Test Report # 3547 A

Equipment Under Test:	Dental Scanner
Requirement(s):	FCC 15.247, FCC 15.209, RSS-247, RSS-GEN BLE DTS (C2PC Antenna Add)
Test Date(s):	January 7th-10th, 2022
Prepared for:	3Shape Attn: Kasper Hansen Niels Juels Gade 13 1059 Copenhagen, Denamrk

Report Issued by: Adam Alger, Laboratory Manager

Signature: Date: 10/6/2022

Report Reviewed by: Adam Alger, Laboratory Manager

Signature: Date: 2/9/2022

Report Constructed by: Zach Wilson, EMC Engineer

Signature: Date: 2/3/2022

This test report may not be reproduced, except in full, without approval of Laird Connectivity LLC.

CONTENTS

Laird Connectivity Test Services in Review

The Laird Connectivity LLC laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025:2017 with Electrical (EMC) Scope

A2LA Certificate Number: 1255.01

Scope of accreditation includes all test methods listed herein unless otherwise noted

---

Federal Communications Commission (FCC) – USA

Accredited Test Firm Registration Number: 953492

Recognition of two 3 meter Semi-Anechoic Chambers

Government of Canada

Innovation, Science and Economic Development Canada

Accredited U.S. Identification Number: US0218

Recognition of two 3 meter Semi-Anechoic Chambers

1 TEST REPORT SUMMARY

During **January 7th-10th, 2022** the Equipment Under Test (EUT), **Dental Scanner**, as provided by **3Shape** was tested to the following requirements of the **Federal Communications Commission** and **Innovation, Science and Economic Development Canada**:

DTS

Requirement	Description	Specification	Method	Result
FCC: 15.247 (d) IC: RSS-GEN 8.10	Spurious Radiated Emissions in Restricted Bands 30 MHz to 25 GHz	FCC 15.209 RSS-GEN 8.9	ANSI C63.10	Complaint

Notice:

The results relate only to the item tested as configured and described in this report. Any additional configurations, modes of operation, or modifications made to the equipment under test after the specified test date(s) are at the decision of the client and may not apply to the data seen in this test report.

The decision rule for Pass / Fail assessment to the specification or standard listed in this test report has been agreed upon by the client and laboratory to be as follows:

Measurement Type	Rule
Emissions – Amplitude	1 dB below specified limit
Emissions – Frequency	1% less than the specification
Immunity	Tested at specified level

2 CLIENT INFORMATION

Company Name	3Shape
Contact Person	Kasper Hansen
Address	Niels Juels Gade 13 1059 Copenhagen, Denamrk

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Dental Scanner
Model Number	TRIOS 5
Serial Number	Engineering Sample
FCC ID	2A4DE-3S001
ISED ID	28188-3S001

2.2 Product Description

Dental scanning device containing 5GHz WLAN, Bluetooth Classic, and Bluetooth Low Energy radios on a single module. The device is battery powered.

2.3 Modifications Incorporated for Compliance

None noted at time of test

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Report Information

Radio previously certified by Laird with an FCC ID of SQG-60SIPT. A change of ID has been completed to place the module under 3Shape. This report is in support of a class two permissive change to add a new antenna.

2.6 Antenna Information

The EUT utilizes a dual-band, 2.4GHz and 4.9-6GHz, monopole antenna. The antenna is a Taoglas FXP840.54.0018B. Antenna 1 has a peal peak gain of -3.08 dBi in the 2.4 GHz band and +2.84 dBi in the 5.8 GHz band. Antenna 2 has a peak gain of -4.72 dBi in the 2.4 GHz band and +3.11 dBi in the 5.8 GHz band.

2.7 Radio Programming and Channel/Data Rates

Radio programmed using the Laird LRU tool, v7.0.0.142.

Data Rate: BLE
Channels: 0 (2402 MHz), 19 (2440 MHz), 39 (2480 MHz)

3 REFERENCES

Publication	Edition	Date	AMD 1	AMD 2
eCFR	-	2022	-	-
ANSI C63.10	-	2013	-	-
RSS-247	2	2017	-	-
RSS-GEN	5	2018	2019	2021

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k = 2.

References	Version / Date
CISPR 16-4-1	Ed. 2 (2009-02)
CISPR 16-4-2	Ed. 2 (2011-06)
CISPR 32	Ed. 1 (2012-01)
ANSI C63.23	2012
A2LA P103	February 4, 2016
A2LA P103c	August 10, 2015
ETSI TR 100-028	V1.3.1 (2001-03)

Measurement Type	Configuration	Uncertainty ±
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

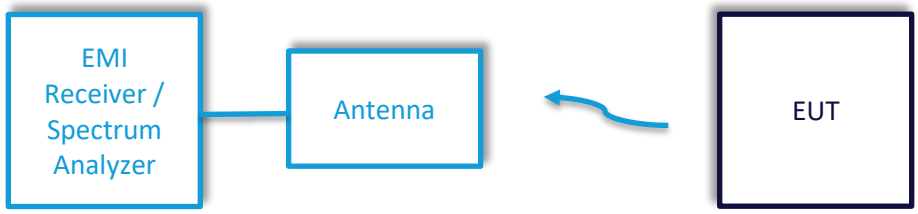
Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	$1x10^{-7}$	$0.55x10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Radiated Emissions

Description of Measurement	The frequency spectrum is investigated for intentional and / or unintentional signals emanating from the EUT by use of a standardized test site and measurement antenna. The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are performed allowing the data to be gathered and reported as corrected values. The maximum emissions from the EUT are determined by turn-table azimuth rotation (360°) and scanning of the measurement antenna. Maximized levels are noted at degree values of azimuth, measurement antenna height, and measurement antenna polarity.
Example Calculations	Measurement (dBµV) + Cable factor (dB) + Other (dB) + Antenna Factor (dB/m) = Corrected Reading (dBµV/m) Margin (dB) = Limit (dBµV/m) - Corrected Reading (dBµV/m) Example at 4000 MHz: Reading = 40 dBµV + 3.4 dB + 0.9 dB + 6.5 dB/m = 50.8 dBµV/m Average Limit = 20 log (500) = 54 dBµV/m Margin = 54 dBµV/m - 50.8 dBµV/m = 3.2 dB

Block Diagram



5.1.1 Radiated Emissions

Operator	Anthony Smith	**QA**	Zach Wilson
Temperature	23.6°C, 24.1°C	**R.H. %**	26.3%, 17.8%
Test Date	1/7/2022, 1/10/2022	**Location**	Chamber 5
Requirement	FCC 15.247, RSS-247 FCC 15.209, RSS-Gen	**Method**	ANSI C63.10

Limits:

Frequency (MHz)	Quasi Peak Limit (dBµV/m)	Average Limit (dBµV/m)	Peak Limit (dBµV/m)
30-88	40.0	-	-
88-216	43.5	-	-
216-960	46.0	-	-
960-1000	54.0	-	-
1000-25000	-	54.0	74.0

Test Parameters

Frequency	30-25000 MHz	**Distance**	3m
Detector(s)	Max hold with peak detector for plots. Quasi peak detector for measurements under 1 GHz. Average measurements taken with a reduced VBW of 470 Hz.	**Table height**	150cm
RBW	Below 1 GHz: 120 kHz Above 1 GHz: 1 MHz	**VBW**	Below 1 GHz: 1.2 MHz Above 1 GHz Peak: 3 MHz Above 1 GHz Average: 470 Hz *30 kHz used for emission identification

EUT Parameters

Input Power	Battery	**Mode**	BLE Transmit
Channels	0, 19, 39	**Data Rate**	Low Energy
Orientations	Flat, Vertical, Horizontal		
Note	Only showing worst case plots.		

Instrumentation

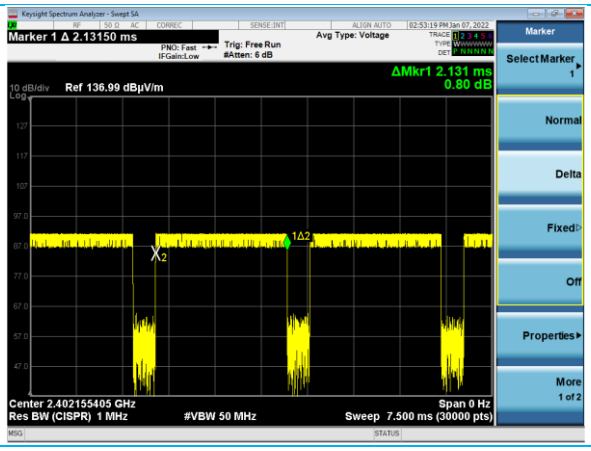
Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960007	Antenna - Double Ridge Horn	EMCO	3115	9311-4138	8/23/2021	8/23/2022	Active Calibration
AA 960153	Filter - High Pass 2.4 GHz	KWM	HPF-L-14186	7272-04	4/21/2021	4/21/2022	Active Calibration
AA 960158	Antenna - Double Ridge Horn	ETS Lindgren	3117	109300	9/27/2021	9/27/2022	Active Calibration
AA 960171	Cable	A.H. Systems, Inc.	SAC-26G-6	386	2/3/2021	2/3/2022	Active Verification
AA 960194	Antenna - Biconical	A.H. Systems, Inc.	SAS-540	780	9/2/2021	9/2/2022	Active Calibration
AA 960209	Antenna - Low Noise Amplifier	Mini-Circuits	ZVA-213X-S+	037101808	8/23/2021	8/23/2022	Active Calibration
EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/20/2021	4/20/2022	Active Calibration
EE 960196	Meter - Hygro-Thermometer	Control Company	90080-03	180045462	5/14/2021	5/14/2022	Active Calibration
EE 960203	Analyzer - EMI Receiver	Keysight	N9038A	MY56400072	4/20/2021	4/20/2022	Active Calibration
LSC-500	Cable	Chamber 5 Emissions	-	-	9/14/2020	9/14/2022	Active Verification
AA 60078	Antenna - Log Periodic	EMCO	93146	9701-4855	9/2/2021	9/2/2022	Active Calibration

Data Tables

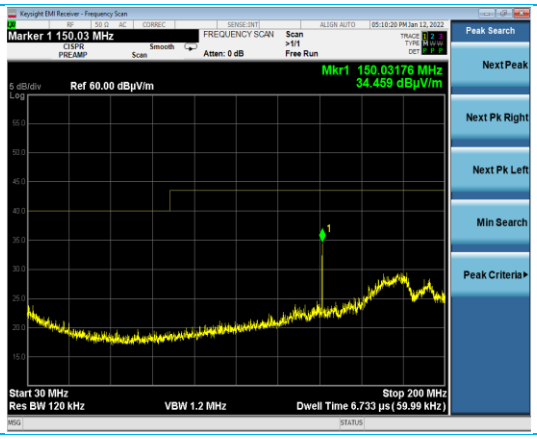
Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Quasi-Peak Reading (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Quasi-Peak Margin (dB)	Channel
150.0	Horizontal	150	290	33.4	43.5	10.1	0
150.0	Vertical	100	140	34.5	43.5	9.0	0
150.0	Horizontal	150	100	34.5	43.5	9.0	39
150.0	Vertical	100	160	35.0	43.5	8.5	39
600.0	Vertical	100	290	42.0	46.0	4.0	39
600.0	Horizontal	100	120	35.9	46.0	10.1	39
600.0	Vertical	100	290	41.3	46.0	4.8	0

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)	Peak Reading (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	EUT Orientation	Channel
2332.8	Horizontal	146	289	44.4	54.0	9.6	-	-	-	Horizontal	0
2332.9	Horizontal	146	289	-	-	-	55.9	74.0	18.1	Horizontal	0
2483.7	Horizontal	165	289	-	-	-	54.0	74.0	20.0	Horizontal	39
2487.7	Horizontal	165	289	42.5	54.0	11.5	-	-	-	Horizontal	39
2700.0	Vertical	100	284	44.8	54.0	9.2	52.0	74.0	22.0	Horizontal	19
2700.0	Vertical	142	102	43.5	54.0	10.5	51.4	74.0	22.6	Vertical	19
2700.0	Horizontal	150	277	46.3	54.0	7.8	52.8	74.0	21.2	Horizontal	19
2700.0	Horizontal	150	141	45.4	54.0	8.6	53.4	74.0	20.6	Flat	19
2700.0	Horizontal	109	55	46.2	54.0	7.8	53.0	74.0	21.0	Vertical	19
2700.1	Vertical	221	183	46.7	54.0	7.3	53.9	74.0	20.1	Flat	19

Plots

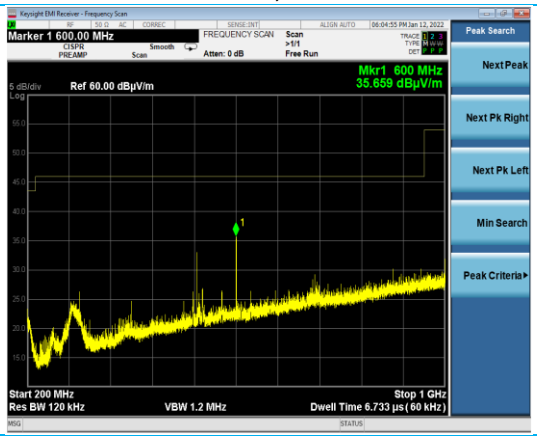


Duty Cycle Measurement

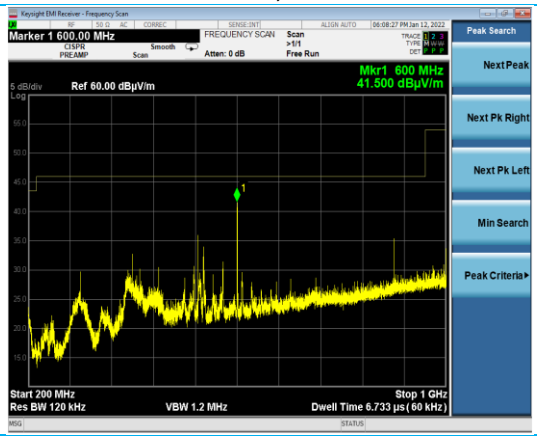


30-200 MHz, Horizontal Antenna
Vertical EUT, Channel 0

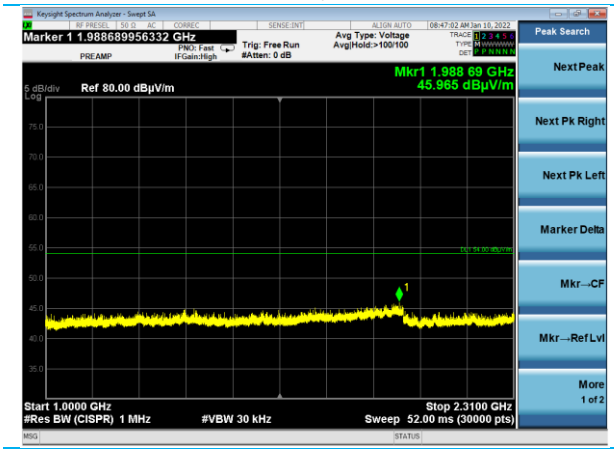
30-200 MHz, Vertical Antenna
Vertical EUT, Channel 0



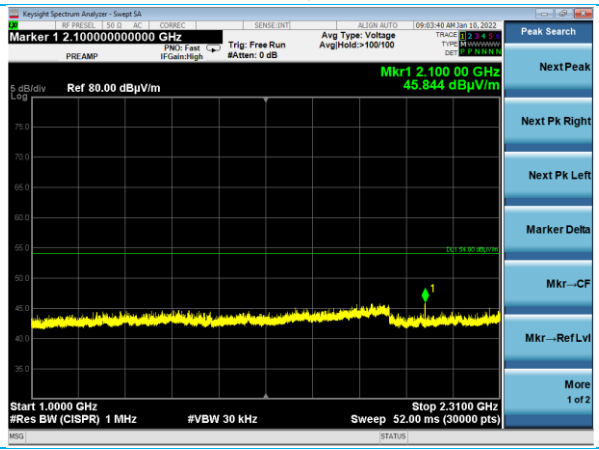
200-1000 MHz, Horizontal Antenna
Vertical EUT, Channel 0



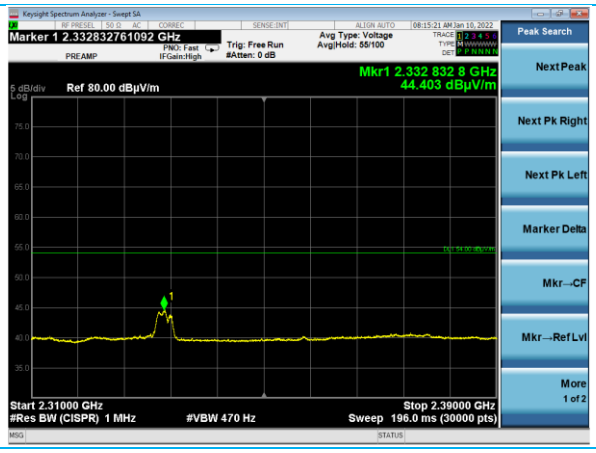
200-1000 MHz, Vertical Antenna
Vertical EUT, Channel 0



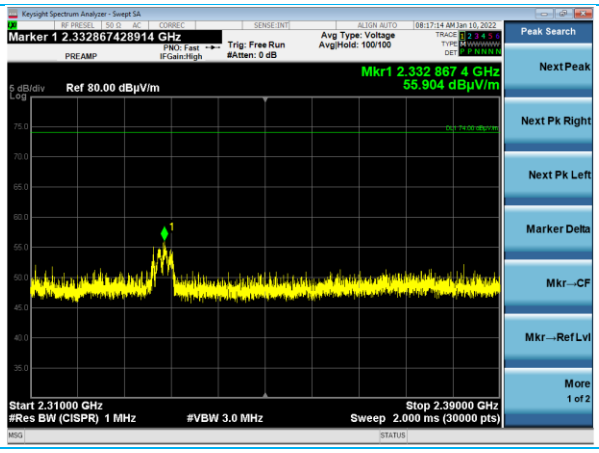
1-2.31 GHz, Horizontal Antenna
Vertical EUT, Channel 19



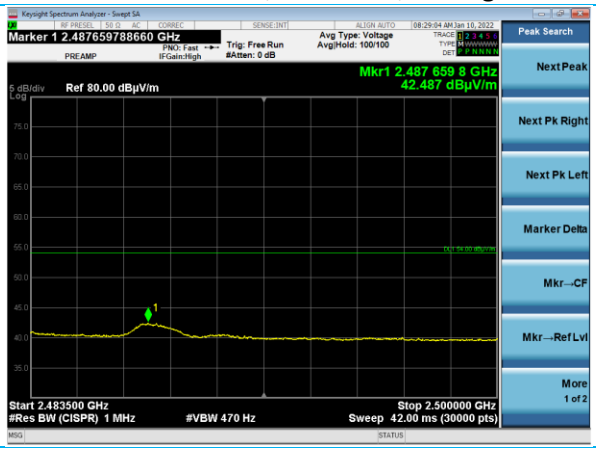
1-2.31 GHz, Vertical Antenna
Vertical EUT, Channel 19



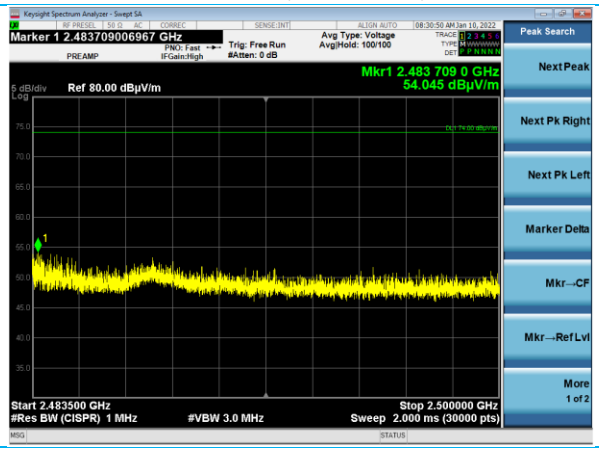
2310-2390 MHz, Horizontal Antenna
Horizontal EUT, Channel 0, Average



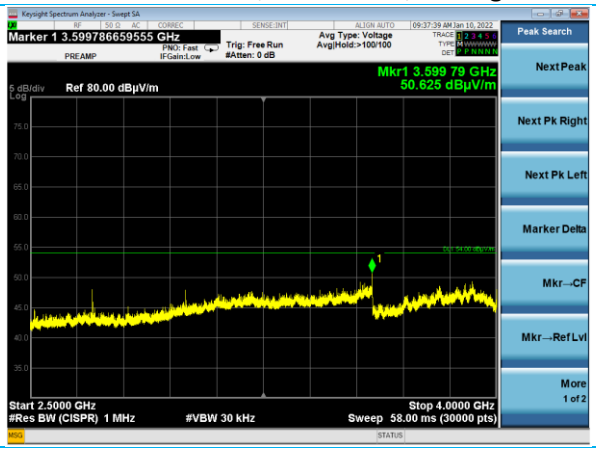
2310-2390 MHz, Horizontal Antenna
Horizontal EUT, Channel 0, Peak



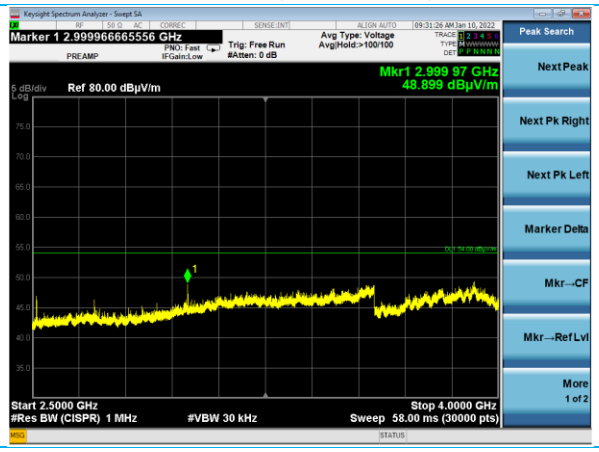
2483.5-2500 MHz, Horizontal Antenna
Horizontal EUT, Channel 39, Average



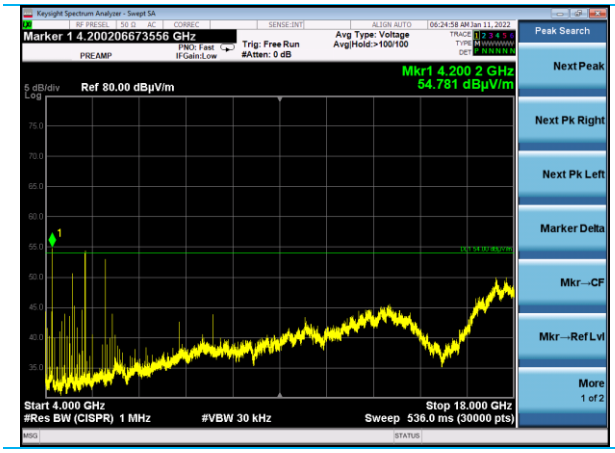
2483.5-2500 MHz, Horizontal Antenna
Horizontal EUT, Channel 39, Peak



2.5-4 GHz, Horizontal Antenna
Vertical EUT, Channel 19



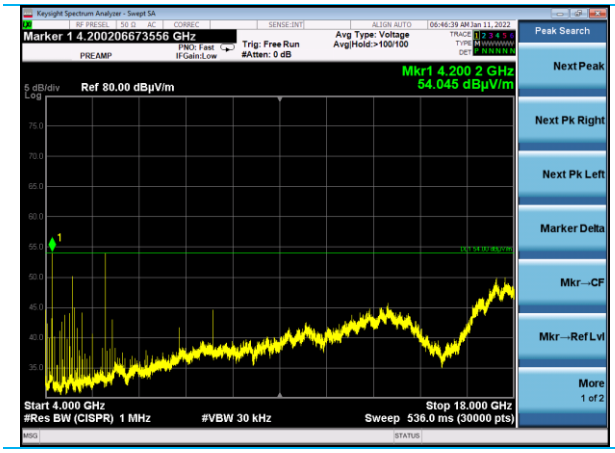
2.5-4 GHz, Vertical Antenna
Vertical EUT, Channel 19



4-18 GHz, Horizontal Antenna
Vertical EUT, Channel 19

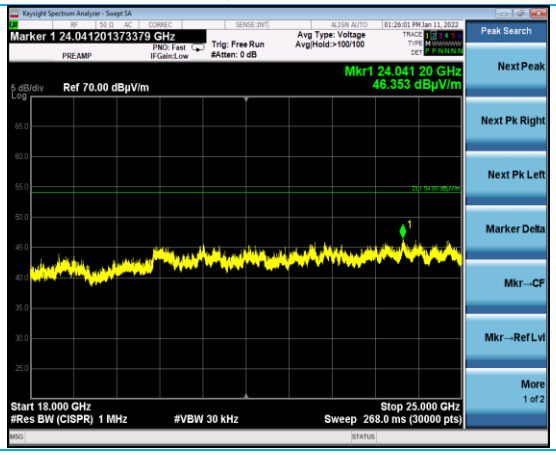
*Emissions are transient in nature and not related to transmitter

4-18 GHz, Vertical Antenna
Vertical EUT, Channel 19

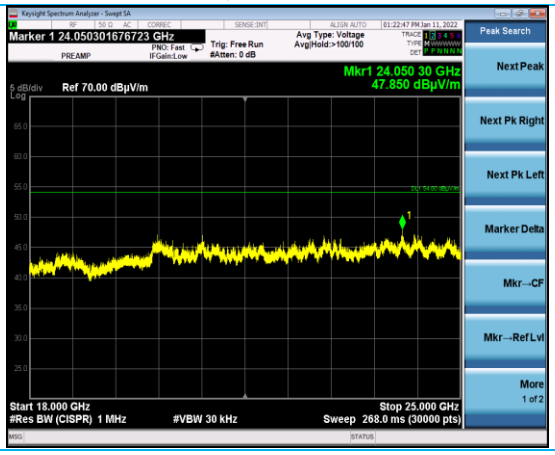


4-18 GHz, Horizontal Antenna
Vertical EUT, *Radio Off, Reference Only

4-18 GHz, Vertical Antenna
Vertical EUT, *Radio Off, Reference Only



18-25 GHz, Horizontal Antenna
Vertical EUT, Channel 19



18-25 GHz, Vertical Antenna
Vertical EUT, Channel 19

6 REVISION HISTORY

Version	Date	Notes	Person
0	2/3/2022	Initial Draft	Zach Wilson
1	8/29/2022	Final	Adam Alger
2	10/6/2022	Updated antenna gain information	Adam Alger

END OF REPORT