FCC PART 90
ISED RSS-111, ISSUE 5, SEPTEMBER 2014

TEST REPORT

For

Cisco Systems, Inc.

FCC: 125 West Tasman Drive
San Jose, CA 95134-1706
IC: 170 W. Tasman Drive, Building P & 7
San Jose, CA 95134, United States of America (Excluding The States of Alaska)

FCC ID: LDKIW9165DH
IC: 2461A-IW9165DH

Report Type: Original Report	**Product Type:** Wi-Fi 6E Outdoor Access Point	
Prepared By:	Christian Schwartz Test Engineer	
Report Number:	R2304111-90	
Report Date:	2023-10-04	
Reviewed By:	Christian McCaig RF Lead Engineer	
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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	R2304111-90	Original	2023-10-04

1 General Information

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1.1 Product Description for Equipment under Test (EUT)

This test report was prepared on behalf of *Cisco Systems, Inc.*, and their product model: *IW9165DH-B (USA), IW9165DH-A (Canada),* **FCC ID**: LDKIW9165DH **IC**: 2461A-IW9165DH, or the "EUT" as referred to in this report. It is a Wi-Fi 6E Outdoor Access Point.

1.2 Mechanical Description

Dimensions (mm): 200 mm (L) x 190 mm (W) x 80 mm (H), Weight = 1.95kg.
Serial Number: FOC2638BL91 assigned by manufacturer.
EUT Photos: See Attachments Annex B.

1.3 Objective

This report was prepared on behalf *Cisco Systems, Inc.* in accordance with Part 90 Subparts I and Y and Part 2 Subpart J of the Federal Communication Commission's rules and with ISEDC RSS-111 Issue 5, September 2014.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All tests and measurements indicated in this document were performed in accordance with ANSI C63.26-2015 American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services.

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 90 Subparts I and Y and Part 2 Subpart J and with ISEDC RSS-111 Issue 5, September 2014.

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 º 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):
  - 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.

2.2 EUT Exercise Software

The test software used was Tera Term. The software is compliant with the standard requirements being tested against.

Please refer to the following power setting table.

Antenna Gain (dBi)	Radio	Frequency (MHz)	MIMO Power Setting Antenna A & B	SISO Power Setting Antenna A & B
15	1	4950	21	28
		4965	20	28
		4980	20	28
	2	4950	21	31
		4965	20	31
		4980	21	31
⩽ 8	1	4950	28	28
		4965	28	28
		4980	28	28

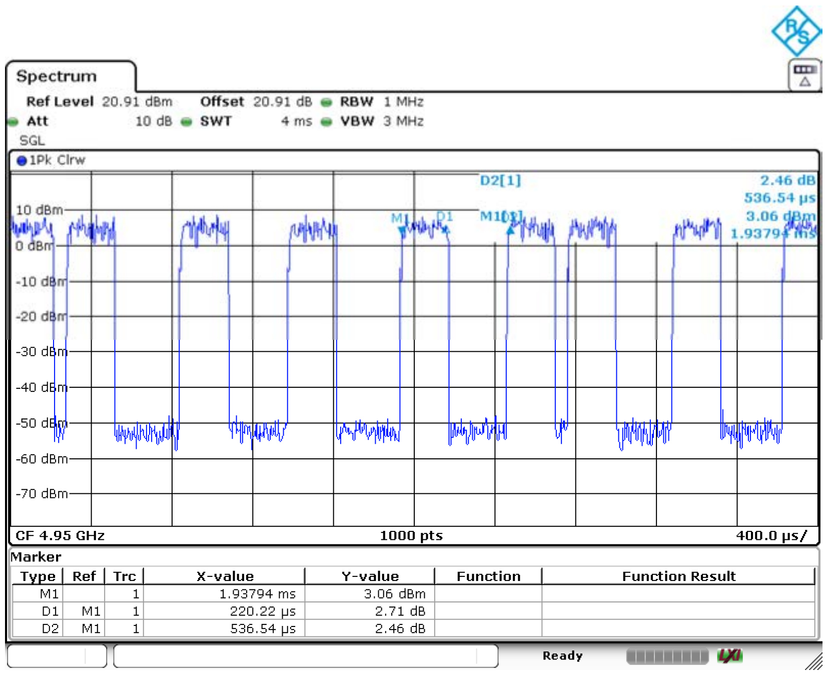
Note: Radio 2 is the primary radio named Cobalt, Radio 1 is the secondary radio named Pine.
*Data rates tested:
802.11a: 6Mbps

2.3 Duty Cycle Correction Factor

On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
0.22022	0.53654	41	3.87

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

Please refer to the following plots.



2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment List and Details

Manufacturer	Descriptions	Models
Dell	Laptop	Latitude E6410

2.6 Remote Support Equipment List and Details

Manufacturer	Descriptions	Models
LiteON	Power Supply	PA-1600-1C

2.7 Interface Ports and Cabling

Cable Description	Length (m)	From	To
Network Cable	< 1	EUT	Ethernet Switch
Power Cable	1	EUT	DC Power Supply
Ethernet Cable	1	Ethernet Switch	Laptop

3 Summary of Test Results

FCC/IC Rules	Description of Tests	Results
FCC §1.1307(b)(1), §2.1091, §90.223, RSS-Gen §3.4	RF Exposure	Compliant
FCC §2.1046, §90.205(p), §90.1215, RSS-111 § 5.3	RF Output Power	Compliant
FCC §90.1215, RSS-111 § 5.4	Transmitter Peak to Average Ratio	Compliant
FCC §2.1046, §90.205(p), §90.1215, RSS-111 § 5.3	Power Spectral Density	Compliant
FCC §2.1049, §90.209, RSS-111 § 5.3	Occupied Bandwidth	Compliant
FCC §2.1053, §90.210, RSS-111 § 5.3	Spurious Radiated Emissions	Compliant
FCC §2.1051, §90.210, RSS-111 § 5.5	Spurious Emissions at Antenna Terminals	Compliant
FCC §2.1051, §90.210, RSS-111 § 5.5	Emission Mask	Compliant
FCC §2.1055, §90.213 RSS-111 § 5.2	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 §1.1307(b) (1), §2.1091 &§90.223 & ISEDC RSS-102 - RF Exposure

4.1 Applicable Standards

FCC §2.1091, (a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular §1.1307(b).

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
(A) 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
(B) Limits for General Population/Uncontrolled Exposure				
0.3-3.0	614	1.63	*(100)	<30
3.0-30	824/f	2.19/f	*(900/f^2)	<30
30-300	27.5	0.073	1.0	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

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

According to ISED RSS-102:

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10[21]	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ $f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ $f^{0.25}$	0.1540/ $f^{0.25}$	8.944/ $f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 $f^{0.3417}$	0.008335 $f^{0.3417}$	0.02619 $f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21 x 10^{-4} $f^{0.5}$	6.67 x 10^{-5} f	616000/$f^{1.2}$

Note: f is frequency in MHz.
* Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

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 RF Exposure Evaluation Exemption for FCC and IC

Radio 1: 15dBi antenna gain

Maximum tune up power at antenna input terminal (dBm):	15.5
Maximum tune up power at antenna input terminal (mW):	35.48
Prediction frequency (MHz):	4950
Antenna Gain, maximum (dBi):	15
Maximum Antenna Gain (numeric):	31.6
Prediction distance (cm):	40
Power density of prediction frequency at 40 cm (mW/cm^2):	0.056
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

Radio 2: 15dBi antenna gain

Maximum tune up power at antenna input terminal (dBm):	15.5
Maximum tune up power at antenna input terminal (mW):	35.48
Prediction frequency (MHz):	4950
Antenna Gain, maximum (dBi):	15
Maximum Antenna Gain (numeric):	31.6
Prediction distance (cm):	40
Power density of prediction frequency at 40 cm (mW/cm^2):	0.056
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

Radio 1: 15dBi antenna gain

Maximum tune up power at antenna input terminal (dBm):	15.5
Maximum tune up power at antenna input terminal (W):	0.03548
Prediction (minimum separation) distance (m):	0.4
Prediction frequency (MHz):	4950
Maximum Antenna Gain, typical (dBi):	15
Maximum Antenna Gain (numeric):	31.6
Power density of prediction frequency at 0.4m (W/m^2):	0.558
Limit for uncontrolled exposure at prediction frequency (W/m^2):	8.77

Radio 2: 15dBi antenna gain

Maximum tune up power at antenna input terminal (dBm):	15.5
Maximum tune up power at antenna input terminal (W):	0.03548
Prediction (minimum separation) distance (m):	0.4
Prediction frequency (MHz):	4950
Maximum Antenna Gain, typical (dBi):	15
Maximum Antenna Gain (numeric):	31.6
Power density of prediction frequency at 0.4m (W/m^2):	0.558
Limit for uncontrolled exposure at prediction frequency (W/m^2):	8.77

Simultaneous Transmission Evaluation

Total Power Densities (Percentages) = 5GHz Radio 1 Power Density % + 5GHz Radio 2 Power Density % + BLE Power Density % + 4.9GHz Radio 1

Total Relative Power Densities (Percentages) = (0.106/1.0) *100 + (0.197/1.0) *100 + (0.001/1)*100 + (0.056/1.0)*100= 10.6 % + 19.7 % + 1% + 5.6 % = 36.9%

Note: above power density percentages are referenced from *Maximum Permissible Exposure Study – Engineering Analysis EDCS#11556830* issued by *Cisco Systems, Inc.*.

5 FCC §2.1046, §90.205(p) & RSS-111 § 5.3 - RF Output Power

5.1 Applicable Standards

FCC §2.1046

FCC §90.205 (p) Limitations on power are specified in § 90.1215.

Channel bandwidth (MHz)	Low power maximum conducted output power (dBm)	High power maximum conducted output power (dBm)
1	7	20
5	14	27
10	17	30
15	18.8	31.8
20	20	33

RSS-111 §5.3

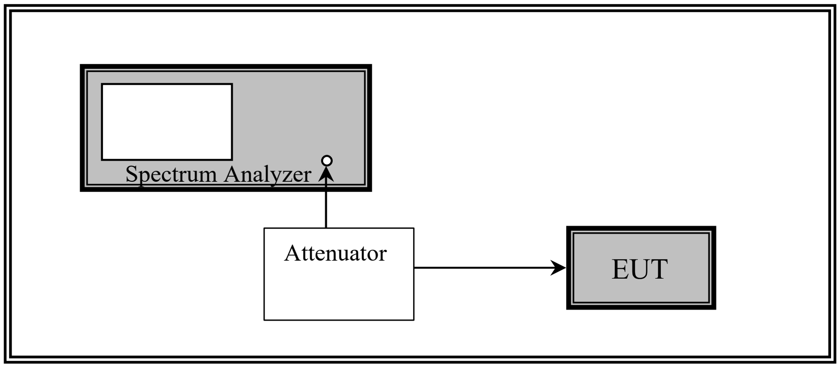
Table 1 — Channel Bandwidth and Power Limits

Channel Bandwidth (MHz)	Transmitter Power, P (dBm)	
	Low-power Device	High-power Device
1	P ≤ 7	7 < P ≤ 20
5	P ≤ 14	14 < P ≤ 27
10	P ≤ 17	17 < P ≤ 30
15	P ≤ 18.8	18.8 < P ≤ 31.8
20	P ≤ 20	20 < P ≤ 33

5.2 Test Procedure

ANSI C63.26-2015 section 5.2.4.

5.3 Test Setup Block Diagram



5.4 Test Equipment List and Details

BACL No.	Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
912	Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008k39-101203-UW	2022-05-05	1 year
-	-	RF Cable	-	-	Each time[1]	N/A
-	-	20dB Attenuator	-	-	Each time[1]	N/A

Note[1]: 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:	18.8° C
Relative Humidity:	34 %
ATM Pressure:	101.8 kPa

The testing was performed by Christian Schwartz from 2023-04-17 to 2023-04-18 in the RF Site.

5.6 Test Results

15dBi MIMO

Radio	Freq. (MHz)	Conducted Power Ant a (dBm)	Conducted Power Ant b (dBm)	Corrected Output Power Ant A (dBm)	Corrected Output Power Ant B (dBm)	Total Output Power (dBm)	Limit (dBm)	Power Setting
1	4950	6.90	7.56	10.77	11.43	14.12	≤ 24	21
1	4965	7.21	7.18	11.08	11.05	14.08	≤ 24	20
1	4980	7.16	7.20	11.03	11.07	14.06	≤ 24	21
2	4950	8.23	7.37	12.1	11.24	14.70	≤ 24	21
2	4965	7.58	6.91	11.45	10.78	14.14	≤ 24	20
2	4980	7.95	7.51	11.82	11.38	14.62	≤ 24	21

Note: individual antenna gain equal 15dBi, combined directional gain equals 18dBi. (Gain Provided by customer)
Note: Corrected Output Power(dBm)=Conducted Power(dBm) + Duty Cycle Correction Factor(dB)
Note: The total maximum conducted output power is calculated by converting logarithmic values to linear values, summing them, then converting the sum into logarithmic value like so: 10*LOG(10^(ant a/10) + 10^(ant b/10)).
Note: If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density limits should be reduced by the amount in decibels that the directional gain of the antennas exceed 9 dBi.

15dBi SISO

Radio	Freq. (MHz)	Conducted Power Ant a (dBm)	Conducted Power Ant b (dBm)	Corrected Output Power Ant A (dBm)	Corrected Output Power Ant B (dBm)	Limit (dBm)	Power Setting
1	4950	9.95	10.38	13.82	14.25	≤ 27	28
1	4965	10.08	10.55	13.95	14.42	≤ 27	28
1	4980	10.29	10.61	14.16	14.48	≤ 27	28
2	4950	13.26	12.52	17.13	16.39	≤ 27	31
2	4965	13.17	12.61	17.04	16.48	≤ 27	31
2	4980	13.04	12.7	16.91	16.57	≤ 27	31

Note: individual antenna gain equal 15dBi. (Gain Provided by customer)
Note: Corrected Output Power(dBm)=Conducted Power(dBm) + Duty Cycle Correction Factor(dB)
Note: If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density limits should be reduced by the amount in decibels that the directional gain of the antennas exceed 9 dBi.

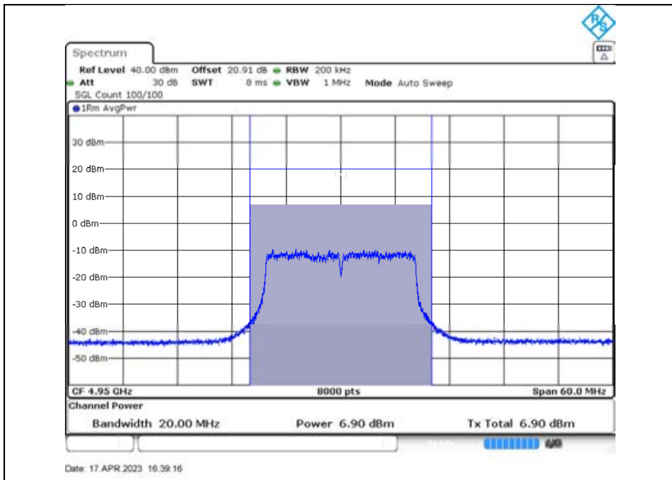
8dBi MIMO, 8dBi SISO, 7dBi MIMO, 7dBi SISO

Radio	Freq. (MHz)	Conducted Power Ant a (dBm)	Conducted Power Ant b (dBm)	Corrected Output Power Ant A (dBm)	Corrected Output Power Ant B (dBm)	Total Output Power (dBm)	Limit (dBm)	Power Setting
1	4950	9.95	10.38	13.82	14.25	17.05	≤ 31	28
1	4965	10.08	10.55	13.95	14.42	17.2	≤ 31	28
1	4980	10.29	10.61	14.16	14.48	17.33	≤ 31	28

Note: Limit based off worst case directional gain 1dBi, which produces the strictest limit. Lower directional gain antennas would produce less strict limits.
Note: individual antenna gain equal 8dBi, combined directional gain equals 11dBi. (Gain Provided by customer)
Note: Corrected Output Power(dBm)=Conducted Power(dBm) + Duty Cycle Correction Factor(dB)
Note: The total maximum conducted output power is calculated by converting logarithmic values to linear values, summing them, then converting the sum into logarithmic value like so: 10*LOG(10^(ant a/10) + 10^(ant b/10)).
Note: If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density limits should be reduced by the amount in decibels that the directional gain of the antennas exceed 9 dBi.

Please refer to the plots below

Title Convention: Radio (1 or 2)-Antenna (A or B) _ Frequency (MHz) _ Power Setting



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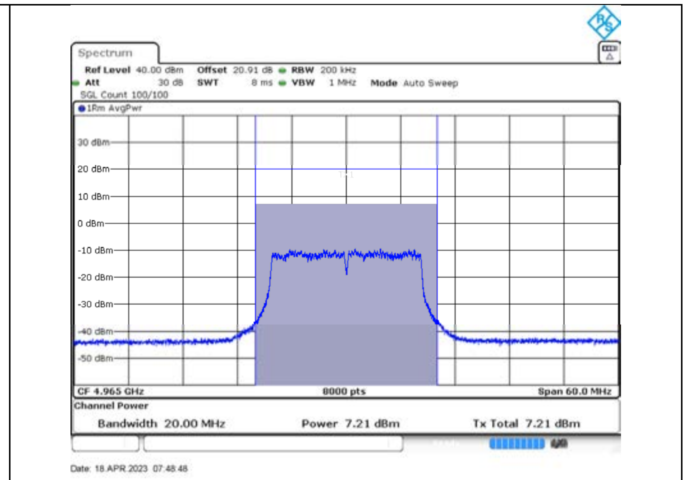

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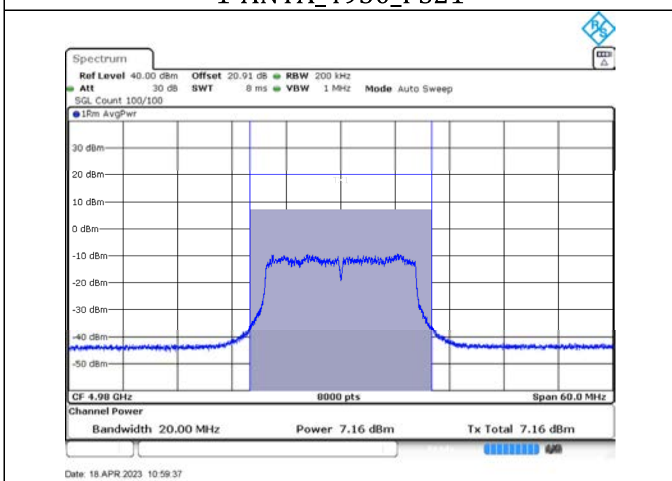

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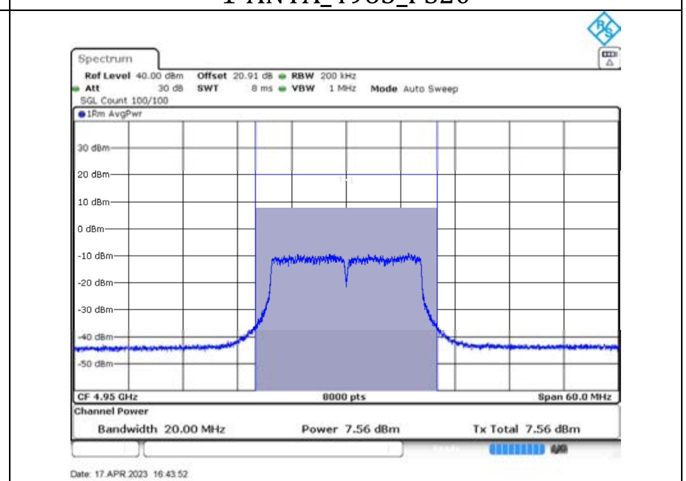

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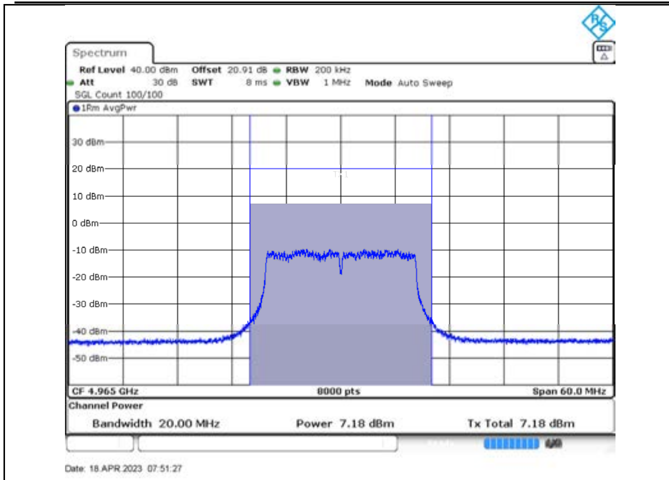

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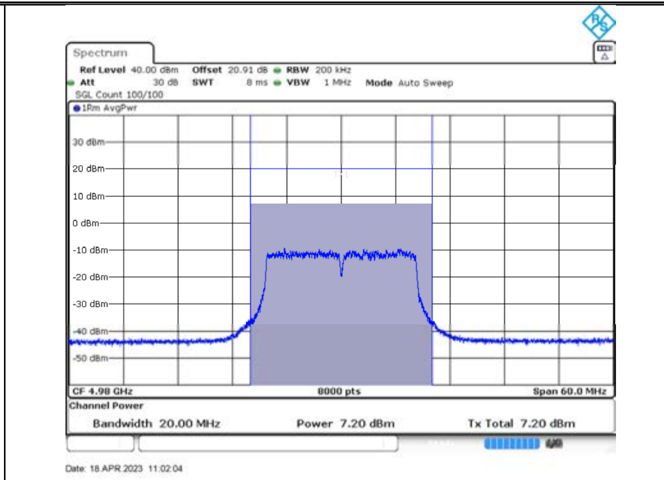

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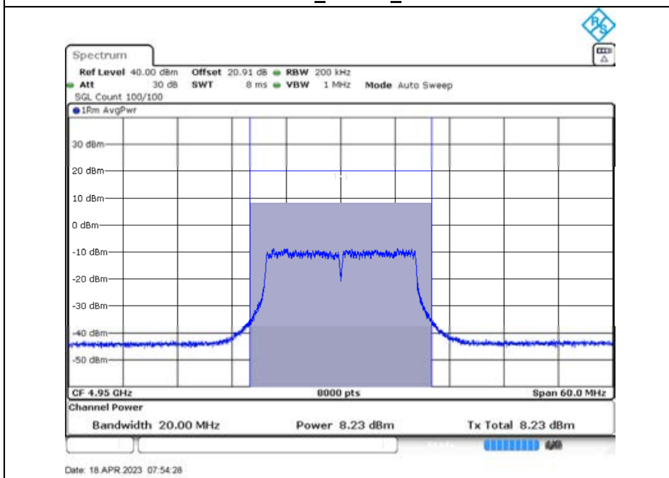

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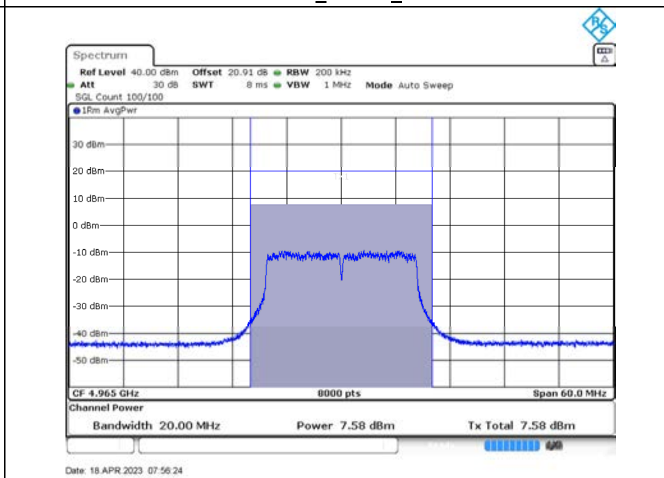

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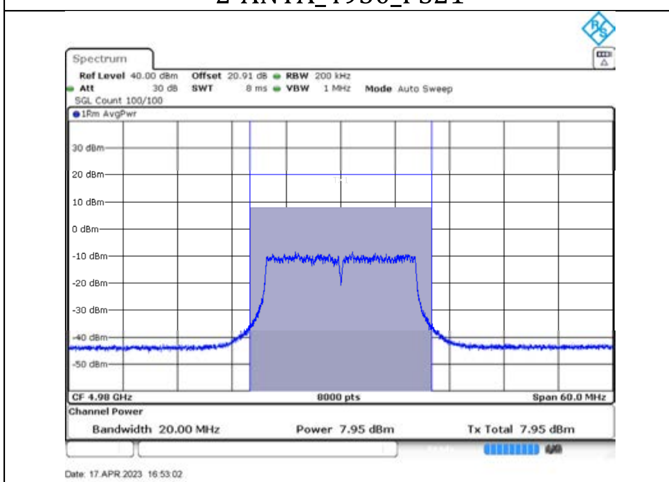

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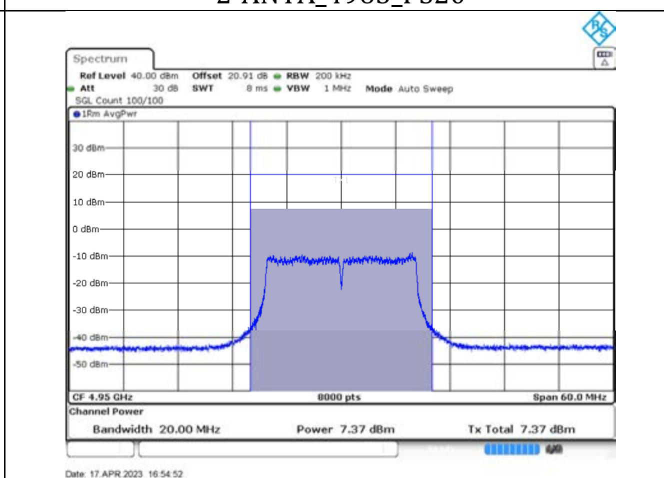

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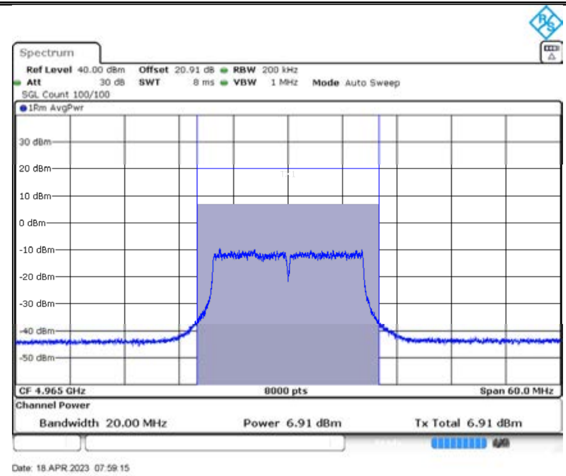
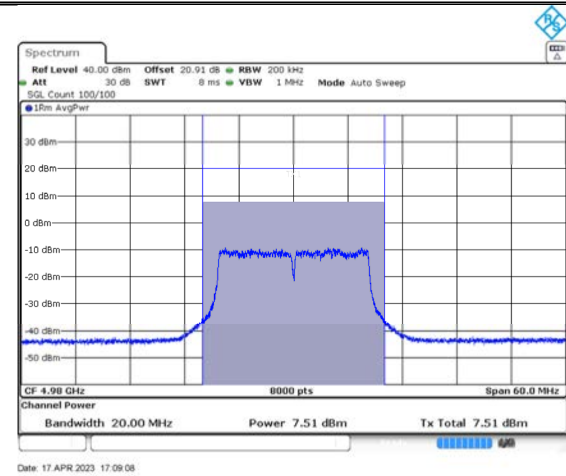
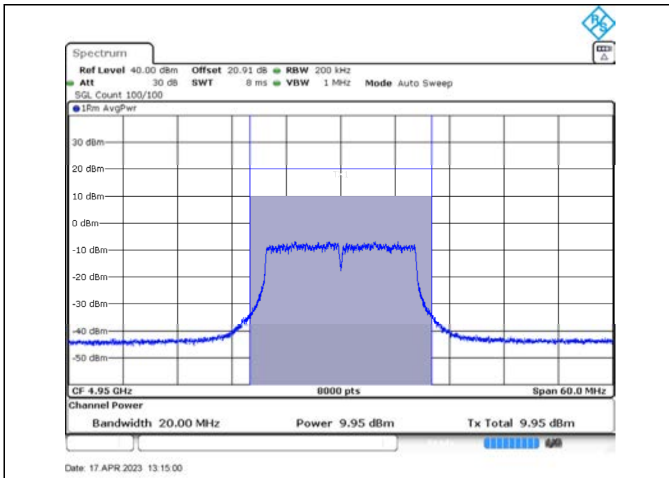
	
2-ANTB_4965_PS20	2-ANTB_4980_PS21



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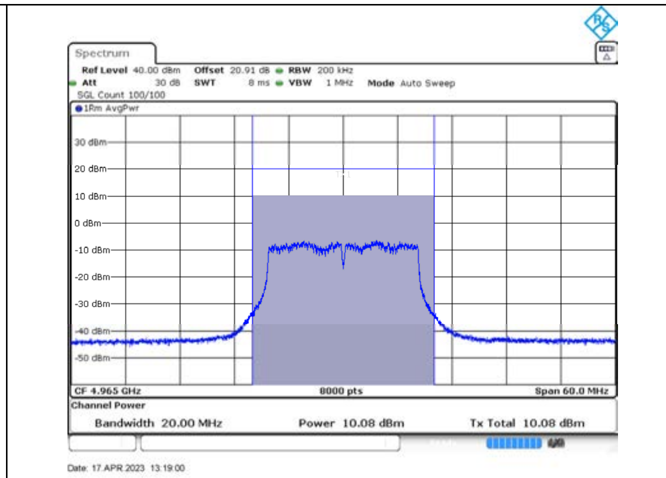

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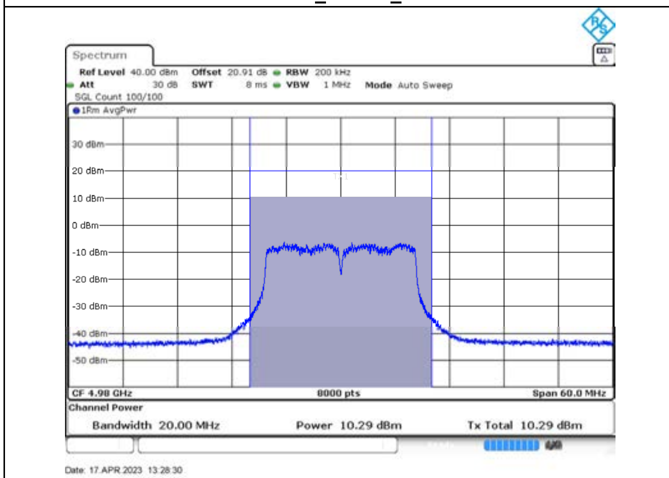

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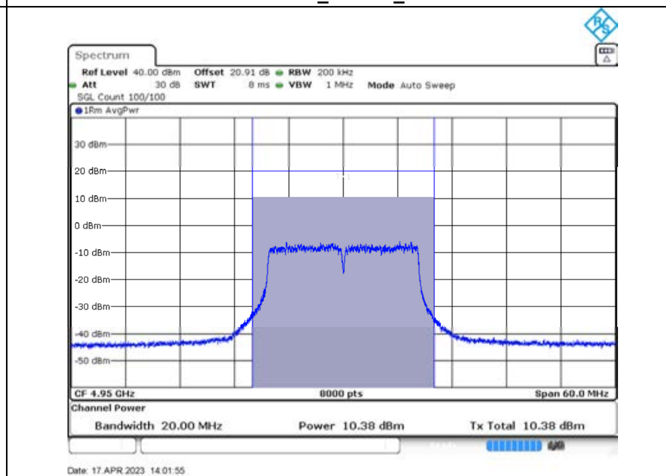

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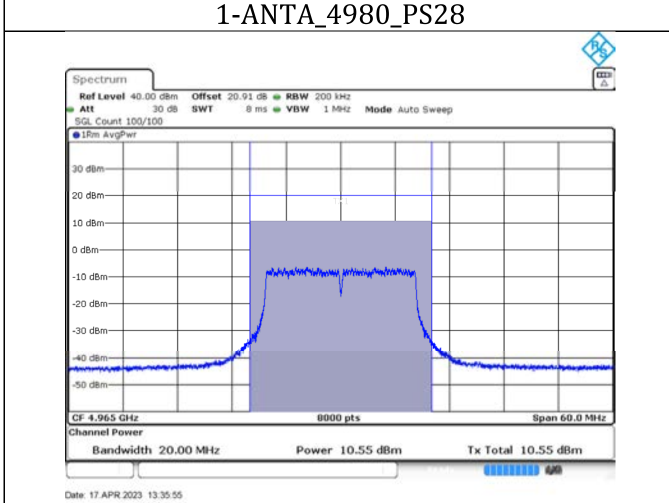

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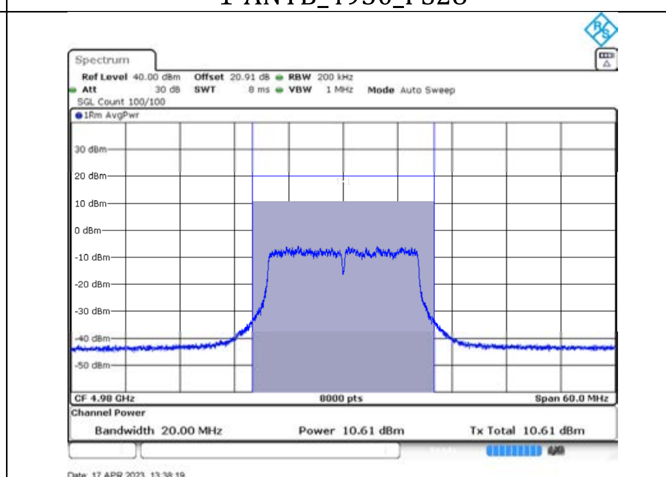

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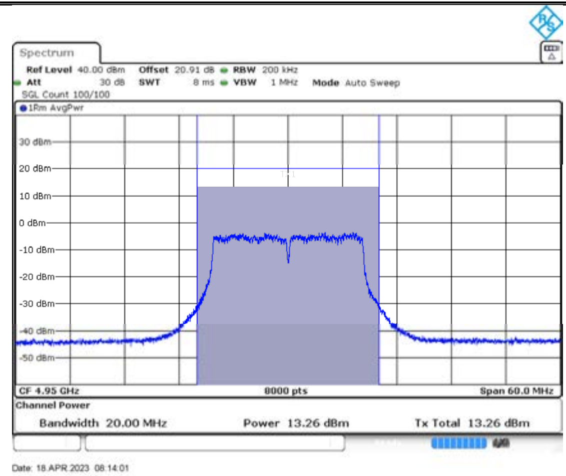

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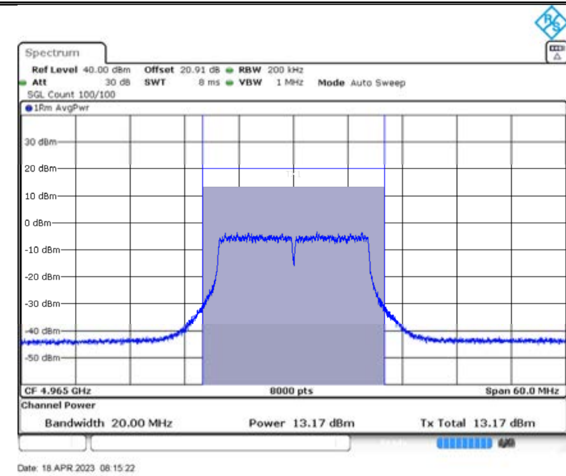

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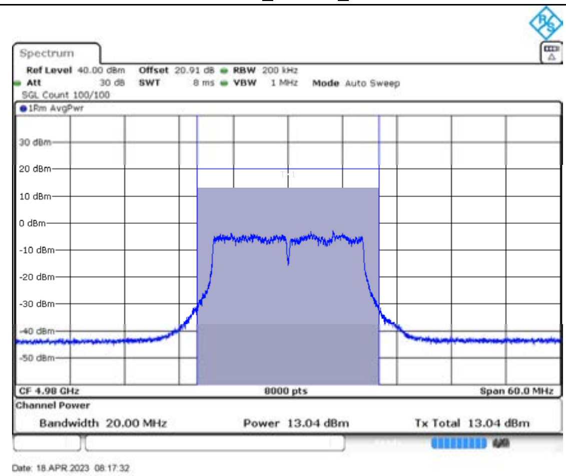

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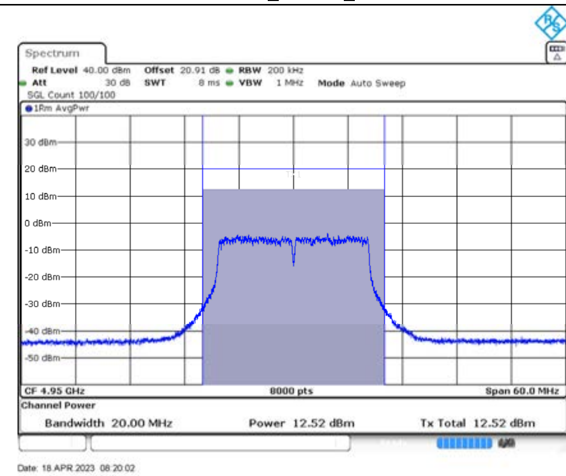

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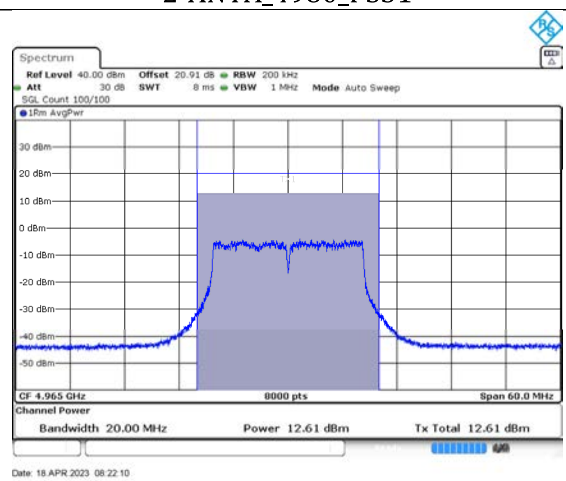

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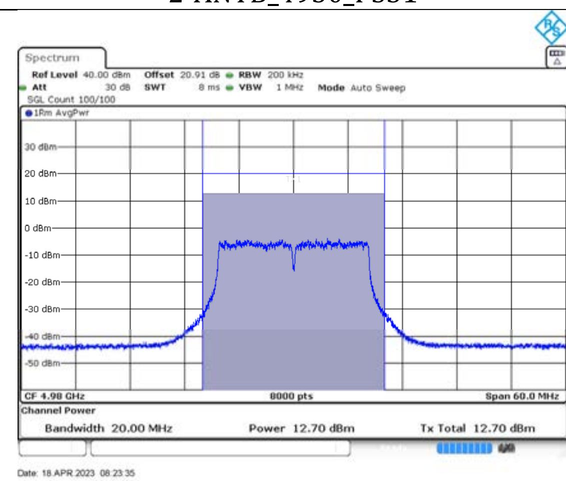


2-ANTB_4980_PS31

6 FCC §2.1046, §90.205(p), §90.1215, RSS-111 § 5.3 - Power Spectral Density

6.1 Applicable Standards

FCC §90.1215

High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point and point-to-multipoint operations (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the maximum conducted output power or spectral density. Corresponding reduction in the maximum conducted output power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

RSS-111 § 5.3

High- and low-power devices are also limited to a maximum power spectral density of 21 dBm/MHz and 8 dBm/MHz respectively. Devices using channel bandwidths other than those listed in Table 1 are permitted; however, the channel bandwidth shall not exceed 20 MHz and the devices shall comply with the maximum power spectral density limits of 21 dBm/MHz for high-power transmitters and 8 dBm/MHz for low-power transmitters. See SP 4940 MHz for antenna gain limits and operational restrictions for the device.

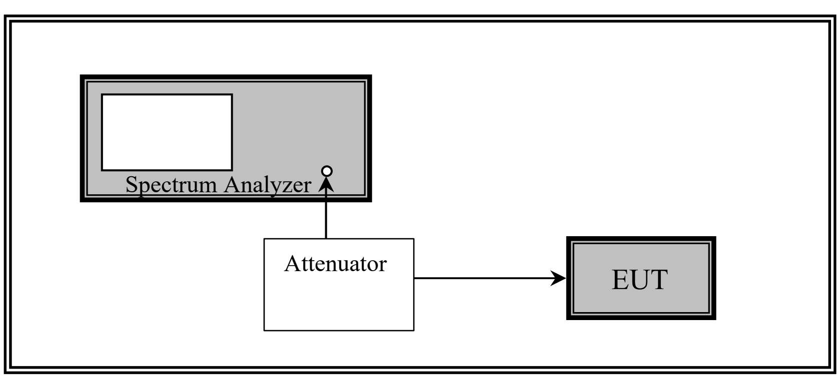
For low-power devices, if a directional antenna is used and its gain exceeds 9 dBi, the transmit power shall be reduced by the same amount that the antenna gain is exceeded.

For high-power fixed point-to-point and point-to-multipoint operations, if the directional antenna gain exceeds 26 dBi, the transmit power shall be reduced by same amount that the antenna gain is exceeded.

6.2 Test Procedure

ANSI C63.26-2015 section 5.2.3.5.

6.3 Test Setup Block Diagram



6.4 Test Equipment List and Details

BACL No.	Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
912	Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008k39-101203-UW	2022-05-05	1 year
-	-	RF Cable	-	-	Each time[1]	N/A
-	-	20dB Attenuator	-	-	Each time[1]	N/A

Note[1]: 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:	18.8° C
Relative Humidity:	34 %
ATM Pressure:	101.8 kPa

The testing was performed by Christian Schwartz from 2023-04-17 to 2023-04-18 in the RF Site.

6.6 Test Results

15dBi MIMO

Radio	Freq. (MHz)	Conducted PSD Ant a (dBm/MHz)	Conducted PSD Ant b (dBm/MHz)	Total PSD (dBm/MHz)	Limit (dBm/MHz)	Power Setting
1	4950	8.46	9.07	11.79	≤ 12	21
1	4965	8.33	8.75	11.56	≤ 12	20
1	4980	8.43	8.84	11.65	≤ 12	21
2	4950	8.84	8.43	11.65	≤ 12	21
2	4965	8.65	8.23	11.46	≤ 12	20
2	4980	8.95	8.63	11.80	≤ 12	21

Note: Individual antenna gain equal 15dBi, combined directional gain equals 18dBi. (Gain Provided by customer)
Note: The total maximum conducted PSD is calculated by converting logarithmic values to linear values, summing them, then converting the sum into logarithmic value like so: 10*LOG(10^(ant a/10) + 10^(ant b/10)).
Note: If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density limits should be reduced by the amount in decibels that the directional gain of the antennas exceed 9 dBi.

15dBi SISO

Radio	Freq. (MHz)	Conducted PSD Ant a (dBm/MHz)	Conducted PSD Ant b (dBm/MHz)	Limit (dBm/MHZ)	Power Setting
1	4950	11.31	11.61	≤ 15	28
1	4965	11.53	11.81	≤ 15	28
1	4980	11.63	12.06	≤ 15	28
2	4950	14.22	13.42	≤ 15	31
2	4965	14.39	13.67	≤ 15	31
2	4980	14.14	13.87	≤ 15	31

Note: Individual antenna gain equal 15dBi. (Gain Provided by customer)
Note: The total maximum conducted PSD is calculated by converting logarithmic values to linear values, summing them, then converting the sum into logarithmic value like so: 10*LOG(10^(ant a/10) + 10^(ant b/10)).
Note: If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density limits should be reduced by the amount in decibels that the directional gain of the antennas exceed 9 dBi.

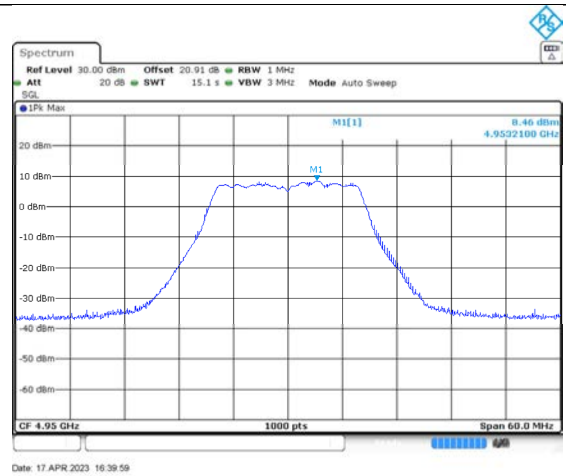
8dBi MIMO, 8dBi SISO, 7dBi MIMO, 7dBi SISO

Radio	Freq. (MHz)	Conducted PSD Ant a (dBm/MHz)	Conducted PSD Ant b (dBm/MHz)	Total PSD (dBm/MHz)	Limit (dBm/MHz)	Power Setting
1	4950	11.31	11.61	14.47	≤ 19	28
1	4965	11.53	11.81	14.68	≤ 19	28
1	4980	11.63	12.06	14.86	≤ 19	28

Note: Limit based of worst case directional gain 11dBi, which produces the strictest limit. Lower directional gain antennas would produce less strict limits.
Note: individual antenna gain equal 8dBi, combined directional gain equals 11dBi. (Gain Provided by customer)
Note: The total maximum conducted PSD is calculated by converting logarithmic values to linear values, summing them, then converting the sum into logarithmic value like so: 10*LOG(10^(ant a/10) + 10^(ant b/10)).
Note: If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density limits should be reduced by the amount in decibels that the directional gain of the antennas exceed 9 dBi.

Please refer to the plots below.

Title Convention: Radio (1 or 2)-Antenna (A or B) _ Frequency (MHz)_ Power Setting



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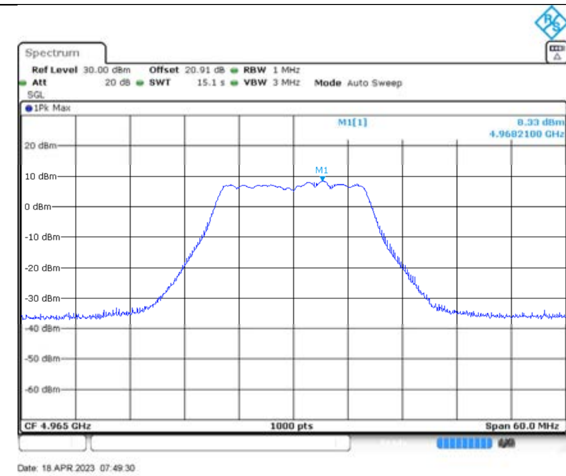

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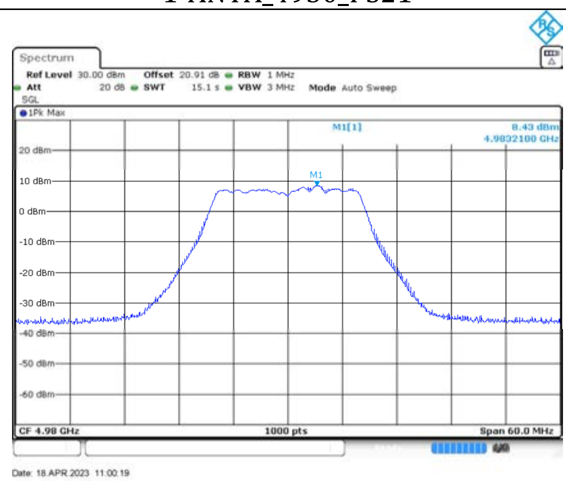

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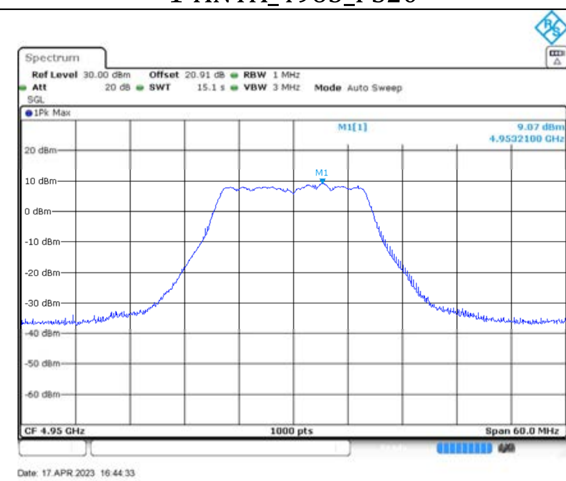

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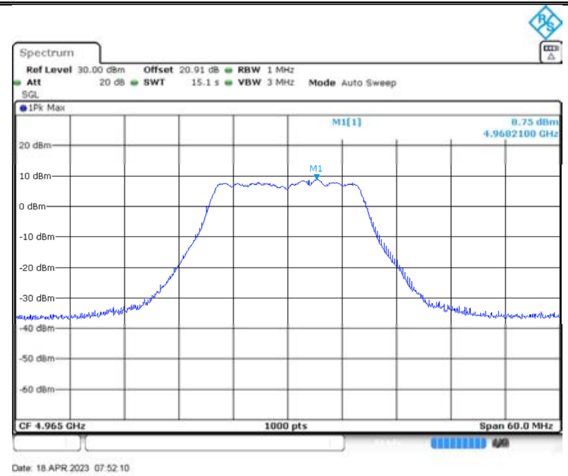

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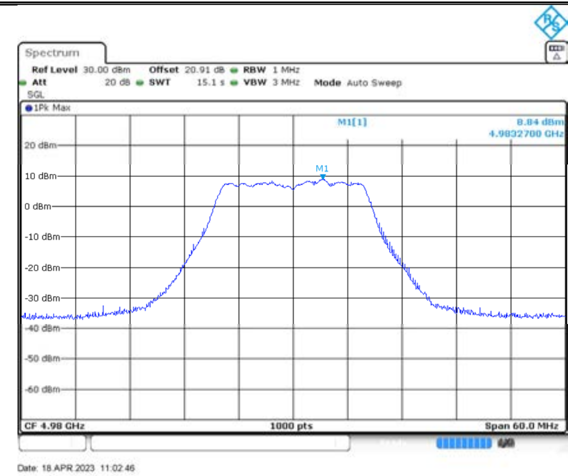

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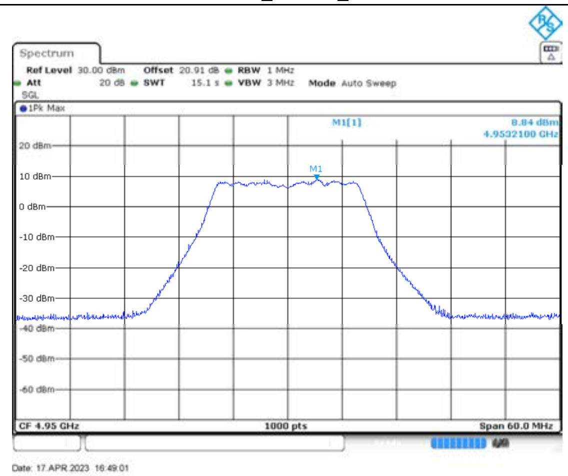

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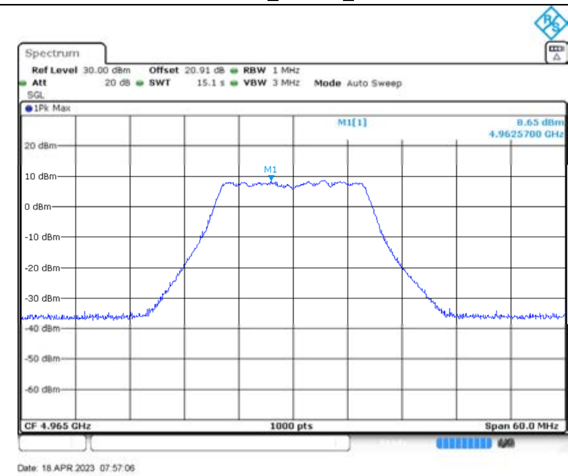

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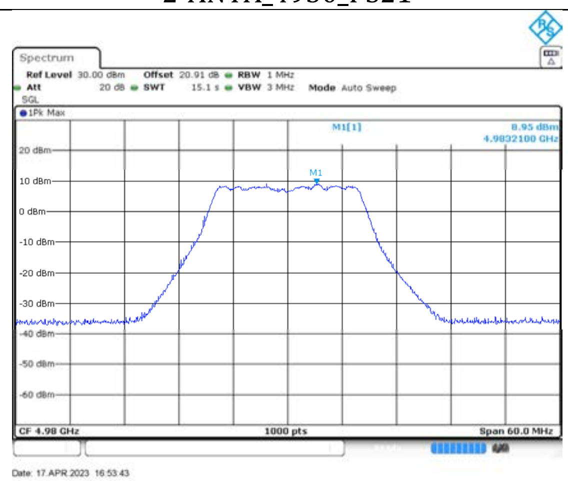

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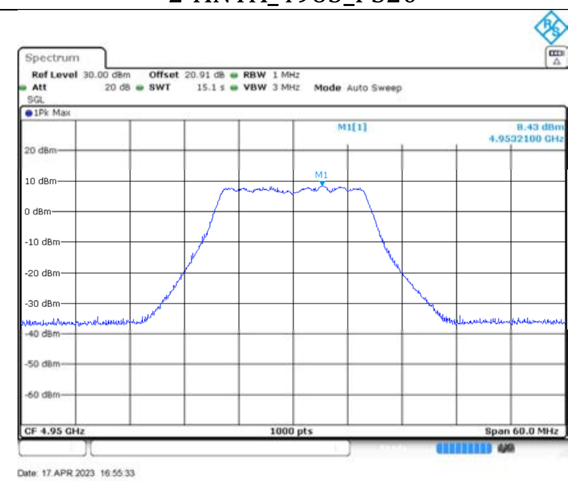

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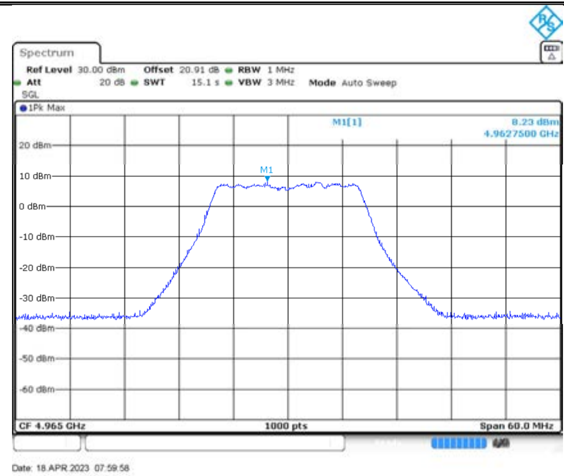
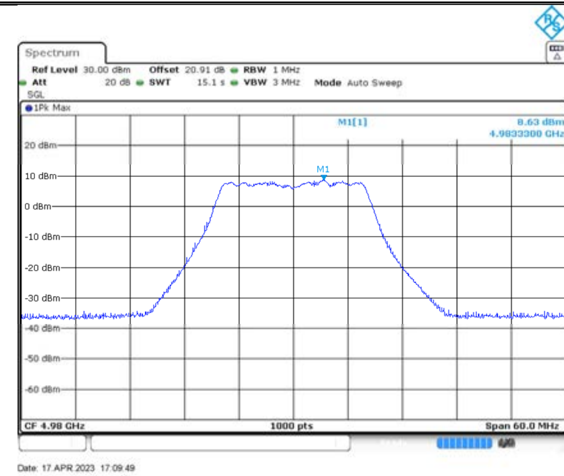
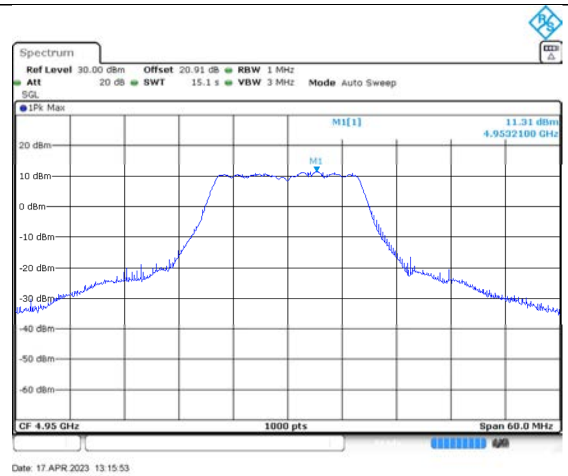
	
2-ANTB_4965_PS20	2-ANTB_4980_PS21



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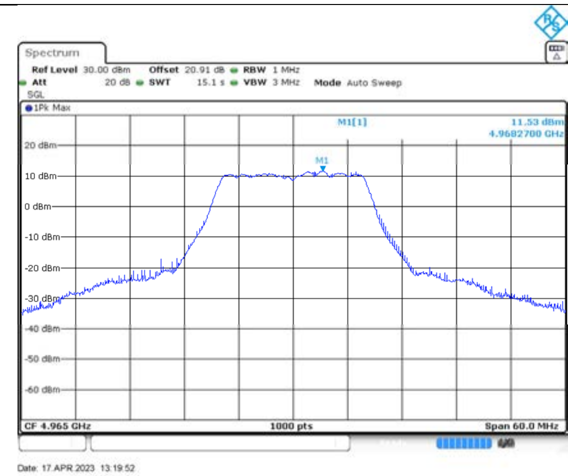

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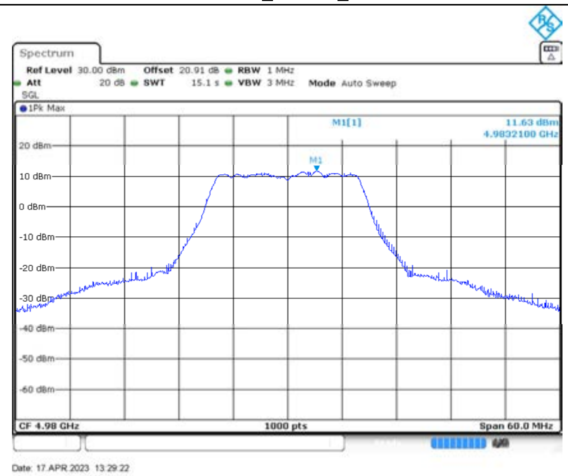

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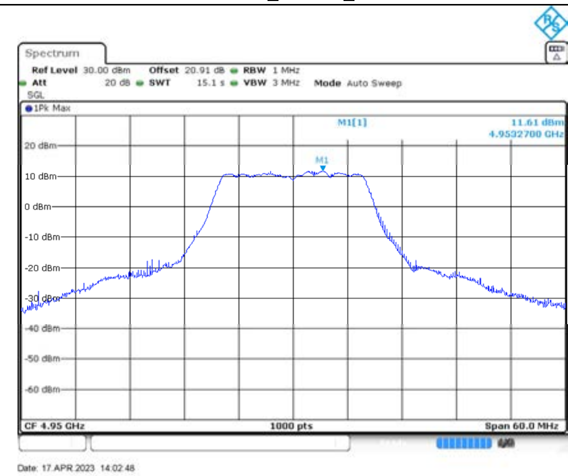

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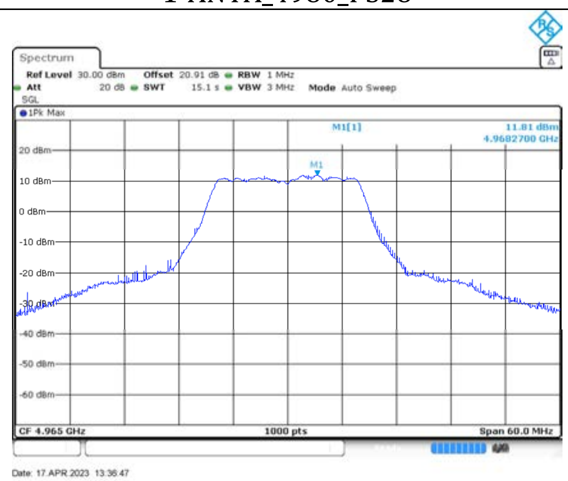

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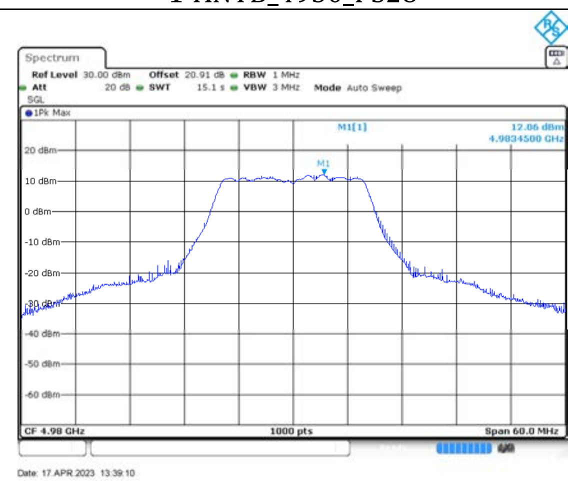

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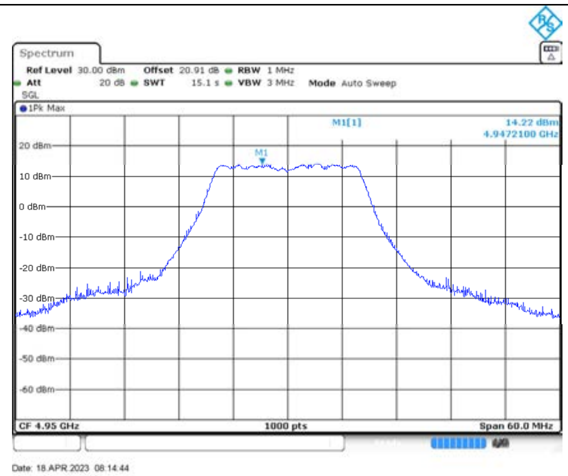

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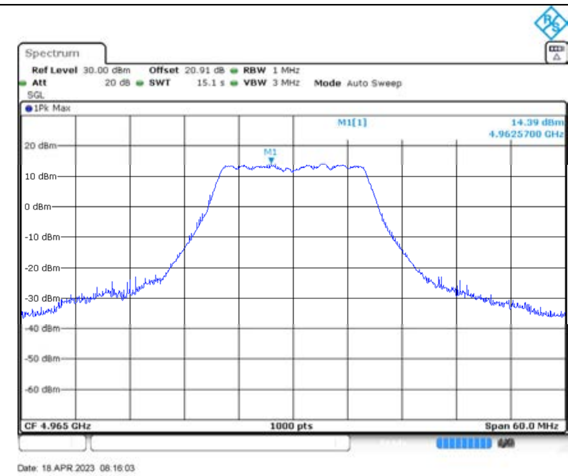

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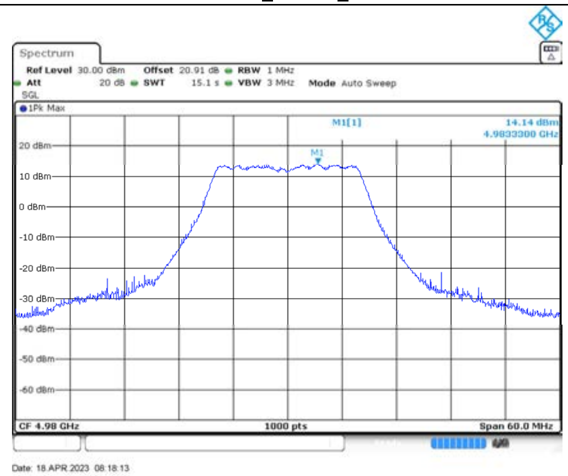

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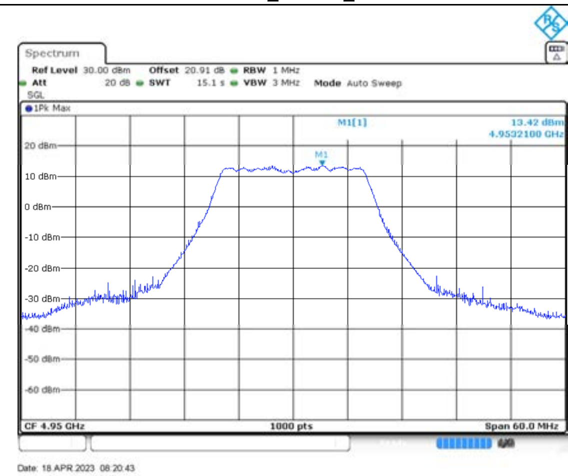

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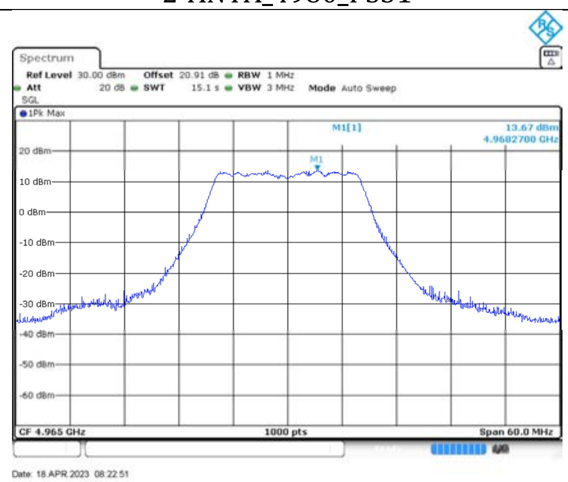

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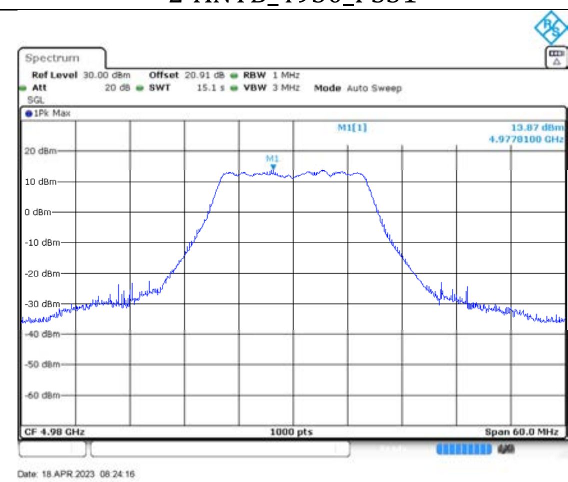


2-ANTB_4980_PS31

7 FCC §90.1215 & RSS-111 § 5.4 – Transmitter Peak to Average Ratio

7.1 Applicable Standards

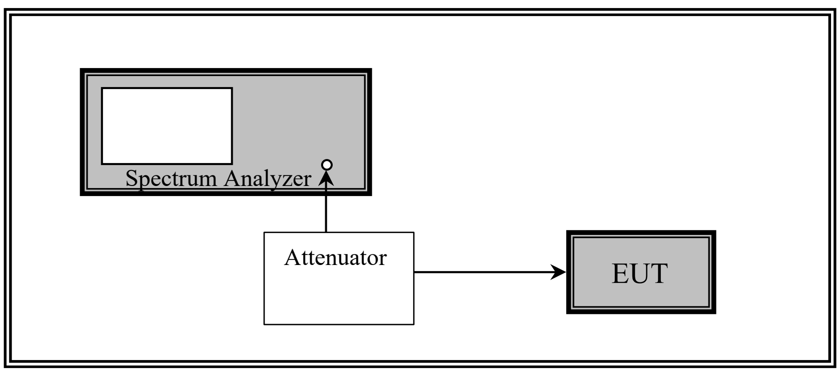
FCC §90.1215: The transmitting power of stations operating in the 4940–4990 MHz band must not exceed the maximum limits in this section. (e) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RSS-111, Clause 5.4: The PAPR of the equipment shall not exceed 13 dB for more than 0.1% of the time, using a signal that corresponds to the highest PAPR during periods of continuous transmission.

7.2 Test Procedure

ANSI C63.26-2015 section 5.2.3.5.
ANSI C63.26-2015 section 5.2.4.

7.3 Test Setup Block Diagram



7.4 Test Equipment List and Details

BACL No.	Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
912	Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008k39-101203-UW	2023-06-02	1 year
-	-	RF Cable	-	-	Each time[1]	N/A
-	-	20dB Attenuator	-	-	Each time[1]	N/A

Note[1]: 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:	18.8° C
Relative Humidity:	34 %
ATM Pressure:	101.8 kPa

The testing was performed by Deepak Mishra on 2023-10-03 in the RF Site.

7.6 Test Results

15dBi MIMO

Radio	Freq. (MHz)	Peak PSD (dBm/MHz)	Avg PSD (dBm/MHz)	Ratio (dB)	Limit (dB)	Power Setting
1	4950	11.79	4.31	7.48	≤ 13	21
1	4965	11.56	3.49	8.07	≤ 13	20
1	4980	11.65	4.12	7.53	≤ 13	21
2	4950	11.65	4.18	7.47	≤ 13	21
2	4965	11.46	3.64	7.82	≤ 13	20
2	4980	11.8	4.35	7.45	≤ 13	21

15dBi SISO

Radio	Freq. (MHz)	Peak PSD (dBm/MHz)	Avg PSD (dBm/MHz)	Ratio (dB)	Limit (dB)	Power Setting
1	4950	11.61	4.36	7.25	≤ 13	28
1	4965	11.81	4.5	7.31	≤ 13	28
1	4980	12.06	4.45	7.61	≤ 13	28
2	4950	14.22	6.74	7.48	≤ 13	31
2	4965	14.39	6.24	8.15	≤ 13	31
2	4980	14.14	6.95	7.19	≤ 13	31

Note: above PSD values are based on higher value between two ports on each radio

8dBi MIMO, 8dBi SISO, 7dBi MIMO, 7dBi SISO

Radio	Freq. (MHz)	Peak PSD (dBm/MHz)	Avg PSD (dBm/MHz)	Ratio (dB)	Limit (dB)	Power Setting
1	4950	14.47	7.16	7.31	≤ 13	28
1	4965	14.68	7.19	7.49	≤ 13	28
1	4980	14.86	7.09	7.77	≤ 13	28

See below screenshots of average PSD data/screenshots for reference in calculating the PAPR above.

15dBi MIMO

Radio	Freq. (MHz)	Average Conducted PSD Ant a (dBm/MHz)	Average Conducted PSD Ant b (dBm/MHz)	Average Corrected PSD Ant a (dBm/MHz)	Average Corrected PSD Ant b (dBm/MHz)	Total Average PSD (dBm/MHz)	Power Setting
1	4950	-2.23	-2.94	1.64	0.93	4.31	21
1	4965	-3.05	-3.76	0.82	0.11	3.49	20
1	4980	-2.43	-3.12	1.44	0.75	4.12	21
2	4950	-2.85	-2.55	1.02	1.32	4.18	21
2	4965	-2.78	-3.76	1.09	0.11	3.64	20
2	4980	-2.04	-3.09	1.83	0.78	4.35	21

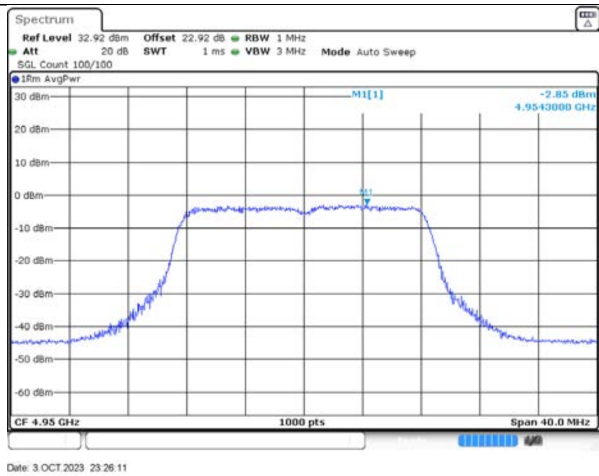
15dBi SISO

Radio	Freq. (MHz)	Average Conducted PSD Ant a (dBm/MHz)	Average Conducted PSD Ant b (dBm/MHz)	Average Corrected PSD Ant a (dBm/MHz)	Average Corrected PSD Ant b (dBm/MHz)	Power Setting
1	4950	0.49	0.05	4.36	3.92	28
1	4965	0.63	-0.03	4.5	3.84	28
1	4980	0.58	-0.2	4.45	3.67	28
2	4950	2.87	2.42	6.74	6.29	31
2	4965	2.37	1.47	6.24	5.34	31
2	4980	3.08	1.82	6.95	5.69	31

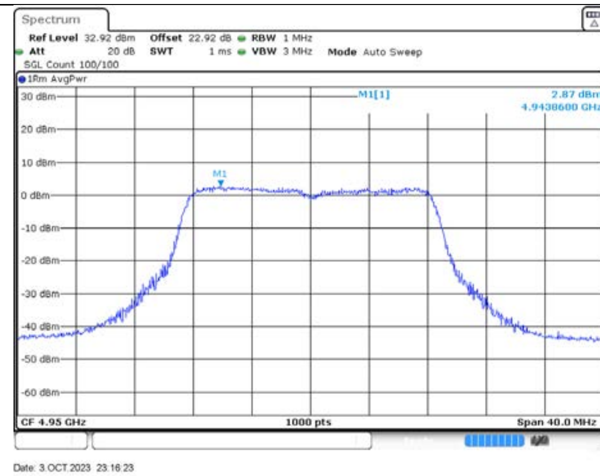
8dBi MIMO, 8dBi SISO, 7dBi MIMO, 7dBi SISO

Radio	Freq. (MHz)	Average Conducted PSD Ant a (dBm/MHz)	Average Conducted PSD Ant b (dBm/MHz)	Average Corrected PSD Ant a (dBm/MHz)	Average Corrected PSD Ant b (dBm/MHz)	Total Average PSD (dBm/MHz)	Power Setting
1	4950	0.49	0.05	4.36	3.92	7.16	28
1	4965	0.63	-0.03	4.5	3.84	7.19	28
1	4980	0.58	-0.2	4.45	3.67	7.09	28

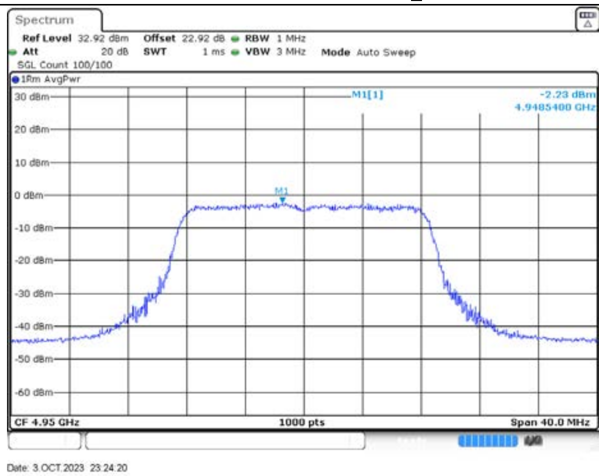
Note: Corrected PSD applies Duty Cycle Correction Factor



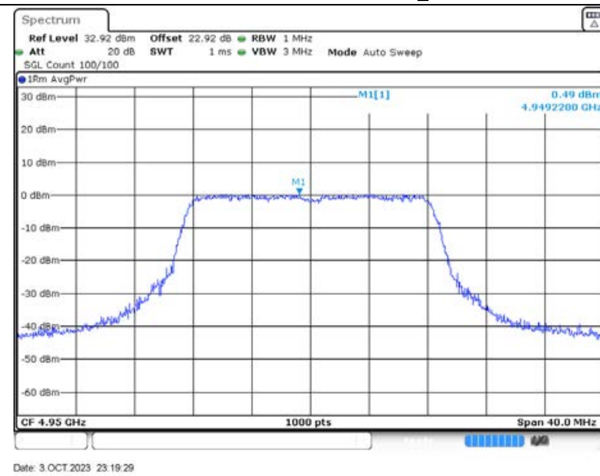
4950MHz-tx1-cobalt_21



4950MHz-tx1-cobalt_31



4950MHz-tx1-pine_21



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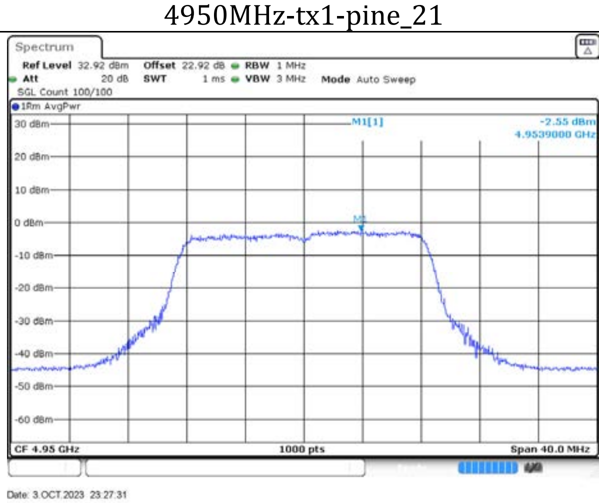

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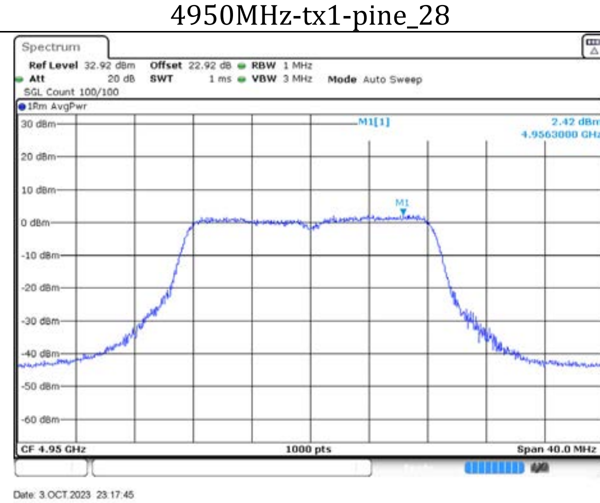

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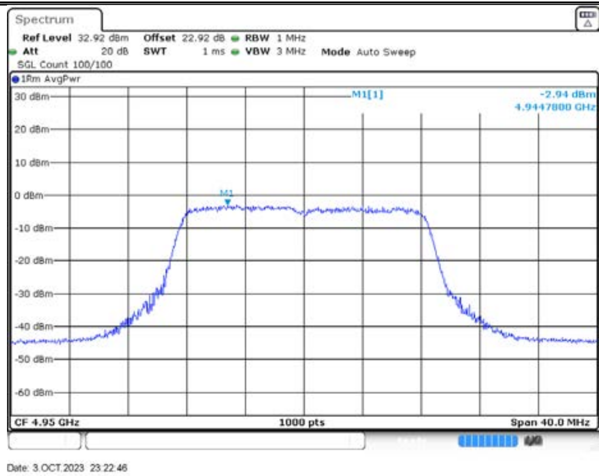

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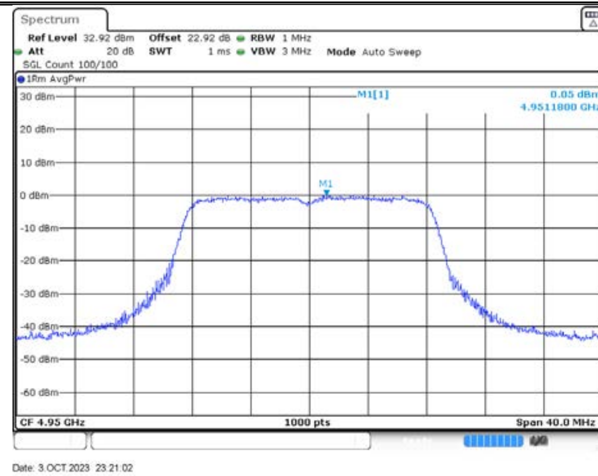
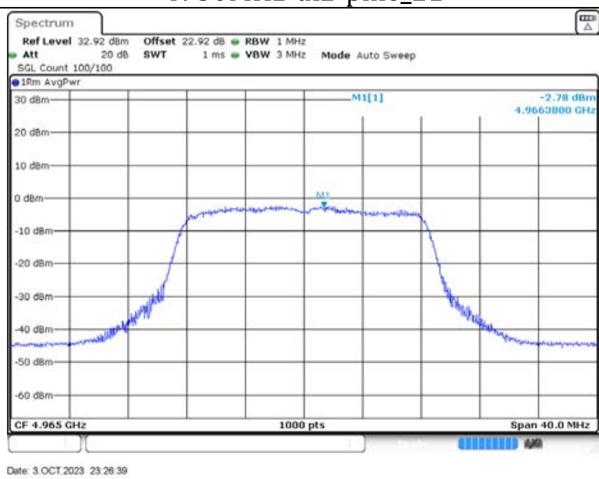
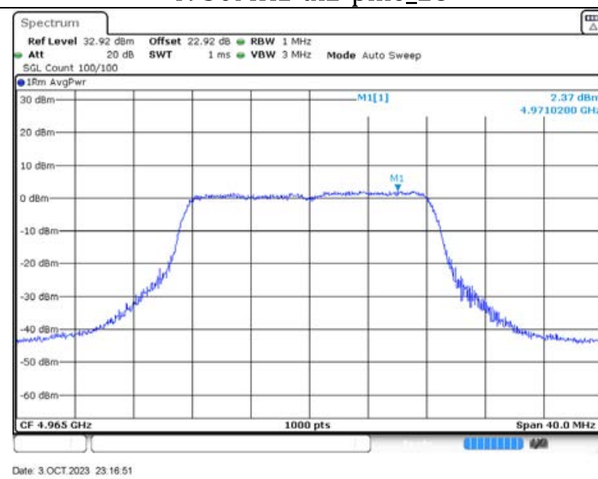


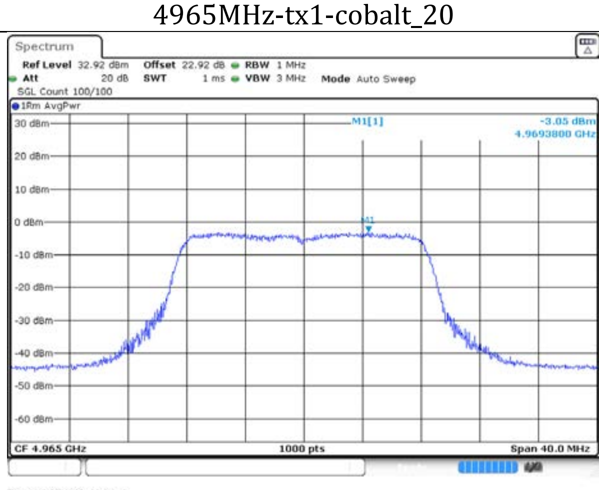
4950MHz-tx2-pine_28



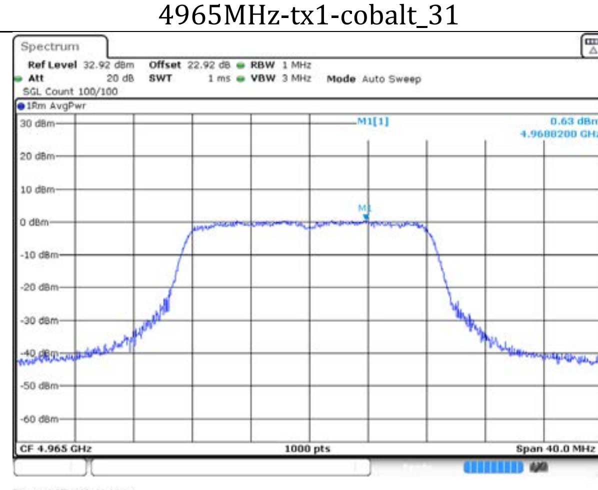
4965MHz-tx1-cobalt_20



4965MHz-tx1-cobalt_31



4965MHz-tx1-pine_20



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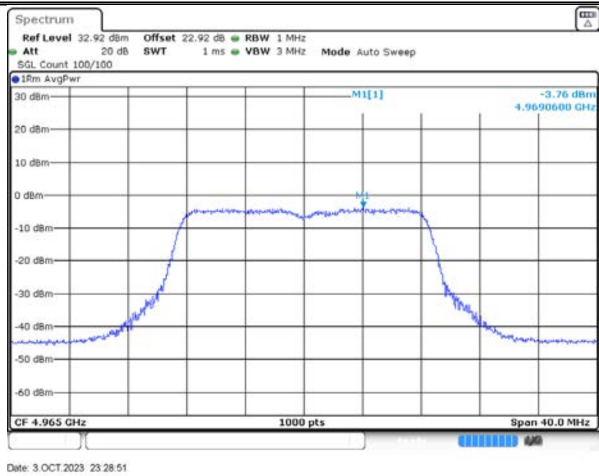
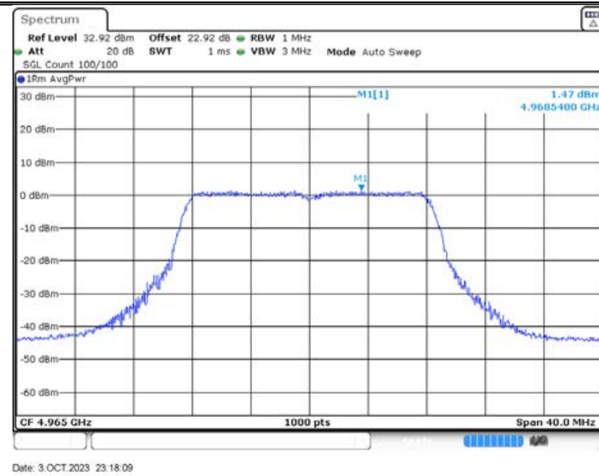


4965MHz-tx2-cobalt_20



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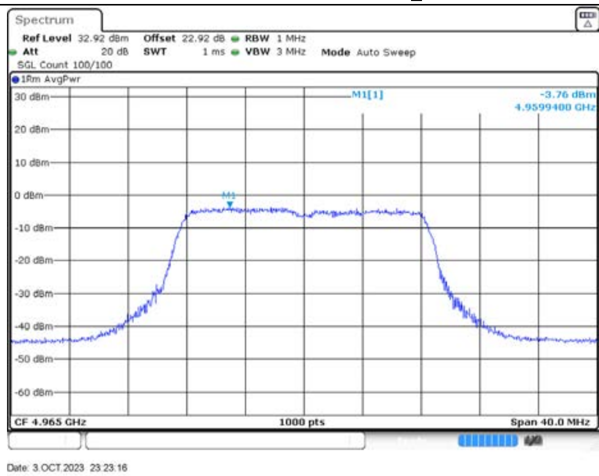

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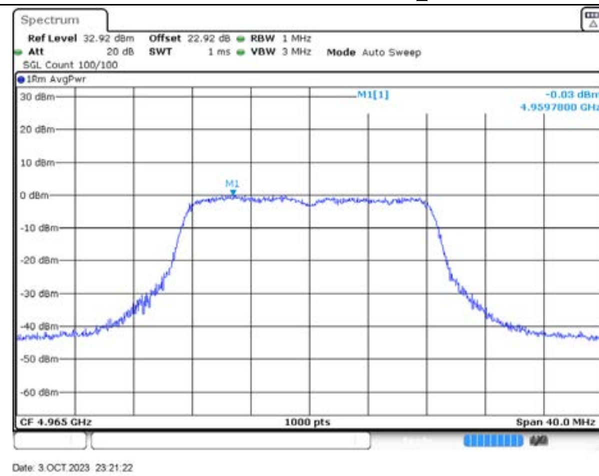
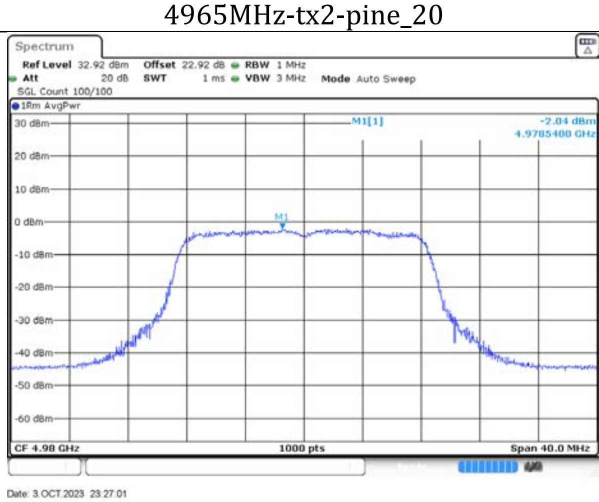
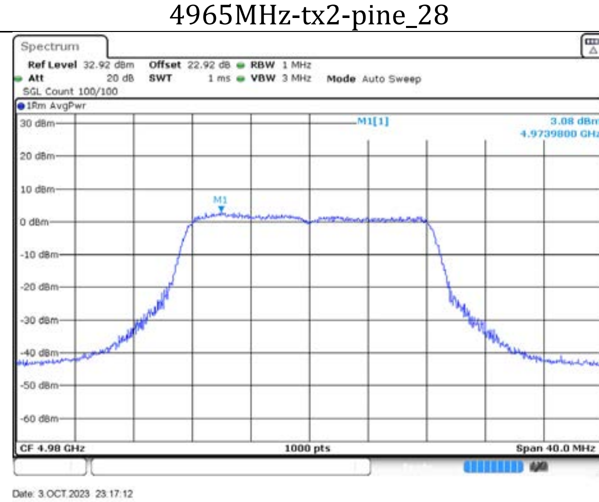


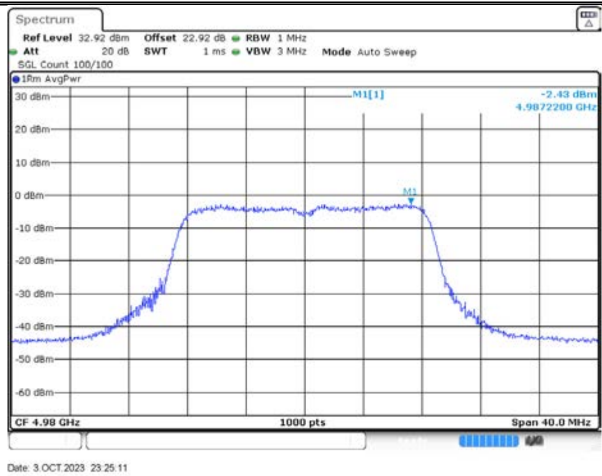
4965MHz-tx2-pine_28



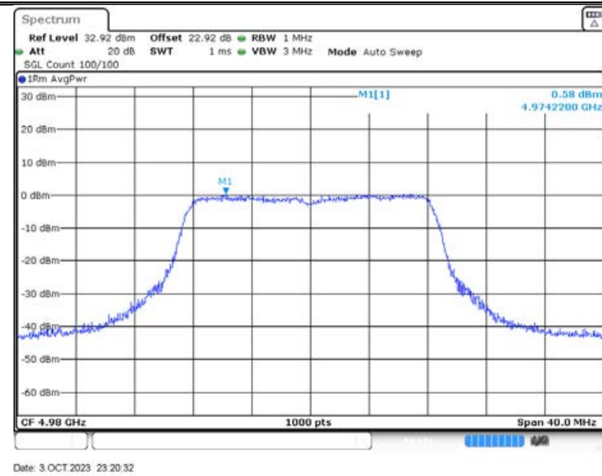
4980MHz-tx1-cobalt_21



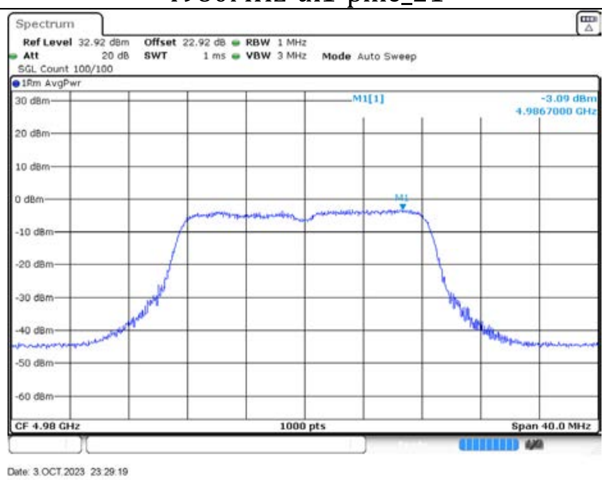
4980MHz-tx1-cobalt_31



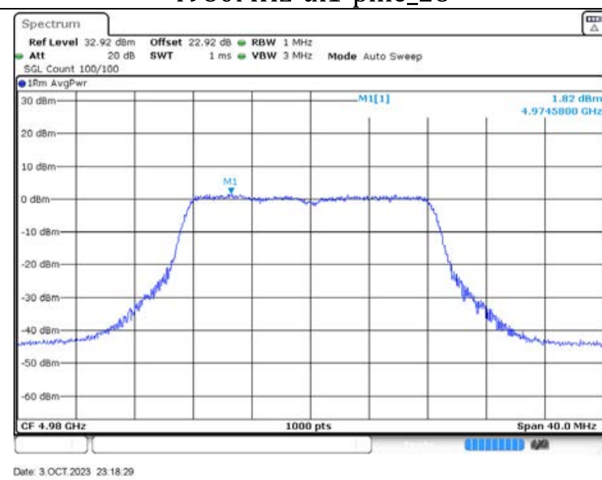
4980MHz-tx1-pine_21



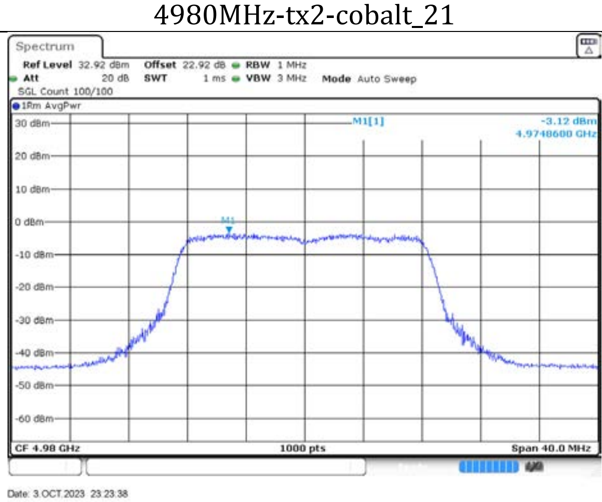
4980MHz-tx1-pine_28



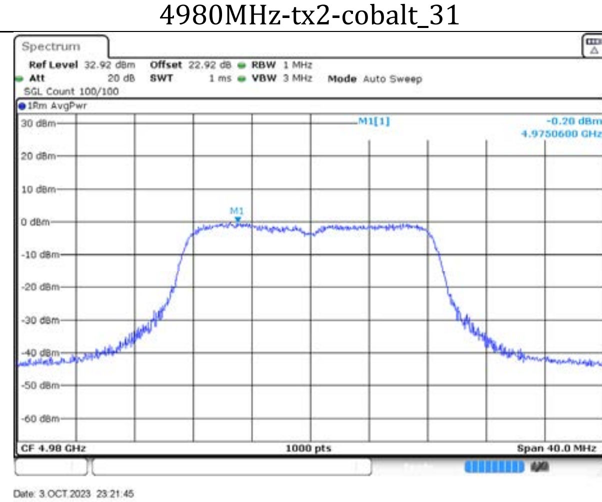
4980MHz-tx2-cobalt_21



4980MHz-tx2-cobalt_31



4980MHz-tx2-pine_21



4980MHz-tx2-pine_28

8 FCC §2.1049, §90.209, RSS-111 § 5.3 - Occupied Bandwidth

8.1 Applicable Standards

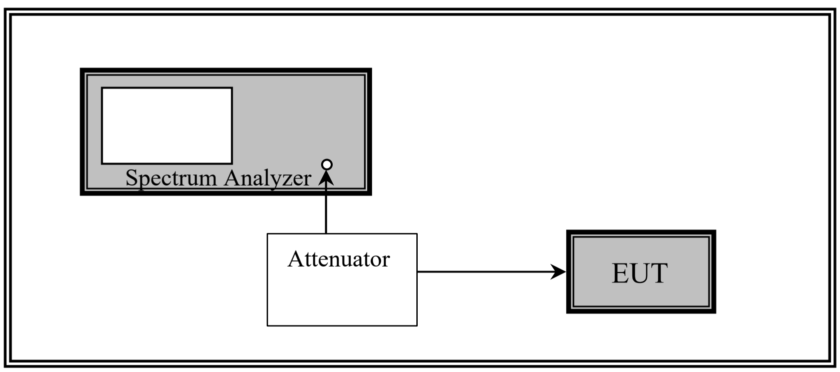
FCC §90.209, RSS-111 § 5.3

The equipment's occupied bandwidth shall not exceed its channel bandwidth.

8.2 Test Procedure

Span = approximately 2 to 5 times the occupied bandwidth, centered on the transmitting channel
RBW = 1% to 5 % of the occupied bandwidth
VBW = 3 * RBW
Sweep = auto
Detector function = peak
Trace = max hold

8.3 Test Setup Block Diagram



8.4 Test Equipment List and Details

BACL No.	Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
912	Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008k39-101203-UW	2022-05-05	1 year
-	-	RF Cable	-	-	Each time[1]	N/A
-	-	20dB Attenuator	-	-	Each time[1]	N/A

Note[1]: 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:	18.8° C
Relative Humidity:	34 %
ATM Pressure:	101.8 kPa

The testing was performed by Christian Schwartz on 2023-04-17 in the RF Site.

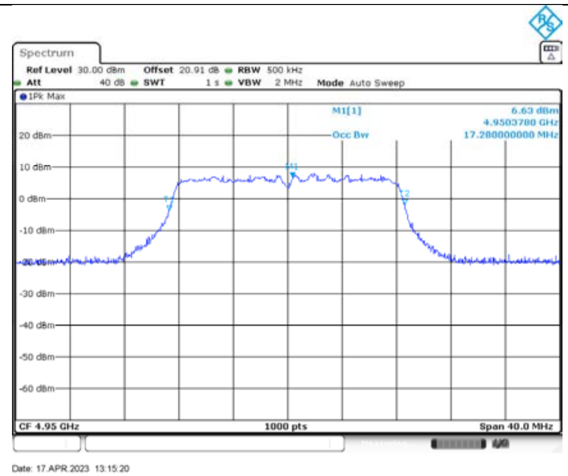
8.6 Test Results

Radio	Frequency (MHz)	99% OBW (MHz) Antenna A	99% OBW (MHz) Antenna B	Limit (MHz)
1	4950	17.28	17.24	≤ 20
1	4965	17.28	17.24	≤ 20
1	4980	17.28	17.24	≤ 20
2	4950	17.12	16.56	≤ 20
2	4965	17.88	16.76	≤ 20
2	4980	16.44	17.12	≤ 20

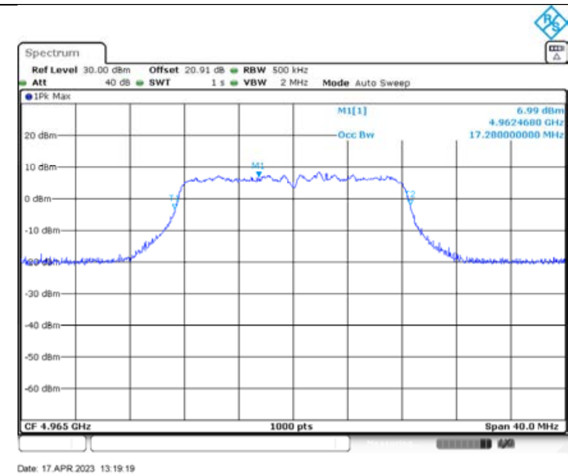
Note: testing was performed at max power setting.

Please refer to the plots below

Title Convention: Radio (1 or 2)-Antenna (A or B) _ Frequency (MHz)



1-ANTA_4950



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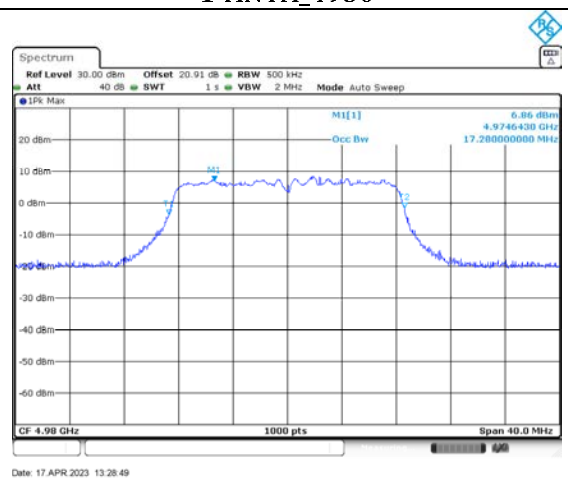

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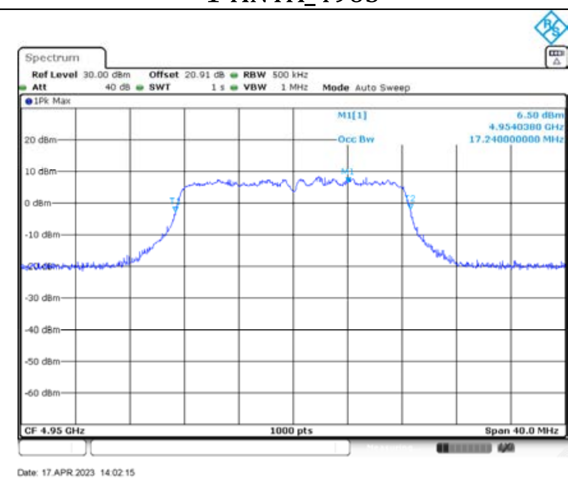
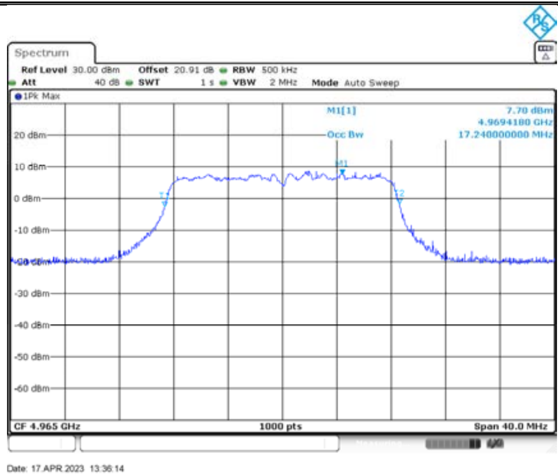
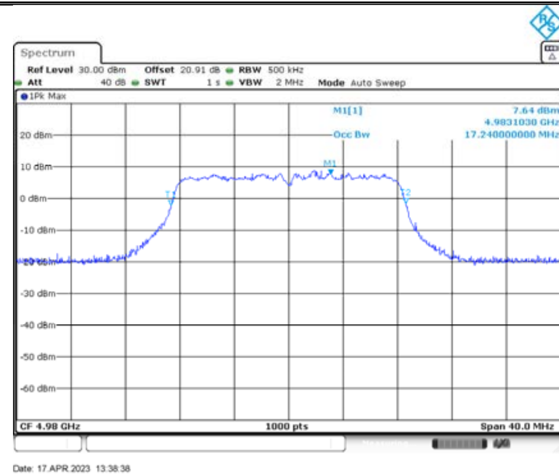


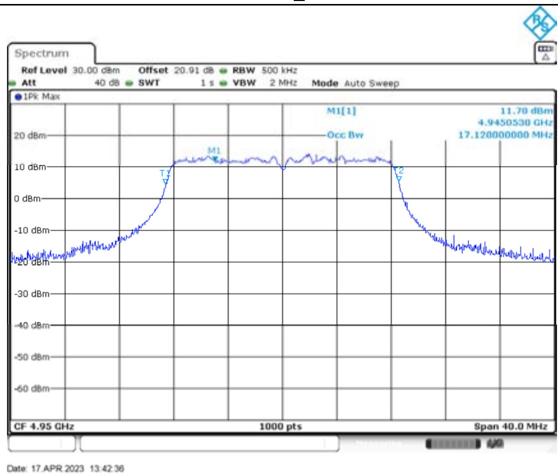
1-ANTB_4950



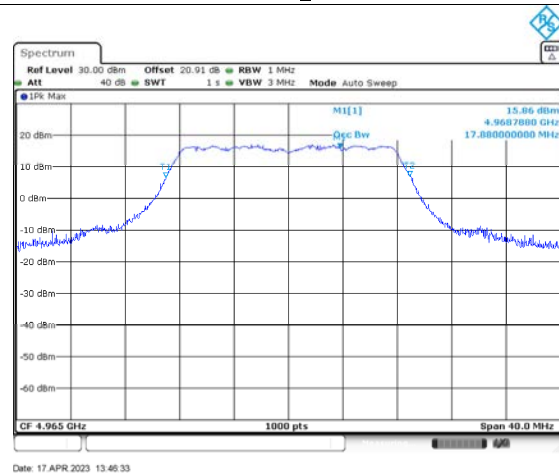
1-ANTB_4965



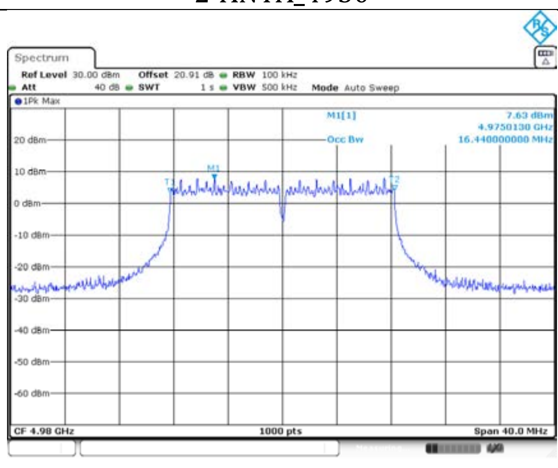
1-ANTB_4980



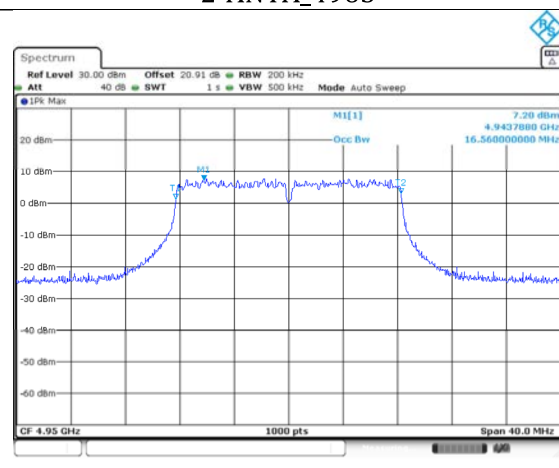
2-ANTA_4950



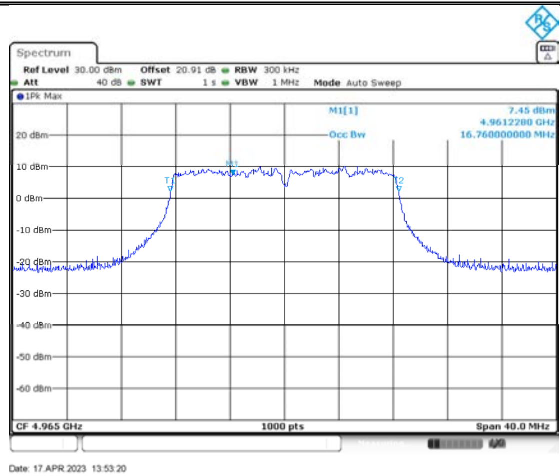
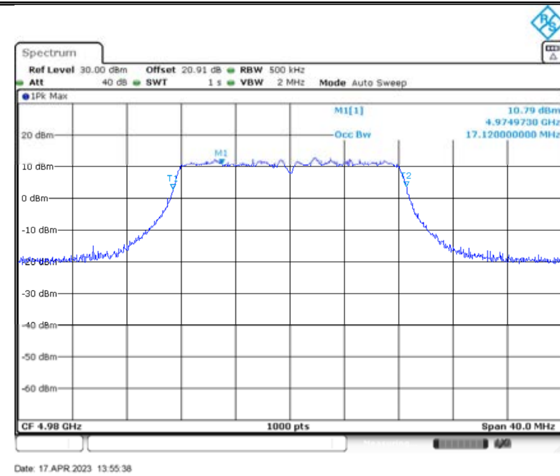
2-ANTA_4965



2-ANTA_4980



2-ANTB_4950

	
2-ANTB_4965	2-ANTB_4980

9 FCC §2.1053 & §90.210, ISEDC RSS-111 §5.5 - Spurious Radiated Emissions

9.1 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[35]	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

According to ISEDC RSS-111 §5.5

5.5 Transmitter Unwanted Emissions

Transmitter unwanted emissions shall be measured according to the method described in Section 4.3.

On any frequency f, offset from the channel centre frequency f_c by a separation f_d (expressed as a percentage of the channel bandwidth), the power spectral density of the unwanted emissions for low- and high-power transmitters shall comply with the limits specified below in Table 2. Figure 1 shows the emission mask for low- and high-power transmitters. For equipment with multiple transmitters, the unwanted emissions of each transmitter shall comply with the emission limits based on the output power of the transmitter regardless of the total output power of the equipment (i.e. total output power from all the transmitters).

Table 2 — Emission Mask for Low- and High-power Transmitters

Offset Frequency f_d (% of the Equipment's Channel Bandwidth)	Minimum Attenuation (dB)	
	Low-power Transmitter	High-power Transmitter
$0 < f_d \leq 45$	0	0
$45 < f_d \leq 50$	219 log (f_d/45)	568 log (f_d/45)
$50 < f_d \leq 55$	10 + 242 log (f_d/50)	26 + 145 log (f_d/50)
$55 < f_d \leq 100$	20 + 31 log (f_d/55)	32 + 31 log (f_d/55)
$100 < f_d \leq 150$	28 + 68 log (f_d/100)	40 + 57 log (f_d/100)
$f_d > 150$	40	whichever is less stringent 50 or 55 + 10 log p

Where: f_d (%) = ((f-f_c)/channel bandwidth) x 100
p: transmitter's output power (in watts), measured as per Section 4.1

9.2 Test Procedure

ANSI C63.26-2015 Section 5.5.3 and 5.5.4

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

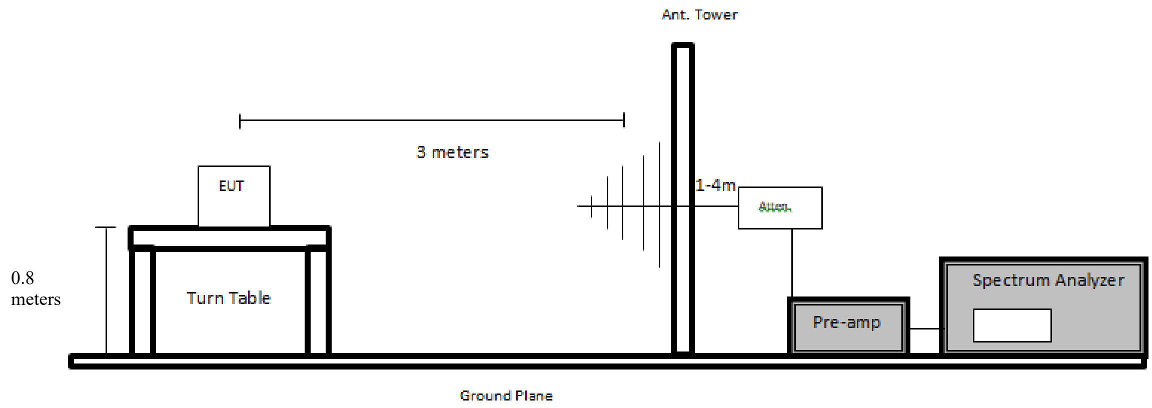
The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

Emissions were investigated up to 40GHz.

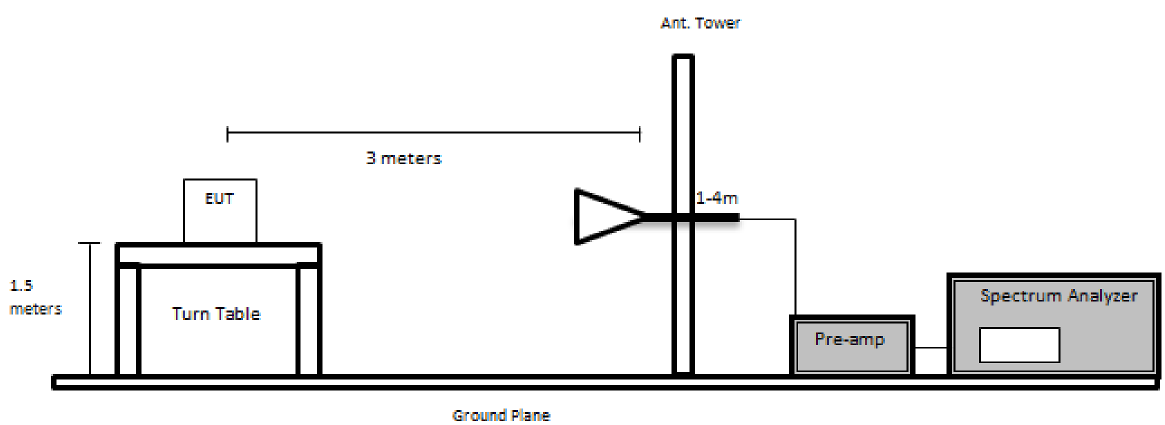
After the emissions were found, the EUT was removed and replaced by a substituting antenna. A signal generator was connected to the substituting antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

9.3 Test Setup Block Diagram

Below 1GHz:



Above 1GHz:



9.4 Test Equipment List and Details

Asset #	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
912	Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008k39-101203-UW	2022-05-10	1 year
327	Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/A
188	Sunol Sciences Corp	Horn Antenna	DRH-118	A052704	2021-10-07	2 years
321	Sunol Sciences Corp	Biconilog Antenna	JB3	A020106-2	2021-11-22	2 years
568	COM-POWER	Antenna, Dipole	AD-100 DB-4	721033DB1,721033DB2,721033DB3,521921	2021-05-10	2 years
1192	ETS Lindgren	Antenna, Horn	3117	00218973	2022-09-29	2 years
316	Sonoma Instruments	Preamplifier	317	260406	2023-04-12	6 months
658	Agilent	Pre-Amplifier	8449B OPT HO2	3008A01103	2022-07-22	1 year
1130	Aglient	MXG Signal Generator	N5183A	MY50140453	2022-09-20	1 year
1186	Pasternack	Coaxial Cable, RG214	PE3062-1050CM	N/A	2023-04-14	6 months
1248	Pasternack	RG214 COAX Cable	PE3062	N/A	2023-04-14	6 months
1249	Time Microwave	LMR-400 Cable Dc-3 GHz	AE13684	2k80612-5 6fts	2023-04-14	6 months
1295	Carlisle	10m Ultra Low Loss Coaxial Cable	UFB142A-1-3937-200200	64639890912-001	2022-10-28	6 months
1354	RFMW	2.92mm 10ft RF Cable DC to 40 GHz	P1CA-29M29M-F150-120	N/A	2023-02-24	6 months
1245	-	6dB Attenuator	PE7390-6	01182018A	2021-11-21	2 years
1246	Hewlet Packard	RF Limiter	11867A	01734	2023-04-13	1 year

Note[1]: 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".*

9.5 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 from 2023-04-14 to 2023-04-17 in 5m chamber 3.

9.6 Test Results

Radio 1: CW, Middle channel tested MIMO(4965 MHz), PS: 28

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)		
94.02	55.71	151	164	H	94.02	-61.81	1.4	0.49	-60.9	-25	-35.9
85.29	55.78	21	130	V	85.29	-61.37	1.4	0.54	-60.51	-25	-35.51
1070	55.17	324	124	H	1070	-58.26	6.623	0.17	-51.807	-25	-26.807
1000	51.15	61	160	V	1000	-62.39	6.114	0.16	-56.436	-25	-31.436
9930	48.22	273	240	H	9930	-46.15	11.164	2.51	-37.496	-25	-12.496
9930	48.31	138	258	V	9930	-46.06	11.164	2.51	-37.406	-25	-12.406

Radio 2: CW, Middle channel tested MIMO(4965 MHz), PS: 31

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)		
94.02	56.43	157	205	H	94.02	-61.09	1.4	0.49	-60.18	-25	-35.18
85.29	54.12	8	122	V	85.29	-63.03	1.4	0.54	-62.17	-25	-37.17
1027.3	58.26	58	144	H	1027.3	-55.37	6.623	0.2	-48.947	-25	-23.947
1159.9	52.06	151	117	V	1159.9	-59.54	6.649	0.24	-53.131	-25	-28.131
9930	48.48	34	260	H	9930	-45.89	11.121	2.51	-37.279	-25	-12.279
9930	48.39	176	217	V	9930	-45.98	11.121	2.51	-37.369	-25	-12.369

Note: Pre-scan was performed in order to determine worst-case orientation of device (shown in Test Setup Photos) with respect to measurement antenna. Plots/data shown represent measurements made in worst-case orientation.
Note: For above cabinet emissions, carrier wave transmitted on middle channel reflected worst-case results with regards to spurious emissions testing. This is after performing pre-scan on the multiple frequency options per ANSI C63.26-2015 §5.5.2.5. For full testing on various channels, please refer to conducted results in section 10.6.

10 FCC §2.1051, §90.210 & RSS-111 § 5.5 - Spurious Emissions at Antenna Terminals

10.1 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[35]	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.

According to ISEDC RSS-111 §5.5

5.5 Transmitter Unwanted Emissions

Transmitter unwanted emissions shall be measured according to the method described in Section 4.3.

On any frequency f, offset from the channel centre frequency f_c by a separation f_d (expressed as a percentage of the channel bandwidth), the power spectral density of the unwanted emissions for low- and high-power transmitters shall comply with the limits specified below in Table 2. Figure 1 shows the emission mask for low- and high-power transmitters. For equipment with multiple transmitters, the unwanted emissions of each transmitter shall comply with the emission limits based on the output power of the transmitter regardless of the total output power of the equipment (i.e. total output power from all the transmitters).

Table 2 — Emission Mask for Low- and High-power Transmitters

Offset Frequency f_d (% of the Equipment's Channel Bandwidth)	Minimum Attenuation (dB)	
	Low-power Transmitter	High-power Transmitter
$0 < f_d \le 45$	0	0
$45 < f_d \le 50$	219 log (f_d/45)	568 log (f_d/45)
$50 < f_d \le 55$	10 + 242 log (f_d/50)	26 + 145 log (f_d/50)
$55 < f_d \le 100$	20 + 31 log (f_d/55)	32 + 31 log (f_d/55)
$100 < f_d \le 150$	28 + 68 log (f_d/100)	40 + 57 log (f_d/100)
$f_d > 150$	40	whichever is less stringent 50 or 55 + 10 log p

Where: f_d (%) = ((f-f_c)/channel bandwidth) x 100
p: transmitter's output power (in watts), measured as per Section 4.1

10.2 Test Procedure

Conducted spurious emissions:

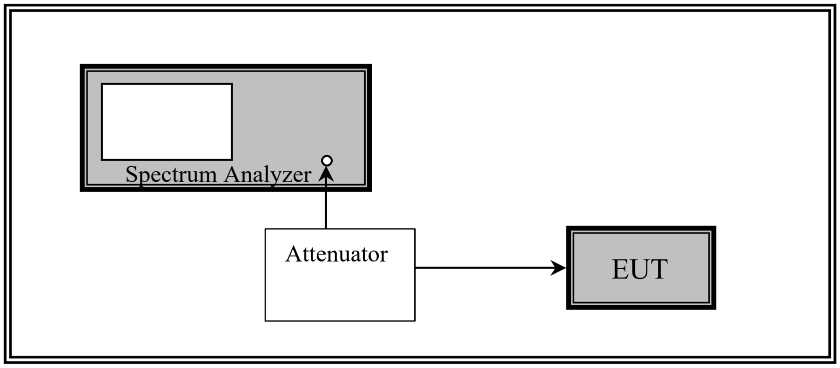
The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz for measurements up to 1GHz and set to 1 MHz for measurements up to the 10^{th} harmonic.

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).

10.3 Test Setup Block Diagram



10.4 Test Equipment List and Details

BACL No.	Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
912	Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008k39-101203-UW	2022-05-05	1 year
-	-	RF Cable	-	-	Each time[1]	N/A
-	-	20dB Attenuator	-	-	Each time[1]	N/A

Note[1]: 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".*

10.5 Test Environmental Conditions

Temperature:	18.8° C
Relative Humidity:	34 %
ATM Pressure:	101.8 kPa

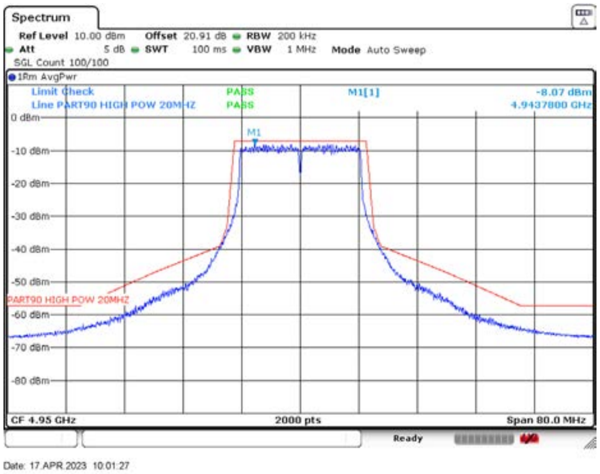
The testing was performed by Christian Schwartz on 2023-04-17 in the RF Site.

10.6 Test Results

Please refer to plots below.

Note: testing was performed at max power setting.

Title Convention: Radio (1 or 2)-Antenna (A or B) _ Frequency (MHz)



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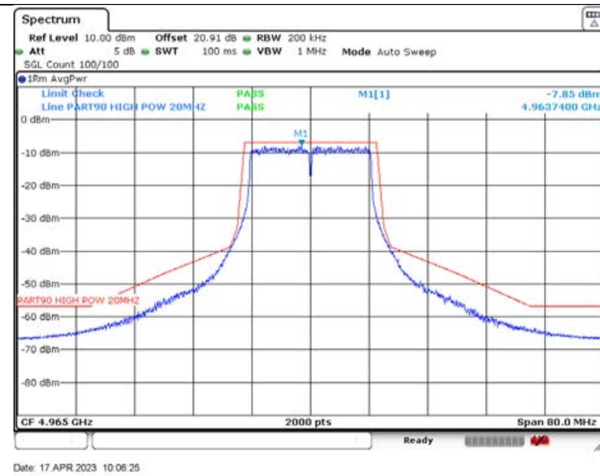

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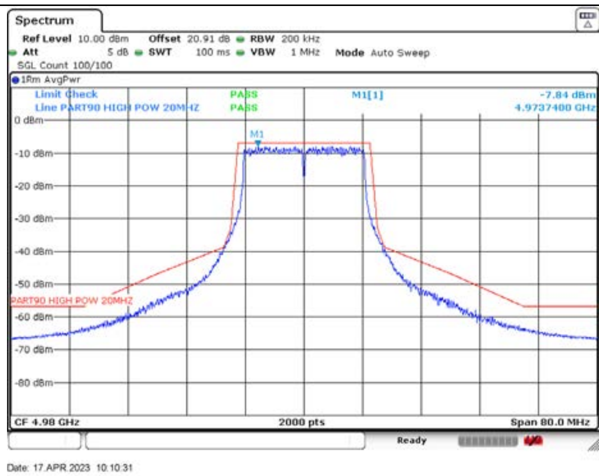

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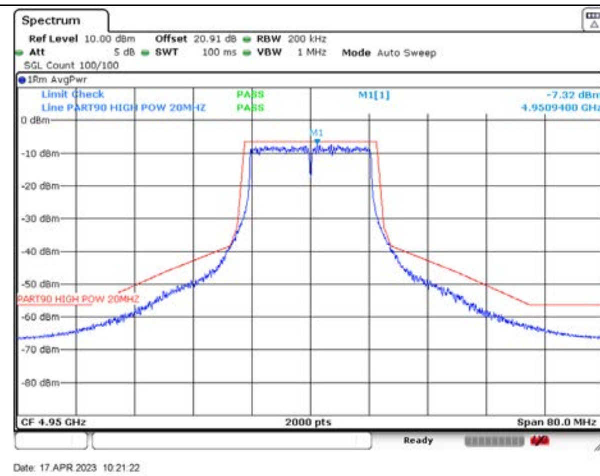

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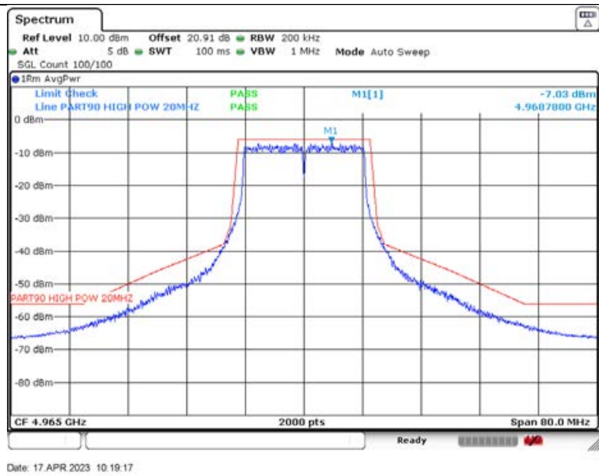

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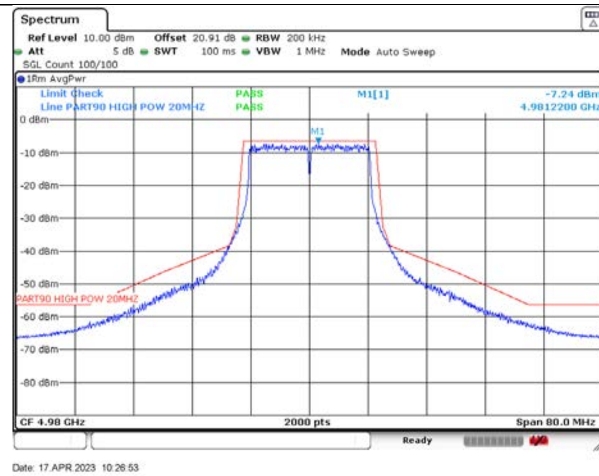

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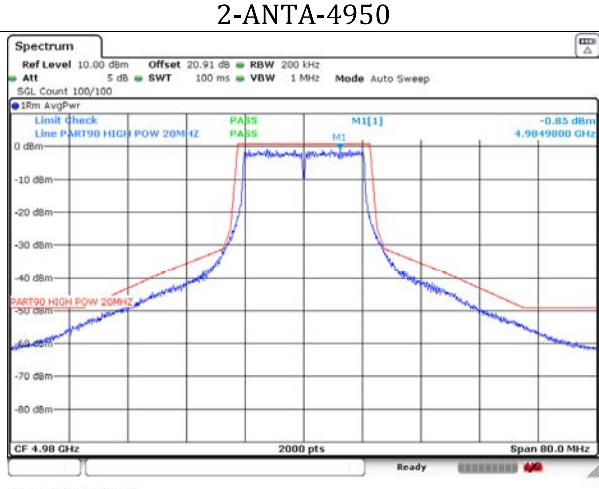
2-ANTA-4950

2-ANTA-4965



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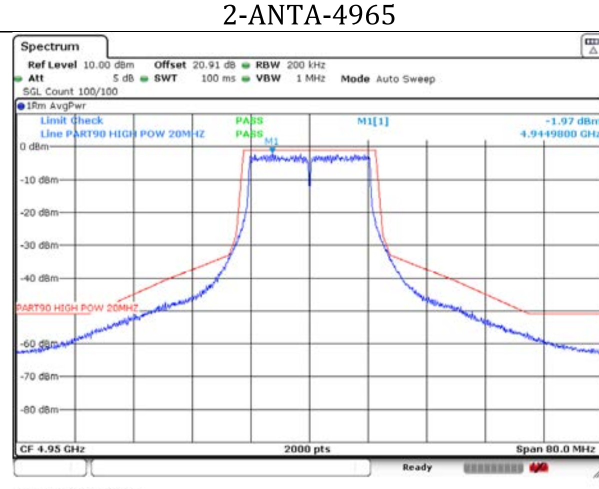

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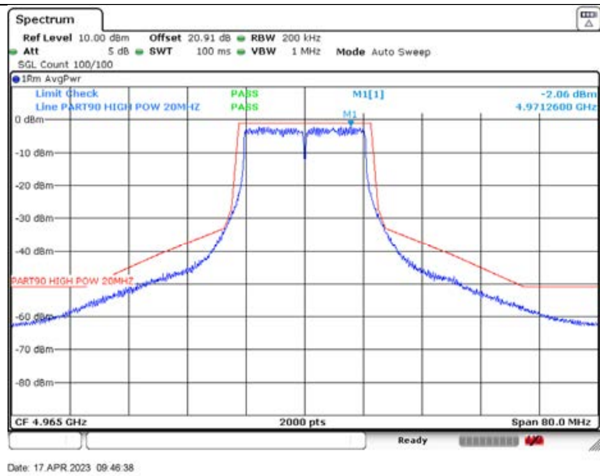

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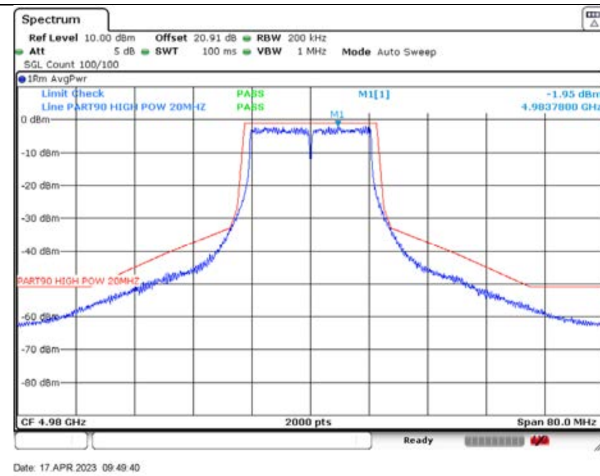

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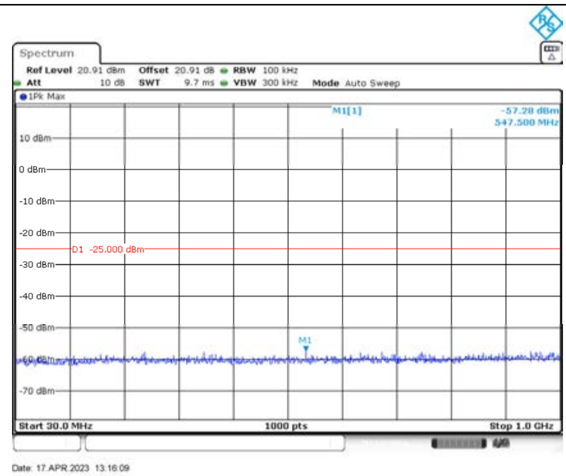
Title Convention: Radio (1 or 2)-Antenna (A or B) _ Frequency (MHz)_Spurious Frequency Range(MHz)



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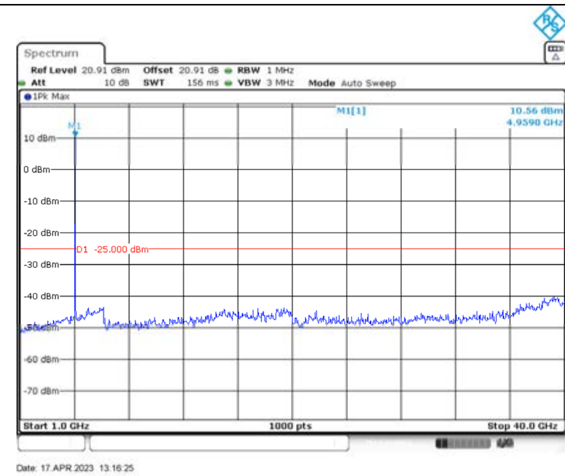

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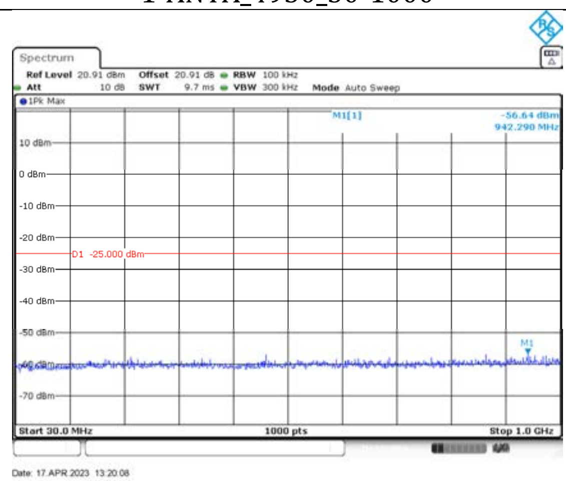

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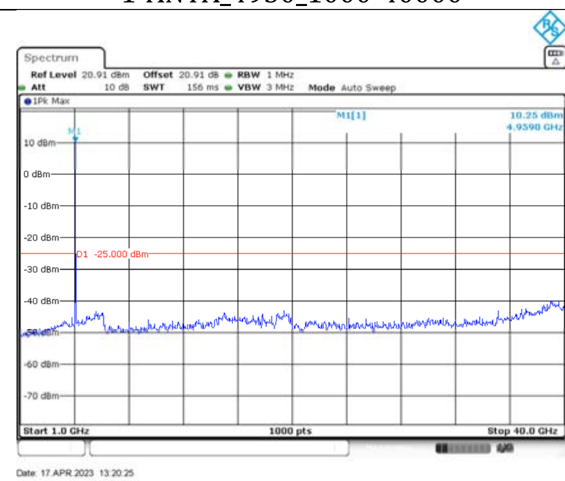

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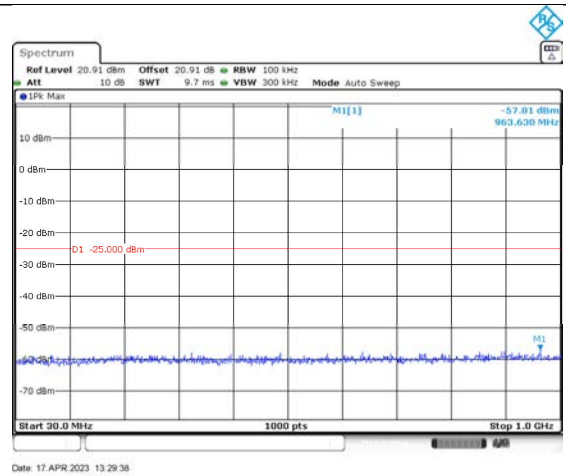

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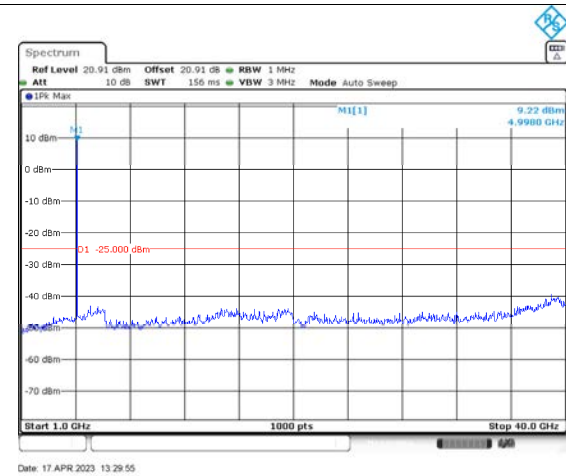

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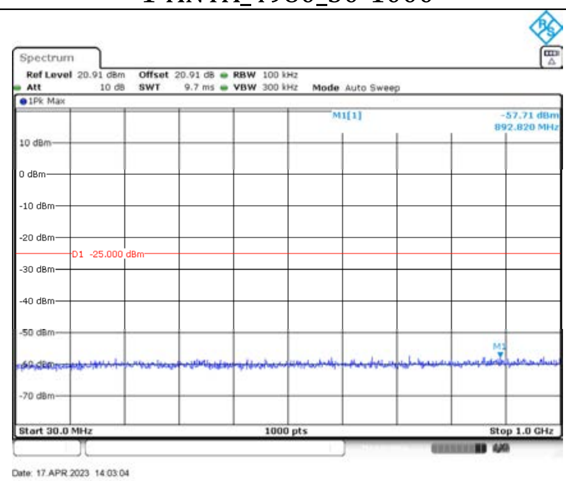

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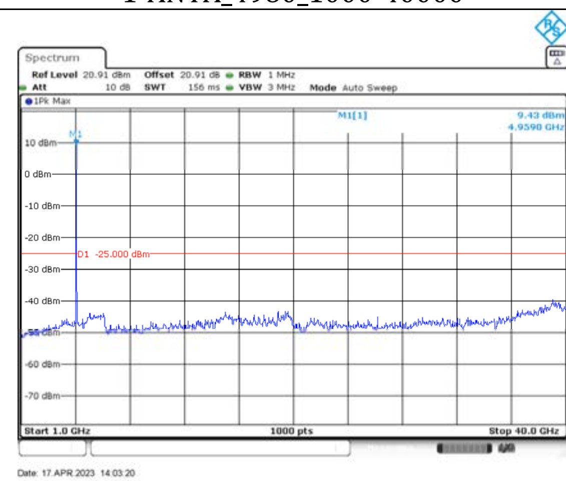

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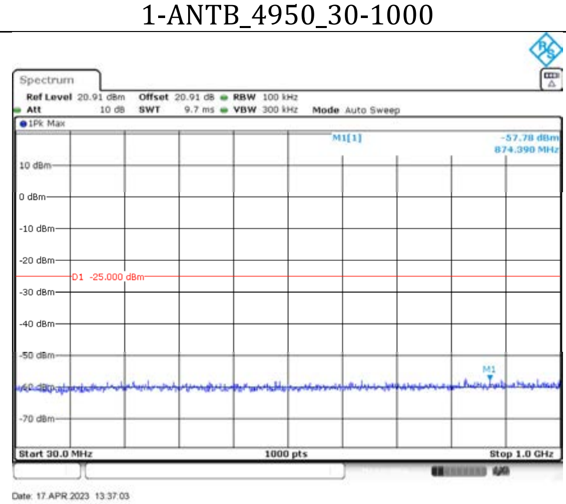

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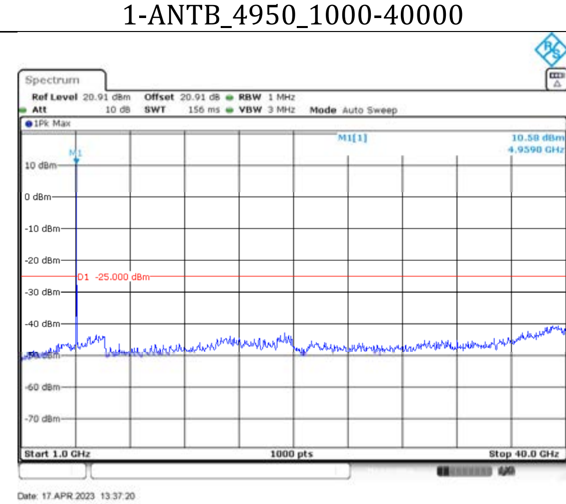

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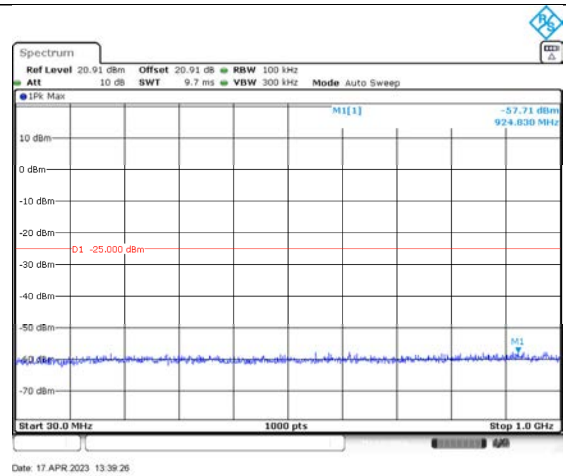

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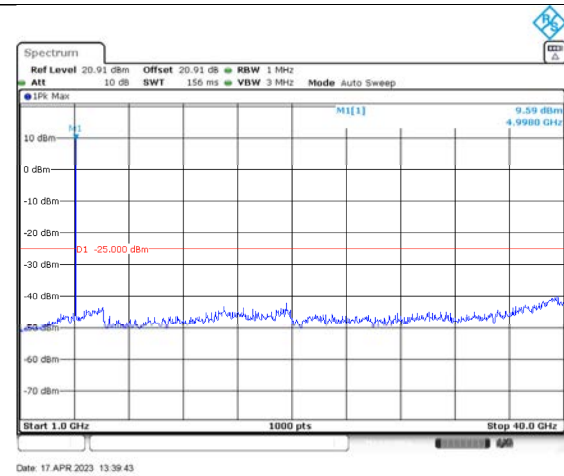

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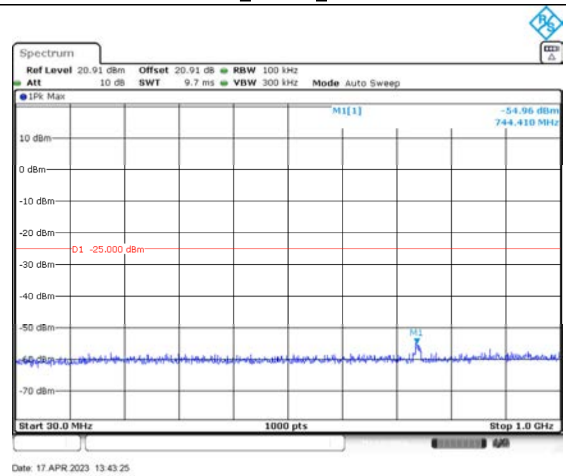

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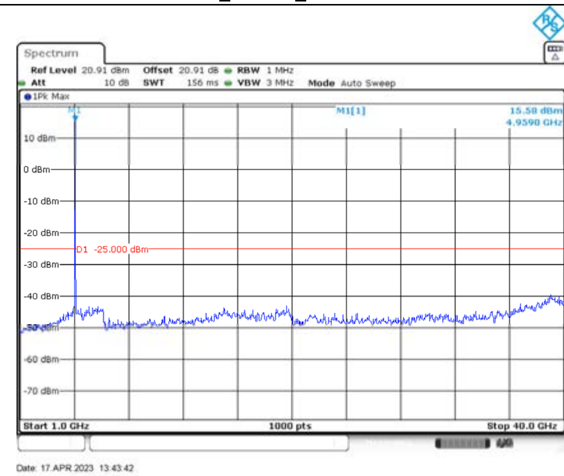

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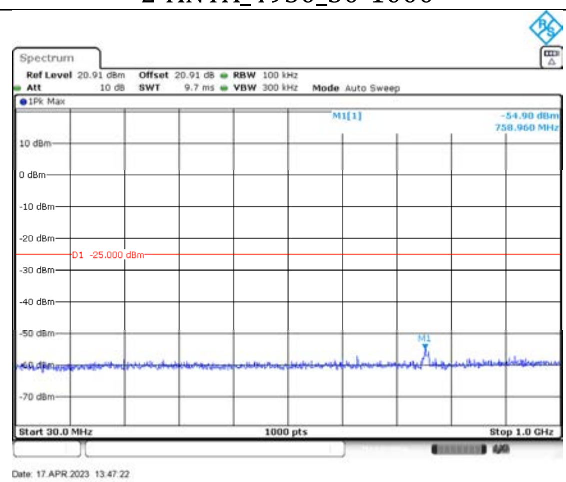

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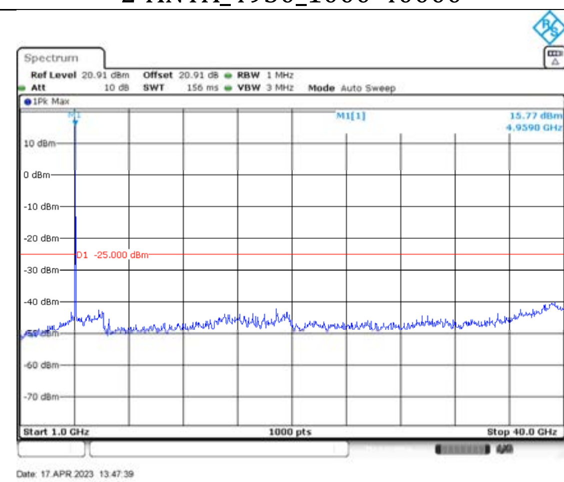

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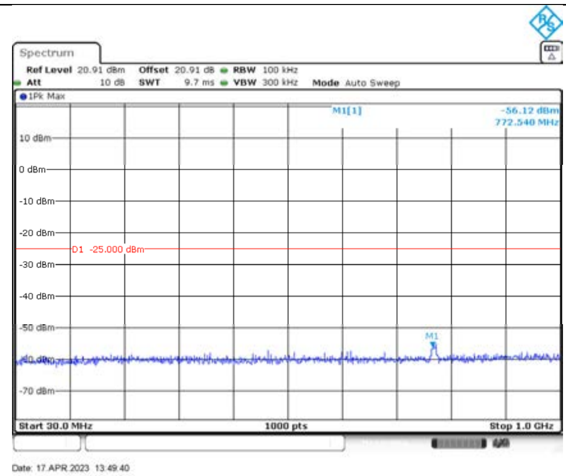

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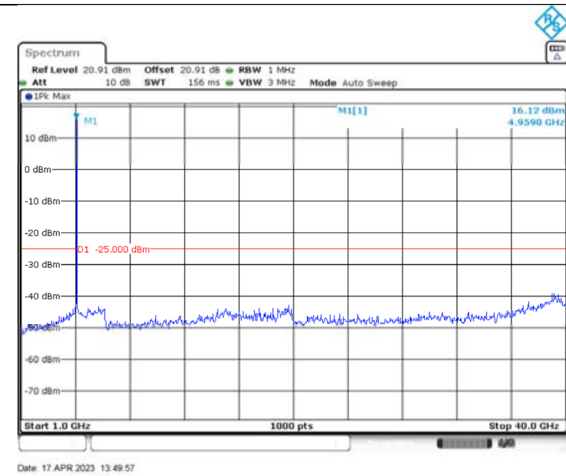

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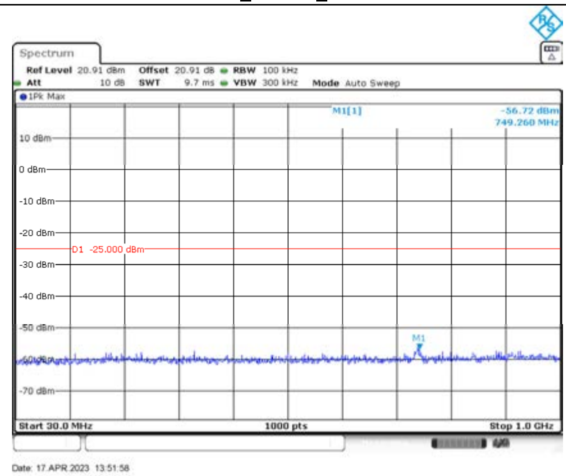

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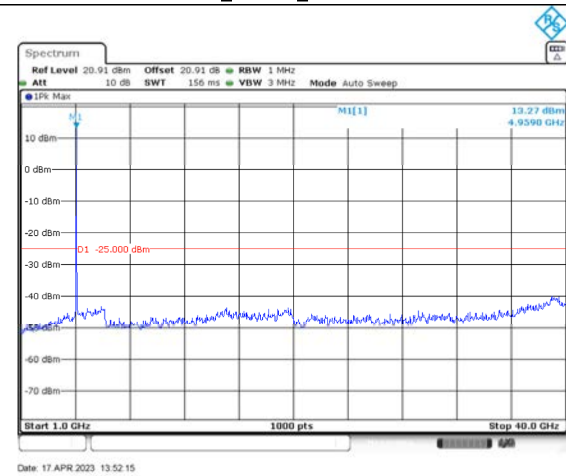

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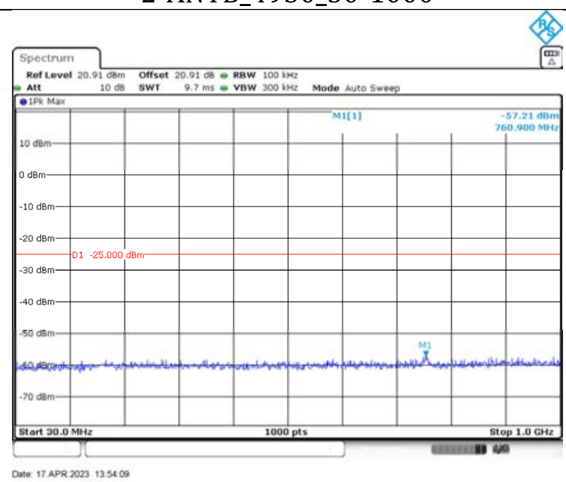

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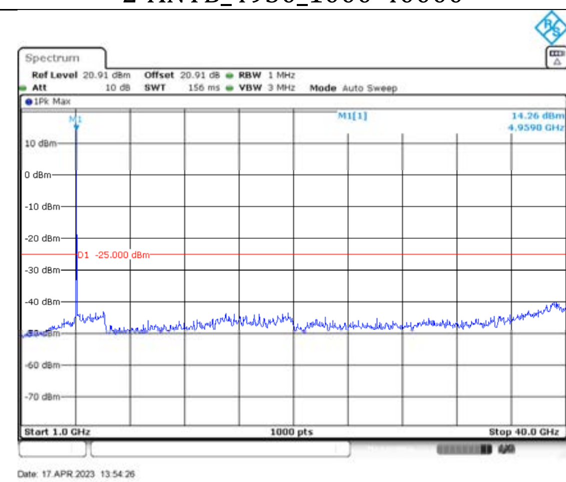

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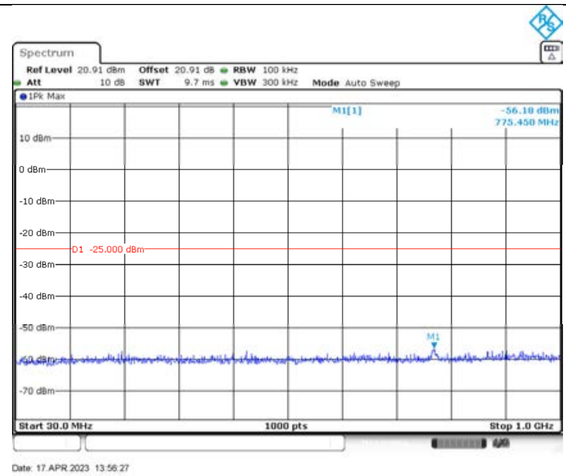
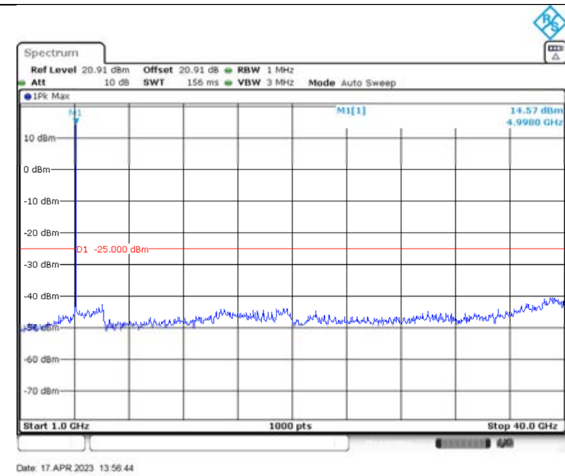
	
2-ANTB_4980_30-1000	2-ANTB_4980_1000-40000

11 FCC §2.1055, §90.213, RSS-111 § 5.2 - Frequency Tolerance

11.1 Applicable Standard

According to FCC Part 90.213,

§90.213 Frequency stability.

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

Table 1 to §90.213(a)—Minimum Frequency Stability

[Parts per million (ppm)]

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	[1 2 3]100	100	200
25-50	20	20	50
72-76	5		50
150-174	[5 11]5	[6]5	[4 6]50
216-220	1.0		1.0
220-222[12]	0.1	1.5	1.5
421-512	[7 11 14]2.5	[8]5	[8]5
806-809	[14]1.0	1.5	1.5
809-824	[14]1.5	2.5	2.5
851-854	1.0	1.5	1.5
854-869	1.5	2.5	2.5
896-901	[14]0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928[13]	2.5	2.5	2.5
929-930	1.5		
935-940	0.1	1.5	1.5
1427-1435	[9]300	300	300
Above 2450[10]			

According to RSS-111 § 5.2,

The applicant shall ensure frequency stability by showing that the occupied bandwidth is maintained within the band of operation when tested at the temperature and supply voltage variations specified for the frequency stability measurement in RSS-Gen.

11.2 Test Procedure

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

(1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(2) From −20° to + 50° 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° 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° 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:

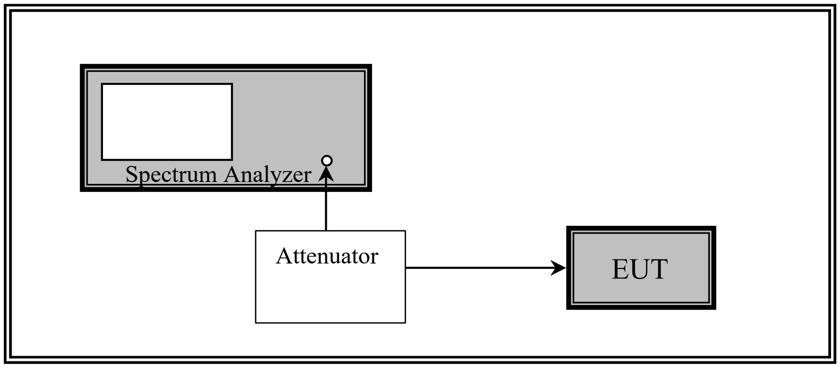
(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(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.)

11.3 Test Setup Block Diagram



11.4 Test Equipment List and Details

BACL No.	Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
912	Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008k39-101203-UW	2022-05-05	1 year
1060	BACL	Temp and Humi Chamber	BTH-150-40	30078	2022-10-27	1 year
1224	Radiall	USB COAXIAL SWITCHES	SPNT R574X11X0 1 USB	-	Each time[1]	N/A
-	-	RF Cable	-	-	Each time[1]	N/A
-	-	10dB Attenuator	-	-	Each time[1]	N/A

Note[1]: 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".*

11.5 Test Environmental Conditions

Temperature:	18.8° C
Relative Humidity:	34 %
ATM Pressure:	101.8 kPa

The testing was performed by Christian Schwartz from 2023-04-19 to 2023-04-20 in the RF Site.

11.6 Test Results

4.9GHz Radio1 and Radio 2 Antenna A:

Temperature (°C)/Voltage Conditions	Radio	Reference Frequency (GHz)	Tested Frequency (GHz)	Frequency Deviation (ppm)	Result
-30°C/normal voltage (120V)	Radio 1	4.965	4.9650475750	9.58	pass
-30°C /normal voltage (120V)	Radio 2	4.965	4.9650602750	12.13	pass
-20°C /normal voltage (120V)	Radio 1	4.965	4.9650565750	11.39	pass
-20°C /normal voltage (120V)	Radio 2	4.965	4.9650617250	12.43	pass
-10°C /normal voltage (120V)	Radio 1	4.965	4.9650556250	11.2	pass
-10°C /normal voltage (120V)	Radio 2	4.965	4.9650582750	11.73	pass
0°C /normal voltage (120V)	Radio 1	4.965	4.9650482750	9.72	pass
0°C /normal voltage (120V)	Radio 2	4.965	4.9650493250	9.93	pass
10°C /normal voltage (120V)	Radio 1	4.965	4.9650299750	6.03	pass
10°C /normal voltage (120V)	Radio 2	4.965	4.9650329250	6.63	pass
20°C /normal voltage (120V)	Radio 1	4.965	4.9650096250	1.9	pass
20°C /normal voltage (120V)	Radio 2	4.965	4.9650131750	2.65	pass
30°C /normal voltage (120V)	Radio 1	4.965	4.96500212150	0.42	pass
30°C /normal voltage (120V)	Radio 2	4.965	4.9650019750	0.39	pass
40°C /normal voltage (120V)	Radio 1	4.965	4.9649799750	-4.03	pass
40°C /normal voltage (120V)	Radio 2	4.965	4.9649834250	-3.33	pass
50°C /normal voltage (120V)	Radio 1	4.965	4.9649691250	-6.21	pass
50°C /normal voltage (120V)	Radio 2	4.965	4.9649762750	-4.77	pass
20°C /low voltage (102V)	Radio 1	4.965	4.9650124250	2.50	pass
20°C /low voltage (102V)	Radio 2	4.965	4.9650089750	1.8	pass
20°C /high voltage (138V)	Radio 1	4.965	4.9650029750	0.59	pass
20°C /high voltage (138V)	Radio 2	4.965	4.9650021250	0.42	pass

Note: Testing done using CW mode
Note: ppm calculated with ((Tested Freq -Reference Freq) / Reference Freq) * 1000000

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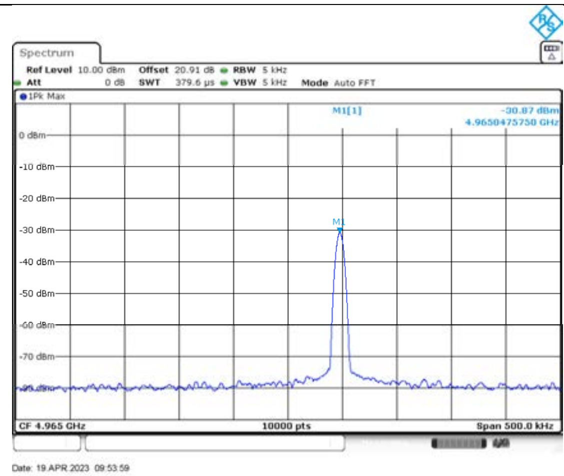
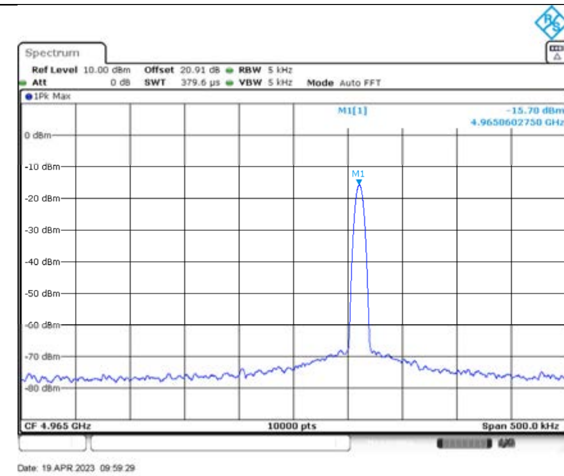
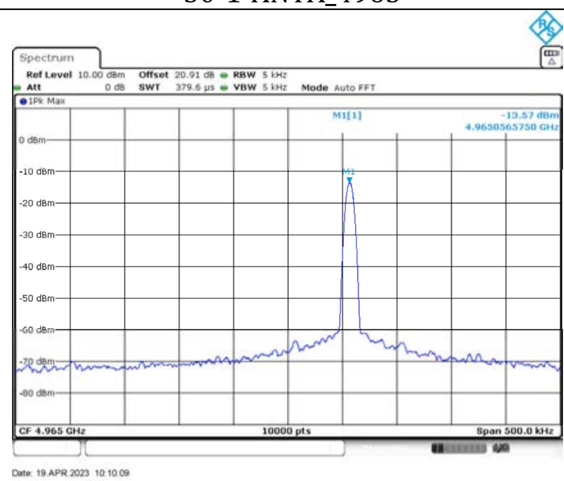
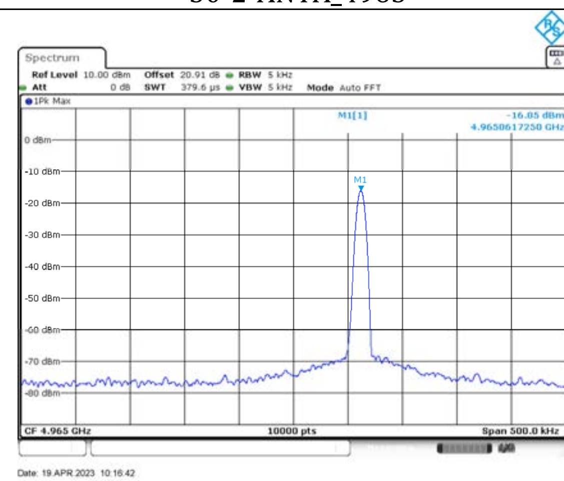
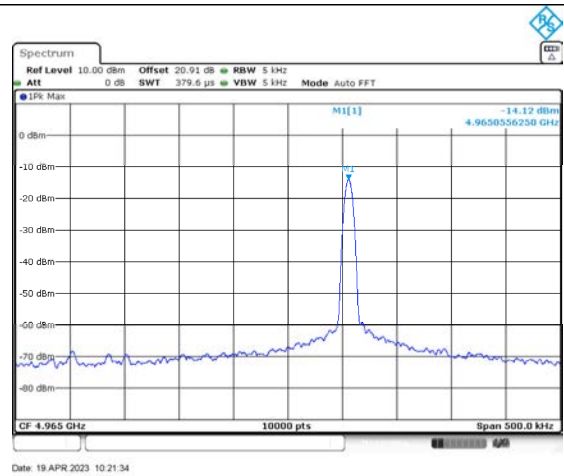
Temperature (°C)/Voltage Conditions	Radio	Antenna	Low Channel (MHz)	High Channel (MHz)	Limit (MHz)	Result
-30°C /normal voltage (120V)	Radio 1	A	4.94186	4.98826	4940 – 4990	pass
-30°C /normal voltage (120V)	Radio 2	A	4.94186	4.98834	4940 – 4990	pass
20°C /normal voltage (120V)	Radio 1	A	4.94178	4.9883	4940 – 4990	pass
20°C /normal voltage (120V)	Radio 2	A	4.94182	4.98826	4940 – 4990	pass
50°C /normal voltage (120V)	Radio 1	A	4.94174	4.98822	4940 – 4990	pass
50°C /normal voltage (120V)	Radio 2	A	4.94174	4.98826	4940 – 4990	pass
20°C /low voltage (102V)	Radio 1	A	4.94142	4.98858	4940 – 4990	pass
20°C /low voltage (102V)	Radio 2	A	4.94138	4.98862	4940 – 4990	pass
20°C /high voltage (138V)	Radio 1	A	4.94134	4.98862	4940 – 4990	pass
20°C /high voltage (138V)	Radio 2	A	4.94134	4.98858	4940 – 4990	pass

Note: Testing done using Modulated mode

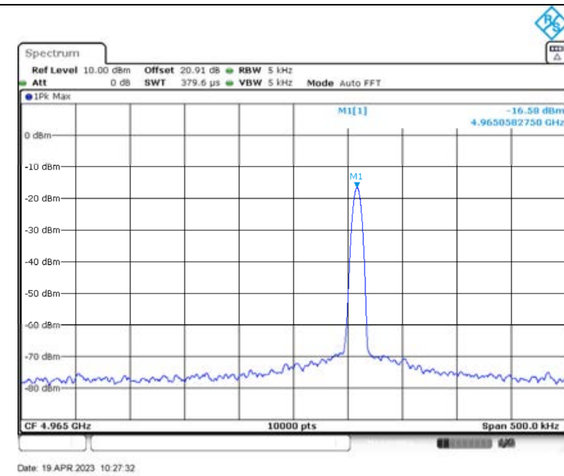
Please refer to plots below for test results

Title Convention: Temperature (°C) -Radio (1 or 2)-Antenna (A or B) _ Frequency (MHz)

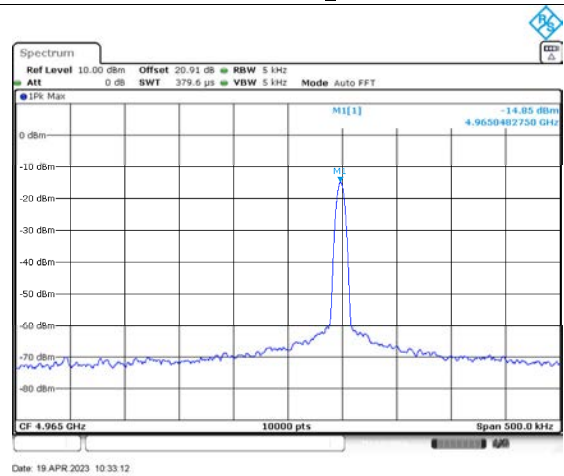
	
-30-1-ANTA_4965	-30-2-ANTA_4965
	
-20-1-ANTA_4965	-20-2-ANTA_4965



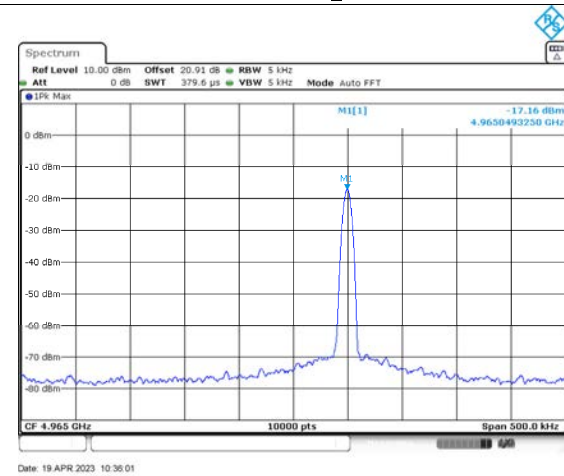
-10-1-ANTA_4965



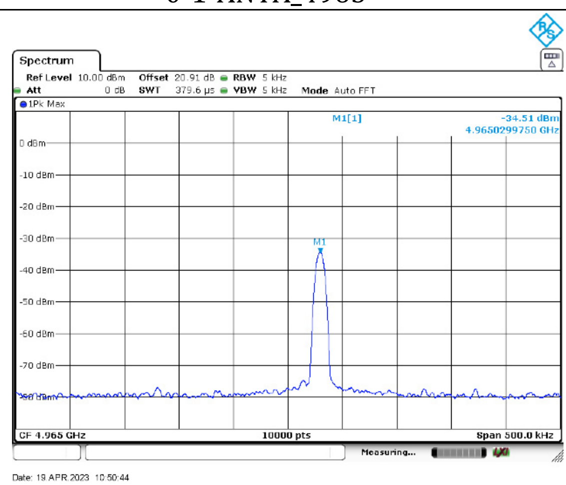
-10-2-ANTA_4965



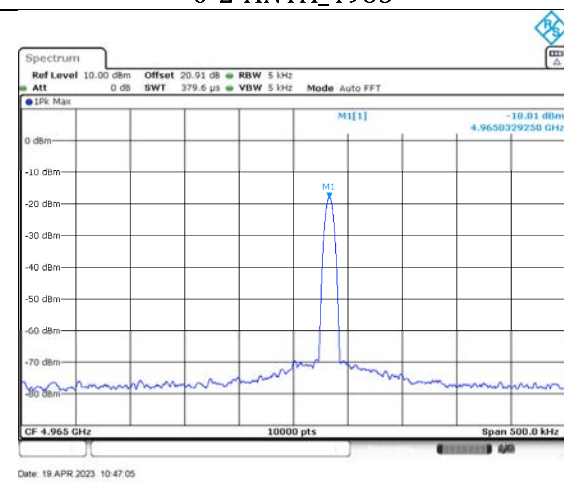
0-1-ANTA_4965



0-2-ANTA_4965



10-1-ANTA_4965



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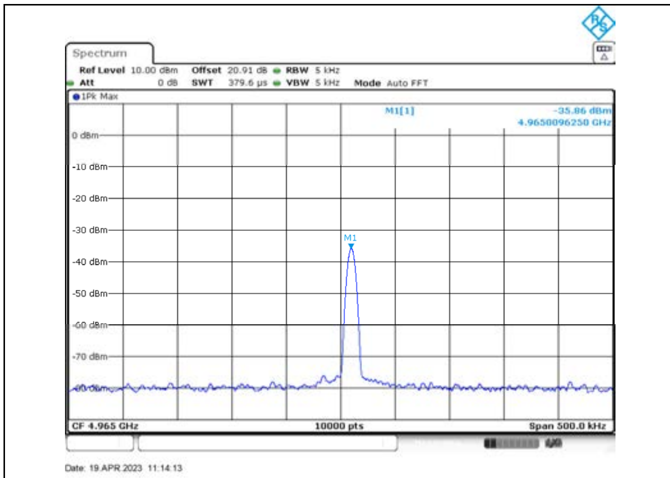
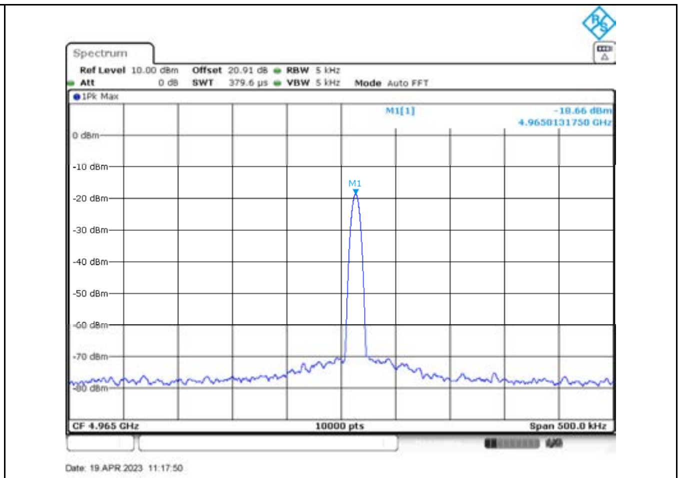


20-1-ANTA_4965



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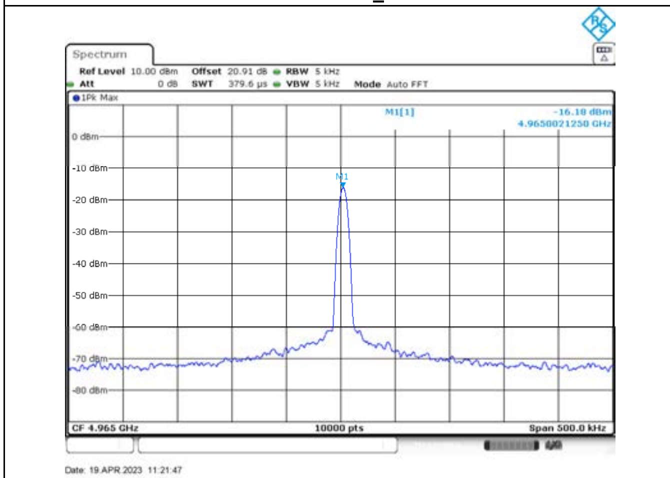

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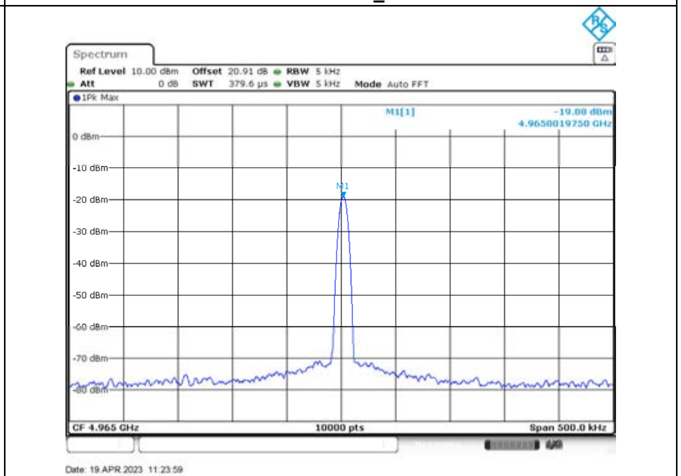

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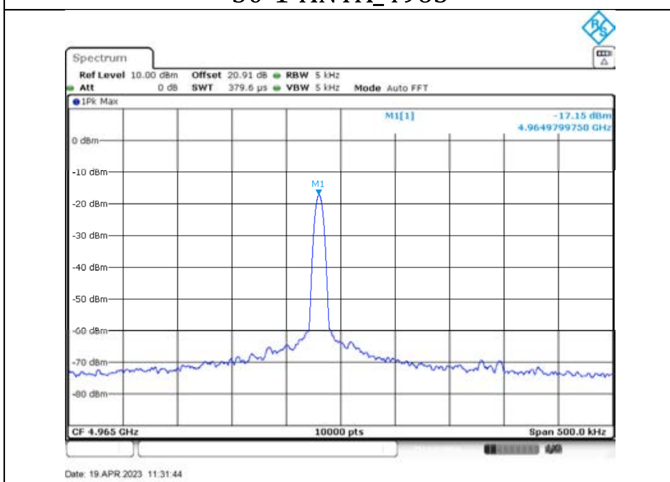
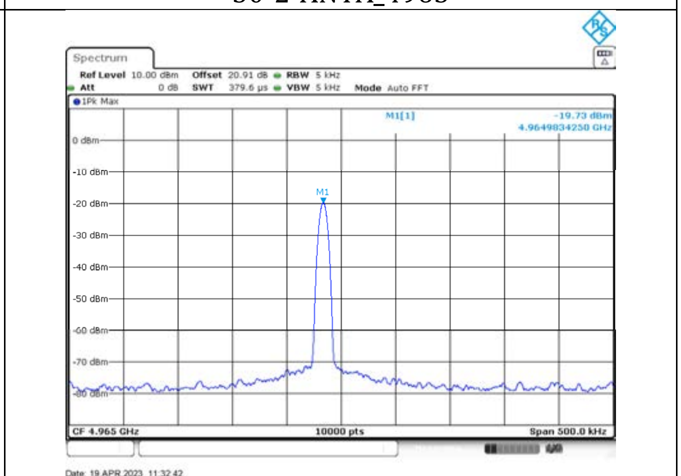


40-1-ANTA_4965



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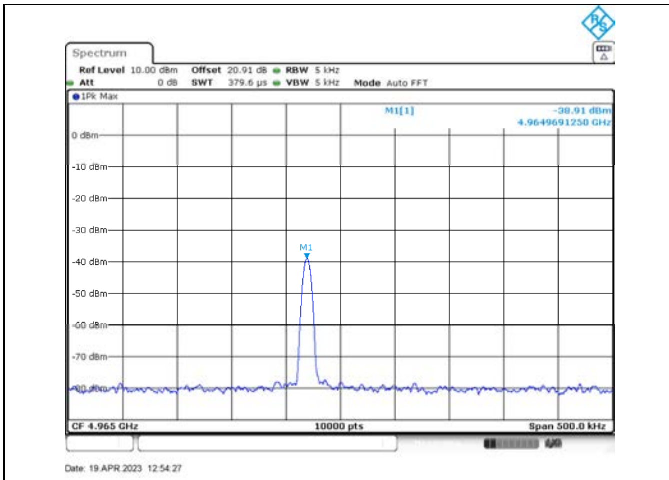
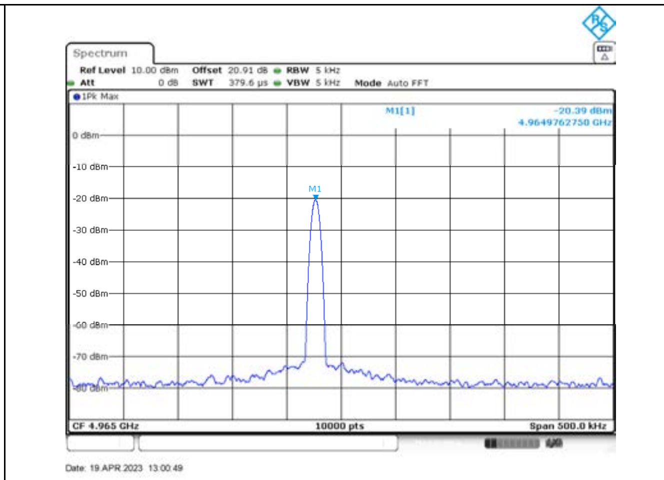
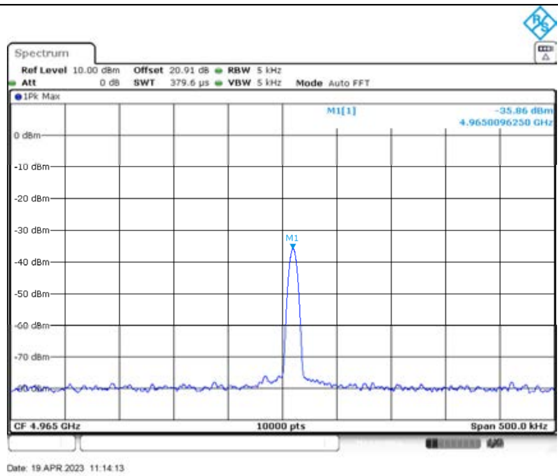


50-1-ANTA_4965

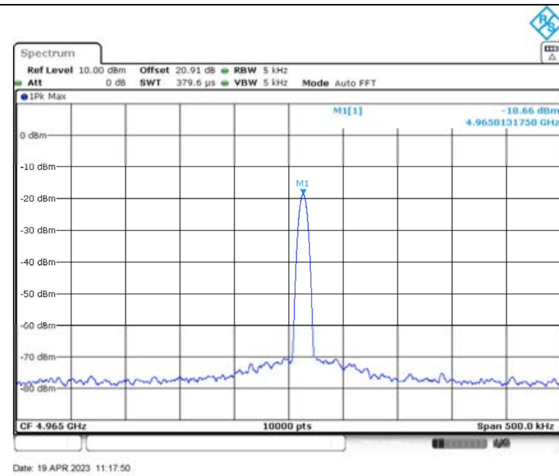


50-2-ANTA_4965

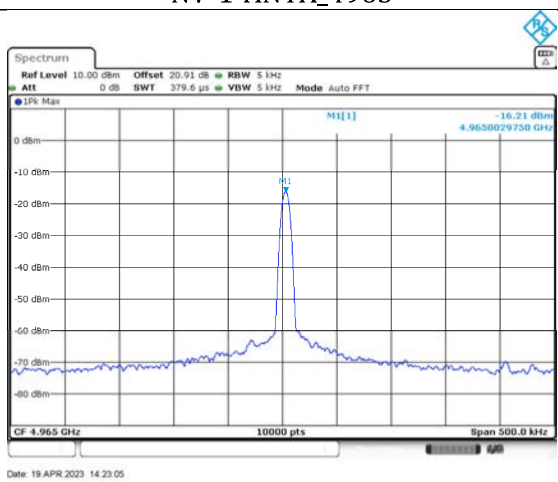
Title Convention: Voltage Setting (NV=120V,LV=102V,HV=138V) -Radio (1 or 2)-Antenna (A or B) _ Frequency (MHz)



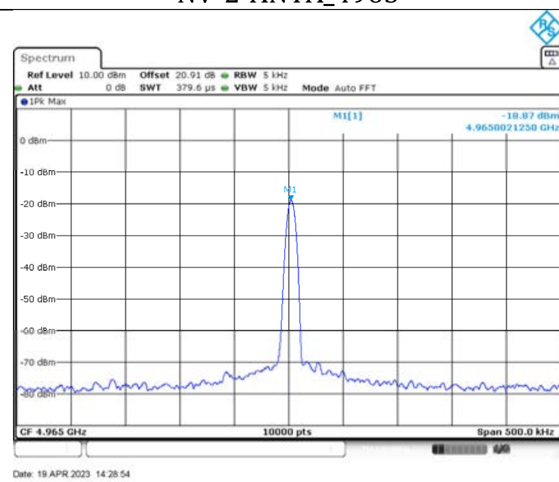
NV-1-ANTA_4965



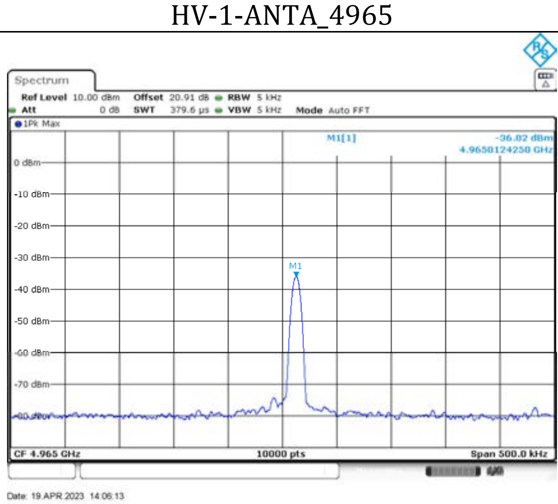
NV-2-ANTA_4965



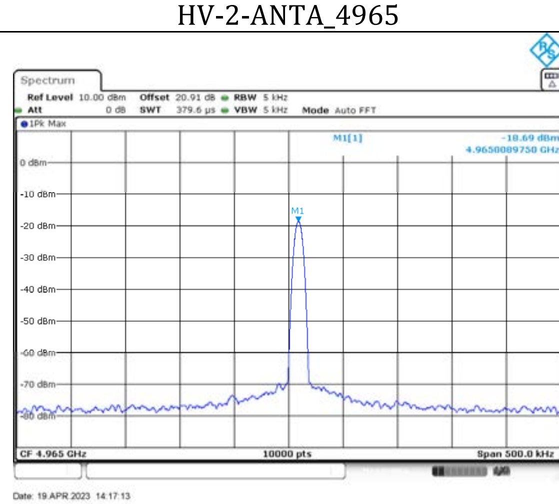
HV-1-ANTA_4965



HV-2-ANTA_4965

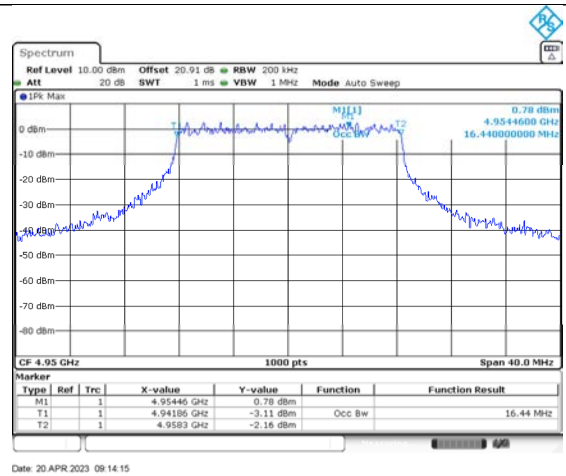


LV-1-ANTA_4965

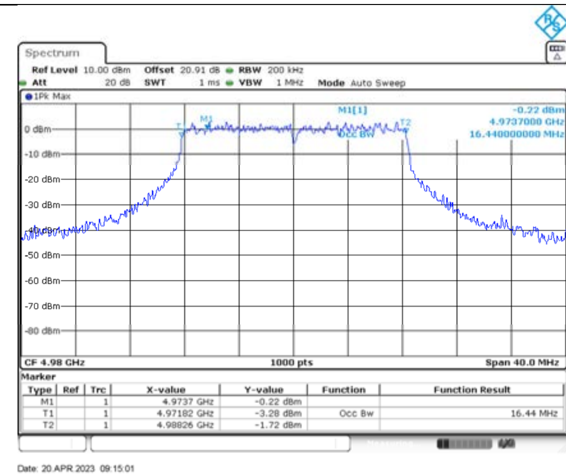


LV-2-ANTA_4965

Title Convention: Temperature (°C) - Radio (1 or 2) - Antenna (A or B) _ Frequency (MHz)



-30-1-ANTA_4950



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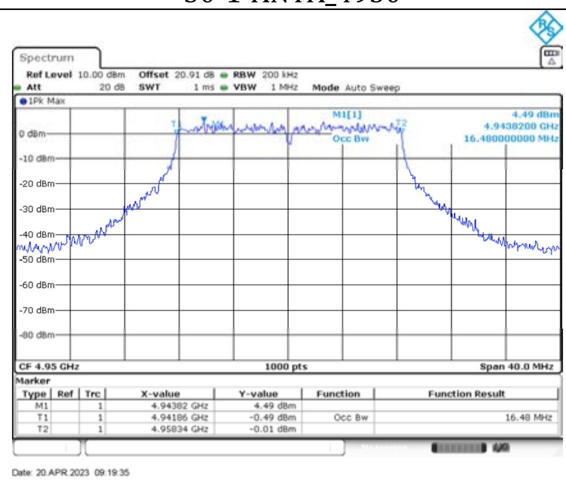

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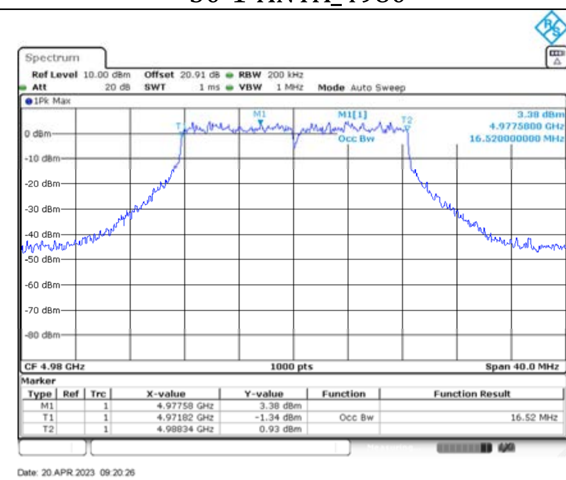

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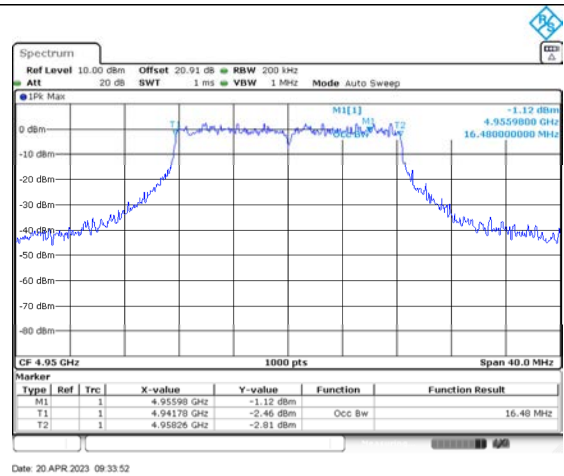
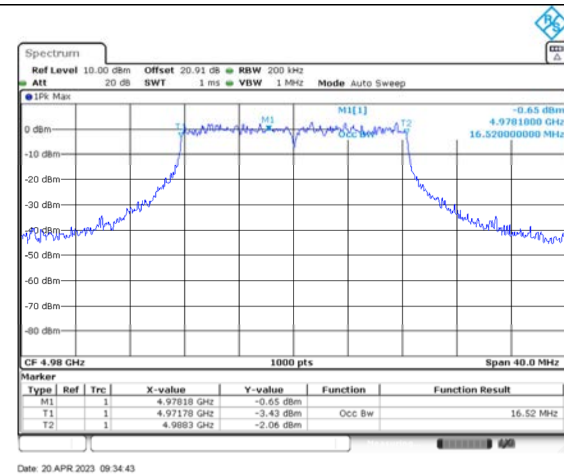


20-1-ANTA_4950



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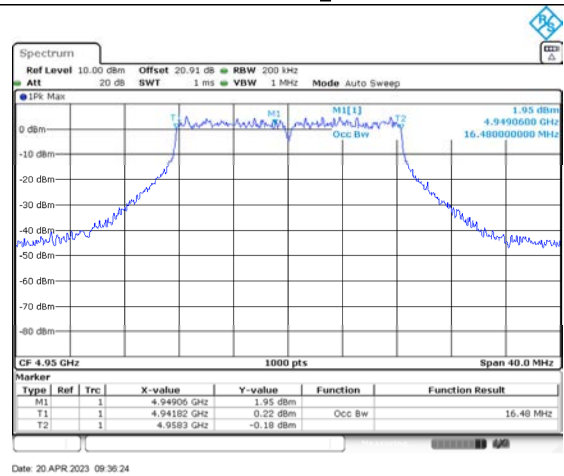

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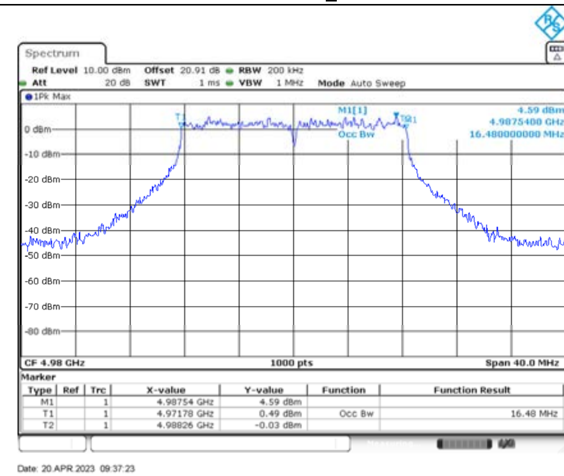

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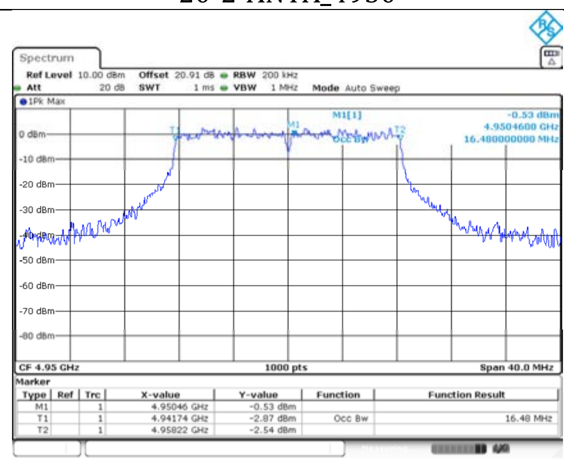

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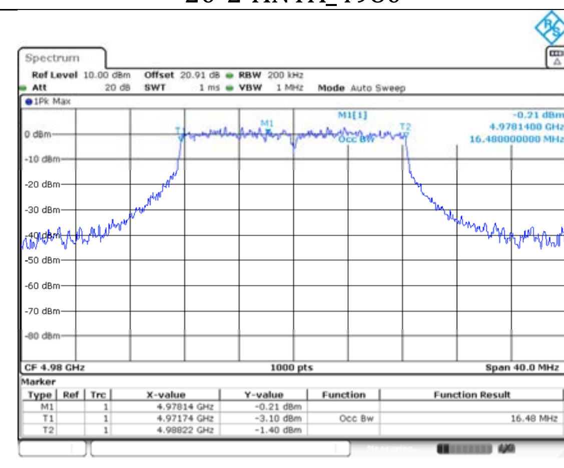
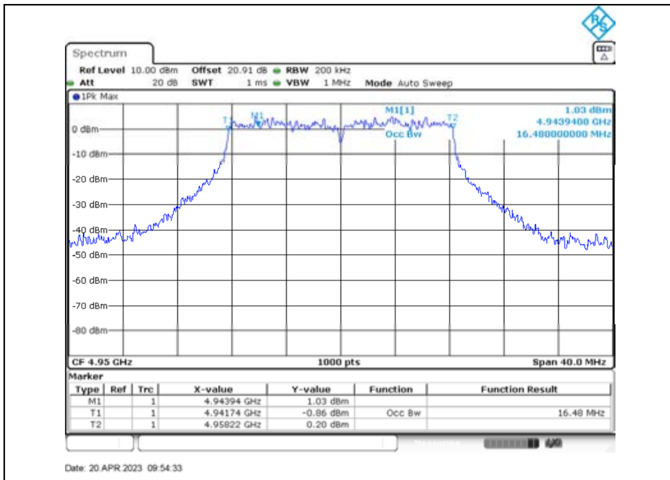
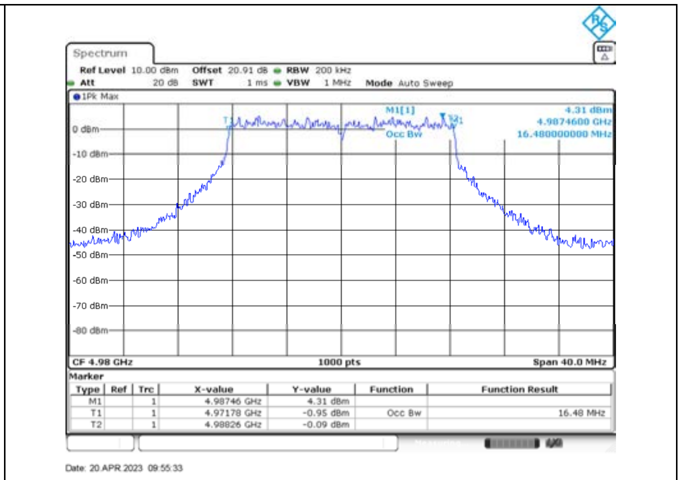
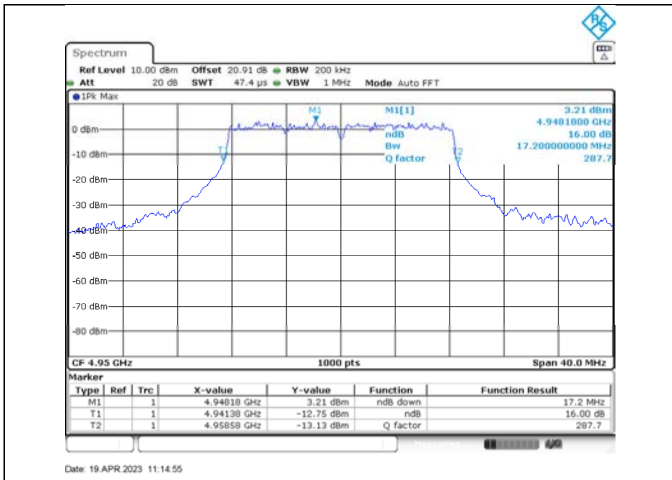


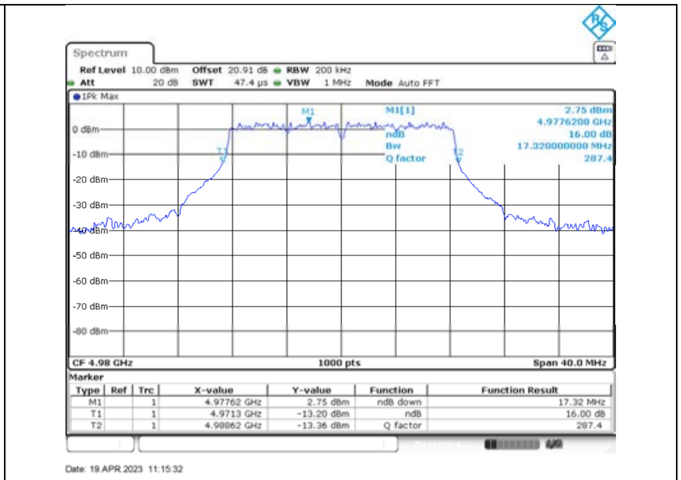
50-1-ANTA_4980

	
50-2-ANTA_4950	50-2-ANTA_4980

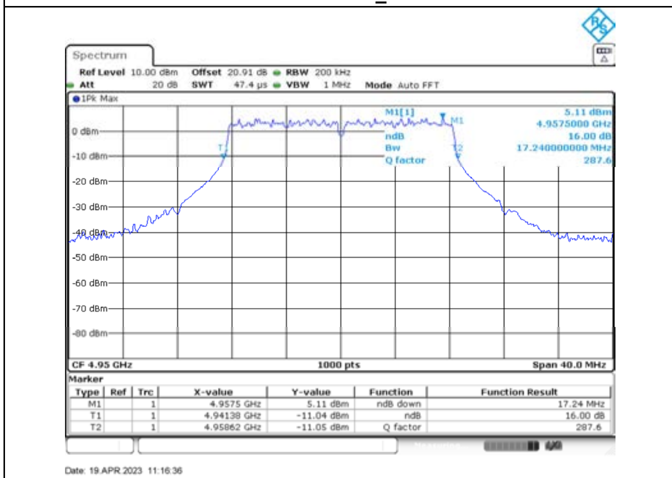
Title Convention: Voltage Setting (NV=120V,LV=102V,HV=138V) -Radio (1 or 2)-Antenna (A or B) _ Frequency (MHz)



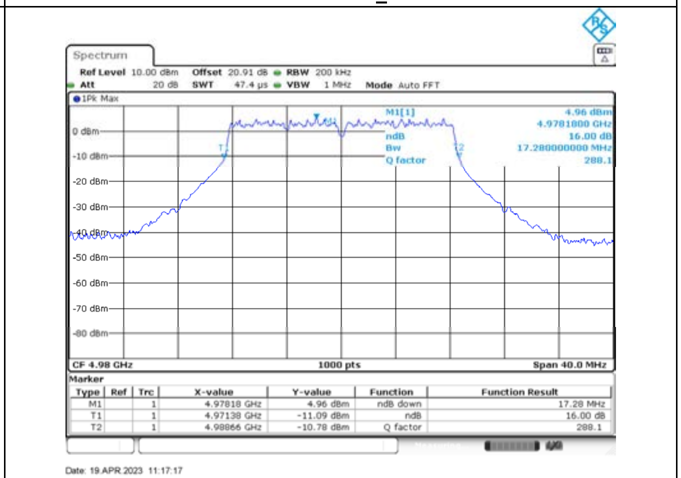
NV-1-ANTA_4950



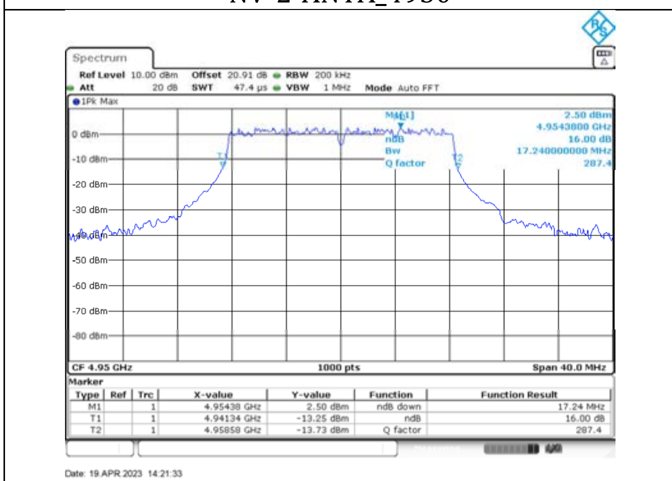
NV-1-ANTA_4980



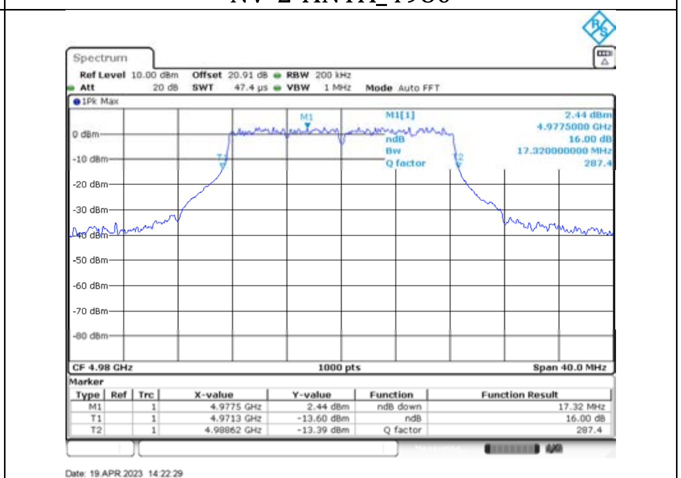
NV-2-ANTA_4950



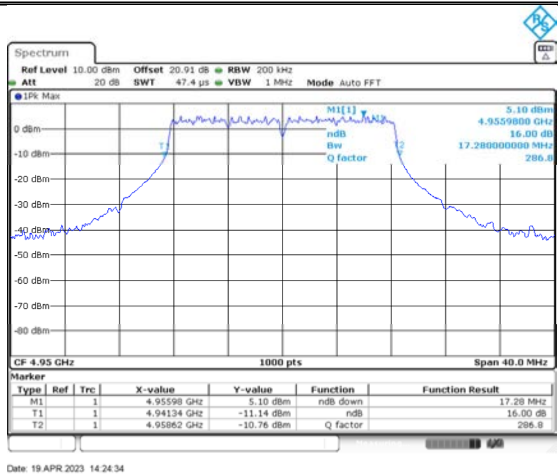
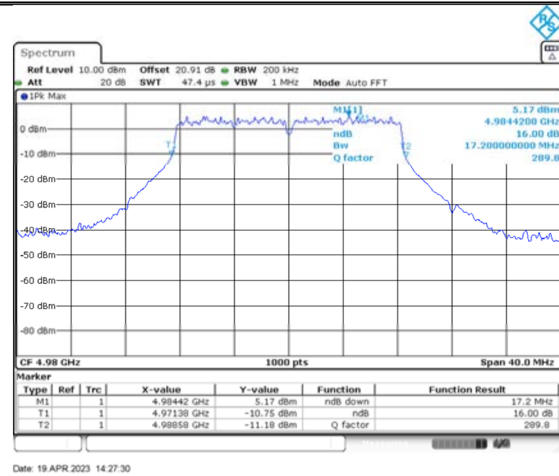
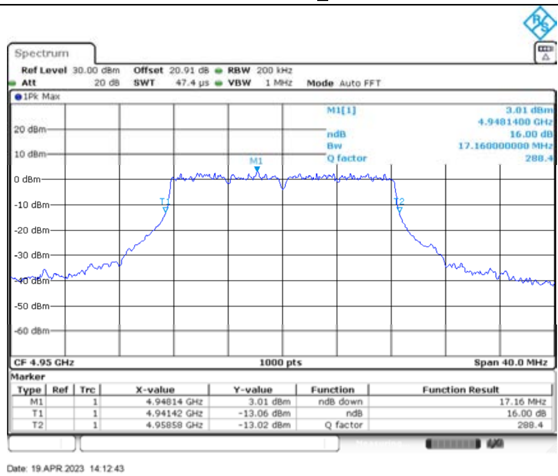
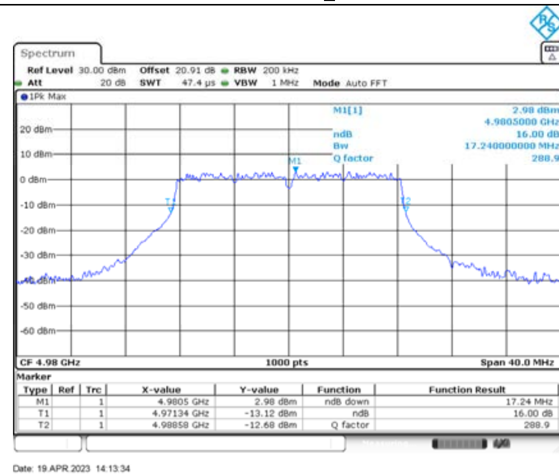
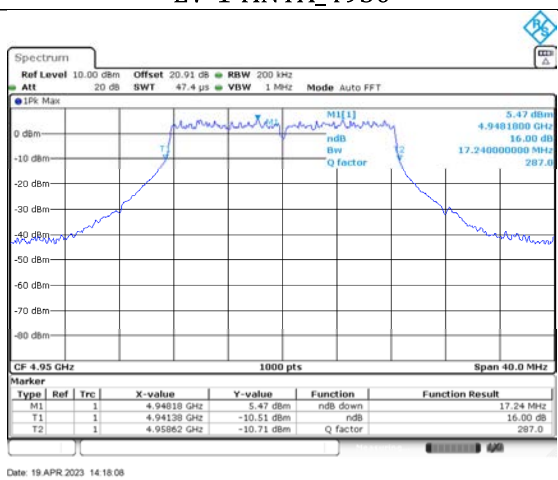
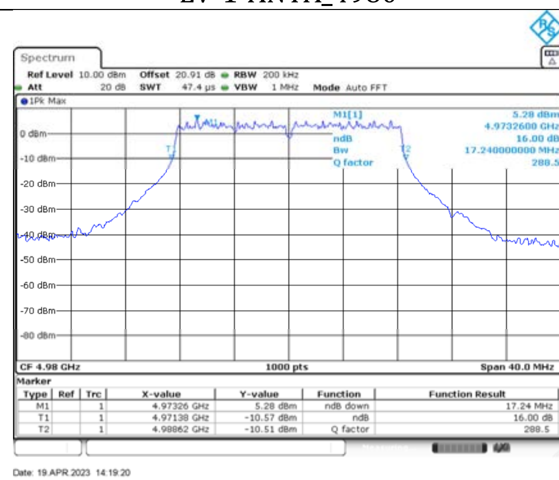
NV-2-ANTA_4980



HV-1-ANTA_4950



HV-1-ANTA_4980

	
HV-2-ANTA_4950	HV-2-ANTA_4980
	
LV-1-ANTA_4950	LV-1-ANTA_4980
	
LV-2-ANTA_4950	LV-2-ANTA_4980

12 Annex A (Normative) - EUT Setup Photographs

Please refer to the attachment

13 Annex B (Normative) – EUT External Photographs

Please refer to the attachment

14 Annex C (Normative) – EUT Internal Photographs

Please refer to the attachment

15 Annex D (Normative) – A2LA Electrical Testing Certificate

ilac-MRA A2LA

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.

Mr. Trace McInturff, 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 ---