

FCC and ISCED Canada Radio Testing of the

Sensus Metering Systems Inc.
522M

In accordance with FCC 47 CFR Part 24 Subpart D, Part 101 Subpart C and ISCED Canada's Radio Standards Specifications RSS-119 and RSS-134

Prepared for: Sensus Metering Systems Inc.
639 Davis Drive
Morrisville, NC 27560

FCC ID: SDBWFL2
IC: 2220A-WFL2

COMMERCIAL-IN-CONFIDENCE

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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorized Signatory	Peter Walsh	2021-May-03	
Testing	Thierry Jean-Charles	2021-May-03	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

FCC Accreditation
Designation Number US1063 Tampa, FL Test Laboratory

Innovation, Science, and Economic Development Canada
Accreditation
Site Number 2087A-2 Tampa, FL Test Laboratory

EXECUTIVE SUMMARY

Samples of this product were tested and found to be in compliance with FCC Part 24 Subpart D, Part 101 Subpart C and ISCED Canada's RSS-119 and RSS-134.

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	2021-May-03

1.2 Introduction

The purpose of this report is to demonstrate compliance with the FCC's Code of Federal Regulations Part 24 Subpart D, Part 101 Subpart C and Innovation Science and Economic Development Canada's Radio Standards Specification RSS-119 and RSS-134 for the tests documented herein.



Applicant	Sensus Metering Systems Inc.
Manufacturer	Sensus Metering Systems Inc.
Applicant's Email Address	james.francisco@xyleminc.com
Model Number(s)	522M
Serial Number(s)	125000283, KDS TCXO (Radiated Emissions) 125000297, TXC TCXO (Radiated Emissions) 125000294, TAITIEN TCXO (Radiated Emissions) 125000296, TXC TCXO (RF Conducted Measurements) 125000291, KDS TCXO (RF Conducted Measurements) 125000293, TAITIEN TCXO (RF Conducted Measurements)
FCC ID	SDBWFL2
ISED Certification Number	2220A-WFL2
Hardware Version(s)	WFL2B
Software Version(s)	B1.0.0.9
Number of Samples Tested	6
Test Specification/Issue/Date	US Code of Federal Regulations (CFR): Title 47, Part 24, Subpart D: Personal Communications Services – 2021 US Code of Federal Regulations (CFR): Title 47, Part 101, Subpart C: Fixed Microwave Services -2012 Industry Canada Radio Standards Specification: RSS-119 - Land Mobile and Fixed Equipment Operating in the Frequency Range 27.41-960 MHz, Issue 12, May 2015 Industry Canada Radio Standards Specification: RSS-134 - 900 MHz Narrowband Personal Communication Service, Issue 2, February 2016
Test Plan/Issue/Date	2021-February-15
Order Number	72166992
Date	2021-February-19
Date of Receipt of EUT	2021-March-25
Start of Test	2021-March-25
Finish of Test	2021-April-29
Name of Engineer(s)	Thierry Jean-Charles, Jean N. Rene
Related Document(s)	US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures - 2021 Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-GEN - General Requirements for Compliance of Radio Apparatus, Issue 5, Amendment 1, March 2019



ANSI C63.26: 2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services.



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with 24 Subpart D, Part 101 Subpart C and ISED Canada's RSS-119 and RSS-134 is shown below.

Table 1.3-1: Test Result Summary

Test Parameter	Test Plan (Yes/No)	Test Results	FCC 47 CFR Rule Part	ISED Canada's RSS	Test Report Page No.
RF Power Output	Yes	Pass	2.1046; 24.132; 101.113(a)	RSS-Gen 6.12; RSS-119 5.4; RSS-134 4.3(a), (b)	12
Out of Band Unwanted Emissions	No	-----	2.1053; 24.133 a(1), a(2); 101.111 a(6)	RSS-Gen 6.13; RSS-119 5.8.6; RSS-134 4.4	28
Occupied Bandwidth	No	-----	2.1049; 101.109	RSS-Gen 6.7	42
Spurious Emissions at Antenna Terminals	No	-----	2.1053; 24.133 a(1), a(2); 101.111 a(6)	RSS-Gen 6.13; RSS-119 5.8.6; RSS-134 4.4	54
Field Strength of Spurious Radiation	Yes	Pass	2.1053; 24.133 a(1), a(2); 101.111a(6)	RSS-Gen 6.13; RSS-119 5.8.6; RSS-134 4.4	60
Frequency Stability	Yes	Pass	2.1055; 24.135; 101.107	RSS-Gen 6.11; RSS-119 5.3; RSS-134 4.5	71



1.4 Product Information

1.4.1 Technical Description

The equipment under test was a two-way endpoint device used in utility metering applications. It is a battery-operated transceiver hardware / software architecture which is able to support Walk By, Drive By and Fixed Base 2-Watt operation.

Technical Details

Mode of Operation: Flexnet Radio
 Frequency Range: 901 - 960 MHz
 Antenna Type/Gain: Asymmetrical Dipole Antenna, 2 dBi
 Input Power: 3.6 VDC

The 522M transmitters produce 6 distinct modulation formats. The emissions designators for the modulation types used by the 522M transmitters are as follows:

EMISSIONS DESIGNATORS:

Normal Mode: 9K60F2D (7-FSK)
 Double Density Mode: 9K60F2D (13-FSK)
 C&I Mode: 4K80F2D (7-FSK)
 Boost Mode: 1K10F2D (7-FSK)
 MPass Mode (5K): 5K90F1D (2-GFSK)
 MPass Mode (10K): 11K80F1D (2-GFSK)

A full description and detailed product specification details are available from the manufacturer.

Table 1.4.1-1 – Cable Descriptions

Cable/Port	Description
Power Leads	2.3m, Not Shielded, Twisted Pair, EUT to DC Power Supply

Table 1.4.1-2 – Support Equipment Descriptions

Make/Model	Description
Lambda / LA-200	Regulated DC Power Supply
Hewlett Packard / 6291A	DC Power Supply, S/N: 1928A05628



Declaration of Build Status

EQUIPMENT DESCRIPTION			
Model Name/Number	522M		
Part Number	5396331200095		
Hardware Version	WFL2B		
Software Version	B1.0.0.9		
FCC ID (if applicable)	SDBWFL2		
ISED ID (if applicable)	2220A-WFL2		
Technical Description (Please provide a brief description of the intended use of the equipment)	Remote Telemetry module		

UN-INTENTIONAL RADIATOR	
Highest frequency generated or used in the device or on which the device operates or tunes	960 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	32kHz
Class A Digital Device (Use in commercial, industrial or business environment) ☐	
Class B Digital Device (Use in residential environment only) ☒	

Power Source			
AC	Single Phase	Three Phase	Nominal Voltage
	☐	☐	
External DC	Nominal Voltage		Maximum Current
Battery	Nominal Voltage		Battery Operating End Point Voltage
	3.6VDC		3.2VDC

EXTREME CONDITIONS			
Maximum temperature	+85	°C	Minimum temperature
			-40 °C

Ancillaries
Please list all ancillaries which will be used with the device.

I hereby declare that the information supplied is correct and complete.

Name: James Francisco

Position held: Sr. HW Test Regulatory Engineer

Date: 4/28/2021



1.4.2 Modes of Operation

The tested mode of operation was for the 900 MHz Flexnet radio transmitting continuously. The TX power setting was not configurable during the evaluation.

1.4.3 Monitoring of Performance

Preliminary measurements were performed three TCXO configurations of the EUT (TXC, KDS and TAITIEN). Where applicable, the results are provided for the worst case.

The radiated emissions evaluations were performed on the EUT connected to a DC power supply. The EUT was investigated in three orthogonal orientations. The EUT set up vertically on the table top was determined to be the worst case and was used for all the radiated emissions results documented herein.

For the RF conducted measurements, the EUT was configured with an RF connector at the antenna port.

The EUT is designed to operate in multiple bands under the requirements of CFR 47 Parts 24 and 101. The following is a list of the frequency bands of operation sorted based on the FCC rule parts in which the band is associated.

CFR Title 47 Rule Part	ISED Canada RSS	Frequency Band of Operation (MHz)
24D	134	901.0 - 902.0
24D	134	930.0 - 931.0
24D	134	940.0 - 941.0
101	119	928.85 - 929.0
101	119	932.0 - 932.5
101	119	941.0 - 941.5
101	N/A	959.85 - 960.0



Based on the requirements set forth in accordance 47 CFR 2.1046-2.1057 as stated above, the methodology in selecting the places to test in the available bands of operation is outlined in the following table.

CFR Title 47 Rule Part	ISED Canada RSS	Frequency Band of Operation (MHz)	Location in the Range of Operation	Approx. Test Freq.
24D	134	901.0 - 902.0	Middle	901.5000
101	119	928.85 - 929.0	Middle	928.9250
24D	134	930.0 - 931.0	Middle	930.5000
101	119	932.0 - 932.5	Middle	932.2500
24D	134	940.0 - 941.0	1 near top and 1 near bottom	940.0125
101	119	941.0 - 941.5		941.4875
101	N/A	959.85 – 960.0	Middle	959.9250

1.4.4 Performance Criteria

The parameters evaluated are summarized below.

Table 1.4.4-1: Performance Criteria

Parameter	Requirement
RF Output Power	FCC 47 CFR Part 2.1046; 24.132; 101.113(a) ISED Canada RSS-119 5.4; RSS-134 4.3(a),(b)
Out-of-Band Unwanted Emissions	FCC 47 CFR Parts: 2.1053; 24.133 a(1), a(2); 101.111 a(6) ISED Canada RSS-119 5.8.6; RSS-134 4.4
Occupied Bandwidth	ISED Canada RSS-GEN 6.7
Unwanted Emissions at the Antenna Terminal	FCC 47 CFR Parts: 2.1053; 24.133 a(1), a(2); 101.111 a(6) ISED Canada RSS-119 5.8.6; RSS-134 4.4
Radiated Spurious Emissions	FCC 47 CFR Parts: 2.1053; 24.133 a(1), a(2); 101.111 a(6) ISED Canada RSS-119 5.8.6; RSS-134 4.4
Frequency Stability	FCC Parts: 2.1055; 24.135 ISED Canada RSS-134 4.5

1.5 Deviations from the Standard

No deviations from the applicable test standard were made during testing.



1.6 EUT Modification Record

The table below details modifications made to the EUT during the test program. The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
None			

1.7 Test Location

TÜV SÜD Product Service conducted the following tests at our Tampa FL Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
DC Powered Operating		
RF Power Output	Thierry Jean-Charles	A2LA
Out of Band Emissions	Thierry Jean-Charles	A2LA
Occupied Bandwidth	Thierry Jean-Charles	A2LA
Spurious Emissions at the Antenna Terminal	Thierry Jean-Charles	A2LA
Field Strength of Spurious Radiation	Thierry Jean-Charles and Jean N. Rene	A2LA
Frequency Stability	Thierry Jean-Charles	A2LA

Office Address:

TÜV SÜD America, Inc.
5610 W. Sligh Ave, Suite 100
Tampa, FL 33634
USA



2 Test Details

2.1 RF Power Output

2.1.1 Specification Reference

FCC 47 CFR Part 2.1046; 24.132; 101.113(a)
ISED Canada RSS-119 5.4; RSS-134 4.3(a),(b)

2.1.2 Equipment Under Test and Modification State

TXC TCXO, SN: 125000296
KDS TCXO, SN: 125000291
TAITIEN TCXO, SN: 125000293

2.1.3 Date of Test

2021-April-16

2.1.4 Test Method

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through 30 dB of passive attenuation. The resolution and video bandwidths of the spectrum analyzer were set at sufficient levels, >> signal bandwidth.

2.1.5 Environmental Conditions

Ambient Temperature	25.9 °C
Relative Humidity	43.2 %
Atmospheric Pressure	1011 mbar

2.1.6 Test Results

522M - TXC TCXO

Table 2.1.6-1: RF Output Power – TXC TCXO – FCC 47 CFR Part 24.132; ISCED Canada RSS-134 4.3

Frequency MHz	Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
901.5	29.83	2	31.83	40.6	8.77
930.5	29.59	2	31.59	40.6	9.01
940.0125	29.42	2	31.42	40.6	9.18

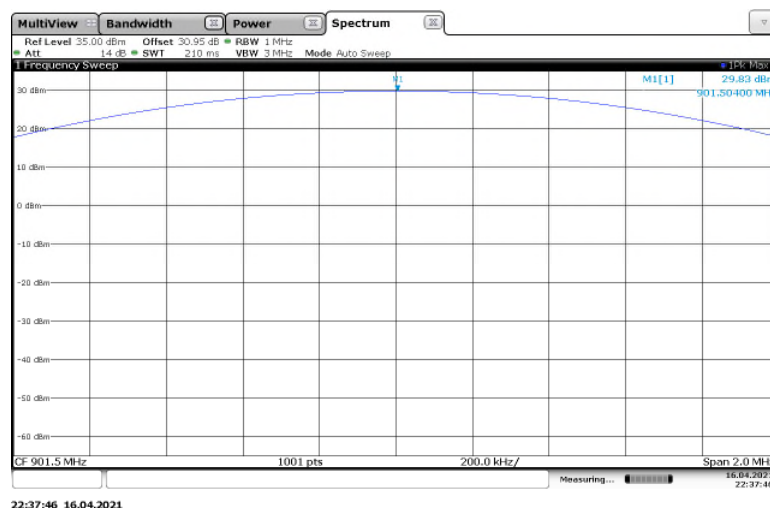


Figure 2.1.6-1: RF Output Power – TXC TCXO – 901.5 MHz

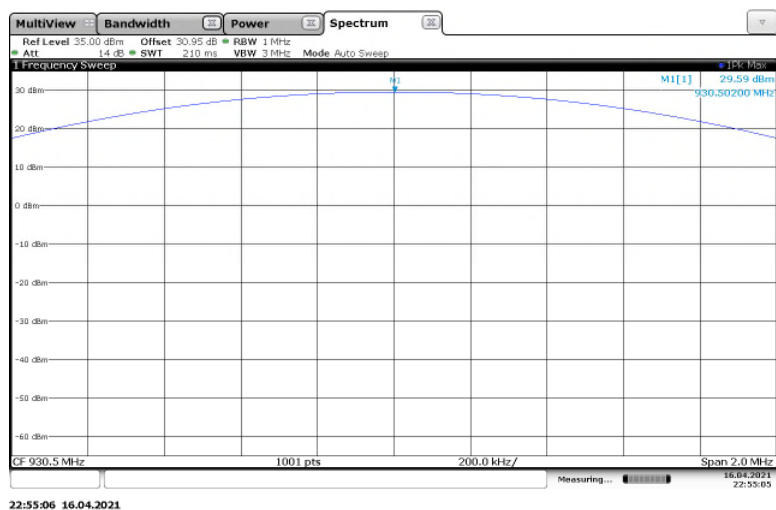


Figure 2.1.6-2: RF Output Power – TxC TCXO – 930.5 MHz

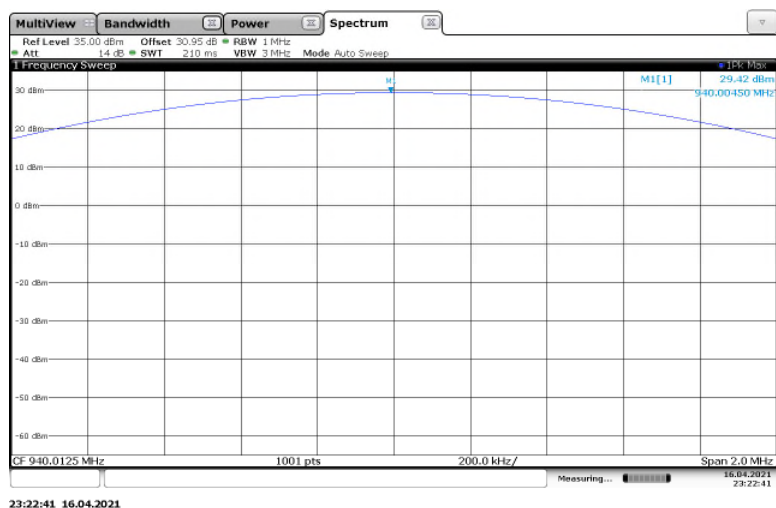


Figure 2.1.6-3: RF Output Power – TxC TCXO – 940.0125 MHz

Table 2.1.6-2: RF Output Power – TXC TCXO – FCC 47 CFR Part 101.113(a); ISED Canada RSS-119 5.4

Frequency MHz	Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
928.925	29.59	2	31.59	44	12.41
932.25	29.54	2	31.54	44	12.46
941.4875	29.40	2	31.40	44	12.60
959.925	29.11	2	31.11	44	12.89

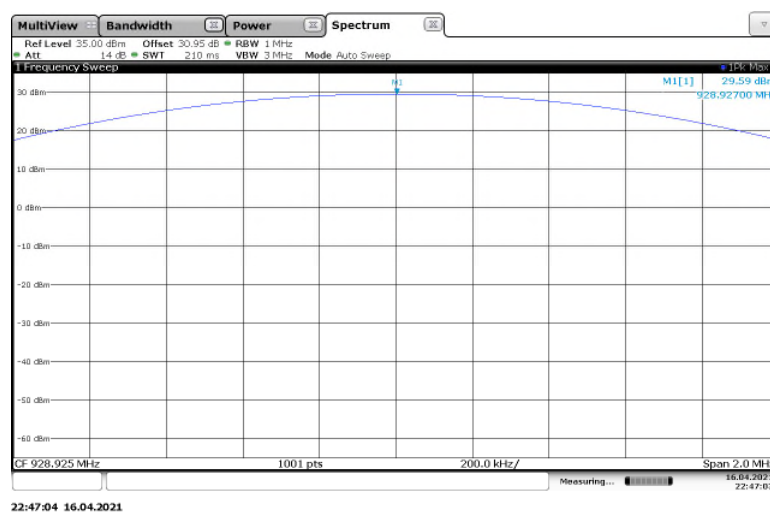


Figure 2.1.6-4: RF Output Power – TXC TCXO – 928.925 MHz

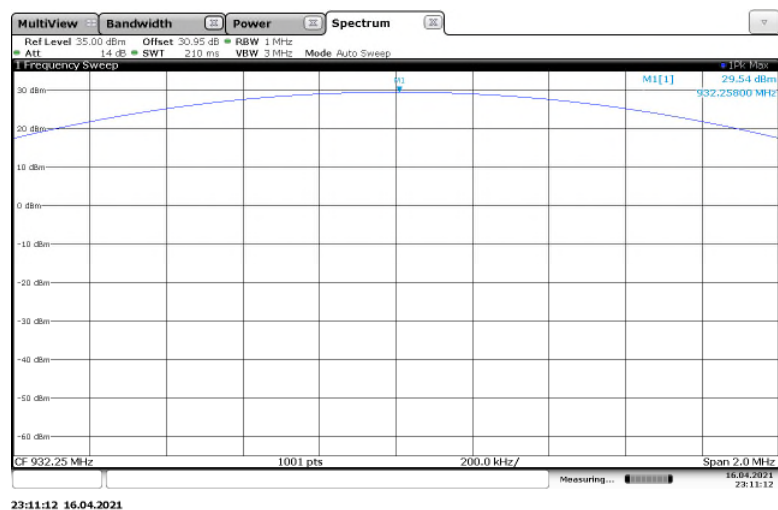


Figure 2.1.6-5: RF Output Power – TXC TCXO – 932.25 MHz

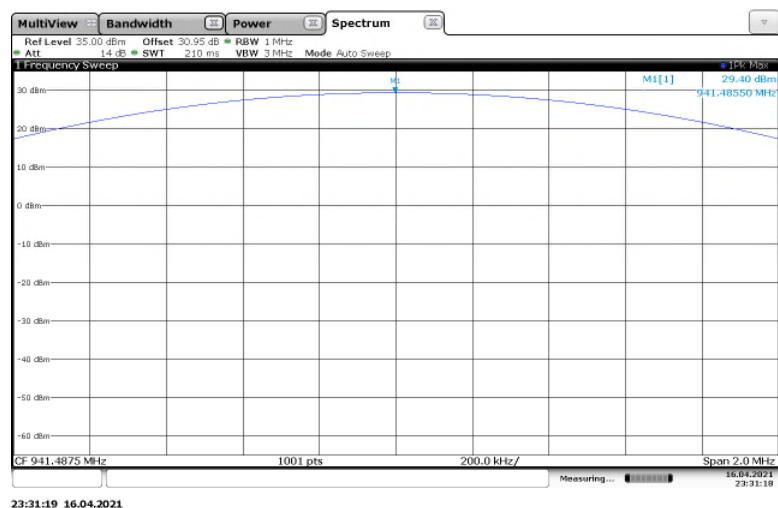


Figure 2.1.6-6: RF Output Power – TXC TCXO – 941.4875 MHz

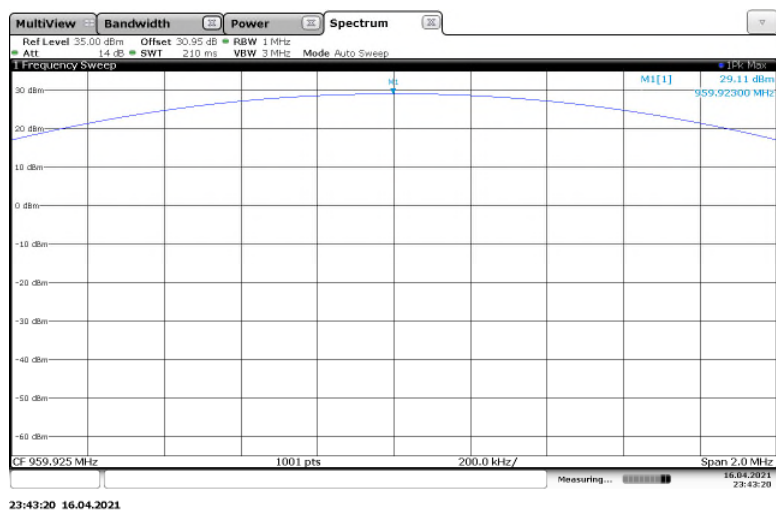


Figure 2.1.6-7: RF Output Power – TXC TCXO – 959.925 MHz

522M - KDS TCXO

Table 2.1.6-3: RF Output Power – KDS TCXO – FCC 47 CFR Part 24.132; ISCED Canada RSS-134 4.3

Frequency MHz	Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
901.5	29.41	2	31.41	40.6	9.19
930.5	29.21	2	31.21	40.6	9.39
940.0125	29.05	2	31.05	40.6	9.55

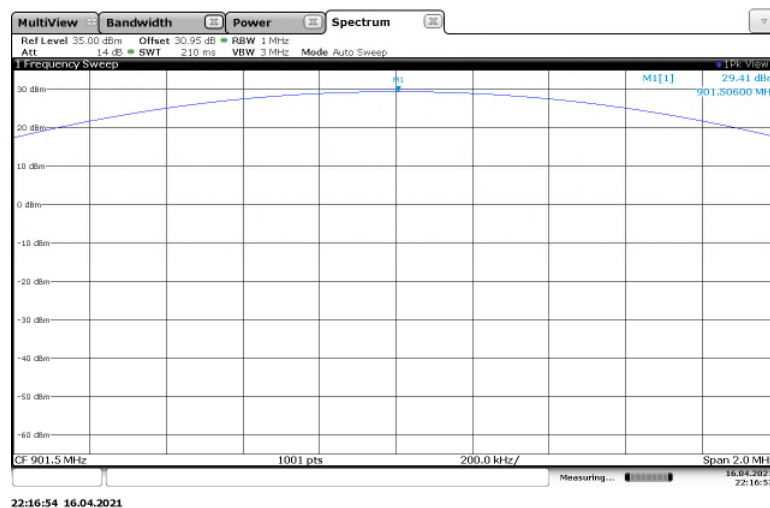


Figure 2.1.6-8: RF Output Power – KDS TCXO – 901.5 MHz

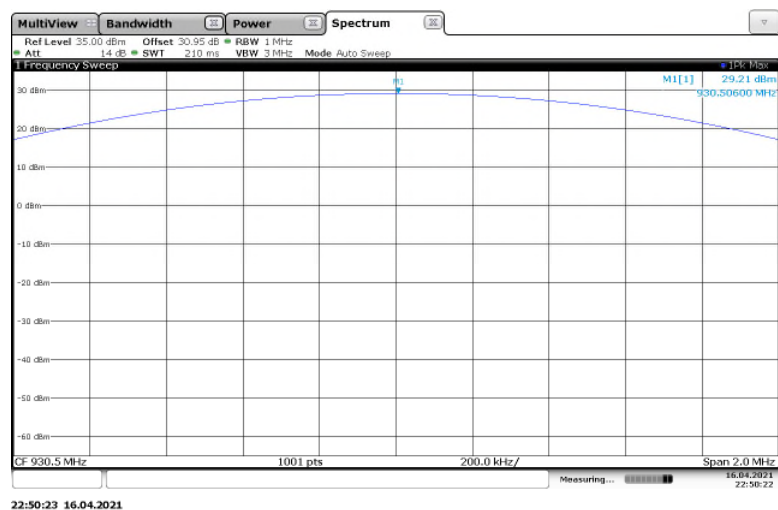


Figure 2.1.6-9: RF Output Power – KDS TCXO – 930.5 MHz

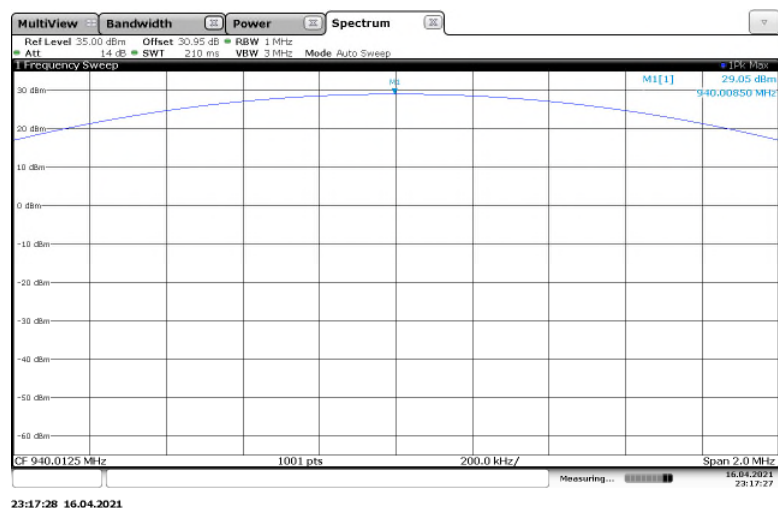


Figure 2.1.6-10: RF Output Power – KDS TCXO – 940.0125 MHz

Table 2.1.6-4: RF Output Power – KDS TCXO – FCC 47 CFR Part 101.113(a); ISED Canada RSS-119 5.4

Frequency MHz	Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
928.925	29.24	2	31.24	44	12.76
932.25	29.19	2	31.19	44	12.81
941.4875	29.03	2	31.03	44	12.97
959.925	28.74	2	30.74	44	13.26

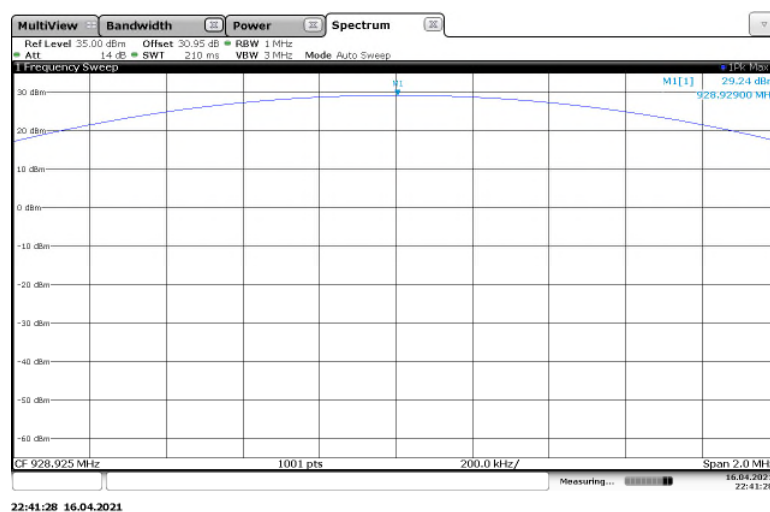


Figure 2.1.6-11: RF Output Power – KDS TCXO – 928.925 MHz

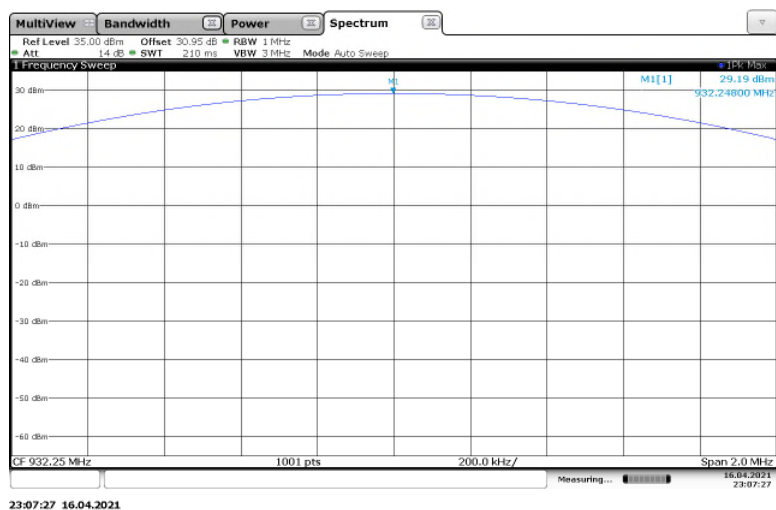


Figure 2.1.6-12: RF Output Power – KDS TCXO – 932.25 MHz

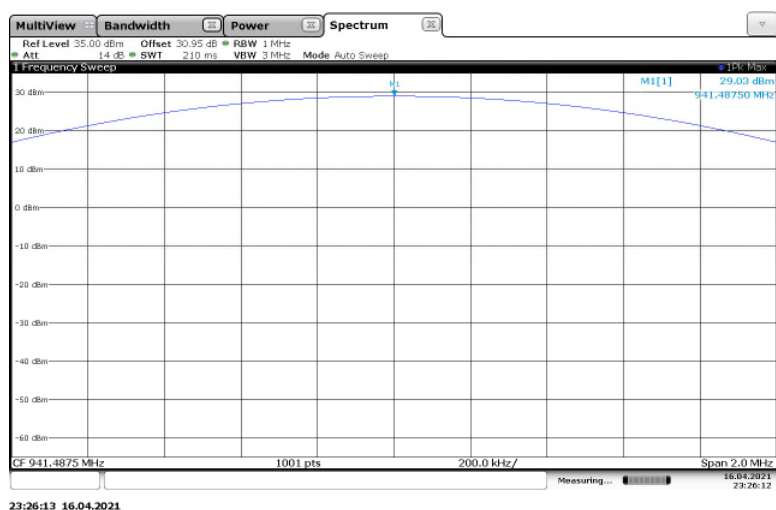


Figure 2.1.6-13: RF Output Power – KDS TCXO – 941.4875 MHz

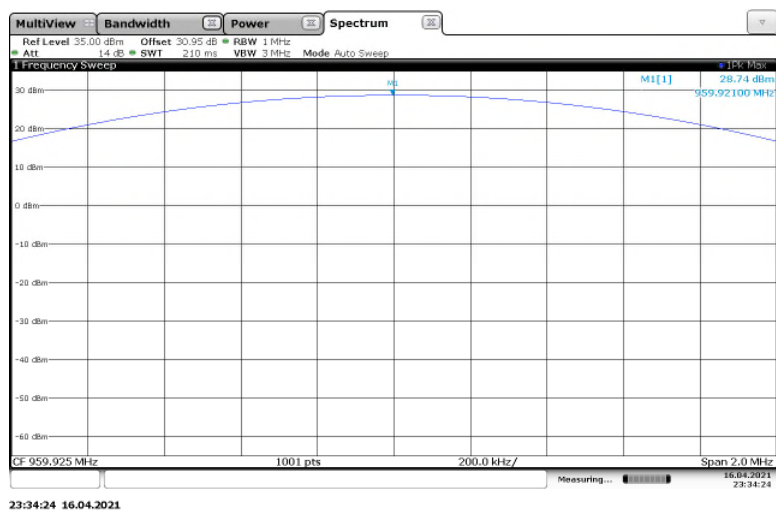


Figure 2.1.6-14: RF Output Power – KDS TCXO – 959.925 MHz

522M - TAITIEN TCXO

Table 2.1.6-5: RF Output Power – TAITIEN TCXO – FCC 47 CFR Part 24.132; ISED Canada RSS-134 4.3

Frequency MHz	Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
901.5	29.6	2	31.60	40.6	9.00
930.5	29.43	2	31.43	40.6	9.17
940.0125	29.28	2	31.28	40.6	9.32

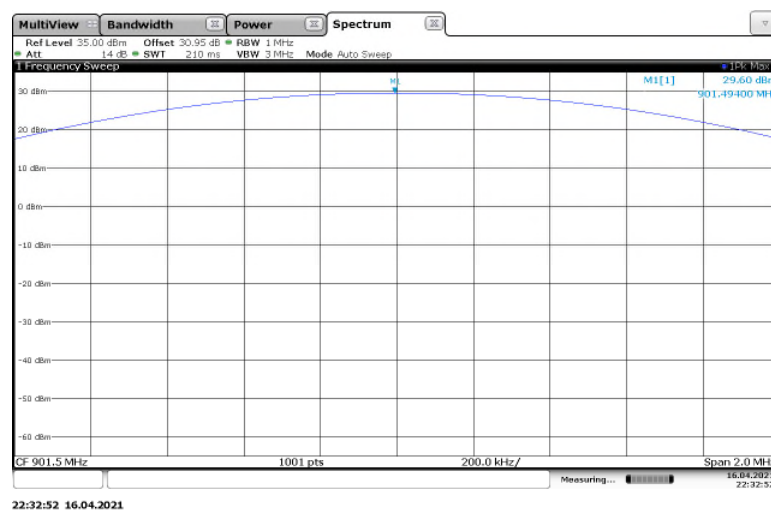


Figure 2.1.6-15: RF Output Power – TAITIEN TCXO – 901.5 MHz

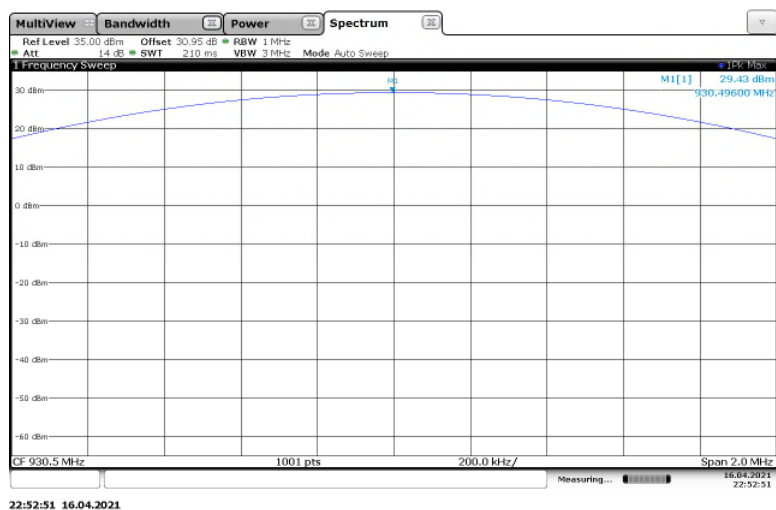


Figure 2.1.6-16: RF Output Power – TAITIEN TCXO – 930.5 MHz

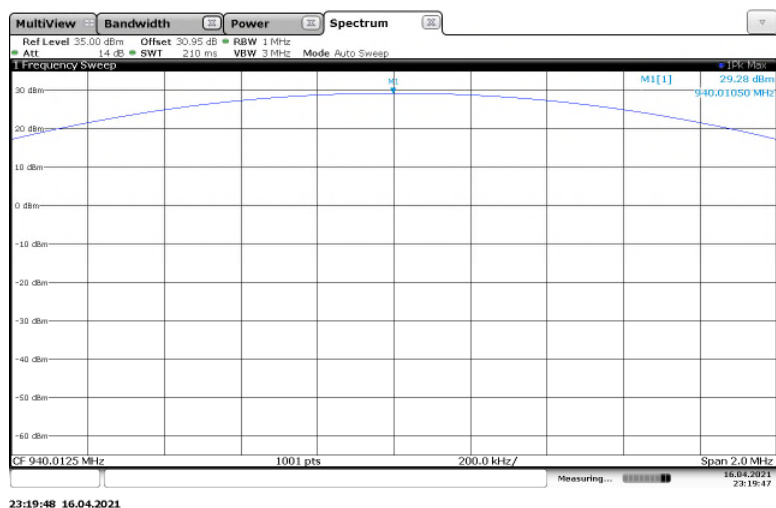


Figure 2.1.6-17: RF Output Power – TAITIEN TCXO – 940.0125 MHz

Table 2.1.6-6: RF Output Power – TAITIEN TCXO – FCC 47 CFR Part 101.113(a); ISED Canada RSS-119 5.4

Frequency MHz	Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
928.925	29.44	2	31.44	44	12.56
932.25	29.26	2	31.26	44	12.74
941.4875	29.25	2	31.25	44	12.75
959.925	28.97	2	30.97	44	13.03

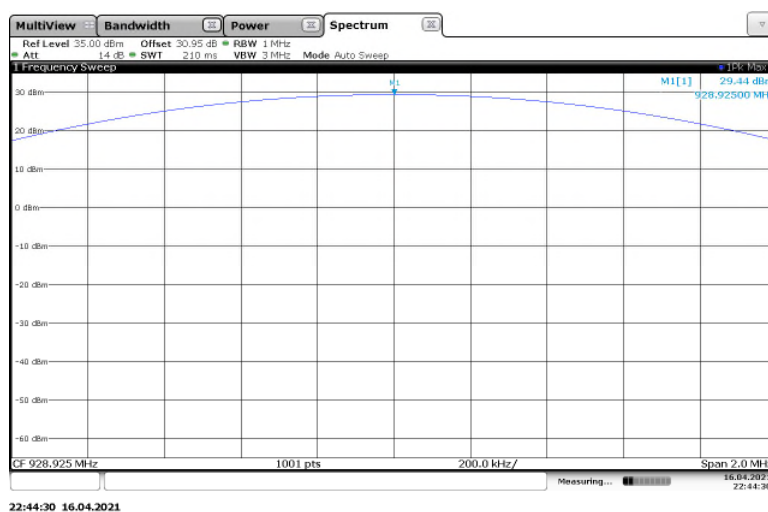


Figure 2.1.6-18: RF Output Power – TAITIEN TCXO – 928.925 MHz

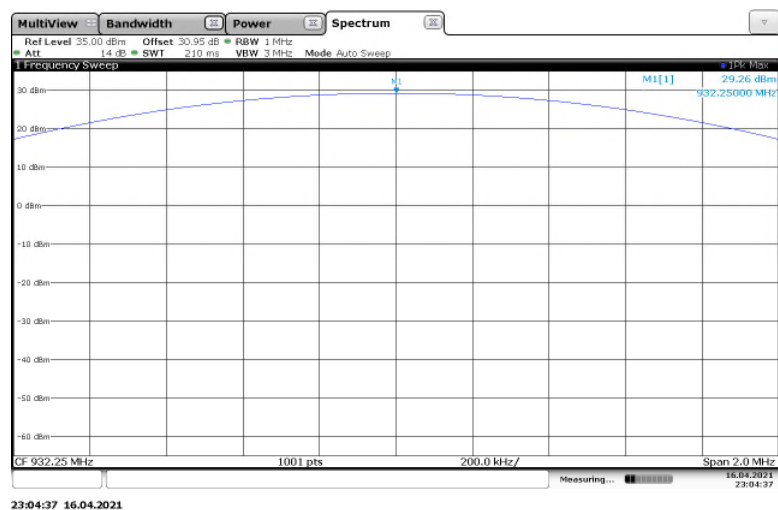


Figure 2.1.6-19: RF Output Power – TAITIEN TCXO – 932.25 MHz

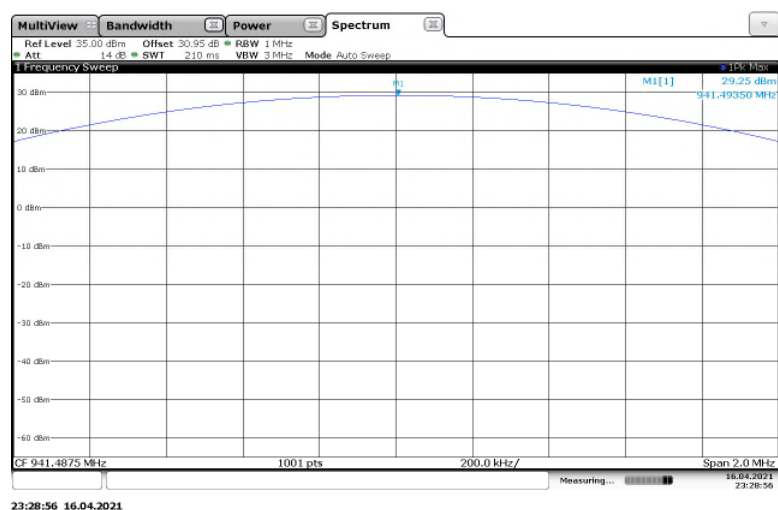


Figure 2.1.6-20: RF Output Power – TAITIEN TCXO – 941.4875 MHz

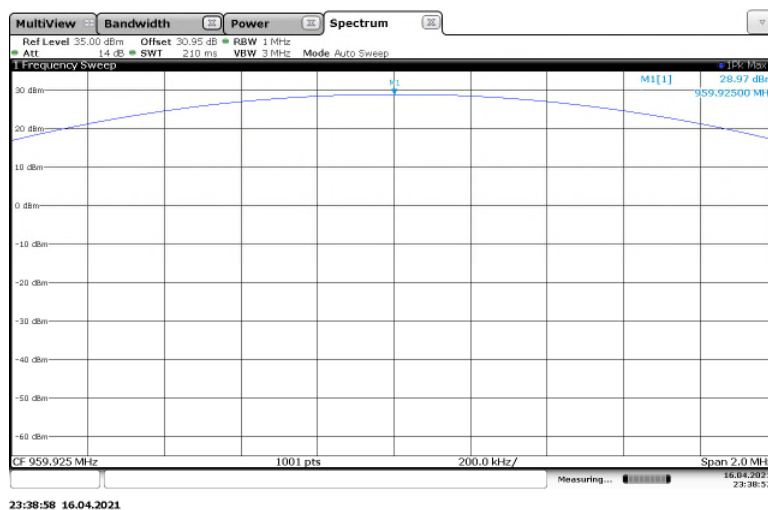


Figure 2.1.6-21: RF Output Power – TAITIEN TCXO – 959.925 MHz

2.1.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Digital MultiMeter	Fluke	115	BEMC02108	N/A	24	29-Mar-2023
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	N/A	24	07-Dec-2022
DC Power Supply	Xantrex	XHR60-18	TEMC00001	N/A	N/A	NCR
2.92mm Attenuator M/F 40GHz 30dB 2W VSWR 1.45	Centric RF	C402-30	TEMC00222	N/A	12	08-Mar-2022

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable

NCR – No Calibration Required



2.2 Out of Band Unwanted Emissions

2.2.1 Specification Reference

FCC 47 CFR Parts: 2.1053; 24.133 a(1), a(2); 101.111 a(6)
ISED Canada RSS-119 5.8.6; RSS-134 4.4

2.2.2 Equipment Under Test and Modification State

TXC TCXO, SN: 125000296

2.2.3 Date of Test

2021-April-19 to 2021-April-29

2.2.4 Test Method

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through a 20 dB passive attenuator. The spectrum analyzer resolution and video bandwidths were set to 300 Hz and 3000 Hz, respectively. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator losses. Results of the test are shown below for all modes of operation.

2.2.5 Environmental Conditions

Ambient Temperature	25.5 °C
Relative Humidity	42.1 %
Atmospheric Pressure	1012.6 mbar

2.2.6 Test Results

DC Powered Operating

FCC 47 CFR Parts: 2.1053; 24.133 a(1), a(2); ISED Canada RSS-134 4.4

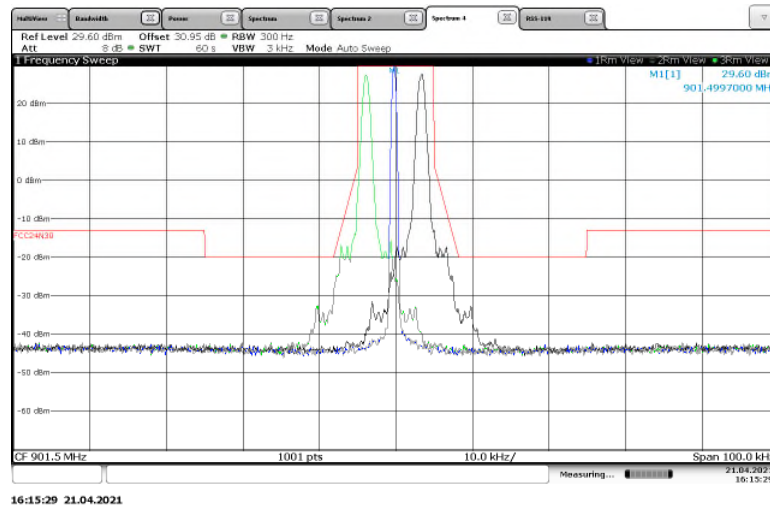


Figure 2.2.6-1: Emissions Mask – TxC TCXO – 901.5 MHz - 12.5 kHz Channel Spacing - Boost Mode – Offset Channel +/- 6 (+/- 3600)

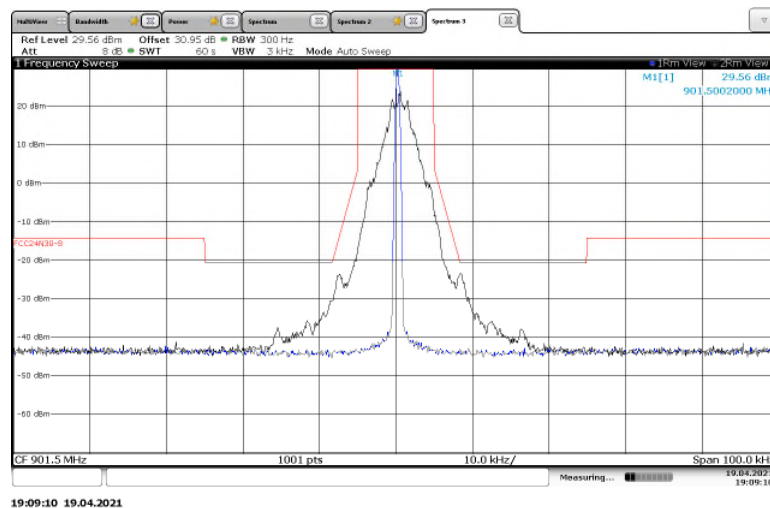


Figure 2.2.6-2: Emissions Mask – TxC TCXO – 901.5 MHz - 12.5 kHz Channel Spacing - C&I Mode

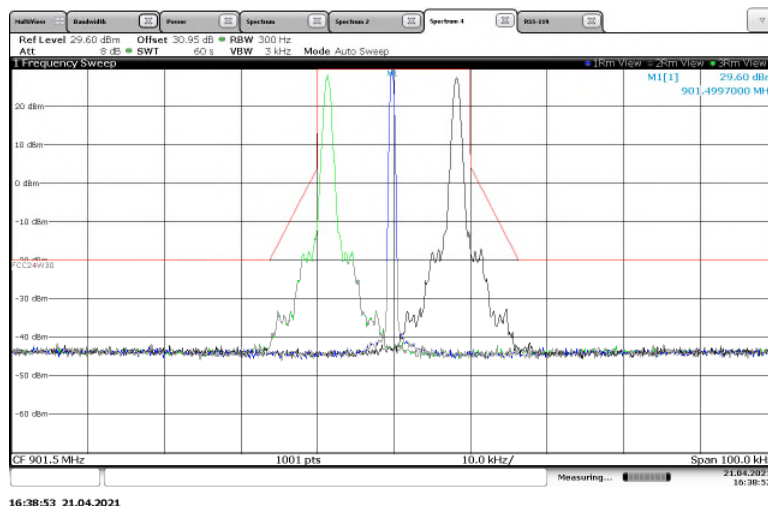


Figure 2.2.6-3: Emissions Mask – TxC TCXO – 901.5 MHz - 25 kHz Channel Spacing- Boost Mode – Offset Channel +/- 14 (+/- 8400)

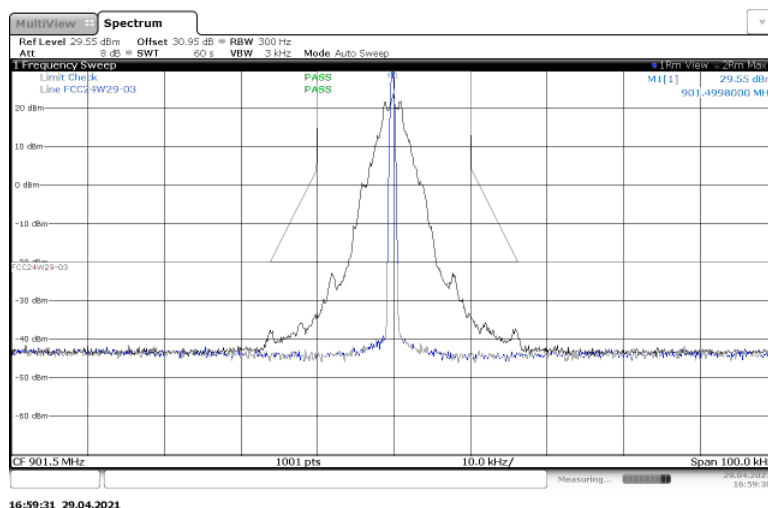


Figure 2.2.6-4: Emissions Mask – TxC TCXO – 901.5 MHz - 25 kHz Channel Spacing- C&I Mode

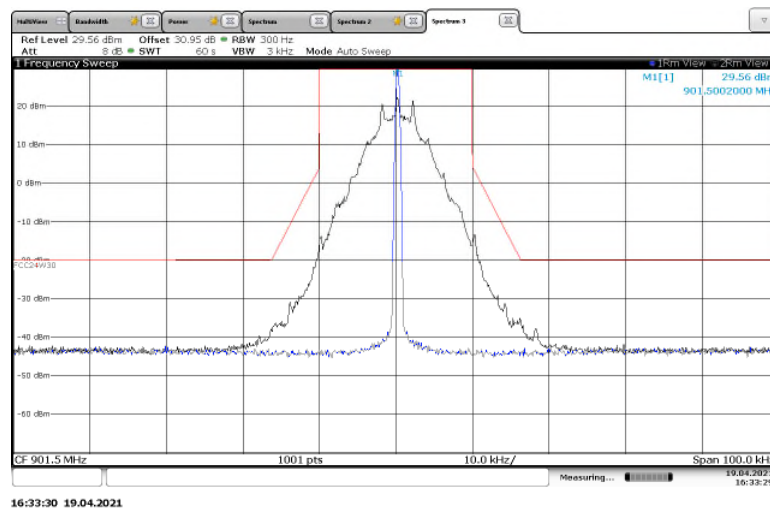


Figure 2.2.6-5: Emissions Mask – TXC TCXO – 901.5 MHz - 25 kHz Channel Spacing- Normal Mode

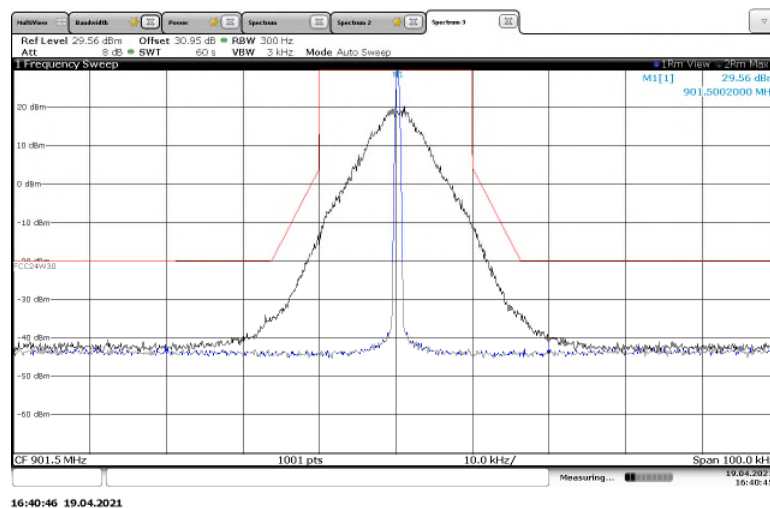
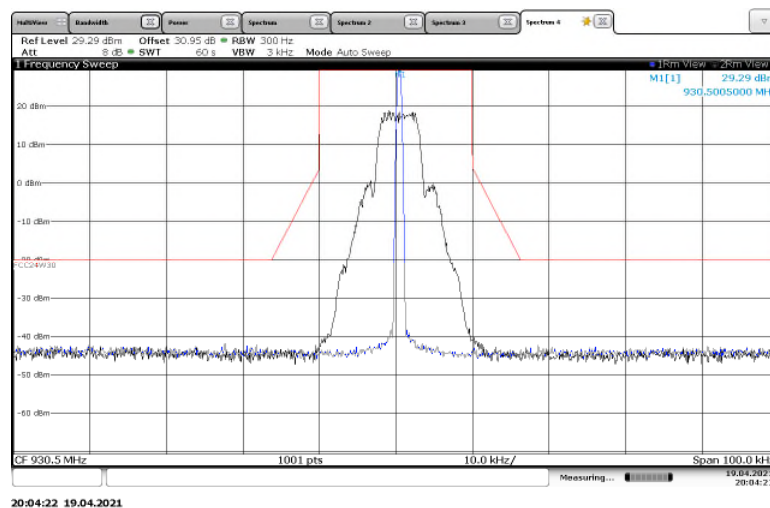
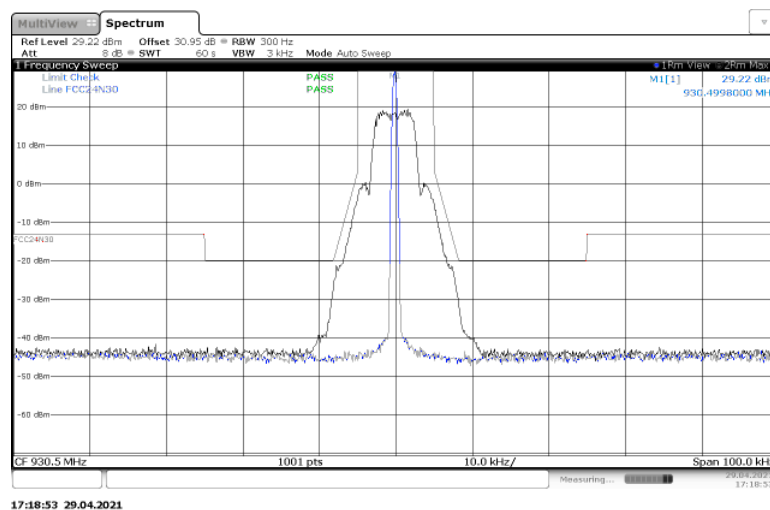


Figure 2.2.6-6: Emissions Mask – TXC TCXO – 901.5 MHz - 25 kHz Channel Spacing- Double Density Mode



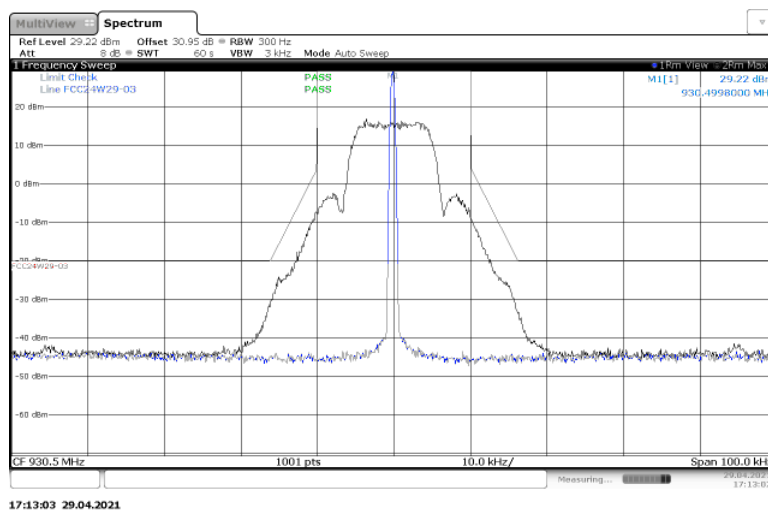


Figure 2.2.6-9: Emissions Mask – TxC TCXO – 930.5 MHz - 25 kHz Channel Spacing- Mpass10k Mode

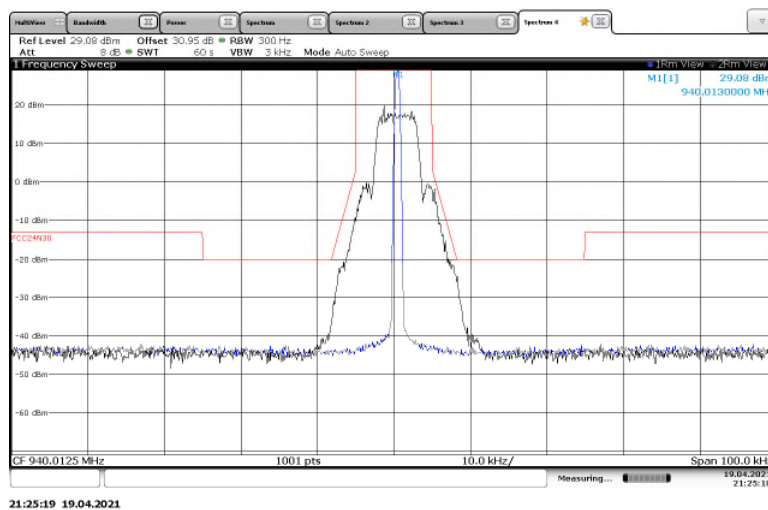
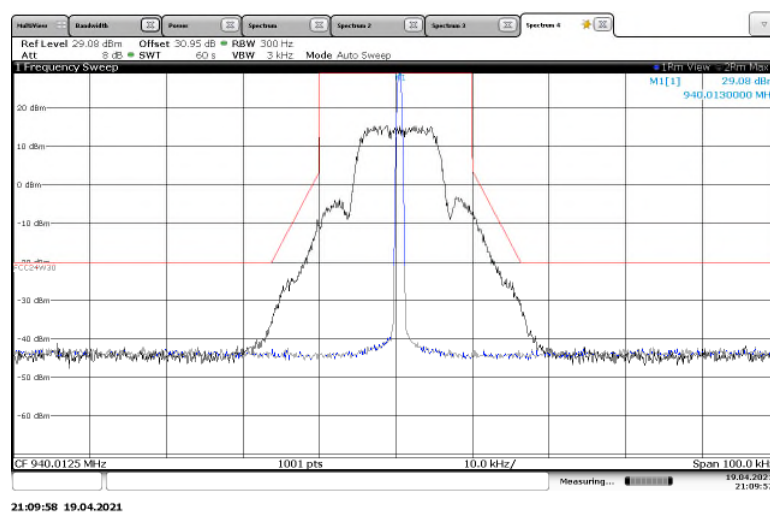
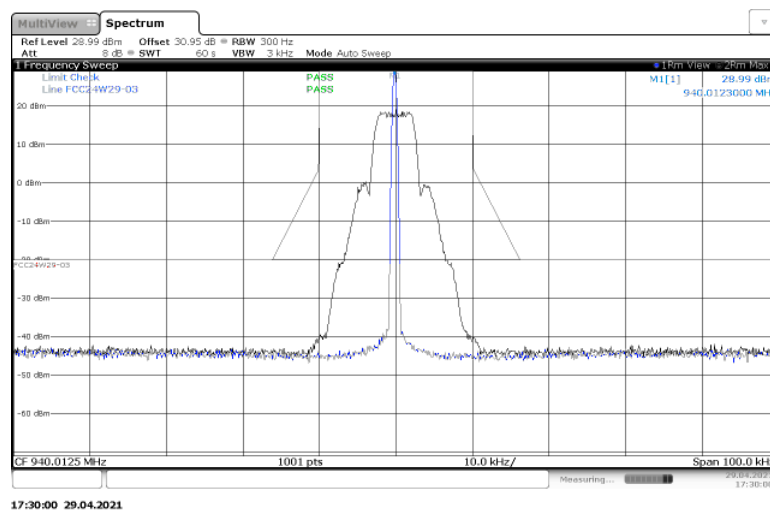


Figure 2.2.6-10: Emissions Mask – TxC TCXO – 940.0125 MHz - 12.5 kHz Channel Spacing- mPass5k Mode



FCC 47 CFR Parts: 2.1053; 101.111 a(6); ISED Canada RSS-119 5.8.6

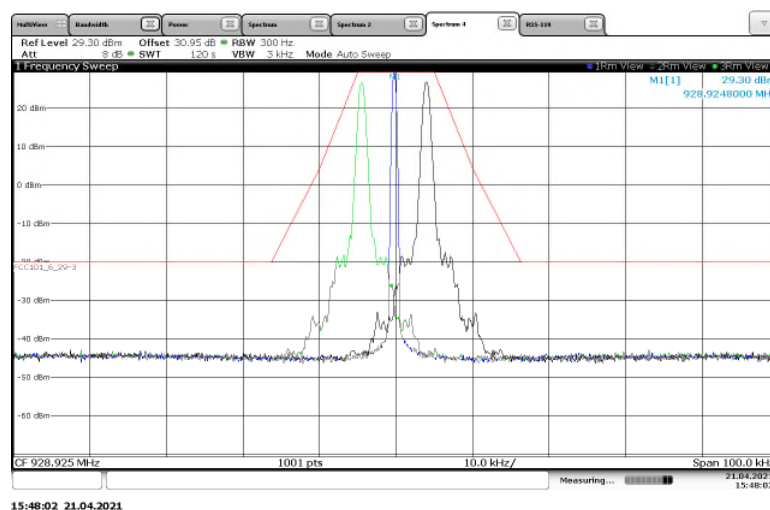


Figure 2.2.6-13: Emissions Mask – TxC TCXO – 928.925 MHz - 25 kHz Channel Spacing- Boost Mode – Offset Channel +/- 7 (+/- 4200)

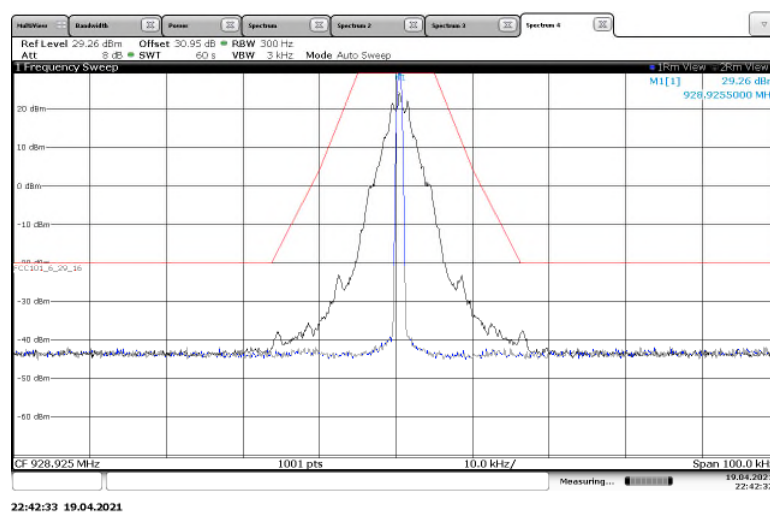


Figure 2.2.6-14: Emissions Mask – TxC TCXO – 928.925 MHz - 25 kHz Channel Spacing- C&I Mode

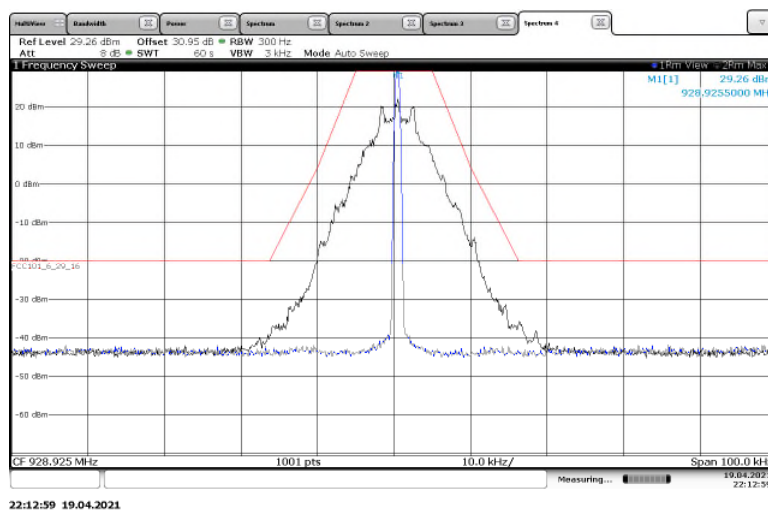


Figure 2.2.6-15: Emissions Mask – TxC TCXO – 928.925 MHz - 25 kHz Channel Spacing- Normal Mode

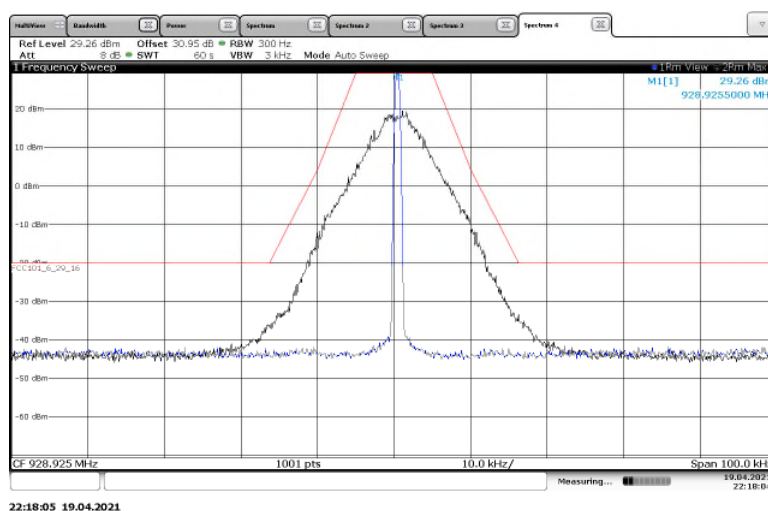


Figure 2.2.6-16: Emissions Mask – TxC TCXO – 928.925 MHz - 25 kHz Channel Spacing- Double Density Mode

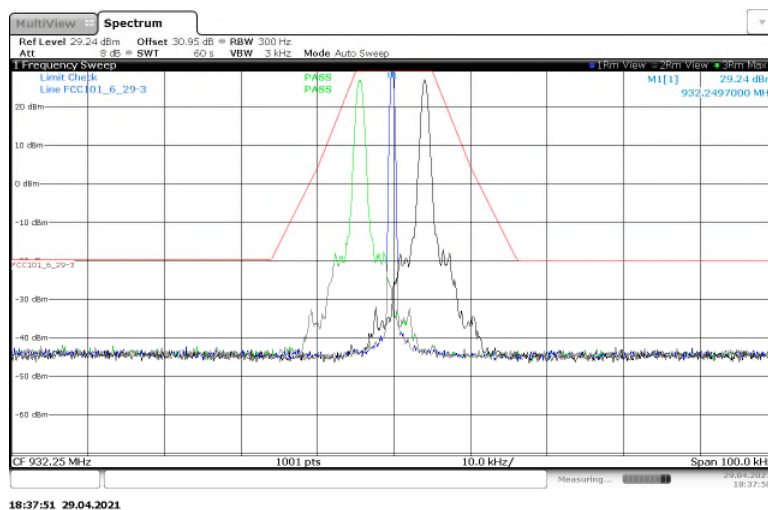


Figure 2.2.6-17: Emissions Mask – TXC TCXO – 932.25 MHz - 25 kHz Channel Spacing- Boost Mode – Offset Channel +/- 7 (+/- 4200)

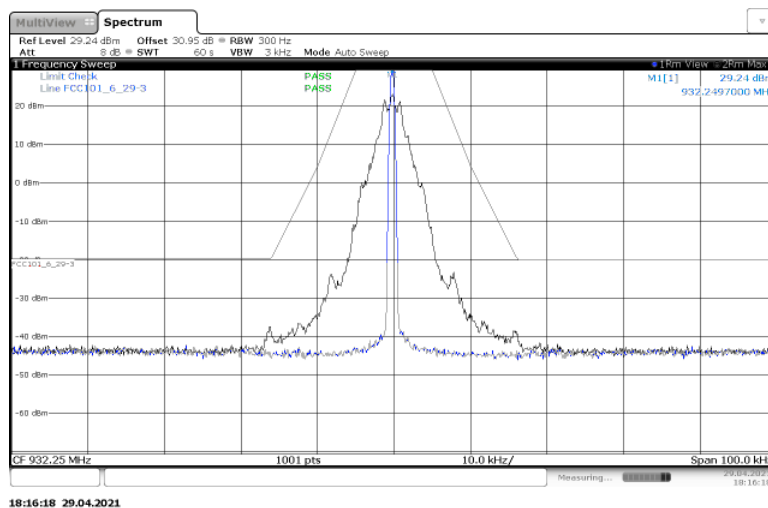


Figure 2.2.6-18: Emissions Mask – TXC TCXO – 932.25 MHz - 25 kHz Channel Spacing- C&I Mode

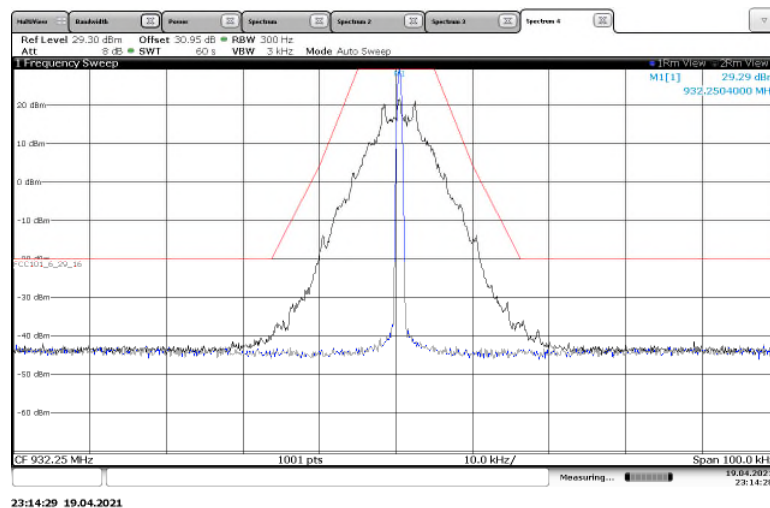


Figure 2.2.6-19: Emissions Mask – TXC TCXO – 932.25 MHz - 25 kHz Channel Spacing- Normal Mode

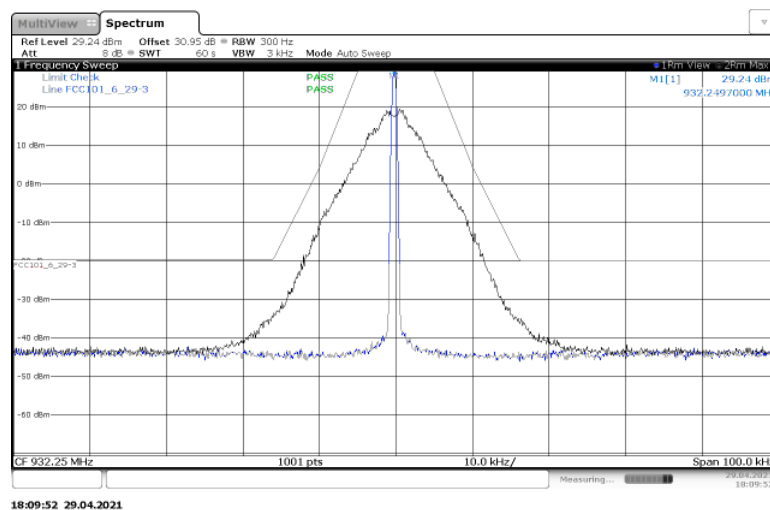


Figure 2.2.6-20: Emissions Mask – TXC TCXO – 932.25 MHz - 25 kHz Channel Spacing- Double Density Mode

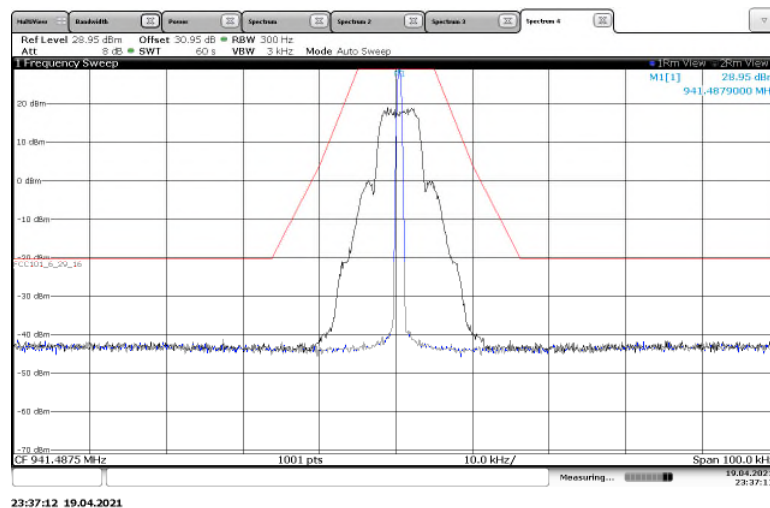


Figure 2.2.6-21: Emissions Mask – TxC TCXO – 941.4875 MHz - 25 kHz Channel Spacing-
mPass5k Mode

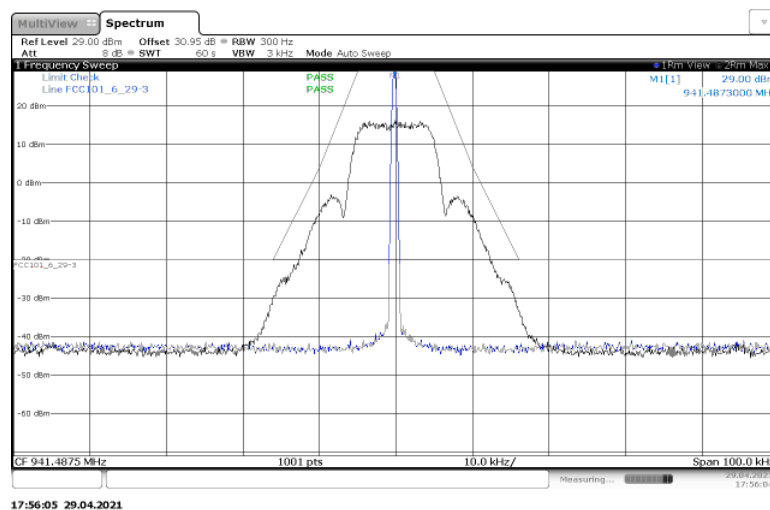


Figure 2.2.6-22: Emissions Mask – TxC TCXO – 941.4875 MHz - 25 kHz Channel Spacing-
Mpass10k Mode

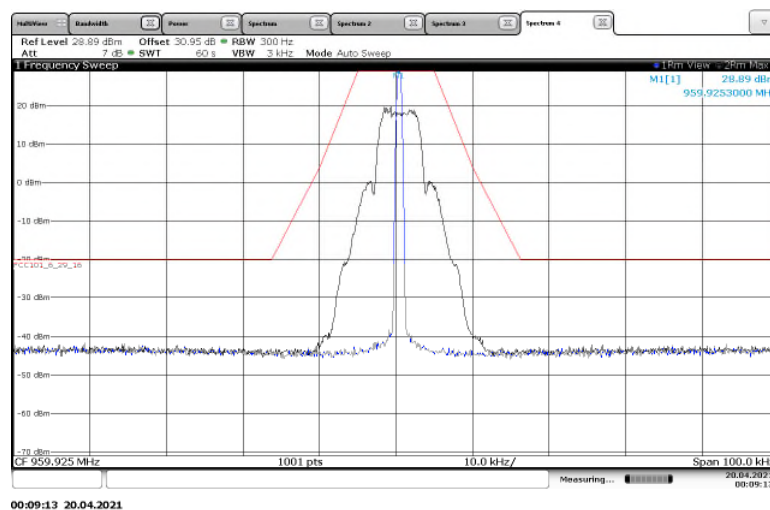


Figure 2.2.6-23: Emissions Mask – TxC TCXO – 959.925 MHz - 25 kHz Channel Spacing- mPass5k Mode

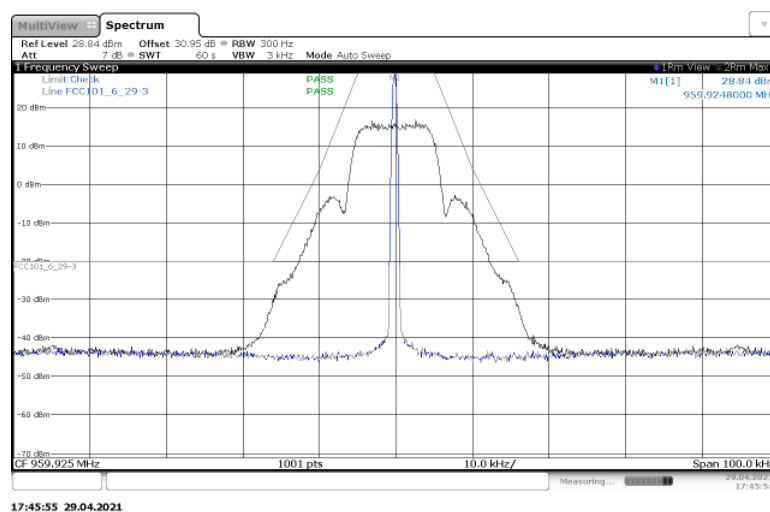


Figure 2.2.6-24: Emissions Mask – TxC TCXO – 959.925 MHz - 25 kHz Channel Spacing- mPass10k Mode



2.2.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Digital MultiMeter	Fluke	115	BEMC02108	N/A	24	29-Mar-2023
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	N/A	24	07-Dec-2022
DC Power Supply	Xantrex	XHR60-18	TEMC00001	N/A	N/A	NCR
2.92mm Attenuator M/F 40GHz 30dB 2W VSWR 1.45	Centric RF	C402-30	TEMC00222	N/A	12	08-Mar-2022

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable

NCR – No Calibration Required



2.3 Occupied Bandwidth

2.3.1 Specification Reference

FCC Section 2.1049; ISED Canada RSS-GEN 6.7

2.3.2 Equipment Under Test and Modification State

TXC TCXO, SN: 125000296

2.3.3 Date of Test

2021-April-17

2.3.4 Test Method

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through suitable of passive attenuation. The internal correction factors of the spectrum analyzer were employed to correct for any cable and attenuator losses.

The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts. The nominal IF filter 3 dB bandwidth (RBW) is in the range of 1% to 5% of the OBW, and the VBW was set $\geq 3 \times$ RBW. The reference level was set to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. The measurements were made using the spectrum analyzer's 99% BW function.

2.3.5 Environmental Conditions

Ambient Temperature	25.6 °C
Relative Humidity	48.2 %
Atmospheric Pressure	1011.5 mbar

2.3.6 Test Results

Table 2.3.6-1: 99% Bandwidth – TXC TCXO – 901.5 MHz

Frequency (MHz)	ISED Canada Rule Part	Mode	99% Bandwidth (kHz)
901.5	RSS-134	Boost	1.2476
901.5	RSS-134	C&I	6.1849
901.5	RSS-134	Normal	11.967
901.5	RSS-134	Double Density	13.8971

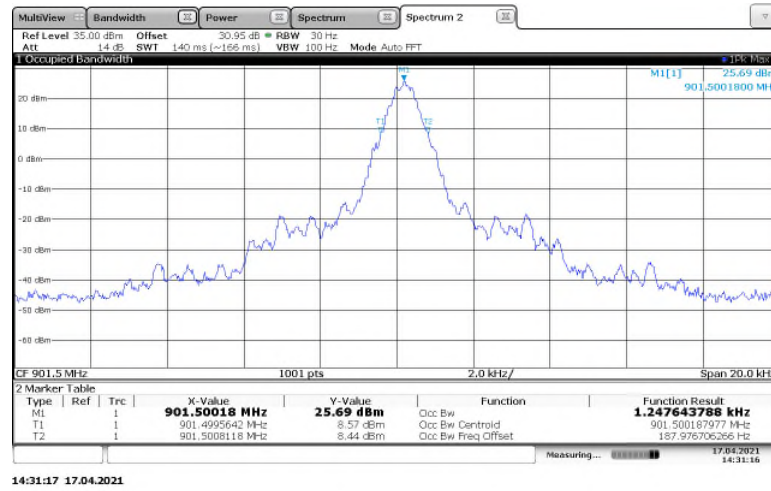


Figure 2.3.6-1: 99% Bandwidth – TXC TCXO – 901.5 MHz - Boost Mode

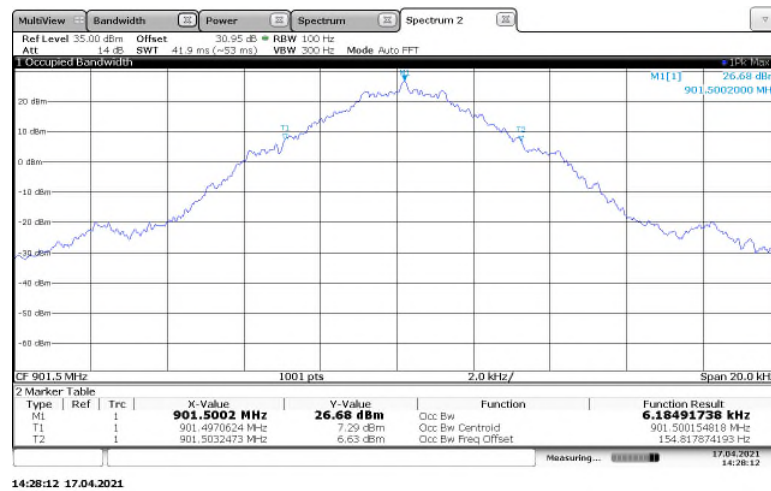


Figure 2.3.6-2: 99% Bandwidth – TXC TCXO – 901.5 MHz - C&I Mode

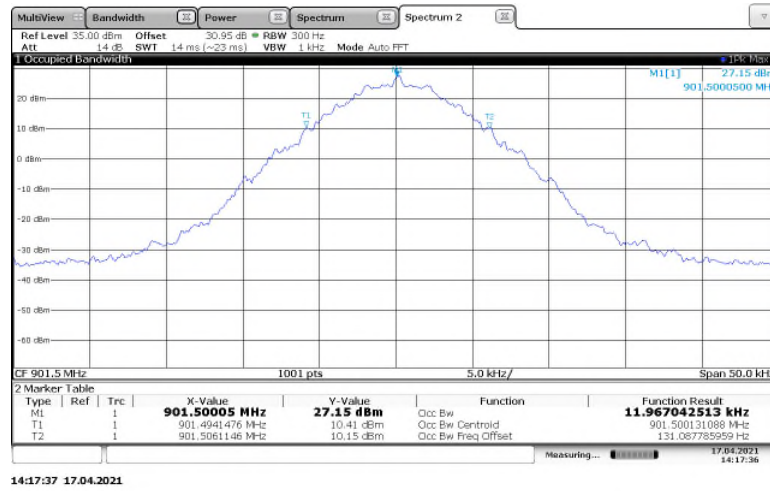


Figure 2.3.6-3: 99% Bandwidth – TxC TCXO – 901.5 MHz - Normal Mode

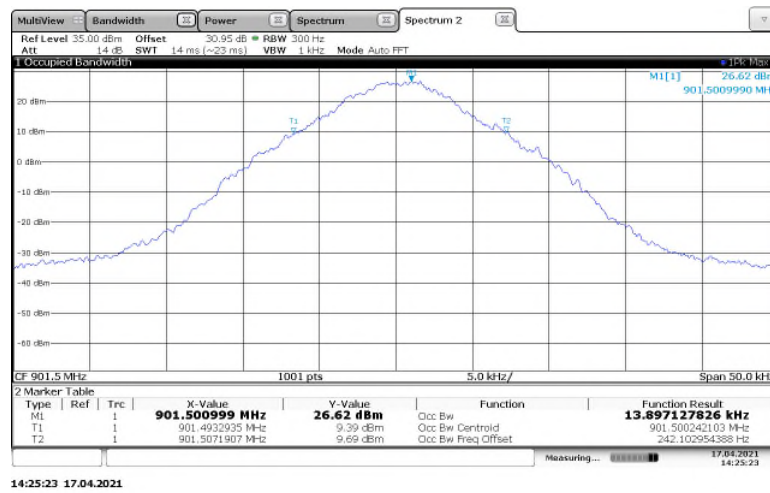


Figure 2.3.6-4: 99% Bandwidth – TxC TCXO – 901.5 MHz - Double Density Mode

Table 2.3.6-2: 99% Bandwidth – TXC TCXO – 928.925 MHz

Frequency (MHz)	ISED Canada Rule Part	Mode	99% Bandwidth (kHz)
928.925	RSS-119	Boost	1.3088
928.925	RSS-119	C&I	6.2072
928.925	RSS-119	Normal	11.9086
928.925	RSS-119	Double Density	13.8972

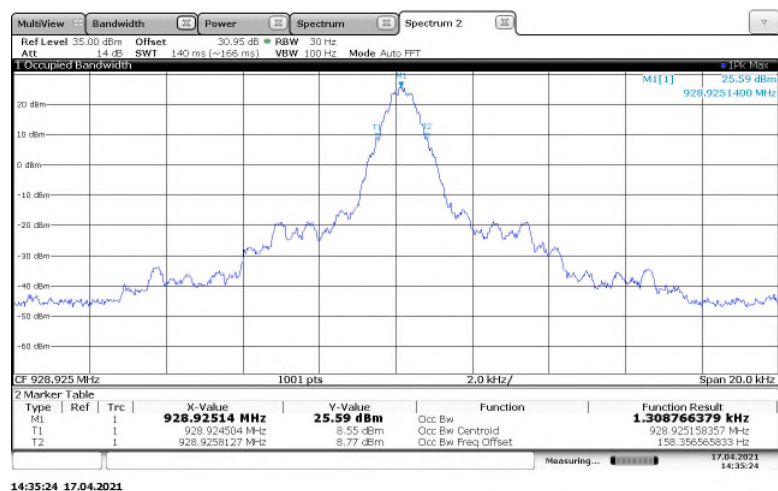


Figure 2.3.6-5: 99% Bandwidth – TXC TCXO – 928.925 MHz - Boost Mode

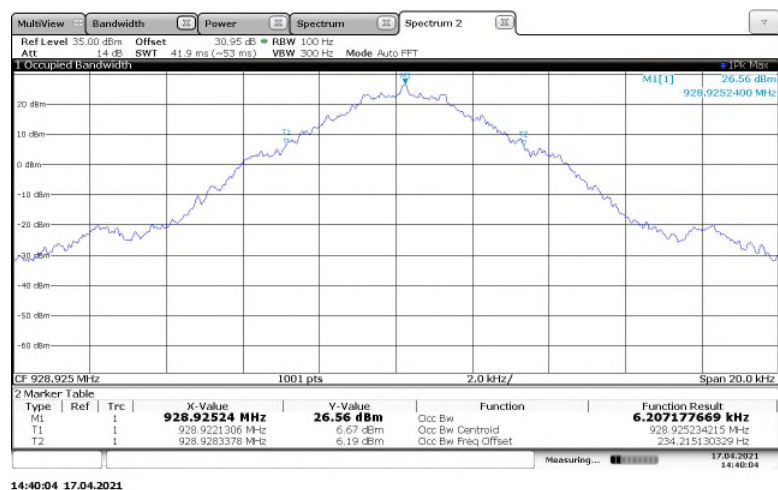


Figure 2.3.6-6: 99% Bandwidth – TXC TCXO – 928.925 MHz - C&I Mode

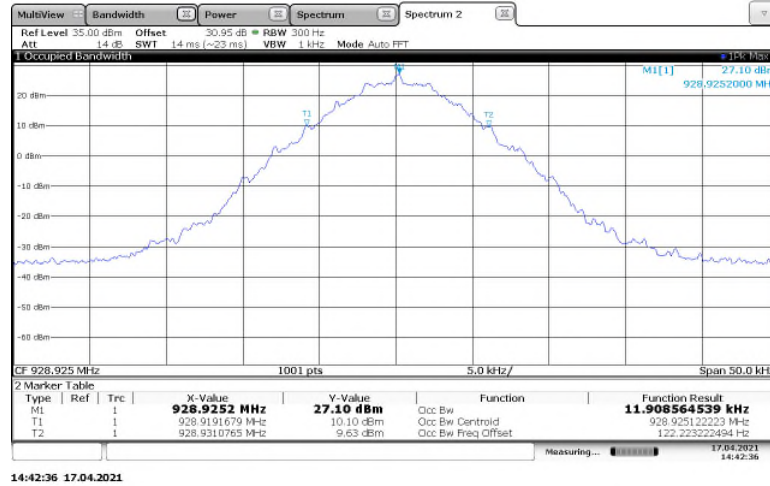


Figure 2.3.6-7: 99% Bandwidth – TXC TCXO – 928.925 MHz - Normal Mode

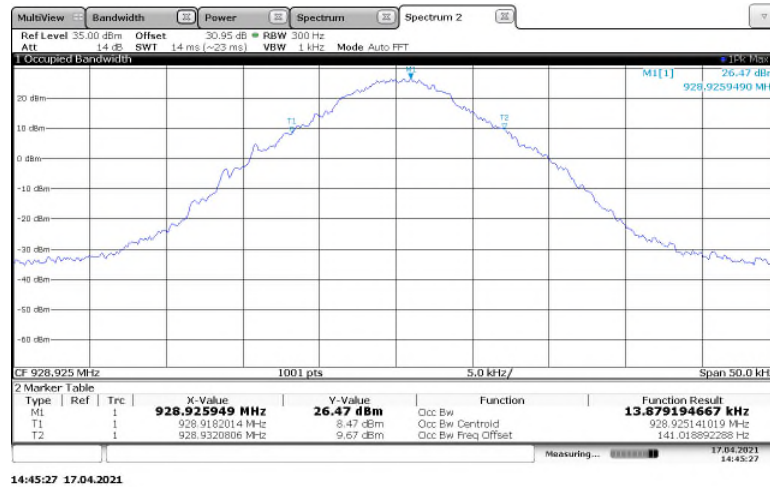


Figure 2.3.6-8: 99% Bandwidth – TXC TCXO – 928.925 MHz - Double Density Mode

Table 2.3.6-3: 99% Bandwidth – TXC TCXO – 930.5 MHz

Frequency (MHz)	ISED Canada Rule Part	Mode	99% Bandwidth (kHz)
930.5	RSS-134	mPass 5k	6.1719
930.5	RSS-134	mPass 10k	11.8454

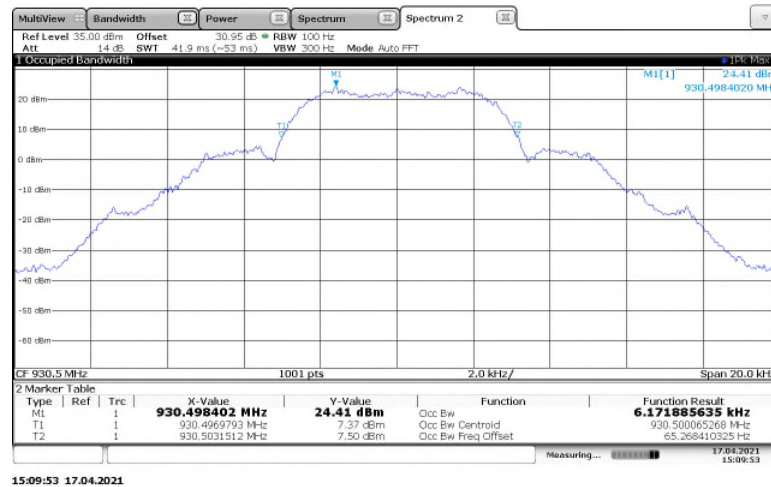
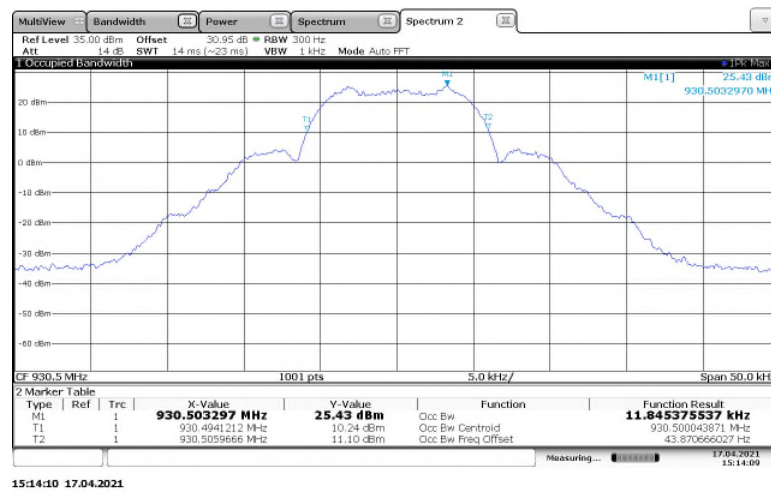
**Figure 2.3.6-9: 99% Bandwidth – TXC TCXO – 930.5 MHz - mPass5k Mode****Figure 2.3.6-10: 99% Bandwidth – TXC TCXO – 930.5 MHz - Mpass10k Mode**

Table 2.3.6-4: 99% Bandwidth – TXC TCXO – 932.25 MHz

Frequency (MHz)	ISED Canada Rule Part	Mode	99% Bandwidth (kHz)
932.25	RSS-119	Boost	1.3384
932.25	RSS-119	C&I	6.2030
932.25	RSS-119	Normal	11.9759
932.25	RSS-119	Double Density	13.7706

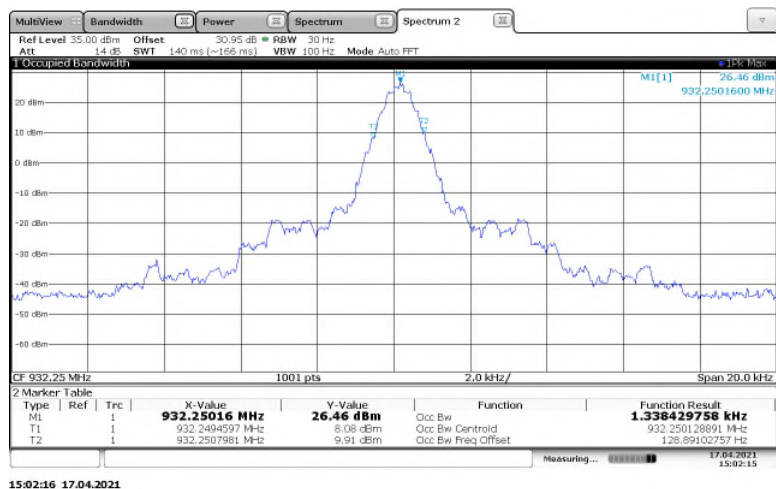


Figure 2.3.6-11: 99% Bandwidth – TXC TCXO – 932.25 MHz - Boost Mode

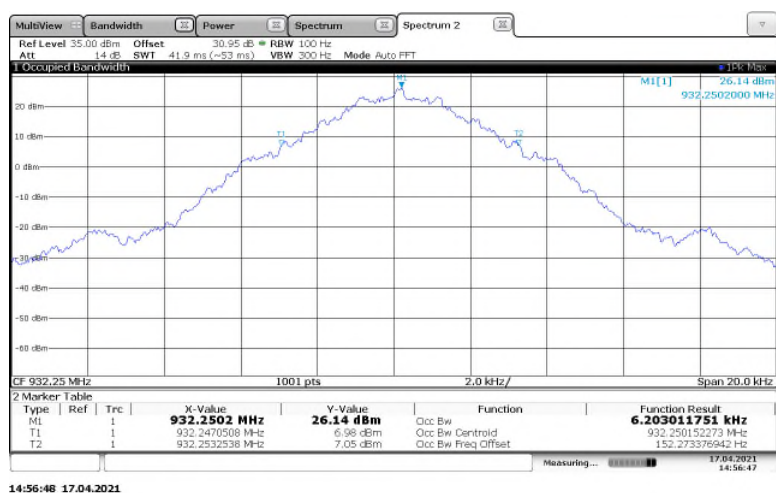


Figure 2.3.6-12: 99% Bandwidth – TXC TCXO – 932.25 MHz - C&I Mode

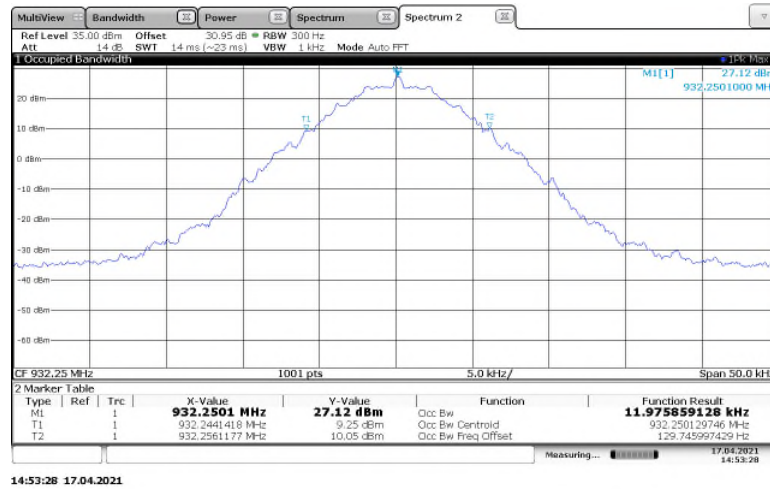


Figure 2.3.6-13: 99% Bandwidth – TXC TCXO – 932.25 MHz - Normal Mode

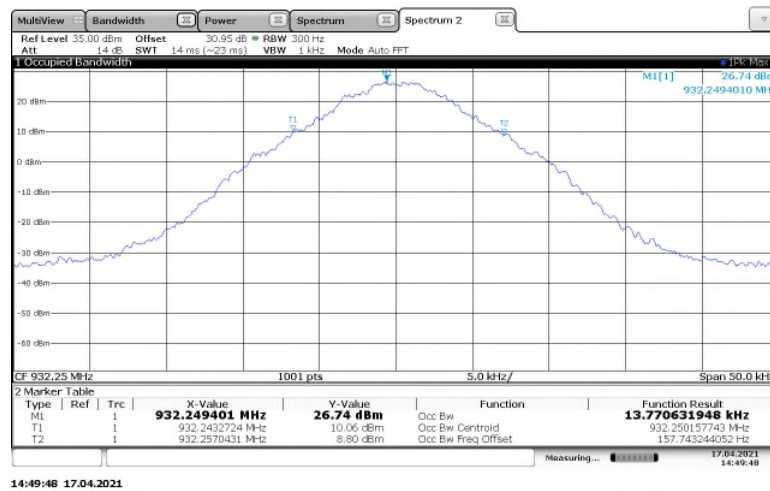


Figure 2.3.6-14: 99% Bandwidth – TXC TCXO – 932.25 MHz - Double Density Mode

Table 2.3.6-5: 99% Bandwidth – TXC TCXO – 940.0125 MHz

Frequency (MHz)	ISED Canada Rule Part	Mode	99% Bandwidth (kHz)
940.0125	RSS-134	mPass 5k	6.0645
940.0125	RSS-134	mPass 10k	11.7915

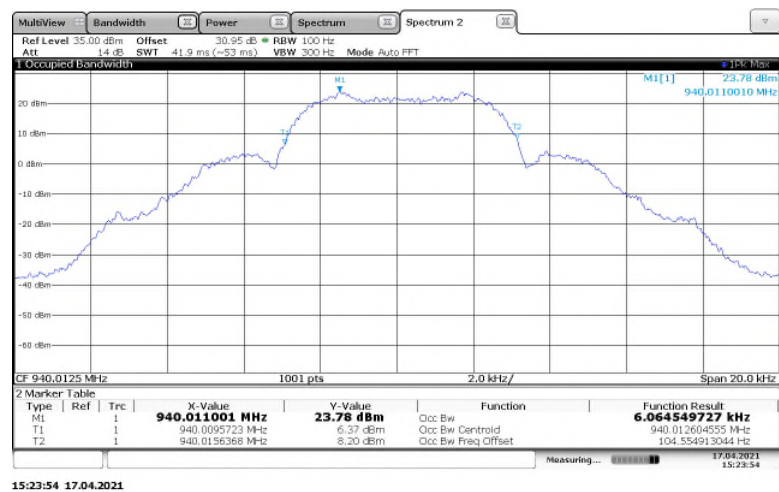


Figure 2.3.6-15: 99% Bandwidth – TXC TCXO – 940.0125 MHz - mPass5k Mode

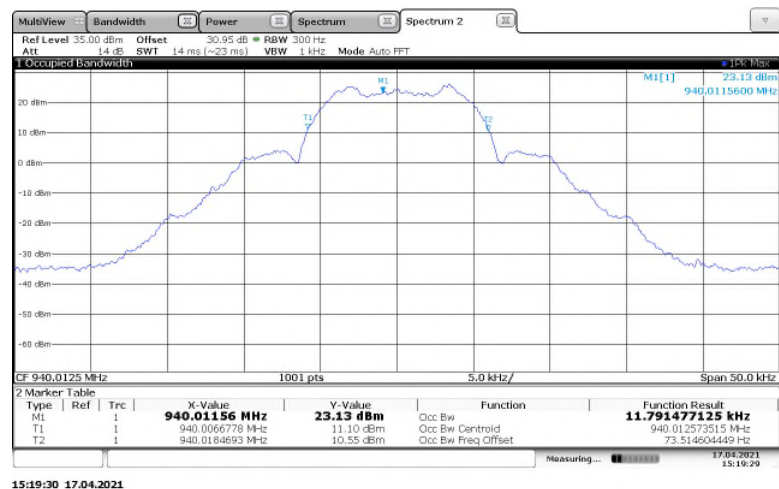


Figure 2.3.6-16: 99% Bandwidth – TXC TCXO – 940.0125 MHz - Mpass10k Mode

Table 2.3.6-6: 99% Bandwidth – TXC TCXO – 941.4875 MHz

Frequency (MHz)	ISED Canada Rule Part	Mode	99% Bandwidth (kHz)
941.4875	RSS-134	mPass 5k	6.0984
941.4875	RSS-134	mPass 10k	11.8821

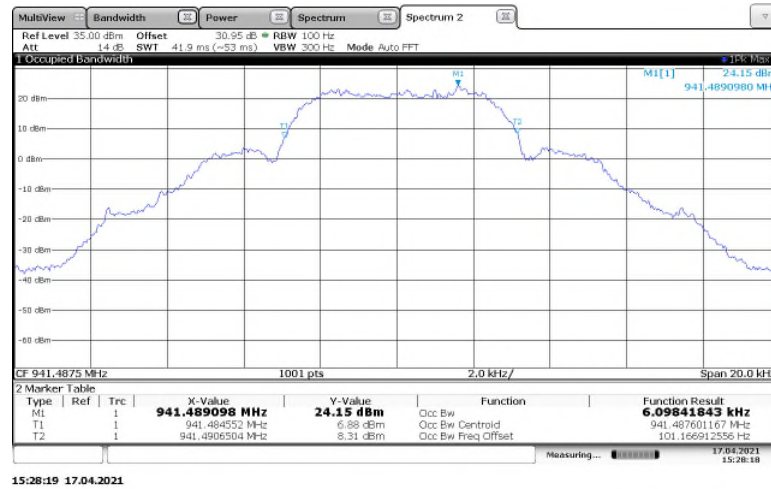


Figure 2.3.6-17: 99% Bandwidth – TXC TCXO – 941.4875 MHz - mPass5k Mode

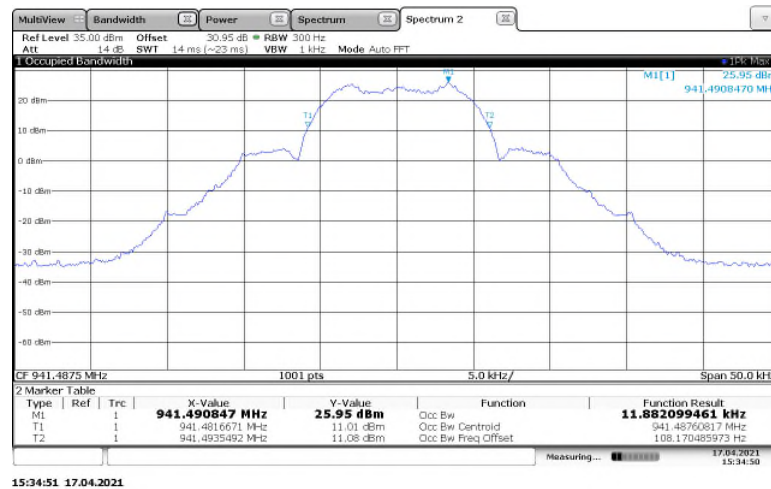
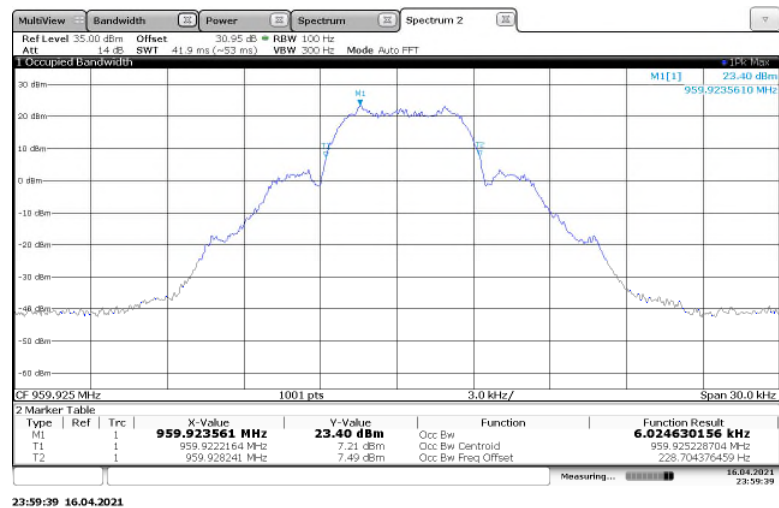
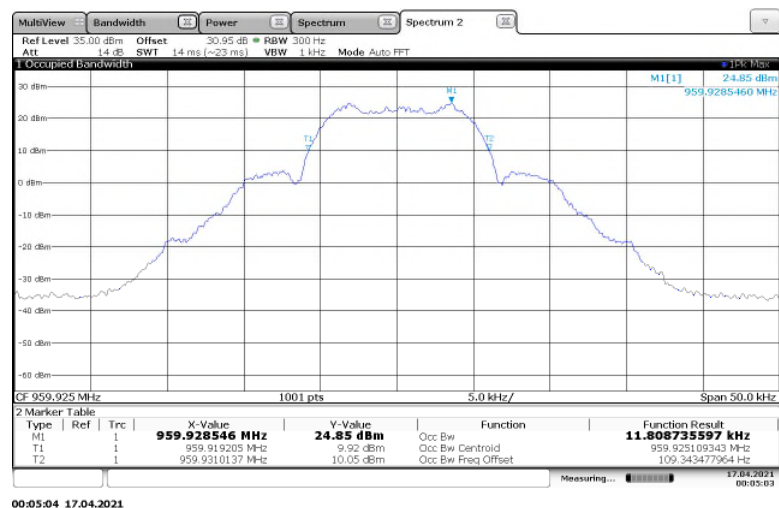


Figure 2.3.6-18: 99% Bandwidth – TXC TCXO – 941.4875 MHz - Mpass10k Mode

Table 2.3.6-7: 99% Bandwidth – TxC TCXO – 959.925 MHz

Frequency (MHz)	ISED Canada Rule Part	Mode	99% Bandwidth (kHz)
959.925	RSS-119	mPass 5k	6.0246
959.925	RSS-119	mPass 10k	11.8087

**Figure 2.3.6-19: 99% Bandwidth – TxC TCXO – 959.925 MHz - mPass5k Mode****Figure 2.3.6-20: 99% Bandwidth – TxC TCXO – 959.925 MHz - Mpass10k Mode**



2.3.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Digital MultiMeter	Fluke	115	BEMC02108	N/A	24	29-Mar-2023
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	N/A	24	07-Dec-2022
DC Power Supply	Xantrex	XHR60-18	TEMC00001	N/A	N/A	NCR
2.92mm Attenuator M/F 40GHz 30dB 2W VSWR 1.45	Centric RF	C402-30	TEMC00222	N/A	12	08-Mar-2022

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable

NCR – No Calibration Required

2.4 Spurious Emissions at Antenna Terminals

2.4.1 Specification Reference

FCC 47 CFR Parts: 2.1053; 24.133 a(1), a(2); 101.111 a(6)
ISED Canada RSS-119 5.8.6; RSS-134 4.4

2.4.2 Equipment Under Test and Modification State

TXC TCXO, SN: 125000296

2.4.3 Date of Test

2021-April-17 to 2021-April-21

2.4.4 Test Method

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through a 30 dB passive attenuator. The spectrum analyzer resolution bandwidth was set to 100 kHz below 1000 MHz and 1 MHz above 1000 MHz. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator. The spectrum was investigated in accordance with CFR 47 Part 2.1057

2.4.5 Environmental Conditions

Ambient Temperature	26.3 °C
Relative Humidity	45.9 %
Atmospheric Pressure	1010.6 mbar

2.4.6 Test Results

DC Powered Operating

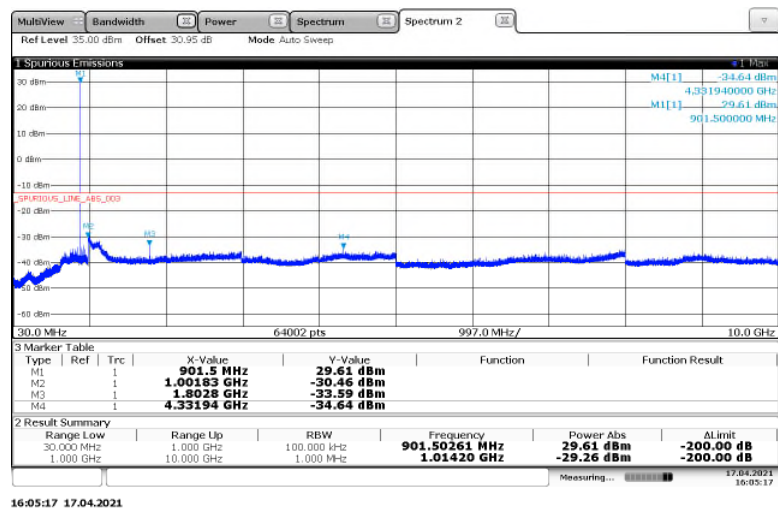


Figure 2.4.6-1: Transmitter Conducted Spurious Emissions – TXC TCXO – 901.5 MHz - Normal Mode

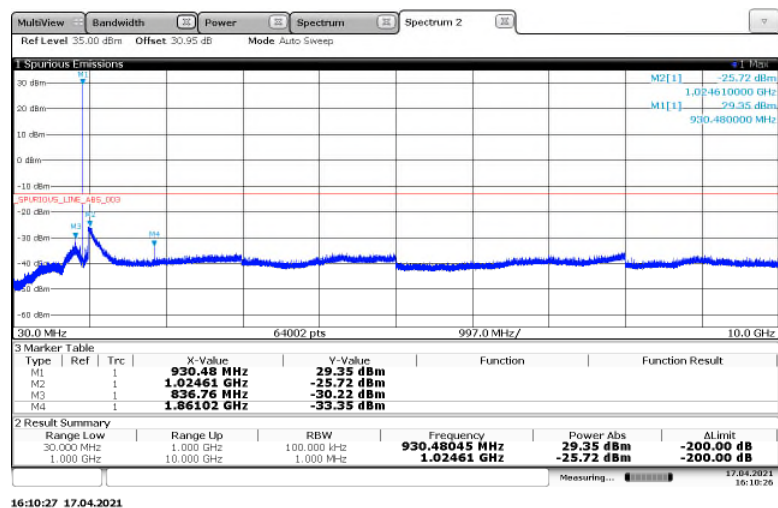


Figure 2.4.6-2: Transmitter Conducted Spurious Emissions – TXC TCXO – 930.5 MHz - mPass5k Mode

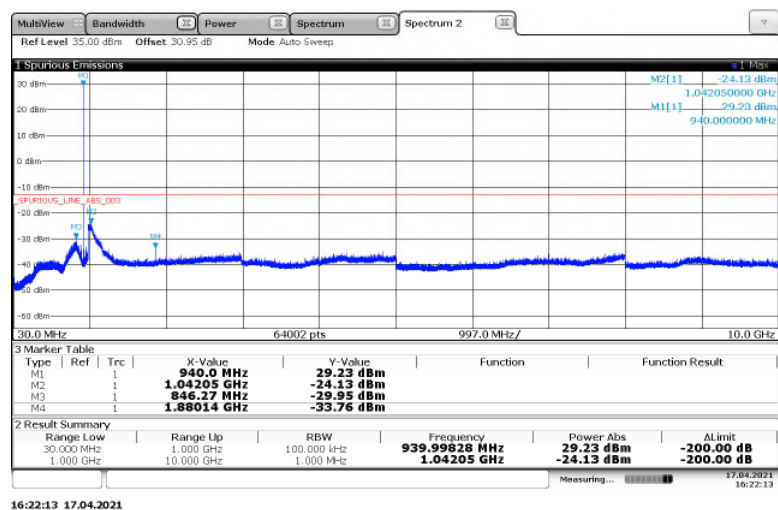


Figure 2.4.6-3: Transmitter Conducted Spurious Emissions – TXC TCXO – 940.0125 MHz - mPass5k Mode

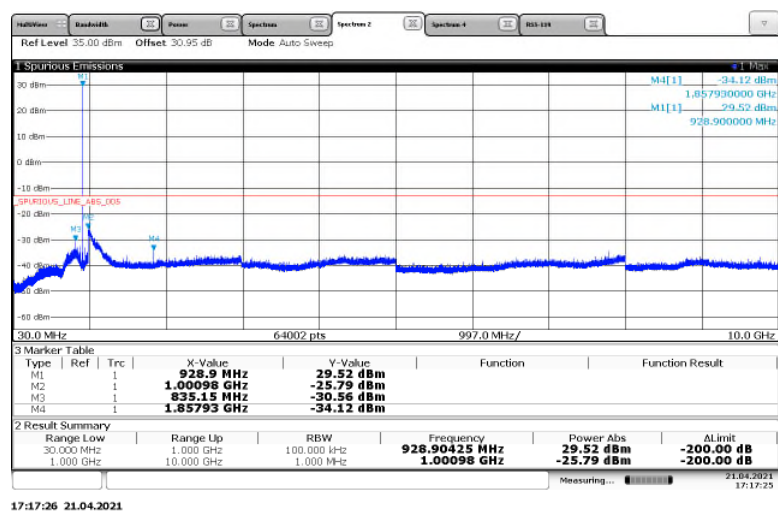


Figure 2.4.6-4: Transmitter Conducted Spurious Emissions – TXC TCXO – 928.925 MHz - Normal Mode

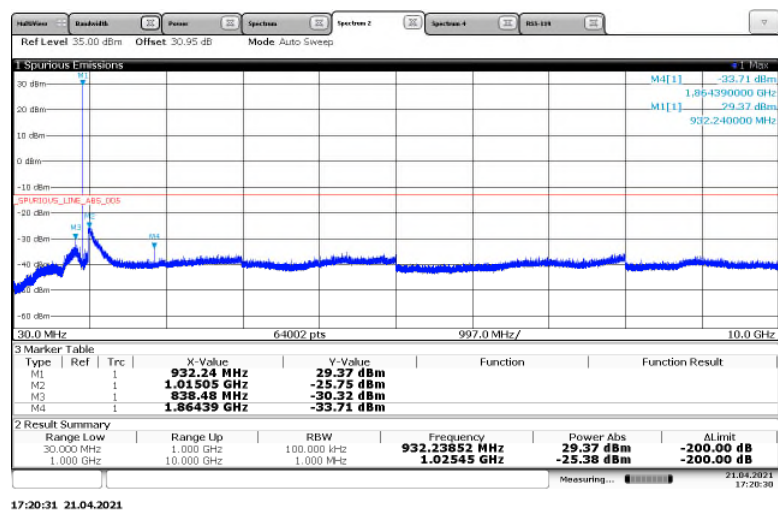


Figure 2.4.6-5: Transmitter Conducted Spurious Emissions – TXC TCXO – 932.25 MHz - Normal Mode

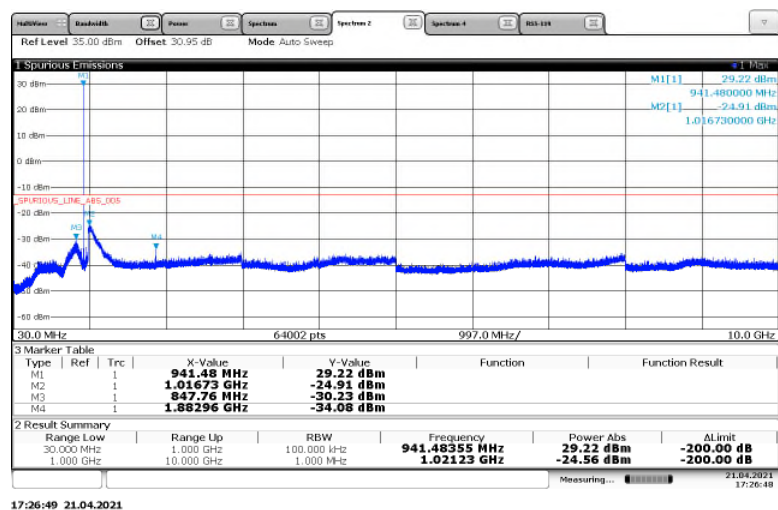


Figure 2.4.6-6: Transmitter Conducted Spurious Emissions – TXC TCXO – 941.4875 MHz - mPass5k Mode

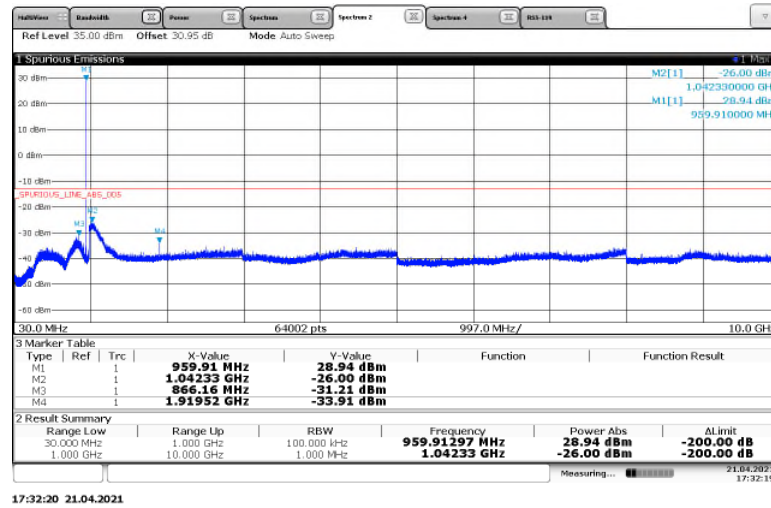


Figure 2.4.6-7: Transmitter Conducted Spurious Emissions – TXC TCXO – 959.925 MHz - mPass5k Mode

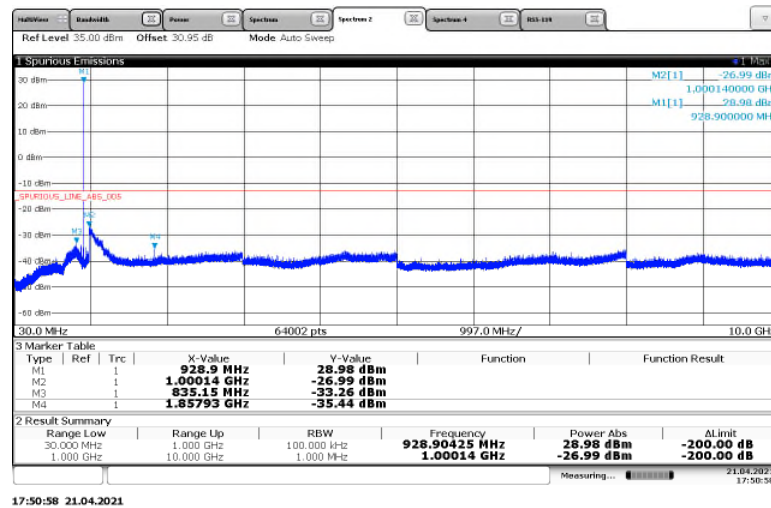


Figure 2.4.6-8: Transmitter Conducted Spurious Emissions – KDS TCXO – 928.925 MHz - Normal Mode

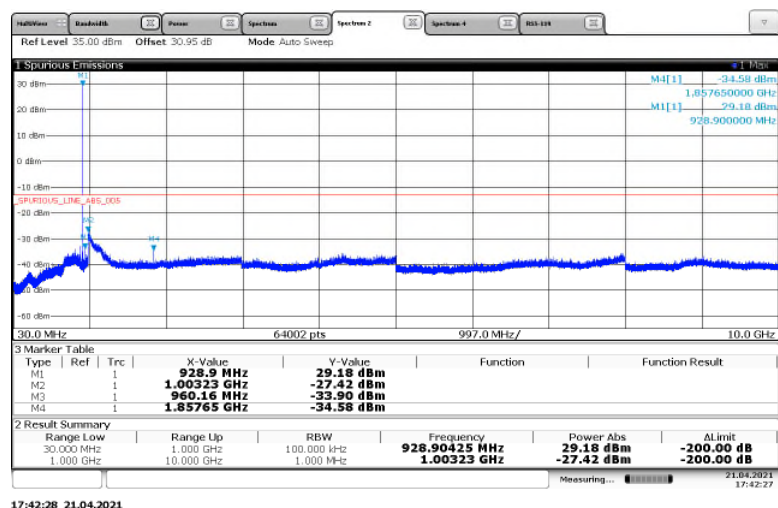


Figure 2.4.6-9: Transmitter Conducted Spurious Emissions – TAITIEN TCXO – 928.925 MHz - Normal Mode

2.4.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Digital MultiMeter	Fluke	115	BEMC02108	N/A	24	29-Mar-2023
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	N/A	24	07-Dec-2022
DC Power Supply	Xantrex	XHR60-18	TEMC00001	N/A	N/A	NCR
2.92mm Attenuator M/F 40GHz 30dB 2W VSWR 1.45	Centric RF	C402-30	TEMC00222	N/A	12	08-Mar-2022

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable

NCR – No Calibration Required



2.5 Field Strength of Spurious Radiation

2.5.1 Specification Reference

FCC 47 CFR Parts: 2.1053; 24.133 a(1), a(2); 101.111 a(6)
ISED Canada RSS-119 5.8.6; RSS-134 4.4

2.5.2 Equipment Under Test and Modification State

KDS TCXO, SN: 125000283

2.5.3 Date of Test

2021-March-25 to 2021-April-29

2.5.4 Test Method

The EUT was evaluated in accordance to ANSI C63.26:2015 Section 5.5.3 Measurement of Spurious Emissions using Substitution Method.

Radiated emissions tests were made over the frequency range of 30 MHz to 10 times the highest fundamental frequency. The equipment under test is placed in the Semi-Anechoic Chamber on a RF transparent table at the turntable center. For each spurious emission, the antenna mast is raised and lowered from one (1) to four (4) meters and the turntable is rotated 360° and the maximum reading on the spectrum analyzer is recorded. This was repeated for both horizontal and vertical polarizations of the receive antenna.

The equipment under test is then replaced with a substitution antenna fed by a signal generator. The signal generator's frequency is set to that of the spurious emission recorded from the equipment under test. The antenna mast is raised and lowered from one (1) to four (4) meters to obtain a maximum reading on the spectrum analyzer. The output of the signal generator is then adjusted until the reading on the spectrum analyzer matches that obtained from the equipment under test. The signal generator level is recorded. The power in dBm of each spurious emission is calculated by correcting the signal generator level for the cable loss and gain of the substitution antenna referenced to a dipole. The spectrum was investigated in accordance to FCC CFR 47 Part 2.1057.

The magnitude of all spurious emissions not reported were attenuated below the noise floor of the measurement system and therefore not specified in this report. Results are shown below.

2.5.5 Environmental Conditions

Ambient Temperature	25.6 °C
Relative Humidity	42.8 %
Atmospheric Pressure	1020.9 mbar



2.5.6 Test Results

DC Powered Operating

FCC Part 24.133a(1),(a2); ISED Canada RSS-134 4.4

Table 2.5.6-1: Transmitter Radiated Spurious Emissions – KDS TCXO – 901.5 MHz - Normal Mode

Frequency MHz	Level dBuV	Antenna Polarity (H/V)	ERP dBm	Limit dBm	Margin dB
1803	66.42	H	-37.69	-13.0	24.69
2704.5	62.94	H	-38.58	-13.0	25.58
3606	55.63	H	-44.96	-13.0	31.96
4507.5	56.11	H	-42.02	-13.0	29.02
5409	53.07	H	-42.71	-13.0	29.71
6310.5	50.03	H	-43.98	-13.0	30.98
7212	47.43	H	-46.19	-13.0	33.19
8113.5	46.22	H	-46.28	-13.0	33.28
9015	47.49	H	-44.07	-13.0	31.07
1803	65.70	V	-38.41	-13.0	25.41
2704.5	65.40	V	-36.12	-13.0	23.12
3606	55.10	V	-45.49	-13.0	32.49
4507.5	54.62	V	-43.51	-13.0	30.51
5409	54.57	V	-41.21	-13.0	28.21
6310.5	48.39	V	-45.62	-13.0	32.62
7212	47.82	V	-45.8	-13.0	32.8
8113.5	50.51	V	-41.99	-13.0	28.99
9015	51.63	V	-39.93	-13.0	26.93



Table 2.5.6-2: Transmitter Radiated Spurious Emissions – KDS TCXO – 930.5 MHz - mPass5k Mode

Frequency MHz	Level dBuV	Antenna Polarity (H/V)	ERP dBm	Limit dBm	Margin dB
1861	66.43	H	-37.25	-13.0	24.25
2791.5	64.62	H	-36.74	-13.0	23.74
3722	60.13	H	-40.18	-13.0	27.18
4652.5	53.27	H	-44.54	-13.0	31.54
5583	53.48	H	-41.85	-13.0	28.85
6513.5	49.00	H	-44.69	-13.0	31.69
7444	47.61	H	-45.94	-13.0	32.94
8374.5	48.08	H	-44.05	-13.0	31.05
9305	45.80	H	-46.18	-13.0	33.18
1861	65.05	V	-38.63	-13.0	25.63
2791.5	60.50	V	-40.86	-13.0	27.86
3722	61.01	V	-39.3	-13.0	26.3
4652.5	54.46	V	-43.35	-13.0	30.35
5583	53.81	V	-41.52	-13.0	28.52
6513.5	50.88	V	-42.81	-13.0	29.81
7444	50.09	V	-43.46	-13.0	30.46
8374.5	54.14	V	-37.99	-13.0	24.99
9305	46.96	V	-45.02	-13.0	32.02



Table 2.5.6-3: Transmitter Radiated Spurious Emissions – KDS TCXO – 940.0125 MHz - mPass5k Mode

Frequency MHz	Level dBuV	Antenna Polarity (H/V)	ERP dBm	Limit dBm	Margin dB
1880.025	60.65	H	-42.89	-13.0	29.89
2820.038	67.17	H	-34.14	-13.0	21.14
3760.05	60.16	H	-40.06	-13.0	27.06
4700.063	52.03	H	-45.68	-13.0	32.68
5640.075	51.81	H	-43.42	-13.0	30.42
6580.088	50.18	H	-43.51	-13.0	30.51
7520.1	47.53	H	-45.96	-13.0	32.96
8460.113	49.74	H	-42.28	-13.0	29.28
9400.125	44.35	H	-47.77	-13.0	34.77
1880.025	62.09	V	-41.45	-13.0	28.45
2820.038	71.84	V	-29.47	-13.0	16.47
3760.05	61.23	V	-38.99	-13.0	25.99
4700.063	51.97	V	-45.74	-13.0	32.74
5640.075	53.12	V	-42.11	-13.0	29.11
6580.088	51.85	V	-41.84	-13.0	28.84
7520.1	50.12	V	-43.37	-13.0	30.37
8460.113	56.89	V	-35.13	-13.0	22.13
9400.125	46.21	V	-45.91	-13.0	32.91



FCC 47 CFR Parts: 101.111 a(6); ISED Canada RSS-119 5.8.6

Table 2.5.6-4: Transmitter Radiated Spurious Emissions – KDS TCXO – 928.925 MHz - Normal Mode

Frequency MHz	Level dBuV	Antenna Polarity (H/V)	ERP dBm	Limit dBm	Margin dB
1857.85	64.78	H	-38.92	-13.0	25.92
2786.775	64.30	H	-37.07	-13.0	24.07
3715.7	59.25	H	-41.07	-13.0	28.07
4644.625	53.23	H	-44.6	-13.0	31.6
5573.55	51.76	H	-43.59	-13.0	30.59
6502.475	48.28	H	-45.41	-13.0	32.41
7431.4	46.99	H	-46.56	-13.0	33.56
8360.325	47.84	H	-44.31	-13.0	31.31
9289.25	45.44	H	-46.52	-13.0	33.52
1857.85	65.22	V	-38.48	-13.0	25.48
2786.775	69.39	V	-31.98	-13.0	18.98
3715.7	59.55	V	-40.77	-13.0	27.77
4644.625	53.79	V	-44.04	-13.0	31.04
5573.55	53.75	V	-41.6	-13.0	28.6
6502.475	51.77	V	-41.92	-13.0	28.92
7431.4	49.54	V	-44.01	-13.0	31.01
8360.325	52.73	V	-39.42	-13.0	26.42
9289.25	47.56	V	-44.4	-13.0	31.4



Table 2.5.6-5: Transmitter Radiated Spurious Emissions – KDS TCXO – 932.25 MHz - Normal Mode

Frequency MHz	Level dBuV	Antenna Polarity (H/V)	ERP dBm	Limit dBm	Margin dB
1864.5	66.51	H	-37.14	-13.0	24.14
2796.75	64.77	H	-36.58	-13.0	23.58
3729	59.37	H	-40.92	-13.0	27.92
4661.25	51.58	H	-46.22	-13.0	33.22
5593.5	53.55	H	-41.76	-13.0	28.76
6525.75	49.08	H	-44.61	-13.0	31.61
7458	47.02	H	-46.52	-13.0	33.52
8390.25	49.08	H	-43.03	-13.0	30.03
9322.5	45.00	H	-47.01	-13.0	34.01
1864.5	64.21	V	-39.44	-13.0	26.44
2796.75	69.15	V	-32.2	-13.0	19.2
3729	61.14	V	-39.15	-13.0	26.15
4661.25	54.35	V	-43.45	-13.0	30.45
5593.5	53.37	V	-41.94	-13.0	28.94
6525.75	52.52	V	-41.17	-13.0	28.17
7458	49.71	V	-43.83	-13.0	30.83
8390.25	55.66	V	-36.45	-13.0	23.45
9322.5	47.03	V	-44.98	-13.0	31.98



Table 2.5.6-6: Transmitter Radiated Spurious Emissions – KDS TCXO – 941.4875 MHz - mPass5k Mode

Frequency MHz	Level dBuV	Antenna Polarity (H/V)	ERP dBm	Limit dBm	Margin dB
1882.975	61.18	H	-42.34	-13.0	29.34
2824.463	67.17	H	-34.13	-13.0	21.13
3765.95	60.10	H	-40.1	-13.0	27.1
4707.438	51.12	H	-46.57	-13.0	33.57
5648.925	50.94	H	-44.27	-13.0	31.27
6590.413	48.71	H	-44.98	-13.0	31.98
7531.9	48.61	H	-44.86	-13.0	31.86
8473.388	49.89	H	-42.11	-13.0	29.11
9414.875	43.74	H	-48.4	-13.0	35.4
1882.975	62.37	V	-41.15	-13.0	28.15
2824.463	71.00	V	-30.3	-13.0	17.3
3765.95	60.07	V	-40.13	-13.0	27.13
4707.438	51.66	V	-46.03	-13.0	33.03
5648.925	52.14	V	-43.07	-13.0	30.07
6590.413	50.59	V	-43.1	-13.0	30.1
7531.9	50.00	V	-43.47	-13.0	30.47
8473.388	57.23	V	-34.77	-13.0	21.77
9414.875	45.30	V	-46.84	-13.0	33.84



Table 2.5.6-7: Transmitter Radiated Spurious Emissions – KDS TCXO – 959.925 MHz - mPass5k Mode

Frequency MHz	Level dBuV	Antenna Polarity (H/V)	ERP dBm	Limit dBm	Margin dB
1919.85	58.05	H	-45.2	-13.0	32.2
2879.775	67.98	H	-33.22	-13.0	20.22
3839.7	60.48	H	-39.54	-13.0	26.54
4799.625	50.29	H	-47.2	-13.0	34.2
5759.55	50.09	H	-44.91	-13.0	31.91
6719.475	48.51	H	-45.18	-13.0	32.18
7679.4	47.03	H	-46.19	-13.0	33.19
8639.325	47.18	H	-44.66	-13.0	31.66
9599.25	45.82	H	-46.1	-13.0	33.1
1919.85	60.10	V	-43.15	-13.0	30.15
2879.775	73.89	V	-27.31	-13.0	14.31
3839.7	61.05	V	-38.97	-13.0	25.97
4799.625	51.76	V	-45.73	-13.0	32.73
5759.55	50.91	V	-44.09	-13.0	31.09
6719.475	49.03	V	-44.66	-13.0	31.66
7679.4	49.13	V	-44.09	-13.0	31.09
8639.325	53.94	V	-37.9	-13.0	24.9
9599.25	46.09	V	-45.83	-13.0	32.83

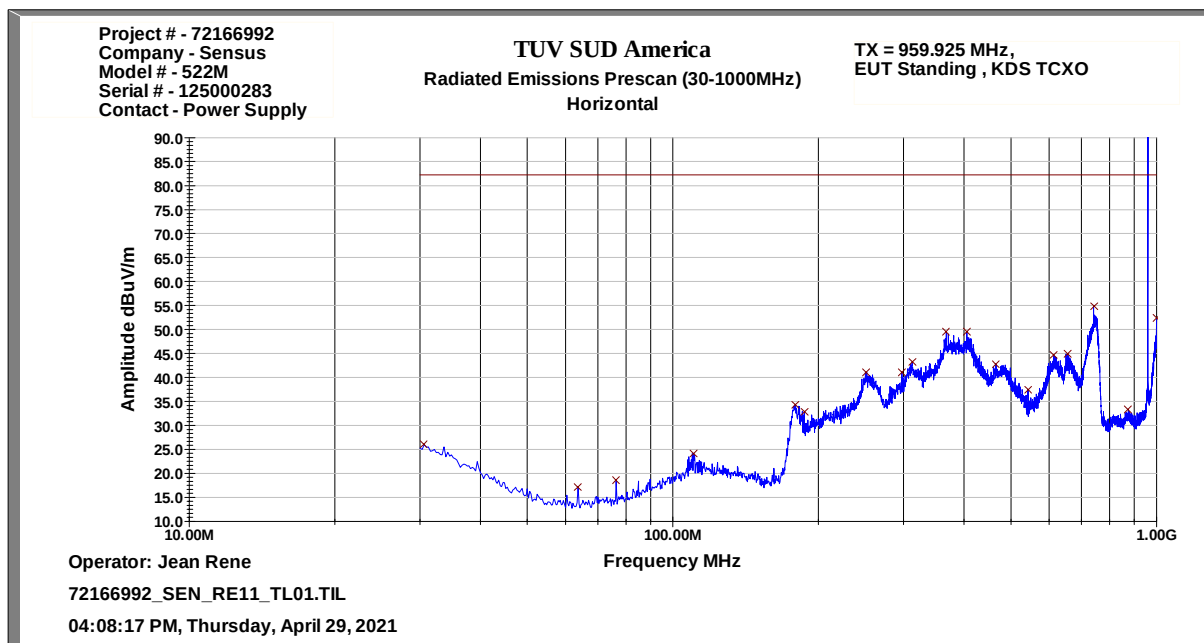


Figure 2.5.6-1: Transmitter Radiated Spurious Emissions – KDS TCXO – 959.925 MHz - mPass5k Mode – 30 MHz – 1 GHz – Horizontal Polarization

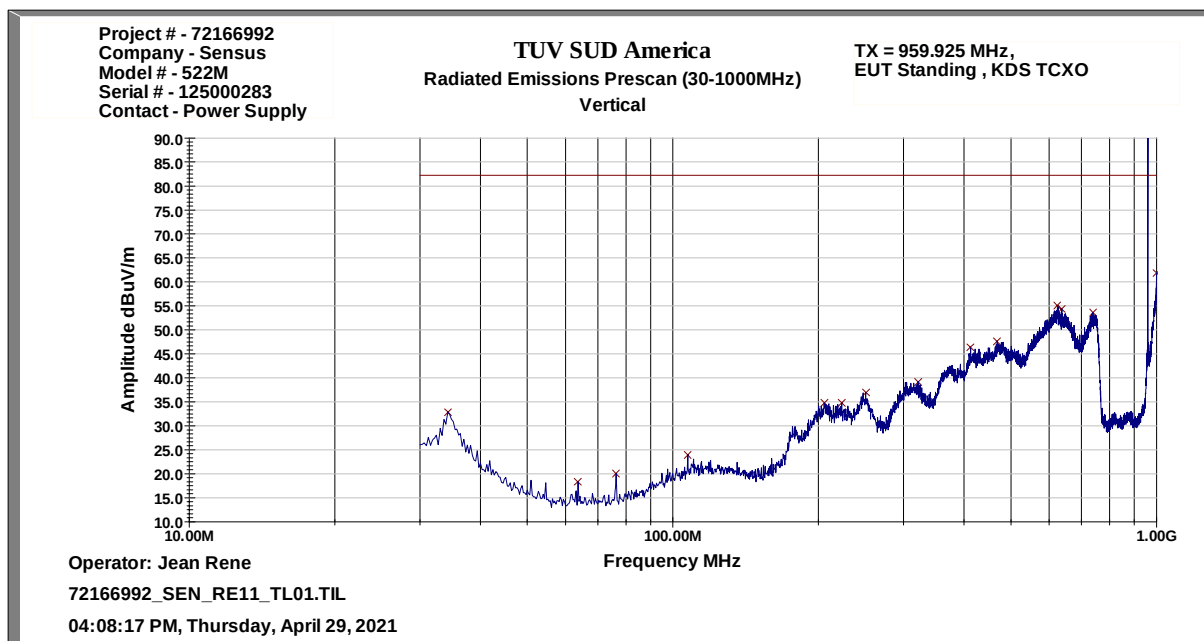


Figure 2.5.6-2: Transmitter Radiated Spurious Emissions – KDS TCXO – 959.925 MHz - mPass5k Mode – 30 MHz – 1 GHz – Vertical Polarization

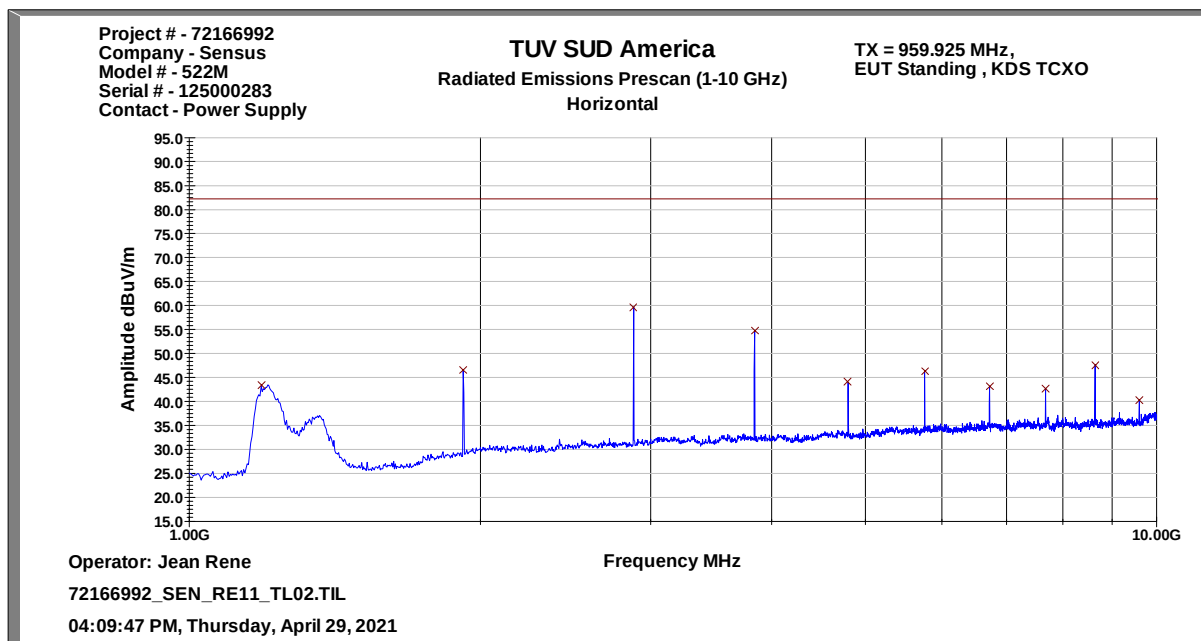


Figure 2.5.6-3: Transmitter Radiated Spurious Emissions – KDS TCXO – 959.925 MHz - mPass5k Mode – 1 GHz – 10 GHz – Horizontal Polarization

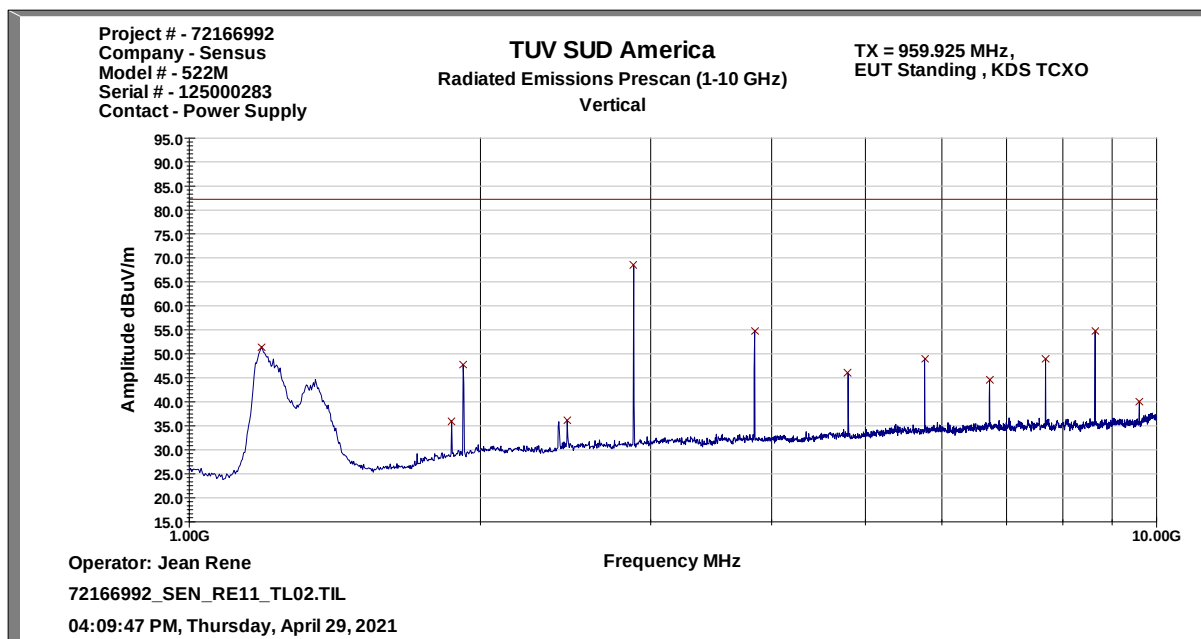


Figure 2.5.6-4: Transmitter Radiated Spurious Emissions – KDS TCXO – 959.925 MHz - mPass5k Mode – 1 GHz – 10 GHz – Vertical Polarization



2.5.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Notch Filter	Trilithic, Inc.	7NM867/122-X1-AA	BEMC02069	N/A	12	21-Jan-2022
Tile Automation Software	ETS Lindgren	TILE4! - Version 4.2.A	BEMC02095	4.2A	N/A	NCR
BI LOG PERIODIC, ANTENNA	Schaffner	CBL6112B	TEMC00005	N/A	24	31-Oct-2021
EMC Analyzer	Agilent	E7405A	TEMC00012	A.09.02	24	27-Mar-2022
EMC Chamber	Panasheild	N/A	TEMC00031	N/A	36	28-Jan-2024
Double Ridge Guide Horn	ETS Lindgren	3117	TEMC00061	N/A	24	07-Feb-2022
PAM-118A	Com-Power Corporation	PAM-118A	TEMC00160	N/A	12	10-Apr-2022
1.2 GHz High Pass Filter	Micro-Tronics	HPM50108-01	TEMC00175	N/A	12	09-Mar-2022
A81-0303 18 GHz Cable Set	Teledyne Storm Products	A81-0303-360/96	TEMC00201	N/A	12	10-Apr-2022

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable

NCR – No Calibration Required



2.6 Frequency Stability

2.6.1 Specification Reference

FCC Section 2.1055; FCC Section 24.135
ISED Canada RSS-134 4.5

2.6.2 Equipment Under Test and Modification State

TXC TCXO, SN: 125000296
KDS TCXO, SN: 125000291
TAITIEN TCXO, SN: 125000293

2.6.3 Date of Test

2021-March-29 to 2021-April-27

2.6.4 Test Method

The equipment under test is placed inside an environmental chamber. The RF output is directly coupled to the input of the measurement equipment and a power supply is attached to the primary supply voltage.

Frequency measurements were made at the extremes of the of temperature range -30° C to +50° C and at intervals of 10° C at normal supply voltage. Sufficient time to stabilize all components of the equipment was allowed at each frequency measurement. At a temperature 20° C the supply voltage was reduced to the battery operating endpoint. The maximum variation of frequency was recorded.

2.6.5 Environmental Conditions

Ambient Temperature	26.7 °C
Relative Humidity	36.8 %
Atmospheric Pressure	1017.4 mbar



2.6.6 Test Results

Frequency Stability

Frequency (MHz): 901.500112

Deviation Limit (PPM): 1

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	901.500681	0.632	100%	3.65
-20 C	901.500577	0.516	100%	3.65
-10 C	901.500328	0.239	100%	3.65
0 C	901.500146	0.038	100%	3.65
10 C	901.500026	-0.095	100%	3.65
20 C	901.500112	0.000	100%	3.65
30 C	901.500088	-0.027	100%	3.65
40 C	901.500142	0.033	100%	3.65
50 C	901.500156	0.049	100%	3.65
20 C	901.500256	0.160	Endpoint	3.20

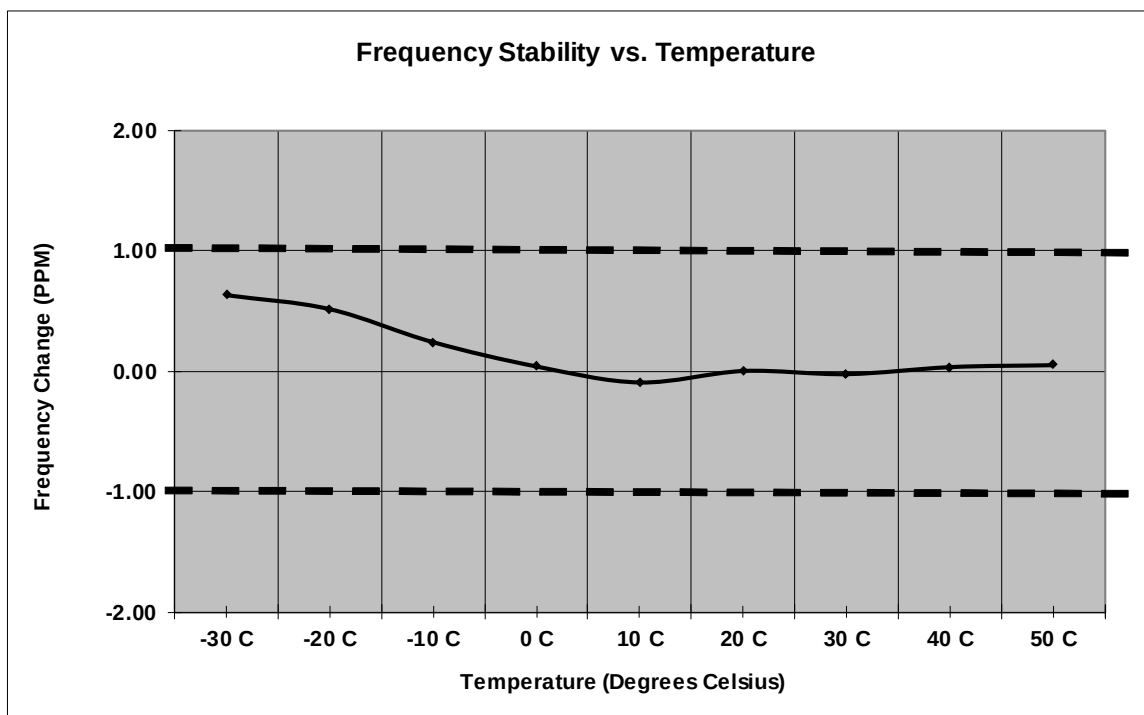


Figure 2.6.6-1: Frequency Stability – TXC TCXO – 901.5 MHz



Frequency Stability

Frequency (MHz): 930.500206

Deviation Limit (PPM): 1

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	930.500707	0.539	100%	3.65
-20 C	930.500541	0.361	100%	3.65
-10 C	930.500300	0.101	100%	3.65
0 C	930.500070	-0.146	100%	3.65
10 C	930.500030	-0.189	100%	3.65
20 C	930.500206	0.000	100%	3.65
30 C	930.500144	-0.067	100%	3.65
40 C	930.500142	-0.069	100%	3.65
50 C	930.500130	-0.082	100%	3.65
20 C	930.500196	-0.011	Endpoint	3.20

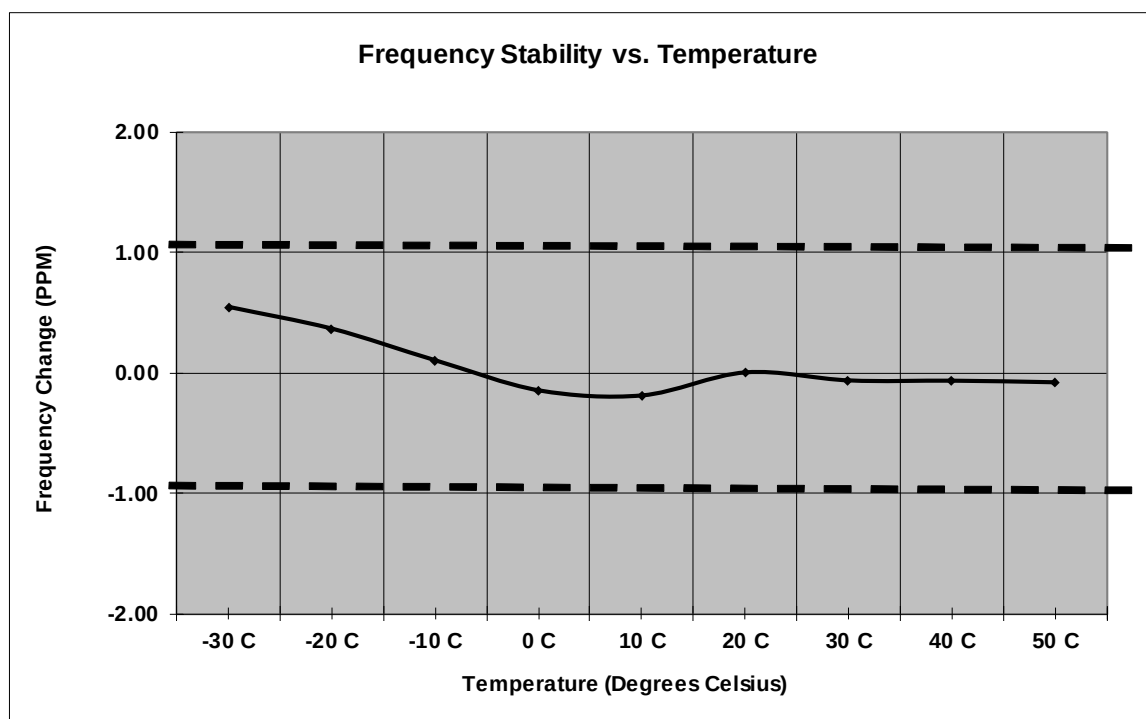


Figure 2.6.6-2: Frequency Stability – TXC TCXO – 930.5 MHz



Frequency Stability

Frequency (MHz): 959.925000

Deviation Limit (PPM): 1

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	959.925701	0.731	100%	3.65
-20 C	959.925533	0.556	100%	3.65
-10 C	959.925302	0.314	100%	3.65
0 C	959.925128	0.133	100%	3.65
10 C	959.924922	-0.081	100%	3.65
20 C	959.925000	0.000	100%	3.65
30 C	959.925118	0.123	100%	3.65
40 C	959.925128	0.133	100%	3.65
50 C	959.925058	0.060	100%	3.65
20 C	959.925186	0.194	Endpoint	3.20

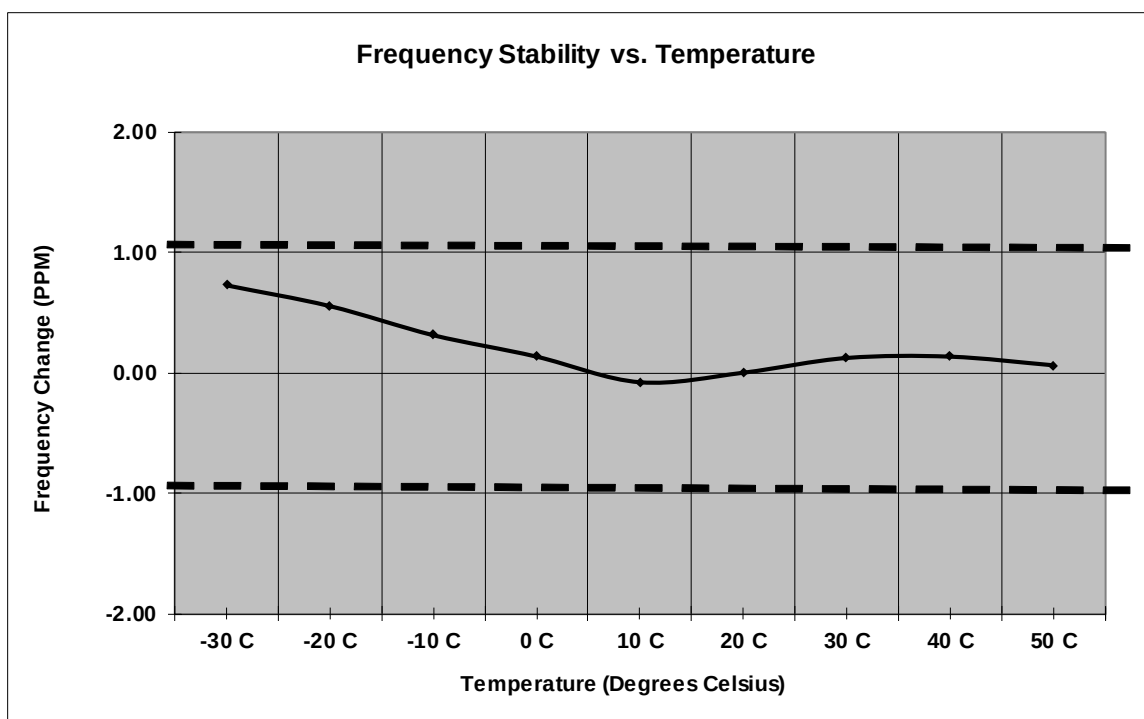


Figure 2.6.6-3: Frequency Stability – TxC TCXO – 959.925 MHz



Frequency Stability

Frequency (MHz): 901.500032

Deviation Limit (PPM): 1

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	901.500232	0.222	100%	3.65
-20 C	901.500038	0.007	100%	3.65
-10 C	901.500012	-0.022	100%	3.65
0 C	901.500084	0.058	100%	3.65
10 C	901.500046	0.015	100%	3.65
20 C	901.500032	0.000	100%	3.65
30 C	901.500022	-0.011	100%	3.65
40 C	901.500180	0.164	100%	3.65
50 C	901.500278	0.273	100%	3.65
20 C	901.500058	0.029	Endpoint	3.20

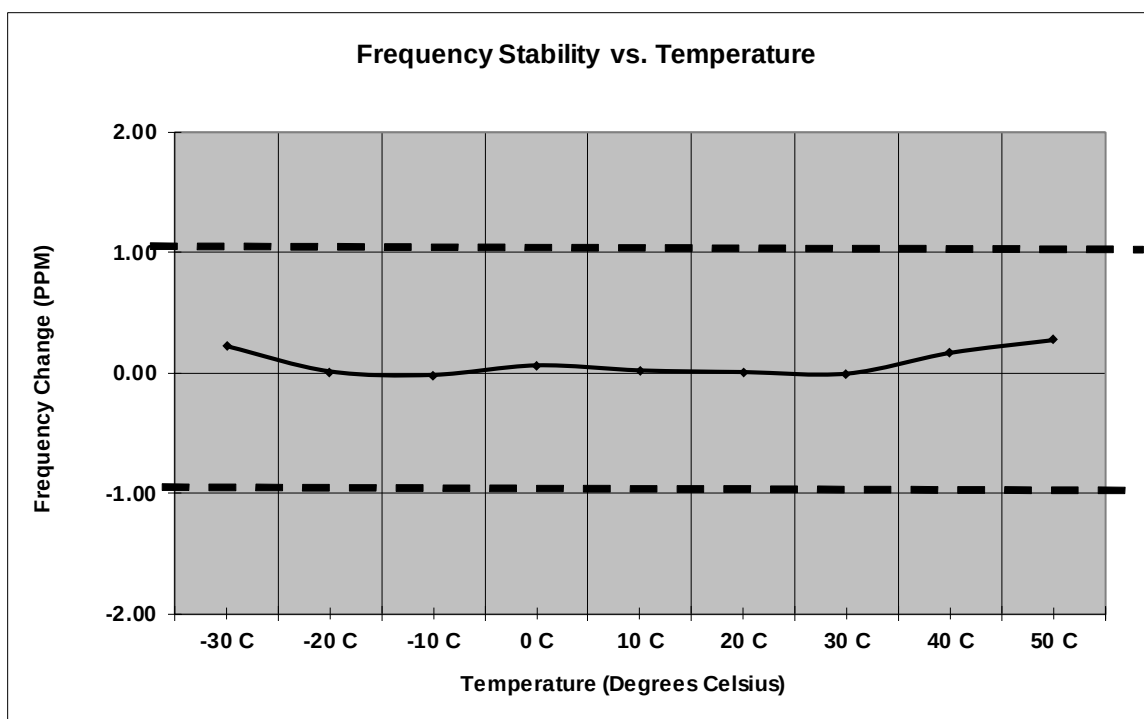


Figure 2.6.6-4: Frequency Stability – KDS TCXO – 901.5 MHz



Frequency Stability

Frequency (MHz): 930.500040

Deviation Limit (PPM): 1

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	930.500070	0.032	100%	3.65
-20 C	930.500046	0.006	100%	3.65
-10 C	930.500106	0.071	100%	3.65
0 C	930.500062	0.024	100%	3.65
10 C	930.500002	-0.041	100%	3.65
20 C	930.500040	0.000	100%	3.65
30 C	930.499934	-0.114	100%	3.65
40 C	930.500130	0.097	100%	3.65
50 C	930.500262	0.238	100%	3.65
20 C	930.500024	-0.017	Endpoint	3.20

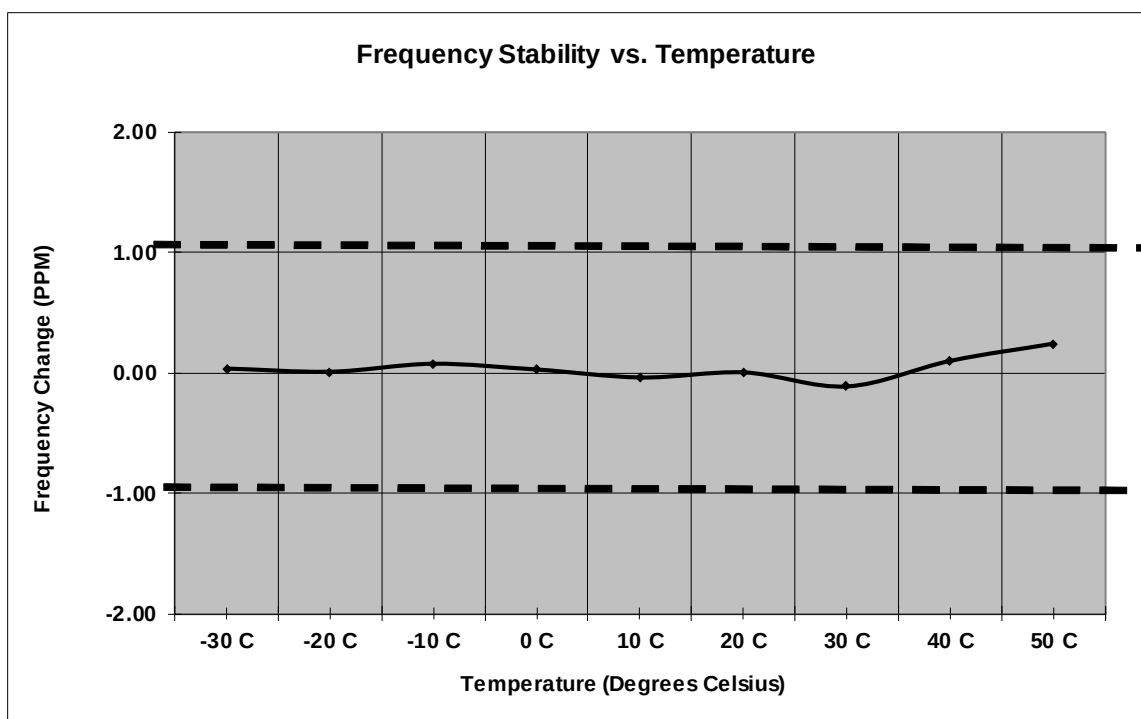


Figure 2.6.6-5: Frequency Stability – KDS TCXO – 930.5 MHz



Frequency Stability

Frequency (MHz): 959.925000

Deviation Limit (PPM): 1

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	959.925056	0.058	100%	3.65
-20 C	959.925056	0.058	100%	3.65
-10 C	959.925116	0.121	100%	3.65
0 C	959.925058	0.060	100%	3.65
10 C	959.924975	-0.026	100%	3.65
20 C	959.925000	0.000	100%	3.65
30 C	959.924916	-0.087	100%	3.65
40 C	959.925146	0.152	100%	3.65
50 C	959.925276	0.287	100%	3.65
20 C	959.925030	0.031	Endpoint	3.20

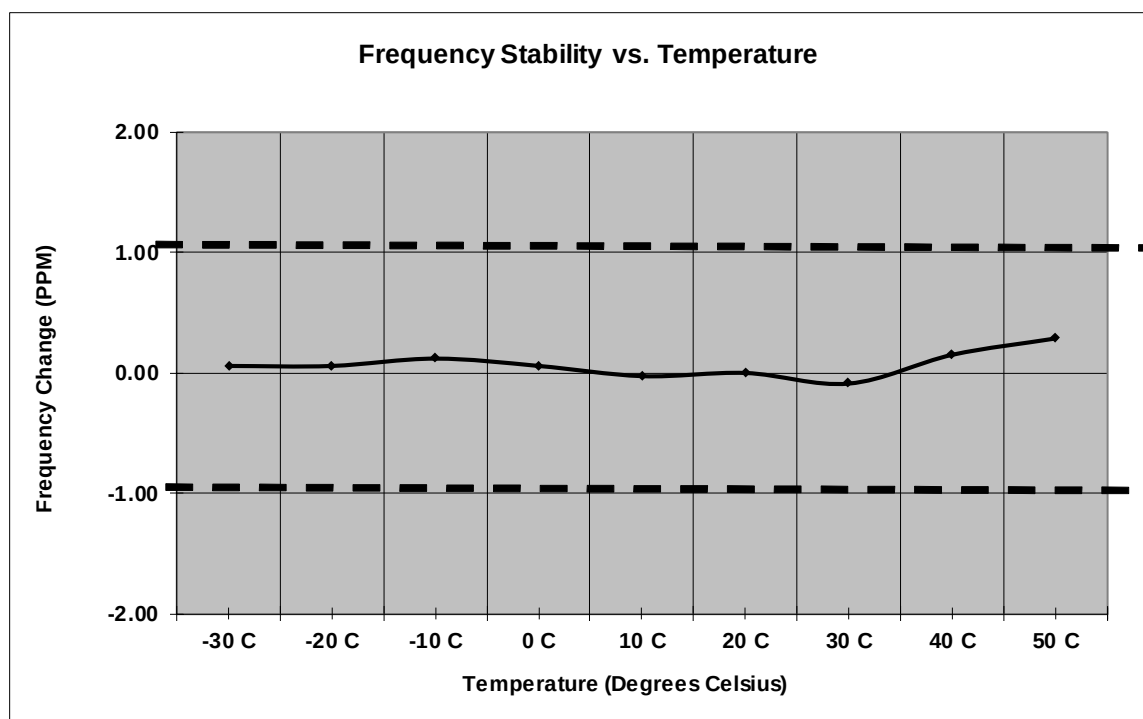


Figure 2.6.6-6: Frequency Stability – KDS TCXO – 959.925 MHz



Frequency Stability

Frequency (MHz): 901.499928

Deviation Limit (PPM): 1

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	901.499463	-0.516	100%	3.65
-20 C	901.499219	-0.787	100%	3.65
-10 C	901.499319	-0.676	100%	3.65
0 C	901.499321	-0.674	100%	3.65
10 C	901.499714	-0.237	100%	3.65
20 C	901.499928	0.000	100%	3.65
30 C	901.499638	-0.321	100%	3.65
40 C	901.499684	-0.270	100%	3.65
50 C	901.499421	-0.563	100%	3.65
20 C	901.500240	0.346	Endpoint	3.20

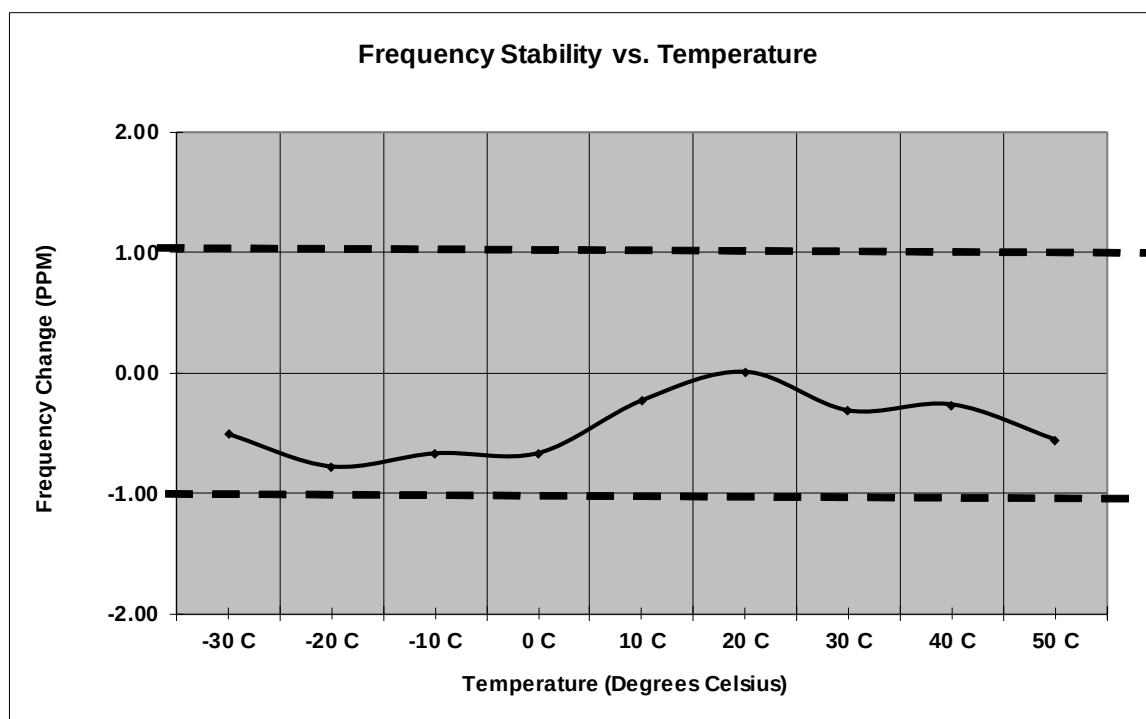


Figure 2.6.6-7: Frequency Stability – TAITIEN TCXO – 901.5 MHz



Frequency Stability

Frequency (MHz): 930.499980

Deviation Limit (PPM):

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	930.499357	-0.670	100%	3.65
-20 C	930.499343	-0.685	100%	3.65
-10 C	930.499505	-0.511	100%	3.65
0 C	930.499592	-0.417	100%	3.65
10 C	930.499618	-0.389	100%	3.65
20 C	930.499980	0.000	100%	3.65
30 C	930.499558	-0.453	100%	3.65
40 C	930.499614	-0.393	100%	3.65
50 C	930.499574	-0.436	100%	3.65
20 C	930.500108	0.137	Endpoint	3.20

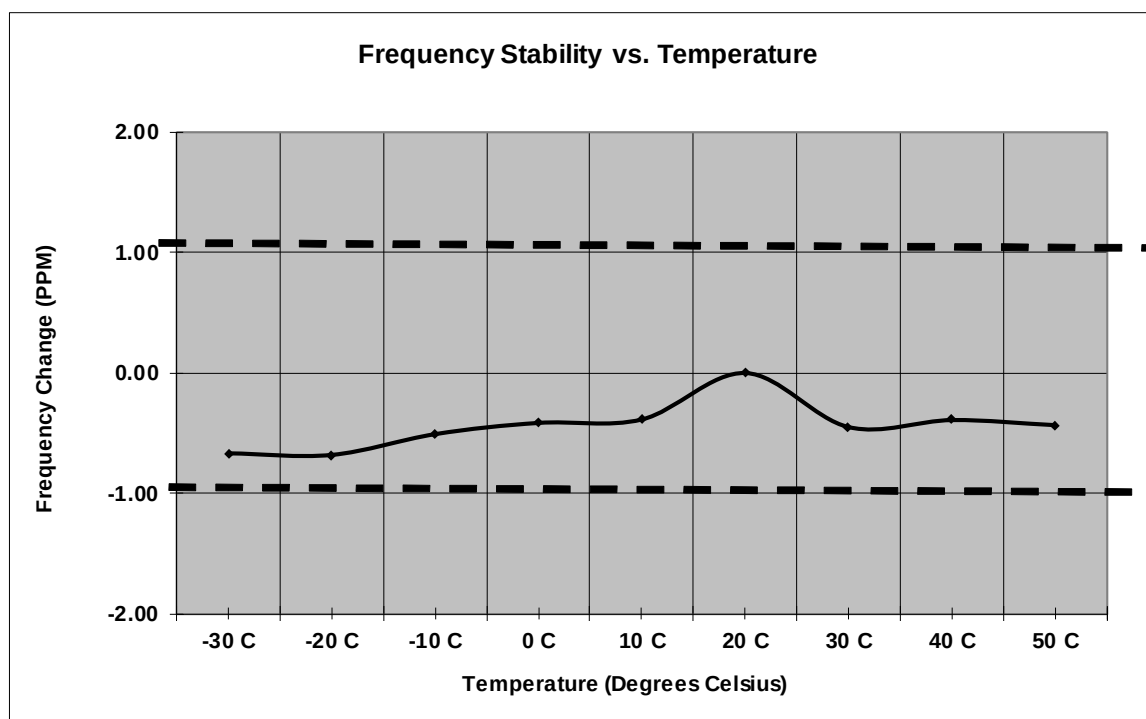


Figure 2.6.6-8: Frequency Stability – TAITIEN TCXO – 930.5 MHz



Frequency Stability

Frequency (MHz): 959.924824

Deviation Limit (PPM):

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	959.924231	-0.618	100%	3.65
-20 C	959.924209	-0.641	100%	3.65
-10 C	959.924395	-0.448	100%	3.65
0 C	959.924520	-0.316	100%	3.65
10 C	959.924578	-0.256	100%	3.65
20 C	959.924824	0.000	100%	3.65
30 C	959.924451	-0.389	100%	3.65
40 C	959.924605	-0.228	100%	3.65
50 C	959.924227	-0.622	100%	3.65
20 C	959.924800	-0.025	Endpoint	3.20

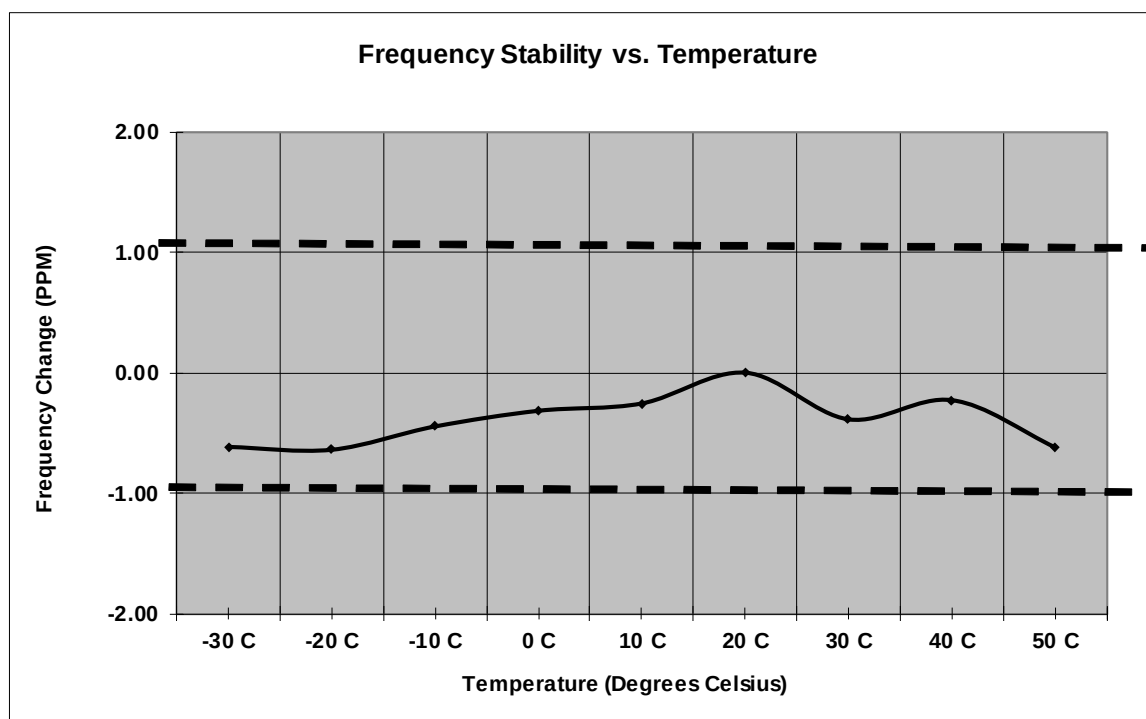


Figure 2.6.6-9: Frequency Stability – TAITIEN TCXO – 959.925 MHz



2.6.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Digital Thermometer	Omega Engineering	MDSS41-TC	BEMC00002	N/A	24	03-Oct-2021
1.5 Cu Ft, -73°C to +175°C, Floor Standing Version	Test Equity	115	BEMC02102	N/A	N/A	NCR
Digital MultiMeter	Fluke	115	BEMC02108	N/A	24	29-Mar-2023
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	N/A	24	07-Dec-2022
DMM Multimeter	Fluke	27	TAME01003	N/A	12	12-Jan-2022
Multimeter	Fluke	77	TAME01006	N/A	12	12-Jan-2022
DC Power Supply	Xantrex	XHR60-18	TEMC00001	N/A	N/A	NCR
2.92mm Attenuator M/F 40GHz 30dB 2W VSWR 1.45	Centric RF	C402-30	TEMC00222	N/A	12	08-Mar-2022

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable

NCR - No Calibration Required



3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Digital Thermometer	Omega Engineering	MDSS41-TC	BEMC00002	N/A	24	03-Oct-2021
1.5 Cu Ft, -73°C to +175°C, Floor Standing Version	Test Equity	115	BEMC02102	N/A	N/A	NCR
Digital MultiMeter	Fluke	115	BEMC02108	N/A	24	29-Mar-2023
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	DEMC3085	N/A	24	07-Dec-2022
DMM Multimeter	Fluke	27	TAME01003	N/A	12	12-Jan-2022
Multimeter	Fluke	77	TAME01006	N/A	12	12-Jan-2022
DC Power Supply	Xantrex	XHR60-18	TEMC00001	N/A	N/A	NCR
2.92mm Attenuator M/F 40GHz 30dB 2W VSWR 1.45	Centric RF	C402-30	TEMC00222	N/A	12	08-Mar-2022
Notch Filter	Trilithic, Inc.	7NM867/122-X1-AA	BEMC02069	N/A	12	21-Jan-2022
Tile Automation Software	ETS Lindgren	TILE4! - Version 4.2.A	BEMC02095	4.2A	N/A	NCR
BI LOG PERIODIC, ANTENNA	Schaffner	CBL6112B	TEMC00005	N/A	24	31-Oct-2021
EMC Analyzer	Agilent	E7405A	TEMC00012	A.09.02	24	27-Mar-2022
EMC Chamber	Panasheild	N/A	TEMC00031	N/A	36	28-Jan-2024
Double Ridge Guide Horn	ETS Lindgren	3117	TEMC00061	N/A	24	07-Feb-2022
PAM-118A	Com-Power Corporation	PAM-118A	TEMC00160	N/A	12	10-Apr-2022
1.2 GHz High Pass Filter	Micro-Tronics	HPM50108-01	TEMC00175	N/A	12	09-Mar-2022
A81-0303 18 GHz Cable Set	Teledyne Storm Products	A81-0303-360/96	TEMC00201	N/A	12	10-Apr-2022
PAM-118A	Com-Power Corporation	PAM-118A	TEMC00160	N/A	12	10-Apr-2022
1.2 GHz High Pass Filter	Micro-Tronics	HPM50108-01	TEMC00175	N/A	12	09-Mar-2022



TU - Traceability Unscheduled
O/P MON - Traceability Unscheduled
N/A - Not Applicable
NCR - No Calibration Required

4 Diagram of Test Set-ups

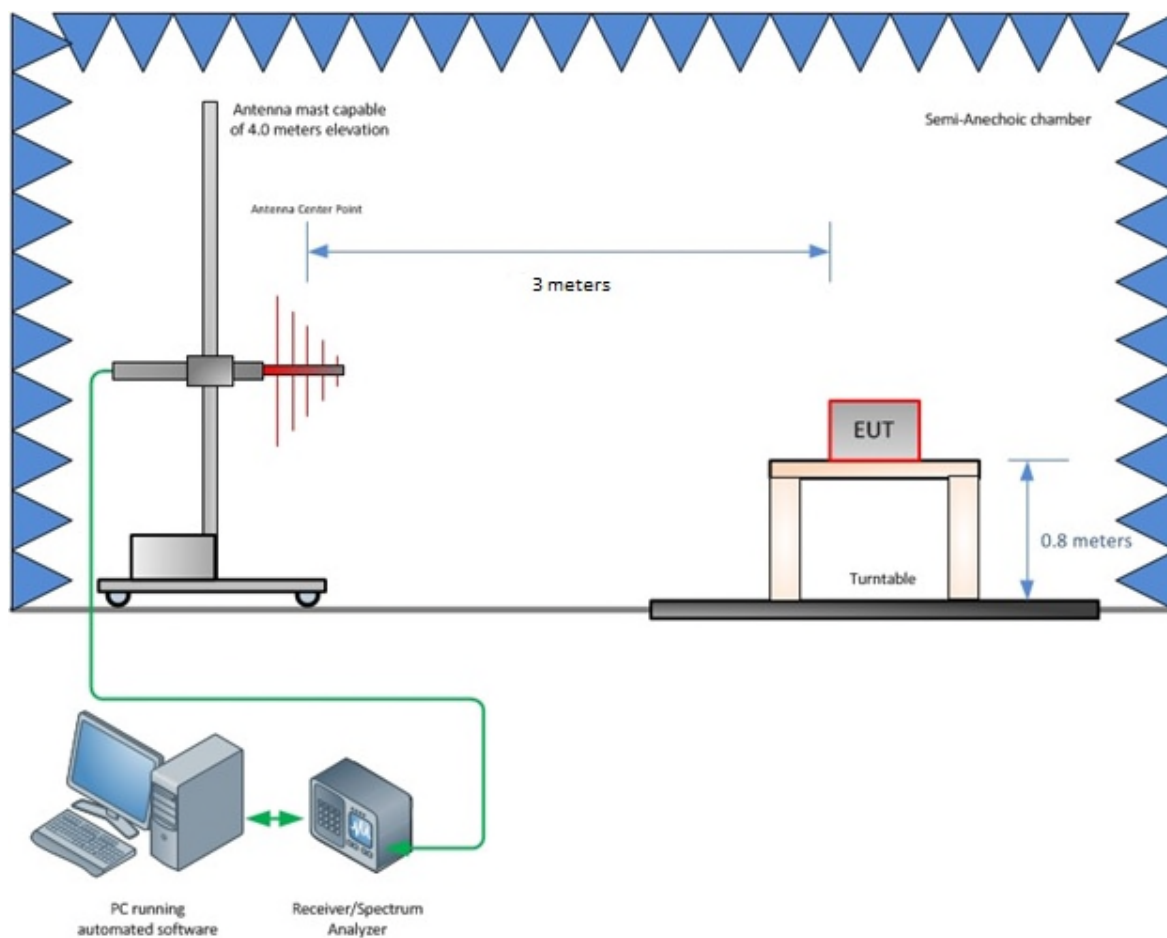


Figure 4-1 - Radiated Emissions Test Setup up to 1 GHz

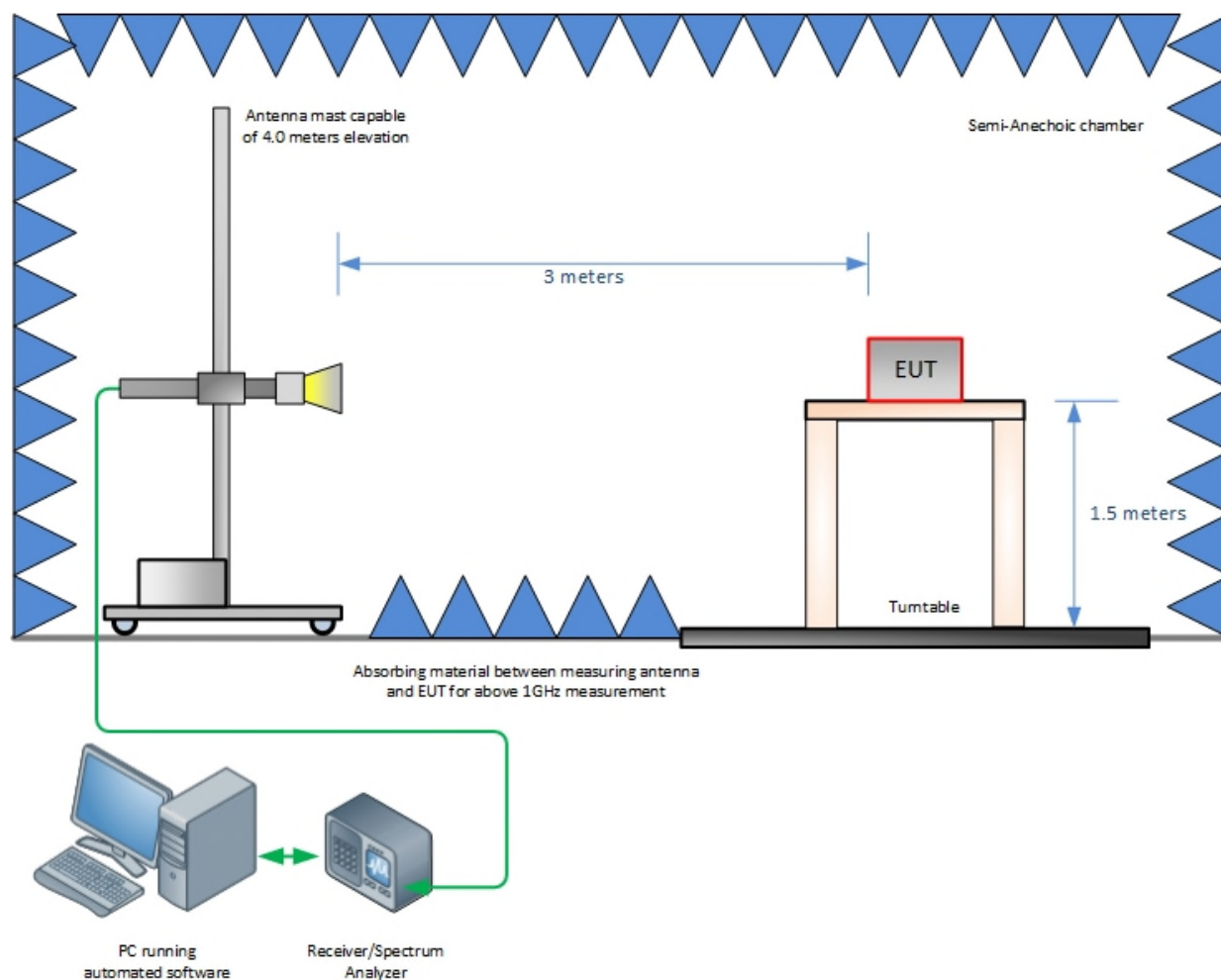


Figure 4-2 - Radiated Emissions Test Setup above 1 GHz

5 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Table 5-1 - Values of U_{CISPR} and U_{Lab}

Measurement	U_{CISPR}	U_{Lab}
Conducted disturbance (mains port) (9 kHz – 150 kHz) (150 kHz – 30 MHz)	3.8 dB 3.4 dB	3.71 dB 3.31 dB
Conducted disturbance (telecom port) (150 kHz – 30 MHz 55 dB LCL) (150 kHz – 30 MHz 65 dB LCL) (150 kHz – 30 MHz 75 dB LCL)	5.0 dB 5.0 dB 5.0 dB	4.11 dB 4.50 dB 4.94 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1 000 MHz) (1 – 6 GHz) (6-18 GHz)	6.3 dB 5.2 dB 5.5 dB	5.85 dB 4.48 dB 4.48 dB

Notes:

U_{CISPR} resembles a value of measurement uncertainty for a specific test, which was determined by considering uncertainties associated with the quantities listed in CISPR 16-4-2:2011.



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