



FCC PART 90



TEST REPORT

For

Weibel Equipment, Inc.

7801 Mainsail Lane,
Sarasota, FL, 34240, USA

FCC ID: 2A8GESL15028PE

Report Type: Original Report	Product Type: X Band CW Doppler Instrumentation Radar
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Report Number R2301264-90	
Report Date 2023-06-30	
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* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*" (Rev.3)

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2301264-90	Original Report	2023-06-30

1 General Information

1.1 Product Description for Equipment under Test (EUT)

This test report was prepared on behalf of *Weibel Equipment, Inc.*, and their product model: Weibel SL-15028PE, FCC ID: 2A8GESL15028PE, which will henceforth be referred to as the EUT (Equipment under Test). The EUT is a X Band CW Doppler Instrumentation radar which measures the velocity of moving objects, typically bullets.

Power Supply	110V AC
Operational Frequency	10.529 GHz
Modulation	CW (Carrier Wave)
Output Power	17.486W

1.2 Mechanical Description

The EUT measured approximately 390 cm (L) x 355 cm (W) x 39 cm (H) and weighs approximately 19kg.

The test data gathered are from typical production sample with BACL assigned serial number: R2301264-1

1.3 Objective

This report was prepared on behalf of *Weibel Equipment, Inc.*, in accordance with Part 90 Subpart I and Part 2 Subpart J of the Federal Communication Commission's rules.

The objective was to determine compliance with FCC rules for RF output power, RF Exposure, occupied bandwidth, frequency tolerance, emission limitations at band edges, spurious emissions at antenna terminal, and field strength of spurious radiation.

1.4 Related Submittal(s)/Grant(s)

None

1.5 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 90 Subpart I and Part 2 Subpart J according to ANSI C63.26-2015.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.6 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
Unwanted Emissions, conducted	±1.57dB
All emissions, radiated	±4.0 dB
Temperature	±2 ° C
Humidity	±5 %
DC and low frequency voltages	±1.0 %
Time	±2 %
Duty Cycle	±3 %

1.7 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.

1.8 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2017 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 17025:2017 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 17025:2017 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 - ISEDC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
 - o BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
 - o NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
 - o EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
 - o Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
 - o 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:
 - o ENERGY STAR Recognized Test Laboratory – US EPA
 - o Telecommunications Certification Body (TCB) – US FCC;
 - o 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.

2.2 EUT Exercise Software

The test software used was WinDopp, provided by *Weibel Equipment, Inc.*, the software is compliant with the standard requirements being tested against.

Modulation	Frequency (MHz)	Power Setting
CW	10529	Default

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Remote Support Equipment List and Details

Manufacturer	Descriptions	Models	Serial Numbers
HP	Laptop	-	-
Weibel	Power Supply	PS-600P	2000448
Weibel	Optical Trigger	FOT-2E	1400465

2.5 Power Supply and Line Filters

Manufacturer	Descriptions	Models	Serial Numbers
Agilent	AC Power Analyzer	6812B	US38390366

2.6 Interface Ports and Cabling

Cable Description	Length (m)	From	To
Ethernet Cable	> 1	Laptop	EUT
Power cable	> 1	AC PSU Outlet	Weibel Power Supply
Power cable	> 1	Weibel Power Supply	EUT
Data cable	> 1	Trigger	EUT

3 Summary of Test Results

FCC Rules	Description of Tests	Results
§1.1310(d)(3), §2.1091, §90.223	RF Exposure	Compliant
§2.1046, §90.205(s)	RF Output Power	Compliant
§2.1049	Occupied Bandwidth	Compliant
§2.1053, §90.210	Spurious Radiated Emissions	Compliant
§2.1051, §90.210	Spurious Emissions at Antenna Terminals	Compliant
§90.210	Emission Mask	Compliant
§2.1055	Frequency Tolerance	Compliant

BACL is responsible for all the information provided in this report, except when information is provided by the customer as identified in this report. Information provided by the customer, e.g., antenna gain, can affect the validity of results.

4 FCC §1.1310(d)(3) §2.1091 & §90.223 - RF Exposure

4.1 Applicable Standards

As per FCC §1.1310(d) (3), At operating frequencies above 6 GHz, the MPE limits listed in Table 1 in paragraph (e)(1) of this section shall be used in all cases to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b) of this part.

TABLE 1 TO §1.1310(E)(1)—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(i) 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
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) 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
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

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

$$S = \text{EIRP}/4\pi R^2$$

Where: S = power density

EIRP = Effective Isotropic Radiated Power

R = distance to the center of radiation of the antenna

4.3 RF exposure evaluation exemption for FCC

Prediction frequency[f] (MHz)	10529
Maximum rated output power (dBm)	42.55
Maximum EIRP (dBm)	70.55
Prediction distance[R] (m)	4.26
Maximum allowed antenna gain (dBi)	28
Power density of prediction frequency at 4.26 m (mW/cm²):	4.977
FCC MPE limit for Occupational/Controlled exposure at prediction frequency (mW/cm²):	5

Note: According to tune up procedure, the power can up to $15W \cdot (1+20\%) = 18W$ (42.55dBm).

Results

For 10529 MHz:

In order to pass the MPE exemption threshold limit of $5mW/cm^2$ with the Output Power being 42.55 dBm, and maximum Antenna Gain of 28dBi, the EUT must have a minimum separation distance of 4.26m

5 FCC §2.1046, §90.205(s) - RF Output Power

5.1 Applicable Standards

According to FCC §90.205(s),

The output power shall not exceed by more than 20 percent either the output power shown in the Radio Equipment List [available in accordance with § 90.203(a)(1)] for transmitters included in this list or when not so listed, the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.

5.2 Test Procedure

Span > 2 * OBW

RBW > OBW

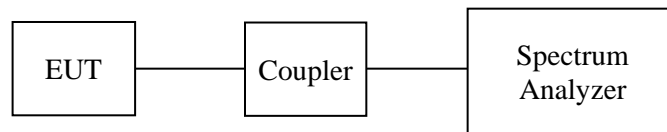
VBW ≥ 3 * RBW

Sweep = auto

Detector function = peak

Trace = max hold

5.3 Test Setup Diagram



5.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
118	Agilent	EXA Signal Analyzer	N9010A	MY4803085 2	2023-04-25	1 year
-	-	Coupler	-	-	Each time ¹	N/A
-	-	Terminator	-	-	Each time ¹	N/A
-	-	RF Cable	-	-	Each time ¹	N/A

Note¹: Equipment was calibrated for each test.

Statement of Traceability: *BACL Corp.* attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".

5.5 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	32 %
ATM Pressure:	101.4-102 kPa

The testing was performed by Arturo Reyes on 2023-06-30 in the RF Site.

5.6 Test Results

Modulation	Frequency (MHz)	Uncorrected Output Power (dBm)		Output Power (dBm)			Output Power Port A+B (Watts)	Limit (Watts)
		Port A	Port B	Port A	Port B	Port A+B		
CW	10529	5.229	5.204	39.429	39.404	42.427	17.486	< 18

Note: Output Power (dBm) = Uncorrected Output Power (dBm) + path loss (dB)

Note: Path loss is 34.2dB

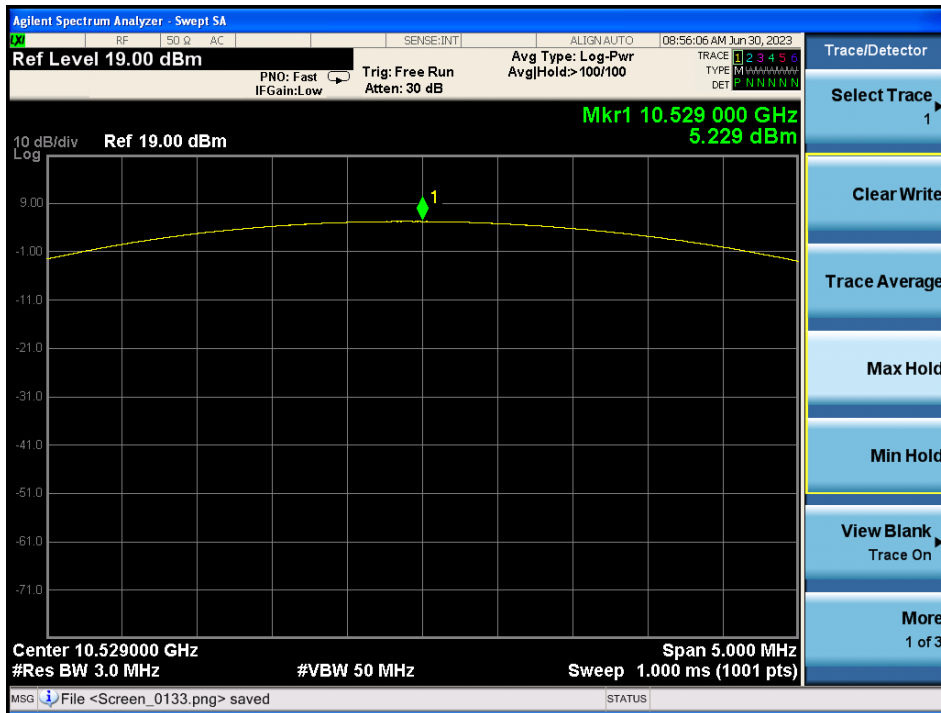
Note: Port A+B (dBm) = $10 \cdot \log(\text{Port A(mW)} + \text{Port B(mW)})$

Note: Rated power is 15W as provided by customer.

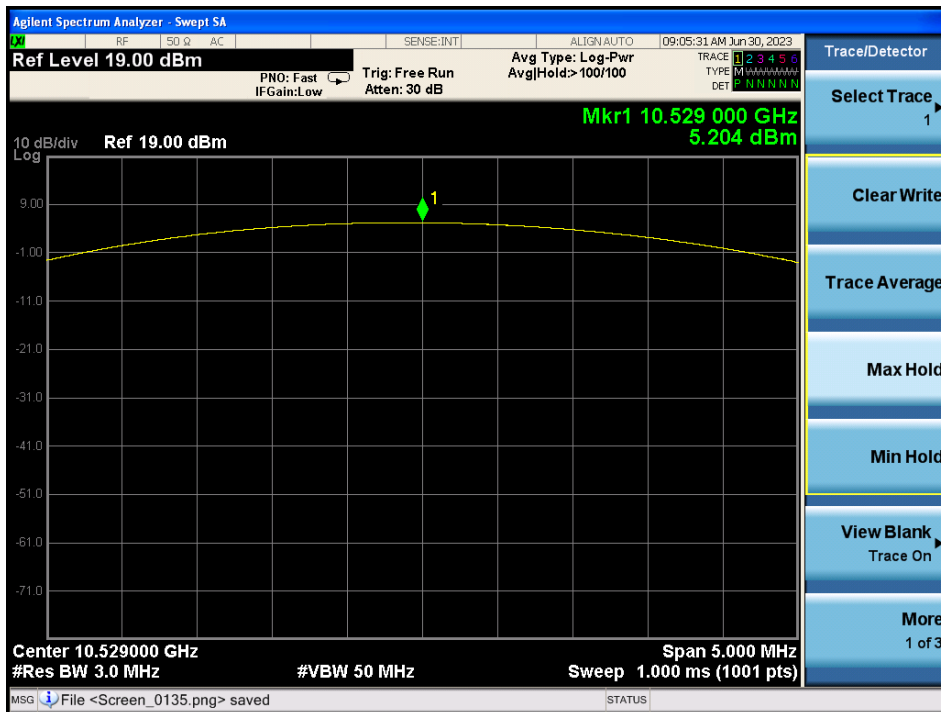
Please refer to the following plots.

Carrier Wave

Port A: 10529 MHz



Port B: 10529 MHz



6 FCC §2.1049 - Occupied Bandwidth

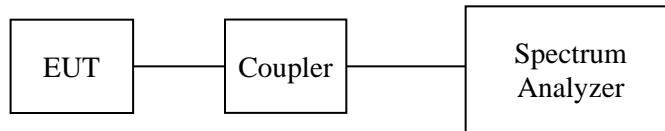
6.1 Applicable Standards

Measurements are for reference.

6.2 Test Procedure

Span > bandwidth
 RBW = 3 kHz
 VBW = 10 kHz
 Sweep = auto
 Detector function = peak
 Trace = max hold

6.3 Test Setup Diagram



6.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
912	Rohde & Schwarz	Signal Analyzer	FSV40	1321.3008k3 9-101203- UW	2022-05-05	12 months
-	-	Coupler	-	-	Each time ¹	N/A
-	-	Terminator	-	-	Each time ¹	N/A
-	-	RF Cable	-	-	Each time ¹	N/A

Note¹: Equipment was calibrated for each test.

Statement of Traceability: BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".

6.5 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	32 %
ATM Pressure:	101.4-102 kPa

The testing was performed by Arturo Reyes on 2023-03-31 in the RF Site.

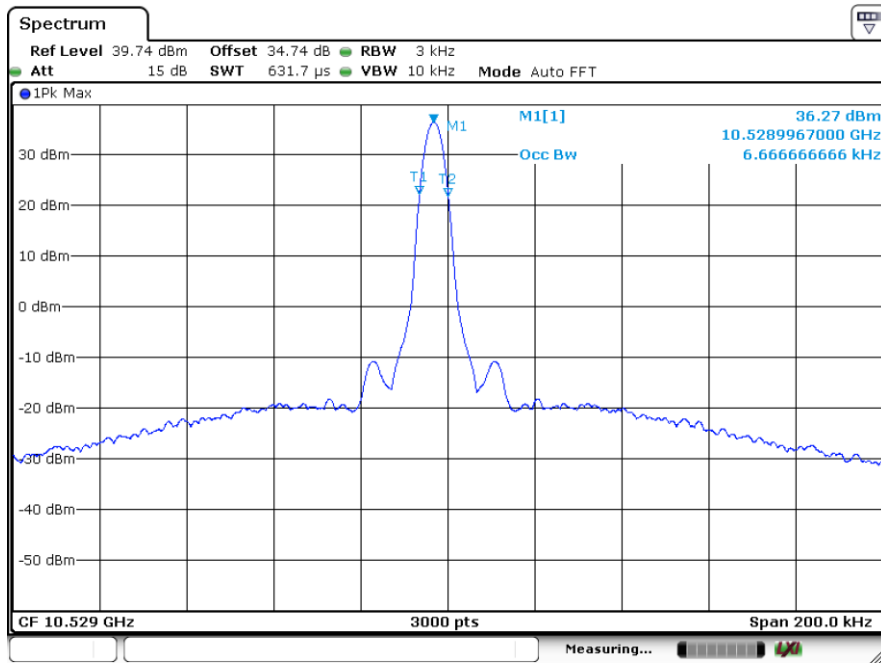
6.6 Test Results

Modulation	Antenna Port	Frequency (MHz)	99% OBW (kHz)
CW	Port A	10529	6.667
	Port B	10529	6.667

Please refer to the following plots.

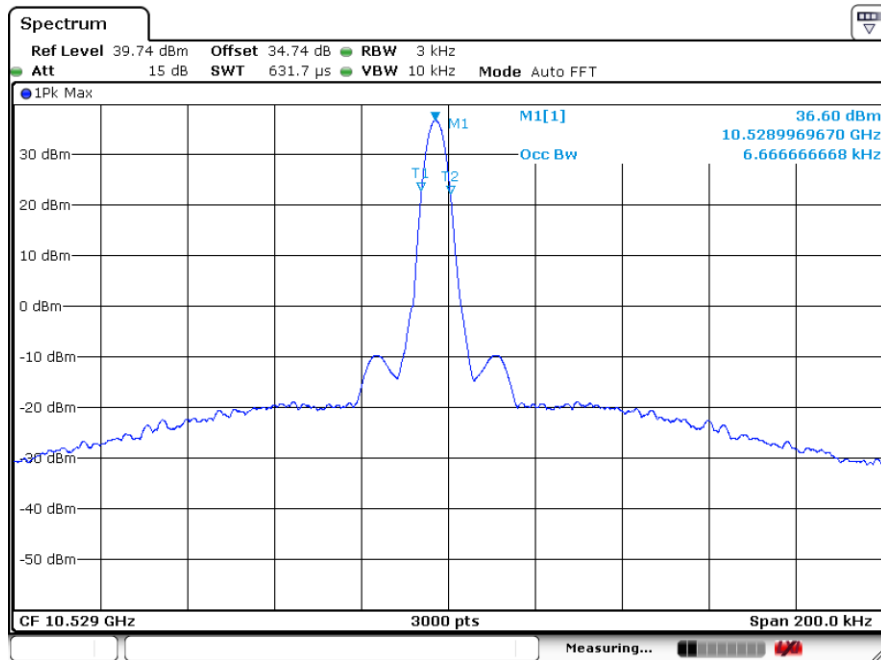
Carrier Wave

Port A: 10529 MHz



Date: 31.MAR.2023 10:10:43

Port B: 10529 MHz



Date: 31.MAR.2023 15:43:43

7 FCC §2.1053 & §90.210 - Spurious Radiated Emissions

7.1 Applicable Standards

According to FCC §90.210

TABLE 1 TO §90.210—APPLICABLE EMISSION MASKS

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25 ¹	A or B	A or C
25-50	B	C
72-76	B	C
150-174 ²	B, D, or E	C, D or E
150 paging only	B	C
220-222	F	F
421-512 ^{2 5}	B, D, or E	C, D, or E
450 paging only	B	G
806-809/851-854 ⁶	B	H
809-824/854-869 ^{3 5}	B, D	D, G.
896-901/935-940	I	J
902-928	K	K
929-930	B	G
4940-4990 MHz	L or M	L or M
5850-5925 ⁴		
All other bands	B	C

7.2 Test Procedure

The transmitter was placed onto a Styrofoam block. The unit was normally transmitting with a 50 ohm terminator connected to the antenna terminal.

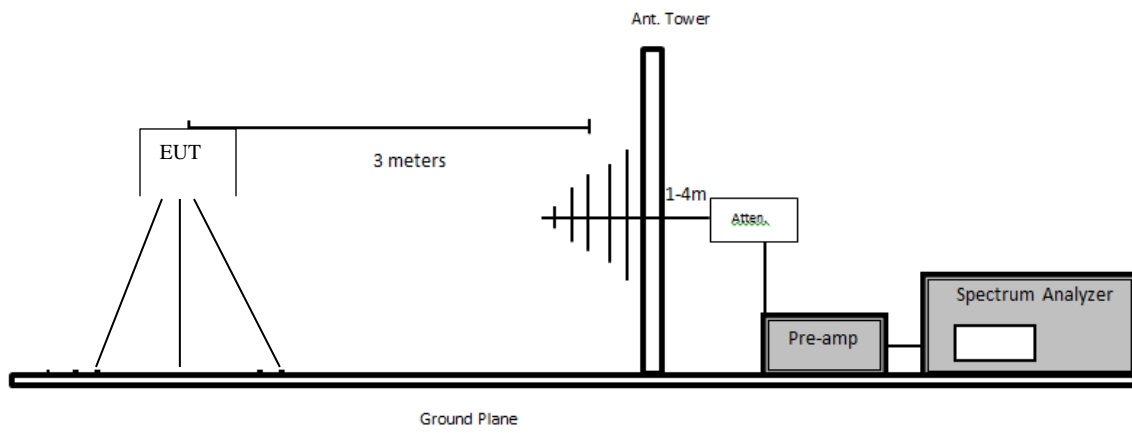
The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

Emissions were investigated up to the 5th harmonic of the fundamental frequency.

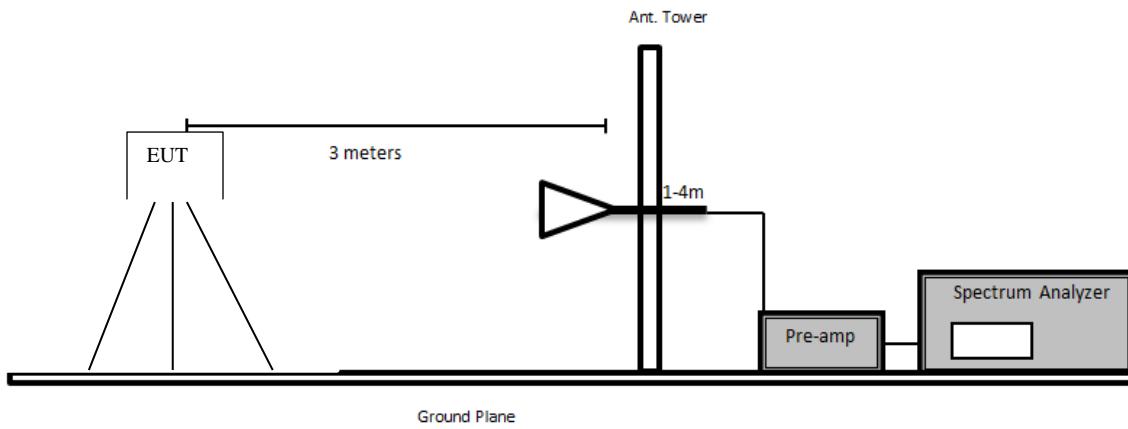
After the emissions were found, the EUT was removed and replaced by a substituting antenna. A signal generator was connected to the substituting antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

7.3 Test Setup Diagram

Below 1 GHz:



Above 1 GHz:



Note: EUT is a floor standing device

7.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
287	HP	PSA spectrum analyzer 3HZ to 44 GHZ	E4446A	US44300386	2022-05-05	1 year
655	Rohde & Schwarz	Signal Analyzer	FSQ26	200749	2022-02-07	2 years
183	Agilent	Signal Generator	83650B	3614A00276	2022-08-03	1 year
688	Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2022-07-28	1 year
327	Sunol Science Corp	System Controller	SC110V	011003-1	N/R	N/A
1186	Pasternack	Coaxial Cable, RG214	PE3062-1050CM	1	2022-09-26	1 year
1247	Uti flex	Micro - Coax	-	-	2022-07-22	1 year
1248	Pasternack	RG214 COAX Cable	PE3062	-	2022-04-12	1 year
1249	Time Microwave	LMR-400 Cable Dc-3 Ghz	AE13684	2k80612-56fts	2022-04-12	1 year
1295	Carlisle	10m Ultra Low Loss Coaxial Cable	UFB142A-1-3937-200200	64639890912-001	2022-10-28	6 months
188	Sunol Sciences	Horn Antenna	DRH-118	A052704	2021-10-07	2 years
321	Sunol Sciences	Biconilog Antenna	JB3	A020106-2	2021-11-22	2 years
568	COM-POWER	Dipole Antennas	AD-100 DB-4	721033DB1, 721033DB2, 721033DB3, 521921	2021-04-30	2 years
1192	ETS Lindgren	Horn Antenna	3117	00218973	2022-09-29	2 years
316	Sonoma Instruments	Pre-Amplifier	317	260406	2022-05-12	1 year
658	Agilent	Pre-Amplifier	8449B OPT HO2	3008A0113	2022-07-27	1 year
91	Wisewave	Antenna, Horn	ARH-4223-02	10555-02	2022-03-08	2 years
90	Wisewave	Antenna, Horn	ARH-2823-02	10555-01	2022-03-17	2 years
827	AH Systems	Preamplifier	PAM 1840 VH	170	2022-06-21	1 year
861	OML Inc.	Mixer and Horn Antenna set	M03HWA, M05HWA M08HWA M012HWA M19HWA	170615-1	N/R	N/A
-	-	RF cable	-	-	Each time ¹	N/A
-	-	Terminator	-	-	Each time ¹	N/A
-	-	Notch Filter	-	-	Each time ¹	N/A

Note¹: This equipment was calibrated for each test.

Statement of Traceability: BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".

7.5 Test Environmental Conditions

Temperature:	20-21°C
Relative Humidity:	47-49 %
ATM Pressure:	101.4-101.6 kPa

The testing was performed by Deepak Mishra on 2023-04-04 in 5 Meter Chamber 3.

7.6 Test Results

CW, Middle channel tested (10529 MHz)

Indicated		Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (cm)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Ant. Gain Correction (dBd/dBi)	Cable Loss (dB)	Absolute Level (dBm)		
220.12	76.43	250	128	H	220.12	-38.52	1.5	0.04	-37.06	-13	-24.06
220.12	78.71	82	143	V	220.12	-36.24	1.5	0.04	-34.78	-13	-21.78
1551	65.85	58	179	H	1551	-46.39	7.404	1.61	-40.596	-13	-27.596
1551	62.84	82	151	V	1551	-49.4	7.404	1.61	-43.606	-13	-30.606
15447	48.89	142	149	H	15447	-45.81	27.088	1.61	-20.332	-13	-7.332
15817	48.7	189	150	V	15817	-46.11	27.088	1.61	-20.632	-13	-7.632

Note: verified noise floor beyond 18GHz

8 FCC §2.1051 & §90.210 - Spurious Emissions at Antenna Terminals

8.1 Applicable Standards

According to FCC §90.210

TABLE 1 TO §90.210—APPLICABLE EMISSION MASKS

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25 ¹	A or B	A or C
25-50	B	C
72-76	B	C
150-174 ²	B, D, or E	C, D or E
150 paging only	B	C
220-222	F	F
421-512 ^{2 5}	B, D, or E	C, D, or E
450 paging only	B	G
806-809/851-854 ⁶	B	H
809-824/854-869 ^{3 5}	B, D	D, G.
896-901/935-940	I	J
902-928	K	K
929-930	B	G
4940-4990 MHz	L or M	L or M
5850-5925 ⁴		
All other bands	B	C

(j) *Emission Mask J.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 2.5 kHz, but no more than 6.25 kHz: At least $53 \log(f_d/2.5)$ dB;

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 6.25 kHz, but no more than 9.5 kHz: At least $103 \log(f_d/3.9)$ dB;

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 9.5 kHz: At least $157 \log(f_d/5.3)$ dB, or $50 + 10 \log(P)$ dB or 70 dB, whichever is the lesser attenuation.

8.2 Test Procedure

Conducted spurious emissions:

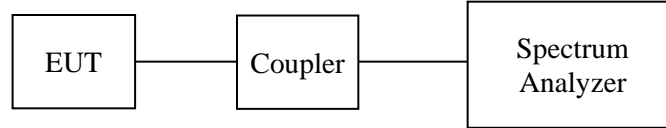
The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz for measurements up to 1GHz and set to 1 MHz for measurements up to the 5th harmonic.

Band-edge emissions:

According to ANSI C63.26-2015 section 5.7 Unwanted (out-of-band and spurious) conducted emissions measurement procedures (conducted test at antenna port):

A RBW narrower than the specified reference bandwidth can be used (generally limited to no less than 1% of the OBW).

8.3 Test Setup Diagram



8.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
912	Rohde & Schwarz	Signal Analyzer	FSV40	1321.3008k39-101203-UW	2022-05-05	12 months
287	HP	PSA spectrum analyzer 3HZ to 44 GHZ	E4446A	US44300386	2022-05-05	1 year
861	OML Inc.	Mixer and Horn Antenna set	M03HW A, M05HW A M08HW A M012HW A M19HW A	170615-1	N/R	N/A
-	-	Coupler	-	-	Each time ¹	N/A
-	-	Terminator	-	-	Each time ¹	N/A
-	-	RF Cable	-	-	Each time ¹	N/A

Note¹: Equipment was calibrated for each test.

Statement of Traceability: BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".

8.5 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	32 %
ATM Pressure:	101.4-102 kPa

The testing was performed by Arturo Reyes on 2023-03-31 in the RF Site.

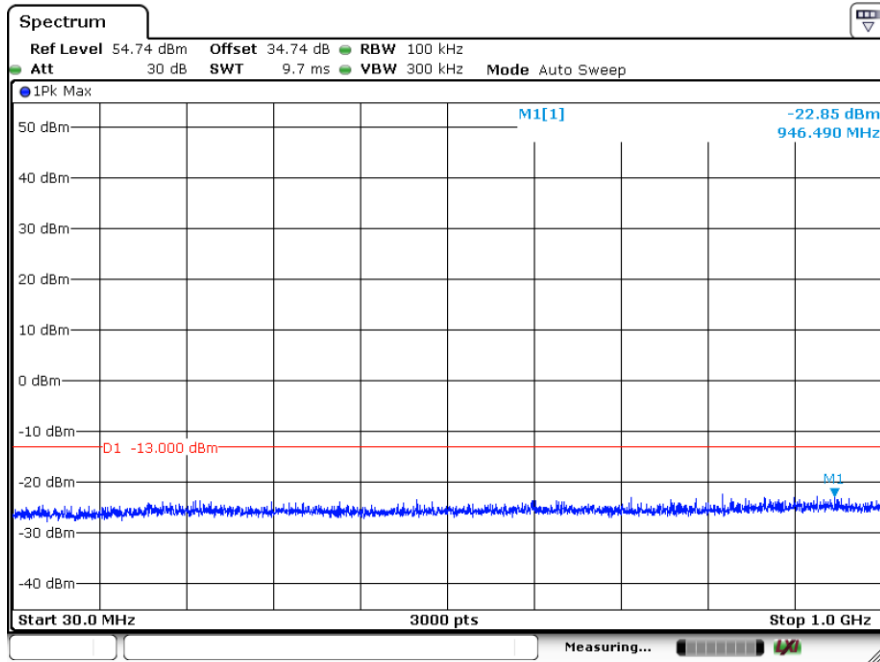
8.6 Test Results

Please refer to the following plots.

Spurious Emissions

Port A: 10529 MHz

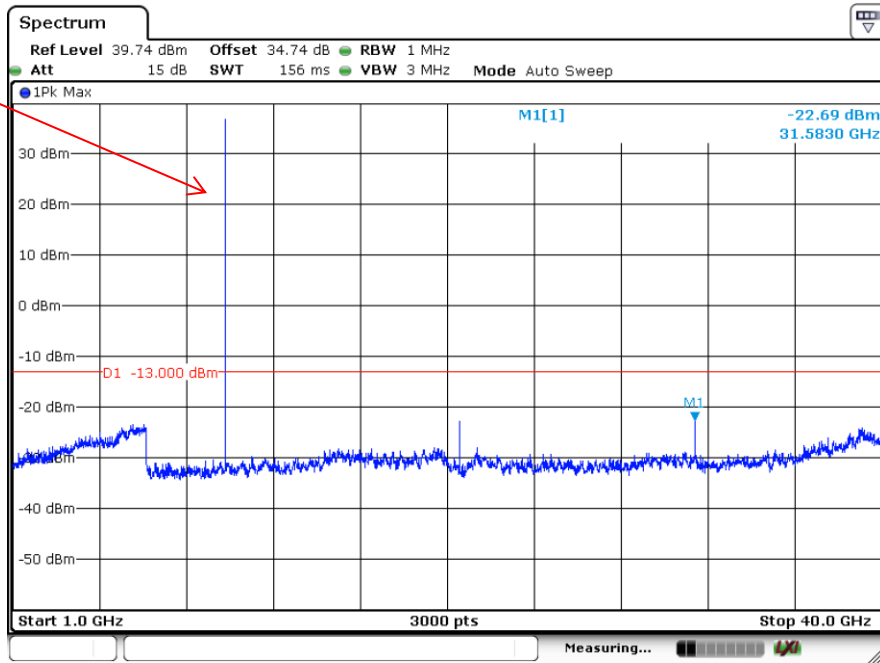
1) 30MHz – 1 GHz



Date: 31.MAR.2023 09:49:27

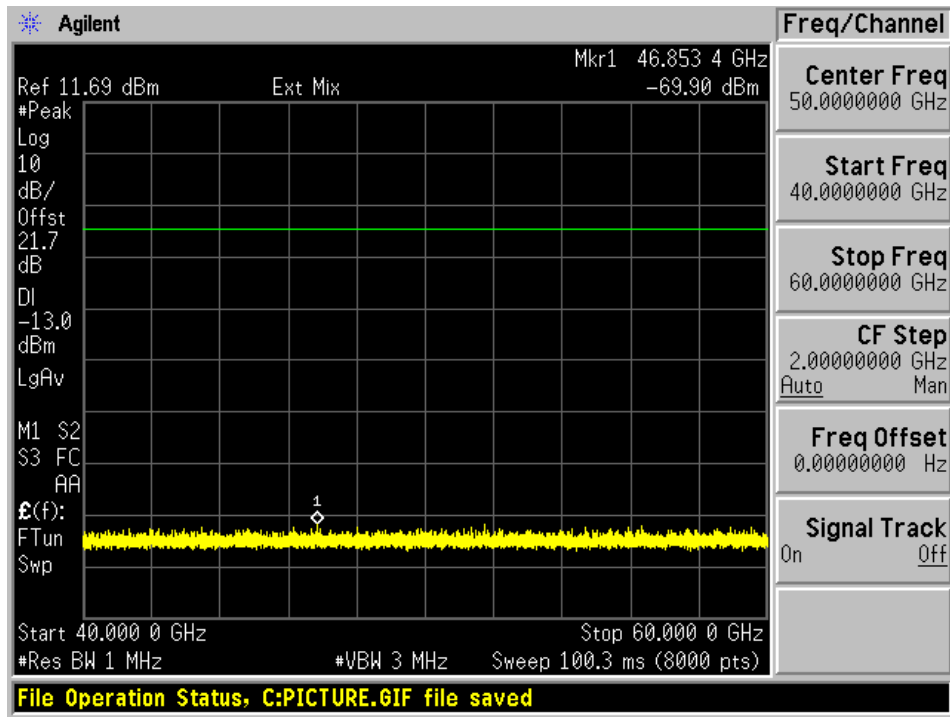
2) 1 – 40 GHz

Fundamental



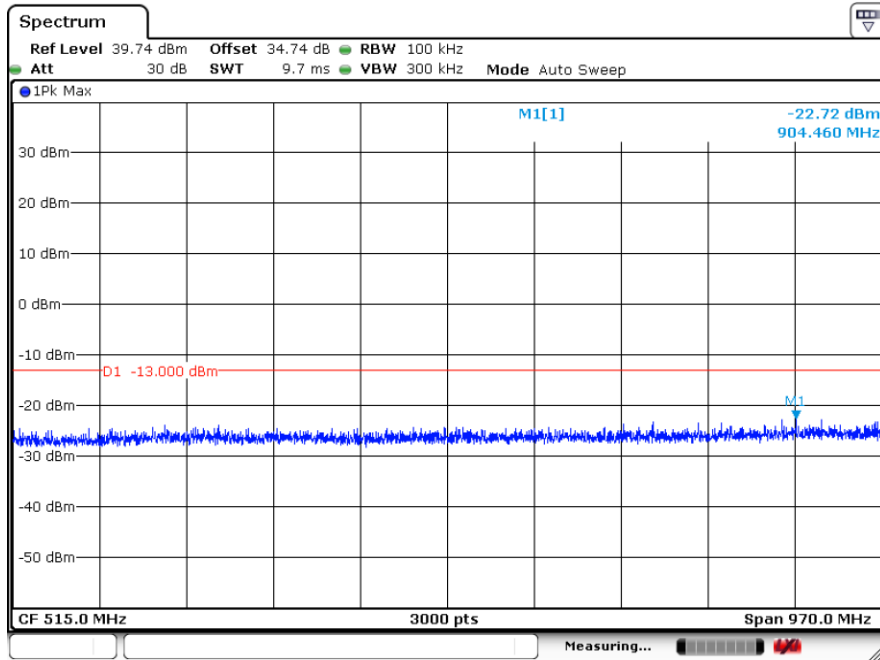
Date: 31.MAR.2023 09:51:24

3) 40 - 60 GHz



Port B: 10529 MHz

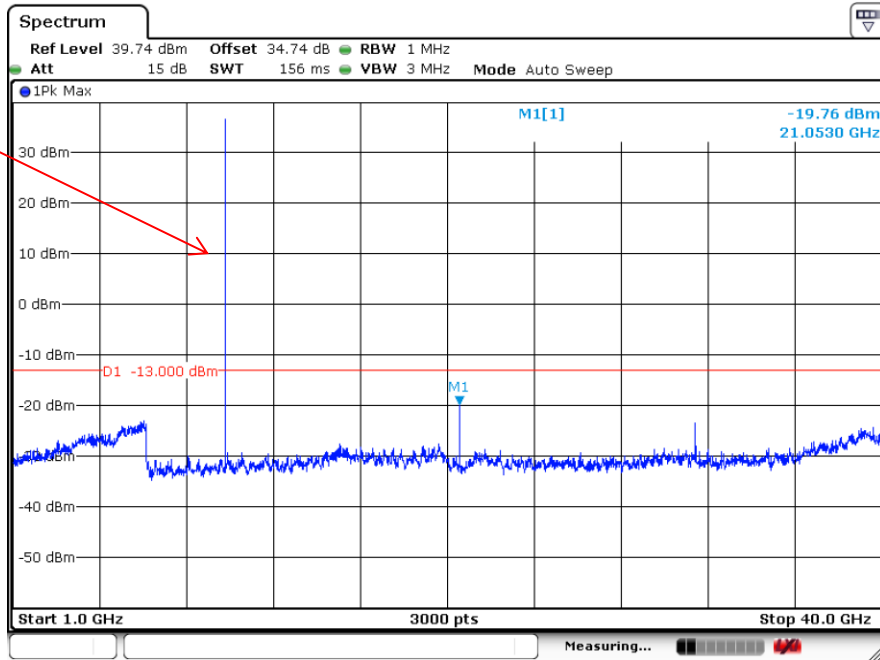
1) 30 MHz – 1 GHz



Date: 31.MAR.2023 15:51:24

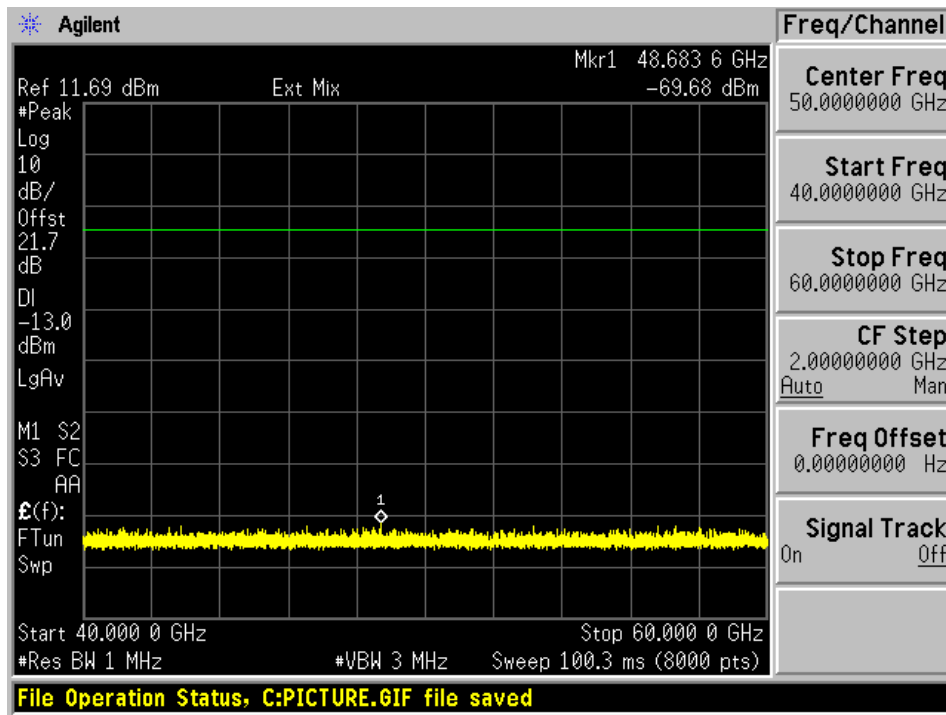
2) 1 – 40 GHz

Fundamental



Date: 31.MAR.2023 15:52:59

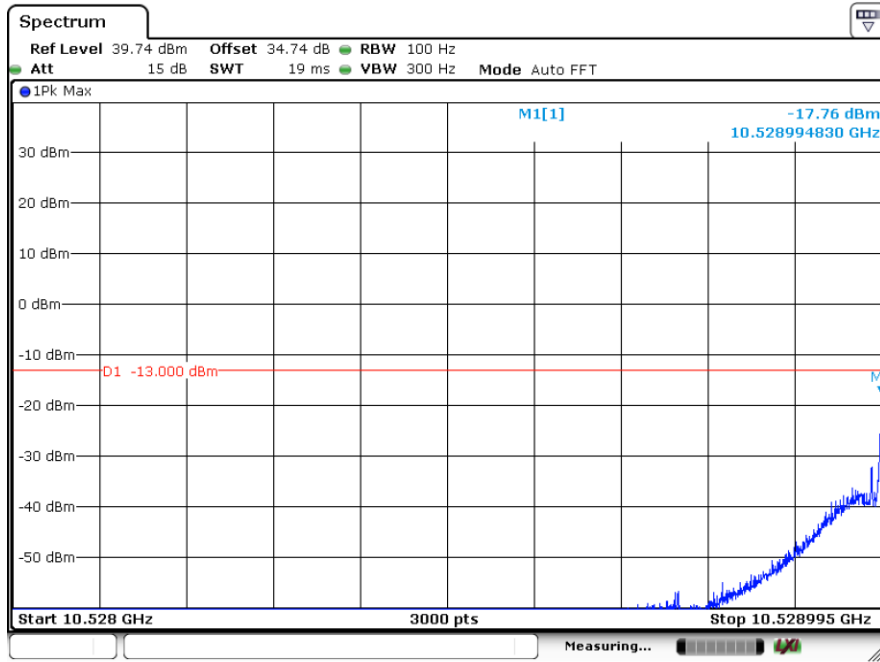
3) 40 - 60 GHz



Emission Mask C:

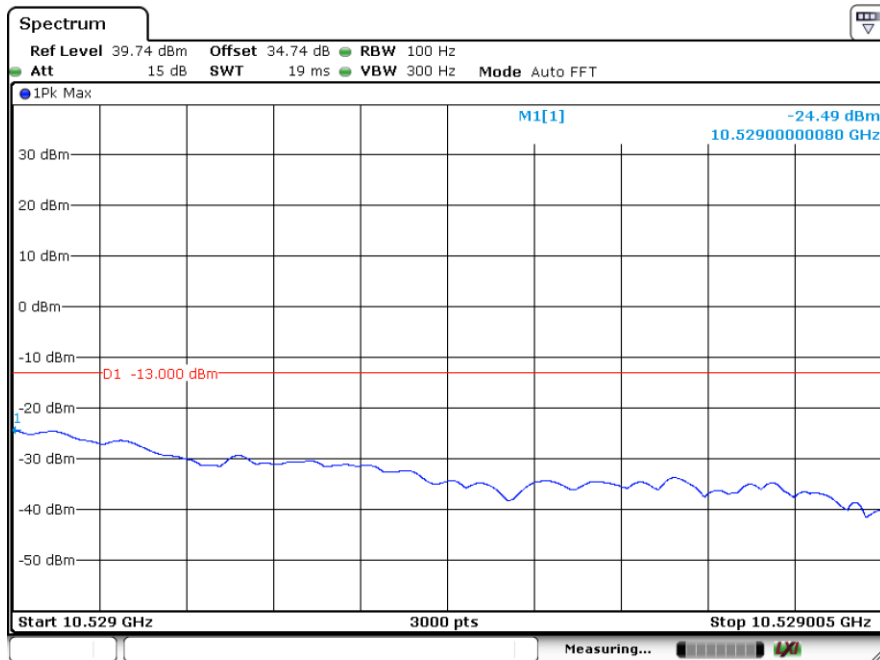
CW

Port A: 10529 MHz; Left Band



Date: 31.MAR.2023 10:12:10

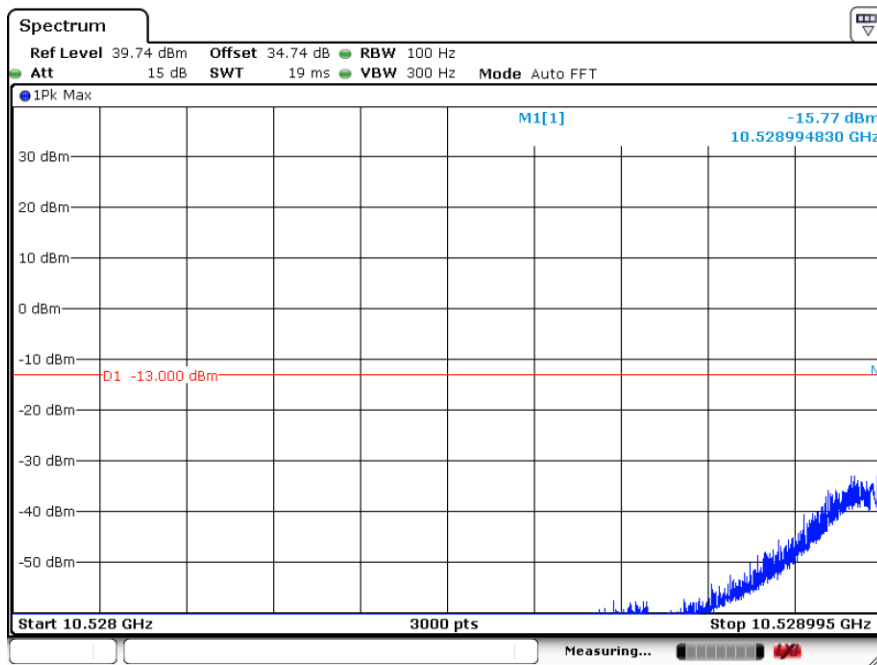
Port A: 10529 MHz; Right Band



Date: 31.MAR.2023 10:13:37

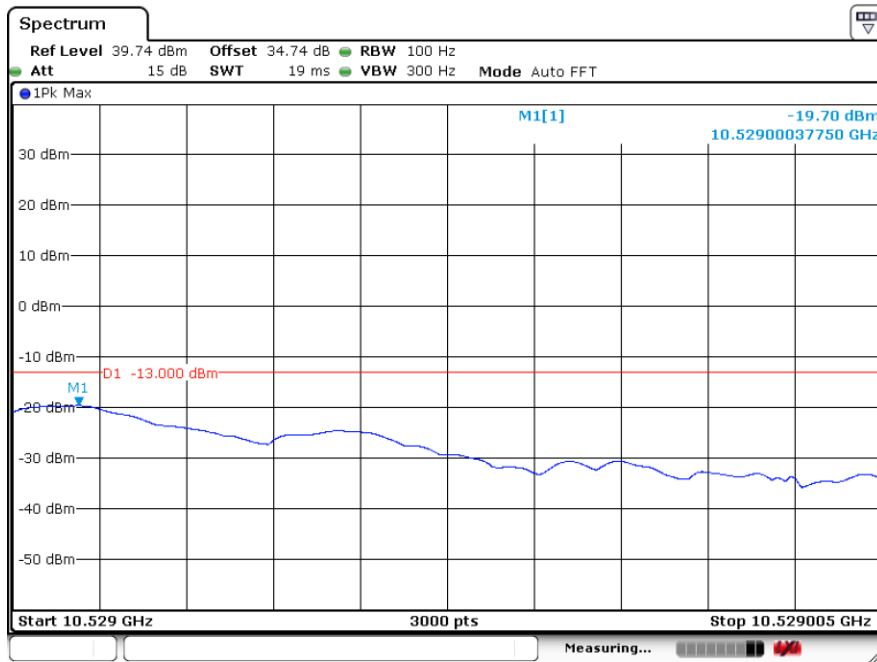
CW

Port B: 10529 MHz; Left Band



Date: 31.MAR.2023 15:48:55

Port B: 10529 MHz; Right Band



Date: 31.MAR.2023 15:50:12

Note: above plots show compliance by using the strictest limit of the emission mask (90.210(c)(3)) and comparing it to the closest bandedge described per 90.210(c)(1)

9 FCC §2.1055 Frequency Tolerance

9.1 Applicable Standard

Measurements are for reference.

9.2 Test Procedure

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30° to $+50^{\circ}$ centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(2) From -20° to $+50^{\circ}$ centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.

(3) From 0° to $+50^{\circ}$ centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(c) In addition to all other requirements of this section, the following information is required for equipment incorporating heater type crystal oscillators to be used in mobile stations, for which type acceptance is first requested after March 25, 1974, except for battery powered, hand carried, portable equipment having less than 3 watts mean output power.

(1) Measurement data showing variation in transmitter output frequency from a cold start and the elapsed time necessary for the frequency to stabilize within the applicable tolerance. Tests shall be made after temperature stabilization at each of the ambient temperature levels; the lower temperature limit, 0° centigrade and $+30^{\circ}$ centigrade with no primary power applied.

(2) Beginning at each temperature level specified in paragraph (c)(1) of this section, the frequency shall be measured within one minute after application of primary power to the transmitter and at intervals of no more than one minute thereafter until ten minutes have elapsed or until sufficient measurements are obtained to indicate clearly that the frequency has stabilized within the applicable tolerance, whichever time period is greater. During each test, the ambient temperature shall not be allowed to rise more than 10° centigrade above the respective beginning ambient temperature level.

(3) The elapsed time necessary for the frequency to stabilize within the applicable tolerance from each beginning ambient temperature level as determined from the tests specified in this paragraph shall be specified in the instruction book for the transmitter furnished to the user.

(4) When it is impracticable to subject the complete transmitter to this test because of its physical dimensions or power rating, only its frequency determining and stabilizing portions need be tested.

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

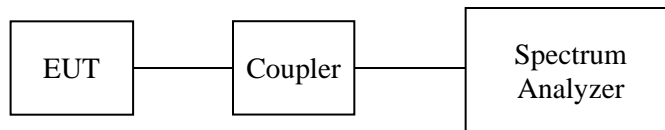
(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c), and (d) of this section. (For example measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

9.3 Test Setup Diagram



9.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
912	Rohde & Schwarz	Signal Analyzer	FSV40	1321.3008k39-101203-UW	2022-05-05	12 months
-	-	Coupler	-	-	Each time ¹	N/A
-	-	Terminator	-	-	Each time ¹	N/A
-	-	RF Cable	-	-	Each time ¹	N/A
147	Agilent	Analyzer, AC Power	6812B	US38390366	N/A	N/A
274	Espec	Chamber, Humidity	ESL-4CA	18010	2022-10-27	12 months

Note¹: Equipment was calibrated for each test.

Statement of Traceability: BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".

9.5 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	32 %
ATM Pressure:	101.4-102 kPa

The testing was performed by Arturo Reyes on 2023-03-31 in the RF Site.

9.6 Test Results

Note: Testing done using CW mode

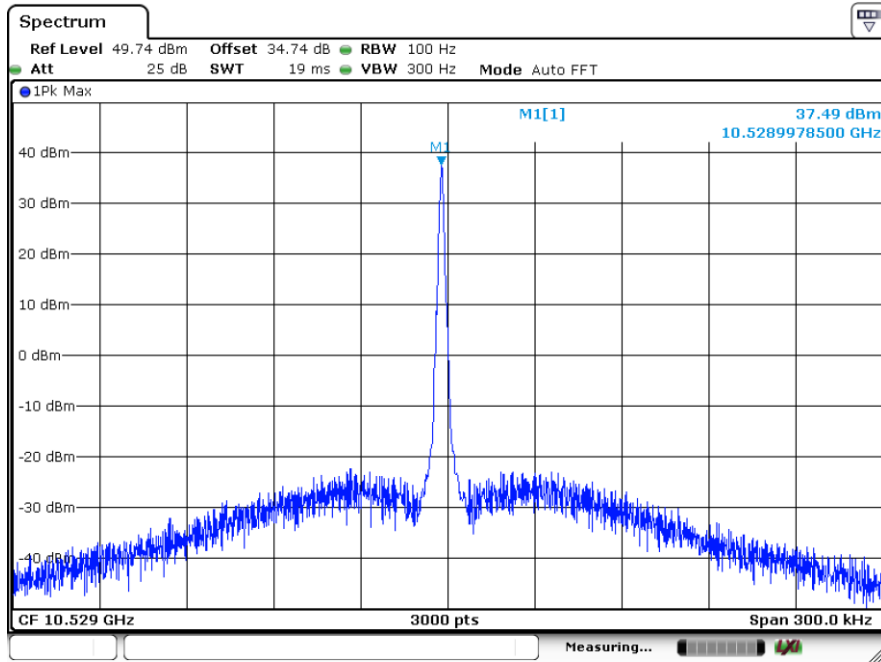
10529 MHz:

Temperature (°C)/ Voltage Conditions	Reference Frequency (MHz)	Tested Frequency (MHz)	Frequency Deviation (ppm)
-30/normal voltage (15V)	10529	10528.99785	-0.20
-20/normal voltage (15V)	10529	10528.99735	-0.25
-10/normal voltage (15V)	10529	10528.99685	-0.30
0/normal voltage (15V)	10529	10528.99655	-0.33
10/normal voltage (15V)	10529	10528.99635	-0.35
20/normal voltage (15V)	10529	10528.99675	-0.31
30/normal voltage (15V)	10529	10528.99675	-0.31
40/normal voltage (15V)	10529	10528.99685	-0.30
50/normal voltage (15V)	10529	10528.99685	-0.30
20/Low Voltage (12.75V)	10529	10528.99715	-0.27
20/High Voltage (17.25V)	10529	10528.99715	-0.27

Please refer to the following plots for measurement results.

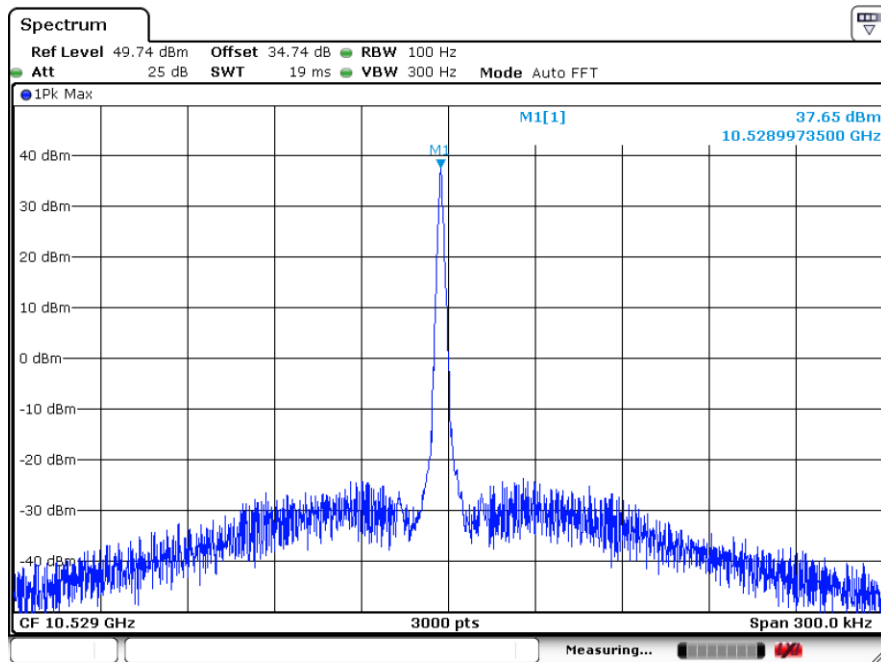
10529 MHz

-30 °C



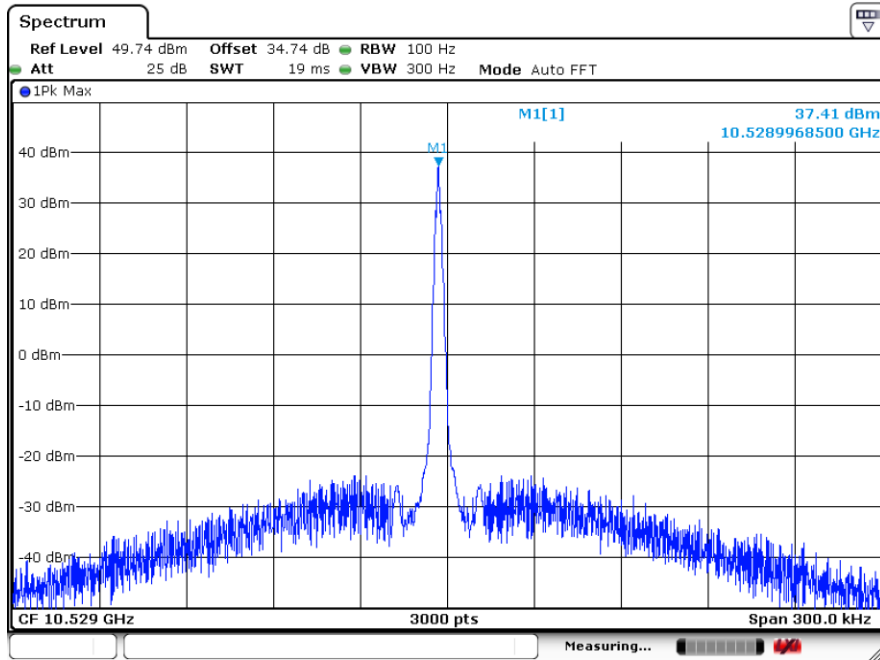
Date: 31.MAR.2023 13:01:12

-20 °C



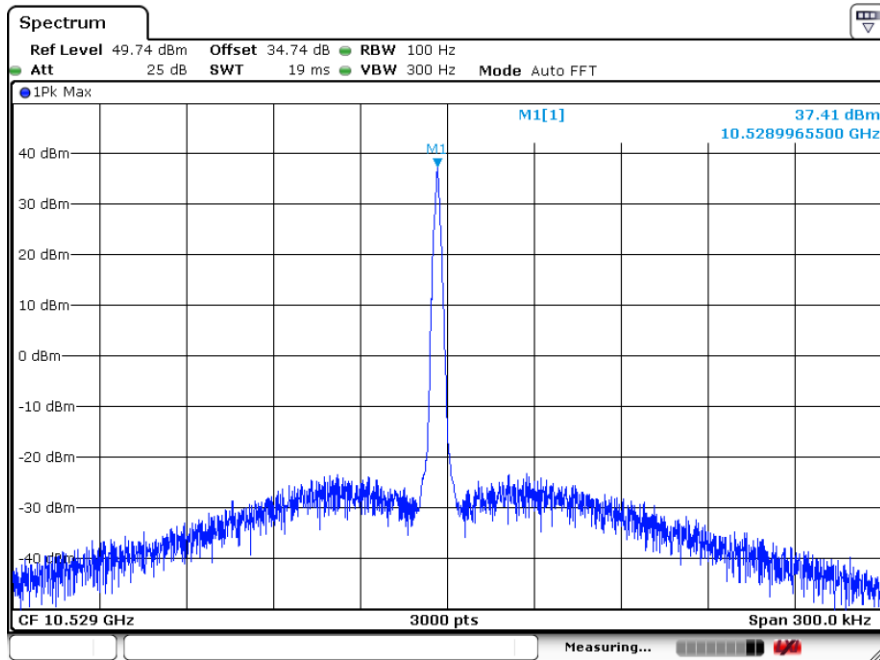
Date: 31.MAR.2023 13:24:38

-10 °C



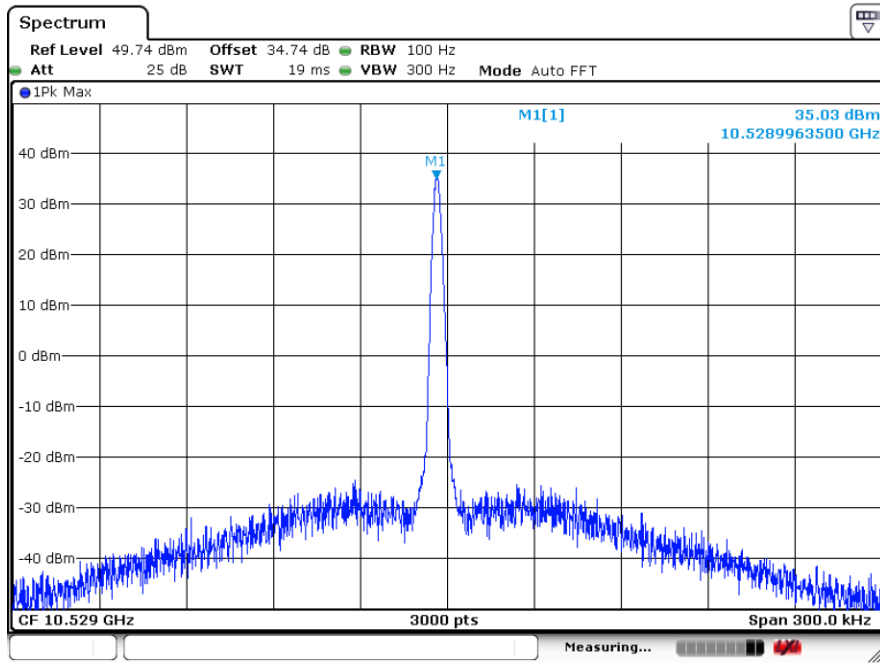
Date: 31.MAR.2023 13:34:10

0 °C



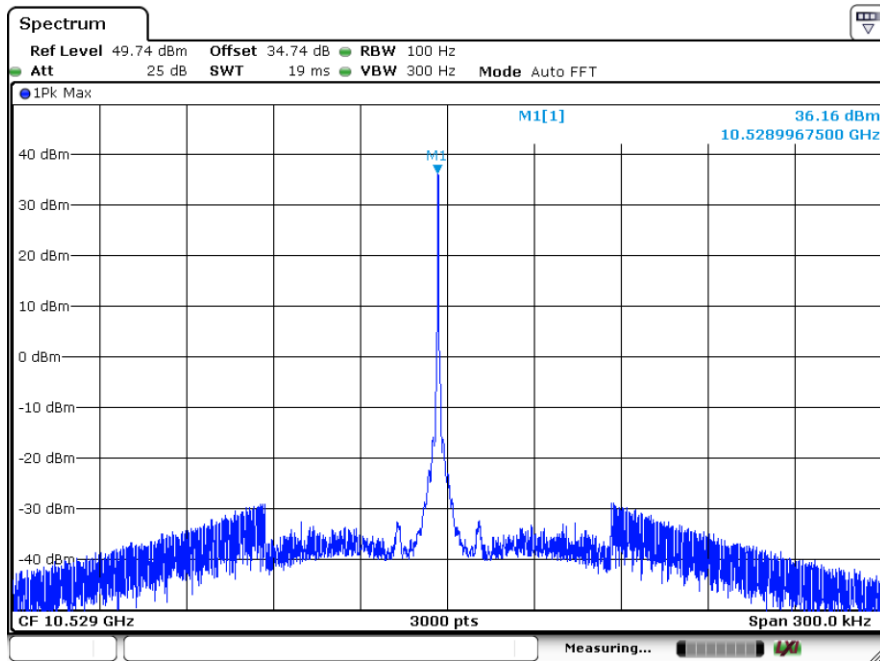
Date: 31.MAR.2023 13:44:15

10 °C



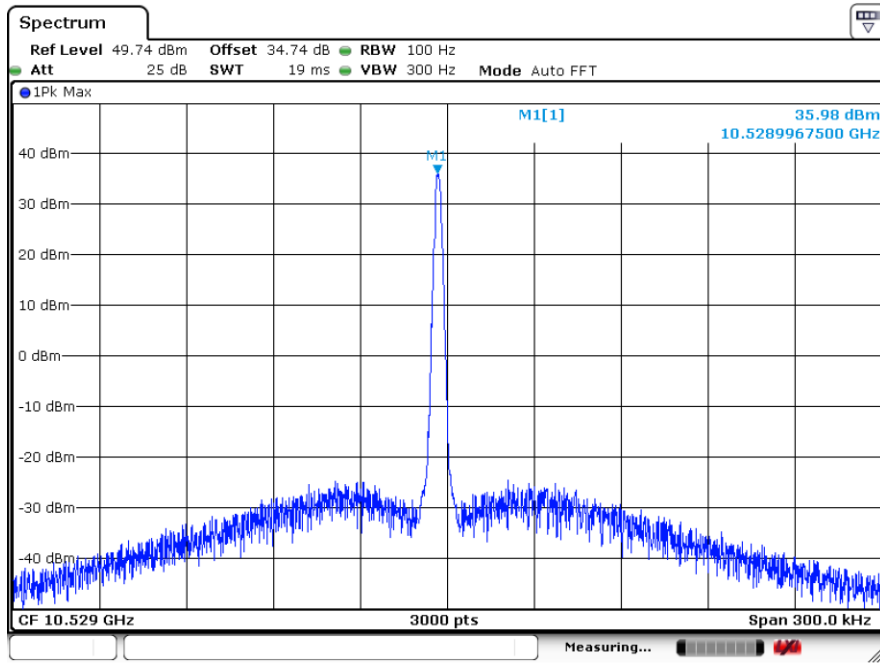
Date: 31.MAR.2023 14:00:06

20 °C



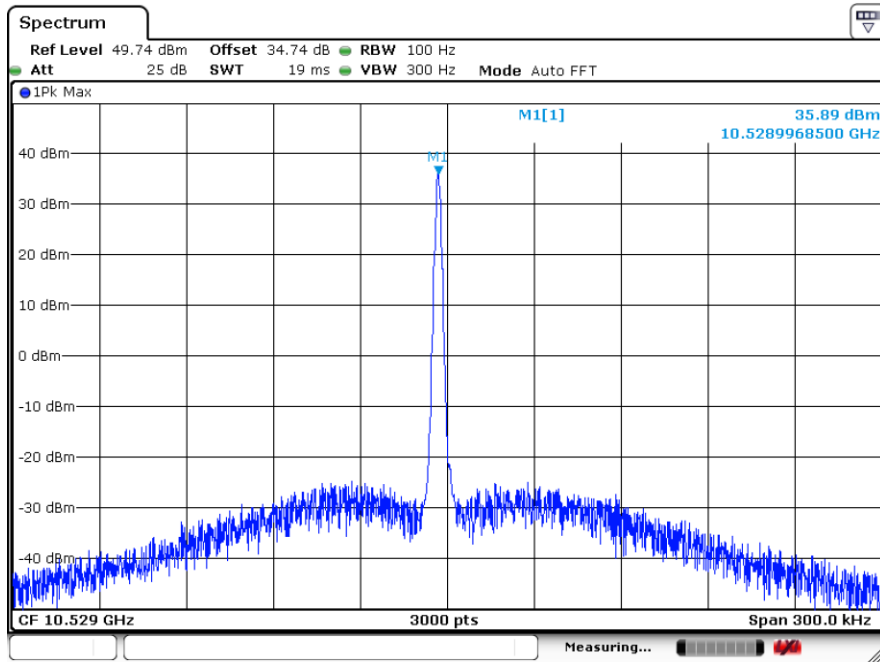
Date: 31.MAR.2023 10:16:53

30 °C



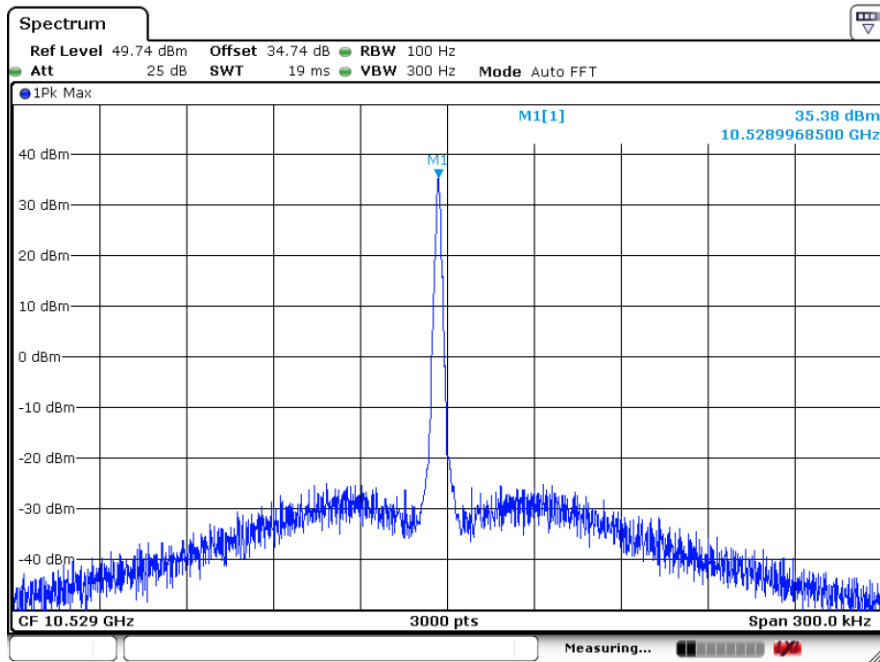
Date: 31.MAR.2023 14:24:29

40 °C



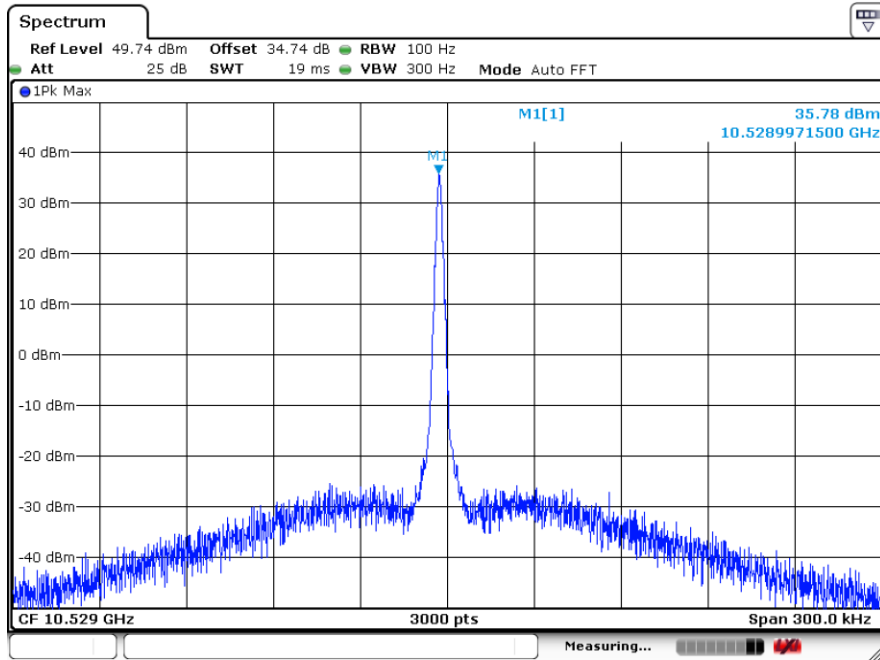
Date: 31.MAR.2023 14:34:16

50 °C



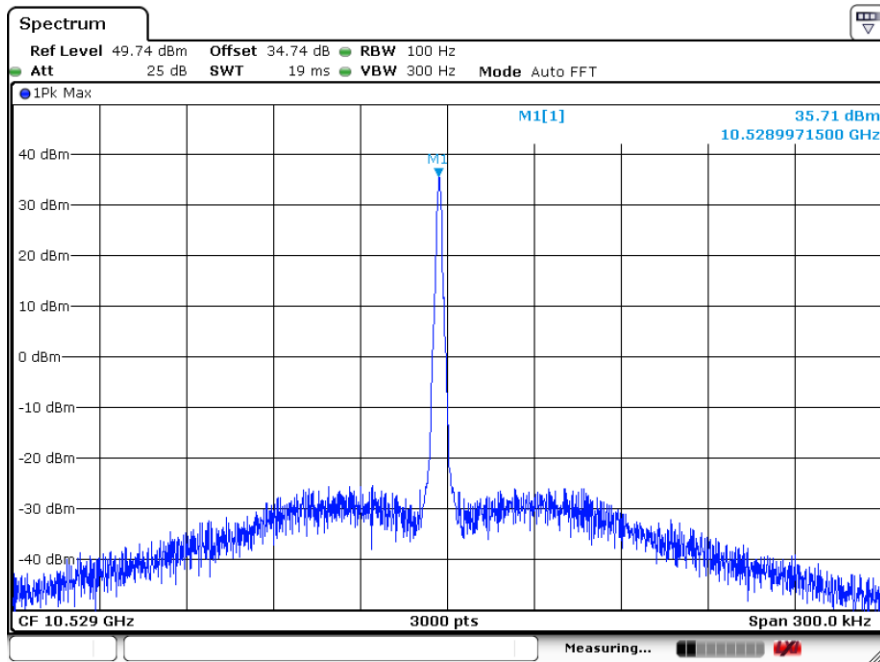
Date: 31.MAR.2023 14:42:32

Low Voltage (12.75 V)



Date: 31.MAR.2023 15:08:24

High Voltage (17.25 V)



Date: 31.MAR.2023 15:02:54

10 Annex A (Normative) - EUT Setup Photographs

Please refer to the attachment

11 Annex B (Normative) - EUT External Photographs

Please refer to the attachment

12 Annex C (Normative) - EUT Internal Photographs

Please refer to the attachment

13 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 17025:2017 *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 21st day of December 2022.



A handwritten signature in blue ink, appearing to read 'Trace McInturf'.

Mr. Trace McInturf, Vice President, Accreditation Services
 For the Accreditation Council
 Certificate Number 3297.02
 Valid to September 30, 2024

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 ---