

# Test Report # 3547 B

<b>Equipment Under Test:</b>	Dental Scanner
<b>Requirement(s):</b>	FCC 15.247, FCC 15.209, RSS-247, RSS-GEN Bluetooth Classic, FHSS (C2PC Antenna Add)
<b>Test Date(s):</b>	January 10 <sup>th</sup> -31 <sup>st</sup> , 2022
<b>Prepared for:</b>	3Shape TRIOS A/S Attn: Kasper Hansen Niels Juels Gade 13 1059 Copenhagen, Denamrk

<b>Report Issued by:</b> Adam Alger, Laboratory Manager	
Signature: <i>Adam Alger</i>	Date: 10/6/2022
<b>Report Reviewed by:</b> Adam Alger, Laboratory Manager	
Signature: <i>Adam Alger</i>	Date: 2/9/2022
<b>Report Constructed by:</b> Zach Wilson, EMC Engineer	
Signature: <i>Zach Wilson</i>	Date: 2/3/2022

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Company: 3Shape TRIOS A/S	Page 1 of 18	Name: Dental Scanner
Report: TR3547 B		Model: TRIOS 5
Quote: NBO-11-2021-004342-2		Serial: Engineering Sample

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**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*

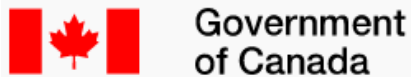
*Scope of accreditation includes all test methods listed herein unless otherwise noted*



**Federal Communications Commission (FCC) – USA**

*Accredited Test Firm Registration Number: 953492*

*Recognition of two 3 meter Semi-Anechoic Chambers*



**Innovation, Science and Economic Development Canada**

*Accredited U.S. Identification Number: US0218*

*Recognition of two 3 meter Semi-Anechoic Chambers*

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# 1 TEST REPORT SUMMARY

During **January 10<sup>th</sup>-31<sup>st</sup>, 2022** the Equipment Under Test (EUT), **Dental Scanner**, as provided by **3Shape TRIOS A/S** was tested to the following requirements of the **Federal Communications Commission** and **Innovation, Science and Economic Development Canada**:

## FHSS

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

<b>Company Name</b>	3Shape TRIOS A/S
<b>Contact Person</b>	Kasper Hansen
<b>Address</b>	Niels Juels Gade 13 1059 Copenhagen, Denamrk

### 2.1 Equipment Under Test (EUT) Information

*The following information has been supplied by the client*

<b>Product Name</b>	Dental Scanner
<b>Model Number</b>	TRIOS 5
<b>Serial Number</b>	Engineering Sample
<b>FCC ID</b>	2A4DE-3S001
<b>ISED ID</b>	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.

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## 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 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: GFSK, EDR2, EDR3

Channels: 0 (2402 MHz), 39 (2440 MHz), 79 (2480 MHz), Hopping (0-79)

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### 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 $\pm$
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. $\pm$	U.C. $\pm$
Radio Frequency, from F0	$1 \times 10^{-7}$	$0.55 \times 10^{-7}$
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

<p><b>Description of Measurement</b></p>	<p>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.</p> <p>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.</p> <p>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.</p>
<p><b>Example Calculations</b></p>	<p>Measurement (dBμV) + Cable factor (dB) + Other (dB) + Antenna Factor (dB/m) = Corrected Reading (dBμV/m)</p> <p>Margin (dB) = Limit (dBμV/m) - Corrected Reading (dBμV/m)</p> <p>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</p>

#### Block Diagram



### 5.1.1 Radiated Emissions

<b>Operator</b>	Anthony Smith	<b>QA</b>	Zach Wilson, Jon Dilley
<b>Temperature</b>	22.5°C, 24.1°C	<b>R.H. %</b>	18.50%, 23.50%
<b>Test Date</b>	1/10/2022, 1/31/2022	<b>Location</b>	Chambers 3 & 5
<b>Requirement</b>	FCC 15.247, RSS-247 FCC 15.209, RSS-Gen	<b>Method</b>	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

<b>Frequency</b>	30-25000 MHz	<b>Distance</b>	3m
<b>Detector(s)</b>	Max hold with peak detector for plots. Quasi peak detector for measurements under 1 GHz. Average measurements taken with a reduced VBW of 2.7 kHz.	<b>Table height</b>	150cm
<b>RBW</b>	Below 1 GHz: 120 kHz Above 1 GHz: 1 MHz	<b>VBW</b>	Below 1 GHz: 1.2 MHz Above 1 GHz Peak: 3 MHz Above 1 GHz Average: 2.7 kHz *30 kHz used for emission identification

#### EUT Parameters

<b>Input Power</b>	Battery Power	<b>Mode</b>	Bluetooth Classic Transmit
<b>Channels</b>	0, 39, 79, Hopping	<b>Data Rate</b>	GFSK, EDR2, EDR3
<b>Orientations</b>	Flat, Vertical, Horizontal		
<b>Note</b>	Only showing worst case plots.		

## Instrumentation

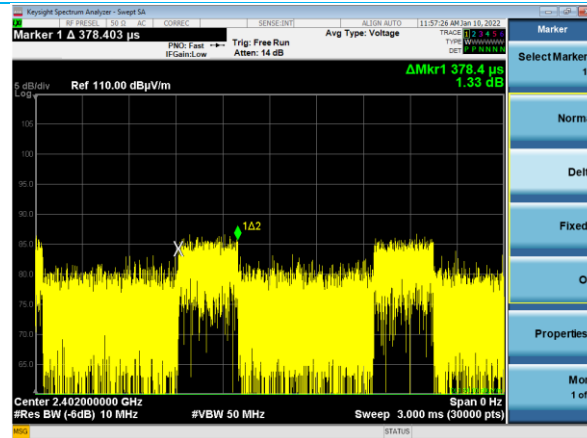
Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960007	Antenna - Double Ridge Horn	EMCO	3115	9311-4138	8/23/2021	8/23/2022	Active Calibration
AA 960153	Filter - High Pass 2.4 GHz	KWM	HPF-L-14186	7272-04	4/21/2021	4/21/2022	Active Calibration
AA 960158	Antenna - Double Ridge 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 (dB $\mu$ V/m)	Quasi-Peak Limit (dB $\mu$ V/m)	Quasi-Peak Margin (dB)	EUT Orientation	Channel	Data Rate
150.0	Horizontal	150	100	32.8	43.5	10.7	Vertical	0	GFSK
150.0	Vertical	100	200	34.7	43.5	8.9	Vertical	0	GFSK
150.0	Horizontal	100	190	33.1	43.5	10.5	Vertical	79	GFSK
150.0	Vertical	100	90	34.1	43.5	9.4	Vertical	79	GFSK
300.0	Horizontal	100	120	35.3	46.0	10.8	Vertical	79	GFSK
600.0	Vertical	100	260	44.5	46.0	1.5	Vertical	79	GFSK
600.0	Vertical	100	275	44.9	46.0	1.1	Vertical	0	GFSK

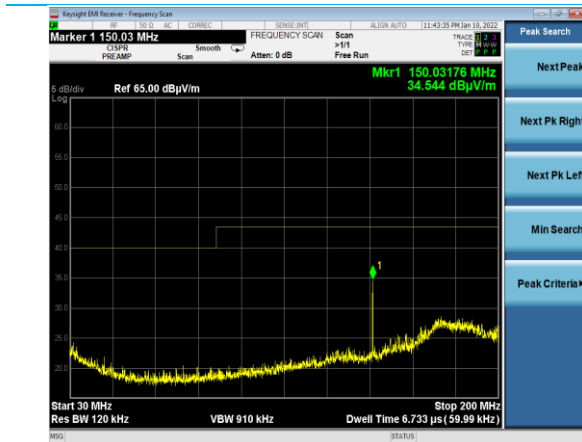
Average Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Average Margin (dB)	Peak Frequency (MHz)	Peak Reading (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	EUT Orientation	Channels/Data Rate
2359.0	Horizontal	195	288	48.2	54.0	5.8	2355.2	56.7	74.0	17.3	Horizontal	Hopping/GFSK
2486.6	Horizontal	195	288	42.7	54.0	11.3	2489.9	53.4	74.0	20.6	Horizontal	Hopping/GFSK
2500.0	Horizontal	195	288	42.2	54.0	11.8	2493.5	52.8	74.0	21.2	Horizontal	Hopping/EDR2
2344.7	Horizontal	195	288	44.7	54.0	9.3	2356.6	53.7	74.0	20.3	Horizontal	Hopping/EDR2
2363.9	Horizontal	195	288	44.8	54.0	9.2	2361.8	54.2	74.0	19.8	Horizontal	Hopping/EDR3
2498.5	Horizontal	195	288	42.1	54.0	11.9	2496.0	53.5	74.0	20.5	Horizontal	Hopping/EDR3

Plots

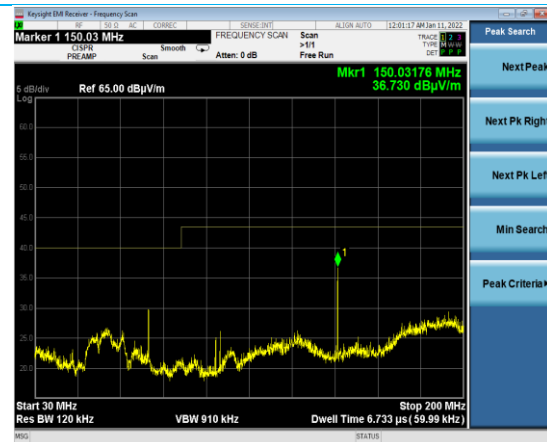


Duty Cycle Measurement

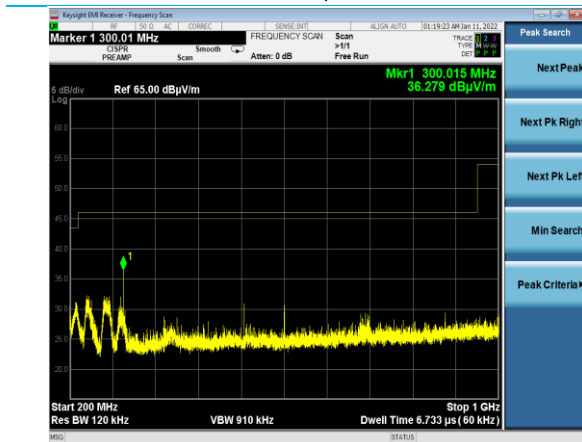
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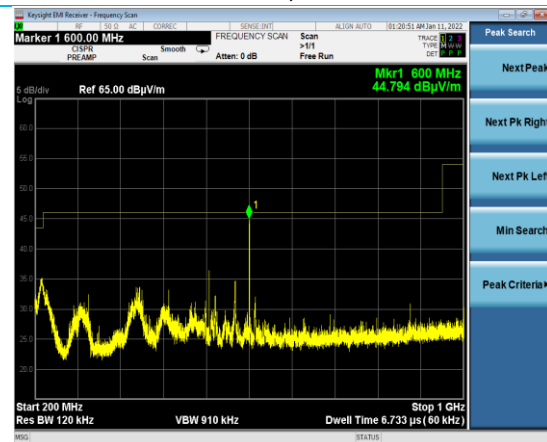
30-200 MHz, Horizontal Antenna  
Vertical EUT, Channel 0



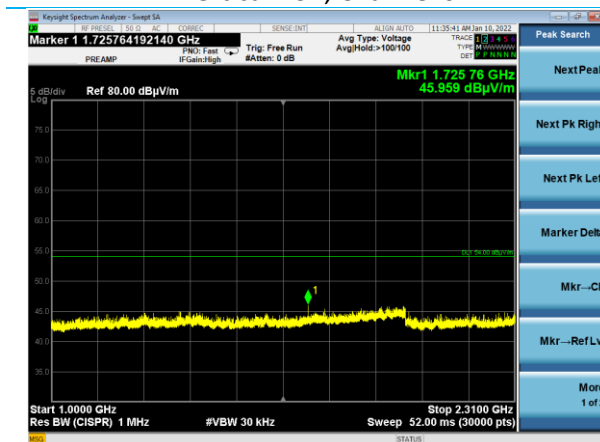
30-200 MHz, Vertical Antenna  
Vertical EUT, Channel 0



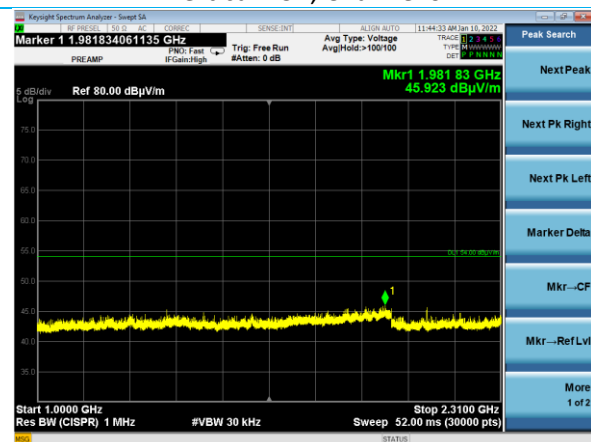
200-1000 MHz, Horizontal Antenna  
Vertical EUT, Channel 0



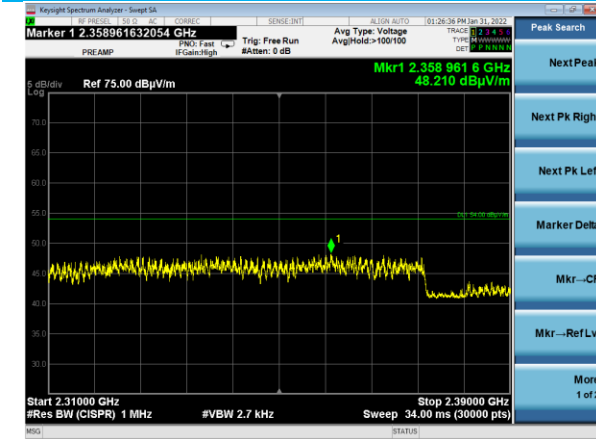
200-1000 MHz, Vertical Antenna  
Vertical EUT, Channel 0



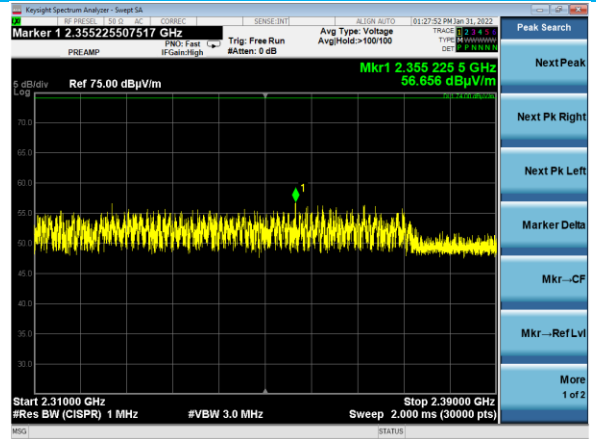
1-2.31 GHz, Horizontal Antenna  
Vertical EUT, Channel 39



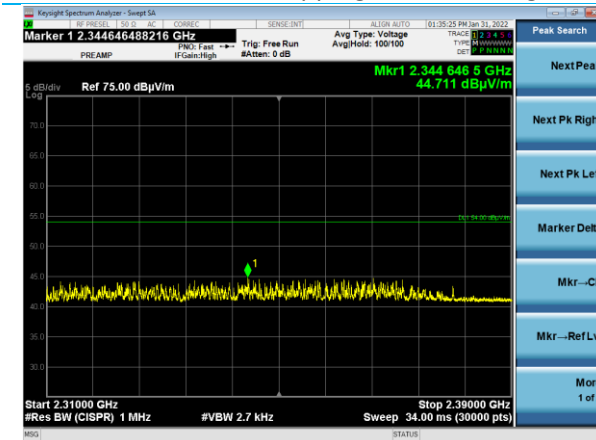
1-2.31 GHz, Vertical Antenna  
Vertical EUT, Channel 39



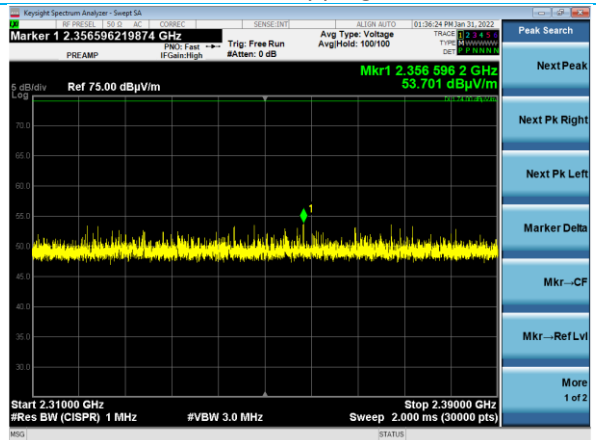
2310-2390 MHz, Horizontal Antenna  
Horizontal EUT, Hopping, GFSK, Average



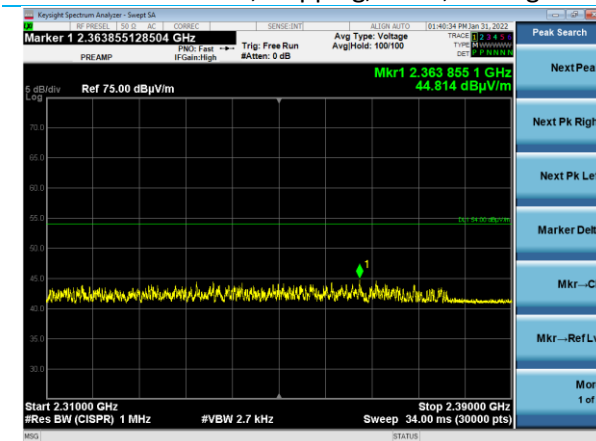
2310-2390 MHz, Horizontal Antenna  
Horizontal EUT, Hopping, GFSK, Peak



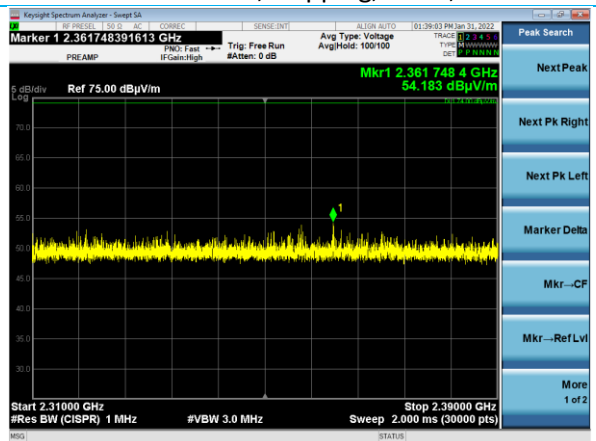
2310-2390 MHz, Horizontal Antenna  
Horizontal EUT, Hopping, EDR2, Average



2310-2390 MHz, Horizontal Antenna  
Horizontal EUT, Hopping, EDR2, Peak

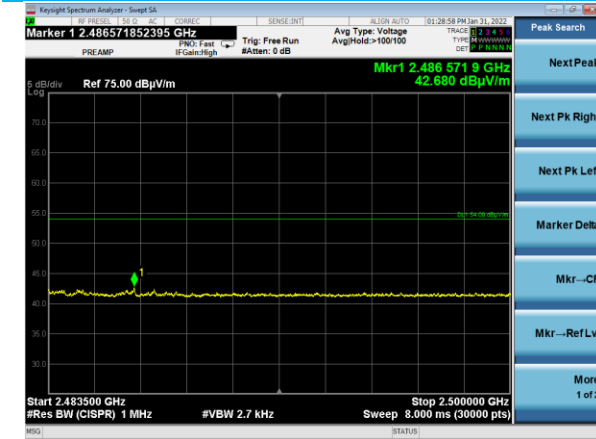


2310-2390 MHz, Horizontal Antenna  
Horizontal EUT, Hopping, EDR3, Average

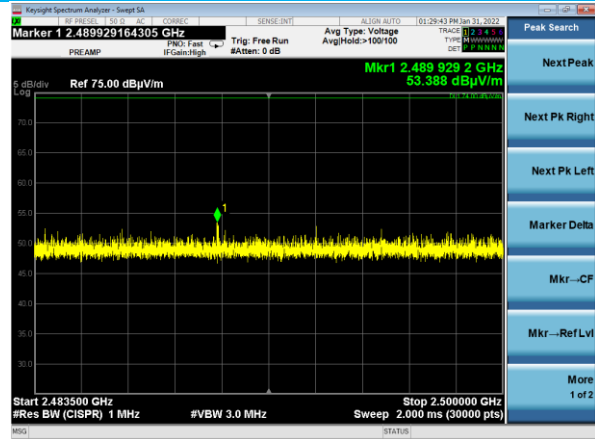


2310-2390 MHz, Horizontal Antenna  
Horizontal EUT, Hopping, EDR3, Peak

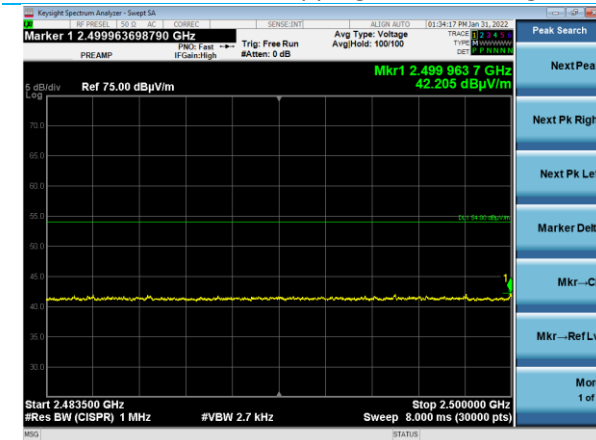
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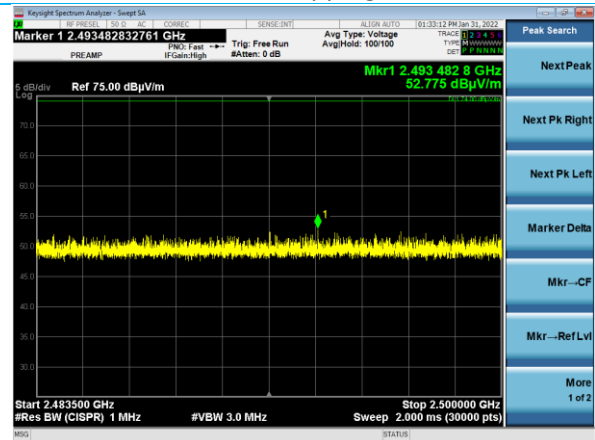
2483.5-2500 MHz, Horizontal Antenna  
Horizontal EUT, Hopping, GFSK, Average



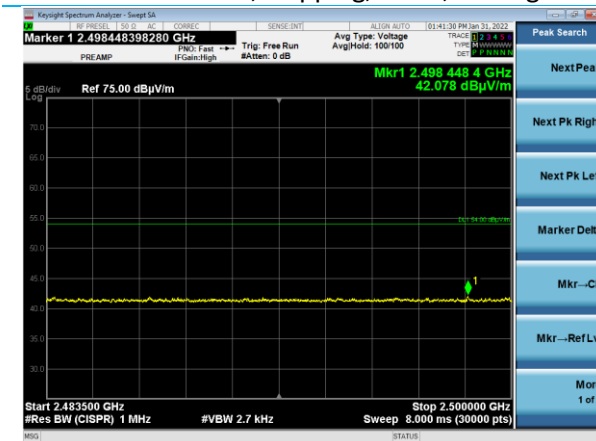
2483.5-2500 MHz, Horizontal Antenna  
Horizontal EUT, Hopping, GFSK, Peak



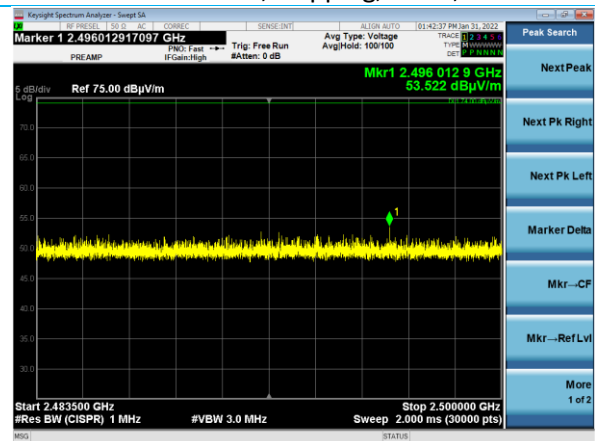
2483.5-2500 MHz, Horizontal Antenna  
Horizontal EUT, Hopping, EDR2, Average



2483.5-2500 MHz, Horizontal Antenna  
Horizontal EUT, Hopping, EDR2, Peak



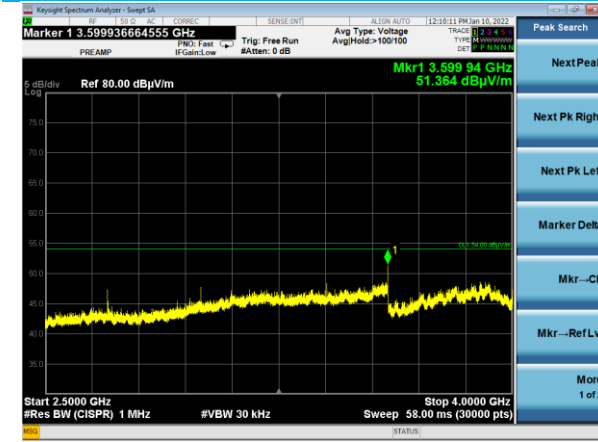
2483.5-2500 MHz, Horizontal Antenna  
Horizontal EUT, Hopping, EDR3, Average



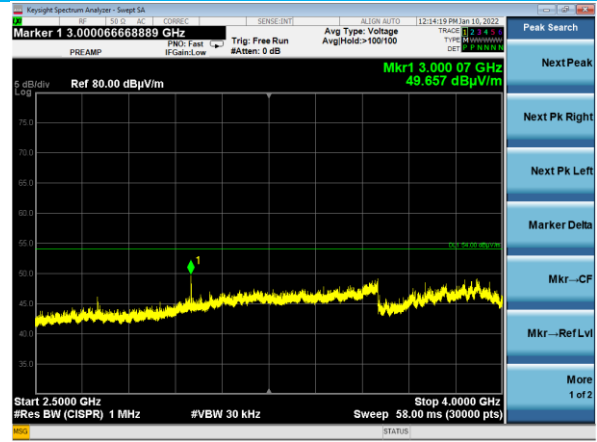
2483.5-2500 MHz, Horizontal Antenna  
Horizontal EUT, Hopping, EDR3, Peak

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2.5-4 GHz, Horizontal Antenna  
Vertical EUT, Channel 39



2.5-4 GHz, Vertical Antenna  
Vertical EUT, Channel 39

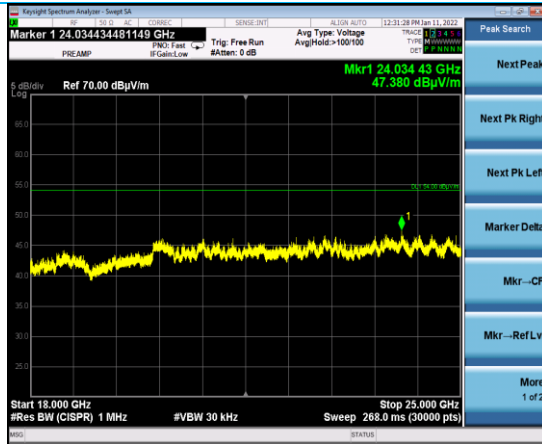


4-18 GHz, Horizontal Antenna  
Vertical EUT, Channel 39

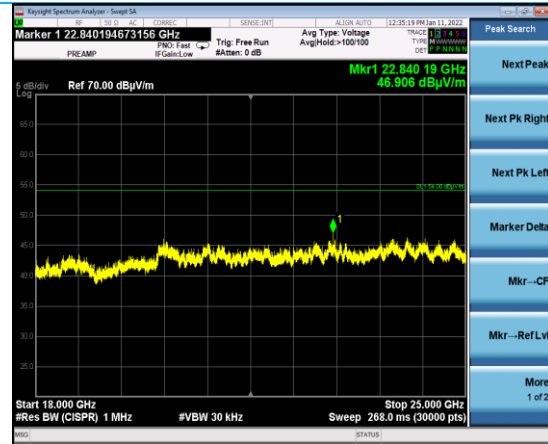


4-18 GHz, Vertical Antenna  
Vertical EUT, Channel 39

\*Emissions are not in restricted band and not TX related



18-25 GHz, Horizontal Antenna  
Vertical EUT, Channel 39



18-25 GHz, Vertical Antenna  
Vertical EUT, Channel 39

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## 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	Adam Alger

**END OF REPORT**