FCC PART 90

TEST REPORT

For

StormQuant

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FCC ID: 2AV9OSQ-DPR

Report Type: Original Report	**Product Type:** Doppler Weather Radar System

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CERTIFICATE #3297.02

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2003134-90	Original Report	2020-05-21

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *StormQuant*, and their product model: SQ100 or the "EUT" as referred to in this report. It is a Doppler Weather Radar System. The EUT operates in the frequency range: 9300 - 9500 MHz with a single channel at 9375 MHz.

1.2 Mechanical Description of EUT

The Doppler Weather Radar System measures approximately 92 mm (L) x 92 mm (W) x 122 mm (H) and weighs approximately 68 kg.

The data gathered are from the typical production sample provided by StormQuant with serial number: R2003134-1, assigned by BACL.

1.3 Objective

This report was prepared on behalf of *StormQuant,* in accordance with Part 2 and Part 90, Subparts F of the Federal Communication Commission's rules.

The objective was to determine compliance with FCC Part 2 and FCC Part 90 rules for RF Output Power, Operating Bandwidth, Radiated Spurious Emissions, and Frequency Stability.

1.4 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.26-2015, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services.

1.5 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Parameter	Measurement uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.57 dB
Power Spectral Density, conducted	±1.48dB
Unwanted Emissions, conducted	±1.57dB
All emissions, radiated	±4.0 dB
AC power line Conducted Emission	±2.0 dB
Temperature	±2 ^{o} C
Humidity	±5 %
DC and low frequency voltages	±1.0 %
Time	±2 %
Duty Cycle	±3 %

1.6 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL's test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Appendix B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL's BSMI Lab Code Number is: SL2-IN-E-1002R

BACL's test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

1.7 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3297.02),*** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices,

Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.03)*** to certify

- For the USA (Federal Communications Commission):
  - 1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
  - 2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
  - 3- All Telephone Terminal Equipment within FCC Scope C.
- For the Canada (Industry Canada):
  - 1 All Scope 1-Licence-Exempt Radio Frequency Devices;
  - 2 All Scope 2-Licensed Personal Mobile Radio Services;
  - 3 All Scope 3-Licensed General Mobile & Fixed Radio Services;
  - 4 All Scope 4-Licensed Maritime & Aviation Radio Services;
  - 5 All Scope 5-Licensed Fixed Microwave Radio Services
  - 6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.
- For Singapore (Info-Communications Development Authority (IDA)):
  - 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
  - 2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2
- For the Hong Kong Special Administrative Region:
  - 1 All Radio Equipment, per KHCA 10XX-series Specifications;
  - 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  - 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
  - 1 MIC Telecommunication Business Law (Terminal Equipment):
    - All Scope A1 - Terminal Equipment for the Purpose of Calls;
    - All Scope A2 - Other Terminal Equipment
  - 2 Radio Law (Radio Equipment):
    - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
    - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
    - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.01)*** to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

1 Electronics and Office Equipment:
- for Telephony (ver. 3.0)
- for Audio/Video (ver. 3.0)
- for Battery Charging Systems (ver. 1.1)
- for Set-top Boxes & Cable Boxes (ver. 4.1)
- for Televisions (ver. 6.1)
- for Computers (ver. 6.0)
- for Displays (ver. 6.0)
- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

2 Commercial Food Service Equipment

- for Commercial Dishwashers (ver. 2.0)
- for Commercial Ice Machines (ver. 2.0)
- for Commercial Ovens (ver. 2.1)
- for Commercial Refrigerators and Freezers

3 Lighting Products
- For Decorative Light Strings (ver. 1.5)
- For Luminaires (including sub-components) and Lamps (ver. 1.2)
- For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
- For Integral LED Lamps (ver. 1.4)

4 Heating, Ventilation, and AC Products
- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)

5 Other
- For Water Coolers (ver. 3.0)

D- ***A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:***

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Innovation, Science and Economic development Canada - ISED) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
  - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
  - Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
  - Low Voltage Directive (LVD) 2014/35/EU
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Media Development Authority - IMDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC;
  - Nationally Recognized Test Laboratory (NRTL) – US OSHA
- Vietnam: APEC Tel MRA -Phase I;

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.26-2015.

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the peak power.

2.2 EUT Exercise Software

The test software used was built in by StormQuant, the EUT firmware is compliant with the standard requirements being tested against.

Modulation	Frequency (MHz)	Power Setting
200HP0N 3M00P0N	9375	50dBm

2.3 Duty Cycle Correction Factor

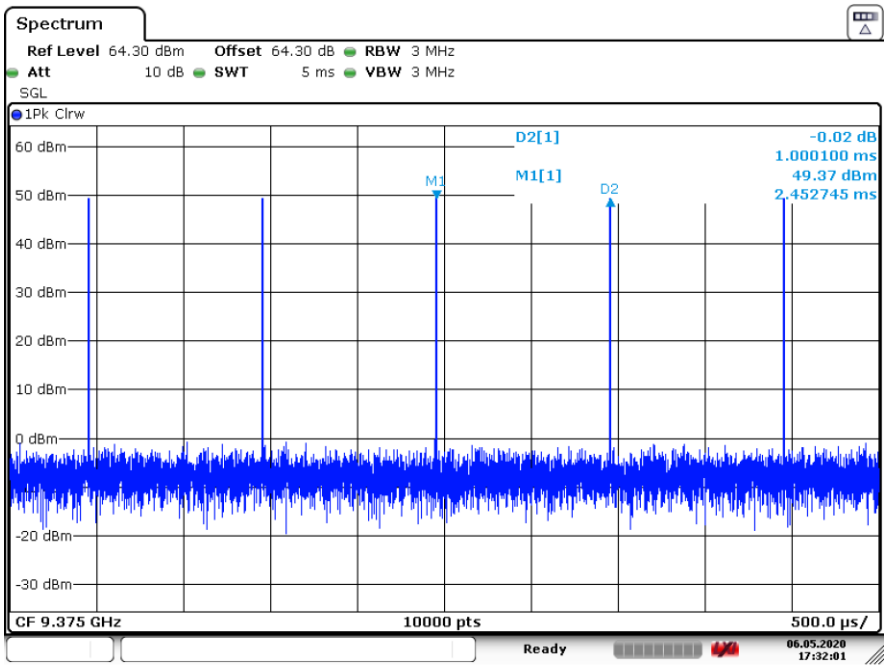
Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be utilized to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration (T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any time that data is being acquired (i.e., no transmitter off-time is to be considered).

On Time (us)	Period (us)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
4	1000	0.4	24

Duty Cycle = On Time (ms)/ Period (ms)
Duty Cycle Correction Factor (dB) = 10*log(1/Duty Cycle)

Please refer to the following plots.

Period



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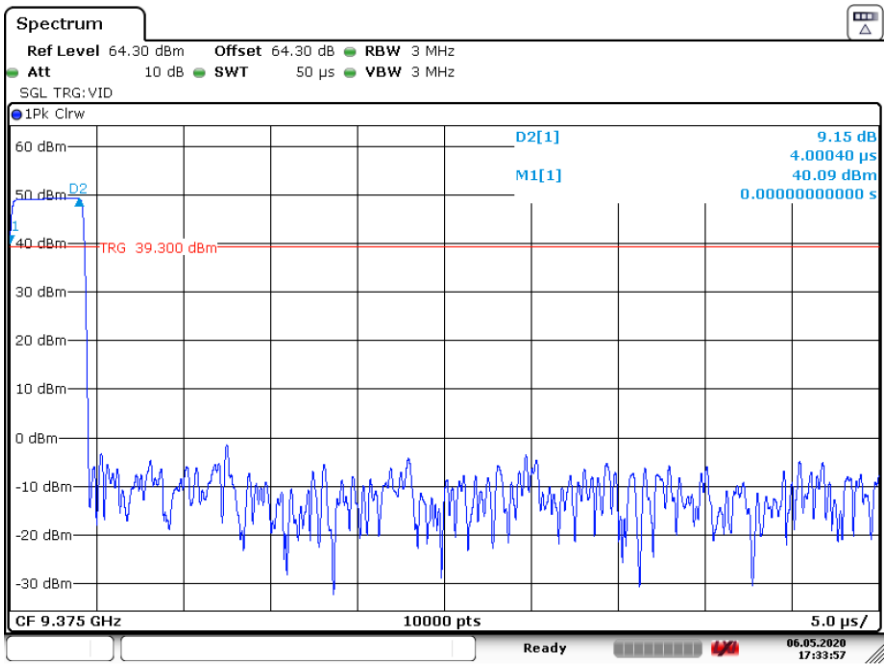
Pulse Width



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2.4 Equipment Modifications

None

2.5 Support Equipment

Manufacturer	Description	Model	Serial Number
AOC	Monitor	-	-
Lenovo	Keyboard	-	-
Vector Telecom Pty Ltd	End-launch Waveguide to Coaxial Adaptor	VT100WECASKPA	182577010004 & 182577010012 & 182577010008
Vector Telecom Pty Ltd	Cross guide Directional Coupler	VT100WL+C60SKPPC	182023040001
u-FXR	Load	WF-0055	-

2.6 Interface Ports and Cabling

Cable Description	Length (m)	To	From
Ethernet Cable	~10	Internet	EUT
Power Cable	~10	Power Source	EUT
HDMI Cable	2	Monitor	EUT
USB cable	2	Keyboard	EUT

3 Summary of Test Results

Results reported relate only to the product tested.

FCC and ISED Rules	Description of Test	Results
FCC §2.1091	RF Exposure	Compliant
FCC §2.1053 FCC §90.210	Radiated Spurious Emissions & Emission Mask	Compliant
FCC §2.1046 FCC §90.205	Maximum Peak Output Power	Compliant
FCC §2.1049 FCC §90.209	99% Emission Bandwidth	Compliant
FCC §2.1055 FCC §90.213	Frequency Stability	Compliant

4 FCC §2.1091 - RF Exposure

4.1 Applicable Standards

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
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
Limits for Occupational/Controlled Exposure				
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

Note: f = frequency in MHz
* = Plane-wave equivalent power density

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

4.3 Test Results

Rated Maximum average output power (dBm):	26.02*
Rated Maximum average output power at antenna input terminal (mW):	399.945
Prediction frequency (MHz):	9375
Maximum Antenna Gain, typical (dBi):	33.6
Maximum Antenna Gain (numeric):	2290.87
FCC MPE limit for controlled exposure at prediction frequency (mW/cm^2):	5.0
Prediction distance (cm):	120.76

The device is compliant with the requirement MPE limit for controlled exposure. The maximum power density at the distance of 120.76 cm is $5mW/cm^2$. Thus the minimum compliant distance is 1.21 m.

*the rated maximum average power was derived from the peak power (50 dBm) and duty cycle (0.4%). The average power is calculated by using the equation below,

$$\text{Average Power (dBm)} = \text{Peak Power (dBm)} - 10*\log(1/\text{Duty Cycle})$$

5 FCC §2.1053, §90.210 - Spurious Radiated Emissions & Emission Mask

5.1 Applicable Standards

FCC §2.1053 and §90.210

5.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.26-2015. The specification used was the FCC 90 limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

5.3 Test Procedure

For the Emission Mask at the band edge, conducted average emission was measured according to ANSI C63.26-2015, section 5.7.3 Out-of-band unwanted emissions measurements.

a) Set the spectrum analyzer center frequency to the block, band, or channel edge frequency.

b) Set the span wide enough to capture the fundamental emission closest to the authorized block or band edge, and to include all modulation products that spill into the immediately adjacent frequency band. In some cases, it may be possible to set the center frequency and span so as to encompass the fundamental emission and the unwanted out-of-band (band-edge) emissions on either side of the authorized block, band, or channel. This can be accomplished with a single (slow) sweep, if adequate overload protection and sufficient dynamic range can be maintained.

c) Set the number of points in sweep $\geqslant 2 \times$ span / RBW.

d) Sweep time should be auto for peak detection. For rms detection the sweep time should be set as follows:

1) If the device can be configured to transmit continuously (duty cycle $\geqslant$ 98%), set the (sweep time) > (number of points in sweep) × (symbol period) (e.g., by a factor of 10 × symbol period × number of points). Increasing the sweep

2) If the device cannot transmit continuously (duty cycle < 98%), a gated sweep shall be used when possible (i.e., gate triggered such that the analyzer only sweeps when the device is transmitting at full power), set the sweep time > (number of points in sweep) × (symbol period) but the sweep time shall always be maintained at a value that is less than or equal to the minimum transmission time.

3) If the device cannot be configured to transmit continuously (duty cycle < 98%) and a free running sweep must be used, set the sweep time so that the averaging is performed over multiple on/off cycles by setting the sweep time > (number of points in sweep) × (transmitter period) (i.e., the transmit on-time + the off-time). The spectrum analyzer readings shall subsequently be corrected by [10 log (1/duty cycle)]. This assumes that the transmission period and duty cycle is relatively constant (duty cycle variation $\leqslant \pm 2\%$).

4) If the device cannot be configured to transmit continuously and a free-running sweep must be used, and if the transmissions exhibit a non-constant duty cycle (duty cycle variations > ±2%), set the sweep time so that the averaging is performed over the on-period by setting the sweep time > (symbol period) × (number of points), while also maintaining the sweep time < (transmitter on-time). The trace

mode shall be set to max hold, since not every display point will be averaged only over just the on-time. Thus, multiple sweeps (e.g., 100) in maximum hold are necessary to ensure that the maximum power is measured.

e) The test report shall include the plots of the measuring instrument display and the measured data.

For the radiated emissions test, the EUT host, and all support equipment power cords were connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT was set 3 meter away from the testing antenna, which was varied from 1-4 meter, and the EUT was placed on a turntable, which was 0.8 meter above the ground plane for measurement, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna's polarity should be changed between horizontal and vertical.

According to ANSI C63.26-2015, section 5.7.4 spurious unwanted emission measurements,

a) Set the spectrum analyzer start frequency to the lowest frequency generated by the EUT, without going below 9 kHz, and the stop frequency to the lower frequency covered by the measurements previously performed in 5.7.3. As an alternative, the stop frequency can be set to the value specified in 5.1.1, depending on the EUT operating range, if the resulting plot can clearly demonstrate compliance for all frequencies not addressed by the out-of-band emissions measurements performed as per 5.7.3.
b) When using an average power (rms) detector, ensure that the number of points in the sweep $\geq 2 \times$ (span / RBW). This may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the spectrum analyzer capabilities. This requirement does not apply to peak-detected power measurements. When average power is specified by the applicable regulation, a peak-detector can be utilized for preliminary measurements to accommodate wider frequency spans. Any emissions found in the preliminary measurement to exceed the applicable limit(s) shall be further examined using a power averaging (rms) detector with the minimum number of measurement points as defined above.
c) The sweep time should be set to auto-couple for performing peak-detector measurements. For measurements that use a power averaging (rms) detector, the sweep time shall be set as described for out-of-band emissions measurements in item d) of 5.7.3.
d) Identify and measure the highest spurious emission levels in each frequency range. It is not necessary to re-measure the out-of-band emissions as a part of this test. Record the frequencies and amplitudes corresponding to the measured emissions and capture the data plots.
e) Repeat step b) through step d) for the upper spurious emission frequency range if not already captured by a wide span measurement performed as per the alternative provided in step a). The upper frequency for this measurement is defined in 5.1.1 as a function of the EUT operating range.
f) Compare the results with the corresponding limit in the applicable regulation.

5.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	MY48250238	2019-06-26	1 year
-	Antennuator	-	-	Each time	-
-	RF Cable	-	-	Each time	-
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
Sunol Sciences	Antenna, Biconi-Log	JB3	A020106-2	2019-11-20	2 years
HP	Pre Amplifier	8447D	2443A04374	2019-08-23	1 year
COM-POWER	Antenna, Dipole	AD-100 DB-4	721033DB1,721033DB2,721033DB3,521921	2019-03-06	2 years
ETS Lindgren	Horn Antenna	3117	218973	2019-02-13	2 years
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2019-04-02	2 years
HP/ Agilant	Pre Amplifier	8449B OPT HO2	3008A0113	2019-09-30	1 year
Wisewave	Antenna, Horn	ARH-4223-02	10555-01	2020-02-27	2 years
Wisewave	Antenna, Horn	ARH-4223-02	10555-02	2020-02-05	2 years
Wisewave	Antenna, Horn	ARH-2823-02	10555-01	2020-02-05	2 years
Wisewave	Antenna, Horn	ARH-2823-02	10555-02	2020-02-27	2 years
AH Systems	Pre-Amplifier	PAM 1840 VH	170	2019-09-24	1 year
IW Microwave	150 Series 2.92mm Cable	KPS1501AN-3780-KPS	DC 1925	2019-09-11	1 year
Insulated Wire Corp.	157 Series 2.92 SM (x2) Armored 33 ft. Cable	KPS-1571AN-3960-KPS	DC 1917	2020-02-28	1 year
MDP Digital	Times Microwave LMR 400 UltraFex Coaxial Cable 35'	LMR400UF	1904161	2019-04-16	14 months
-	SMA cable	-	C00011	Each time1	N/A
-	N-Type Cable	-	C00012	Each time1	N/A
-	N-Type Cable	-	C00014	Each time1	N/A
HP	Generator, Signal	83650B	3614A00276	2019-05-12	13 months

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL *attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.*

5.5 Test Environmental Conditions

Temperature:	24 ºC
Relative Humidity:	33 %
ATM Pressure:	102.7 kPa

The testing was performed by Zhao Zhao on 2020-05-06 at RF site, on 2020-05-07and 2020-05-19 in 5m chamber 3.

5.6 Summary of Test Results

According to the data hereinafter, the EUT complied with FCC Title 47, Part 90 standard's radiated emissions limits, and had the worst margin of:

Mode: Transmitting & Charging Mode			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel**
-2.556	28125	Horizontal	9375 MHz

Please refer to the following table and plots for specific test result details.

5.7 Radiated Emissions Test Results

Freq. (MHz)	S.A. Amp. (dBμV/m)	Table Azimuth (Degrees)	Test Antenna		Substitution				Absolute Level (dBm)	FCC	
			Height (cm)	Polar (H/V)	Freq. (MHz)	S.G. Level (dBm)	Antenna Gain (dB)	Cable Loss (dB)		Limit (dBm)	Margin (dB)
18GHz – 40GHz											
28125	60.33	181	182	H	28125	-33.58	21.724	3.7	-15.556	-13	-2.556
28125	60.23	214	135	V	28125	-33.68	21.724	3.7	-15.656	-13	-2.656
18750	60.8	307	109	H	18750	-39.08	21.906	3.35	-20.524	-13	-7.524
18750	55.33	90	127	V	18750	-44.55	21.906	3.35	-25.994	-13	-12.994
18740	50.02	25	131	H	18740	-49.86	21.91	3.35	-31.304	-13	-18.304
18740	45.16	3	131	V	18740	-54.72	21.91	3.35	-36.164	-13	-23.164
1GHz – 18GHz											
1457.6	58.89	107	195	H	1457.6	-50.73	8.75	1.1	-43.076	-13	-30.076
1457.6	63.37	140	131	V	1457.6	-46.25	8.60	1.1	-38.746	-13	-25.746
1485	62.33	304	100	H	1485	-47.29	8.75	1.1	-39.636	-13	-26.636
1485	63.29	330	100	V	1485	-46.33	8.60	1.1	-38.826	-13	-25.826
30MHz – 1GHz											
169.8	43.28	126	146	H	169.8	-66.04	0.00	0.2	-66.24	-13	-53.24
169.8	38.75	302	140	V	169.8	-70.57	0.00	0.2	-70.77	-13	-57.77
594.1	48.71	15	136	H	594.1	-52.58	0.00	0.5	-53.08	-13	-40.08
594.1	56.48	239	104	V	594.1	-44.81	0.00	0.5	-45.31	-13	-32.31
742.7	49.87	8	139	H	742.7	-45.28	0.00	0.5	-45.78	-13	-32.78
742.7	44.5	275	103	V	742.7	-50.65	0.00	0.5	-51.15	-13	-38.15
891	38.77	289	122	H	891	-58.39	0.00	0.6	-58.99	-13	-45.99
891	35.05	347	115	V	891	-62.11	0.00	0.6	-62.71	-13	-49.71

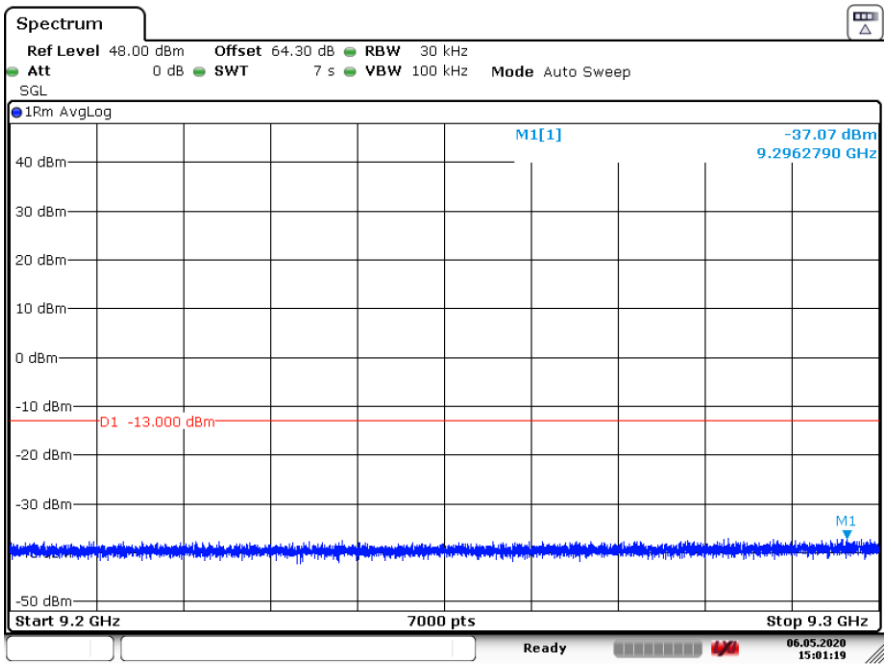
5.8 Conducted Band-edge & Emission Mask

	Measured Power (dBm)	Duty Cycle Correction Factor	Correct Power (dBm)	Limit (dBm)	Margin (dB)	Result
Lower Band-edge	-37.07	24	-13.07	-13	-0.07	Pass
Higher Band-edge	-39.23	24	-15.23	-13	-2.23	Pass

Note: The carrier signal is designed to be 120 dB attenuated from the modulated signal peak (50 dBm), which is about -70 dBm, and is well under the lowest limit line from the emission mask requirement. Therefore, the device meets the requirement of Emissions Mask C. Emission Mask C was selected because the device doesn't have audio low pass filter.

Please refer to the following plots for conducted emission test at the band edge. Spurious emissions are covered by the radiated spurious emission measurements.

Lower Band Edge



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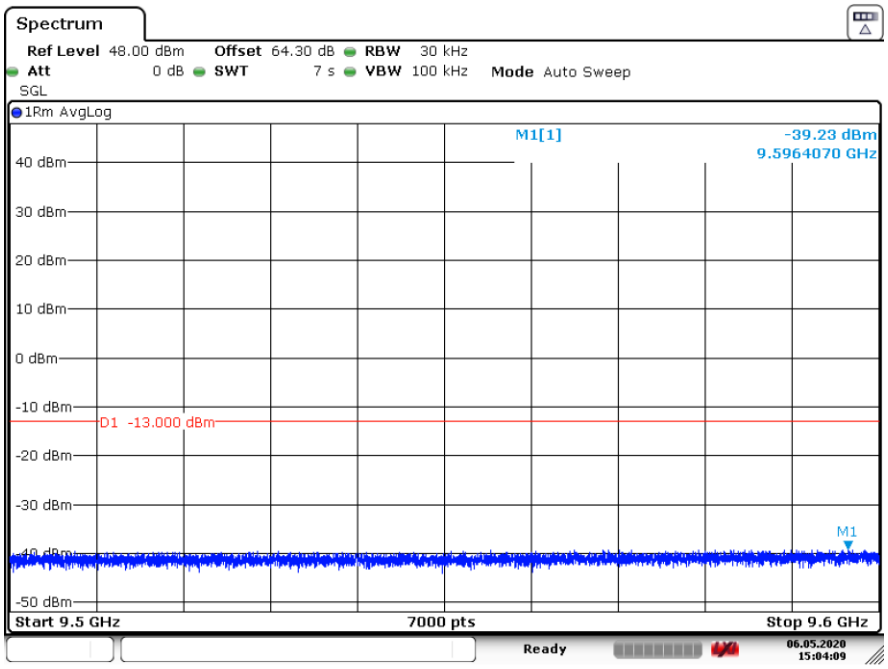
Higher Band Edge



Date: 6.MAY.2020 15:04:10

6 FCC §2.1046 & §90.205 - Output Power Measurement

6.1 Applicable Standards

FCC §2.1046 and §90.205.

6.2 Measurement Procedure

According to ANSI C63.26-2015. Section 5.2.3.3

This procedure can be used to measure the peak power in either a CW-like or noise-like narrowband RF signal. The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW $\geqslant 3 \times$ RBW.

a) Set the RBW $\geqslant$ OBW.
b) Set VBW $\geqslant 3 \times$ RBW.
c) Set span $\geqslant 2 \times$ OBW.
d) Sweep time $\geqslant 10 \times$ (number of points in sweep) $\times$ (transmission symbol period).
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the peak amplitude level.

6.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Signal Analyzer	FSV40	1321.3008K39-101203-UW	2019-08-06	1 year
-	RF Cable	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

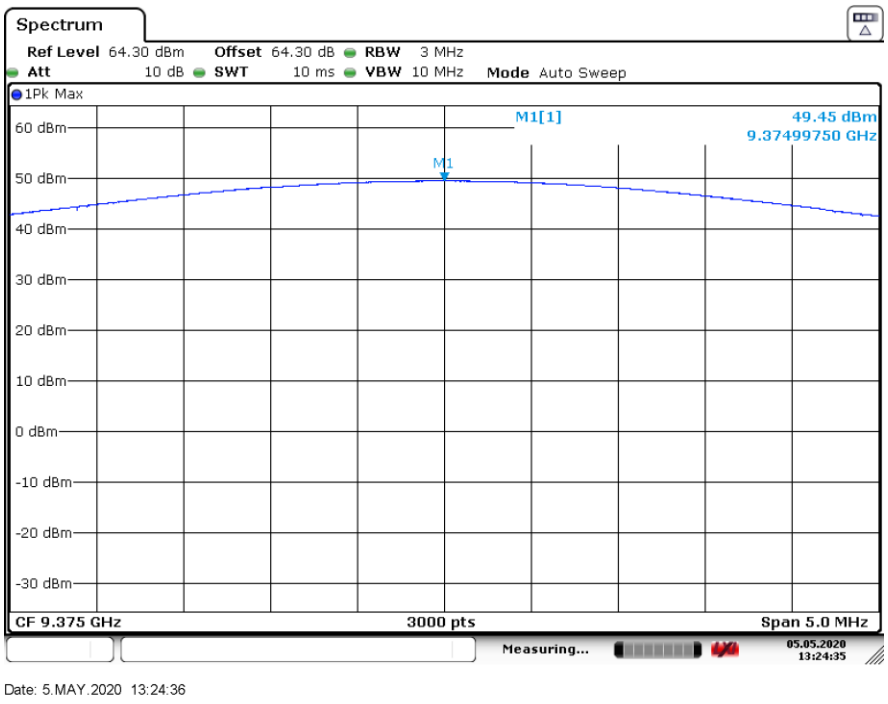
6.4 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	37 %
ATM Pressure:	101.7 KPa

The testing was performed by Zhao Zhao on 2020-05-05 at RF site.

6.5 Test Results

Frequency (MHz)	Conducted Peak Power (dBm)	System Rated Power (dBm)	Tolerance (%)	Limit
9375	49.45	50	-10.87	< 20%



7 FCC §2.1049 & §90.209 - Emission Bandwidth

7.1 Applicable Standards

FCC§2.1047 & §90.207:

7.2 Measurement Procedure

According to ANSI C63.26-2015. Section 5.4.4 Occupied Bandwidth – Power Bandwidth (99%) measurement procedure.

The OBW is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

The following procedure shall be used for measuring (99%) power bandwidth:

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 × OBW is sufficient).
b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.
c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
NOTE—Step a), step b), and step c) may require iteration to adjust within the specified tolerances.
d) Set the detection mode to peak, and the trace mode to max-hold.
e) If the instrument does not have a 99% OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5% of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5% of the total is reached and record that frequency as the upper OBW frequency. The 99% power OBW can be determined by computing the difference these two frequencies.
f) The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Signal Analyzer	FSV40	1321.3008K39-101203-UW	2019-08-06	1 year
-	RF Cable	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

7.4 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	37 %
ATM Pressure:	101.7 KPa

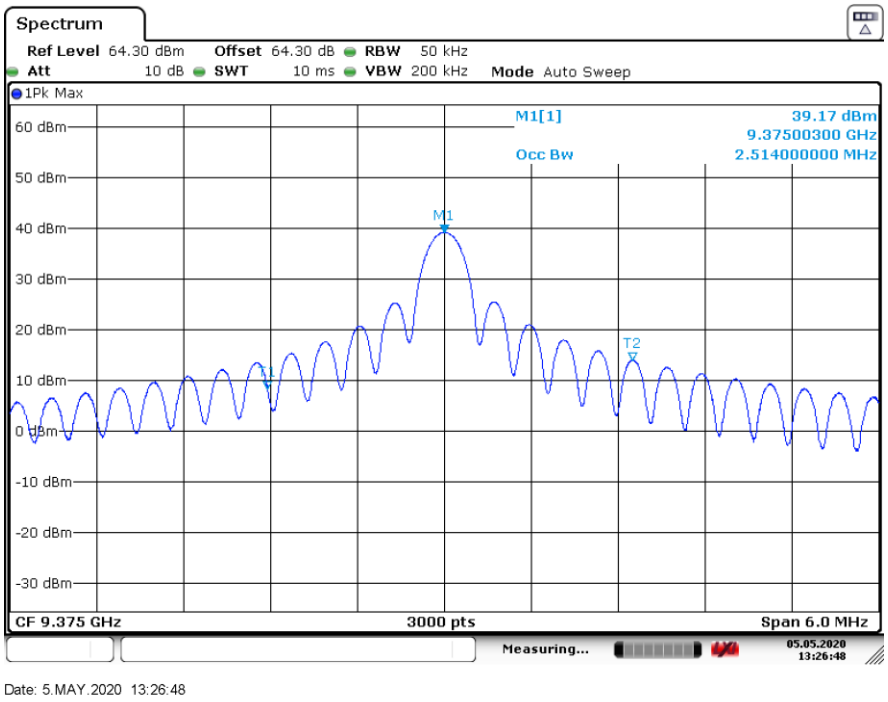
The testing was performed by Zhao Zhao on 2020-05-05 at RF site.

7.5 Test Results

Frequency (MHz)	99% OBW (kHz)
9375	2514

Please refer to the following plots for detailed test results.

99% OBW



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8 FCC §2.1055 & §90.213 – Frequency Stability

8.1 Applicable Standards

FCC §2.1055 & §90.213

8.2 Measurement Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external AC power supply and the RF output was connected to a frequency counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The AC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized, measured the 20 dB bandwidth, record the frequencies of the left edge and the right edge. Calculated the average frequency as the measured center frequency.

The frequency stability shall be measured with variation of primary supply voltage as follows:

Vary primary supply voltage from 85 to 115 percent of the nominal value.

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Signal Analyzer	FSV40	1321.3008K39-101203-UW	2019-08-06	1 year
InterPower	Power Source	85510510	39711	NCR	Each time
Espec	Temperature Chamber	ESL-4CA	18010	2019-04-25	14 months
-	RF Cable	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

8.4 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	37 %
ATM Pressure:	102.7 KPa

The testing was performed by Zhao Zhao on 2020-05-05 and 2020-05-06 at RF site.

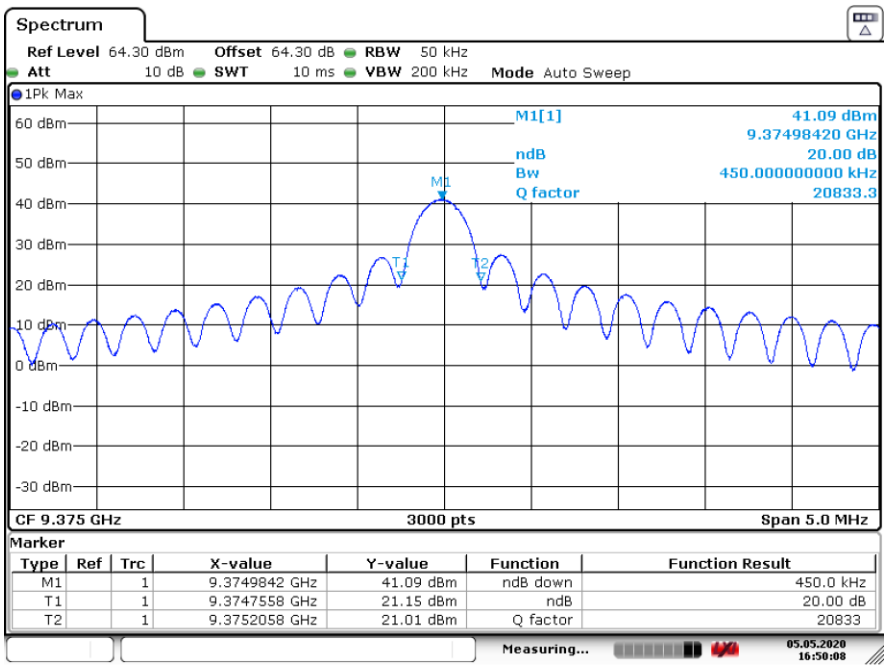
8.5 Test Results

Temperature (°C)	Left Edge(MHz)	Right Edge (MHz)	Measured Frequency (MHz)	Frequency Tolerance (ppm)
Target Frequency : 9375MHz				
-30	9374.7558	9375.2058	9374.9808	-2.0480
-20	9374.7558	9375.2058	9374.9808	-2.0480
-10	9374.7575	9375.2092	9374.98335	-1.7760
0	9374.7625	9375.2125	9374.9875	-1.3333
10	9374.7675	9375.2175	9374.9925	-0.8000
20	9374.7858	9375.2292	9375.0075	0.8000
30	9374.7758	9375.2225	9374.99915	-0.0907
40	9374.7742	9375.2225	9374.99835	-0.1760
50	9374.7792	9375.2258	9375.0025	0.2667

Voltage (V)	Left Edge(MHz)	Right Edge (MHz)	Measured Frequency (MHz)	Frequency Tolerance (ppm)
Target Frequency : 9375MHz				
102	9374.7758	9375.2225	9374.9992	-0.0009
138	9374.7775	9375.2225	9375.0000	0.0000

Please refer to the following plots for detailed test results.

-30 °C



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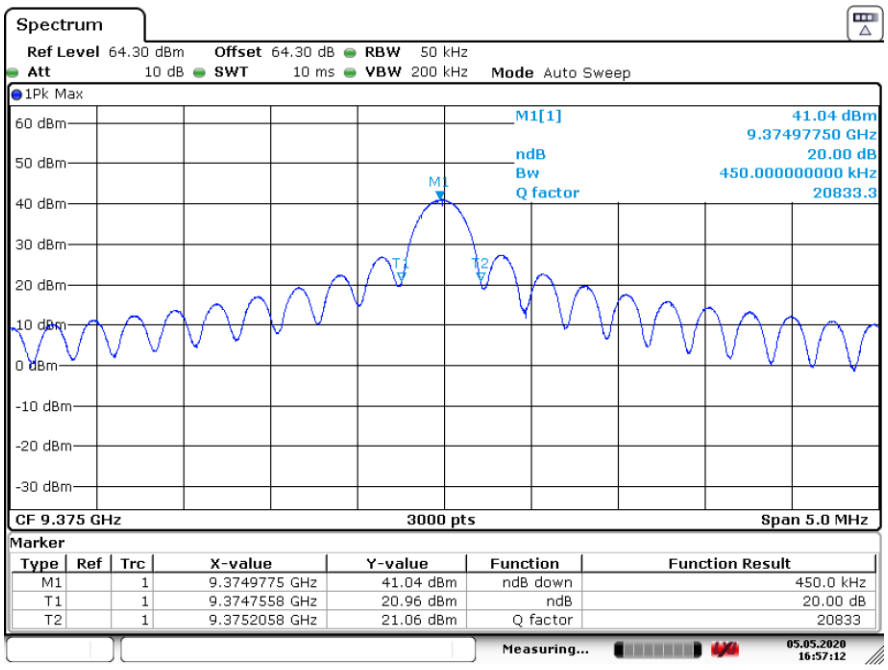
-20 °C



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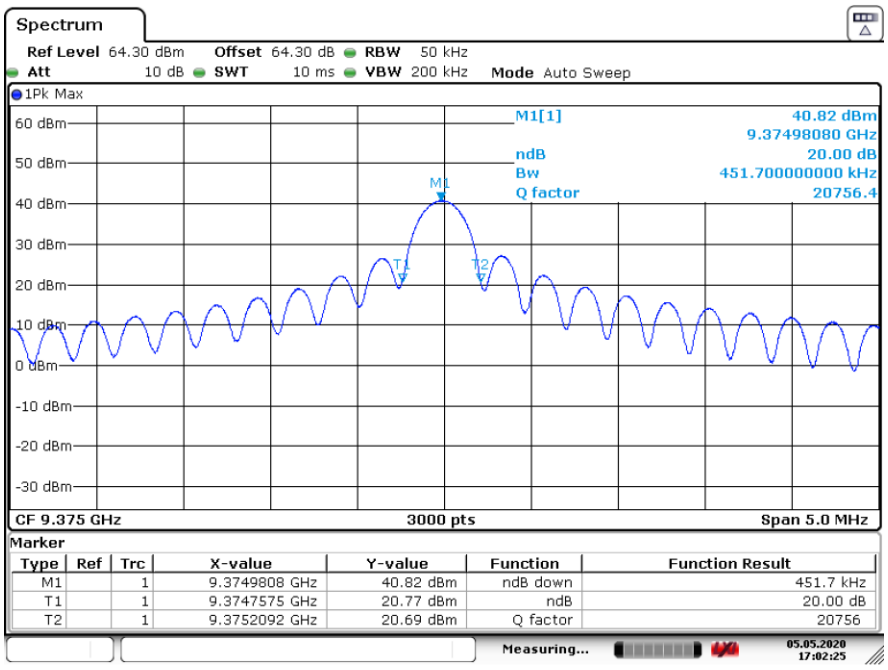
-10 °C



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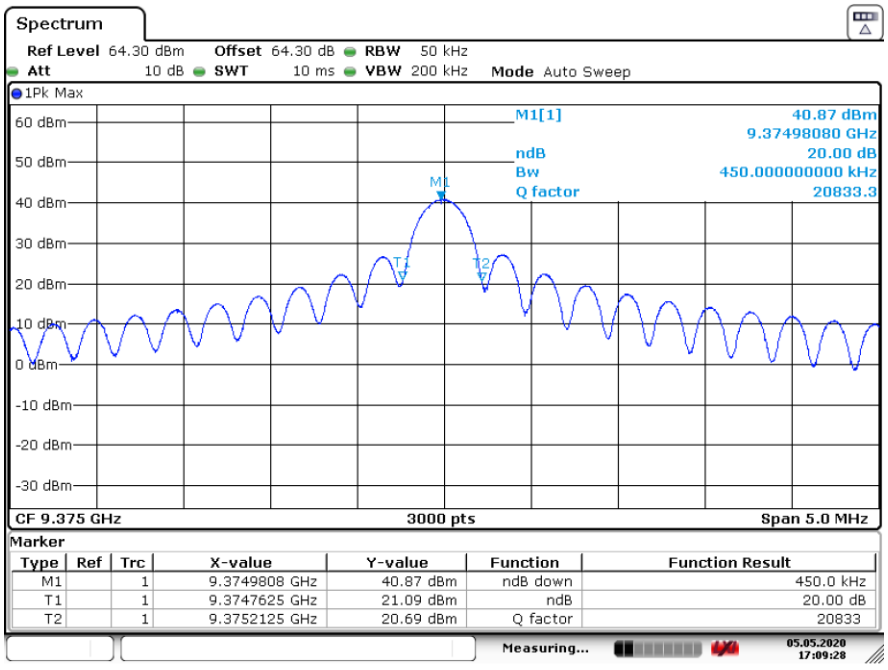
0 °C



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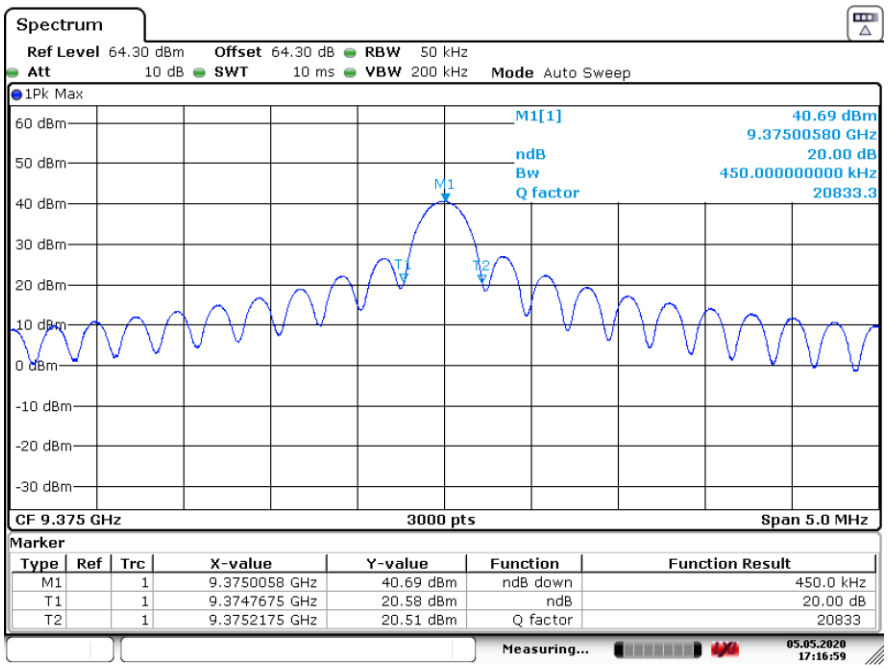
10 °C



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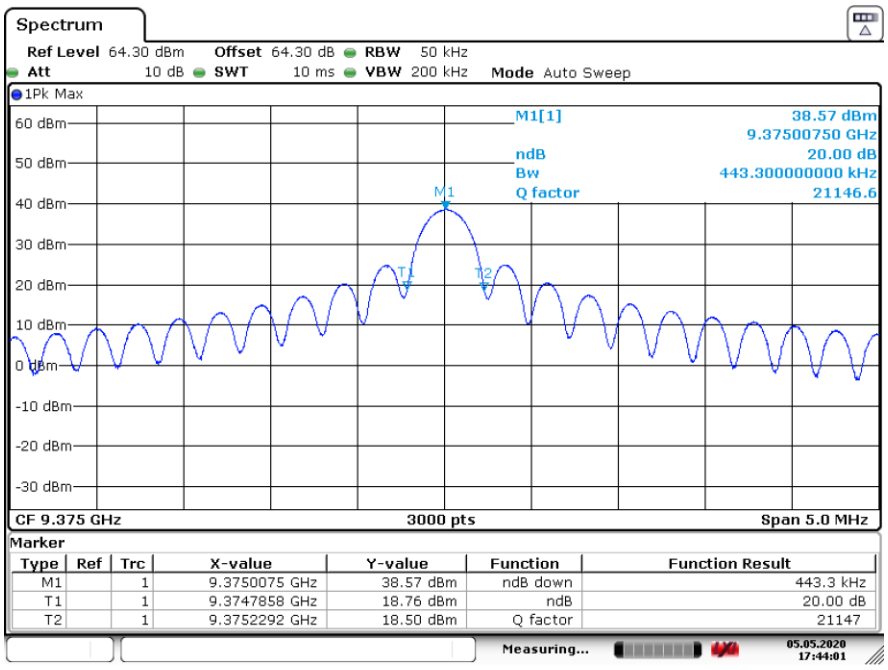
20 °C



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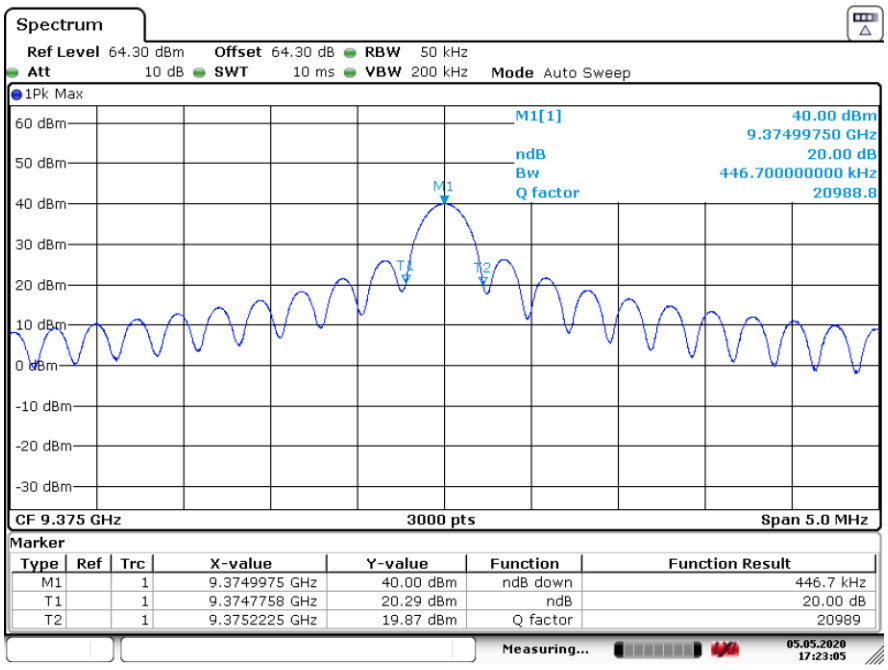
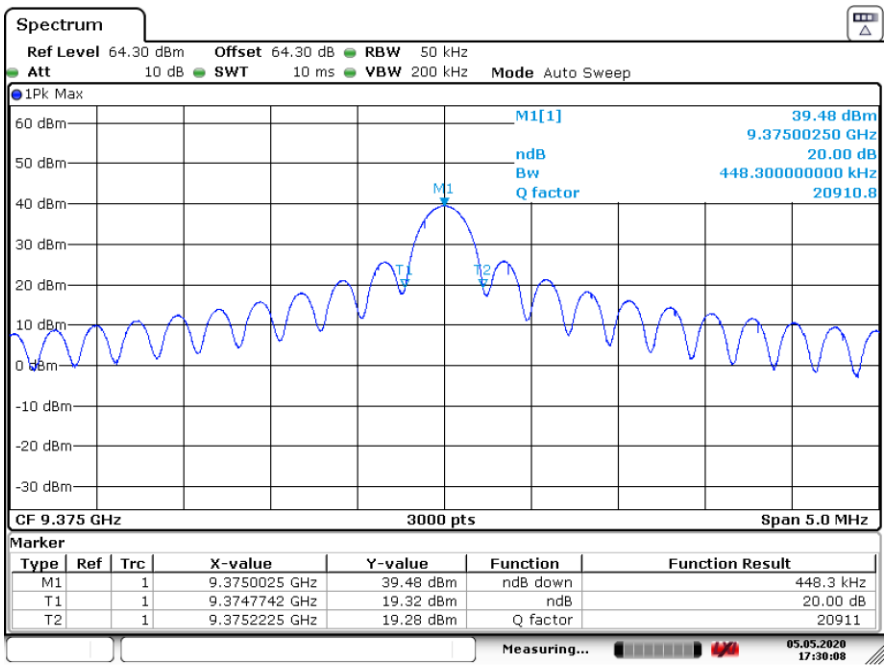
30 °C



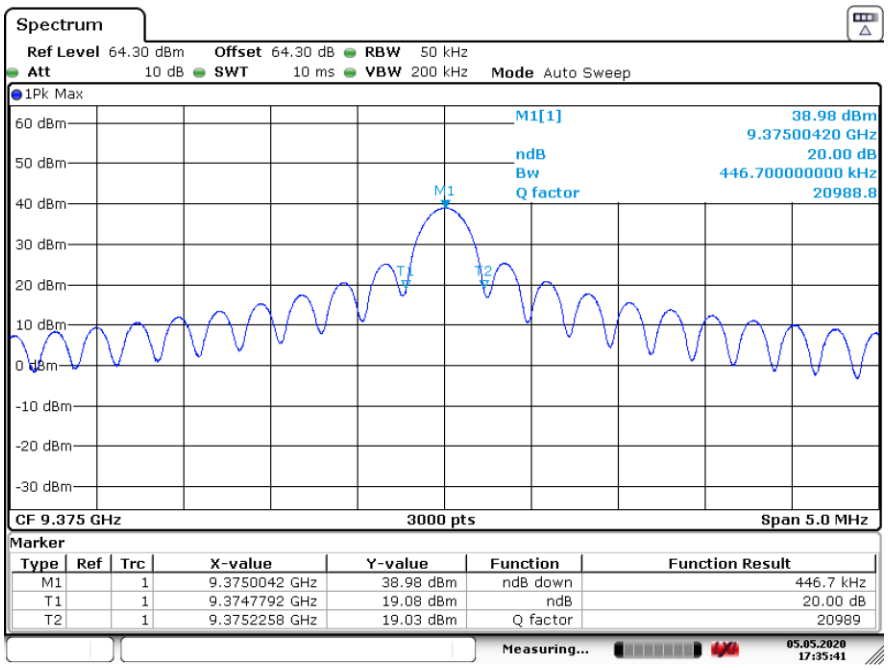
Date: 5.MAY.2020 17:23:05

40 °C



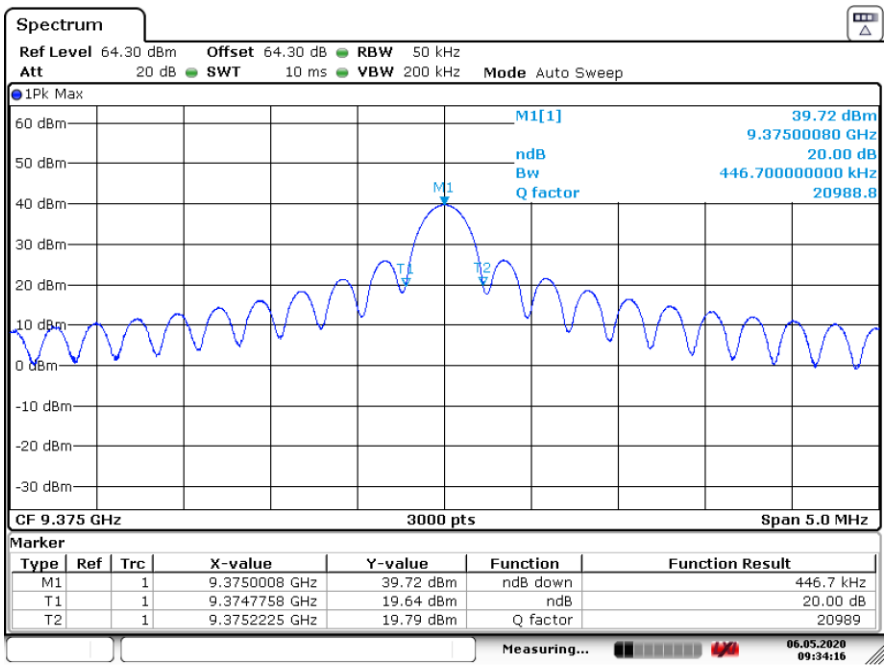
Date: 5.MAY.2020 17:30:09

50 °C



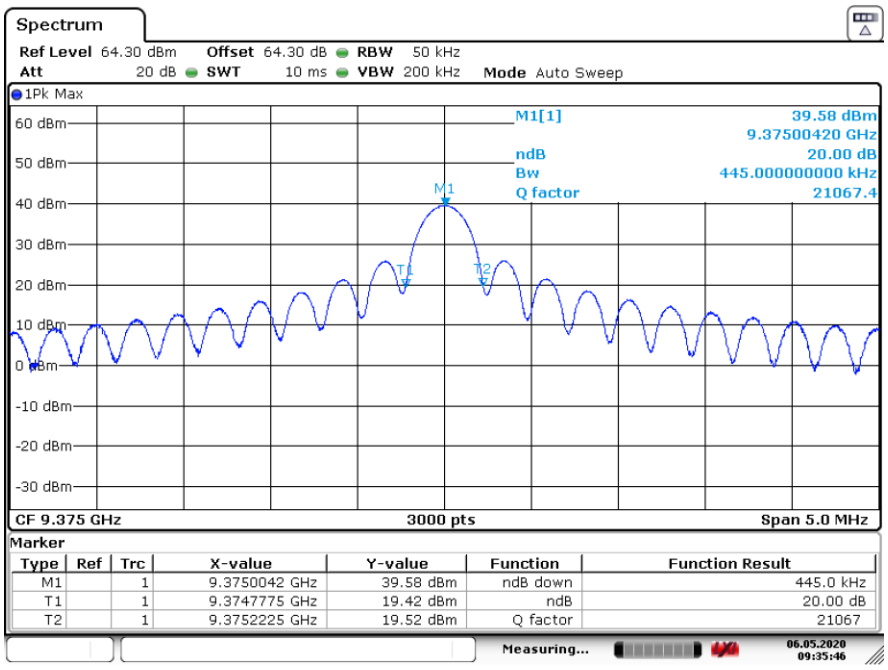
Date: 5.MAY.2020 17:35:41

102 V



Date: 6.MAY.2020 09:34:16

138 V



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9 Annex A – EUT Test Setup Photographs

Please refer to the attachment.

10 Annex B – EUT External Photographs

Please refer to the attachment.

11 Annex C – EUT Internal Photographs

Please refer to the attachment.

12 Annex D (Normative) - A2LA Electrical Testing Certificate

Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets A2LA *R222 - Specific Requirements EPA ENERGY STAR Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 2nd day of October 2018.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2020
Revised June 5, 2019

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

Please follow the web link below for a full ISO 17025 scope

https://www.a2la.org/scopepdf/3297-02.pdf

--- END OF REPORT ---