Occupied Bandwidth – Path 3, Low 37.16 GHz, Modulation MCS0, Bandwidth 40 MHz

10:09:07 AM 08/03/2023

Occupied Bandwidth – Path 3, Mid 38.56 GHz, Modulation MCS0, Bandwidth 40 MHz

10:15:48 AM 08/03/2023

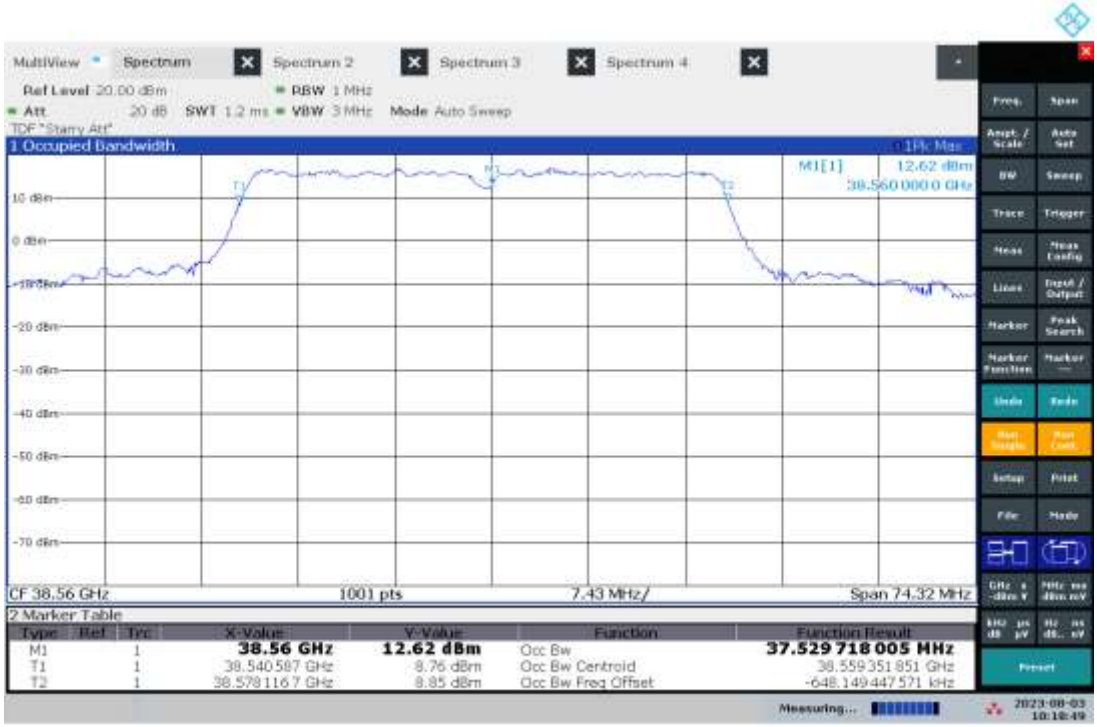
Occupied Bandwidth – Path 3, High 39.96 GHz, Modulation MCS0, Bandwidth 40 MHz

10:21:46 AM 08/03/2023

Occupied Bandwidth – Path 3, Low 37.16 GHz, Modulation MCS9, Bandwidth 40 MHz

10:12:32 AM 08/03/2023

Occupied Bandwidth – Path 3, Mid 38.56 GHz, Modulation MCS9, Bandwidth 40 MHz



10:18:49 AM 08/03/2023

Occupied Bandwidth – Path 3, High 39.96 GHz, Modulation MCS9, Bandwidth 40 MHz

10:25:11 AM 08/03/2023

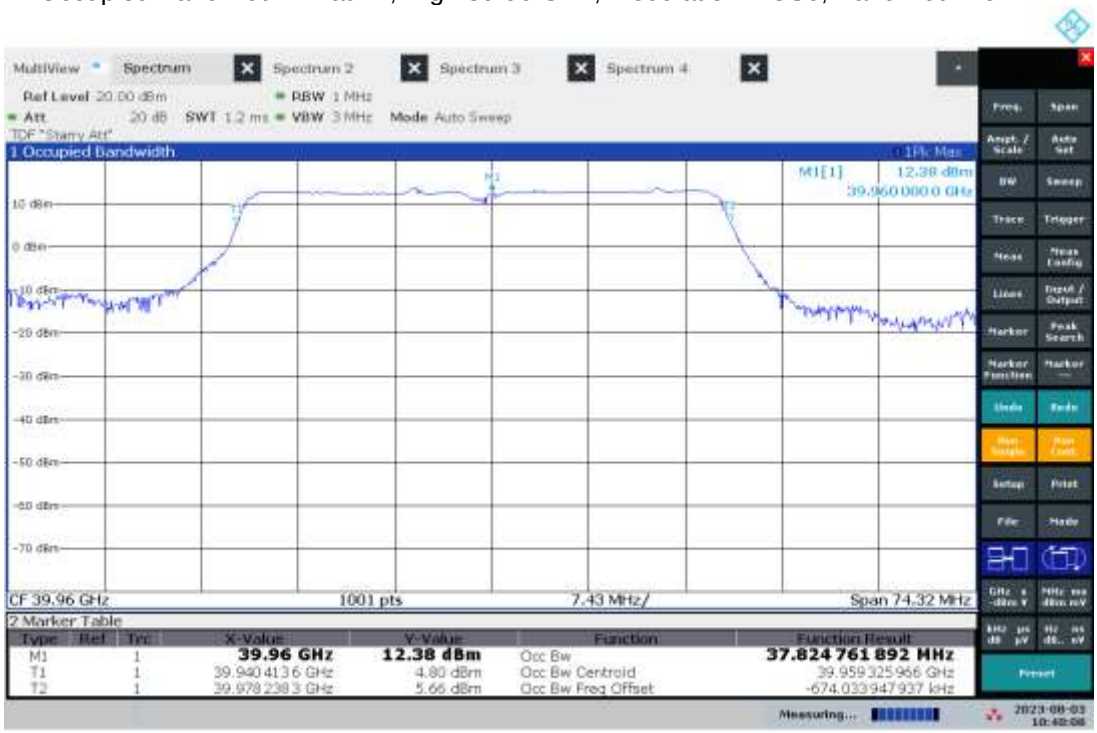
Occupied Bandwidth – Path 4, Low 37.16 GHz, Modulation MCS0, Bandwidth 40 MHz

10:29:48 AM 08/03/2023

Occupied Bandwidth – Path 4, Mid 38.56 GHz, Modulation MCS0, Bandwidth 40 MHz

10:35:44 AM 08/03/2023

Occupied Bandwidth – Path 4, High 39.96 GHz, Modulation MCS0, Bandwidth 40 MHz



10:40:08 AM 08/03/2023

Occupied Bandwidth – Path 4, Low 37.16 GHz, Modulation MCS9, Bandwidth 40 MHz

10:32:41 AM 08/03/2023

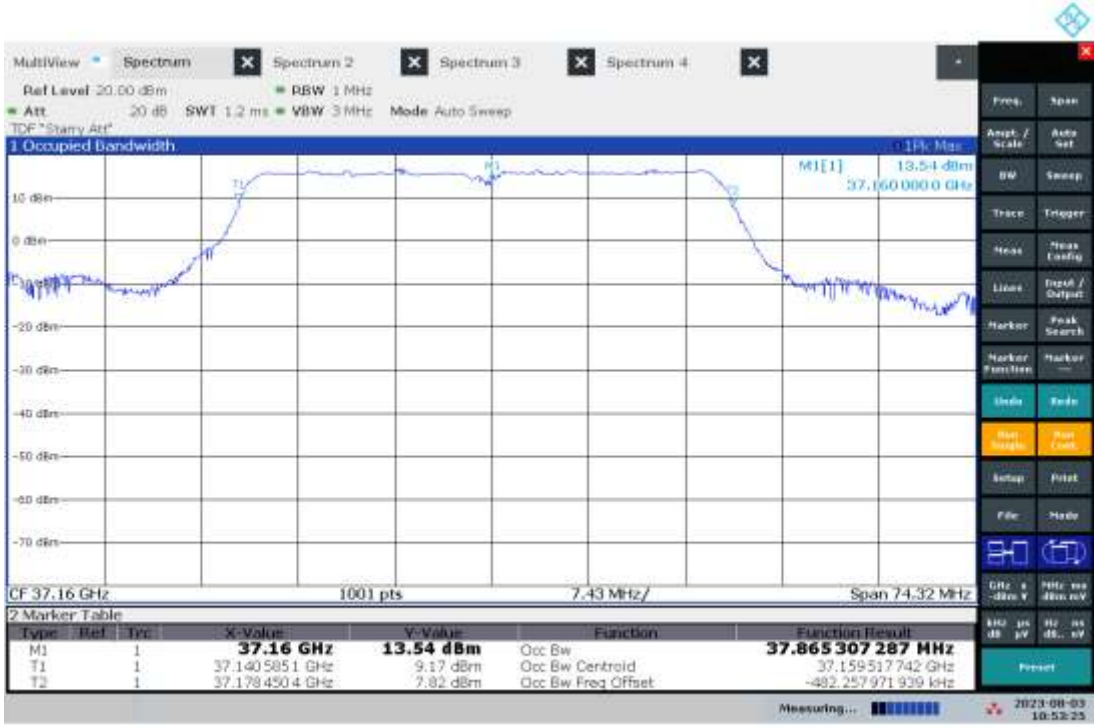
Occupied Bandwidth – Path 4, Mid 38.56 GHz, Modulation MCS9, Bandwidth 40 MHz

10:38:04 AM 08/03/2023

Occupied Bandwidth – Path 4, High 39.96 GHz, Modulation MCS9, Bandwidth 40 MHz

10:42:28 AM 08/03/2023

Occupied Bandwidth – Path 5, Low 37.16 GHz, Modulation MCS0, Bandwidth 40 MHz



10:53:26 AM 08/03/2023

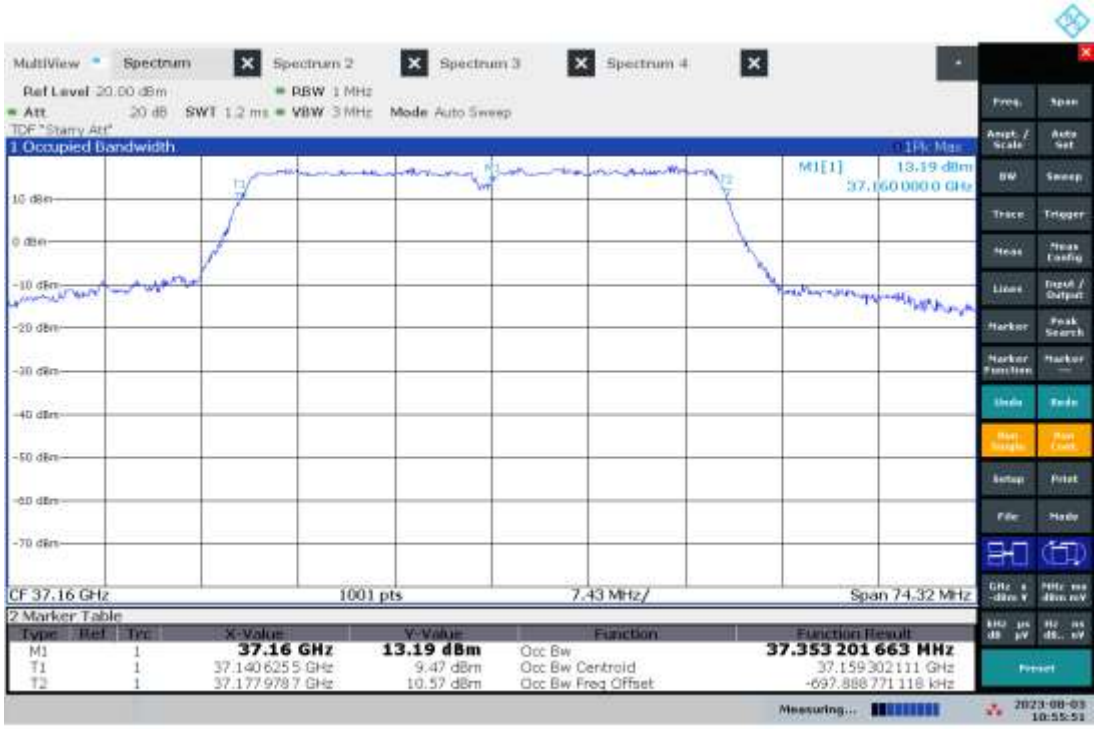
Occupied Bandwidth – Path 5, Mid 38.56 GHz, Modulation MCS0, Bandwidth 40 MHz

10:58:30 AM 08/03/2023

Occupied Bandwidth – Path 5, High 39.96 GHz, Modulation MCS0, Bandwidth 40 MHz

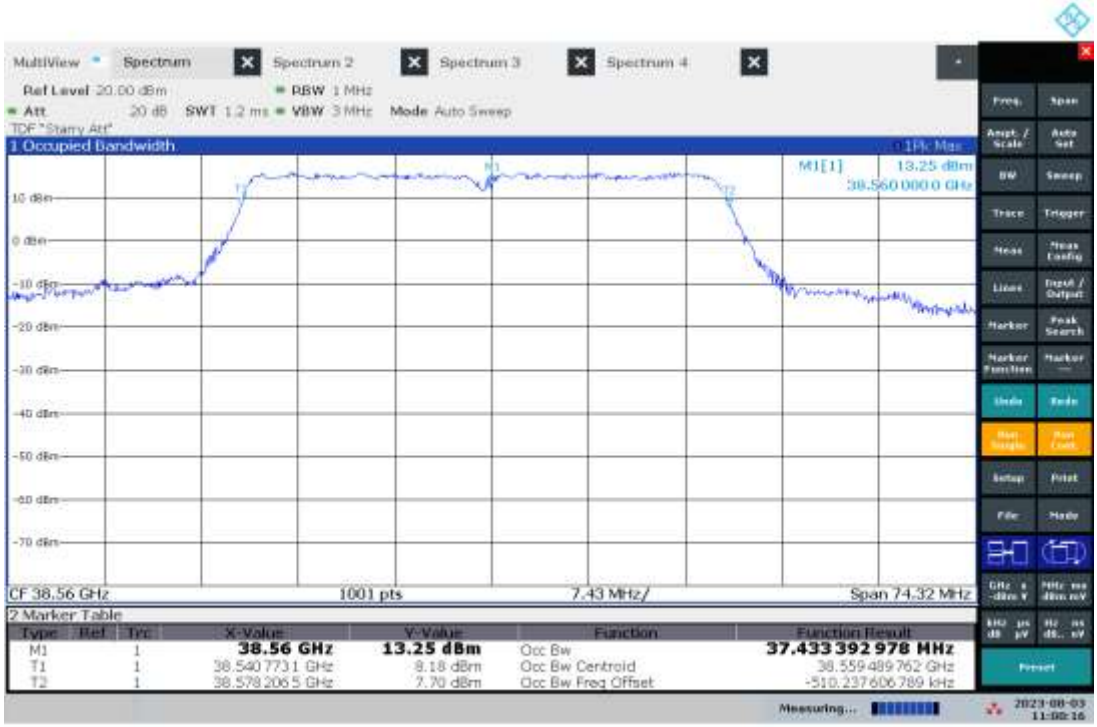
11:02:16 AM 08/03/2023

Occupied Bandwidth – Path 5, Low 37.16 GHz, Modulation MCS9, Bandwidth 40 MHz



10:55:51 AM 08/03/2023

Occupied Bandwidth – Path 5, Mid 38.56 GHz, Modulation MCS9, Bandwidth 40 MHz



11:00:16 AM 08/03/2023

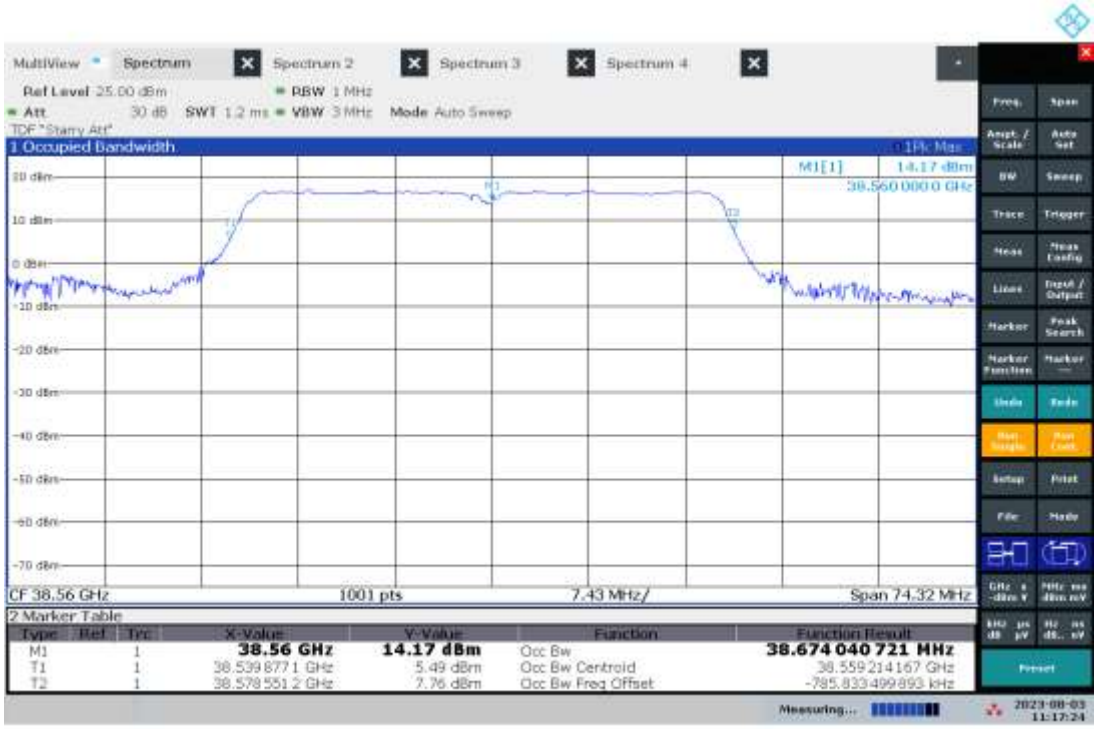
Occupied Bandwidth – Path 5, High 39.96 GHz, Modulation MCS9, Bandwidth 40 MHz

11:04:34 AM 08/03/2023

Occupied Bandwidth – Path 6, Low 37.16 GHz, Modulation MCS0, Bandwidth 40 MHz

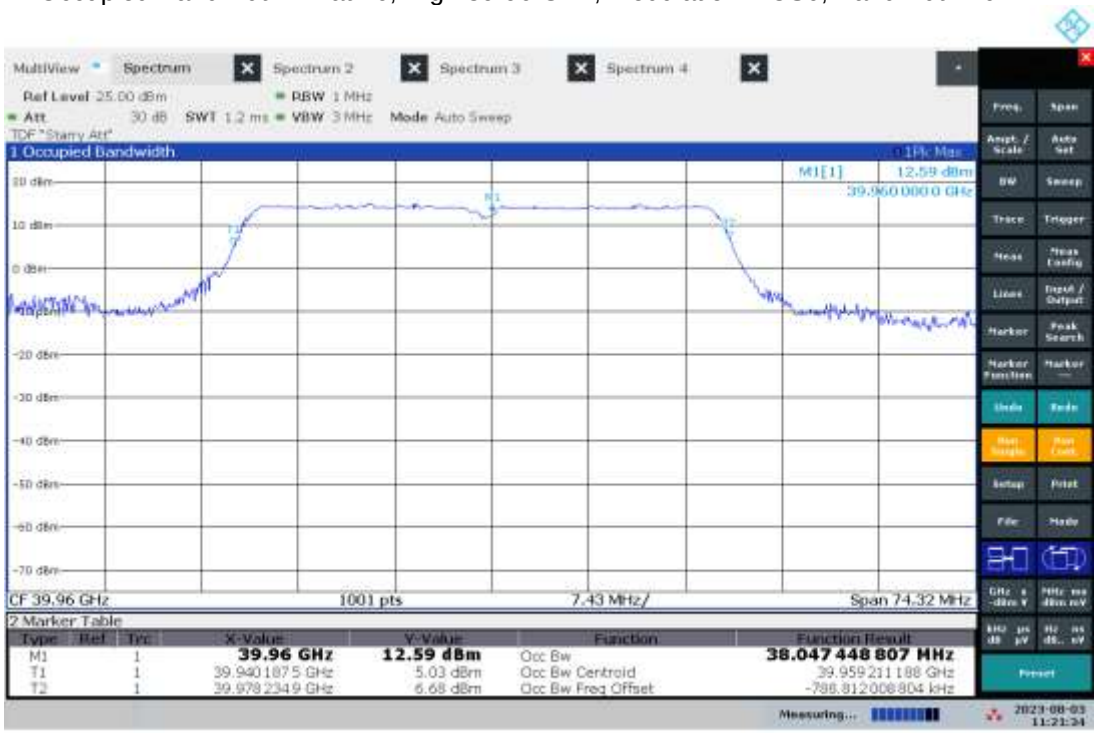
11:10:12 AM 08/03/2023

Occupied Bandwidth – Path 6, Mid 38.56 GHz, Modulation MCS0, Bandwidth 40 MHz



11:17:24 AM 08/03/2023

Occupied Bandwidth – Path 6, High 39.96 GHz, Modulation MCS0, Bandwidth 40 MHz

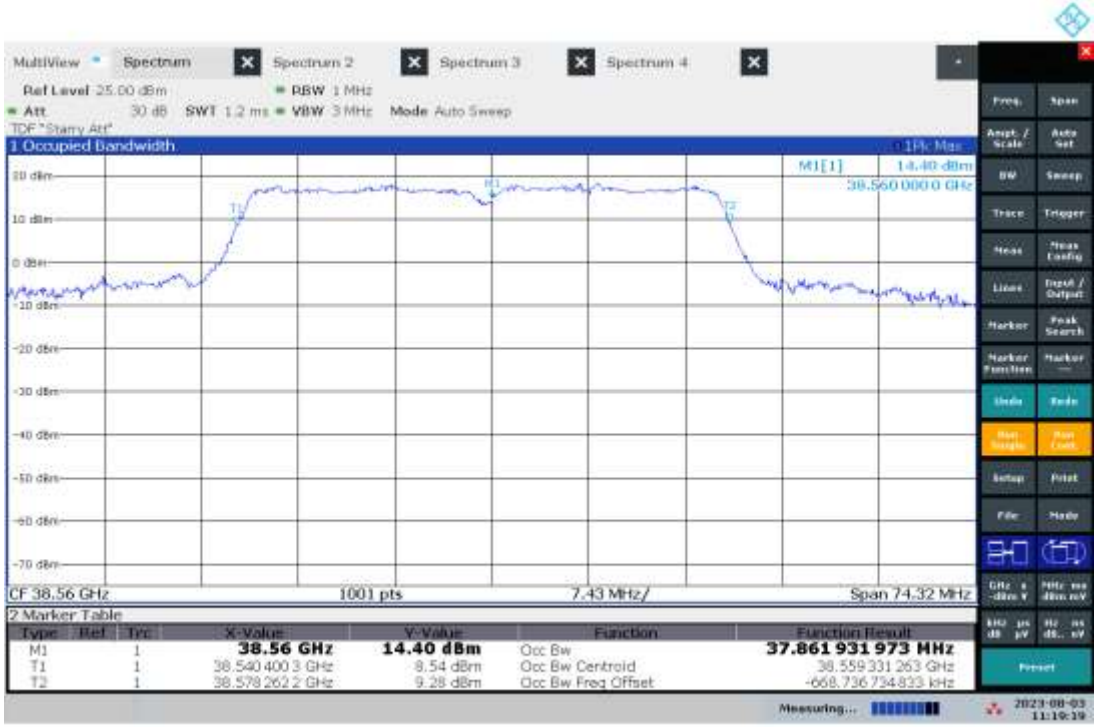


11:21:34 AM 08/03/2023

Occupied Bandwidth – Path 6, Low 37.16 GHz, Modulation MCS9, Bandwidth 40 MHz

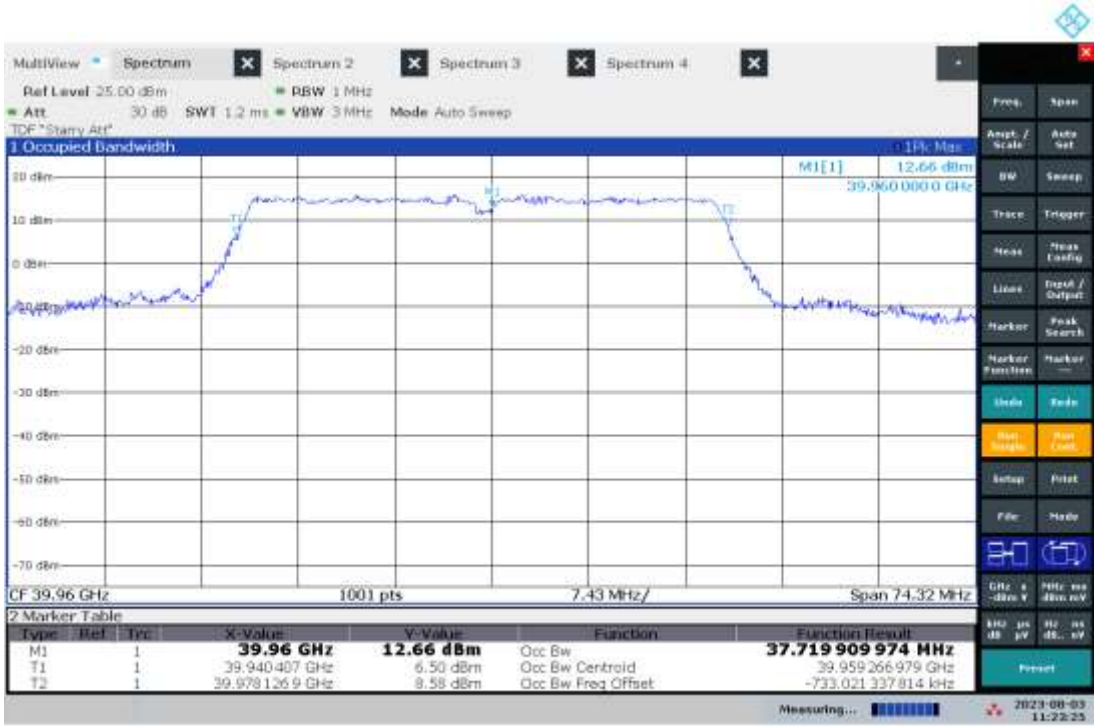
11:12:39 AM 08/03/2023

Occupied Bandwidth – Path 6, Mid 38.56 GHz, Modulation MCS9, Bandwidth 40 MHz



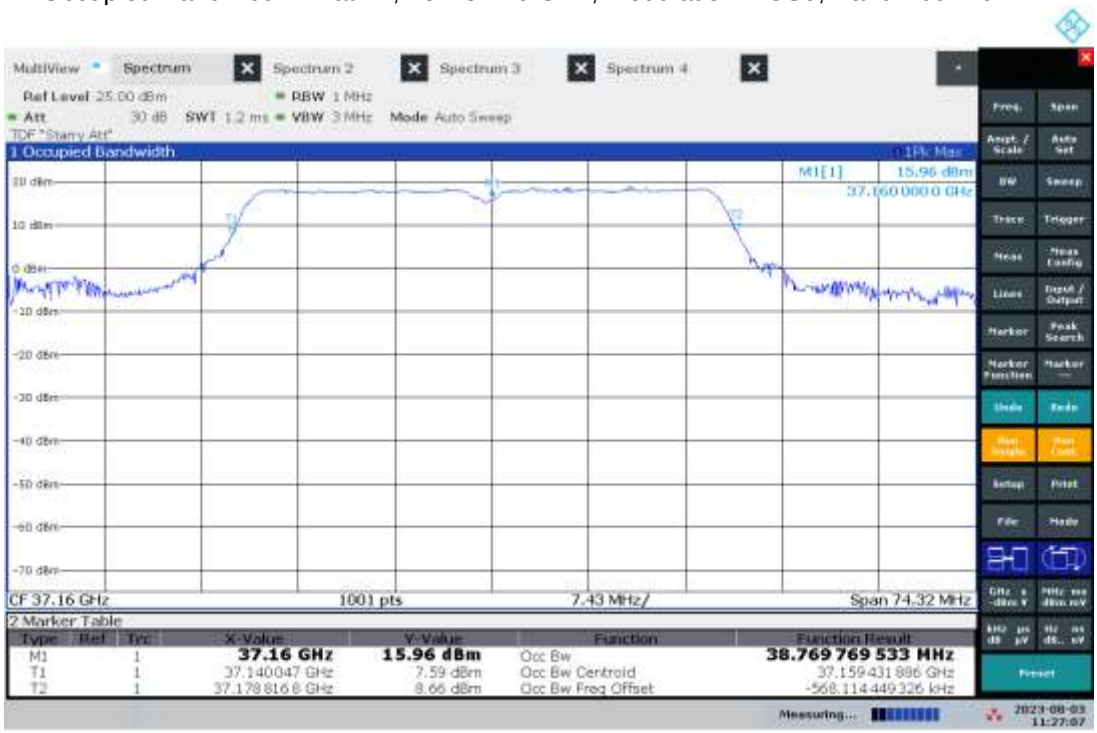
11:19:19 AM 08/03/2023

Occupied Bandwidth – Path 6, High 39.96 GHz, Modulation MCS9, Bandwidth 40 MHz



11:23:25 AM 08/03/2023

Occupied Bandwidth – Path 7, Low 37.16 GHz, Modulation MCS0, Bandwidth 40 MHz



11:27:07 AM 08/03/2023

Occupied Bandwidth – Path 7, Mid 38.56 GHz, Modulation MCS0, Bandwidth 40 MHz

11:32:18 AM 08/03/2023

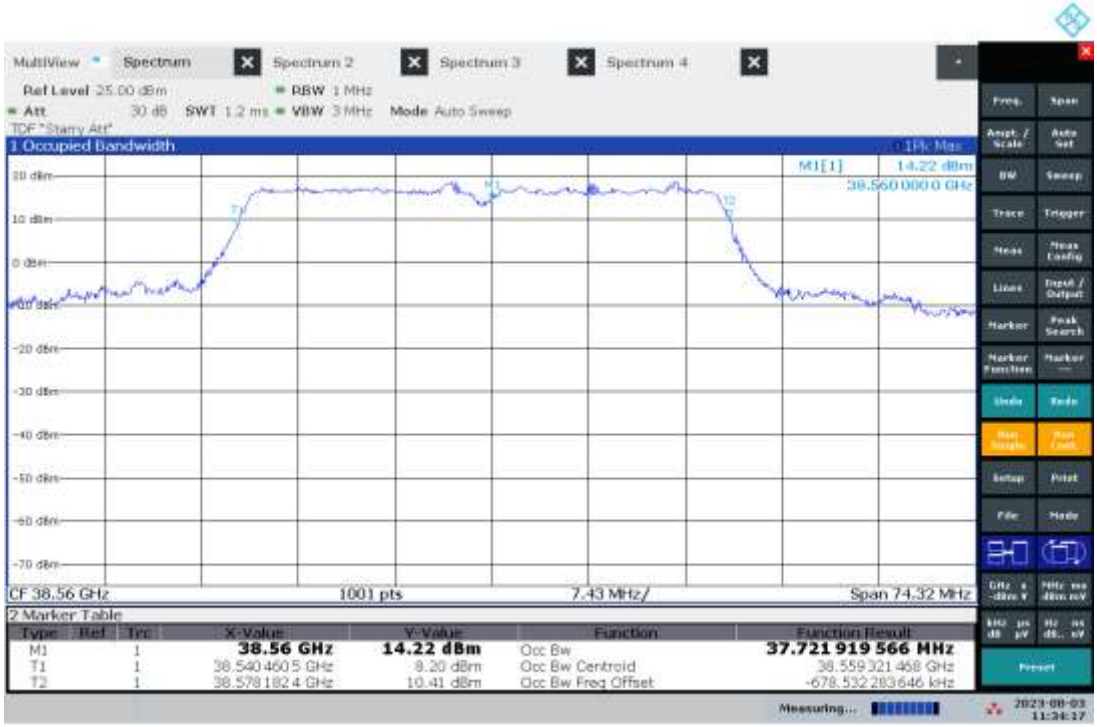
Occupied Bandwidth – Path 7, High 39.96 GHz, Modulation MCS0, Bandwidth 40 MHz

11:36:00 AM 08/03/2023

Occupied Bandwidth – Path 7, Low 37.16 GHz, Modulation MCS9, Bandwidth 40 MHz

11:30:00 AM 08/03/2023

Occupied Bandwidth – Path 7, Mid 38.56 GHz, Modulation MCS9, Bandwidth 40 MHz



11:34:17 AM 08/03/2023

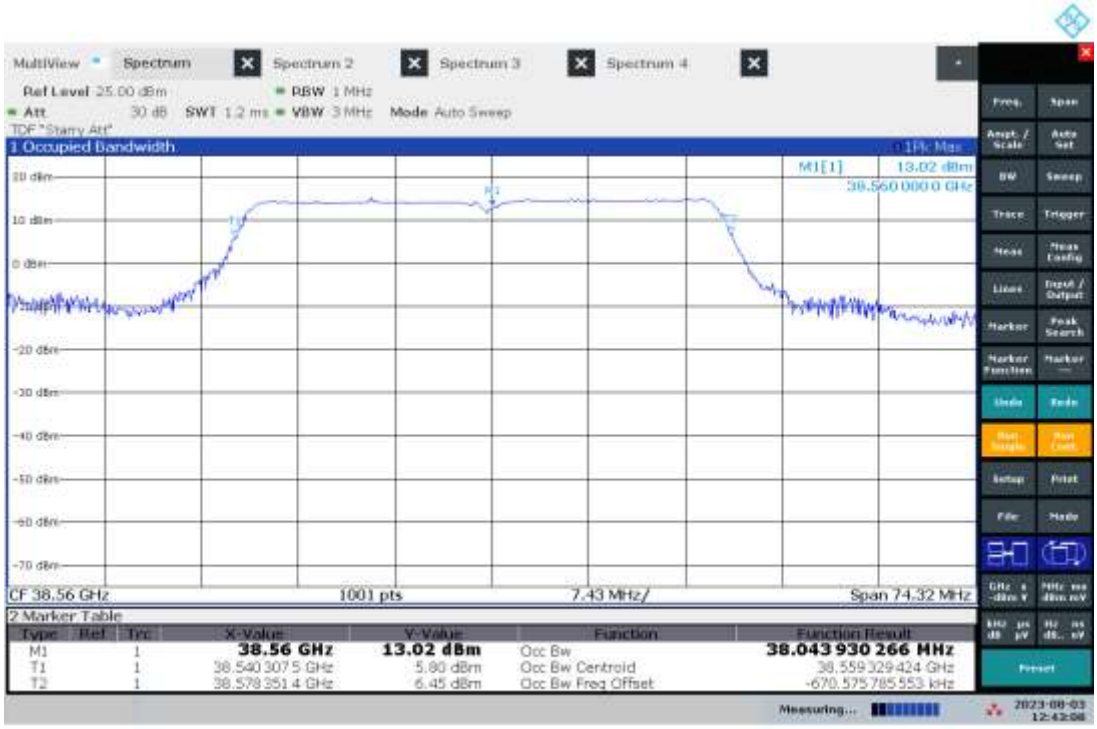
Occupied Bandwidth – Path 7, High 39.96 GHz, Modulation MCS9, Bandwidth 40 MHz

11:38:13 AM 08/03/2023

Occupied Bandwidth – Path 8, Low 37.16 GHz, Modulation MCS0, Bandwidth 40 MHz

12:38:25 PM 08/03/2023

Occupied Bandwidth – Path 8, Mid 38.56 GHz, Modulation MCS0, Bandwidth 40 MHz

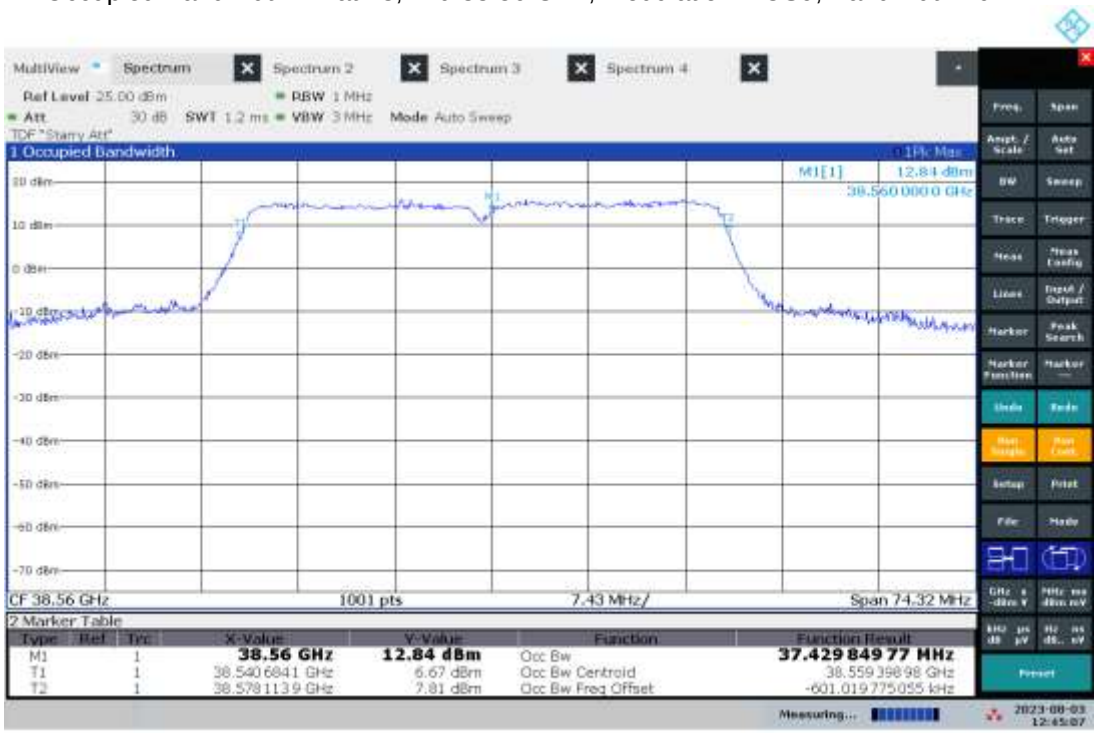


12:43:08 PM 08/03/2023

Occupied Bandwidth – Path 8, High 39.96 GHz, Modulation MCS0, Bandwidth 40 MHz

Occupied Bandwidth – Path 8, Low 37.16 GHz, Modulation MCS9, Bandwidth 40 MHz

Occupied Bandwidth – Path 8, Mid 38.56 GHz, Modulation MCS9, Bandwidth 40 MHz



12:45:07 PM 08/03/2023

Occupied Bandwidth – Path 8, High 39.96 GHz, Modulation MCS9, Bandwidth 40 MHz

12:48:31 PM 08/03/2023

Occupied Bandwidth – Path 1, Low 37.14 GHz, Modulation MCS0, Bandwidth 80 MHz

12:59:15 PM 08/03/2023

Occupied Bandwidth – Path 1, Mid 38.54 GHz, Modulation MCS0, Bandwidth 80 MHz

01:08:26 PM 08/03/2023

Occupied Bandwidth – Path 1, High 39.94 GHz, Modulation MCS0, Bandwidth 80 MHz

01:11:52 PM 08/03/2023

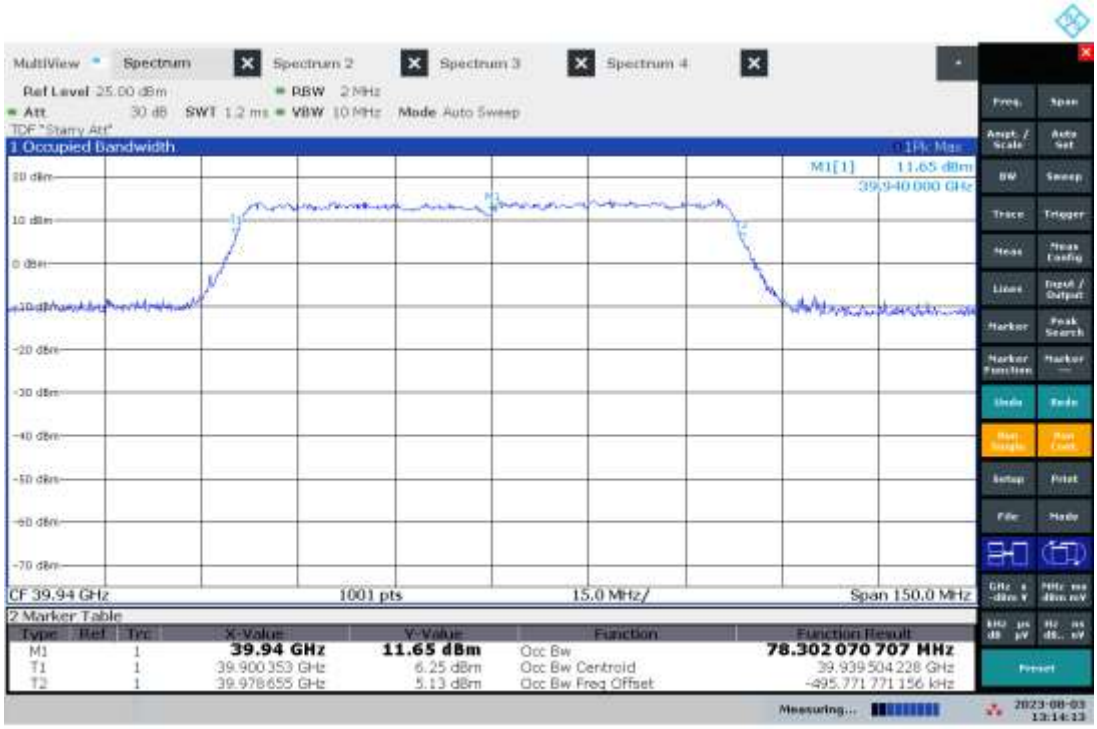
Occupied Bandwidth – Path 1, Low 37.14 GHz, Modulation MCS9, Bandwidth 80 MHz

01:04:46 PM 08/03/2023

Occupied Bandwidth – Path 1, Mid 38.54 GHz, Modulation MCS9, Bandwidth 80 MHz

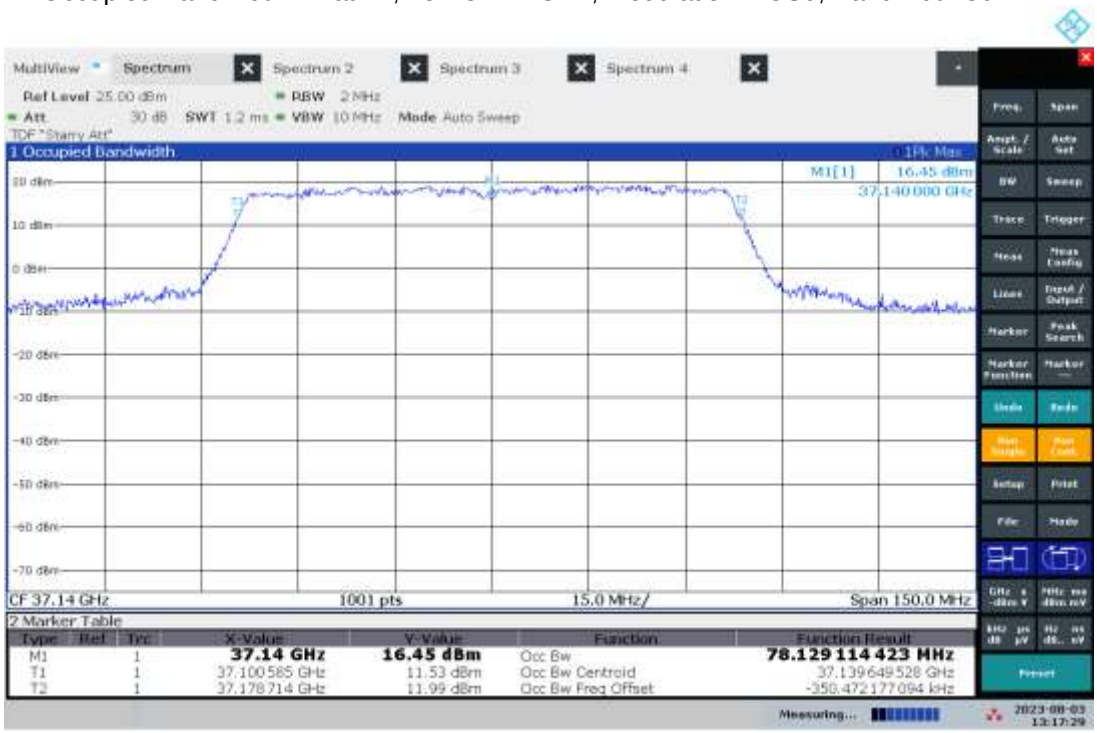
01:10:22 PM 08/03/2023

Occupied Bandwidth – Path 1, High 39.94 GHz, Modulation MCS9, Bandwidth 80 MHz



01:14:13 PM 08/03/2023

Occupied Bandwidth – Path 2, Low 37.14 GHz, Modulation MCS0, Bandwidth 80 MHz

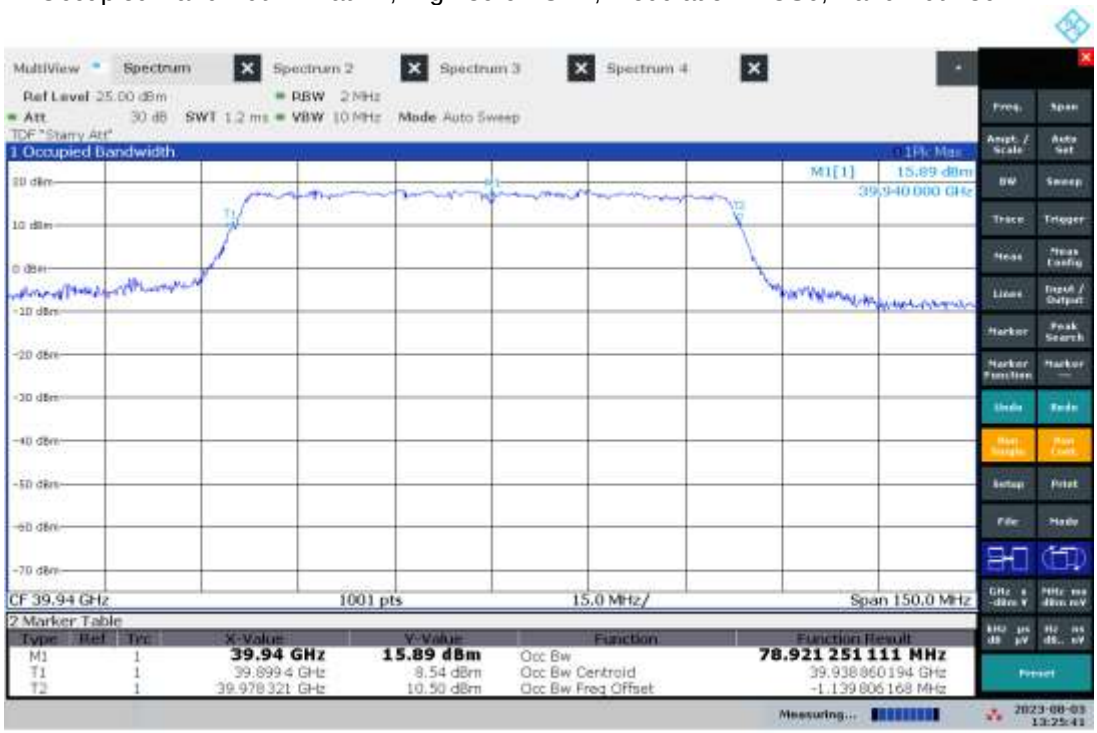


01:17:29 PM 08/03/2023

Occupied Bandwidth – Path 2, Mid 38.54 GHz, Modulation MCS0, Bandwidth 80 MHz

01:22:01 PM 08/03/2023

Occupied Bandwidth – Path 2, High 39.94 GHz, Modulation MCS0, Bandwidth 80 MHz

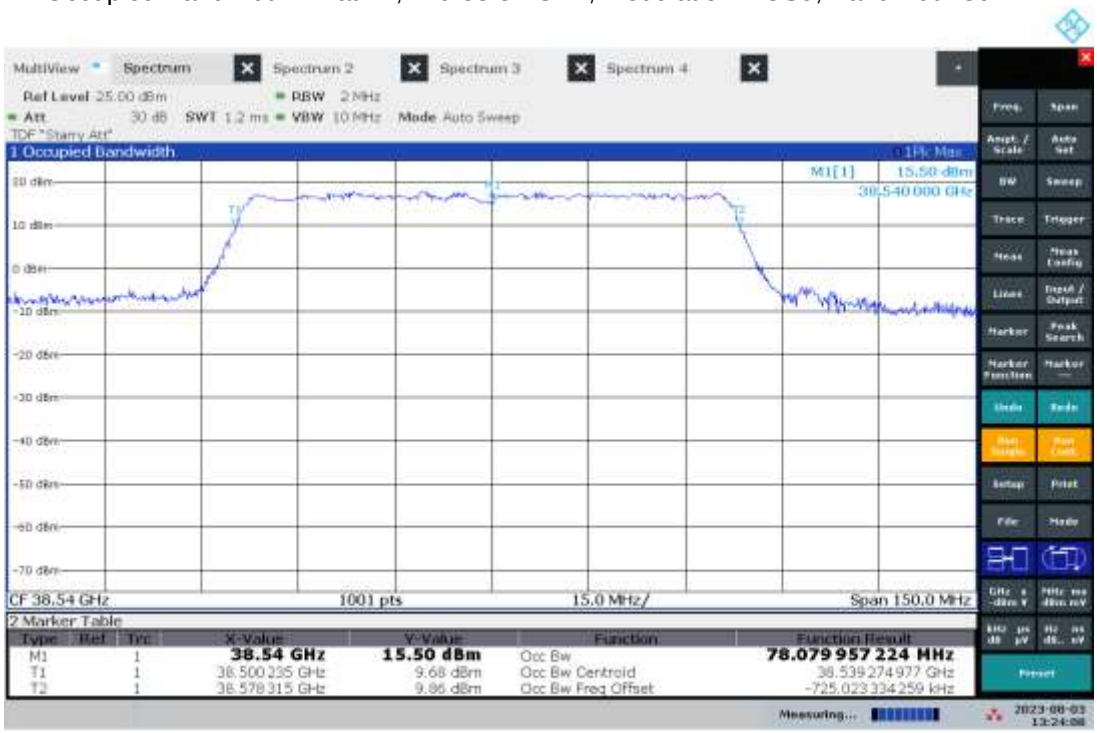


01:25:41 PM 08/03/2023

Occupied Bandwidth – Path 2, Low 37.14 GHz, Modulation MCS9, Bandwidth 80 MHz

01:19:23 PM 08/03/2023

Occupied Bandwidth – Path 2, Mid 38.54 GHz, Modulation MCS9, Bandwidth 80 MHz

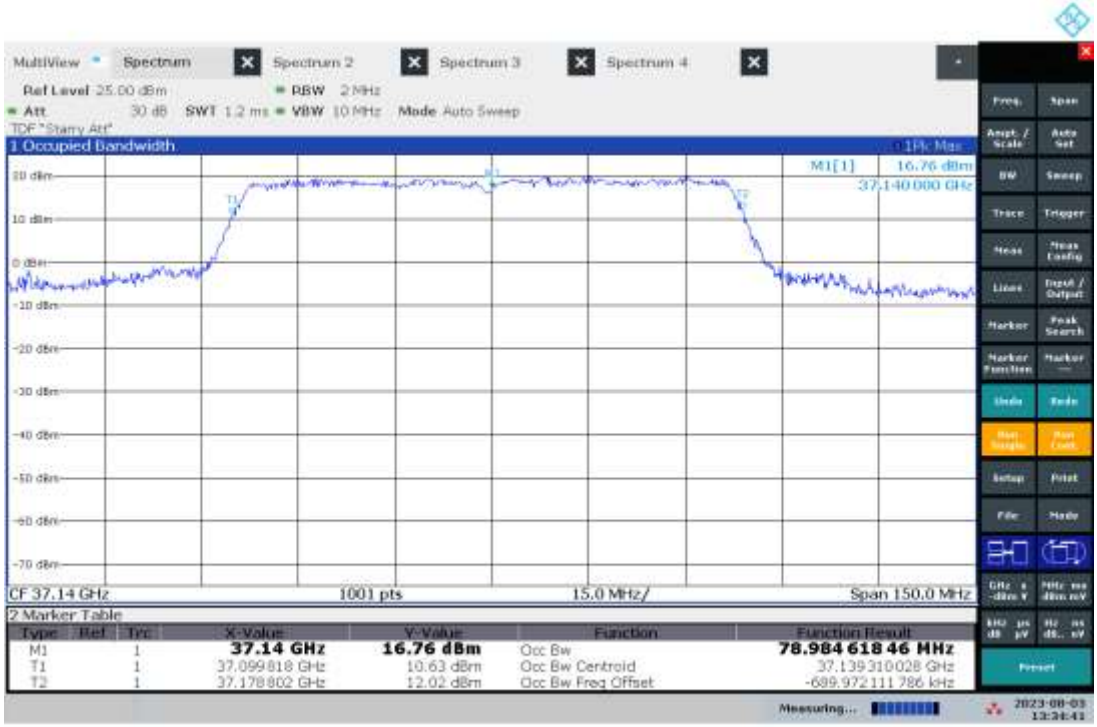


01:24:08 PM 08/03/2023

Occupied Bandwidth – Path 2, High 39.94 GHz, Modulation MCS9, Bandwidth 80 MHz

01:28:39 PM 08/03/2023

Occupied Bandwidth – Path 3, Low 37.14 GHz, Modulation MCS0, Bandwidth 80 MHz



01:34:41 PM 08/03/2023

Occupied Bandwidth – Path 3, Mid 38.54 GHz, Modulation MCS0, Bandwidth 80 MHz

01:41:09 PM 08/03/2023

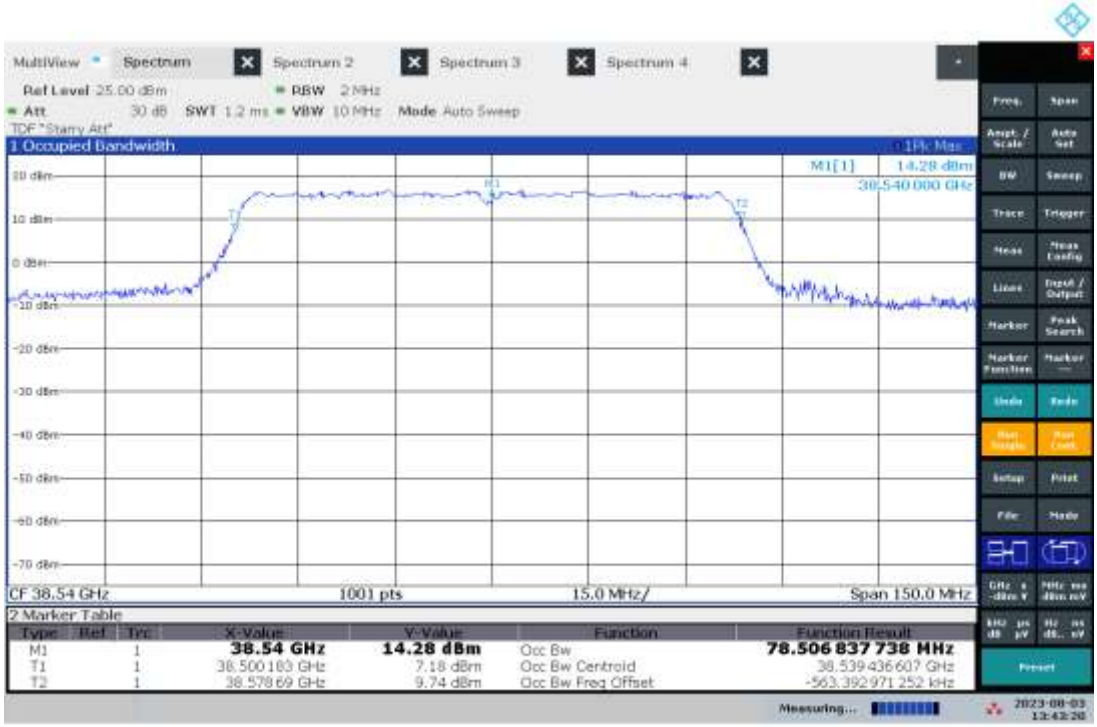
Occupied Bandwidth – Path 3, High 39.94 GHz, Modulation MCS0, Bandwidth 80 MHz

01:45:19 PM 08/03/2023

Occupied Bandwidth – Path 3, Low 37.14 GHz, Modulation MCS9, Bandwidth 80 MHz

01:39:22 PM 08/03/2023

Occupied Bandwidth – Path 3, Mid 38.54 GHz, Modulation MCS9, Bandwidth 80 MHz



01:43:21 PM 08/03/2023

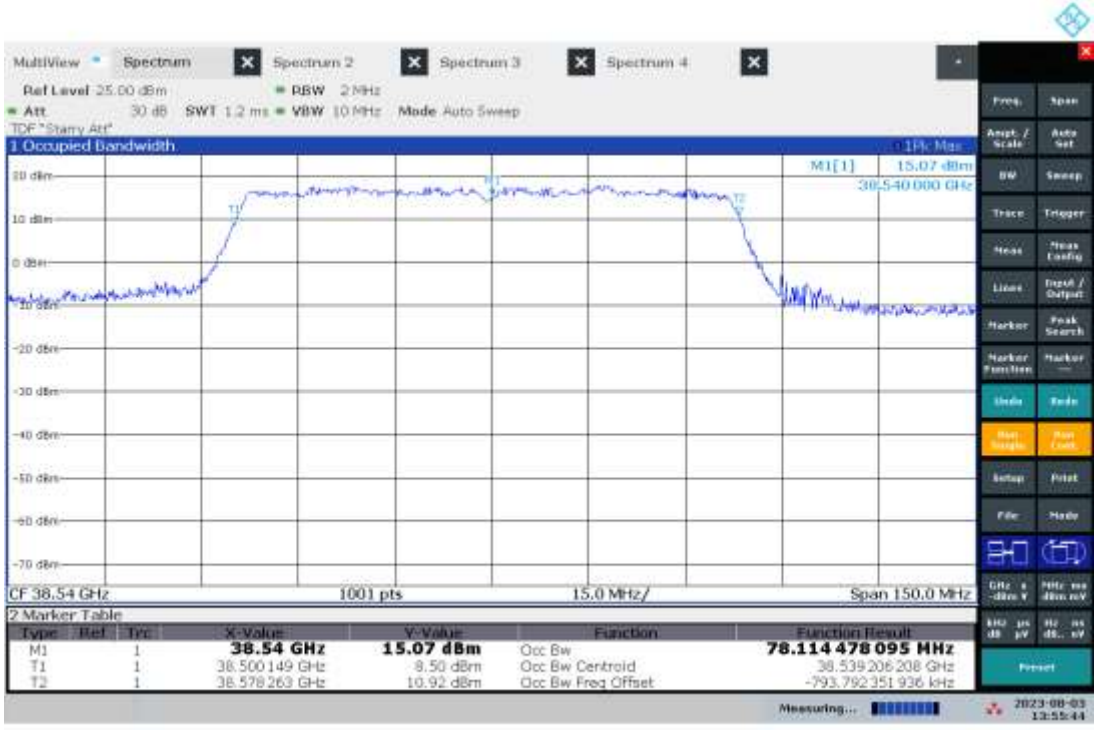
Occupied Bandwidth – Path 3, High 39.94 GHz, Modulation MCS9, Bandwidth 80 MHz

01:47:38 PM 08/03/2023

Occupied Bandwidth – Path 4, Low 37.14 GHz, Modulation MCS0, Bandwidth 80 MHz

01:51:18 PM 08/03/2023

Occupied Bandwidth – Path 4, Mid 38.54 GHz, Modulation MCS0, Bandwidth 80 MHz



01:55:44 PM 08/03/2023

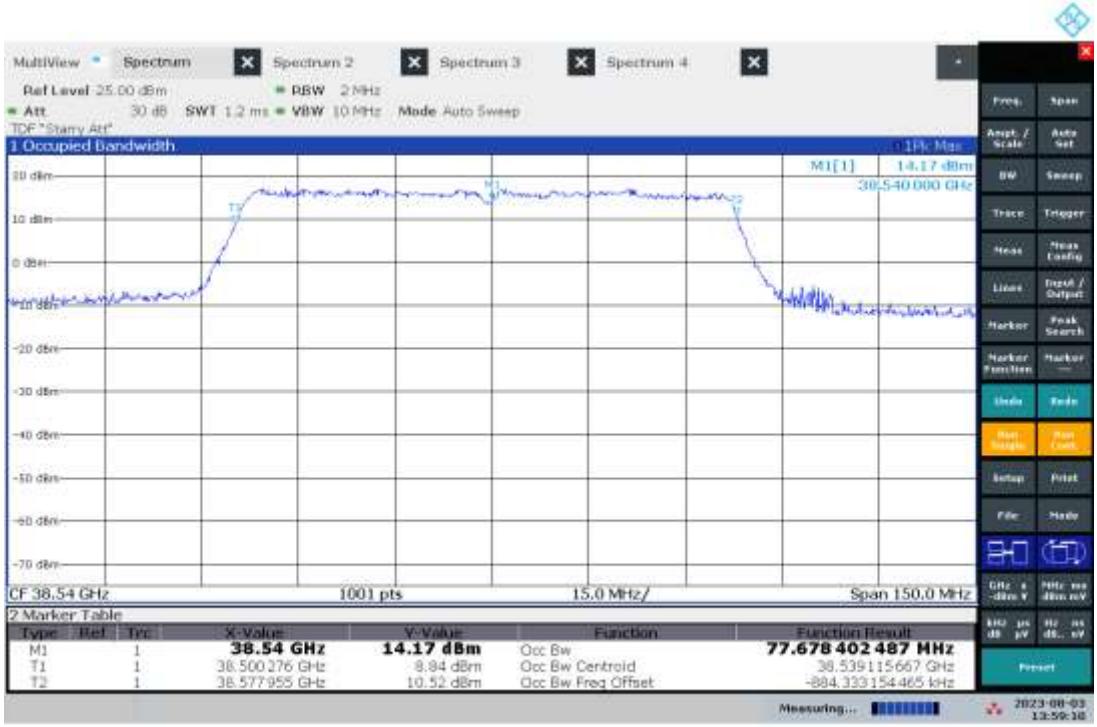
Occupied Bandwidth – Path 4, High 39.94 GHz, Modulation MCS0, Bandwidth 80 MHz

02:01:07 PM 08/03/2023

Occupied Bandwidth – Path 4, Low 37.14 GHz, Modulation MCS9, Bandwidth 80 MHz

01:54:12 PM 08/03/2023

Occupied Bandwidth – Path 4, Mid 38.54 GHz, Modulation MCS9, Bandwidth 80 MHz

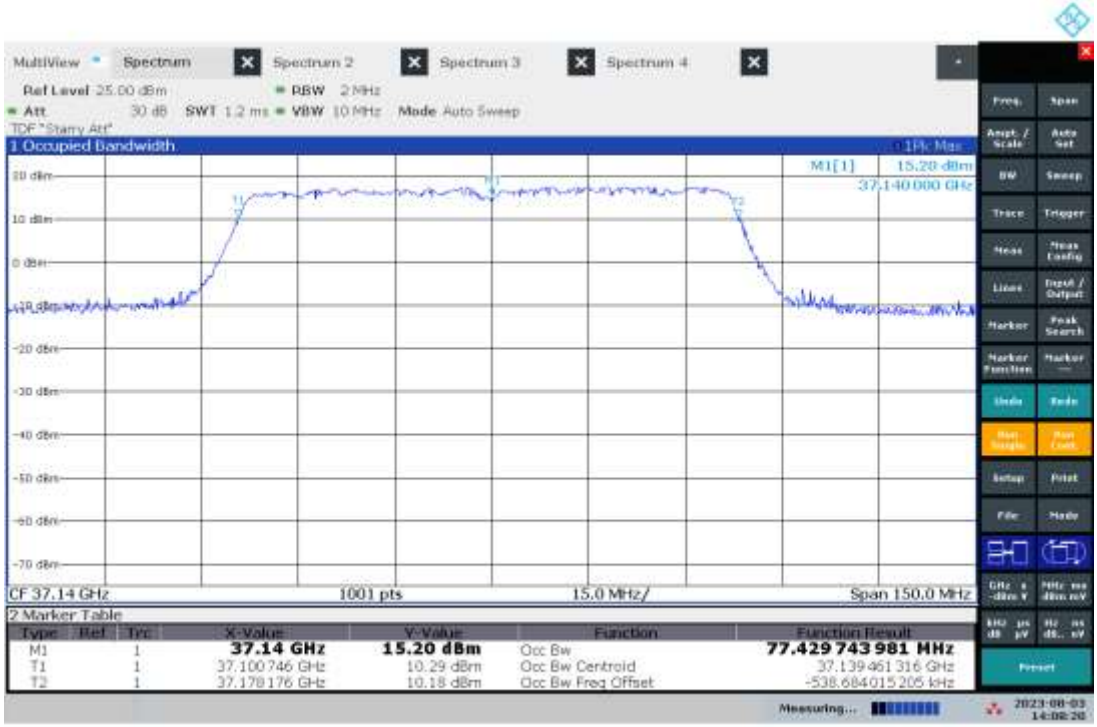


01:59:10 PM 08/03/2023

Occupied Bandwidth – Path 4, High 39.94 GHz, Modulation MCS9, Bandwidth 80 MHz

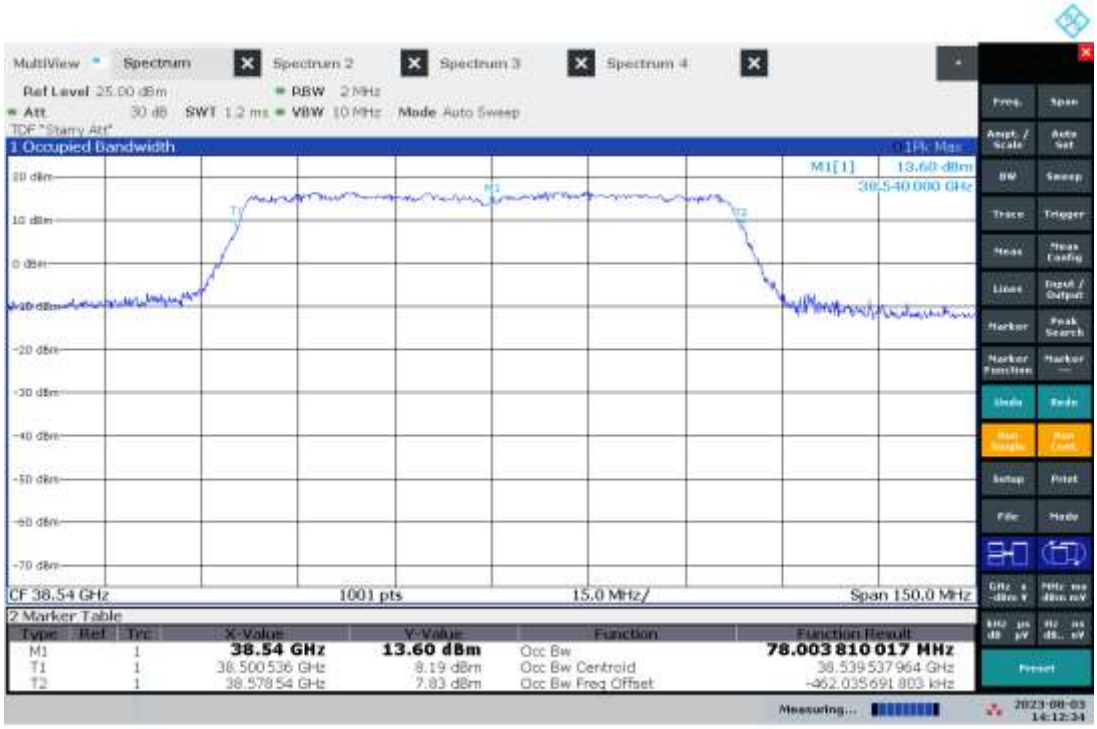
02:03:17 PM 08/03/2023

Occupied Bandwidth – Path 5, Low 37.14 GHz, Modulation MCS0, Bandwidth 80 MHz



02:08:20 PM 08/03/2023

Occupied Bandwidth – Path 5, Mid 38.54 GHz, Modulation MCS0, Bandwidth 80 MHz



02:12:34 PM 08/03/2023

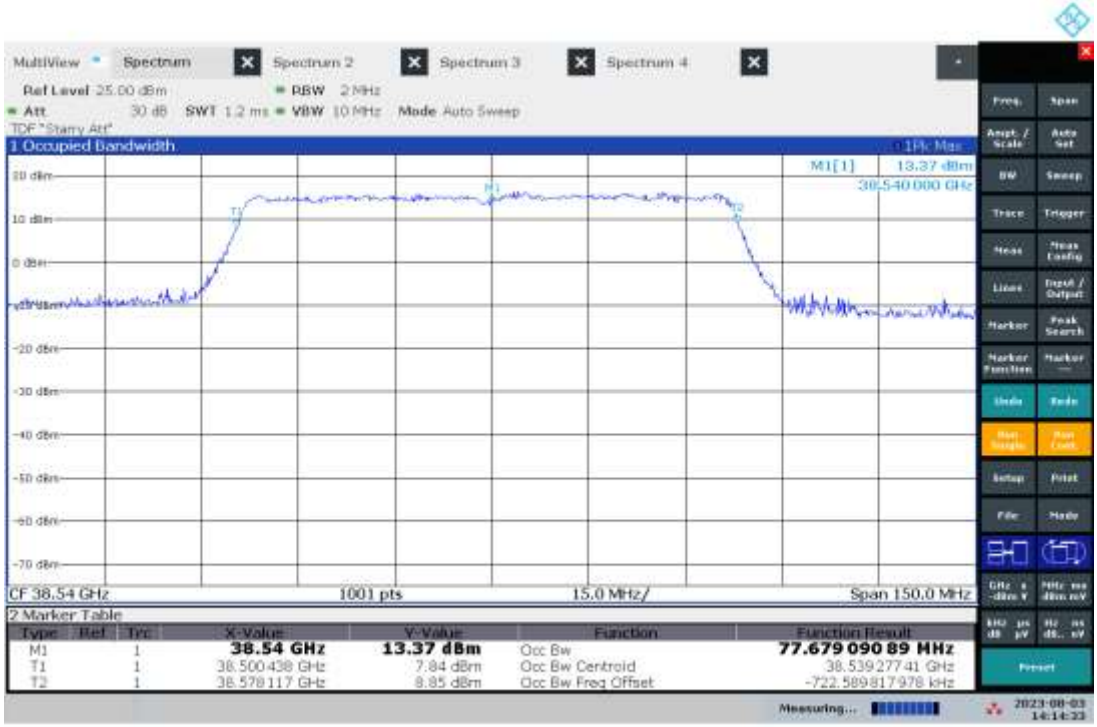
Occupied Bandwidth – Path 5, High 39.94 GHz, Modulation MCS0, Bandwidth 80 MHz

02:16:11 PM 08/03/2023

Occupied Bandwidth – Path 5, Low 37.14 GHz, Modulation MCS9, Bandwidth 80 MHz

02:10:44 PM 08/03/2023

Occupied Bandwidth – Path 5, Mid 38.54 GHz, Modulation MCS9, Bandwidth 80 MHz



02:14:33 PM 08/03/2023

Occupied Bandwidth – Path 5, High 39.94 GHz, Modulation MCS9, Bandwidth 80 MHz

02:18:28 PM 08/03/2023

Occupied Bandwidth – Path 6, Low 37.14 GHz, Modulation MCS0, Bandwidth 80 MHz

02:21:48 PM 08/03/2023

Occupied Bandwidth – Path 6, Mid 38.54 GHz, Modulation MCS0, Bandwidth 80 MHz

02:25:32 PM 08/03/2023

Occupied Bandwidth – Path 6, High 39.94 GHz, Modulation MCS0, Bandwidth 80 MHz

02:29:15 PM 08/03/2023

Occupied Bandwidth – Path 6, Low 37.14 GHz, Modulation MCS9, Bandwidth 80 MHz

02:23:47 PM 08/03/2023

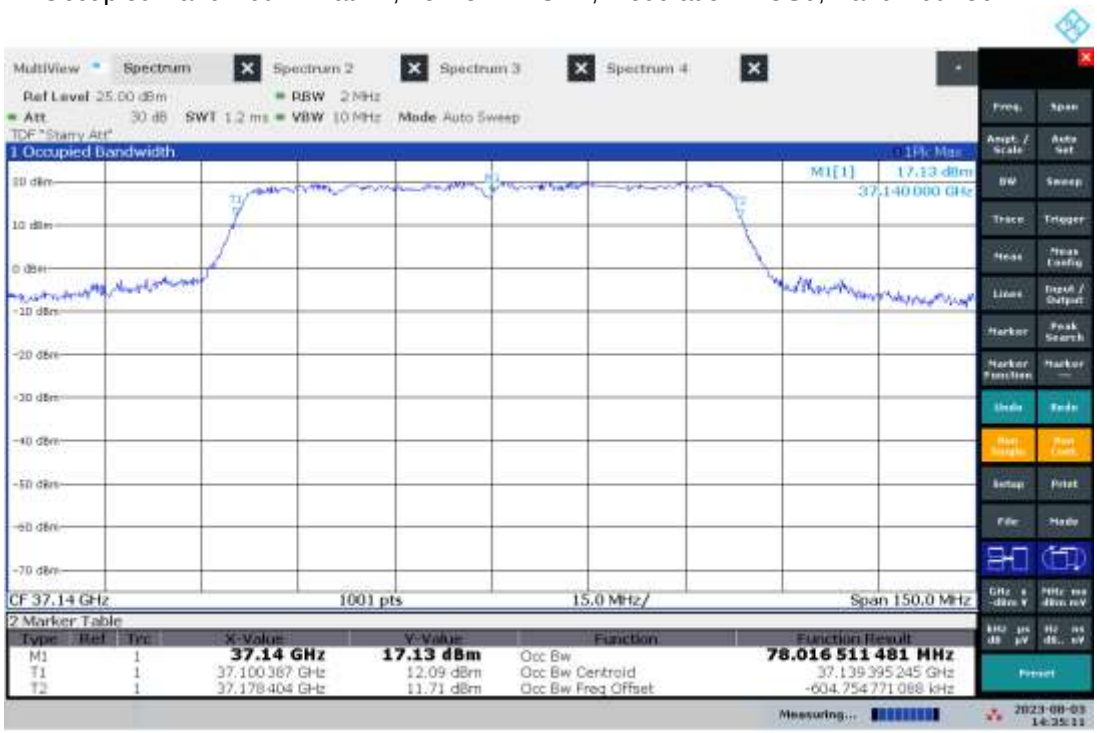
Occupied Bandwidth – Path 6, Mid 38.54 GHz, Modulation MCS9, Bandwidth 80 MHz

02:27:23 PM 08/03/2023

Occupied Bandwidth – Path 6, High 39.94 GHz, Modulation MCS9, Bandwidth 80 MHz

02:30:57 PM 08/03/2023

Occupied Bandwidth – Path 7, Low 37.14 GHz, Modulation MCS0, Bandwidth 80 MHz



02:35:11 PM 08/03/2023

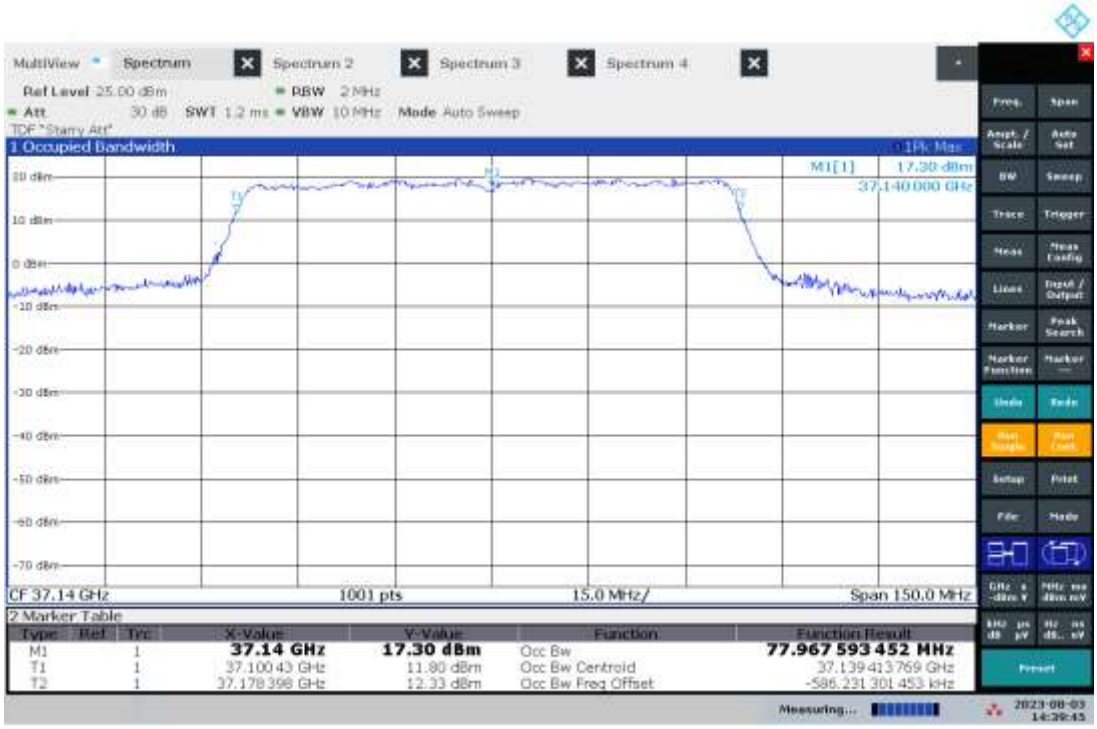
Occupied Bandwidth – Path 7, Mid 38.54 GHz, Modulation MCS0, Bandwidth 80 MHz

02:42:26 PM 08/03/2023

Occupied Bandwidth – Path 7, High 39.94 GHz, Modulation MCS0, Bandwidth 80 MHz

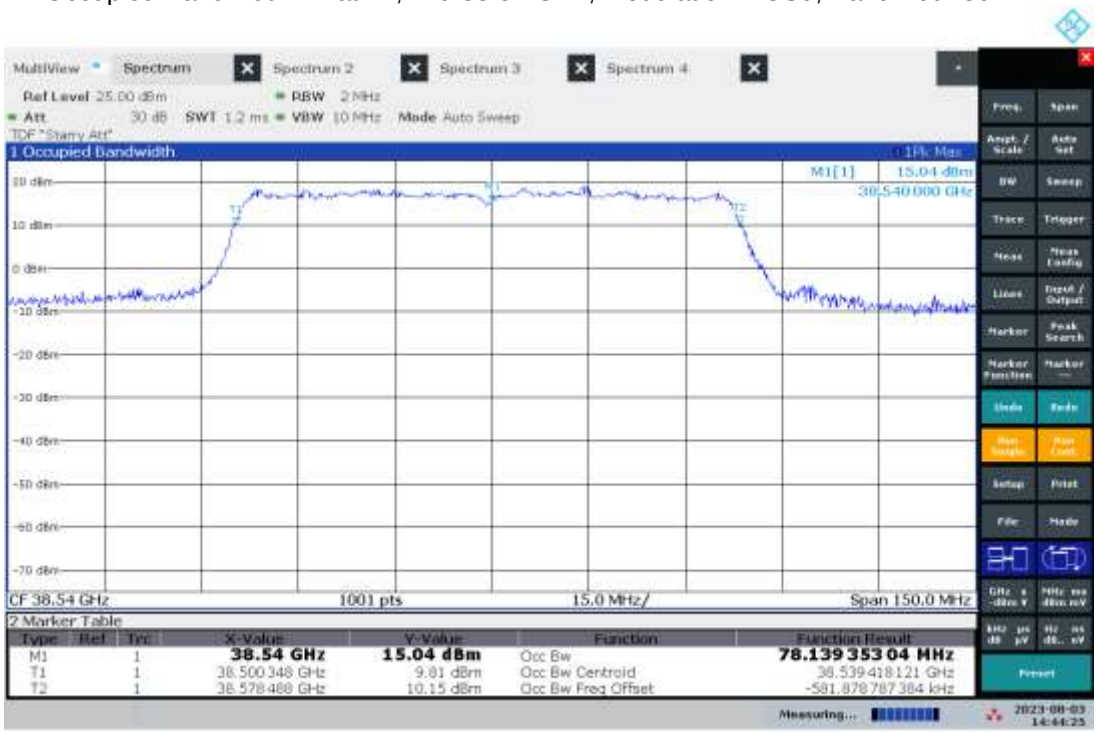
02:45:58 PM 08/03/2023

Occupied Bandwidth – Path 7, Low 37.14 GHz, Modulation MCS9, Bandwidth 80 MHz



02:39:45 PM 08/03/2023

Occupied Bandwidth – Path 7, Mid 38.54 GHz, Modulation MCS9, Bandwidth 80 MHz

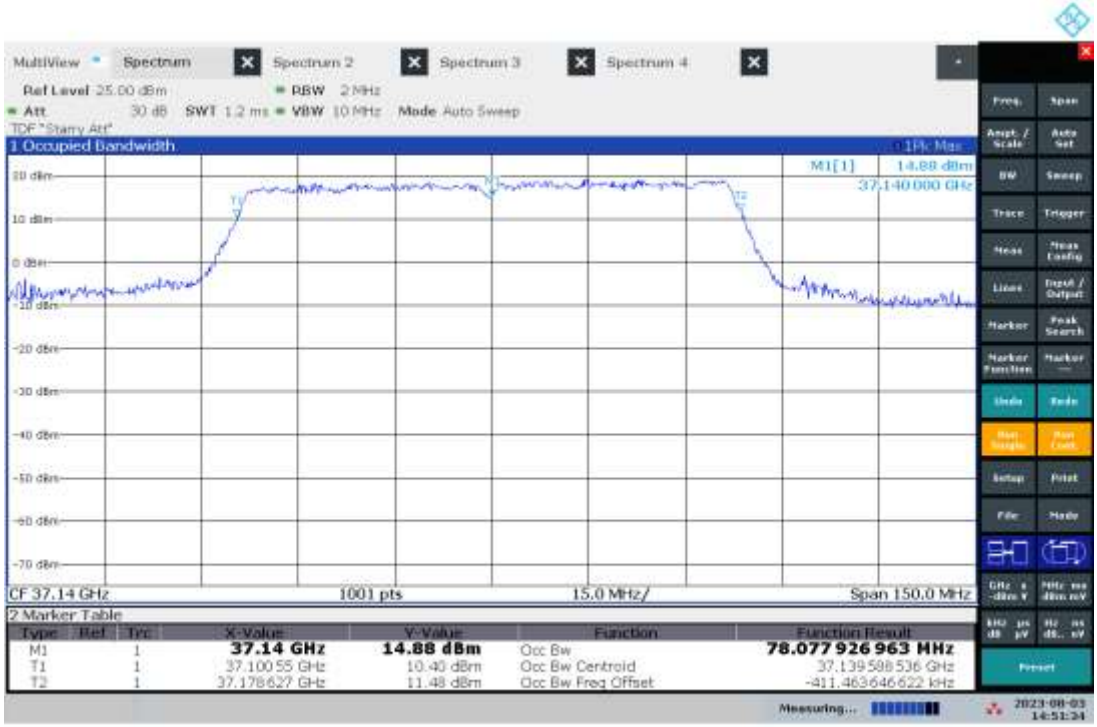


02:44:25 PM 08/03/2023

Occupied Bandwidth – Path 7, High 39.94 GHz, Modulation MCS9, Bandwidth 80 MHz

02:47:45 PM 08/03/2023

Occupied Bandwidth – Path 8, Low 37.14 GHz, Modulation MCS0, Bandwidth 80 MHz



02:51:34 PM 08/03/2023

Occupied Bandwidth – Path 8, Mid 38.54 GHz, Modulation MCS0, Bandwidth 80 MHz

02:55:47 PM 08/03/2023

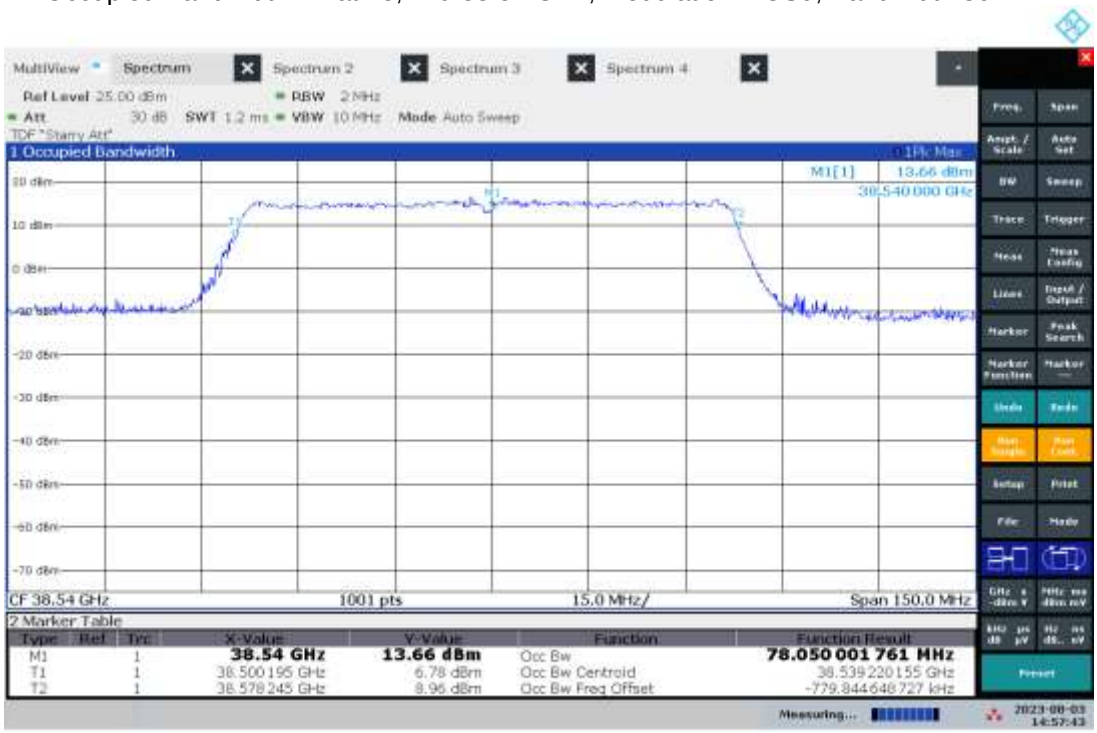
Occupied Bandwidth – Path 8, High 39.94 GHz, Modulation MCS0, Bandwidth 80 MHz

02:59:23 PM 08/03/2023

Occupied Bandwidth – Path 8, Low 37.14 GHz, Modulation MCS9, Bandwidth 80 MHz

02:53:47 PM 08/03/2023

Occupied Bandwidth – Path 8, Mid 38.54 GHz, Modulation MCS9, Bandwidth 80 MHz



02:57:43 PM 08/03/2023

Occupied Bandwidth – Path 8, High 39.94 GHz, Modulation MCS9, Bandwidth 80 MHz

03:01:53 PM 08/03/2023

Product Standard: FCC 47CFR Part 30 Subparts C and E				Limit applied: See Report Section 9.2			
Test Date	Test Personnel/ Initials	Supervising Engineer/ Initials	Input Voltage	Mode	Atmospheric Data		
					Temp °C	Relative Humidity %	Atmospheric Pressure mbar
04/20/2023	Kouma Sinn	N/A	48VDC Via External P/S	See Report Section 4	22	21	1021
04/21/2023	Kouma Sinn	N/A	48VDC Via External P/S	See Report Section 4	24	24	1024
08/03/2023	Kouma Sinn	N/A	48VDC Via External P/S	See Report Section 4	23	55	1022

Deviations, Additions, or Exclusions: None

10 Frequency Stability

10.1 Method

Tests are performed in accordance with FCC 47CFR Part 30 Subparts E Section 30.402, FCC 47CFR Part 2.1055, FCC 47CFR Part 2.1041, KDB 842590 D01 Upper Microwave Flexible Use Service v01r02 April 20, 2021 Subclause 4.5, and ANSI C63.26-2015 Subclause 5.6.

TEST SITE: Safety Lab

10.2 Limit:

Limit – FCC 47CFR Part 30 Subparts E Section 30.402: The carrier frequency shall remain within ±0.001% with variation of voltages and temperatures.

10.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
Starry cable	Flexible 10' 40 GHz coaxial cable, 2.92mm M - 2.92mm M	San-tron	99139-02 M120	None	04/19/2023	N/A
Starry attenuator	20 dB Fixed Attenuator, 2.92mm M - 2.92mm F, 2W	Pasternack	PE7395-20	None	04/19/2023	N/A
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/18/2022	11/18/2023
TEL056'	Digital Multimeter	Fluke	87	54130556	06/17/2022	06/17/2023
CBLHF2012-5M-2'	5m 9kHz-40GHz Coaxial Cable - SET2	Huber & Suhner	SF102	252676002	02/25/2023	02/25/2024
SAF1153'	Freezing Rain\Icing\Temp\Humidity\ -73deg C to +190deg C, 95% humidity, Ice Freezing Rain	Cincinnati Sub-Zero	CTH-(FR)64-6-6-SC/AC	12-CT15628	12/02/2022	12/02/2023
SAF1504'	Weather Station	Davis	Vantage Vue	MR200526013	01/31/2023	01/31/2024
SAF167'	DC Power Supply	Wayne Kerr	11AP10090	9700001878	VBU	Verified

Software Utilized:

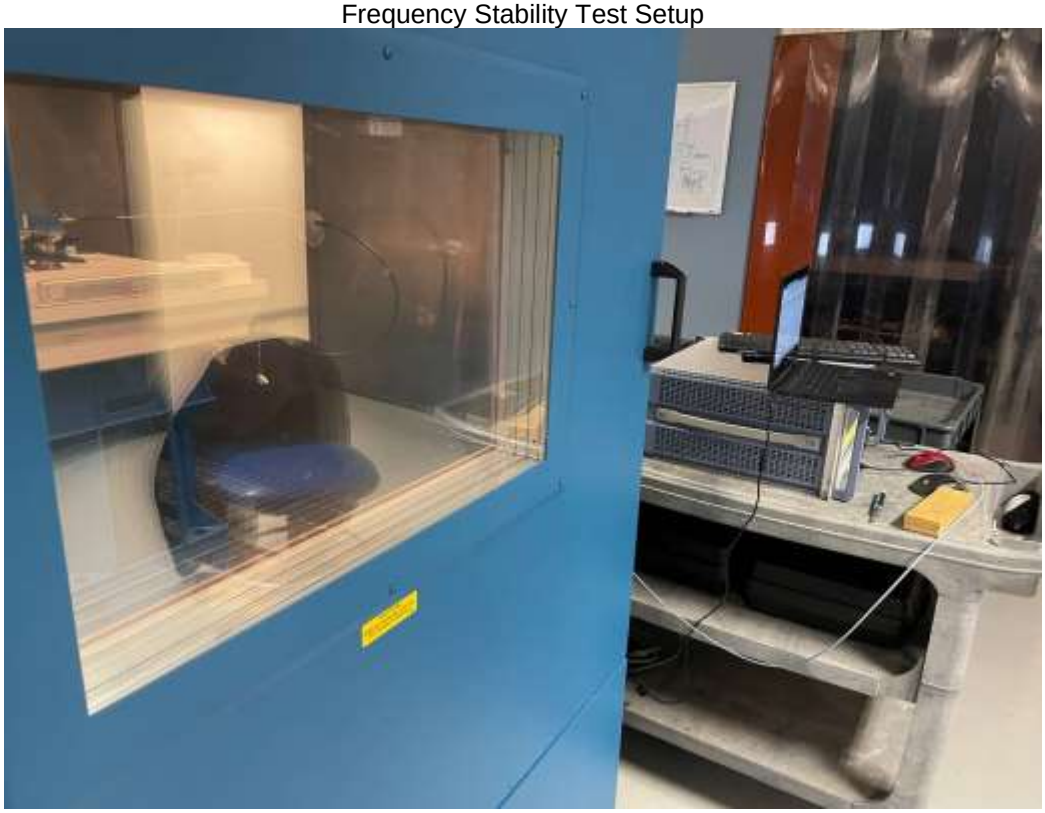
Name	Manufacturer	Version
EMI Boxborough.xls	Intertek	08/27/2010

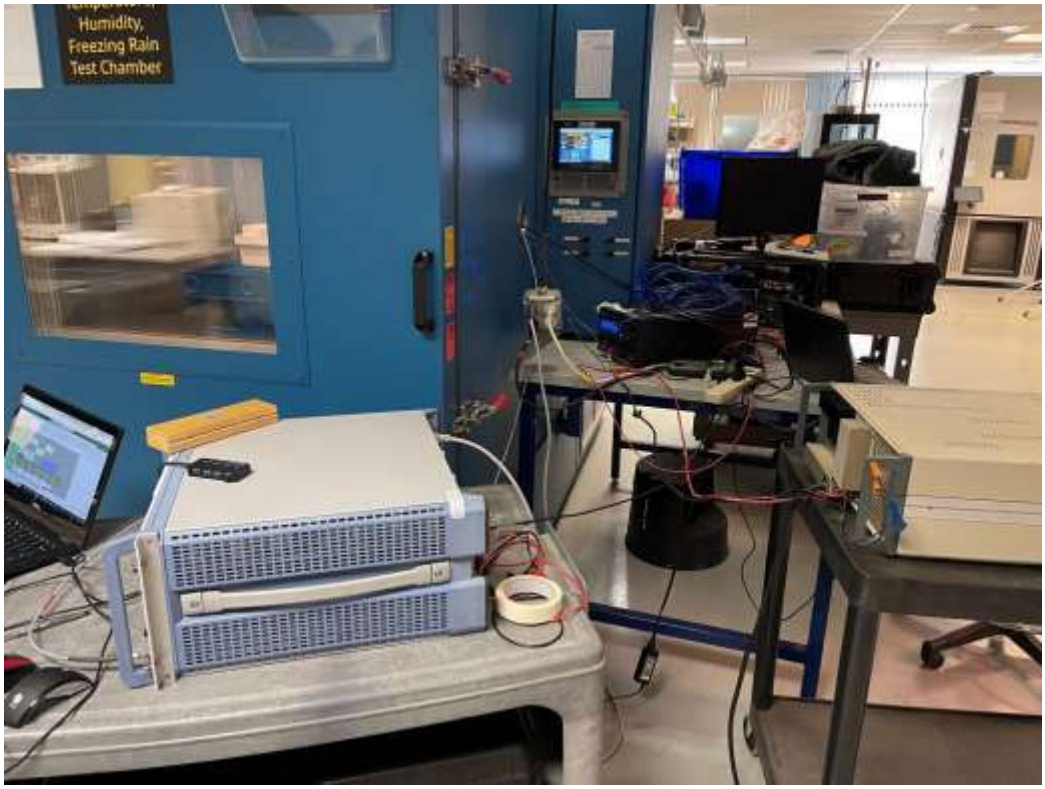
10.4 Results:

The sample tested was found to Comply.

10.5 Setup Photographs:

Frequency Stability Test Setup





10.6 Test Data:

Low Channel (Path 2, Modulation = MCS9, Bandwidth = 160 MHz) Frequency Stability

Company: Starry
Model #: Titan 37
Serial #: 2045200059
Engineer(s): Kouma Sinn
Project #: G105391852
Standard: FCC Part 30.402

Test Equipment Used:
SAF1153 SAF1504

Location: Safety Lab
Date(s): 5/15/2023, 24C/22%/1011mbar 5/19/2023, 24C%/1017mbar/29

Limit: 10 PPM 0.001%
Nominal f: 37100 MHz
Voltage: 48 VDC

%	Voltage Volts	Frequency MHz	Deviation kHz	Limit kHz
-15%	40.8	37100.000200	0	371.00
+0%	48	37100.000200	0	371.00
+15%	55.2	37099.999800	-0.4	371.00

Temp Celsius	Frequency MHz	Deviation kHz	Limit kHz
-30	37100.000000	-0.2	371.00
-20	37100.000000	-0.2	371.00
-10	37100.000400	0.2	371.00
0	37100.000000	-0.2	371.00
10	37100.000200	0	371.00
20	37100.000200	0	371.00
30	37100.000600	0.4	371.00
40	37099.999200	-1	371.00
50	37099.999600	-0.6	371.00

Mid Channel (Path 2, Modulation = MCS9, Bandwidth = 160 MHz) Frequency Stability

Company: Starry
Model #: Titan 37
Serial #: 2045200059
Engineer(s): Kouma Sinn
Project #: G105391852
Standard: FCC Part 30.402

Test Equipment Used:
SAF1153 SAF1504

Location: Safety Lab
Date(s): 5/15/2023, 24C/22%/1011mbar 5/19/2023, 24C%/1017mbar/29

Limit: 10 PPM 0.001%
Nominal f: 38500 MHz
Voltage: 48 VDC

%	Voltage Volts	Frequency MHz	Deviation kHz	Limit kHz
-15%	40.8	38500.000400	1	385.00
+0%	48	38499.999400	0	385.00
+15%	55.2	38500.000000	0.6	385.00

Temp Celsius	Frequency MHz	Deviation kHz	Limit kHz
-30	38500.000200	0.8	385.00
-20	38500.000000	0.6	385.00
-10	38500.000000	0.6	385.00
0	38500.000800	1.4	385.00
10	38499.999600	0.2	385.00
20	38499.999400	0	385.00
30	38499.999400	0	385.00
40	38500.000800	1.4	385.00
50	38500.000800	1.4	385.00

High Channel (Path 2, Modulation = MCS9, Bandwidth = 160 MHz) Frequency Stability

Company: Starry
Model #: Titan 37
Serial #: 2045200059
Engineer(s): Kouma Sinn
Project #: G105391852
Standard: FCC Part 30.402

Test Equipment Used:
SAF1153 SAF1504

Location: Safety
Date(s): 5/15/2023, 24C/22%/1011mbar 5/19/2023, 24C%/1017mbar/29

Limit: 10 PPM 0.001%
Nominal f: 39900 MHz
Voltage: 48 VDC

%	Voltage Volts	Frequency MHz	Deviation kHz	Limit kHz
-15%	40.8	39899.999800	-0.6	399.00
+0%	48	39900.000400	0	399.00
+15%	55.2	39900.000200	-0.2	399.00

Temp Celsius	Frequency MHz	Deviation kHz	Limit kHz
-30	39899.999400	-1	399.00
-20	39900.000200	-0.2	399.00
-10	39899.998200	-2.2	399.00
0	39900.000000	-0.4	399.00
10	39899.999800	-0.6	399.00
20	39900.000400	0	399.00
30	39899.999200	-1.2	399.00
40	39900.000200	-0.2	399.00
50	39899.999400	-1	399.00

Product Standard: FCC 47CFR Part 30 Subparts C and E				Limit applied: See Report Section 10.2			
Test Date	Test Personnel/ Initials	Supervising Engineer/ Initials	Input Voltage	Mode	Atmospheric Data		
					Temp °C	Relative Humidity %	Atmospheric Pressure mbar
05/15/2023	Kouma Sinn KS	N/A	48VDC Via External P/S	See Report Section 4	24	22	1011
05/19/2023	Kouma Sinn KS	N/A	48VDC Via External P/S	See Report Section 4	24	29	1017

Deviations, Additions, or Exclusions: None

11 AC Main Conducted Emissions

11.1 Method

Tests are performed in accordance with FCC Part 15 Subpart B and ANSI C63.4.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
AC Line Conducted Emissions	150 kHz - 30 MHz	1.5 dB	3.4 dB
Telco Port Emissions	150 kHz - 30 MHz	3.3 dB	5.0 dB
AC Line Conducted Emissions	9 kHz - 150 MHz	1.5 dB	3.4 dB

As shown in the table above our conducted emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculations

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF
Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN or ISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:
NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(49.1\ dB\mu V / 20)}$ = 285.1 μV/m

When BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes LISN Factor, Attenuator, and Cable Loss. These are already accounted for in the “Level” column.

11.2 Limit:

For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the table below.

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	79	66
0.5-30	73	60

11.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV006’	Weather Station	Davis	6250	MS191218071	02/21/2023	02/21/2024
LISN35’	LISN 50uH/250uH 50ohm	Com Power	LI-215A	191960	06/14/2022	06/14/2023
CBLBNC2012-4’	50 Ohm Coaxial Cable	Pomona	RG58C/U	CBLBCN2012-4	10/04/2022	10/04/2023
NAR006’	EMI CISPR Receiver	NARDA	PMM 9010	696WW30303	03/08/2023	03/08/2024
MC20’	20dB attenuator DC-2GHz	Mini Circuits	HAT20+	MC20	06/07/2022	06/07/2023

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	Nexio	3.20.0.21

11.4 Results:

The sample tested was found to Comply.

11.5 Setup Photograph:

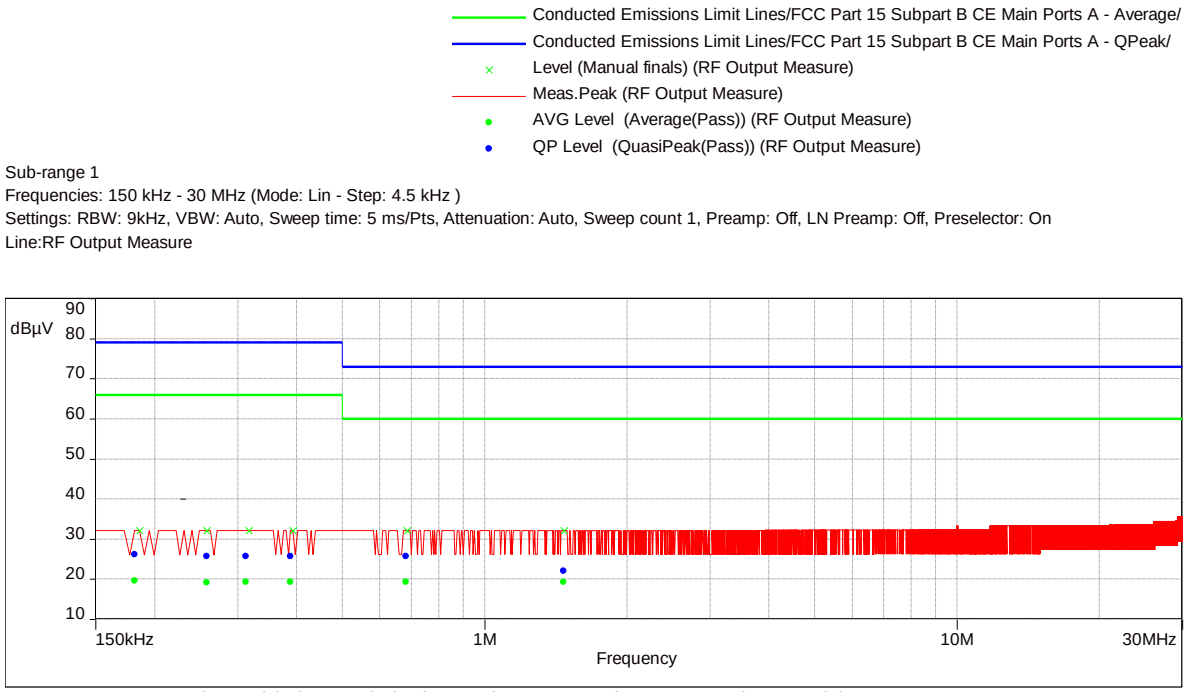
AC Mains Line Conducted Emissions

11.6 Plots/Data:

Test Information:

Date and Time	5/10/2023 11:19:32 AM
Client and Project Number	Starry
Engineer	Kouma Sinn
Temperature	24 Deg C
Humidity	28 %
Atmospheric Pressure	1010 mbar
Comments	120VAC 60Hz (Transmitting), PMM Single Phase Under 15 Amp_150kHz to 30 MHz

Graph:



Results:

QuasiPeak(Pass) (6)

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBuV)	QP Margin (dB)	Position	RBW (Hz)	Correction (dB)
0.182	26.13	79.00	-52.87	Neutral	9000.00	20.08
0.2562	25.69	79.00	-53.31	Phase 1	9000.00	20.08
0.3119	25.72	79.00	-53.28	Neutral	9000.00	20.09
0.3882001	25.76	79.00	-53.24	Neutral	9000.00	20.09
0.6815001	25.75	73.00	-47.25	Neutral	9000.00	20.11
1.4688	22.09	73.00	-50.91	Neutral	9000.00	20.13

Average(Pass) (6)

Frequency (MHz)	AVG Level (dBµV)	AVG Limit (dBuV)	AVG Margin (dB)	Position	RBW (Hz)	Correction (dB)
0.182	19.60	66.00	-46.40	Neutral	9000.00	20.08
0.2562	19.21	66.00	-46.79	Phase 1	9000.00	20.08
0.3119	19.24	66.00	-46.76	Neutral	9000.00	20.09
0.3882001	19.28	66.00	-46.72	Neutral	9000.00	20.09
0.6815001	19.32	60.00	-40.68	Neutral	9000.00	20.11
1.4688	19.25	60.00	-40.75	Neutral	9000.00	20.13
Product Standard: FCC Part 15 Subpart B			Limit applied: See Report Section 12.2 Pretest Verification w/ signal generator: Yes			

Test Date	Test Personnel/ Initials	Supervising Engineer/ Initials	Input Voltage	Mode	Atmospheric Data		
					Temp C°	Relative Humidity %	Atmospheric Pressure mbar
05/10/2023	Kouma Sinn	N/A	120VAC 60Hz	See Report Section 4	24	28	1010

Deviations, Additions, or Exclusions: None

12 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	08/21/2023	105391852BOX-001	KPS	VFV	Original Issue
1	12/18/2023	105391852BOX-001.1	KPS	VFV	- Added the Derivation of EIRP Calculations in Section 6.6 - Added the explanation of how the spectrum analyzer plots represent the final corrected values in Section 8 - Corrected the upper frequency range of investigation states from 100 GHz to 200 GHz. - Filled in missing equipment details in Section 10.3 - Added measurement uncertainty for conducted emissions Section 11.1 - Updated the Lab accreditation scope in Section 15.
2	01/21/2024	105391852BOX-001.2	KPS	VFV	Added limits in data table on pages 12 & 13
3	02/09/2024	105391852BOX-001.3	KPS	VFV	See Note # 1 below
4	03/06/2024	105391852BOX-001.4	KPS	VFV	Added notes on page 13 for power and limit calculations

Note # 1:
1) Included test setup photos for all tests
2) Added, “The conducted method was used, using EMI Receiver power channel integration with RMS Average detector” in Section 6.1 and 7.1.
3) Added, “From 9kHz to 40 GHz both conducted and radiated methods were used and above 40 GHz only radiated method was used.
Radiated Method From 9kHz-30 MHz: The EUT was placed on a non-conductive structure 3 meters away from the receiving antenna. The automated testing was performed using Nexio software with antenna height fixed at 1 meter and EUT rotated from 0 to 360° with receiver antenna in X, Y, and Z axis.
Radiated Method From 30 MHz-18 GHz: The EUT was placed on a non-conductive structure 3 meters away from the receiving antenna with RF absorbers placed between the EUT and receiving antenna. The automated testing was performed using Nexio software. For pre-scan, the EUT was rotated from 0 to 360° at 1, 2, 3, and 4 meters in both vertical and horizontal polarities. For final measurements, the Nexio software picked 6 highest points and performed the final measurement with EUT rotated from 0 to 360° and receiving antenna varied from 1 to 4 meters to find the maximum emission level.
Radiated Method From 18-220 GHz: The EUT was placed on a non-conductive structure 3 meters away from the receiving antenna with RF absorbers placed between the EUT and receiving antenna. The testing was performed manually. The EUT was rotated from 0 to 360° and the receiving antenna was varied from 1 to 4 meters to find the maximum emission”

13 Appendix A – Mixer Conversion Loss

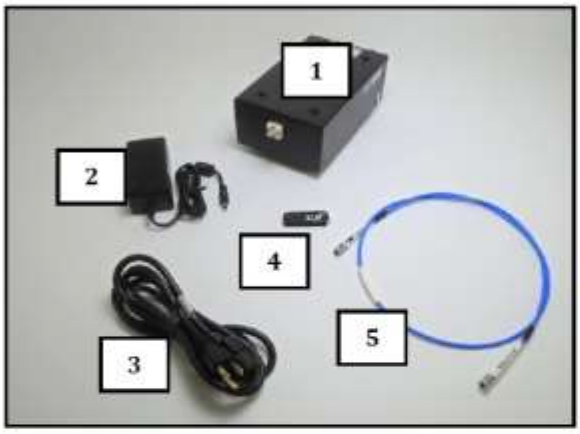
40-60 GHz Mixer Conversion Loss

WR19.0SAX-F

1 Product Overview

Product List (Quantity)	Serial Number(s)	Order No.	Date / Initials
WR19.0SAX-F (1)	SAX 835	21108A	03/26/2021 SAB

Product Description: This VDI product includes one WR19.0 Frequency Extender, intended for use with Rohde & Schwarz FSW spectrum analyzers. This user guide details the operation of the Frequency Extension Module.



No.	Part Description
1	SAX 835
2	9V Power Supply
3	AC Power Cable
4	USB Drive
5	LO Cable (not included)

Figure 1: Photograph of typical configuration. All items may not be included.
Note: Photographs and specifications of accessories (horns, waveguide straights, etc.) are not included in this user guide.

2 Warning and Caution Statements

WARNING AND CAUTION STATEMENTS	
WARNING	This product can be permanently damaged by Electrostatic Discharge (ESD). It is recommended that engineers and technicians wear a special grounded wrist strap when handling this component. In addition, the work environment around the component should be well grounded.
WARNING	Opening the blocks, parts, or components will damage the internal components. VDI is not responsible for the warranty or guaranty of products damaged as a result of improper handling, testing, biasing, or use by customer.
CAUTION	VDI assumes the customer is familiar with microwave, millimeter wave, and VDI products. The user and customer are expected to understand all safety guidelines, health hazards, and general advisories that may exist and are associated with the use of this device. VDI is not responsible for any human hazards that may exist or may occur while using this device.

3 Product Specifications

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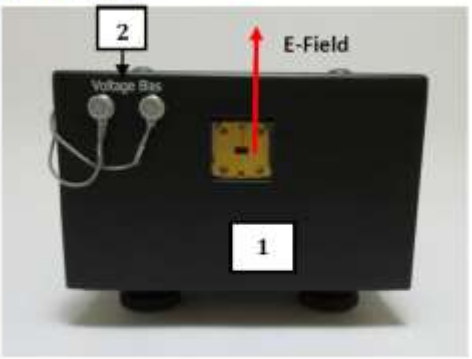

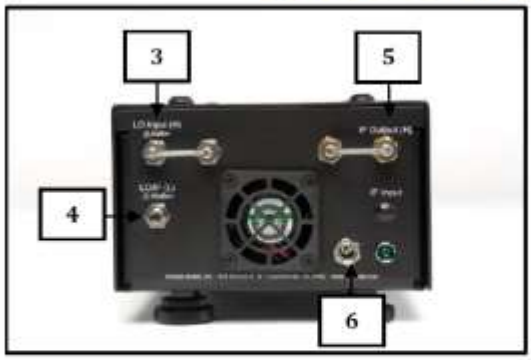

Description		Specification	Connector
RF Input [1]	Frequency Range	40-60GHz	WR19.0 UG-599/UM
	Power (Optimal / Damage)	<-20dBm / -10dBm	
Voltage Bias Port [2]	External Component Bias Voltage	+9V Output 50mA Maximum	LEMO 00 (f)
LO Input High Freq. [3]	Frequency Range	20-30GHz	2.9mm(f)
	Power (Typical† / Damage)	0dBm / 16dBm	
	Multiplication Factor	2	
LO Input Standard Freq. [4]*	Frequency Range	10-15GHz	2.9mm(f)
	Power (Typical† / Damage)	13dBm / 20dBm	
	Multiplication Factor	4	
IF Output Standard Freq. [4]*	Frequency Range	100MHz-2.5GHz	2.9mm(f)
IF Output High Freq. [5]	Frequency Range	100MHz-6GHz	2.9mm(f)
DC Input [6]	DC Power Connection	9V Output, 5A Maximum	2.1mm I.D. x 5.5mm O.D. x 9.5mm Male
Intrinsic Mixer**	SSB Conversion Loss***	9dB	-
Displayed Average Noise Level***		-152dBm/Hz	-

Table 1: General product specifications are shown.
† System is operational within +/- 3dB of nominal input power.
*Standard Freq. LO and IF share the same port.
**Intrinsic mixer conversion loss is measured before any IF amplification and cannot be accessed by user.
***See Section 5 for actual performance.

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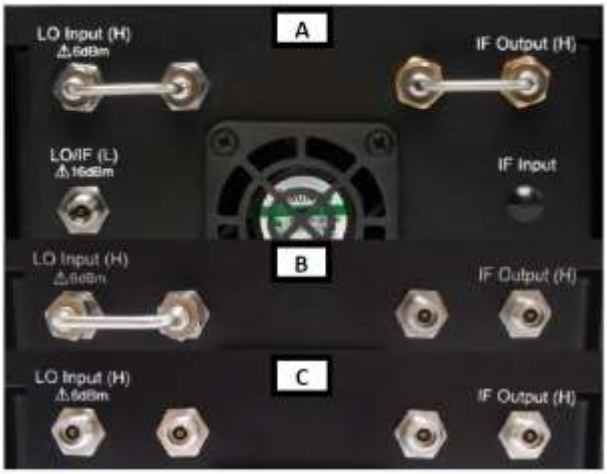

Configuration	LO Frequency	IF Frequency
A	Standard	Standard
B	Standard	High
C	High	High

Figure 2: Configuration details of dual LO input and dual IF output frequency modes are shown.

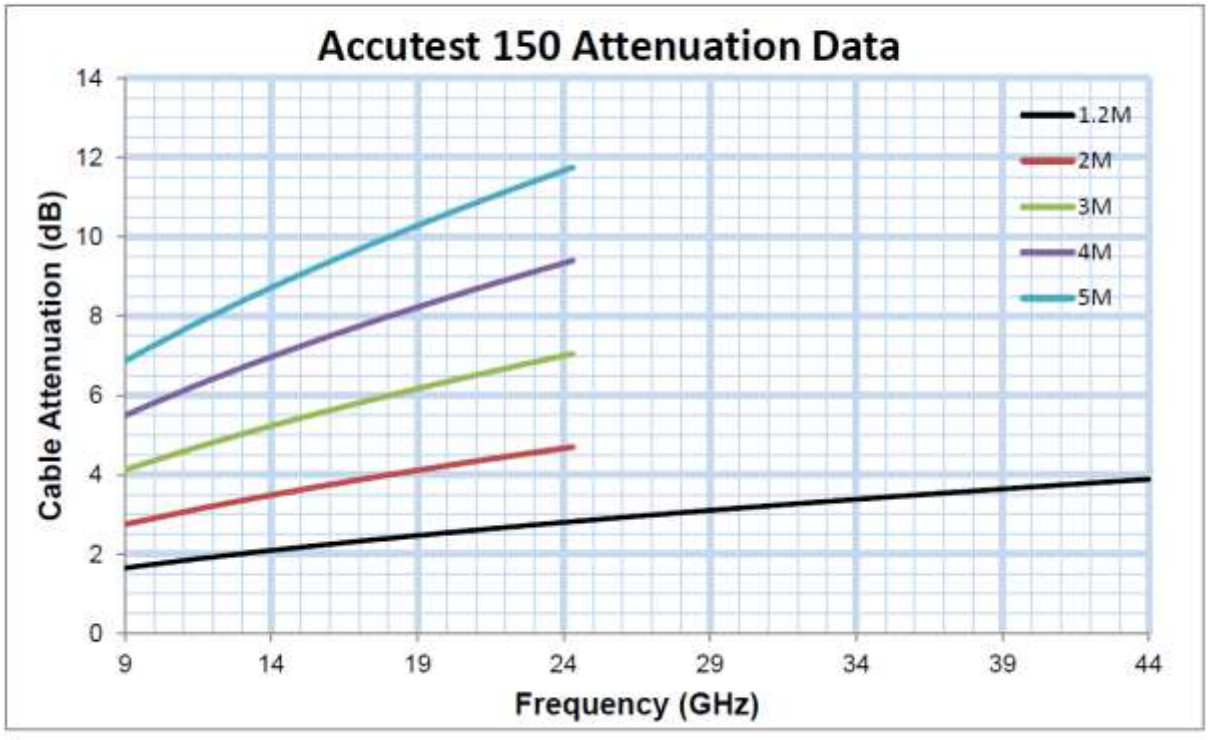

Figure 3: Insertion Loss of Accutest 150 (RF/LO Cable) with respect to frequency.

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USER GUIDE

4 General Operating Procedures and Guidelines

VDI assumes the customer is familiar with VDI products, and VDI is not responsible for the warranty or guaranty of products damaged as a result of improper handling, testing, biasing, or use by customer. VDI offers the following general guidelines for using these products and recommends the customer contact VDI at (434) 297-3257 for assistance if needed. The following procedures are a quick guide for turning on and off the product. In each case the individual steps must be followed in the proper sequence to avoid damaging critical components.

4.1 Required Operating Procedures

- DO NOT exceed damage limits listed in Table 1.
- DO NOT apply any external biases to the system.
- Make proper RF connections depending on desired configuration (i.e. Standard/High LO and Standard/High IF operation). Refer to Figure 2A-C for more information.

Failure to follow these procedures will damage or destroy the device.

4.2 Additional Guidelines, Limitations, and Recommendations

- The SAX is shipped with a reusable dust cover attached. Remove dust cover before operation.

4.3 Turn-On Procedure

1. The user and test bench must be properly grounded and protected against ESD.
2. With the LO and RF input power turned off, make all necessary connections (i.e. LO cable, AC cable, DC cable). See Figure 2A-C for configuration details.
3. Turn on the LO input power.
4. Turn on the small signal RF input power and monitor the IF output.

4.4 Turn-Off Procedure

1. The user and test bench must be properly grounded and protected against ESD.
2. Turn off the RF input power.
3. Turn off the LO input power.
4. Disconnect the DC Power Supply.
5. After completing turn-off procedures described above, it is now safe to turn off all other equipment on user test bench.

Contact VDI with questions or concerns regarding operational procedures and limitations.

5 Product Performance

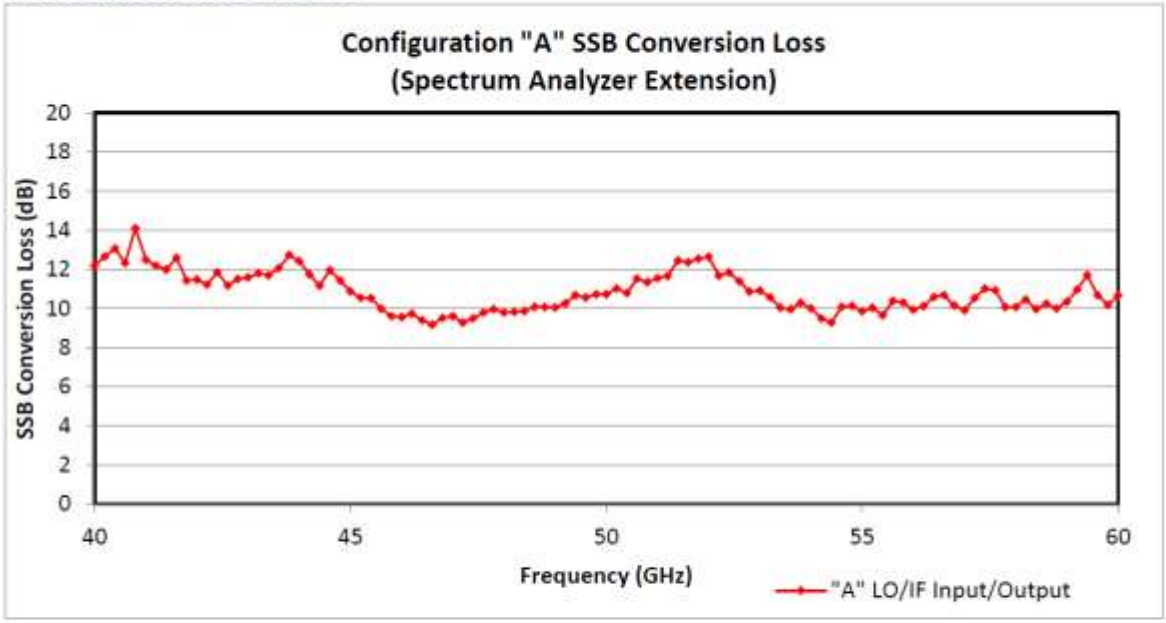

Figure 4: The product performance (SSB conversion loss vs. RF frequency) is shown for an LO input power of ~15dBm in Standard LO Frequency operation. IF power measured from "LO/IF" port with IF frequency fixed at 1.3GHz. CSV Data file included on USB Drive.

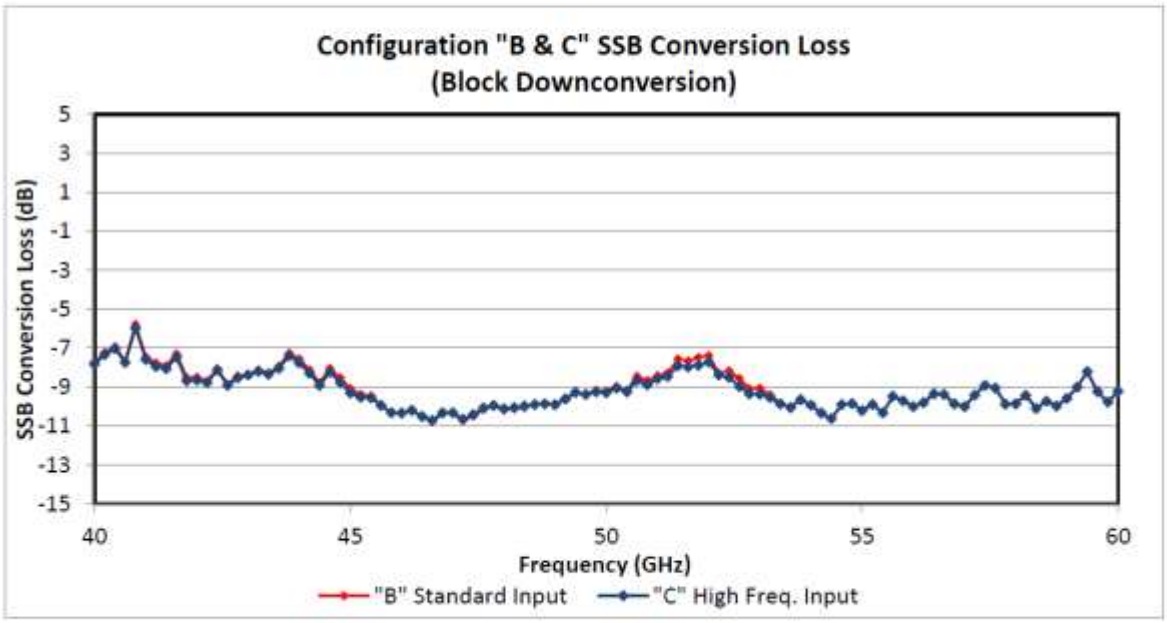

Figure 5: The product performance (SSB conversion loss vs. RF frequency) is shown for an LO input power of ~15dBm in Standard LO Frequency operation and LO input power of ~0dBm in High LO Frequency operation. IF power measured from "IF Output" port with IF frequency fixed at 1.3GHz. CSV Data file included on USB Drive.

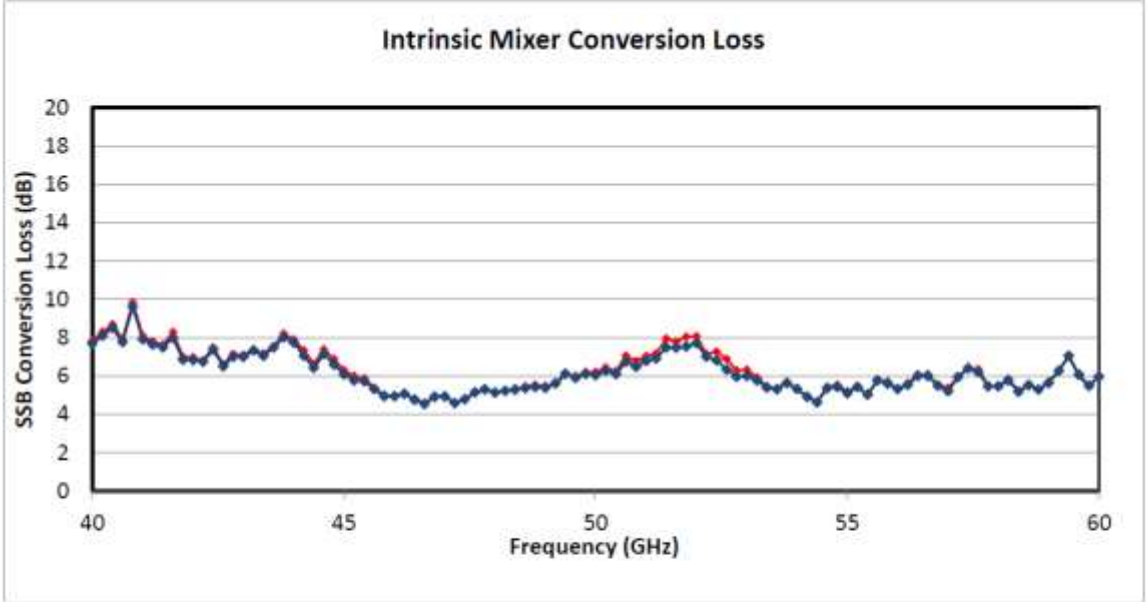

Figure 6: The product performance (SSB conversion loss vs. RF frequency) is shown for an LO input power of ~15dBm in Standard LO Frequency operation and LO input power of ~0dBm in High LO Frequency operation. IF power measured from mixer port with IF frequency fixed at 1.3GHz. Note: mixer port is not accessible for use by the user. CSV Data file included on USB Drive.

Measured Displayed Average Noise Level (dBm/Hz)	
Typical	-152.62

*Measured with a Keysight N9030A PXA Spectrum Analyzer.

SAX 835 Conversion Loss

Note: Out of band data is not guaranteed to be accurate

Freq(GHz)	"A" LO/IF Input/Output	"B" Standard Input	"C" High Freq. Input	High Freq. Intrinsic Mixer Loss	Standard Freq. Intrinsic Mixer Loss
40	12.18393	-7.73106531	-7.83106531	7.69093469	7.83793469
40.2	12.65257	-7.227428425	-7.346428425	8.089571575	8.295571575
40.4	13.04476	-6.935240346	-7.031240346	8.506759654	8.681759654
40.6	12.31643	-7.671565301	-7.756565301	7.763434699	7.913434699
40.8	14.09561	-5.784389207	-5.976389207	9.605610793	9.822610793
41	12.47222	-7.450776143	-7.586776143	7.911223857	8.075223857
41.2	12.17642	-7.766582166	-7.955582166	7.632417834	7.794417834
41.4	11.98468	-7.903316327	-8.068316327	7.491683673	7.628683673
41.6	12.58671	-7.300293808	-7.475293808	7.980706192	8.287706192
41.8	11.42126	-8.517743767	-8.682743767	6.840256233	6.992256233
42	11.46096	-8.504035139	-8.649035139	6.835964861	6.965964861
42.2	11.21847	-8.684527279	-8.781527279	6.735472721	6.799472721
42.4	11.83738	-8.055620485	-8.146620485	7.366379515	7.484379515
42.6	11.17569	-8.856309768	-8.917309768	6.502690232	6.599690232
42.8	11.49528	-8.435723496	-8.534723496	6.994276504	7.141276504
43	11.56904	-8.375963687	-8.395963687	6.987036313	7.103036313
43.2	11.79484	-8.120156119	-8.196156119	7.335843881	7.372843881
43.4	11.67951	-8.279490341	-8.364490341	7.050509659	7.176509659
43.6	12.05336	-7.943637944	-8.048637944	7.490362056	7.536362056
43.8	12.72018	-7.259817722	-7.400817722	8.024182278	8.205182278
44	12.40928	-7.555723107	-7.764723107	7.756276893	7.900276893
44.2	11.72591	-8.119091237	-8.296091237	7.052908763	7.335908763
44.4	11.15254	-8.774458098	-8.927458098	6.418541902	6.611541902
44.6	11.94911	-8.046893419	-8.235893419	7.146106581	7.381106581
44.8	11.41168	-8.535320915	-8.779320915	6.593679085	6.880679085
45	10.86545	-9.074546037	-9.315546037	6.077453963	6.296453963
45.2	10.52373	-9.371265586	-9.527265586	5.767734414	6.004734414
45.4	10.51426	-9.446741028	-9.563741028	5.714258972	5.882258972
45.6	9.986746	-9.939254477	-9.954254477	5.306745523	5.378745523
45.8	9.59202	-10.34998045	-10.33198045	4.939019546	4.994019546
46	9.54945	-10.34955021	-10.34255021	4.945449791	4.942449791
46.2	9.718601	-10.20139894	-10.20139894	5.06660106	5.08660106
46.4	9.4014	-10.51059989	-10.50859989	4.75540011	4.80640011
46.6	9.164813	-10.76618735	-10.72018735	4.525812655	4.559812655
46.8	9.49849	-10.37151002	-10.32451002	4.910489976	4.952489976
47	9.590663	-10.34933683	-10.32533683	4.919663167	4.930663167
47.2	9.264478	-10.73452184	-10.66252184	4.576478163	4.565478163
47.4	9.487929	-10.49307072	-10.42707072	4.788929277	4.774929277

Freq(GHz)	"A" LO/IF Input/Output	"B" Standard Input	"C" High Freq. Input	High Freq. Intrinsic Mixer Loss	Standard Freq. Intrinsic Mixer Loss
47.6	9.782794	-10.16320569	-10.07820569	5.142794307	5.116794307
47.8	9.95227	-9.987729761	-9.946729761	5.294270239	5.264270239
48	9.779821	-10.1941788	-10.1251788	5.128821195	5.129821195
48.2	9.817198	-10.11880169	-10.06180169	5.213198315	5.238198315
48.4	9.861049	-10.05895142	-9.99095142	5.29204858	5.22604858
48.6	10.07245	-9.889547923	-9.900547923	5.367452077	5.450452077
48.8	10.07077	-9.841233026	-9.876233026	5.424766974	5.527766974
49	10.02539	-9.862610661	-9.921610661	5.379389339	5.465389339
49.2	10.24586	-9.671136617	-9.615136617	5.606863383	5.561863383
49.4	10.6675	-9.289503278	-9.286503278	6.107496722	6.065496722
49.6	10.5412	-9.356800369	-9.393800369	5.891199631	5.991199631
49.8	10.71795	-9.170051536	-9.242051536	6.089948464	6.211948464
50	10.72015	-9.202846251	-9.294846251	6.036153749	6.207153749
50.2	11.01845	-8.967548981	-9.055548981	6.261451019	6.439451019
50.4	10.78694	-9.175059654	-9.246059654	6.097940346	6.231940346
50.6	11.51114	-8.446861426	-8.672861426	6.740138574	7.043138574
50.8	11.34446	-8.666536526	-8.891536526	6.471463474	6.789463474
51	11.54523	-8.420770486	-8.581770486	6.787229514	7.028229514
51.2	11.64424	-8.273764545	-8.461764545	6.912235455	7.159235455
51.4	12.45045	-7.554554578	-7.923554578	7.493445422	7.940445422
51.6	12.34762	-7.672378642	-7.986378642	7.465621358	7.783621358
51.8	12.53203	-7.48396897	-7.88396897	7.53103103	8.03103103
52	12.63471	-7.392294596	-7.710294596	7.710705404	8.068705404
52.2	11.66922	-8.296777367	-8.395777367	6.998222633	7.135222633
52.4	11.82163	-8.176370856	-8.512370856	6.820629144	7.266629144
52.6	11.38115	-8.567850502	-8.981850502	6.324149498	6.876149498
52.8	10.85834	-9.088660283	-9.362660283	5.949339717	6.282339717
53	10.90889	-9.054111321	-9.370111321	6.000888679	6.315888679
53.2	10.55653	-9.398471843	-9.553471843	5.768528157	5.922528157
53.4	10.02485	-9.857147743	-9.879147743	5.394852257	5.452852257
53.6	9.957231	-10.00976887	-10.05476887	5.300231127	5.343231127
53.8	10.28107	-9.656928444	-9.648928444	5.624071556	5.671071556
54	10.00557	-9.945426854	-9.944426854	5.313573147	5.316573147
54.2	9.483862	-10.38213777	-10.35113777	4.90986223	4.92486223
54.4	9.27475	-10.63425049	-10.62325049	4.602749509	4.658749509
54.6	10.07448	-9.899524203	-9.899524203	5.357475797	5.419475797
54.8	10.12309	-9.847914944	-9.861914944	5.428085056	5.530085056
55	9.843976	-10.19002385	-10.21402385	5.092976146	5.194976146
55.2	10.03561	-9.908389973	-9.910389973	5.416610027	5.438610027
55.4	9.643359	-10.31664094	-10.33464094	5.038359057	4.973359057
55.6	10.37222	-9.49677748	-9.48777748	5.76322252	5.79722252

Freq(GHz)	"A" LO/IF Input/Output	"B" Standard Input	"C" High Freq. Input	High Freq. Intrinsic Mixer Loss	Standard Freq. Intrinsic Mixer Loss
55.8	10.30295	-9.680049143	-9.713049143	5.588950857	5.707950857
56	9.930571	-10.00042911	-10.01842911	5.310570886	5.301570886
56.2	10.10271	-9.786290637	-9.816290637	5.528709363	5.602709363
56.4	10.57445	-9.318550175	-9.357550175	6.002449825	6.064449825
56.6	10.66912	-9.349881086	-9.393881086	6.004118914	6.076118914
56.8	10.14375	-9.840248304	-9.875248304	5.478751696	5.545751696
57	9.894501	-9.992499215	-10.01649921	5.211500785	5.371500785
57.2	10.52904	-9.407962195	-9.419962195	5.934037805	5.908037805
57.4	11.01629	-8.88670661	-8.91570661	6.39329339	6.41629339
57.6	10.9171	-9.033897975	-9.064897975	6.195102025	6.348102025
57.8	10.05695	-9.8670484	-9.8830484	5.4619516	5.4749516
58	10.06586	-9.834143573	-9.880143573	5.457856427	5.450856427
58.2	10.45513	-9.422873675	-9.434873675	5.770126325	5.841126325
58.4	9.959582	-10.09041812	-10.10741812	5.165581881	5.204581881
58.6	10.23535	-9.720652896	-9.738652896	5.511347104	5.584347104
58.8	9.987653	-9.967346763	-9.989346763	5.289653237	5.282653237
59	10.32975	-9.594251231	-9.600251231	5.624748769	5.691748769
59.2	10.94742	-9.004582916	-9.007582916	6.263417084	6.266417084
59.4	11.69635	-8.21964914	-8.21264914	7.04235086	7.01935086
59.6	10.67157	-9.294432287	-9.235432287	6.069567713	6.001567713
59.8	10.16657	-9.771428462	-9.783428462	5.485571538	5.447571538
60	10.64813	-9.237874856	-9.223874856	5.947125144	6.016125144

60-90 GHz Mixer Conversion Loss

Virginia Diodes, Inc.

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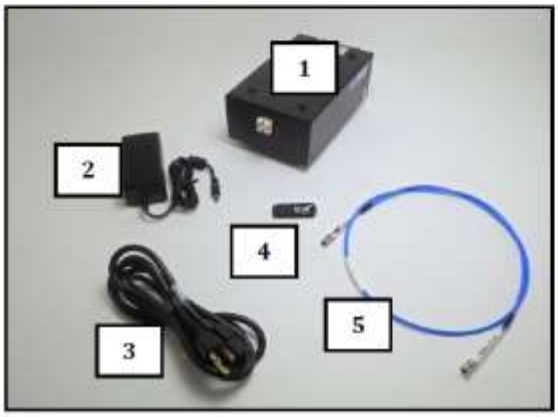
WR12.0SAX-F

1 Product Overview

Product List (Quantity)	Serial Number(s)	Order No.	Date / Initials
WR12.0SAX-F (1)	SAX 836	21108B	04/06/2021 CXS

Product Description: This VDI product includes one WR12.0 Frequency Extender, intended for use with Rohde & Schwarz FSW spectrum analyzers. This user guide details the operation of the Frequency Extension Module.



No.	Part Description
1	SAX 836
2	9V Power Supply
3	AC Power Cable
4	USB Drive
5	LO Cable (not included)

Figure 1: Photograph of typical configuration. All items may not be included.
Note: Photographs and specifications of accessories (horns, waveguide straights, etc.) are not included in this user guide.

2 Warning and Caution Statements

WARNING AND CAUTION STATEMENTS	
WARNING	This product can be permanently damaged by Electrostatic Discharge (ESD). It is recommended that engineers and technicians wear a special grounded wrist strap when handling this component. In addition, the work environment around the component should be well grounded.
WARNING	Opening the blocks, parts, or components will damage the internal components. VDI is not responsible for the warranty or guaranty of products damaged as a result of improper handling, testing, biasing, or use by customer.
CAUTION	VDI assumes the customer is familiar with microwave, millimeter wave, and VDI products. The user and customer are expected to understand all safety guidelines, health hazards, and general advisories that may exist and are associated with the use of this device. VDI is not responsible for any human hazards that may exist or may occur while using this device.

3 Product Specifications

Virginia Diodes, Inc.

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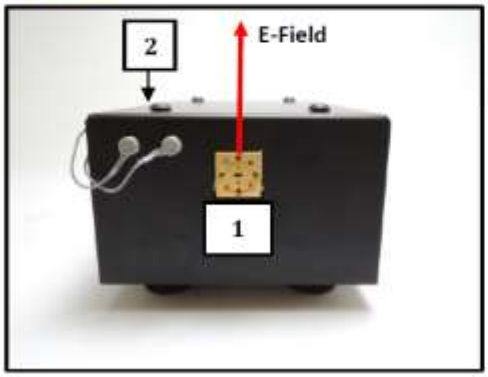

Description		Specification	Connector
RF Input [1]	Frequency Range	60-90GHz	WR12.0 UG-599/UM
	Power (Optimal / Damage)	<-20dBm / -10dBm	
Voltage Bias Port [2]	External Component Bias Voltage	+9V Output 50mA Maximum	LEMO 00 (f)
LO Input High Freq. [3]	Frequency Range	10-15GHz	2.9mm(f)
	Power (Typical† / Damage)	0dBm / 16dBm	
	Multiplication Factor	6	
LO Input Standard Freq. [4]*	Frequency Range	10-15GHz	2.9mm(f)
	Power (Typical† / Damage)	13dBm / 20dBm	
	Multiplication Factor	6	
IF Output Standard Freq. [4]*	Frequency Range	100MHz-2.5GHz	2.9mm(f)
IF Output High Freq. [5]	Frequency Range	100MHz-9GHz	2.9mm(f)
DC Input [6]	DC Power Connection	9V Output, 5A Maximum	2.1mm I.D. x 5.5mm O.D. x 9.5mm Male
Intrinsic Mixer**	SSB Conversion Loss***	10dB	-
Displayed Average Noise Level***		-152dBm/Hz	-

Table 1: General product specifications are shown.
† System is operational within +/- 3dB of nominal input power.
*Standard Freq. LO and IF share the same port.
**Intrinsic mixer conversion loss is measured before any IF amplification and cannot be accessed by user.
***See Section 5 for actual performance.

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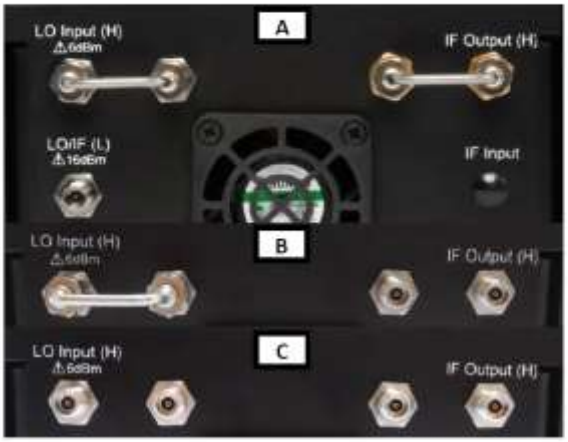

Configuration	LO Frequency	IF Frequency
A	Standard	Standard
B	Standard	High
C	High	High

Figure 2: Configuration details of dual LO input and dual IF output frequency modes are shown.

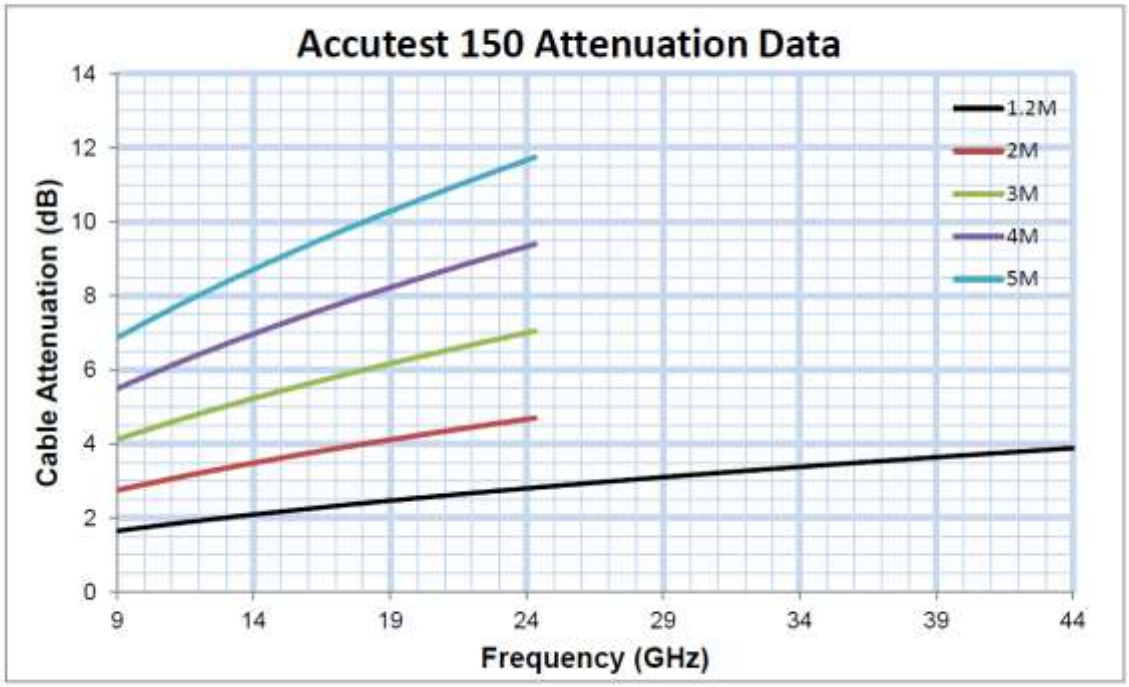

Figure 3: Insertion Loss of Accutest 150 (RF/LO Cable) with respect to frequency.

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4 General Operating Procedures and Guidelines

VDI assumes the customer is familiar with VDI products, and VDI is not responsible for the warranty or guaranty of products damaged as a result of improper handling, testing, biasing, or use by customer. VDI offers the following general guidelines for using these products and recommends the customer contact VDI at (434) 297-3257 for assistance if needed. The following procedures are a quick guide for turning on and off the product. In each case the individual steps must be followed in the proper sequence to avoid damaging critical components.

4.1 Required Operating Procedures

- DO NOT exceed damage limits listed in Table 1.
- DO NOT apply any external biases to the system.
- Make proper RF connections depending on desired configuration (i.e. Standard/High LO and Standard/High IF operation). Refer to Figure 2A-C for more information.

Failure to follow these procedures will damage or destroy the device.

4.2 Additional Guidelines, Limitations, and Recommendations

- The SAX is shipped with a reusable dust cover attached. Remove dust cover before operation.

4.3 Turn-On Procedure

1. The user and test bench must be properly grounded and protected against ESD.
2. With the LO and RF input power turned off, make all necessary connections (i.e. LO cable, AC cable, DC cable). See Figure 2A-C for configuration details.
3. Turn on the LO input power.
4. Turn on the small signal RF input power and monitor the IF output.

4.4 Turn-Off Procedure

1. The user and test bench must be properly grounded and protected against ESD.
2. Turn off the RF input power.
3. Turn off the LO input power.
4. Disconnect the DC Power Supply.
5. After completing turn-off procedures described above, it is now safe to turn off all other equipment on user test bench.

Contact VDI with questions or concerns regarding operational procedures and limitations.

5 Product Performance

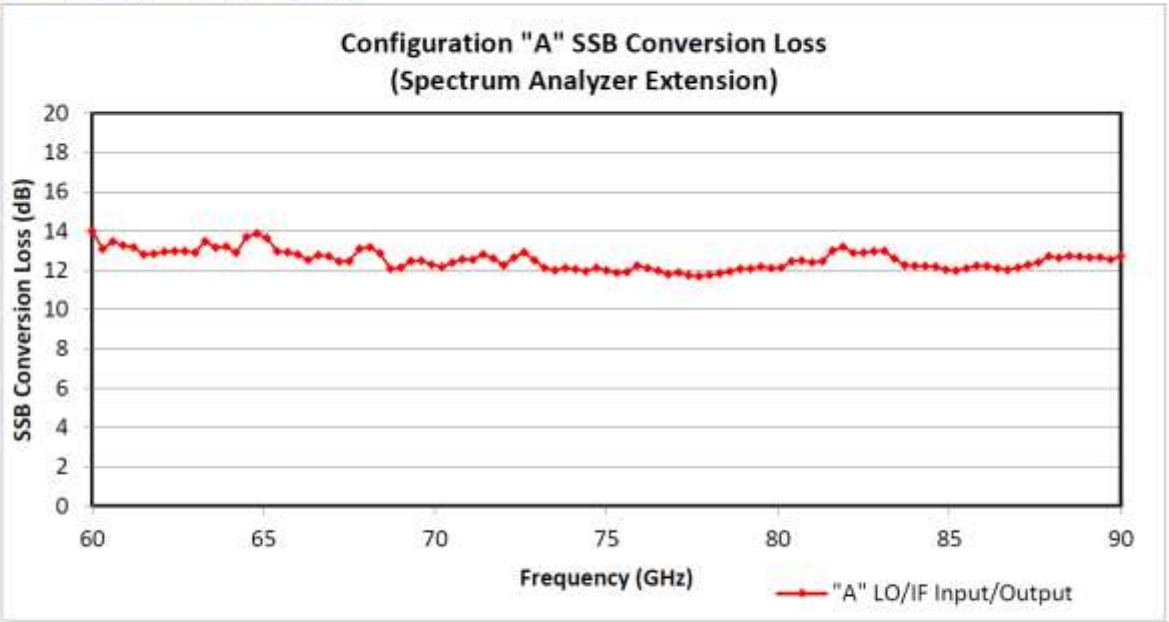


Figure 4: The product performance (SSB conversion loss vs. RF frequency) is shown for an LO input power of ~15dBm in Standard LO Frequency operation. IF power measured from "LO/IF" port with IF frequency fixed at 1.3GHz. CSV Data file included on USB Drive.

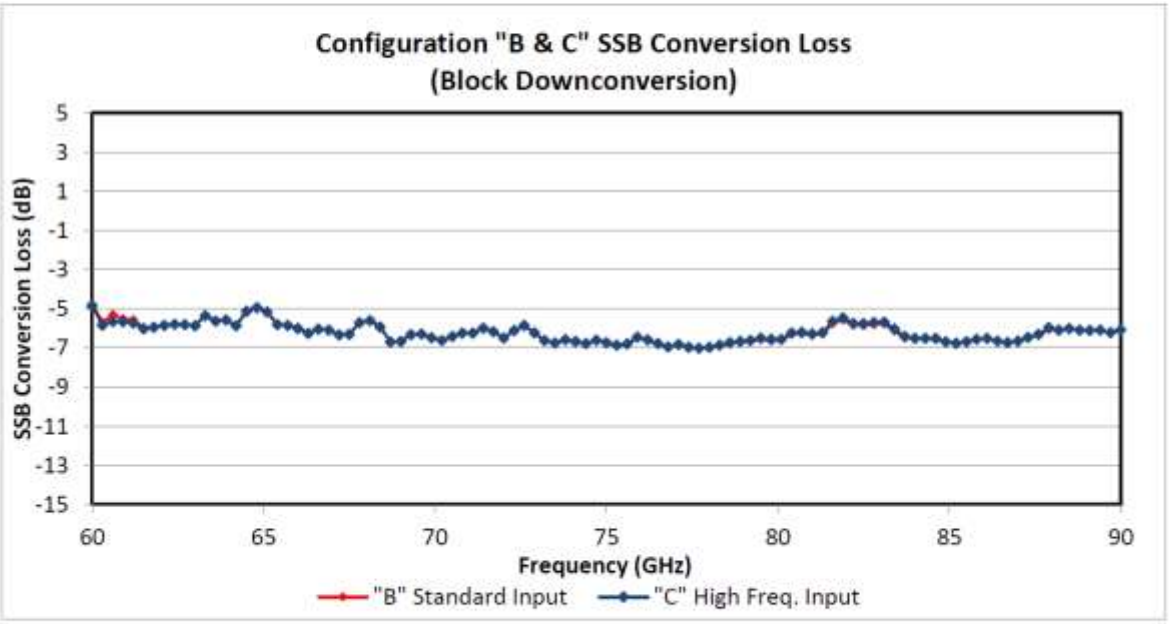


Figure 5: The product performance (SSB conversion loss vs. RF frequency) is shown for an LO input power of ~15dBm in Standard LO Frequency operation and LO input power of ~0dBm in High LO Frequency operation. IF power measured from "IF Output" port with IF frequency fixed at 1.3GHz. CSV Data file included on USB Drive.

Virginia Diodes, Inc.

USER GUIDE

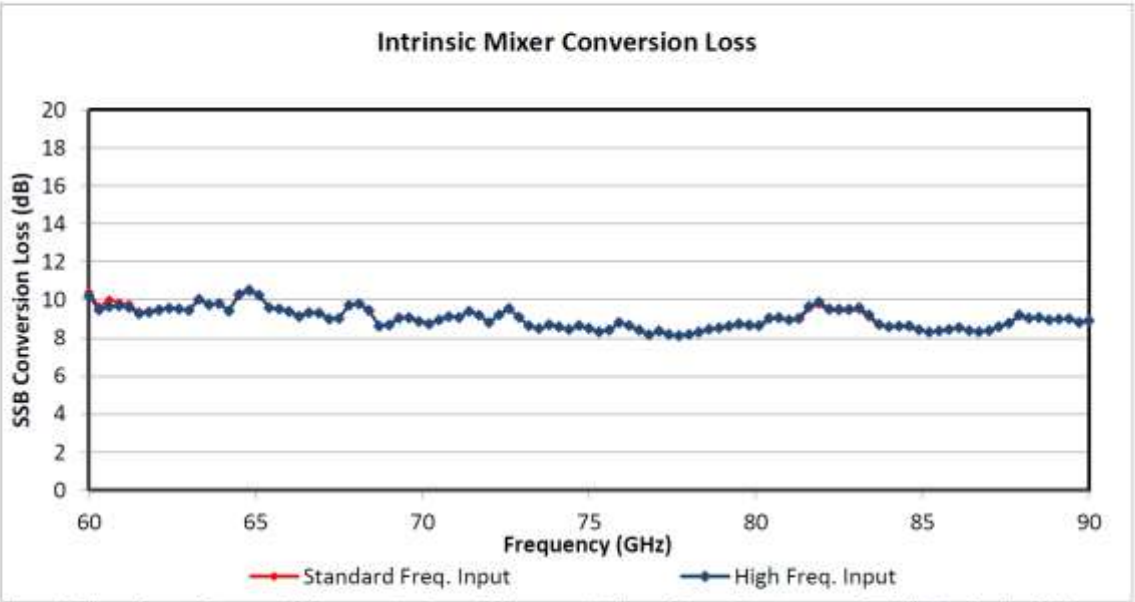


Figure 6: The product performance (SSB conversion loss vs. RF frequency) is shown for an LO input power of ~15dBm in Standard LO Frequency operation and LO input power of ~0dBm in High LO Frequency operation. IF power measured from mixer port with IF frequency fixed at 1.3GHz. Note: mixer port is not accessible for use by the user. CSV Data file included on USB Drive.

Measured Displayed Average Noise Level (dBm/Hz)	
Typical	-150.65

*Measured with a Keysight N9030A PXA Spectrum Analyzer.

SAX 836 Conversion Loss

Note: Out of band data is not guaranteed to be accurate

Freq(GHz)	"A" LO/IF Input/Output	"B" Standard Input	"C" High Freq. Input	High Freq. Intrinsic Mixer Loss	Standard Freq. Intrinsic Mixer Loss
60	14.00809673	-4.74690327	-4.86490327	10.22409673	10.40709673
60.3	13.08177247	-5.686227526	-5.842227526	9.482772474	9.645772474
60.6	13.44988267	-5.300117334	-5.655117334	9.656882666	10.01088267
60.9	13.26543128	-5.497568718	-5.666568718	9.689431282	9.877431282
61.2	13.17933468	-5.566665317	-5.739665317	9.610334683	9.782334683
61.5	12.80009579	-5.949904212	-6.025904212	9.275095788	9.380095788
61.8	12.82914386	-5.919856141	-5.953856141	9.363143859	9.427143859
62.1	12.94303505	-5.816964953	-5.851964953	9.468035047	9.537035047
62.4	12.97887686	-5.769123137	-5.797123137	9.562876863	9.595876863
62.7	12.96847511	-5.790524891	-5.806524891	9.521475109	9.549475109
63	12.90047744	-5.846522559	-5.880522559	9.443477441	9.500477441
63.3	13.47453136	-5.305468637	-5.358468637	10.03153136	10.09053136
63.6	13.16719015	-5.597809855	-5.631809855	9.743190145	9.784190145
63.9	13.21223698	-5.54176302	-5.57776302	9.80323698	9.83423698
64.2	12.89882197	-5.858178027	-5.877178027	9.423821973	9.472821973
64.5	13.68621534	-5.074784662	-5.137784662	10.27721534	10.35121534
64.8	13.87468986	-4.891310145	-4.952310145	10.50468986	10.58768986
65.1	13.63537185	-5.11962815	-5.16362815	10.24337185	10.29937185
65.4	12.96383529	-5.779164713	-5.809164713	9.594835287	9.641835287
65.7	12.90818146	-5.823818544	-5.864818544	9.523181456	9.563181456
66	12.79905144	-5.948948563	-6.018948563	9.387051437	9.445051437
66.3	12.52625358	-6.224746423	-6.264746423	9.128253577	9.178253577
66.6	12.77501349	-6.002986511	-6.044986511	9.332013489	9.386013489
66.9	12.70577709	-6.056222906	-6.098222906	9.304777094	9.340777094
67.2	12.44844547	-6.298554532	-6.348554532	8.999445468	9.058445468
67.5	12.45771307	-6.27928693	-6.30628693	9.03571307	9.05871307
67.8	13.09446348	-5.662536517	-5.710536517	9.711463483	9.745463483
68.1	13.18159215	-5.574407845	-5.614407845	9.789592155	9.842592155
68.4	12.86269872	-5.889301275	-5.932301275	9.452698725	9.498698725
68.7	12.06465654	-6.679343461	-6.704343461	8.624656539	8.651656539
69	12.12697909	-6.634020906	-6.663020906	8.681979094	8.730979094
69.3	12.47379099	-6.275209006	-6.320209006	9.048790994	9.109790994
69.6	12.49635632	-6.266643679	-6.302643679	9.061356321	9.119356321
69.9	12.29461412	-6.451385875	-6.487385875	8.877614125	8.913614125
70.2	12.15951216	-6.599487841	-6.628487841	8.725512159	8.760512159
70.5	12.38334399	-6.369656014	-6.416656014	8.946343986	8.999343986
70.8	12.55179008	-6.206209925	-6.243209925	9.126790075	9.154790075
71.1	12.53542905	-6.22657095	-6.25057095	9.07142905	9.11942905

Freq(GHz)	"A" LO/IF Input/Output	"B" Standard Input	"C" High Freq. Input	High Freq. Intrinsic Mixer Loss	Standard Freq. Intrinsic Mixer Loss
71.4	12.80331874	-5.95168126	-6.00068126	9.40331874	9.41931874
71.7	12.59441785	-6.142582148	-6.177582148	9.194417852	9.228417852
72	12.26506093	-6.485939069	-6.497939069	8.817060931	8.831060931
72.3	12.6529332	-6.105066802	-6.130066802	9.223933198	9.253933198
72.6	12.91123601	-5.84176399	-5.85376399	9.54023601	9.55323601
72.9	12.50543192	-6.253568082	-6.234568082	9.097431918	9.095431918
73.2	12.12384684	-6.638153158	-6.616153158	8.645846842	8.647846842
73.5	11.99820018	-6.767799823	-6.748799823	8.497200177	8.484200177
73.8	12.11430193	-6.643698071	-6.582698071	8.701301929	8.647301929
74.1	12.05944184	-6.710558164	-6.669558164	8.594441836	8.540441836
74.4	11.94565033	-6.811349671	-6.778349671	8.456650329	8.429650329
74.7	12.11754896	-6.642451036	-6.607451036	8.659548964	8.623548964
75	11.99113212	-6.768867875	-6.733867875	8.506132125	8.483132125
75.3	11.86630909	-6.900690911	-6.860690911	8.333309089	8.310309089
75.6	11.91810032	-6.838899678	-6.798899678	8.423100322	8.401100322
75.9	12.24548213	-6.500517867	-6.451517867	8.808482133	8.772482133
76.2	12.10239893	-6.643601074	-6.590601074	8.650398926	8.617398926
76.5	11.98551471	-6.789485292	-6.773485292	8.417514708	8.412514708
76.8	11.79713504	-6.968864956	-6.945864956	8.175135044	8.189135044
77.1	11.88064822	-6.869351775	-6.824351775	8.367648225	8.314648225
77.4	11.7419614	-7.018038601	-6.974038601	8.182961399	8.171961399
77.7	11.70070307	-7.05529693	-7.02129693	8.12070307	8.12070307
78	11.75970185	-6.99429815	-6.96829815	8.18070185	8.17970185
78.3	11.84442873	-6.900571271	-6.854571271	8.310428729	8.287428729
78.6	11.95018765	-6.799812349	-6.734812349	8.461187651	8.414187651
78.9	12.06854076	-6.706459237	-6.665459237	8.532540763	8.518540763
79.2	12.07851172	-6.674488276	-6.618488276	8.626511724	8.567511724
79.5	12.18083903	-6.574160969	-6.495160969	8.753839031	8.672839031
79.8	12.10740792	-6.654592085	-6.567592085	8.682407915	8.602407915
80.1	12.12624941	-6.617750592	-6.567750592	8.650249408	8.586249408
80.4	12.45676064	-6.305239365	-6.226239365	9.050760635	8.968760635
80.7	12.49277424	-6.273225761	-6.198225761	9.072774239	9.015774239
81	12.39938675	-6.35061325	-6.28161325	8.95738675	8.90238675
81.3	12.46230193	-6.292698068	-6.222698068	9.038301932	8.952301932
81.6	13.00393377	-5.757066234	-5.633066234	9.655933766	9.553933766
81.9	13.1857019	-5.5832981	-5.4612981	9.8847019	9.7637019
82.2	12.87742475	-5.848575252	-5.743575252	9.531424748	9.429424748
82.5	12.89518705	-5.867812949	-5.763812949	9.519187051	9.423187051
82.8	12.95150506	-5.81749494	-5.70349494	9.52050506	9.42650506
83.1	12.98575567	-5.77524433	-5.68224433	9.59075567	9.47675567
83.4	12.59718822	-6.140811779	-6.029811779	9.215188221	9.091188221

Freq(GHz)	"A" LO/IF Input/Output	"B" Standard Input	"C" High Freq. Input	High Freq. Intrinsic Mixer Loss	Standard Freq. Intrinsic Mixer Loss
83.7	12.25796009	-6.493039911	-6.419039911	8.712960089	8.670960089
84	12.23114021	-6.524859786	-6.506859786	8.586140214	8.569140214
84.3	12.20708834	-6.540911658	-6.506911658	8.629088342	8.584088342
84.6	12.18133493	-6.580665066	-6.515665066	8.645334934	8.565334934
84.9	12.01835551	-6.731644488	-6.691644488	8.437355512	8.409355512
85.2	11.97910956	-6.769890438	-6.757890438	8.310109562	8.331109562
85.5	12.09929486	-6.662705139	-6.685705139	8.368294861	8.384294861
85.8	12.22092835	-6.529071647	-6.559071647	8.449928353	8.487928353
86.1	12.21270567	-6.532294329	-6.513294329	8.549705671	8.545705671
86.4	12.10955656	-6.659443442	-6.661443442	8.391556558	8.413556558
86.7	12.01941635	-6.735583651	-6.734583651	8.320416349	8.351416349
87	12.12790597	-6.652094034	-6.659094034	8.388905966	8.431905966
87.3	12.2779043	-6.474095698	-6.469095698	8.598904302	8.628904302
87.6	12.39380025	-6.359199748	-6.316199748	8.776800252	8.773800252
87.9	12.70905543	-6.059944574	-5.963944574	9.212055426	9.121055426
88.2	12.63644451	-6.145555491	-6.093555491	9.051444509	8.987444509
88.5	12.72378687	-6.047213129	-6.017213129	9.075786871	9.078786871
88.8	12.69878056	-6.070219442	-6.093219442	8.943780558	8.993780558
89.1	12.64415049	-6.140849508	-6.113849508	8.990150492	8.997150492
89.4	12.66086495	-6.119135052	-6.096135052	9.011864948	9.040864948
89.7	12.54474949	-6.223250512	-6.212250512	8.804749488	8.861749488
90	12.70351072	-6.062489285	-6.075489285	8.899510715	8.976510715

90-140 GHz Mixer Conversion Loss

Virginia Diodes, Inc.

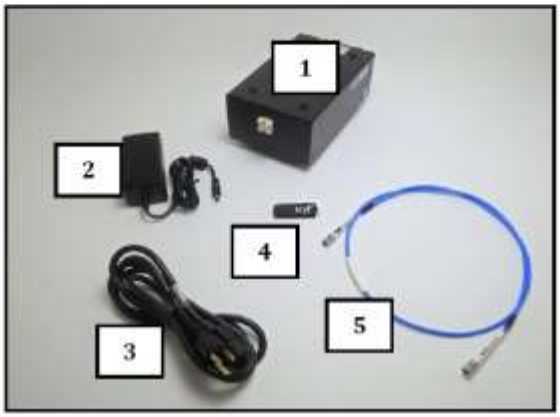
USER GUIDE

WR8.0SAX-F

1 Product Overview

Product List (Quantity)	Serial Number(s)	Order No.	Date / Initials
WR8.0SAX-F (1)	SAX 837	21108C	06/10/2021 DNS

Product Description: This VDI product includes one WR8.0 Frequency Extender, intended for use with Rohde & Schwarz FSW spectrum analyzers. This user guide details the operation of the Frequency Extension Module.



No.	Part Description
1	SAX 837
2	9V Power Supply
3	AC Power Cable
4	USB Drive
5	LO Cable (not included)

Figure 1: Photograph of typical configuration. All items may not be included.
Note: Photographs and specifications of accessories (horns, waveguide straights, etc.) are not included in this user guide.

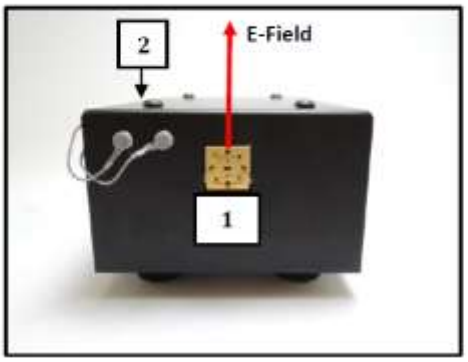
2 Warning and Caution Statements

WARNING AND CAUTION STATEMENTS	
WARNING	This product can be permanently damaged by Electrostatic Discharge (ESD). It is recommended that engineers and technicians wear a special grounded wrist strap when handling this component. In addition, the work environment around the component should be well grounded.
WARNING	Opening the blocks, parts, or components will damage the internal components. VDI is not responsible for the warranty or guaranty of products damaged as a result of improper handling, testing, biasing, or use by customer.
CAUTION	VDI assumes the customer is familiar with microwave, millimeter wave, and VDI products. The user and customer are expected to understand all safety guidelines, health hazards, and general advisories that may exist and are associated with the use of this device. VDI is not responsible for any human hazards that may exist or may occur while using this device.

3 Product Specifications

Virginia Diodes, Inc.

USER GUIDE



Description		Specification	Connector
RF Input [1]	Frequency Range	90-140GHz	WR8.0 UG-599/UM
	Power (Optimal / Damage)	<-20dBm / -10dBm	
Voltage Bias Port [2]	External Component Bias Voltage	+9V Output 50mA Maximum	LEMO 00 (f)
LO Input High Freq. [3]	Frequency Range	30-46.67GHz	2.9mm(f)
	Power (Typical† / Damage)	0dBm / 6dBm	
	Multiplication Factor	3	
LO Input Standard Freq. [4]*	Frequency Range	10-15.56GHz	2.9mm(f)
	Power (Typical† / Damage)	13dBm / 20dBm	
	Multiplication Factor	9	
IF Output Standard Freq. [4]*	Frequency Range	100MHz-2.5GHz	2.9mm(f)
IF Output High Freq. [5]	Frequency Range	100MHz-14GHz	2.9mm(f)
DC Input [6]	DC Power Connection	9V Output, 5A Maximum	2.1mm I.D. x 5.5mm O.D. x 9.5mm Male
Intrinsic Mixer**	SSB Conversion Loss***	10dB	-
Displayed Average Noise Level***		-150dBm/Hz	-

Table 1: General product specifications are shown.
† System is operational within +/- 3dB of nominal input power.
*Standard Freq. LO and IF share the same port.
**Intrinsic mixer conversion loss is measured before any IF amplification and cannot be accessed by user.
***See Section 5 for actual performance.

Virginia Diodes, Inc.

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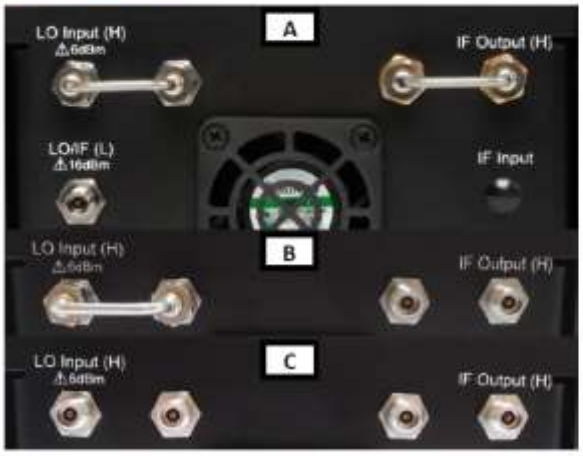

Configuration	LO Frequency	IF Frequency
A	Standard	Standard
B	Standard	High
C	High	High

Figure 2: Configuration details of dual LO input and dual IF output frequency modes are shown.

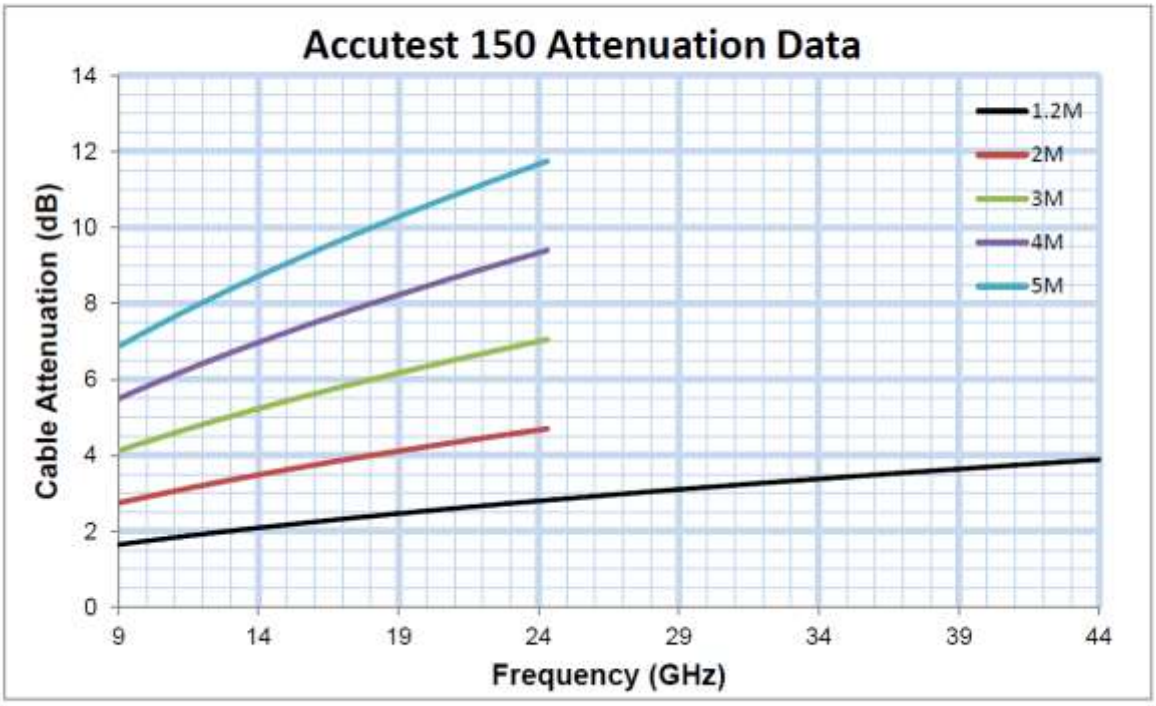

Figure 3: Insertion Loss of Accutest 150 (RF/LO Cable) with respect to frequency.

Virginia Diodes, Inc.

USER GUIDE

4 General Operating Procedures and Guidelines

VDI assumes the customer is familiar with VDI products, and VDI is not responsible for the warranty or guaranty of products damaged as a result of improper handling, testing, biasing, or use by customer. VDI offers the following general guidelines for using these products and recommends the customer contact VDI at (434) 297-3257 for assistance if needed. The following procedures are a quick guide for turning on and off the product. In each case the individual steps must be followed in the proper sequence to avoid damaging critical components.

4.1 Required Operating Procedures

- DO NOT exceed damage limits listed in Table 1.
- DO NOT apply any external biases to the system.
- Make proper RF connections depending on desired configuration (i.e. Standard/High LO and Standard/High IF operation). Refer to Figure 2A-C for more information.

Failure to follow these procedures will damage or destroy the device.

4.2 Additional Guidelines, Limitations, and Recommendations

- The SAX is shipped with a reusable dust cover attached. Remove dust cover before operation.

4.3 Turn-On Procedure

1. The user and test bench must be properly grounded and protected against ESD.
2. With the LO and RF input power turned off, make all necessary connections (i.e. LO cable, AC cable, DC cable). See Figure 2A-C for configuration details.
3. Turn on the LO input power.
4. Turn on the small signal RF input power and monitor the IF output.

4.4 Turn-Off Procedure

1. The user and test bench must be properly grounded and protected against ESD.
2. Turn off the RF input power.
3. Turn off the LO input power.
4. Disconnect the DC Power Supply.
5. After completing turn-off procedures described above, it is now safe to turn off all other equipment on user test bench.

Contact VDI with questions or concerns regarding operational procedures and limitations.

5 Product Performance

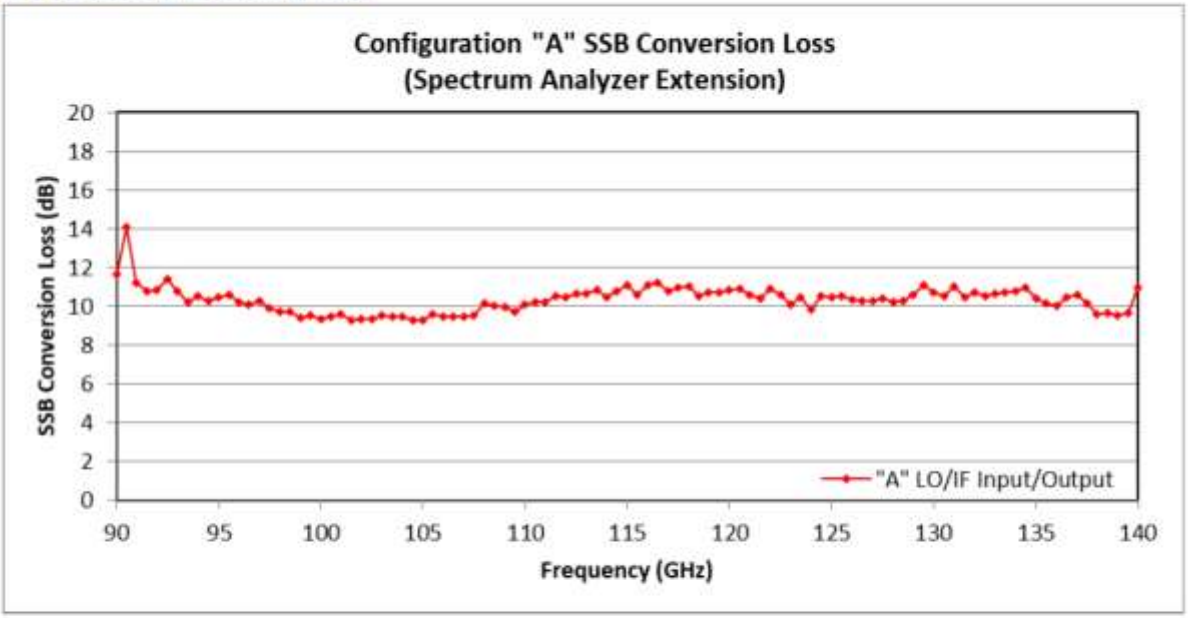

Figure 4: The product performance (SSB conversion loss vs. RF frequency) is shown for an LO input power of ~15dBm in Standard LO Frequency operation. IF power measured from "LO/IF" port with IF frequency fixed at 1.3GHz. CSV Data file included on USB Drive.

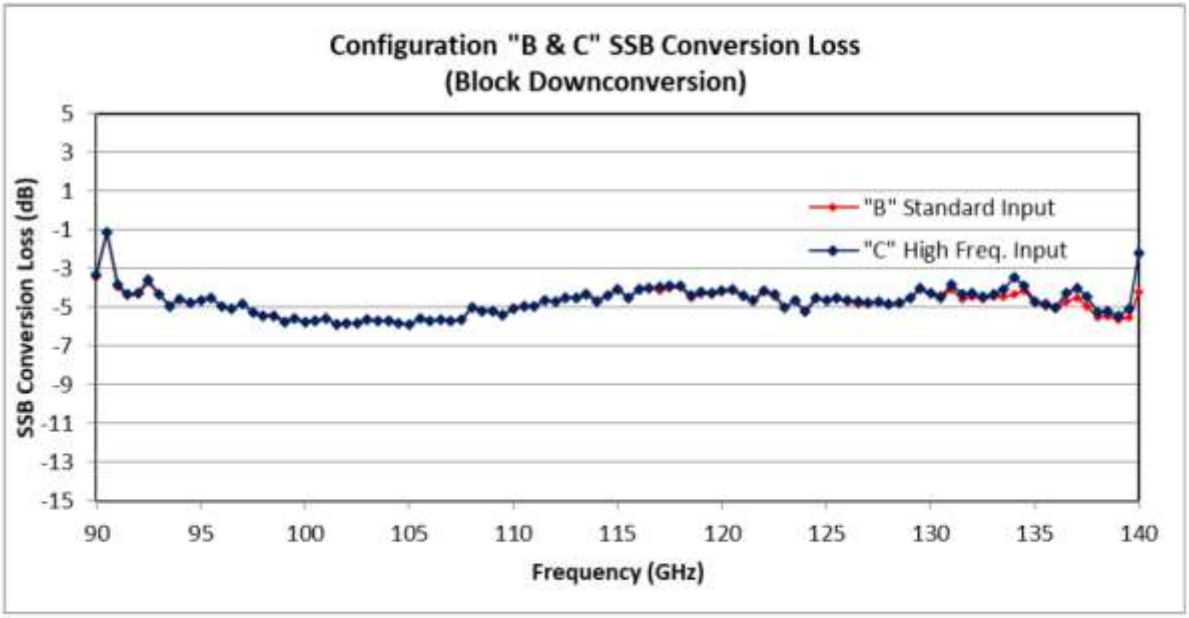

Figure 5: The product performance (SSB conversion loss vs. RF frequency) is shown for an LO input power of ~15dBm in Standard LO Frequency operation and LO input power of ~0dBm in High LO Frequency operation. IF power measured from "IF Output" port with IF frequency fixed at 1.3GHz. CSV Data file included on USB Drive.

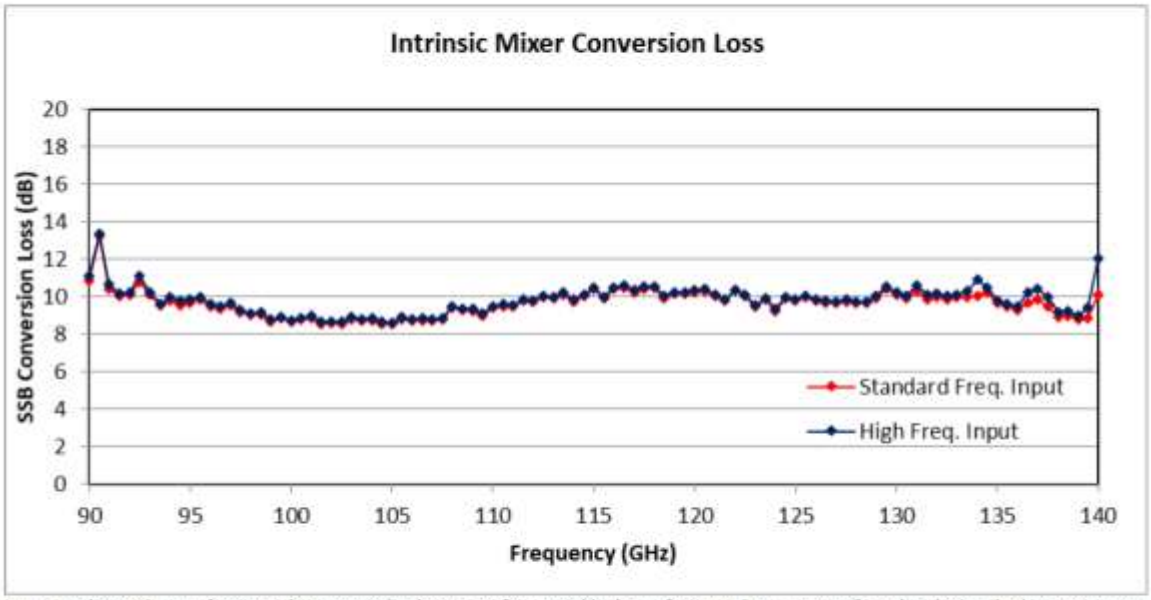

Figure 6: The product performance (SSB conversion loss vs. RF frequency) is shown for an LO input power of ~15dBm in Standard LO Frequency operation and LO input power of ~0dBm in High LO Frequency operation. IF power measured from mixer port with IF frequency fixed at 1.3GHz. Note: mixer port is not accessible for use by the user. CSV Data file included on USB Drive.

Measured Displayed Average Noise Level (dBm/Hz)	
Typical	-149.5

*Measured with a Keysight N9030A PXA Spectrum Analyzer.

SAX 837 Conversion Loss

Note: Out of band data is not guaranteed to be accurate.

Freq(GHz)	"A" LO/IF Input/Output	"B" Standard Input	"C" High Freq. Input	High Freq. Intrinsic Mixer Loss	Standard Freq. Intrinsic Mixer Loss
90	11.67514724	-3.451852763	-3.337852763	11.13014724	10.85114724
90.5	14.10568478	-1.079315219	-1.162315219	13.39768478	13.21768478
91	11.19284379	-3.952156213	-3.831156213	10.66284379	10.43484379
91.5	10.77353378	-4.372466216	-4.345466216	10.19653378	10.03853378
92	10.8156319	-4.3273681	-4.2933681	10.2776319	10.0966319
92.5	11.40549847	-3.724501532	-3.574501532	11.09249847	10.79149847
93	10.79724258	-4.331757419	-4.317757419	10.24124258	10.10624258
93.5	10.21914168	-4.91885832	-4.95285832	9.63014168	9.54914168
94	10.55024142	-4.587758581	-4.565758581	9.996241419	9.821241419
94.5	10.29788363	-4.822116373	-4.753116373	9.778883628	9.588883628
95	10.4741589	-4.669841103	-4.660841103	9.843158897	9.695158897
95.5	10.60265733	-4.50734267	-4.51534267	9.99665733	9.89265733
96	10.1907898	-4.953210203	-4.985210203	9.625789797	9.505789797
96.5	10.083555	-5.061445003	-5.079445003	9.479554997	9.372554997
97	10.30032929	-4.847670708	-4.859670708	9.661329292	9.553329292
97.5	9.894886965	-5.239113035	-5.255113035	9.296886965	9.162886965
98	9.696380637	-5.421619363	-5.441619363	9.135380637	9.034380637
98.5	9.728739538	-5.401260462	-5.427260462	9.168739538	9.038739538
99	9.401152675	-5.731847325	-5.746847325	8.803152675	8.707152675
99.5	9.542871349	-5.586128651	-5.600128651	8.951871349	8.840871349
100	9.367058164	-5.769941836	-5.782941836	8.777058164	8.658058164
100.5	9.496118475	-5.651881525	-5.678881525	8.901118475	8.787118475
101	9.563891248	-5.561108752	-5.575108752	8.981891248	8.875891248
101.5	9.294818879	-5.847181121	-5.869181121	8.686818879	8.578818879
102	9.32353949	-5.80946051	-5.83646051	8.70453949	8.60753949
102.5	9.312544107	-5.835455893	-5.854455893	8.691544107	8.586544107
103	9.538372928	-5.604627072	-5.619627072	8.933372928	8.824372928
103.5	9.440667741	-5.698332259	-5.705332259	8.834667741	8.727667741
104	9.473096285	-5.666903715	-5.678903715	8.866096285	8.770096285
104.5	9.295835708	-5.846164292	-5.856164292	8.670835708	8.571835708
105	9.26675987	-5.86924013	-5.87924013	8.63275987	8.53575987
105.5	9.587719809	-5.566280191	-5.585280191	8.920719809	8.823719809
106	9.447107698	-5.688892302	-5.696892302	8.806107698	8.722107698
106.5	9.47817723	-5.65582277	-5.66782277	8.86217723	8.77317723
107	9.445819292	-5.693180709	-5.715180709	8.831819292	8.718819292
107.5	9.506835045	-5.627164955	-5.646164955	8.896835045	8.804835045
108	10.15543137	-4.980568633	-5.021568633	9.515431367	9.429431367
108.5	10.01501141	-5.139988586	-5.184988586	9.375011414	9.292011414

Freq(GHz)	"A" LO/IF Input/Output	"B" Standard Input	"C" High Freq. Input	High Freq. Intrinsic Mixer Loss	Standard Freq. Intrinsic Mixer Loss
109	9.986943402	-5.163056598	-5.180056598	9.359943402	9.259943402
109.5	9.700311379	-5.427688621	-5.415688621	9.090311379	9.007311379
110	10.11440377	-5.034596231	-5.068596231	9.480403769	9.435403769
110.5	10.23931625	-4.896683751	-4.935683751	9.593316249	9.506316249
111	10.19914709	-4.941852911	-4.978852911	9.567147089	9.514147089
111.5	10.51961626	-4.630383737	-4.666383737	9.887616263	9.822616263
112	10.45156748	-4.687432519	-4.685432519	9.837567481	9.740567481
112.5	10.66102657	-4.482973427	-4.488973427	10.07402657	9.973026573
113	10.62316393	-4.517836074	-4.541836074	10.01716393	9.943163926
113.5	10.84547099	-4.287529014	-4.341529014	10.22647099	10.14647099
114	10.46605969	-4.667940312	-4.688940312	9.862059688	9.774059688
114.5	10.76937147	-4.369628526	-4.376628526	10.14637147	10.05437147
115	11.11837657	-4.04062343	-4.05262343	10.48737657	10.40737657
115.5	10.59959028	-4.534409721	-4.539409721	10.02759028	9.940590279
116	11.08255473	-4.042445266	-4.056445266	10.50855473	10.41955473
116.5	11.23473017	-3.950269828	-4.014269828	10.59973017	10.49673017
117	10.75491026	-4.152089736	-3.939089736	10.36291026	10.26991026
117.5	10.96623836	-4.013761637	-3.885761637	10.55123836	10.44823836
118	11.04450356	-3.973496442	-3.878496442	10.56050356	10.48550356
118.5	10.52617331	-4.502826691	-4.414826691	10.04817331	9.940173309
119	10.71214465	-4.310855347	-4.229855347	10.27714465	10.18914465
119.5	10.73550138	-4.318498616	-4.257498616	10.26750138	10.16450138
120	10.83361073	-4.226389267	-4.143389267	10.35961073	10.27661073
120.5	10.88819078	-4.15980922	-4.09380922	10.41419078	10.33619078
121	10.61391575	-4.435084247	-4.384084247	10.13691575	10.06591575
121.5	10.37585906	-4.697140936	-4.630140936	9.876859064	9.825859064
122	10.92118158	-4.177818422	-4.117818422	10.38918158	10.35018158
122.5	10.59706531	-4.452934691	-4.359934691	10.13506531	10.05606531
123	10.06564904	-5.02435096	-4.99135096	9.55564904	9.48764904
123.5	10.43854116	-4.643458841	-4.628458841	9.936541159	9.847541159
124	9.860132081	-5.249867919	-5.203867919	9.352132081	9.265132081
124.5	10.50591325	-4.589086747	-4.518086747	10.00491325	9.903913253
125	10.4479865	-4.673013497	-4.657013497	9.882986503	9.791986503
125.5	10.54246455	-4.560535451	-4.549535451	10.03846455	9.965464549
126	10.350356	-4.721644004	-4.674644004	9.874355996	9.804355996
126.5	10.27868628	-4.807313723	-4.735313723	9.805686277	9.713686277
127	10.26573962	-4.837260384	-4.798260384	9.773739616	9.685739616
127.5	10.39357186	-4.74042814	-4.71242814	9.85857186	9.76757186
128	10.2407497	-4.876250305	-4.819250305	9.737749695	9.661749695
128.5	10.27302715	-4.815972854	-4.774972854	9.753027146	9.666027146
129	10.57790721	-4.539092789	-4.493092789	10.04490721	9.944907211

Freq(GHz)	"A" LO/IF Input/Output	"B" Standard Input	"C" High Freq. Input	High Freq. Intrinsic Mixer Loss	Standard Freq. Intrinsic Mixer Loss
129.5	11.06294687	-4.055053128	-4.017053128	10.52894687	10.44894687
130	10.74665017	-4.351349831	-4.264349831	10.25565017	10.14965017
130.5	10.54234128	-4.571658716	-4.477658716	10.04334128	9.919341284
131	10.99784288	-4.095157118	-3.820157118	10.59784288	10.32284288
131.5	10.48624586	-4.582754137	-4.311754137	10.14424586	9.843245863
132	10.71127934	-4.428720663	-4.285720663	10.18227934	10.02627934
132.5	10.54574278	-4.587257219	-4.439257219	10.07174278	9.893742781
133	10.64369663	-4.477303375	-4.340303375	10.14769663	9.976696625
133.5	10.68664451	-4.43135549	-4.10535549	10.33764451	9.99364451
134	10.78700975	-4.313990247	-3.460990247	10.93500975	10.07700975
134.5	10.95997375	-4.161026252	-3.916026252	10.52797375	10.25597375
135	10.37279947	-4.751200533	-4.707200533	9.788799467	9.689799467
135.5	10.1724832	-4.934516804	-4.843516804	9.642483196	9.511483196
136	10.044754	-5.108245999	-4.999245999	9.512754001	9.332754001
136.5	10.45312533	-4.676874665	-4.252874665	10.25012533	9.695125335
137	10.61386016	-4.518139838	-3.994139838	10.42886016	9.852860162
137.5	10.14375506	-4.948244935	-4.476244935	9.965755065	9.481755065
138	9.604980629	-5.520019371	-5.270019371	9.185980629	8.939980629
138.5	9.663838852	-5.432161148	-5.190161148	9.272838852	9.004838852
139	9.512629562	-5.615370438	-5.452370438	9.013629562	8.813629562
139.5	9.644409056	-5.524590944	-5.063590944	9.413409056	8.893409056
140	10.95996759	-4.22003241	-2.22503241	12.05596759	10.15096759

Notes: The test equipment was provided by Starry, Inc. The vendor does not provide a calibration certificate.

Standard gain horn antenna inspection

Intertek

Equipment visual inspection

Equipment	Frequency (GHz)	Date	Initial
WR-19	40-60	3/10/2022	VFV
WR-12	60-90	3/10/2022	VFV
WR-8.0	90-140	3/10/2022	VFV

The Conical horn antennas were visually spected for damage prior to testing.
No damaged was observed.

14 Appendix B – Mixer Verification Certificates

VDIWR19.0SAX-F (40-60 GHz)

Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902
Phone: 434-297-3257
Fax: 434-297-3258

Certificate of Conformance

To: Starry, Inc.
38 Chauncy Street
2nd Floor
Boston, MA 02111
United States

From: Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902

Packing List No: 211085 **Today's Date:** 03/31/21
Shipping Date: 03/30/21 **PO Number:** PO20183

Quantity Shipped	Unit	Description	Order-Job Number
1	EA	VDIWR19.0SAX-F S/N: SAX 835	21108A-01
1	EA	RCHO19R CONICAL HORN ANTENNA	21108A-02

The VDI product(s) in this shipment meet(s) the guidelines for performance specifications established in accordance with the corresponding Purchase Order. Data presented in the User Guide, where applicable, has been obtained in accordance with VDI's Quality Management System. All instruments, used to obtain data, which require calibration have been calibrated with equipment traceable to the National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI).

Authorized Signature
Virginia Diodes, Inc

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VDIWR12.0SAX-F (60-90 GHz)

Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902
Phone: 434-297-3257
Fax: 434-297-3258

Certificate of Conformance

To: Starry, Inc.
38 Chauncy Street
2nd Floor
Boston, MA 02111
United States

From: Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902

Packing List No: 211211
Shipping Date: 04/08/21
Today's Date: 04/12/21
PO Number: PO20183

Quantity Shipped	Unit	Description	Order-Job Number
1	EA	VDIWR12.0SAX-F S/N: SAX 836	21108B-01
1	EA	RCHO12RL Conical Horn Antenna	21108B-02

The VDI product(s) in this shipment meet(s) the guidelines for performance specifications established in accordance with the corresponding Purchase Order. Data presented in the User Guide, where applicable, has been obtained in accordance with VDI's Quality Management System. All instruments, used to obtain data, which require calibration have been calibrated with equipment traceable to the National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI).

Authorized Signature
Virginia Diodes, Inc

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VDIWR8.0SAX-F (90-140 GHz)

Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902
Phone: 434-297-3257
Fax: 434-297-3258

Certificate of Conformance

To: Starry, Inc.
38 Chauncy Street
2nd Floor
Boston, MA 02111
United States

From: Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902

Packing List No: 212029 **Today's Date:** 06/11/21
Shipping Date: 06/11/21 **PO Number:** PO20183

Quantity Shipped	Unit	Description	Order-Job Number
1	EA	VDIWR8.0SAX-F WR8.0SAX-F / SN: SAX 837	21108C-01
1	EA	RCHO8RL WR8.0CH - Conical Horn Antenna / RCHO8RL	21108C-02

The VDI product(s) in this shipment meet(s) the guidelines for performance specifications established in accordance with the corresponding Purchase Order. Data presented in the User Guide, where applicable, has been obtained in accordance with VDI's Quality Management System. All instruments, used to obtain data, which require calibration have been calibrated with equipment traceable to the National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI).

Authorized Signature
Virginia Diodes, Inc

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VDIWR5.1SAX-F (140-220 GHz)

Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902
Phone: 434-297-3257
Fax: 434-297-3258

Certificate of Conformance

To: Starry, Inc.
38 Chauncy Street
2nd Floor
Boston, MA 02111
United States

From: Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902

Packing List No: 211604
Shipping Date: 05/11/21
Today's Date: 05/11/21
PO Number: PO20183

Quantity Shipped	Unit	Description	Order-Job Number
1	EA	VDIWR5.1SAX-F WR5.1SAX-F / SN: SAX 838	21108D-01
1	EA	RCHO5RL WR5.1CH / SN: RCHO5RL	21108D-02

The VDI product(s) in this shipment meet(s) the guidelines for performance specifications established in accordance with the corresponding Purchase Order. Data presented in the User Guide, where applicable, has been obtained in accordance with VDI's Quality Management System. All instruments, used to obtain data, which require calibration have been calibrated with equipment traceable to the National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI).

Authorized Signature
Virginia Diodes, Inc

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15 Appendix C – Test Laboratory Accreditation Scope

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

INTERTEK TESTING SERVICES NA INC.
70 Codman Hill Road
Boxborough, MA 01719
Corporate Representative: Mark Barry Phone: (978) 635 8634
Email: mark.barry@intertek.com
Local Representative: Yaqing Liu Phone: (978) 635 8662
Email: yaqing.liu@intertek.com

ELECTRICAL

Valid to: June 30, 2024 Certificate Number: 1350.01

In recognition of the successful completion of the A2LA evaluation process (including an assessment of the organization's compliance with A2LA's FDA ASCA Accreditation Program[3] requirements), accreditation is granted to this laboratory at the location listed above to perform the following product safety, electromagnetic compatibility, and telecommunications testing:

Tests:	Standard(s)[1, 2, 3]:
Product Safety (excluding LED test per IEC 62471, Lithium battery test, Oxygen bomb test, UV Radiation, Flammable Liquids, and flammable anesthetic mixtures test, Cathode ray tubes test)	AS/NZS 60335.1; AS/NZS 60335.2.29; AS/NZS 60335.2.82; IEC 60335-2-65; IEC 60335-2-82; UL 60335-1; IEC 60335-2-2 (*except vacuum cleaner with current-carrying hoses*); IEC 60335-2-10; CAN/CSA C22.2 No. 335.1; CAN/CSA C22.2.60335-1; IEC/EN 60335-1; IEC/EN 60335-2-29; IEC/EN 60335-2-80; IEC 60601-1 (Ed. 3, Ed. 3 + Am 1, Ed. 3 + Am 1 + Am 2); GB 9706.1:2020; ANSI/AAMI ES60601-1:2005 + C1:2009 + A2:2010; ANSI AAMI ES60601-1:2005/(R)2012 AND A1:2012, C1:2009/(R)2012 and A2:2010/(R)2012; ANSI AAMI ES60601-1:2005/(R)2012 AND A1:2012, C1:2009/(R)2012 and A2:2010/(R)2012 / A2:2021; UL 60601-1 (Ed. 1); CSA C22.2.60601.1; IEC/EN 60601-1 (Ed. 2 + Am 1 + Am 2); GB 9706.1:2007; IEC/EN 60601-1-1 (Ed. 1 + Am 1, Ed. 2); IEC/EN 60601-1-3 (Ed. 1, Ed. 2 + Am1 + Am2); IEC/EN 60601-1-4 (Ed.1 + Am 1); IEC/EN 60601-1-6 (Ed. 1, Ed. 2, Ed. 3 + Am 1 + Am 2); IEC/EN 60601-1-8 (Ed. 2 + Am 1 + Am 2); IEC/EN 60601-1-9 (Ed. 1 + Am 1+ Am 2); IEC/EN 60601-1-10 (Ed. 1 + Am 1 + Am 2); IEC/EN 60601-1-11 (Ed. 1, Ed. 2 + Am 1); IEC/EN 60601-1-12 (Ed. 1+ Am 1); IEC/EN 60601-2-2 (Ed. 4, Ed. 5, Ed. 6); IEC/EN 60601-2-4 (Ed. 2, Ed. 3 + Am1); IEC/EN 60601-2-6 (Ed. 2 + Am 1); IEC/EN 60601-2-7 (Ed. 2); IEC/EN 60601-2-8 (Ed.1+Am1, Ed.2 +Am1); IEC/EN 60601-2-12 (Ed. 2); IEC/EN 60601-2-16 (Ed. 2, Ed. 3); IEC/EN 60601-2-18 (Ed. 2 + Am 1, Ed. 3);

Tests:	Standard(s)[1,2,3]:
Product Safety (cont.)	IEC/EN 60601-2-19 (Ed. 2 +Am1, Ed. 3); IEC/EN 60601-2-21 (Ed. 2 + Am1, Ed. 3); IEC 60601-2-22 (Ed. 2, Ed. 3 + Am 1, Ed.4); IEC 60601-2-23 (Ed. 3); IEC/EN 60601-2-24 (Ed. 1, Ed. 2); IEC/EN 60601-2-25 (Ed. 1 + Am 1, Ed. 2, Ed. 3); IEC/EN 60601-2-26 (Ed. 2, Ed. 3); IEC/EN 60601-2-27 (Ed. 1, Ed. 2, Ed. 3); IEC/EN 60601-2-28 (Ed. 1, Ed. 2, Ed.3); IEC/EN 60601-2-30 (Ed. 1, Ed. 2); IEC/EN 60601-2-32 (Ed. 1); IEC/EN 60601-2-33 (Ed. 2 + Am 1 + Am 2, Ed. 3 + Am 1 + Am 2); IEC/EN 60601-2-34 (Ed. 2, Ed. 3); IEC/EN 60601-2-37 (Ed. 1, Ed. 2 + Am 1); IEC/EN 60601-2-38 (Ed. 1); IEC/EN 60601-2-40 (Ed. 1, Ed.2); IEC/EN 60601-2-43 (Ed. 1, Ed. 2 + Am 1); IEC/EN 60601-2-44 (Ed. 2 + Am 1, Ed. 3 + Am 1 + Am 2); IEC/EN 60601-2-45 (Ed. 2, Ed. 3 + Am 1); IEC/EN 60601-2-46 (Ed. 1, Ed. 2); IEC/EN 60601-2-47 (Ed. 2); IEC/EN 60601-2-49 (Ed. 1, Ed. 2); IEC/EN 60601-2-51 (Ed. 1); IEC/EN 60601-2-52 (Ed. 1 + Am 1); IEC/EN 60601-2-54 (Ed. 1 + Am 1 + Am 2); IEC/EN 60601-2-57 (Ed. 1); IEC/EN 60601-2-63 (Ed. 1 + Am 1 + Am 2); IEC/EN 60601-2-65 (Ed. 1 + Am 1 + Am 2); IEC 60825-1 (Ed. 2, Ed. 3); AS/NZS 60950; AS/NZS 60950.1; UL 60950; UL 60950-1; CAN/CSA C22.2 No. 60950; CAN/CSA C22.2 No. 60950-1; CAN/CSA C22.2 No. 601.1; IEC 60950; IEC 60950-1; EN 60950; EN 60950-1; SI 62368 Part 1; QCVN 22:2010/BTTTT; IEC/EN 62368-1 (Ed.2; Ed.3); UL 62368-1; CSA C22.2 No. 62368-1; IEC 62368-3; CAN/CSA C22.2 No. 61010-1; UL 61010-1; IEC/EN 61010-1 (Ed. 1 + Am 1 + Am 2); IEC/EN 61010-1 (Ed. 2, Ed. 3, Ed. 3.1); IEC 61010-2-010 (Ed. 2, Ed.3); IEC 61010-2-020 (Ed. 2, Ed. 3); IEC 61010-2-030 (Ed. 1, Ed.2); IEC 61010-2-040 (Ed. 1, Ed. 2); IEC 61010-2-081 (Ed. 1 + Am 1, Ed. 2); IEC 61010-2-051 (Ed. 3); IEC 61010-2-091(Ed. 1); IEC 61010-2-101 (Ed. 1, Ed. 2); ISO 80601-2-30 (Ed. 1 + Am 1, Ed. 2); IEC/EN 80601-2-35 (Ed. 2 +Am1); IEC 80601-2-49 (2018); IEC/EN 80601-2-58 (Ed. 1, Ed. 2 +Am1); IEC/EN 80601-2-60 (Ed. 1, Ed. 2); ISO 80601-2-12 (Ed. 1); ISO 80601-2-55 (Ed. 1, Ed. 2); ISO 80601-2-56 (Ed. 1, Ed.2+Am1); ISO 80601-2-61 (Ed. 1, Ed. 2); ISO 80601-2-67 (Ed. 1); ISO 80601-2-69 (Ed. 1, Ed. 2); ISO 80601-2-70 (Ed. 1, Ed. 2); UL 508A; NFPA 79; ISO 11195 (Ed. 1); IEC/EN 62366 (Ed. 1 + Am 1); IEC 62366-1 (Ed. 1 + Am 1); IEC/EN 62304 (Ed. 1 +Am1); ISO 14708-1(Ed.2, Ed.1); EN 45502-1 (2015); ISO 14708-3(Ed.2, Ed.1); ISO 14708-4 (Ed.1); (All ISO 14708 and EN 45502-1 standards excludes Cl.14.2 and Cl.22; ISO 14708-3 (Ed.2); ISO 80601-2-72 (Ed. 1); ISO 80601-2-74 (Ed. 1); ISO 80601-2-80 (Ed. 1); ISO 81060-1 (Ed.1); IEC 80601-2-26 (Ed. 1); ANSI AAMI IEC 80601-2-30: 2009&A1:2013 (R2016); ANSI AAMI IEC 80601-2-30:2018; ANSI AAMI IEC 60601-2-47:2012/(R) 2016; ANSI AAMI IEC80601-2-35:2009/A1:2016; ANSI AAMI HA60601-1-11:2015

Tests:	**Standard(s)[1,2,3]:**
Emisstions	
Radiated and Conducted	47 CFR, FCC Part 11; 47 CFR, FCC Part 15B (using ANSI C63.4:2014); ICES-001; ICES-003; IEC/CISPR 11; EN 55011; AS/NZS CISPR 11; KS C 9811; IEC/CISPR 14-1; EN 55014-1; AS/NZS CISPR 14-1; KS C 9814-1; J55014-1; EN 55022; IEC/CISPR 22; AS/NZS CISPR 22; CISPR 22 (2002, 2006, 2008); CAN/CSA-CEI/IEC CISPR 22; CNS 13438 (*up to 6 GHz*); VCCI V-3 (*up to 6 GHz*); TCVN 7189 (2009); QCVN 118 (2018)
Broadcast Receiver	CISPR 13; EN 55013
Lighting and Similar Equipment	CISPR 15; EN 55015; KS C 9815
Multimedia Equipment	CISPR 32; CISPR 32 (Ed 2.0); CISPR 32 (Ed 2.1); EN 55032; EN 55032:2015; EN 55032:2015+A1:2020; KS C 9832; AS/NZS CISPR 32; AS/NZS CISPR 32:2015; AS/NZS CISPR 32:2015+A1:2020; VCCI-CISPR 32:2016; SI 961 Part 32
Lifts Escalators and Moving Walks - Emission	EN 12015
Transmitter/Receiver	ETSI EN 301 893; ETSI EN 300 330; ETSI EN 300 440; ETSI EN 300 113; ETSI EN 300 220-1; ETSI EN 300 220-2; ETSI EN 300 220-3-1; ETSI EN 300 220-3-2; ETSI EN 300 220-4; ETSI EN 300 296; ETSI EN 300 390; ETSI EN 300 328
Current Harmonics	IEC 61000-3-2; EN 61000-3-2; KS C 9610-3-2; JIS C 61000-3-2; IEC 61000-3-4; EN 61000-3-4; IEC 61000-3-12; EN 61000-3-12 (16 to 37 A); KS C 9610-3-12
Flicker and Fluctuations	IEC 61000-3-3; EN 61000-3-3; KS C 9610-3-3; IEC 61000-3-11; EN 61000-3-11 (16 to 37 A); KS C 9610-3-11
Immunity	
Electrostatic Discharge	IEC 61000-4-2; EN 61000-4-2; KS C 9610-4-2
Radiated Immunity	IEC 61000-4-3; EN 61000-4-3; KS C 9610-4-3
Electrical Fast Transient/Burst	IEC 61000-4-4; EN 61000-4-4; KS C 9610-4-4
Surge Immunity	IEC 61000-4-5; EN 61000-4-5; KS C 9610-4-5
Conducted Immunity	IEC 61000-4-6; EN 61000-4-6; KS C 9610-4-6; IEC 61000-4-16; EN 61000-4-16 (16 to 37 A)
Power Frequency Magnetic Field Immunity	IEC 61000-4-8; EN 61000-4-8; KS C 9610-4-8

Tests:	Standard(s)[1,2,3]:
Immunity (cont.)	
Voltage Dips, Short Interruptions and Line Voltage Variations	IEC 61000-4-11; EN 61000-4-11; KS C 9610-4-11; IEC 61000-4-34; EN 61000-4-34 (16 to 37 A)
Aerospace standards	
Radio Frequency Susceptibility (Conducted)	RTCA/DO-160G (Section 20.4)
Radio Frequency Susceptibility (Radiated Anechoic Chamber Method)	RTCA/DO-160G (Section 20.5) (*Cat. R, S, and T only*)
Emission of Radio Frequency Energy (Conducted)	RTCA/DO 160G (Section 21.4)
Emission of Radio Frequency Energy (Radiated)	RTCA/DO 160G (Section 21.5)
Electrostatic Discharge Susceptibility	RTCA/DO-160G (Section 25)
Generic and Product Specific EMC Standards	
Laboratory	IEC/EN 61326-1 (Ed. 1, Ed. 2, Ed. 3); IEC/EN 61326-2-1 (Ed. 1, Ed. 2); IEC/EN 61326-2-2 (Ed. 1, Ed. 2); IEC/EN 61326-2-3 (Ed. 1, Ed. 2); IEC/EN 61326-2-4 (Ed. 1, Ed. 2); IEC/EN 61326-2-5 (Ed. 1, Ed. 2); IEC/EN 61326-2-6 (Ed. 1, Ed. 2); IEC/EN 61326-3-1 (Ed. 1); IEC/EN61326-3-2 (Ed. 1)
Medical	IEC 60601-1-2 (Ed. 2 + Am 1); IEC/EN 60601-1-2 (Ed. 3); IEC 60601-1-2 (Ed. 4, Ed 4 + Am 1); EN 60601-1-2 (Ed. 4+Am1); KS C IEC 60601-1-2; AIM 7351731; YY0505-2012; GB 9706.102-2021
ITE/Telecom	IEC/CISPR 24; EN 55024; SI 961 Part 24; EN 300 386; TCN 68-196 (2001); TCVN 7319 (2003); CISPR 35; KS C 9835; EN 55035
Lifts Escalators and Moving Walks - Immunity	EN 12016
Household Appliances	IEC/CISPR 14-2; EN 55014-2; KS C 9814-2
Generic Emission	IEC 61000-6-3; EN 61000-6-3; KS C 9610-6-3; IEC 61000-6-4; EN 61000-6-4; KS C 9610-6-4

Tests:	**Standard(s)[1,2,3]:**
Generic and Product Specific EMC Standards (cont.)	
Generic Immunity	IEC 61000-6-1; EN 61000-6-1; KS C 9610-6-1; IEC 61000-6-2; EN 61000-6-2; KN C 9610-6-2
Transmitter/Receiver	ETSI EN 301 489-1; KS X 3124; ETSI EN 301 489-3; KS X 3125; ETSI EN 301 489-5; KS X 3127; ETSI EN 301 489-17; KS X 3126; ETSI EN 301 489-19
Telecom	CFR 47 Part 68 (using T1.TRQ.5:1999, TSB-31D); ANSI/TIA-968-A; ANSI/TIA-968-A-1; ANSI/TIA-968-A-2; ANSI/TIA-968-A-3; ANSI/TIA-968-A-4; ANSI/TIA-968-A-5; ANSI/TIA-968-B; ANSI/TIA-968-B-1; ANSI/TIA-968-B-2; AS/ACIF S002; AS/ACIF S003; AS/ACIF S004; AS/ACIF S016; AS/ACIF S038; AS/ACIF S041; AS/ACIF S043; CS-03 Part I, Issue 9, Amendment 5, 2016; CS-03 Part II, Issue 9, Amendment 1, 2012; CS-03 Part V, Issue 9, Amendment 2, 2017; CS-03 Part VI, Issue 9, Amendment 1, 2012; CS-03 Part VII, Issue 9, Amendment 4, 2012; CS-03 Part VIII, Issue 9, Amendment 5, 2016; ETSI TS 103 021; ETSI EG 201 121; ETSI EN 301 437; ETSI ES 203 021; HKTA 2011; HKTA 2013; HKTA 2017; HKTA 2018; HKTA 2028; IDA TS PSTN 1; JATE (using Blue Book and Green Book); Israel MoC 023/96; NOM-151; NOM-152; PSTN01; PTC-211; TNA 115; TNA 117; TBR4; TBR12; TBR13; TBR21; TBR38
Industry Canada Radio Standards Specification (RSS in Category I Equipment Standards List) (excluding SAR)	BETS-1; BETS-4; BETS-5; BETS-6; BETS-8; BETS-9; RSS-102 measurement (RF Exposure); RSS-111; RSS-112; RSS-117; RSS-119; RSS-123; RSS-125; RSS-127; RSS-130; RSS-131; RSS-132; RSS-133; RSS-134; RSS-135; RSS-137; RSS-139; RSS-140; RSS-141; RSS-142; RSS-170; RSS-181; RSS-182; RSS-191; RSS-192; RSS 194; RSS-195; RSS-196; RSS-197; RSS-199; RSS-210; RSS-211; RSS-213; RSS-215; RSS-216; RSS-220; RSS-222; RSS-236; RSS-238; RSS-243; RSS-244; RSS-246; RSS-247; RSS-248; RSS-251; RSS-252; RSS-287; RSS-288; RSS-310; RSS-Gen
Intentional Radiators (excluding SAR)	47 CFR Part 2; 47 CFR Part 15 C/D/E/F/G/H ANSI C63.10:2013, ANSI C63.17:2013, and FCC KDB 905462 D02 (v01)); 47 CFR Part 18 (using FCC MP-5:1986); 47 CFR Part 30 C/H; 47 CFR Parts 20, 22 (cellular), 24, 25, and 27, 30, 73, 74, 80, 87 90, 95, and 97 101(using ANSI/TIA 603-E; TIA-102.CAAA-E); FCC KDB 935210 D03 (v04), FCC KDB 935210 D04 (v02), FCC KDB 935210 D05 (v01r01)); FCC Public Notice DA 00-705; FCC Public Notice DA 02-2138; FCC KDB Publications 200443 and 558074; ANSI C63.26; LP0002; AS/NZS 4365 (2002, 2011)
Automotive Standards	
RF Conducted Emissions	CISPR 25 (3rd Edition w/2009 Corrections) Sections 6.2 and 6.3
RF Radiated Emissions	CISPR 25 (3rd Edition w/2009 Corrections) Section 6.4

Testing to the above mentioned standards applies to the following products or types of products:
Appliances, Industrial, Scientific, and Medical (ISM), Information Technology Equipment (ITE), Telecommunications, Unintentional Radiators, Automotive, Military, and Aerospace.

[1] *The laboratory is only accredited for testing activities outlined within the test methods listed above. Reference to any other activity within these standards, such as risk management or risk assessment, does not fall within the laboratory's accredited capabilities.*

[2] *When the date, revision or edition of a test method standard is not identified on the scope of accreditation, the laboratory may use the previous version for a period of one year after the date of publication of the current version. Reference part C., Section 1 of A2LA policy R101 - General Requirements- Accreditation of ISO-IEC 17025 Laboratories.*

[3] *For Product Family Standards listed on this scope of accreditation, the laboratory is found to be compliant with all test methods referenced within the Product Family Standard.*

Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1[4]

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
Unintentional Radiators Part 15B	ANSI C63.4:2014	260000
Industrial, Scientific, and Medical Equipment Part 18	FCC MP-5 (February 1986)	260000
Intentional Radiators Part 15C	ANSI C63.10:2013	260000
Unlicensed Personal Communication Systems Devices Part 15D	ANSI C63.17:2013	260000
U-NII without DFS Intentional Radiators Part 15E	ANSI C63.10:2013	260000
U-NII with DFS Intentional Radiators Part 15E	FCC KDB 905462 D02 (v01)	260000
UWB Intentional Radiators Part 15F	ANSI C63.10:2013	260000
BPL Intentional Radiators Part 15G	ANSI C63.10:2013	260000
White Space Device Intentional Radiators Part 15H	ANSI C63.10:2013	260000

Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1[4]

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
Commercial Mobile Services (FCC Licensed Radio Service Equipment) Parts 22 (cellular), 24, 25 (below 3 GHz), and 27	ANSI/TIA-603-E; ANSI C63.26:2015 TIA-102.CAAA-E	260000
General Mobile Radio Services (FCC Licensed Radio Service Equipment) Parts 22 (non-cellular), 90 (below 3 GHz), 95, 97 (below 3 GHz), and 101 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	260000
Citizens Broadband Radio Services (FCC Licensed Radio Service Equipment) Part 96	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	260000
Maritime and Aviation Radio Services Parts 80 and 87	ANSI/TIA-603-E; ANSI C63.26:2015	260000
Microwave and Millimeter Bands Radio Services Parts 25, 30, 74, 90 (above 3 GHz), 95, 97 (above 3 GHz), and 101	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	260000
Broadcast Radio Services Parts 73 and 74 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	260000
Signal Boosters Part 20 (Wideband Consumer Signal Boosters, Provider-specific signal boosters, and Industrial Signal Boosters)	ANSI C63.26:2015	260000

[4]*Accreditation does not imply acceptance to the FCC equipment authorization program. Please see the FCC website (https://apps.fcc.gov/oetcf/eas/) for a listing of FCC approved laboratories.*

Testing Activities performed under the scope of the U.S FDA ASCA Pilot Program Specifications:
Basic Safety and Essential Performance of Medical Electrical Equipment, Medical Electrical Systems, and Laboratory Medical Equipment – Standards Specific Information for the Accreditation Scheme for Conformity Assessment (ASCA) Pilot Program published on September 25th, 2020, and in accordance with all requirements of A2LA *R256 Specific Requirements- FDA ASCA Program*[5]

Standards	Document ID
ANSI AAMI ES60601-1:2005/(R)2012 AND A1:2012, C1:2009/(R)2012 and A2:2010/(R)2012 (Consolidated Text) *(excluding Cl. 9.5.2 Cathode ray tube test; Cl. 10.4 LED test per IEC 62471 Cl.11.4, flammable anesthetic mixtures test; Cl. 15.4.3.4 Lithium battery test per IEC 62133-2 or IEC 60086-4);*	19-46
IEC 61010-1 Edition 3.1 2017-01 *(excluding Cl.12.2.1.3 Cathode ray tubes test; Cl. 12.3 UV Radiation (part of LED test per IEC 62471);*	19-34
IEC 60601-1-2 Edition 4.0 2014-02;	19-8
IEC 60601-1-2 Edition 4.1 2020-09 CONSOLIDATED VERSION;	19-36
IEC 60601-1-3 Edition 2.1 2013-04;	12-269
IEC 60601-1-3 Edition 2.2 2021-01 CONSOLIDATED VERSION;	12-336
IEC 60601-1-6 Edition 3.1 2013-10;	5-89
IEC 60601-1-6 Edition 3.2 2020-07;	5-132
IEC 60601-1-8 Edition 2.1 2012-11;	5-76
IEC 60601-1-8 Edition 2.2 2020-07;	5-131
IEC 60601-1-10 Edition 1.1 2013-11;	19-9
IEC 60601-1-10 Edition 1.2 2020-07;	19-37
IEC 60601-1-11 Edition 2.0 2015-01;	19-14
IEC 60601-1-11 Edition 2.1 2020-07;	19-38
ANSI AAMI HA60601-1-11:2015;	19-16
IEC 60601-1-12 Edition 1.0 2014-06;	19-15
IEC 60601-1-12 Edition 1.1 2020-07;	19-39
IEC 60601-2-2 Edition 6.0 2017-03;	6-389
IEC 60601-2-6 Edition 2.1 2016-04;	6-423
IEC 60601-2-8 Edition 2.1 b:2015;	12-301
IEC 60601-2-18: Edition 3.0 2009-08;	9-114
IEC 60601-2-19 Edition 2.1 2016-04;	6-385
IEC 60601-2-19 Edition 3.0 2020-09;	6-461
IEC 60601-2-21 Edition 2.1 2016-04;	6-388
IEC 60601-2-21 Edition 3.0 2020-09;	6-463
IEC 60601-2-22 Edition 3.1 2012-10;	12-268
IEC 60601-2-23 Edition 3.0 2011-02;	1-87
IEC 60601-2-25 Edition 2.0 2011-10;	3-105
IEC 60601-2-27 Edition 3.0 2011-03;	3-126
IEC 60601-2-28 Edition 3.0 2017-06;	12-309
IEC 60601-2-33 Ed. 3.2 b:2015;	12-295

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Standards	Document ID
IEC 60601-2-34 Edition 3.0 2011-05;	3-115
IEC 60601-2-37 Edition 2.1 2015;	12-293
IEC 60601-2-43 Edition 2.1 2017-05 CONSOLIDATED VERSION;	12-308
IEC 60601-2-44 Edition 3.2: 2016;	12-302
IEC 60601-2-45 Edition 3.1 2015;	12-294
IEC 60601-2-47 Edition 2.0 2012-02;	3-155
ANSI AAMI IEC 60601-2-47:2012/(R)2016;	3-155
IEC 60601-2-52 Edition 1.0 2009-12;	6-321
IEC 60601-2-54 Edition 1.2 2018-06 CONSOLIDATED VERSION;	12-317
IEC 60601-2-57 Edition 1.0 2011-01;	12-242
IEC 60601-2-63 Edition 1.1 2017-07 CONSOLIDATED VERSION;	12-310
IEC 60601-2-63 Edition 1.2 2021-05 CONSOLIDATED VERSION;	12-339
IEC 60601-2-65 Edition 1.1 2017-05 CONSOLIDATED VERSION;	12-311
IEC 60601-2-65 Edition 1.2 2021-05 CONSOLIDATED VERSION;	12-340
ISO 80601-2-12 First edition 2011-04-15;	1-98
IEC 80601-2-30 Edition 2.0 2018-03;	3-123
ANSI AAMI IEC 80601-2-30: 2018-03;	3-123
IEC 80601-2-35 Edition 2.1 2016-04;	6-390
ANSI AAMI IEC 80601-2-35: 2009/A1:2016;	6-390
ISO 80601-2-55 Second edition 2018-02;	1-140
ISO 80601-2-56 Second edition 2017-03;	6-421
IEC 80601-2-60 Edition 2.0 2019-06;	4-262
ISO 80601-2-61 Second edition 2017-12 (Corrected version 2018-02);	1-139
ISO 80601-2-69 First edition 2014-07-15;	1-102
ISO 80601-2-69 Second edition 2020-11;	1-148
ISO 80601-2-70 First Edition 2015-01-15;	1-115
ISO 80601-2-70 Second edition 2020-11;	1-151
ISO 80601-2-72 First edition 2015-04-11;	1-105
ISO 80601-2-74 First edition 2017-05;	1-138
ISO 80601-2-80 First edition 2018-07	1-144

[5] *These methods have been assessed by A2LA according to A2LA's FDA ASCA Program requirements. Accreditation by A2LA does not imply FDA ASCA-Accreditation. All ASCA-accreditation decisions for testing laboratory applications are made solely by the FDA, a list of approved laboratories can be found at FDA.gov.*

Accredited Laboratory

A2LA has accredited

INTERTEK TESTING SERVICES NA INC.

Boxborough, MA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets *A2LA R256 – Specific Requirements FDA ASCA Program* This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 13th day of July 2022.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1350.01
Valid to June 30, 2024

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