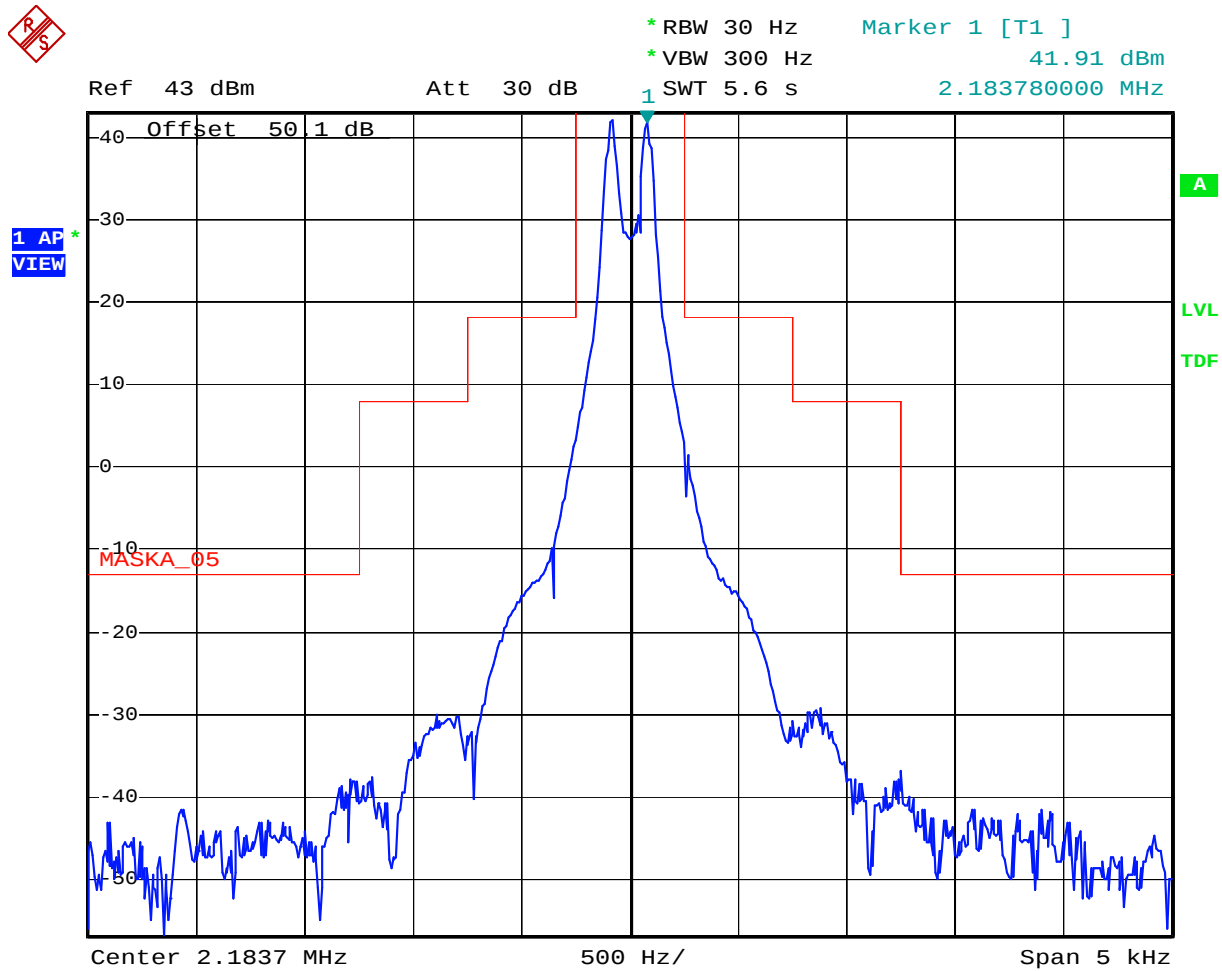
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 2.182MHz, Low power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:13:27

ULTRATECH GROUP OF LABS

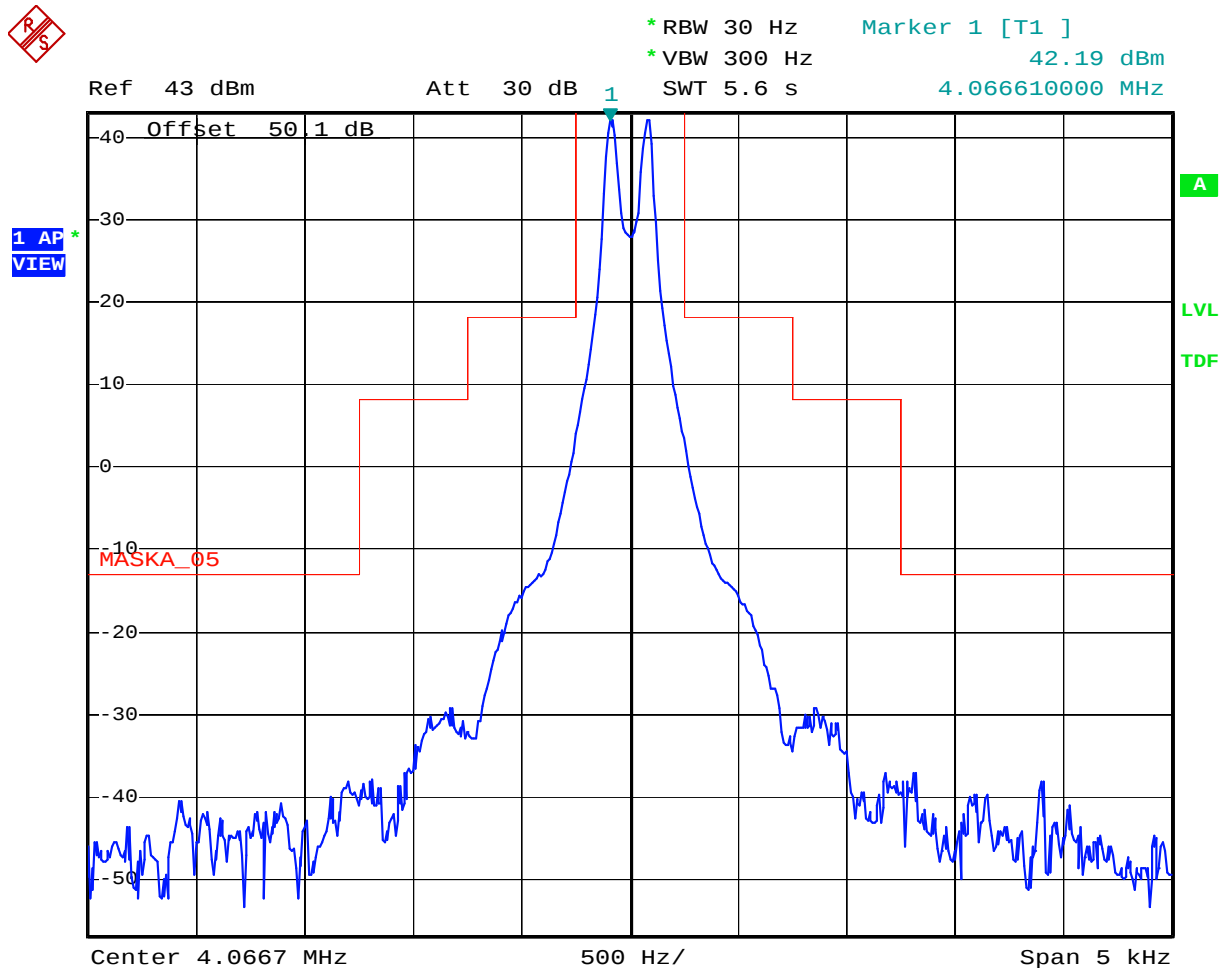
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 4.065MHz, Low power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:15:26

ULTRATECH GROUP OF LABS

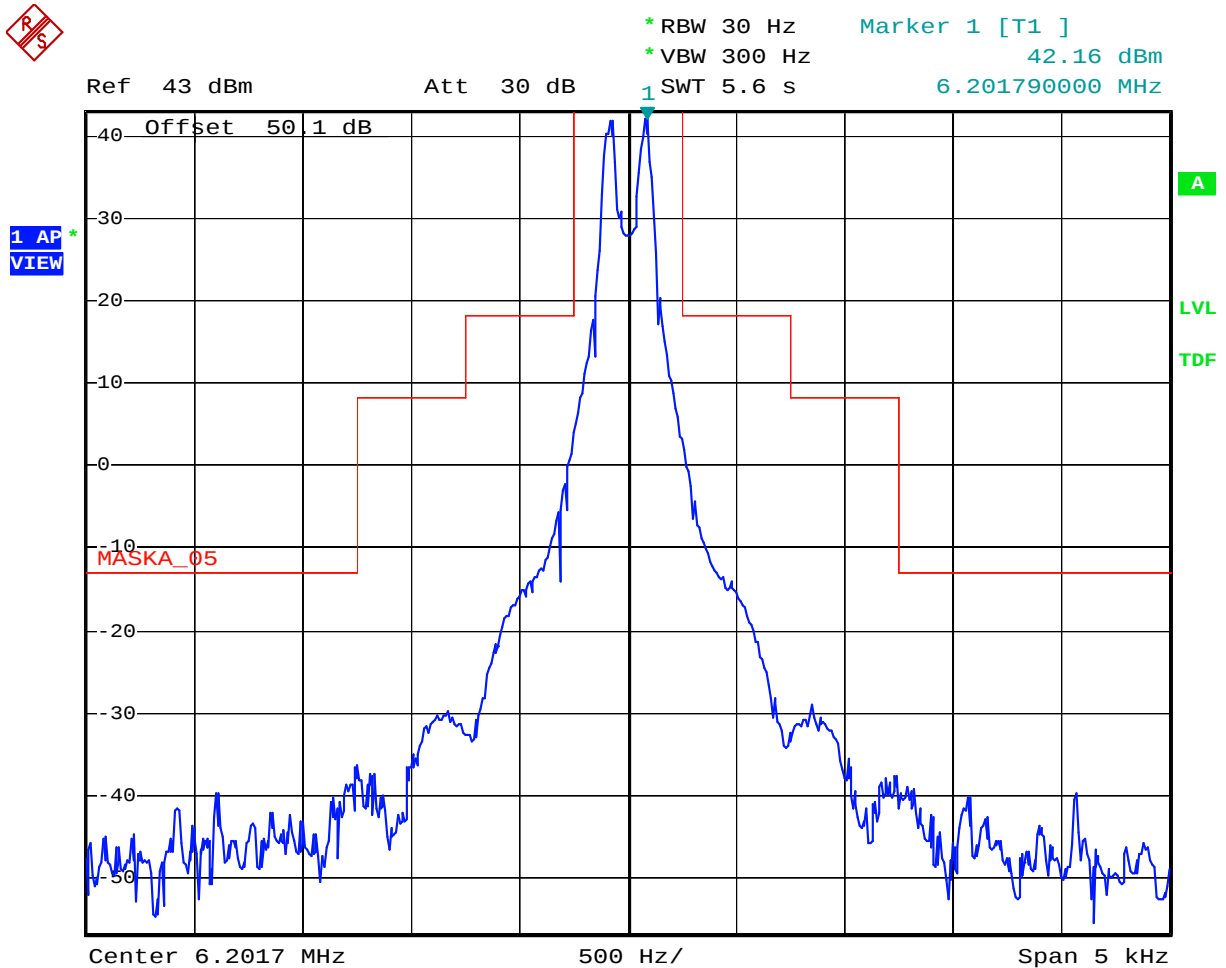
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 6.2MHz, Low power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:17:15

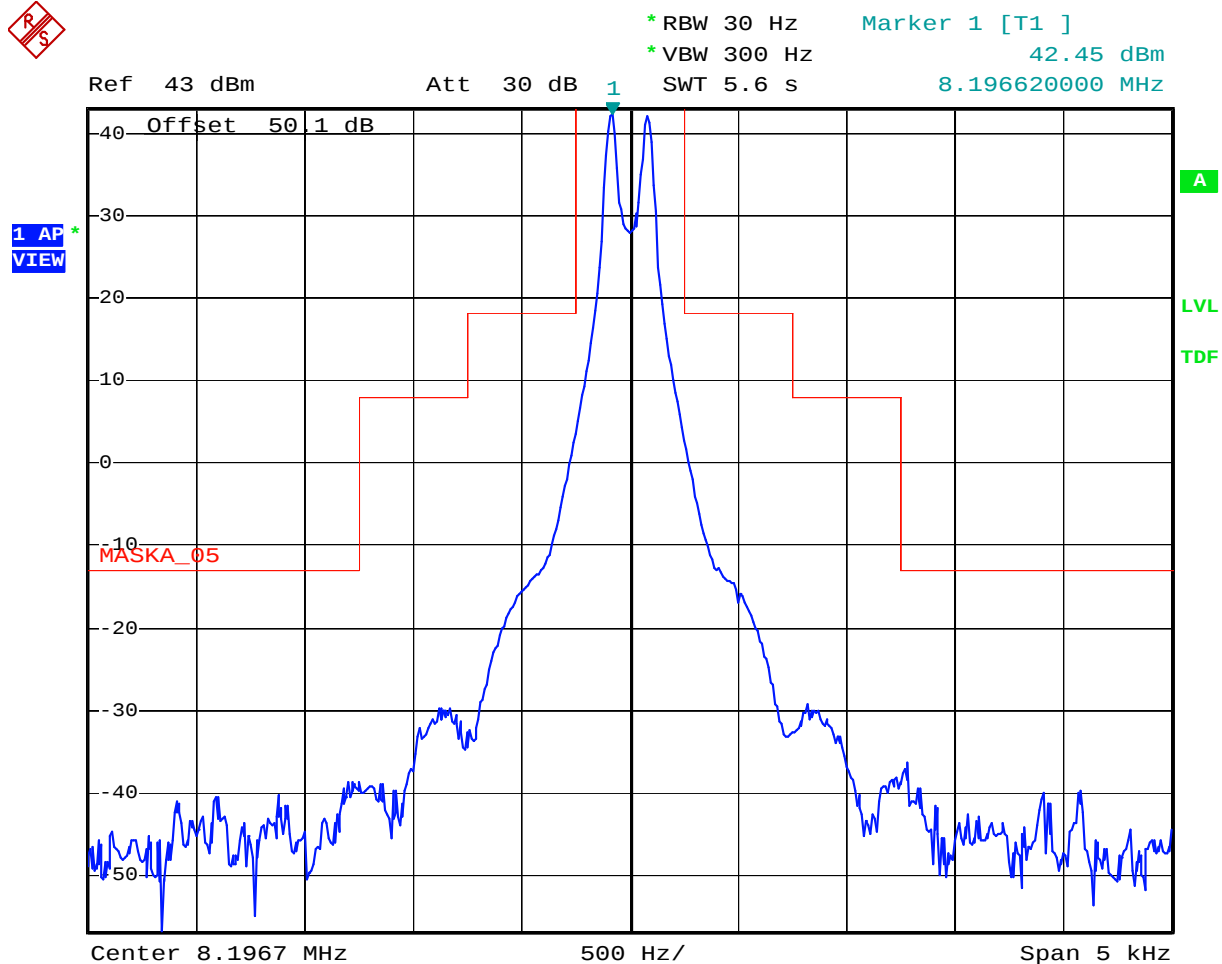
ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 8.195MHz, Low power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:19:18

ULTRATECH GROUP OF LABS

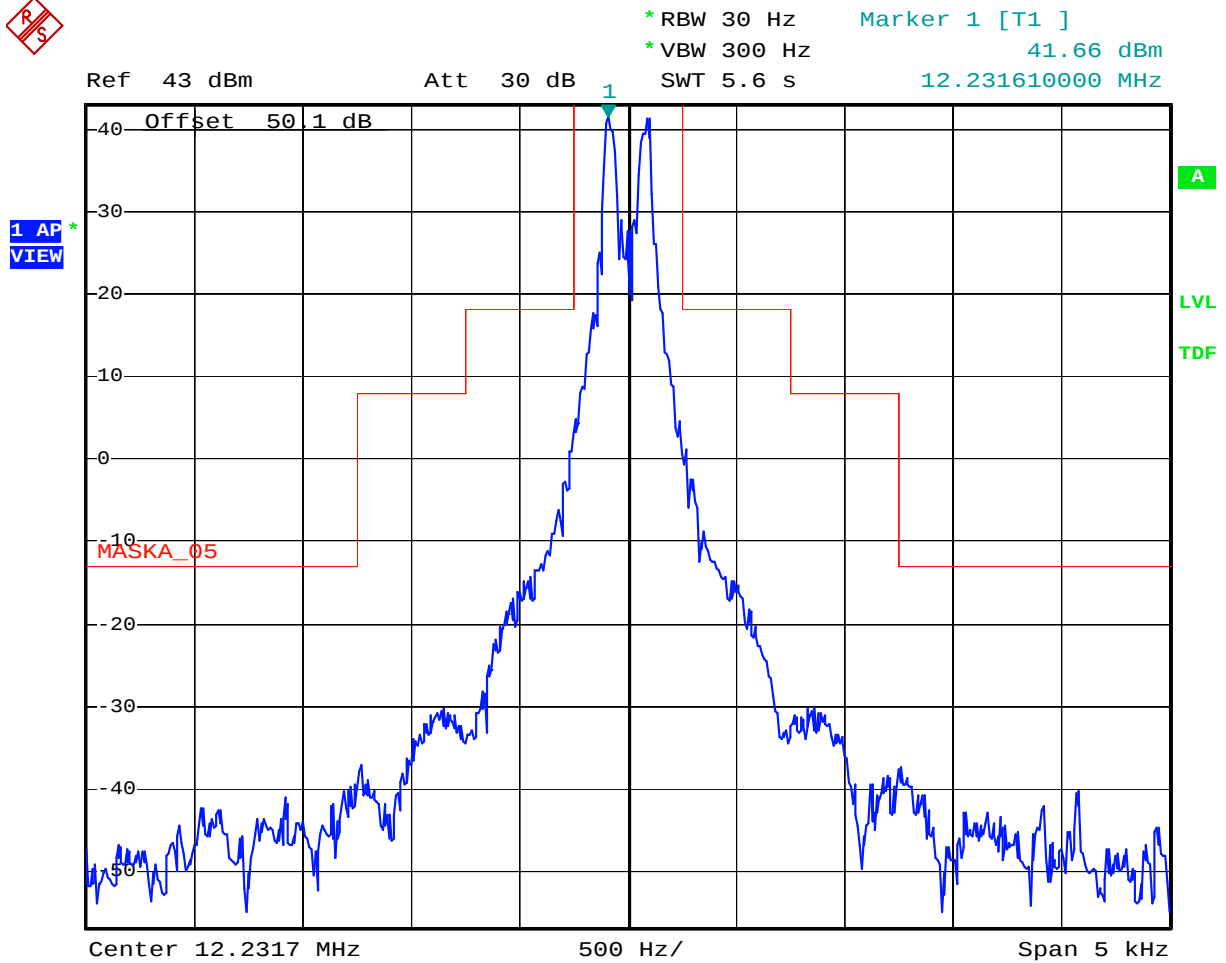
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 12.230MHz, Low power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:20:53

ULTRATECH GROUP OF LABS

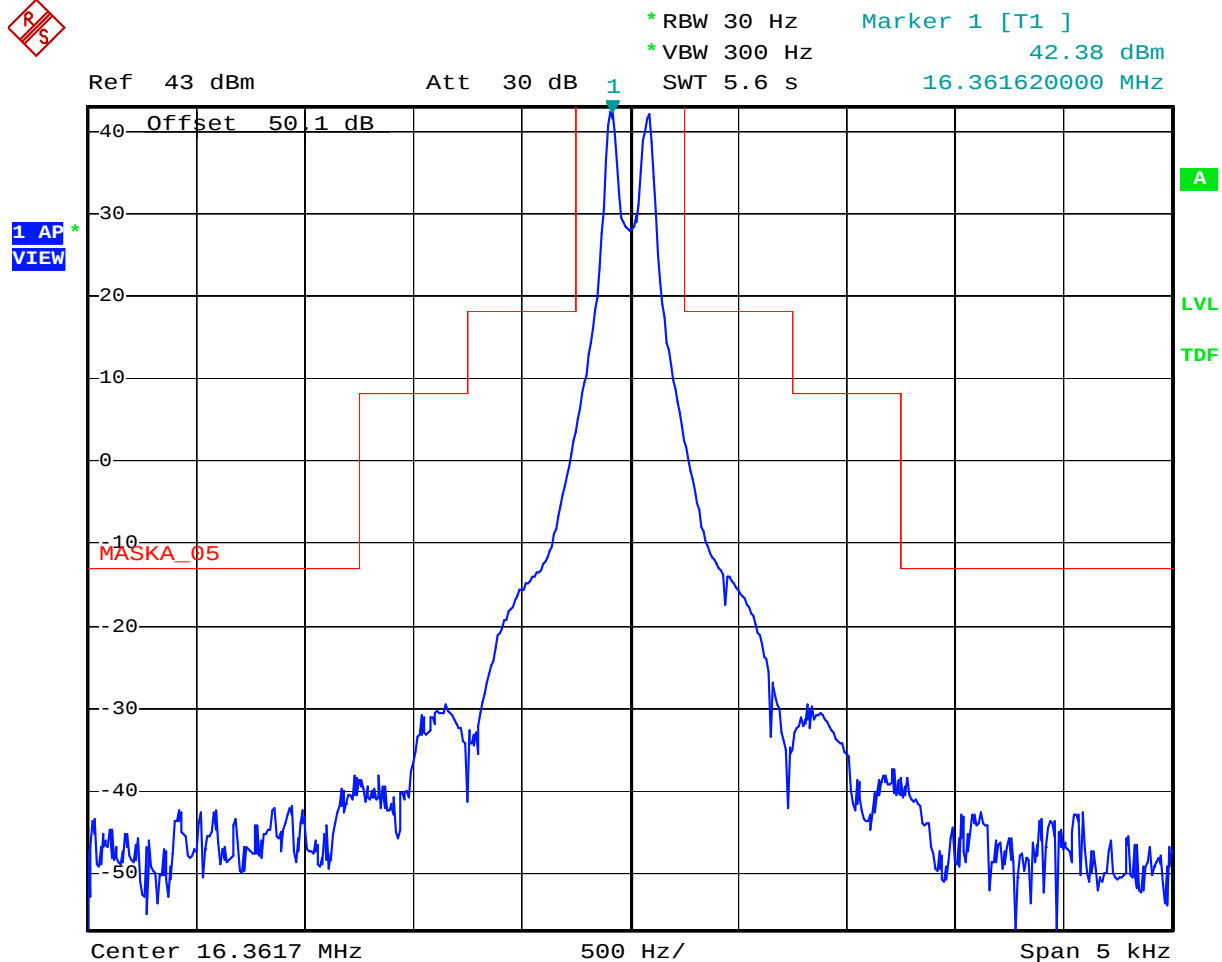
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 16.360MHz, Low power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:23:08

ULTRATECH GROUP OF LABS

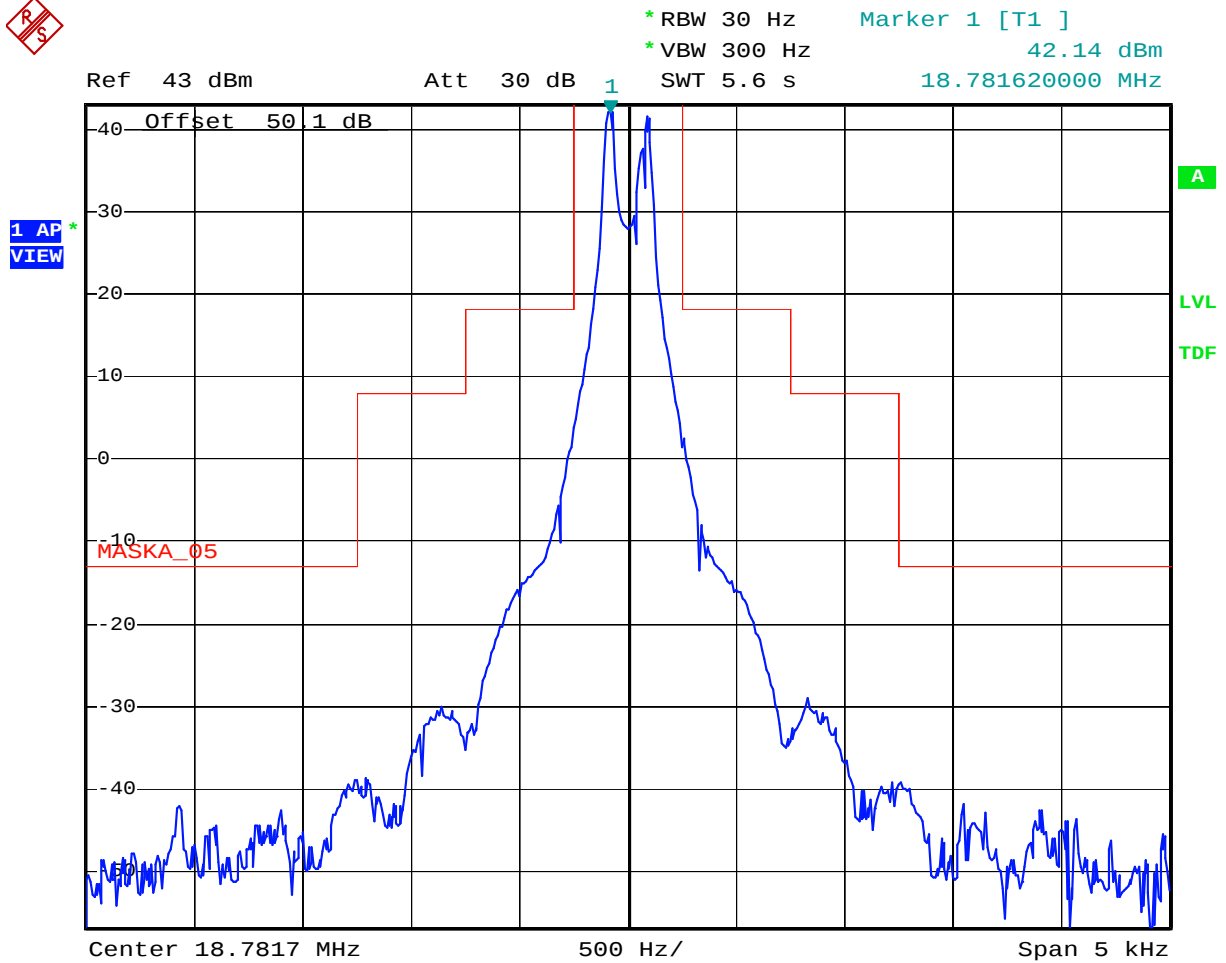
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 18.780MHz, Low power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:24:59

ULTRATECH GROUP OF LABS

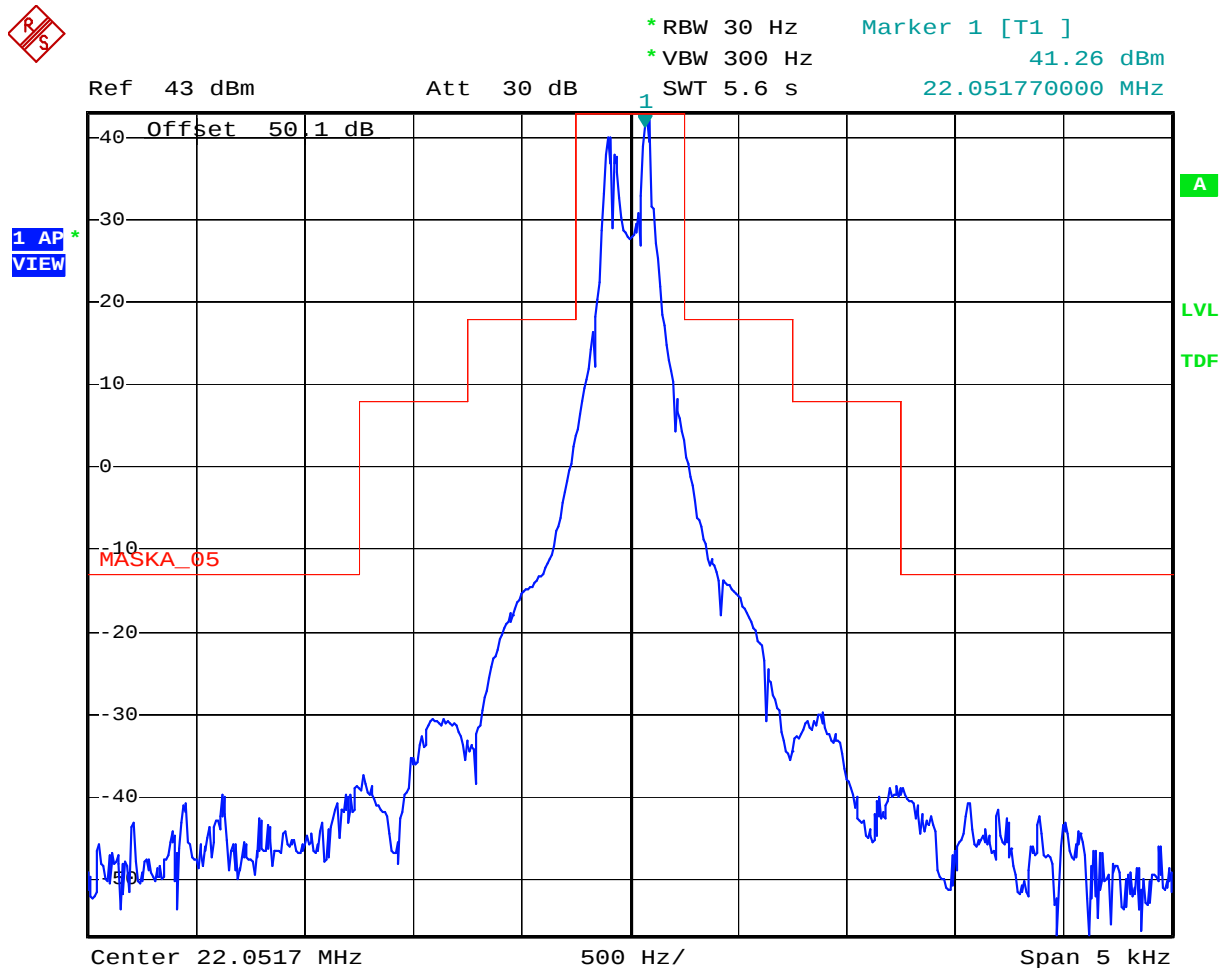
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 22.050MHz, Low power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:26:44

ULTRATECH GROUP OF LABS

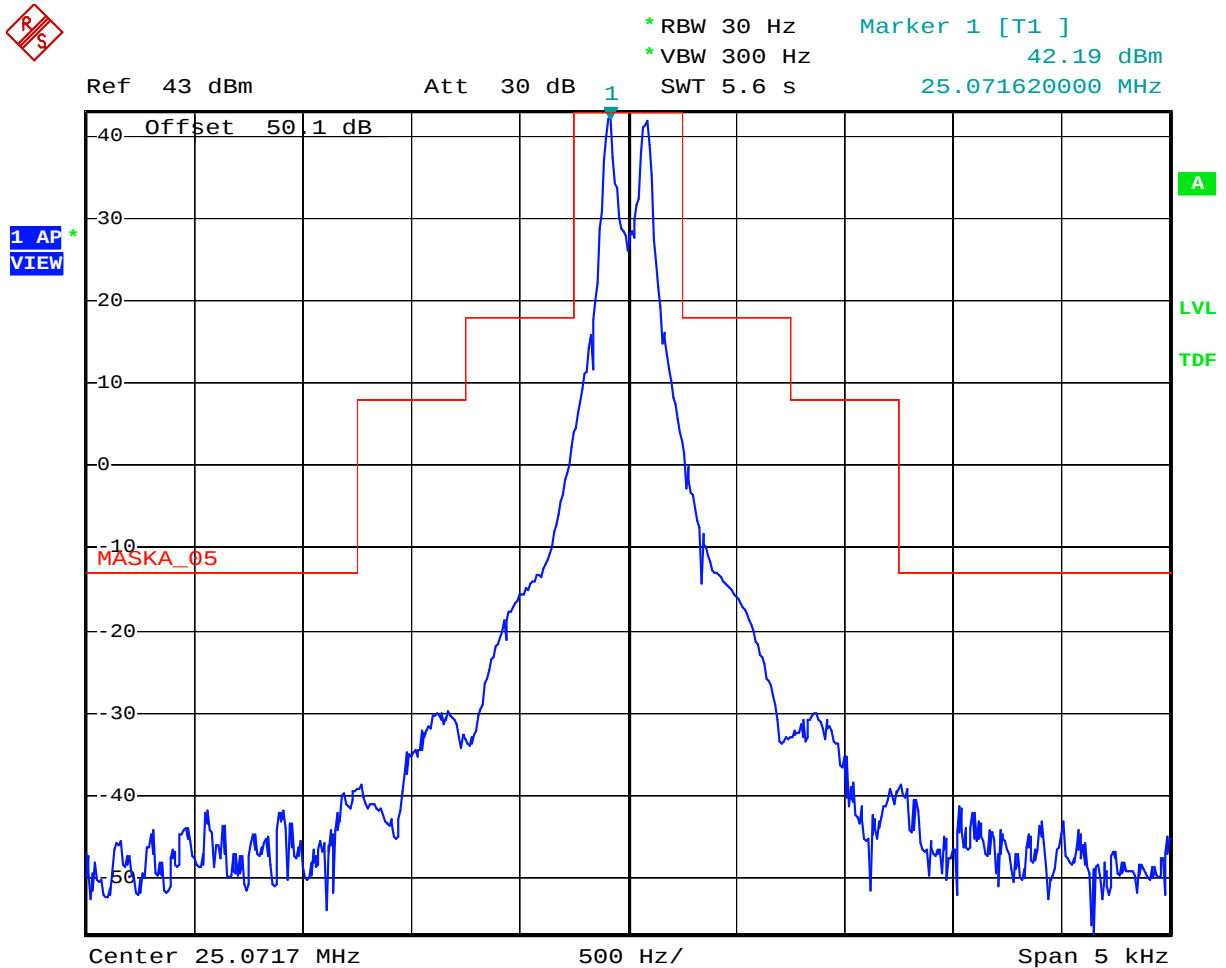
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 25.070MHz, Low power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:28:00

ULTRATECH GROUP OF LABS

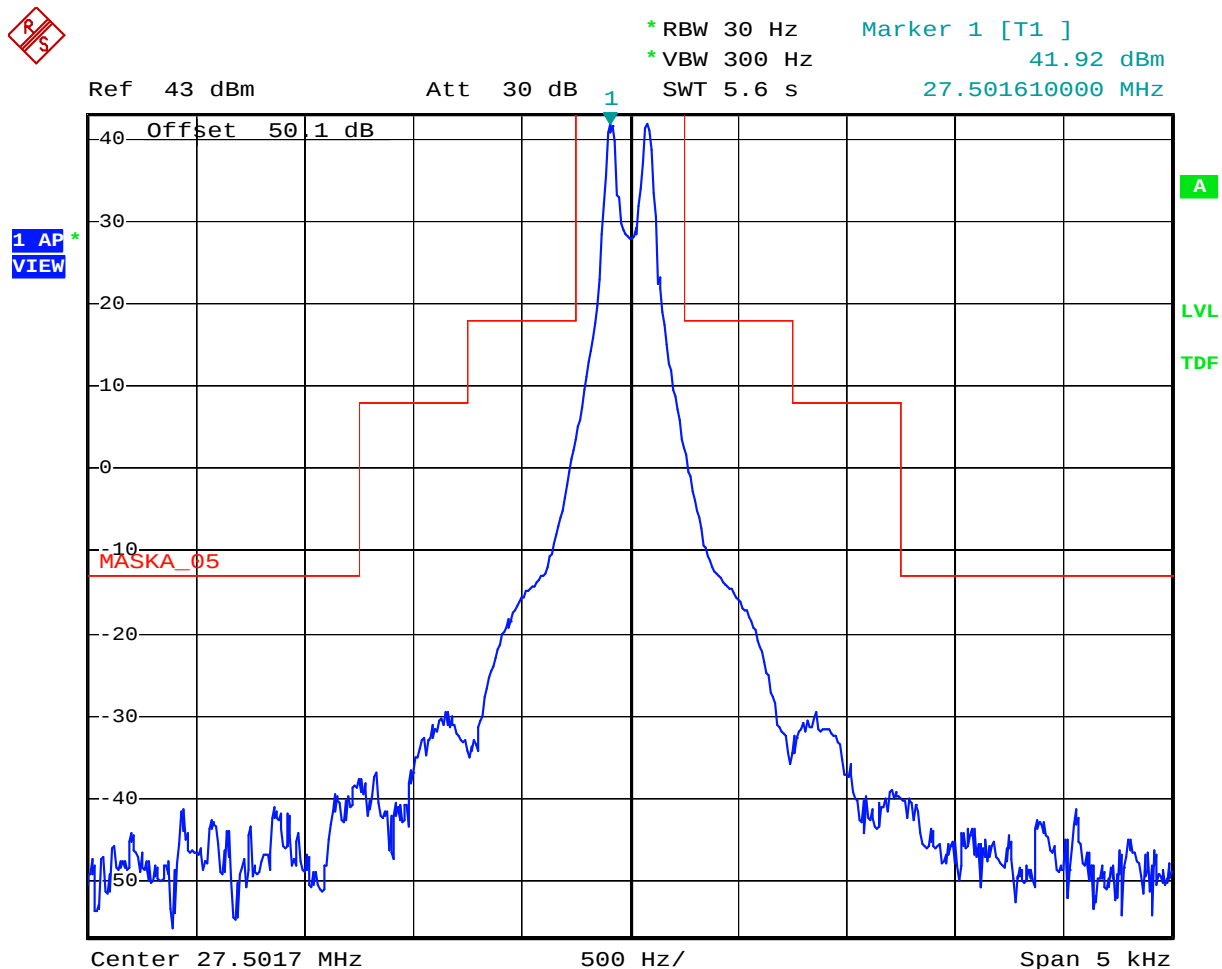
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: F1B (FSK), 27.5MHz, Low power, Mark Frequency: 1615Hz, Shift Frequency: 170Hz



Date: 30.OCT.2019 09:30:05

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

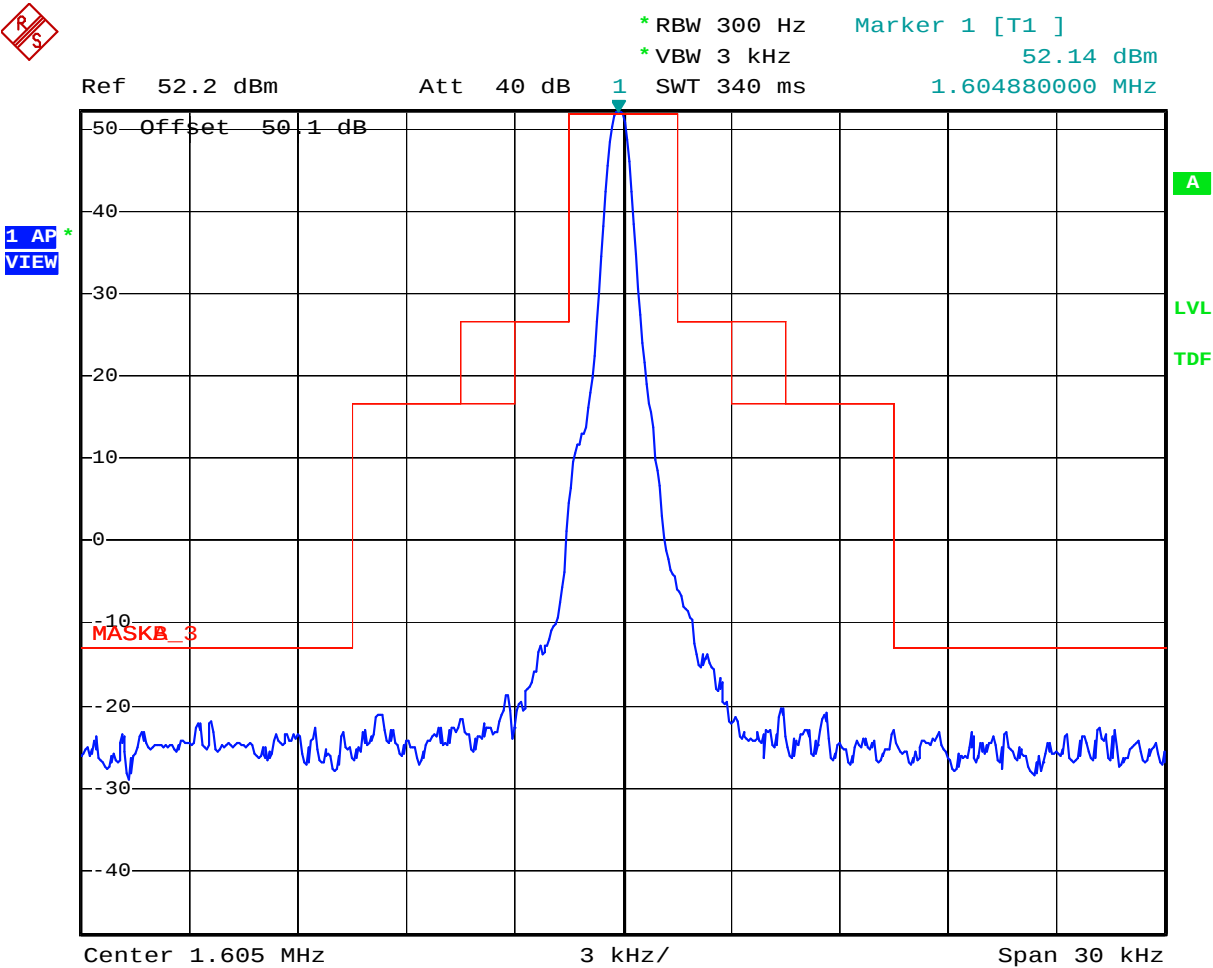
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

MASK FOR J2B

High Power

Configuration: J2B (AFSK), 1.605MHz, High power, Modulation: 1.7 KHz



Date: 30.OCT.2019 14:56:20

ULTRATECH GROUP OF LABS

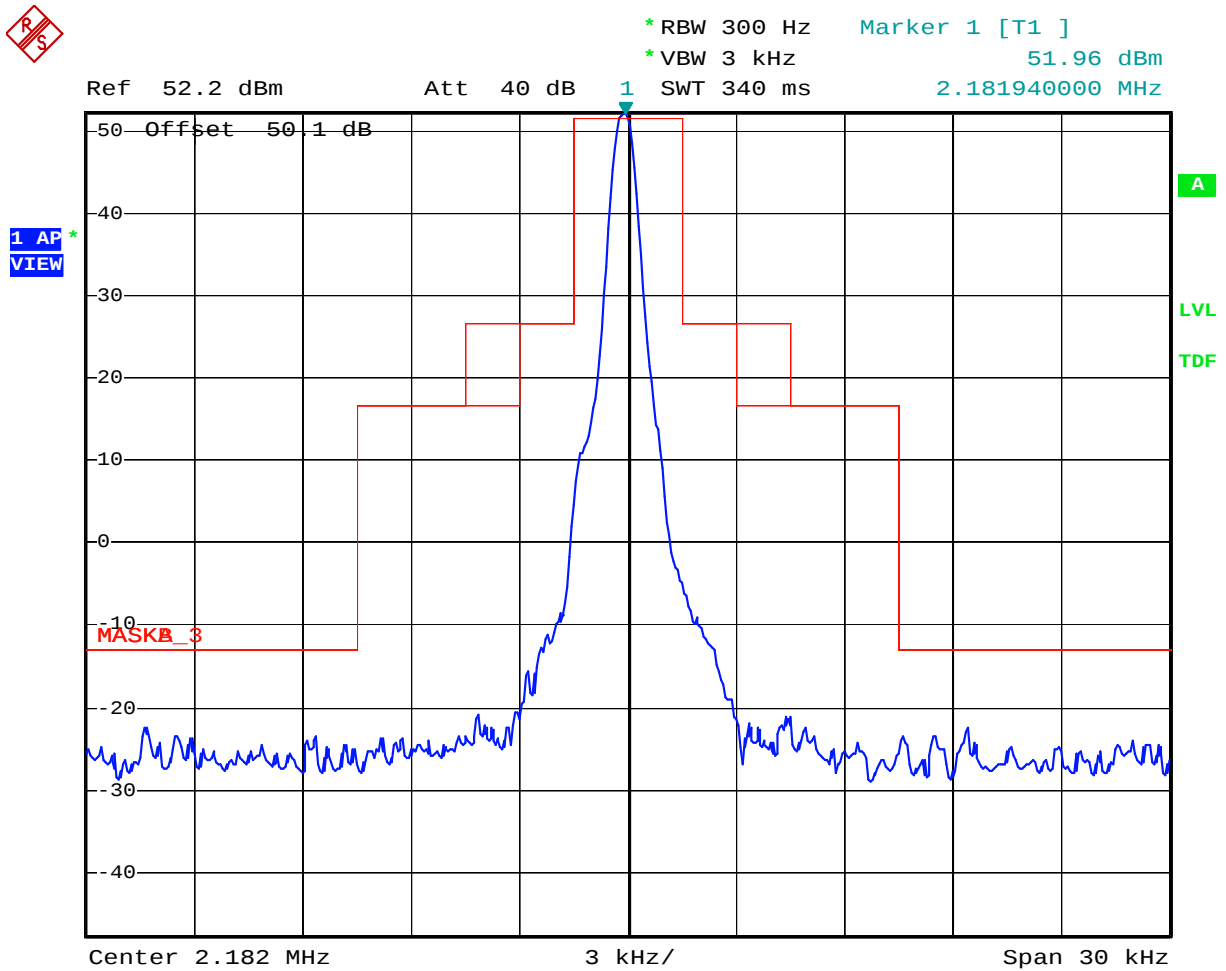
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 2.182MHz, High power, Modulation: 1.7 KHz



Date: 30.OCT.2019 14:58:22

ULTRATECH GROUP OF LABS

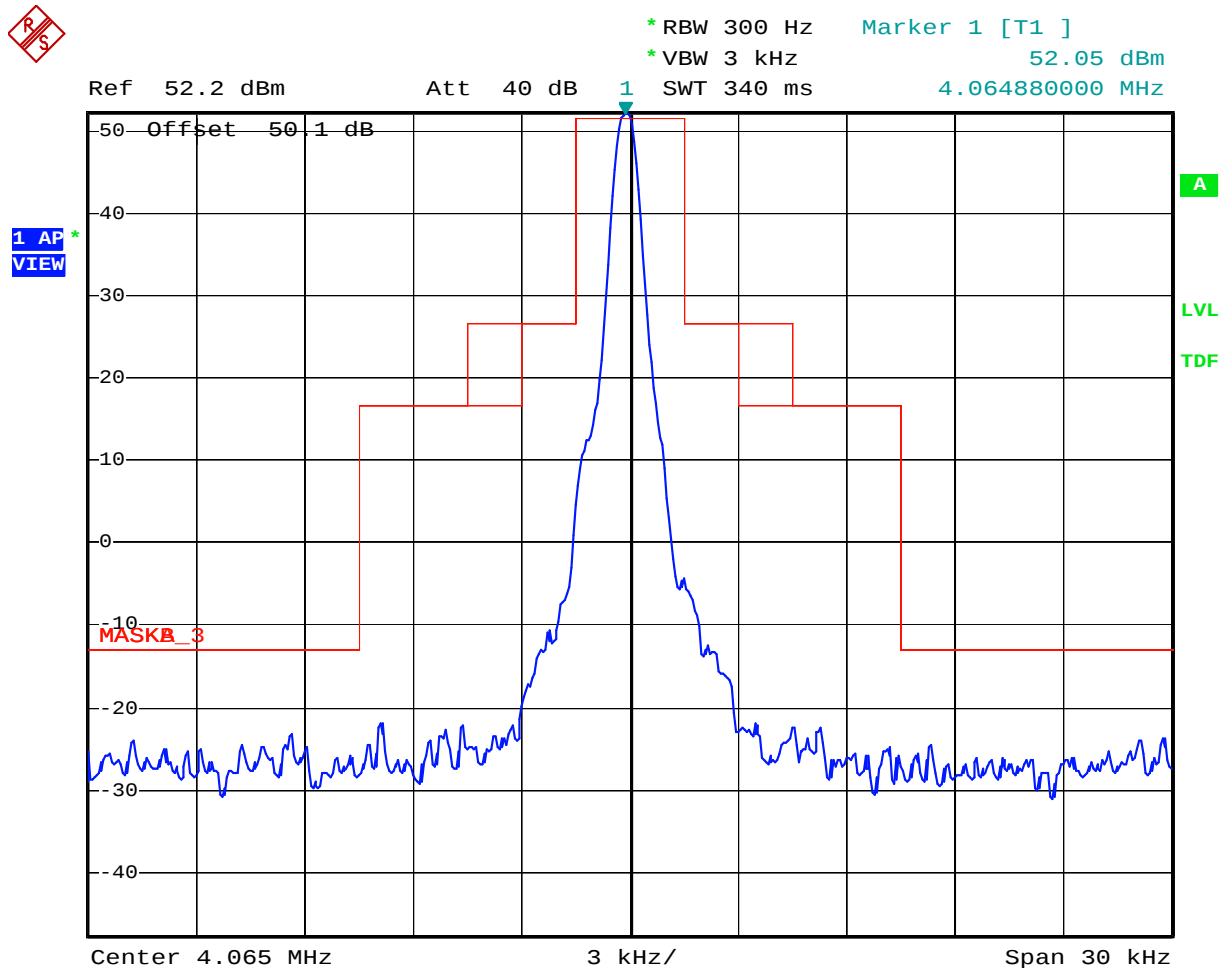
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 4.065MHz, High power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:00:20

ULTRATECH GROUP OF LABS

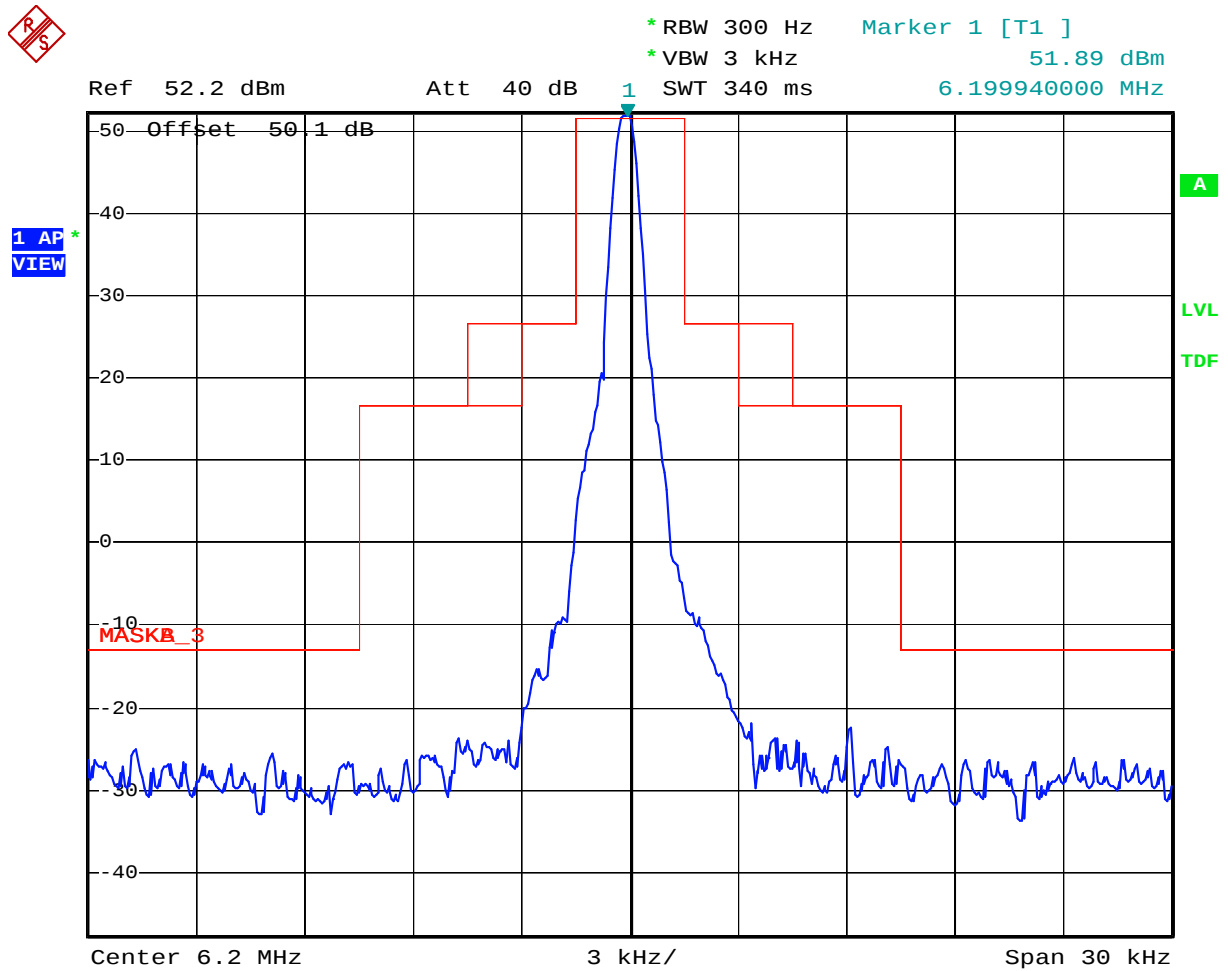
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 6.2MHz, High power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:02:29

ULTRATECH GROUP OF LABS

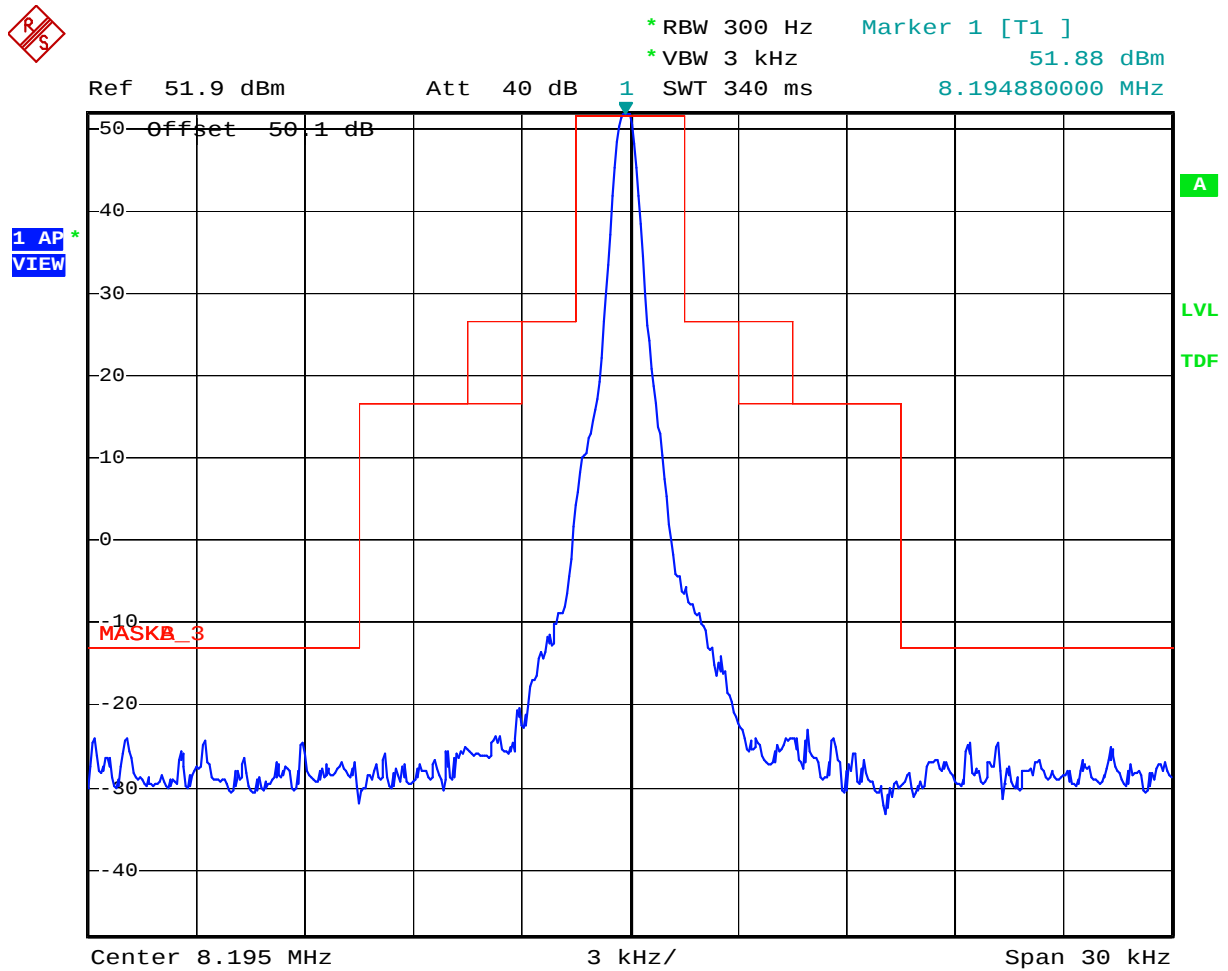
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 8.195MHz, High power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:09:02

ULTRATECH GROUP OF LABS

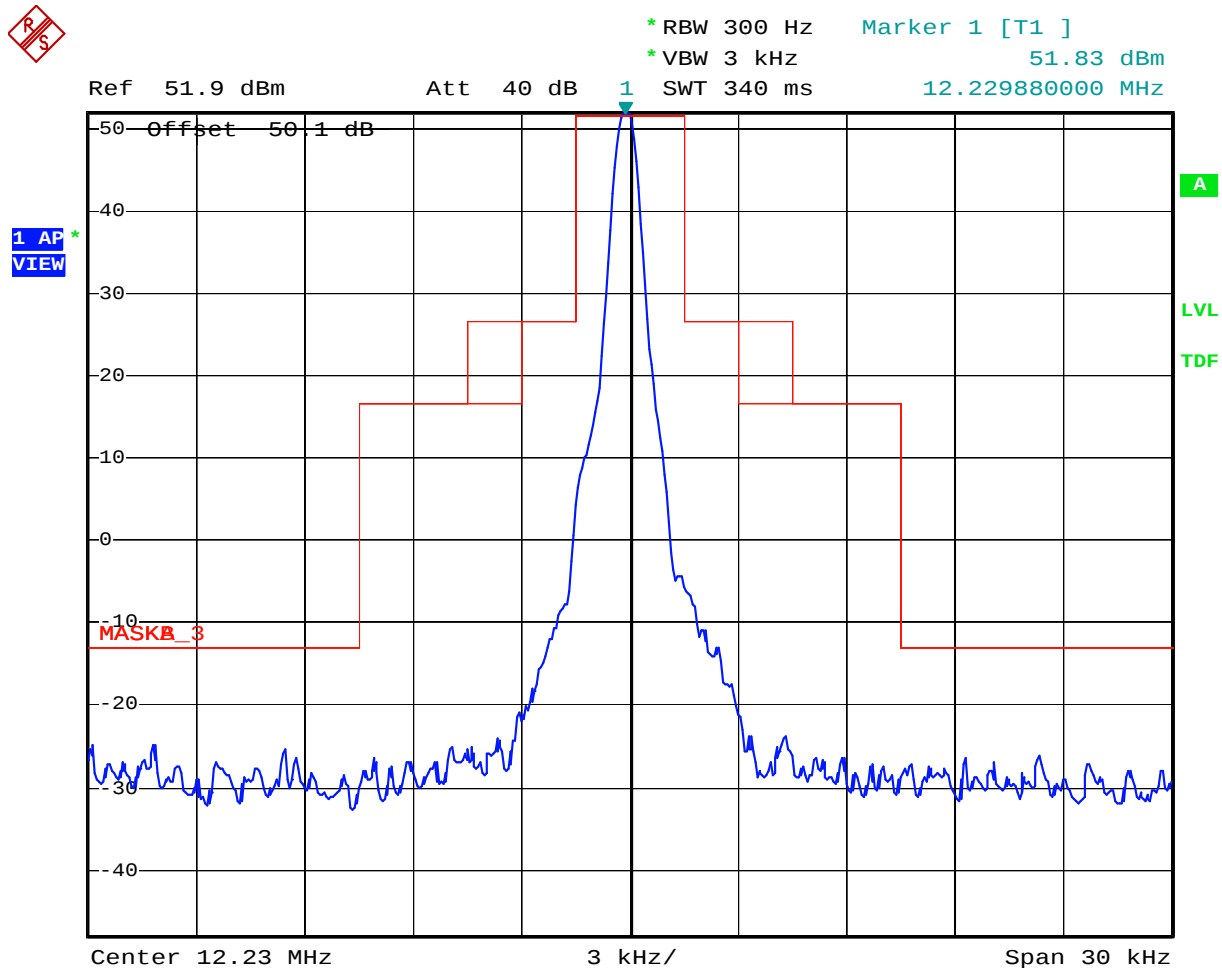
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 12.230MHz, High power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:11:28

ULTRATECH GROUP OF LABS

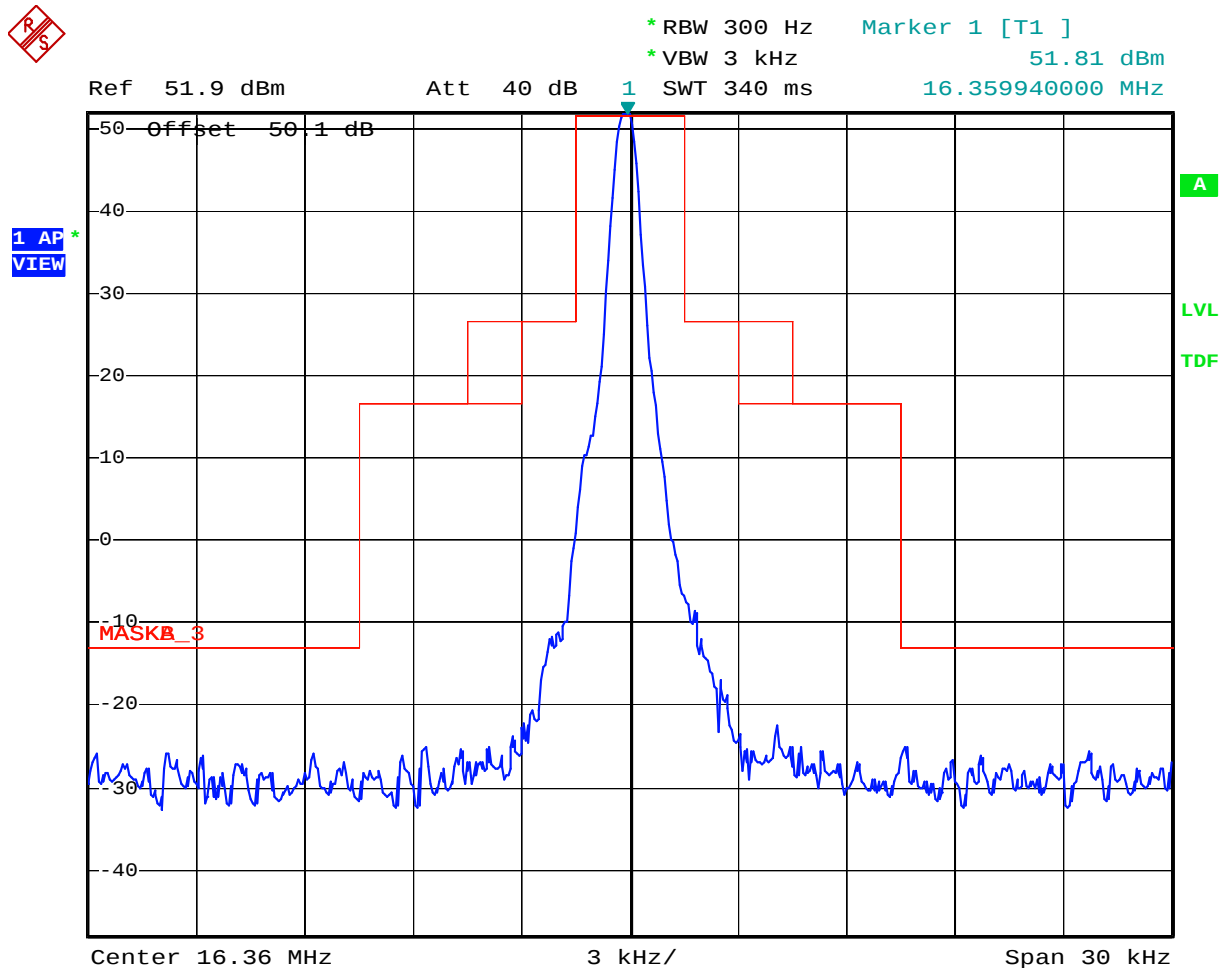
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 16.360MHz, High power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:13:19

ULTRATECH GROUP OF LABS

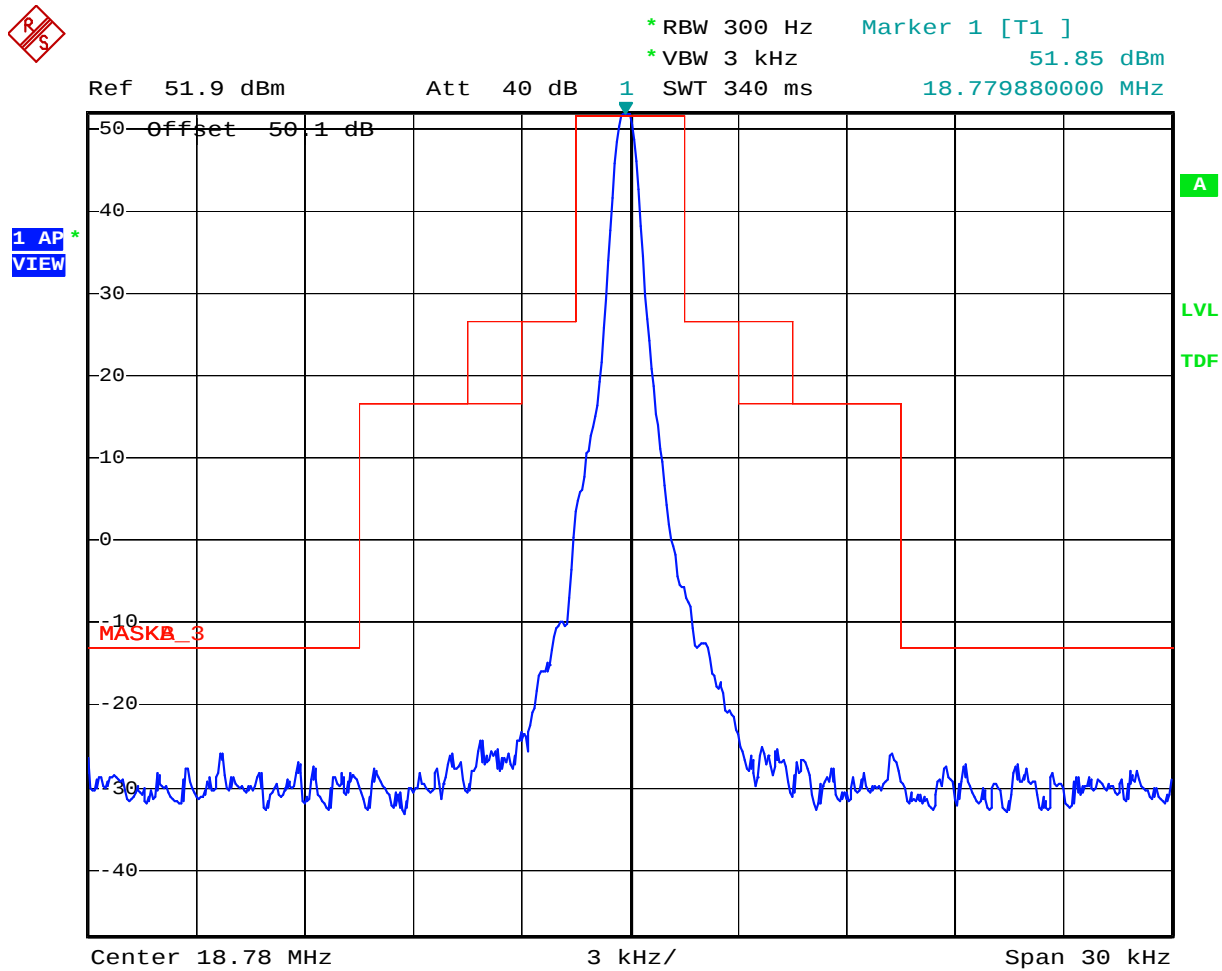
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 18.780MHz, High power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:15:27

ULTRATECH GROUP OF LABS

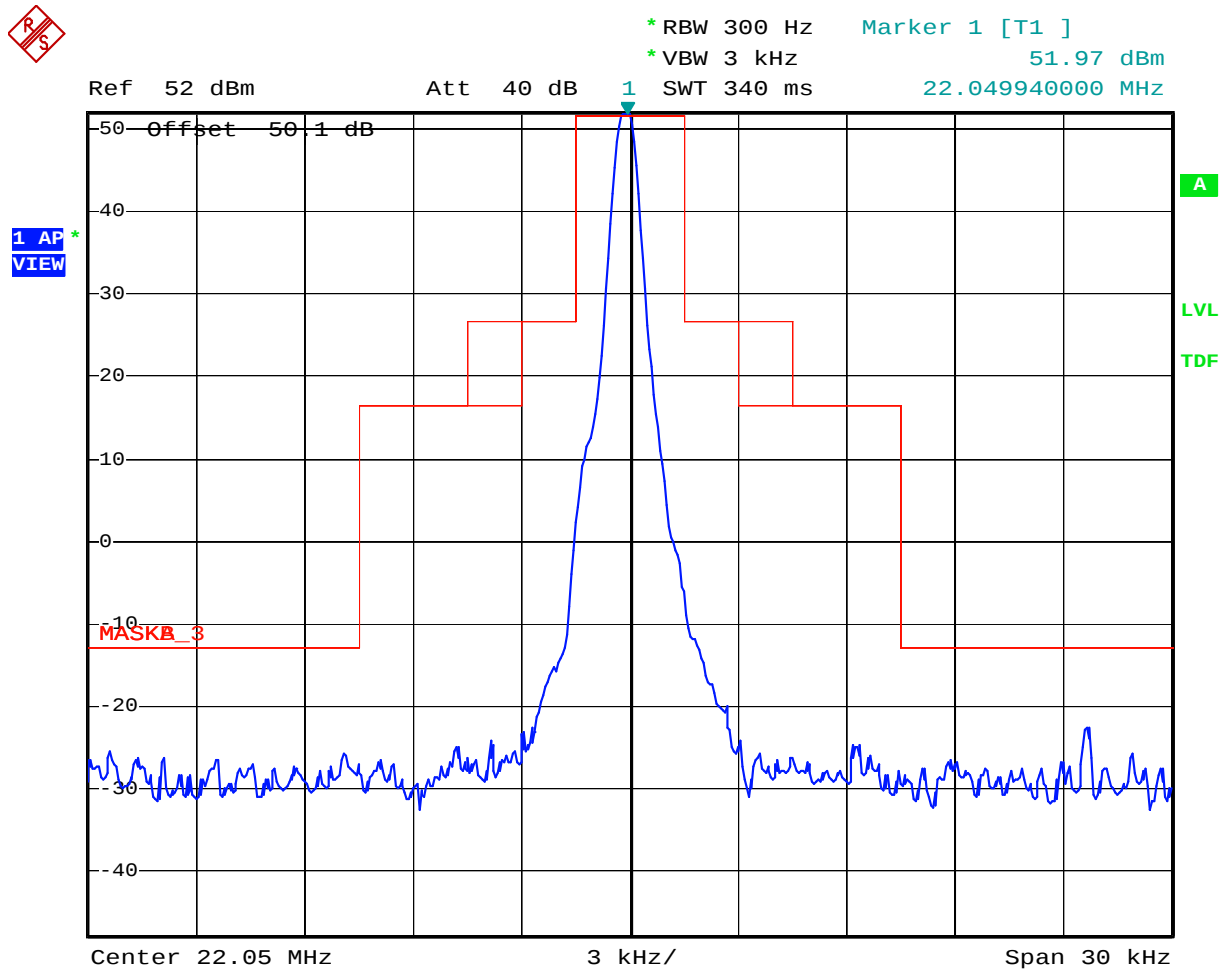
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 22.050MHz, High power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:17:35

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

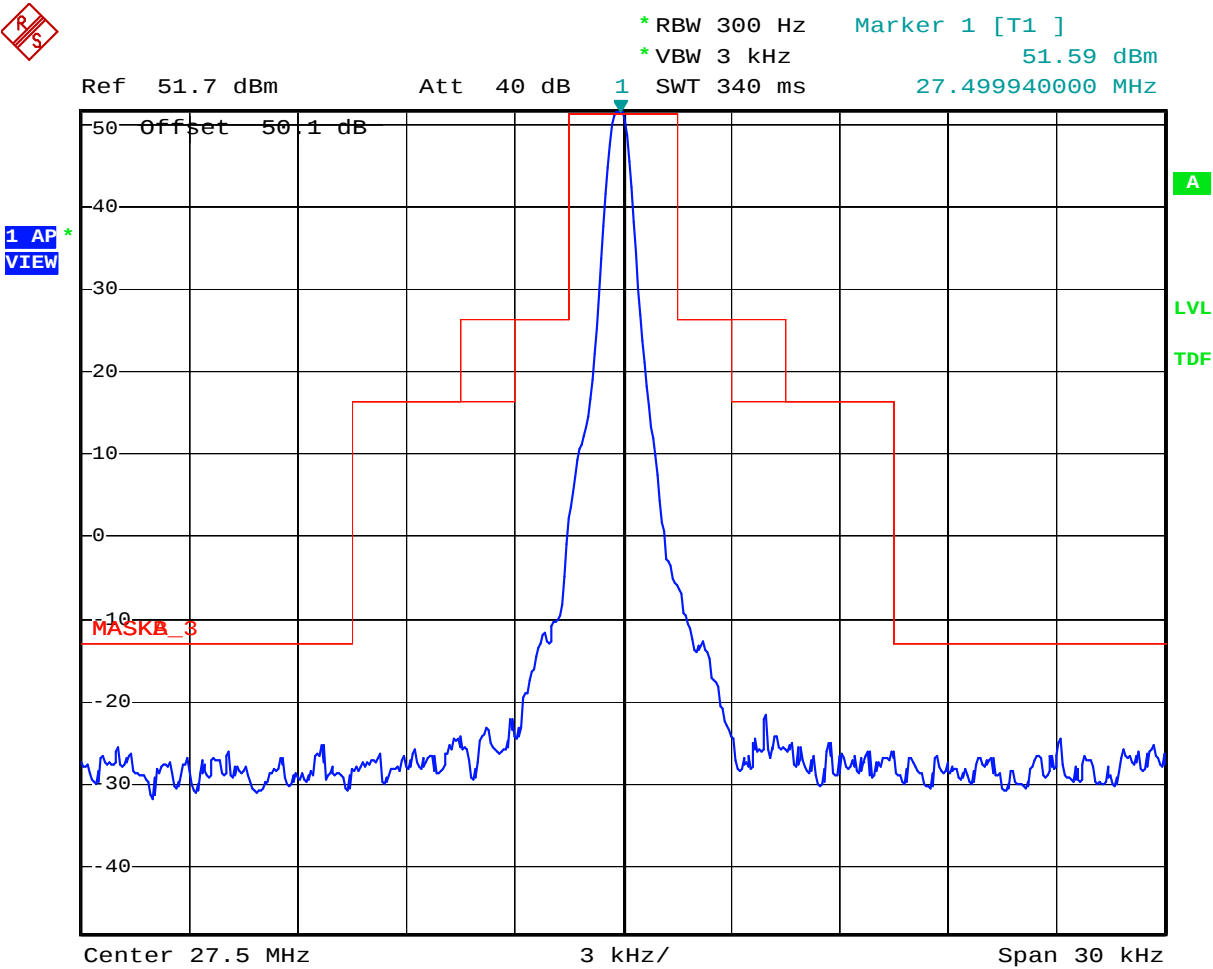


A

LVL

TDF

Configuration: J2B (AFSK), 27.5MHz, High power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:21:27

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

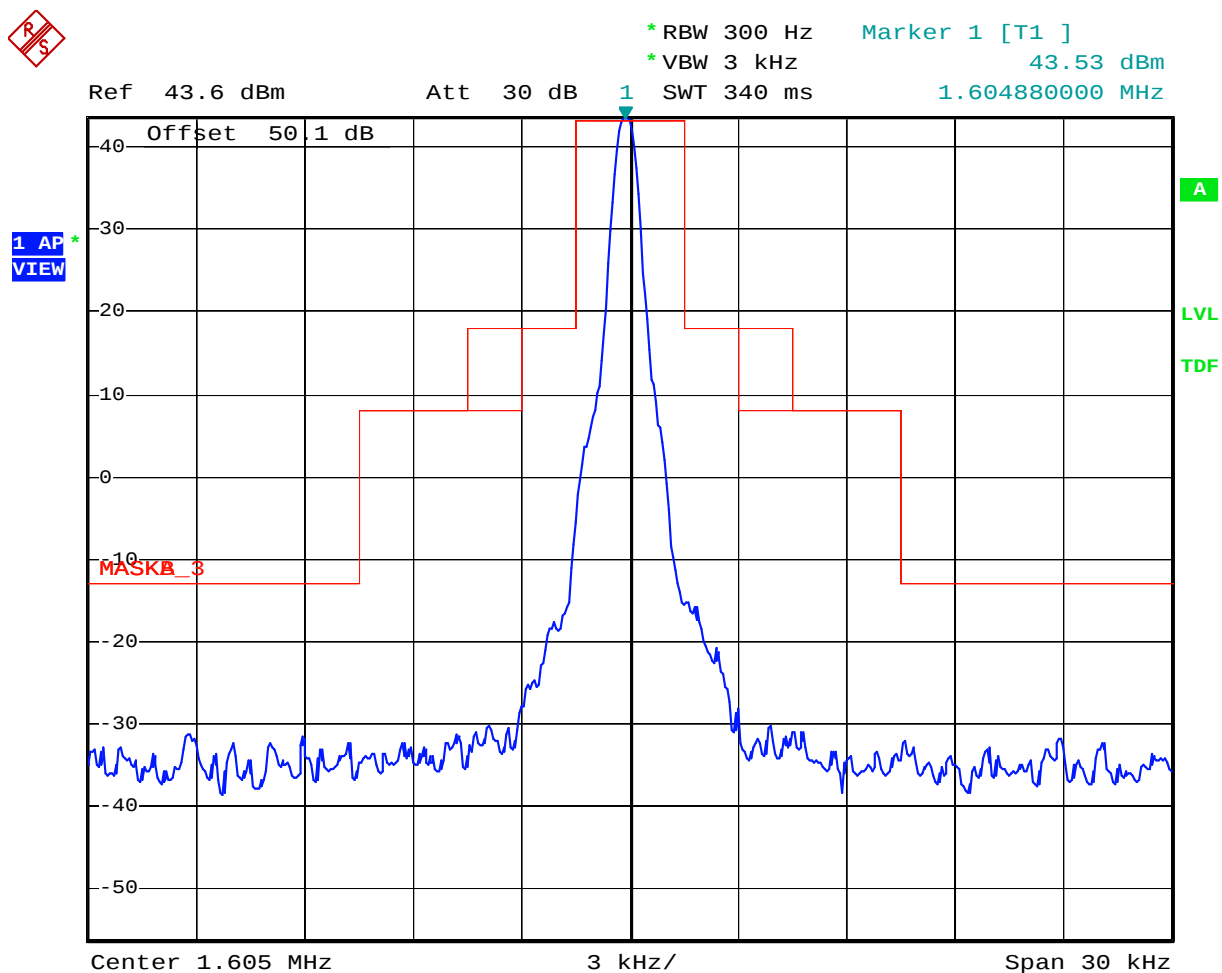
File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Low Power

Configuration: J2B (AFSK), 1.605MHz, Low power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:25:38

ULTRATECH GROUP OF LABS

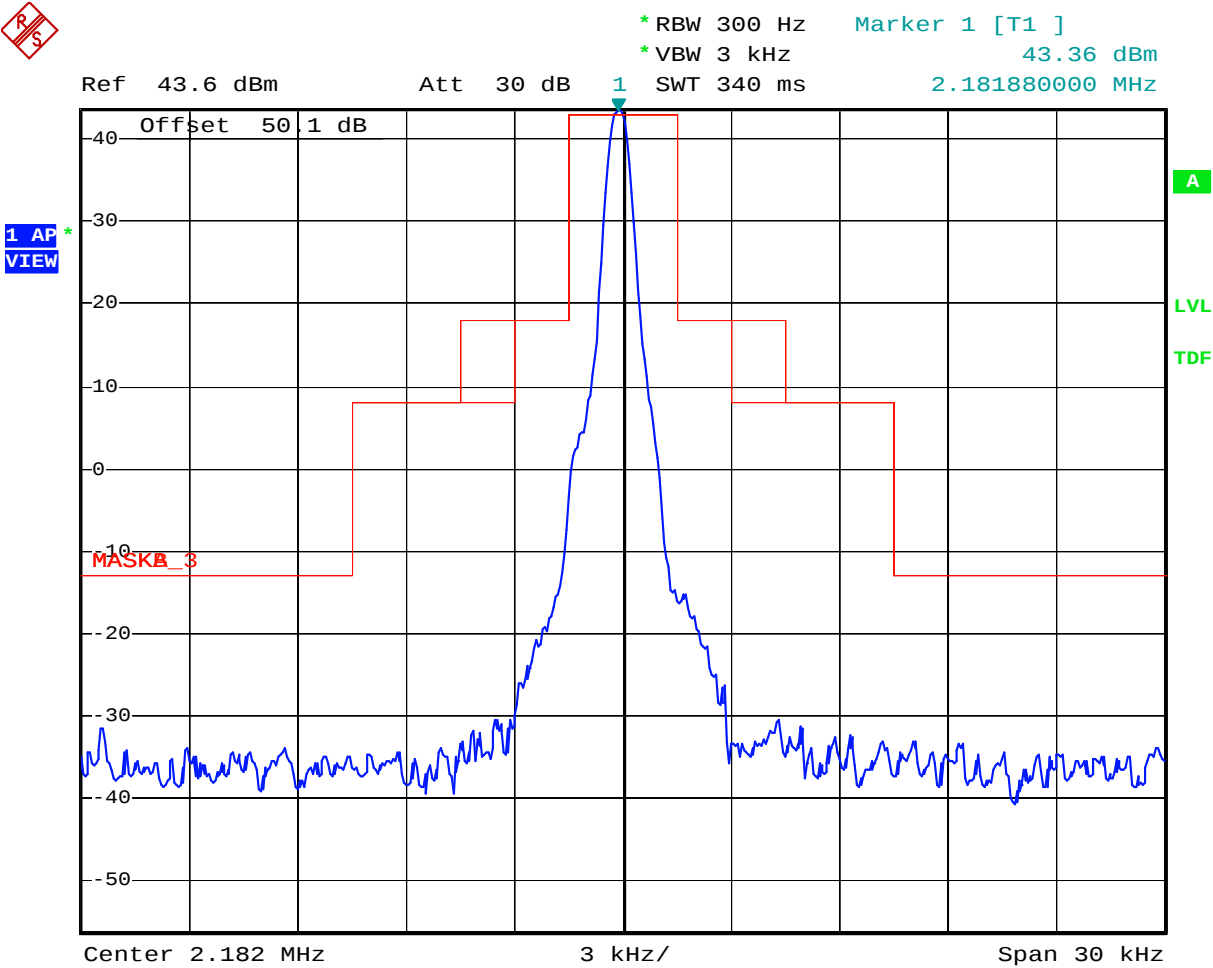
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 2.182MHz, Low power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:27:57

ULTRATECH GROUP OF LABS

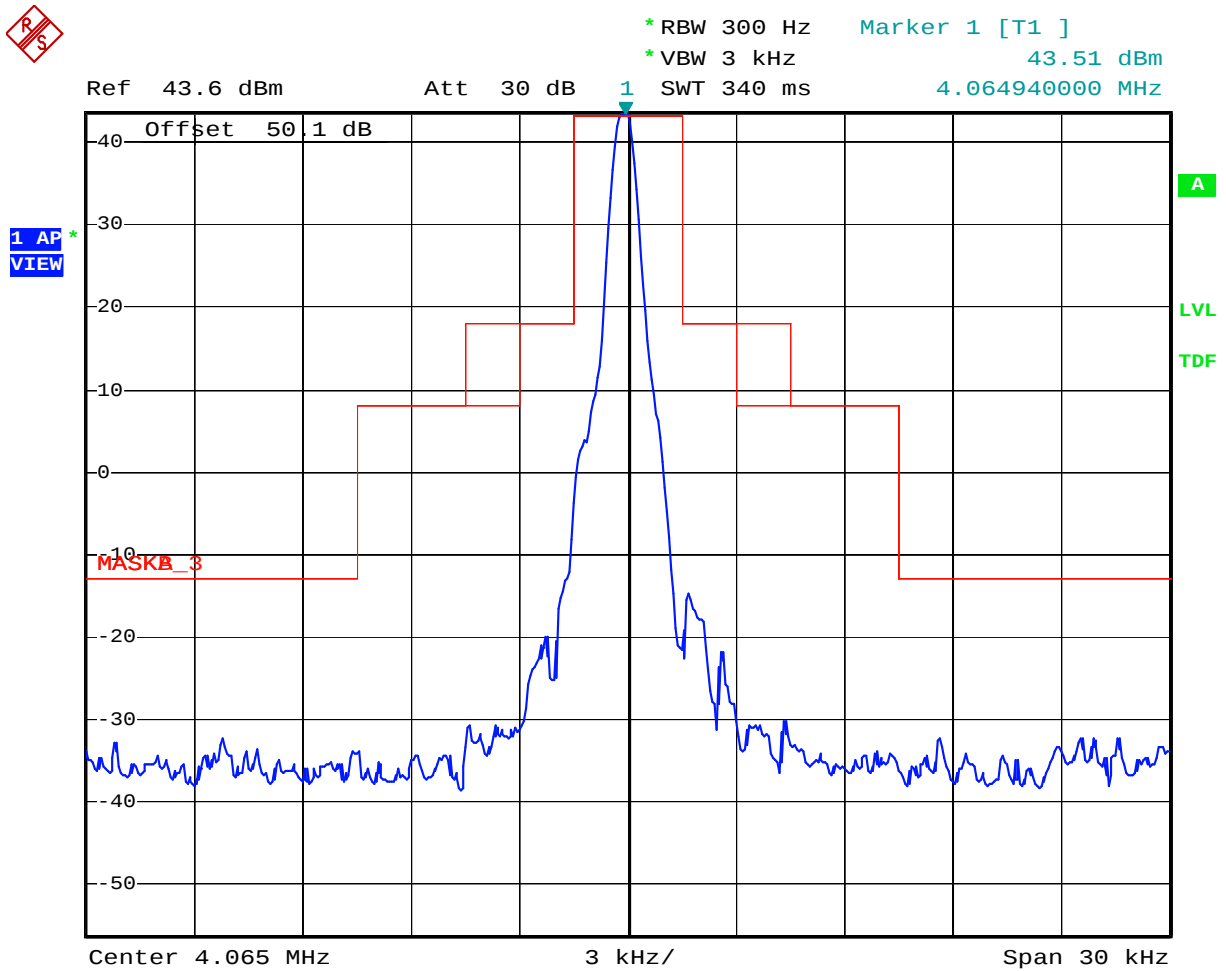
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 4.065MHz, Low power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:29:50

ULTRATECH GROUP OF LABS

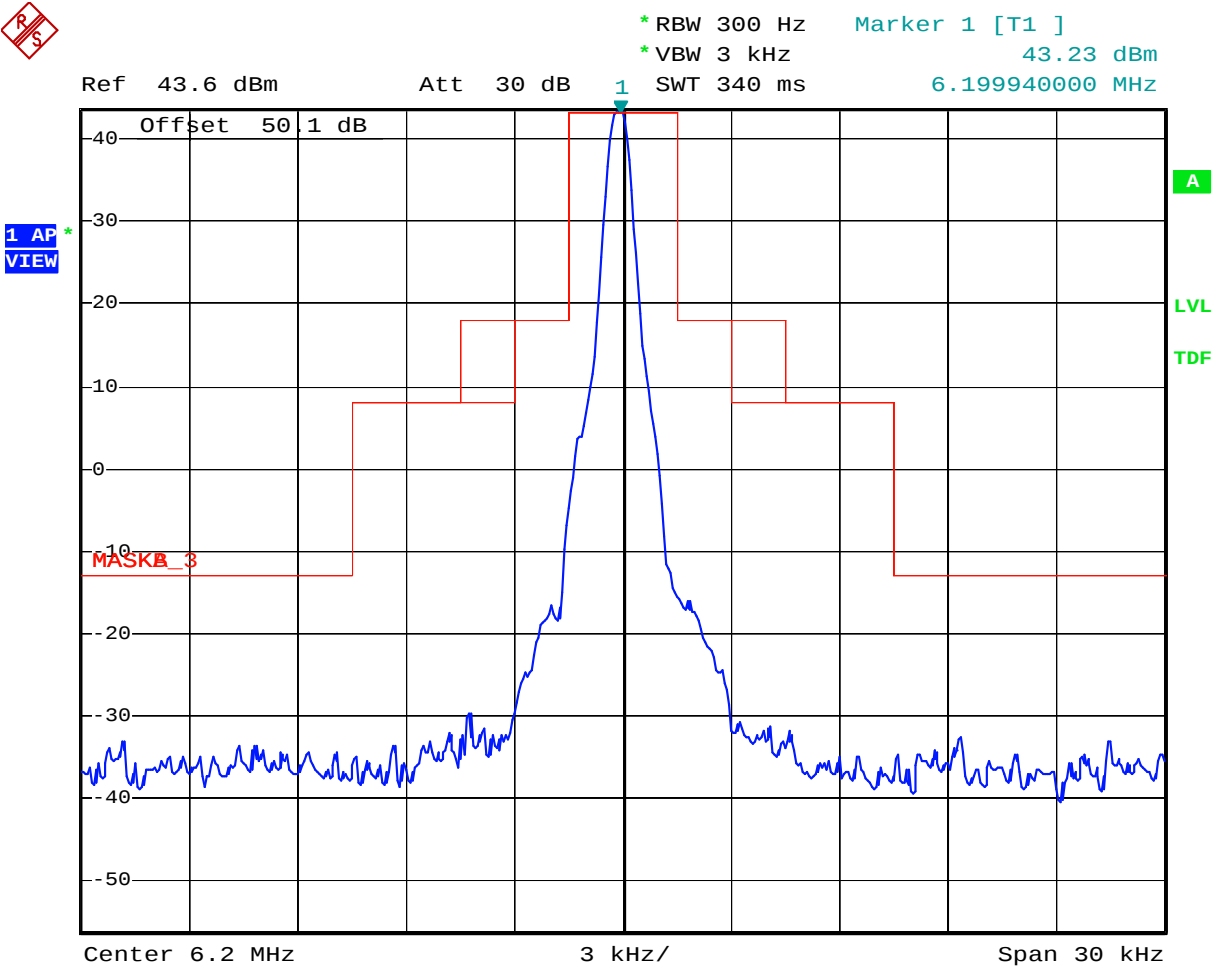
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 6.2MHz, Low power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:31:23

ULTRATECH GROUP OF LABS

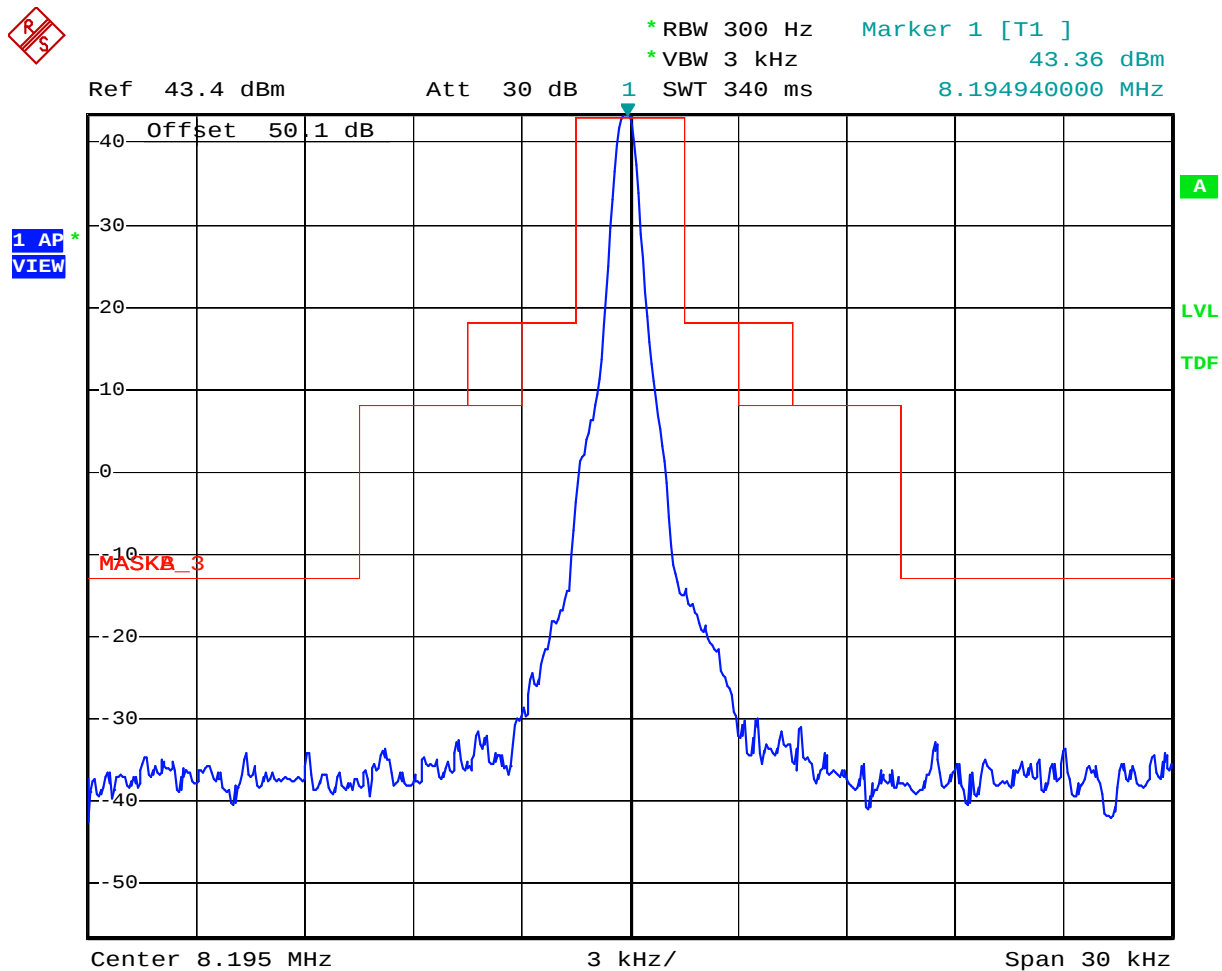
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 8.195MHz, Low power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:33:56

ULTRATECH GROUP OF LABS

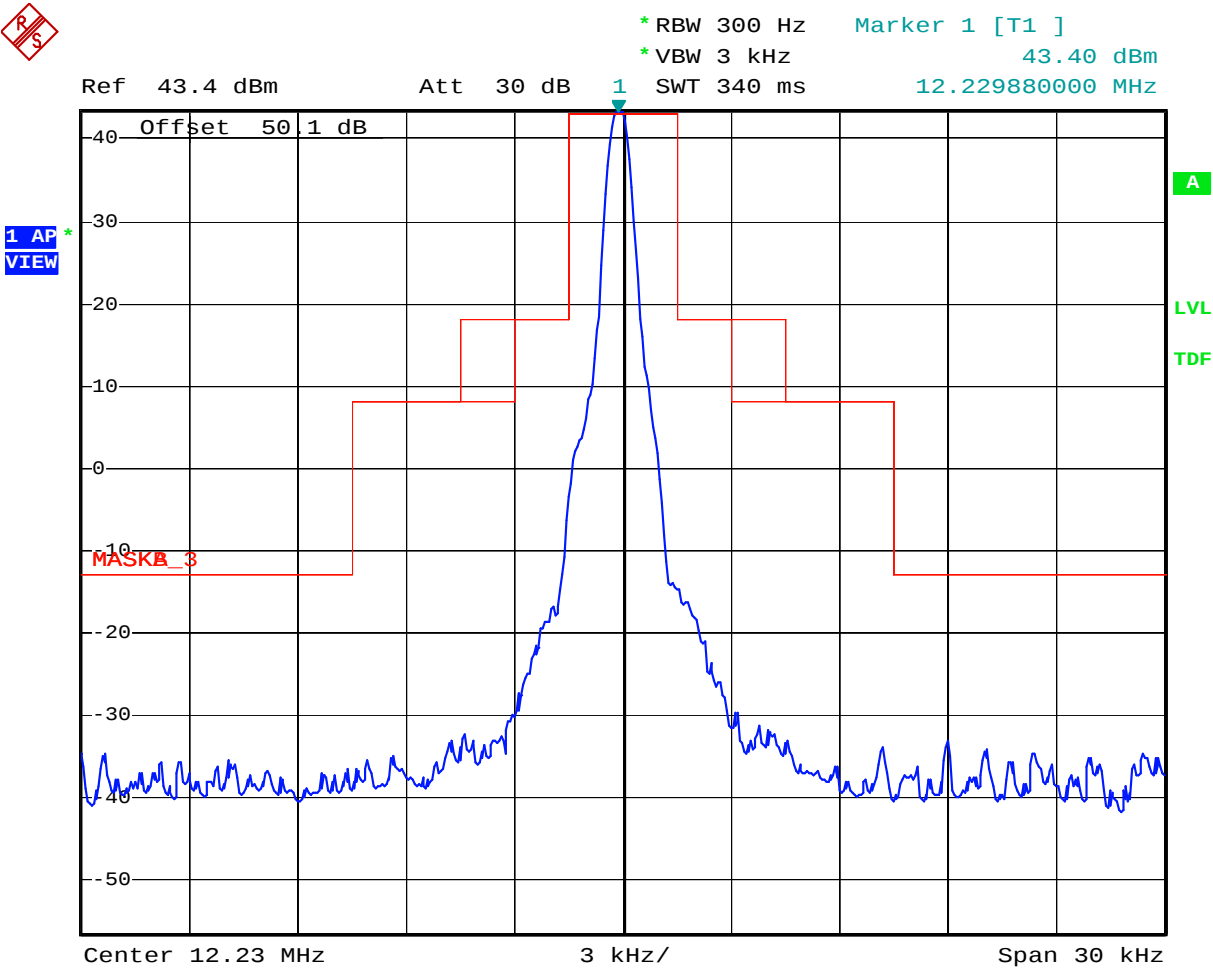
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 12.230MHz, Low power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:34:43

ULTRATECH GROUP OF LABS

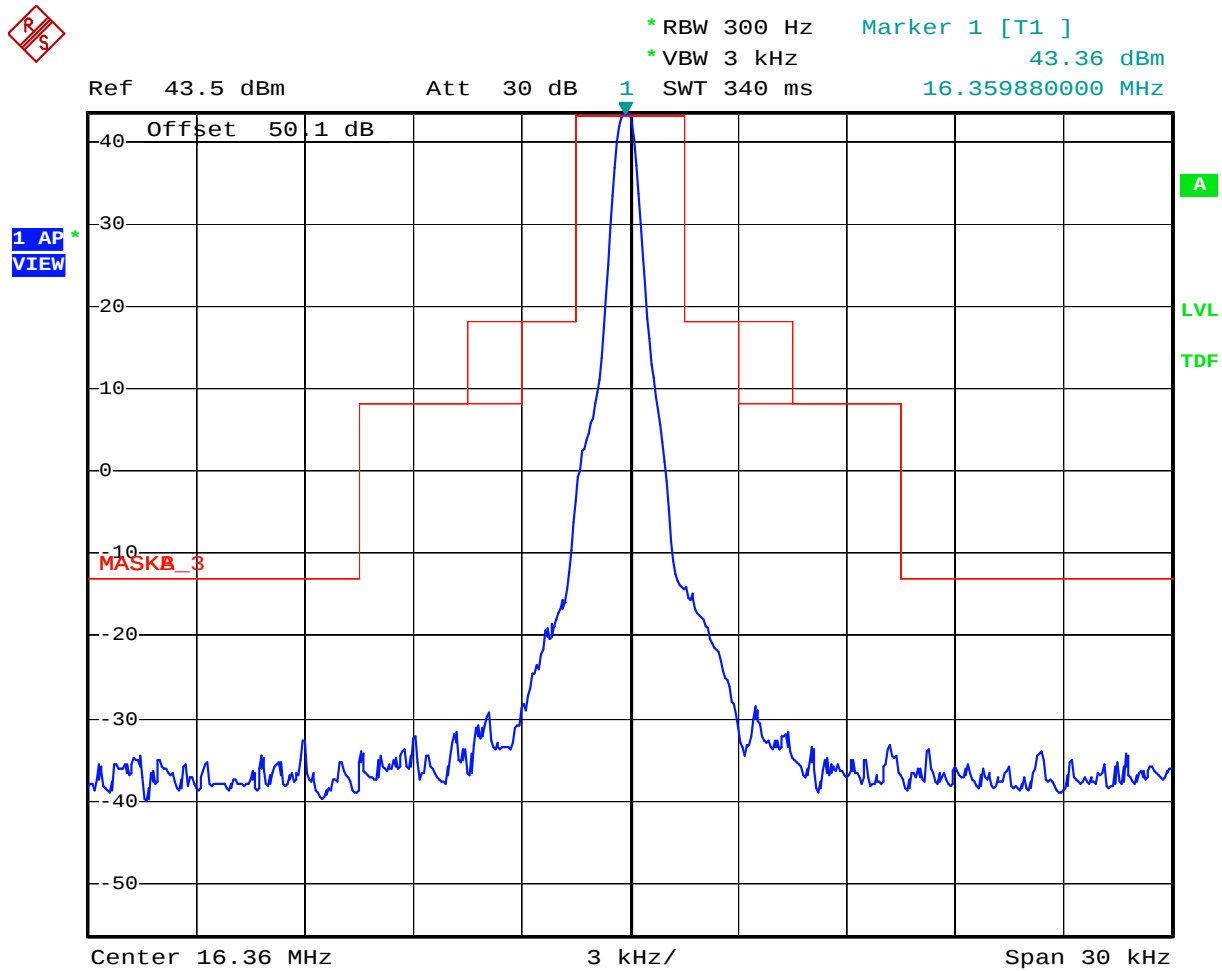
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 16.360MHz, Low power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:36:44

ULTRATECH GROUP OF LABS

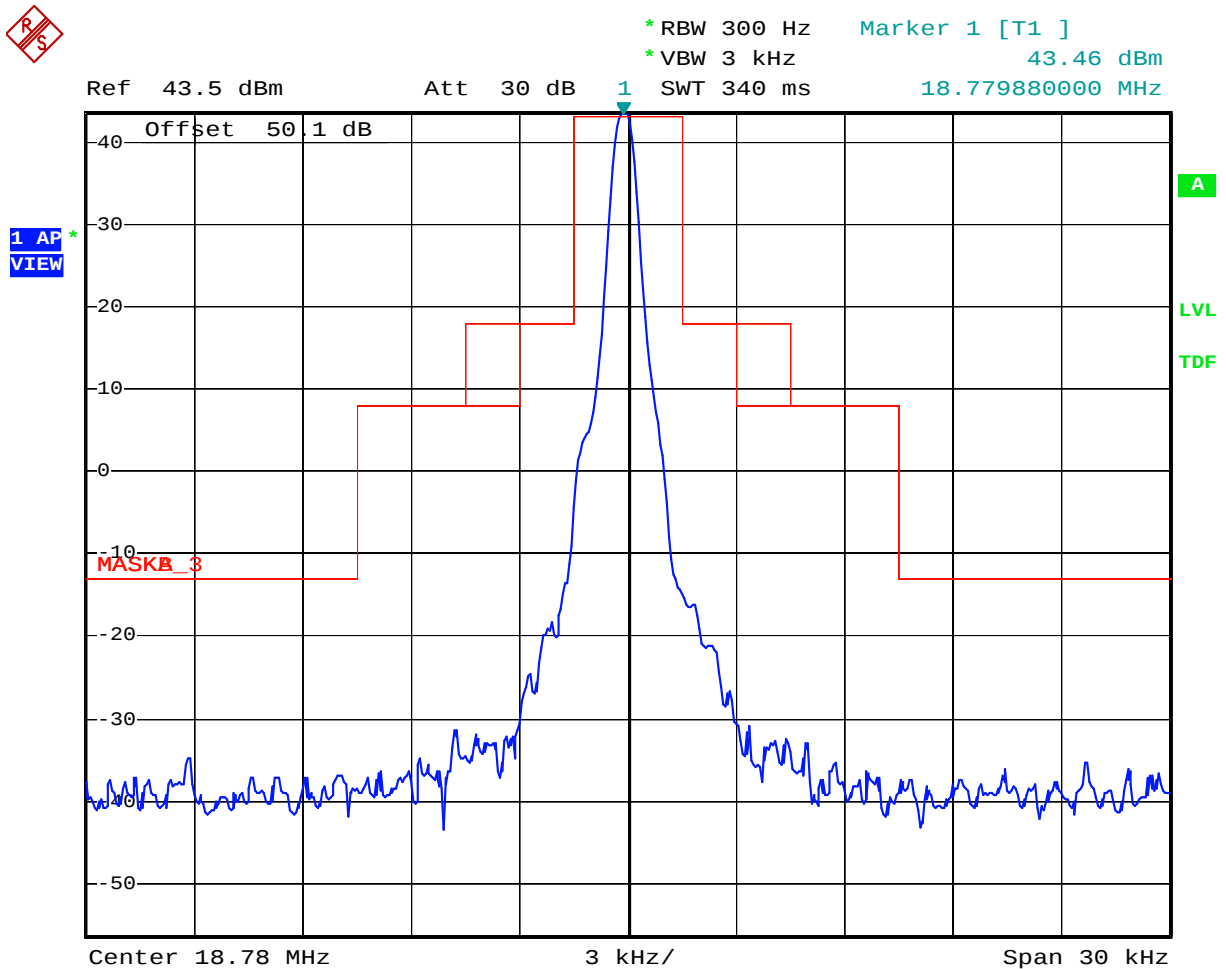
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 18.780MHz, Low power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:38:26

ULTRATECH GROUP OF LABS

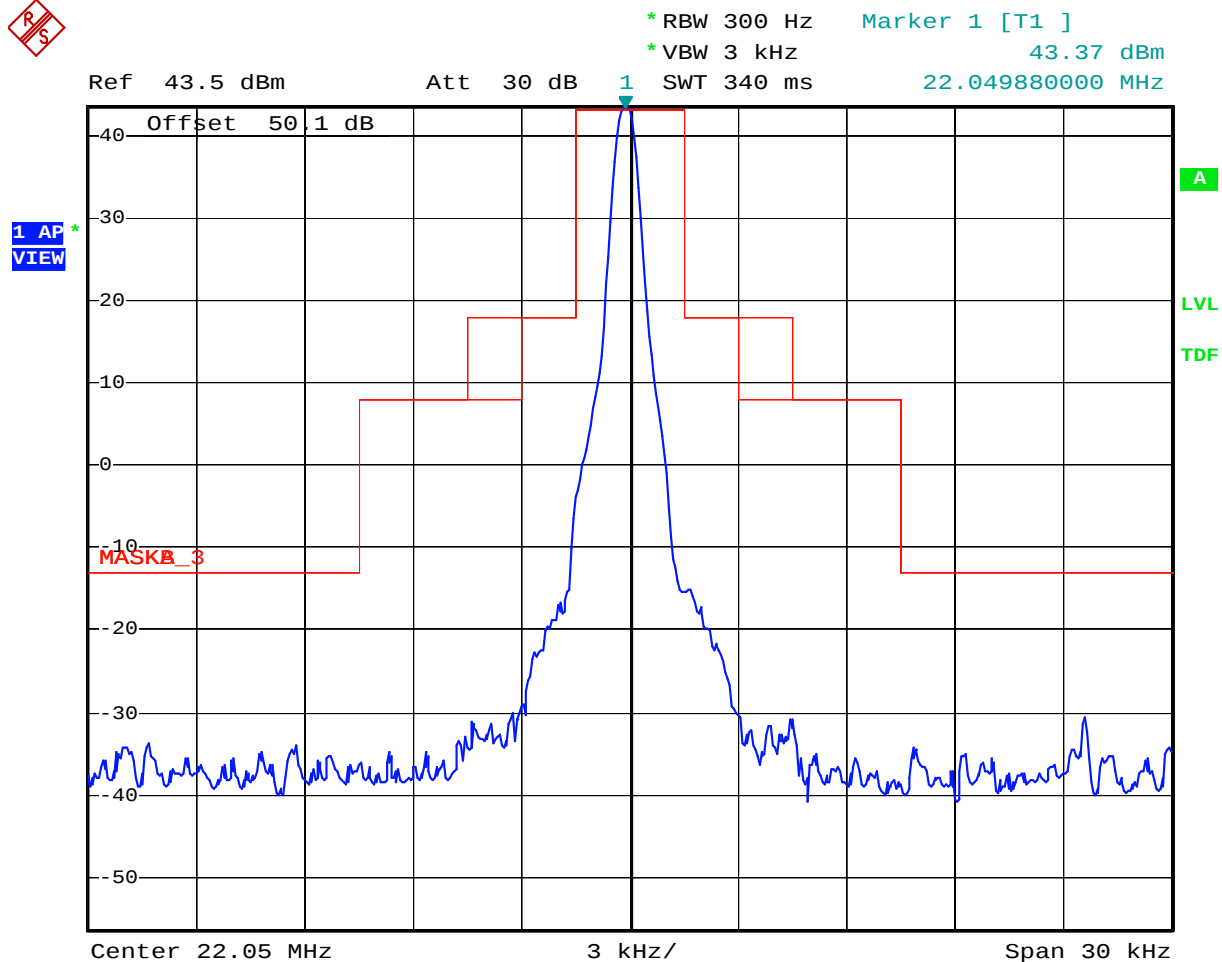
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 22.050MHz, Low power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:39:57

ULTRATECH GROUP OF LABS

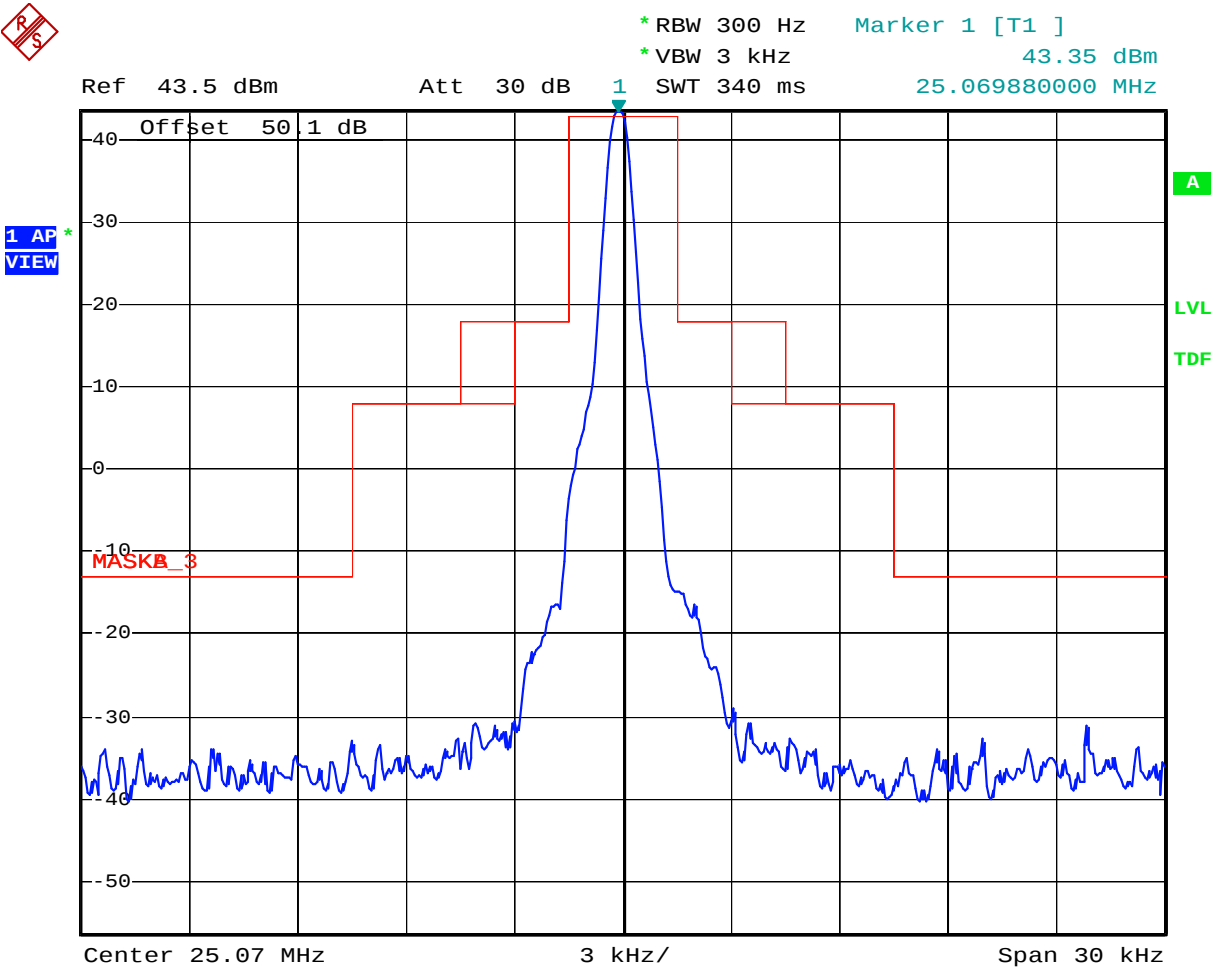
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 25.070MHz, Low power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:41:42

ULTRATECH GROUP OF LABS

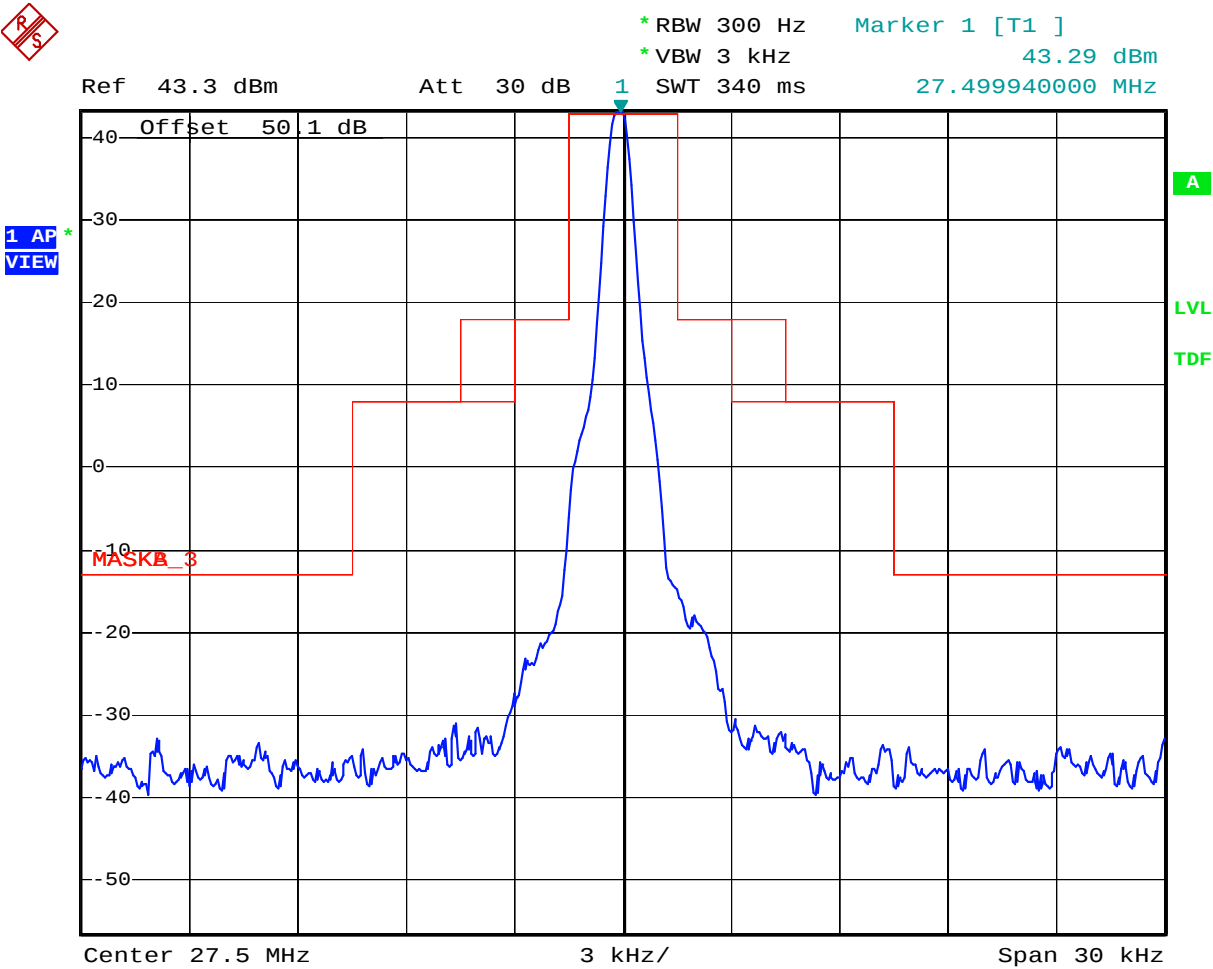
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: J2B (AFSK), 27.5MHz, Low power, Modulation: 1.7 KHz



Date: 30.OCT.2019 15:44:02

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

MASK FOR J3E

High Power

Configuration: Mask A, J3E (USB), 1.605MHz, High power, Modulation: 400+1800Hz

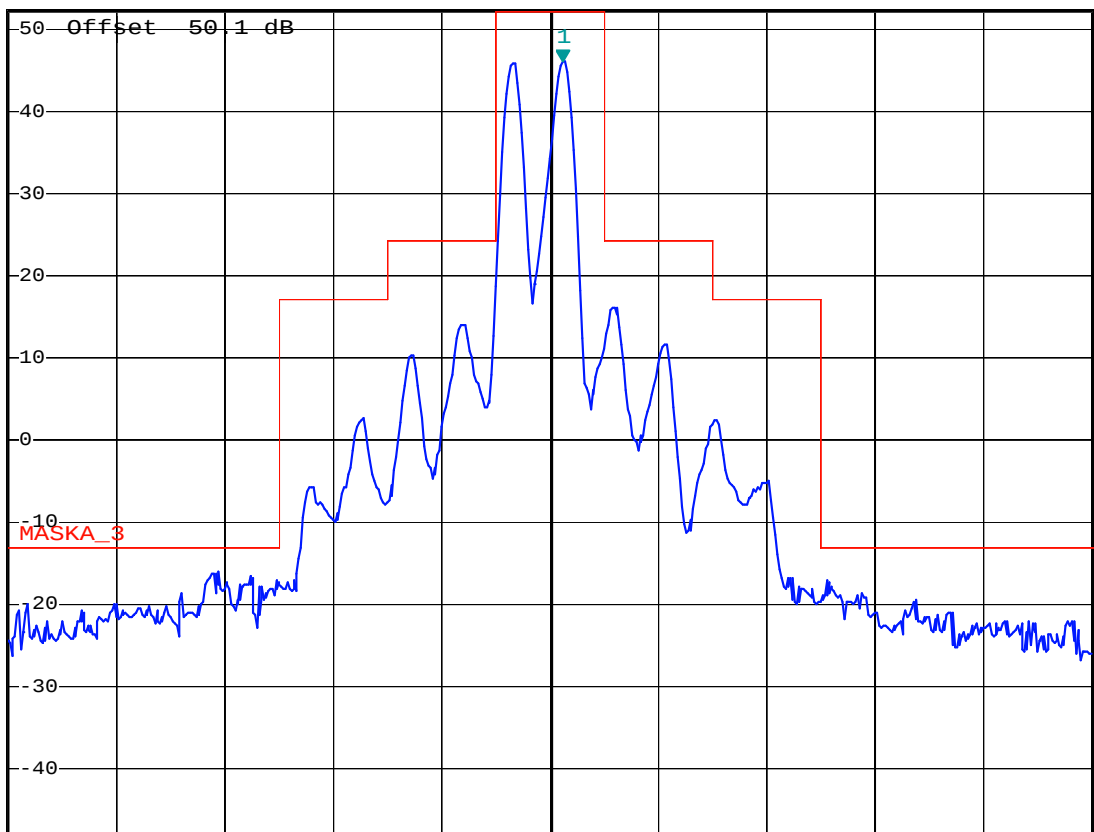


* RBW 300 Hz Marker 1 [T1]
* VBW 3 kHz 46.03 dBm
* SWT 500 ms 1.606760000 MHz

Ref 52.1 dBm

Att 40 dB

1 AP
VIEW



A

LVL

TDF

Center 1.6064 MHz

3 kHz/

Span 30 kHz

Date: 1.NOV.2019 15:06:37

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)



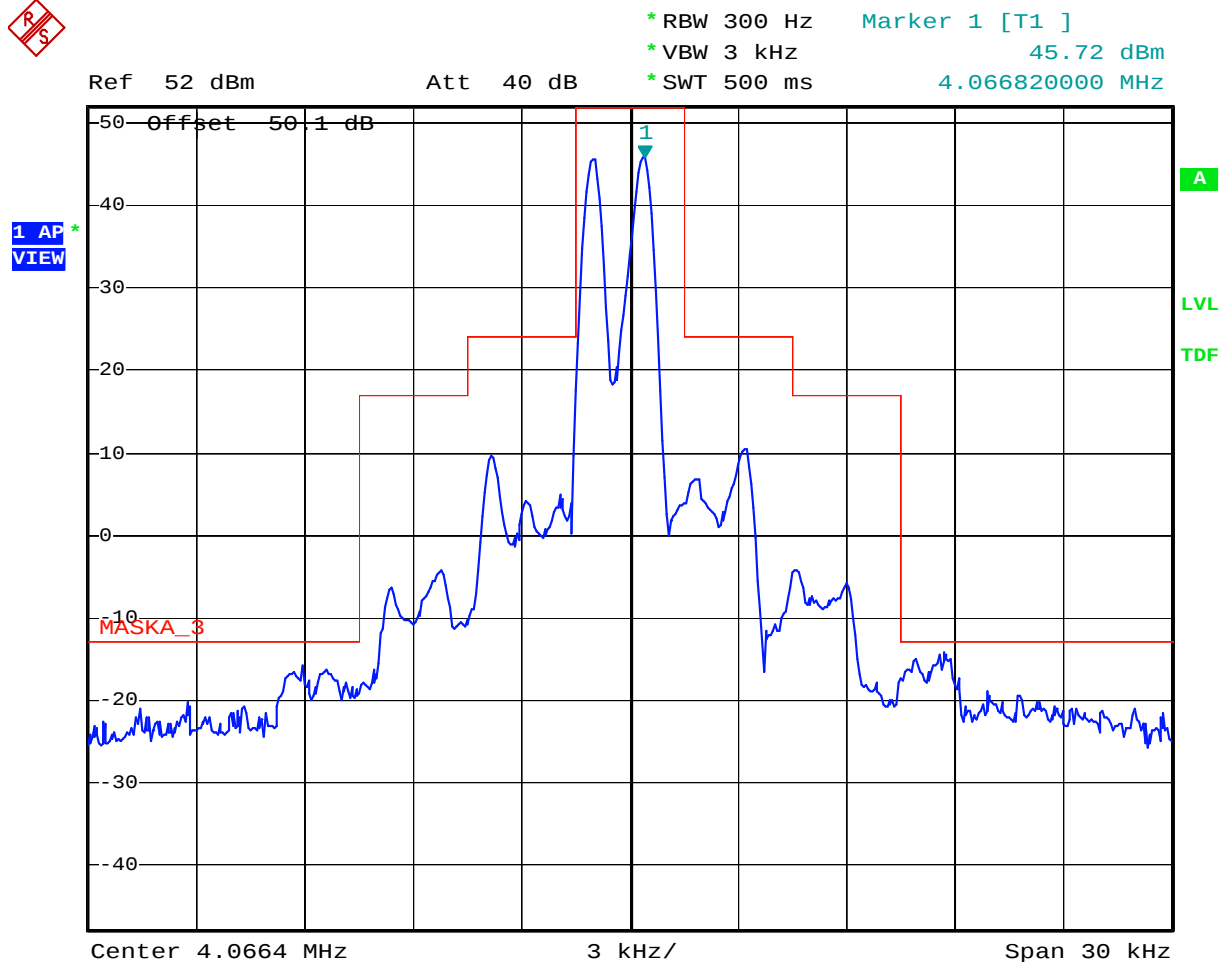
* SWT 500 ms

2.183820000 MHz



All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 4.065MHz, High power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:16:52

ULTRATECH GROUP OF LABS

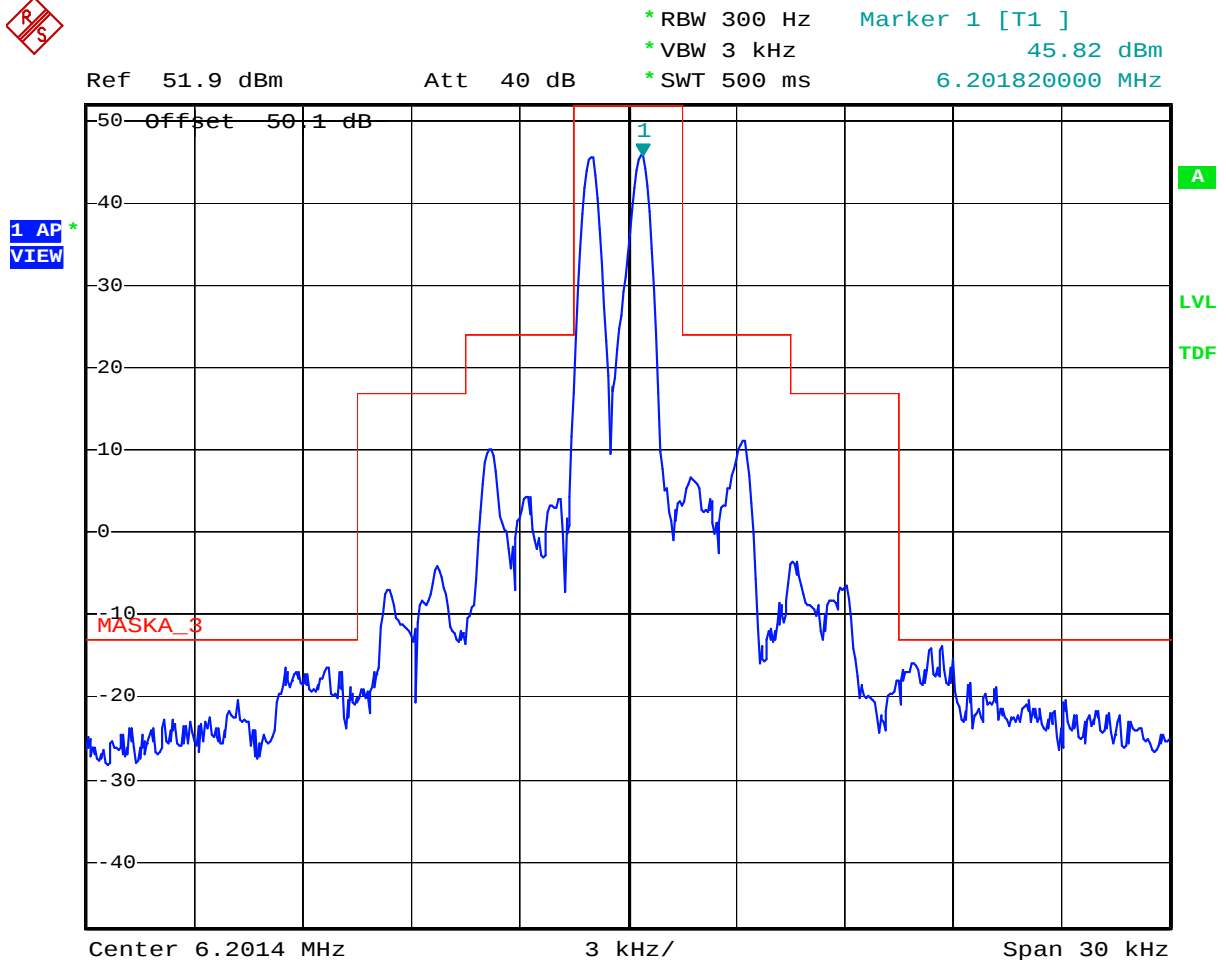
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 6.2MHz, High power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:14:14

ULTRATECH GROUP OF LABS

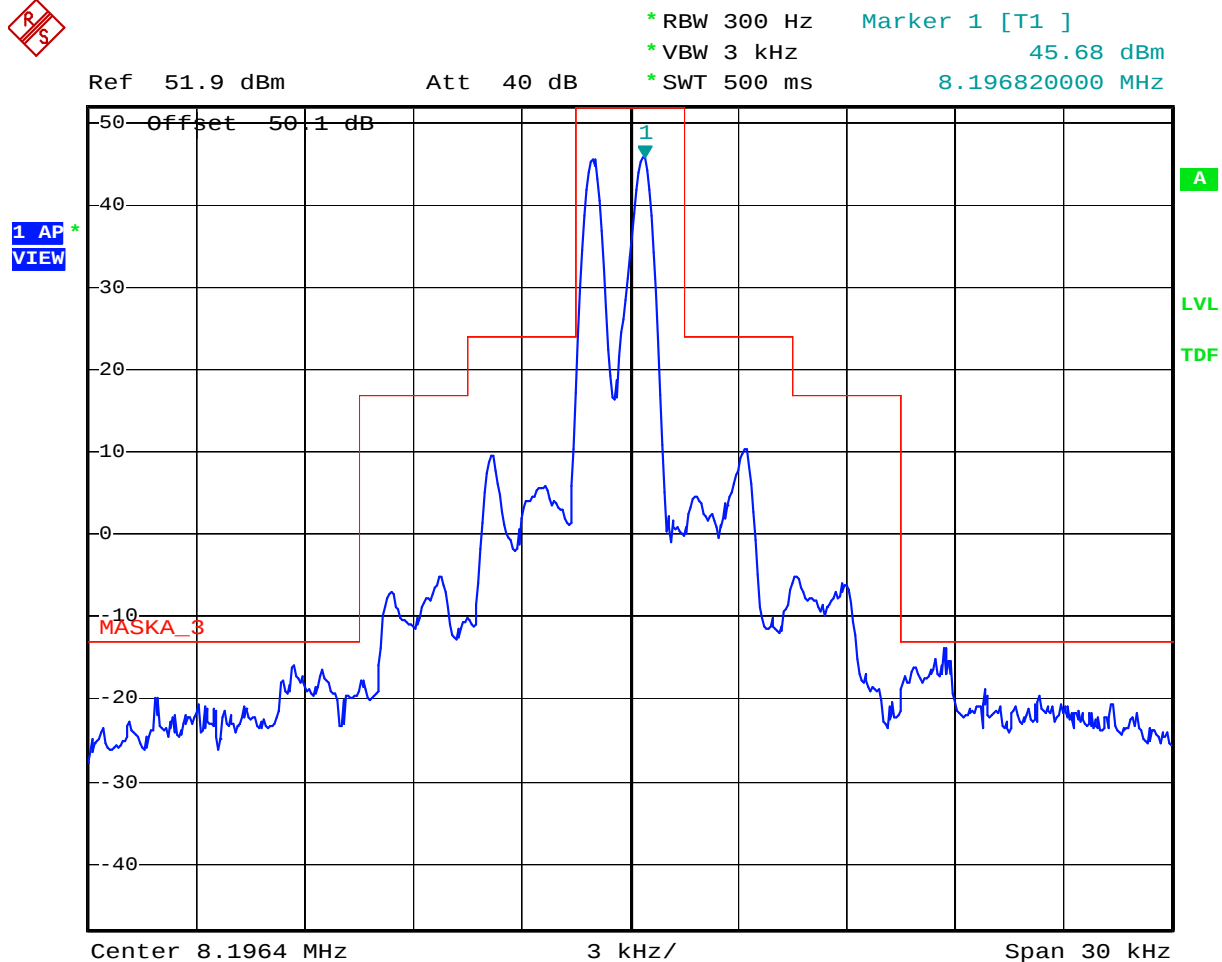
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 8.195MHz, High power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:18:11

ULTRATECH GROUP OF LABS

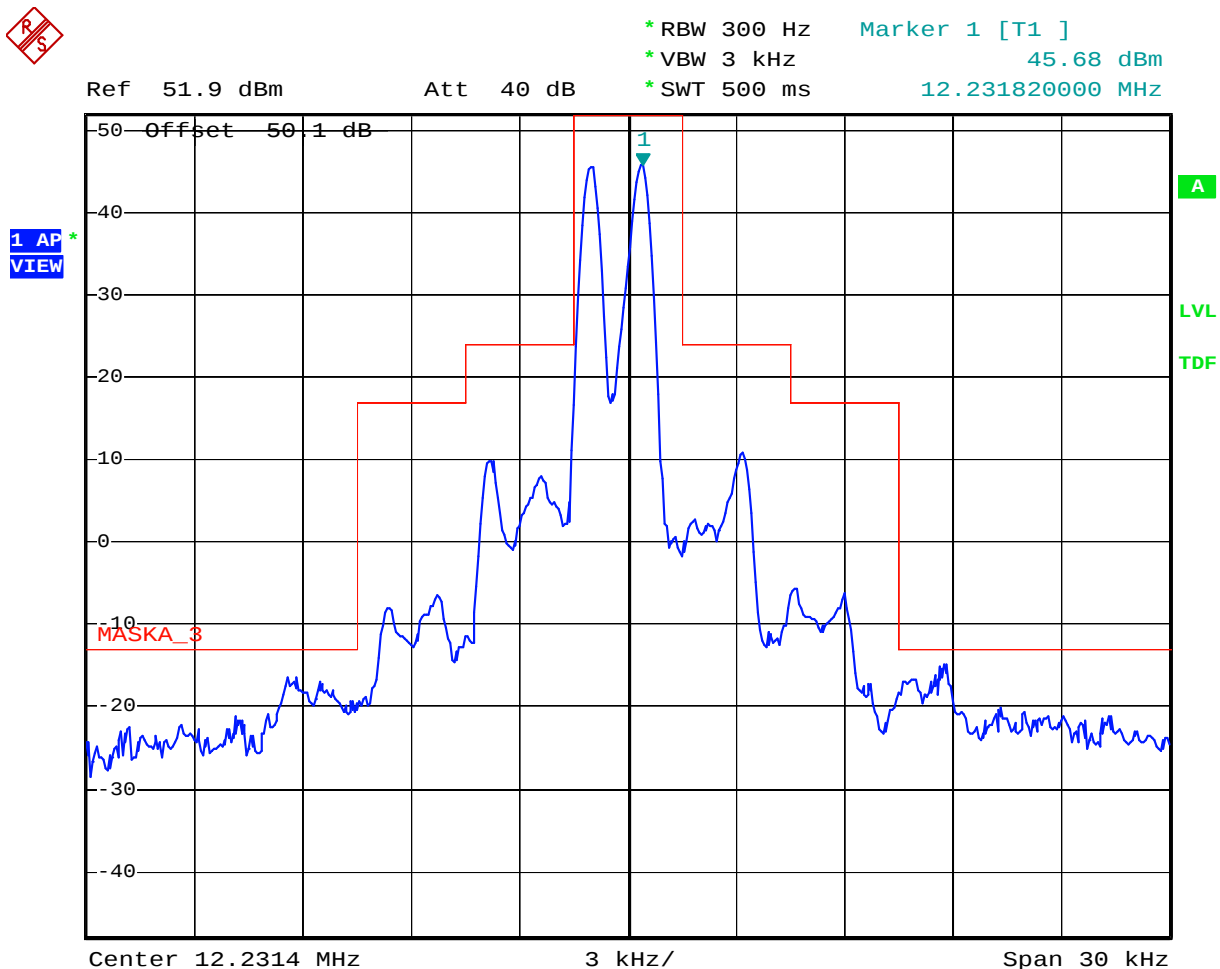
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 12.230MHz, High power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:19:45

ULTRATECH GROUP OF LABS

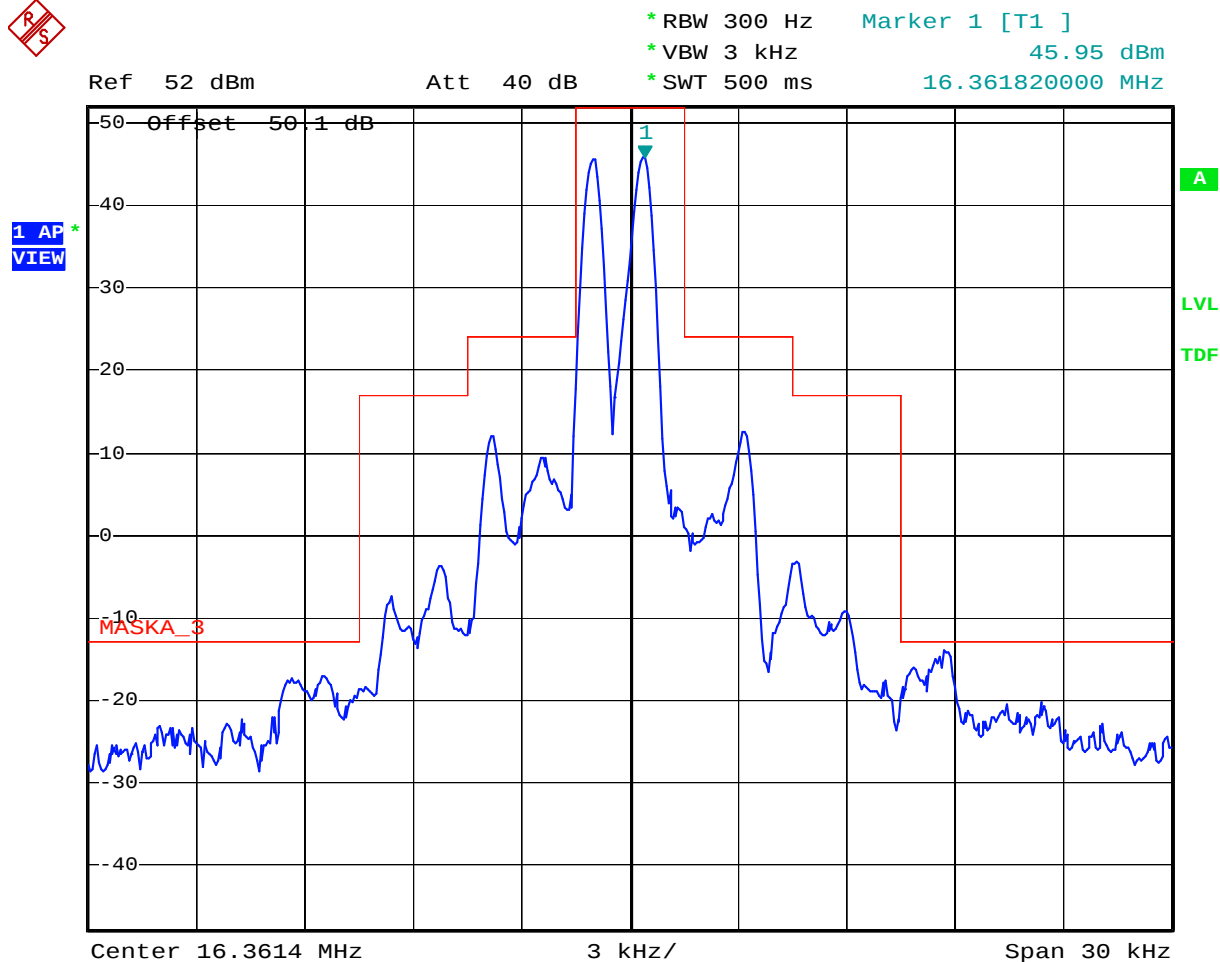
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 16.360MHz, High power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:21:07

ULTRATECH GROUP OF LABS

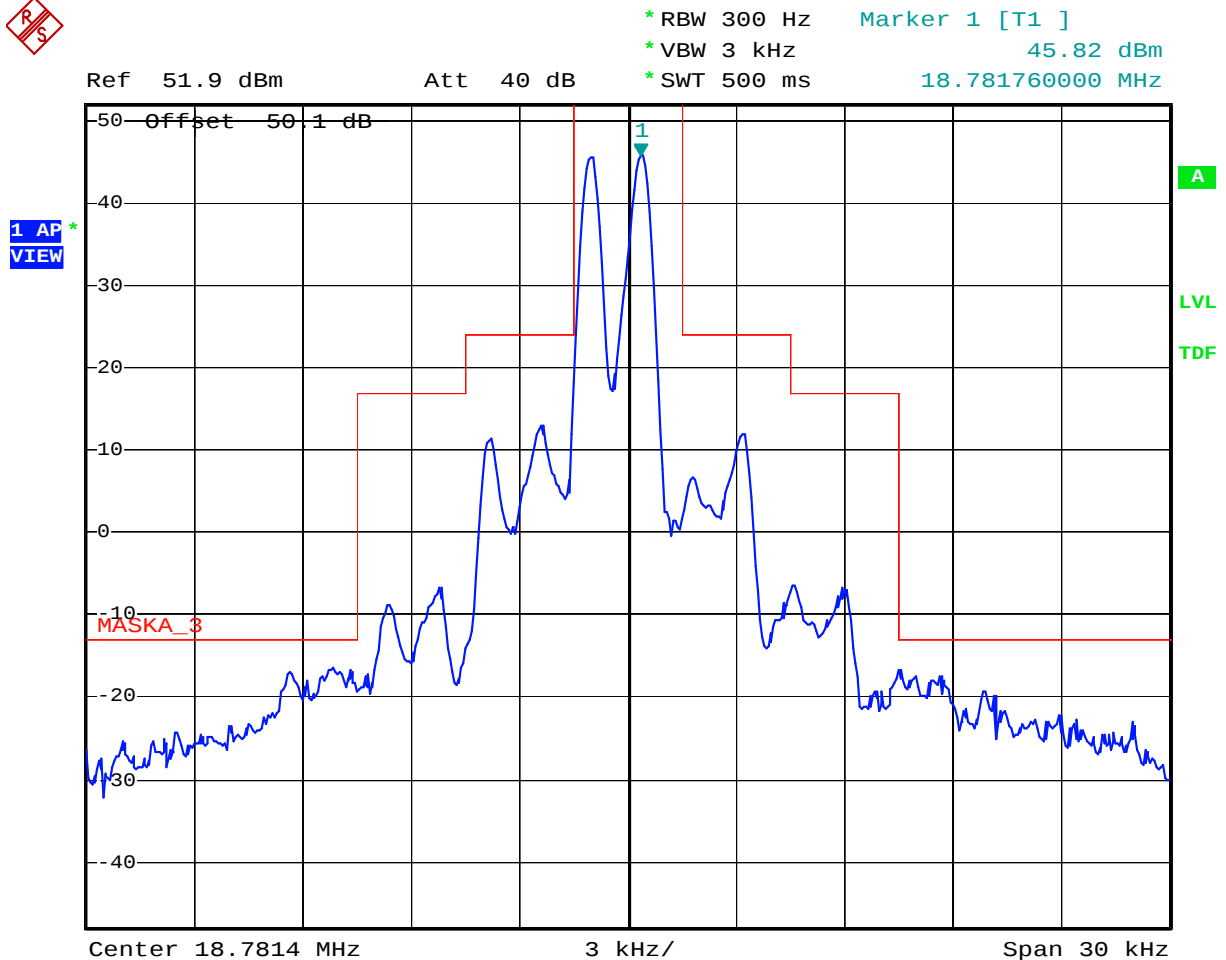
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 18.780MHz, High power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:22:23

ULTRATECH GROUP OF LABS

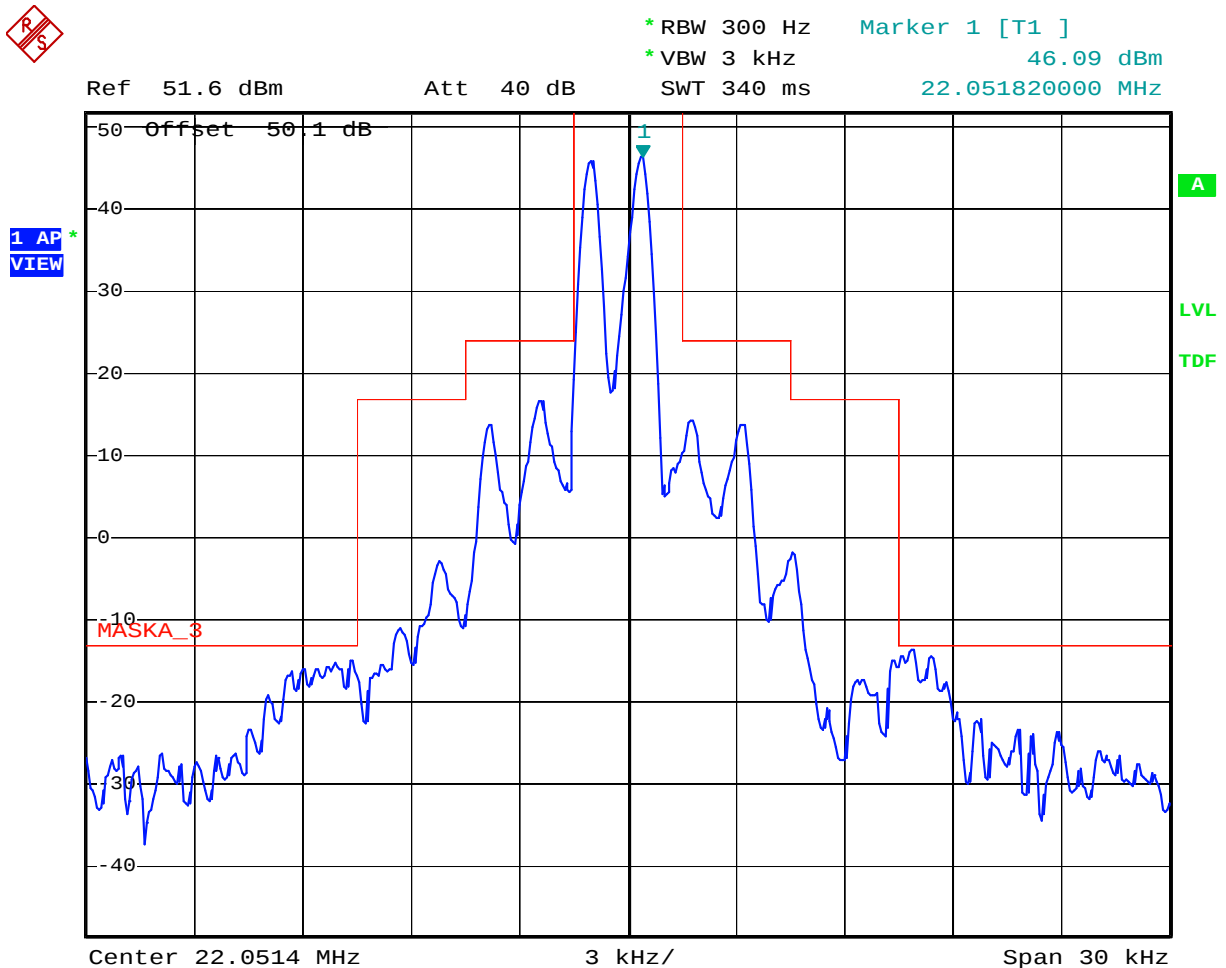
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 22.050MHz, High power, Modulation: 400+1800Hz



Date: 4.NOV.2019 09:38:24

ULTRATECH GROUP OF LABS

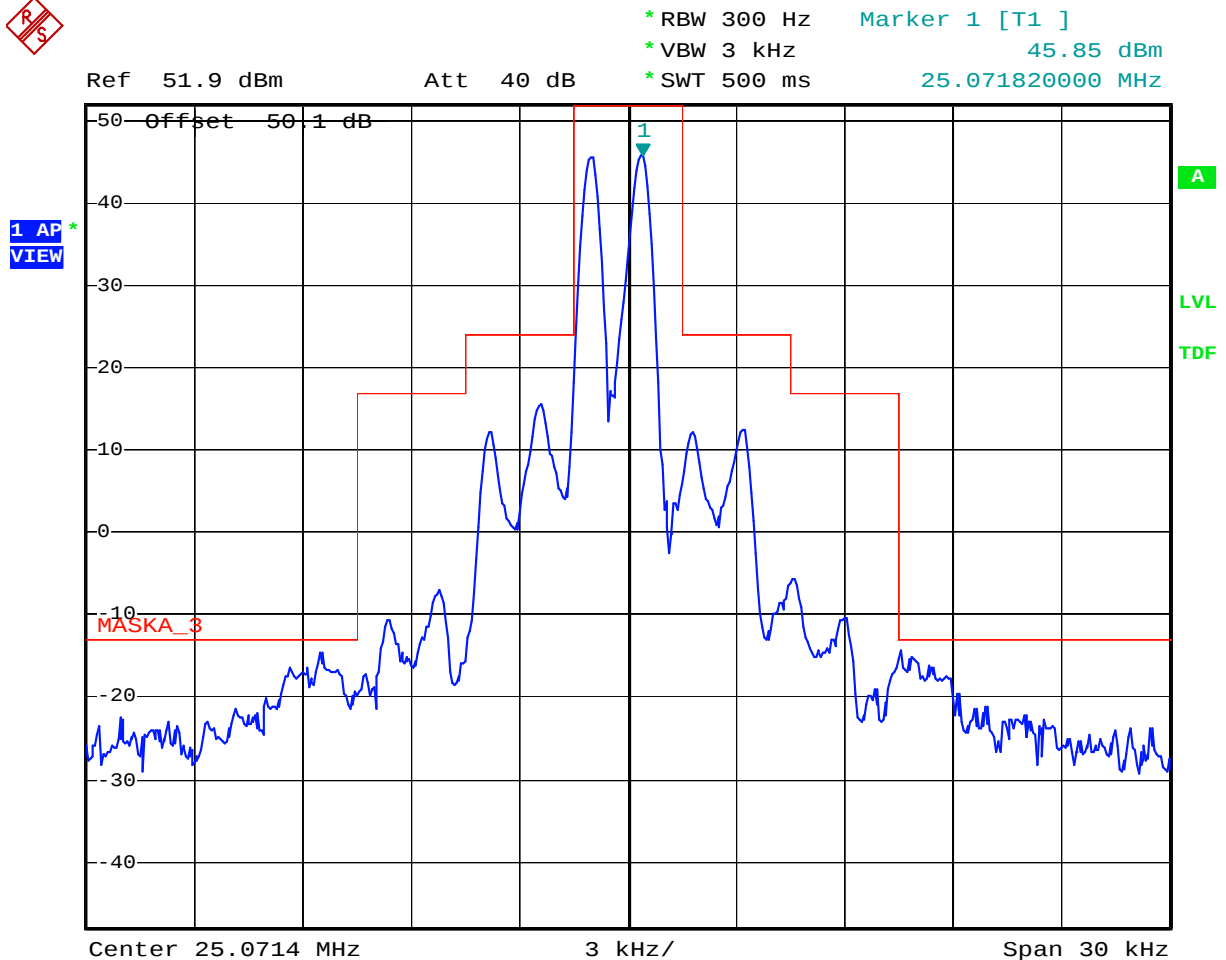
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 25.070MHz, High power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:27:27

ULTRATECH GROUP OF LABS

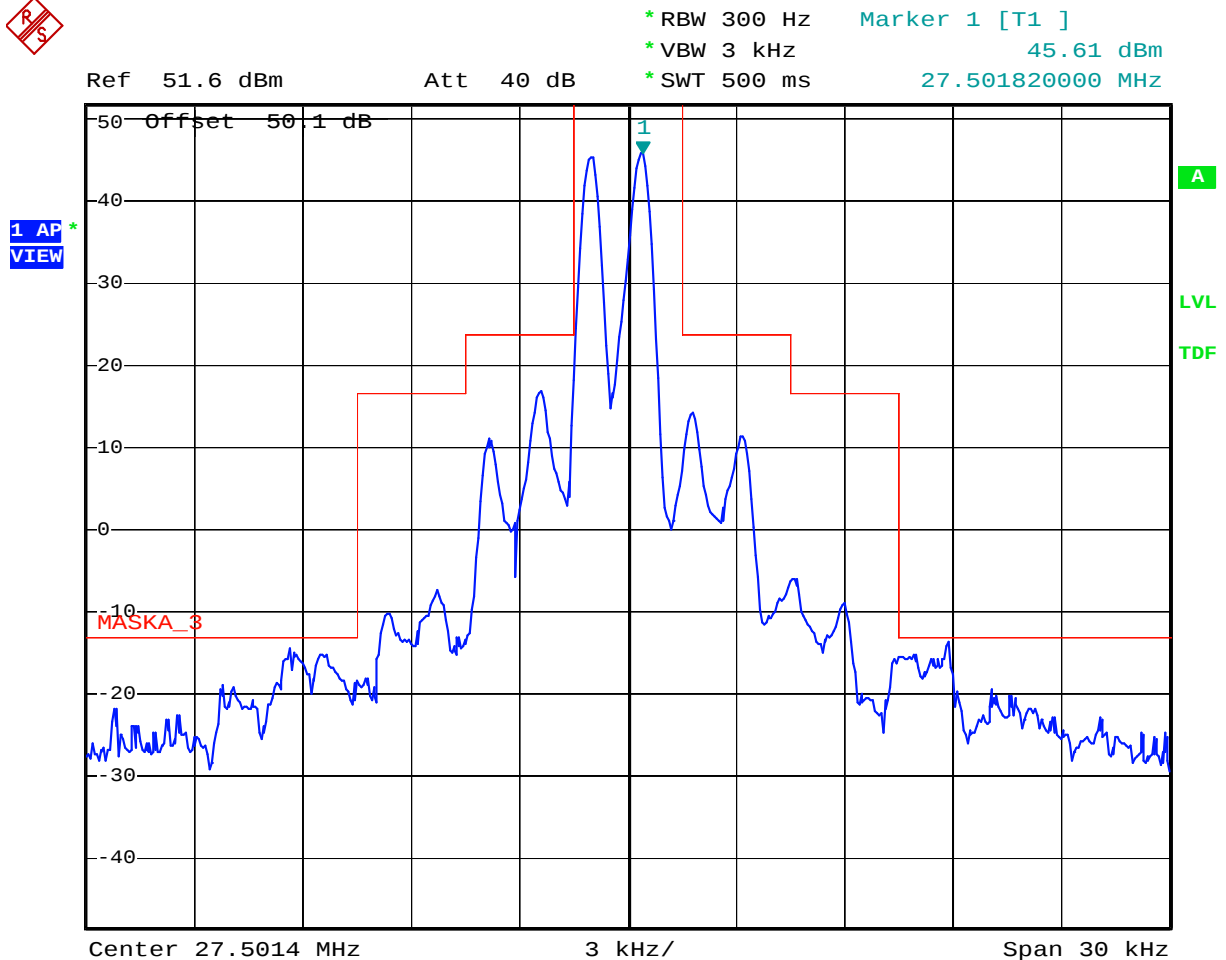
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 27.5MHz, High power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:29:14
Low Power

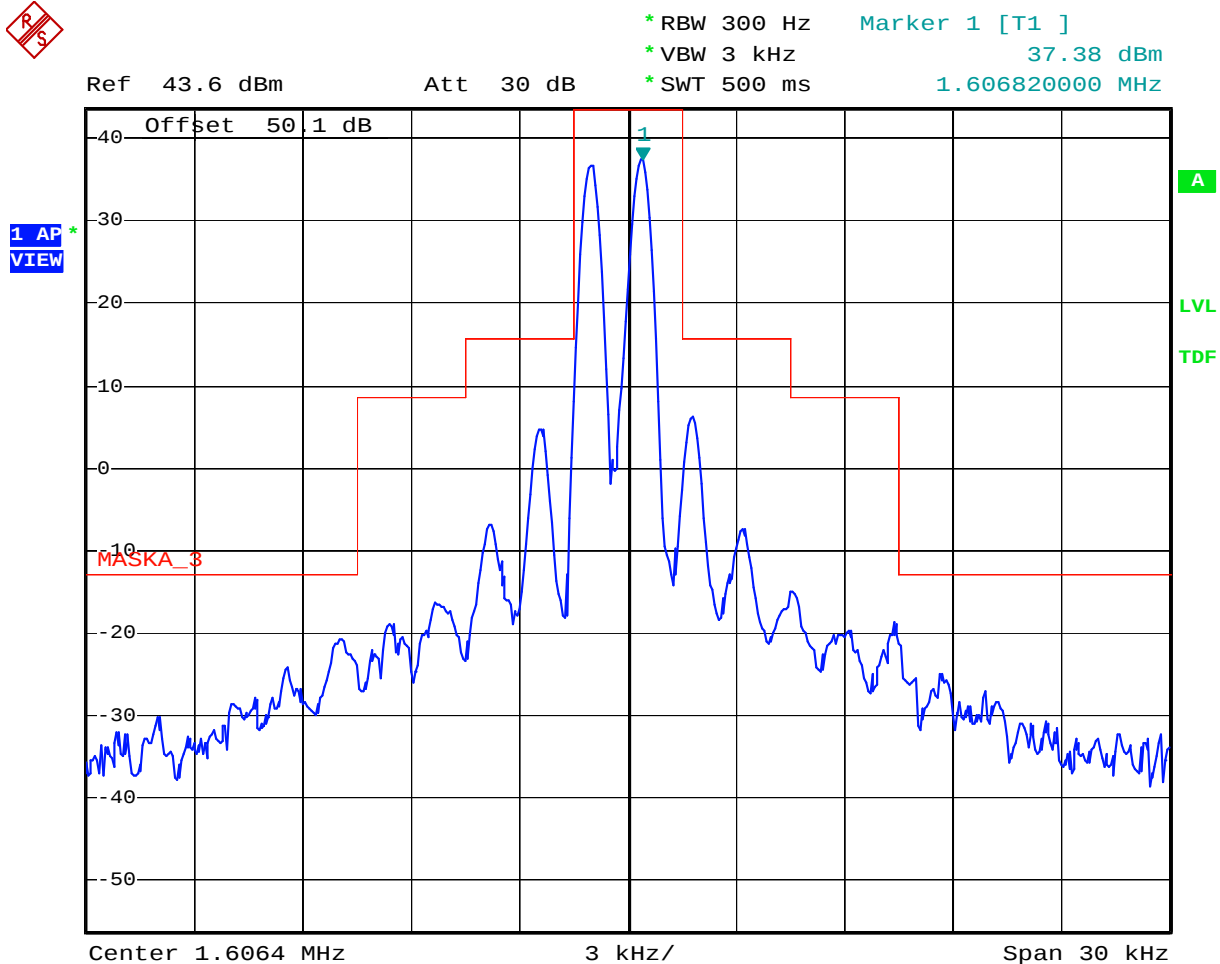
ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 1.605MHz, Low power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:32:28

ULTRATECH GROUP OF LABS

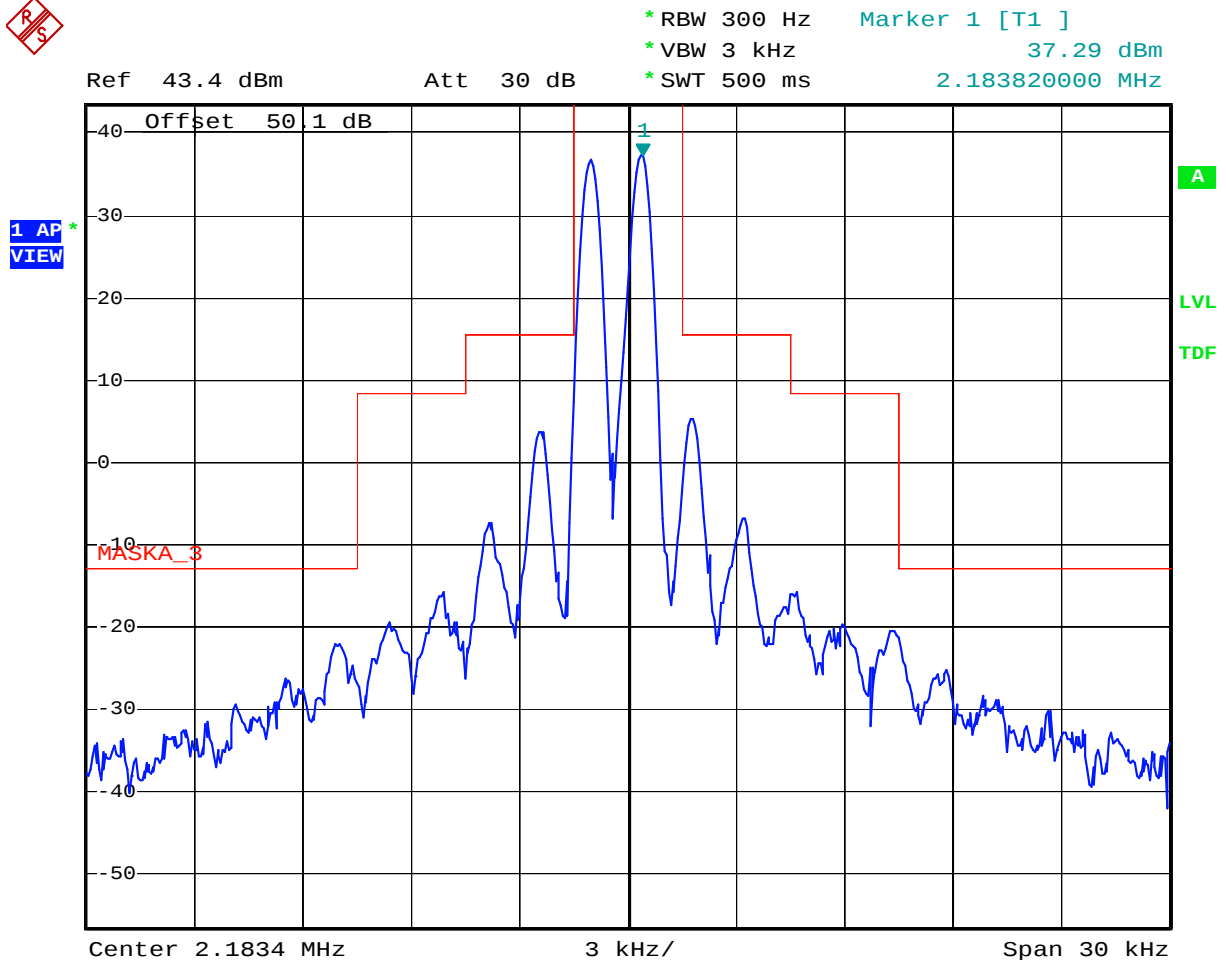
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 2.182MHz, Low power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:34:05

ULTRATECH GROUP OF LABS

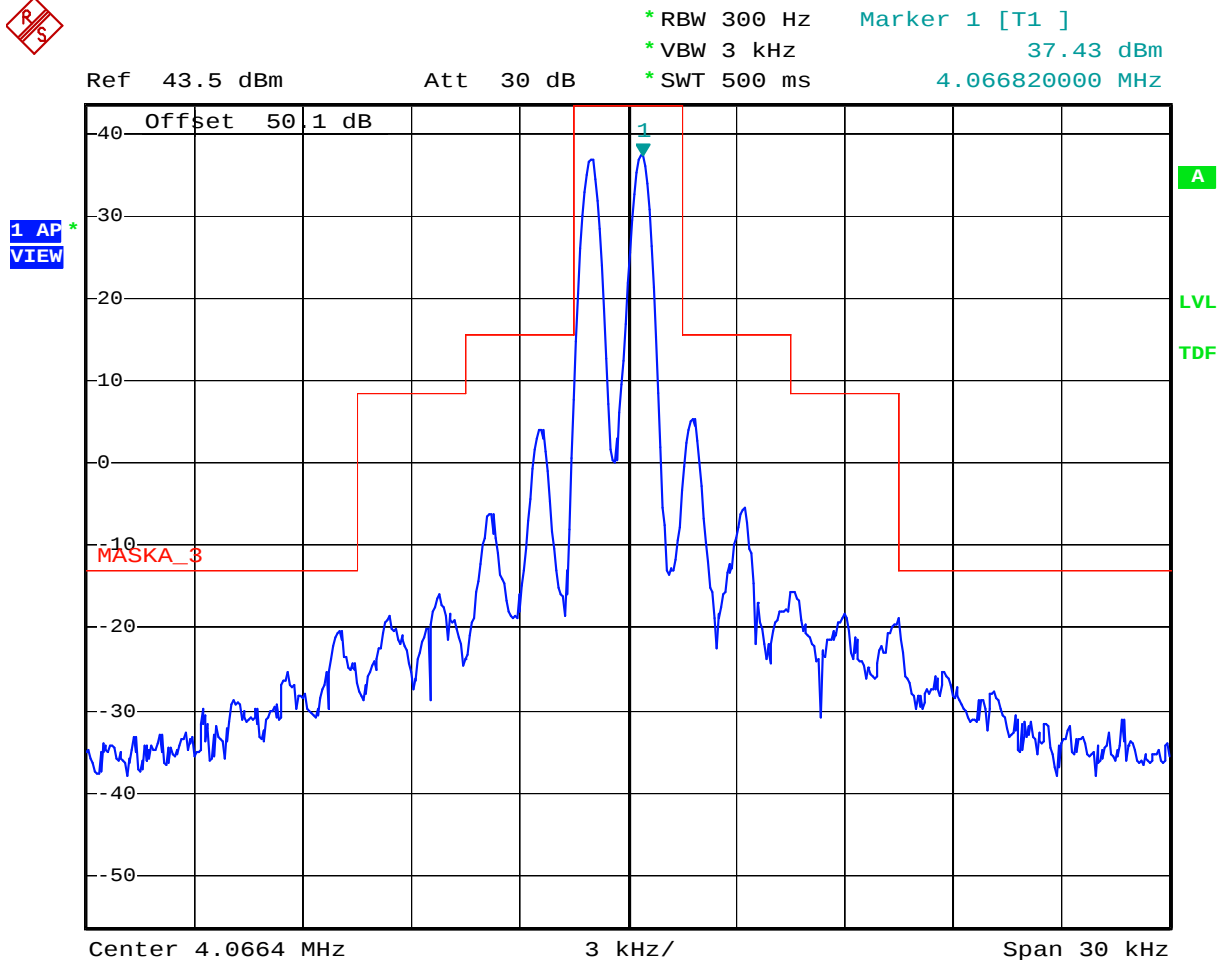
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 4.065MHz, Low power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:35:36

ULTRATECH GROUP OF LABS

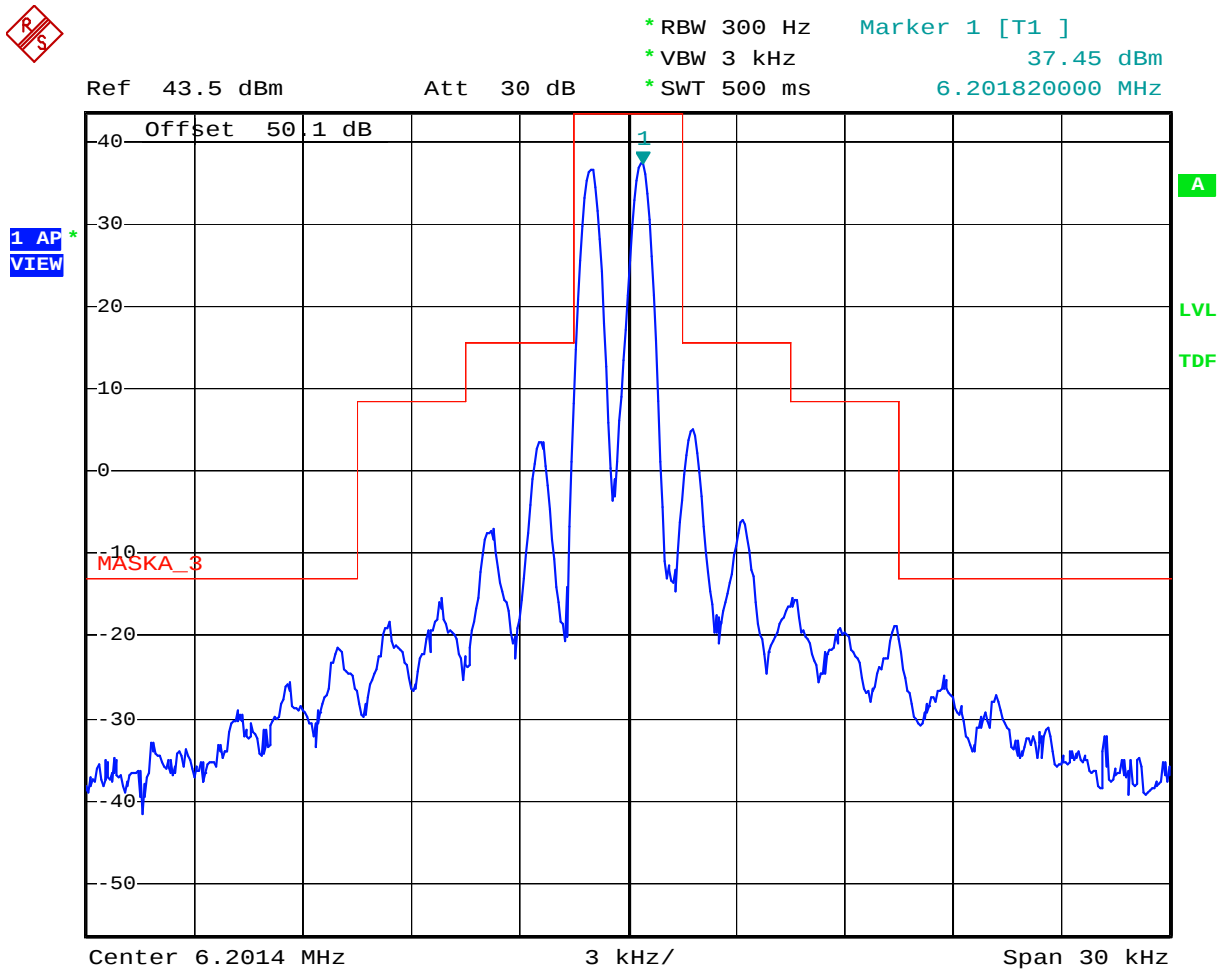
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 6.2MHz, Low power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:37:12

ULTRATECH GROUP OF LABS

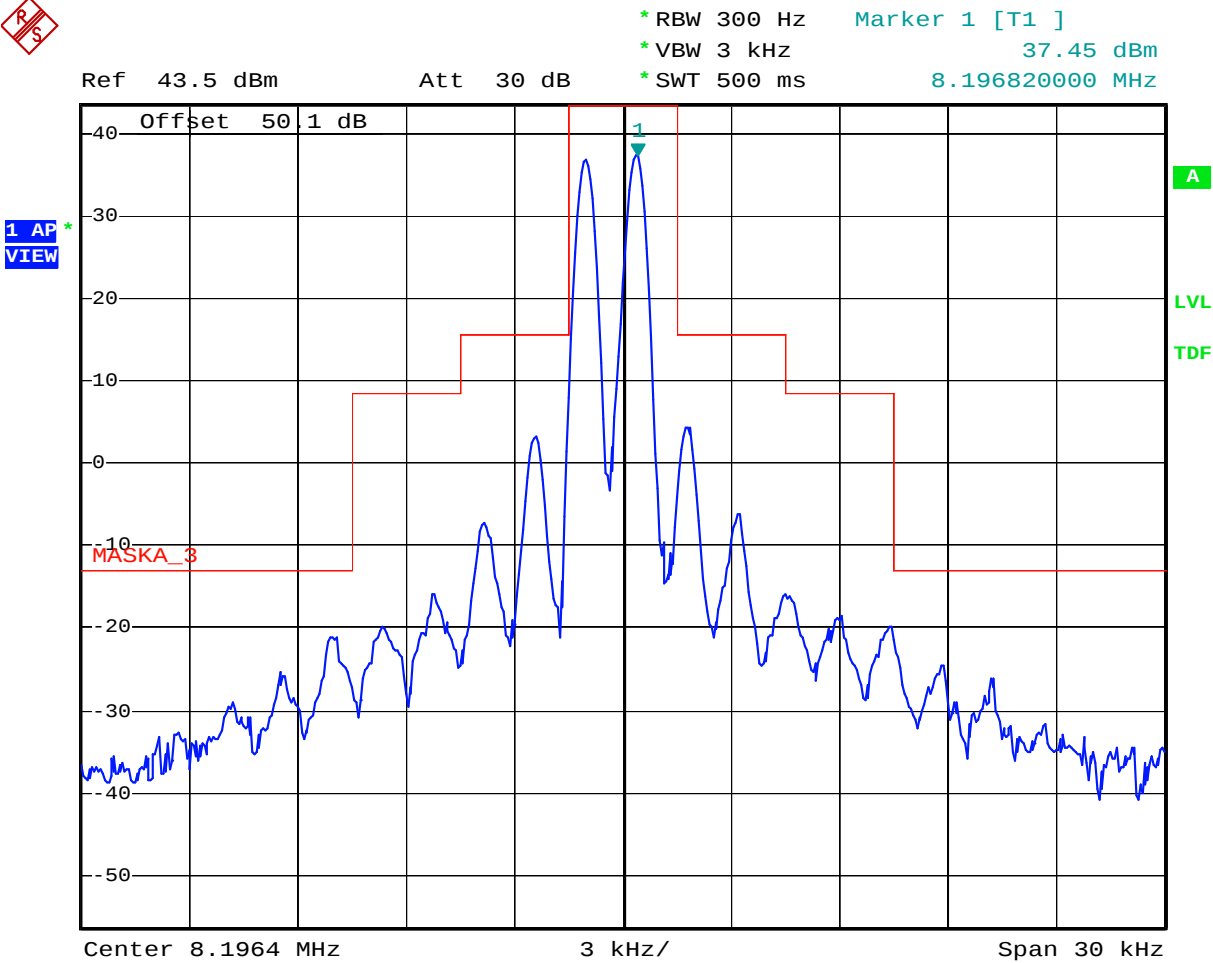
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 8.195MHz, Low power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:38:17

ULTRATECH GROUP OF LABS

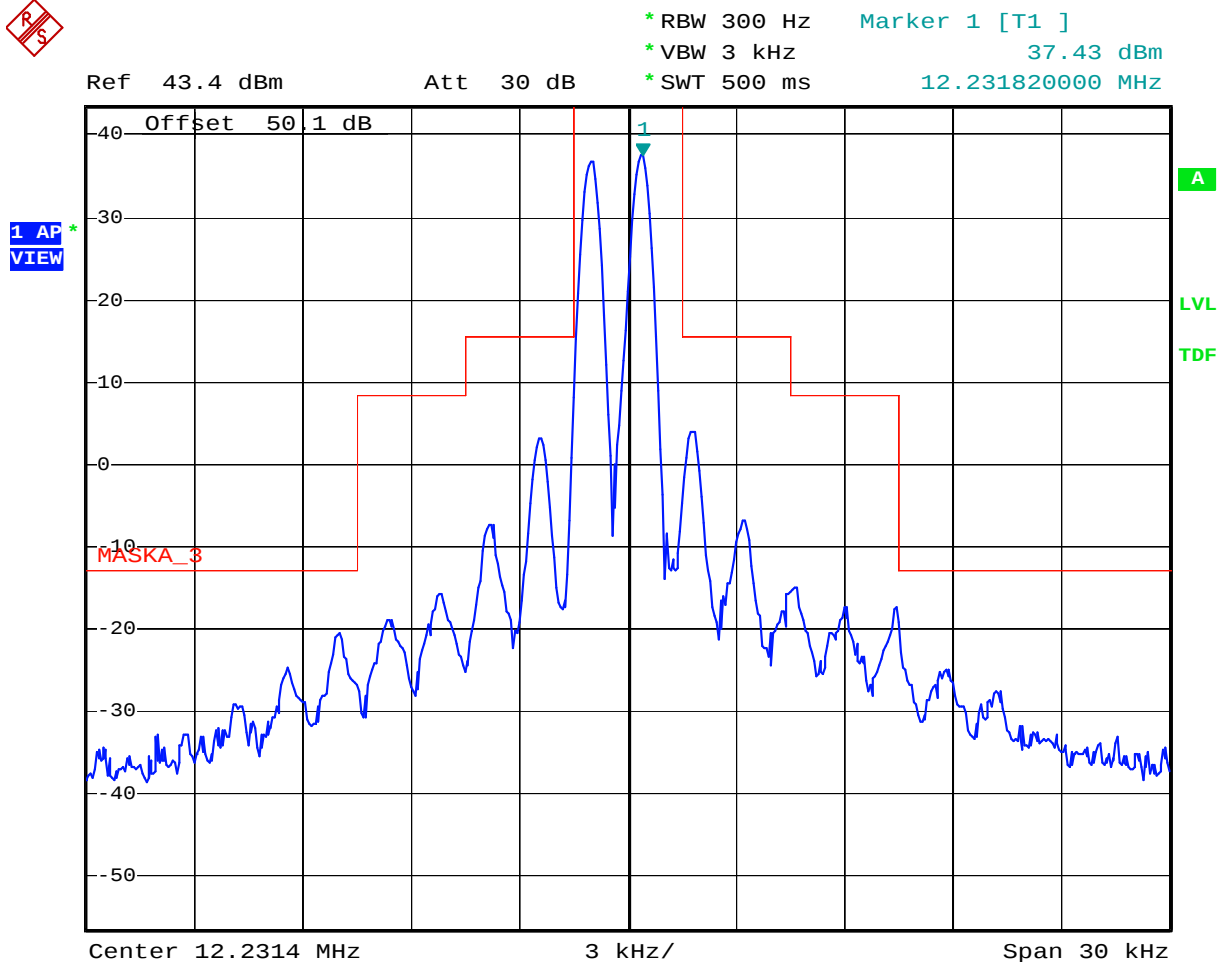
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 12.230MHz, Low power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:39:33

ULTRATECH GROUP OF LABS

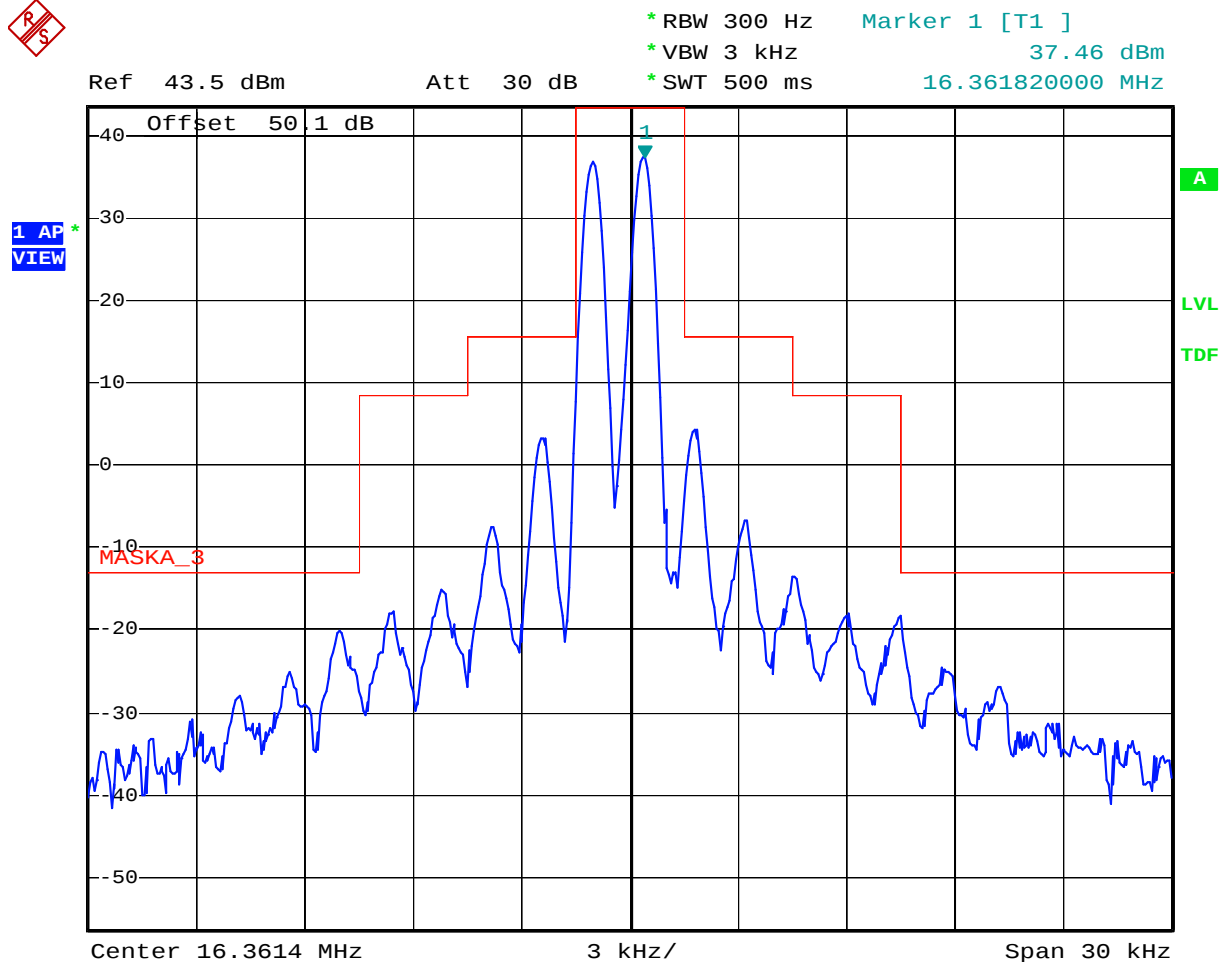
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 16.360MHz, Low power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:40:52

ULTRATECH GROUP OF LABS

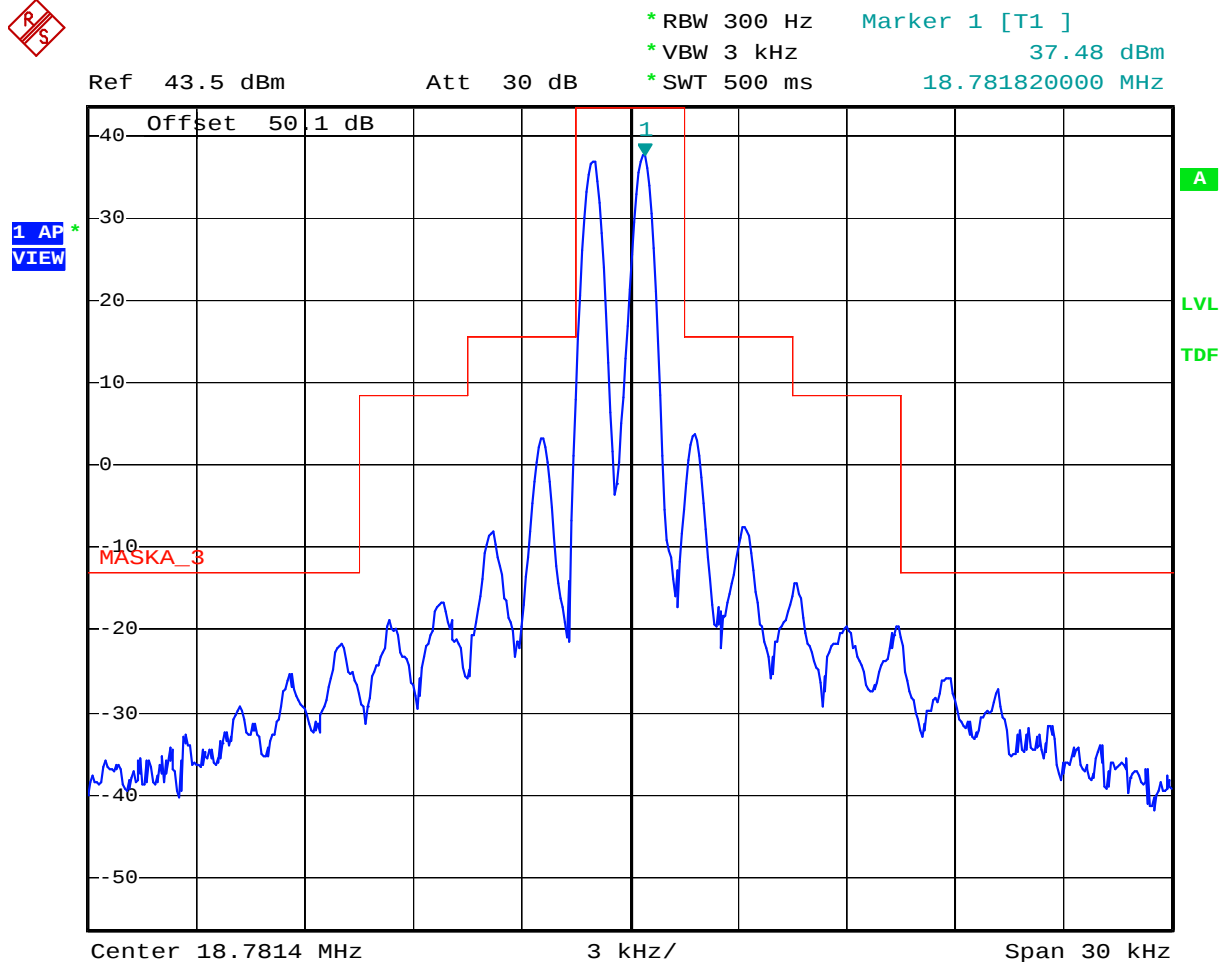
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 18.780MHz, Low power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:41:57

ULTRATECH GROUP OF LABS

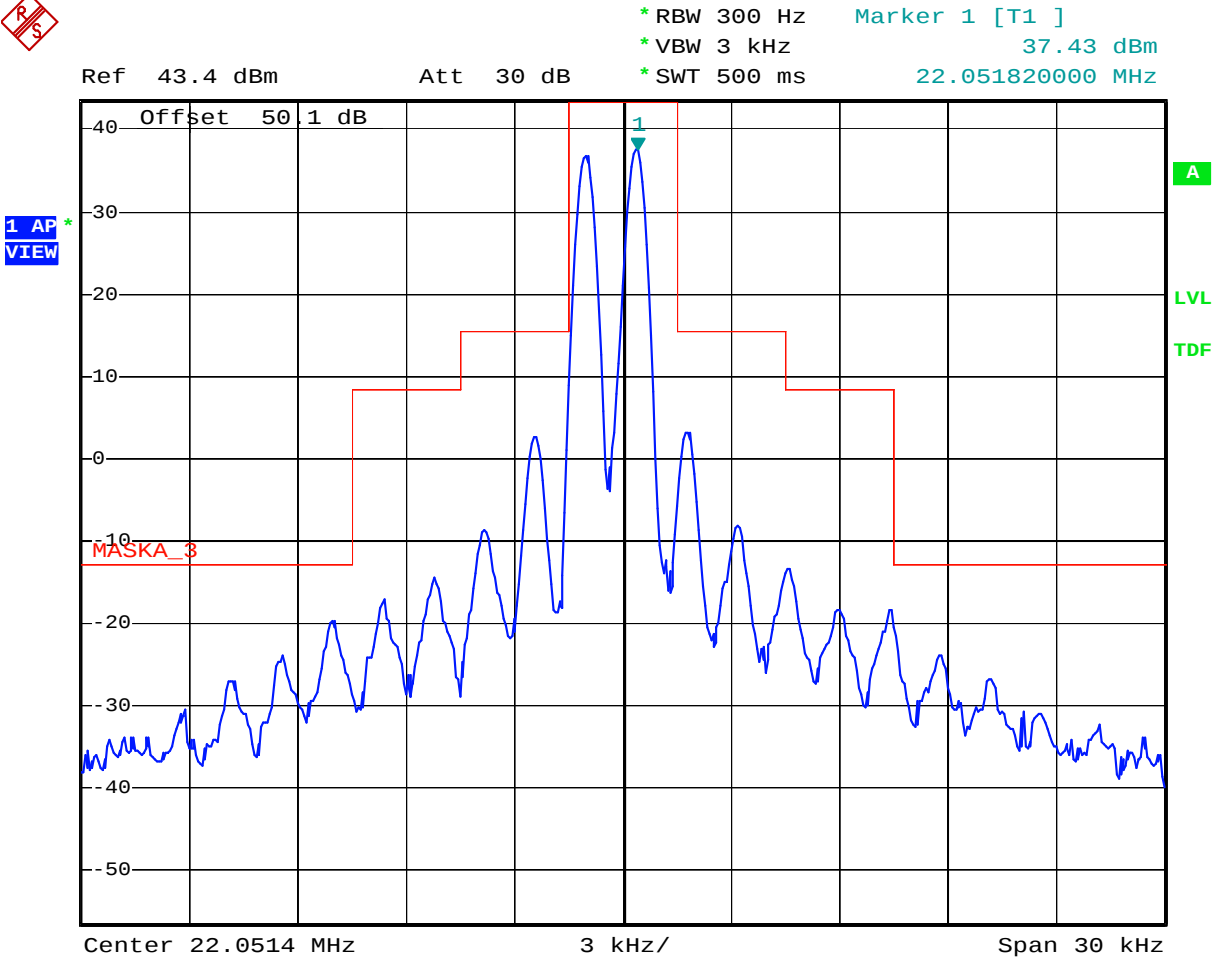
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 22.050MHz, Low power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:43:20

ULTRATECH GROUP OF LABS

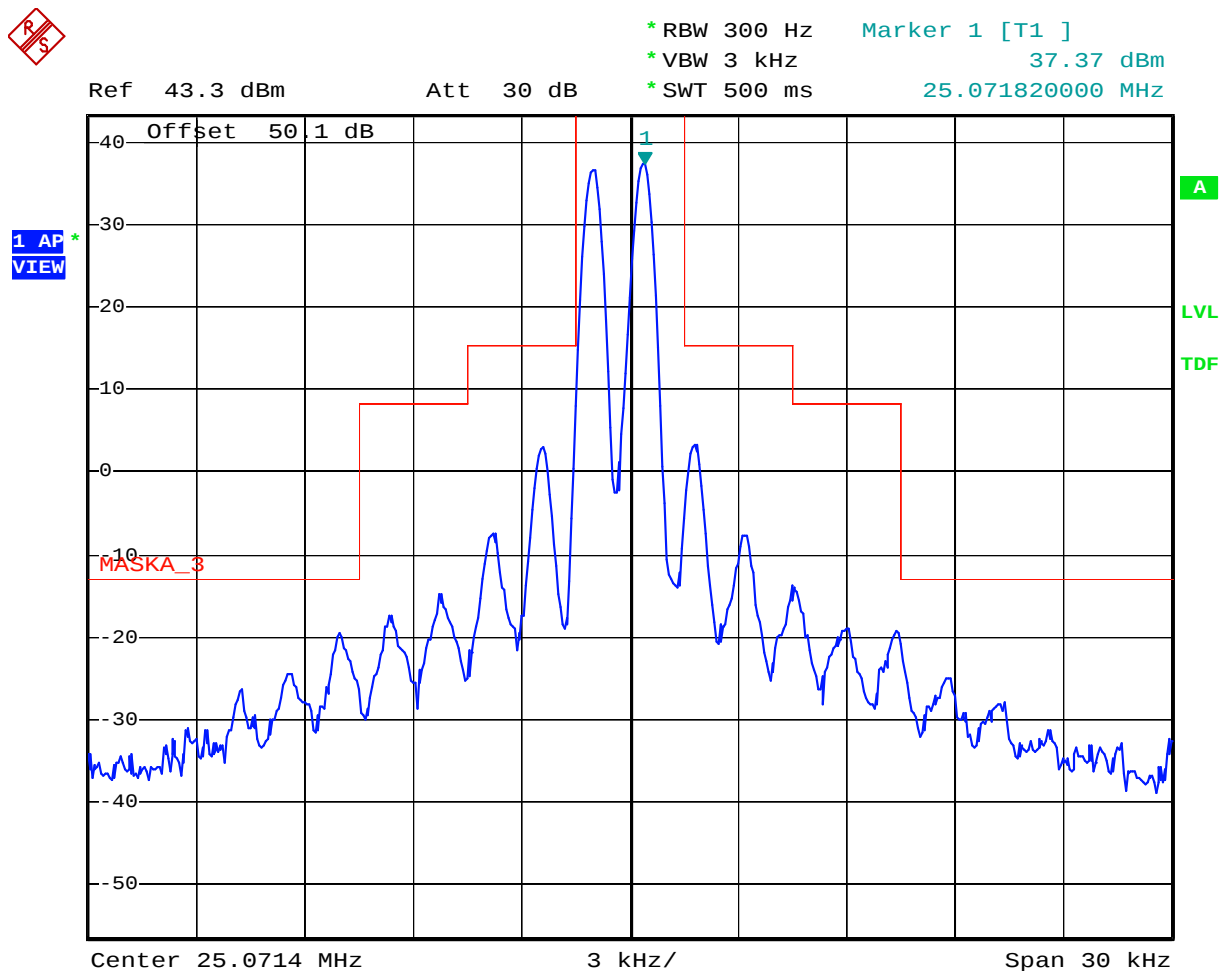
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 25.070MHz, Low power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:44:39

ULTRATECH GROUP OF LABS

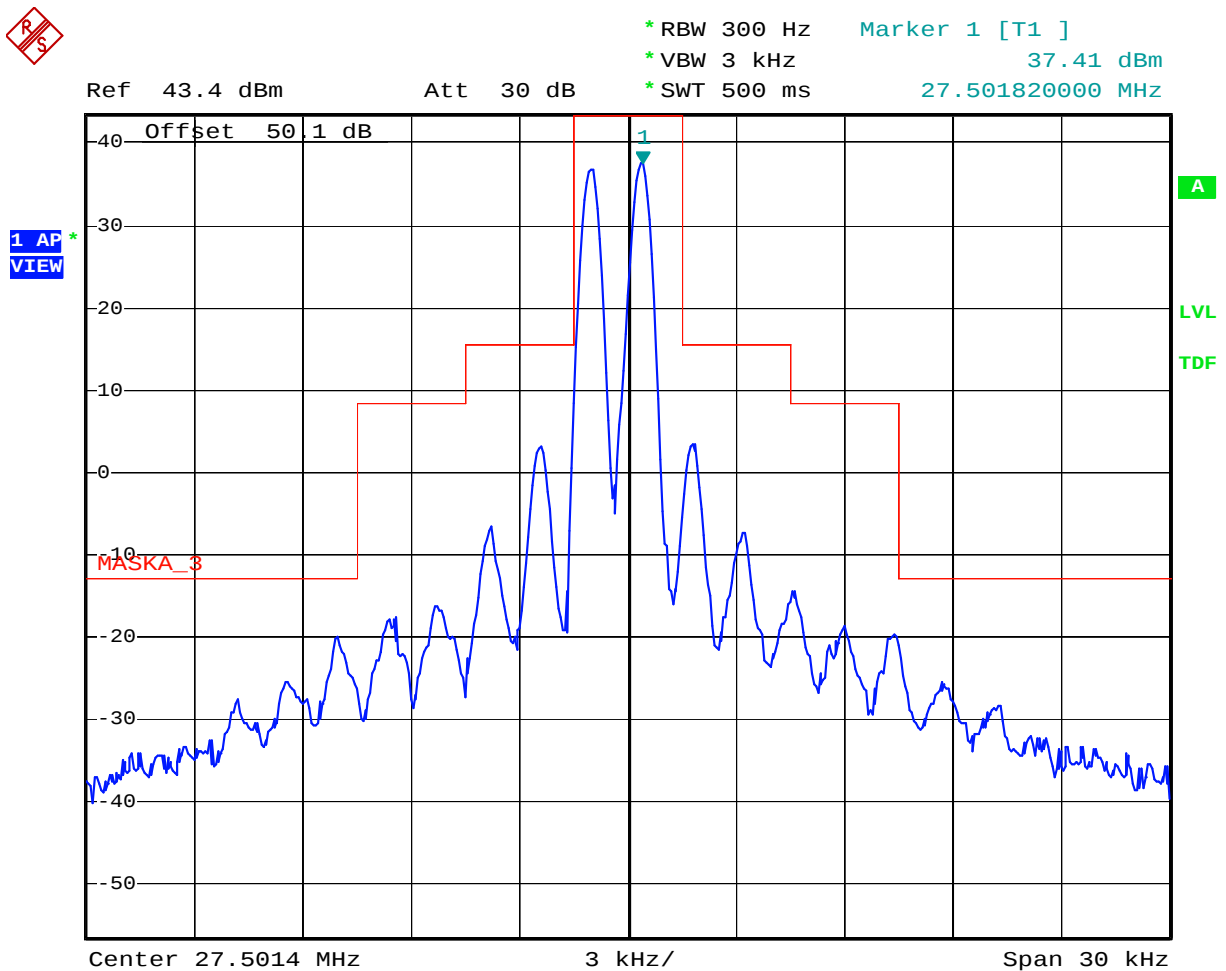
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Configuration: Mask A, J3E (USB), 27.5MHz, Low power, Modulation: 400+1800Hz



Date: 1.NOV.2019 15:45:56

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

5.9. TRANSMITTER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS [§ 2.1051, 2.1057, 80.211(f)(3) & 90.210]

5.9.1. Limits

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Attenuation Limit (dBc)
§ 22.359	At least 43 + 10 log (P) dB.
§ 80.211(f)(3),	At least 43 + 10log ₁₀ (mean power in watts) dB
§ 90.210(b)	At least 43 + 10 log (P) dB
§ 90.210(d)	At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.
§ 90.210(e)	At least 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

5.9.2. Method of Measurements

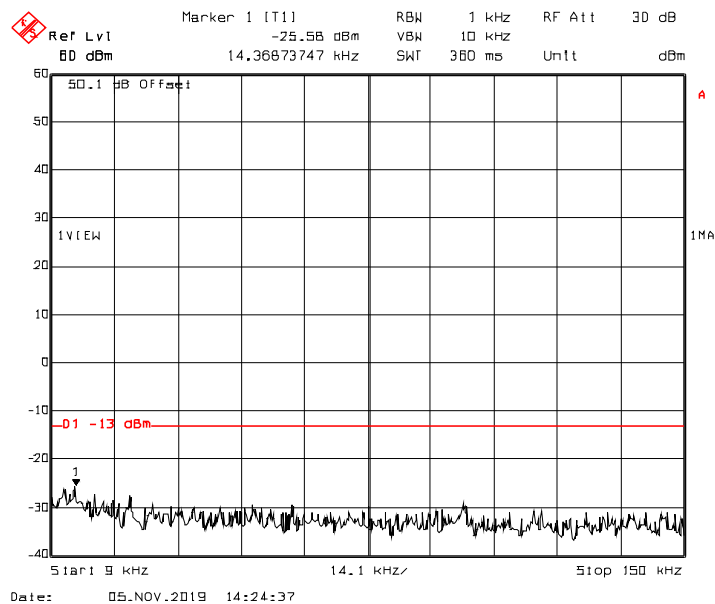
Refer to Section 8.4 of this report for measurement details

5.9.3. Test Data

- Note:**
- The spurious/harmonic emissions of J3E is tested to represent worst case
- The emissions were scanned from 8 kHz to 1000 MHz; all spurious emissions that are in excess of 20dB below the specified limits were recorded.

High Power

5.9.3.1. Configuration: Tx Conducted, J3E (USB), 1.605MHz, High power, Modulation: 400+1800Hz

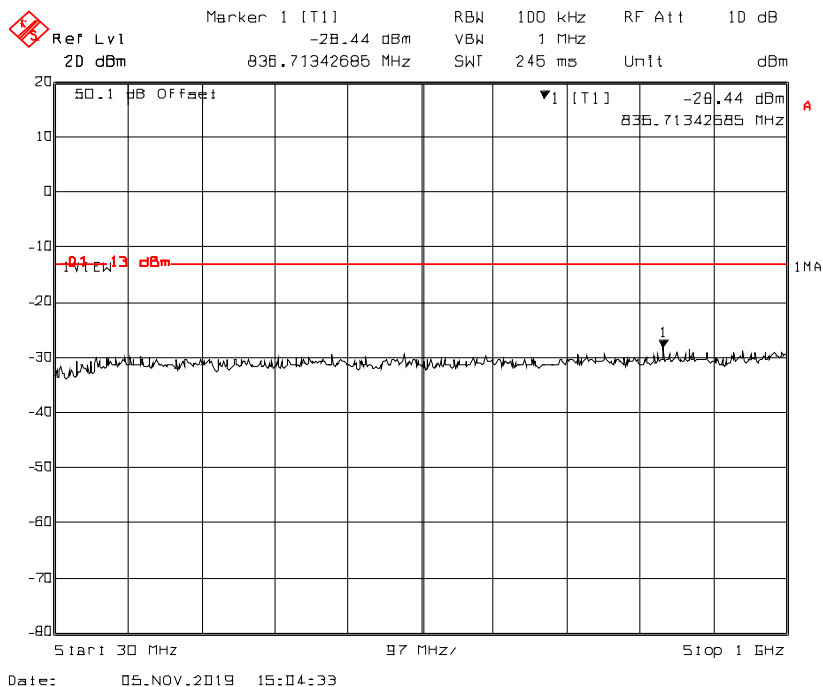
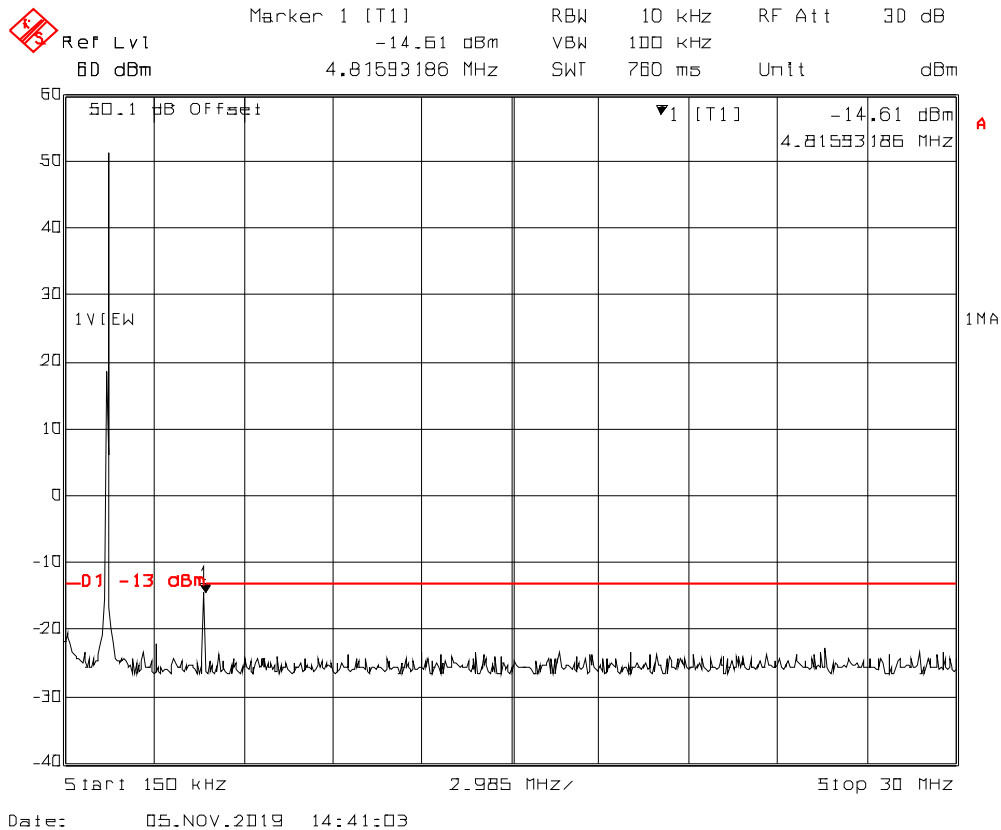


ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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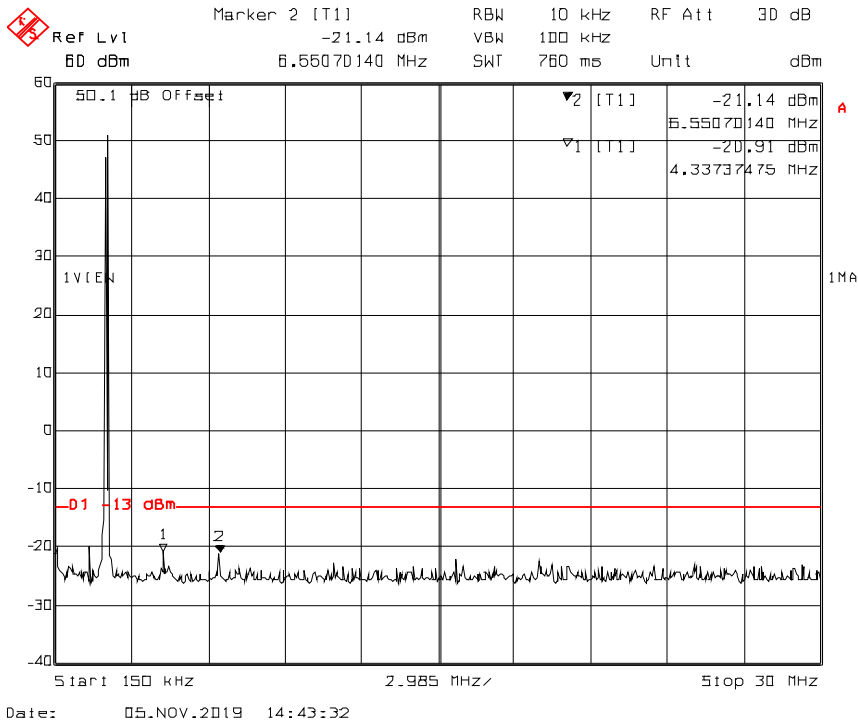
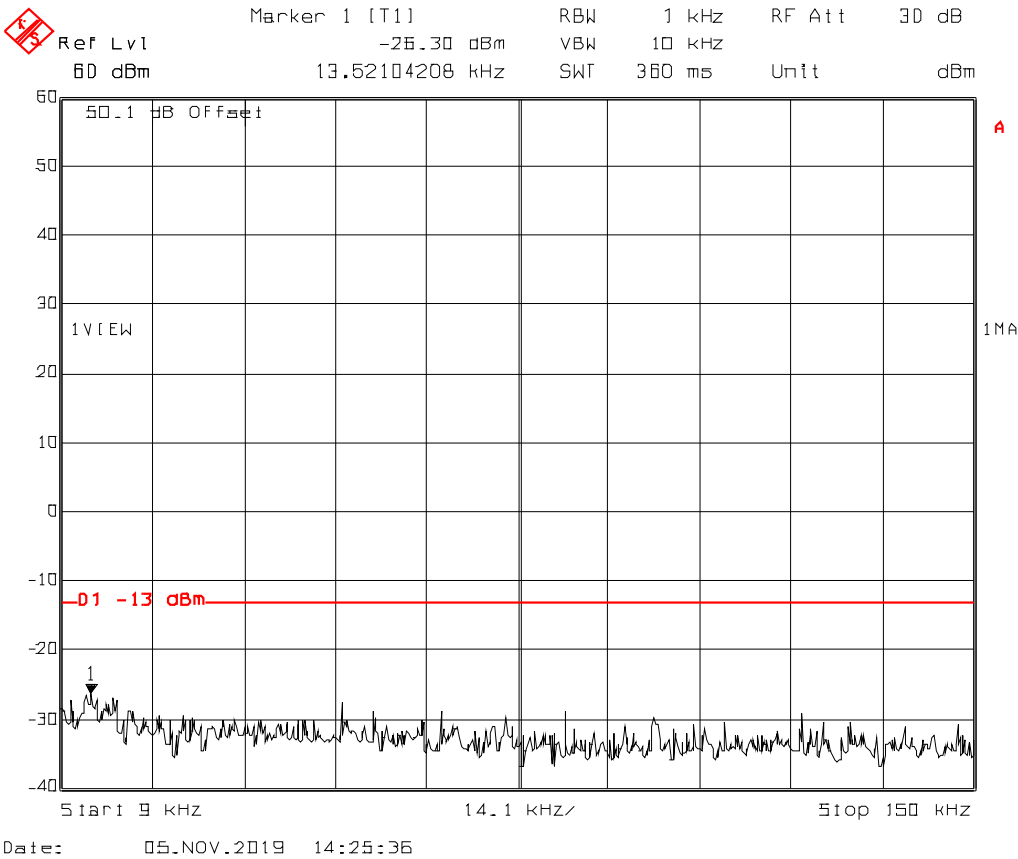
ULTRATECH GROUP OF LABS

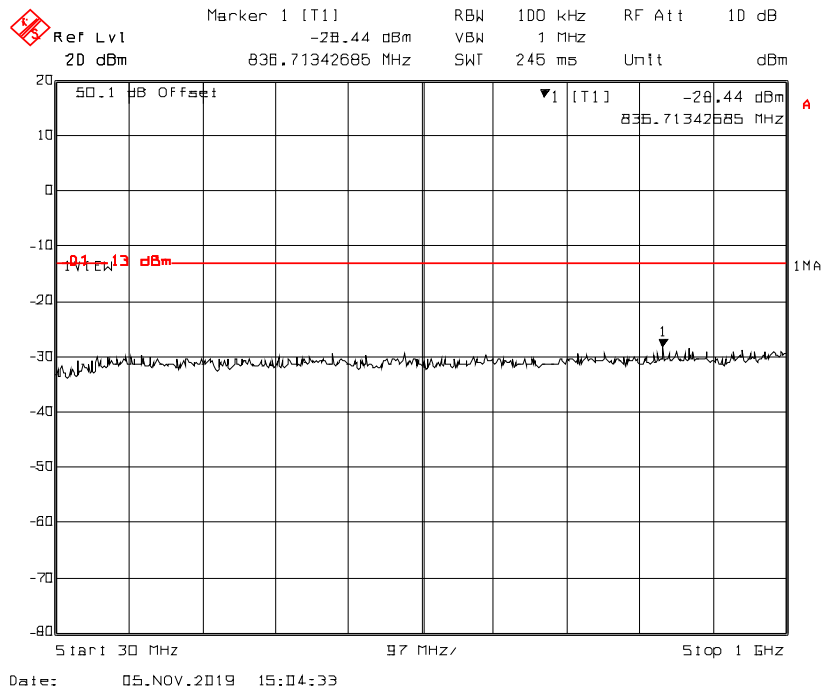
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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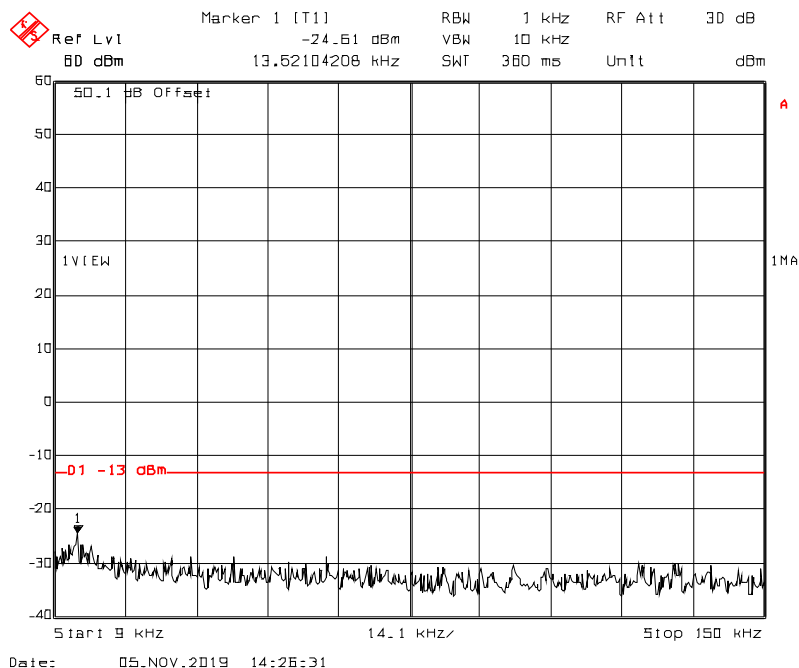
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

5.9.3.2. Configuration: Tx Conducted, J3E (USB), 2.182MHz, High power, Modulation: 400+1800Hz





5.9.3.3. Configuration: Tx Conducted, J3E (USB), 4.065MHz, High power, Modulation: 400+1800Hz



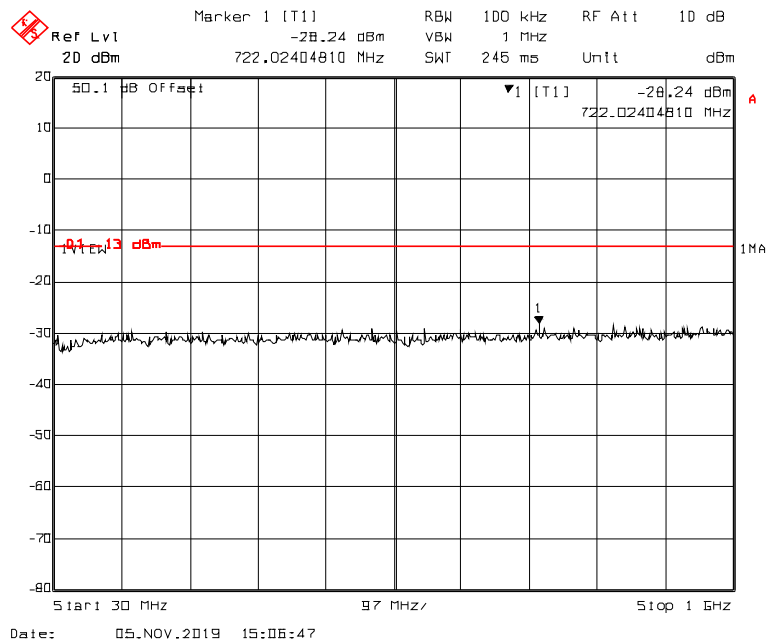
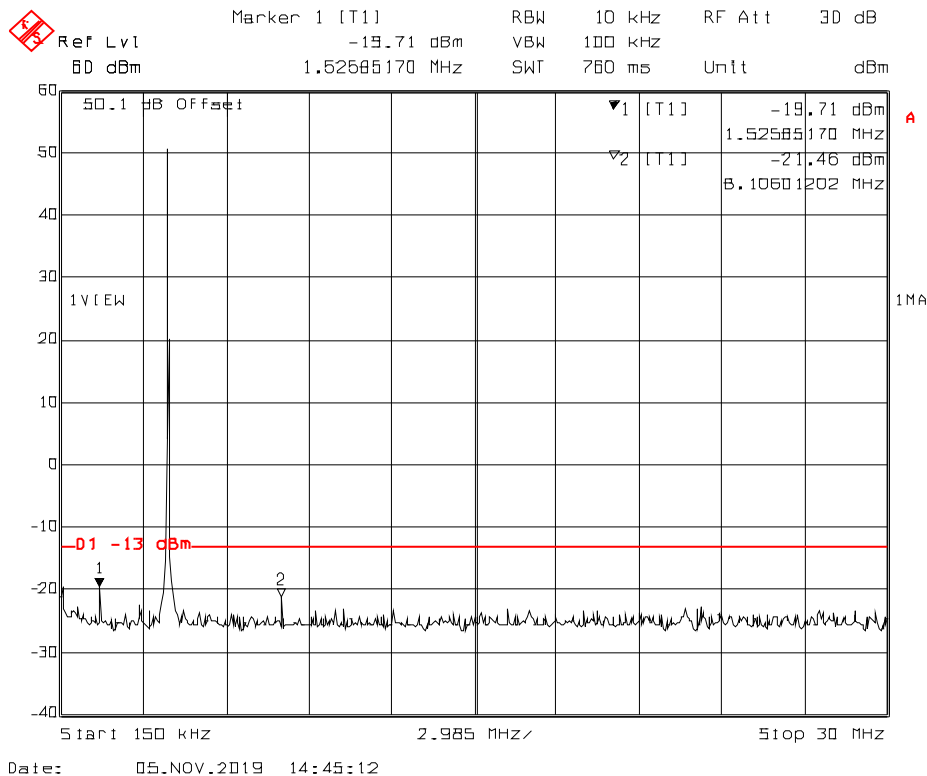
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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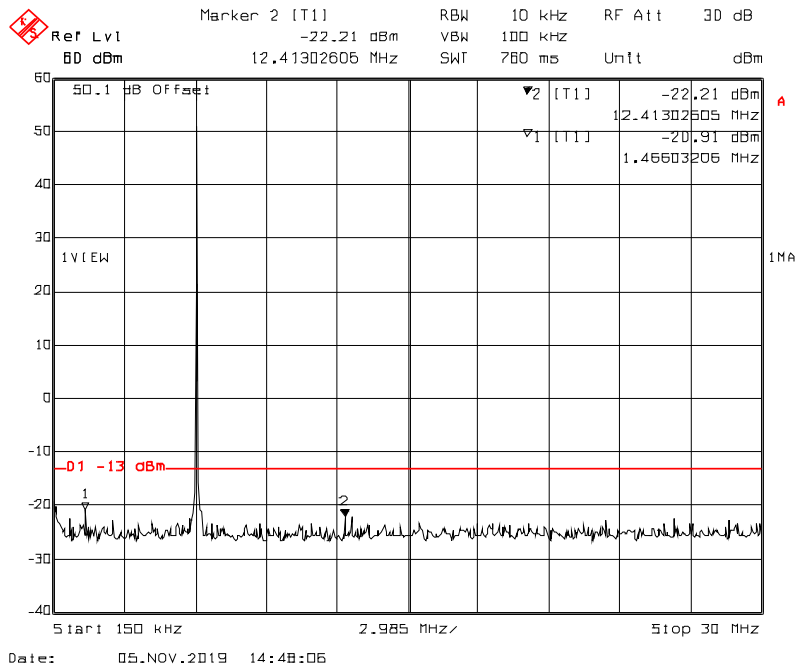
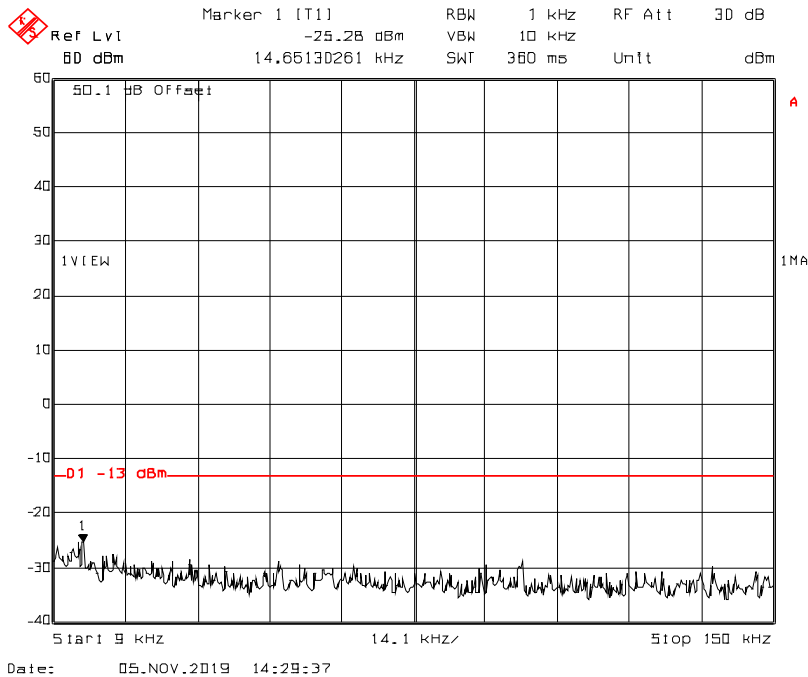
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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5.9.3.4. Configuration: Tx Conducted, J3E (USB), 6.2MHz, High power, Modulation: 400+1800Hz



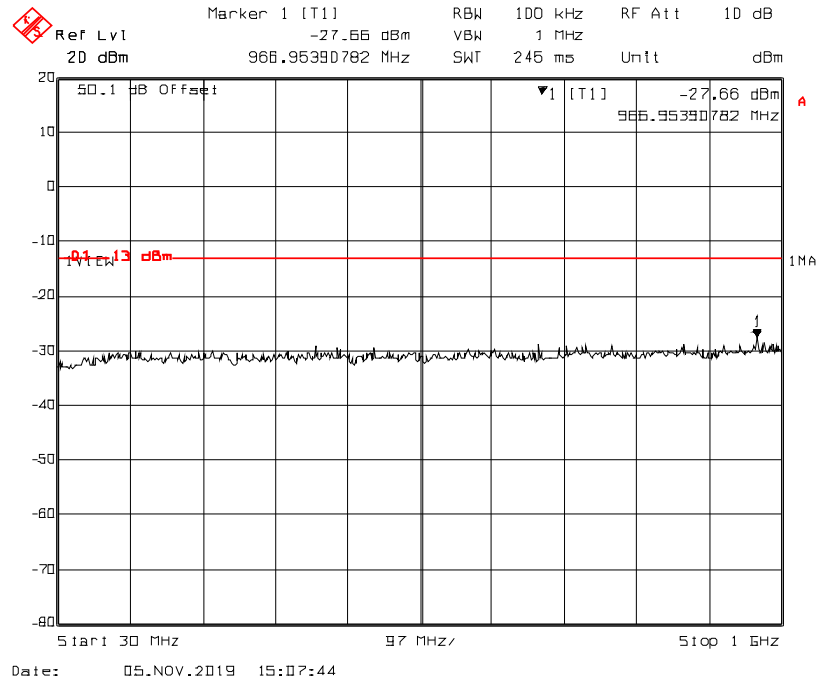
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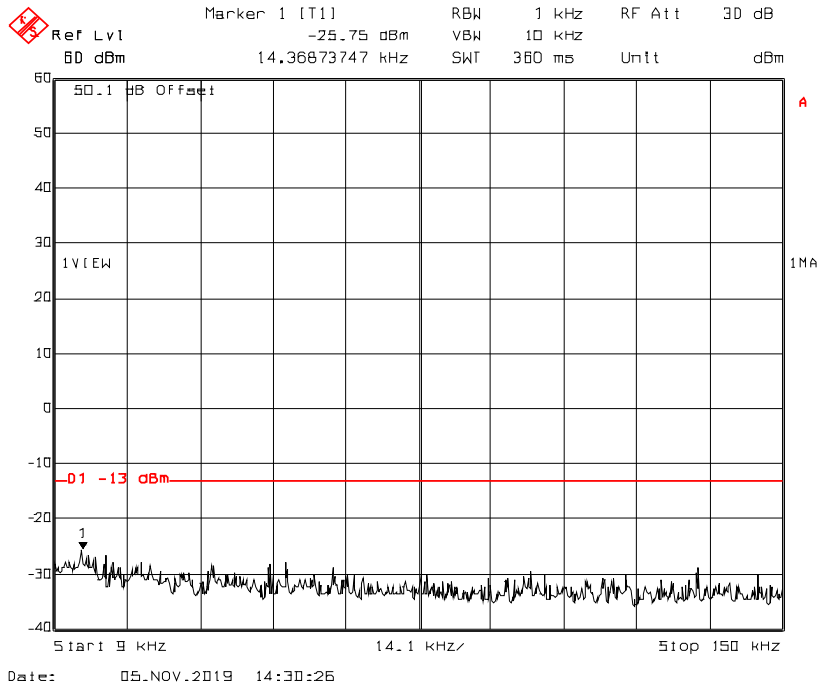
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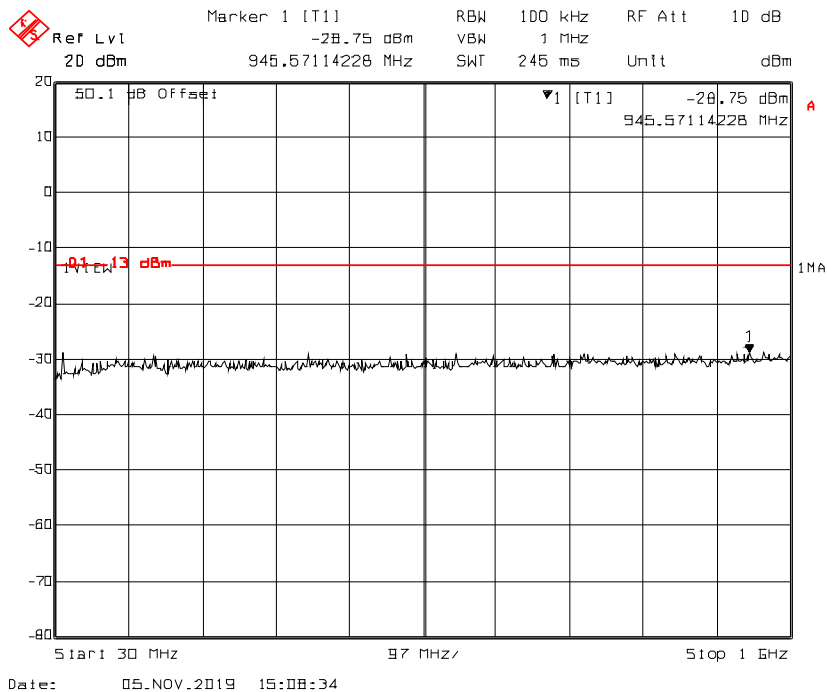
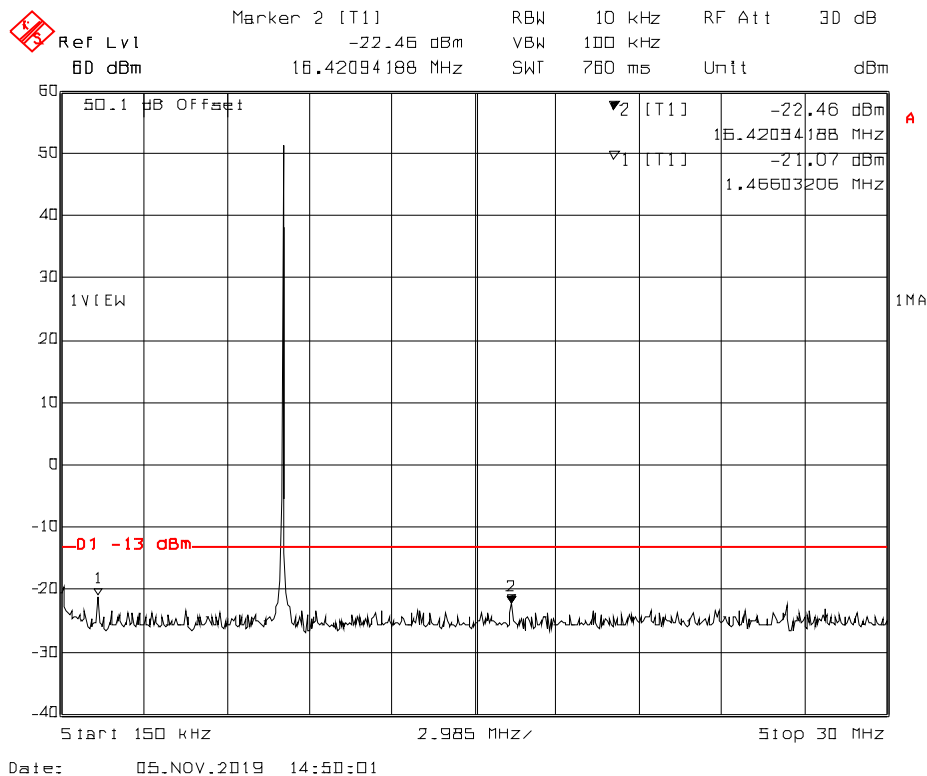
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5.9.3.5. Configuration: Tx Conducted, J3E (USB), 8.195MHz, High power, Modulation: 400+1800Hz





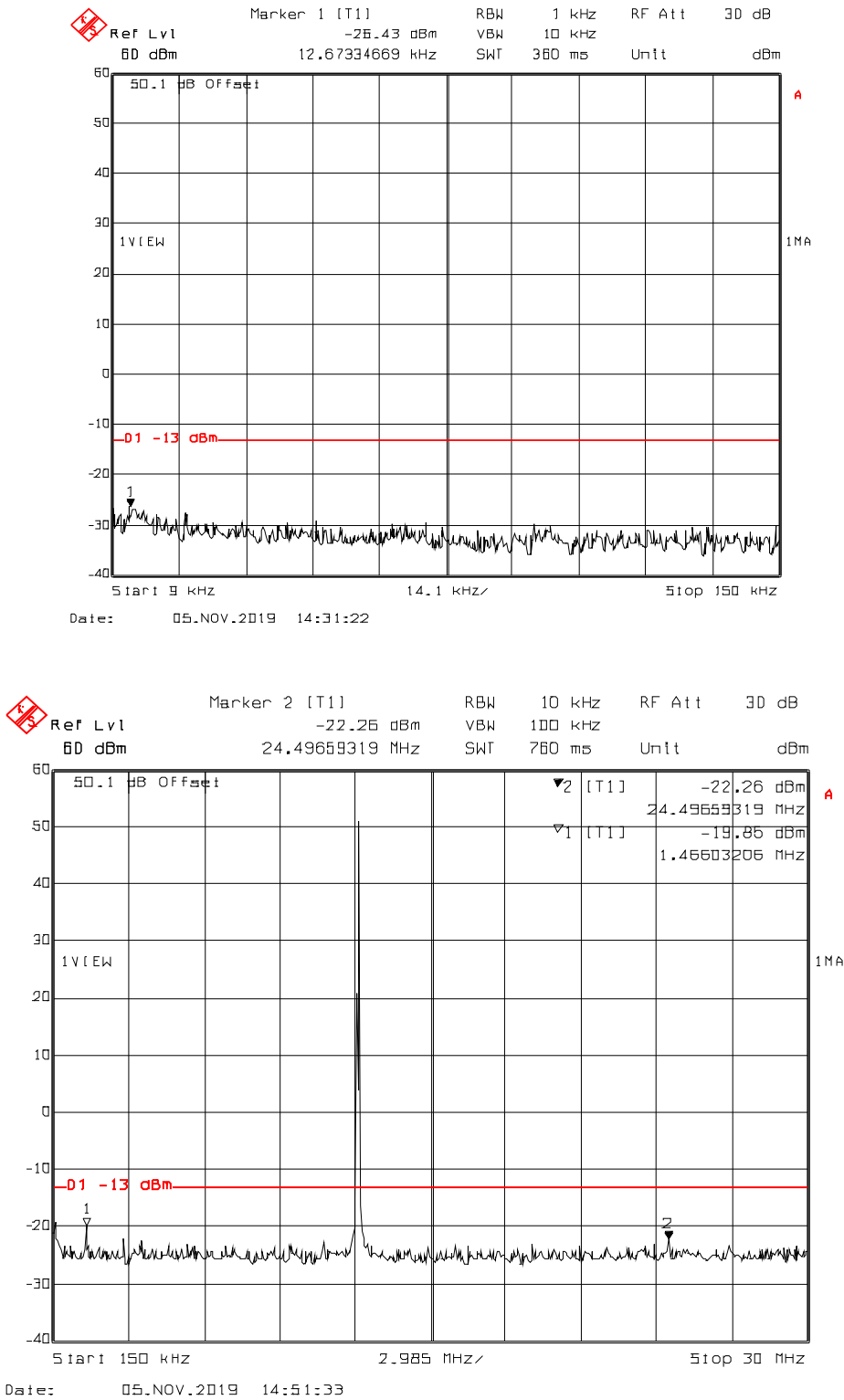
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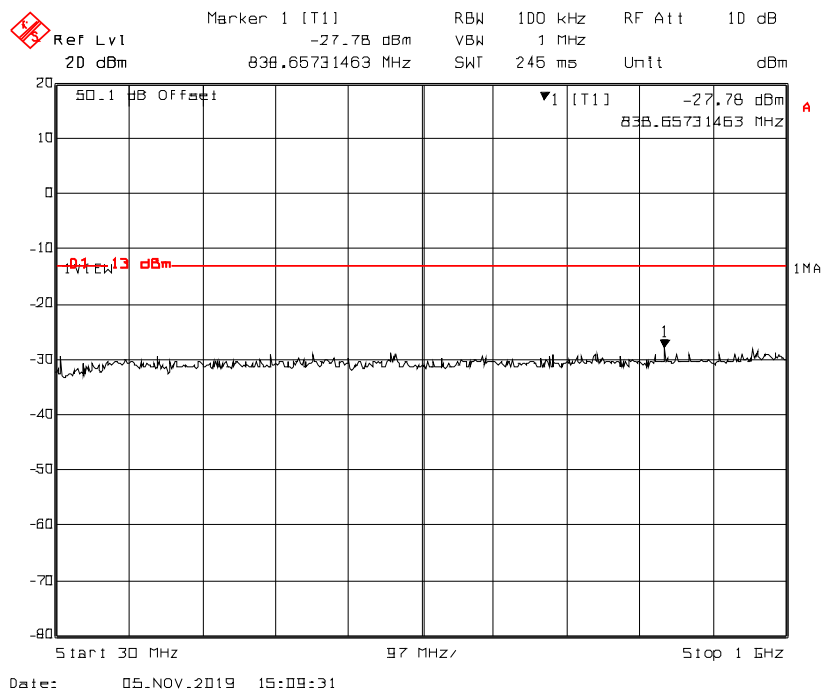
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80
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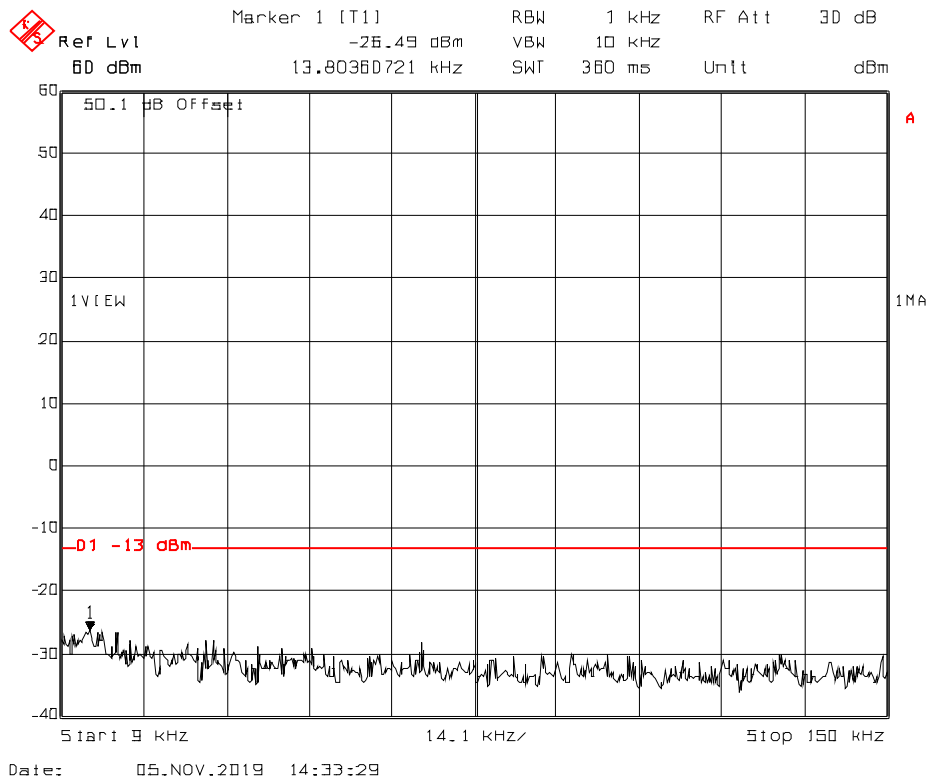
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

5.9.3.6. Configuration: Tx Conducted, J3E (USB), 12.230MHz, High power, Modulation: 400+1800Hz





5.9.3.7. Configuration: Tx Conducted, J3E (USB), 16.360MHz, High power, Modulation: 400+1800Hz



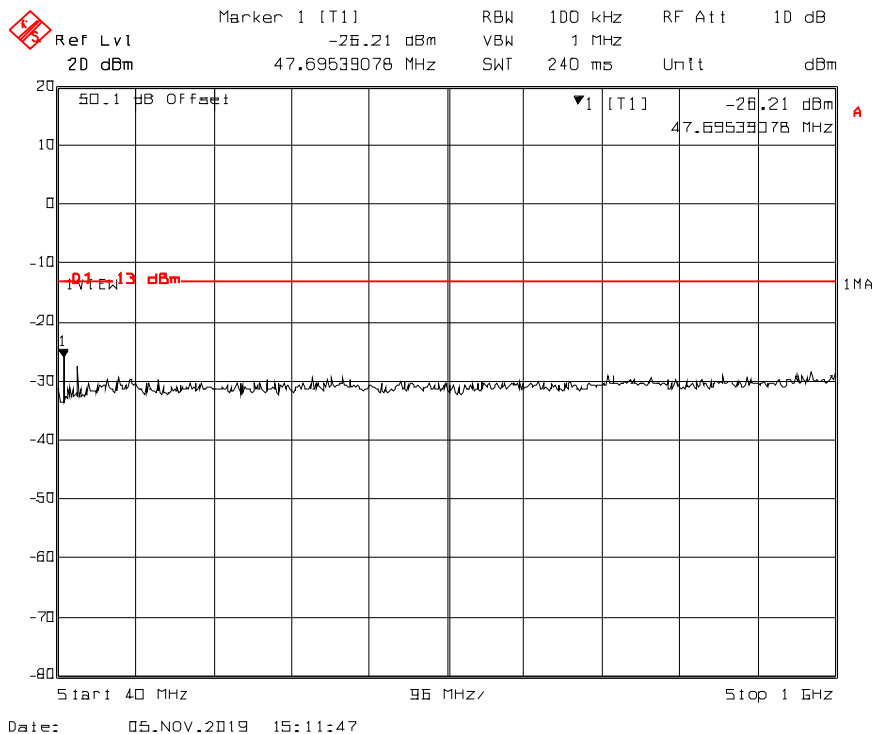
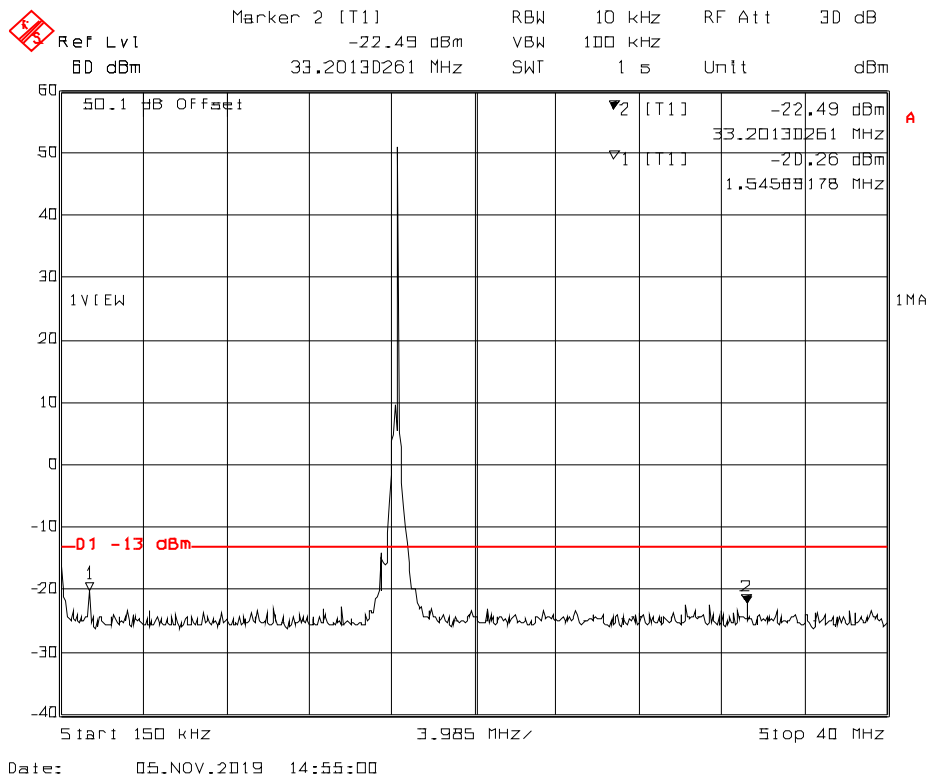
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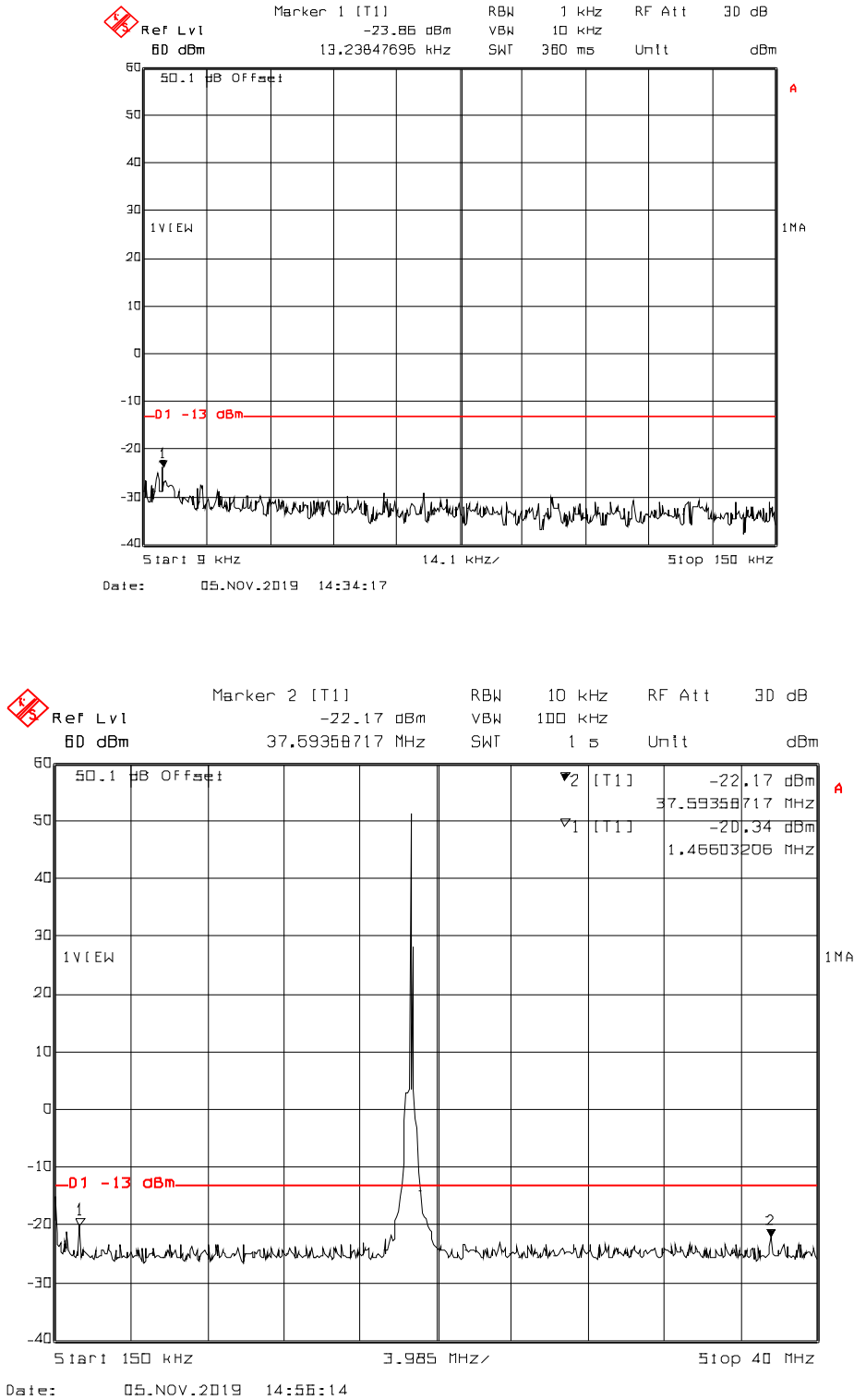
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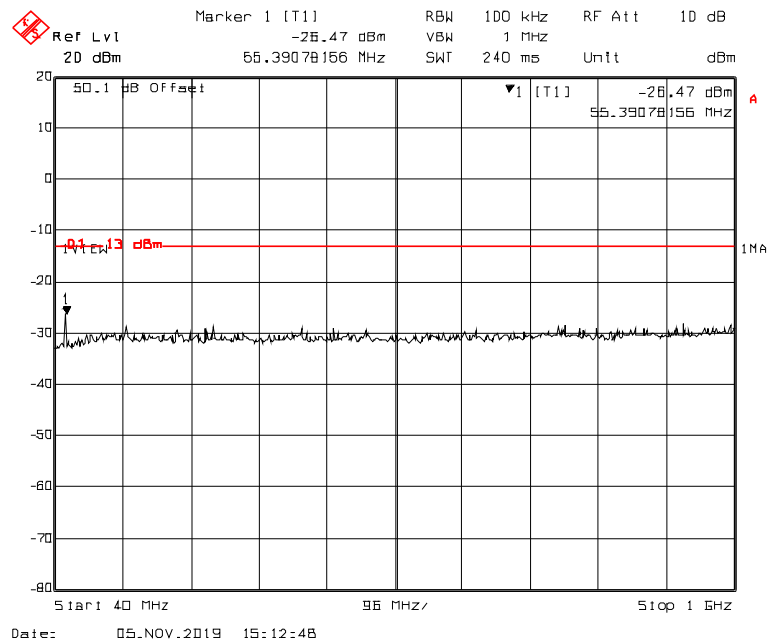
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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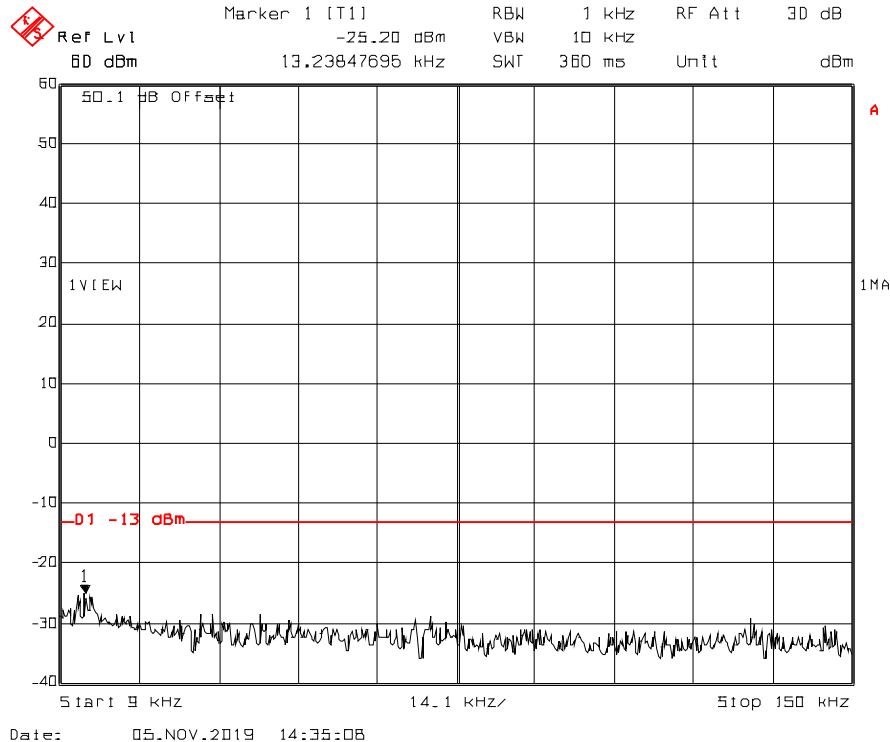
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

5.9.3.8. Configuration: Tx Conducted, J3E (USB), 18.780MHz, High power, Modulation: 400+1800Hz





5.9.3.9. Configuration: Tx Conducted, J3E (USB), 22.050MHz, High power, Modulation: 400+1800Hz



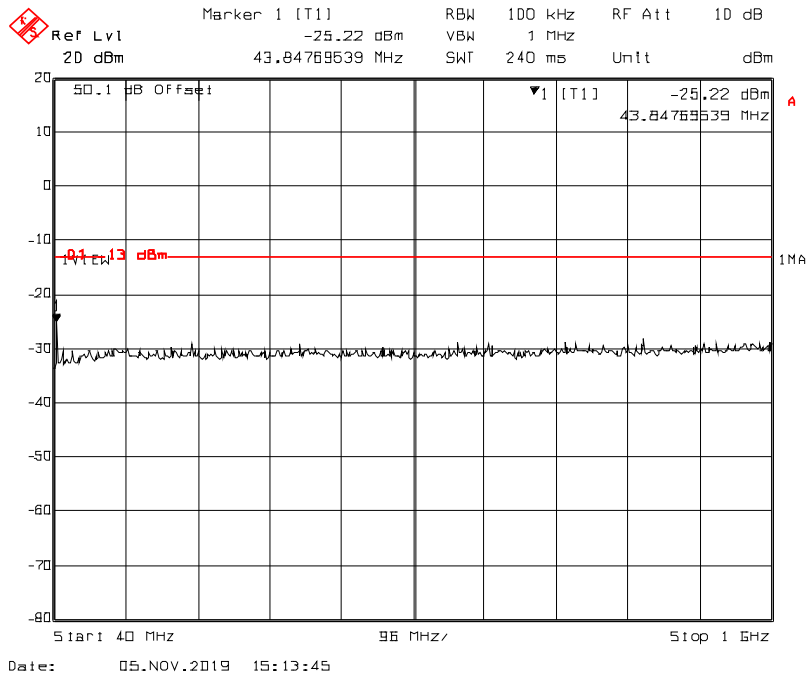
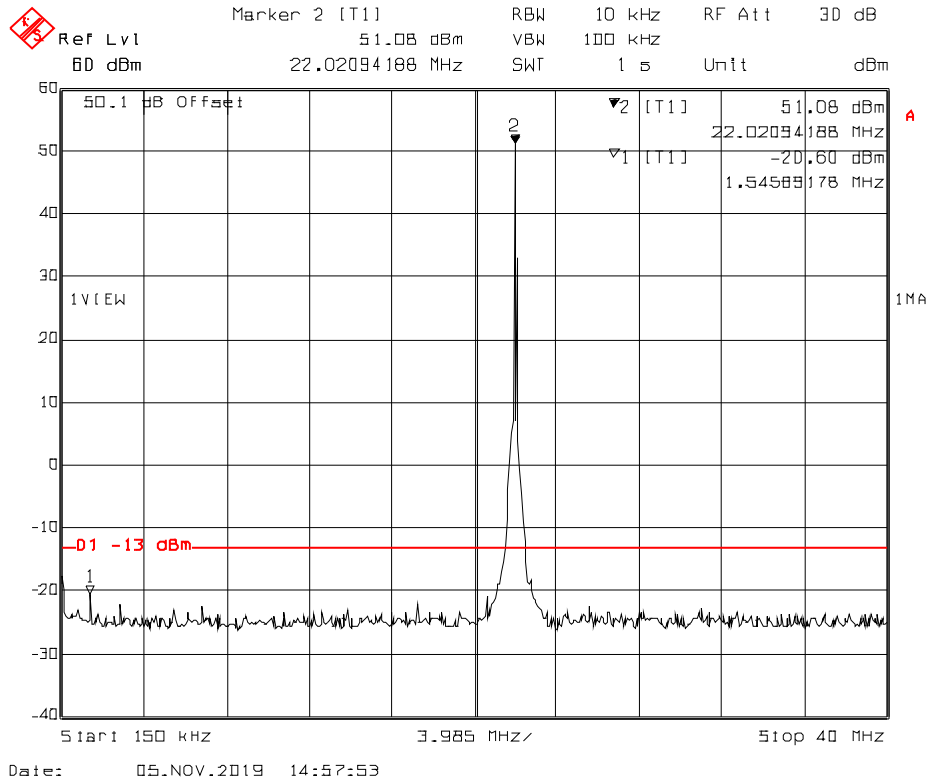
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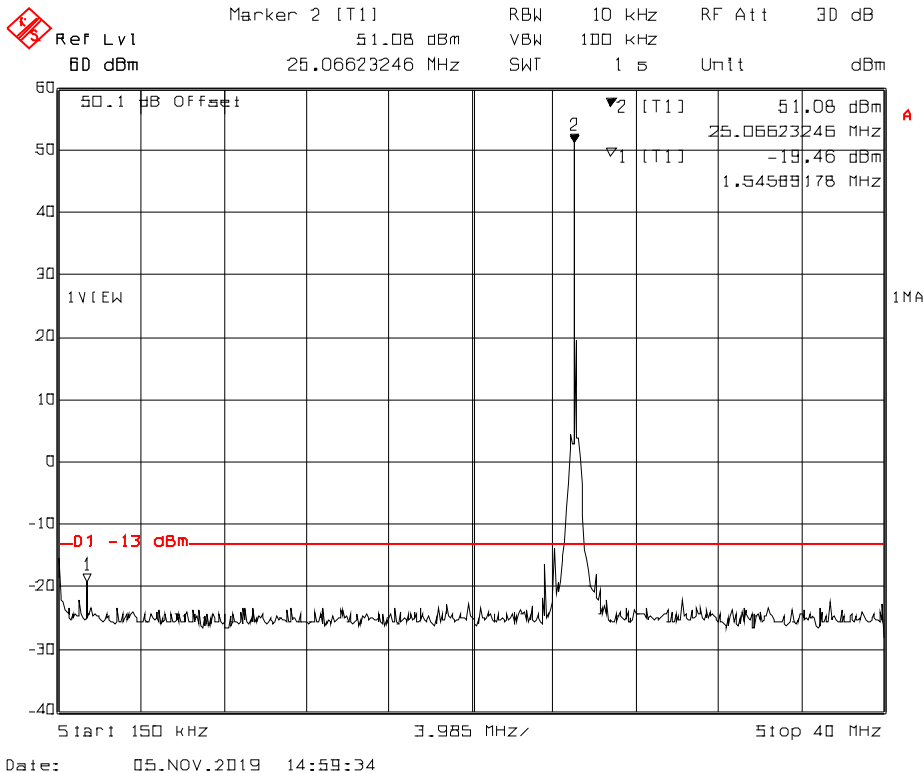
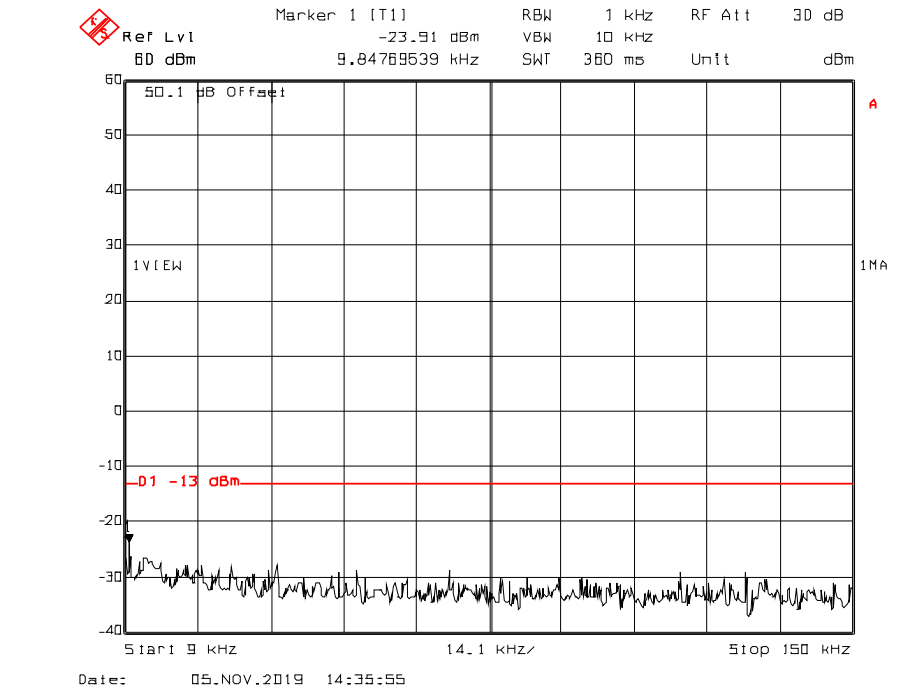
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5.9.3.10. Configuration: Tx Conducted, J3E (USB), 25.070MHz, High power, Modulation: 400+1800Hz



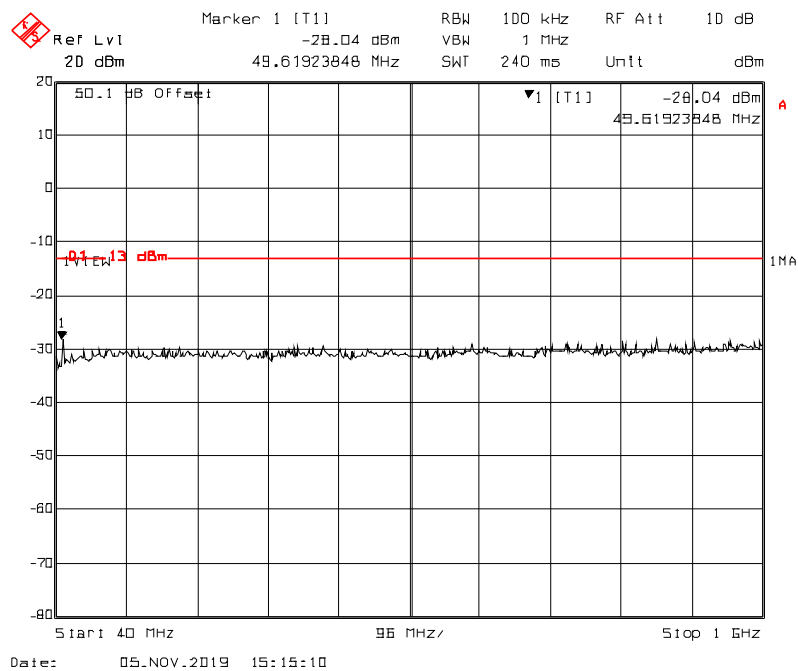
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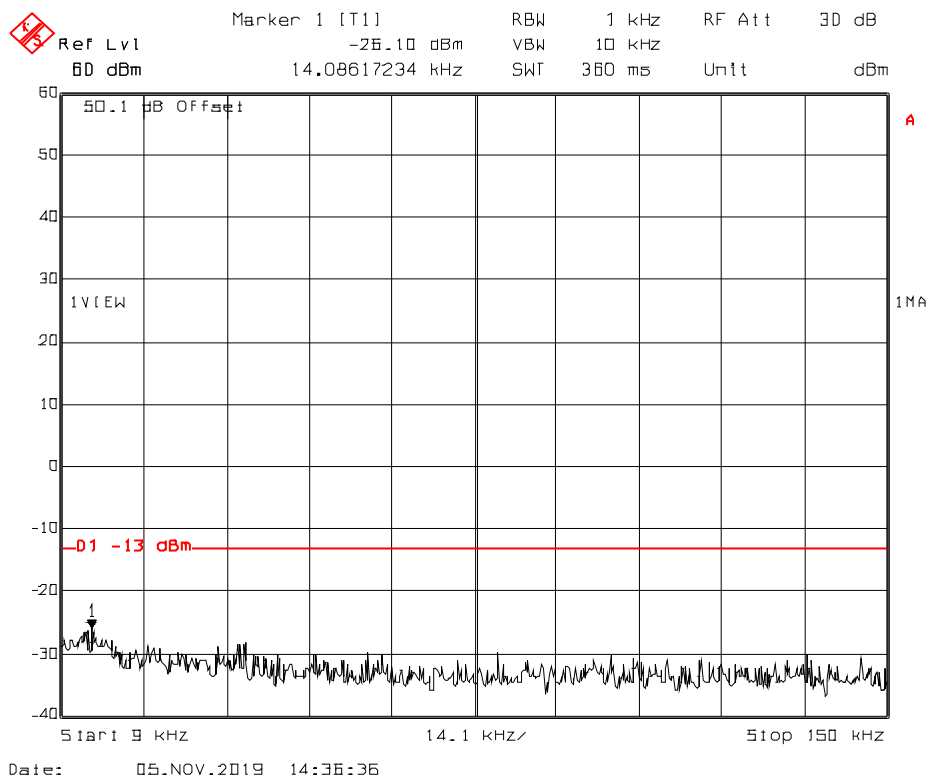
File #: 19ICOM515_FCC80

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5.9.3.11. Configuration: Tx Conducted, J3E (USB), 27.5MHz, High power, Modulation: 400+1800Hz



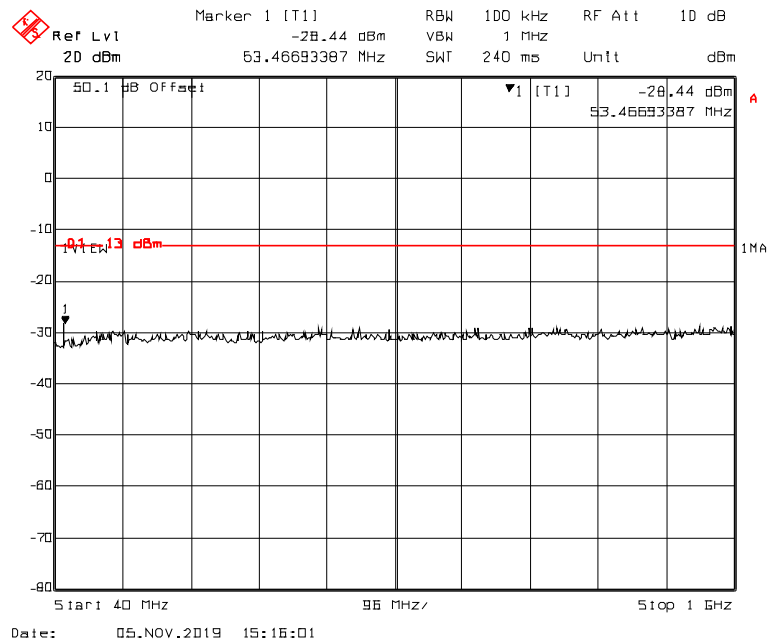
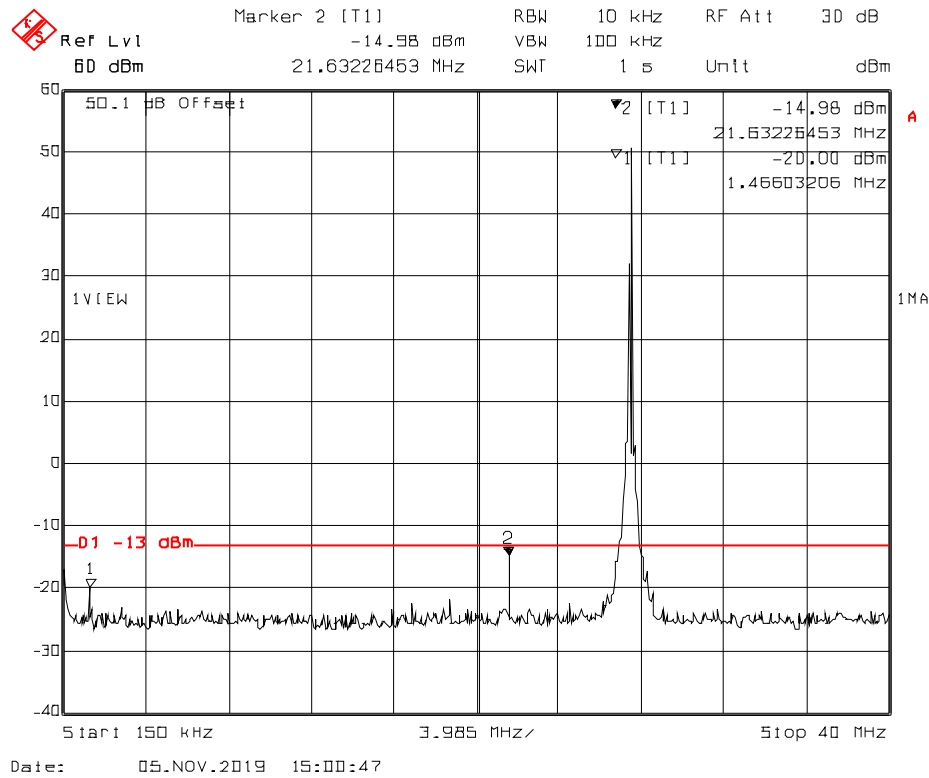
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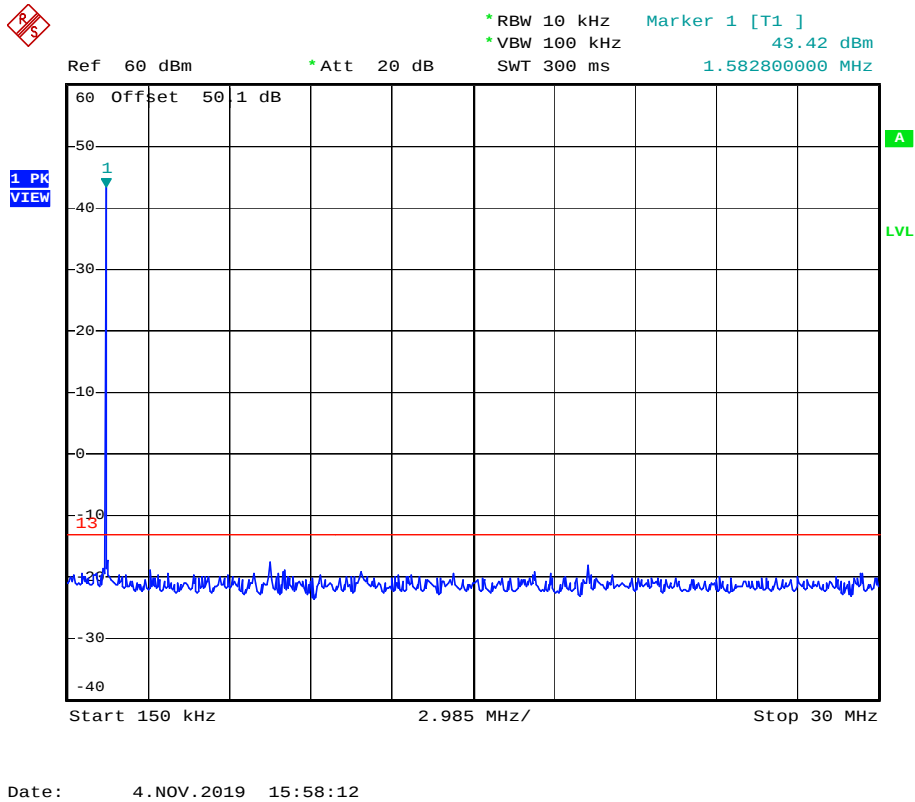
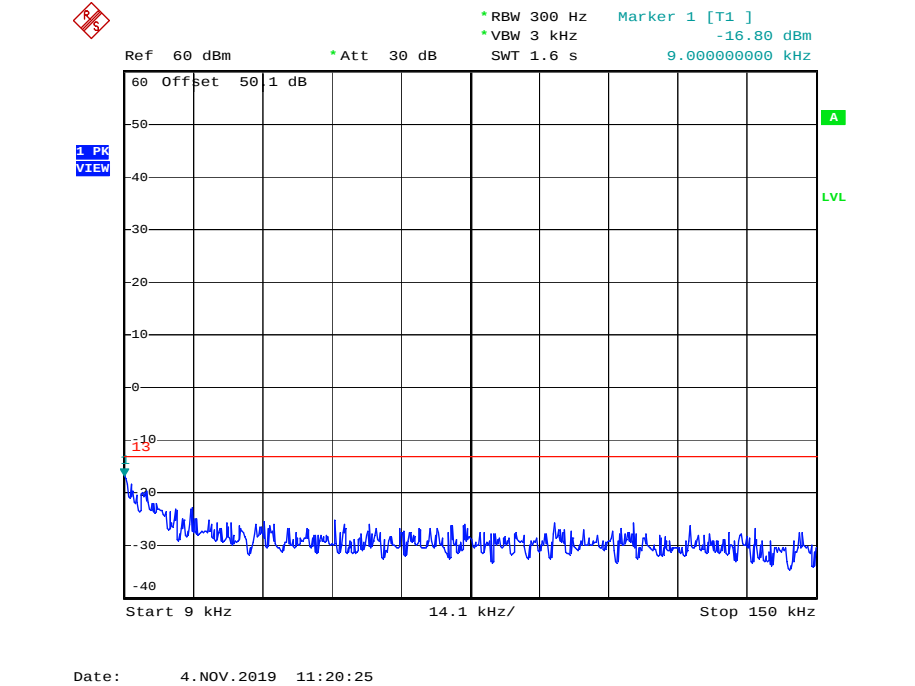
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Low Power

5.9.3.12. Configuration: Tx Conducted, J3E (USB), 1.605MHz, Low power, Modulation: 400+1800Hz



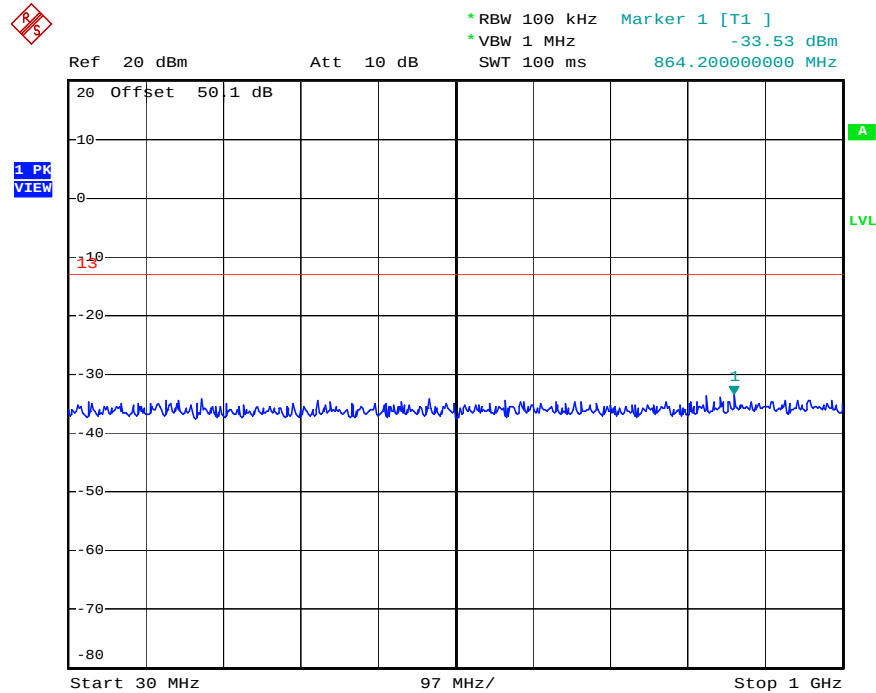
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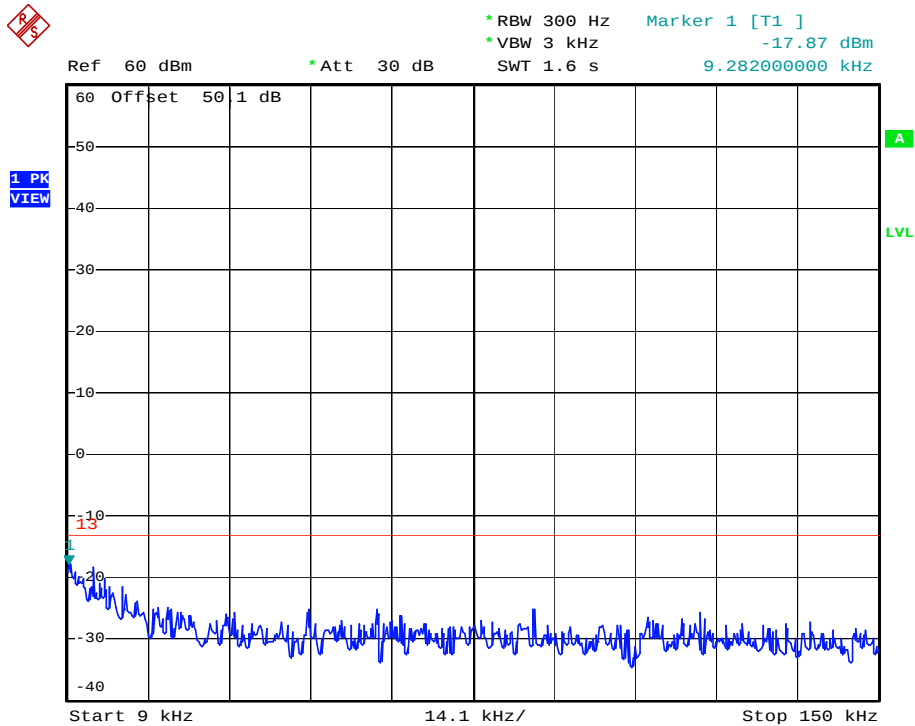
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)



Date: 4.NOV.2019 16:23:13

5.9.3.13. Configuration: Tx Conducted, J3E (USB), 2.182MHz, Low power, Modulation: 400+1800Hz



Date: 4.NOV.2019 11:23:45

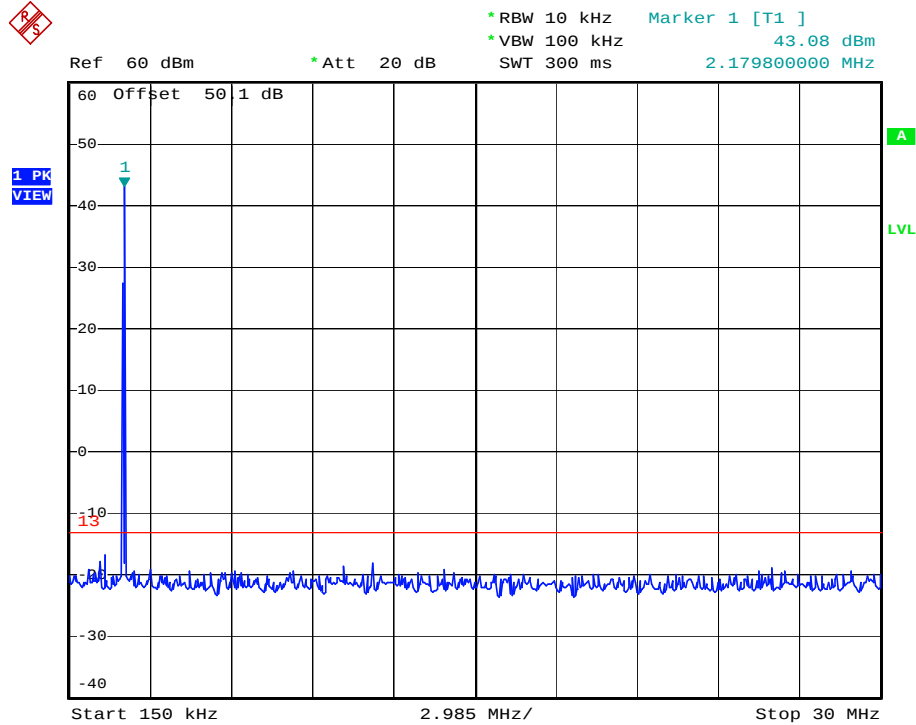
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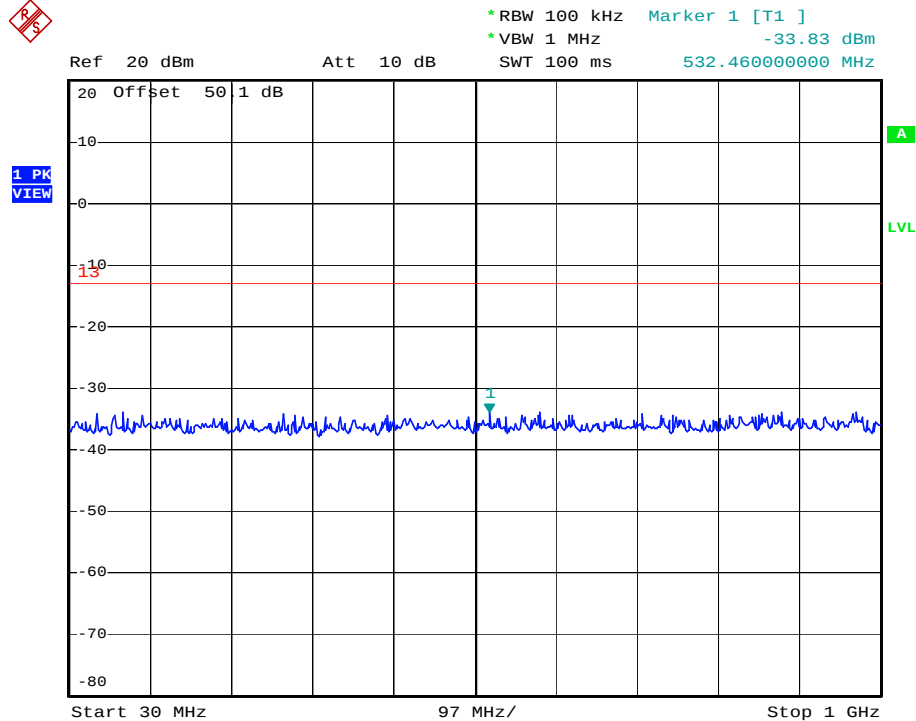
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Date: 4.NOV.2019 16:22:37

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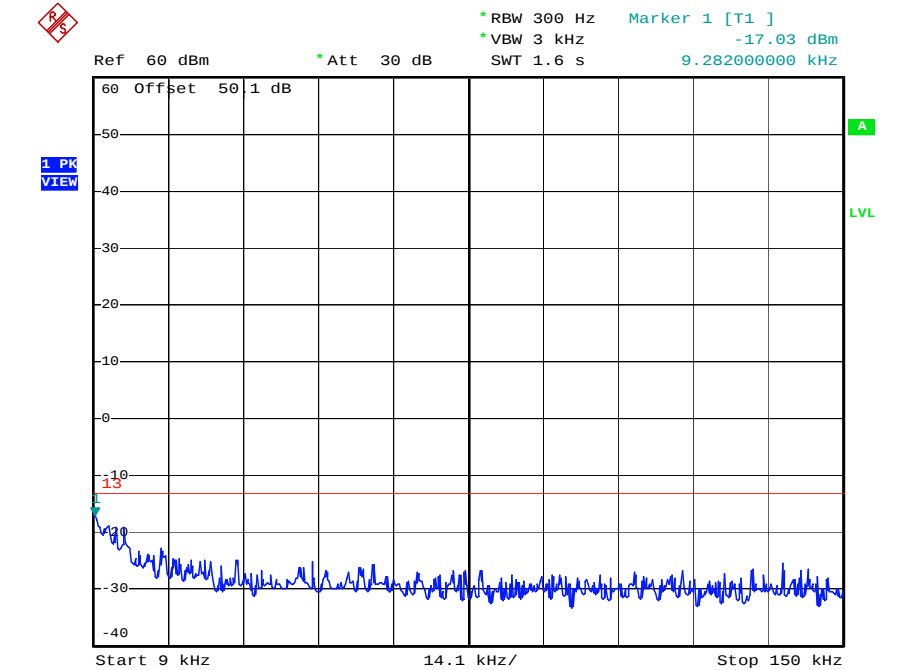
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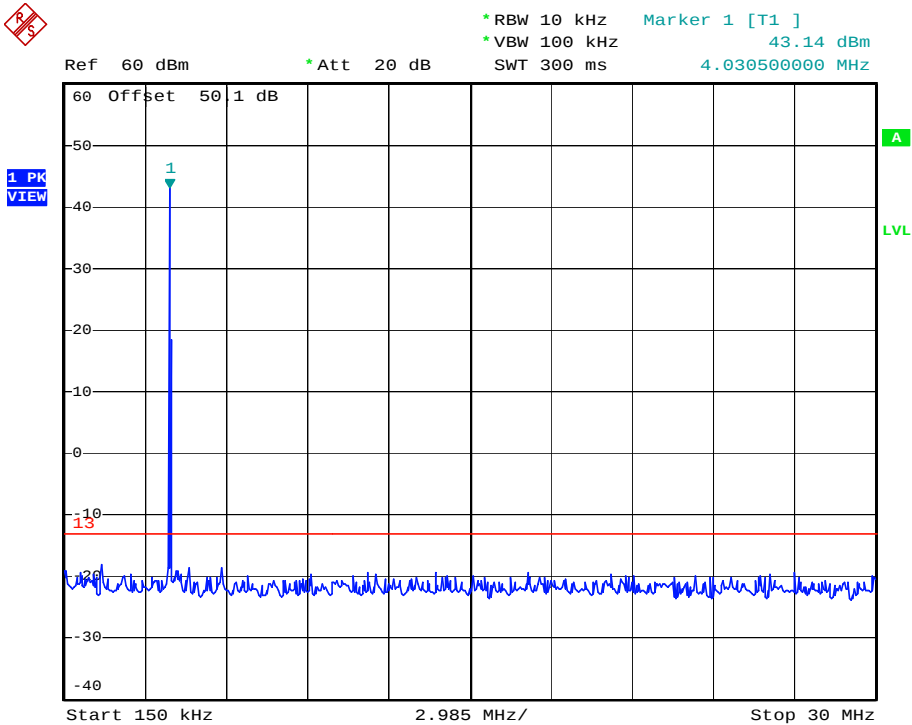
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5.9.3.14. Configuration: Tx Conducted, J3E (USB), 4.065MHz, Low power, Modulation: 400+1800Hz



Date: 4.NOV.2019 11:35:32



Date: 4.NOV.2019 16:01:14

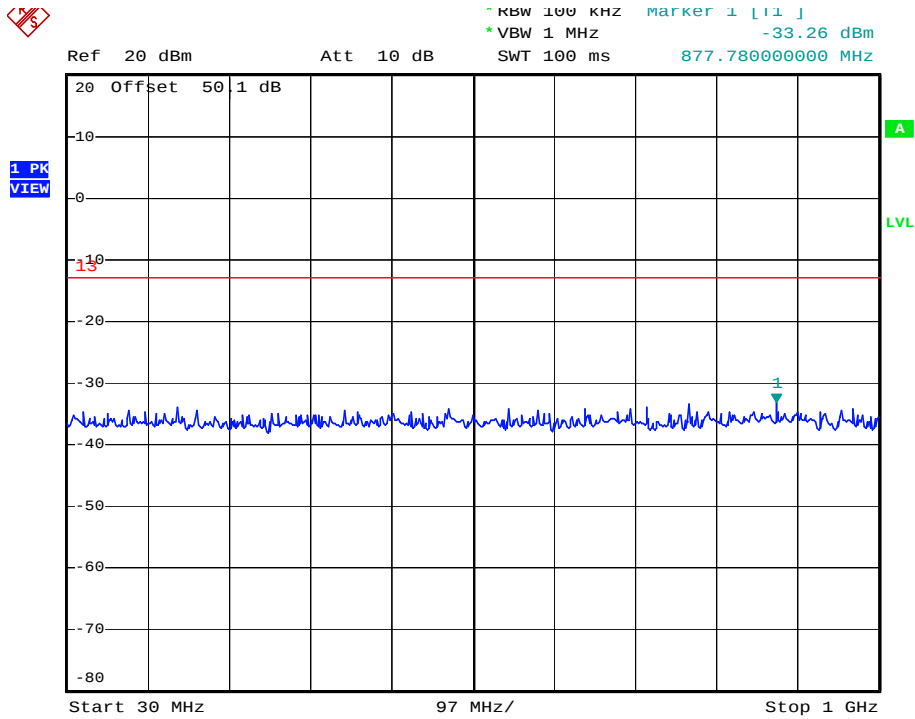
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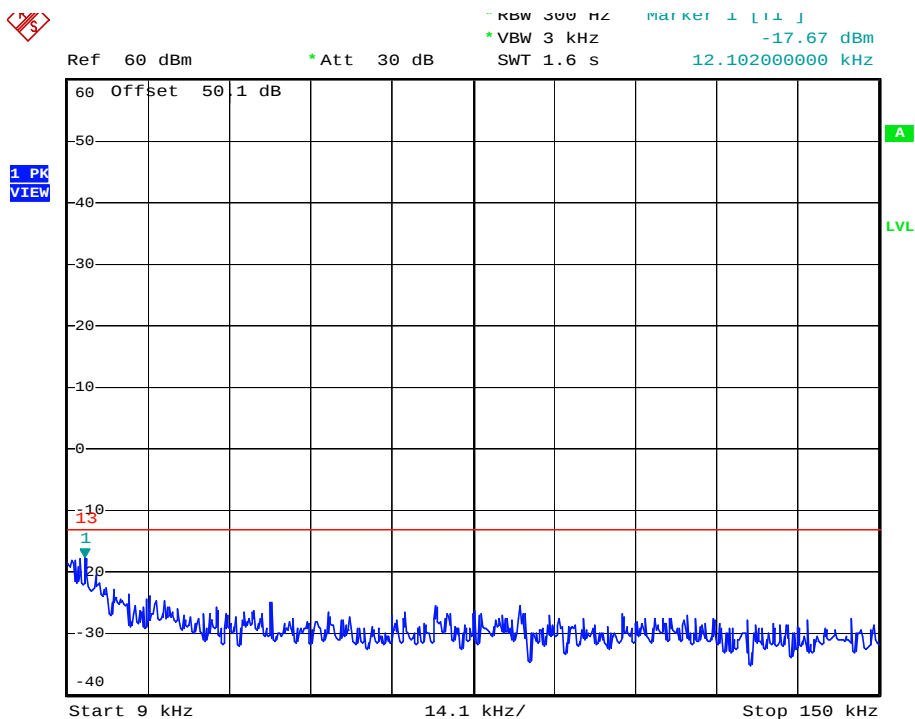
November 14, 2019

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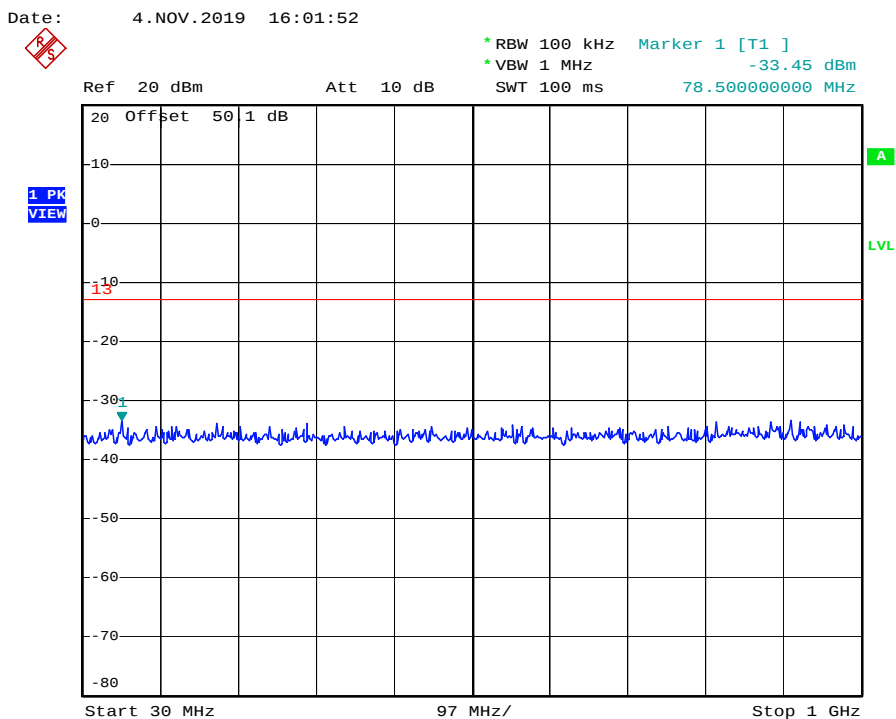


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5.9.3.15. Configuration: Tx Conducted, J3E (USB), 6.2MHz, Low power, Modulation: 400+1800Hz

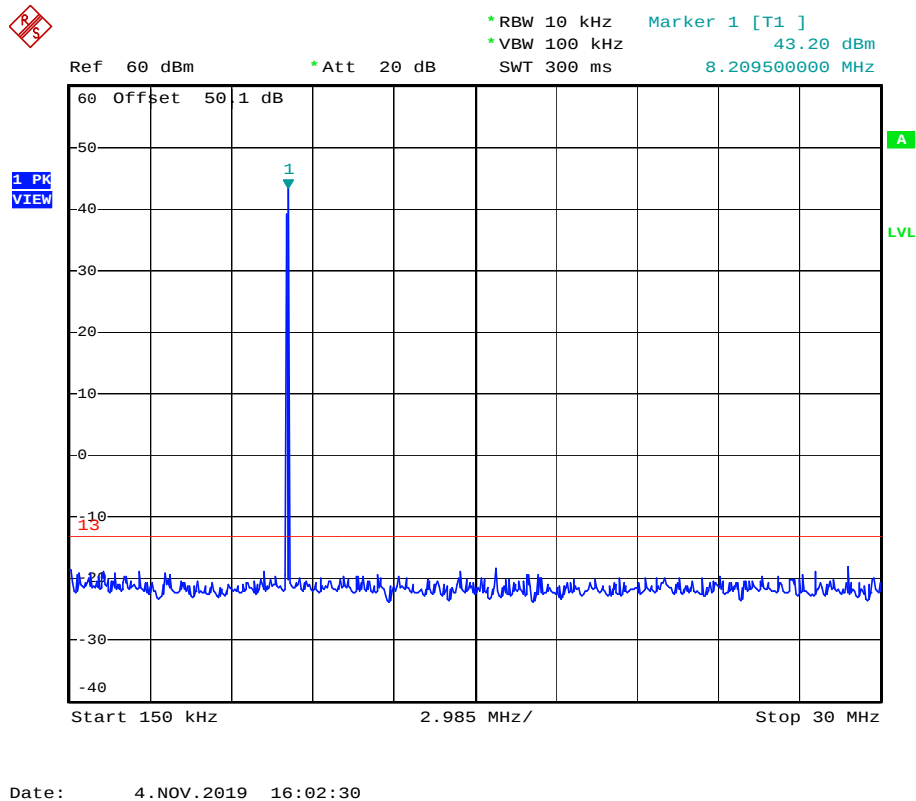
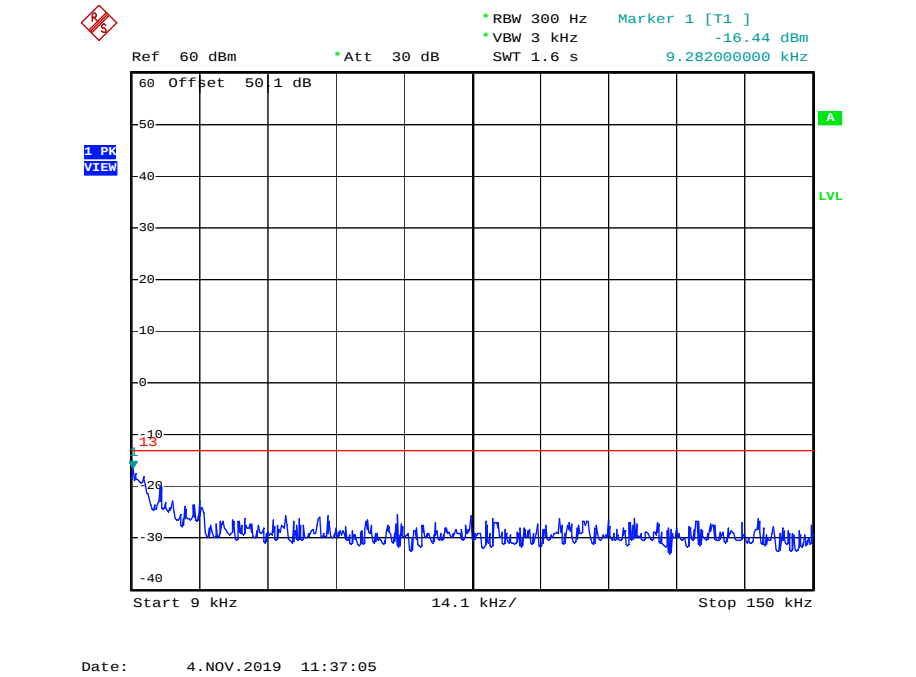


Date: 4.NOV.2019 11:36:17



Date: 4.NOV.2019 16:21:27

5.9.3.16. Configuration: Tx Conducted, J3E (USB), 8.195MHz, Low power, Modulation: 400+1800Hz

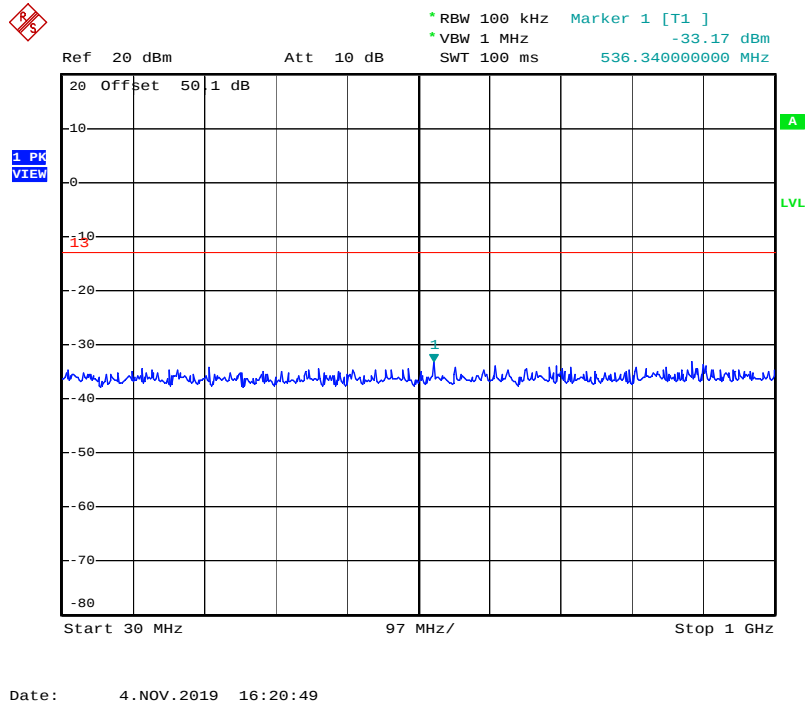


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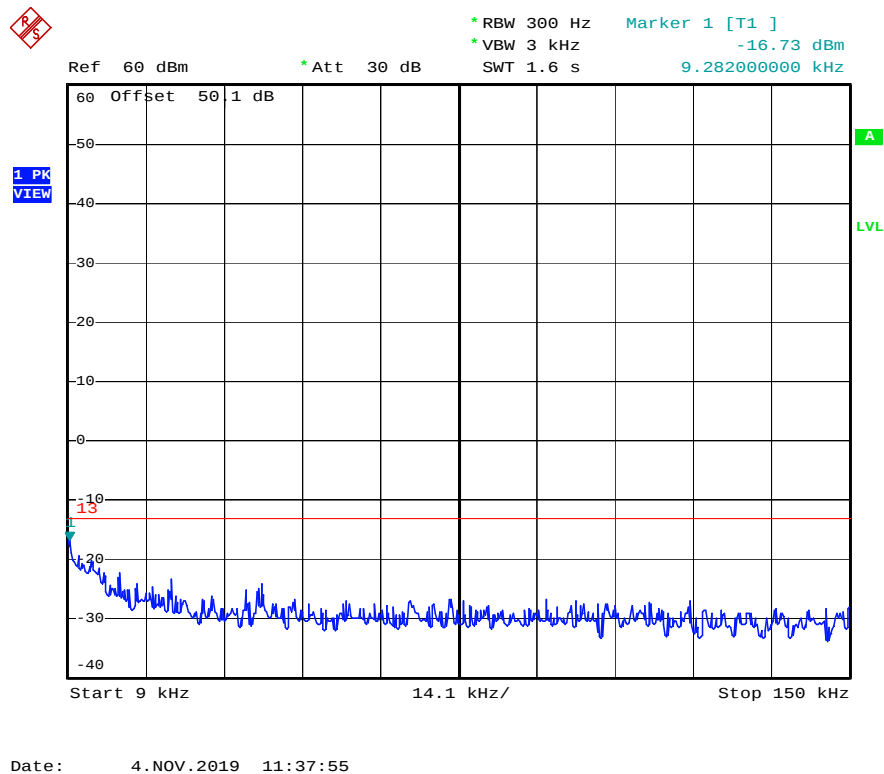
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November 14, 2019

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5.9.3.17. Configuration: Tx Conducted, J3E (USB), 12.230MHz, Low power, Modulation: 400+1800Hz



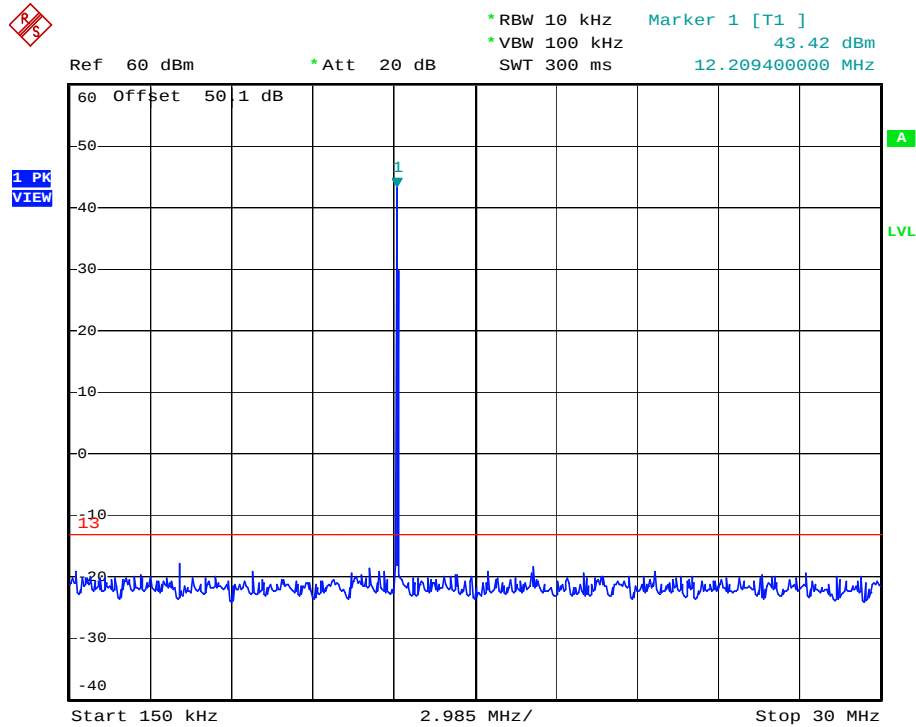
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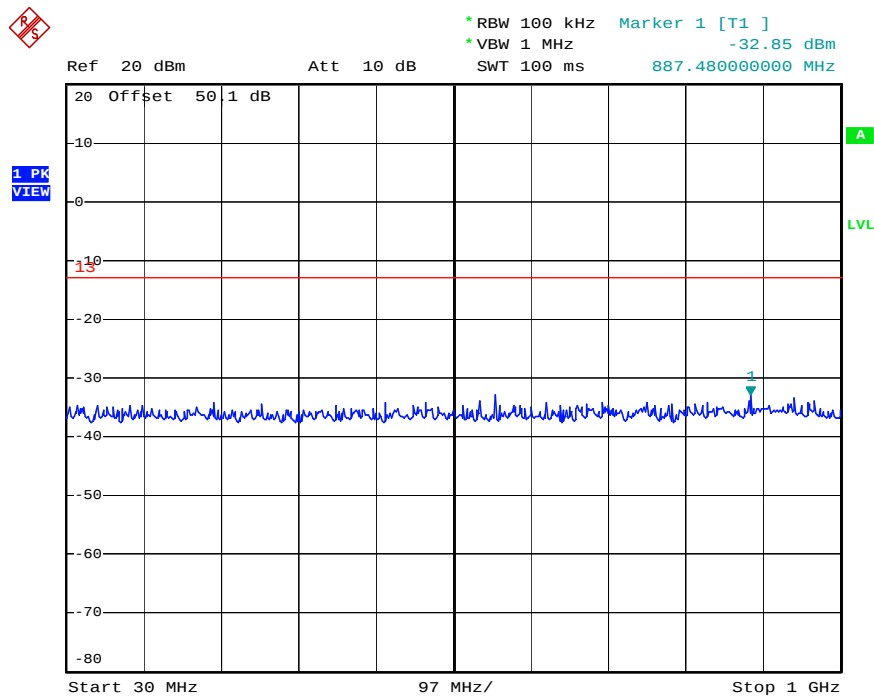
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November 14, 2019

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Date: 4.NOV.2019 16:04:33



Date: 4.NOV.2019 16:20:14

ULTRATECH GROUP OF LABS

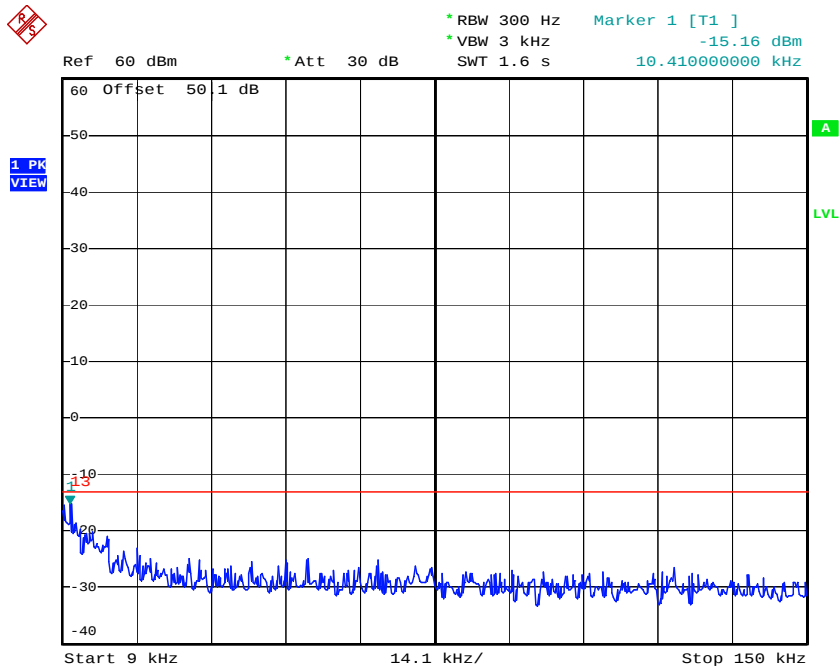
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

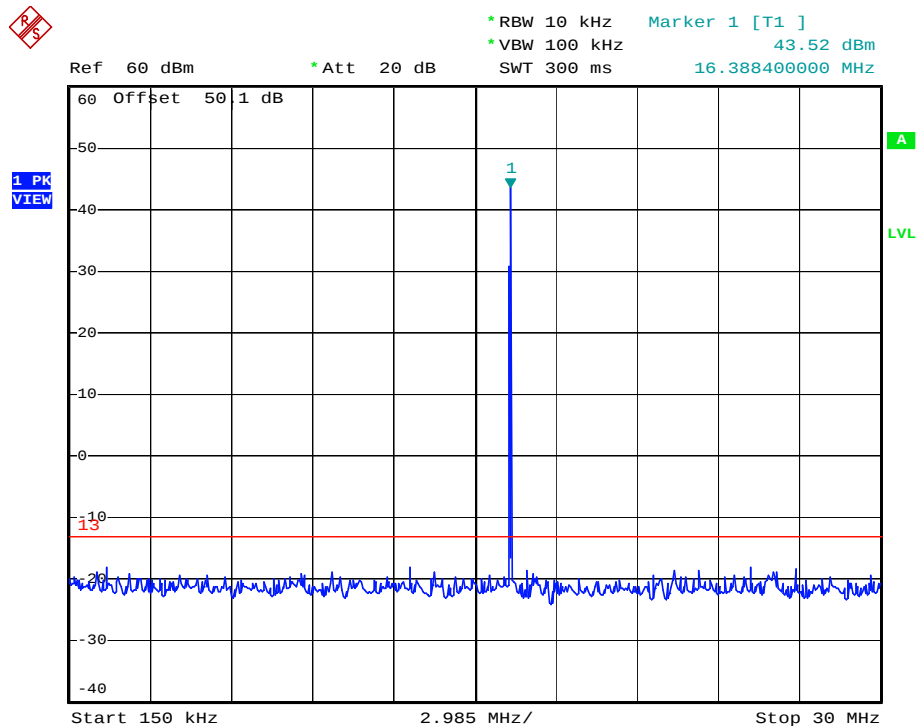
November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

5.9.3.18. Configuration: Tx Conducted, J3E (USB), 16.360MHz, Low power, Modulation: 400+1800Hz



Date: 4.NOV.2019 11:38:44



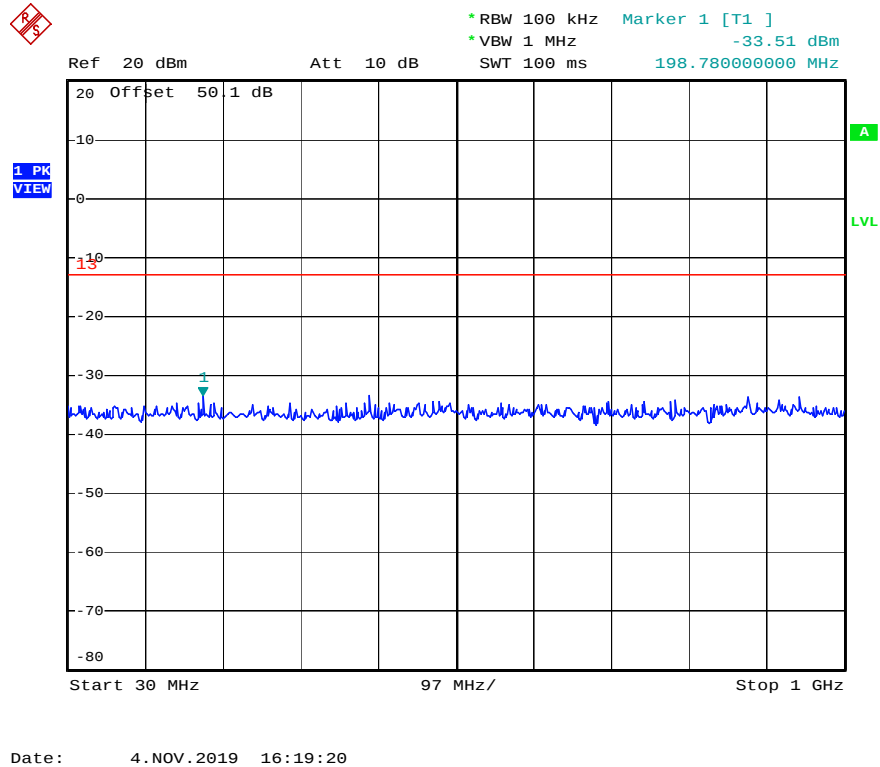
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ULTRATECH GROUP OF LABS

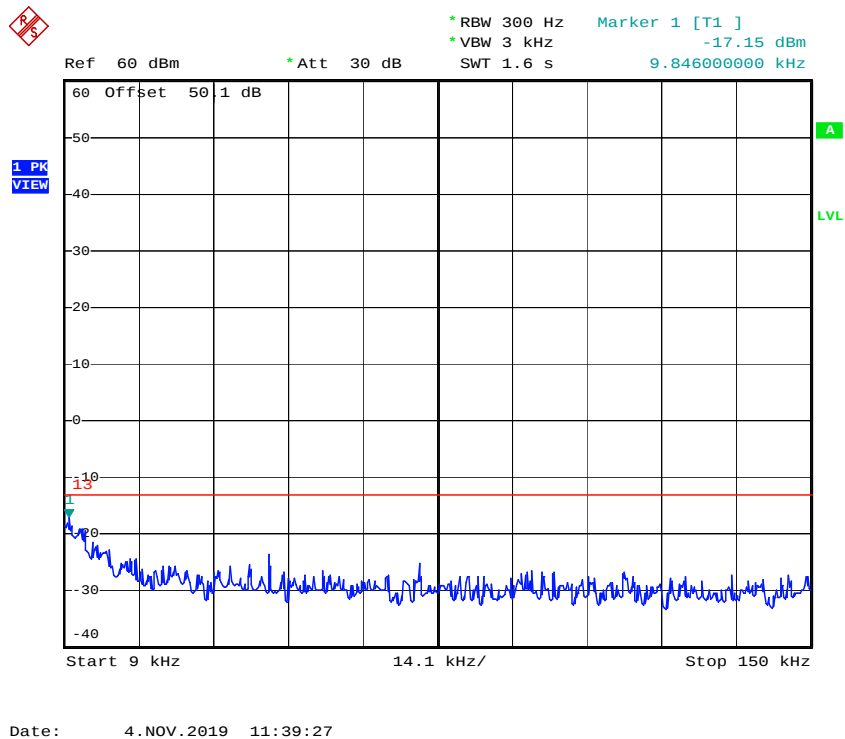
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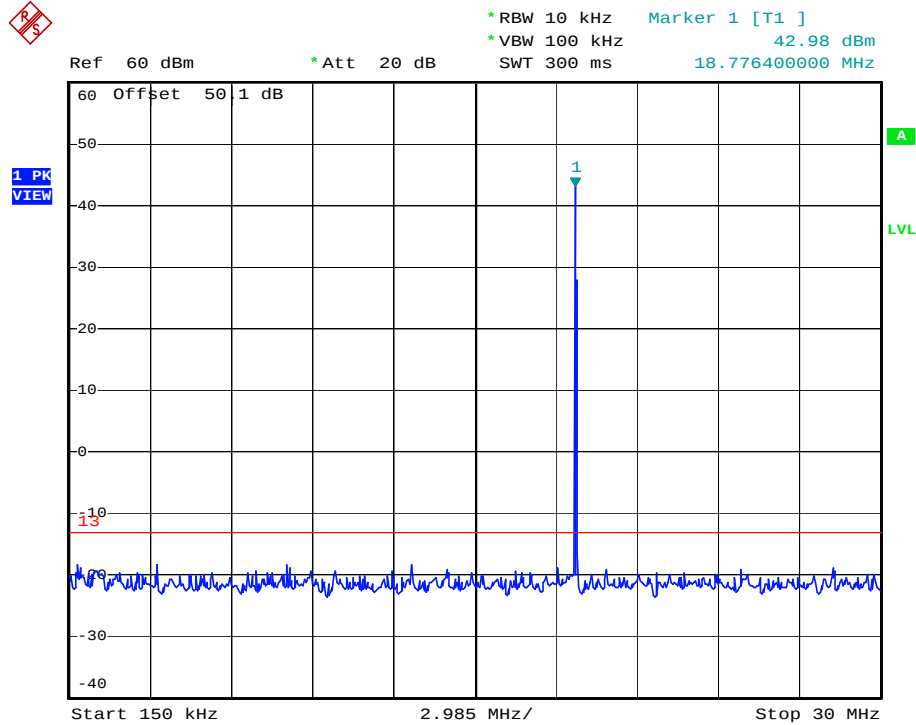
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November 14, 2019

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

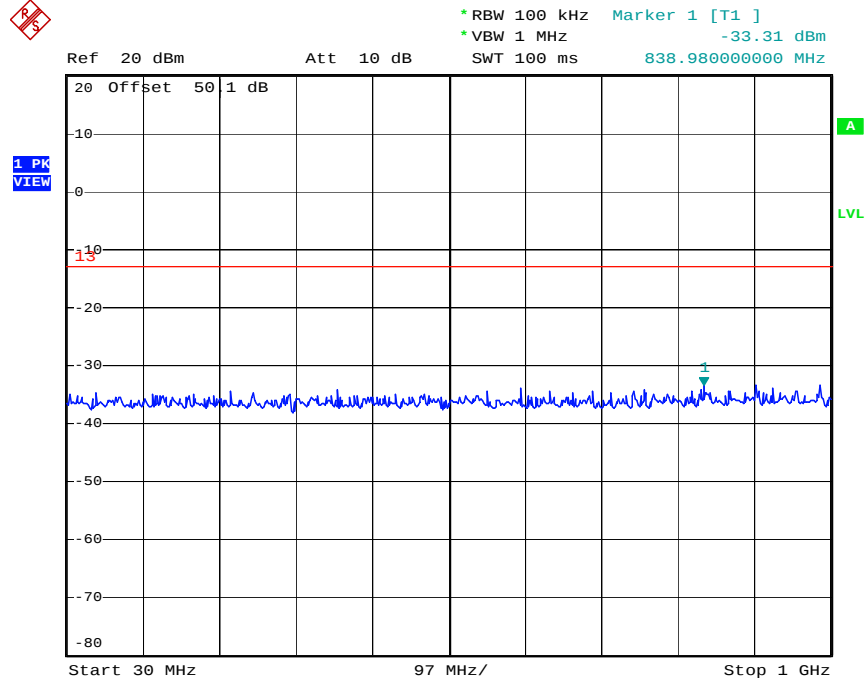


5.9.3.19. Configuration: Tx Conducted, J3E (USB), 18.780MHz, Low power, Modulation: 400+1800Hz





Date: 4.NOV.2019 16:05:47



Date: 4.NOV.2019 16:18:43

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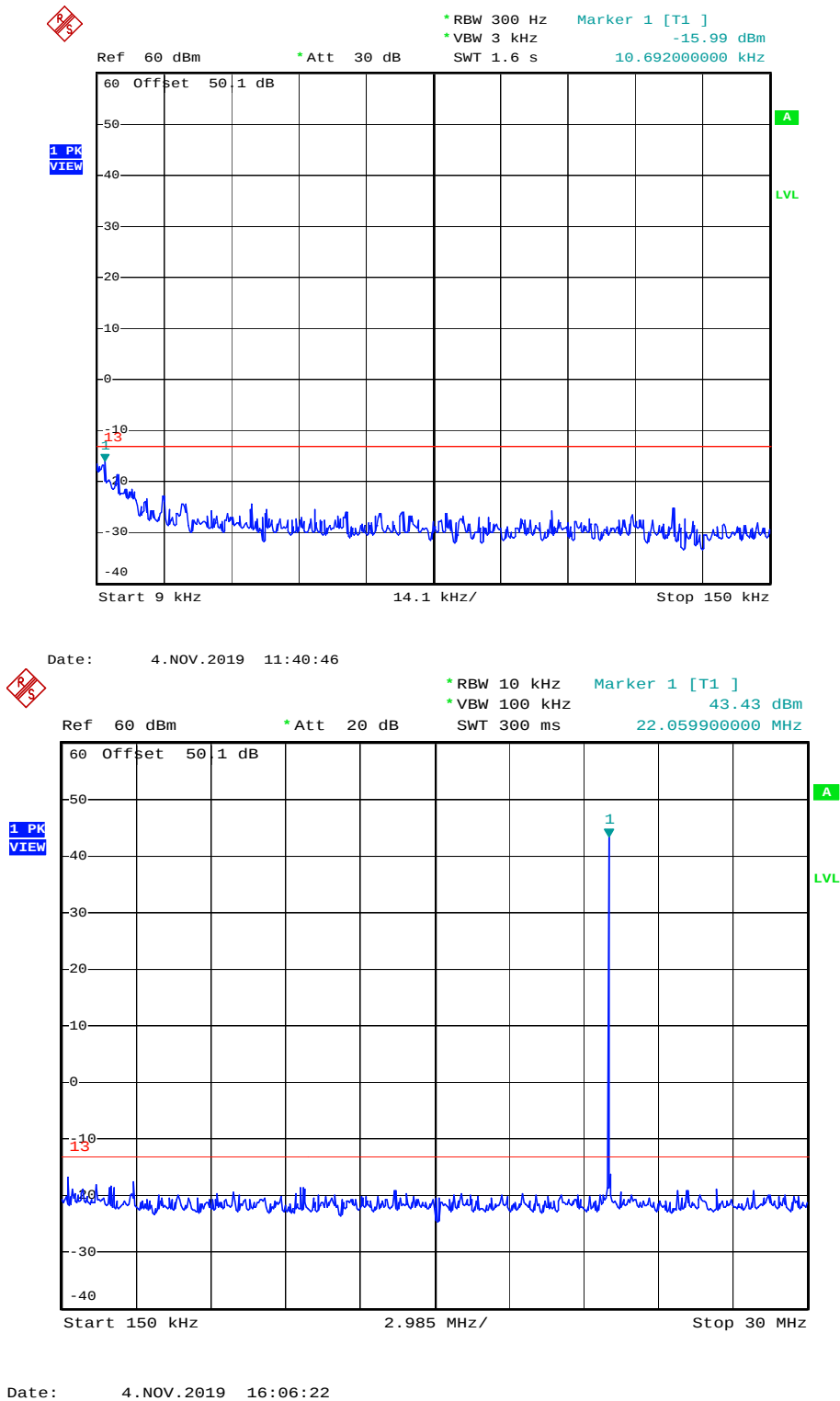
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

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5.9.3.20. Configuration: Tx Conducted, J3E (USB), 22.050MHz, Low power, Modulation: 400+1800Hz



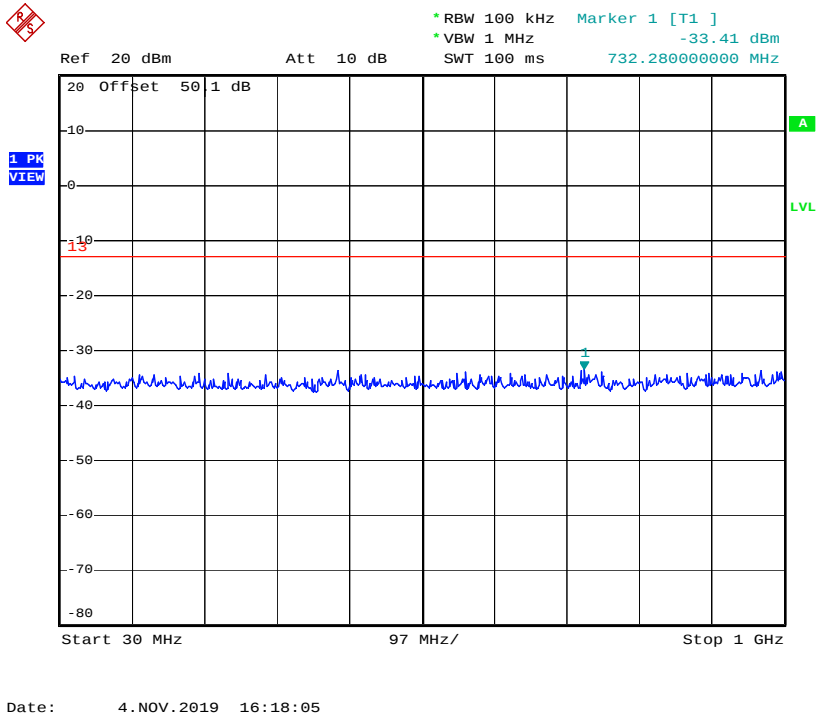
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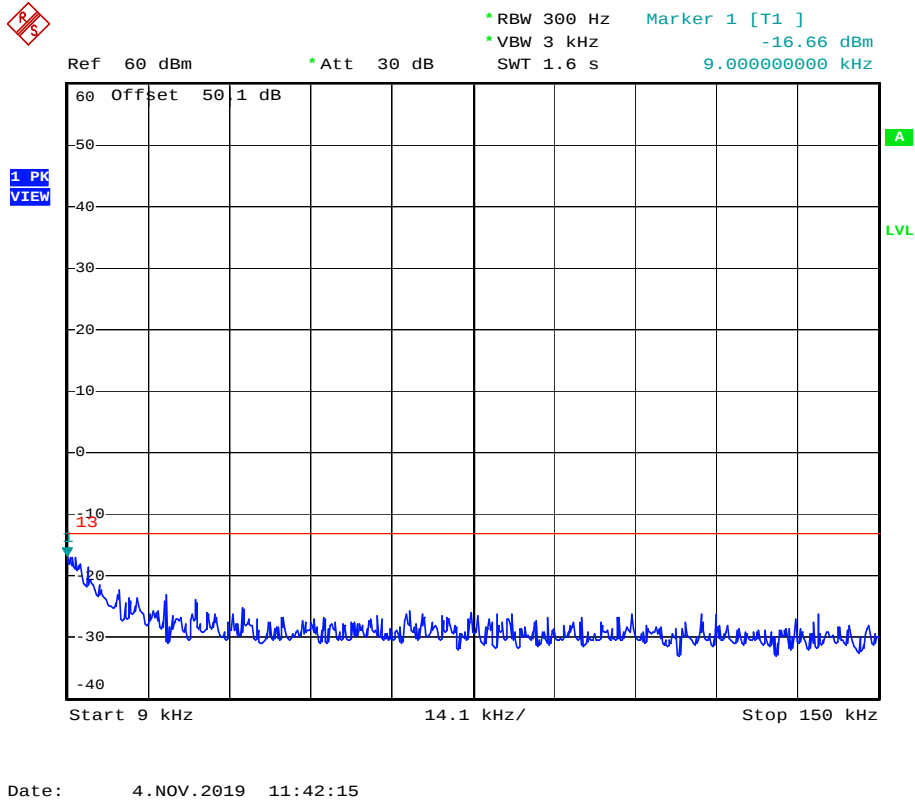
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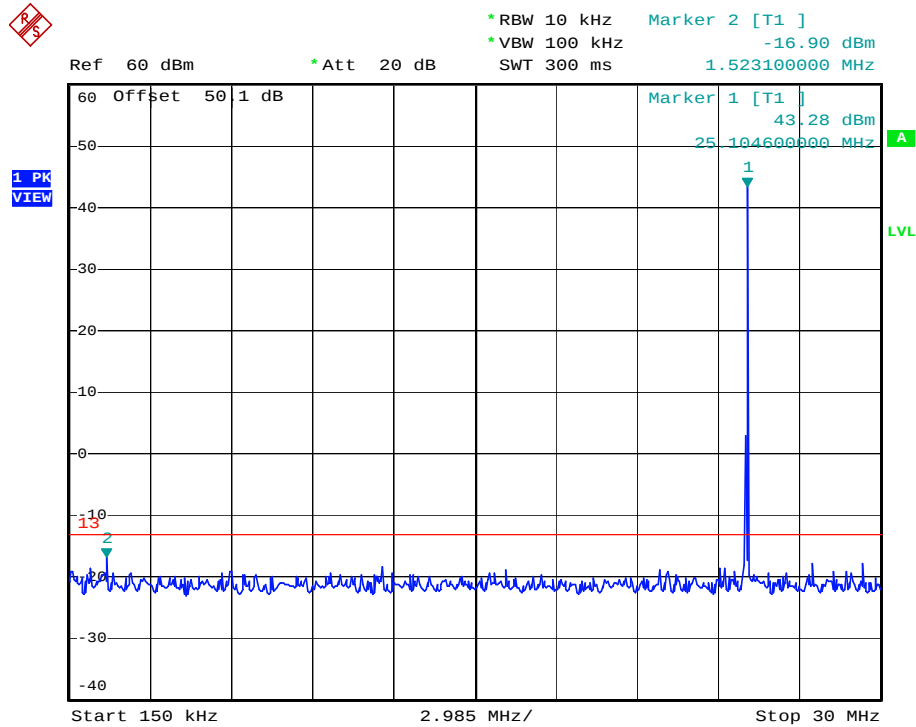
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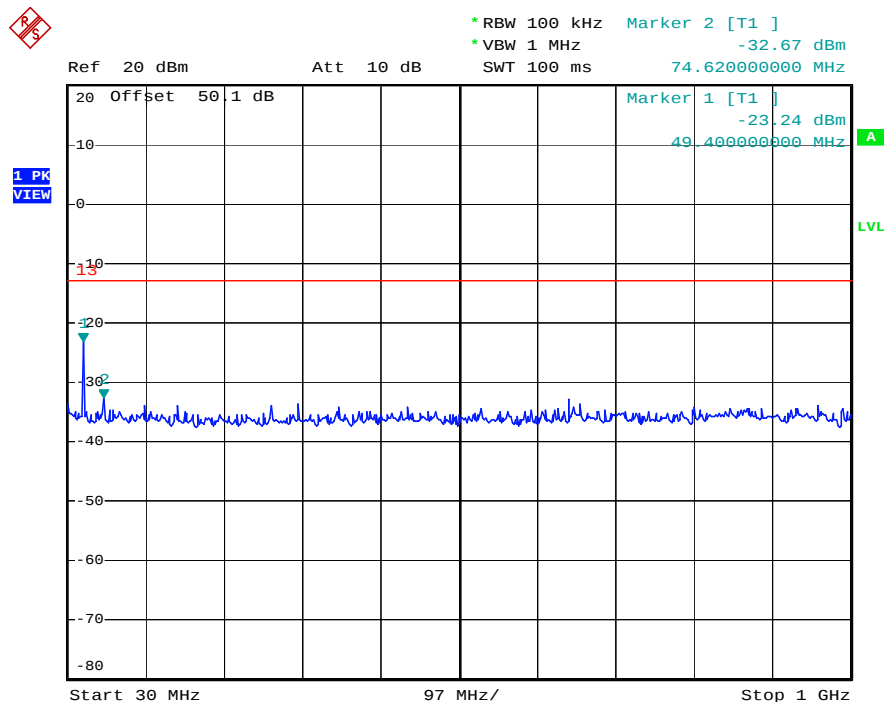


5.9.3.21. Configuration: Tx Conducted, J3E (USB), 25.070MHz, Low power, Modulation: 400+1800Hz





Date: 4.NOV.2019 16:07:23



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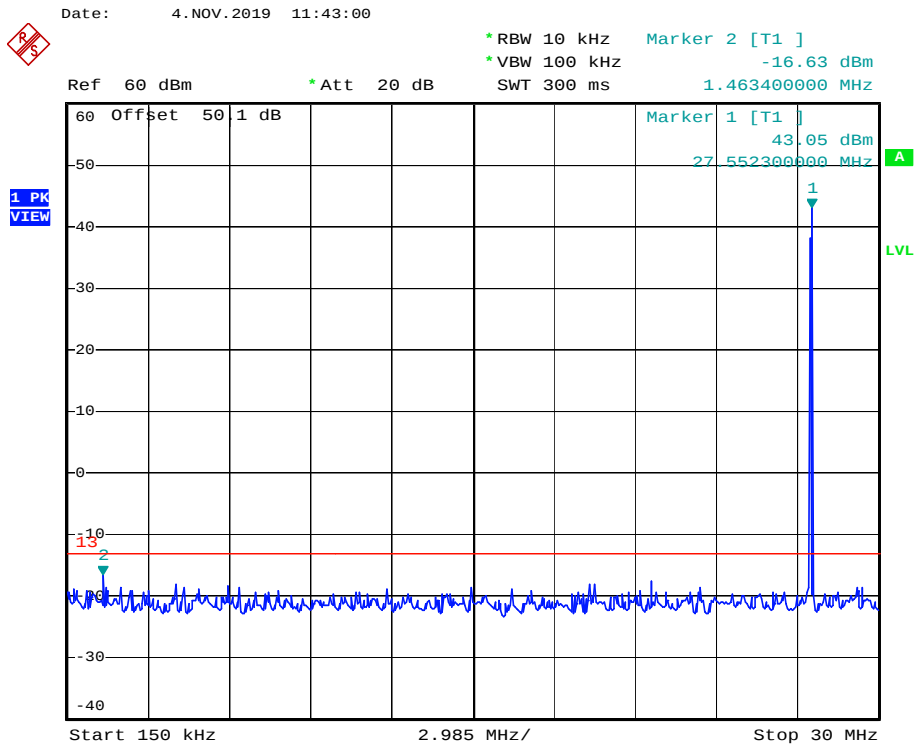
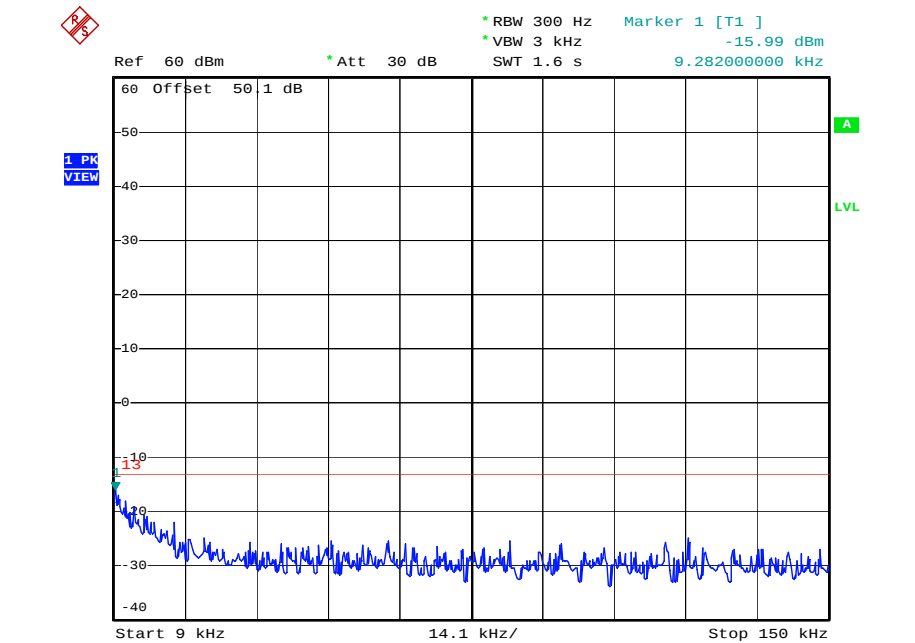
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5.9.3.22. Configuration: Tx Conducted, J3E (USB), 27.5MHz, Low power, Modulation: 400+1800Hz



Date: 4.NOV.2019 16:08:17

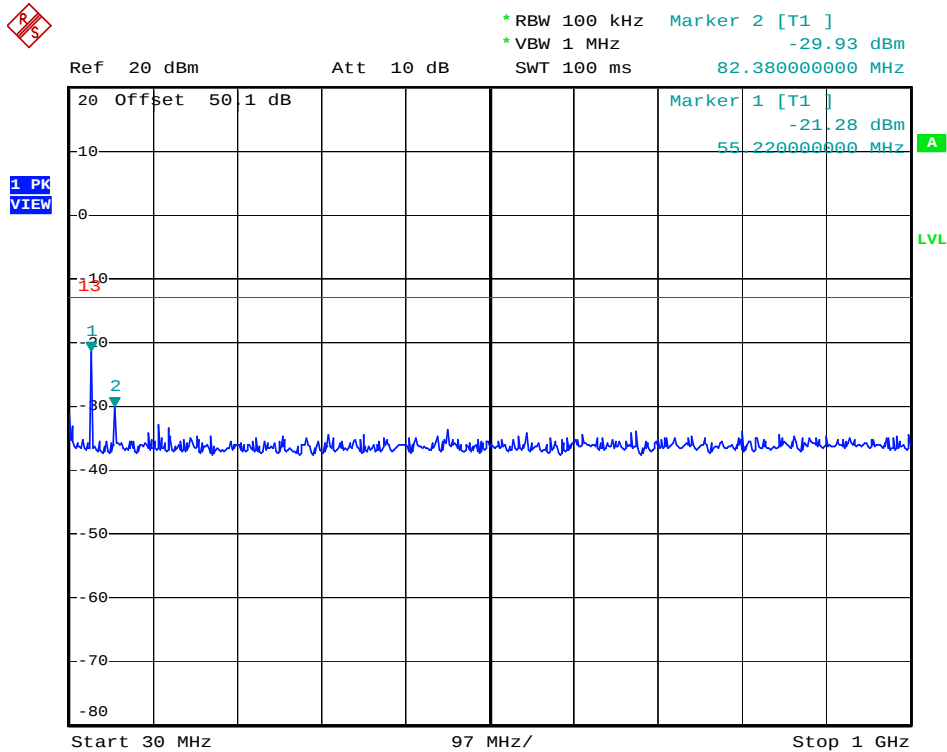
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5.10. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS [§§ 2.1053, 2.1057, 80.211(f)(3) & 90.210]

5.10.1. Limits

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Attenuation Limit (dBc)
§ 22.359	At least $43 + 10 \log (P)$ dB.
§ 80.211(f)(3),	At least $43 + 10 \log_{10}$ (mean power in watts) dB
§ 90.210(b)	At least $43 + 10 \log (P)$ dB
§ 90.210(d)	At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.
§ 90.210(e)	At least $55 + 10 \log (P)$ or 65 dB, whichever is the lesser attenuation.

5.10.2. Method of Measurements

The radiated measurements are made using method specified in Section 8.2 of this report.

5.10.3. Test Data

Remarks:

- The radiated emissions were performed with high power setting at 3 m distance to represents the worst-case test configuration.
- The spurious/harmonic emissions of J3E is tested to represent worst case
- The emissions were scanned from 9 kHz to 1000 MHz; all spurious emissions that are in excess of 20dB below the specified limits were recorded.

5.10.3.1. Near Lowest Frequency (1.605)

Test Frequency (MHz):	1.605
Power Setting:	High
Limit (dBm):	-13
All emissions are more than 20 dB below the limit line.	

5.10.3.2. Near Lowest Frequency (2.182)

Test Frequency (MHz):	2.182
Power Setting:	High
Limit (dBm):	-13
All emissions are more than 20 dB below the limit line.	

5.10.3.3. Near Lowest Frequency (4.065)

Test Frequency (MHz):	4.065
Power Setting:	High
Limit (dBm):	-13
All emissions are more than 20 dB below the limit line.	

5.10.3.4. Near Lowest Frequency (6.2)

Test Frequency (MHz):	4.065
Power Setting:	High
Limit (dBm):	-13
All emissions are more than 20 dB below the limit line.	

5.10.3.5. Near Lowest Frequency (8.195)

Test Frequency (MHz):	8.195
Power Setting:	High
Limit (dBm):	-13
All emissions are more than 20 dB below the limit line.	

5.10.3.6. Near Lowest Frequency (12.23)

Test Frequency (MHz):	12.23
Power Setting:	High
Limit (dBm):	-13
All emissions are more than 20 dB below the limit line.	

5.10.3.7. Near Highest Frequency (16.36 MHz)

Test Frequency (MHz):		16.36				
Power Setting:		High				
Limit (dBm):		-13				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
49.08	75.41	PEAK	V	-21.94	-13	-8.94
65.44	65.44	PEAK	V	-25.67	-13	-12.67
All other emissions are more than 20 dB below the limit line.						

5.10.3.8. Near Highest Frequency (18.78 MHz)

Test Frequency (MHz):		18.78				
Power Setting:		High				
Limit (dBm):		-13				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
56.34	76.2	PEAK	V	-21.15	-13	-8.15
75.12	67.2	PEAK	V	-30.15	-13	-17.15
131.46	65.69	PEAK	V	-31.66	-13	-18.66
All other emissions are more than 20 dB below the limit line.						

5.10.3.9. Near Highest Frequency (22.05 MHz)

Test Frequency (MHz):		22.05				
Power Setting:		High				
Limit (dBm):		-13				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
66.15	72.5	PEAK	V	-24.85	-13	-11.85
132.3	67.17	PEAK	V	-30.18	-13	-17.18
198.45	70.25	PEAK	V	-27.1	-13	-14.1
198.45	73.54	PEAK	H	-23.81	-13	-10.81
All other emissions are more than 20 dB below the limit line.						

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5.10.3.10. Near Highest Frequency (25.07 MHz)

Test Frequency (MHz):		25.07				
Power Setting:		High				
Limit (dBm):		-13				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
50.14	75.41	PEAK	V	-32.74	-13	-19.74
75.21	63.77	PEAK	V	-19.17	-13	-6.17
75.21	65.44	PEAK	H	-27.36	-13	-14.36
125.35	67.22	PEAK	H	-30.13	-13	-17.13
200.56	66.11	PEAK	V	-31.24	-13	-18.24
200.56	68.61	PEAK	H	-28.74	-13	-15.74
All other emissions are more than 20 dB below the limit line.						

5.10.3.11. Near Highest Frequency (27.5 MHz)

Test Frequency (MHz):		27.5				
Power Setting:		High				
Limit (dBm):		-13				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
82.5	71.86	PEAK	V	-25.49	-13	-12.49
82.5	66.81	PEAK	H	-30.54	-13	-17.54
110	68.07	PEAK	V	-29.28	-13	-16.28
192.5	65.6	PEAK	V	-31.75	-13	-18.75
192.5	68.38	PEAK	H	-28.97	-13	-15.97
All other emissions are more than 20 dB below the limit line.						

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5.11. FREQUENCY STABILITY [§§ 2.1055, 80.209 & 90.213]

5.11.1. Limits

§ 90.213 Transmitters used must have minimum frequency stability as specified in the following table.

Frequency Range (MHz)	Frequency Tolerance (ppm)		
	Fixed and Base Stations	Mobile Stations	
		> 2 W	≤ 2 W
Below 25 MHz	100ppm ¹²³	100	200
25-50 MHz	20 ppm	20	50

1 Fixed and base stations with over 200 watts transmitter power must have a frequency stability of 50 ppm except for equipment used in the Public Safety Pool where the frequency stability is 100 ppm.

2 For single sideband operations below 25 MHz, the carrier frequency must be maintained within 50 Hz of the authorized carrier frequency.

3 Travelers information station transmitters operating from 530-1700 kHz and transmitters exceeding 200 watts peak envelope power used for disaster communications and long distance circuit operations pursuant to §§ 90.242 and 90.264 must maintain the carrier frequency to within 20 Hz of the authorized frequency.

§ 80.209

Band 1.6-4MHz and 4-27.5 MHz: Ship Stations 10 Hz

5.11.2. Method of Measurements

Refer to Section 8.3 of this report for measurement details

5.11.3. Test Data

Test Frequency:		27.5 MHz	
Full Power Level:		51.64 dBm	
Frequency Tolerance Limit:		± 10 Hz	
Max. Frequency Tolerance Measured:		-7 Hz	
Input Voltage Rating:		13.6 VDC (nominal)	
Ambient Temperature (°C)	Frequency Drift (Hz)		
	Supply Voltage (Nominal) 13.6 VDC	Supply Voltage (-15%) 11.56 VDC	Supply Voltage (+15%) 15.64 VDC
-30	-4	--	--
-20	-5	--	--
-10	-4	--	--
0	-5	--	--
10	-6	--	--
20	2	-7	-7
30	-7	--	--
40	-4	--	--
50	7	--	--
60	7	--	--

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5.12. SUPPRESSION OF INTERFERENCE ABOARD SHIPS [§§ 80.217]

5.12.1. Limits

Deliver not more than the following amounts of power, to an artificial antenna having electrical characteristics equivalent to those of the average receiving antenna(s) use on shipboard:

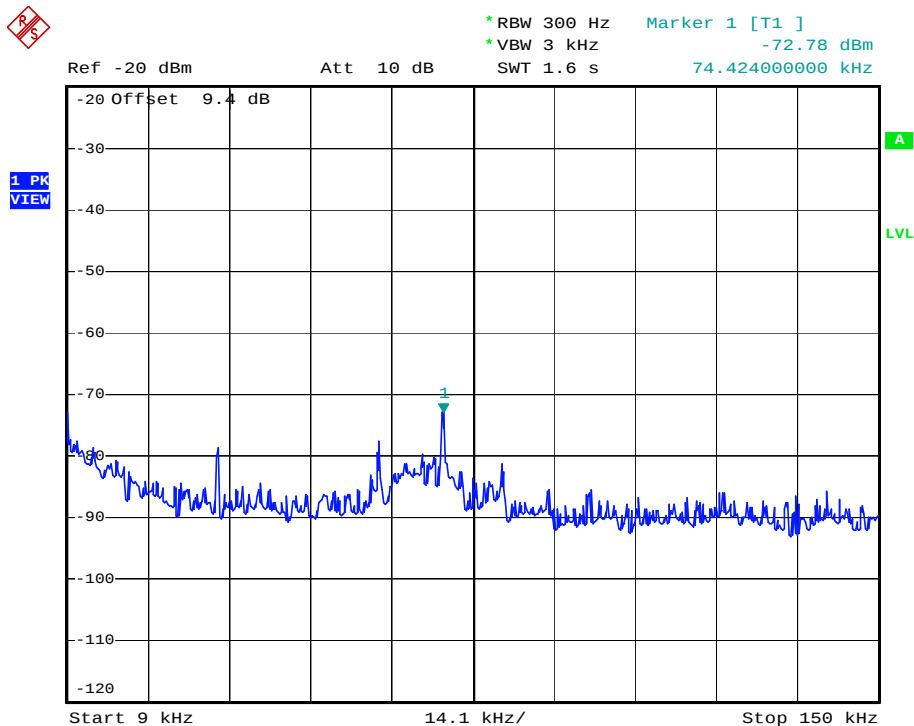
Frequency of interfering emissions	Power to artificial antenna in microwatts
Below 30 MHz	400 (-4dBm)
30 to 100 MHz	4,000
100 to 300 MHz	40,000
Over 300 MHz	400,000

5.12.2. Method of Measurements

ANSI C63.26

5.12.3. Test Data

5.12.3.1. Configuration: 1.605MHz Rx @ TRX port



Date: 7.NOV.2019 15:16:20

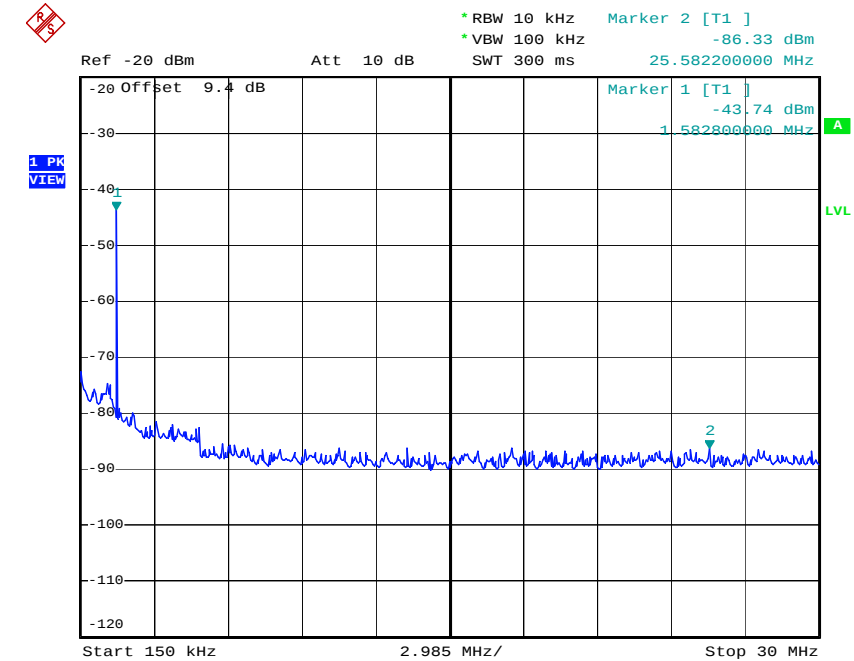
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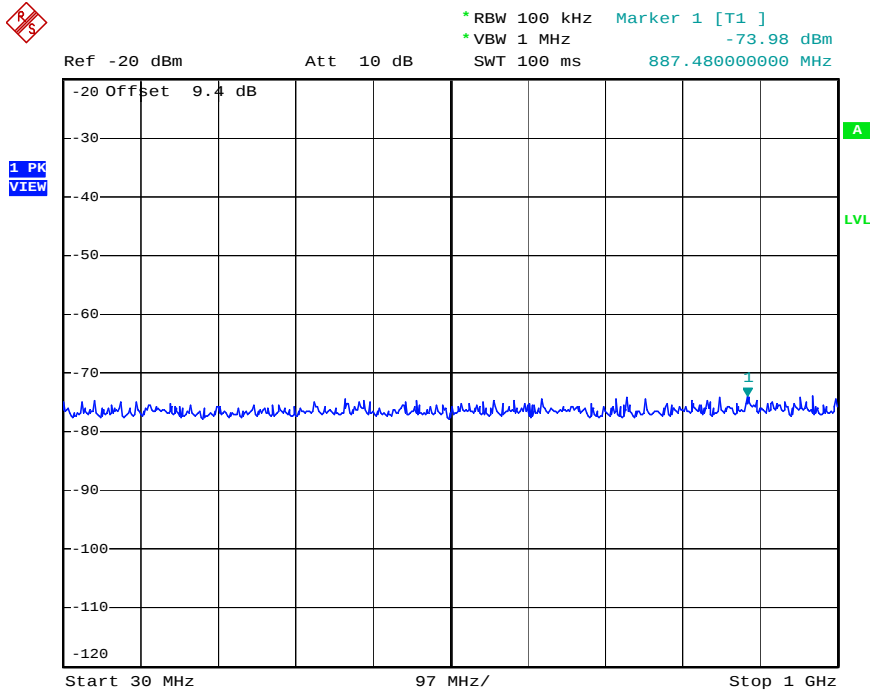
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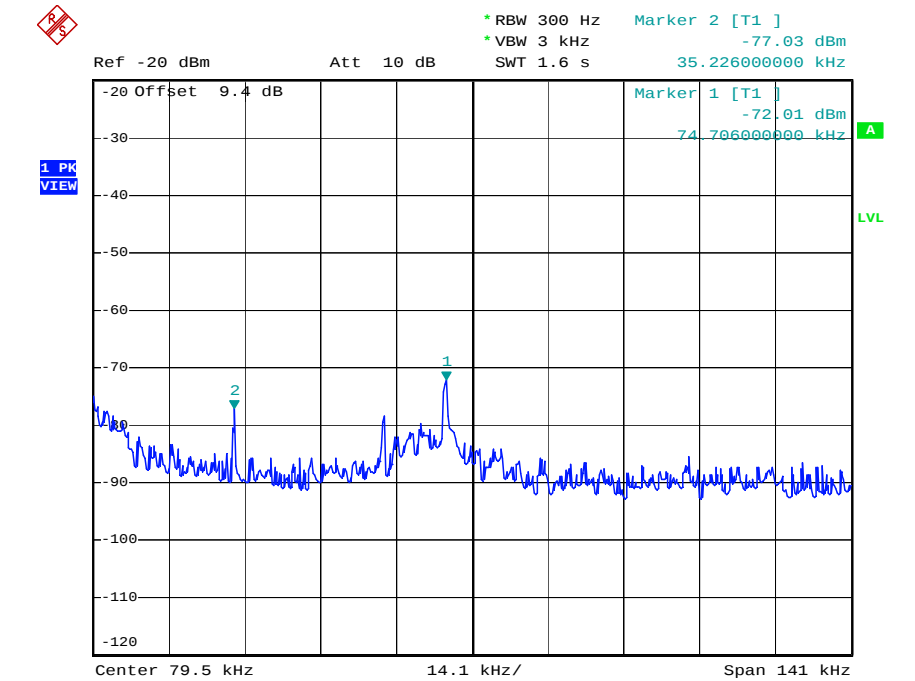
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Highest peak is Rx Signal input (1mV rms)

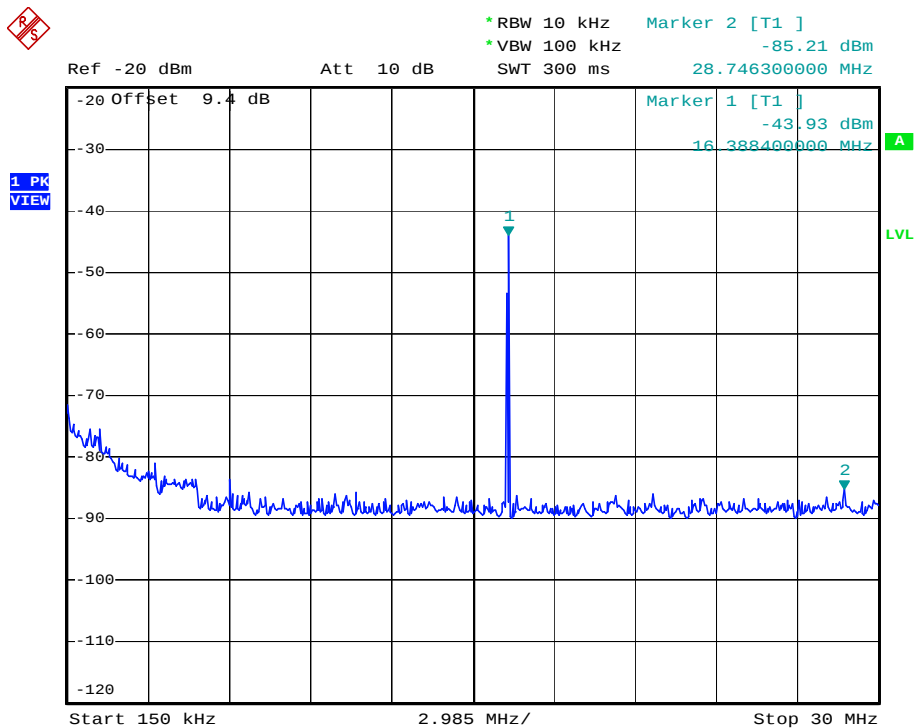


Date: 7.NOV.2019 15:19:41

5.12.3.2. Configuration: 16.36MHz Rx @ TRX port

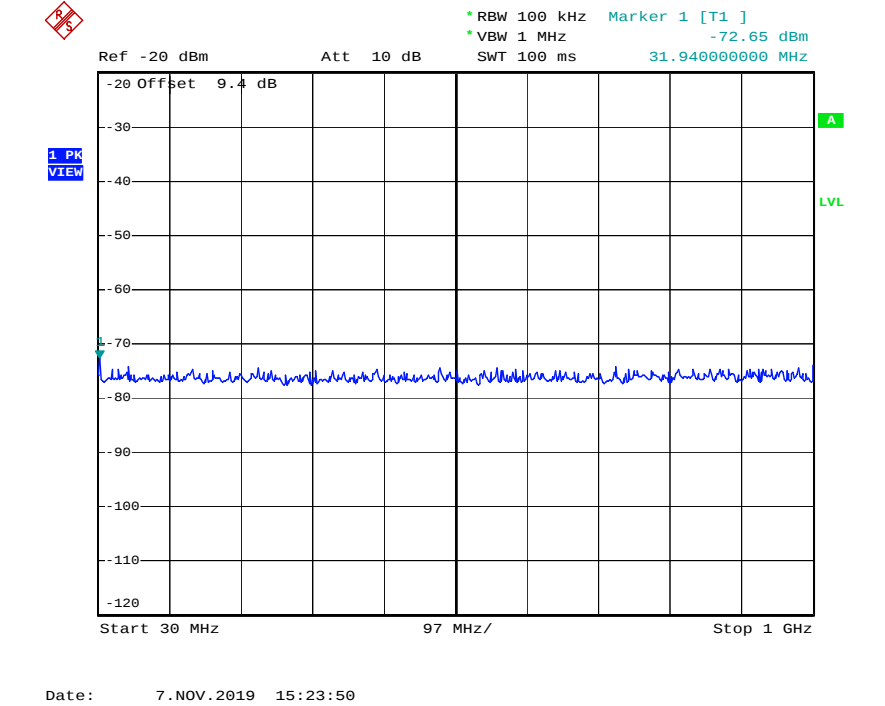


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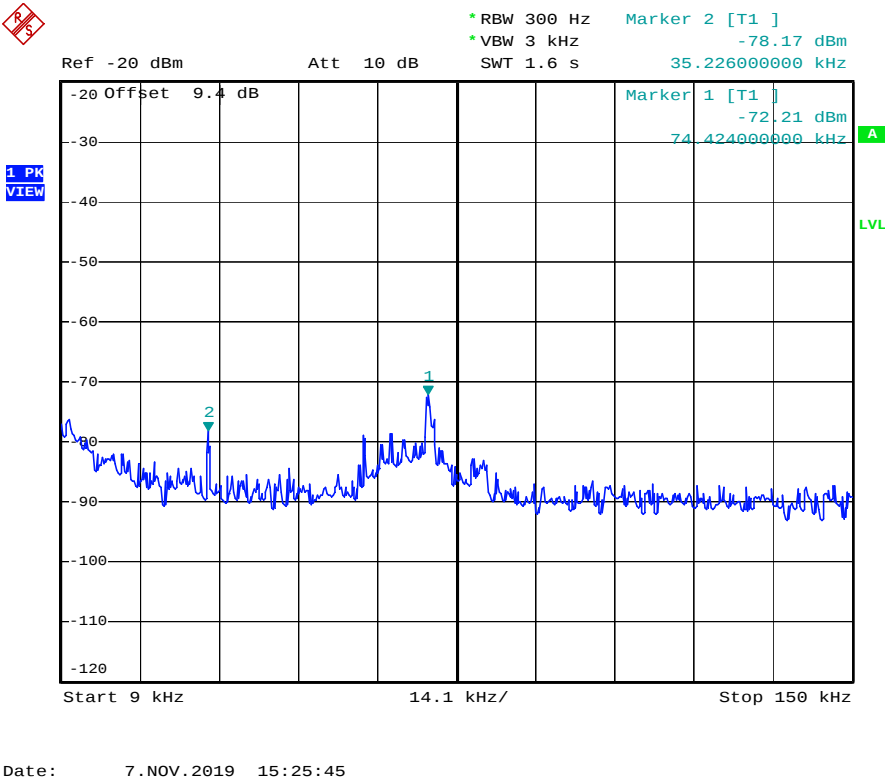


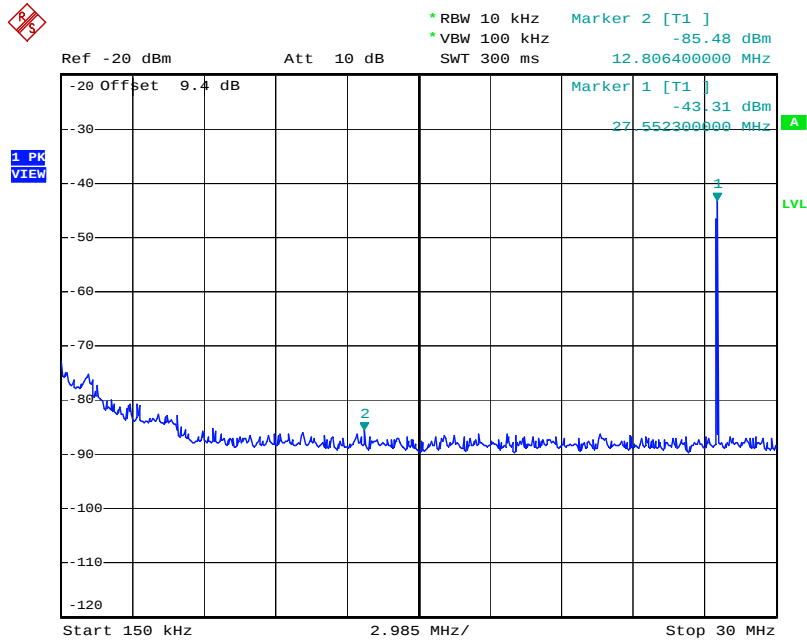
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Highest peak is Rx Signal input (1mV rms)

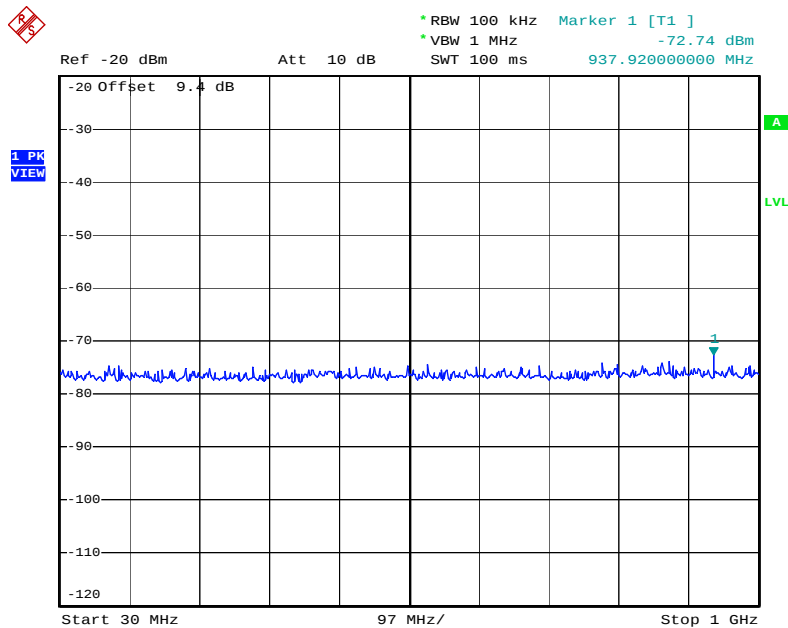


5.12.3.3. Configuration: 27.5MHz Rx @ TRX port





Date: 7.NOV.2019 15:27:02
Highest peak is Rx Signal input (1mV rms)



Date: 7.NOV.2019 15:28:09

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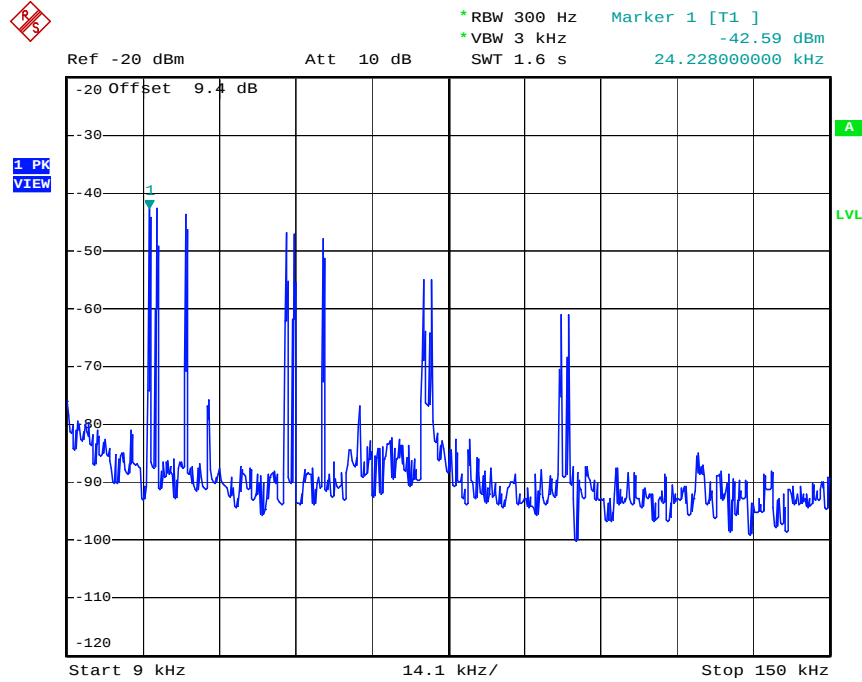
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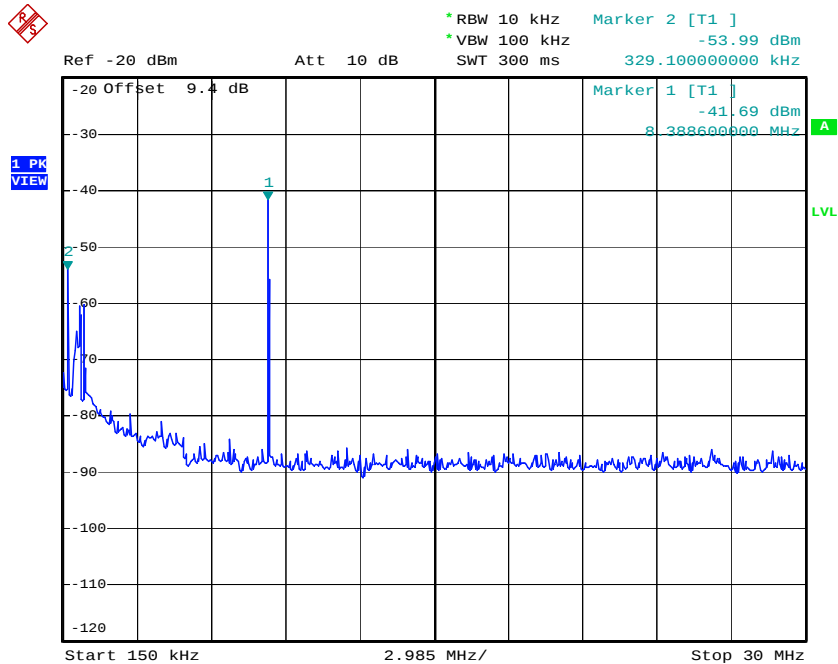
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5.12.3.4. Configuration: 1.605MHz Rx @ DSC port



Date: 7.NOV.2019 16:18:44



Date: 7.NOV.2019 16:19:45

Highest peak is Rx Signal input (1mV rms)

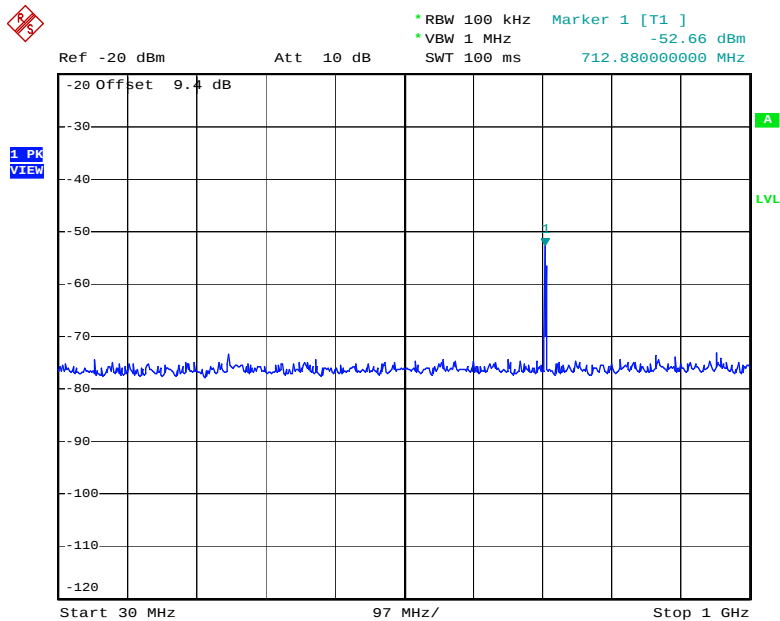
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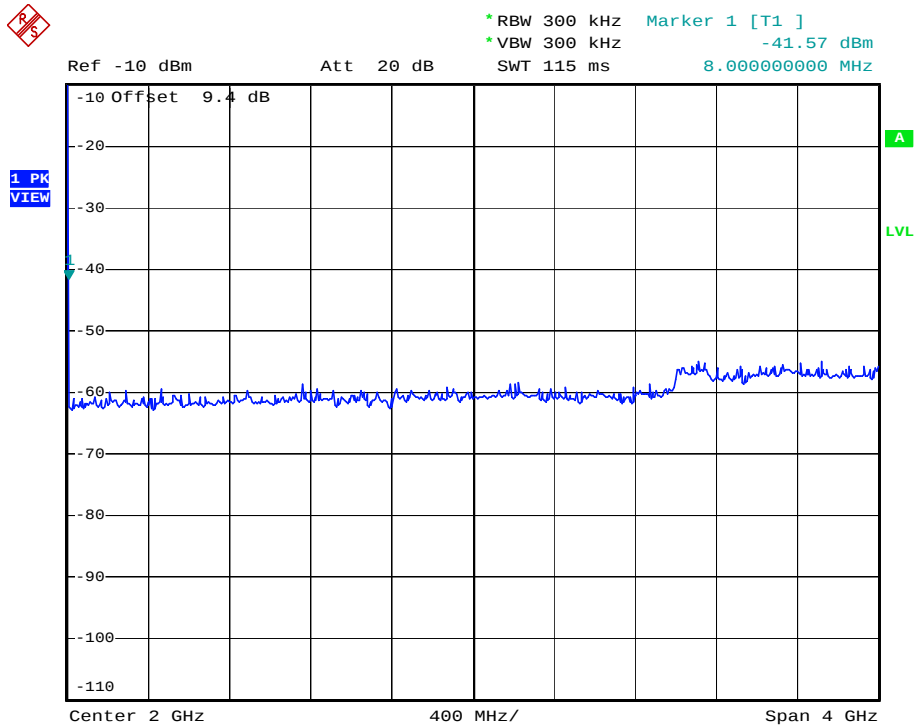
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Date: 7.NOV.2019 16:20:50



Date: 7.NOV.2019 16:22:54

Highest peak is Rx Signal input (1mV rms)

5.13. RF EXPOSURE REQUIREMENTS [§§ 1.1310 & 2.1091]

5.13.1. Limits

§ 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

Note 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

5.13.2. Method of Measurements

Calculation Method of RF Safety Distance:

$$S = \frac{PG}{4\pi \cdot r^2} = \frac{EIRP}{4\pi \cdot r^2}$$

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Where, P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm²
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

$$r = \sqrt{\frac{PG}{4\pi \cdot S}} = \sqrt{\frac{EIRP}{4\pi \cdot S}}$$

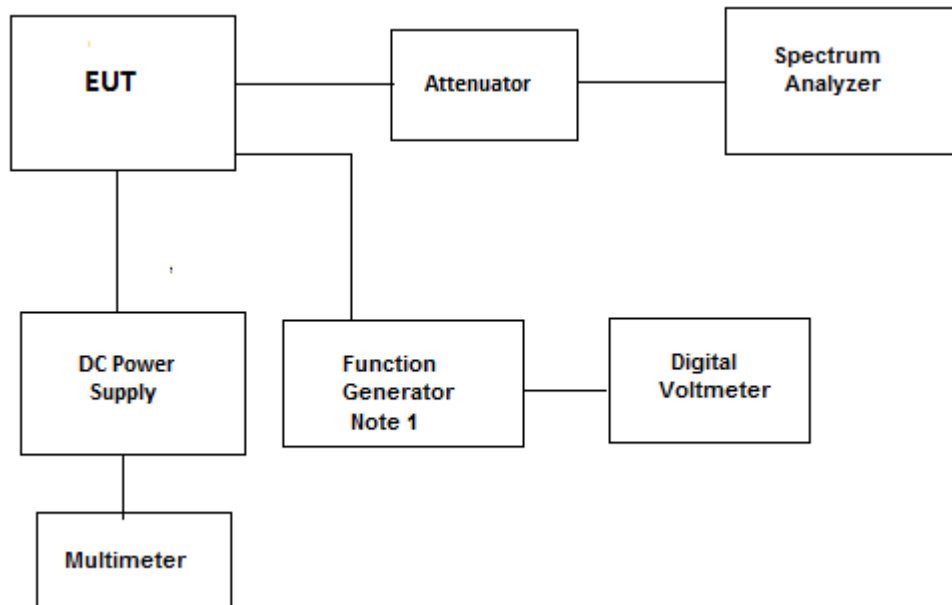
FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device.

5.13.3. Evaluation of RF Exposure Compliance Requirements

Maximum RF Power conducted, P_{conducted}[W] :	160.32
Maximum Antenna Gain, G[dBi] :	9
Maximum EIRP, P_{EIRP}[W] :	1273503
User-based time-average for PTT	50%
MPE Limit for Occupational/Controlled Exposure, S_{controlled}[mW/cm²] :	1.19
MPE Limit for General Population/Uncontrolled Exposure, S_{uncontrolled}[mW/cm²] :	0.238
Min Calculated RF Safety Distance for Occupational/Controlled Exposure,	207cm
Min Calculated RF Safety Distance for General Population/Uncontrolled Exposure, r_{safety_uncontrolled}[cm]	462 cm

EXHIBIT 6. TEST SETUP DIAGRAMS AND EQUIPMENT LIST

6.1. Conducted Power



Note 1: Kuman FY6600-60M and HP 8920B or HP 33120A

Test Instrument	Manufacturer	Model No	Serial No	Frequency Range	Cal Due date
Spectrum analyzer	Rohde&schwarz	FSP	100646	9KHz-7 GHz	04 Dec 2020
Attenuator(20dB)	Weinschel	WA35-20-33	A164	DC-8.5 GHz	Cal on use
Attenuator(30dB)	Weinschel	46-30-34	BR9127	DC-18 GHz	Cal on use
Function generator	Kuman	FY6600-60M	170966000106	DC-60M	02 Apr 2020
AF Signal Generator	HP	HP-8920B	US39064699	250KHz-1GHz	20 Mar 2020
Function generator	HP	33120A	US34011688	15M	24 Aug 2021
Digital Voltmeter	HP	3456A	2015A04523	--	19 Dec 2019
Combiner	Weinschel	1515	--	DC-18GHz	Cal on use
Power supply	Pyramid	PS-36KX	--	12-15 Vdc, 35A	--
Multimeter	Fluke	8842A	4142058	---	05 Sep 2020

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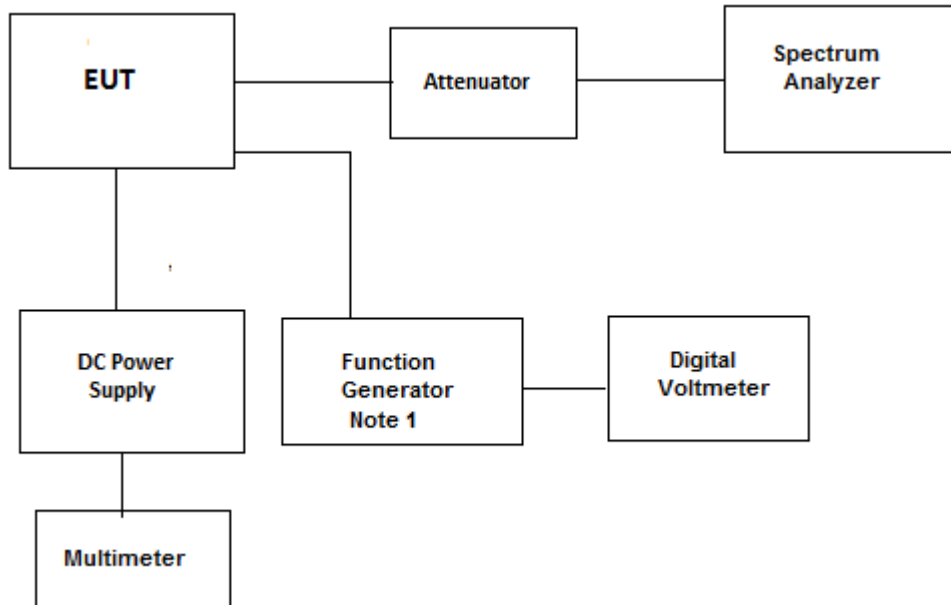
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6.2. Modulation Limit



Note 1: Kuman FY6600-60M and HP 8920B or HP 33120A

Test Instrument	Manufacturer	Model No	Serial No	Frequency Range	Cal Due date
Spectrum analyzer	Rohde&schwarz	FSP	100646	9KHz-7 GHz	04 Dec 2020
Attenuator(20dB)	Weinschel	WA35-20-33	A164	DC-8.5 GHz	Cal on use
Attenuator(30dB)	Weinschel	46-30-34	BR9127	DC-18 GHz	Cal on use
Function generator	Kuman	FY6600-60M	170966000106	DC-60M	02 Apr 2020
AF Signal Generator	HP	HP-8920B	US39064699	250KHz-1GHz	20 Mar 2020
Function generator	HP	33120A	US34011688	15M	24 Aug 2021
Digital Voltmeter	HP	3456A	2015A04523	--	19 Dec 2019
Combiner	Weinschel	1515	--	DC-18GHz	Cal on use
Power supply	Pyramid	PS-36KX	--	12-15 Vdc, 35A	--
Multimeter	Fluke	8842A	4142058	---	05 Sep 2020

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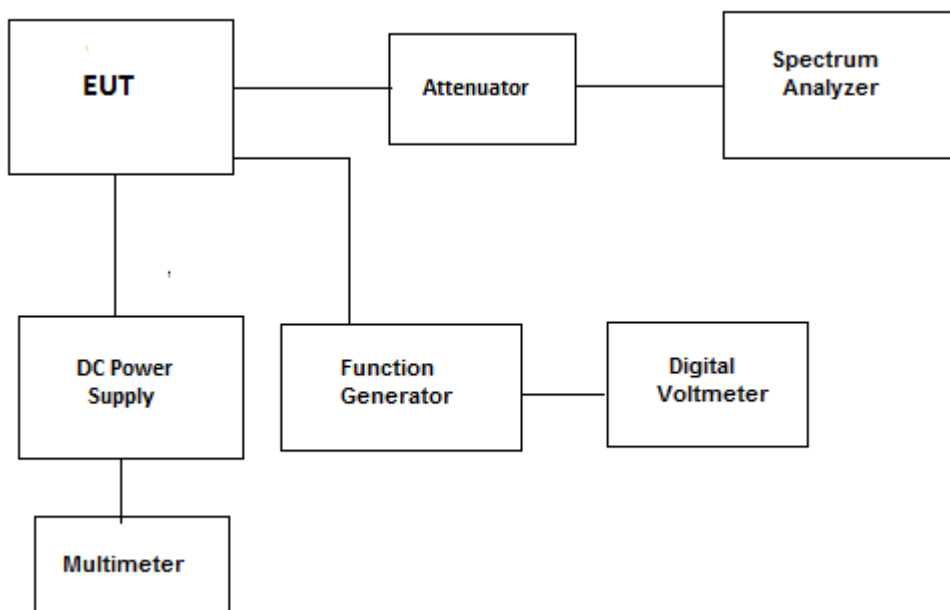
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

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6.3. Audio Frequency Response



Test Instrument	Manufacturer	Model No	Serial No	Frequency Range	Cal Due date
Spectrum analyzer	Rohde&schwarz	FSP	100646	9KHz-7 GHz	04 Dec 2020
Attenuator(20dB)	Weinschel	WA35-20-33	A164	DC-8.5 GHz	Cal on use
Attenuator(30dB)	Weinschel	46-30-34	BR9127	DC-18 GHz	Cal on use
AF Signal Generator	HP	HP-8920B	US39064699	250KHz-1GHz	20 Mar 2020
Digital Voltmeter	HP	3456A	2015A04523	--	19 Dec 2019
Power supply	Pyramid	PS-36KX	--	12-15 Vdc, 35A	--
Multimeter	Fluke	8842A	4142058	---	05 Sep 2020

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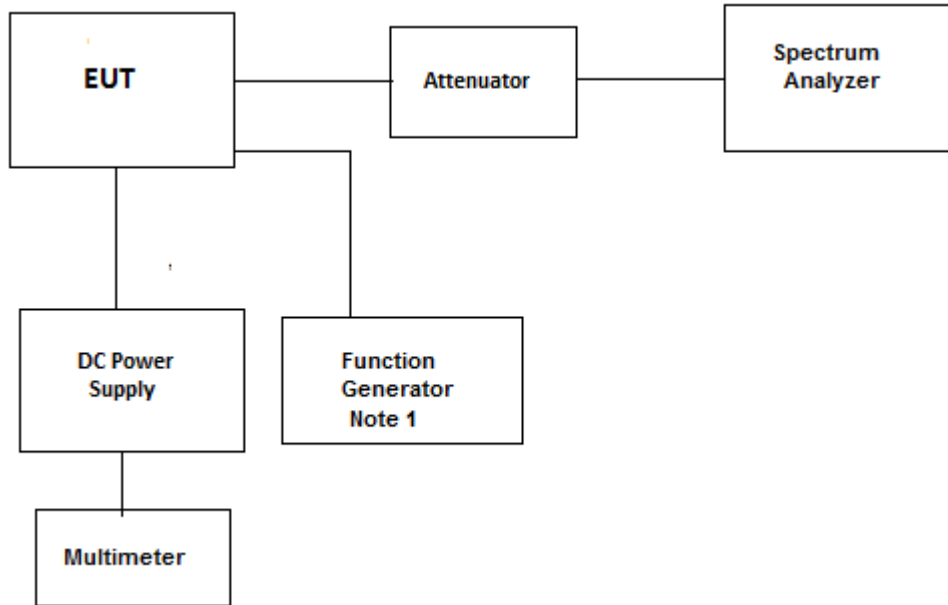
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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6.4. 99% OBW and Mask



Note 1: Kuman FY6600-60M and HP 8920B or HP 33120A

Test Instrument	Manufacturer	Model No	Serial No	Frequency Range	Cal Due date
Spectrum analyzer	Rohde&schwarz	FSP	100646	9KHz-7 GHz	04 Dec 2020
Attenuator(20dB)	Weinschel	WA35-20-33	A164	DC-8.5 GHz	Cal on use
Attenuator(30dB)	Weinschel	46-30-34	BR9127	DC-18 GHz	Cal on use
Function generator	Kuman	FY6600-60M	170966000106	DC-60M	02 Apr 2020
AF Signal Generator	HP	HP-8920B	US39064699	250KHz-1GHz	20 Mar 2020
Function generator	HP	33120A	US34011688	15M	24 Aug 2021
Digital Voltmeter	HP	3456A	2015A04523	--	19 Dec 2019
Combiner	Weinschel	1515	--	DC-18GHz	Cal on use
Power supply	Pyramid	PS-36KX	--	12-15 Vdc, 35A	--
Multimeter	Fluke	8842A	4142058	---	05 Sep 2020

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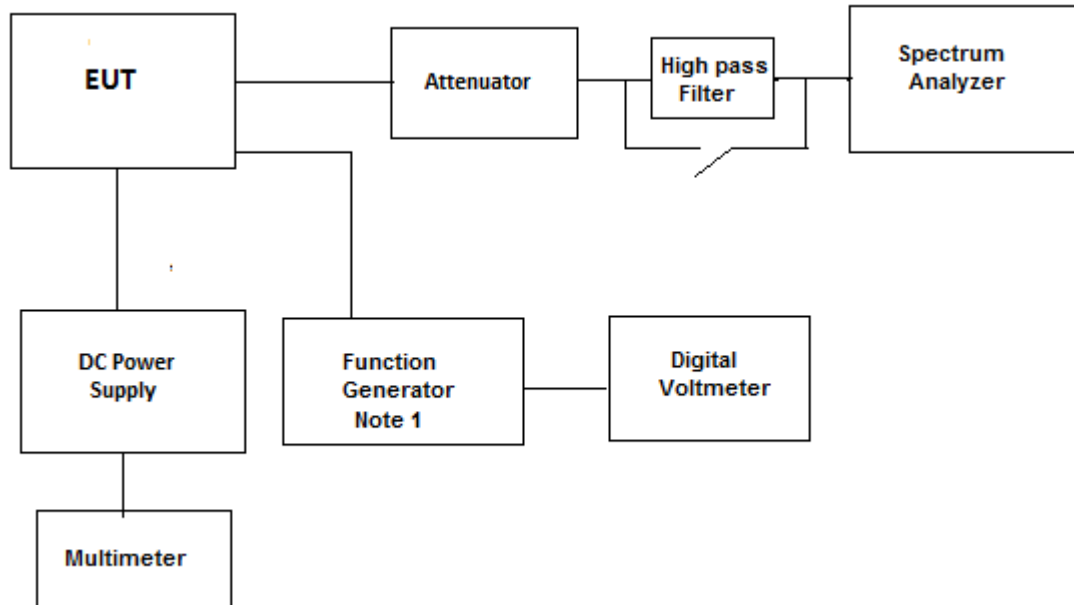
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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6.5. Tx Conducted Emission



Test Instrument	Manufacturer	Model No	Serial No	Frequency Range	Cal Due date
Spectrum analyzer	Rohde&schwarz	FSEK30	100077	20Hz-40GHz	30 Nov 2020
Attenuator(20dB)	Weinschel	WA35-20-33	A164	DC-8.5 GHz	Cal on use
Attenuator(30dB)	Weinschel	46-30-34	BR9127	DC-18 GHz	Cal on use
Function generator	Kuman	FY6600-60M	170966000106	DC-60M	02 Apr 2020
AF Signal Generator	HP	HP-8920B	US39064699	250KHz-1GHz	20 Mar 2020
Digital Voltmeter	HP	3456A	2015A04523	--	19 Dec 2019
High pass filter	Mini-Circuits	SHP-25+	15542	27.5-800MHz	Cal on use
High pass filter	Mini-Circuits	SHP-50+	15542	41-800MHz	Cal on use
Combiner	Weinschel	1515	--	DC-18GHz	Cal on use
Power supply	Pyramid	PS-36KX	--	12-15 Vdc, 35A	--
Multimeter	Fluke	8842A	4142058	---	05 Sep 2020

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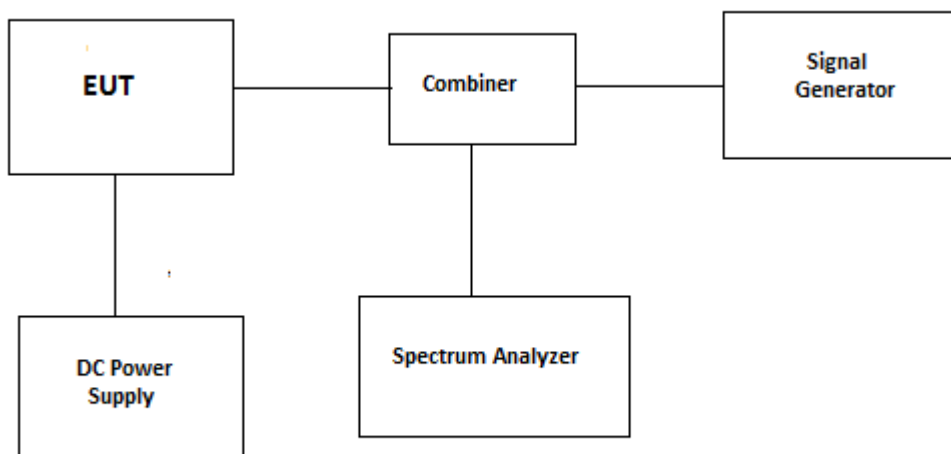
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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6.6. Rx Conducted Emission



Test Instrument	Manufacturer	Model No	Serial No	Frequency Range	Cal Due date
Spectrum analyzer	Rohde&schwarz	FSP	100646	9KHz-7 GHz	04 Dec 2020
Signal Generator	Marconi	2024	112255/164	9KHz-2.4GHz	19 Sep 2021
Combiner	Weinschel 93458	1515	PS119	DC-18GHz	Cal on use
Power supply	Pyramid	PS-36KX	--	12-15 Vdc, 35A	--
Multimeter	Fluke	8842A	4142058	---	05 Sep 2020

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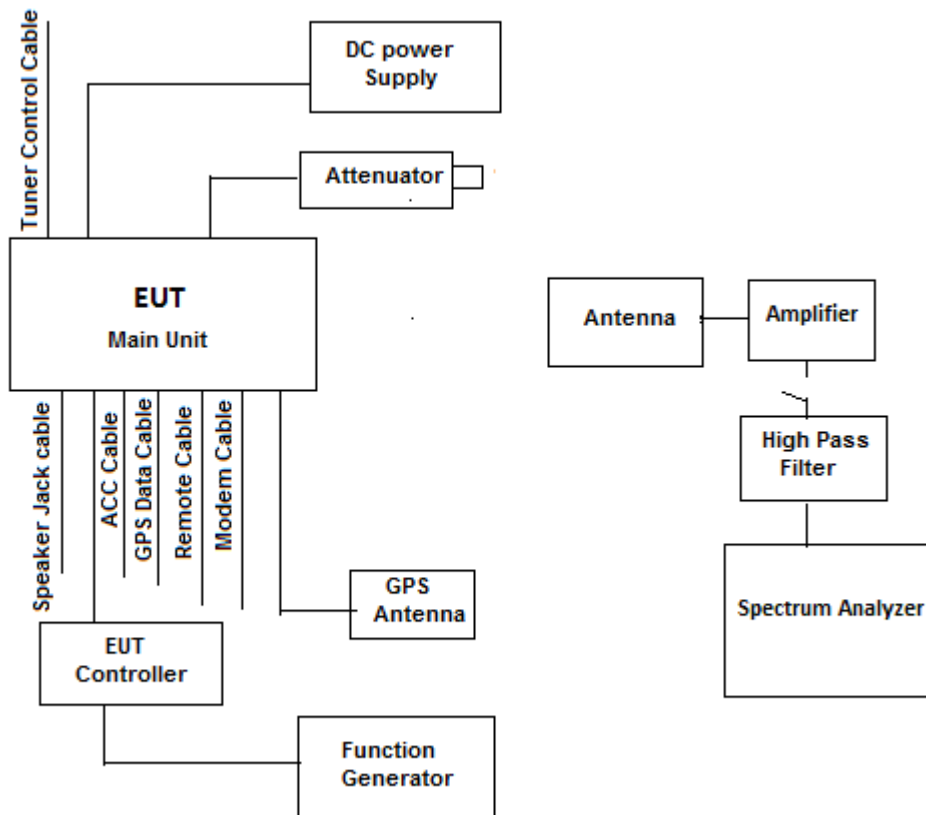
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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6.7. Tx Radiated



Test Instrument	Manufacturer	Model No	Serial No	Frequency Range	Cal Due date
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20Hz-40GHz	15 Mar 2020
Biconilog Antenna	EMCO	3142B	1575	26-2000 MHz	10 May 2020
Loop Antenna	EMCO	6502	9104-2611	9KHz-30MHz	15 Dec 2019
Horn Antenna	EMCO	3115	9701-5061	1-18 GHz	30 Apr 2020
Attenuator(20dB)	Weinschel	WA35-20-33	A164	DC-8.5 GHz	Cal on use
Attenuator(30dB)	Weinschel	46-30-34	BR9127	DC-18 GHz	Cal on use
Function generator	Kuman	FY6600-60M	170966000106	DC-60M	02 Apr 2020
AF Signal Generator	HP	HP-8920B	US39064699	250KHz-1GHz	20 Mar 2020
Combiner	Weinschel	1515	--	DC-18GHz	Cal on use
High pass filter	Mini-Circuits	SHP-25+	15542	27.5-800MHz	Cal on use
High pass filter	Mini-Circuits	SHP-50+	15542	41-800MHz	Cal on use
Power supply	Pyramid	PS-36KX	--	12-15 Vdc, 35A	--
Multimeter	Fluke	8842A	4142058	---	05 Sep 2020

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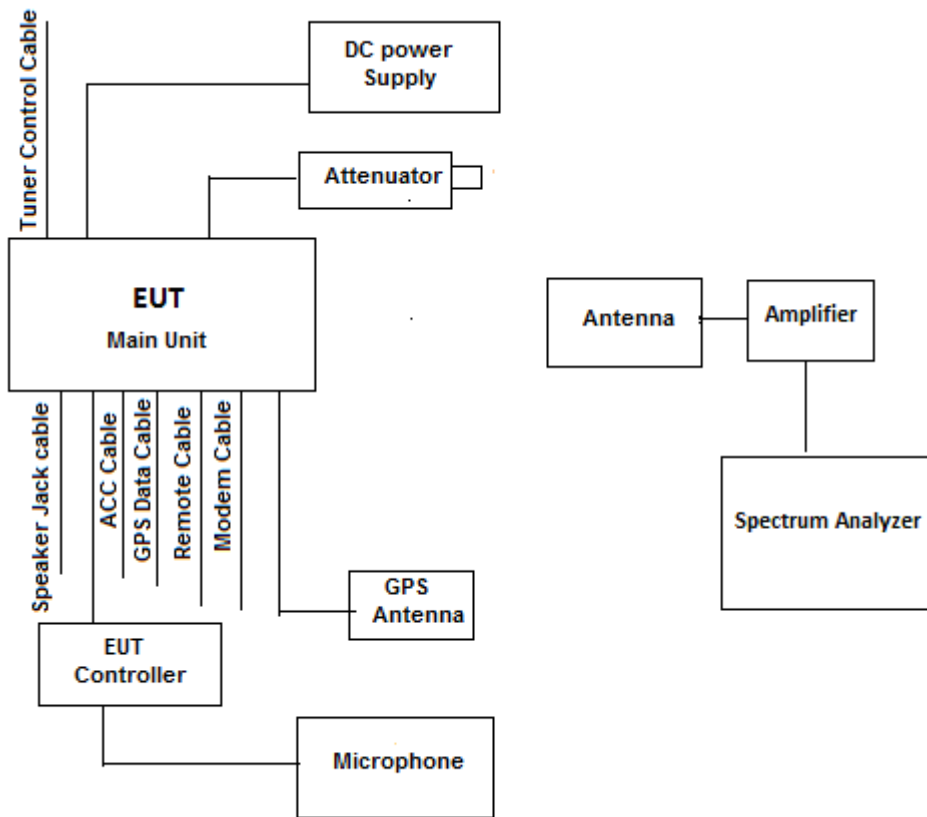
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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6.8. Rx Radiated



Test Instrument	Manufacturer	Model No	Serial No	Frequency Range	Cal Due date
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20Hz-40GHz	15 Mar 2020
Biconilog Antenna	EMCO	3142B	1575	26-2000 MHz	10 May 2020
Loop Antenna	EMCO	6502	9104-2611	9KHz-30MHz	15 Dec 2019
Horn Antenna	EMCO	3115	9701-5061	1-18 GHz	30 Apr 2020
Pre-Amplifier	Com-Power	PAM-118A	551052	500MHz-18GHz	24 Jul 2020
Horn Antenna	ETS	3115	5061	1-18GHz	30 Apr 2020
Attenuator(20dB)	Weinschel	WA35-20-33	A164	DC-8.5 GHz	Cal on use
Attenuator(30dB)	Weinschel	46-30-34	BR9127	DC-18 GHz	Cal on use
Power supply	Pyramid	PS-36KX	--	12-15 Vdc, 35A	--
Multimeter	Fluke	8842A	4142058	---	05 Sep 2020

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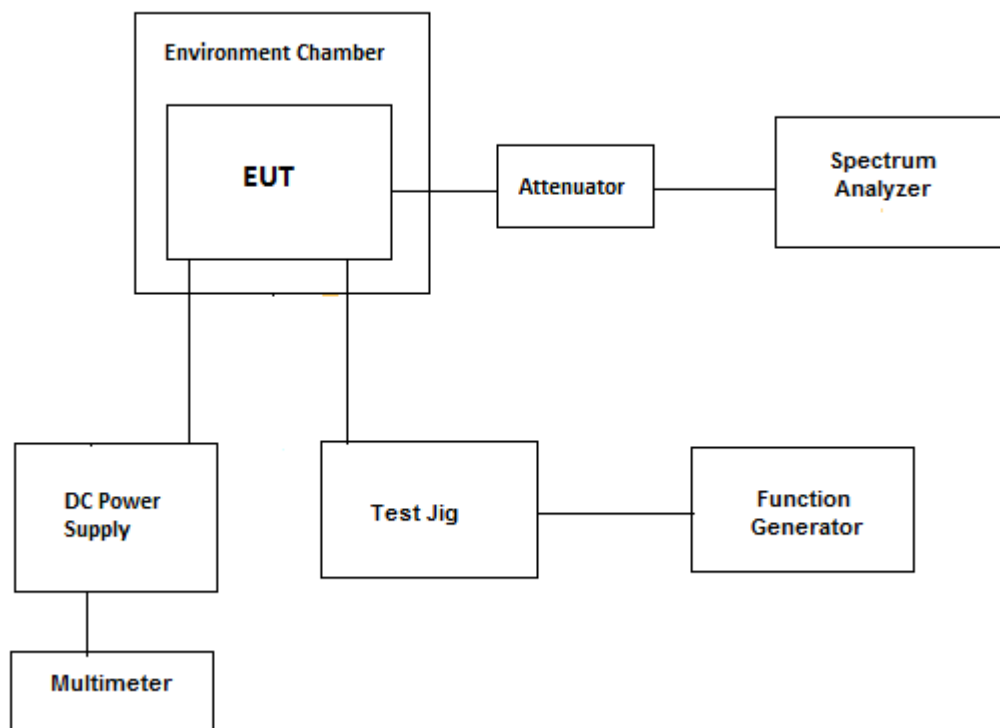
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 19ICOM515_FCC80

November 14, 2019

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6.9. Frequency Stability



Test Instrument	Manufacturer	Model No	Serial No	Frequency Range	Cal Due date
Environmental Chamber	Envirotronics	S5.5C	29388	-60 to 177° C	10 Jun 2021
Spectrum analyzer	Rohde&schwarz	FSP	100646	9KHz-7 GHz	04 Dec 2020
Attenuator(20dB)	Weinschel	WA35-20-33	A164	DC-8.5 GHz	Cal on use
Attenuator(30dB)	Weinschel	46-30-34	BR9127	DC-18 GHz	Cal on use
AF Signal Generator	HP	HP-8920B	US39064699	250KHz-1GHz	20 Mar 2020
Power supply	Pyramid	PS-36KX	--	12-15 Vdc, 35A	--
Multimeter	Fluke	8842A	4142058	---	05 Sep 2020

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EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	Measured	Limit
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 2.15	± 2.6
U	Expanded uncertainty U: $U = 2u_c(y)$	± 4.30	± 5.2

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	Measured	Limit
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 2.39	± 2.6
U	Expanded uncertainty U: $U = 2u_c(y)$	± 4.78	± 5.2

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	Measured	Limit
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 1.87	Under consideration
U	Expanded uncertainty U: $U = 2u_c(y)$	± 3.75	Under consideration

EXHIBIT 8. MEASUREMENT METHODS

8.1. CONDUCTED POWER MEASUREMENTS

- The following shall be applied to the combination(s) of the radio device and its intended antenna(e).
- If the RF level is user adjustable, all measurements shall be made with the highest power level available to the user for that combination.
- The following method of measurement shall apply to both conducted and radiated measurements.
- The radiated measurements are performed at the Ultratech Calibrated Open Field Test Site.
- The measurement shall be performed using normal operation of the equipment with modulation.

Test procedure shall be as follows:

Step 1: Duty Cycle measurements if the transmitter's transmission is transient

- Using a EMI Receiver with the frequency span set to 0 Hz and the sweep time set at a suitable value to capture the envelope peaks and the duty cycle of the transmitter output signal;
- The duty cycle of the transmitter, $x = \text{Tx on} / (\text{Tx on} + \text{Tx off})$ with $0 < x < 1$, is measure and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal or more than 0.1.

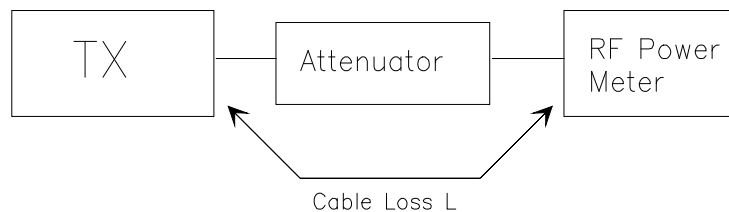
Step 2: Calculation of Average EIRP. See Figure 1

- The average output power of the transmitter shall be determined using a wideband, calibrated RF average power meter with the power sensor with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "A" (in dBm);
- The e.i.r.p. shall be calculated from the above measured power output "A", the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:

$$\text{EIRP} = A + G + 10\log(1/x)$$

{X = 1 for continuous transmission => $10\log(1/x) = 0$ dB}

Figure 1.



8.2. RADIATED POWER MEASUREMENTS

8.2.1. MAXIMIZING RF EMISSION LEVEL (E-FIELD)

- (a) The measurements were performed with full rf output power and modulation.
- (b) Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
- (c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
- (d) The LOOP Antenna (<30 MHz), BICONILOG antenna (20 MHz to 1 GHz) or HORN antenna (1 GHz to 18 GHz) was used for measuring.
- (e) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
 $E \text{ (dB}\mu\text{V/m)} = \text{Reading (dB}\mu\text{V)} + \text{Total Correction Factor (dB/m)}$

- (f) Set the EMI Receiver and #2 as follows:

Center Frequency: test frequency
Resolution BW: 100 KHz
Video BW: same
Detector Mode: positive
Average: off
Span: 3 x the signal bandwidth

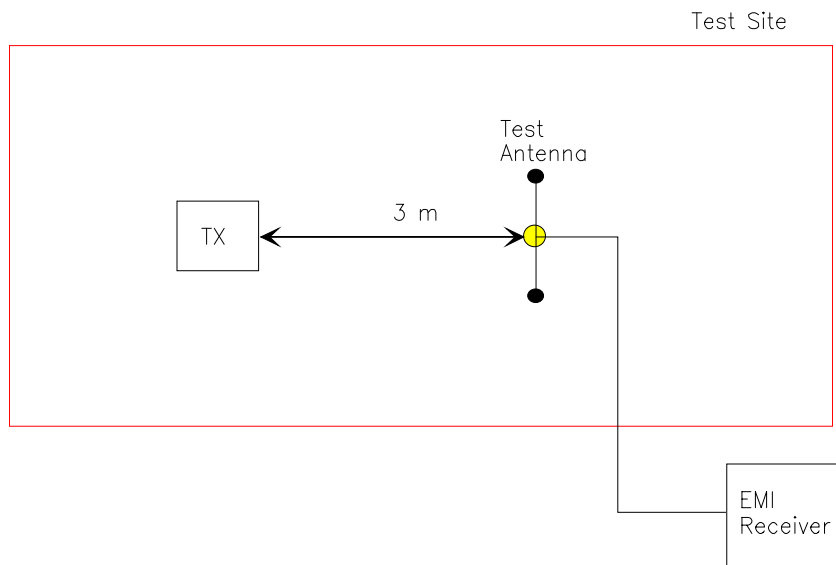
- (g) The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
- (h) The transmitter was rotated through 360° about a vertical axis until a higher maximum signal was received.
- (i) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
- (j) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
- (k) The above steps were repeated with both transmitters' antenna and test receiving antenna placed in vertical and horizontal polarization. Both readings with the antennas placed in vertical and horizontal polarization shall be recorded.
- (l) Repeat for all different test signal frequencies.

Calculation of ERP: KDB 412172 D01, KDB 971168 D01

$\text{EIRP (dBm)} = E \text{ (dB}\mu\text{V/m)} + 20\log D - 104.8$; D is measurement distance in m.

$\text{ERP} = \text{EIRP} - 2.15$

Figure 2



8.3. FREQUENCY STABILITY

Refer to FCC @ 2.1055.

- (a) The frequency stability shall be measured with variation of ambient temperature as follows: From -30 to +50 centigrade except that specified in subparagraph (2) & (3) of this paragraph.
- (b) Frequency measurements shall be made at extremes of the specified temperature range and at intervals of not more than 10 centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short-term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stability circuitry need be subjected to the temperature variation test.
- (d) The frequency stability supply shall be measured with variation of primary supply voltage as follows:
 - (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
 - (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.
 - (3) The supply voltage shall be measured at the input to the cable normally provide with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.
- (e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment).

8.4. SPURIOUS EMISSIONS (CONDUCTED)

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.1049, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the EMI Receiver. The transmitter was operated at a full rated power output, and modulated as follows:

FCC 47 CFR 2.1057 - Frequency spectrum to be investigated: The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10th harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC 47 CFR 2.1051 - Spurious Emissions at Antenna Terminal: The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of the harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.1049 as appropriate. The magnitude of spurious emissions, which are attenuated more than 20 dB below the permissible value, need not be specified.