CFR 47 FCC PART 15 SUBPART E

TEST REPORT

For

Wireless CarPlay / Android Auto Kits

MODEL NUMBER: GC2, GC6, GC8, GC10, GC12, GC16, GC18, GC20, GC22, GC26, GC28, GC30, GC32, GC36, GC38, GC52, GC56, GC58, GC60, GC62, Cp1, Cp3, Cp5, Cp7, Cp9, Cp11, Cp13, Cp15, Cp17, Cp19, Cp21, Cp23, Cp25, Cp27, Cp29, Cp31, Cp33, Cp35, Cp37, Cp39

REPORT NUMBER: E04A24120085F00101

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Prepared for

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Prepared by

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This report is based on a single evaluation of the submitted sample(s) of the above mentioned product, it does not imply an assessment of the production of the products. This report shall not be reproduced, except in full, without the written approval of Guangdong Global Testing Technology Co., Ltd.

Revision History

Rev.	Issue Date	Revisions	Revised By
V0	January 13, 2025	Initial Issue	

Summary of Test Results

Test Item	Clause	Limit/Requirement	Result
ON TIME AND DUTY CYCLE	ANSI C63.10-2013, Clause 12.2	None; for reporting purposes only.	Pass
6dB AND 26dB EMISSION BANDWIDTH AND 99% OCCUPIED BANDWIDTH	KDB 789033 D02 v02r01 Section C.1	FCC Part 15.407 (a)(2)(5)	Pass
CONDUCTED OUTPUT POWER	KDB 789033 D02 v02r01 Section E.3.a (Method PM)	FCC Part 15.407 (a)(1)(2)(3)	Pass
POWER SPECTRAL DENSITY	KDB 789033 D02 v02r01 Section F	FCC Part 15.407 (a)(1)(2)(3)	Pass
AC POWER LINE CONDUCTION EMISSION	ANSI C63.10-2013, Clause 6.2.	FCC 15.207	Pass
RADIATED EMISSIONS AND BAND EDGE MEASUREMENT	KDB 789033 D02 v02r01 Section G.3, G.4, G.5, and G.6	FCC Part 15.407 (b)(1)(2)(3)(4)(6), FCC Part 15.209/205	Pass
FREQUENCY STABILITY		FCC 15.407 (g)	Pass
DYNAMIC FREQUENCY SELECTION (SLAVE)	KDB 905462 D03 Client Without DFS New Rules v01r02	FCC Part 15.407 (h)	N/A
DYNAMIC FREQUENCY SELECTION (MASTER)	KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02	FCC Part 15.407 (h)	N/A
ANTENNA REQUIREMENT	N/A	FCC Part 15.203, FCC Part 15.407(a)(1) (2)	Pass

Note:
1. N/A: In this whole report not applicable.

*This test report is only published to and used by the applicant, and it is not for evidence purpose in China.
*The measurement result for the sample received is <Pass> according to <CFR 47 FCC PART 15 SUBPART E> when <Accuracy Method> decision rule is applied.

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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name:	Kepule Technology (Zhuhai) Co.,Ltd.
Address:	Doumen District, Huxin Road, No.308 Cuihu Road, Building 1, Zhuhai City, Guangdong

Manufacturer Information

Company Name:	Kepule Technology (Zhuhai) Co.,Ltd.
Address:	Doumen District, Huxin Road, No.308 Cuihu Road, Building 1, Zhuhai City, Guangdong

EUT Information

Product Description:	Wireless CarPlay / Android Auto Kits
Model:	GC2
Series Model:	GC6, GC8, GC10, GC12, GC16, GC18, GC20, GC22, GC26, GC28, GC30, GC32, GC36, GC38, GC52, GC56, GC58, GC60, GC62, Cp1, Cp3, Cp5, Cp7, Cp9, Cp11, Cp13, Cp15, Cp17, Cp19, Cp21, Cp23, Cp25, Cp27, Cp29, Cp31, Cp33, Cp35, Cp37, Cp39
Brand:	CarPlayKits, IJEUF, OSCOCM
Sample Received Date:	December 19, 2024
Sample Status:	Normal
Sample ID:	A24120085 001
Date of Tested:	December 19, 2024 to January 13, 2025

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 FCC PART 15 SUBPART E	**Pass**

Prepared By:

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Approved By:

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Laboratory Manager

2. TEST METHODOLOGY

All tests were performed in accordance with the standard CFR 47 FCC PART 15 SUBPART E

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	**A2LA (Certificate No.: 6947.01)** Guangdong Global Testing Technology Co., Ltd. has been assessed and proved to be in compliance with A2LA. **FCC (FCC Designation No.: CN1343)** Guangdong Global Testing Technology Co., Ltd. has been recognized to perform compliance testing on equipment subject to Supplier's Declaration of Conformity (SDoC) and Certification rules **ISED (Company No.: 30714)** Guangdong Global Testing Technology Co., Ltd. has been registered and fully described in a report filed with ISED. The Company Number is 30714 and the test lab Conformity Assessment Body Identifier (CABID) is CN0148.

Note: All tests measurement facilities use to collect the measurement data are located at Room 101-105, 203-210, Building 1, No.2, Keji 8 Road, Songshan Lake Park, Dongguan city, Guangdong, People’s Republic of China, 523808

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Items	k	Uncertainty
Emission Bandwidth	1.96	±9.0 PPM
Conduct Output Power	1.96	± 1.12 dB
Power Spectral Density	1.96	± 2.1 dB
Conducted Spurious Emission	1.96	9 kHz-30 MHz: ± 0.95 dB 30 MHz-1 GHz: ± 1.5 dB 1GHz-12.75GHz: ± 1.8 dB 12.75 GHz-26.5 GHz: ± 2.1dB 26.5 GHz-40 GHz: ± 2.6 dB
Frequency Stability	1.96	±9.0 PPM
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.		

Test Item	Frequency Range	k	U(dB)
Conducted emissions from the AC mains power ports (AMN)	150 kHz ~ 30 MHz	2	3.37
Radiated emissions	9 kHz ~ 30 MHz	2	4.16
Radiated emissions	30 MHz ~ 1 GHz	2	3.79
Radiated emissions	1 GHz ~ 18 GHz	2	5.62
Radiated emissions	18 GHz ~ 40 GHz	2	5.54
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.			

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

EUT Name		Wireless CarPlay / Android Auto Kits
Model		GC2
Series Model		GC6, GC8, GC10, GC12, GC16, GC18, GC20, GC22, GC26, GC28, GC30, GC32, GC36, GC38, GC52, GC56, GC58, GC60, GC62, Cp1, Cp3, Cp5, Cp7, Cp9, Cp11, Cp13, Cp15, Cp17, Cp19, Cp21, Cp23, Cp25, Cp27, Cp29, Cp31, Cp33, Cp35, Cp37, Cp39
Model Difference		Note: The circuit principle is the same, the PCB is the same, one is USB port, the other is Type-C port.
Hardware Version		DGSD201_V0.1
Software Version		202411251639
Ratings		Input: 5.0V ⎓ 1A
Power Supply	DC	5V

Frequency Band:	5150 MHz to 5250 MHz
Frequency Range:	5180 MHz
Support Standards:	IEEE 802.11a/n/ac/ax
Type of Modulation:	IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac: OFDM(256QAM, 64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ax: OFDM(1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK)
Channel Spacing:	IEEE 802.11a/n-HT20/ac-VHT20/ax-HE20: 20 MHz
Data Rate:	IEEE 802.11a: Up to 54 Mbps IEEE 802.11n-HT20: Up to MCS7 IEEE 802.11ac-VHT20: Up to MCS8 IEEE 802.11ax-HE20: Up to MCS11
Number of Channels:	5150 MHz to 5250 MHz: 4 for IEEE 802.11a/n-HT20/ac-VHT20/ax-HE20
Maximum conducted output power:	13.96 dBm
Antenna Type:	PCB Antenna
Antenna Gain:	-2.23 dBi
Normal Test Voltage:	5 Vdc
EUT Test software:	CMD
Note:	The Antenna Gain was provided by customer, and this information may affect the validity of the results, customer should be responsible for this.

5.2. CHANNEL LIST

UNII-1 (For Bandwidth = 20 MHz)

Channel	Frequency (MHz)
36	5180

5.3. MAXIMUM AVERAGE CONDUCTED POWER

UNII-1 BAND(FCC&ISED)

IEEE Std. 802.11	Frequency (MHz)	Maximum Average Conducted Power (dBm)	Max Average EIRP (dBm)
a	5180	10.81	/
n HT20		9.5	/
ac VHT20		8.05	/
ax HE20		13.96	/

5.4. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter	
Test Software	CMD

UNII-1

Mode	Rate	Channel	Soft set value
			ANT 1
11a	6M	36	12
11n HT20	MCS0	36	12
11ac VHT20	MCS0	36	12
11ax HE20	MCS0	36	12

THE WORSE CASE CONFIGURATIONS

The EUT was tested in the following configuration(s):

Controlled in test mode using a software application on the EUT supplied by customer. The application was used to enable a continuous transmission and to select the mode, test channels, bandwidth, data rates as required.

Test channels referring to section 5.4.

Maximum power setting referring to section 5.4.

Worst case Data Rates declared by the customer:

802.11a 20 mode: 6 Mbps
802.11n HT20 mode: MCS0
802.11ac VHT20 mode: MCS0
802.11ax HE mode: MCS0

5.5. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna No.	Frequency Band	Antenna Type	Max Antenna Gain (dBi)
1	5150-5250	PCB	-2.23

IEE Std. 802.11	Transmit and Receive Mode	Description
802.11a	☒TX, RX	ANT 1 can be used as transmitting/receiving antenna.
802.11n HT20	☒TX, RX	ANT 1 can be used as transmitting/receiving antenna.
802.11ac VHT20	☒TX, RX	ANT 1 can be used as transmitting/receiving antenna.
802.11ax HE20	☒TX, RX	ANT 1 can be used as transmitting/receiving antenna.

5.6. SUPPORT UNITS FOR SYSTEM TEST

The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	Laptop	Lenovo	Thinkpad T14	PF-3EAKYR	GTG Support

5.7. SETUP DIAGRAM

Radiated emissions & AC Power Line Conducted Emission:

6. MEASURING EQUIPMENT AND SOFTWARE USED

Test Equipment of Conducted RF					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Due Date**
Spectrum Analyzer	Rohde & Schwarz	FSV40	102257	2024/09/14	2025/09/13
Spectrum Analyzer	KEYSIGHT	N9020A	MY51285127	2024/09/14	2025/09/13
EXG Analog Signal Generator	KEYSIGHT	N5173B	MY61253075	2024/09/14	2025/09/13
Vector Signal Generator	Rohde & Schwarz	SMM100A	101899	2024/09/14	2025/09/13
RF Control box	MWRF-test	MW100-RFCB	MW220926GTG	2024/09/14	2025/09/13
Wideband Radio Communication Tester	Rohde & Schwarz	CMW270	102792	2024/09/14	2025/09/13
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	103235	2024/09/14	2025/09/13
temperature humidity chamber	Espec	SH-241	SH-241-2014	2024/09/14	2025/09/13
RF Test Software	MWRF-test	MTS8310E (Ver. V2/0)	N/A	N/A	N/A

Test Equipment of Radiated emissions below 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Due Date**
3m Semi-anechoic Chamber	ETS	9m*6m*6m	Q2146	2022/08/30	2025/08/29
EMI Test Receiver	Rohde & Schwarz	ESCI3	101409	2024/09/14	2025/09/13
Spectrum Analyzer	KEYSIGHT	N9020A	MY51283932	2024/09/14	2025/09/13
Pre-Amplifier	HzEMC	HPA-9K0130	HYPA21001	2024/09/14	2025/09/13
Biconilog Antenna	Schwarzbeck	VULB 9168	01315	2022/10/10	2025/10/09
Biconilog Antenna	ETS	3142E	00243646	2022/03/23	2025/03/22
Loop Antenna	ETS	6502	243668	2022/03/30	2025/03/29
Test Software	Farad	EZ-EMC (Ver.FA-03A2 RE)	N/A	N/A	N/A

Test Equipment of Radiated emissions above 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Due Date**
3m Semi-anechoic Chamber	ETS	9m*6m*6m	Q2149	2022/08/30	2025/08/29
Spectrum Analyzer	Rohde & Schwarz	FSV40	101413	2024/09/14	2025/09/13
Spectrum Analyzer	KEYSIGHT	N9020A	MY51283932	2024/09/14	2025/09/13
Pre-Amplifier	A-INFO	HPA-1G1850	HYPA21003	2024/09/14	2025/09/13
Horn antenna	A-INFO	3117	246069	2022/03/11	2025/03/10
Pre-Amplifier	ZKJC	HPA-184057	HYPA21004	2024/09/14	2025/09/13

Horn antenna	ZKJC	3116C	246265	2022/03/29	2025/03/28
Test Software	Farad	EZ-EMC (Ver.FA-03A2 RE+)	N/A	N/A	N/A

Test Equipment of Conducted emissions					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Due Date**
Shielded Room	CHENG YU	8m*5m*4m	N/A	2022/10/29	2025/10/28
EMI Test Receiver	Rohde & Schwarz	ESR3	102647	2024/09/14	2025/09/13
LISN/AMN	Rohde & Schwarz	ENV216	102843	2024/09/14	2025/09/13
NNLK 8129 RC	Schwarzbeck	NNLK 8129 RC	5046	2024/09/14	2025/09/13
Test Software	Farad	EZ-EMC (Ver. EMC-con-3A1 1+)	N/A	N/A	N/A

7. ANTENNA PORT TEST RESULTS

7.1. ON TIME AND DUTY CYCLE

LIMITS

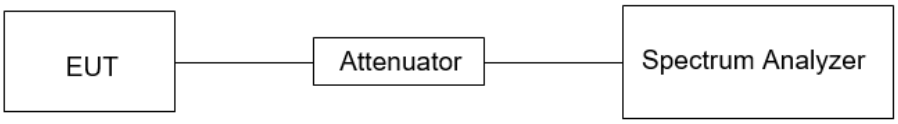
None; for reporting purposes only.

TEST PROCEDURE

Refer to KDB 789033 D02 General U-NII Test Procedures New Rules v02r01 section II.B.

The zero-span mode on a spectrum analyzer or EMI receiver, if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T, where T is defined in II.B.1.a), and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

TEST SETUP



TEST ENVIRONMENT

Temperature	21.1℃	Relative Humidity	49%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.2. 6DB AND 26DB EMISSION BANDWIDTH AND 99% OCCUPIED BANDWIDTH

LIMITS

CFR 47 FCC Part15, Subpart E ISED RSS-247 ISSUE 3		
Test Item	Limit	Frequency Range (MHz)
26 dB Emission Bandwidth	For reporting purposes only.	5150 ~ 5250
26 dB Emission Bandwidth	For reporting purposes only.	5250 ~ 5350
26 dB Emission Bandwidth	For reporting purposes only.	5470 ~ 5725 (For FCC) 5470 ~ 5600 (For ISED) 5650 ~ 5725 (For ISED)
6 dB Emission Bandwidth	The minimum 6 dB emission bandwidth shall be 500 kHz.	5725 ~ 5850
99 % Occupied Bandwidth	For reporting purposes only.	5150 ~ 5825 (For ISED)

TEST PROCEDURE

Refer to KDB 789033 D02 General U-NII Test Procedures New Rules v02r01 section II.C1. for 26 dB Emission Bandwidth; section II.C2. for 6 dB Emission Bandwidth; section II.D. for 99 % Occupied Bandwidth.
Connect the EUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	For 6 dB Emission Bandwidth: RBW=100 kHz For 26 dB Emission bandwidth: approximately 1 % of the EBW. For 99 % Occupied Bandwidth: approximately 1 % ~ 5 % of the OBW.
VBW	For 6 dB Bandwidth: ≥ 3*RBW For 26 dB Bandwidth: >3*RBW For 99 % Bandwidth: >3*RBW
Trace	Max hold
Sweep	Auto couple

a) Use the 99 % power bandwidth function of the instrument, allow the trace to stabilize and report the measured bandwidth.
b) Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6/26 dB relative to the maximum level measured in the fundamental emission.

Calculation for 99 % Bandwidth of UNII-2C and UNII-3 Straddle Channel:

For Example: Fundamental Frequency: 5720 MHz

99 % OBW: 21.00 MHz

Turning Frequency: 5725 MHz

99 % Bandwidth of UNII-2C Band Portion = (5725-(5720-(21.00/2)) = 15.50 MHz

99 % Bandwidth of UNII-3 Band Portion = (5720+(21.00/2)-5725) = 5.50 MHz

Calculation for 26 dB Bandwidth of UNII-2C Straddle Channel:

For Example: Fundamental frequency: 5720 MHz

26 dB BW: 20.00 MHz

FL: 5710.16 MHz

FH: 5730.16 MHz

Turning Frequency: 5725 MHz

26 dB Bandwidth of UNII-2C Band Portion = 5725-5710.16=14.84 MHz

Calculation for 6dB Bandwidth of UNII-3 Straddle Channel:

For Example: Fundamental frequency: 5720 MHz

6 dB BW: 16.44 MHz

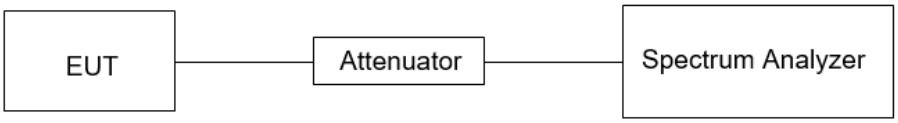
FL: 5711.76 MHz

FH: 5728.2 MHz

Turning Frequency: 5725 MHz

6 dB Bandwidth of UNII-3 band Portion = 5728.2-5725=3.2 MHz

TEST SETUP



TEST ENVIRONMENT

Temperature	21.1℃	Relative Humidity	49%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.3. CONDUCTED OUTPUT POWER

LIMITS

CFR 47 FCC Part15, Subpart E		
Test Item	Limit	Frequency Range (MHz)
Conducted Output Power	☐ Outdoor Access Point: 1 W (30 dBm) ☐ Indoor Access Point: 1 W (30 dBm) ☐ Fixed Point-To-Point Access Points: 1 W (30 dBm) ☒ Client Devices: 250 mW (24 dBm)	5150 ~ 5250
	Shall not exceed the lesser of 250 mW (24dBm) or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.	5250 ~ 5350 5470 ~ 5725
	Shall not exceed 1 Watt (30 dBm).	5725 ~ 5850

ISED RSS-247 ISSUE 3		
Test Item	Limit	Frequency Range (MHz)
Conducted Output Power or e.i.r.p.	The maximum e.i.r.p. shall not exceed 200 mW (23 dBm) or 10 + 10 $\log_{10}$B, dBm, whichever power is less. B is the 99 % emission bandwidth in megahertz.	5150 ~ 5250
	a. The maximum conducted output power shall not exceed 250 mW (24 dBm) or 11 + 10 $\log_{10}$B dBm, whichever is less. b. The maximum e.i.r.p. shall not exceed 1.0 W (30 dBm) or 17 + 10 $\log_{10}$B dBm, whichever is less. B is the 99 % emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.	5250 ~ 5350 5470 ~ 5600 5650 ~ 5725
	Shall not exceed 1 Watt (30 dBm). The e.i.r.p. shall not exceed 4 W	5725 ~ 5850

Note:
The above limits are based upon the maximum antenna gain does not exceed 6 dBi.
If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

Refer to KDB 789033 D02 General U-NII Test Procedures New Rules v02r01 section II.E.

Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep):
(i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.
(ii) Set RBW = 1 MHz.
(iii) Set VBW ≥ 3 MHz.
(iv) Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

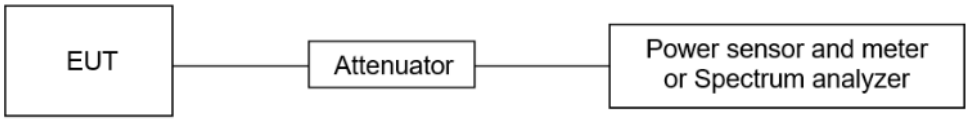
(v) Sweep time = auto.
(vi) Detector = power averaging (rms), if available. Otherwise, use sample detector mode.
(vii) If transmit duty cycle < 98 %, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 %, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run.”
(viii) Trace average at least 100 traces in power averaging (rms) mode.
(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’s band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

Method PM (Measurement using an RF average power meter):
(i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the following conditions are satisfied:
a. The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
b. At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
c. The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
(ii) If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in II.B.
(iii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
(iv) Adjust the measurement in dBm by adding 10 log (1/x) where x is the duty cycle (e.g., 10 log (1/0.25) if the duty cycle is 25 %).

Method PM-G (Measurement using a gated RF average power meter):
Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

Straddle channel power was measured using spectrum analyzer.

TEST SETUP



TEST ENVIRONMENT

Temperature	21.1℃	Relative Humidity	49%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.4. POWER SPECTRAL DENSITY

LIMITS

CFR 47 FCC Part15, Subpart E		
Test Item	Limit	Frequency Range (MHz)
Power Spectral Density	☐ Outdoor Access Point: 17 dBm/MHz ☐ Indoor Access Point: 17 dBm/MHz ☐ Fixed Point-To-Point Access Points: 17 dBm/MHz ☒ Client Devices: 11 dBm/MHz	5150 ~ 5250
	11 dBm/MHz	5250 ~ 5350 5470 ~ 5725
	30 dBm/500kHz	5725 ~ 5850

ISED RSS-247 ISSUE 3		
Test Item	Limit	Frequency Range (MHz)
Power Spectral Density	The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.	5150 ~ 5250
	The power spectral density shall not exceed 11 dBm inany 1.0 MHz band.	5250 ~ 5350 5470 ~ 5600 5650 ~ 5725
	30 dBm / 500 kHz	5725 ~ 5850

Note:
The above limits are based upon the maximum antenna gain does not exceed 6 dBi.
If transmitting antennas of directional gain greater than 6 dBi are used, maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

Refer to KDB 789033 D02 General U-NII Test Procedures New Rules v02r01 section II.F.

Connect the EUT to the spectrum analyser and use the following settings:

For U-NII-1, U-NII-2A and U-NII-2C band:

Center Frequency	The center frequency of the channel under test
Detector	RMS
RBW	1 MHz
VBW	≥3 × RBW
Span	Encompass the entire emissions bandwidth (EBW) of the signal
Trace	Max hold
Sweep time	Auto

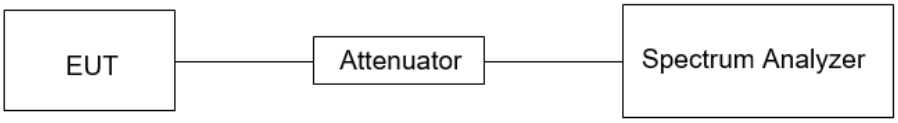
For U-NII-3:

Center Frequency	The center frequency of the channel under test

Detector	RMS
RBW	500 kHz
VBW	≥3 × RBW
Span	Encompass the entire emissions bandwidth (EBW) of the signal
Trace	Max hold
Sweep time	Auto

Allow trace to fully stabilize and Use the peak search function on the instrument to find the peak of the spectrum and record its value.
Add 10 log (1/x), where x is the duty cycle, to the peak of the spectrum, the result is the Maximum PSD over 1 MHz / 500 kHz reference bandwidth.

TEST SETUP



TEST ENVIRONMENT

Temperature	21.1℃	Relative Humidity	49%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.5. FREQUENCY STABILITY

LIMITS

The frequency of the carrier signal shall be maintained within band of operation.

TEST PROCEDURE

1. The EUT was placed inside an environmental chamber as the temperature in the chamber was varied between 0 °C ~ 40 °C (declared by customer).

2. The temperature was incremented by 10 °C intervals and the unit allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded.

3. The primary supply voltage is varied from 85 % to 115 % of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

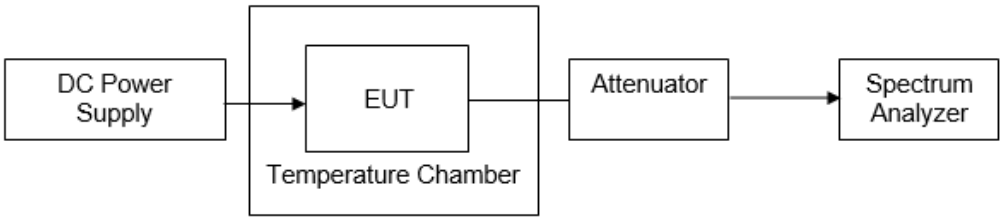
Connect the EUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	10 kHz
VBW	≥3 × RBW
Span	Encompass the entire emissions bandwidth (EBW) of the signal
Trace	Max hold
Sweep time	Auto

4. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup, and at 2 minutes, 5minutes, and 10 minutes after the EUT is energized.

5. Allow the trace to stabilize, find the peak value of the power envelope and record the frequency, then calculated the frequency drift.

TEST SETUP



TEST ENVIRONMENT

Temperature	21.1℃	Relative Humidity	49%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.6. DYNAMIC FREQUENCY SELECTION (SLAVE)

LIMITS

(1) DFS Detection Thresholds

Table 3: DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP ≥ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

(2) DFS Response Requirements

Table 4: DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.
Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required facilitating a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

APPLICABILITY OF DFS REQUIREMENTS

A U-NII network will employ a DFS function to detect signals from radar systems and to avoid co-channel operation with these systems. This applies to the 5250-5350 MHz and/or 5470-5725 MHz bands.
Within the context of the operation of the DFS function, a U-NII device will operate in either Master Mode or Client Mode. U-NII devices operating in Client Mode can only operate in a network controlled by a U-NII device operating in Master Mode.

Table 1: Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	☐ Master	☒ Client Without Radar Detection	☐ Client With Radar Detection
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	☐ Master Device or Client with Radar Detection	☒ Client Without Radar Detection
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required

Additional requirements for devices with multiple bandwidth modes	☐ Master Device or Client with Radar Detection	☒ Client Without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

PARAMETERS OF RADAR TEST WAVEFORMS

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

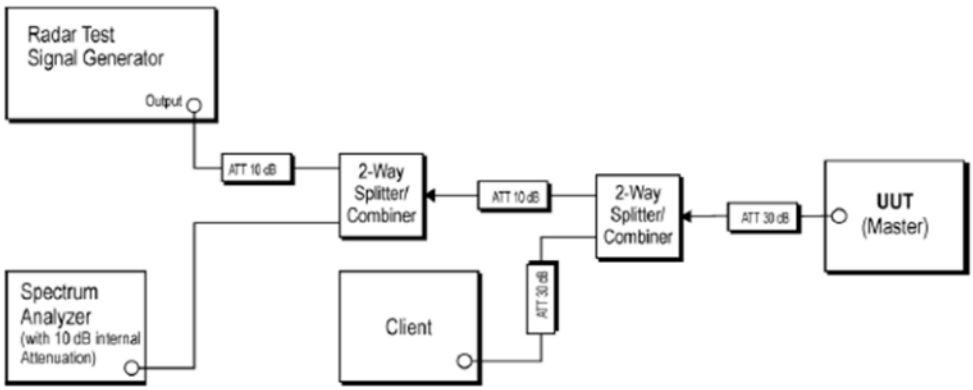
Table 5 Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{\text{PRI}_{\mu sec}}\right)\right\}$	60%	30
		Test B			
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.
Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a
Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. If more than 30 waveforms are used for Short Pulse Radar Types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. If more than 30 waveforms are used for Short Pulse Radar Type 1, then each additional waveform is generated with Test B and must also be unique and not repeated from the previous waveforms in Tests A or B. Test aggregate is average of the percentage of successful detections of short pulse radar types 1-4.

TEST SETUP



TEST ENVIRONMENT

Temperature	℃	Relative Humidity	%
Atmosphere Pressure	kPa		

TEST RESULTS

N/A.

7.7. DYNAMIC FREQUENCY SELECTION (MASTER)

LIMITS

(3) DFS Detection Thresholds

Table 3: DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP ≥ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

(4) DFS Response Requirements

Table 4: DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.
Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required facilitating a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

APPLICABILITY OF DFS REQUIREMENTS

A U-NII network will employ a DFS function to detect signals from radar systems and to avoid co-channel operation with these systems. This applies to the 5250-5350 MHz and/or 5470-5725 MHz bands.
Within the context of the operation of the DFS function, a U-NII device will operate in either Master Mode or Client Mode. U-NII devices operating in Client Mode can only operate in a network controlled by a U-NII device operating in Master Mode.

Table 1: Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	☒ Master	☐ Client Without Radar Detection	☐ Client With Radar Detection
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	☒ Master Device or Client with Radar Detection	☐ Client Without Radar Detection
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required

Additional requirements for devices with multiple bandwidth modes	☒ Master Device or Client with Radar Detection	☐ Client Without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

PARAMETERS OF RADAR TEST WAVEFORMS

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

Table 5 Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
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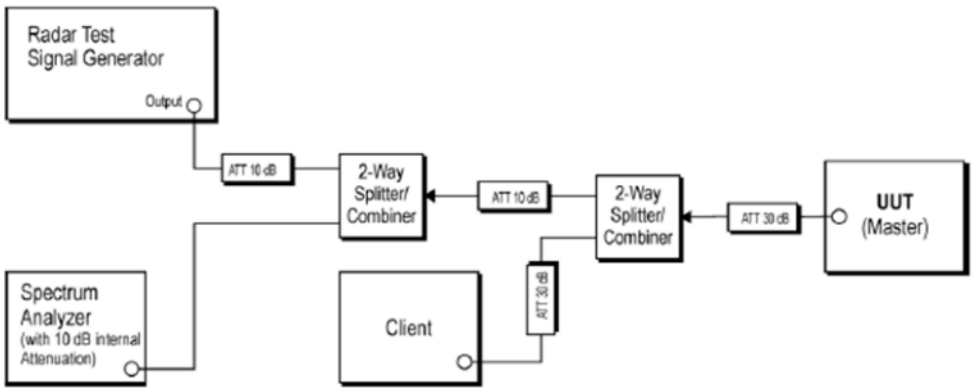
		Test B			
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.
Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a
Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. If more than 30 waveforms are used for Short Pulse Radar Types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. If more than 30 waveforms are used for Short Pulse Radar Type 1, then each additional waveform is generated with Test B and must also be unique and not repeated from the previous waveforms in Tests A or B. Test aggregate is average of the percentage of successful detections of short pulse radar types 1-4.

TEST SETUP



TEST ENVIRONMENT

Temperature	℃	Relative Humidity	%
Atmosphere Pressure	kPa		

TEST RESULTS

N/A.

8. RADIATED TEST RESULTS

LIMITS

Refer to CFR 47 FCC §15.205, §15.209 and §15.407 (b).

Refer to ISED RSS-GEN Clause 8.9, Clause 8.10 and ISED RSS-247 6.2.

Radiation Disturbance Test Limit for FCC (Class B) (9 kHz ~ 1 GHz)

Emissions radiated outside of the specified frequency bands above 30 MHz			
Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m	
		Quasi-Peak	
30 - 88	100	40	
88 - 216	150	43.5	
216 - 960	200	46	
Above 960	500	54	
Above 1000	500	Peak	Average
		74	54

FCC Emissions radiated outside of the specified frequency bands below 30 MHz		
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30

ISED General field strength limits at frequencies below 30 MHz

Table 6 – General field strength limits at frequencies below 30 MHz		
Frequency	**Magnetic field strength (H-Field) (µA/m)**	**Measurement distance (m)**
9 - 490 kHz[Note 1]	6.37/F (F in kHz)	300
490 - 1705 kHz	63.7/F (F in kHz)	30
1.705 - 30 MHz	0.08	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

ISED Restricted bands refer to ISED RSS-GEN Clause 8.10

Table 7 – Restricted frequency bands[Note 1]		
MHz	MHz	GHz
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 – 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 – 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 – 8500	
108 – 138		

Note 1: Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

FCC Restricted bands of operation refer to FCC §15.205 (a):

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41			

Note: [1]Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2]Above 38.6c

Limits of unwanted/undesirable emission out of the restricted bands refer to CFR 47 FCC §15.407 (b) and ISED RSS-247 6.2.

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1GHz)

Frequency Range (MHz)	EIRP Limit	Field Strength Limit (dBuV/m) at 3 m
5150~5250 MHz	PK: -27 (dBm/MHz)	PK:68.2(dBμV/m)
5250~5350 MHz		
5470~5725 MHz		
5725~5850 MHz	PK: -27 (dBm/MHz) *1 PK: 10 (dBm/MHz) *2 PK: 15.6 (dBm/MHz) *3 PK: 27 (dBm/MHz) *4	PK: 68.2(dBμV/m) *1 PK: 105.2 (dBμV/m) *2 PK: 110.8(dBμV/m) *3 PK: 122.2 (dBμV/m) *4
Note: *1 beyond 75 MHz or more above of the band edge. *2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above. *3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above. *4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.		

TEST PROCEDURE

Below 30 MHz

The setting of the spectrum analyser

RBW	200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz)
VBW	200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz)
Sweep	Auto

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.4.

2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both Horizontal, Face-on and Face-off polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80 cm above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a 1 m height antenna tower.

5. The radiated emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

6. For measurement below 1 GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak and average detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak and average detector and reported.

7. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field site based on KDB 414788.

8. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free

space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to Y-51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

Below 1 GHz and above 30 MHz

The setting of the spectrum analyser

RBW	120 kHz
VBW	300 kHz
Sweep	Auto
Detector	Peak/QP
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.5.

2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80 cm above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. For measurement below 1 GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

Above 1 GHz

The setting of the spectrum analyser

RBW	1 MHz
VBW	PEAK: 3 MHz AVG: see note 6
Sweep	Auto
Detector	Peak
Trace	Max hold

1. The testing follows the guidelines in KDB 789033 D02 General U-NII Test Procedures New Rules v02r01 section II.G.3 ~ II.G.6.

2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

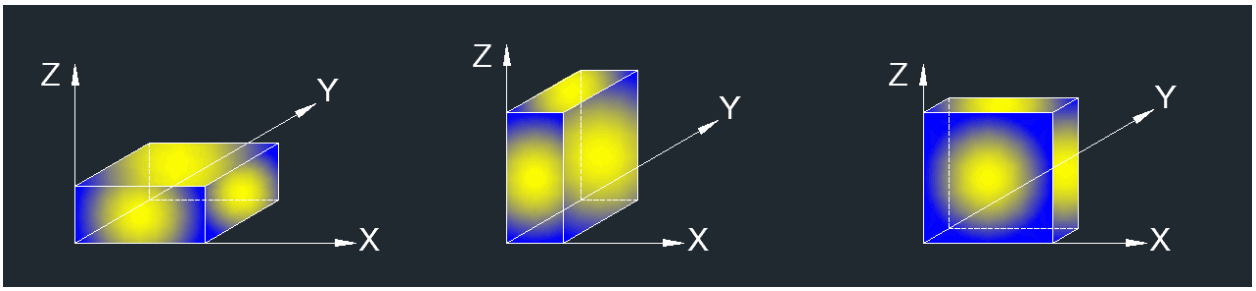
3. The EUT was placed on a turntable with 1.5 m above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. For measurement above 1 GHz, the emission measurement will be measured by the peak detector. This peak level, once corrected, must comply with the limit specified in Section 15.209.

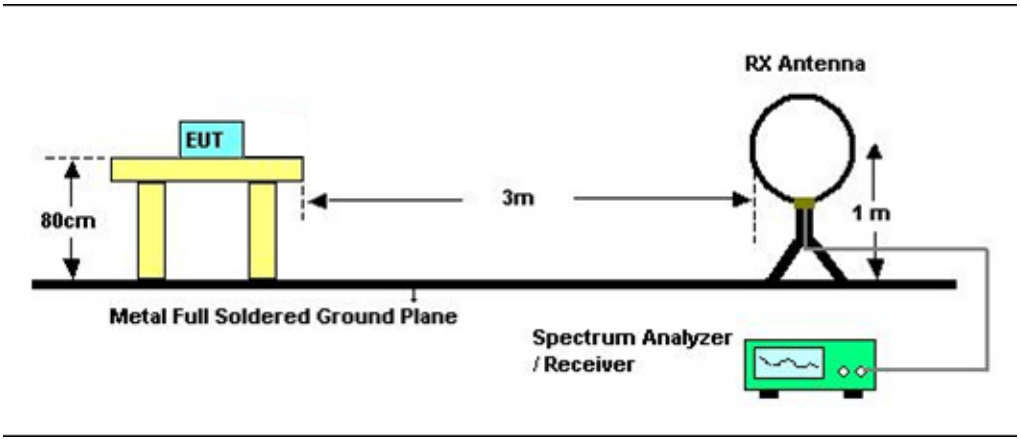
6. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 7.1.ON TIME AND DUTY CYCLE.

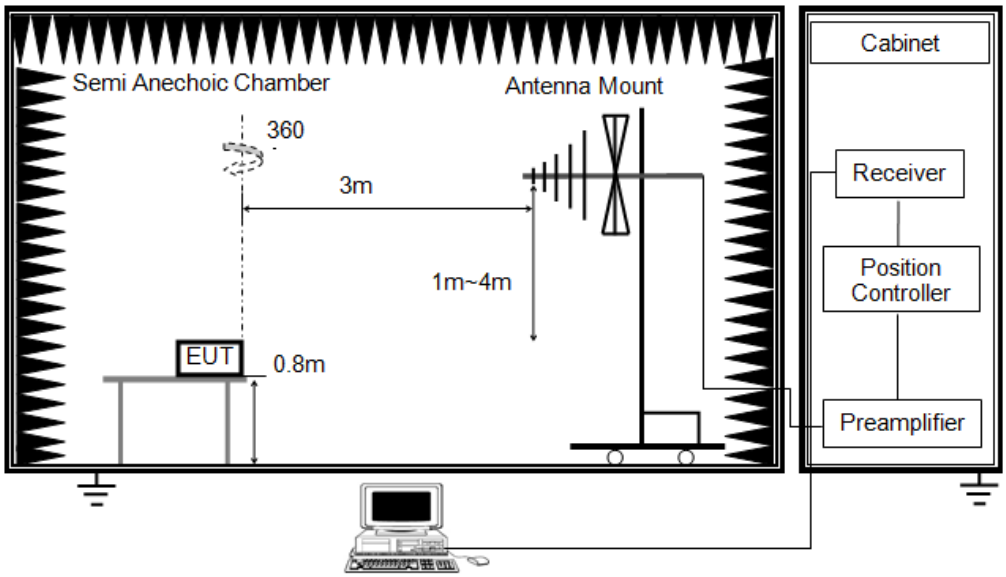
X axis, Y axis, Z axis positions:

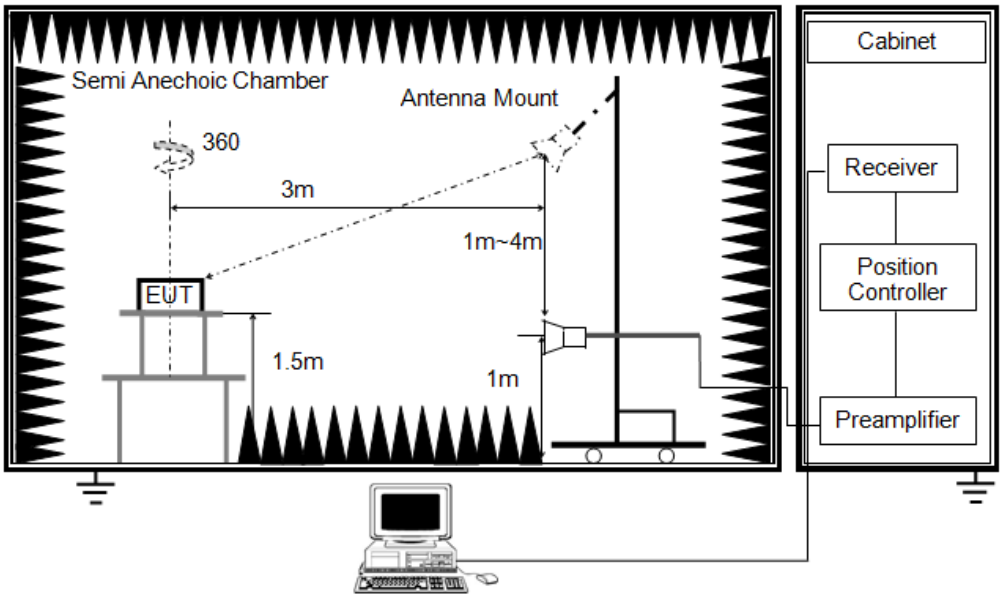


Note 1: For all radiated test, EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

TEST SETUP







TEST ENVIRONMENT

Temperature	23.5℃	Relative Humidity	51%
Atmosphere Pressure	101kPa		

TEST RESULTS

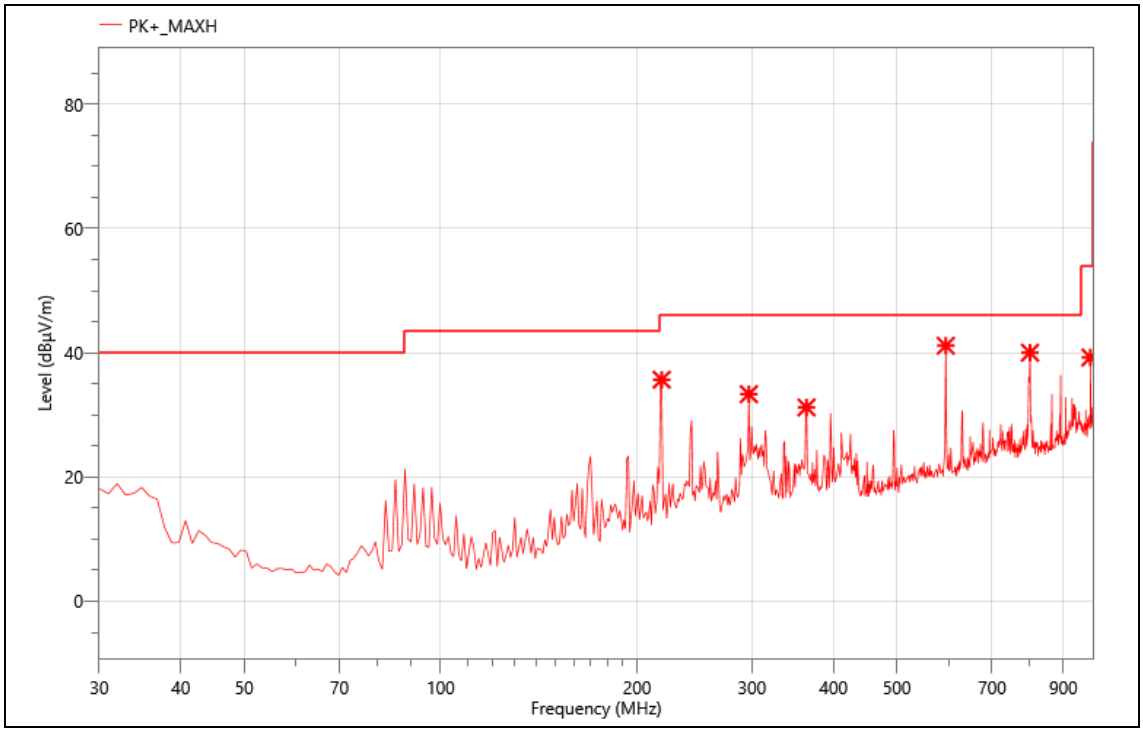
8.1. RADIATED EMISSIONS AND BAND EDGE MEASUREMENT

Undesirable radiated Spurious Emission below 1GHz (30MHz to 1GHz)

All modes have been tested and the worst result as bellow:

USB Port:

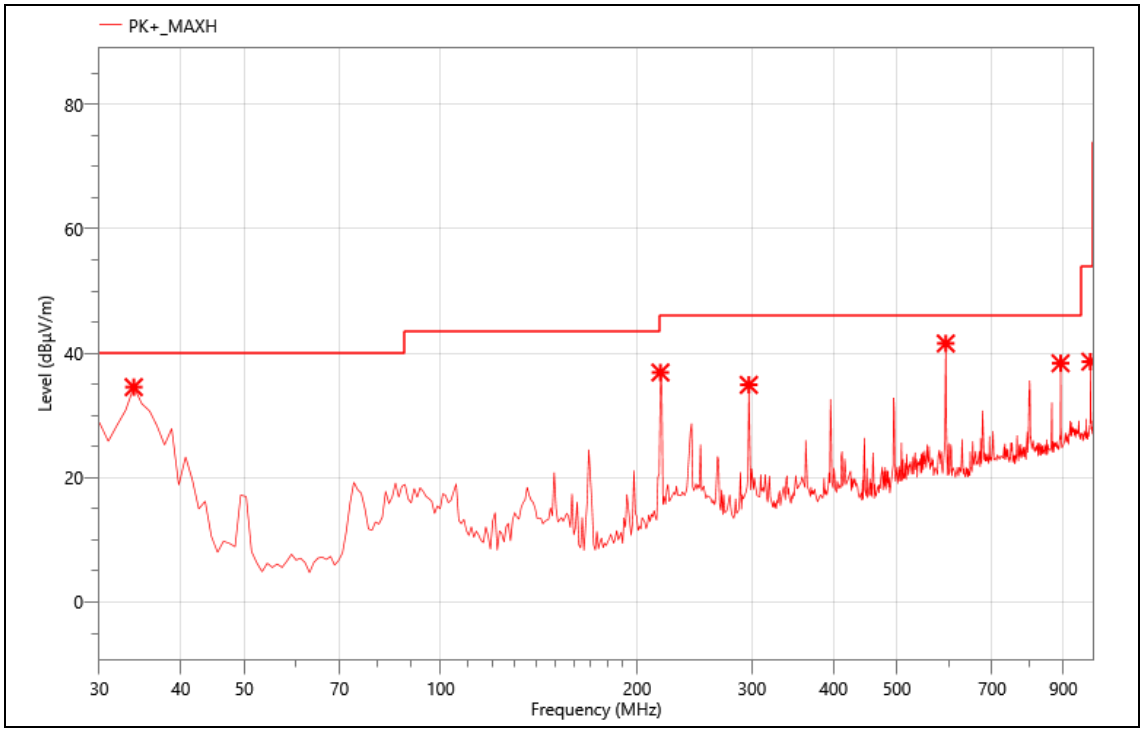
Mode:	AX20-5180
Power:	DC 5V
TE:	Berny
Date	2024/12/25
T/A/P	23.5℃/51%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	218.180	56.30	-20.63	35.67	46.00	10.33	PK+	H
2	296.750	52.24	-18.9	33.34	46.00	12.66	PK+	H
3	363.680	46.73	-15.53	31.20	46.00	14.80	PK+	H
4	594.540	50.69	-9.56	41.13	46.00	4.87	PK+	H
5	800.180	45.77	-5.76	40.01	46.00	5.99	PK+	H
6	990.300	41.79	-2.55	39.24	53.90	14.66	PK+	H

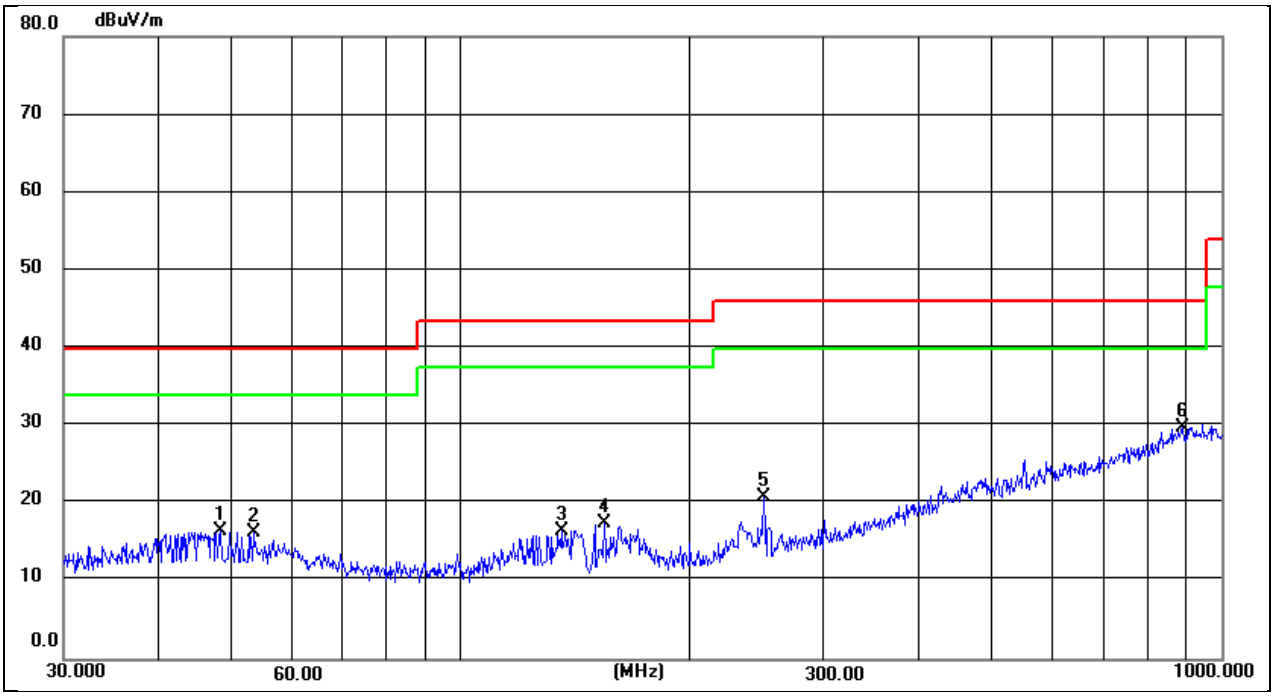
Mode:	AX20-5180
Power:	DC 5V
TE:	Berny
Date	2024/12/25
T/A/P	23.5℃/51%/101Kpa



Critical_Freqs

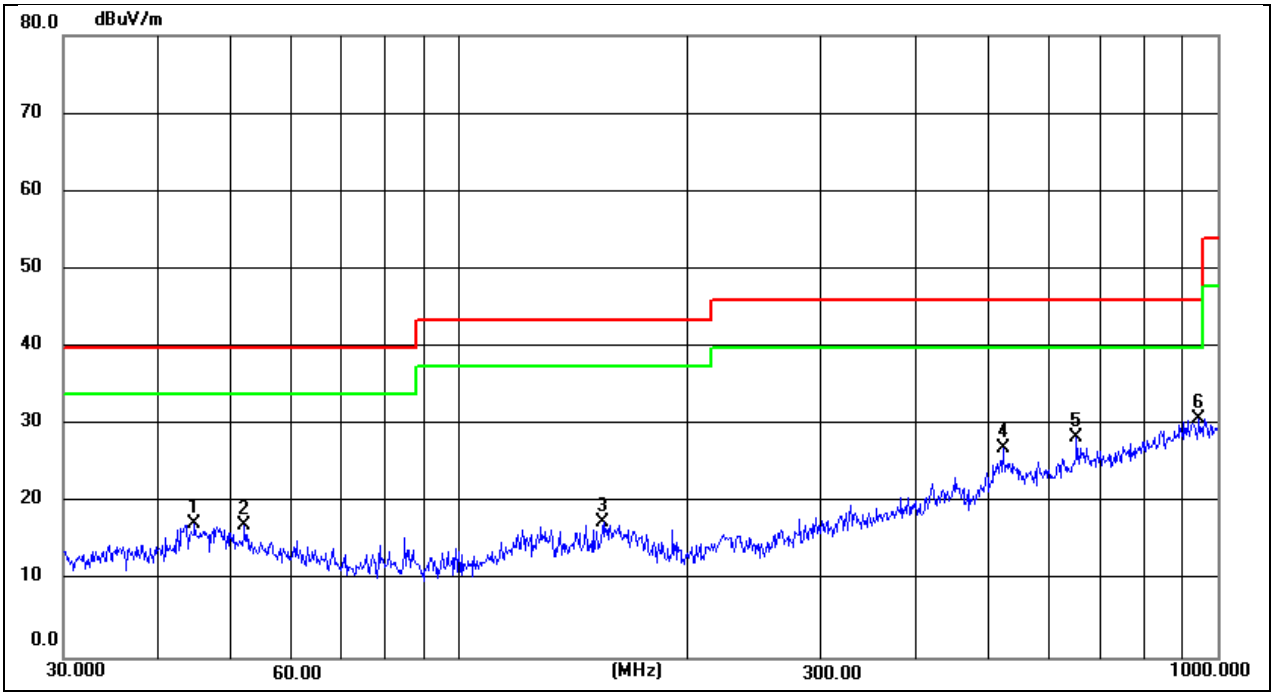
No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	33.880	51.18	-16.63	34.55	40.00	5.45	PK+	V
2	217.210	57.58	-20.67	36.91	46.00	9.09	PK+	V
3	296.750	53.82	-18.9	34.92	46.00	11.08	PK+	V
4	594.540	51.13	-9.56	41.57	46.00	4.43	PK+	V
5	891.360	42.75	-4.36	38.39	46.00	7.61	PK+	V
6	990.300	41.20	-2.55	38.65	53.90	15.25	PK+	V

Type-C Port:



Mode:	AX20-5180	Antenna: Horizontal

No.	Frequency (MHz)	Reading Level(dBuV)	Correct Factor(dB/m)	Measure-ment(dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Comment
1	48.3316	28.73	-12.24	16.49	40.00	-23.51	peak	
2	53.3180	29.05	-12.64	16.41	40.00	-23.59	peak	
3	135.5061	28.53	-12.03	16.50	43.50	-27.00	peak	
4	154.2785	29.12	-11.58	17.54	43.50	-25.96	peak	
5	250.3011	34.97	-14.09	20.88	46.00	-25.12	peak	
6 *	890.7277	29.41	0.49	29.90	46.00	-16.10	peak	



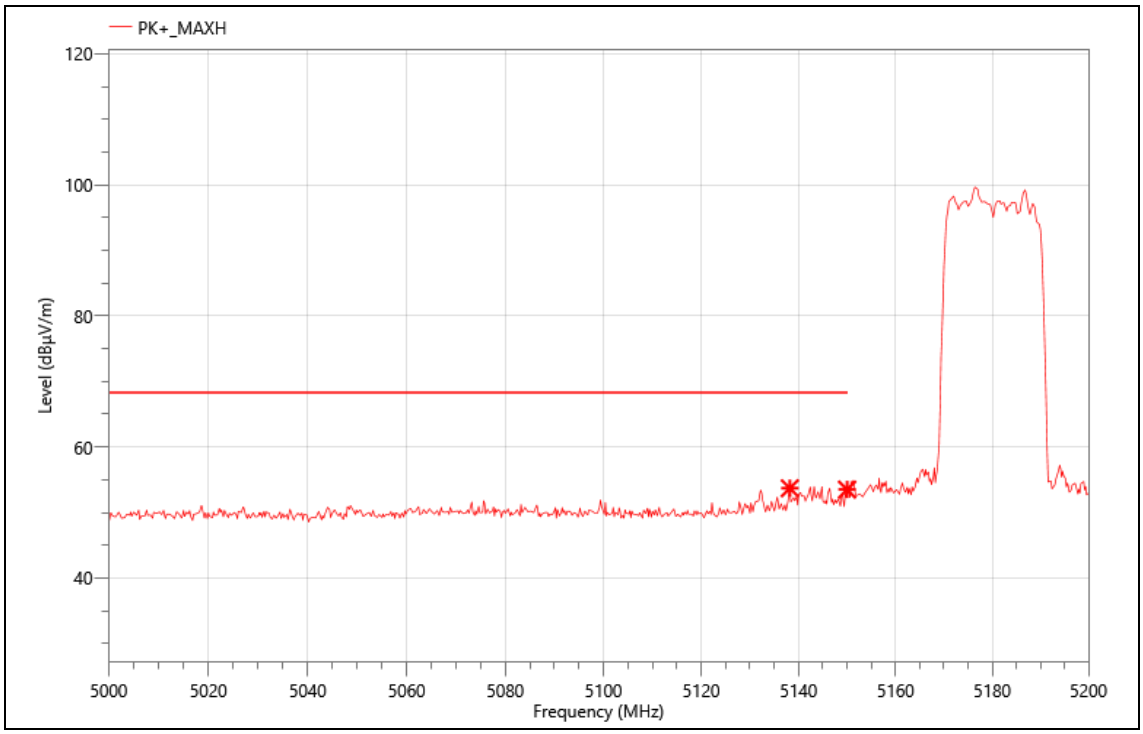
Mode:	AX20-5180	Antenna: Vertical

No.	Frequency (MHz)	Reading Level(dBuV)	Correct Factor(dB/m)	Measure-ment(dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Comment
1	44.7433	29.91	-12.60	17.31	40.00	-22.69	peak	
2	52.0251	29.46	-12.41	17.05	40.00	-22.95	peak	
3	154.8204	29.07	-11.57	17.50	43.50	-26.00	peak	
4	520.8882	33.78	-6.78	27.00	46.00	-19.00	peak	
5	651.9417	32.37	-4.05	28.32	46.00	-17.68	peak	
6 *	945.4400	29.91	0.83	30.74	46.00	-15.26	peak	

Band Edge

All modes have been tested and the worst result as bellow:

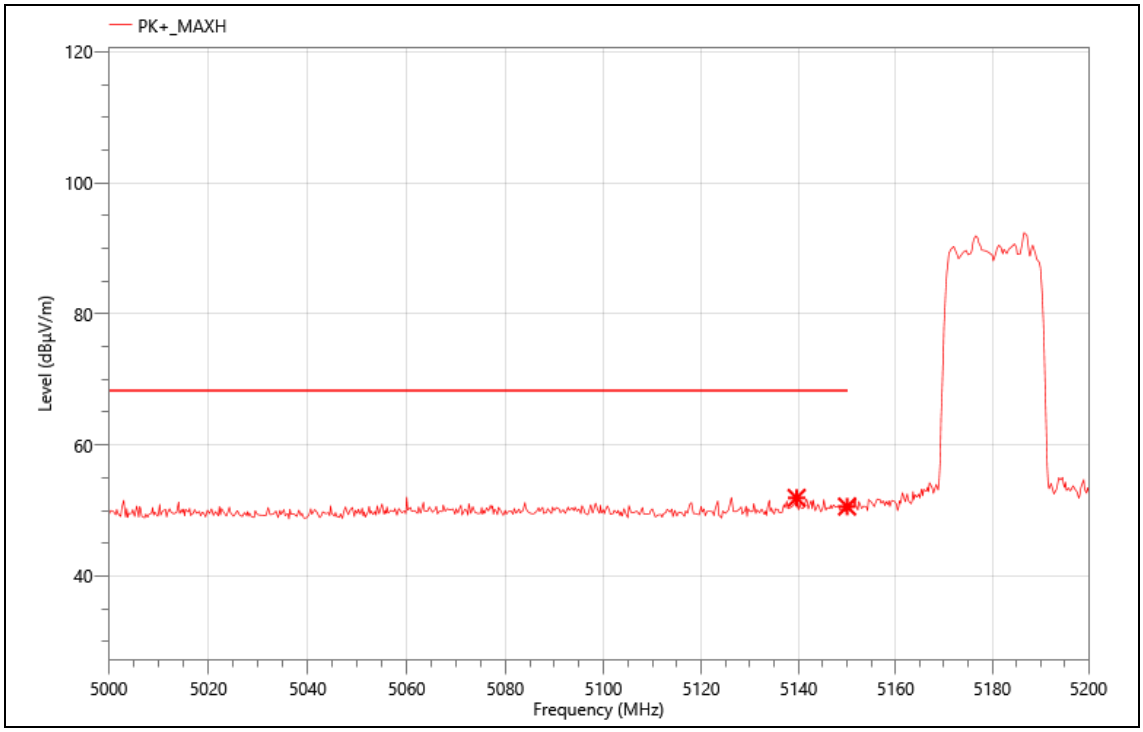
Mode:	AX20-5180
Power:	DC 5V
TE:	Berny
Date	2024/12/25
T/A/P	23.5℃/51%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	5138.200	25.16	28.54	53.70	68.20	14.50	PK+	V
2	5150.000	25.05	28.45	53.50	68.20	14.70	PK+	V

Mode:	AX20-5180
Power:	DC 5V
TE:	Berny
Date	2024/12/25
T/A/P	23.5℃/51%/101Kpa



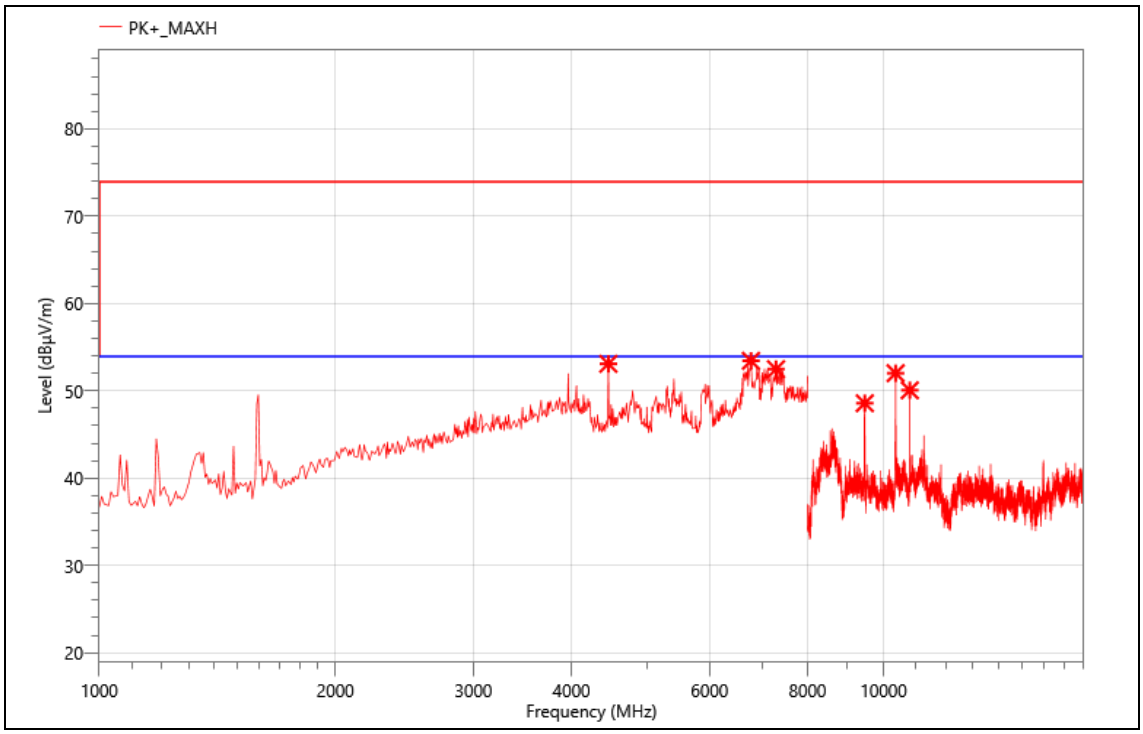
Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	5139.600	23.35	28.57	51.92	68.20	16.28	PK+	H
2	5150.000	22.15	28.45	50.60	68.20	17.60	PK+	H

Undesirable radiated Spurious Emission Above 1GHz (1GHz to 40GHz)

All modes have been tested and the worst result as bellow:

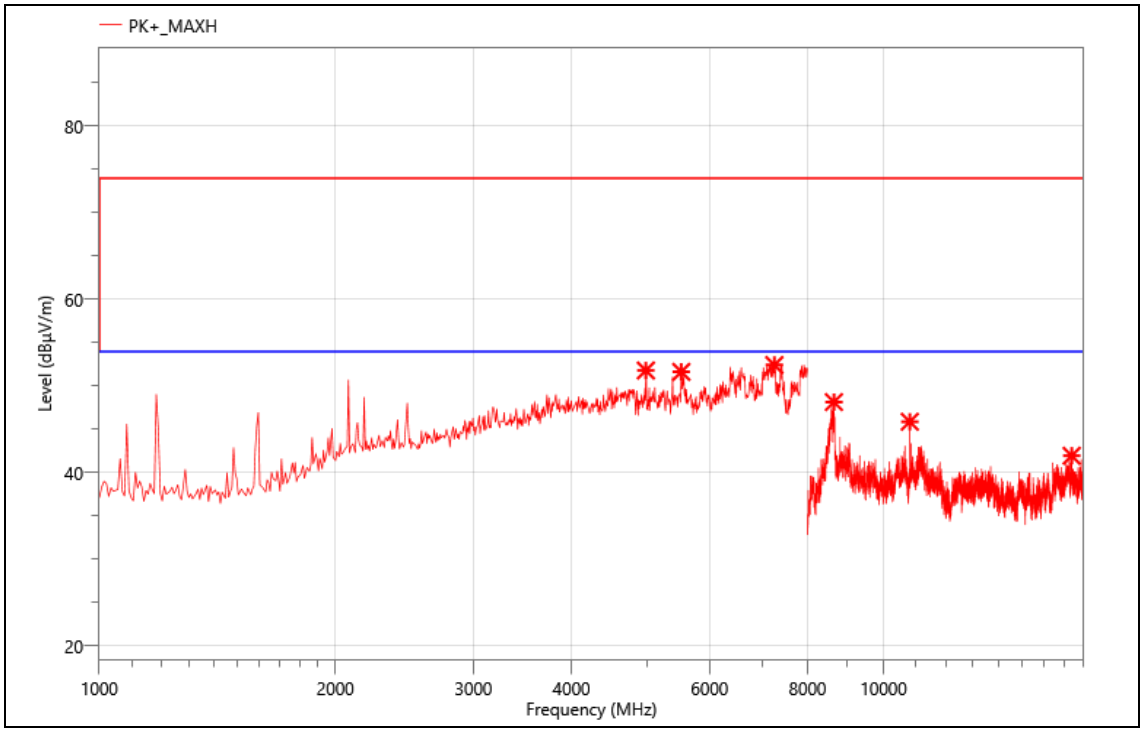
Mode:	AX20-5180
Power:	DC 5V
TE:	Berny
Date	2024/12/25
T/A/P	23.5℃/51%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	4458.000	56.21	-3.12	53.09	74.00	20.91	PK+	H
2	6775.000	46.34	7.1	53.44	74.00	20.56	PK+	H
3	7293.000	42.19	10.29	52.48	74.00	21.52	PK+	H
4	9463.000	55.17	-6.59	48.58	74.00	25.42	PK+	H
5	10360.000	57.69	-5.67	52.02	74.00	21.98	PK+	H
6	10800.000	55.06	-5	50.06	74.00	23.94	PK+	H

Mode:	AX20-5180
Power:	DC 5V
TE:	Berny
Date	2024/12/25
T/A/P	23.5℃/51%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	4976.000	53.57	-1.77	51.80	74.00	22.20	PK+	V
2	5522.000	52.42	-0.78	51.64	74.00	22.36	PK+	V
3	7258.000	42.03	10.4	52.43	74.00	21.57	PK+	V
4	8644.000	56.10	-7.95	48.15	74.00	25.85	PK+	V
5	10800.000	50.88	-5	45.88	74.00	28.12	PK+	V
6	17373.000	42.25	-0.3	41.95	74.00	32.05	PK+	V

9. AC POWER LINE CONDUCTION EMISSION

LIMITS

Please refer to CFR 47 FCC §15.207 (a) and ISED RSS-Gen Clause 8.8

FREQUENCY (MHz)	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

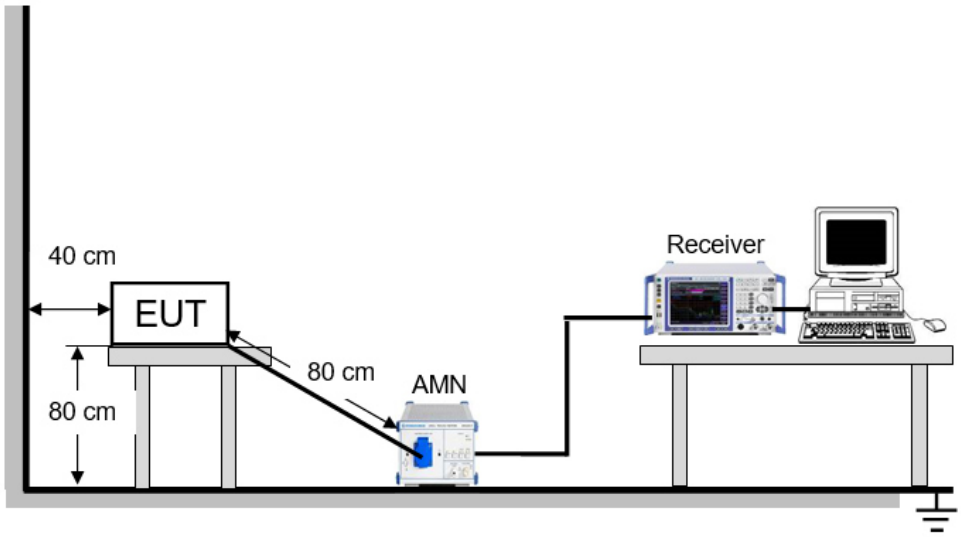
TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 6.2.

The EUT is put on a table of non-conducting material that is 80 cm high. The vertical conducting wall of shielding is located 40 cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI Measurement Receiver (R&S Test Receiver ESR3) is used to test the emissions from both sides of AC line. According to the requirements in Section 6.2 of ANSI C63.10-2013.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9 kHz.

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

TEST SETUP

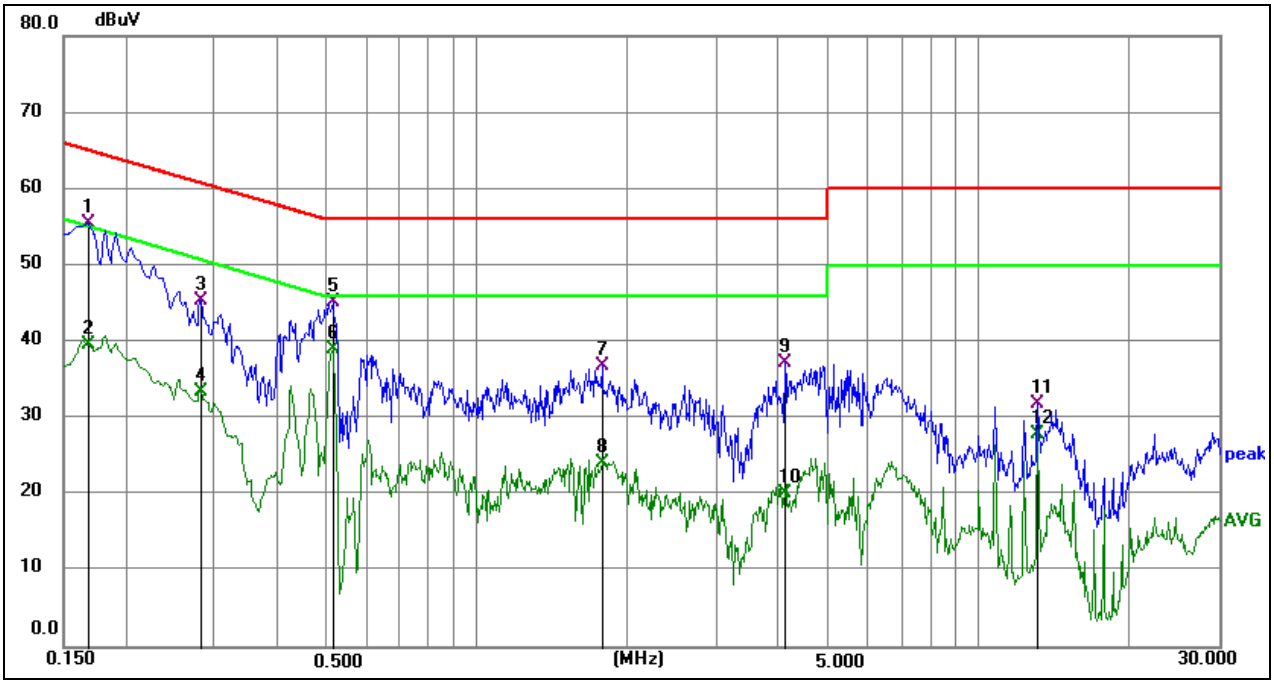


TEST ENVIRONMENT

Temperature	23.3℃	Relative Humidity	54%
Atmosphere Pressure	101kPa		

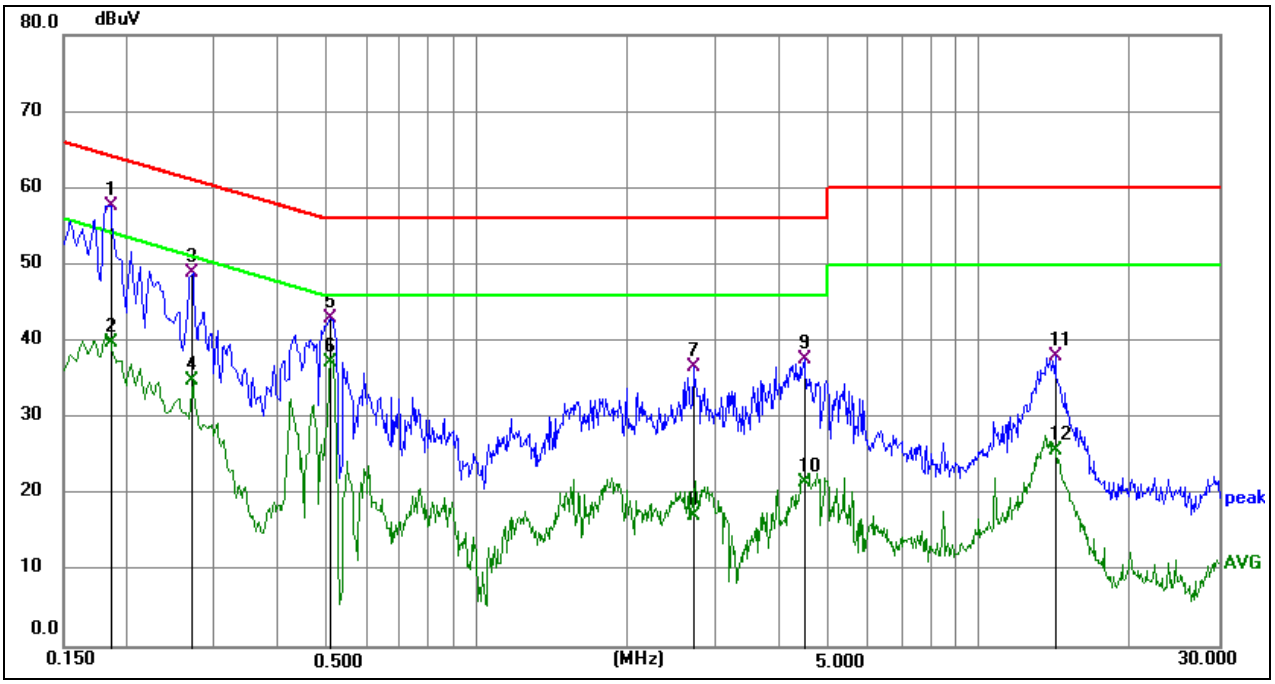
TEST RESULTS

USB Port:



Phase: N	Mode: ax20 5180MHz

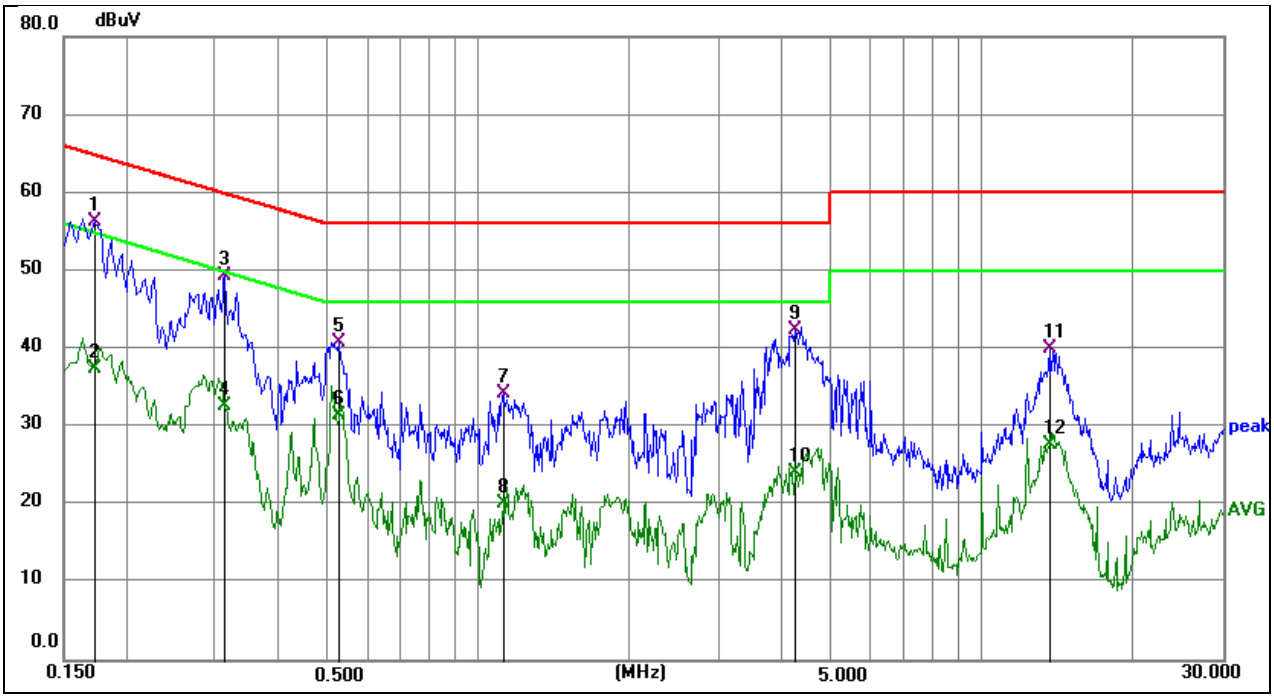
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1680	45.85	9.67	55.52	65.06	-9.54	QP
2	0.1680	29.87	9.67	39.54	55.06	-15.52	AVG
3	0.2805	35.77	9.68	45.45	60.80	-15.35	QP
4	0.2805	23.86	9.68	33.54	50.80	-17.26	AVG
5	0.5144	35.39	9.69	45.08	56.00	-10.92	QP
6	0.5144	29.28	9.69	38.97	46.00	-7.03	AVG
7	1.7744	27.08	9.72	36.80	56.00	-19.20	QP
8	1.7744	14.38	9.72	24.10	46.00	-21.90	AVG
9	4.0964	27.48	9.76	37.24	56.00	-18.76	QP
10	4.0964	10.45	9.76	20.21	46.00	-25.79	AVG
11	13.0830	21.82	10.13	31.95	60.00	-28.05	QP
12	13.0830	17.68	10.13	27.81	50.00	-22.19	AVG



Phase: L1	Mode: ax20 5180MHz

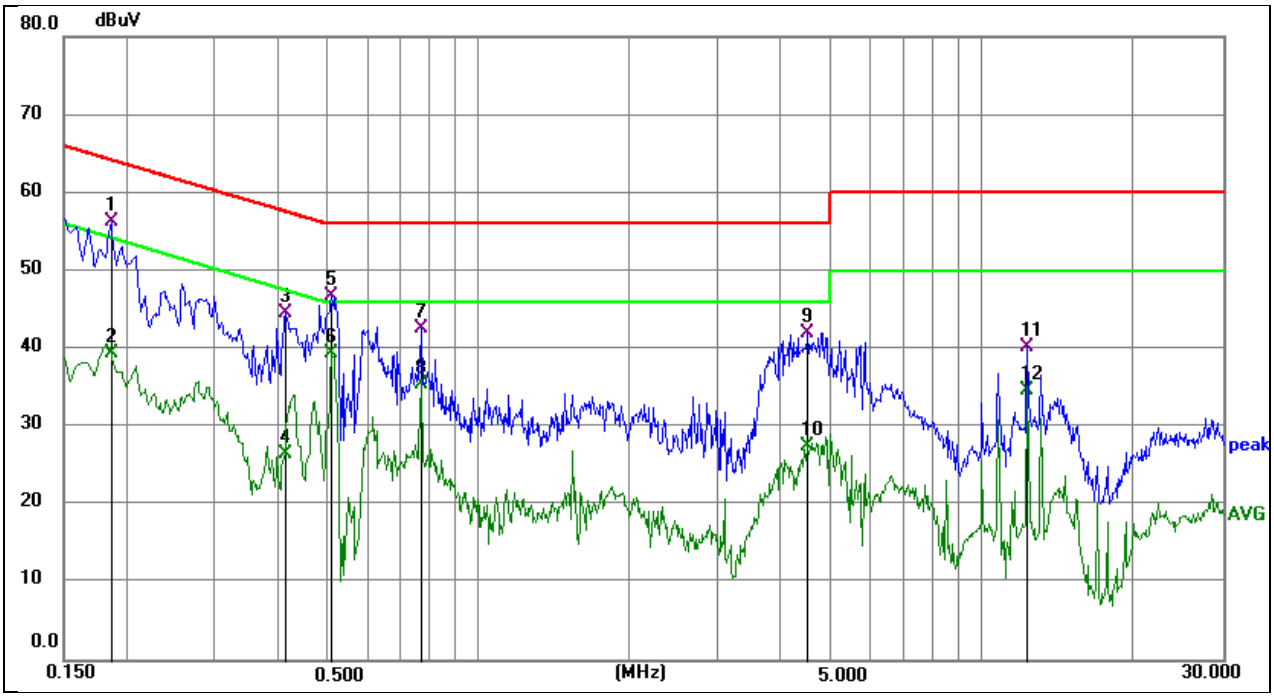
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1860	47.79	9.78	57.57	64.21	-6.64	QP
2	0.1860	30.07	9.78	39.85	54.21	-14.36	AVG
3	0.2714	39.13	9.78	48.91	61.07	-12.16	QP
4	0.2714	25.09	9.78	34.87	51.07	-16.20	AVG
5	0.5100	33.10	9.79	42.89	56.00	-13.11	QP
6	0.5100	27.51	9.79	37.30	46.00	-8.70	AVG
7	2.6925	26.75	9.84	36.59	56.00	-19.41	QP
8	2.6925	7.38	9.84	17.22	46.00	-28.78	AVG
9	4.4835	27.81	9.86	37.67	56.00	-18.33	QP
10	4.4835	11.66	9.86	21.52	46.00	-24.48	AVG
11	14.2125	27.94	10.14	38.08	60.00	-21.92	QP
12	14.2125	15.48	10.14	25.62	50.00	-24.38	AVG

Type-C Port:



Phase: N	Mode: ax20 5180MHz

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1723	46.43	9.77	56.20	64.85	-8.65	QP
2	0.1723	27.70	9.77	37.47	54.85	-17.38	AVG
3	0.3120	39.55	9.78	49.33	59.92	-10.59	QP
4	0.3120	22.89	9.78	32.67	49.92	-17.25	AVG
5	0.5280	31.10	9.79	40.89	56.00	-15.11	QP
6	0.5280	21.66	9.79	31.45	46.00	-14.55	AVG
7	1.1220	24.51	9.81	34.32	56.00	-21.68	QP
8	1.1220	10.35	9.81	20.16	46.00	-25.84	AVG
9	4.2675	32.55	9.86	42.41	56.00	-13.59	QP
10	4.2675	14.19	9.86	24.05	46.00	-21.95	AVG
11	13.5870	29.94	10.13	40.07	60.00	-19.93	QP
12	13.5870	17.58	10.13	27.71	50.00	-22.29	AVG



Phase: L1	Mode: ax20 5180MHz

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1860	46.68	9.68	56.36	64.21	-7.85	QP
2	0.1860	29.81	9.68	39.49	54.21	-14.72	AVG
3	0.4110	34.91	9.69	44.60	57.63	-13.03	QP
4	0.4110	16.87	9.69	26.56	47.63	-21.07	AVG
5	0.5100	37.01	9.69	46.70	56.00	-9.30	QP
6	0.5100	29.74	9.69	39.43	46.00	-6.57	AVG
7	0.7710	32.85	9.70	42.55	56.00	-13.45	QP
8	0.7710	25.79	9.70	35.49	46.00	-10.51	AVG
9	4.5240	32.30	9.78	42.08	56.00	-13.92	QP
10	4.5240	17.64	9.78	27.42	46.00	-18.58	AVG
11	12.3134	30.11	10.11	40.22	60.00	-19.78	QP
12	12.3134	24.50	10.11	34.61	50.00	-15.39	AVG

10. ANTENNA REQUIREMENT

REQUIREMENT

Please refer to FCC §15.203
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Please refer to FCC §15.407(a)(1)(2)(3)
If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DESCRIPTION

Pass

11. TEST DATA - Appendix A

Duty Cycle

Condition	Mode	Frequency (MHz)	Antenna	Duty Cycle (%)	Correction Factor (dB)	1/T (kHz)
NVNT	a	5180	Ant1	100	0	0
NVNT	n20	5180	Ant1	100	0	0
NVNT	ac20	5180	Ant1	100	0	0
NVNT	ax20	5180	Ant1	100	0	0

Maximum Conducted Output Power

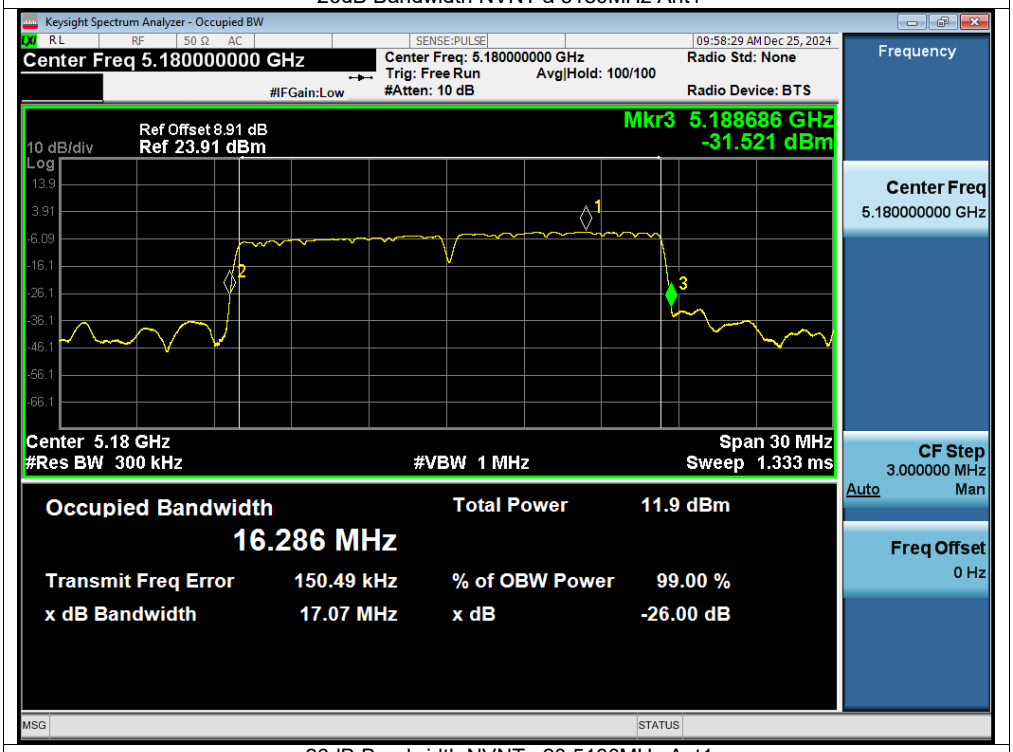
Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Verdict
NVNT	a	5180	Ant1	10.81	0	10.81	24	Pass
NVNT	n20	5180	Ant1	9.5	0	9.5	24	Pass
NVNT	ac20	5180	Ant1	8.05	0	8.05	24	Pass
NVNT	ax20	5180	Ant1	13.96	0	13.96	24	Pass

-26dB Bandwidth

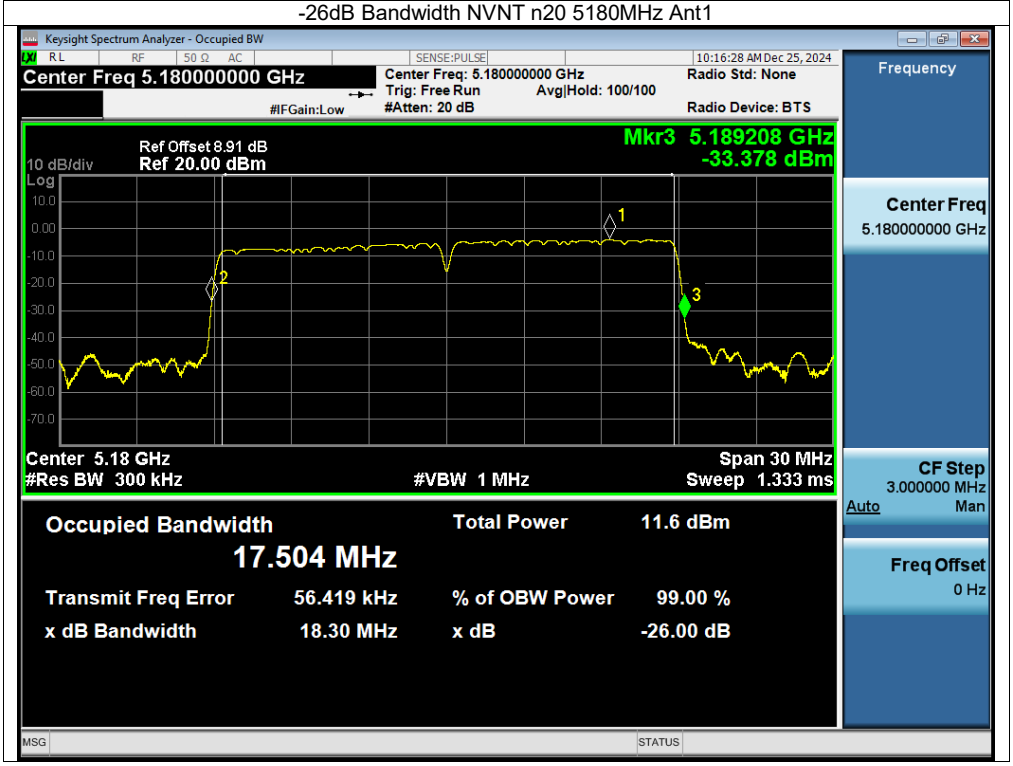
Condition	Mode	Frequency (MHz)	Antenna	-26 dB Bandwidth (MHz)	Limit -26 dB Bandwidth (MHz)	Verdict
NVNT	a	5180	Ant1	17.07	N/A	N/A
NVNT	n20	5180	Ant1	18.3	N/A	N/A
NVNT	ac20	5180	Ant1	19.7	N/A	N/A
NVNT	ax20	5180	Ant1	19.16	N/A	N/A

Test Graphs

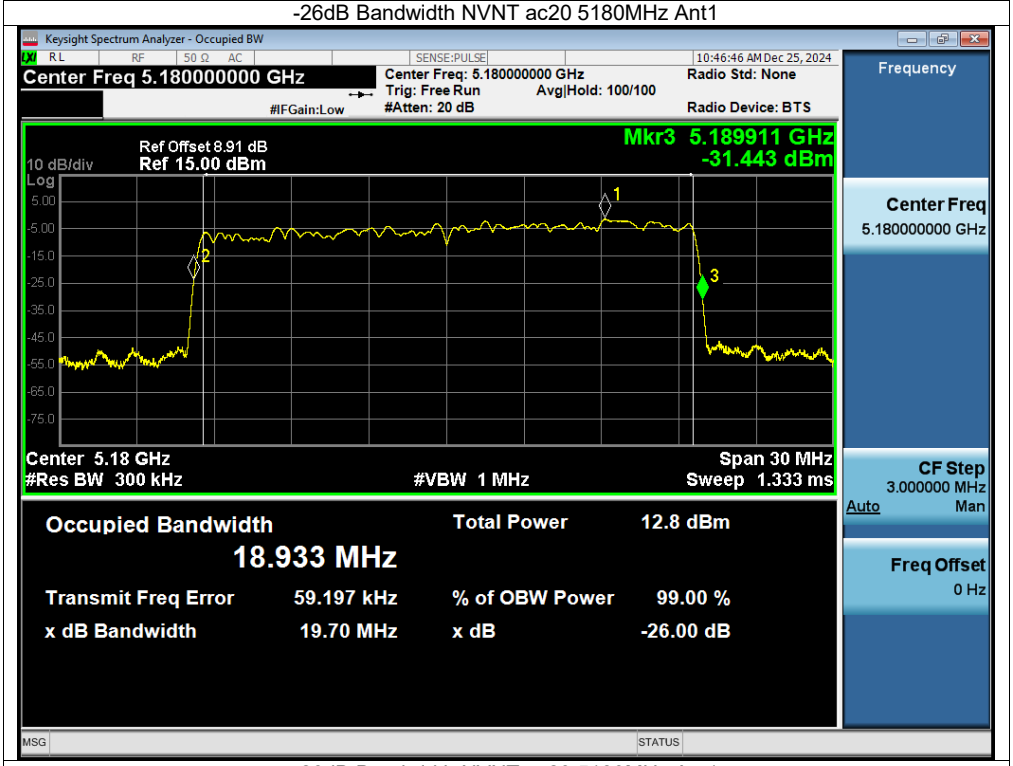
-26dB Bandwidth NVNT a 5180MHz Ant1



-26dB Bandwidth NVNT n20 5180MHz Ant1



-26dB Bandwidth NVNT ac20 5180MHz Ant1



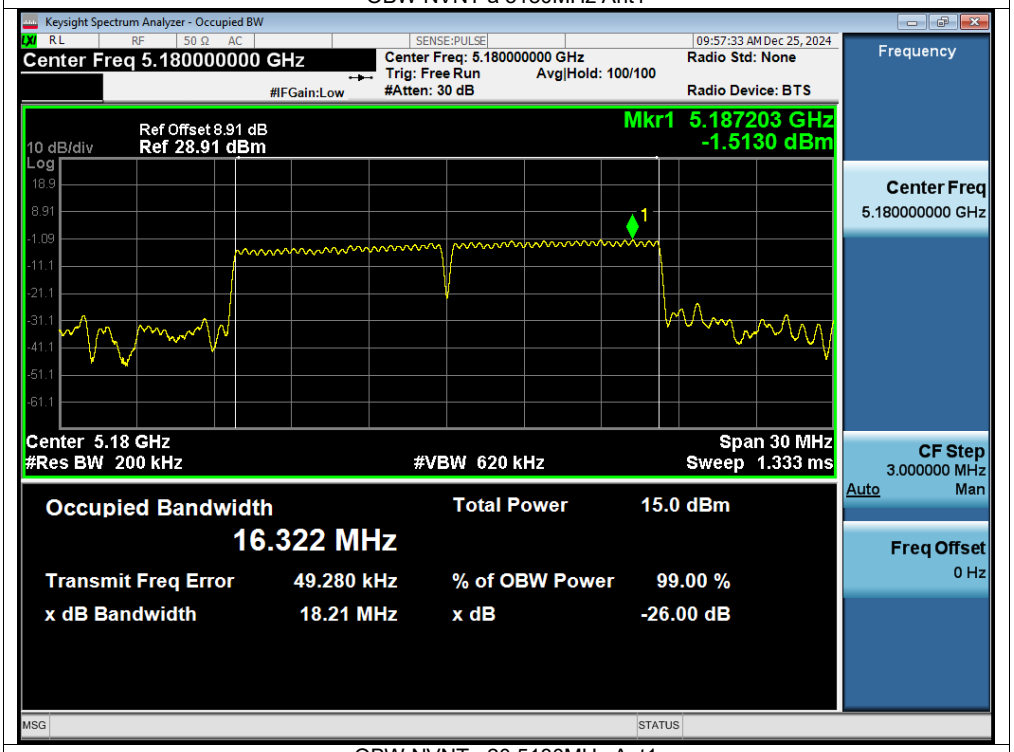
-26dB Bandwidth NVNT ax20 5180MHz Ant1

Occupied Channel Bandwidth

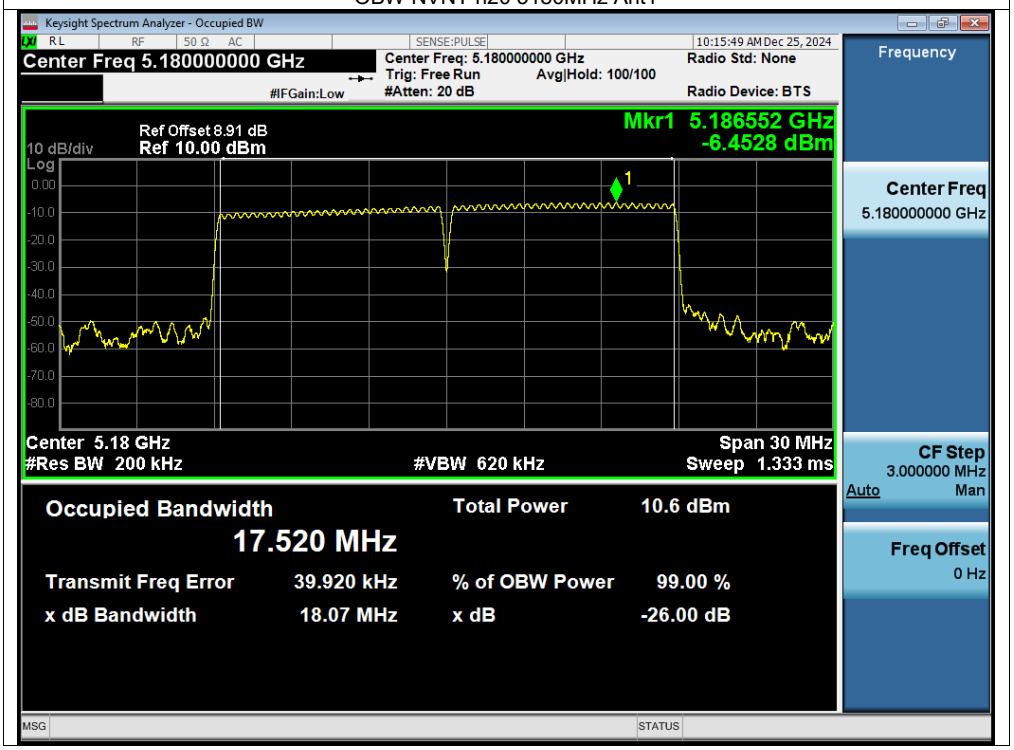
Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)
NVNT	a	5180	Ant1	16.322
NVNT	n20	5180	Ant1	17.52
NVNT	ac20	5180	Ant1	18.885
NVNT	ax20	5180	Ant1	17.526

Test Graphs

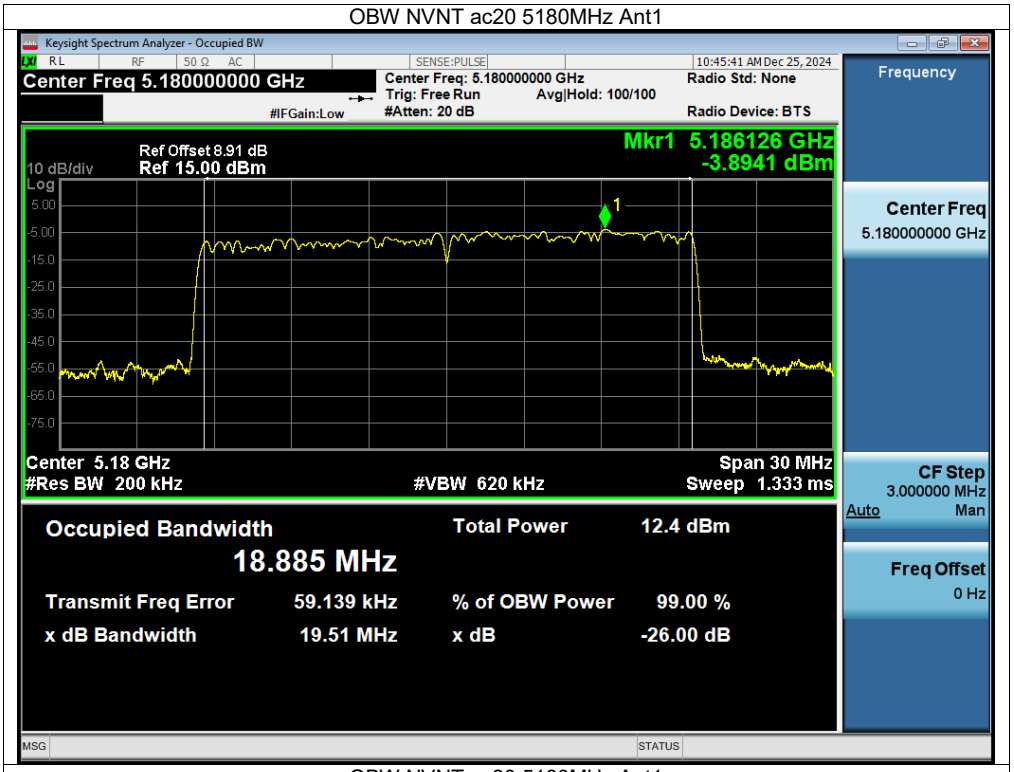
OBW NVNT a 5180MHz Ant1



OBW NVNT n20 5180MHz Ant1



OBW NVNT ac20 5180MHz Ant1



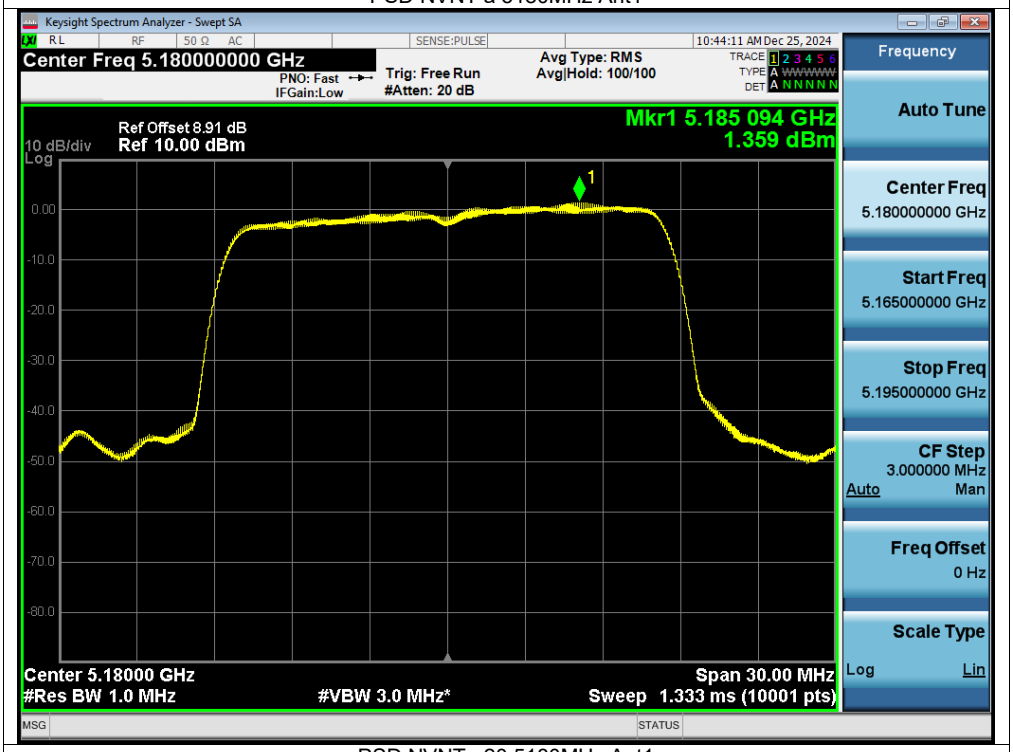
OBW NVNT ax20 5180MHz Ant1

Maximum Power Spectral Density Level

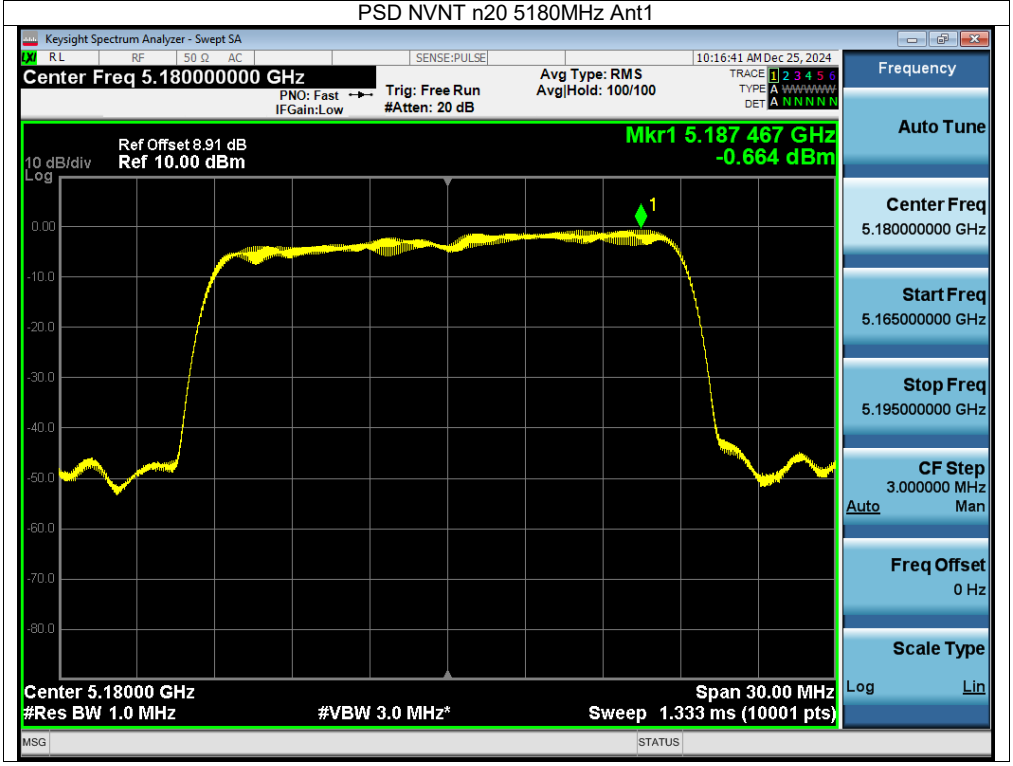
Condition	Mode	Frequency (MHz)	Antenna	Conducted PSD (dBm)	Duty Factor (dB)	Total PSD (dBm)	Limit (dBm)	Verdict
NVNT	a	5180	Ant1	1.36	0	1.36	11	Pass
NVNT	n20	5180	Ant1	-0.66	0	-0.66	11	Pass
NVNT	ac20	5180	Ant1	-2.27	0	-2.27	11	Pass
NVNT	ax20	5180	Ant1	3.9	0	3.9	11	Pass

Test Graphs

PSD NVNT a 5180MHz Ant1



PSD NVNT n20 5180MHz Ant1



PSD NVNT ac20 5180MHz Ant1

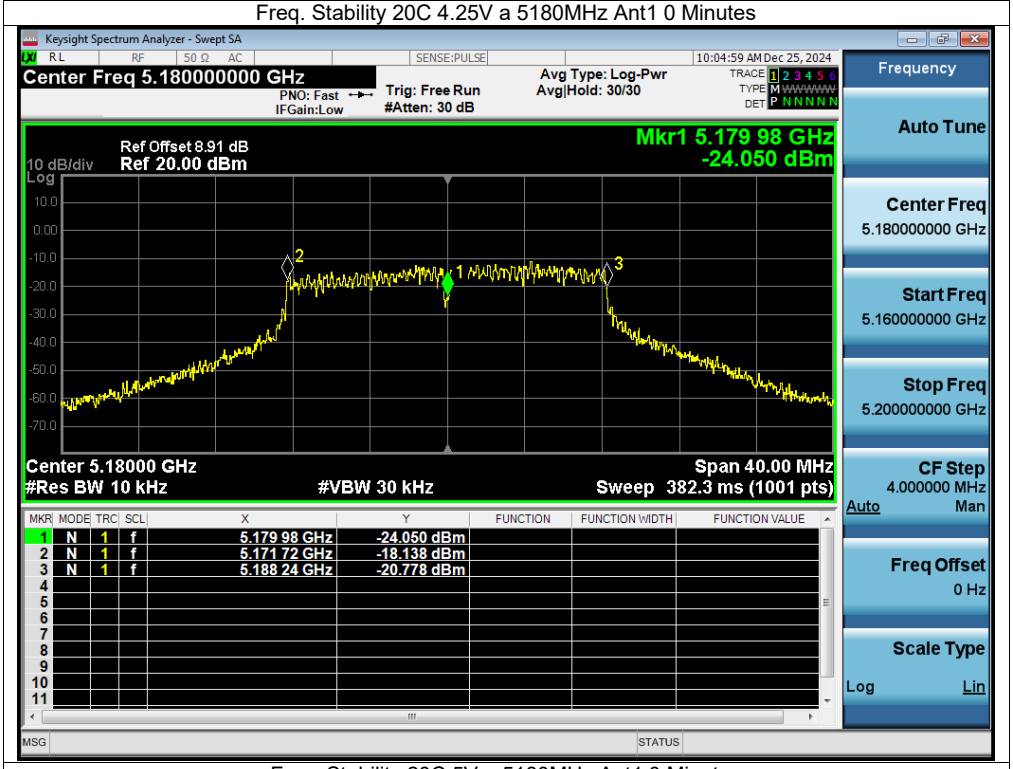
PSD NVNT ax20 5180MHz Ant1

Frequency Stability

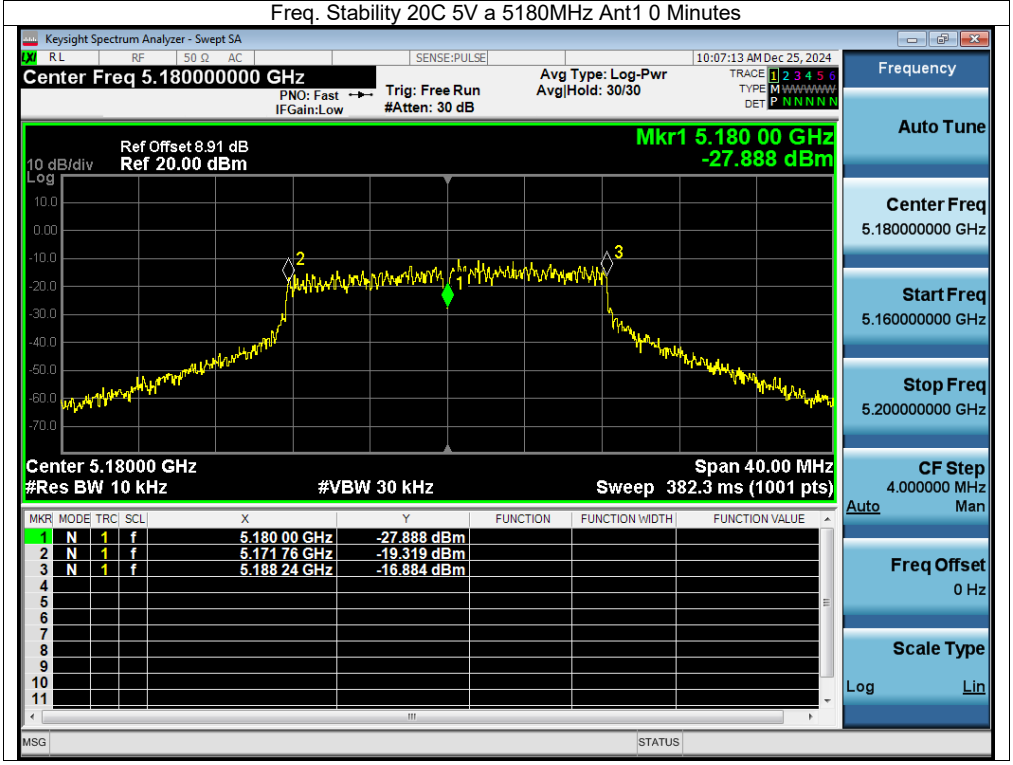
Condition	Mode	Time (mins)	Frequency (MHz)	Antenna	Measured Frequency (MHz)	Frequency Error (Hz)	Deviation (ppm)	Limit (ppm)	Verdict
20C 4.25V	a	0	5180	Ant1	5179.98	-20000	-3.86	25	Pass
20C 5V	a	0	5180	Ant1	5180	0	0	25	Pass
20C 5.88V	a	0	5180	Ant1	5180	0	0	25	Pass
-20C 5V	a	0	5180	Ant1	5180	0	0	25	Pass
-10C 5V	a	0	5180	Ant1	5179.96	-40000	-7.72	25	Pass
0C 5V	a	0	5180	Ant1	5180	0	0	25	Pass
10C 5V	a	0	5180	Ant1	5179.98	-20000	-3.86	25	Pass
30C 5V	a	0	5180	Ant1	5180	0	0	25	Pass
40C 5V	a	0	5180	Ant1	5180	0	0	25	Pass
50C 5V	a	0	5180	Ant1	5180	0	0	25	Pass
20C 4.25V	n20	0	5180	Ant1	5180.12	120000	23.17	25	Pass
20C 5V	n20	0	5180	Ant1	5180	0	0	25	Pass
20C 5.88V	n20	0	5180	Ant1	5180.02	20000	3.86	25	Pass
-20C 5V	n20	0	5180	Ant1	5180.04	40000	7.72	25	Pass
-10C 5V	n20	0	5180	Ant1	5179.96	-40000	-7.72	25	Pass
0C 5V	n20	0	5180	Ant1	5180	0	0	25	Pass
10C 5V	n20	0	5180	Ant1	5180.02	20000	3.86	25	Pass
30C 5V	n20	0	5180	Ant1	5180	0	0	25	Pass
40C 5V	n20	0	5180	Ant1	5180.04	40000	7.72	25	Pass
50C 5V	n20	0	5180	Ant1	5179.98	-20000	-3.86	25	Pass
20C 4.25V	ac20	0	5180	Ant1	5180.16	160000	30.89	25	Pass
20C 5V	ac20	0	5180	Ant1	5180.12	120000	23.17	25	Pass
20C 5.88V	ac20	0	5180	Ant1	5180.12	120000	23.17	25	Pass
-20C 5V	ac20	0	5180	Ant1	5180.34	340000	65.64	25	Pass
-10C 5V	ac20	0	5180	Ant1	5180.08	80000	15.44	25	Pass
0C 5V	ac20	0	5180	Ant1	5179.98	-20000	-3.86	25	Pass
10C 5V	ac20	0	5180	Ant1	5179.98	-20000	-3.86	25	Pass
30C 5V	ac20	0	5180	Ant1	5180.06	60000	11.58	25	Pass
40C 5V	ac20	0	5180	Ant1	5180.06	60000	11.58	25	Pass
50C 5V	ac20	0	5180	Ant1	5180.06	60000	11.58	25	Pass
20C 4.25V	ax20	0	5180	Ant1	5179.98	-20000	-3.86	25	Pass
20C 5V	ax20	0	5180	Ant1	5179.98	-20000	-3.86	25	Pass
20C 5.88V	ax20	0	5180	Ant1	5179.98	-20000	-3.86	25	Pass
-20C 5V	ax20	0	5180	Ant1	5180	0	0	25	Pass
-10C 5V	ax20	0	5180	Ant1	5179.96	-40000	-7.72	25	Pass
0C 5V	ax20	0	5180	Ant1	5180.02	20000	3.86	25	Pass
10C 5V	ax20	0	5180	Ant1	5180	0	0	25	Pass
30C 5V	ax20	0	5180	Ant1	5180	0	0	25	Pass
40C 5V	ax20	0	5180	Ant1	5180.02	20000	3.86	25	Pass
50C 5V	ax20	0	5180	Ant1	5179.98	-20000	-3.86	25	Pass

Test Graphs

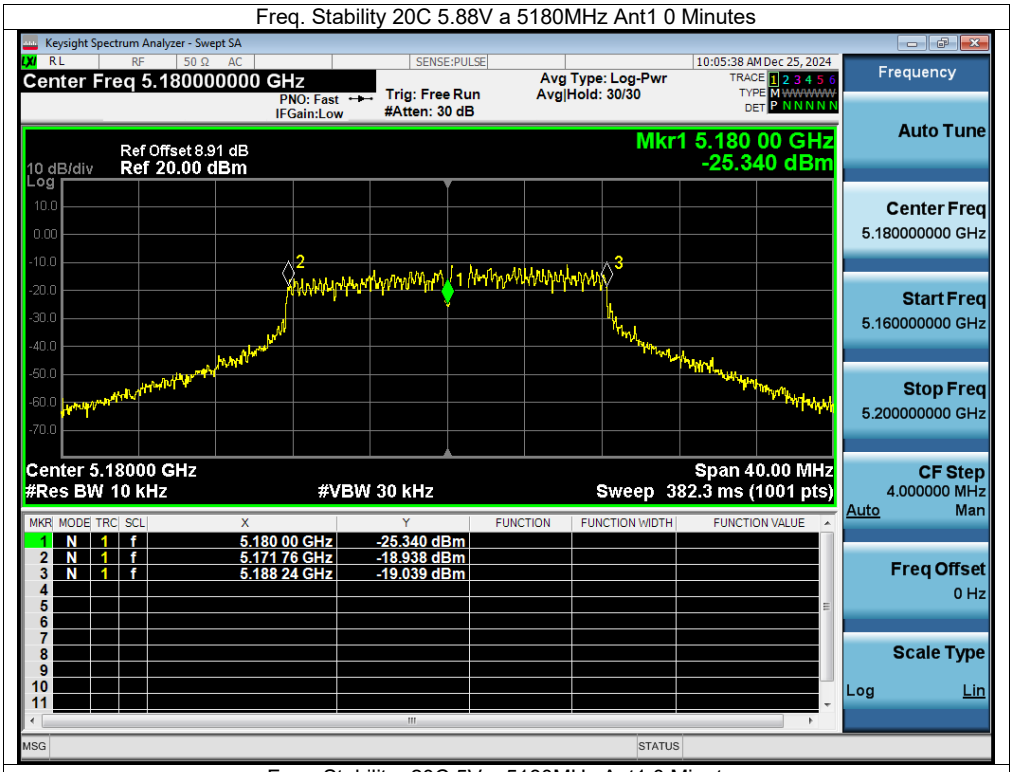
Freq. Stability 20C 4.25V a 5180MHz Ant1 0 Minutes



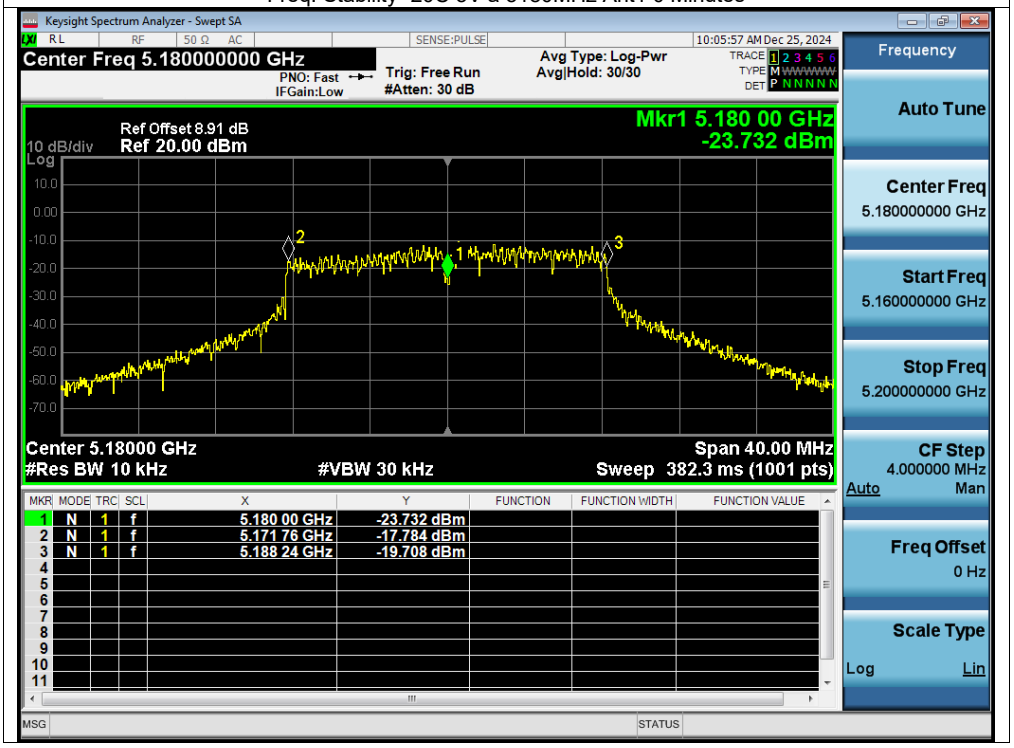
Freq. Stability 20C 5V a 5180MHz Ant1 0 Minutes



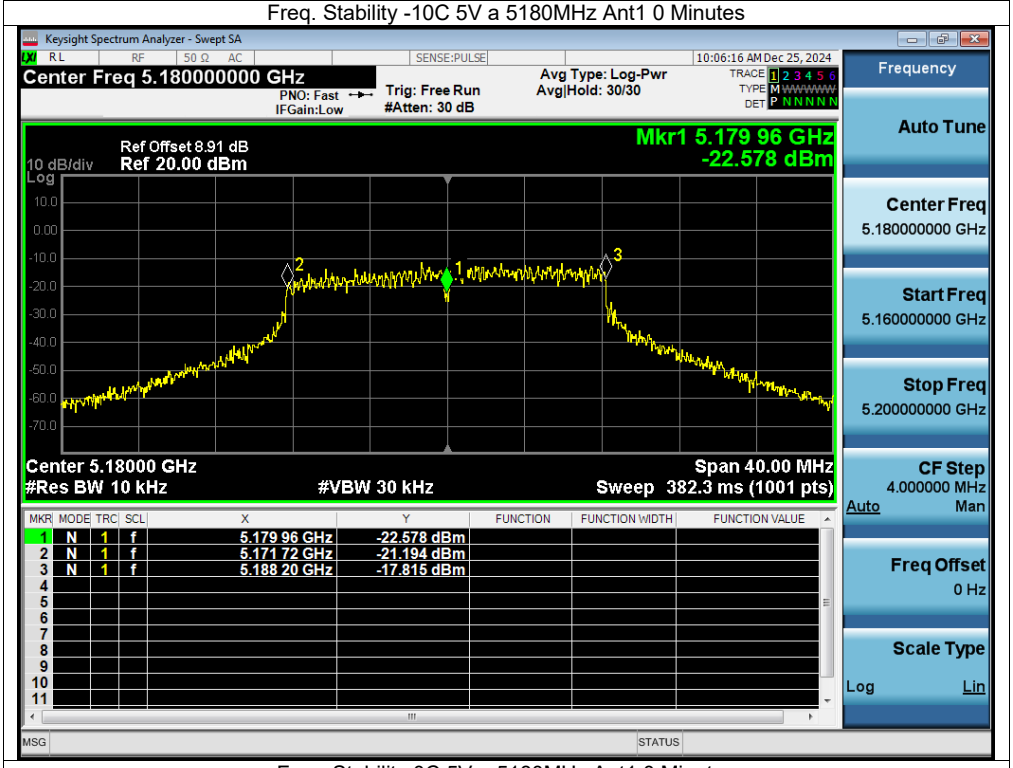
Freq. Stability 20C 5.88V a 5180MHz Ant1 0 Minutes



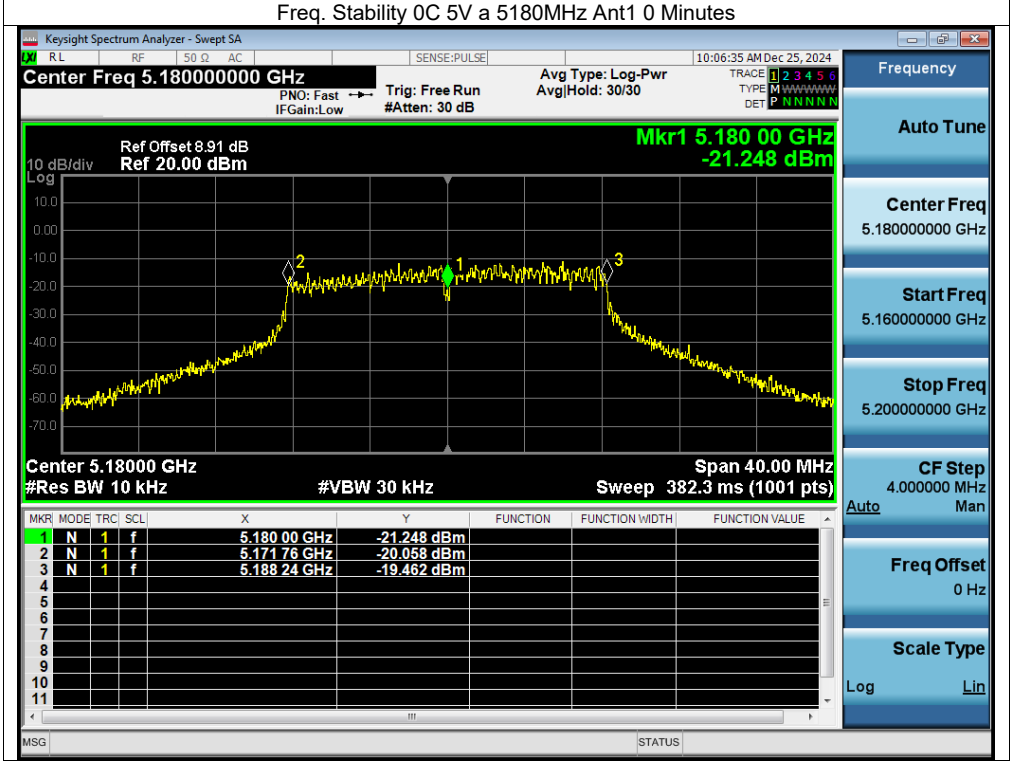
Freq. Stability -20C 5V a 5180MHz Ant1 0 Minutes



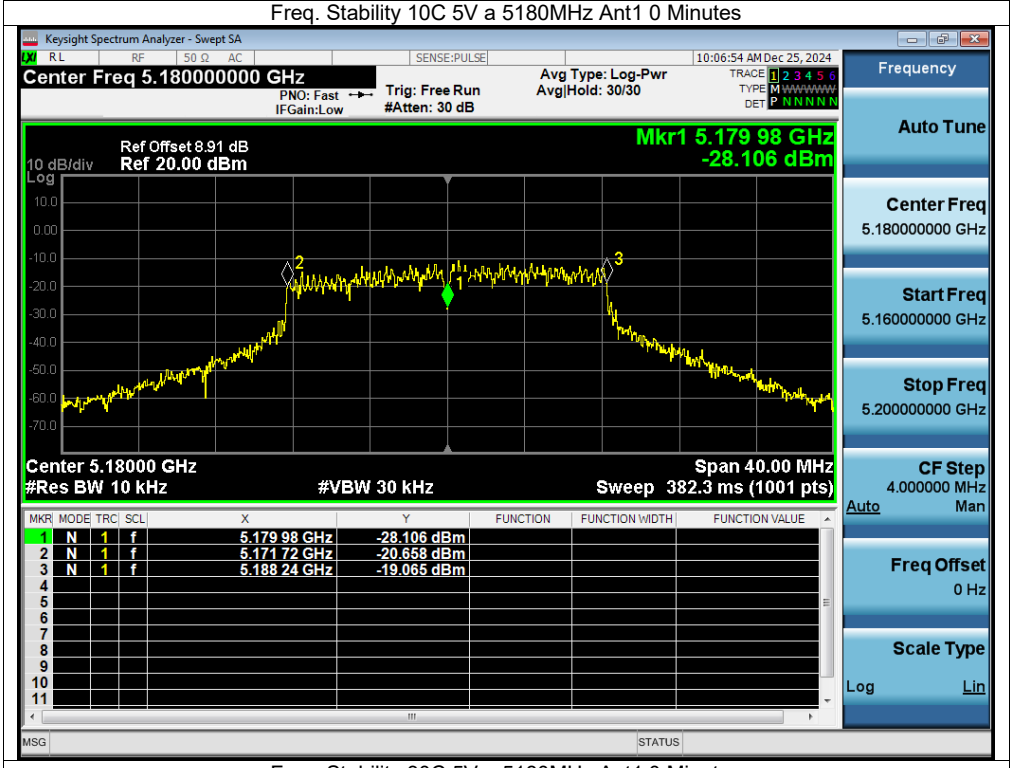
Freq. Stability -10C 5V a 5180MHz Ant1 0 Minutes



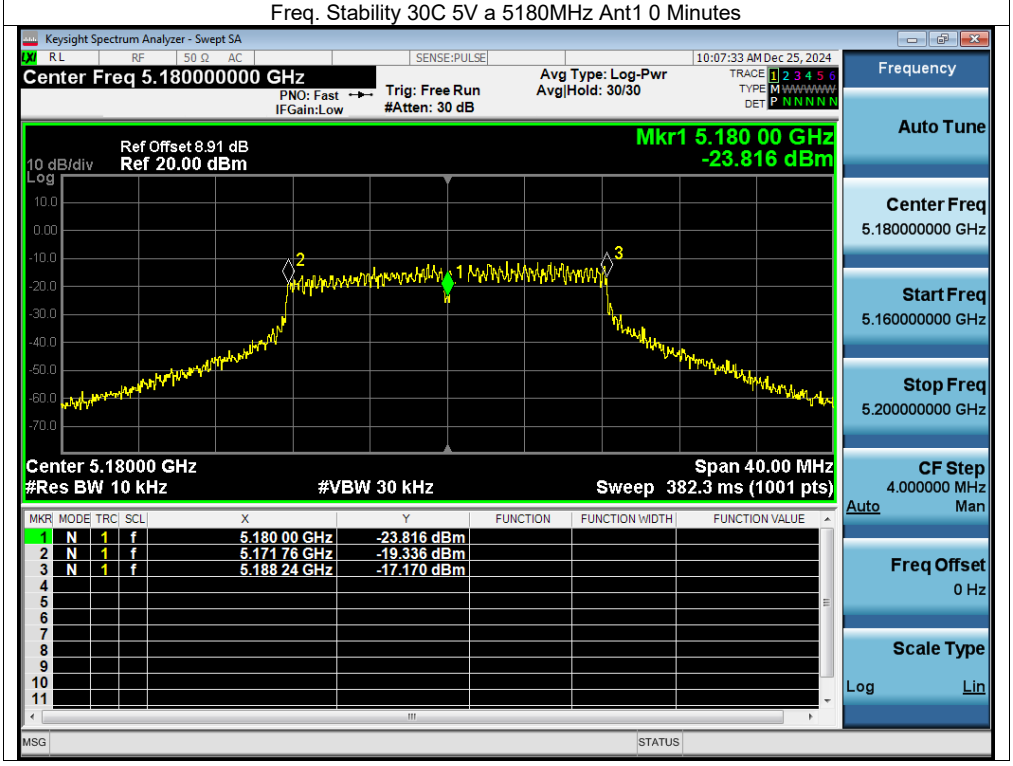
Freq. Stability 0C 5V a 5180MHz Ant1 0 Minutes



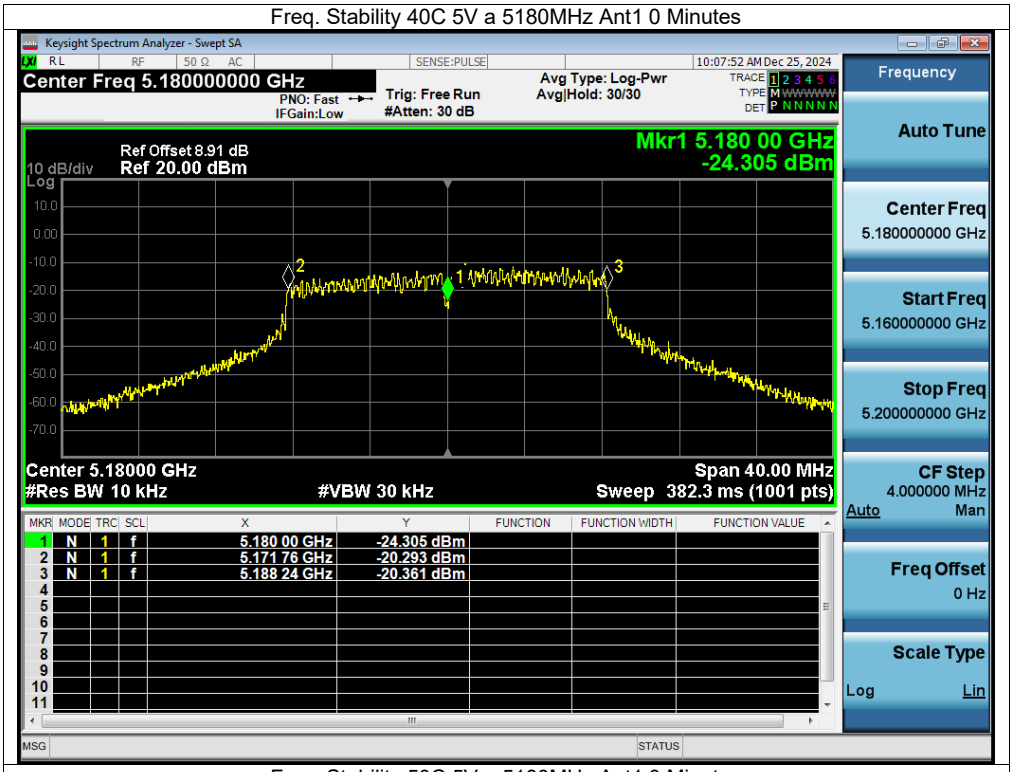
Freq. Stability 10C 5V a 5180MHz Ant1 0 Minutes



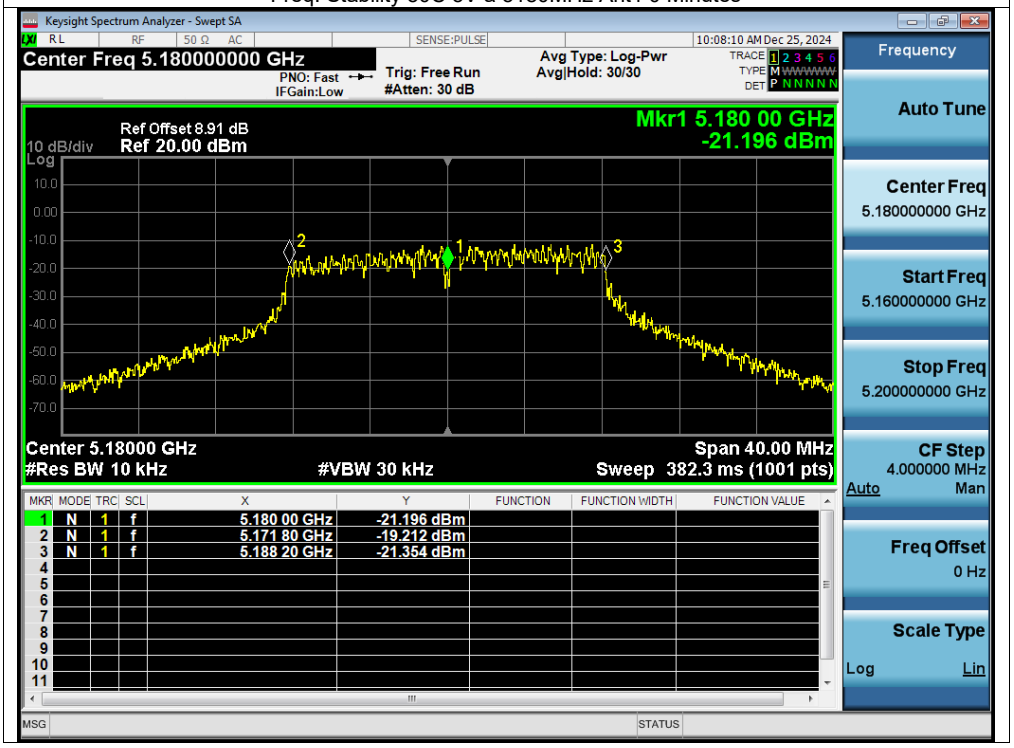
Freq. Stability 30C 5V a 5180MHz Ant1 0 Minutes



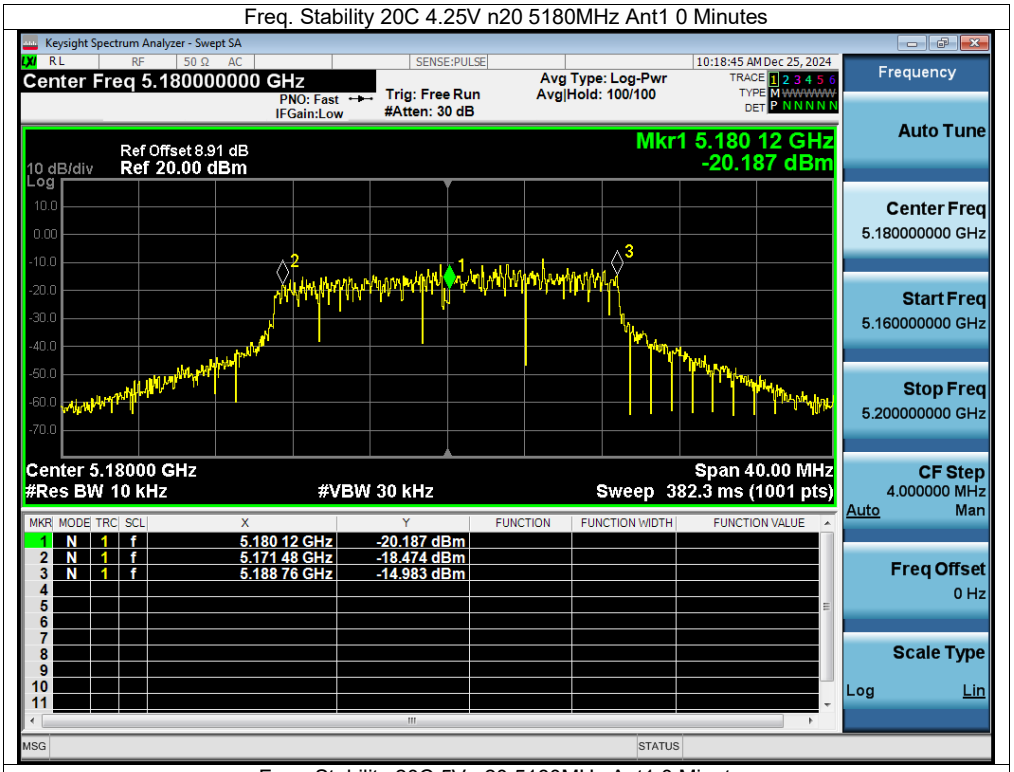
Freq. Stability 40C 5V a 5180MHz Ant1 0 Minutes



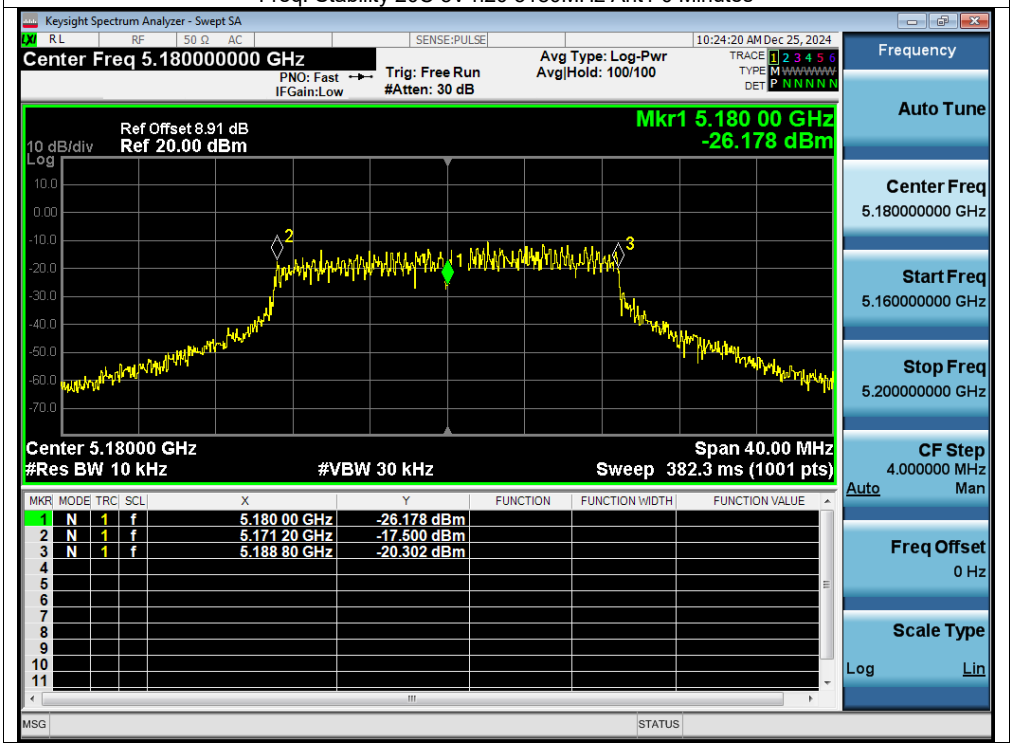
Freq. Stability 50C 5V a 5180MHz Ant1 0 Minutes



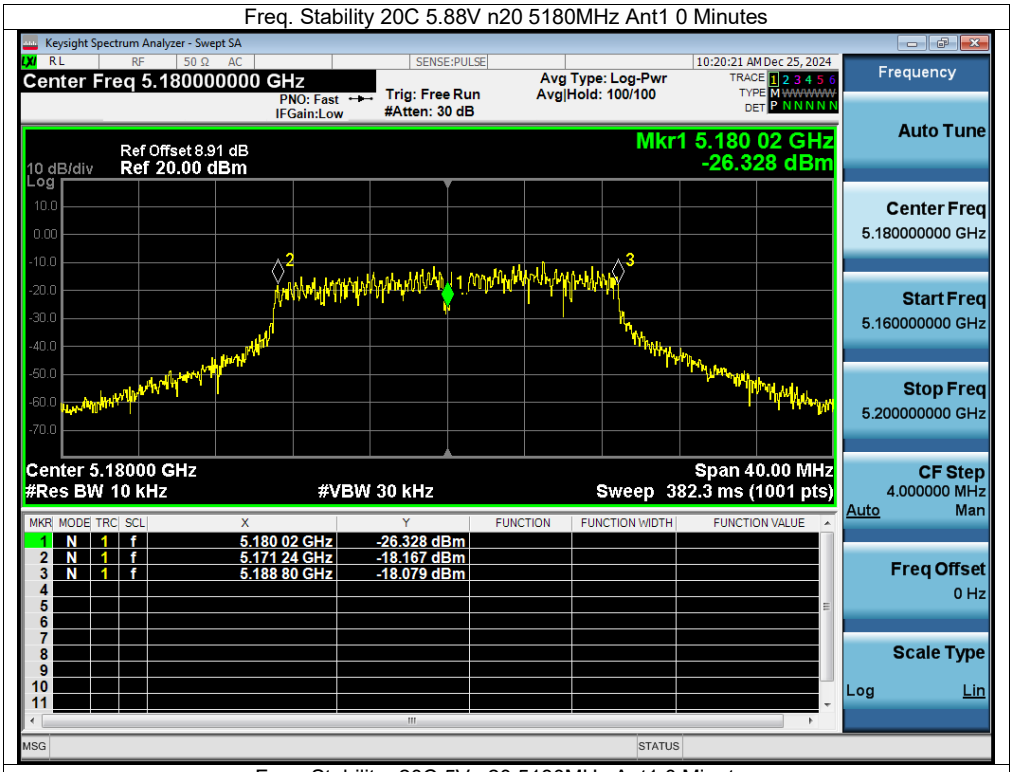
Freq. Stability 20C 4.25V n20 5180MHz Ant1 0 Minutes



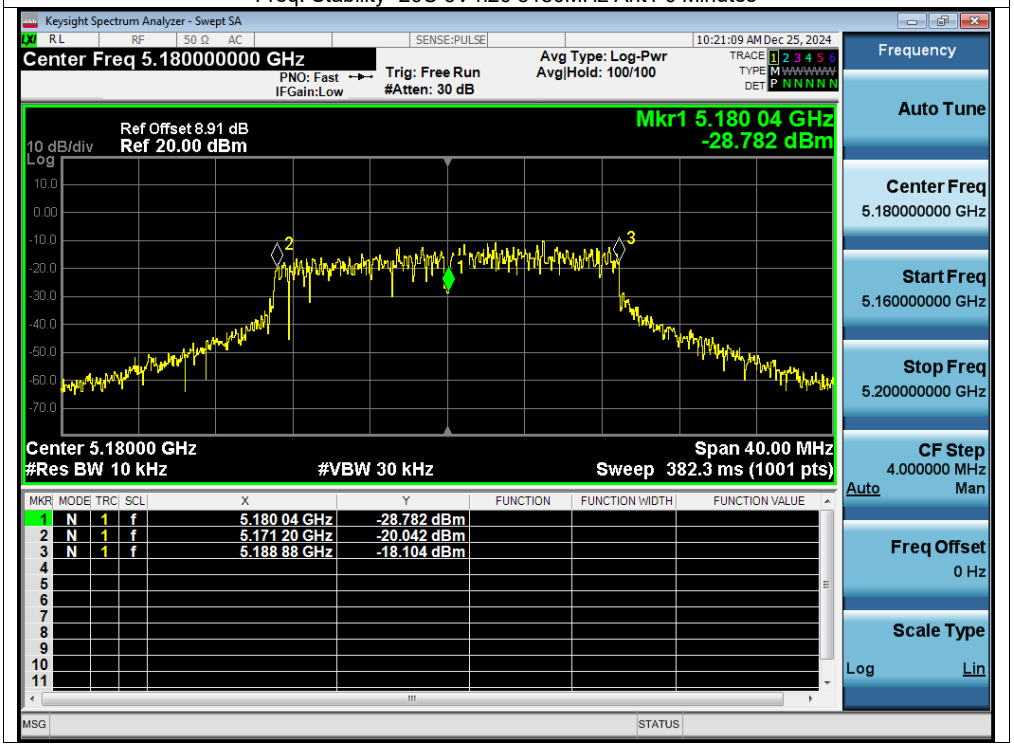
Freq. Stability 20C 5V n20 5180MHz Ant1 0 Minutes



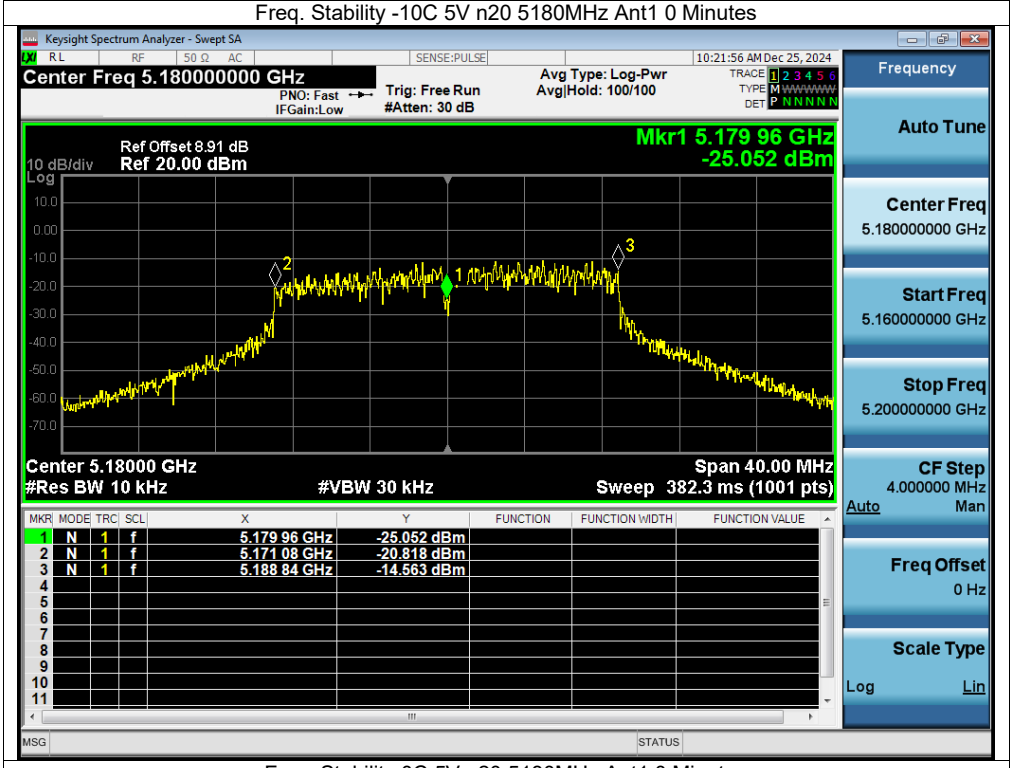
Freq. Stability 20C 5.88V n20 5180MHz Ant1 0 Minutes



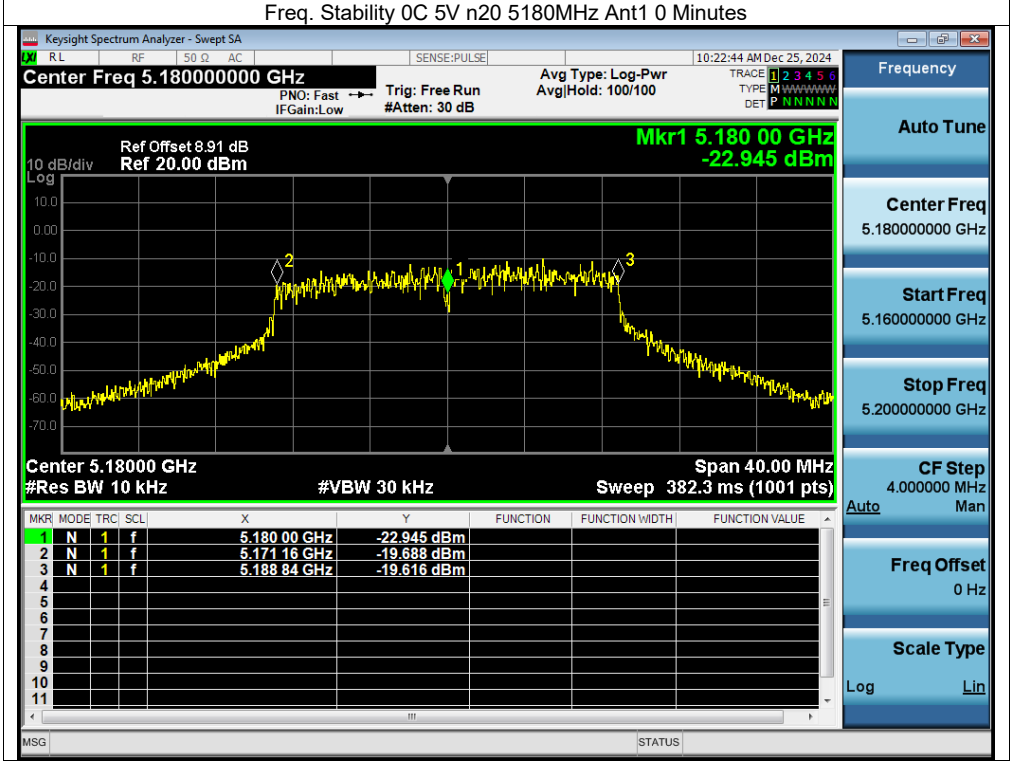
Freq. Stability -20C 5V n20 5180MHz Ant1 0 Minutes



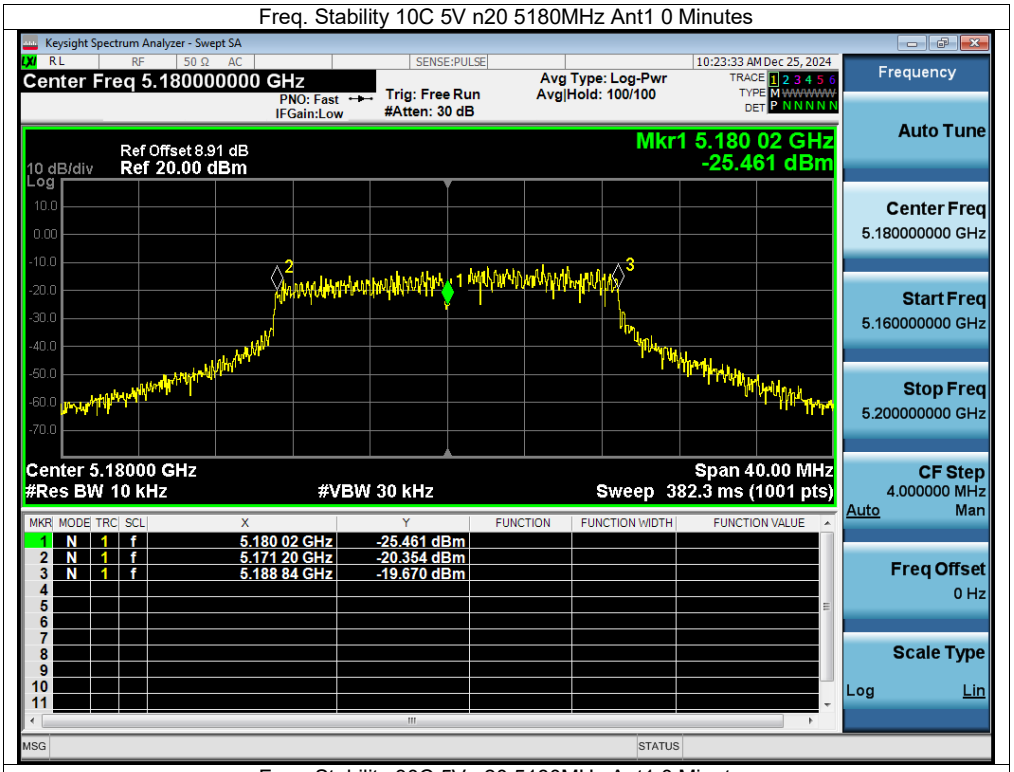
Freq. Stability -10C 5V n20 5180MHz Ant1 0 Minutes



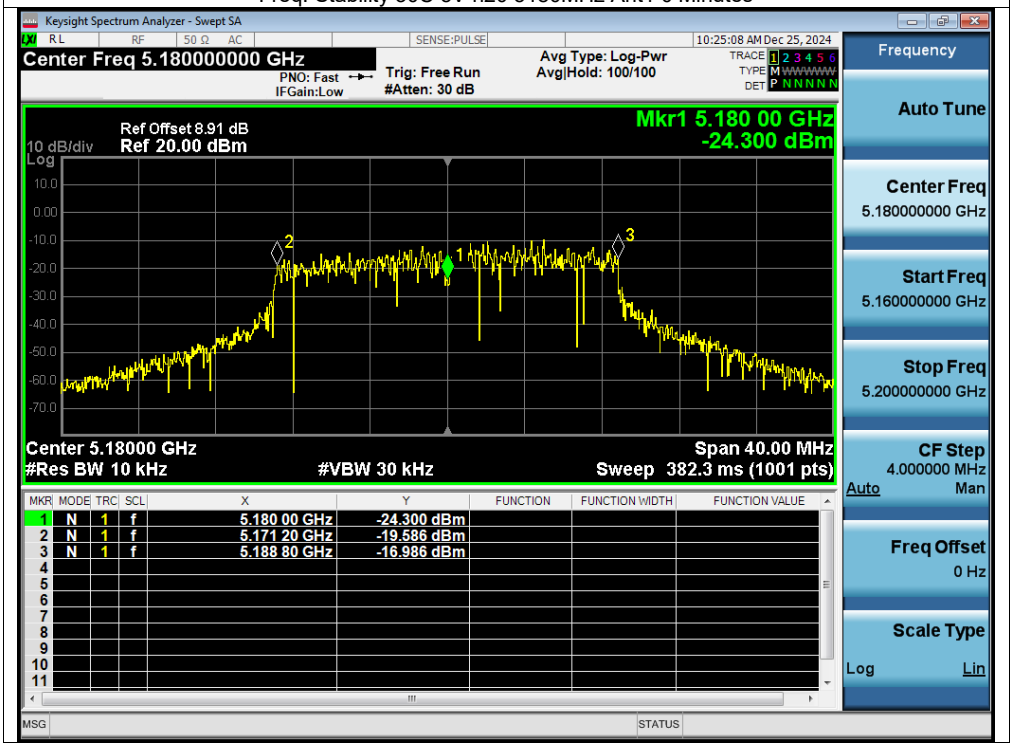
Freq. Stability 0C 5V n20 5180MHz Ant1 0 Minutes



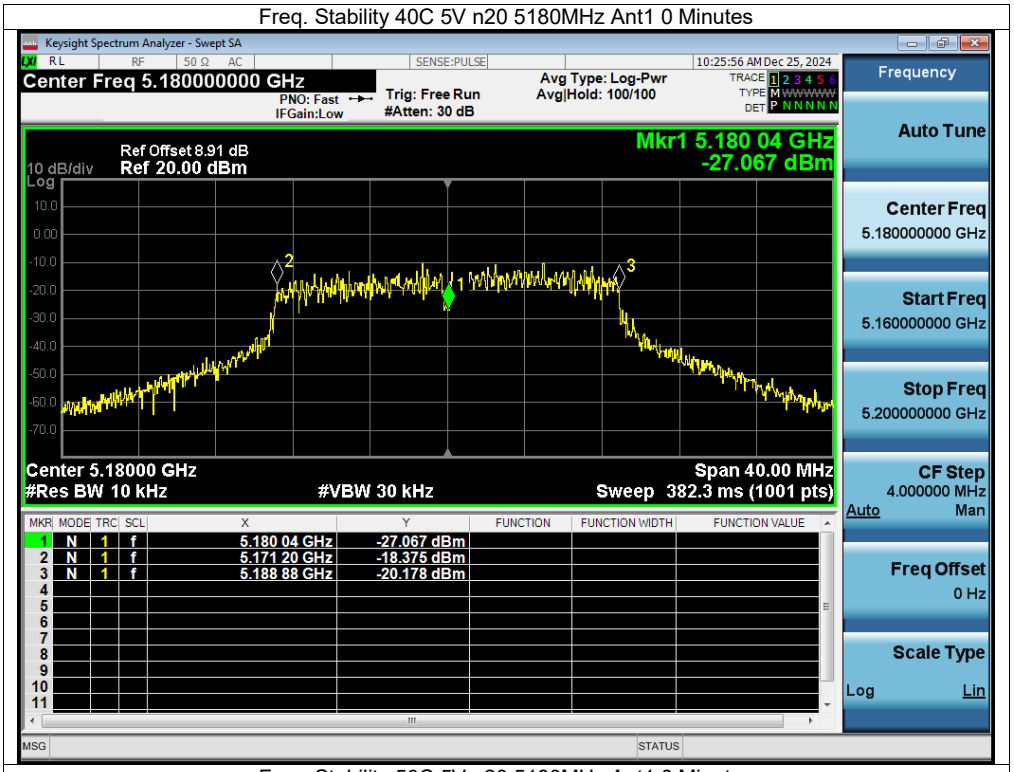
Freq. Stability 10C 5V n20 5180MHz Ant1 0 Minutes



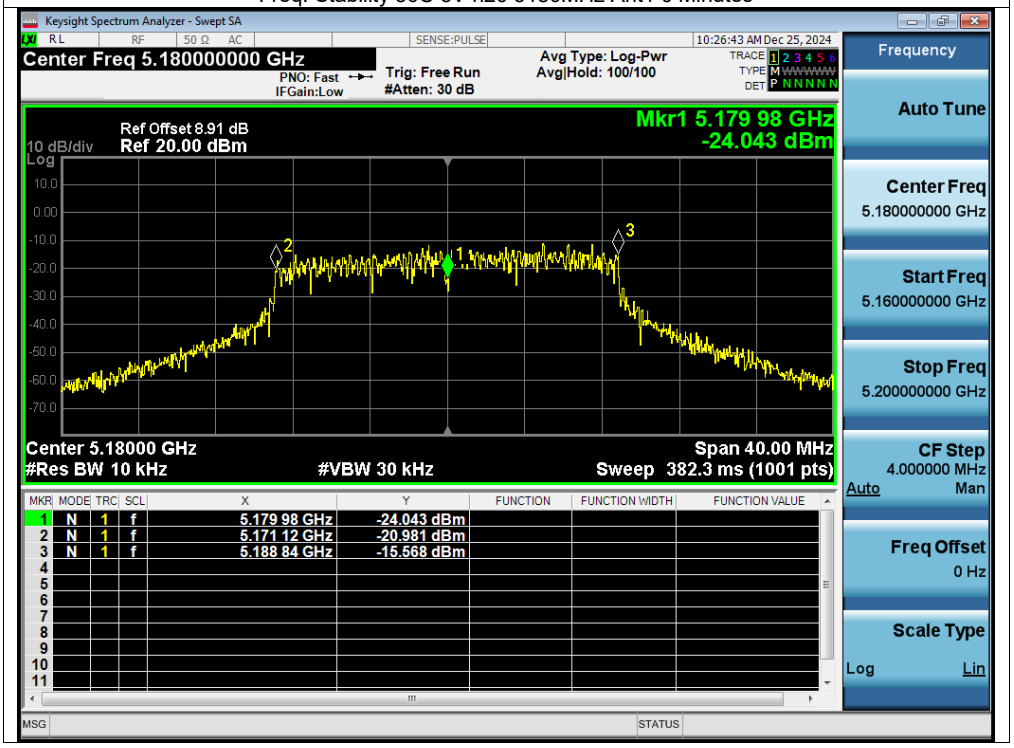
Freq. Stability 30C 5V n20 5180MHz Ant1 0 Minutes



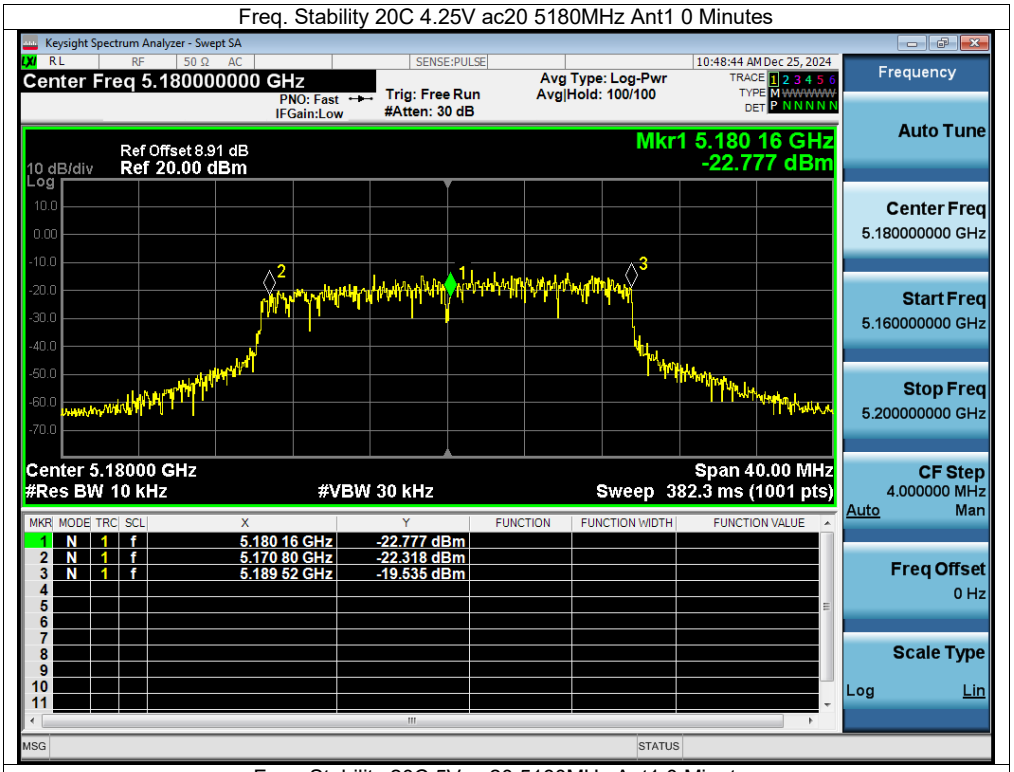
Freq. Stability 40C 5V n20 5180MHz Ant1 0 Minutes



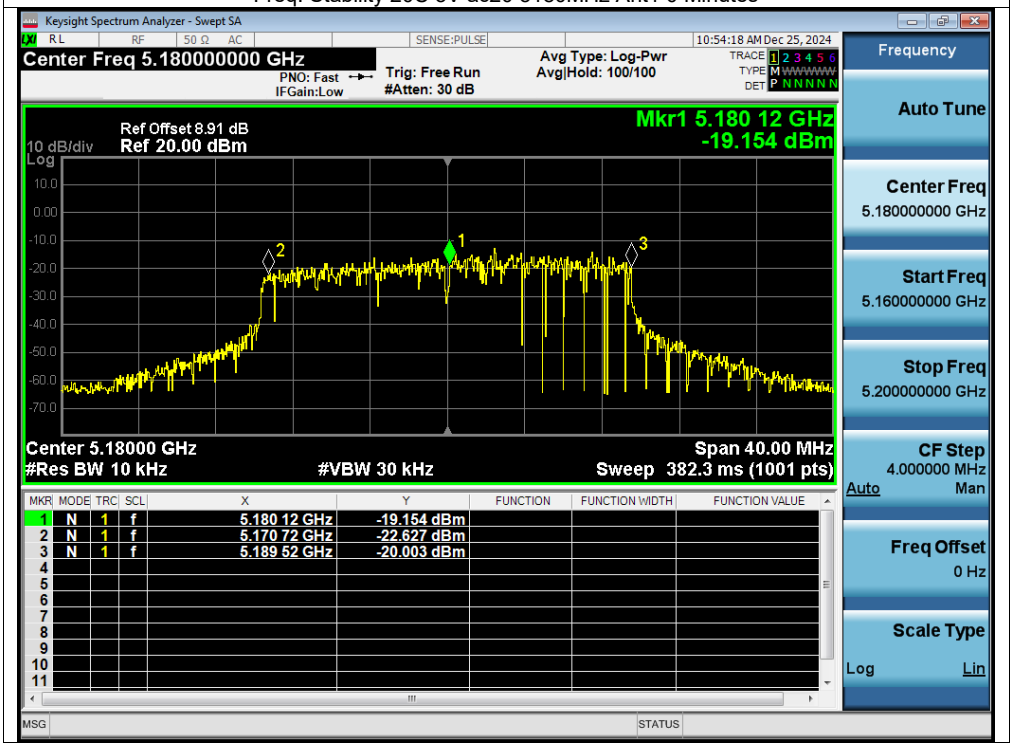
Freq. Stability 50C 5V n20 5180MHz Ant1 0 Minutes



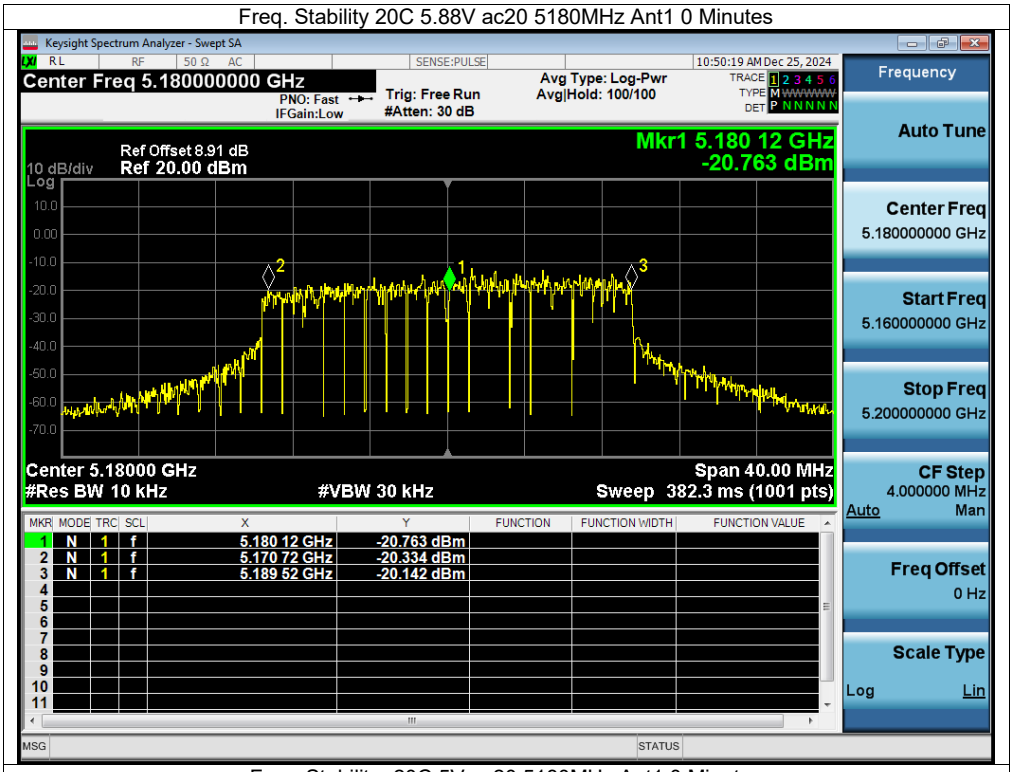
Freq. Stability 20C 4.25V ac20 5180MHz Ant1 0 Minutes



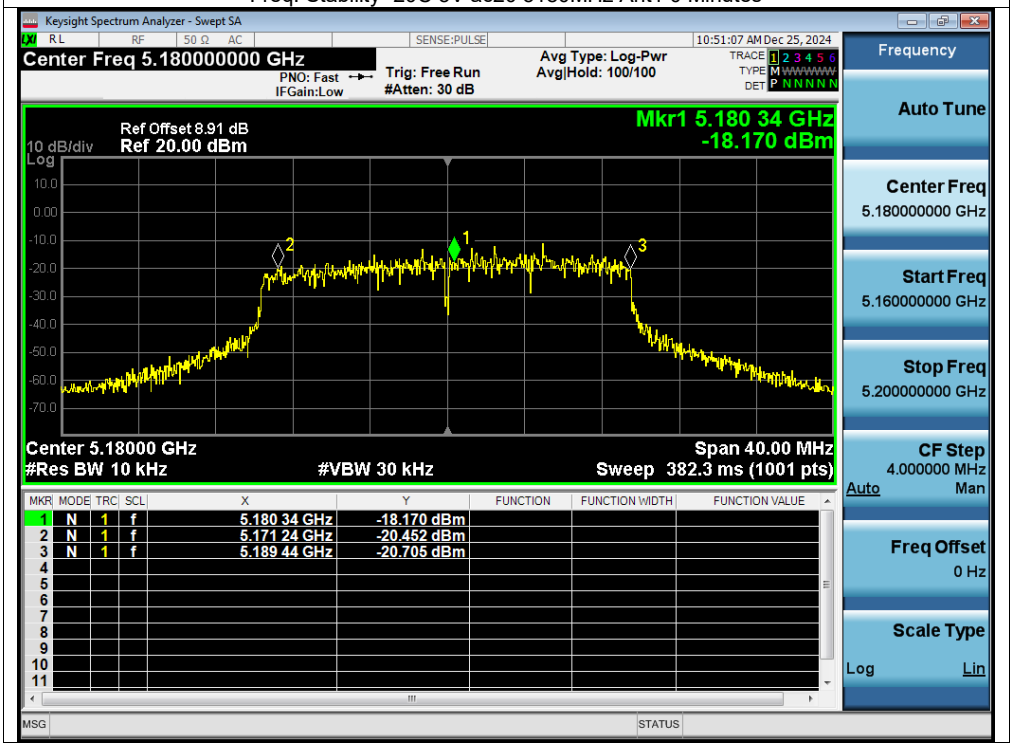
Freq. Stability 20C 5V ac20 5180MHz Ant1 0 Minutes



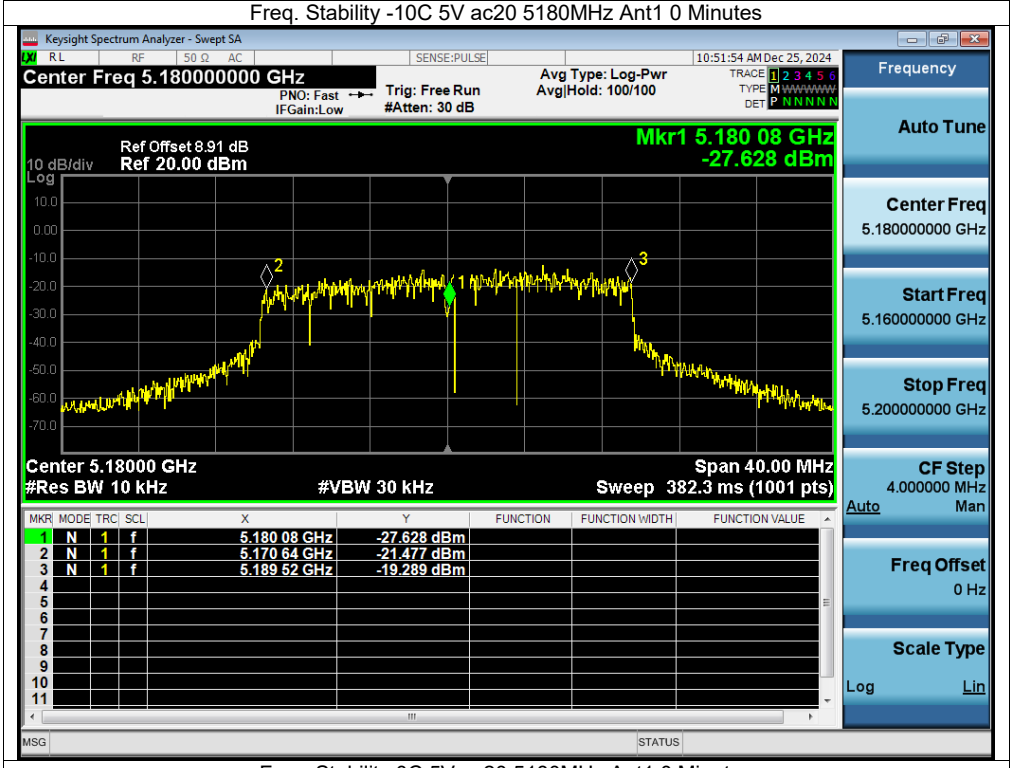
Freq. Stability 20C 5.88V ac20 5180MHz Ant1 0 Minutes



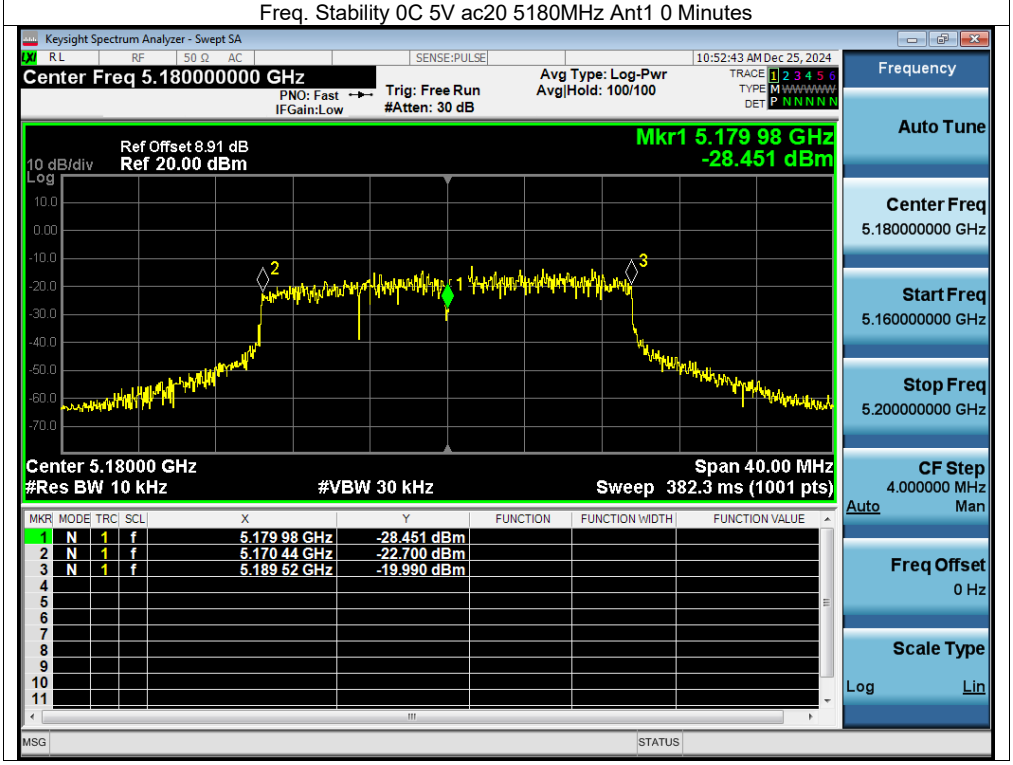
Freq. Stability -20C 5V ac20 5180MHz Ant1 0 Minutes



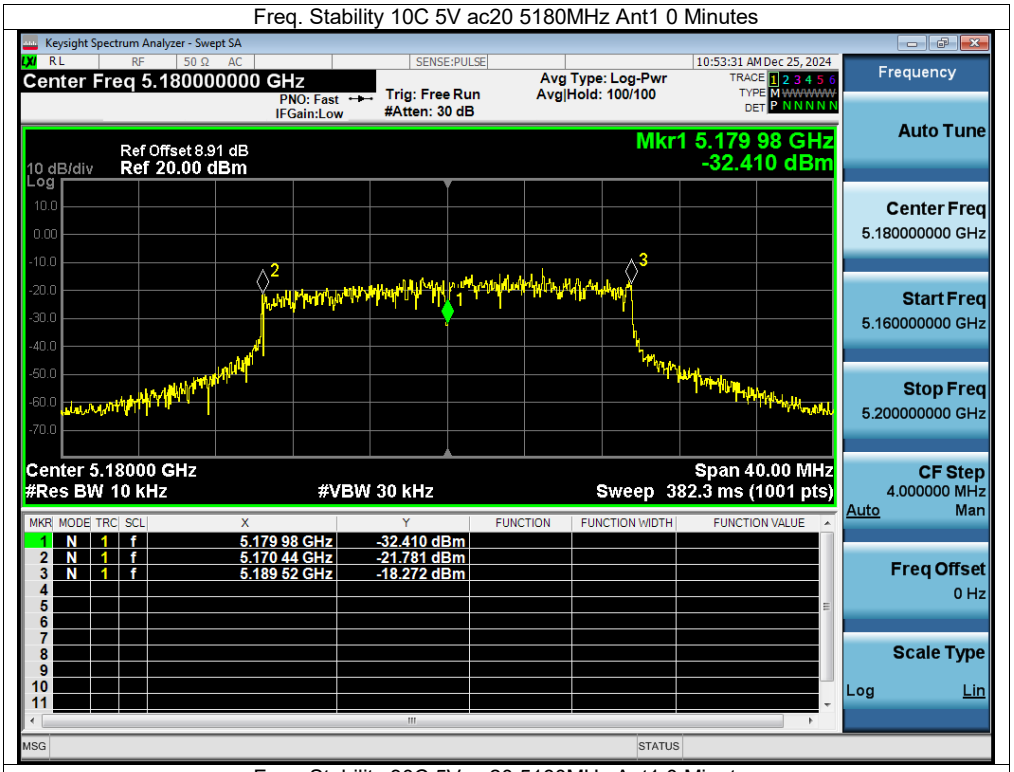
Freq. Stability -10C 5V ac20 5180MHz Ant1 0 Minutes



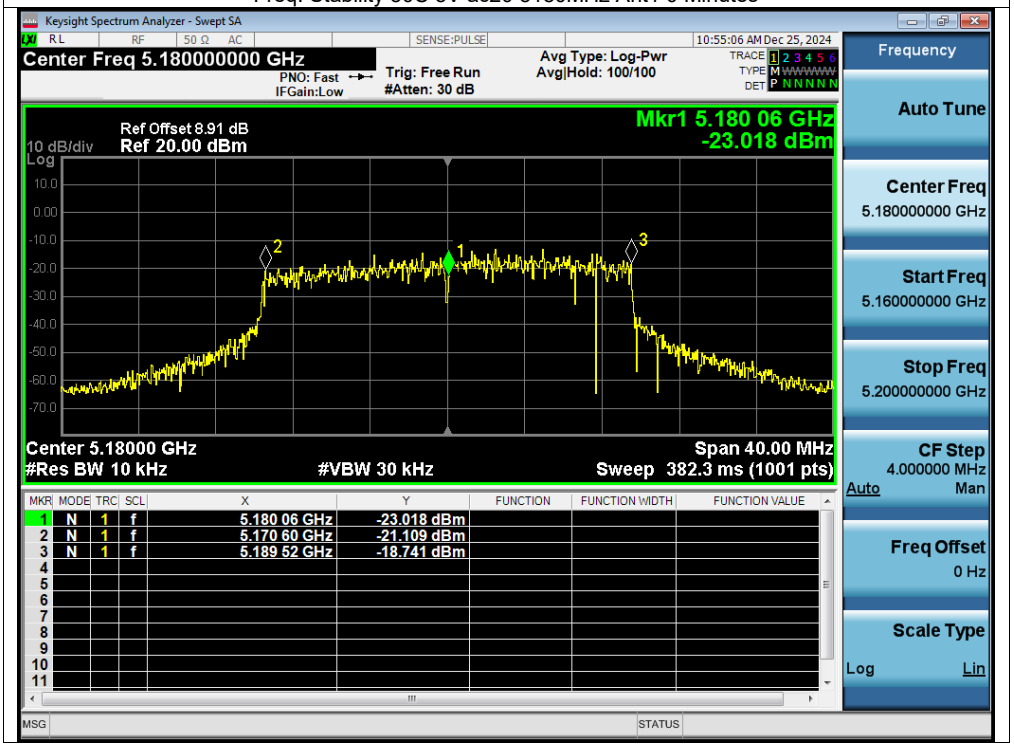
Freq. Stability 0C 5V ac20 5180MHz Ant1 0 Minutes



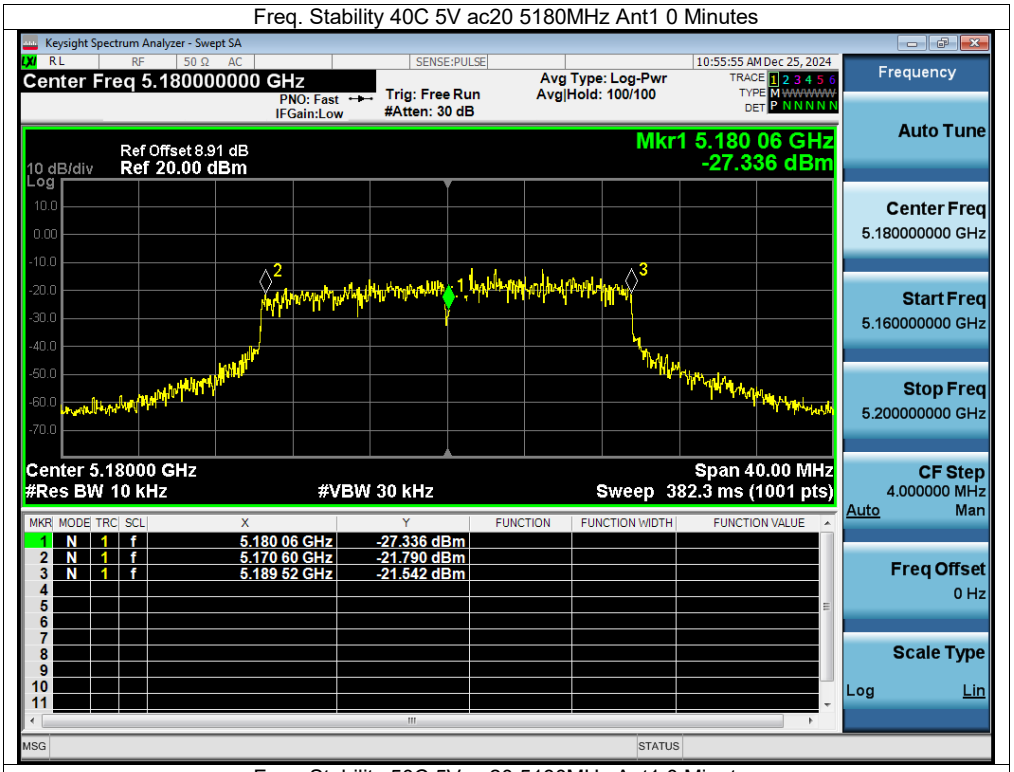
Freq. Stability 10C 5V ac20 5180MHz Ant1 0 Minutes



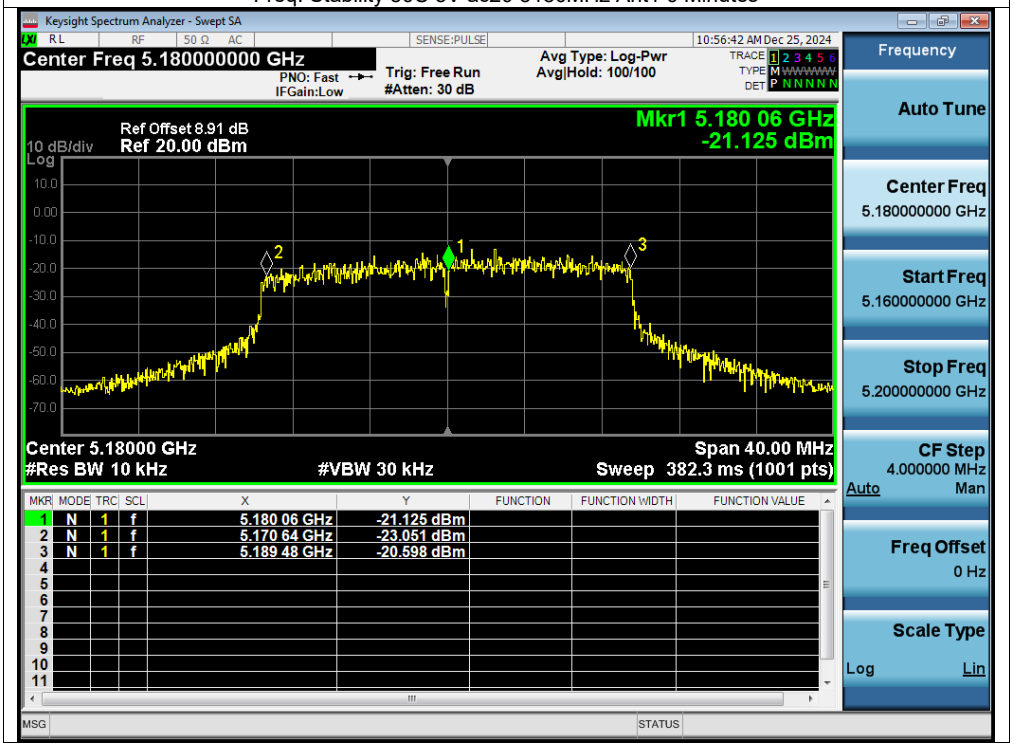
Freq. Stability 30C 5V ac20 5180MHz Ant1 0 Minutes



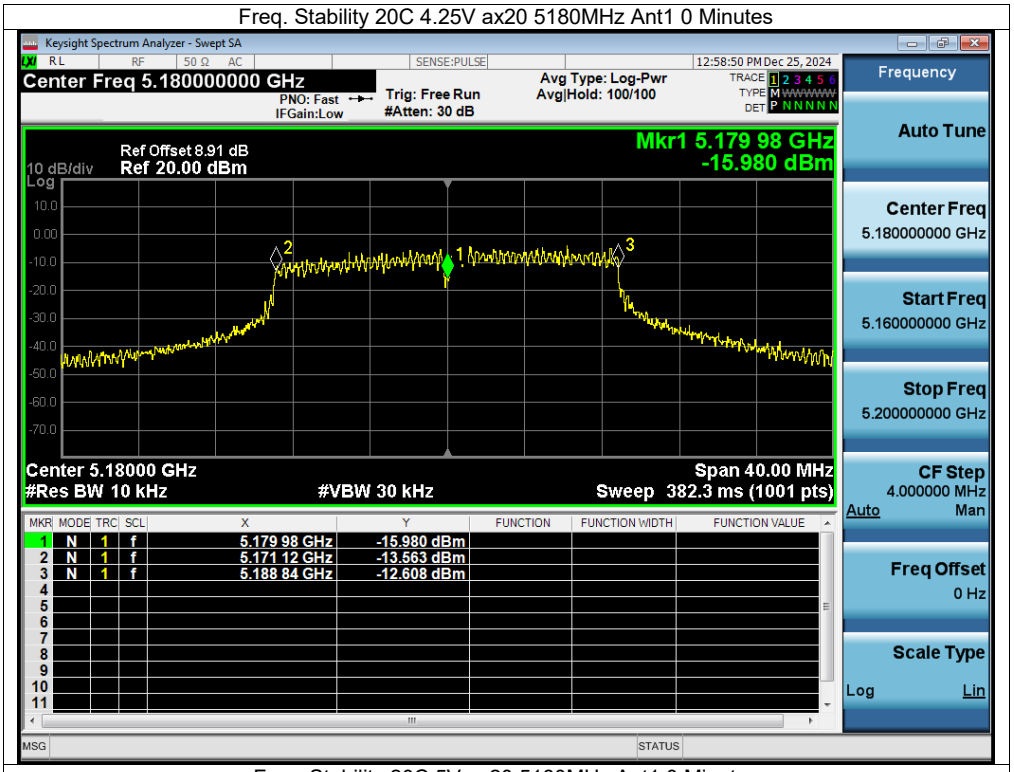
Freq. Stability 40C 5V ac20 5180MHz Ant1 0 Minutes



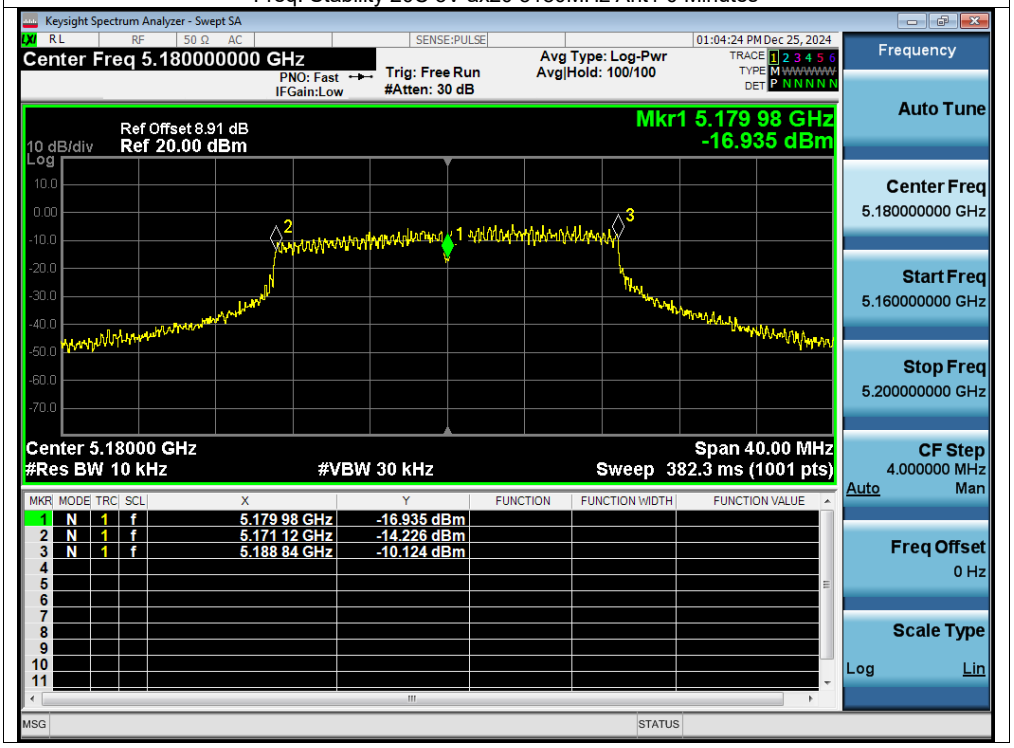
Freq. Stability 50C 5V ac20 5180MHz Ant1 0 Minutes



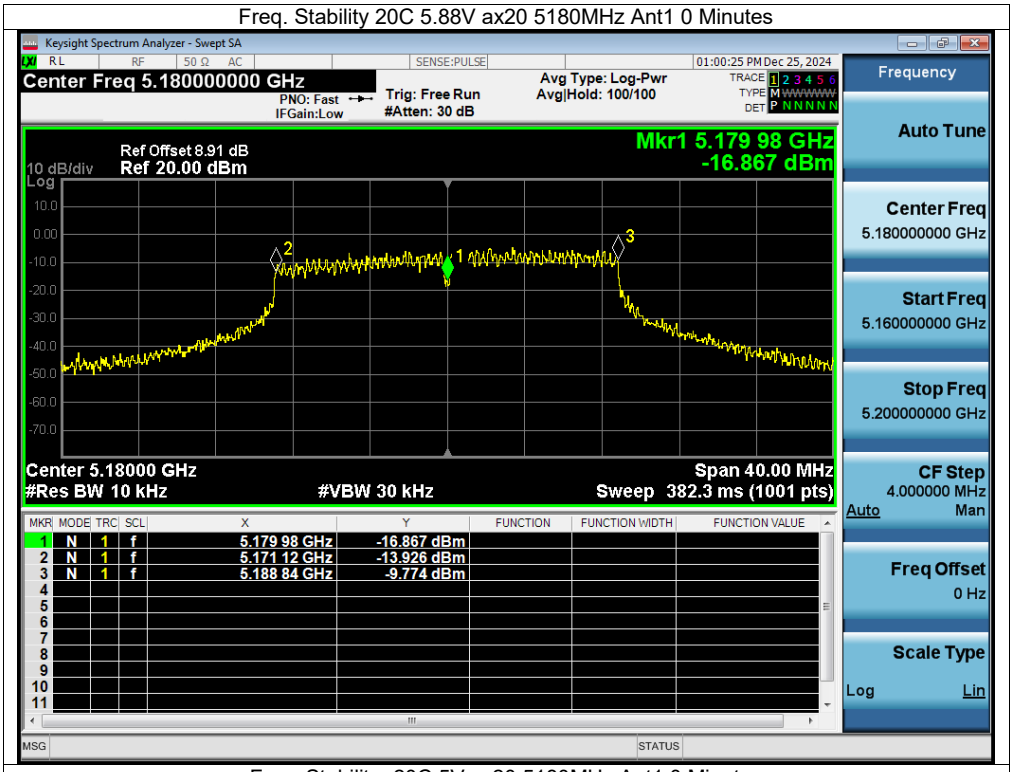
Freq. Stability 20C 4.25V ax20 5180MHz Ant1 0 Minutes



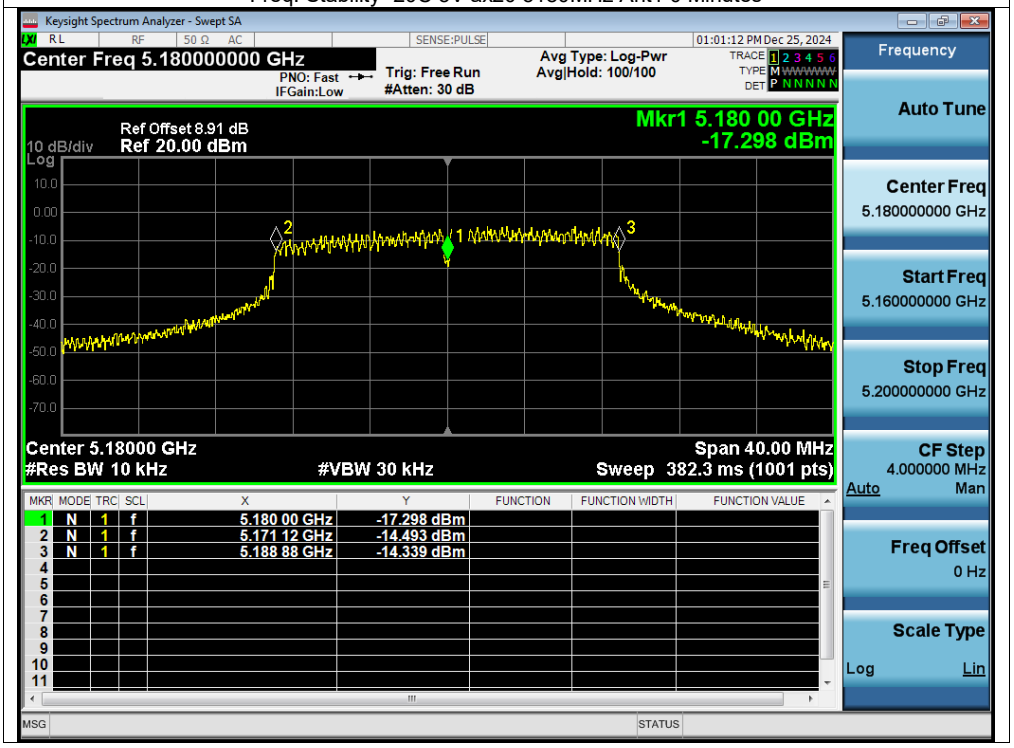
Freq. Stability 20C 5V ax20 5180MHz Ant1 0 Minutes



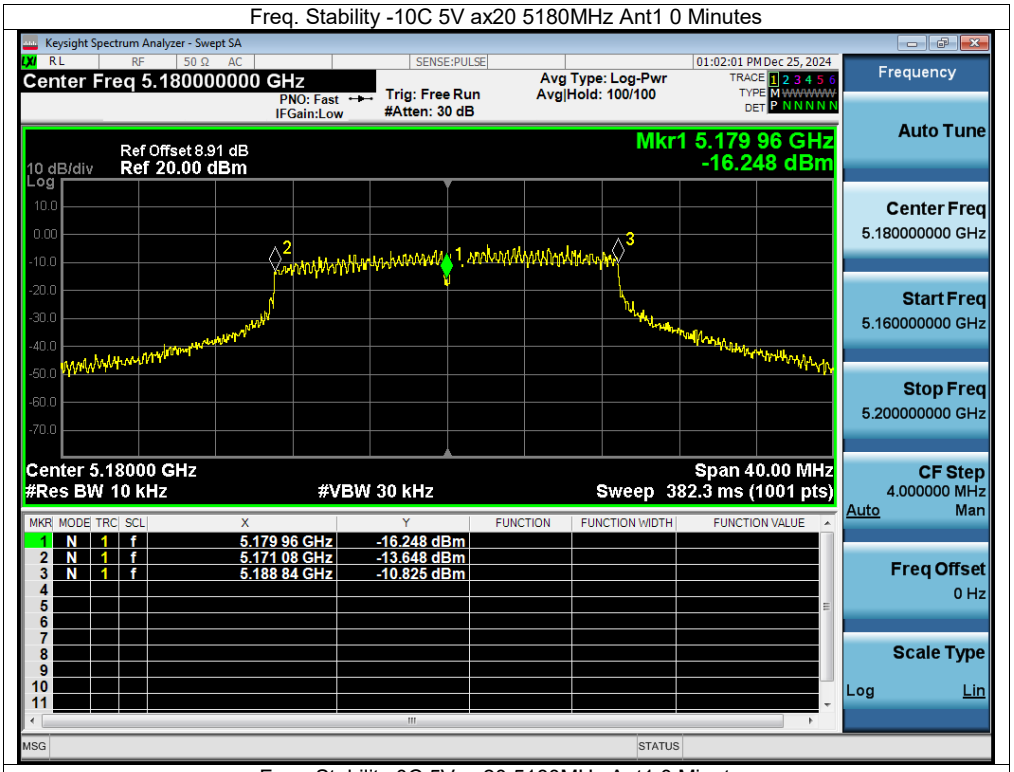
Freq. Stability 20C 5.88V ax20 5180MHz Ant1 0 Minutes



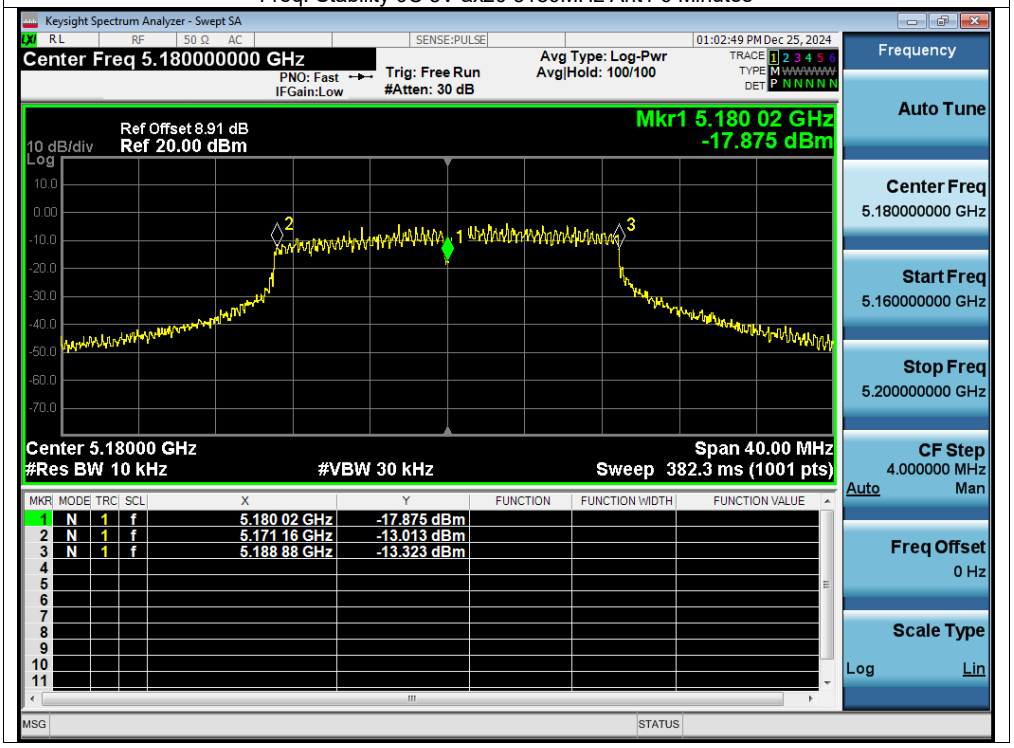
Freq. Stability -20C 5V ax20 5180MHz Ant1 0 Minutes



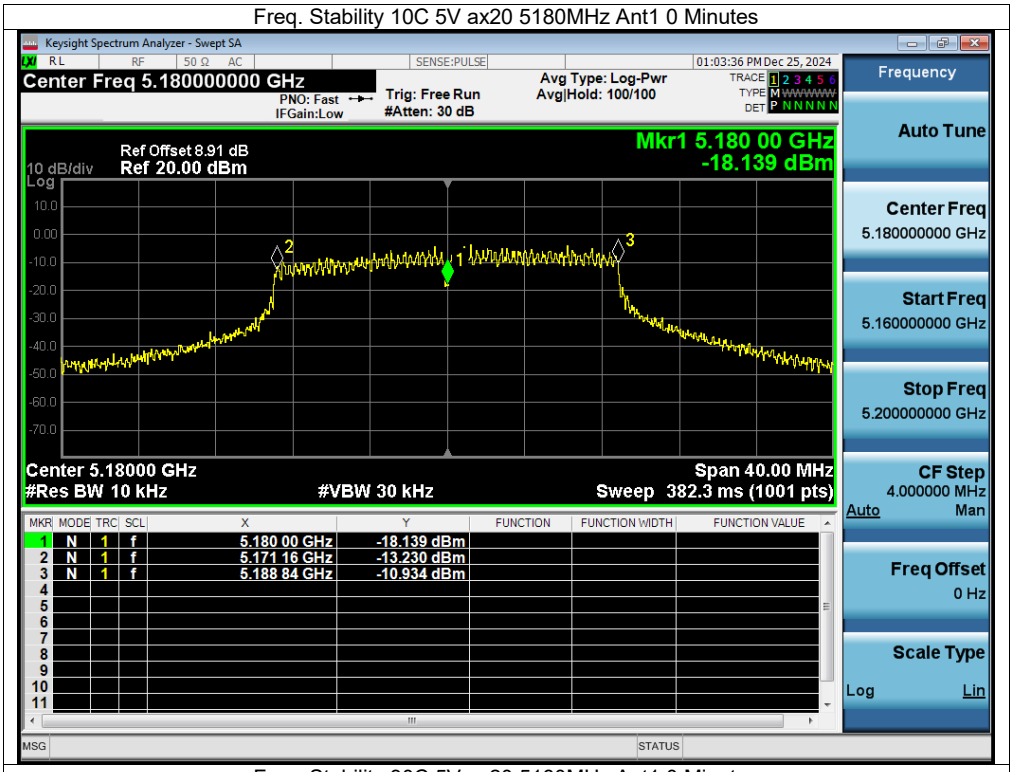
Freq. Stability -10C 5V ax20 5180MHz Ant1 0 Minutes



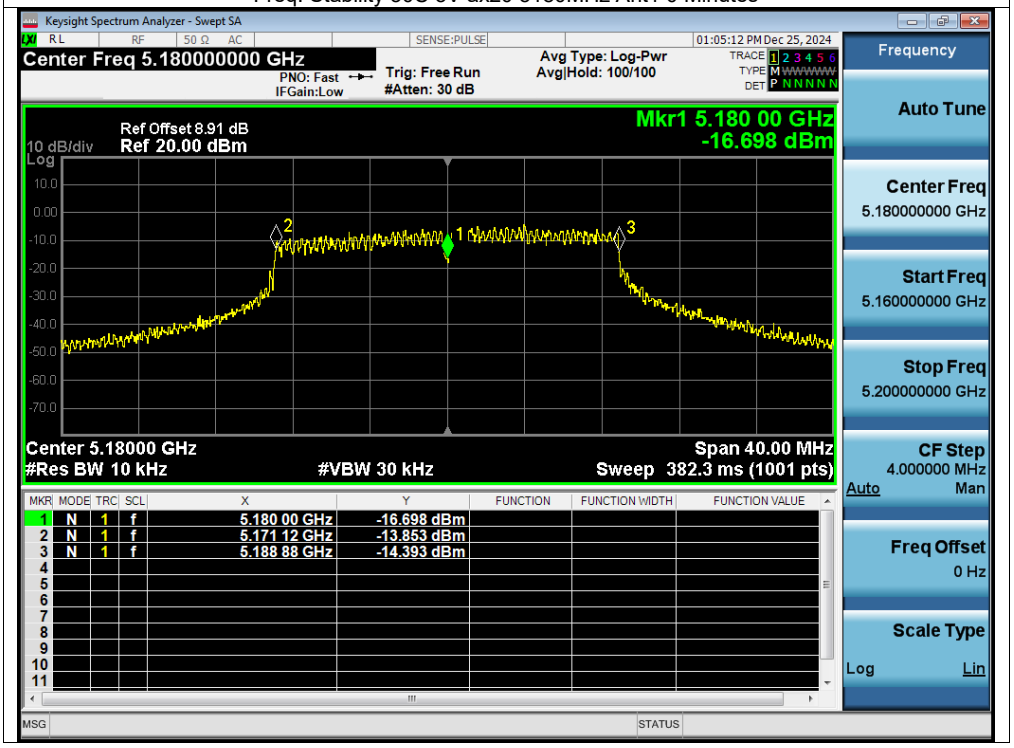
Freq. Stability 0C 5V ax20 5180MHz Ant1 0 Minutes



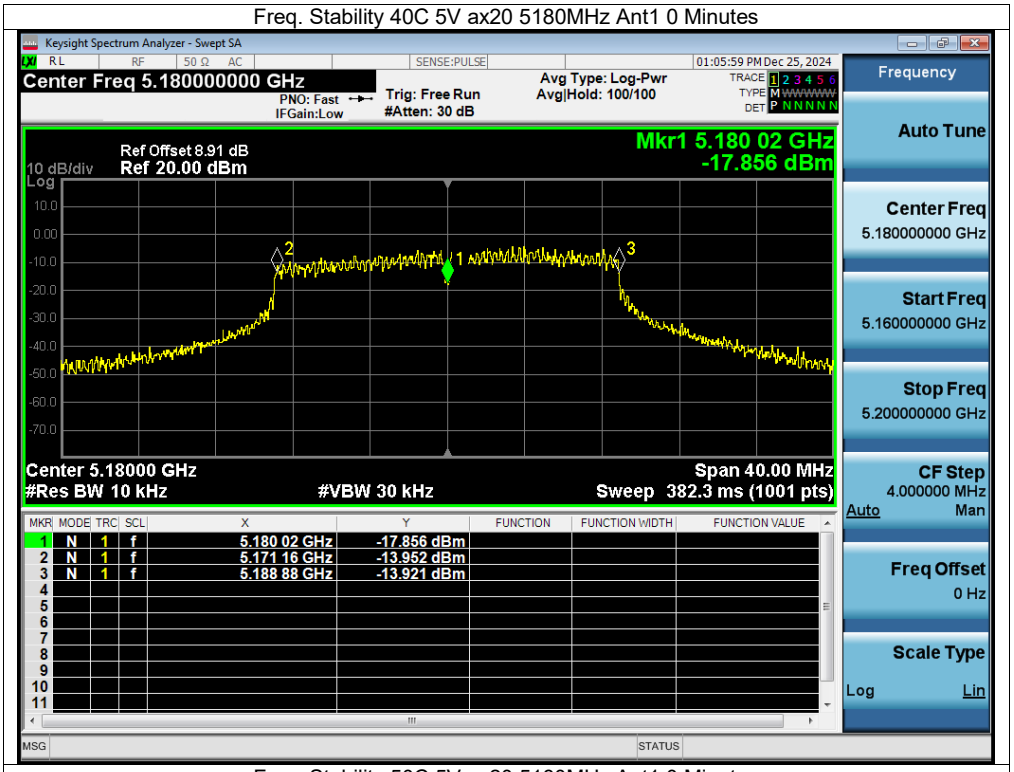
Freq. Stability 10C 5V ax20 5180MHz Ant1 0 Minutes



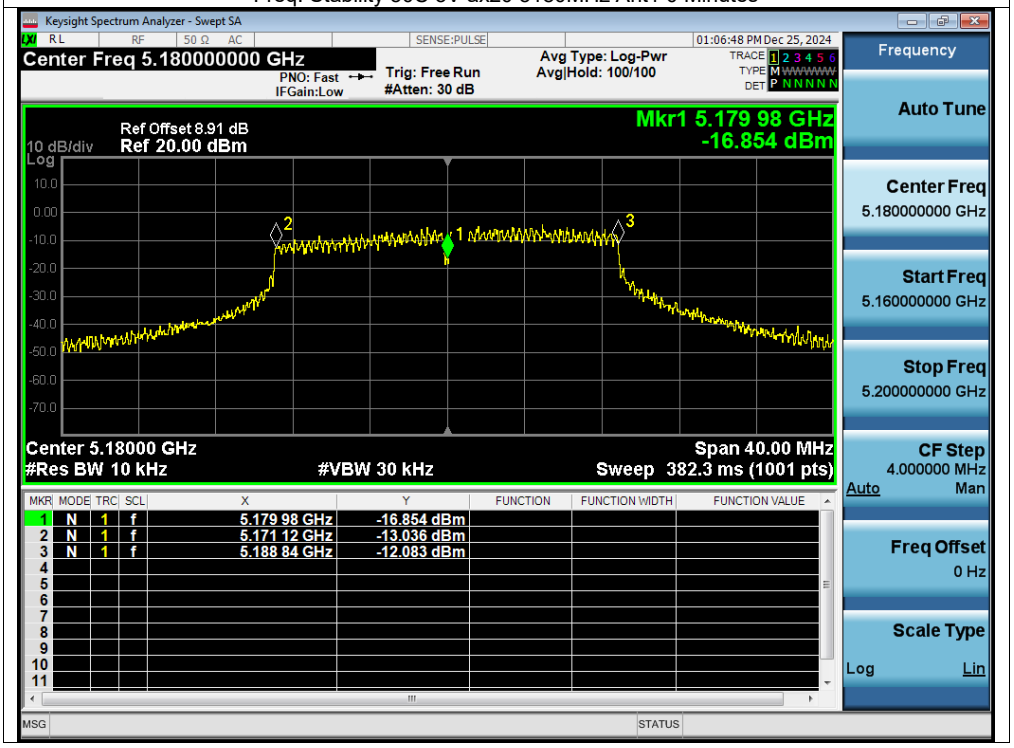
Freq. Stability 30C 5V ax20 5180MHz Ant1 0 Minutes



Freq. Stability 40C 5V ax20 5180MHz Ant1 0 Minutes



Freq. Stability 50C 5V ax20 5180MHz Ant1 0 Minutes



END OF REPORT