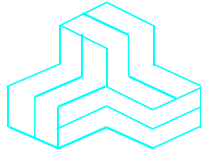


ENGINEERING TEST REPORT



QT-AD10 Family:
PlayerMic S, PlayerMic, AquaMic, AquaMic L, CoachMic, RefMic
RefMic HD, BeltMic, Incognito, GolfCupMic, TapshoeMic, BouyMic

Models:
QT-AD10PS, QT-AD10PM, QT-AD10CM, QT-AD10RF, QT-AD10RD,
QT-AD10BM, QT-AD10IM, QT-AD10GM, QT-AD10TM, QT-AD10WM, QT-AD10AM, QT-AD10AL

FCC ID: Q5N-QTAD10A15

Applicant:
Quantum5x Systems Inc.
30 Adelaide Street North Suite 12
London, Ontario, Canada N6B 3N5

In Accordance With

FCC Part 15, Subpart C, Section 15.236
Operation of Wireless Microphones in the Bands 470-608 MHz and 614-698 MHz

UltraTech's File No.: 20Q5X071_F15C236

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

Date: January 20, 2021

Report Prepared by: Santhosh Fernandez

Tested by: Hung Trinh

Issued Date: January 20, 2021

Test Dates: February 2 - April 21, 2020

- The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.
- This report must not be used by the client to claim product endorsement by any agency of the US Government.
- This test report shall not be reproduced, except in full, without a written approval from UltraTech

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APEC TEL CA0001



1309



CA 0001/2049



AT-1945



SL2-IN-E-1119R



Korea KCC-RRA
CA0001

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EXHIBIT 1. INTRODUCTION**1.1. SCOPE**

Reference:	FCC Part 15, Subpart C, Section 15.236
Title:	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15 – Radio Frequency Devices
Purpose of Test:	Equipment Certification for Section 15.236 Operation of Wireless Microphones
Test Procedures:	▪ ANSI C63.4 ▪ ANSI C63.10
Environmental Classification:	[x] Commercial, industrial or business environment [x] Residential environment

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

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 0-19	2020	Code of Federal Regulations (CFR), Title 47 – 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
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
FCC KDB Publication No. 206256 D01 Wireless Microphone Certification v02	2017	Basic certification requirements for wireless microphones

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EXHIBIT 2. PERFORMANCE ASSESSMENT**2.1. CLIENT INFORMATION**

Applicant	
Name:	Quantum5x Systems Inc.
Address:	30 Adelaide Street North Suite 12 London, Ontario Canada N6B 3N5
Contact Person:	Mr. Paul Johnson Phone #: 519-675-6999 Fax #: 519-667-2162 Email Address: paul@q5x.com

Manufacturer	
Name:	Quantum5x Systems Inc.
Address:	30 Adelaide Street North Suite 12 London, Ontario Canada N6B 3N5
Contact Person:	Mr. Paul Johnson Phone #: 519-675-6999 Fax #: 519-667-2162 Email Address: paul@q5x.com

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

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

Brand Name:	Quantum5x Systems Inc.
Model Name or Number:	QT-AD10 Family representative sample*
Serial Number:	Test Sample
Type of Equipment:	Wireless Microphone
Input Power Supply Type:	Lithium-Ion Battery / External DC Power
Primary User Functions of EUT:	The Primary use is to broadcast audio from the user.

*Prototype test sample representing all models of the family was provided by the applicant for intentional radiator testing.

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2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter	
Equipment Type:	Portable and Mobile
Intended Operating Environment:	Commercial, industrial or business environment
Power Supply Requirement:	3.7 V Lithium-Ion battery/ 5 VDC via AC adapter
RF Output Power Rating:	12.15 dBm (16.41 mW)
Operating Frequency Range:	470.150-607.975 MHz and 614.025-615.975 MHz
RF Output Impedance:	50 Ω
Duty Cycle:	100%
Modulation Type:	16MR Digital Modulation
Emission Type	G2E
Antenna Connector Types:	Integral(MH-4L internal) / SSMA connector

2.4. ASSOCIATED ANTENNA DESCRIPTIONS

Antenna Type	Maximum Gain (dBi)
¼ Wave wire UHF	0

2.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Audio Connector	1	Single Pin Lemo	4" min length, Shielded
2	UHF Antenna	1	Hardwired	129mm
3	802.15.4 Antenna	1	Hardwired	30mm
4	Battery Charger	1	Micro USB	<3 feet - Shielded

2.6. 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:	AC/DC Adapter 5 V, 500 mA
Brand name:	Emerson Network Power
Model Name or Number:	DCH3-050US-0002
Serial#	010138
Connected to EUT's Port:	Micro USB

Ancillary Equipment # 2	
Description:	Remote Gateway
Brand name:	Q5X
Model Name or Number:	QG-N3
Connected to EUT's Port:	Wirelessly

Ancillary Equipment # 3	
Description:	Laptop
Brand name:	Acer
Model Name or Number:	D270-1998
Serial#	NUSGAAA 0012281 DF327614
Connected to EUT's Port:	N/A

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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 to 23 °C
Humidity:	45 to 58%
Pressure:	102 kPa
Power Input Source:	3.7 V Lithium-Ion battery / 5 VDC via AC adapter

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
Special Test Software:	Test software provided by the Applicant to operate the EUT at each channel frequency continuously and in the range of typical modes of operation.
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):	470.150 - 607.975 MHz 614.025 - 615.975 MHz
Frequency(ies) Tested:	470.150 MHz, 539.000 MHz, 607.975 MHz 614.025 MHz, 615.975 MHz
RF Power Output: (measured maximum output power at antenna terminals)	12.15 dBm (16.41 mW) Avg
Normal Test Modulation:	Digital16MR
Modulating Signal Source:	Internal

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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.

AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

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 EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Applicability (Yes/No)
15.203	Antenna requirements	N/A ¹
15.207(a)	AC Power Line Conducted Emissions	Yes
15.236(d)	Maximum Radiated Power	Yes
15.236 (f)(2)	Operating Bandwidth	Yes
15.236 (f)(3)	Frequency tolerance of carrier signal	Yes
15.236 (g)	Emission Masks	Yes
15.236 (g)	Transmitter Spurious Radiated Emissions	Yes
15.236 (g)	Transmitter Spurious Conducted Emissions	Yes
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure	Yes

¹Pursuant to KDB 206256 D01 Section IV(f), Compliance with Section 15.203 antenna requirements does not apply to devices operated under Section 15.236.

4.3. DEVIATION OF STANDARD TEST PROCEDURES

None

4.4. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

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January 20, 2021

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EXHIBIT 5. TEST DATA**5.1. MAXIMUM RADIATED POWER [§ 15.236(d)][RSS 210 Annex G G.1]****5.1.1. Limit(s)**

§ 15.236(d) The maximum radiated power shall not exceed the following values:

- (1) In the bands allocated and assigned for broadcast television and in the 600 MHz service band: 50 mW EIRP
- (2) In the 600 MHz guard band and the 600 MHz duplex gap: 20 mW EIRP.

RSS 210 Annex G

Frequency bands (MHz)	Transmit e.i.r.p. (mW)	Authorized bandwidth (kHz)	Frequency stability (± ppm)
470-608	250	200	50
614-616 653-663	20	200	50

5.1.2. Method of Measurements & Test Arrangement

ANSI 63.10

5.1.3. Test Equipment

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Peak Power Analyzer	Hewlett Packard	8991A	3342A00657	0.5 - 40 GHz	Sep 12, 2021
Peak Power Sensor	Hewlett Packard	84814A	3205A00175	0.5 - 40 GHz	Sep 12, 2021
Attenuator	Hewlett Packard	8493C	0461	DC - 26.5 GHz	Cal on use
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	Cal on use
Laptop	Acer	D270-1998	NUSGAAA 0012281 DF327614	0.045 – 26.5 GHz	-
Remote Gateway	Q5X	QG-N3	61719	-	-
DC Power Supply	HQ Power	PS613U	NSN	0 – 30V 3A	Cal on use
Multi-meter	Fluke	8842A	4142058	20mV - 1kV	Sep 5, 2020

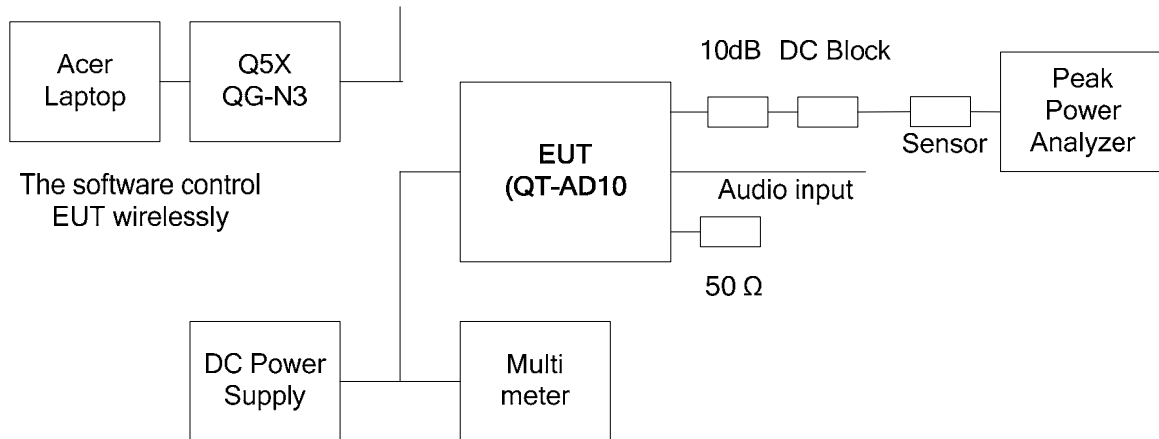
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5.1.4. Test Arrangement



5.1.5. Test Data

, Average Conducted Output Power, Wire antenna 0dBi, 16MR Modulation

Digital Modulation	Frequency (MHz)	Power Setting (mW)	Power Measured (dBm)	Power Measured (mW)	Average Limit EIRP (mW)
16MR	470.150	High	12.15	16.41	50
16MR	539.000	High	11.61	14.49	50
16MR	607.975	High	11.35	13.65	50
16MR	614.025	High	11.08	12.82	20
16MR	615.975	High	11.39	11.39	20

Digital Modulation	Frequency (MHz)	Power Setting (mW)	Power Measured (dBm)	Power Measured (mW)	Average Limit EIRP (mW)
16MR	470.150	2	3.35	2.16	50
16MR	539.000	2	2.97	1.98	50
16MR	607.975	2	3.14	2.06	50
16MR	614.025	2	2.61	1.82	20
16MR	615.975	2	2.68	1.85	20

Note: EUT Modulation cannot be disabled while operating.

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5.2. OCCUPIED BANDWIDTH [§ 15.236(f)]**5.2.1. Limit(s)**

§ 15.236(f) The operating frequency within a permissible band of operation as defined in paragraph (c) must comply with the following requirements.

- (1) The frequency selection shall be offset from the upper or lower band limits by 25 kHz or an integral multiple thereof.
- (2) One or more adjacent 25 kHz segments within the assignable frequencies may be combined to form a channel whose maximum bandwidth shall not exceed 200 kHz. The operating bandwidth shall not exceed 200 kHz.

5.2.2. Method of Measurements

ANSI 63.10

5.2.3. Test Equipment

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSU26	200946	20Hz–26.5 GHz	Jul 25, 2020
Attenuator	Hewlett Packard	8493C	0461	DC - 26.5 GHz	Cal on use
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	Cal on use
Laptop	Acer	D270-1998	NUSGAAA 0012281 DF327614	0.045 – 26.5 GHz	-
Remote Gateway	Q5X	QG-N3	61719	-	-
DC Power Supply	HQ Power	PS613U	NSN	0 – 30V 3A	Cal on use
Multi-meter	Fluke	8842A	4142058	20mV - 1kV	Sep 5, 2020

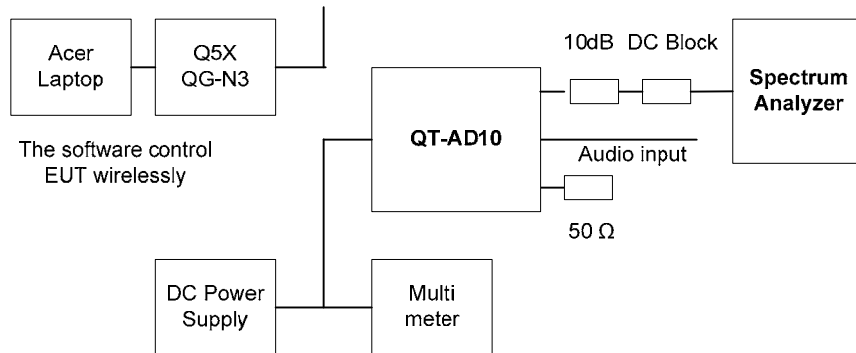
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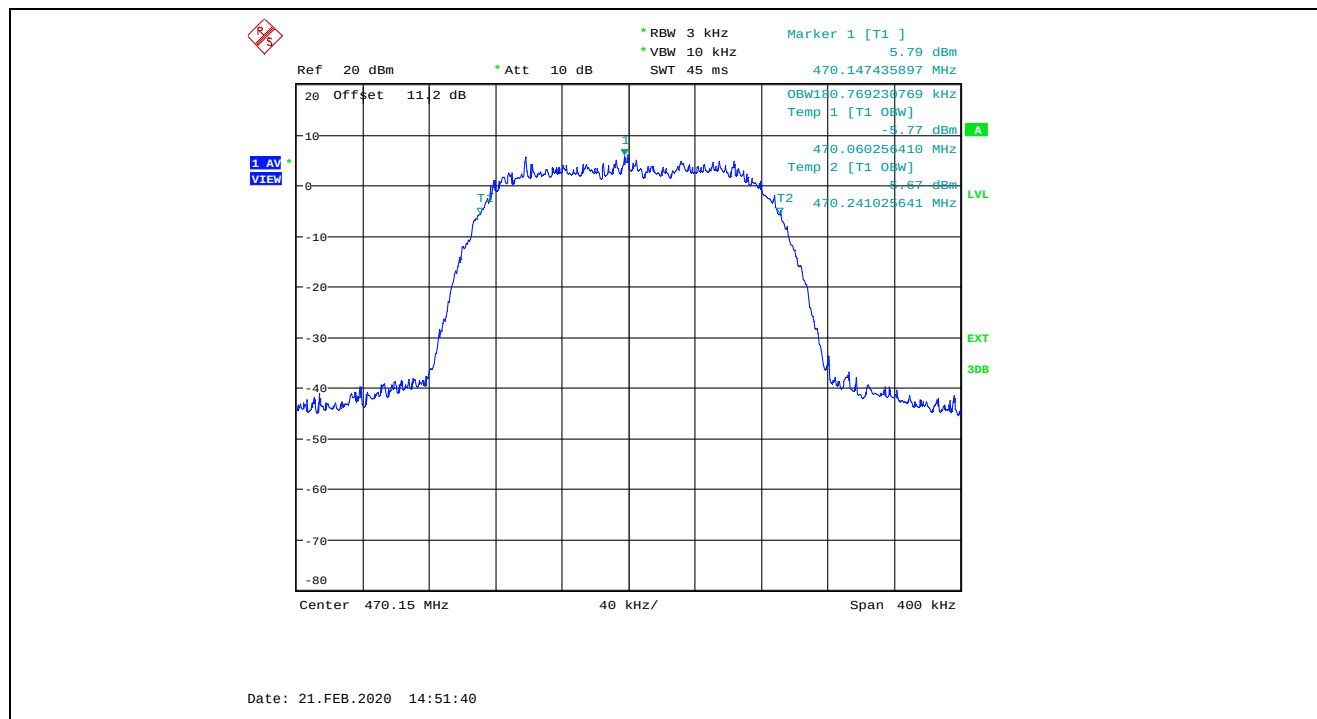
5.2.4. Test Arrangement



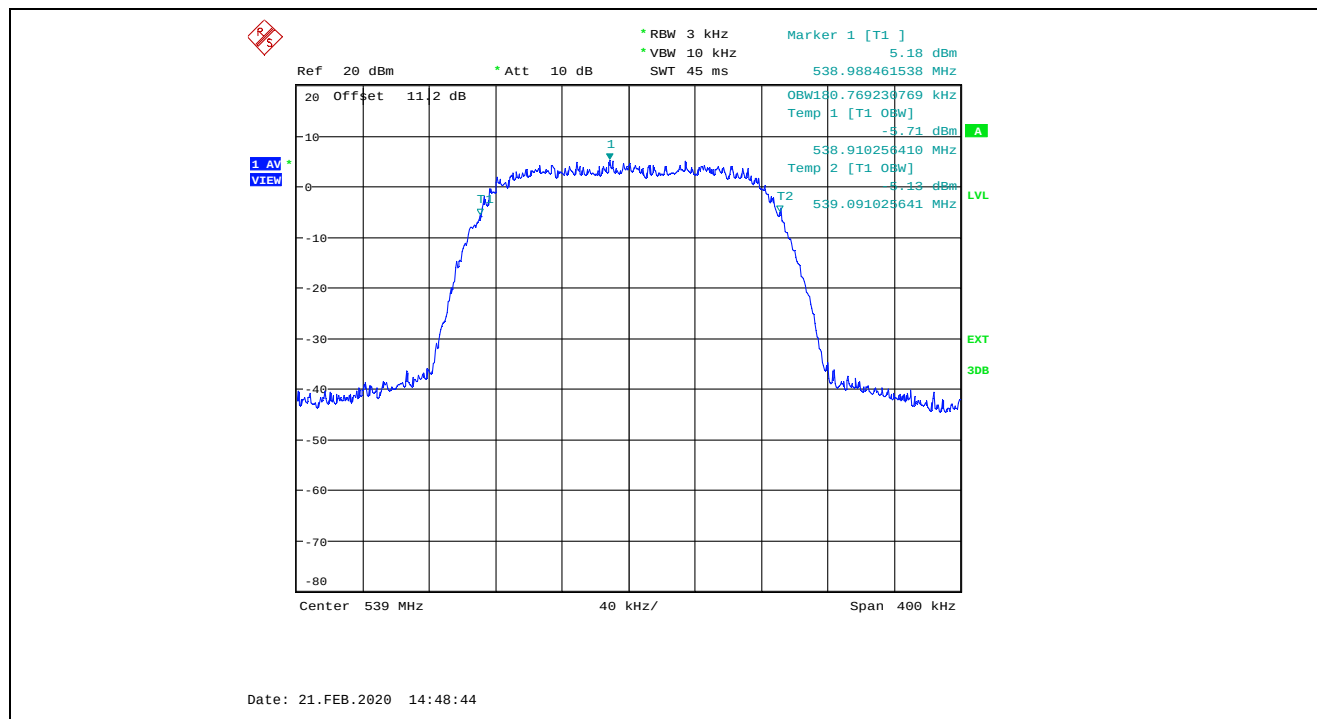
5.2.5. Test Data

Frequency (MHz)	Digital Modulation	Power Setting	99% OBW (kHz)	Limit (kHz)
470.150	16MR	High	180.77	200
539.000	16MR	High	180.77	200
607.975	16MR	High	181.41	200
614.025	16MR	High	180.77	200
615.975	16MR	High	181.41	200

Plot 5.2.5.1. 99% Occupied Bandwidth, 470.150 MHz, Digital modulation 16MR



Plot 5.2.5.2. 99% Occupied Bandwidth, 539.000 MHz, Digital modulation 16MR



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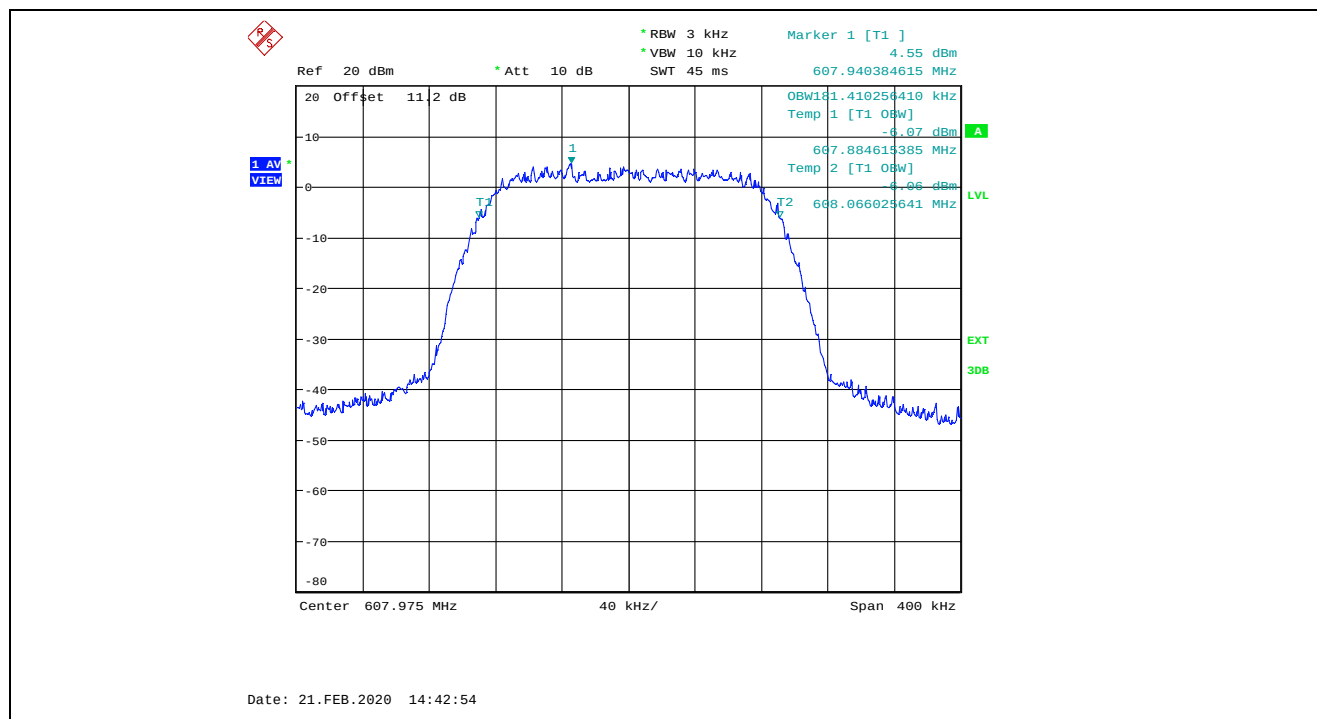
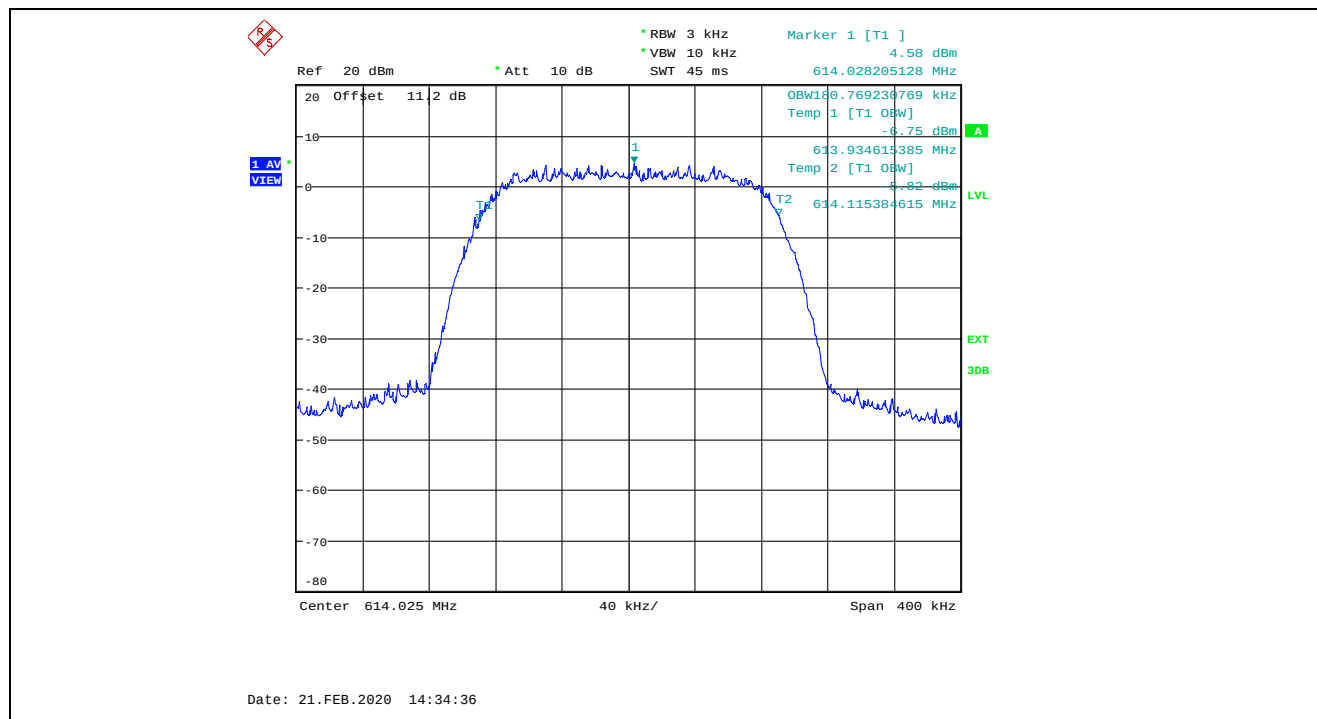
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Plot 5.2.5.3. 99% Occupied Bandwidth, 607.975 MHz, Digital modulation 16MR**Plot 5.2.5.4.** 99% Occupied Bandwidth, 614.025 MHz, Digital modulation 16MR**ULTRATECH GROUP OF LABS**

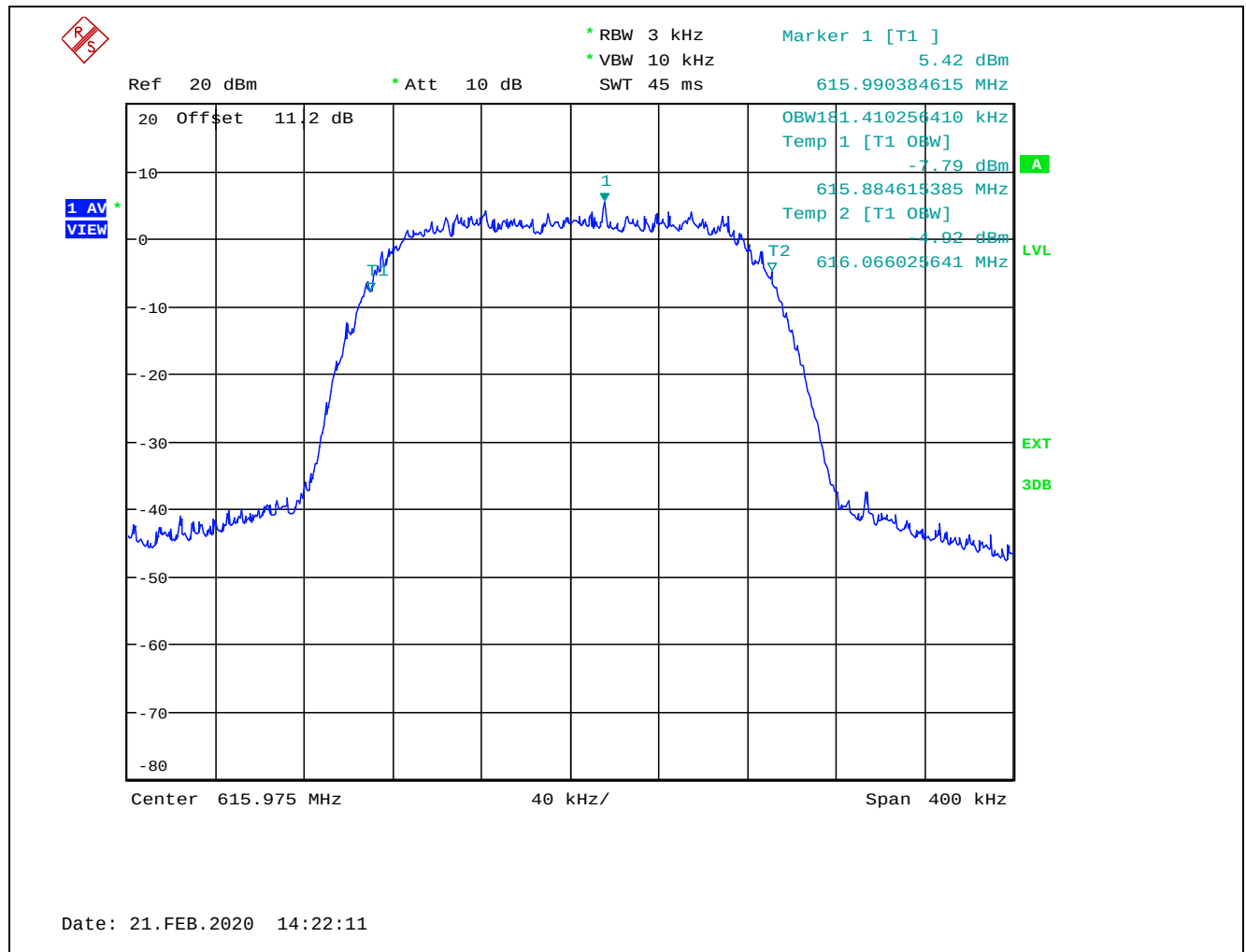
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Plot 5.2.5.5. 99% Occupied Bandwidth, 615.975 MHz, Digital modulation 16MR**ULTRATECH GROUP OF LABS**

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5.3. FREQUENCY TOLERANCE [§ 15.236(f)(3)]**5.3.1. Limit(s)**

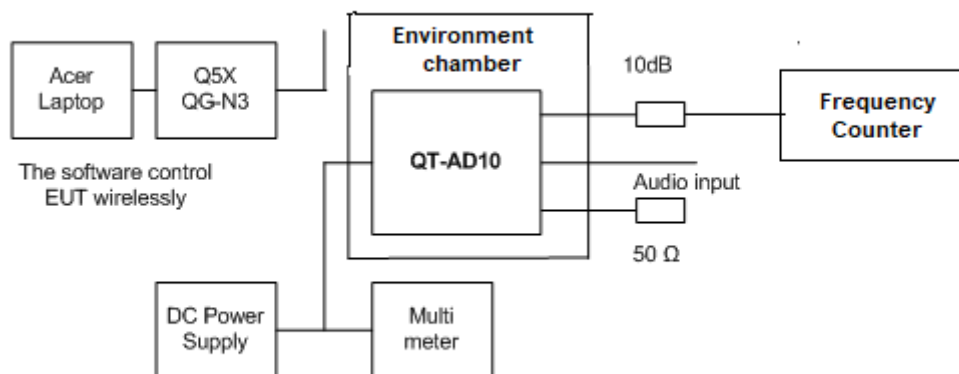
§ 15.236(f)(3) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.005\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. Battery operated equipment shall be tested using a new battery.

5.3.2. Method of Measurements & Test Arrangement

ANSI C63.10

5.3.3. Test Equipment

Test Instrument	Manufacturer	Model No	Serial No	Frequency Range	Cal Due date
Environmental Chamber	Envirotronics	SSH32C	11994847-S-11059	-60 to 177° C	10 Jun 2021
Frequency Counter	EIP	545A	2683	10MHz-1GHz	07 Aug 2020
Attenuator	Radiall	R411.820.121	--	DC-18GHz	Cal on use
Power Supply	Tenma	72-7295	490300271	1-40V, DC 5A	----
Multimeter	Fluke	8842A	4142058	---	05 Sep 2020

5.3.4. Test Arrangement

5.3.5. Test Data

Center frequency: 470.150 MHz

Full Power Level: 16.41mW

Frequency Tolerance Limit: $\pm 0.005\%$ or 23507.5 Hz

Max. Frequency Tolerance Measured: 657 Hz (1.4 ppm)

Temperature	Nominal Voltage	Battery End Point	115% Voltage
oC	3.7 Vdc	3.1 Vdc	4.255 Vdc
-20	199	--	--
-10	246	--	--
0	289	--	--
10	306	--	--
20	304	299	298
30	390	--	--
40	456	--	--
50	657	--	--

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File #: 20Q5X071_F15C236

January 20, 2021

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

5.4. EMISSION MASK [§ 15.236(g)]**5.4.1. Limit(s)**

§ 15.236(g) Emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in §8.3 of ETSI EN 300 422-1 V1.4.2 (2011-08), *Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement*. Emissions outside of this band shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 V1.4.2 (2011-08).

ETSI EN 300 422-1 V1.4.2 Clause 8.3.2.2 Limits for Digital Systems

The transmitter output spectrum shall be within the mask defined in figure 4. This mask may also be used for analogue.

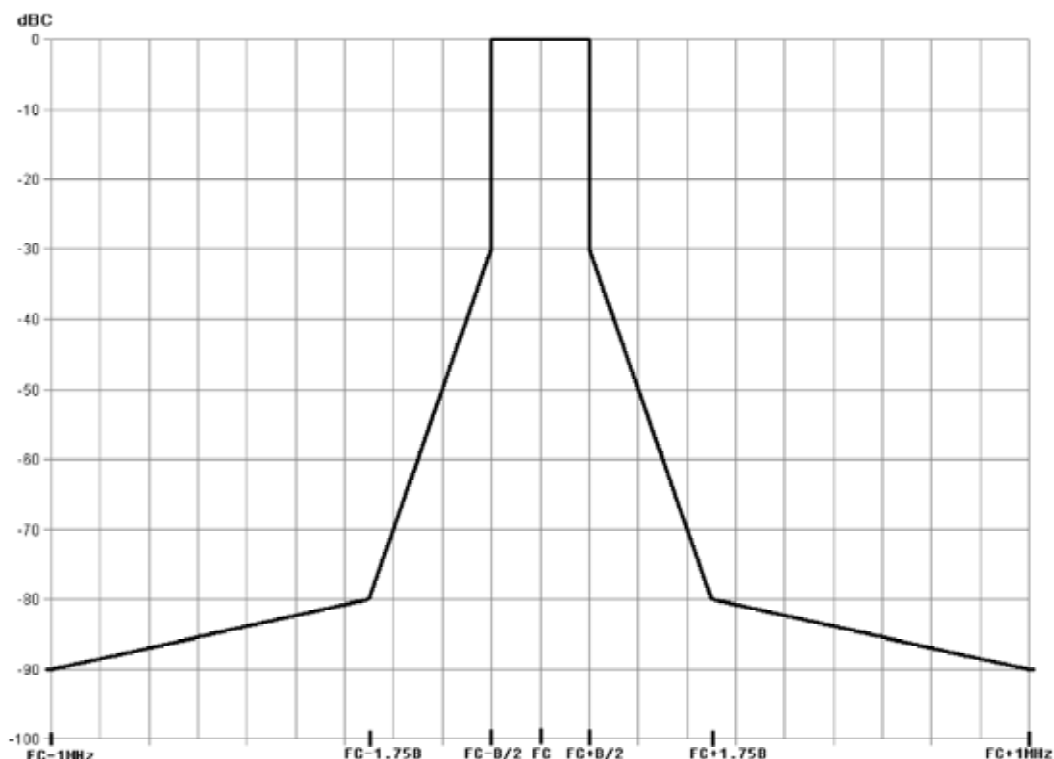


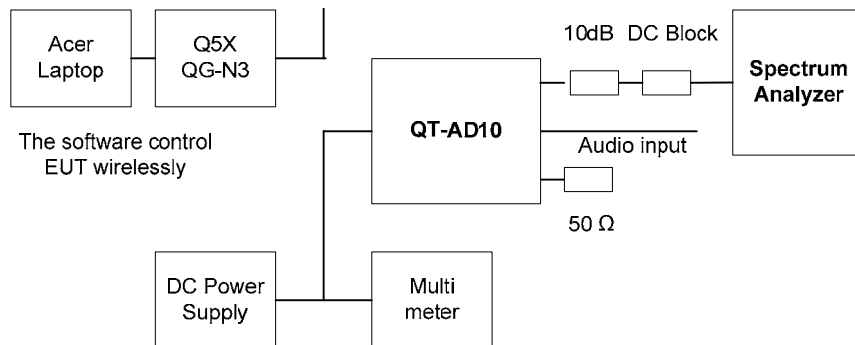
Figure 4: Spectrum mask for digital systems below 1 GHz

5.4.2. Method of Measurements

ETSI EN 300 422-1 V1.4.2 Clause 8.3.2

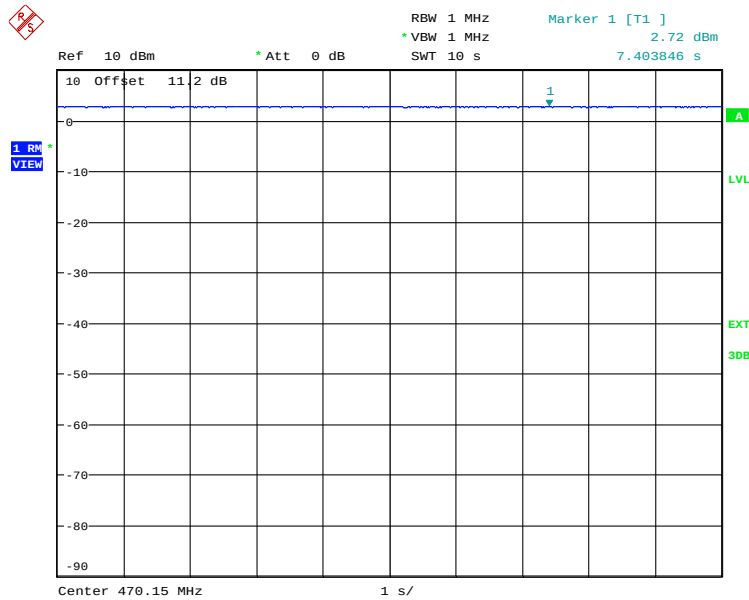
5.4.3. Test Equipment

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSU26	200946	20Hz–26.5 GHz	Jul 25, 2020
Attenuator	Hewlett Packard	8493C	0461	DC - 26.5 GHz	Cal on use
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	Cal on use
Laptop	Acer	D270-1998	NUSGAAA 0012281 DF327614	0.045 – 26.5 GHz	-
Remote Gateway	Q5X	QG-N3	61719	-	-
DC Power Supply	HQ Power	PS613U	NSN	0 – 30V 3A	Cal on use
Multi-meter	Fluke	8842A	4142058	20mV - 1kV	Sep 5, 2020

5.4.4. Test Arrangement

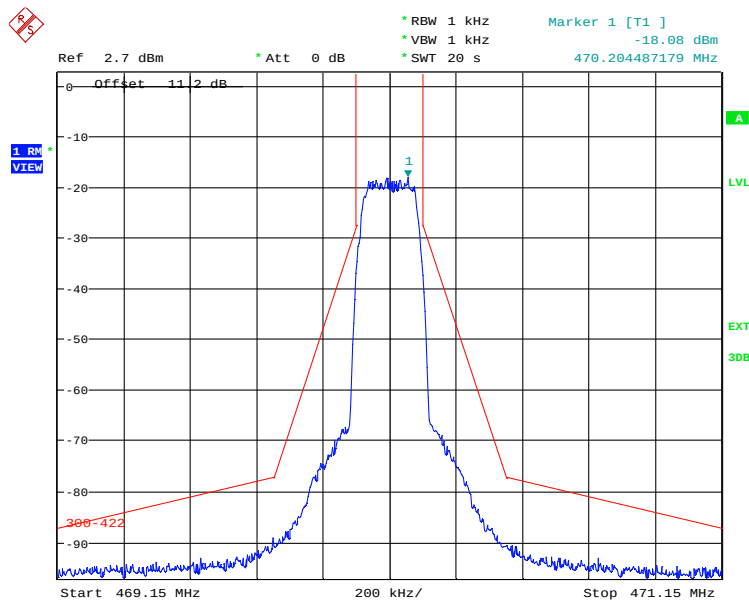
5.4.5. Test Data

5.4.5.1. 470.150 MHz, Digital modulation 16MR, RF Power setting Low



Date: 24.FEB.2020 16:32:56

Carrier power reference



Date: 24.FEB.2020 16:36:20

MASK

ULTRATECH GROUP OF LABS

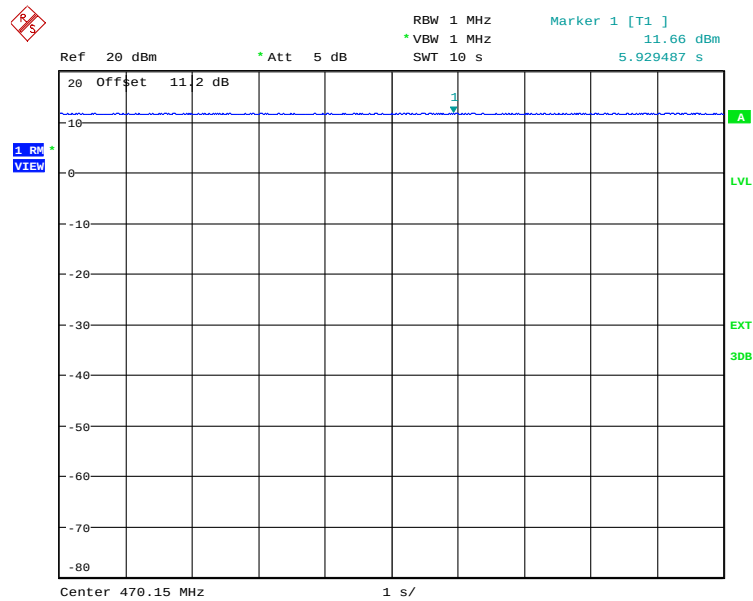
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

File #: 20Q5X071_F15C236

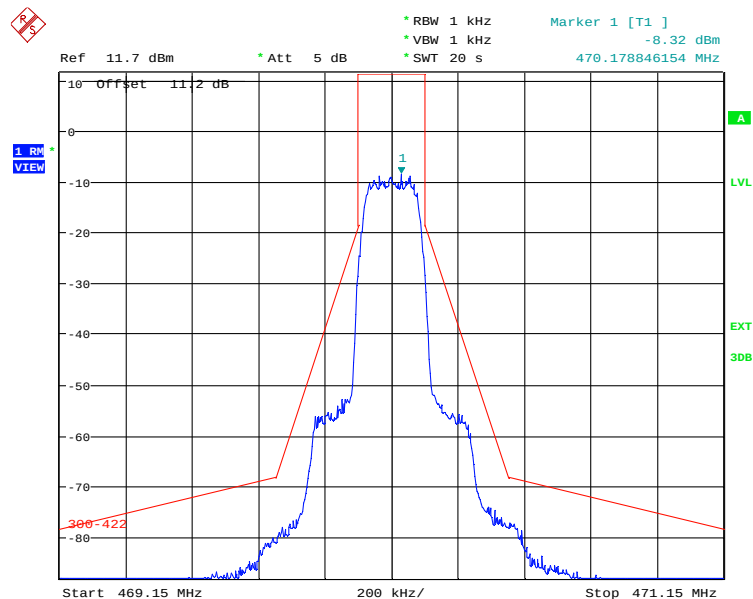
January 20, 2021

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

5.4.5.2. 470.150 MHz, Digital modulation 16MR, RF Power setting High

Date: 24.FEB.2020 15:02:26

Carrier power reference



Date: 24.FEB.2020 15:06:14

MASK

ULTRATECH GROUP OF LABS

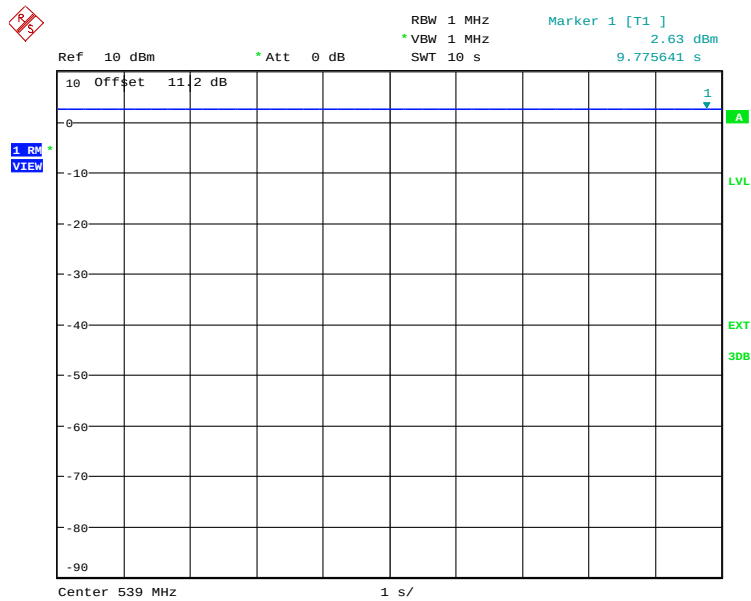
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

File #: 20Q5X071_F15C236

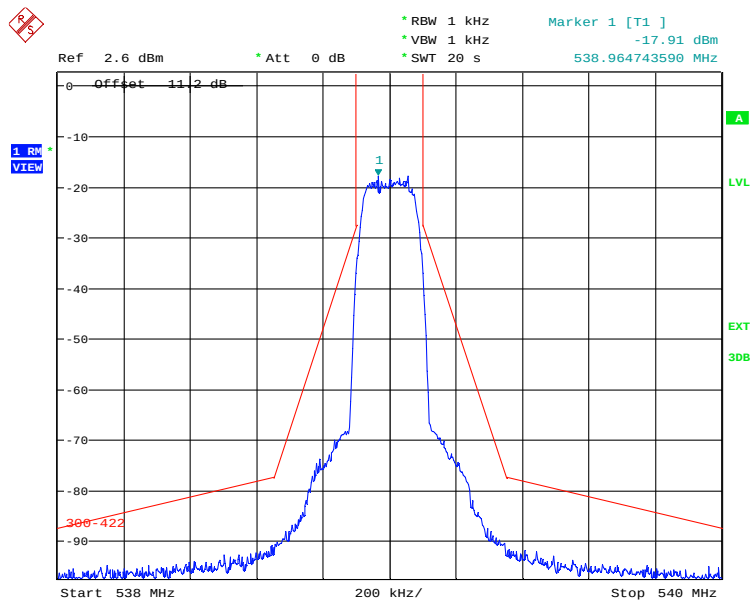
January 20, 2021

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

5.4.5.3. 539.000 MHz, Digital modulation 16MR, RF Power setting Low

Date: 24.FEB.2020 16:39:19

Carrier power reference



Date: 24.FEB.2020 16:53:52

MASK

ULTRATECH GROUP OF LABS

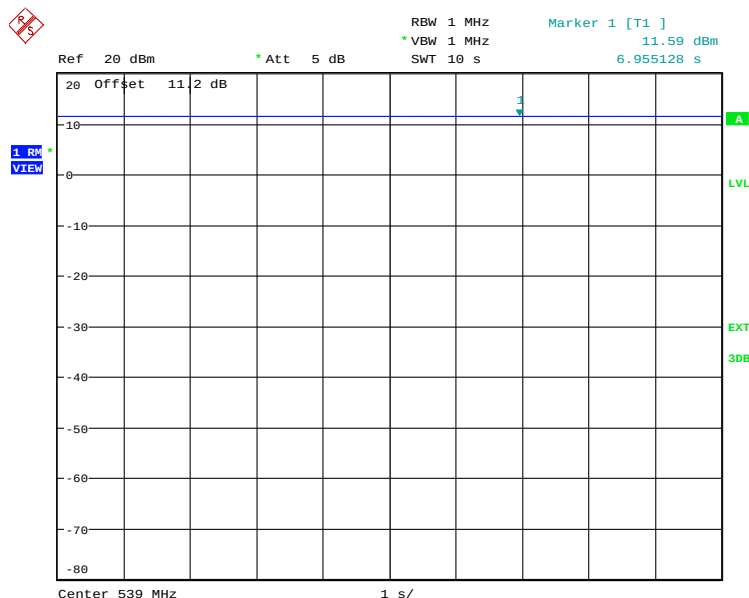
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

File #: 20Q5X071_F15C236

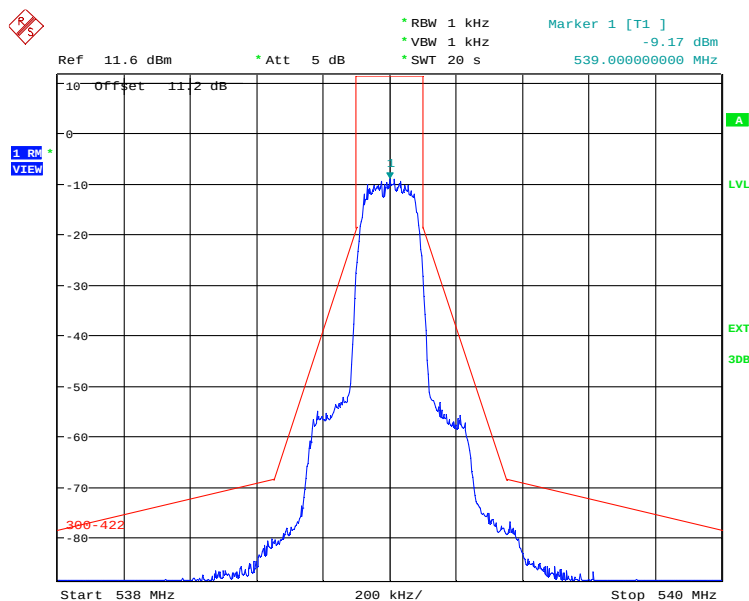
January 20, 2021

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

5.4.5.4. 539.000 MHz, Digital modulation 16MR, RF Power setting High

Date: 24.FEB.2020 15:21:49

Carrier power reference



Date: 24.FEB.2020 15:24:19

MASK

ULTRATECH GROUP OF LABS

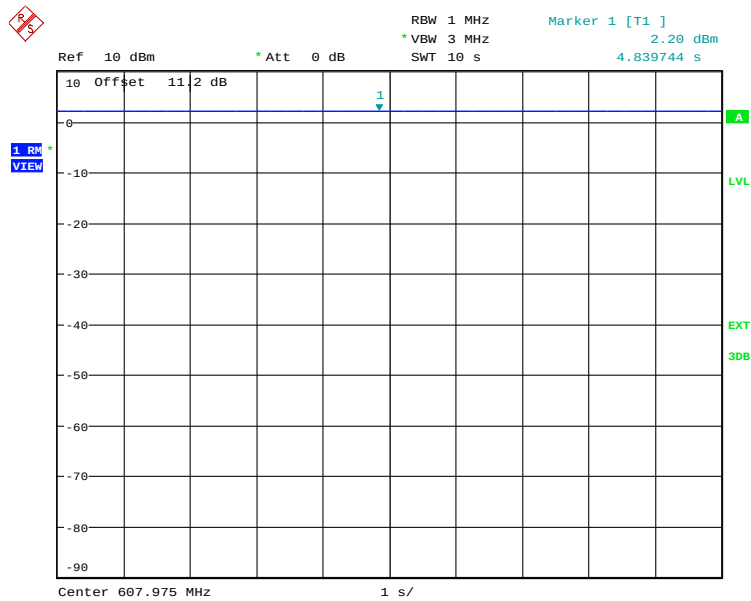
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

File #: 20Q5X071_F15C236

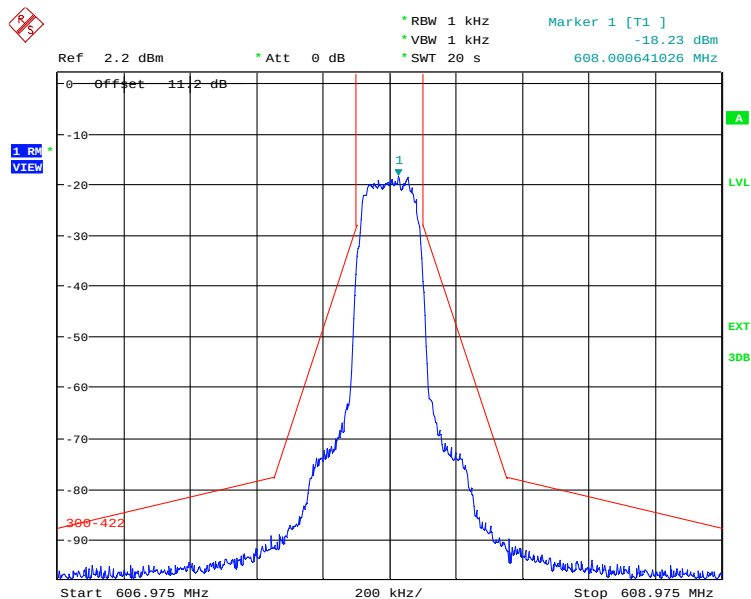
January 20, 2021

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

5.4.5.5. 607.975 MHz, Digital modulation 16MR, RF Power setting Low

Date: 24.FEB.2020 16:46:56

Carrier power reference



Date: 24.FEB.2020 17:05:25

MASK

ULTRATECH GROUP OF LABS

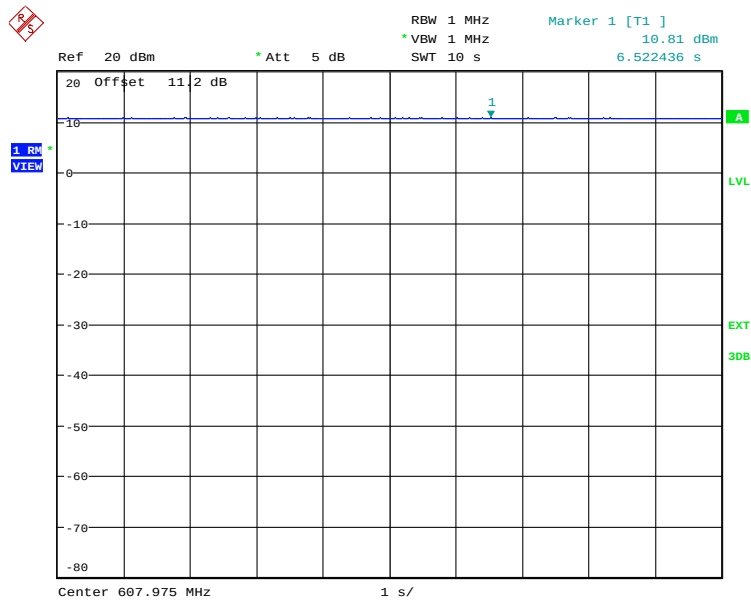
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

File #: 20Q5X071_F15C236

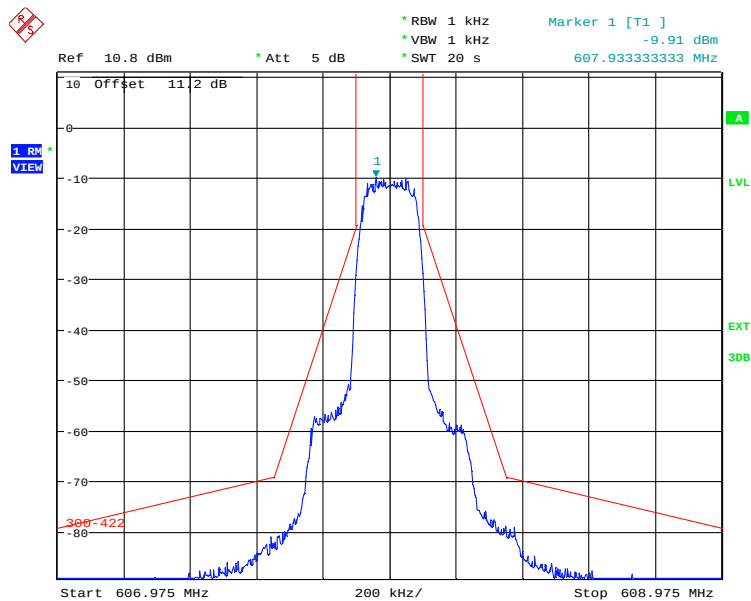
January 20, 2021

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

5.4.5.6. 607.975 MHz, Digital modulation 16MR, RF Power setting High

Date: 24.FEB.2020 15:29:30

Carrier power reference



Date: 24.FEB.2020 15:34:19

MASK

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

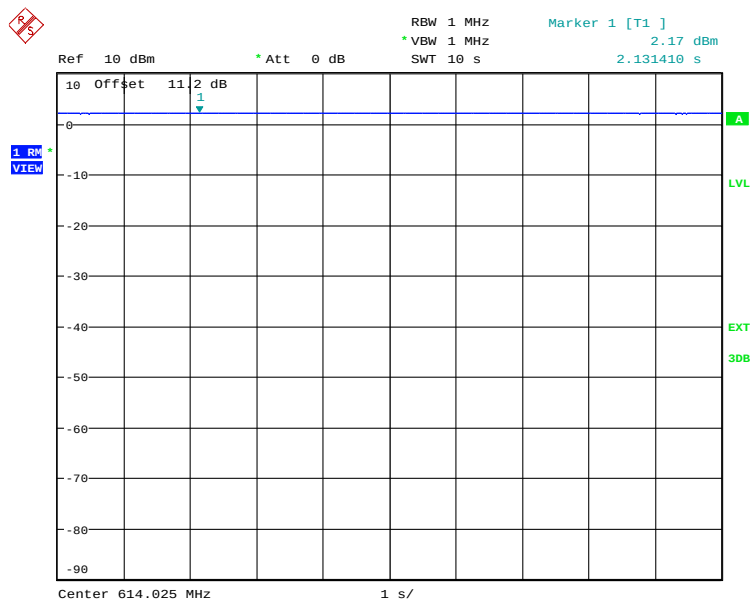
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 20Q5X071_F15C236

January 20, 2021

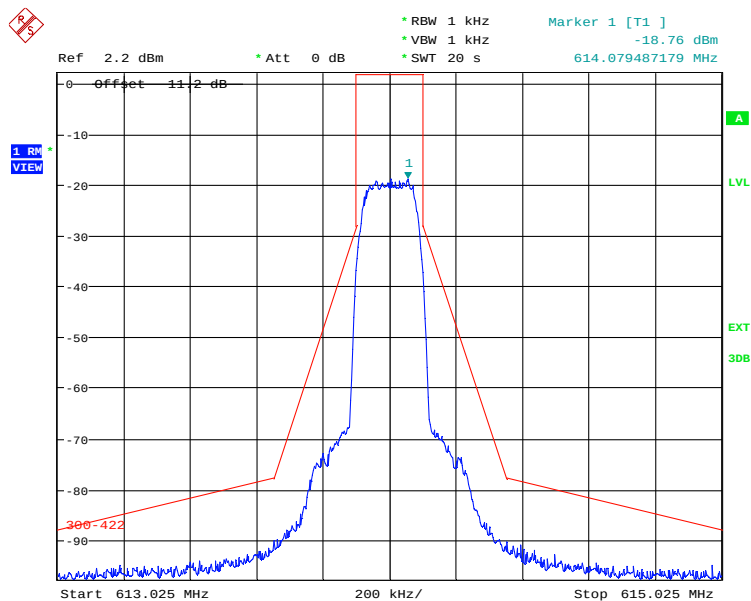
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

5.4.5.7. 614.025 MHz, Digital modulation 16MR, RF Power setting Low



Date: 24.FEB.2020 16:56:37

Carrier power reference



Date: 24.FEB.2020 16:58:48

MASK

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

File #: 20Q5X071_F15C236

January 20, 2021

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

The screenshot shows a Spectrum Analyzer interface. At the top left is a logo. The top right displays 'Marker 1 [T1]' with a value of '10.97 dBm'. Below this, '3.541667 s' is shown. The main display area is a grid with a blue trace at -10 dBm. The y-axis is labeled 'dBm' and ranges from -80 to 20. The x-axis is labeled 'MHz' and ranges from 614.025 to 614.035. The trace is labeled '1' with a blue arrow pointing to it. The bottom status bar shows 'Center 614.025 MHz' and '1 s/'.

RBW 1 MHz
VBW 1 MHz
SWT 10 s

Ref 20 dBm
Att 5 dB

Marker 1 [T1]
10.97 dBm
3.541667 s

20 Offset 11 2 dB

10
0
-10
-20
-30
-40
-50
-60
-70
-80

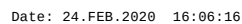
1

1 RM
V1BW

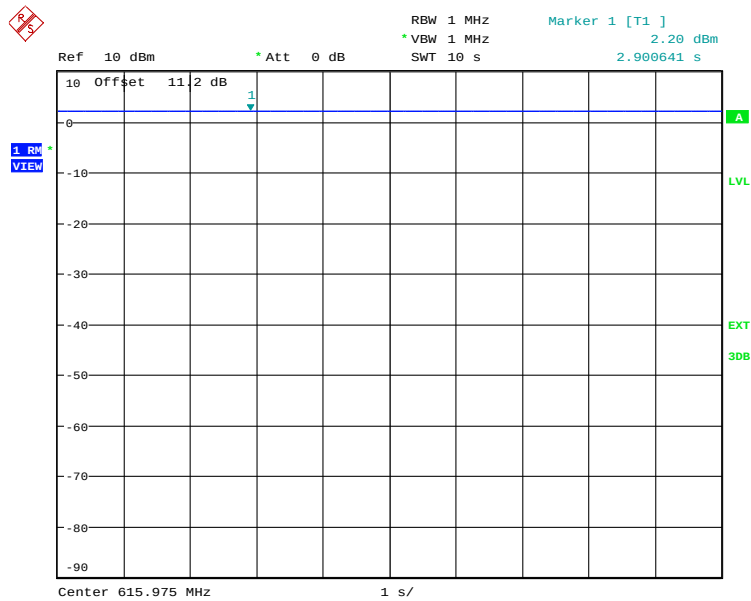
A
LVL
EXT
3DB

Center 614.025 MHz 1 s/

Carrier power reference

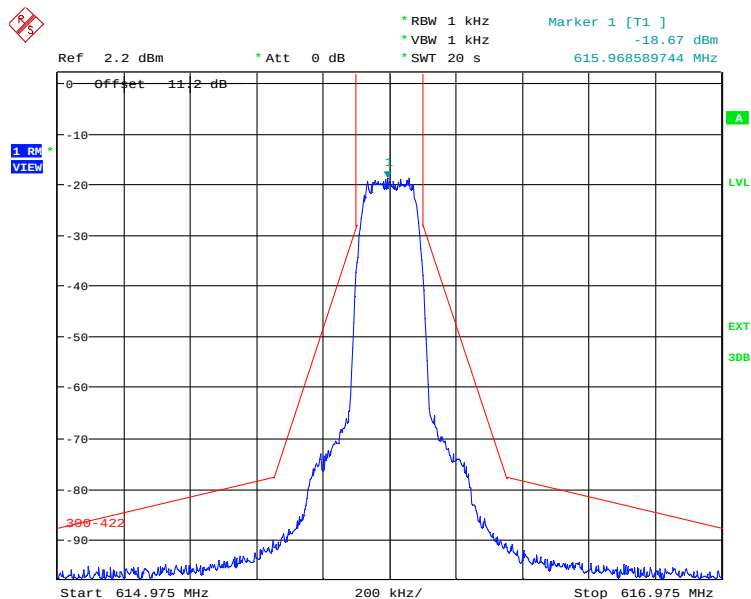


MASK

5.4.5.9. 615.975 MHz, Digital modulation 16MR, RF Power setting Low

Date: 24.FEB.2020 17:01:18

Carrier power reference



Date: 24.FEB.2020 17:03:09

MASK

ULTRATECH GROUP OF LABS

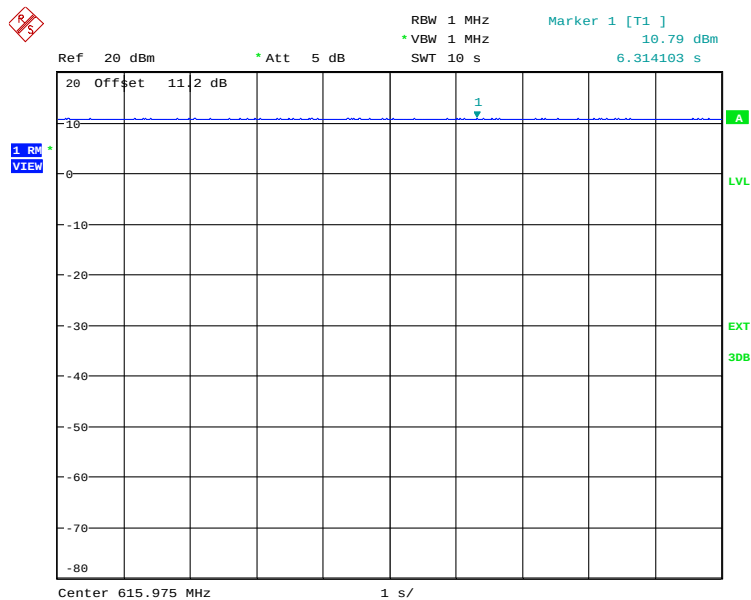
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

File #: 20Q5X071_F15C236

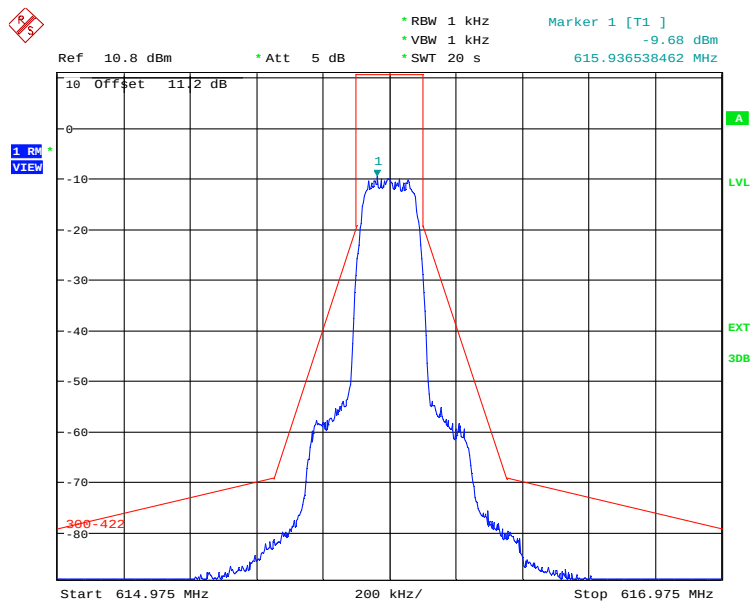
January 20, 2021

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

5.4.5.10. 615.975 MHz, Digital modulation 16MR, RF Power setting High

Date: 24.FEB.2020 16:00:41

Carrier power reference



Date: 24.FEB.2020 16:03:02

MASK

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File #: 20Q5X071_F15C236

January 20, 2021

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

5.5. SPURIOUS EMISSIONS AT ANTENNA TERMINAL [§§ 15.236(g)]**5.5.1. Limit(s)**

Emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in § 8.3 of ETSI EN 300 422-1 V1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement. Emissions outside of this band shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 V1.4.2 (2011-08).

EN 300 422-1 V2.1.2 (2017-01) Table 3: Limit for spurious emissions

State \ Frequency	47 MHz to 74 MHz 87.5 MHz to 137 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies below 1 000 MHz	Frequencies above 1 000 MHz
TX mode	4 nW	250 nW	1 µW
RX and all other modes	2 nW	2 nW	20 nW

In dBm

State \ Frequency	47 MHz to 74 MHz 87.5 MHz to 137 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies below 1 000 MHz	Frequencies above 1 000 MHz
TX mode	-54 dBm	-36 dBm	-30 dBm
RX and all other modes	-57 dBm	-57 dBm	-47 dBm

5.5.2. Method of Measurements

ETSI EN 300 422-1 V1.4.2

5.5.3. Test Equipment

Test Instrument	Manufacturer	Model No	Serial No	Frequency Range	Cal Due date
Spectrum Analyzer	Rohde & Schwarz	FSU	100398	20Hz-26.5GHz	23 Oct 2021
High pass filter	Mini-Circuits	SHP-800	15542	Cut off 800	Cal on use
High pass filter	Mini-Circuits	SHP-800	19949	Cut off 600	Cal on use
Attenuator (10dB)	Pasternack	PE7001-10	--	DC-3GHz	Cal on use
Power Supply	Tenma	72-7295	490300271	1-40V, DC 5A	----
Multimeter	Fluke	8842A	5021295	---	19 Dec 2020

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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

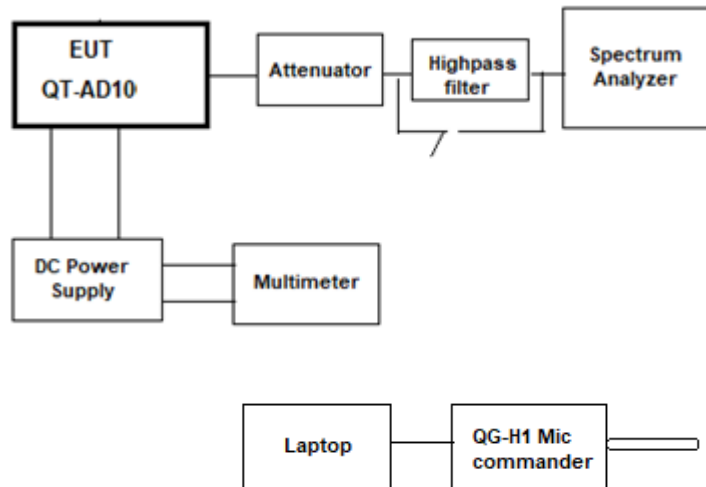
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 20Q5X071_F15C236

January 20, 2021

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

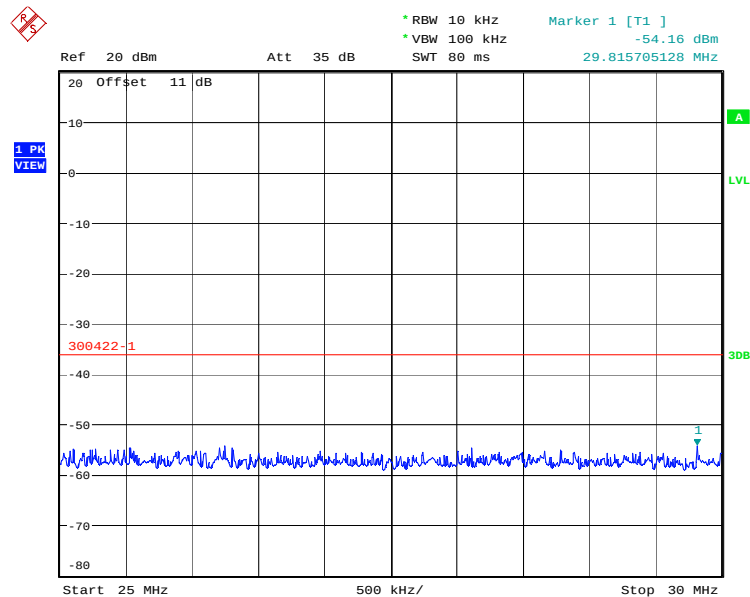
5.5.4. Test Arrangement



5.5.5. Test Data

HIGH POWER

5.5.5.1. Tx Conducted @470.150 MHz- High Power



Date: 21.APR.2020 09:39:37

ULTRATECH GROUP OF LABS

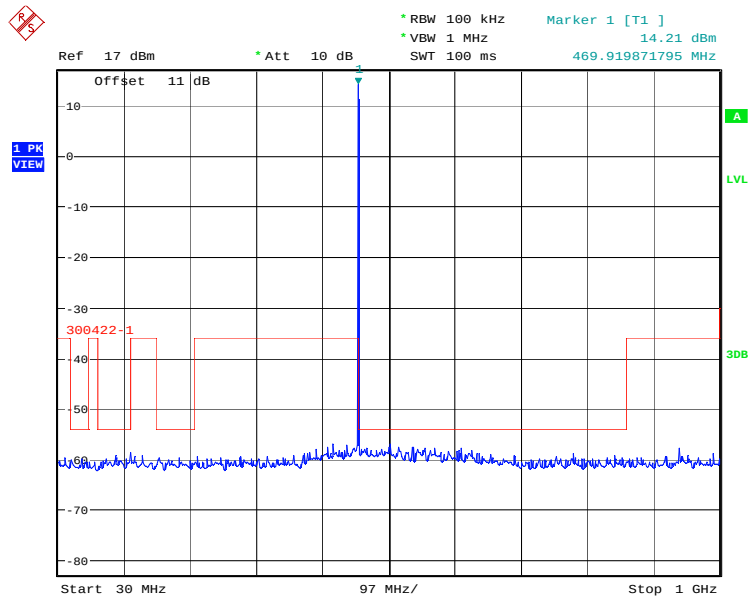
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

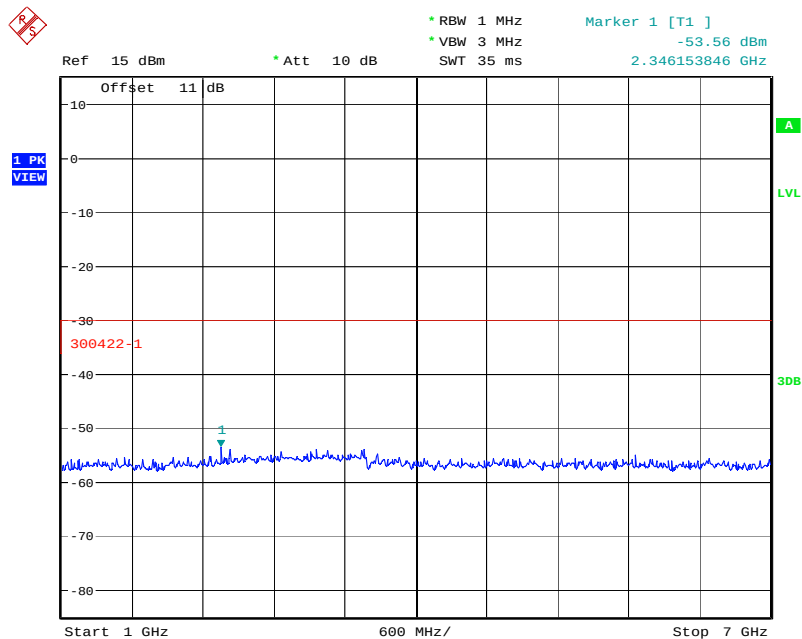
File #: 20Q5X071_F15C236

January 20, 2021

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



Date: 21.APR.2020 10:09:06



Date: 21.APR.2020 10:19:08

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

File #: 20Q5X071_F15C236

January 20, 2021

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

Ref 20 dBm Att 35 dB

Marker 1 [T1] -54.31 dBm

29.527243590 MHz

RBW 10 kHz

VBW 100 kHz

SWT 80 ms

1 PK VIEW

300422-1

Start 25 MHz 500 kHz/ Stop 30 MHz

Ref 17 dBm Att 10 dB RBW 100 kHz VBW 1 MHz SWT 100 ms Marker 1 [T1] 14.66 dBm 539.871794872 MHz

Offset 11 dB

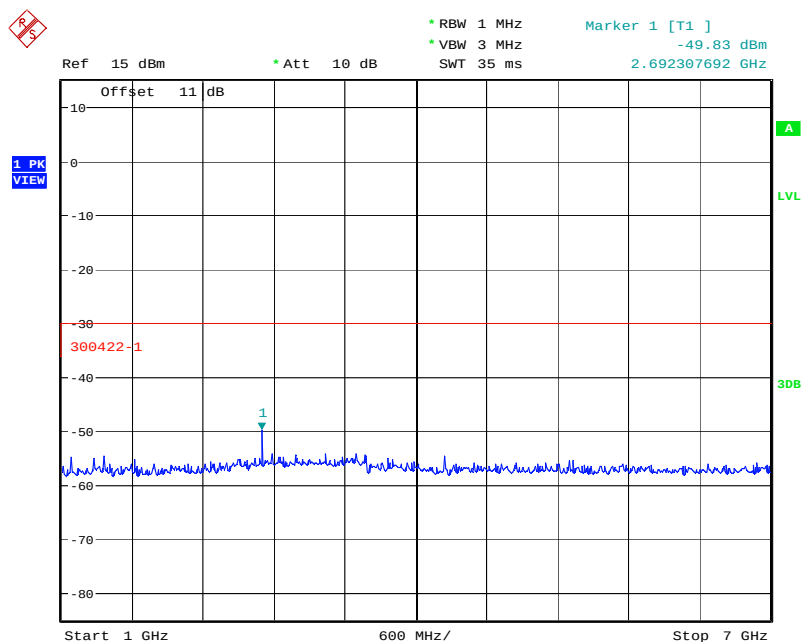
1 PK VIEW

300.422-1

Start 30 MHz 97 MHz/ Stop 1 GHz

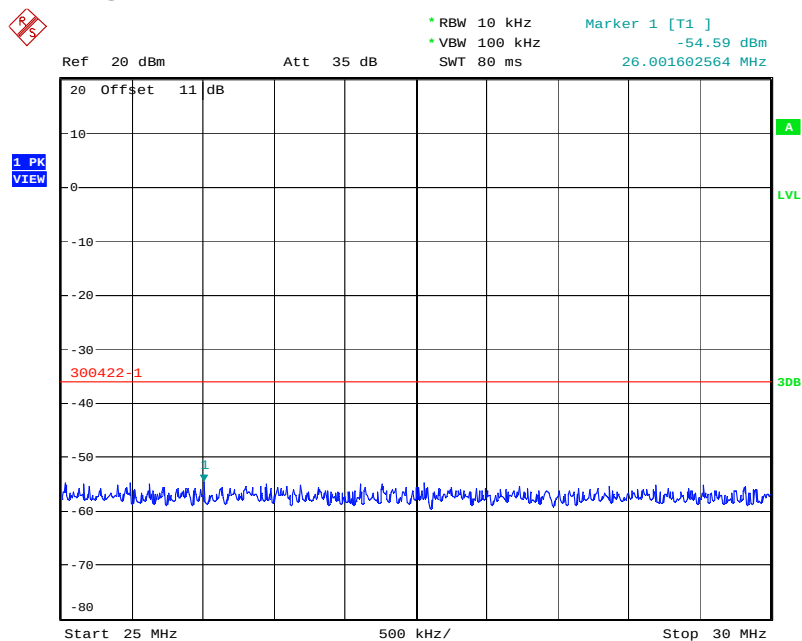
File #: 20Q5X071_F15C236
January 20, 2021

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



Date: 21.APR.2020 10:21:32

5.5.5.3. TX Conducted @ 607.975 MHz- High power



Date: 21.APR.2020 09:42:10

ULTRATECH GROUP OF LABS

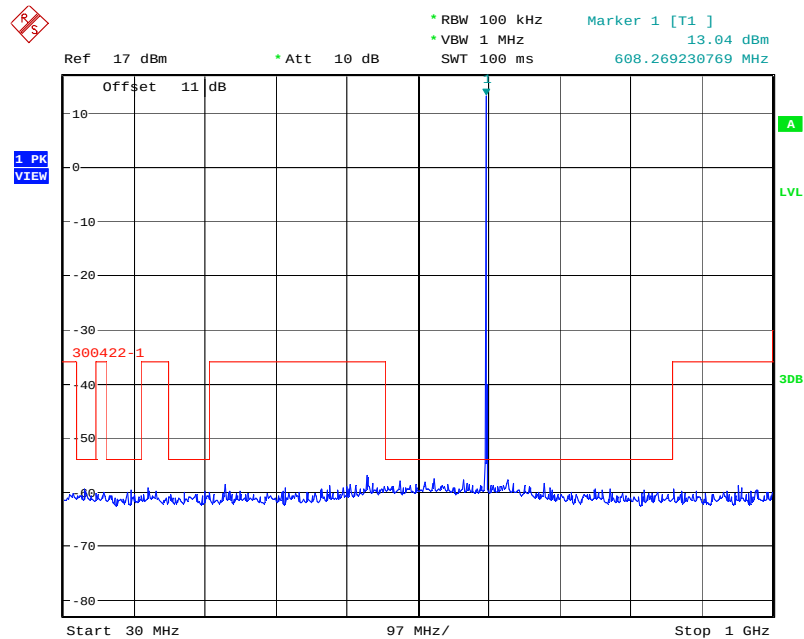
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

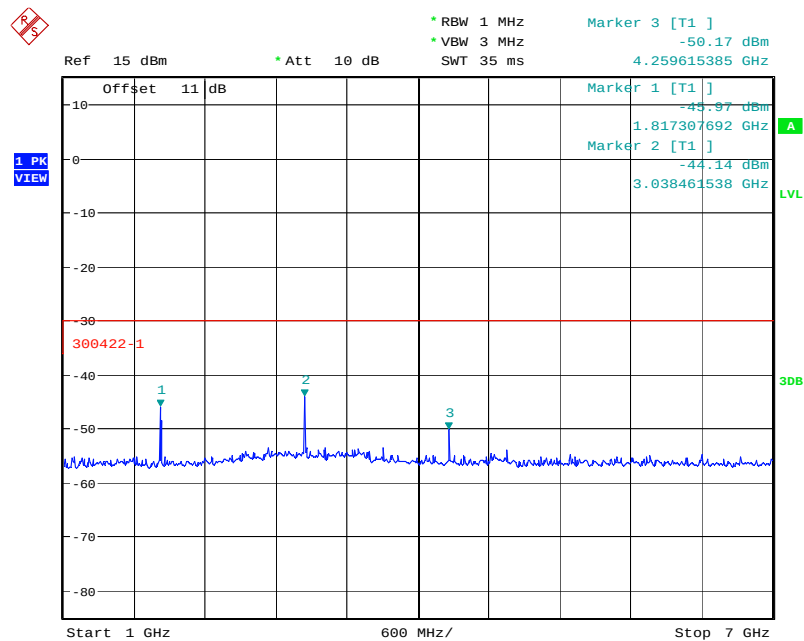
File #: 20Q5X071_F15C236

January 20, 2021

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



Date: 21.APR.2020 10:12:13



Date: 21.APR.2020 10:39:45

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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

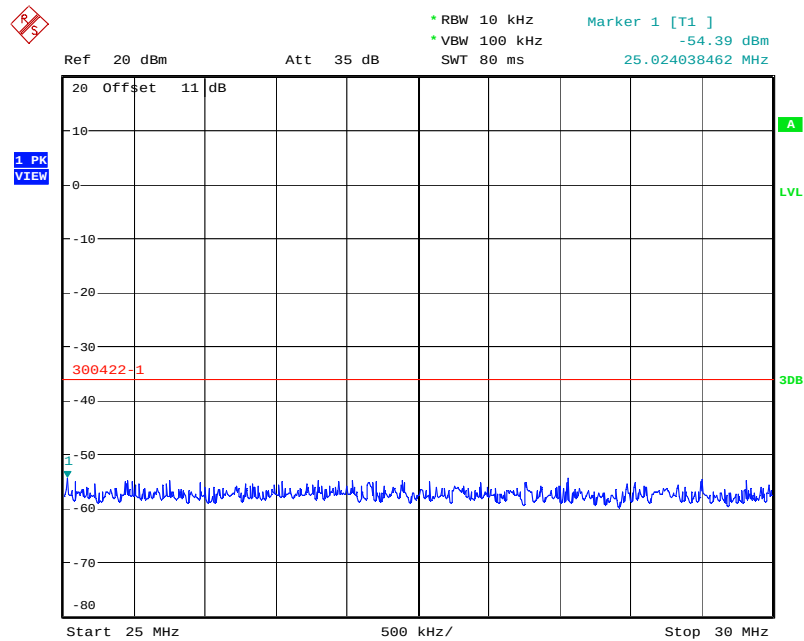
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 20Q5X071_F15C236

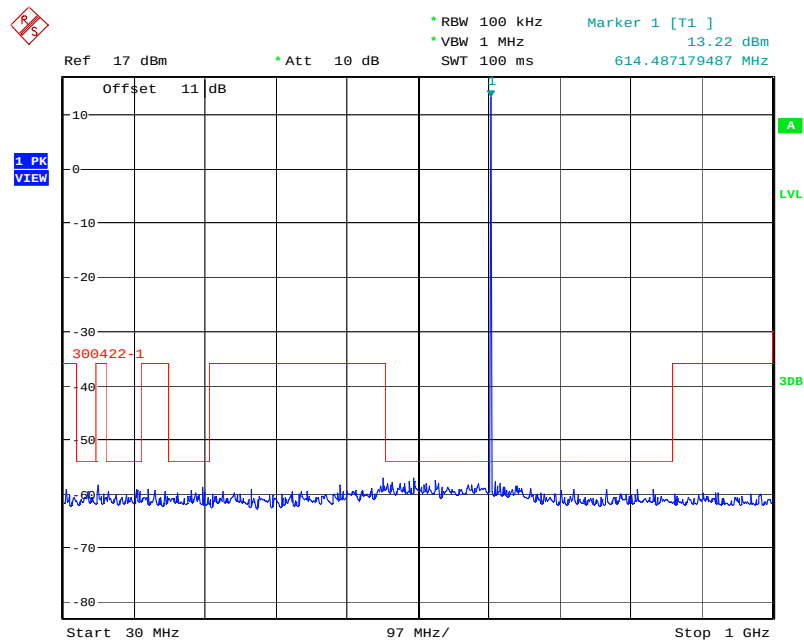
January 20, 2021

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

5.5.5.4. Tx Conducted @: 614.025 MHz- High power



Date: 21.APR.2020 09:43:38



Date: 21.APR.2020 10:13:15

ULTRATECH GROUP OF LABS

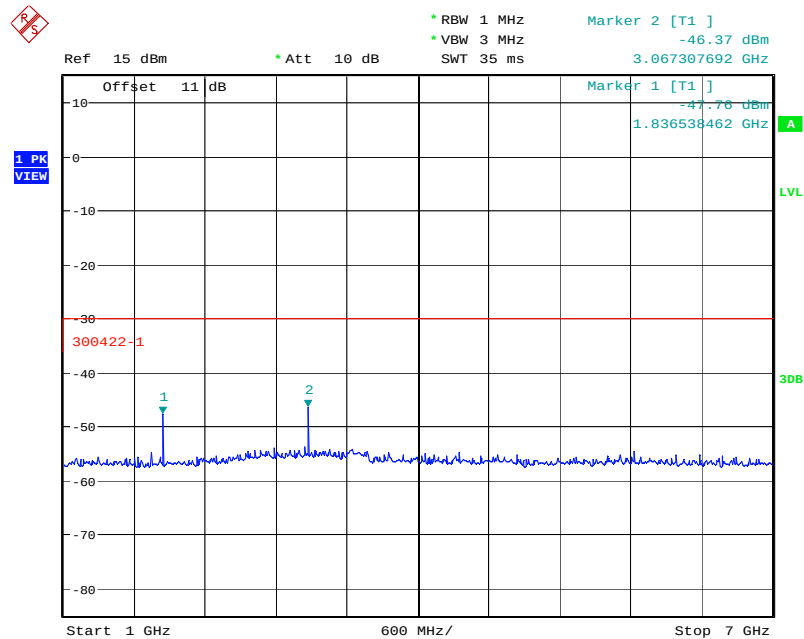
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

File #: 20Q5X071_F15C236

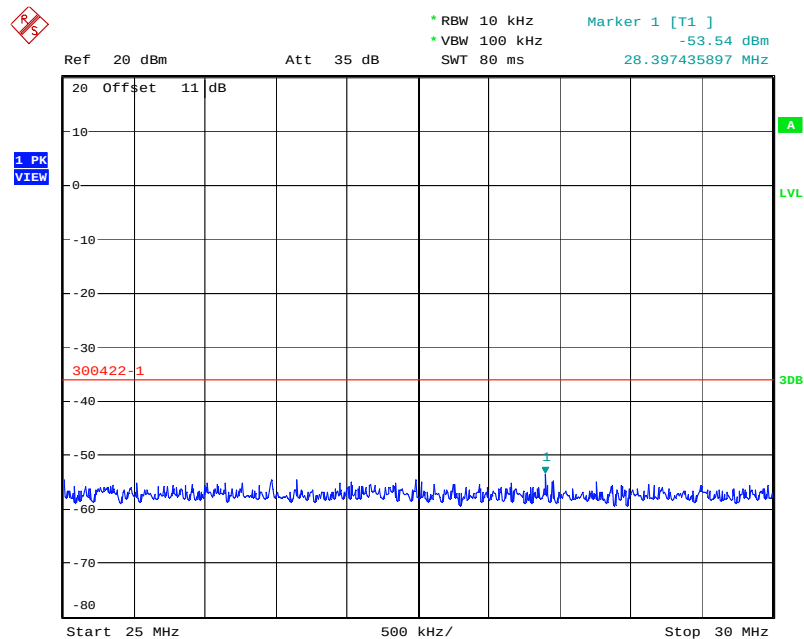
January 20, 2021

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



Date: 21.APR.2020 10:35:22

5.5.5.5. Tx Conducted @ 615.975 MHz- High power



Date: 21.APR.2020 09:44:47

ULTRATECH GROUP OF LABS

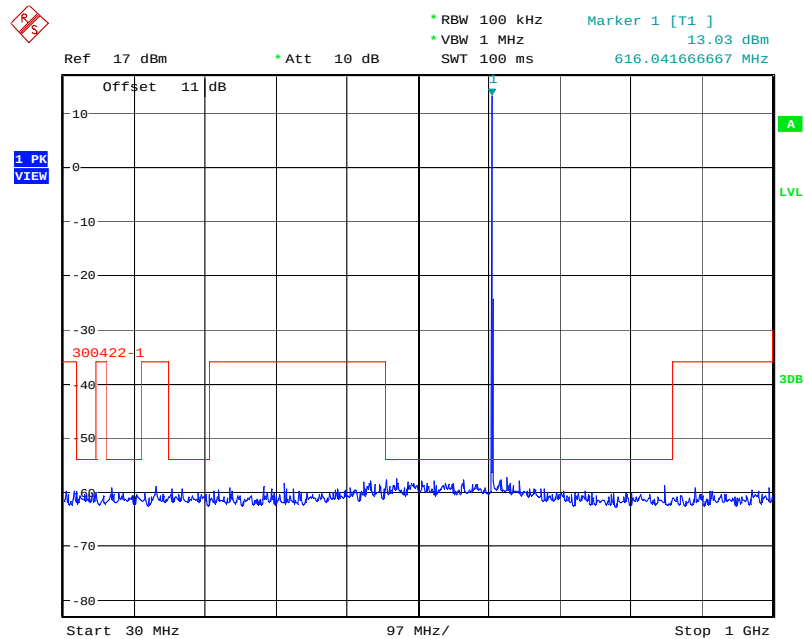
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

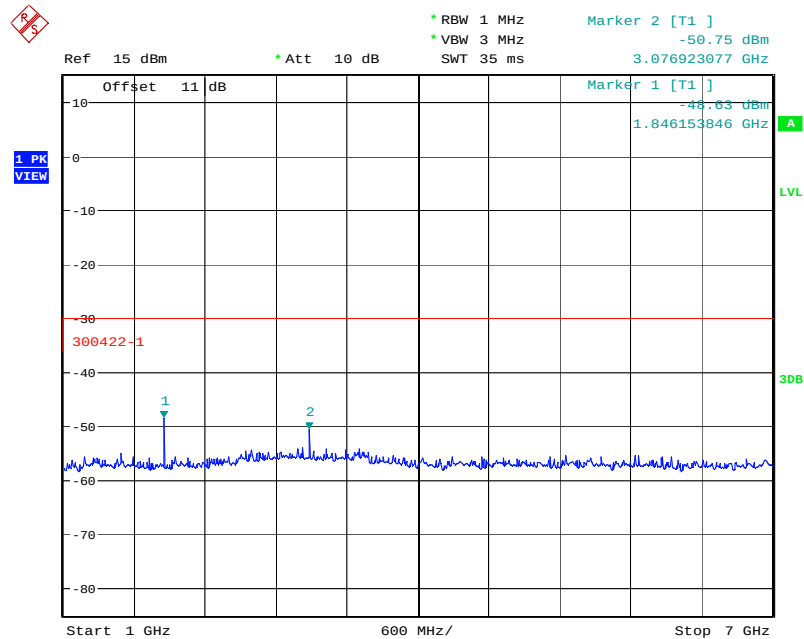
File #: 20Q5X071_F15C236

January 20, 2021

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



Date: 21.APR.2020 10:14:22



Date: 21.APR.2020 10:33:16

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>

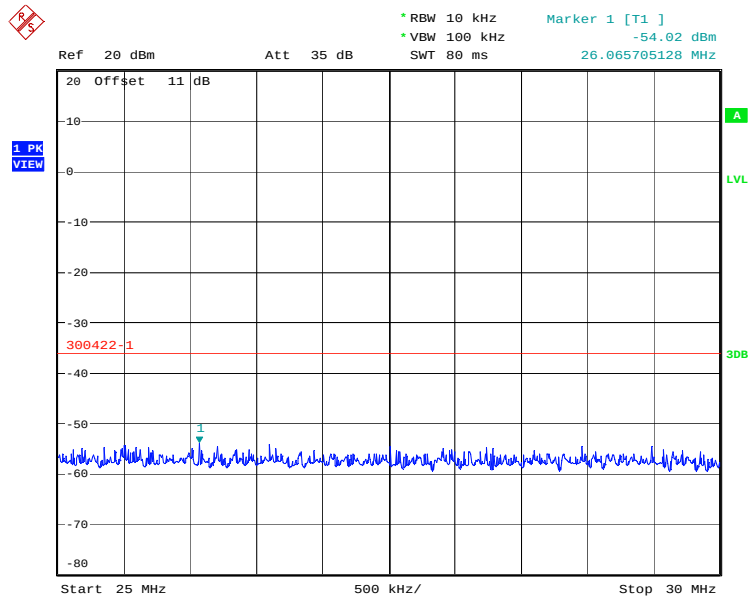
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January 20, 2021

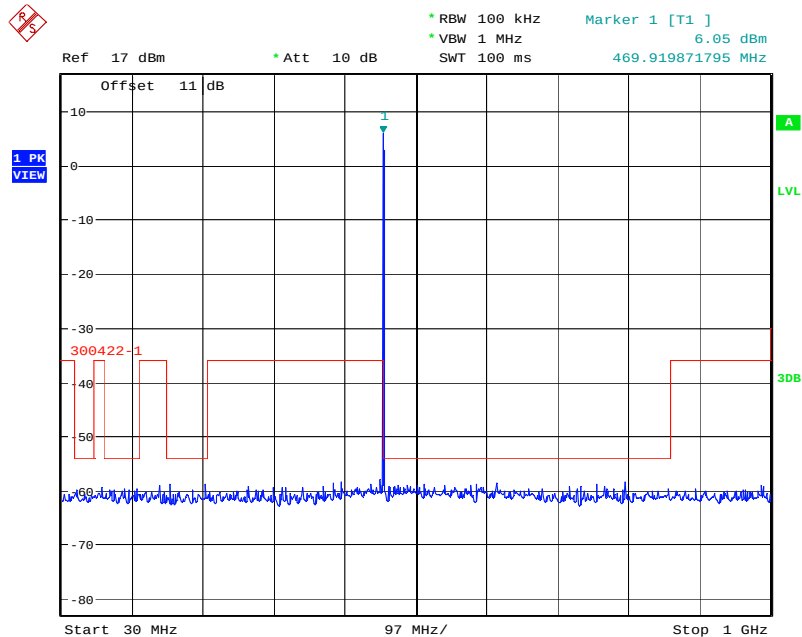
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

LOW POWER

5.5.5.6. Tx Conducted @ 470.15 MHz- Low power



Date: 21.APR.2020 09:49:24



Date: 21.APR.2020 09:58:26

ULTRATECH GROUP OF LABS

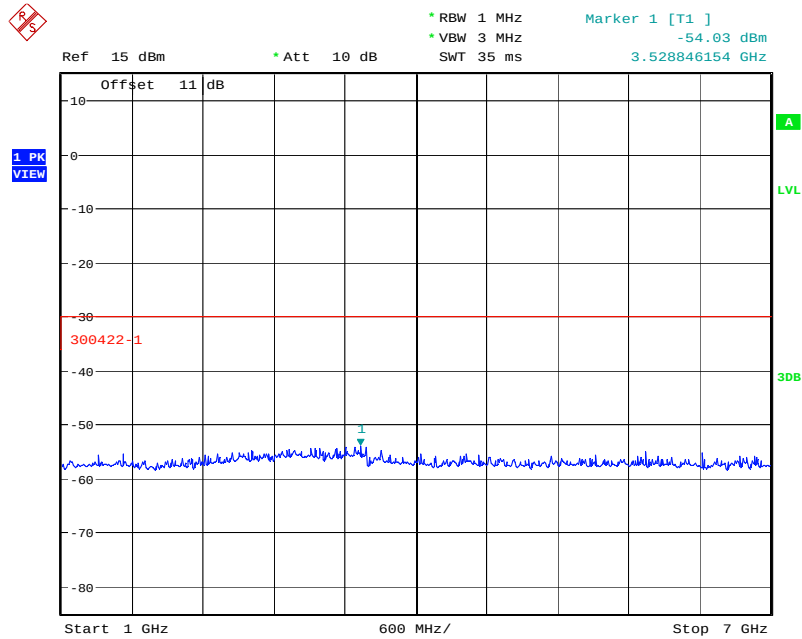
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

File #: 20Q5X071_F15C236

January 20, 2021

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



Date: 21.APR.2020 10:24:51

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

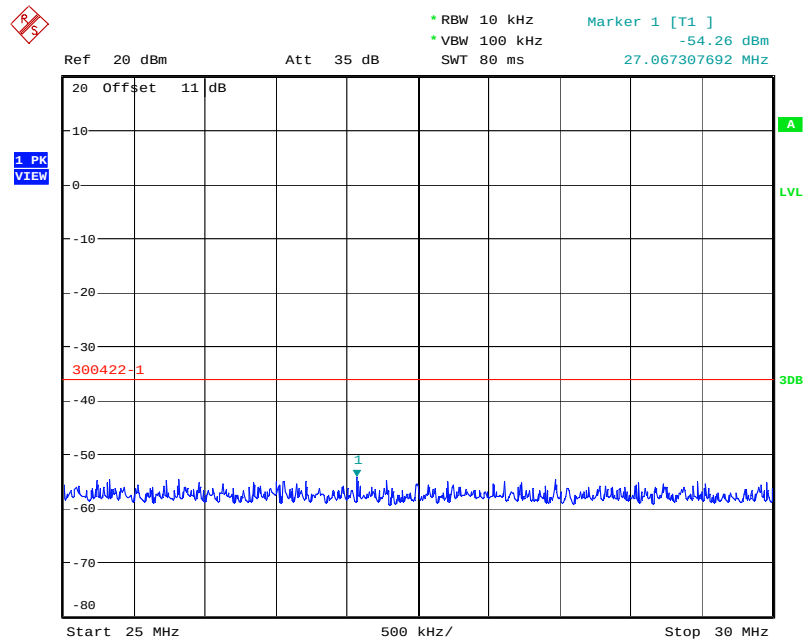
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 20Q5X071_F15C236

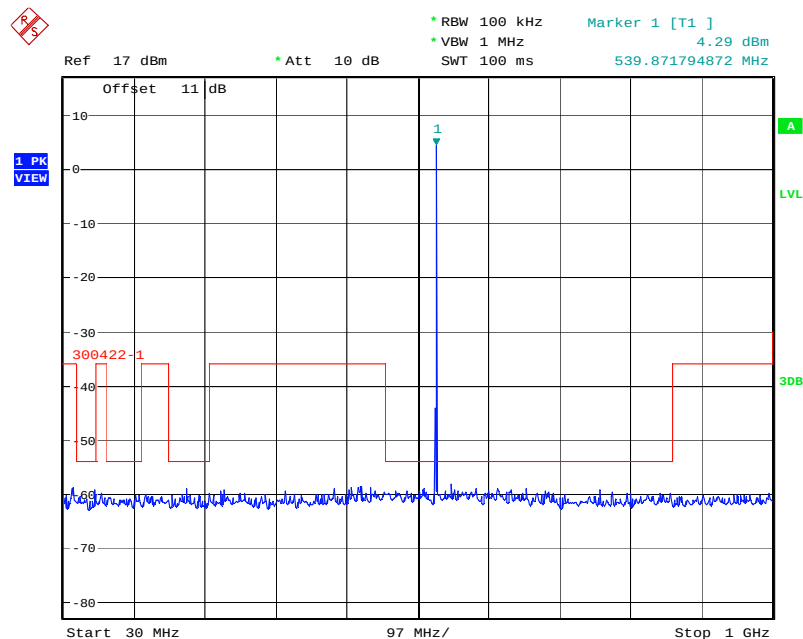
January 20, 2021

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

5.5.5.7. Tx Conducted@ 539 MHz-Low power



Date: 21.APR.2020 09:50:21



Date: 21.APR.2020 10:01:04

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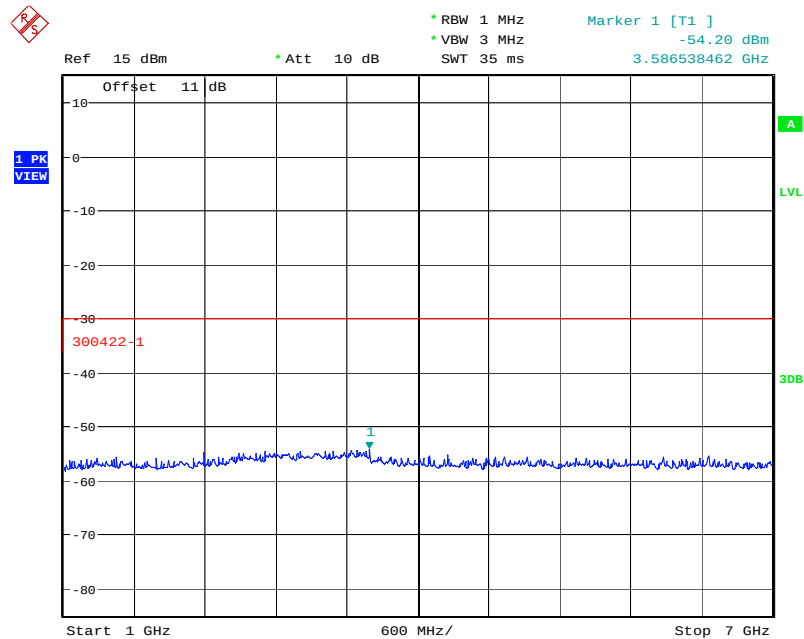
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

File #: 20Q5X071_F15C236

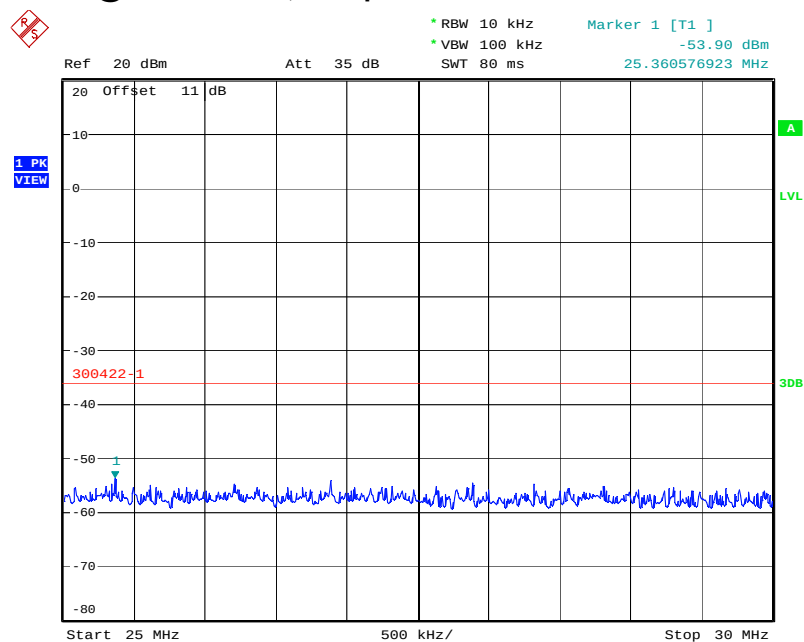
January 20, 2021

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



Date: 21.APR.2020 10:23:38

5.5.5.8. Tx Conducted @ 607.975 MHz, Low power



Date: 21.APR.2020 09:51:42

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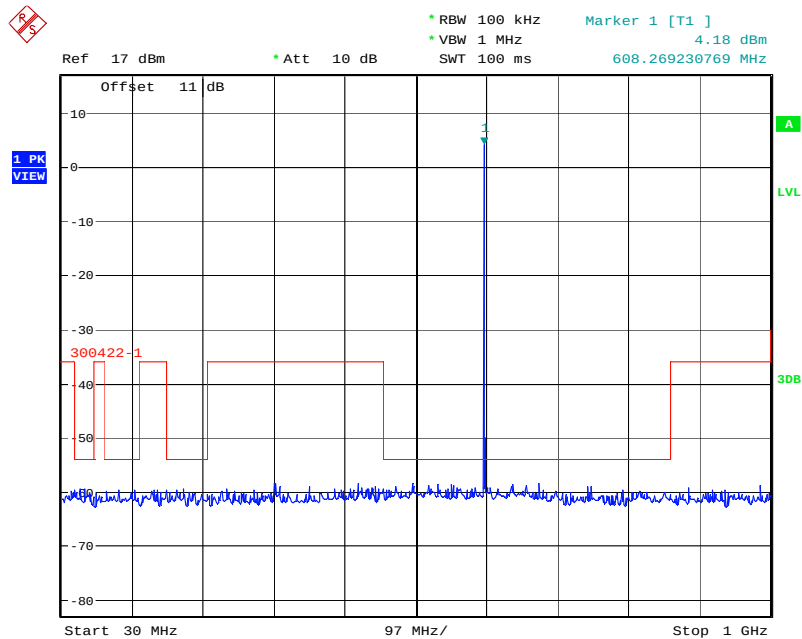
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

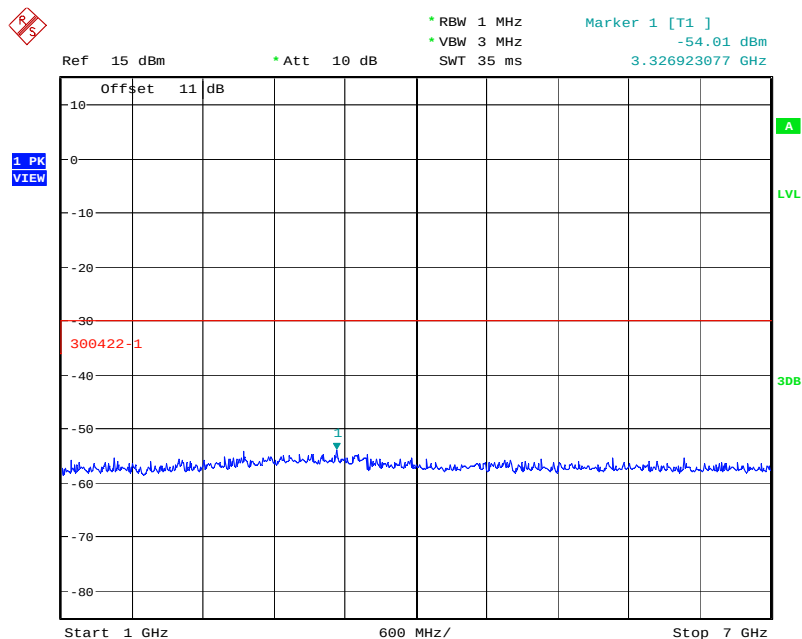
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January 20, 2021

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



Date: 21.APR.2020 10:03:31



Date: 21.APR.2020 10:27:10

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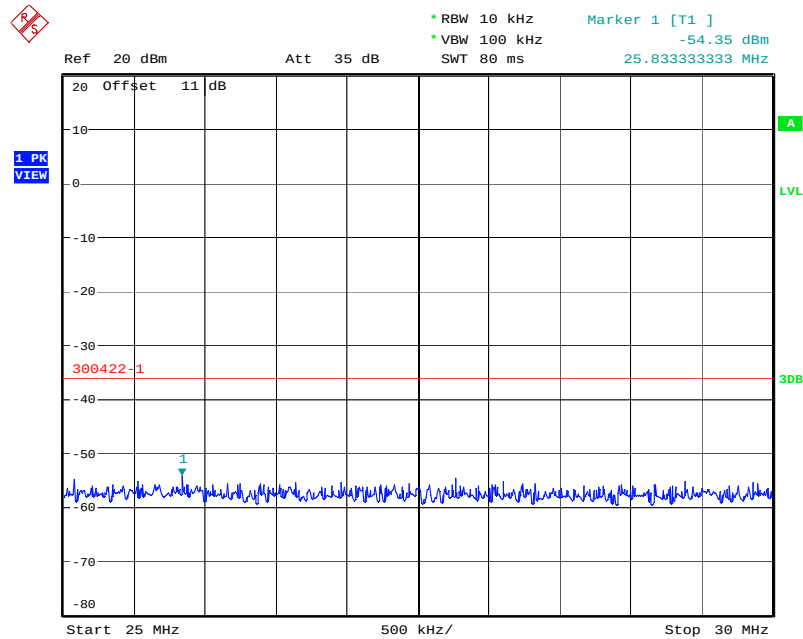
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 20Q5X071_F15C236

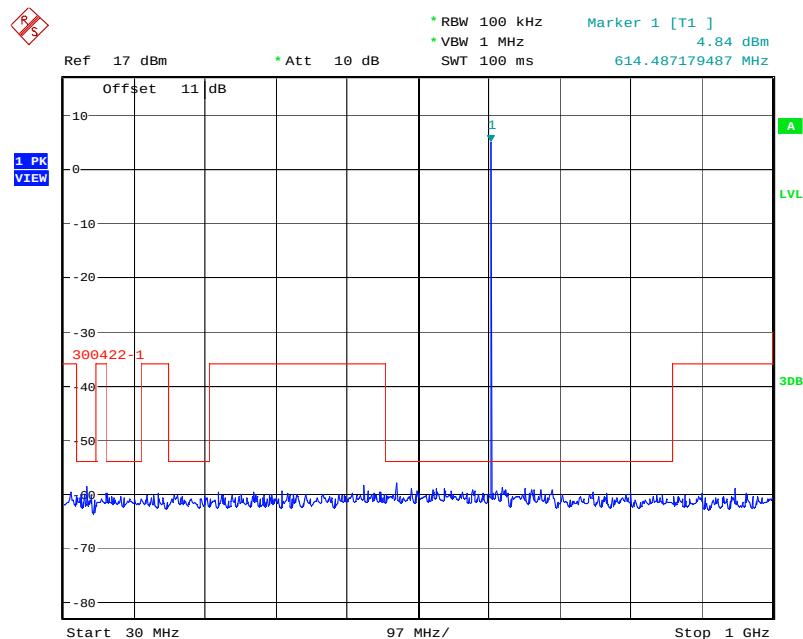
January 20, 2021

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

5.5.5.9. Tx Conducted @ 614.025 MHz, Low power



Date: 21.APR.2020 09:52:55



Date: 21.APR.2020 10:04:33

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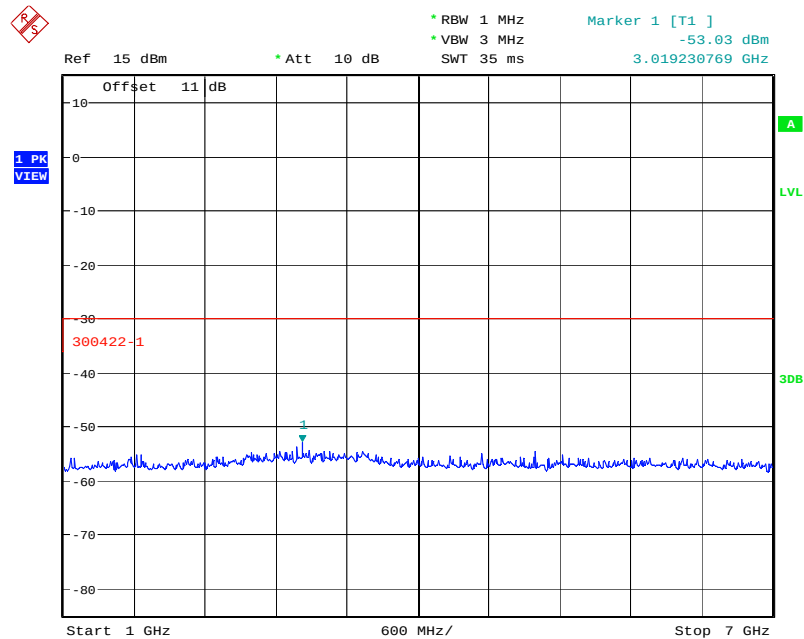
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

File #: 20Q5X071_F15C236

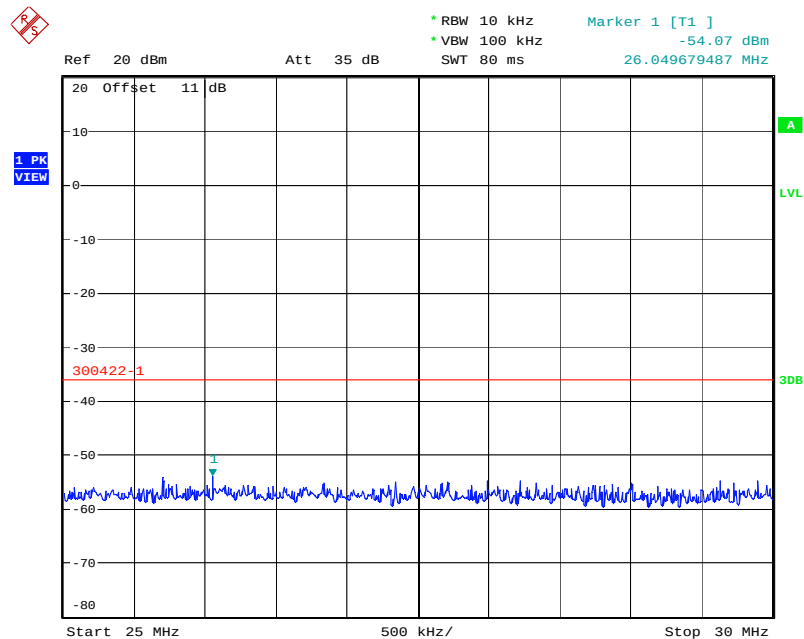
January 20, 2021

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



Date: 21.APR.2020 10:28:06

5.5.5.10. Tx Conducted @ 615.975 MHz- Low power



Date: 21.APR.2020 09:54:02

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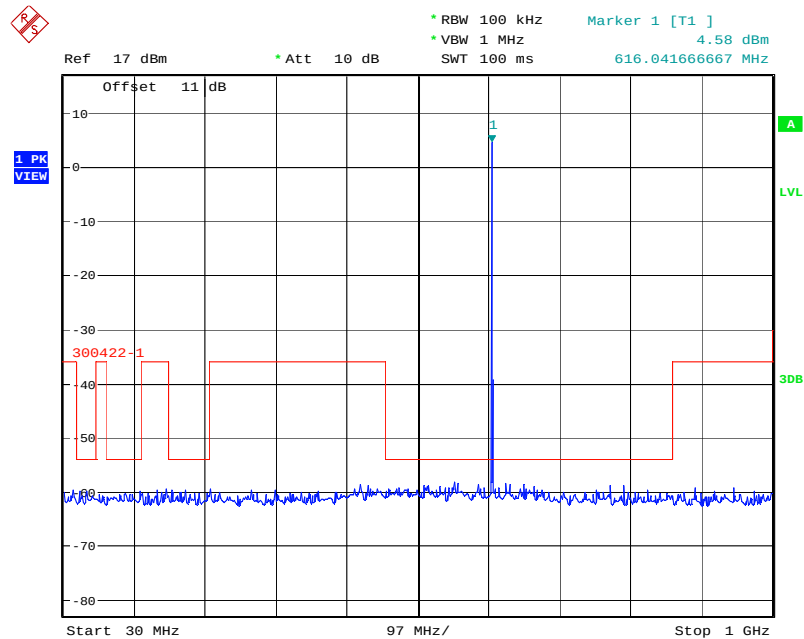
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

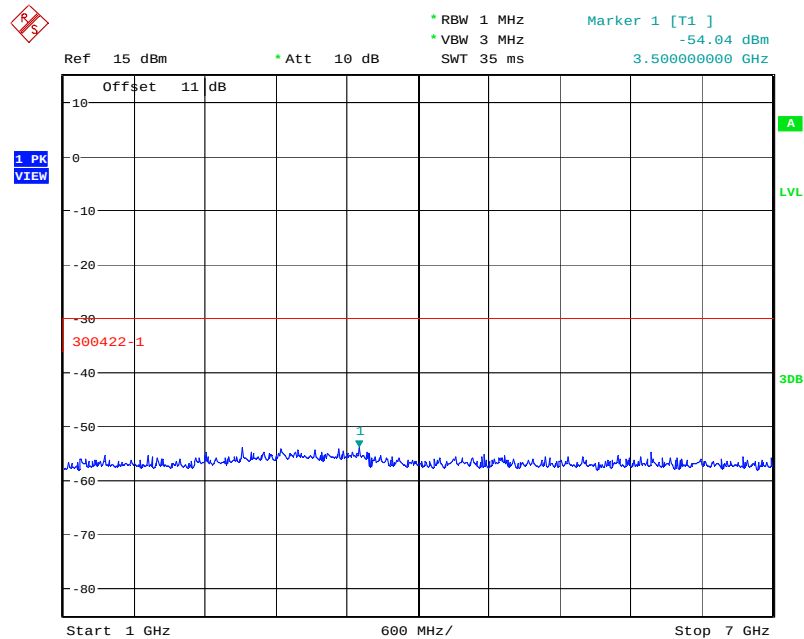
File #: 20Q5X071_F15C236

January 20, 2021

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Date: 21.APR.2020 10:06:11



Date: 21.APR.2020 10:29:22

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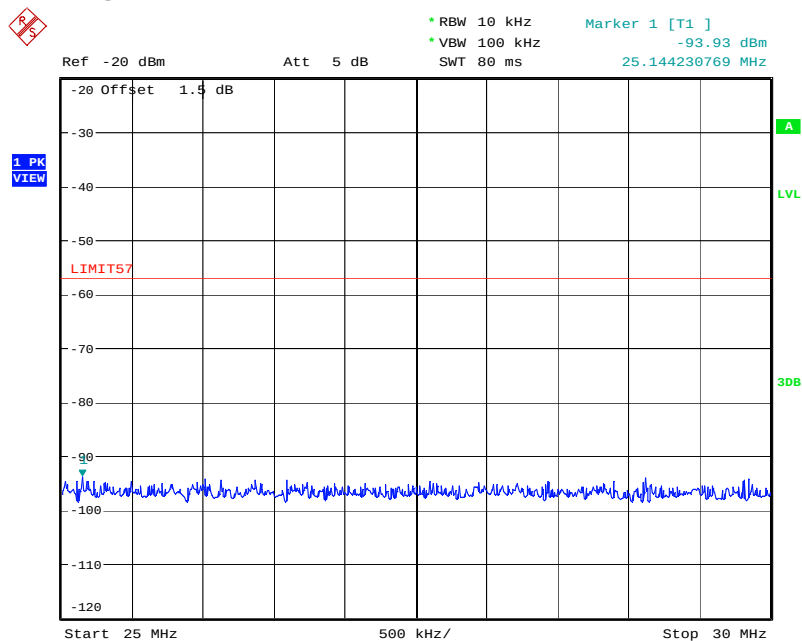
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 20Q5X071_F15C236

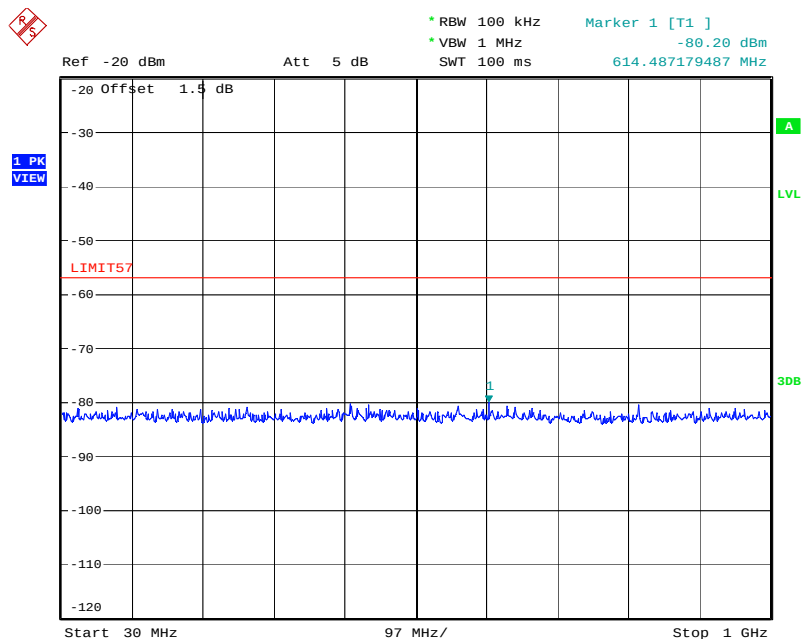
January 20, 2021

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

5.5.5.11. Tx Conducted @ Standby



Date: 21.APR.2020 11:17:13



Date: 21.APR.2020 11:17:59

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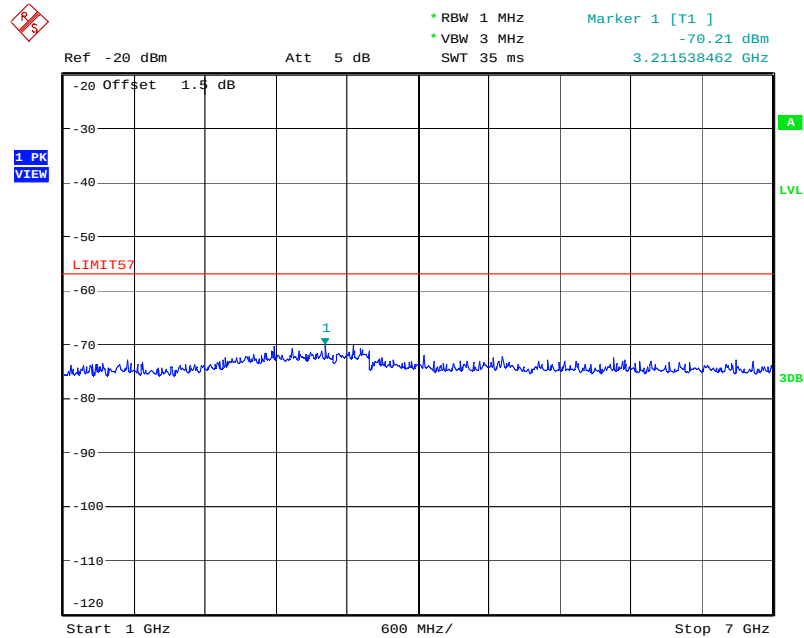
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

File #: 20Q5X071_F15C236

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Date: 21.APR.2020 11:19:10

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File #: 20Q5X071_F15C236

January 20, 2021

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5.6. TRANSMITTER SPURIOUS RADIATED EMISSIONS AT 3 METERS [§§ 15.236(g)]**5.6.1. Limit(s)**

Emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in § 8.3 of ETSI EN 300 422-1 V1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement. Emissions outside of this band shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 V1.4.2 (2011-08).

EN 300 422-1 V2.1.2 (2017-01) Table 3: Limit for spurious emissions

State \ Frequency	47 MHz to 74 MHz 87.5 MHz to 137 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies below 1 000 MHz	Frequencies above 1 000 MHz
TX mode	4 nW	250 nW	1 µW
RX and all other modes	2 nW	2 nW	20 nW

In dBµV/m@ 3m

State \ Frequency	47 MHz to 74 MHz 87.5 MHz to 137 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies below 1 000 MHz	Frequencies above 1 000 MHz
TX mode	41.2 dBµV/m	59.2 dBµV/m	65.2 dBµV/m
RX and all other modes	38.2 dBµV/m	38.2 dBµV/m	48.2 dBµV/m

5.6.2. Method of Measurements

ETSI EN 300 422-1 V1.4.2

5.6.3. Test Equipment

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
EMI Receiver	Rohde & Schwarz	ESU40	100037	20Hz–40 GHz	Mar 15, 2020
Spectrum Analyzer	Rohde & Schwarz	FSU26	200946	20Hz–26.5 GHz	Jul 25, 2020
RF Amplifier	Com-Power	PAM-0118A	551052	0.5 – 18 GHz	Jul 24, 2020
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	Jan 7, 2021
Loop antenna	Emco	6502	9104-2611	9 kHz – 30 MHz	Jan 24, 2022
Biconilog	Emco	3142B	1575	26-2000 MHz	May 10, 2020
Horn Antenna	Emco	3155	6570	1 – 18 GHz	Oct 11, 2020
DC Power Supply	HQ Power	PS613U	NSN	0 – 30V 3A	Cal on use
Multi-meter	Fluke	8842A	4142058	20mV - 1kV	Sep 5, 2020

Test Date: February 25, 2020

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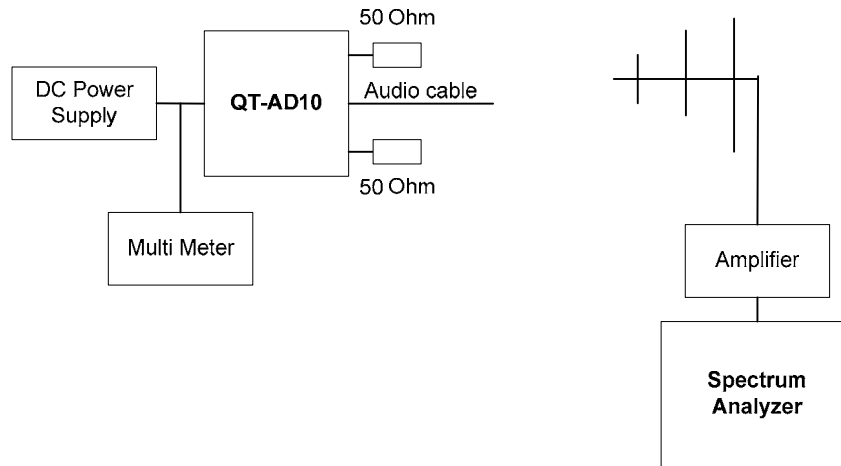
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

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

File #: 20Q5X071_F15C236

January 20, 2021

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5.6.4. Test Arrangement**5.6.5. Test Data****Remark(s):**

- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT shall be tested in three orthogonal positions.
- The following test results at high power setting to represent the worst-case.

Fundamental Frequency:	470.150 MHz
Frequency Test Range:	30 MHz – 4 GHz
All spurious emissions and harmonics are more than 20 dB below the applicable limit.	

Fundamental Frequency:	539.000 MHz
Frequency Test Range:	30 MHz – 4 GHz
All spurious emissions and harmonics are more than 20 dB below the applicable limit.	

Fundamental Frequency:	607.975 MHz
Frequency Test Range:	30 MHz – 4 GHz
All spurious emissions and harmonics are more than 20 dB below the applicable limit.	

Fundamental Frequency:	614.025 MHz
Frequency Test Range:	30 MHz – 4 GHz
All spurious emissions and harmonics are more than 20 dB below the applicable limit.	

Fundamental Frequency:	615.975 MHz
Frequency Test Range:	30 MHz – 4 GHz
All spurious emissions and harmonics are more than 20 dB below the applicable limit.	

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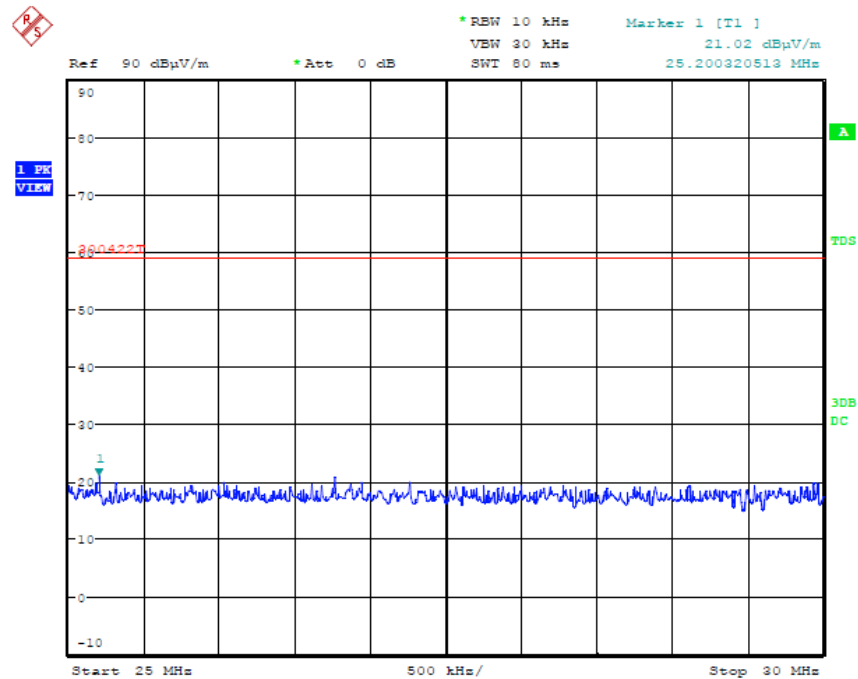
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 20Q5X071_F15C236
 January 20, 2021

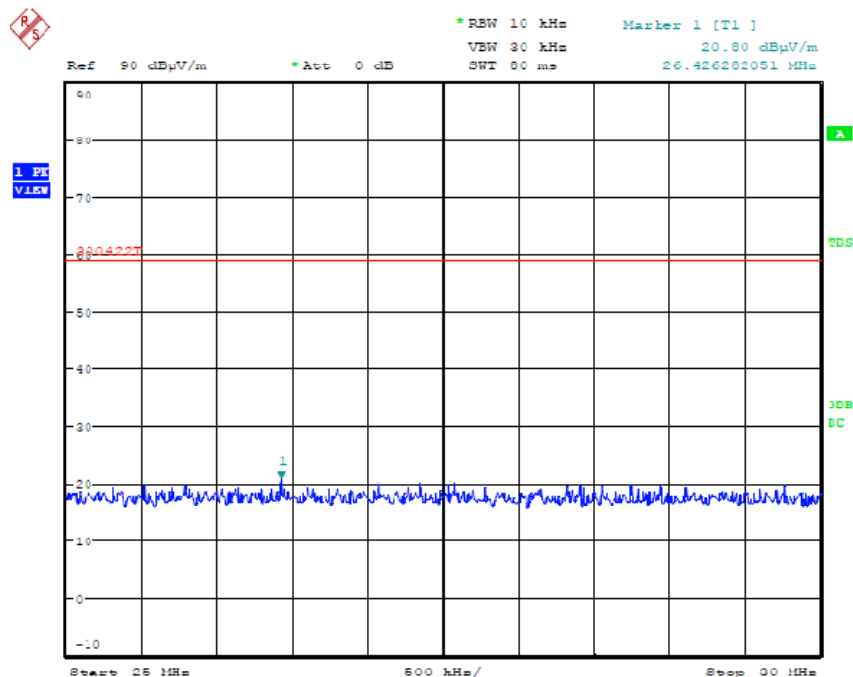
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Note: The module has a 2.4GHz DTS radio next to the UHF microphone radio being tested and this intentional signal will be displayed in the plots below

5.6.5.1. 470.150 MHz Tx Radiated 25-30 MHz @ 3m-Vertical



5.6.5.2. 470.150 MHz Tx Radiated 25-30 MHz @ 3m-Horizontal



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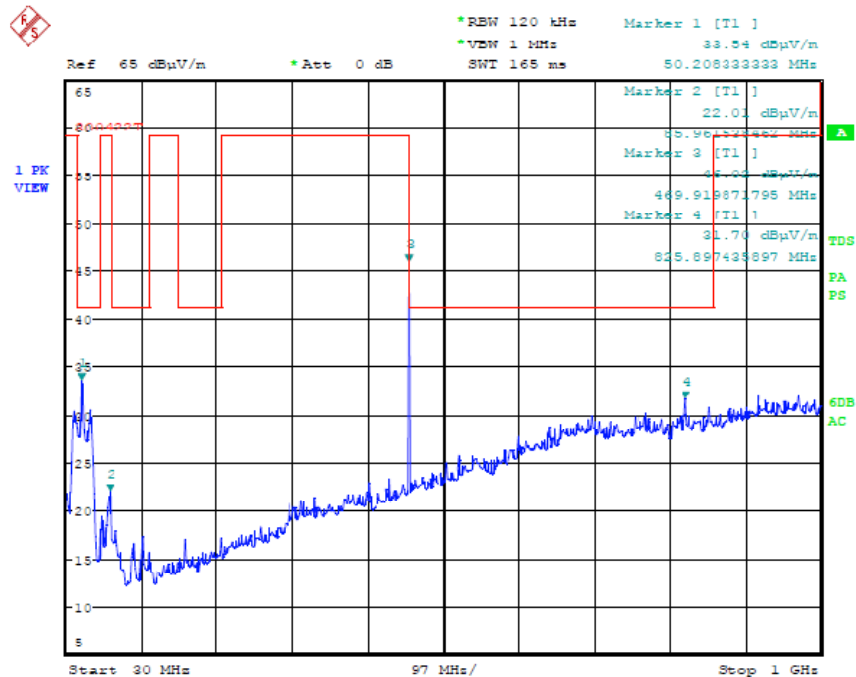
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 20Q5X071_F15C236

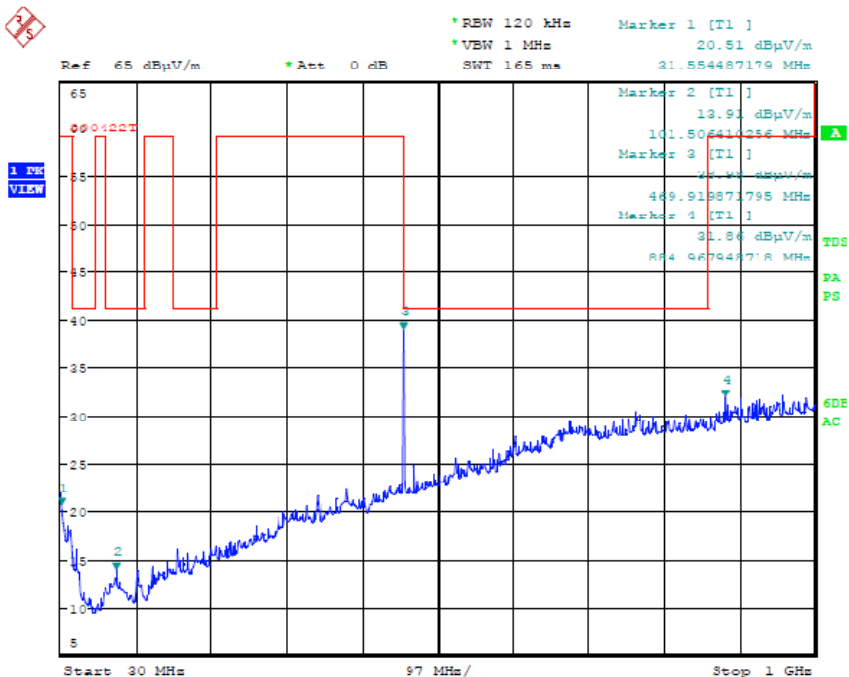
January 20, 2021

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

5.6.5.3. 470.150 MHz Tx Radiated 30-1000 MHz @ 3m-Vertical



5.6.5.4. 470.150 MHz Tx Radiated 30-1000 MHz @ 3m-Horizontal



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File #: 20Q5X071_F15C236

January 20, 2021

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

1. PG VIEW

Ref 80 dBmV/m *Att 0 dB *RBW 1 MHz Marker 1 [T1] 61.09 dBmV/m
 *VSW 3 MHz SWT 20 ms 2.480769231 GHz

80
 75
 70
 65
 60
 55
 50
 45
 40
 35
 30
 25
 20

Start 1 GHz 300 MHz/ Stop 4 GHz

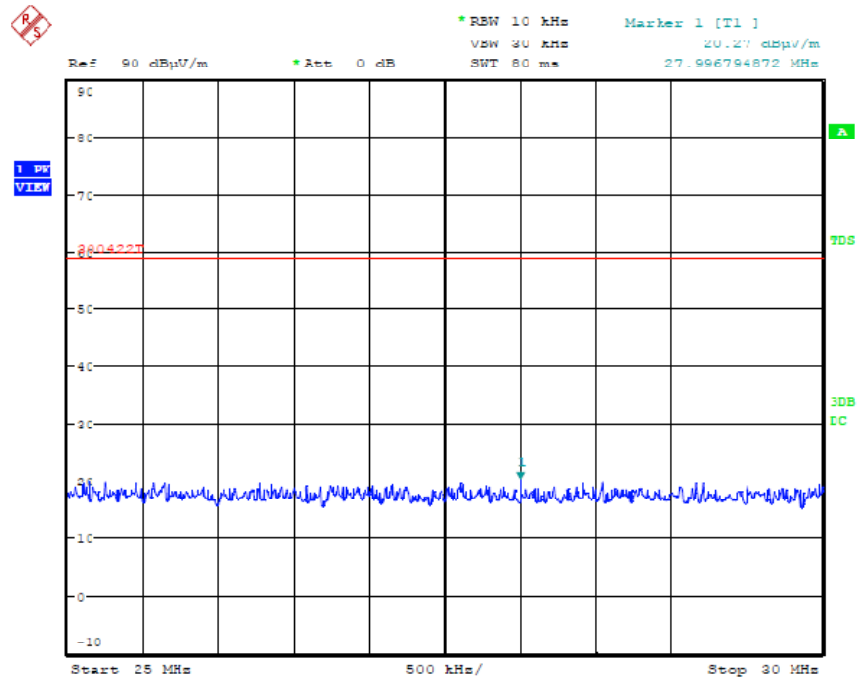
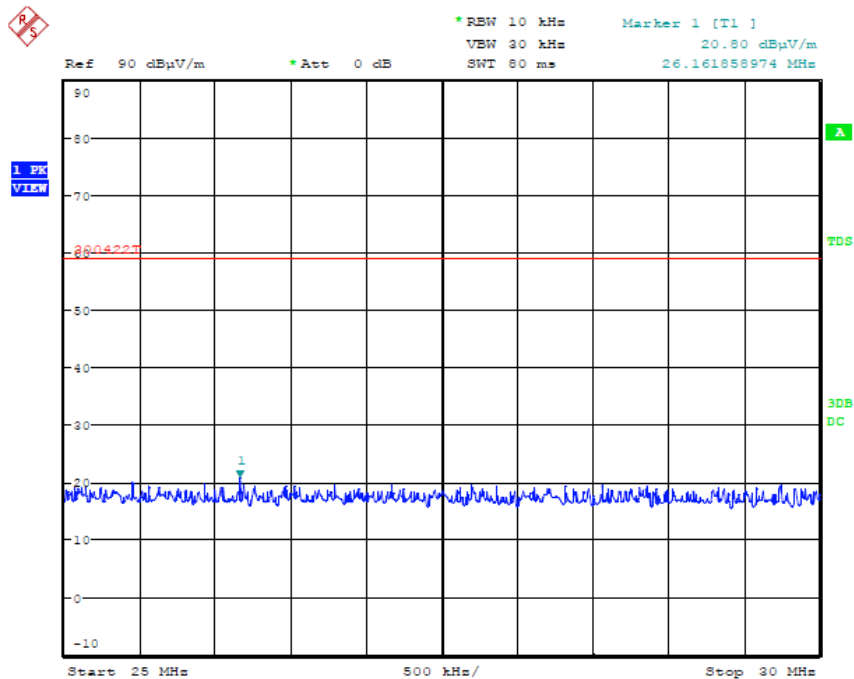
Ref 60 dBuV/m * Att 0 dB * RBW 1 MHz * VBW 3 MHz SWI 20 ms Marker 1 [T1] 59.29 dBuV/m 2.480769231 GHz

1 PK VIEW

60dB AC

TDS

Start 1 GHz 300 MHz/ Stop 4 GHz

5.6.5.7. 539.000 MHz Tx Radiated 25-30 MHz @ 3m-Vertical**5.6.5.8. 539.000 MHz Tx Radiated 25-30 MHz @ 3m-Horizontal****ULTRATECH GROUP OF LABS**

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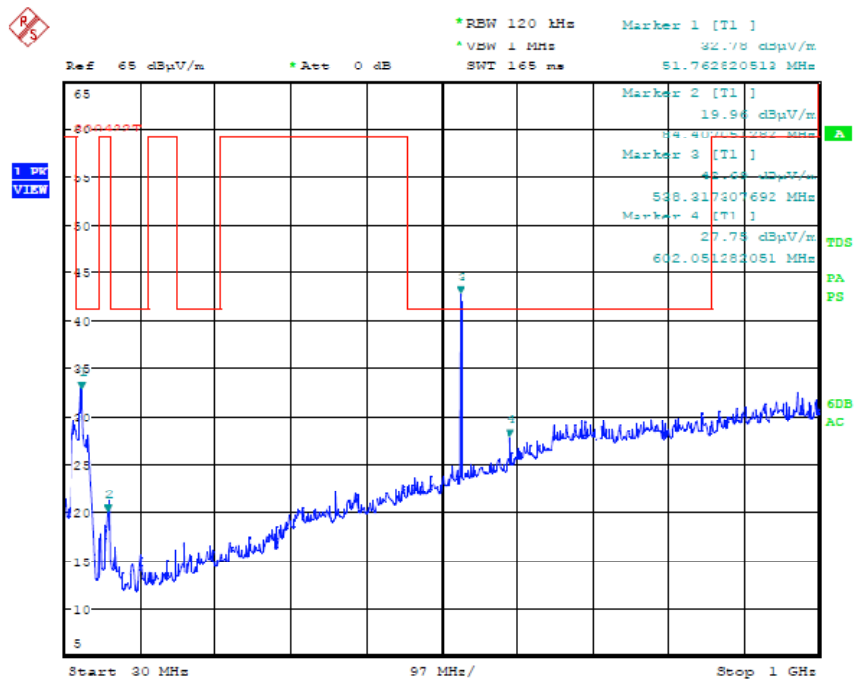
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 20Q5X071_F15C236

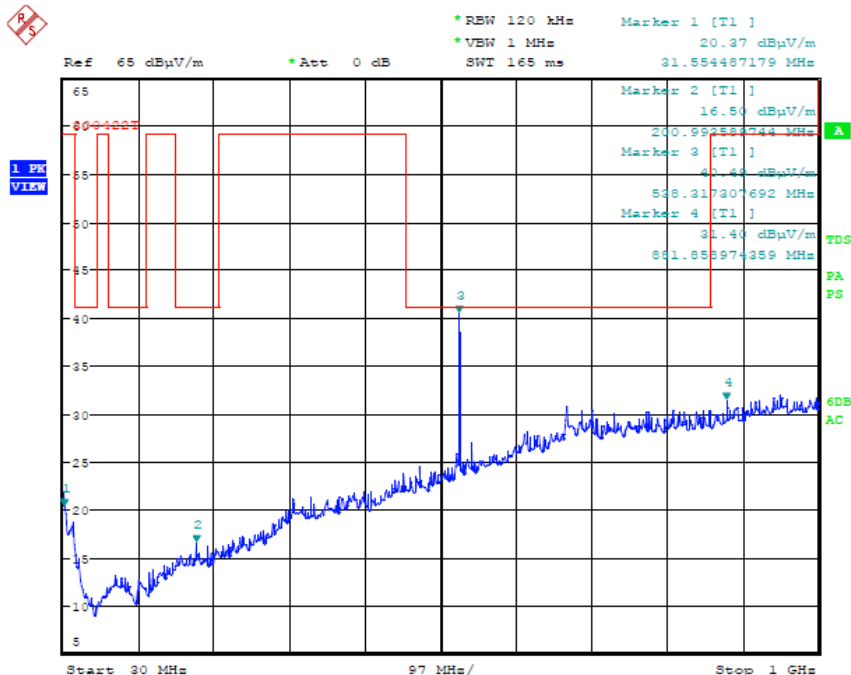
January 20, 2021

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

5.6.5.9. 539.000 MHz Tx Radiated 30-1000 MHz @ 3m-Vertical



5.6.5.10. 539.000 MHz Tx Radiated 30-1000 MHz @ 3m-Horizontal



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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

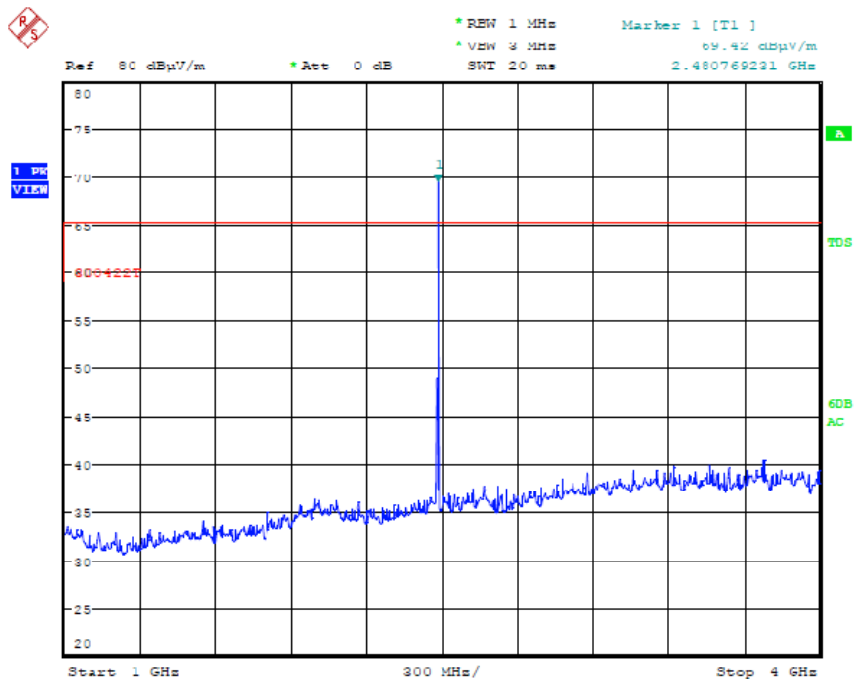
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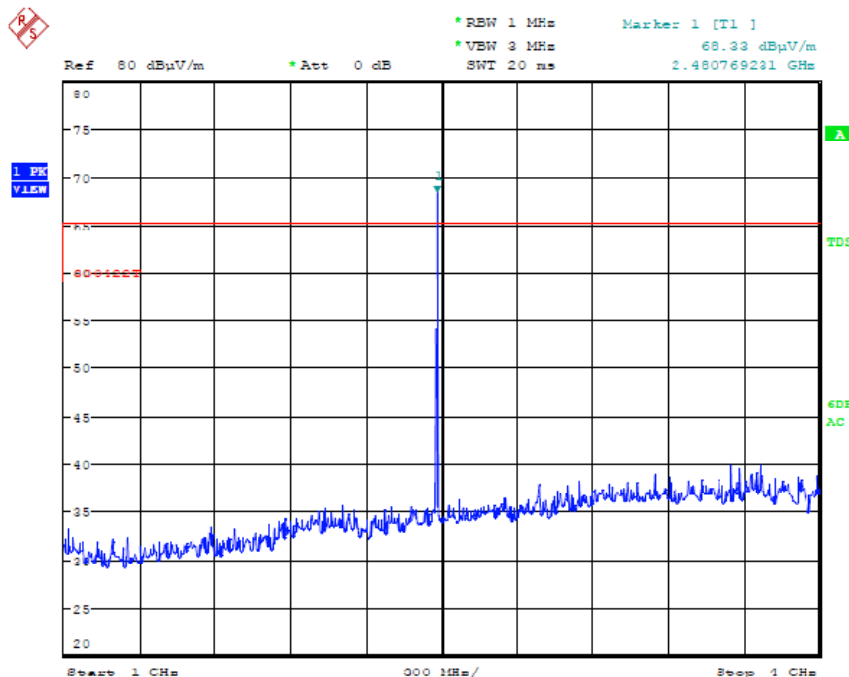
January 20, 2021

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

5.6.5.11. 539.000 MHz Tx Radiated 1-4GHz @ 3m-Vertical



5.6.5.12. 539.000 MHz Tx Radiated 1-4GHz @ 3m- Horizontal



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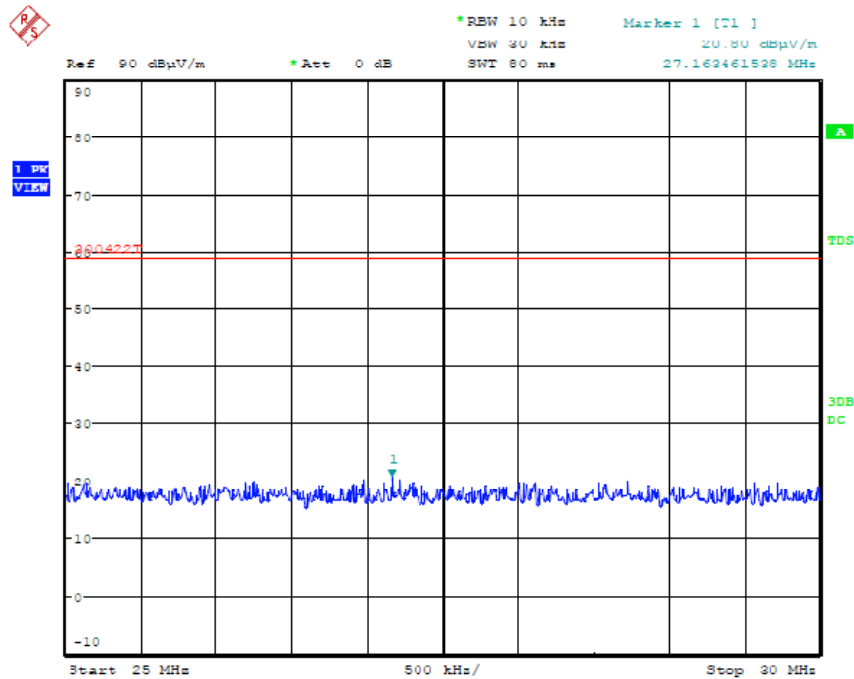
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 20Q5X071_F15C236

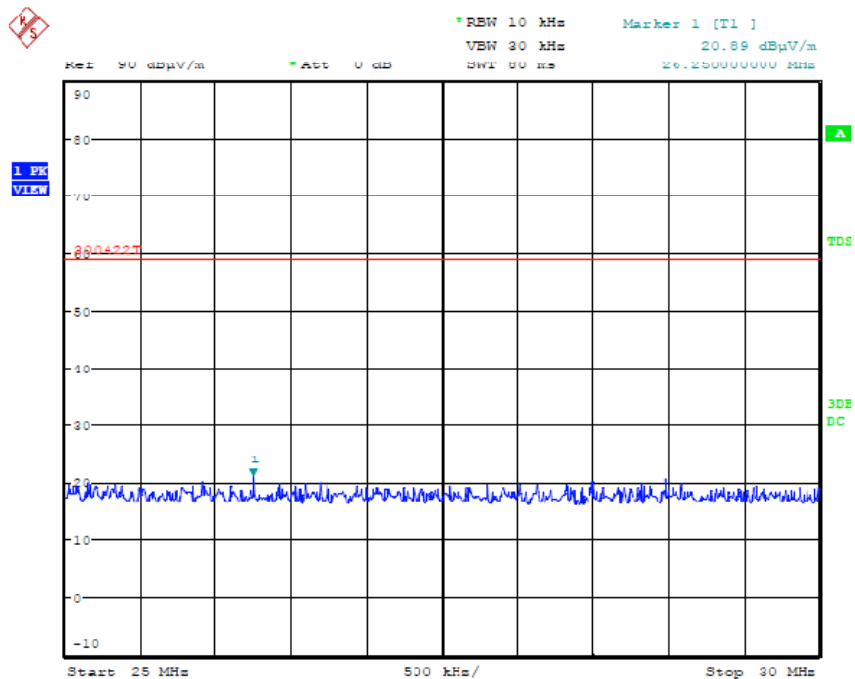
January 20, 2021

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

5.6.5.13. 607.975MHz Tx Radiated 25-30 MHz @ 3m-Vertical



5.6.5.14. 607.975MHz Tx Radiated 25-30 MHz @ 3m-Horizontal



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File #: 20Q5X071_F15C236

January 20, 2021

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

Ref 65 dBuV/m *Att 0 dB SWI 168 ms 51.762820813 MHz

*RBW 120 kHz Marker 1 [T1]
 *VBW 1 MHz 22.79 dBuV/m
 84.40705283 MHz
 Marker 2 [T1]
 20.04 dBuV/m
 64.40705283 MHz
 Marker 3 [T1]
 68.21 dBuV/m
 608.269230769 MHz
 Marker 4 [T1]
 31.60 dBuV/m
 912.948717949 MHz

1 PK VIEW

Start 30 MHz 97 MHz/ Stop 1 GHz

TDS PA PS 6DB AC

*RBW 120 MHz
 *VBW 1 MHz
 *Att 0 dB
 *SWT 165 ns

Marker 1 [TL]
 18.81 dBμV/m
 24.662461528 MHz

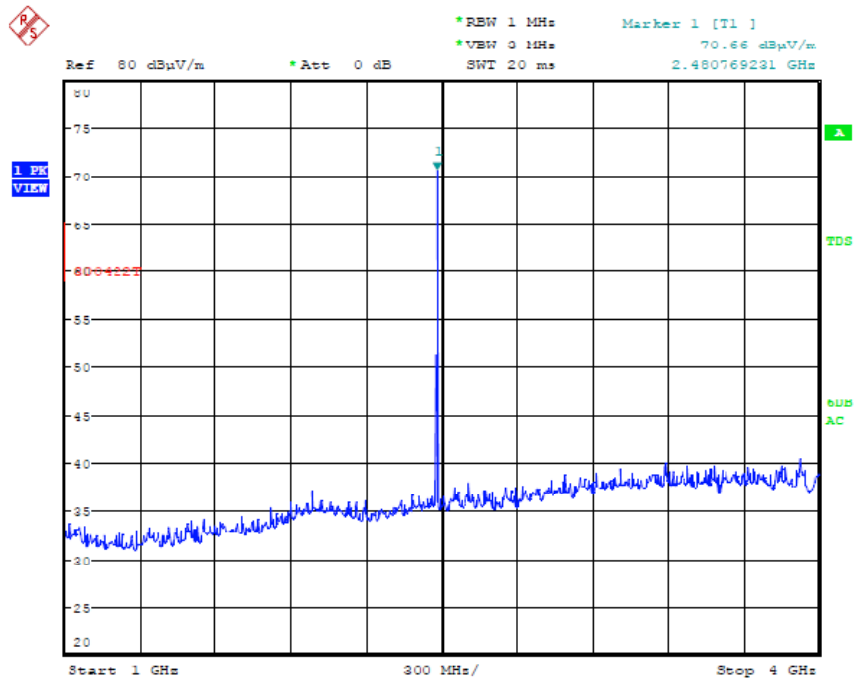
Marker 2 [TL]
 22.93 dBμV/m
 33.802431214 MHz

Marker 3 [TL]
 53.22 dBμV/m
 608.269230769 MHz

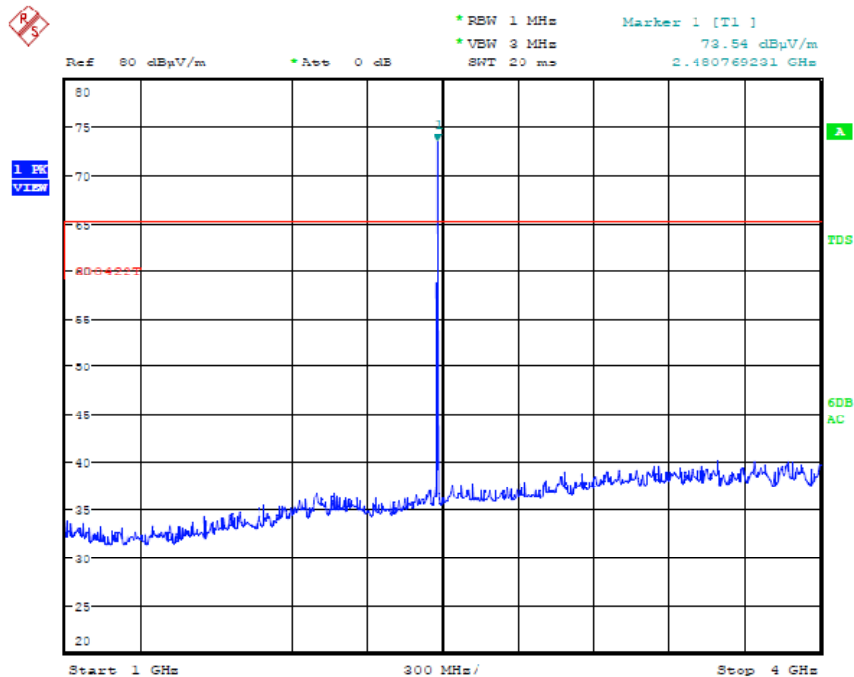
Marker 4 [TL]
 31.11 dBμV/m
 766.828923077 MHz

Start 30 MHz
 97 MHz/
 Stop 1 GHz

5.6.5.17. 607.975MHz Tx Radiated 1-4GHz @ 3m-Vertical



5.6.5.18. 607.975MHz Tx Radiated 1-4GHz @ 3m- Horizontal



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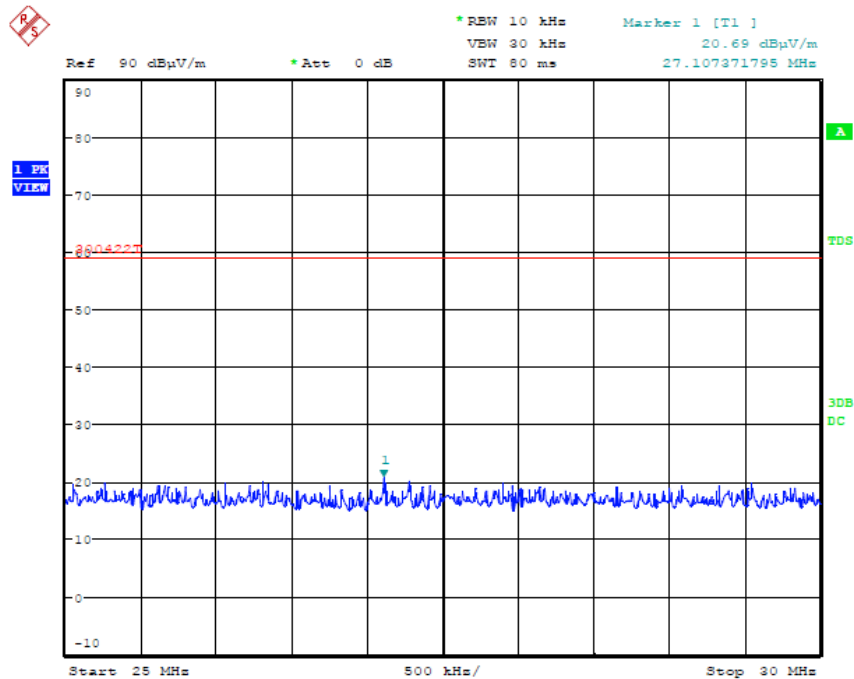
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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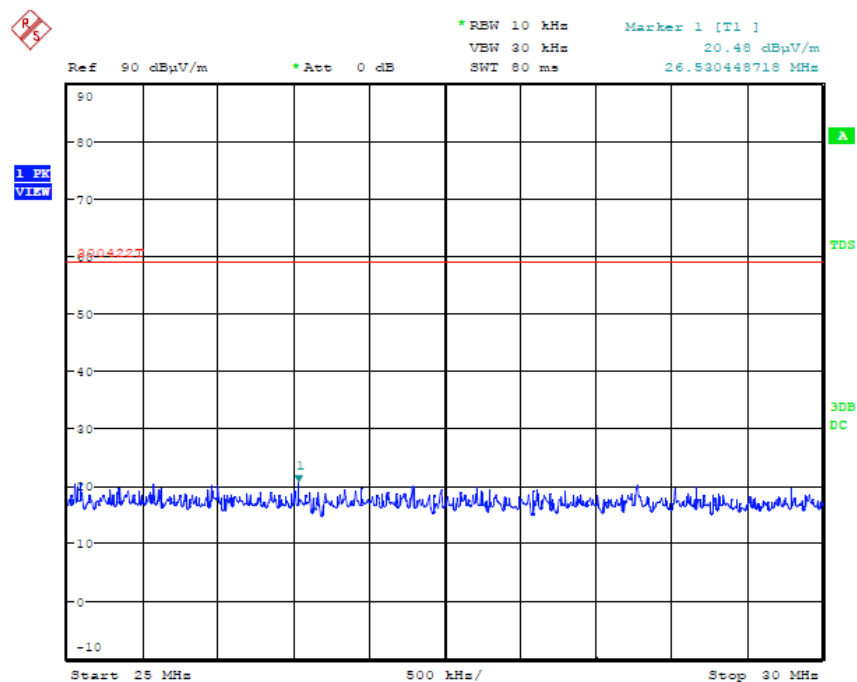
January 20, 2021

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5.6.5.19. 614.025MHz Tx Radiated 25-30 MHz @ 3m-Vertical



5.6.5.20. 614.025MHz Tx Radiated 25-30 MHz @ 3m-Horizontal



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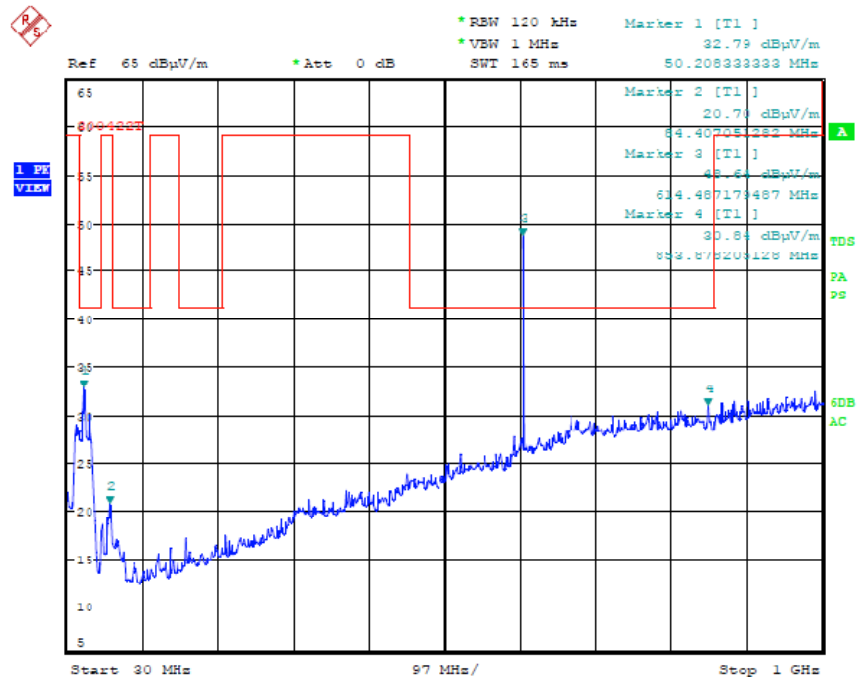
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 20Q5X071_F15C236

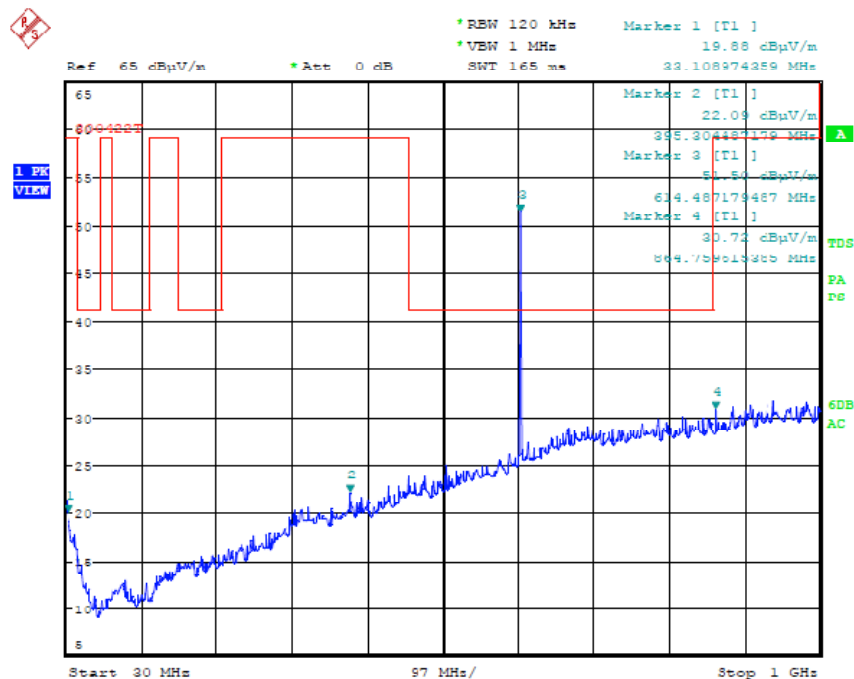
January 20, 2021

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

5.6.5.21. 614.025MHz Tx Radiated 30-1000 MHz @ 3m-Vertical



5.6.5.22. 614.025MHz Tx Radiated 30-1000 MHz @ 3m-Horizontal



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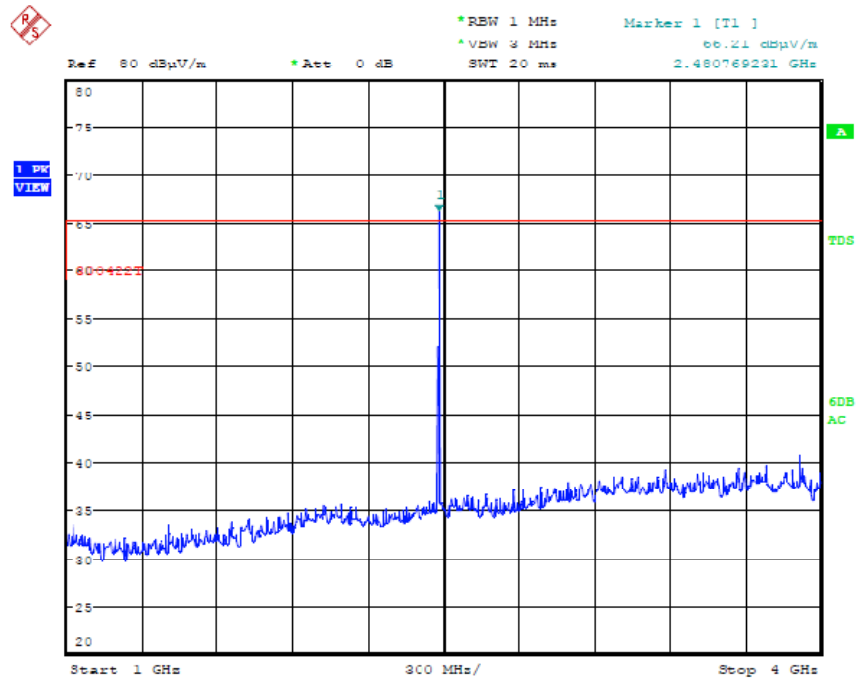
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 20Q5X071_F15C236

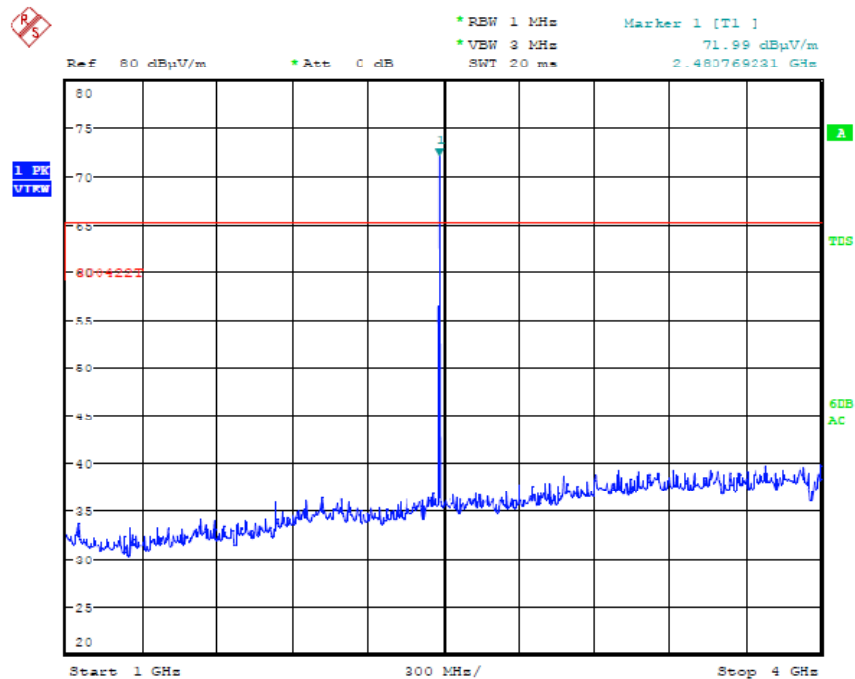
January 20, 2021

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

5.6.5.23. 614.025MHz Tx Radiated 1-4GHz @ 3m-Vertical



5.6.5.24. 614.025MHz Tx Radiated 1-4GHz @ 3m- Horizontal



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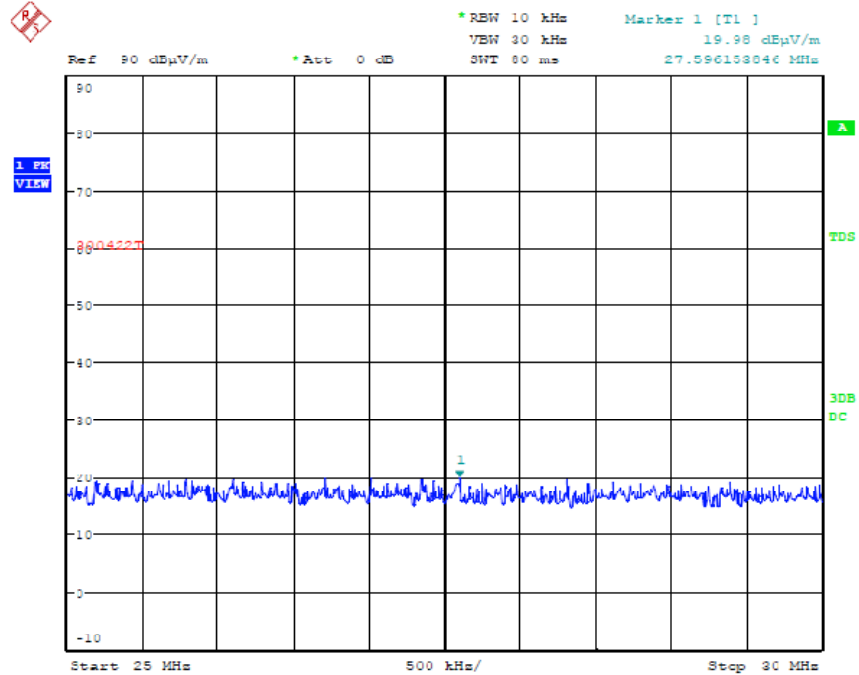
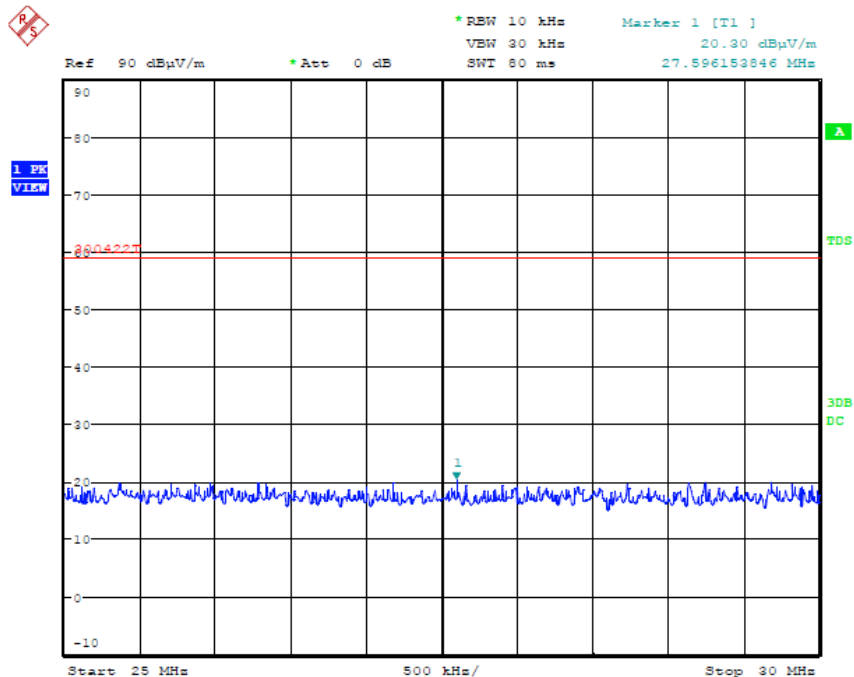
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5.6.5.25. 615.975MHz Tx Radiated 25-30 MHz @ 3m-Vertical**5.6.5.26. 615.975MHz Tx Radiated 25-30 MHz @ 3m-Horizontal****ULTRATECH GROUP OF LABS**

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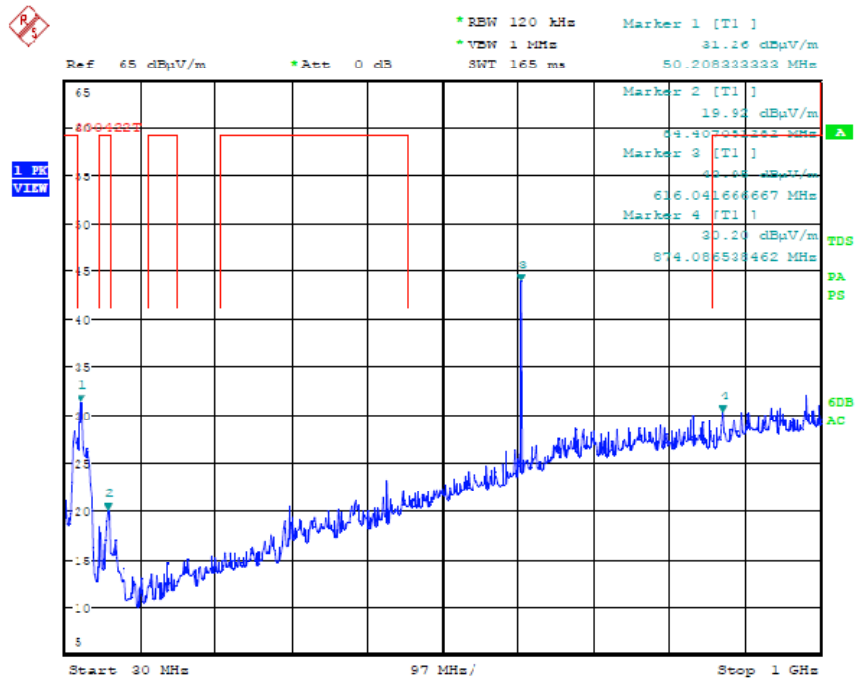
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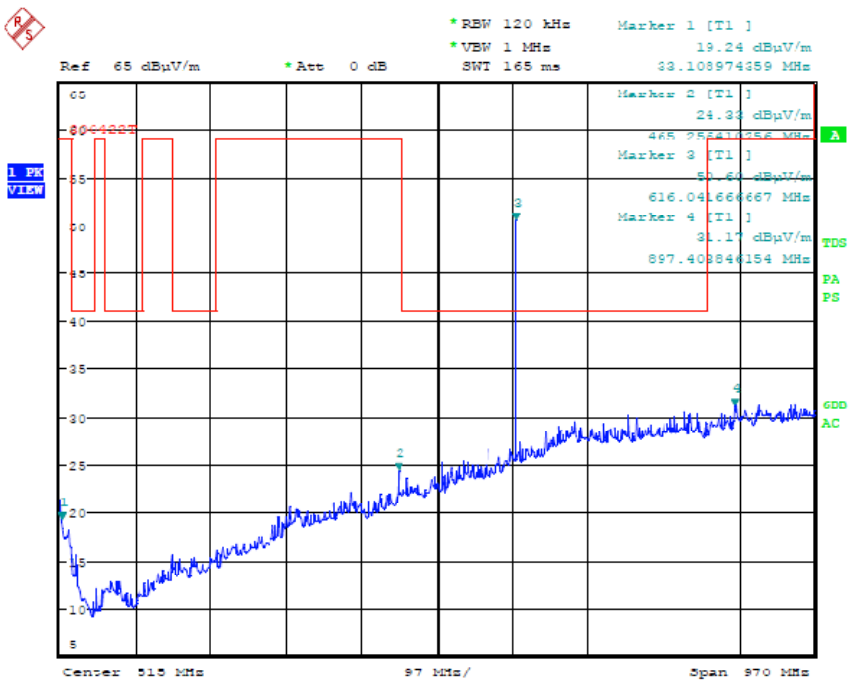
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5.6.5.27. 615.975MHz Tx Radiated 30-1000 MHz @ 3m-Vertical



5.6.5.28. 615.975MHz Tx Radiated 30-1000 MHz @ 3m-Horizontal



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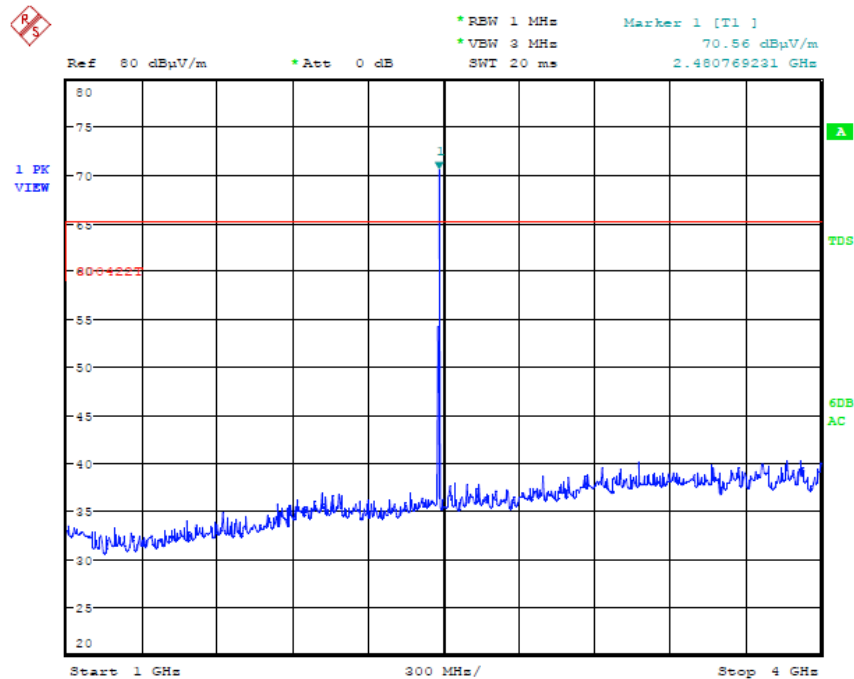
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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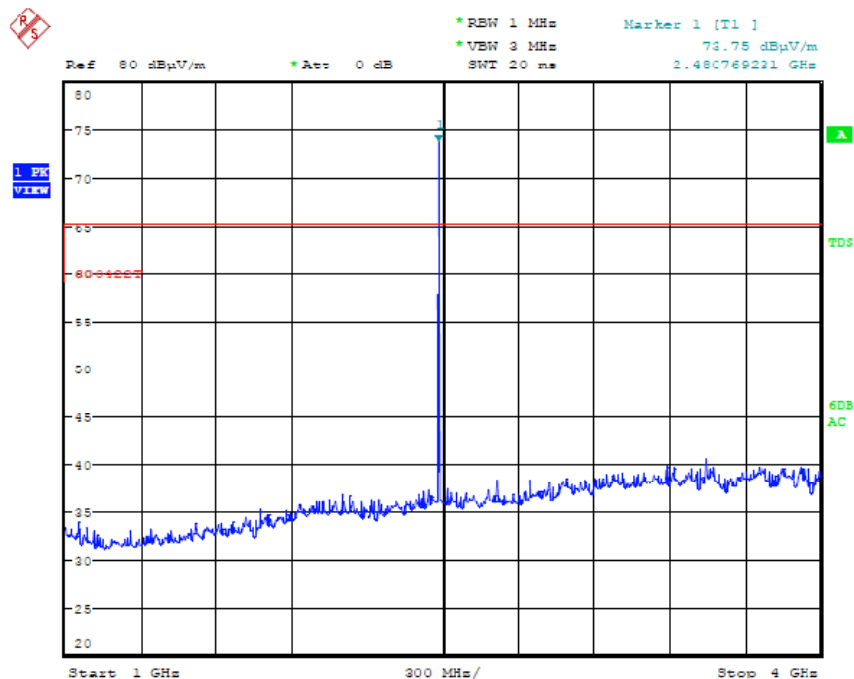
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5.6.5.29. 615.975MHz Tx Radiated 1-4GHz @ 3m-Vertical



5.6.5.30. 615.975MHz Tx Radiated 1-4GHz @ 3m- Horizontal



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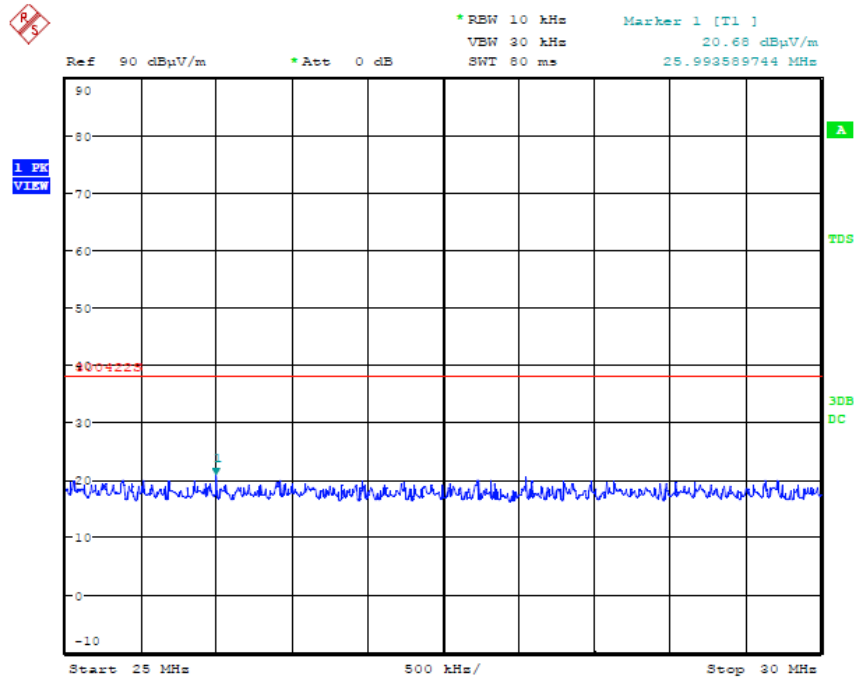
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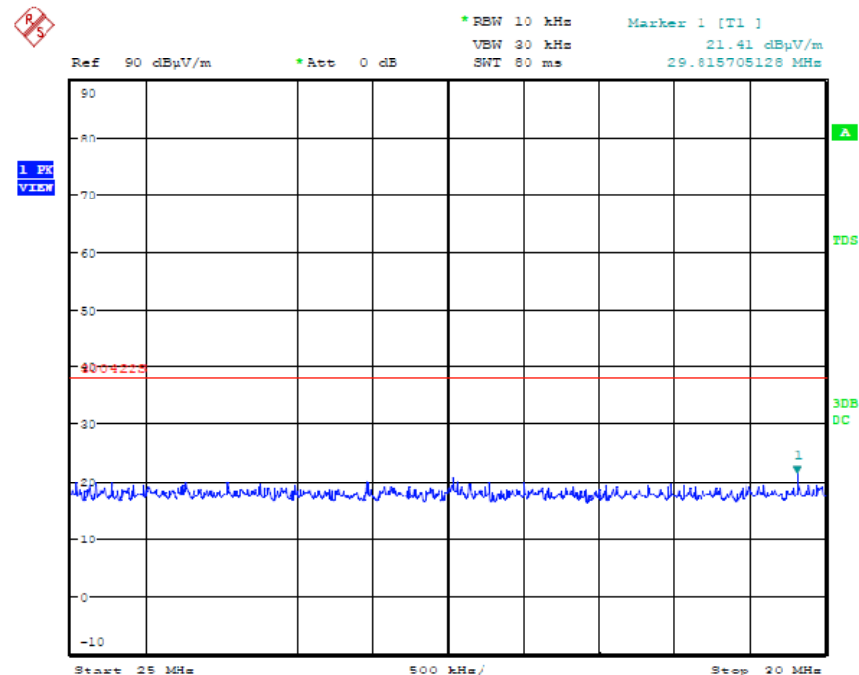
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5.6.5.31. Standby mode Radiated 25-30 MHz @ 3m-Vertical



5.6.5.32. Standby mode Radiated 25-30 MHz @ 3m-Horizontal



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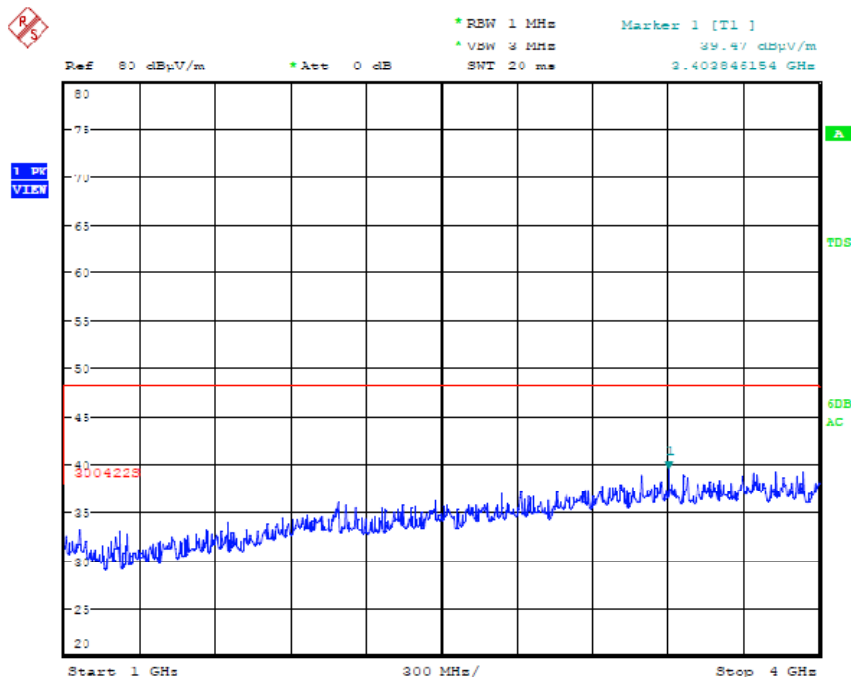
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The screenshot shows a spectrum analyzer interface. At the top, there is a red square icon with a white 'R' and a green square icon with a white 'S'. Below these, the text '1 PK VIEW' is displayed. The main display area is a grid with a vertical axis labeled 'dB' ranging from 5 to 65 and a horizontal axis labeled 'MHz' ranging from 30 to 97. A blue signal trace starts at approximately 15 dB at 30 MHz and rises to about 30 dB at 97 MHz, with significant noise. A red horizontal line is drawn across the grid at approximately 38 dB, labeled '38.04225'. On the right side of the grid, there are labels 'TDS', 'FA', 'PS', '6dB', and 'AC'. At the bottom, the text 'Start 30 MHz', '97 MHz/', and 'Stop 1 GHz' is visible.

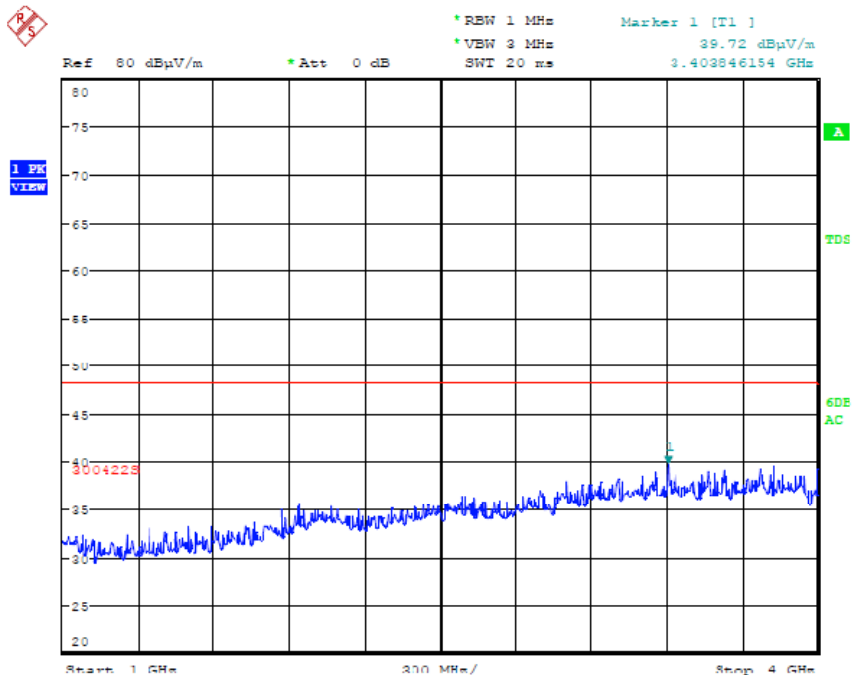
*RBW 120 kHz Marker 1 [T1]
 *VBW 1 MHz 32.32 dEpV/m
 *Att 0 dB SWT 165 ms 976.682692208 MHz

Ref 35 dEpV/m
 1 PK VIEW
 30.4223
 1 W
 6DB AC
 Start 30 MHz 97 MHz/ Stop 1 GHz

5.6.5.35. Standby mode Radiated 1-4GHz @ 3m-Vertical



5.6.5.36. Standby mode Radiated 1-4GHz @ 3m- Horizontal



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5.7. RF EXPOSURE REQUIREMENTS [§§ 15.247(i), 1.1310 & 2.1091]**5.7.1. Limits**

FCC has specified the general guidance for meeting RF Exposure requirements in KDB 447498 D01 General RF Exposure Guidance v06, the following are the applicable sections for this module summarized from this guidance.

- 1) The RF exposure requirements for devices operating in mobile and portable exposure conditions are different. When both exposure conditions apply to a device, compliance is determined according to the rules and policies established for both exposure conditions. Equipment authorization for devices that are categorically excluded from routine RF exposure evaluation according to §2.1091(c) and §2.1093(c).
- 2) Standalone and simultaneous transmission use conditions for mobile and portable exposure conditions must be determined according to the host platform and product operating configuration requirements
- 3) Transmitter modules must be approved according to one of the following host platform exposure conditions, with respect to the product configurations tested or evaluated for equipment approval for incorporation in qualified host products. The approved host platform exposure condition(s) must be identified on the grant of equipment certification. When transmitter modules are incorporated in host devices that qualify for RF exposure test exclusion and no other testing or equipment approval is required, the standalone and simultaneous transmission configurations and test exclusion conditions must be fully documented in the grantee's records.
- 4) The 1-g body and 10-g extremity SAR Test Exclusion Thresholds in 4.3 should be applied to determine SAR test requirements.

RSS 102 Limits:

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance^{4,5}

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

5.7.1.1. Standalone SAR test exclusion threshold condition for radio is verified as per below.

Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition(s), listed below, is (are) satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions. The minimum test separation distance defined in 4.1 f) is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander. To qualify for SAR test exclusion, the test separation distances applied must be fully explained and justified, typically in the SAR measurement or SAR analysis report, by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, according to the required published RF exposure KDB procedures. When no other RF exposure testing or reporting are required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for SAR test exclusion. When required, the device specific conditions described in the other published RF exposure KDB procedures must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops and tablets, etc.

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4.3.1 (a) For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR, where

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz.
- Power and distance are rounded to the nearest mW and mm before calculation³¹
- The result is rounded to one decimal place for comparison
- The values 3.0 and 7.5 are referred to as numeric thresholds

Radio#1 UHF Mic Radio:

Max frequency: 616 MHz

Max power 16.41 mW,

Antenna gain 0 dBi and @ 5 mm separation distance.

Power= 16.41 mW

Relative to Numeric Threshold =

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}]$

$= (16.41) / 5 \times (\sqrt{0.616}) = \mathbf{2.58} < 3$, satisfies the exclusion threshold for STAND ALONE

Radio#2 WIFI Radio:

Max frequency: 2.48 GHz

Max power 16.62 dbm,

Antenna gain 2 dBi and duty Cycle of 3.458% @ 5 mm separation distance.

Power= 16.62+2=18.62 dBm=72.77mW at 100%

Power after duty cycle=0.03458*72.77=2.52 mW

Relative to Numeric Threshold

$= [(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}]$

$= (2.52) / 5 \times (\sqrt{2.48}) < 3 = \mathbf{0.793} < 3$, satisfies the exclusion threshold for STAND ALONE

5.7.1.2. Simultaneous transmission SAR test exclusion considerations

4.32 (b) When an antenna qualifies for the standalone SAR test exclusion of 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:

- 1) $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] / x$ W/kg, for test separation distances ≤ 50 mm; where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.

This SAR estimation formula has been considered in conjunction with the SAR Test Exclusion Thresholds to result in substantially conservative SAR values of ≤ 0.4 W/kg. When SAR is estimated, the peak SAR location is assumed to be at the feed-point or geometric center of the antenna, whichever provides a smaller antenna separation distance, and this location must be clearly identified in test reports. The estimated SAR is used only to determine simultaneous transmission SAR test exclusion; it should not be reported as the standalone SAR. When SAR is estimated, it must be applied to determine the sum of 1-g SAR test exclusion. When SAR to peak location separation ratio test exclusion is applied, the highest reported SAR for simultaneous transmission can be an estimated standalone SAR if the estimated SAR is the highest among the simultaneously transmitting antennas (see also KDB Publication 690783 D01). For situations where the estimated SAR is overly conservative for certain conditions, the test lab may choose to perform standalone SAR measurements, then use the measured SAR to determine simultaneous transmission SAR test exclusion. Estimated SAR values at selected frequencies, distances, and power levels are illustrated in Appendix D

1. WIFI Radio:

Max frequency: 2.48 GHz

Max power 16.62 dbm,

Antenna gain 2 dBi and duty Cycle of 3.458%

@ 5 mm separation distance.

Power= 16.62+2=18.62 dBm=72.77mW at 100%

Power after duty cycle=0.03458*72.77=2.52

Estimated SAR₁ [2.52/5]·[√2.48/7.5]=[0.504*0.2099]=0.106 W/kg

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2. UHF Mic Radio:
Max frequency: 616 MHz
Max power 16.41 mW,
Antenna gain 0 dBi and duty Cycle of 100% @ 5 mm separation distance.

Power = 16.41 mW

Estimated SAR₂ $[16.41/5] \cdot [\sqrt{0.616/7.5}] = [3.2820 \cdot 0.1046] = 0.343 \text{ W/kg}$

4.32 c) When the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio. The simultaneously transmitting antennas in each operating mode and exposure condition combination must be considered one pair at a time to determine the SAR to peak location separation ratio to qualify for test exclusion. The ratio is determined by $(\text{SAR}_1 + \text{SAR}_2)^{1.5}/R_i$, rounded to two decimal digits, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion. When 10-g SAR applies, the ratio must be ≤ 0.10 . SAR₁ and SAR₂ are the highest reported or estimated SAR values for each antenna in the pair, and R_i is the separation distance in mm between the peak SAR locations for the antenna pair. The antennas in all antenna pairs that do not qualify for simultaneous transmission SAR test exclusion must be tested for SAR compliance, according to the enlarged zoom scan and volume scan post-processing procedures in KDB Publication 865664 D01.



Peak SAR location distance measured at feed points of antenna pairs: $r_1 = 25.02 \text{ mm}$ $r_2 = 44.59 \text{ mm}$

SAR to peak location separation ratio (SPLSR) = $(\text{Estimated SAR}_1 + \text{Estimated SAR}_2)^{1.5}/R_i$

SPLSR = $(0.106 + 0.343) \cdot 1.5/25.02 = 0.012$ must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion

5.8. POWER LINE CONDUCTED EMISSIONS [§15.207(a)]**5.8.1. Limit(s)**

The equipment shall meet the limits of the following table:

Frequency of emission (MHz)	Conducted Limits (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases linearly with the logarithm of the frequency

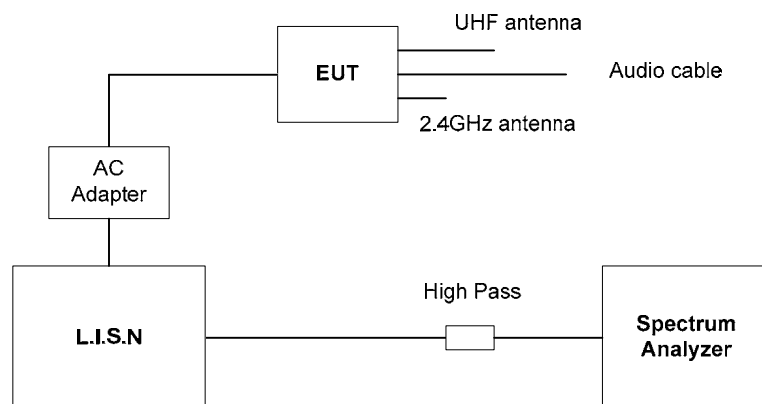
5.8.2. Method of Measurements

ANSI C63.4

5.8.3. Test Equipment

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Hewlett Packard	HP 8593EM	3412800103	9 kHz–26.5 GHz	Aug 12, 2021
High Pass filter	Rohde & Schwarz	EZ-25	830164/006	Cut off 150kHz	Jun 7, 2020
LISN Used	Schwarzbeck	NSLK 8127	8127276	10 kHz–30 MHz	Mar 1, 2020
AC/DC Adaptor	Emerson Network Power	DCH3-050US-0002	010138	5 V, 500 mA	---

Test Date: February 2, 2020

5.8.4. Test Arrangement**ULTRATECH GROUP OF LABS**

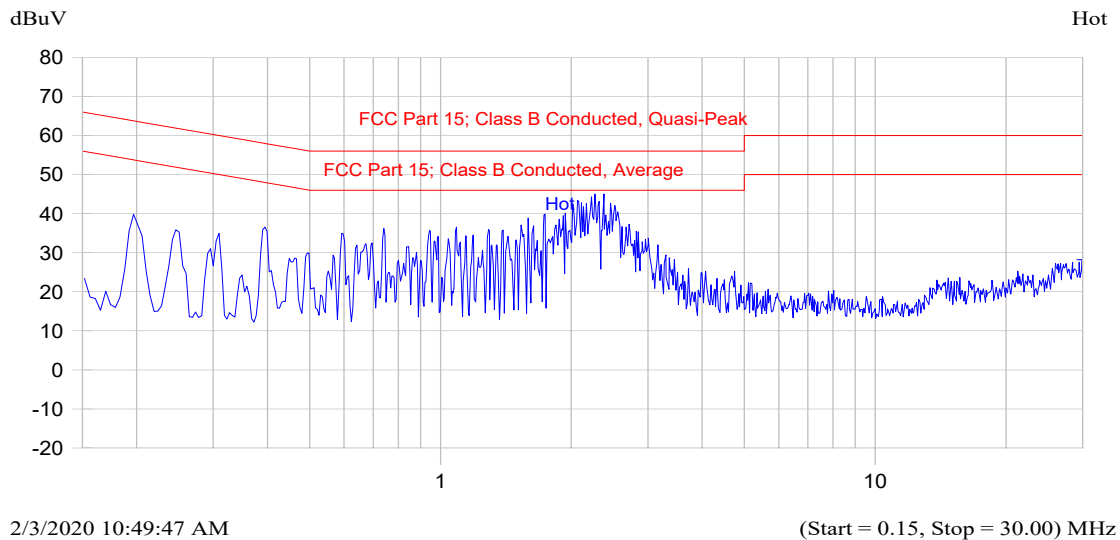
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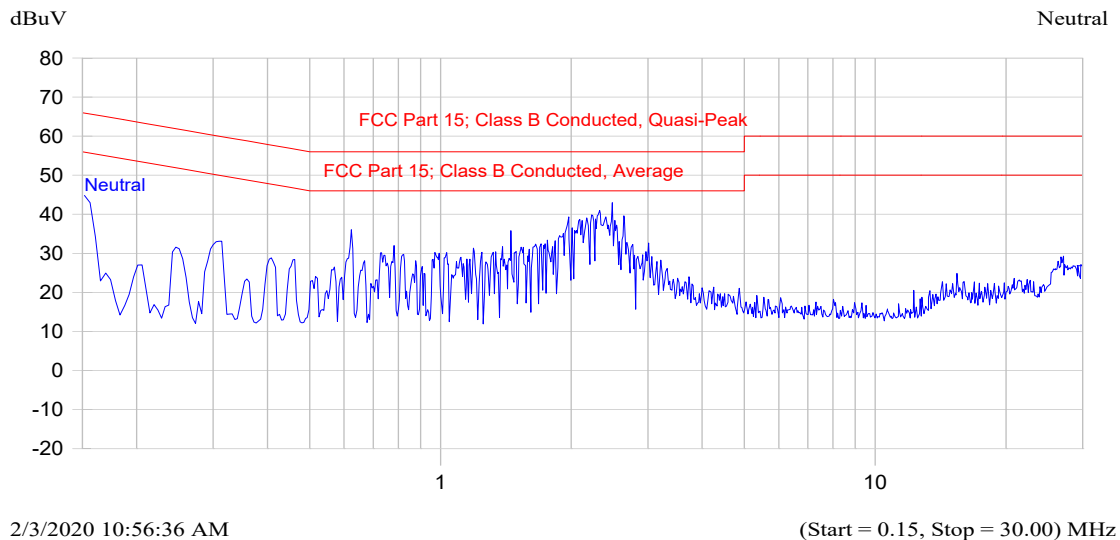
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5.8.5. Test Data**Plot 5.8.5.1.** Power Line Conducted Emission, Tx Mode
Line Voltage: AC 120 V; Line Tested: Line**Current Graph****Current List**

Frequency MHz	Peak dBuV	QP dBuV	QP-QP Limit dB	Avg dBuV	Avg-Avg Limit dB	Trace Name
0.202	41.9	38.9	-24.6	26.0	-27.5	Hot
0.402	35.6	31.2	-26.6	21.9	-25.9	Hot
0.743	37.9	35.1	-20.9	23.0	-23.0	Hot
1.735	40.4	37.8	-18.2	23.2	-22.8	Hot
2.267	45.5	42.6	-13.4	28.2	-17.8	Hot
2.375	45.4	42.7	-13.3	27.6	-18.4	Hot

Plot 5.8.5.2. Power Line Conducted Emission, Tx Mode
Line Voltage: AC 120 V; Line Tested: Neutral

Current Graph

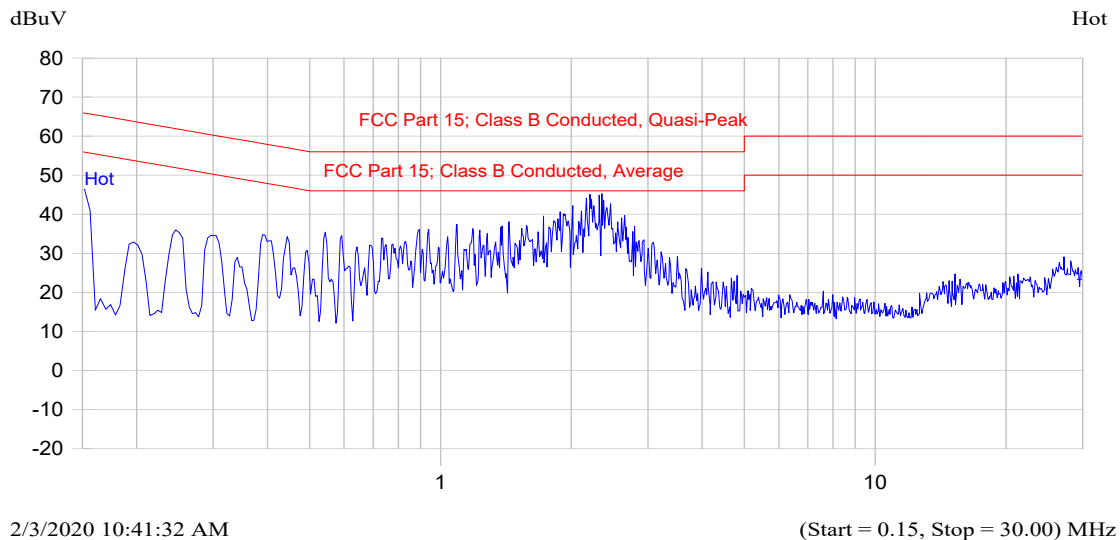


Current List

Frequency MHz	Peak dBuV	QP dBuV	QP-QP Limit dB	Avg dBuV	Avg-Avg Limit dB	Trace Name
0.154	45.3	43.3	-22.5	28.7	-27.1	Neutral
0.309	36.6	32.3	-27.7	21.4	-28.6	Neutral
0.619	37.7	33.3	-22.7	19.7	-26.3	Neutral
1.443	37.2	32.4	-23.6	19.9	-26.1	Neutral
2.479	43.1	38.9	-17.1	23.9	-22.1	Neutral

Plot 5.8.5.3. Power Line Conducted Emission, Rx Mode
Line Voltage: AC 120 V; Line Tested: Line

Current Graph

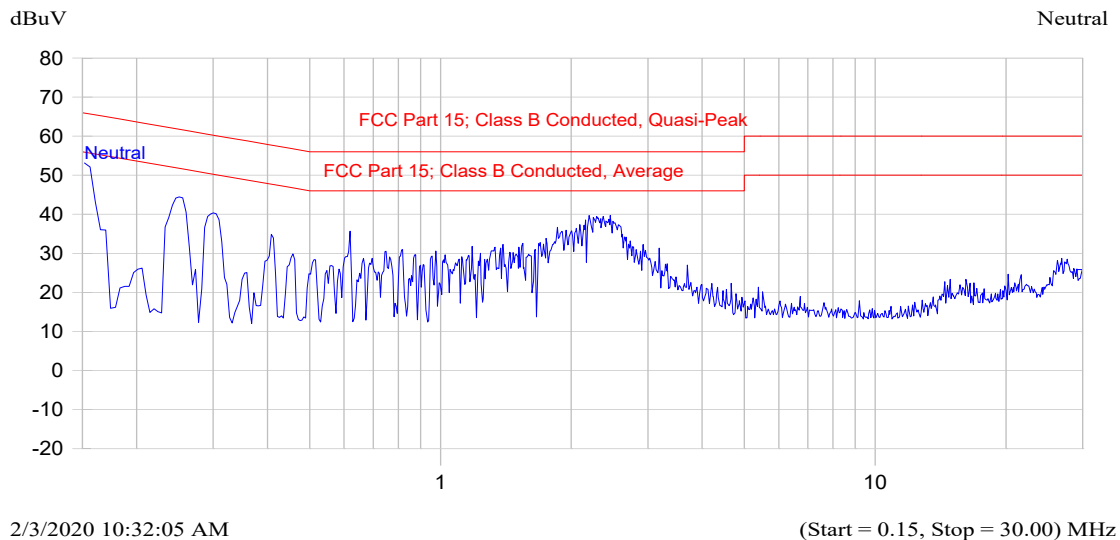


Current List

Frequency MHz	Peak dBuV	QP dBuV	QP-QP Limit dB	Avg dBuV	Avg-Avg Limit dB	Trace Name
0.154	47.2	45.7	-20.1	30.2	-25.6	Hot
0.258	40.3	37.9	-23.6	23.9	-27.7	Hot
0.392	36.7	34.8	-23.2	23.1	-24.9	Hot
0.543	36.3	33.9	-22.1	22.6	-23.4	Hot
1.083	38.4	35.6	-20.4	22.2	-23.8	Hot
2.369	45.7	42.9	-13.1	27.1	-18.9	Hot

Plot 5.8.5.4. Power Line Conducted Emission, Rx Mode
Line Voltage: AC 120 V; Line Tested: Neutral

Current Graph



Current List

Frequency MHz	Peak dBuV	QP dBuV	QP-QP Limit dB	Avg dBuV	Avg-Avg Limit dB	Trace Name
0.154	51.3	50.0	-15.8	33.3	-22.5	Neutral
0.247	42.9	40.1	-21.7	25.7	-26.1	Neutral
0.294	38.1	35.7	-24.7	19.8	-30.6	Neutral
0.613	36.5	32.0	-24.0	21.0	-25.0	Neutral
2.461	44.3	39.0	-17.0	24.3	-21.7	Neutral

EXHIBIT 6. 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.

6.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

	Line Conducted Emission Measurement Uncertainty (9 kHz – 30 MHz):	Measured	Limit
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 1.44	± 1.8
U	Expanded uncertainty U: $U = 2u_c(y)$	± 2.89	± 3.6

6.2. 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: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 2.14	± 2.6
U	Expanded uncertainty U: $U = 2u_c(y)$	± 4.29	± 5.2

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	Measured	Limit
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 1.52	Under consideration
U	Expanded uncertainty U: $U = 2u_c(y)$	± 3.04	Under consideration

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