TEST REPORT

Report Number: R13545692-E1

Applicant	:	GOGO BUISNESS AVIATION 105 EDGEVIEW DRIVE SUITE 300 BROOMFIELD CO, 80021
Model	:	DMA
FCC ID	:	2AW6C-DMA
EUT Description	:	AIR TO GROUND TRANSCEIVER
Test Standard(s)	:	FCC CFR47 Part 22 Subpart G

Date Of Issue:
2021-03-29

Prepared by:
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NVLAP TESTING

NVLAP Lab code: 200246-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2021-03-12	Initial Issue	Noah Bennett
V2	2021-03-18	-Removed setup photos due to Confidentiality statement -Revised Meas. Equip List	Noah Bennett
V3	2021-03-29	-Updated Output power table. -Updated Max power table. -Updated Radiated Data -Added HPF to Meas. Equip list	Noah Bennett

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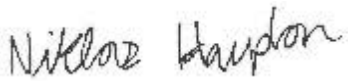
1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	GOGO BUISNESS AVIATION 105 EDGEVIEW DRIVE SUITE 300 BROOMFIELD CO, 80021
Model	DMA
FCC ID	2AW6C-DMA
EUT Description	AIR TO GROUND TRANSCEIVER
Serial Number	3411000201546
Sample Receipt Date	2021-02-22
Date Tested	2021-02-22 to 2021-03-25
Applicable Standards	FCC CFR47 Part 22 Subpart G
Test Results	Compliant

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released By:	Reviewed By:	Prepared By:
		
Dan Coronia Operations Leader UL LLC	Niklas Haydon Operations Leader UL LLC	Noah Bennett Engineer UL LLC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with the following:

- ANSI C63.26:2015
- FCC CFR 47 Part 22 Subpart G
- FCC KDB 971168 D01 v03r01: Power Meas License Digital Systems
- FCC KDB 971168 D02 v02r01: Misc Rev Approv License Devices
- FCC KDB 412172 D01 v01r01. Determining ERP and EIRP

3. FACILITIES AND ACCREDITATION

UL LLC is accredited by NVLAP, Laboratory Code 200246-0, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
☐	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	703469
☒	Building: 2800 Perimeter Park Drive, Suite B, Morrisville, NC, 27560	US0067	2180C	703469

4. DECISION RULES AND MEASUREMENT UNCERTAINTY

4.1 METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

4.2 DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

4.3 MEASUREMENT UNCERTAINTY

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

PARAMETER	U_{Lab}
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 db
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 db
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.84 db
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 db
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.51 db
Occupied Channel Bandwidth	±1.22 %
Temperature	±2.26 °C
Supply voltages	±0.45 %
Time	±0.02 %

Uncertainty figures are valid to a confidence level of 95%.

4.4 SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

5. EQUIPMENT UNDER TEST

5.1 DESCRIPTION OF EUT

The EUT is an Air to Ground Transceiver.

5.2 MAXIMUM OUTPUT POWER

EIRP/ERP TEST PROCEDURE

ANSI C63.26:2015
KDB 971168 D01 Section 5.6

ERP/EIRP = PMeas + GT − LC
where: ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);
PMeas = measured transmitter output power or PSD, in dBm or dBW;
GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);
LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

For devices utilizing multiple antennas, KDB 662911 provides guidance for determining the effective array transmit antenna gain term to be used in the above equation.

The transmitter has a peak conducted and ERP output powers as follows:

Frequency (MHz)	Packet Size	Peak Power (dBm)	ERP correction factor	Corrected Peak Power	Peak power (mW)	Comments
894.75	3072	39.75	-2.15	40.52	11271.97	P12949 Antenna w/ Max loss cable
894.75	128	38.41	-2.15	40.59	11455.13	P12949 Antenna w/ Min loss cable

5.3 SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version 93.1.41.0.

5.4 MAXIMUM ANTENNA GAIN AND CABLE LOSS

The antenna gain(s) and the type, as provided by the manufacturer, are as follows:

Frequency	Antenna Model	Antenna Gain (dBi)
894.75MHz	P12949	5.8
894.75MHz	P17770/P17772	7
894.75MHz	P17204	8.5
894.75MHz	P35500	8.7

Frequency	Cable	Loss (dB)
894.75MHz	Minimum	1.5
894.75MHz	Maximum	5

5.5 WORST-CASE CONFIGURATION AND MODE

The worst-case scenario for all measurements is based on the Peak conducted output power measurement investigation results. Output power measurements were measured for various packet sizes. The EUT supports packet sizes as follows: 128,256,512,768,1024,1536,2048,3072,4096,6144,8192, and 12288. It was found that packet size 3072 results were worst case. All spurious testing was performed using 3072 packet sizes to represent the worst case. P12949 antenna with highest loss cable was highest power therefore that level was used.

The EUT was investigated in three orthogonal orientations X/Y/Z with antennas terminated to a communications tester (cabinet method). It was determined that X orientation was worst-case orientation. Therefore, all radiated testing is reported in X orientation. P12949 antenna with highest loss cable was highest power therefore that level was used for testing.

5.6 DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Callbox	Agilent Keysight	E5515E	MY44495044	NA
Callbox	Agilent Keysight	E5515C	GB46311143	NA
Desktop	Lenovo	M91P	1S4524BD6MJMMBVFP	NA
Switch	Netgear	GS724T	2ME5275L00CC1	NA
DC Power Supply	BK Precicion	1687B	347J19115	NA
Signal Generator	Rohde & Schwarz	SMBV100A	1205790	NA
Laptop	Lenovo	T460	NA	NA

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	ATG	8	TNC	Shielded	>3m	RF Coax cables Goes to Switch
2	Power (J1)	1	Circular Mil	Shielded	>3m	Goes to DC power Supply
3	SMA	6	SMA	Shileded	<3m	Goes from EUT to Signal Generator
4	USB Micro	1	USB	Shielded	<3m	Goes from debug board on the front of EUT to the laptop

Setup Diagrams

Refer to R13545693-EP1 for Setup Diagrams and photos.

6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - North Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	**(Loop Ant.)**			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2020-08-20	2021-08-20
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2020-07-27	2021-07-27
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-04-27	2021-04-27
	Gain-Loss Chains				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2020-07-10	2021-07-10
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2020-07-10	2021-07-10
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-07-06	2021-07-06
	Receiver & Software				
SA0026	Spectrum Analyzer	Agilent	N9030A	2020-07-16	2021-07-16
SOFTEMI	EMI Software	UL	2020-08-19	NA	NA
	Additional Equipment used				
s/n 20037610	Environmental Meter	Fisher Scientific	HI0094	2020-01-21	2022-01-21
HPF012	1GHz high-pass filter, 2W, F_{high} =18GHz	Micro-Tronics	HPM18129	2021-02-15	2022-02-15

Test Equipment Used – Antenna Port – RF Conducted (Morrisville – Conducted 2)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA0027	Spectrum Analyzer	Keysight	N9030A	2020-06-10	2021-06-10
PWM005	Power Meter	Keysight	N1912A	2020-07-14	2021-07-14
PWS005	Power Sensor	Keysight	N1921A	2020-05-26	2021-05-26
HI0090	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
EMISoftware	Antenna Port Software	UL LLC	AP Version 2021.2.16	NA	NA

NOTES:

1. * Testing is completed before equipment expiration date.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

7. RF OUTPUT POWER

TEST PROCEDURE

The transmitter output was connected to a characterized coaxial cable and coupler, the other end of which was connected to a peak power meter. The peak power was measured with the peak power meter at the middle channel in each band.

LIMIT

FCC: §22.867
The effective radiated power (ERP) of ground and airborne stations operating on the frequency ranges listed in §22.857 must not exceed the limits in this section.

(a) The peak ERP of airborne mobile station transmitters must not exceed 12 Watts.

RESULTS

OUTPUT POWER

Test Engineer ID:	40882	Test Date:	2021-02-22

Antenna 1: P12949 & Cable 1: Min Loss

Frequency (MHz)	Mode/ Packet Size	Peak Power (dBm)	Antenna Gain (dBi)	ERP Correction Factor (dB)	Cable Loss (dB)	Output ERP (dBm)	Limit (dBm)	Margin (dBm)
894.75	128	38.41	5.8	-2.15	1.5	40.56	40.79	-0.23
894.75	256	38.32	5.8	-2.15	1.5	40.47	40.79	-0.32
894.75	512	38.29	5.8	-2.15	1.5	40.44	40.79	-0.35
894.75	768	38.3	5.8	-2.15	1.5	40.45	40.79	-0.34
894.75	1024	38.33	5.8	-2.15	1.5	40.48	40.79	-0.31
894.75	1536	38.34	5.8	-2.15	1.5	40.49	40.79	-0.3
894.75	2048	38.36	5.8	-2.15	1.5	40.51	40.79	-0.28
894.75	3072	38.37	5.8	-2.15	1.5	40.52	40.79	-0.27
894.75	4096	38.29	5.8	-2.15	1.5	40.44	40.79	-0.35
894.75	6144	38.34	5.8	-2.15	1.5	40.49	40.79	-0.3
894.75	8192	38.29	5.8	-2.15	1.5	40.44	40.79	-0.35
894.75	12288	38.32	5.8	-2.15	1.5	40.47	40.79	-0.32

Antenna 1: P12949 & Cable 2: Max Loss

Frequency (MHz)	Mode/ Packet Size	Peak Power (dBm)	Antenna Gain (dBi)	ERP Correction Factor (dB)	Cable Loss (dB)	Output ERP (dBm)	Limit (dBm)	Margin (dBm)
894.75	128	39.71	5.8	-2.15	5	38.36	40.79	-2.43
894.75	256	39.7	5.8	-2.15	5	38.35	40.79	-2.44
894.75	512	39.62	5.8	-2.15	5	38.27	40.79	-2.52
894.75	768	39.62	5.8	-2.15	5	38.27	40.79	-2.52
894.75	1024	39.73	5.8	-2.15	5	38.38	40.79	-2.41
894.75	1536	39.65	5.8	-2.15	5	38.30	40.79	-2.49
894.75	2048	39.6	5.8	-2.15	5	38.25	40.79	-2.54
894.75	3072	39.75	5.8	-2.15	5	38.40	40.79	-2.39
894.75	4096	39.51	5.8	-2.15	5	38.16	40.79	-2.63
894.75	6144	39.66	5.8	-2.15	5	38.31	40.79	-2.48
894.75	8192	39.55	5.8	-2.15	5	38.20	40.79	-2.59
894.75	12288	39.57	5.8	-2.15	5	38.22	40.79	-2.57

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Antenna 2: P17770/17772 & Cable 1: Min Loss

Frequency (MHz)	Mode/ Packet Size	Peak Power (dBm)	Antenna Gain (dBi)	ERP Correction Factor (dB)	Cable Loss (dB)	Output ERP (dBm)	Limit (dBm)	Margin (dBm)
894.75	128	37.13	7	-2.15	1.5	40.48	40.79	-0.31
894.75	256	37.17	7	-2.15	1.5	40.52	40.79	-0.27
894.75	512	37.2	7	-2.15	1.5	40.55	40.79	-0.24
894.75	768	37.25	7	-2.15	1.5	40.60	40.79	-0.19
894.75	1024	37.25	7	-2.15	1.5	40.60	40.79	-0.19
894.75	1536	37.12	7	-2.15	1.5	40.47	40.79	-0.32
894.75	2048	37.11	7	-2.15	1.5	40.46	40.79	-0.33
894.75	3072	37.13	7	-2.15	1.5	40.48	40.79	-0.31
894.75	4096	37.15	7	-2.15	1.5	40.50	40.79	-0.29
894.75	6144	37.29	7	-2.15	1.5	40.64	40.79	-0.15
894.75	8192	37.14	7	-2.15	1.5	40.49	40.79	-0.3
894.75	12288	37.32	7	-2.15	1.5	40.67	40.79	-0.12

Antenna 2: P17770/17772 & Cable 2: Max Loss

Frequency (MHz)	Mode/ Packet Size	Peak Power (dBm)	Antenna Gain (dBi)	ERP Correction Factor (dB)	Cable Loss (dB)	Output ERP (dBm)	Limit (dBm)	Margin (dBm)
894.75	128	39.71	7	-2.15	5.0	39.56	40.79	-1.23
894.75	256	39.7	7	-2.15	5.0	39.55	40.79	-1.24
894.75	512	39.62	7	-2.15	5.0	39.47	40.79	-1.32
894.75	768	39.62	7	-2.15	5.0	39.47	40.79	-1.32
894.75	1024	39.73	7	-2.15	5.0	39.58	40.79	-1.21
894.75	1536	39.65	7	-2.15	5.0	39.50	40.79	-1.29
894.75	2048	39.6	7	-2.15	5.0	39.45	40.79	-1.34
894.75	3072	39.75	7	-2.15	5.0	39.60	40.79	-1.19
894.75	4096	39.51	7	-2.15	5.0	39.36	40.79	-1.43
894.75	6144	39.66	7	-2.15	5.0	39.51	40.79	-1.28
894.75	8192	39.55	7	-2.15	5.0	39.40	40.79	-1.39
894.75	12288	39.57	7	-2.15	5.0	39.42	40.79	-1.37

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Antenna 3: P17204 & Cable 1: Min Loss

Frequency (MHz)	Mode/ Packet Size	Peak Power (dBm)	Antenna Gain (dBi)	ERP Correction Factor (dB)	Cable Loss (dB)	Output ERP (dBm)	Limit (dBm)	Margin (dBm)
894.75	128	35.5	8.5	-2.15	1.5	40.35	40.79	-0.44
894.75	256	35.88	8.5	-2.15	1.5	40.73	40.79	-0.06
894.75	512	35.57	8.5	-2.15	1.5	40.42	40.79	-0.37
894.75	768	35.75	8.5	-2.15	1.5	40.60	40.79	-0.19
894.75	1024	35.71	8.5	-2.15	1.5	40.56	40.79	-0.23
894.75	1536	35.3	8.5	-2.15	1.5	40.15	40.79	-0.64
894.75	2048	35.8	8.5	-2.15	1.5	40.65	40.79	-0.14
894.75	3072	35.68	8.5	-2.15	1.5	40.53	40.79	-0.26
894.75	4096	35.53	8.5	-2.15	1.5	40.38	40.79	-0.41
894.75	6144	35.76	8.5	-2.15	1.5	40.61	40.79	-0.18
894.75	8192	35.89	8.5	-2.15	1.5	40.74	40.79	-0.05
894.75	12288	35.62	8.5	-2.15	1.5	40.47	40.79	-0.32

Antenna 3: P17204 & Cable 2: Max Loss

Frequency (MHz)	Mode/ Packet Size	Peak Power (dBm)	Antenna Gain (dBi)	ERP Correction Factor (dB)	Cable Loss (dB)	Output ERP (dBm)	Limit (dBm)	Margin (dBm)
894.75	128	39.07	8.5	-2.15	5.0	40.42	40.79	-0.37
894.75	256	38.96	8.5	-2.15	5.0	40.31	40.79	-0.48
894.75	512	38.94	8.5	-2.15	5.0	40.29	40.79	-0.5
894.75	768	39.07	8.5	-2.15	5.0	40.42	40.79	-0.37
894.75	1024	39.06	8.5	-2.15	5.0	40.41	40.79	-0.38
894.75	1536	39.18	8.5	-2.15	5.0	40.53	40.79	-0.26
894.75	2048	39.29	8.5	-2.15	5.0	40.64	40.79	-0.15
894.75	3072	39.06	8.5	-2.15	5.0	40.41	40.79	-0.38
894.75	4096	39.17	8.5	-2.15	5.0	40.52	40.79	-0.27
894.75	6144	39.17	8.5	-2.15	5.0	40.52	40.79	-0.27
894.75	8192	39.2	8.5	-2.15	5.0	40.55	40.79	-0.24
894.75	12288	39.18	8.5	-2.15	5.0	40.53	40.79	-0.26

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Antenna 4: P35500 & Cable 1: Min Loss

Frequency (MHz)	Mode/ Packet Size	Peak Power (dBm)	Antenna Gain (dBi)	ERP Correction Factor (dB)	Cable Loss (dB)	Output ERP (dBm)	Limit (dBm)	Margin (dBm)
894.75	128	35.5	8.7	-2.15	1.5	40.55	40.79	-0.24
894.75	256	35.62	8.7	-2.15	1.5	40.67	40.79	-0.12
894.75	512	35.57	8.7	-2.15	1.5	40.62	40.79	-0.17
894.75	768	35.66	8.7	-2.15	1.5	40.71	40.79	-0.08
894.75	1024	35.71	8.7	-2.15	1.5	40.76	40.79	-0.03
894.75	1536	35.3	8.7	-2.15	1.5	40.35	40.79	-0.44
894.75	2048	35.72	8.7	-2.15	1.5	40.77	40.79	-0.02
894.75	3072	35.68	8.7	-2.15	1.5	40.73	40.79	-0.06
894.75	4096	35.53	8.7	-2.15	1.5	40.58	40.79	-0.21
894.75	6144	35.66	8.7	-2.15	1.5	40.71	40.79	-0.08
894.75	8192	35.74	8.7	-2.15	1.5	40.79	40.79	0
894.75	12288	35.62	8.7	-2.15	1.5	40.67	40.79	-0.12

Antenna 4: P35500 & Cable 2: Max Loss

Frequency (MHz)	Mode/ Packet Size	Peak Power (dBm)	Antenna Gain (dBi)	ERP Correction Factor (dB)	Cable Loss (dB)	Output ERP (dBm)	Limit (dBm)	Margin (dBm)
894.75	128	39.07	8.7	-2.15	5.0	40.62	40.79	-0.17
894.75	256	38.96	8.7	-2.15	5.0	40.51	40.79	-0.28
894.75	512	38.94	8.7	-2.15	5.0	40.49	40.79	-0.3
894.75	768	39.07	8.7	-2.15	5.0	40.62	40.79	-0.17
894.75	1024	39.06	8.7	-2.15	5.0	40.61	40.79	-0.18
894.75	1536	39.18	8.7	-2.15	5.0	40.73	40.79	-0.06
894.75	2048	39.04	8.7	-2.15	5.0	40.59	40.79	-0.2
894.75	3072	39.06	8.7	-2.15	5.0	40.61	40.79	-0.18
894.75	4096	39.17	8.7	-2.15	5.0	40.72	40.79	-0.07
894.75	6144	39.17	8.7	-2.15	5.0	40.72	40.79	-0.07
894.75	8192	39.2	8.7	-2.15	5.0	40.75	40.79	-0.04
894.75	12288	39.18	8.7	-2.15	5.0	40.73	40.79	-0.06

8. CONDUCTED TEST RESULTS

This report contains data provided by the applicant which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

8.1 OCCUPIED BANDWIDTH

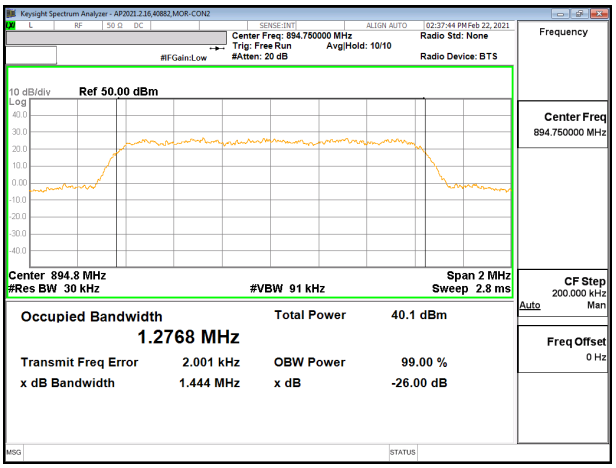
RULE PART(S)
FCC: §2.1049

LIMITS
For reporting purposes only.

TEST PROCEDURE
The transmitter output was connected to a characterized coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The bandwidth was measured with the spectrum analyzer at the middle channel in each band.

RESULTS

Frequency	Packet Side/ Mode	99% OBW (MHz)	-26dB BW (MHZ)
894.75	128	1.2768	1.45
894.75	256	1.2783	1.44
894.75	512	1.2844	1.435
894.75	768	1.279	1.435
894.75	1024	1.2745	1.435
894.75	1536	1.2716	1.44
894.75	2048	1.2769	1.425
894.75	3072	1.2742	1.445
894.75	4096	1.2779	1.44
894.75	6144	1.2767	1.435
894.75	8192	1.2759	1.44
894.75	12288	1.276	1.44



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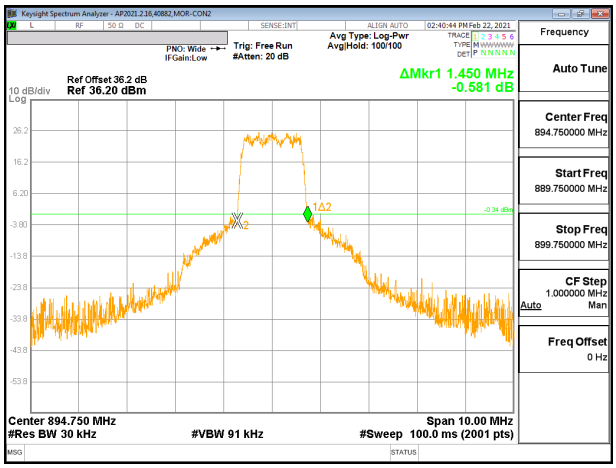

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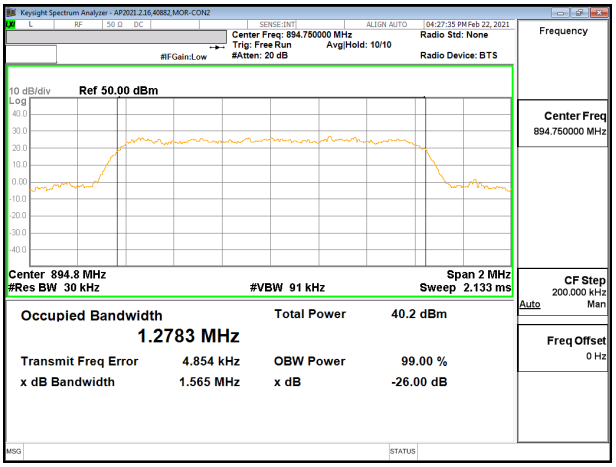

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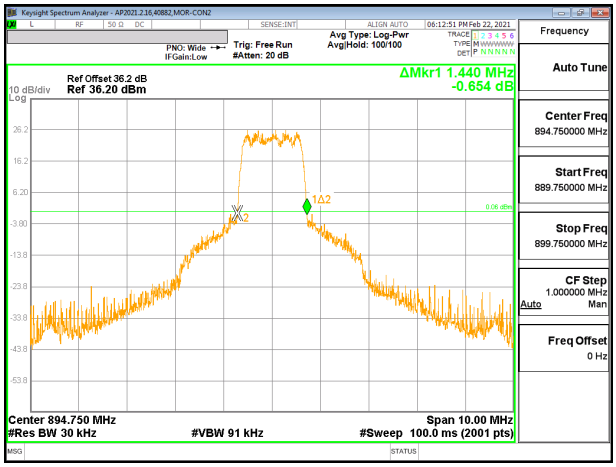

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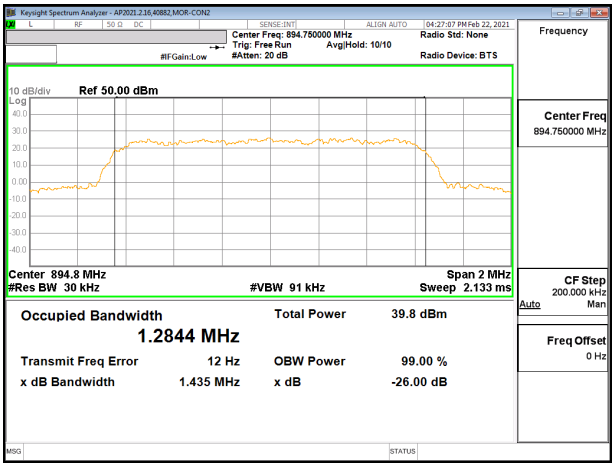

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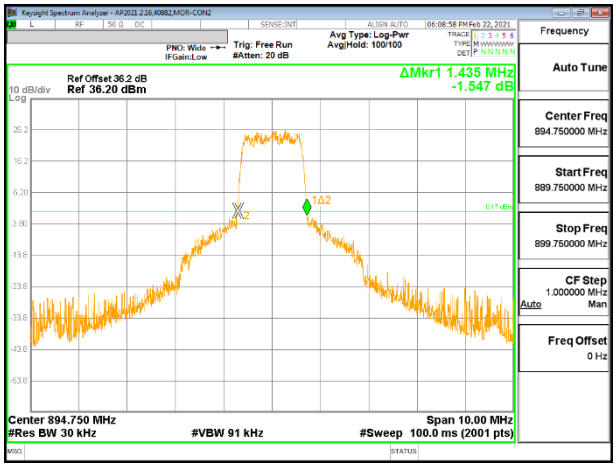

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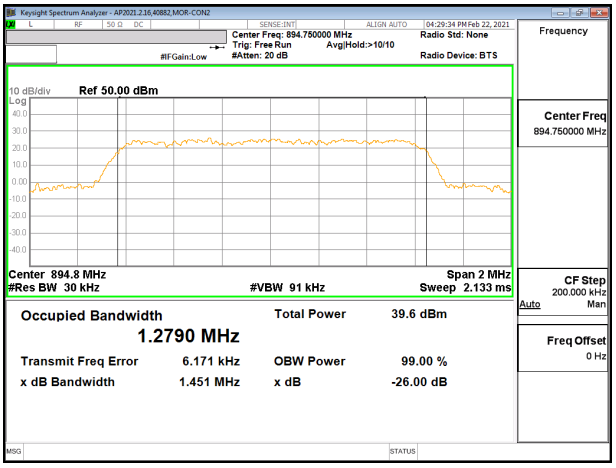

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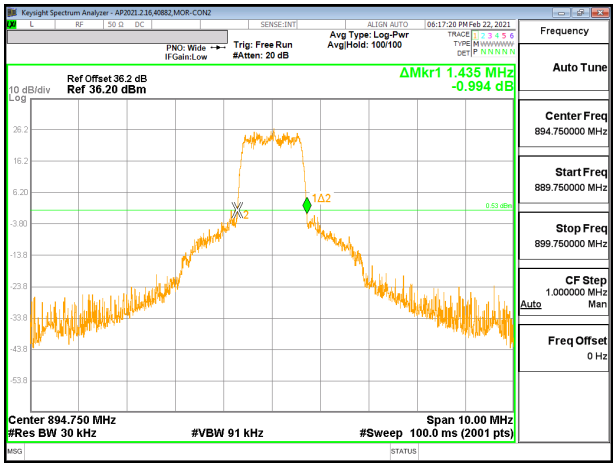

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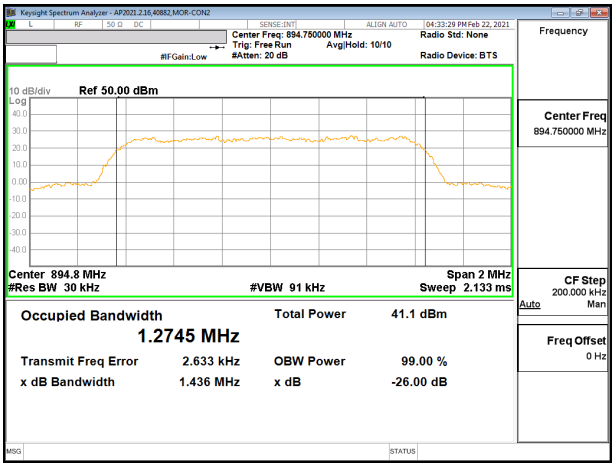

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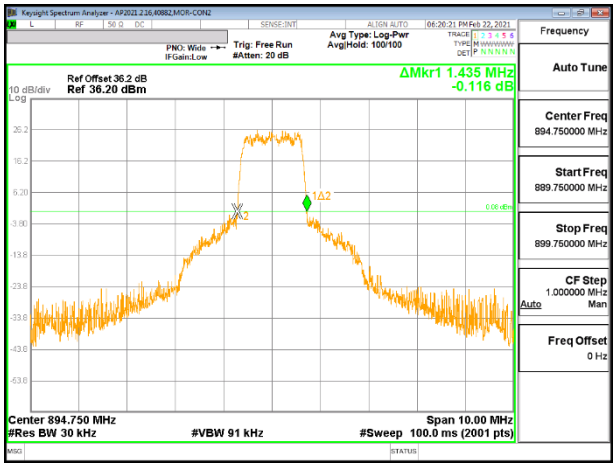

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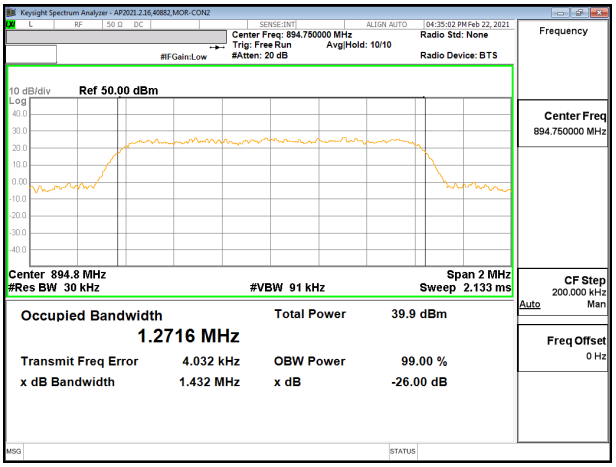

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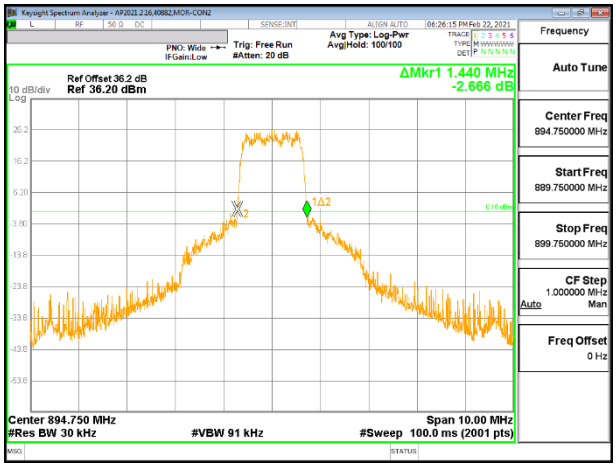

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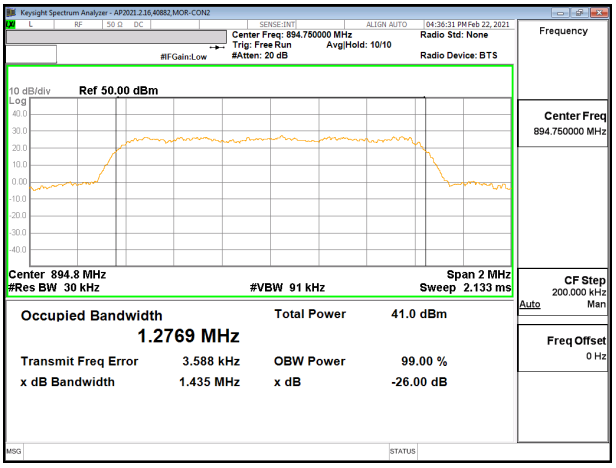

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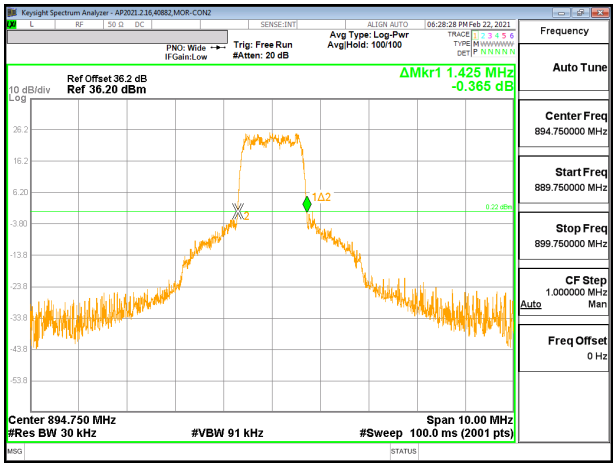
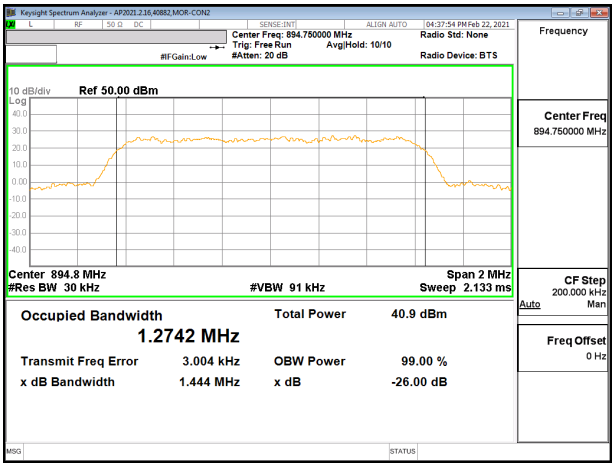


Packet Size 2048 (-26dB)



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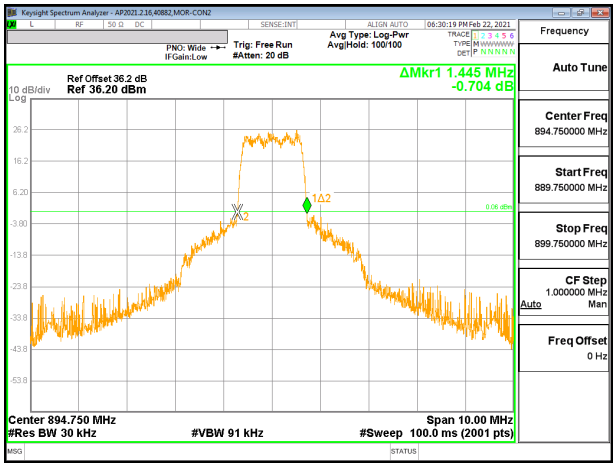

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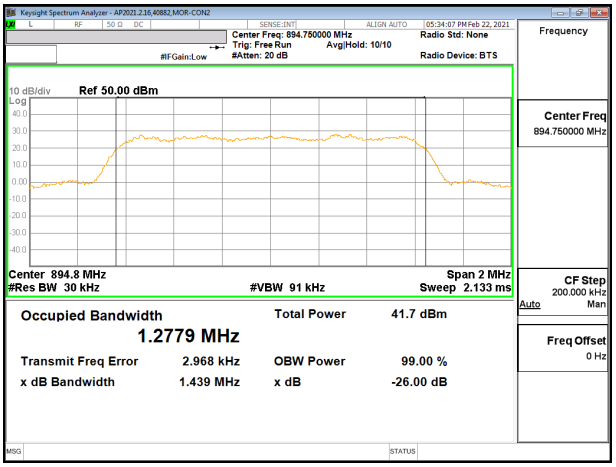

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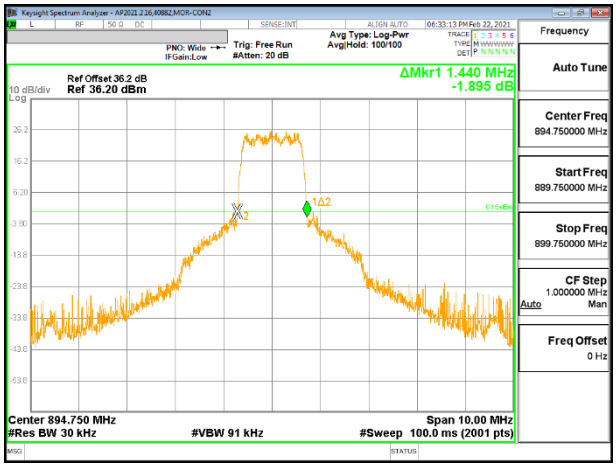

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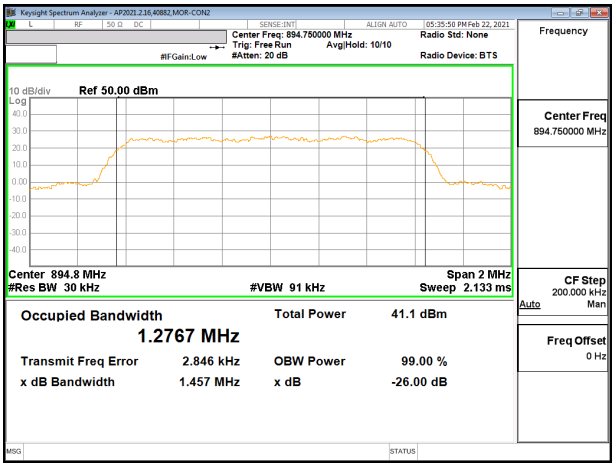

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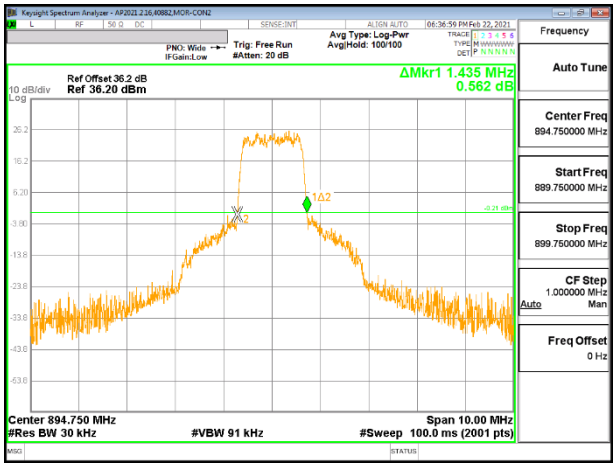

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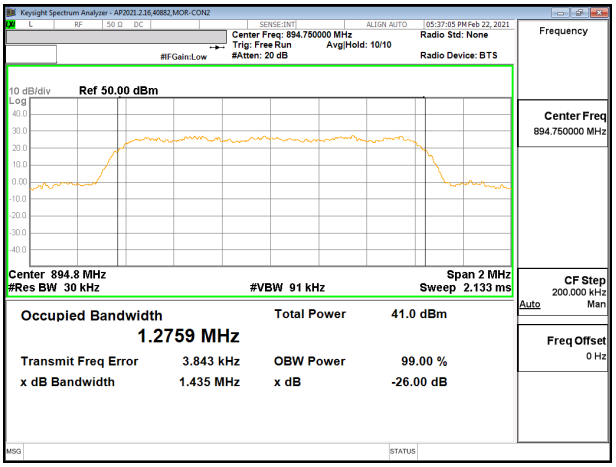

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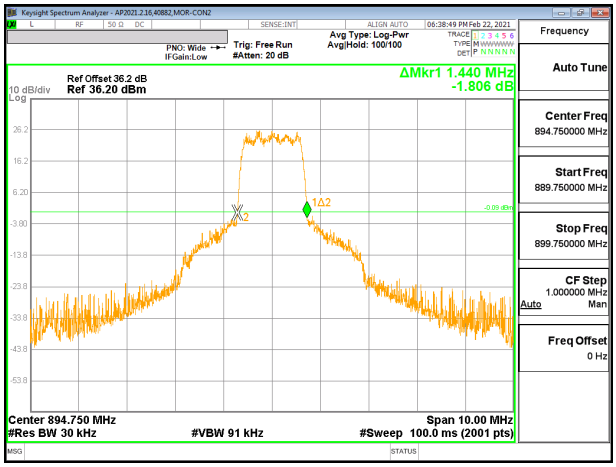

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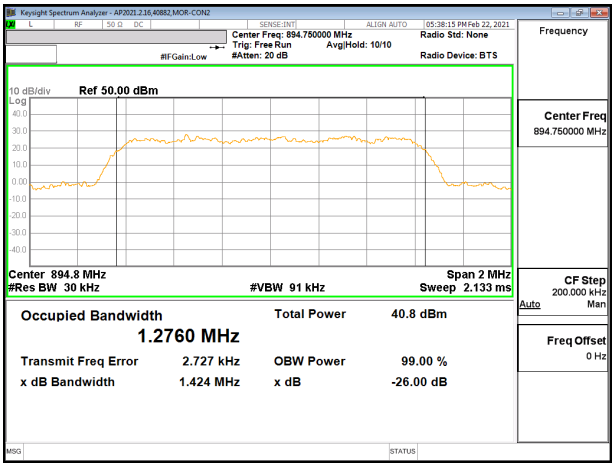

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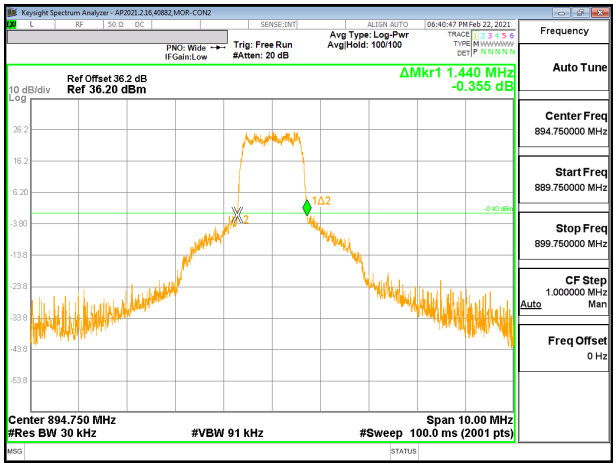


Packet Size 12288 (-26dB)

8.2 FREQUENCY STABILITY

TEST PROCEDURE

FCC Guidance (917768 D01 Power meas Licensed Digital Systems V02r01)

Frequency Stability vs Temperature:
The EUT is placed inside a temperature chamber. The temperature is set to 20ºC and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50ºC or -30ºC is reached.

Frequency Stability vs Voltage:
The peak frequency error is recorded (worst-case).

LIMIT

FCC Part 22.863, The frequency stability of equipment used under this subpart shall be sufficient to ensure that, after accounting for Doppler Frequency shifts, the occupied bandwidth of the fundamental emissions remains within the authorized frequency bands of operation.

RESULTS

Test Engineer ID:	40882	Test Date:	2021-02-23

	Voltage	Temp (deg C)	99% BW Point Freq Low MHz	99% BW Point Freq High MHz	Freq Center MHz	Freq Error from 894.75MHz MHz PPM	Freq Error from Nominal MHz PPM
	28v	50	894.053	895.452	894.753	2.794	-0.559
	28v	40	894.053	895.451	894.751	0.559	-2.794
	28v	30	894.05	895.451	894.751	0.559	-2.794
Nominal	28v	20	894.05	895.456	894.753	3.353	0.000
High	32.2v	20	894.054	895.451	894.749	-1.118	-4.471
Low	23.8v	20	894.05	895.455	894.751	1.118	-2.235
	28v	10	894.047	895.452	894.753	3.353	0.000
	28v	0	894.054	895.449	894.747	-3.353	-6.706
	28v	-10	894.045	895.454	894.754	3.912	0.559
	28v	-20	894.053	895.449	894.748	-2.235	-5.588
	28v	-30	894.047	895.449	894.748	-2.235	-5.588

8.3 SPURIOUS EMISSION AT ANTENNA TERMINAL

TEST PROCEDURE

The transmitter output was connected to a Keysight Communications Tester and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

FCC: §22.861
b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e., 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

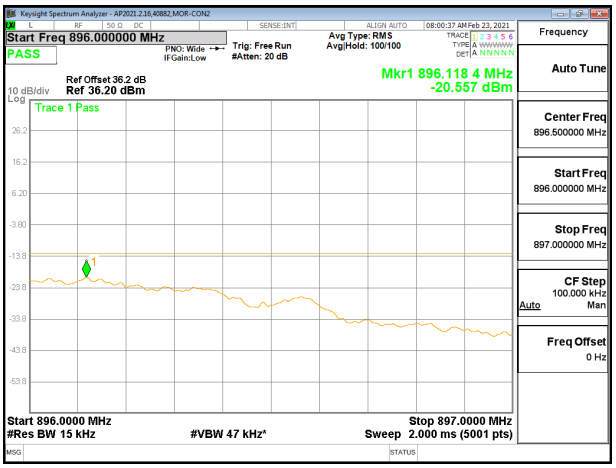
The emission limits shall be measured with the carrier frequency set at both the highest settable frequency and the lowest settable frequency permitted by the design of the equipment.

LIMITS

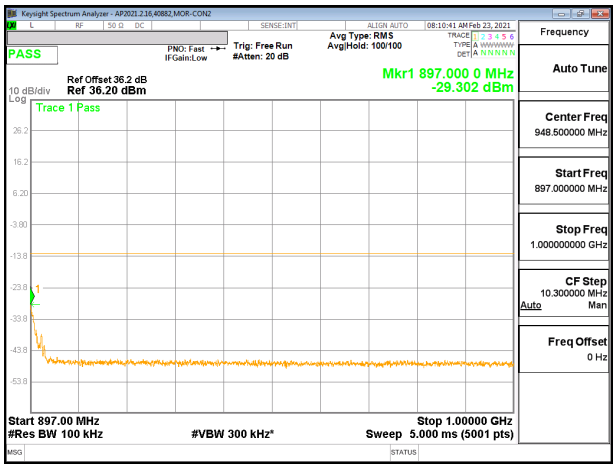
FCC: §22.861 (a)
Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB.

RESULTS

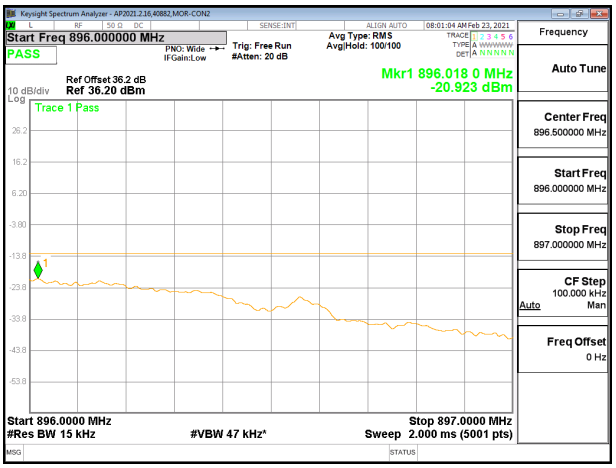
8.3.1 Conducted Band Edge



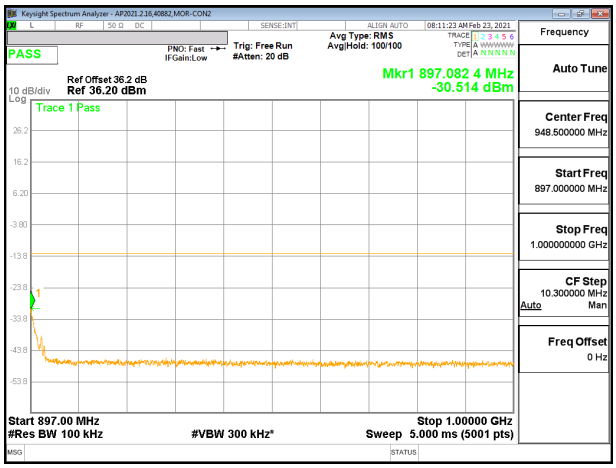
High Range Plot 1: 128



High Range Plot 2: 128



High Range Plot 1: 256



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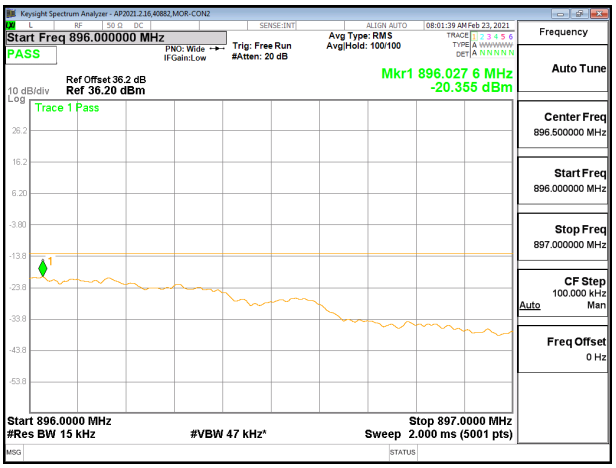
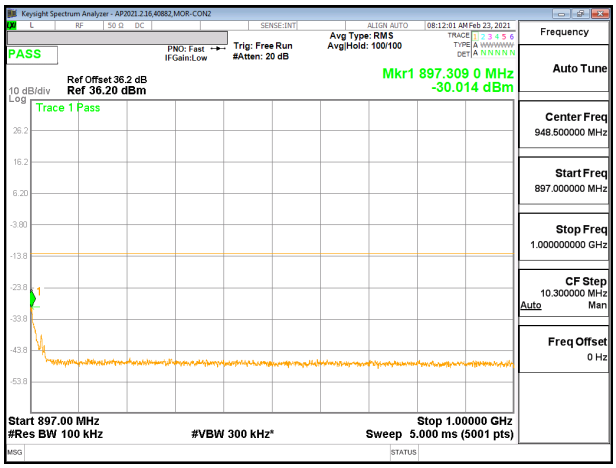
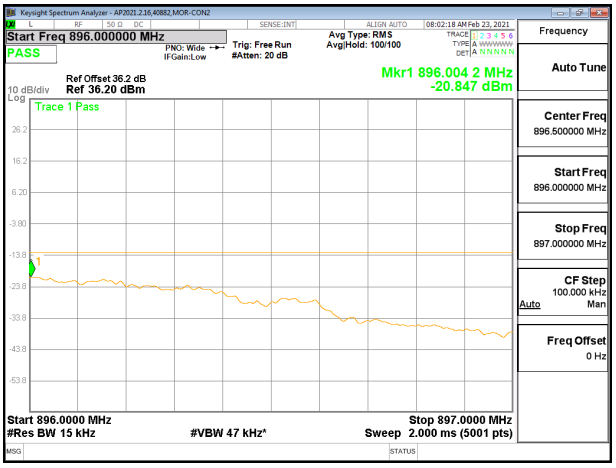


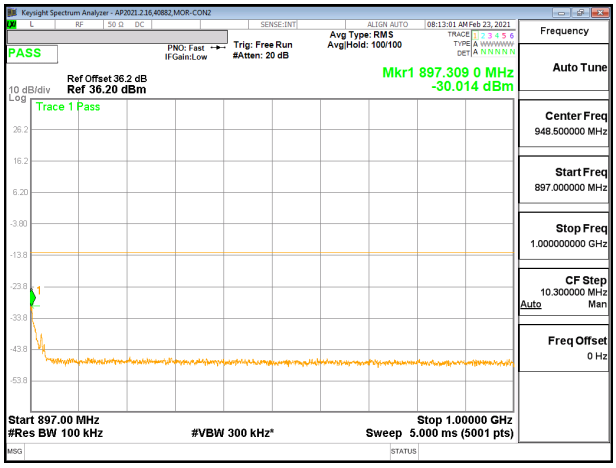
High Range Plot 1: 512



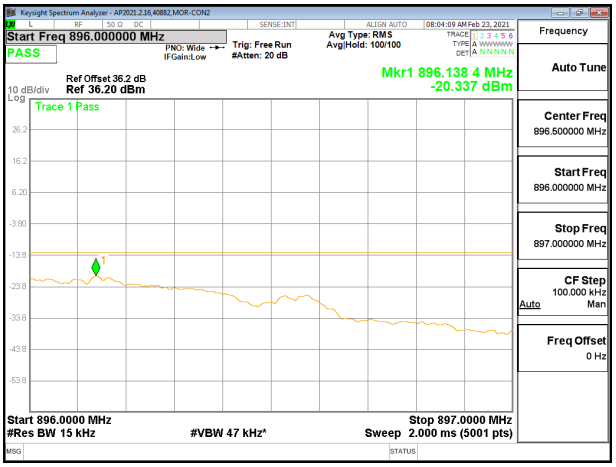
High Range Plot 2: 512



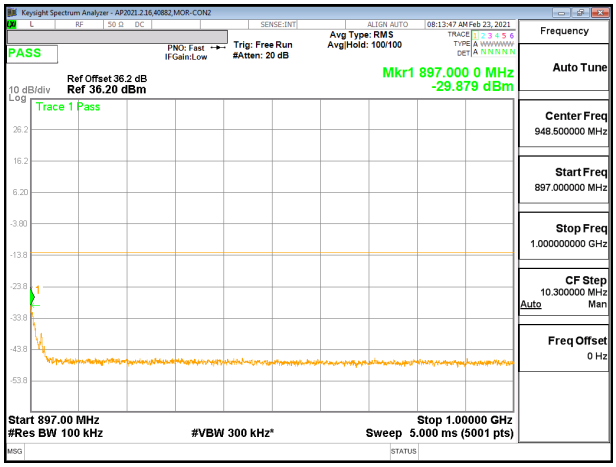
High Range Plot 1: 768



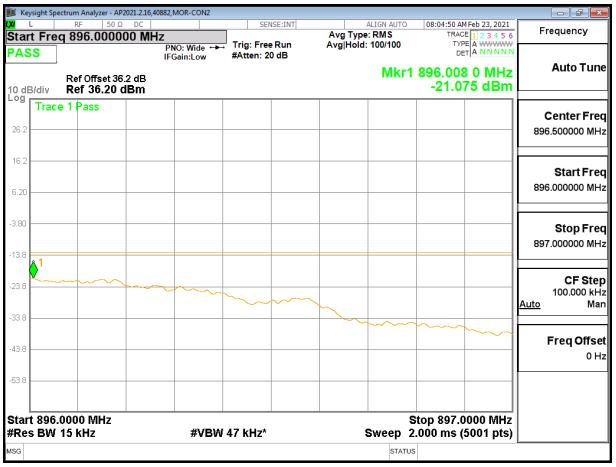
High Range Plot 2: 768



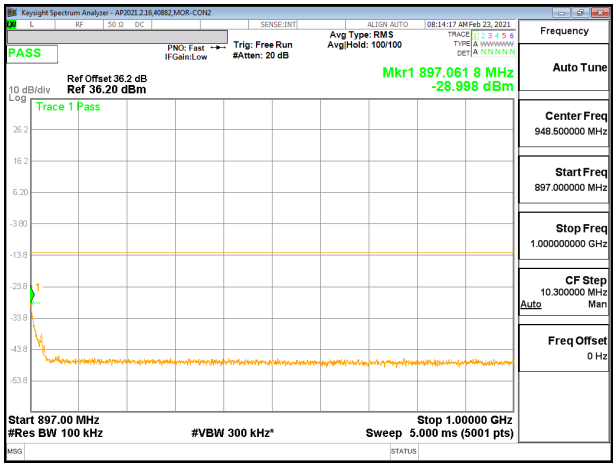
High Range Plot 1: 1024



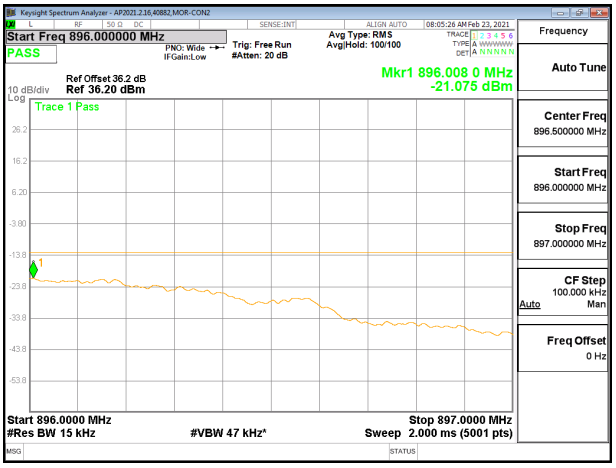
High Range Plot 2: 1024



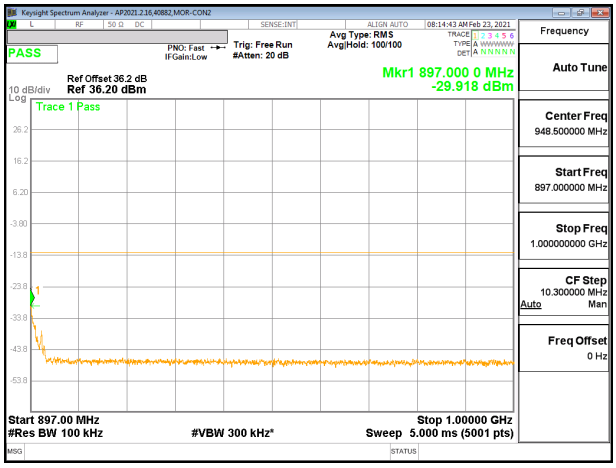
High Range Plot 1: 1536



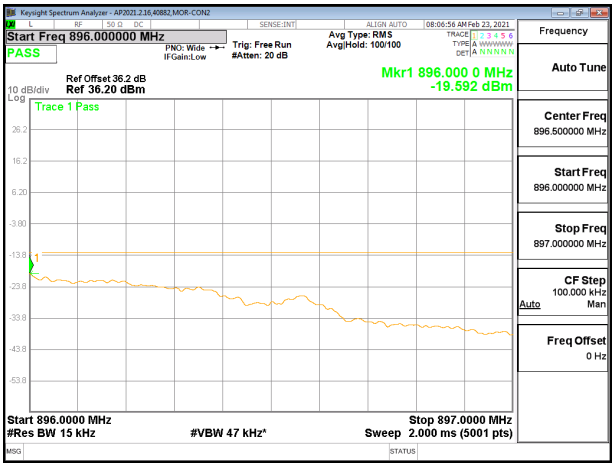
High Range Plot 2: 1536



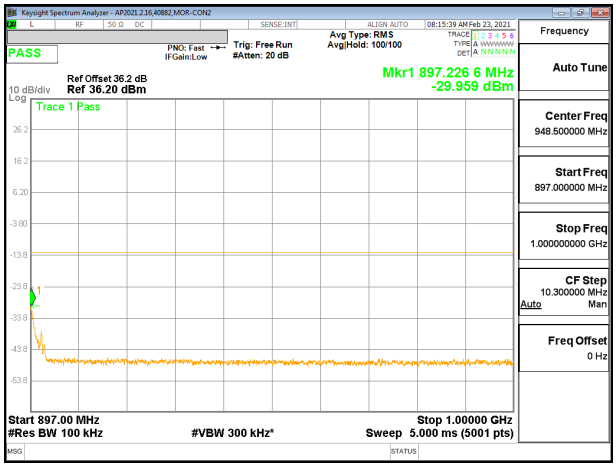
High Range Plot 1: 2048



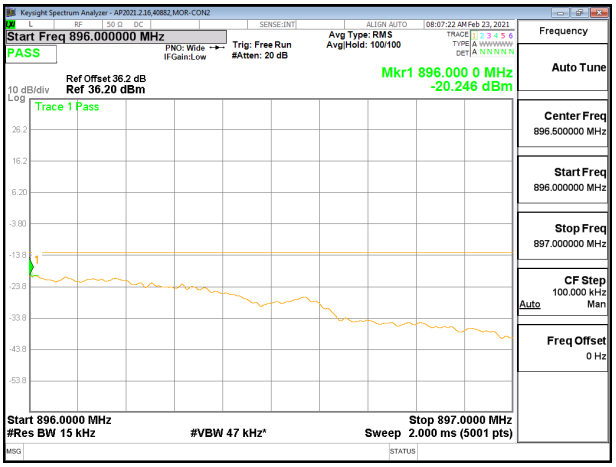
High Range Plot 2: 2048



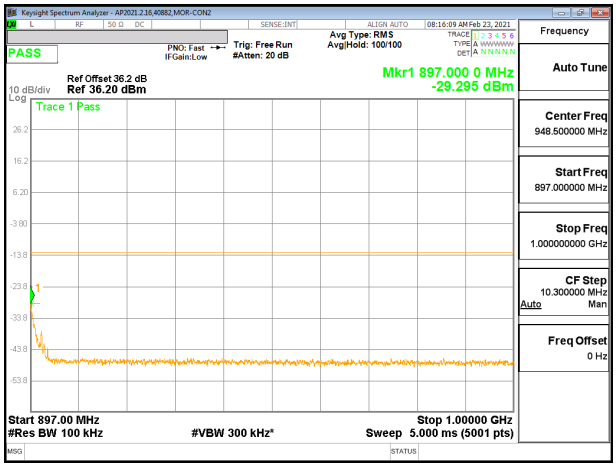
High Range Plot 1: 3072



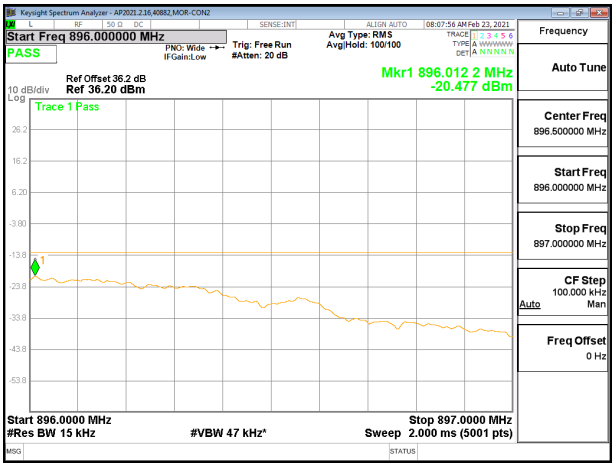
High Range Plot 2: 3072



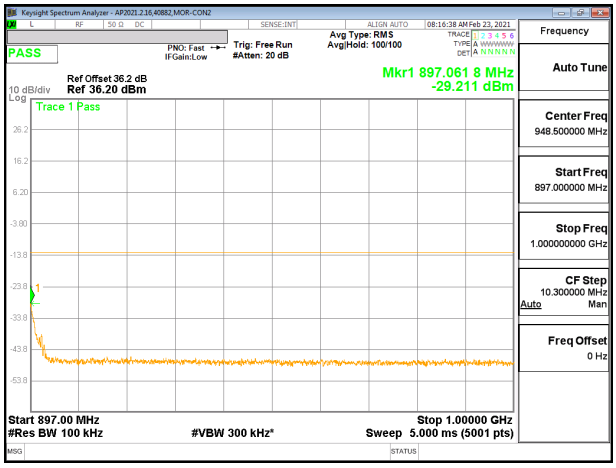
High Range Plot 1: 4096



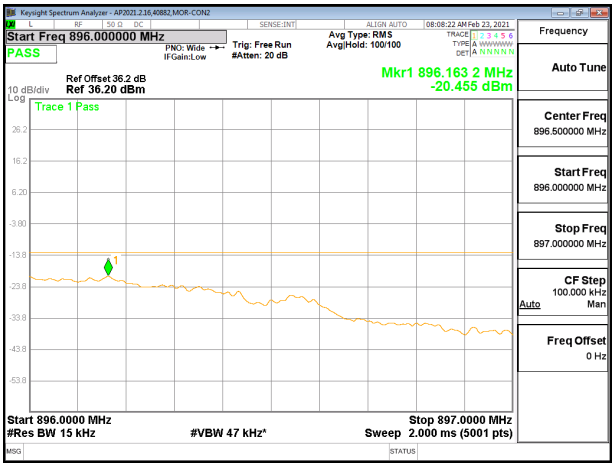
High Range Plot 2: 4096



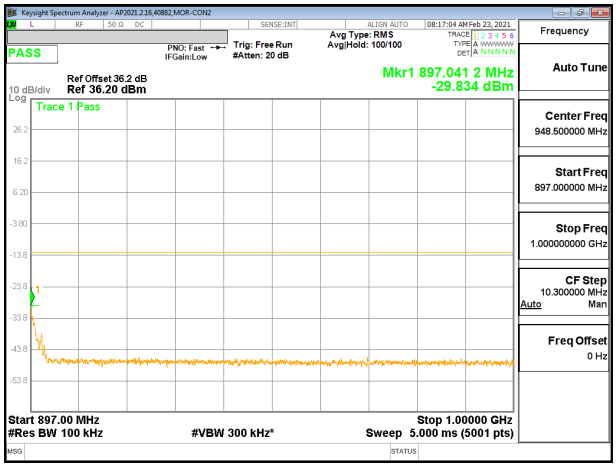
High Range Plot 1: 6144



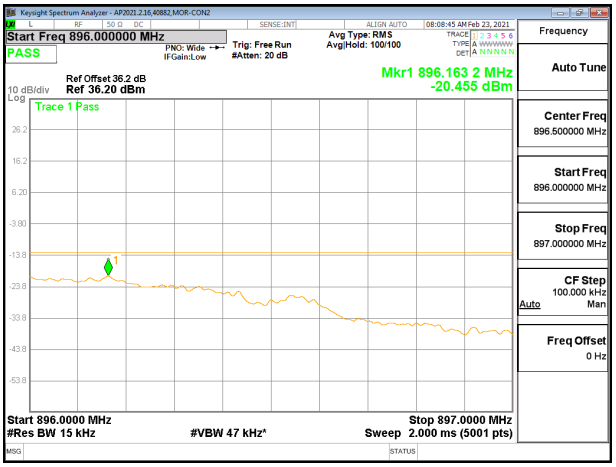
High Range Plot 2: 6144



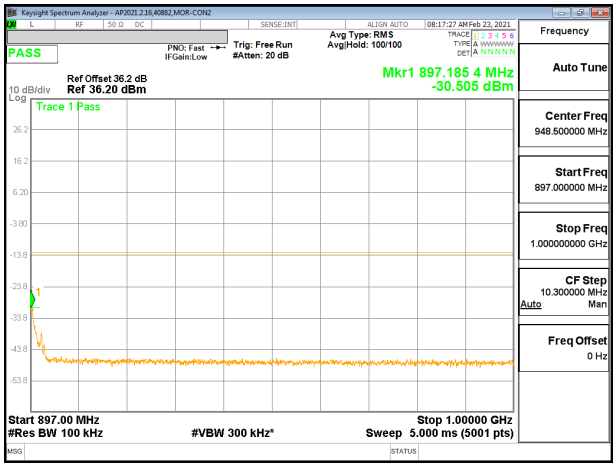
High Range Plot 1: 8192



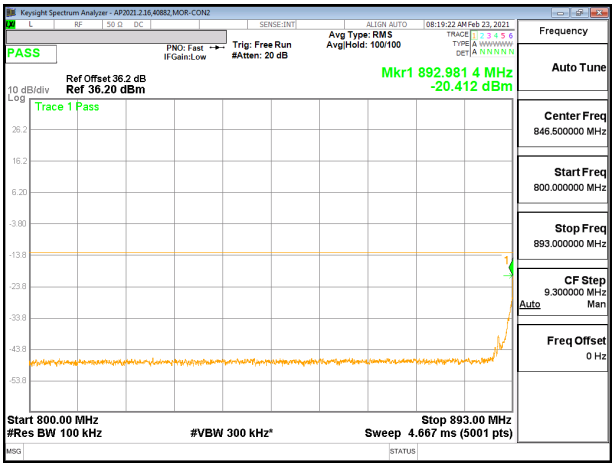
High Range Plot 2: 8192



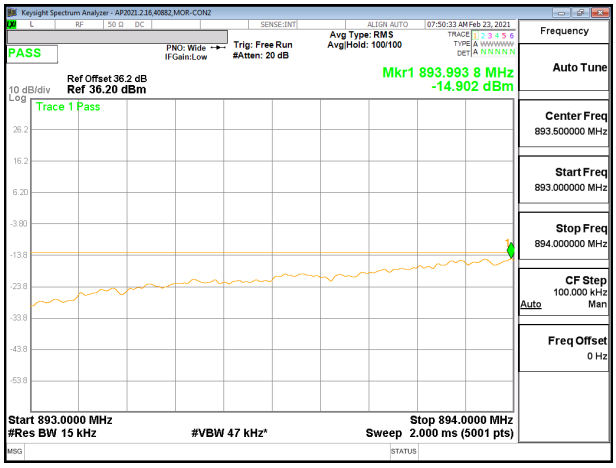
High Range Plot 1: 12288



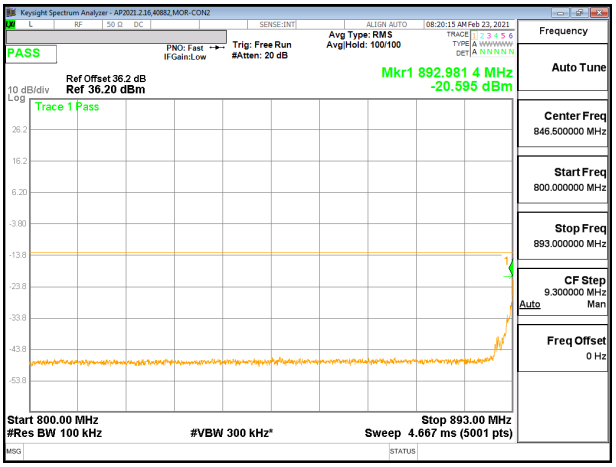
High Range Plot 2: 12288



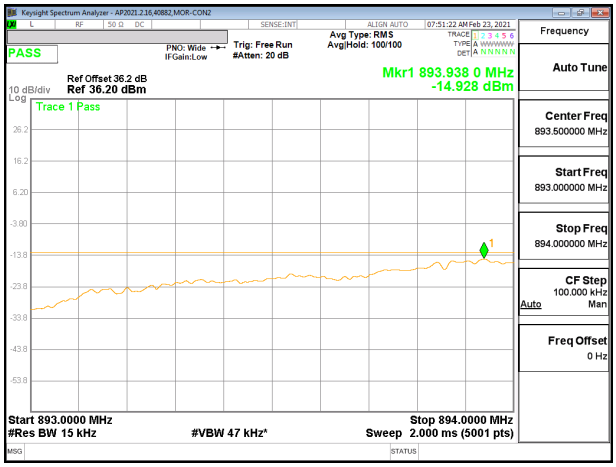
Low Range Plot 1: 128



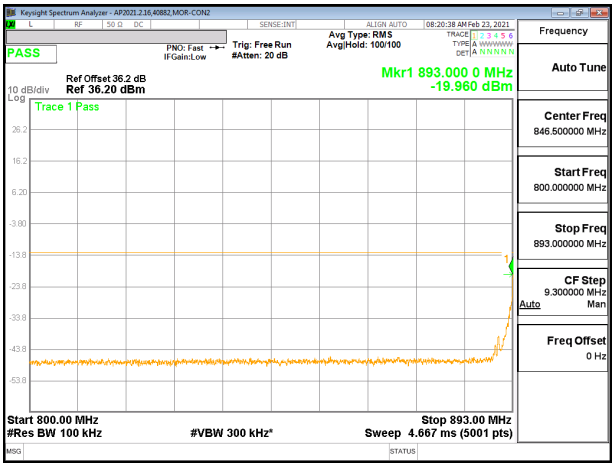
Low Range Plot 2: 128



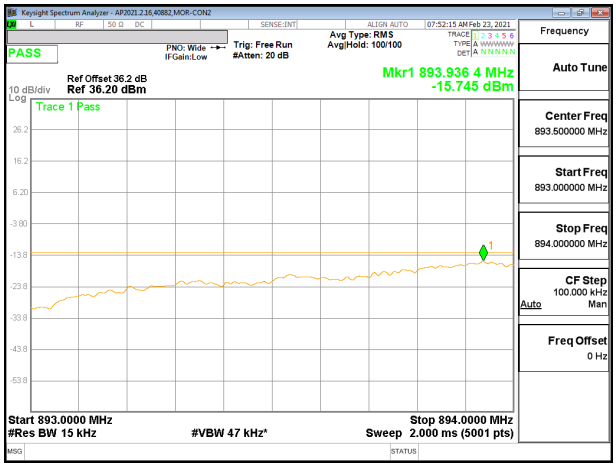
Low Range Plot 1: 256



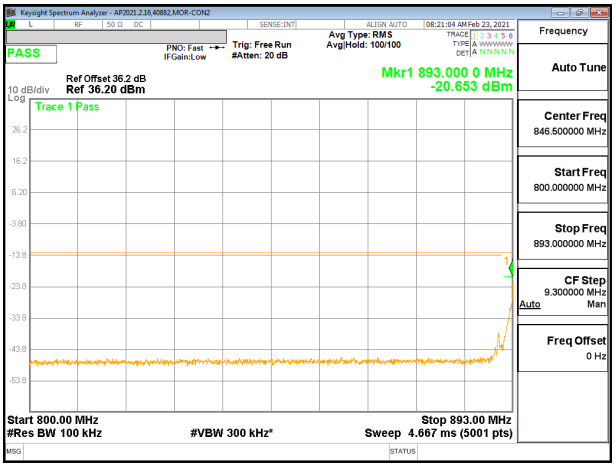
Low Range Plot 2: 256



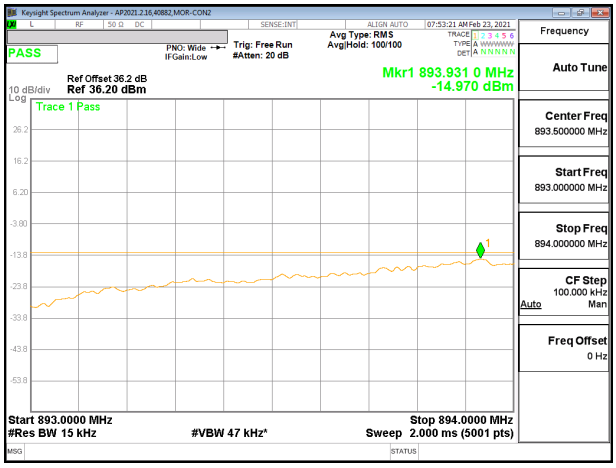
Low Range Plot 1: 512



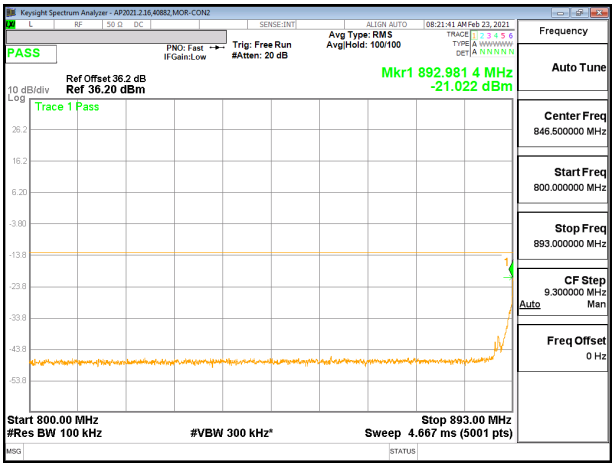
Low Range Plot 2: 512



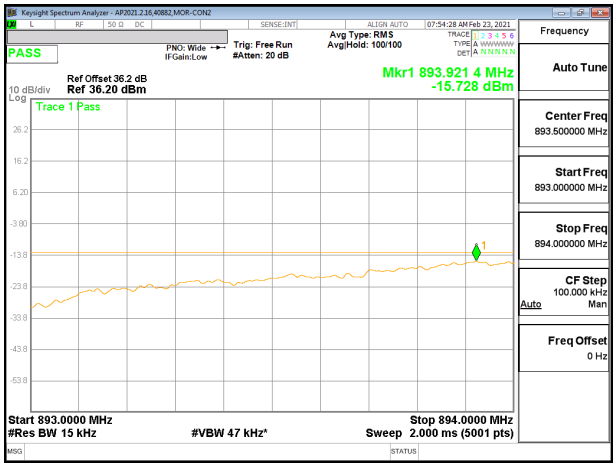
Low Range Plot 1: 768



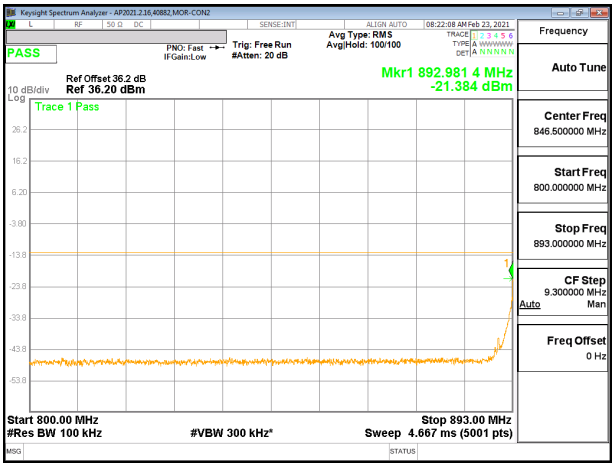
Low Range Plot 2: 768



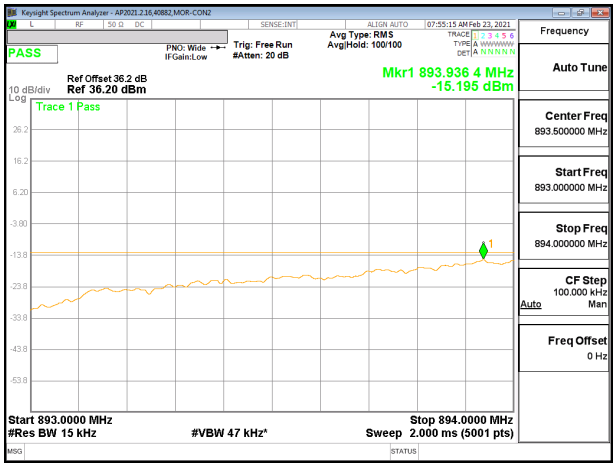
Low Range Plot 1: 1024



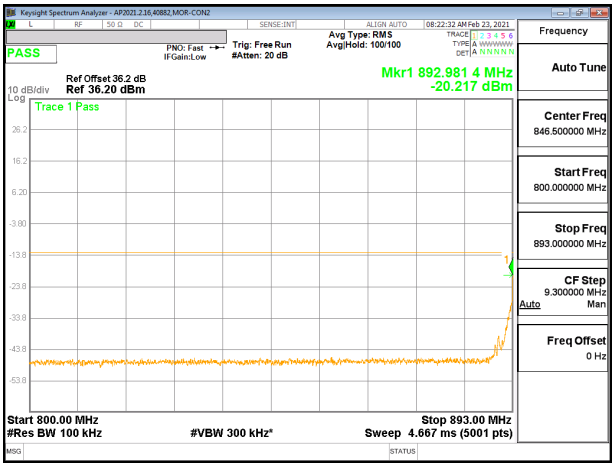
Low Range Plot 2: 1024



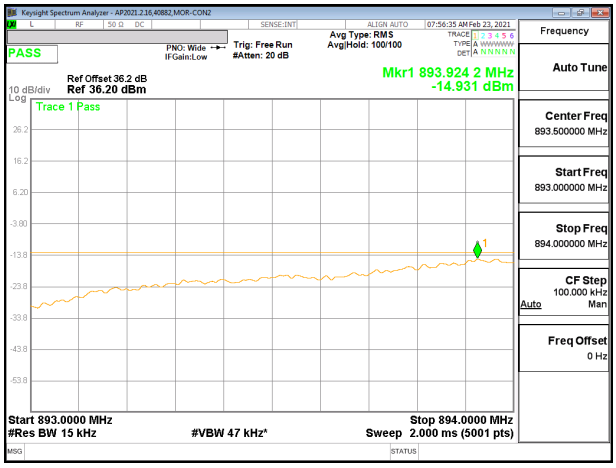
Low Range Plot 1: 1536



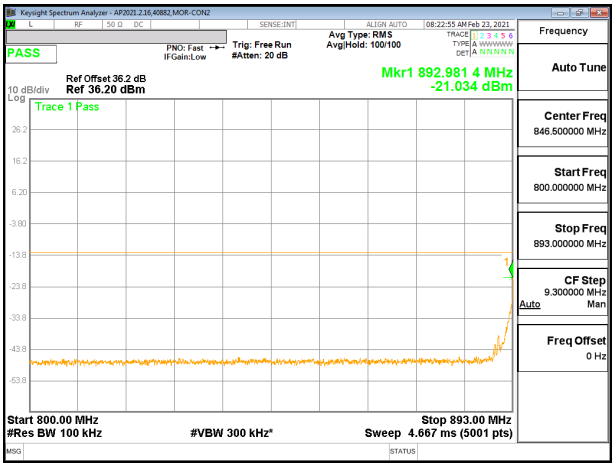
Low Range Plot 2: 1536



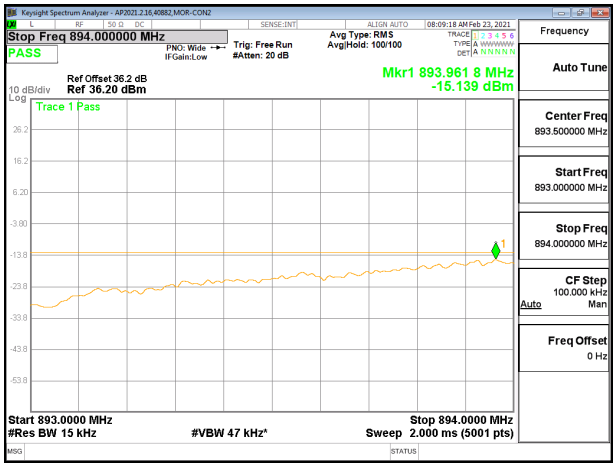
Low Range Plot 1: 2048



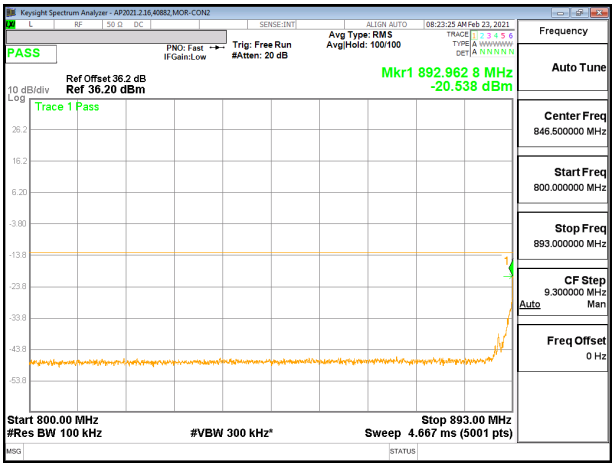
Low Range Plot 2: 2048



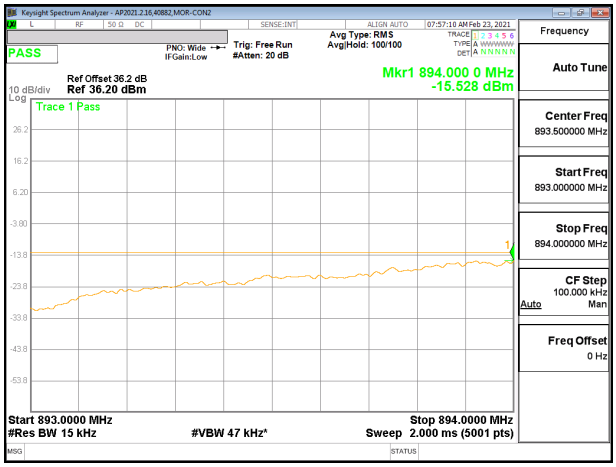
Low Range Plot 1: 3072



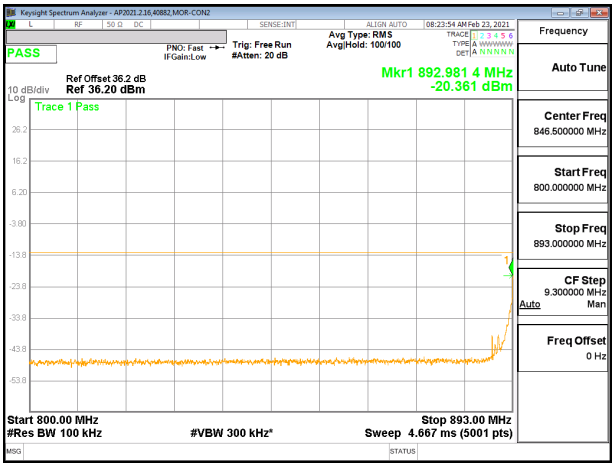
Low Range Plot 2: 3072



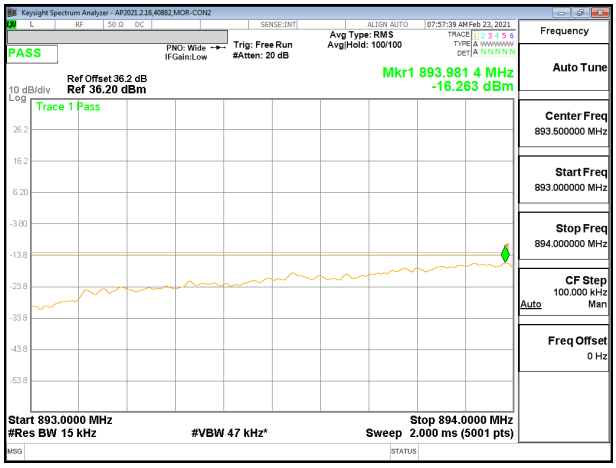
Low Range Plot 1: 4096



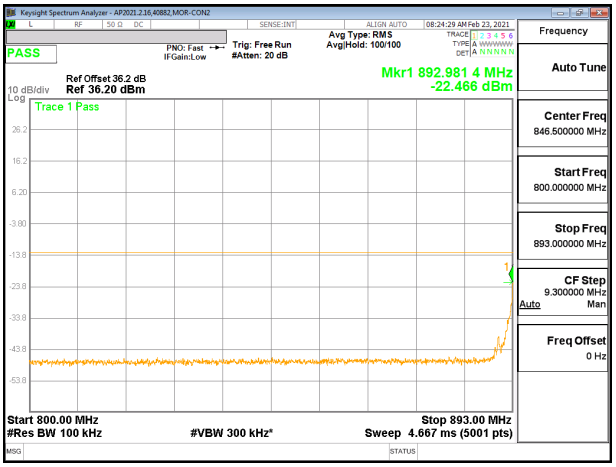
Low Range Plot 2: 4096



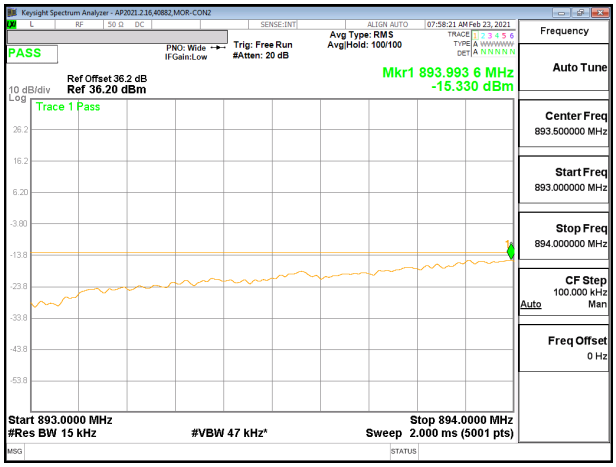
Low Range Plot 1: 6144



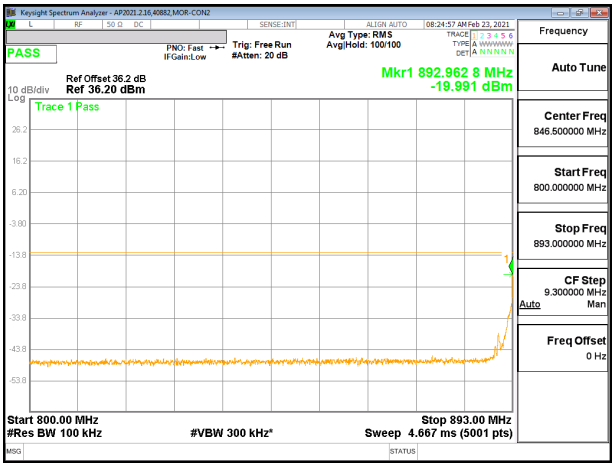
Low Range Plot 2: 6144



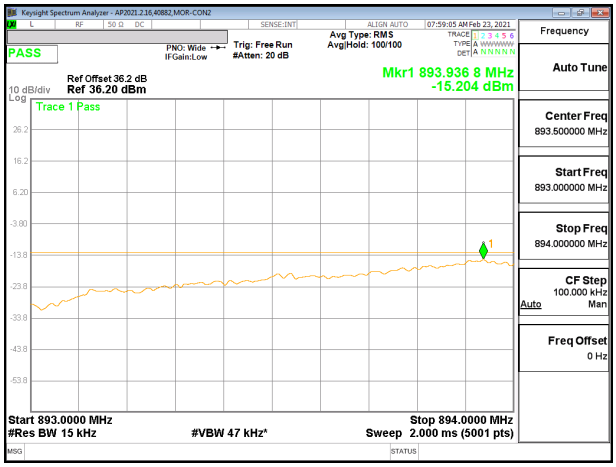
Low Range Plot 1: 8192



Low Range Plot 2: 8192



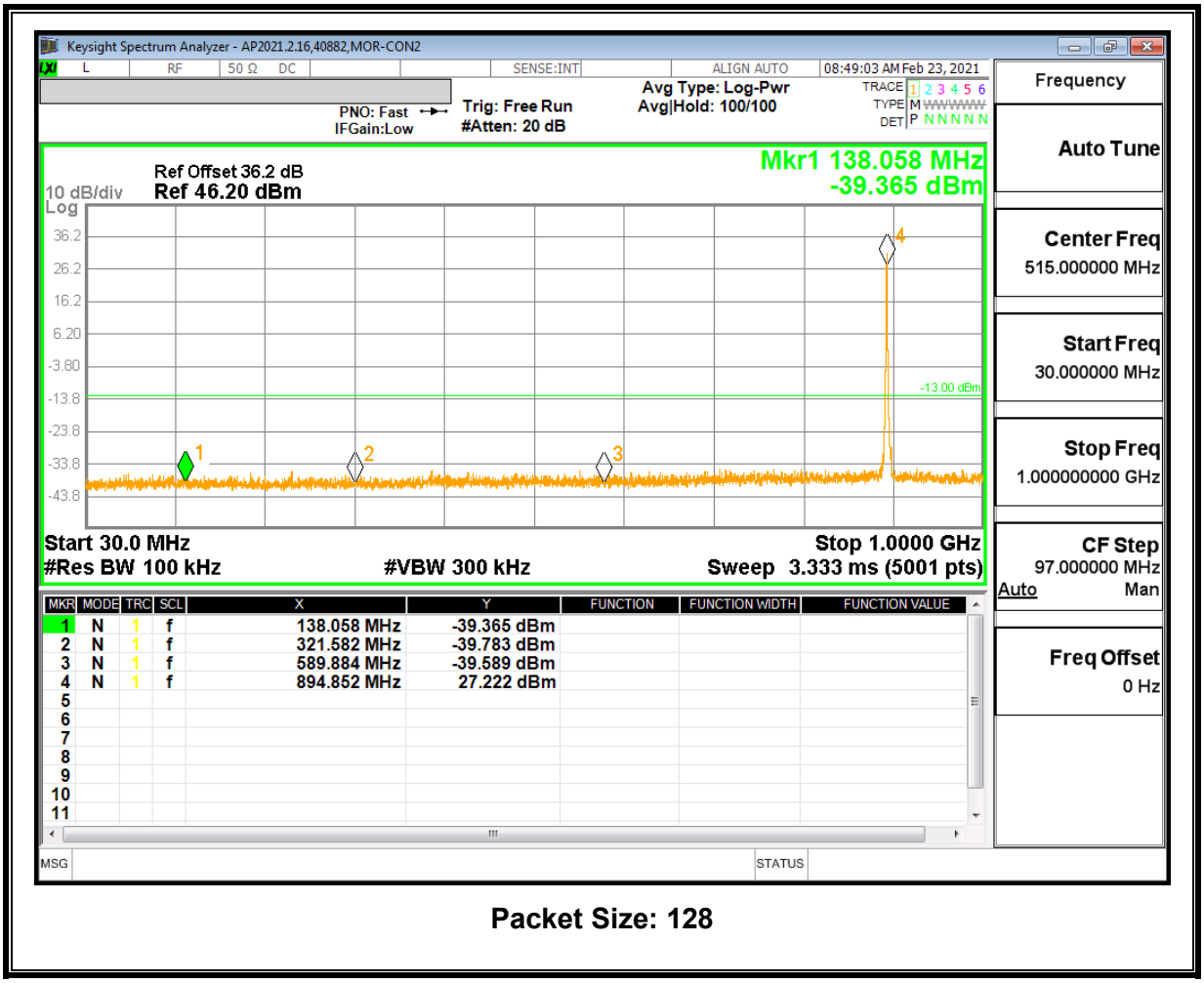
Low Range Plot 1: 12288



Low Range Plot 2: 12288

8.3.2 Conducted Spurious Emissions

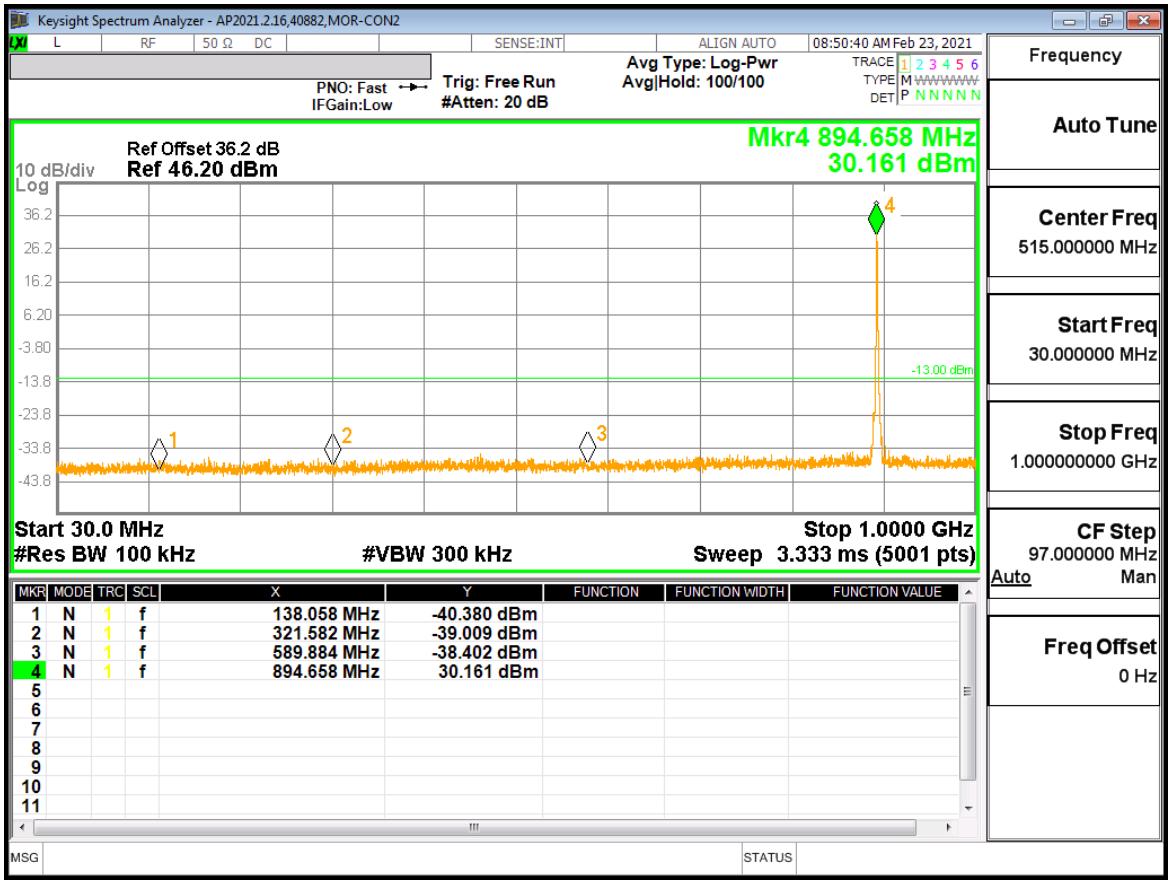
30-1000MHz



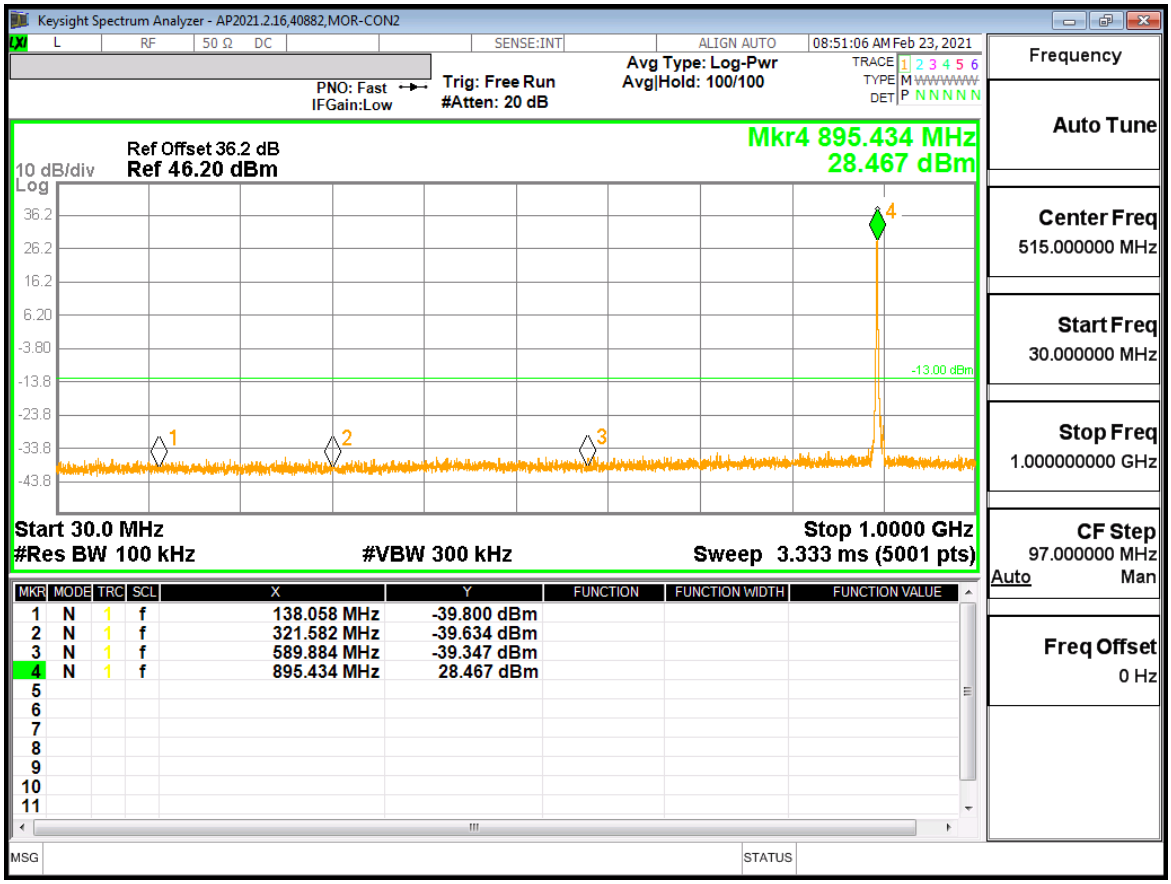
Packet Size: 128

Packet Size: 256

Packet Size: 512

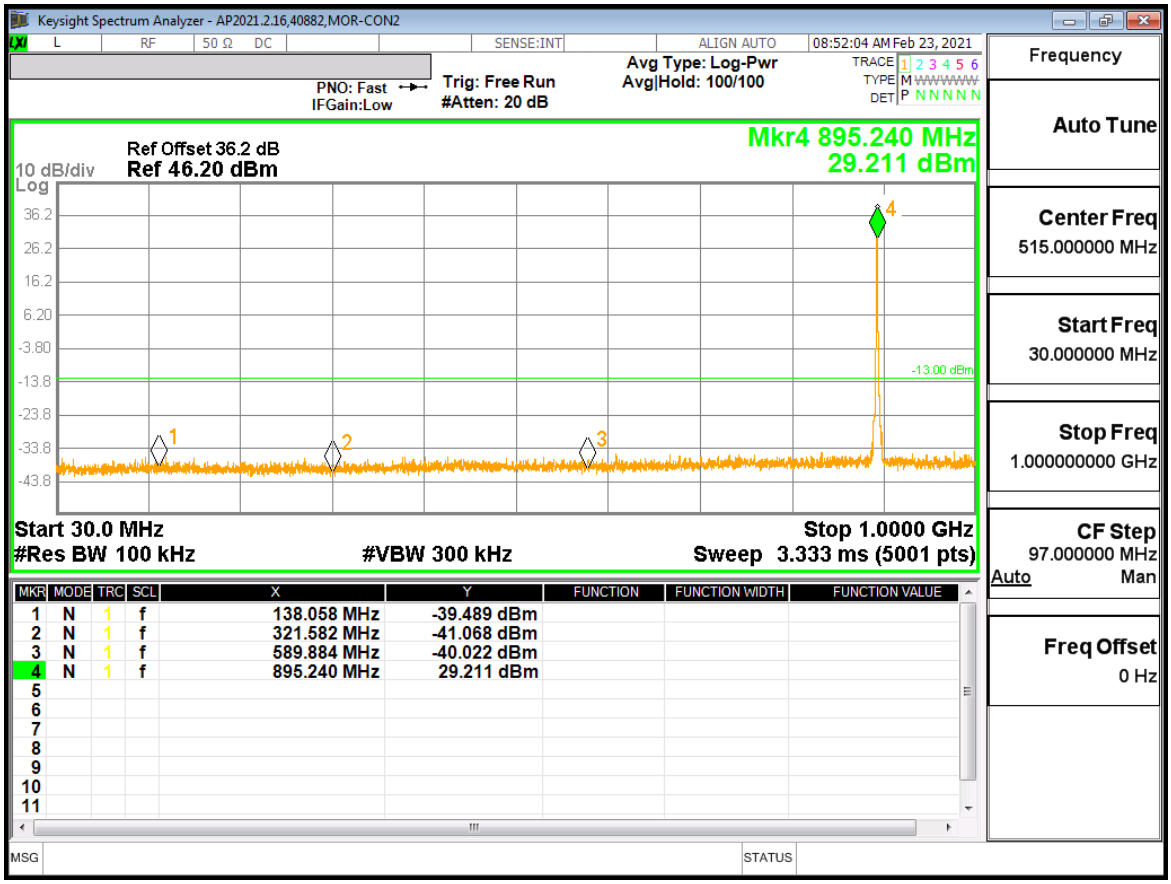


Packet Size: 768



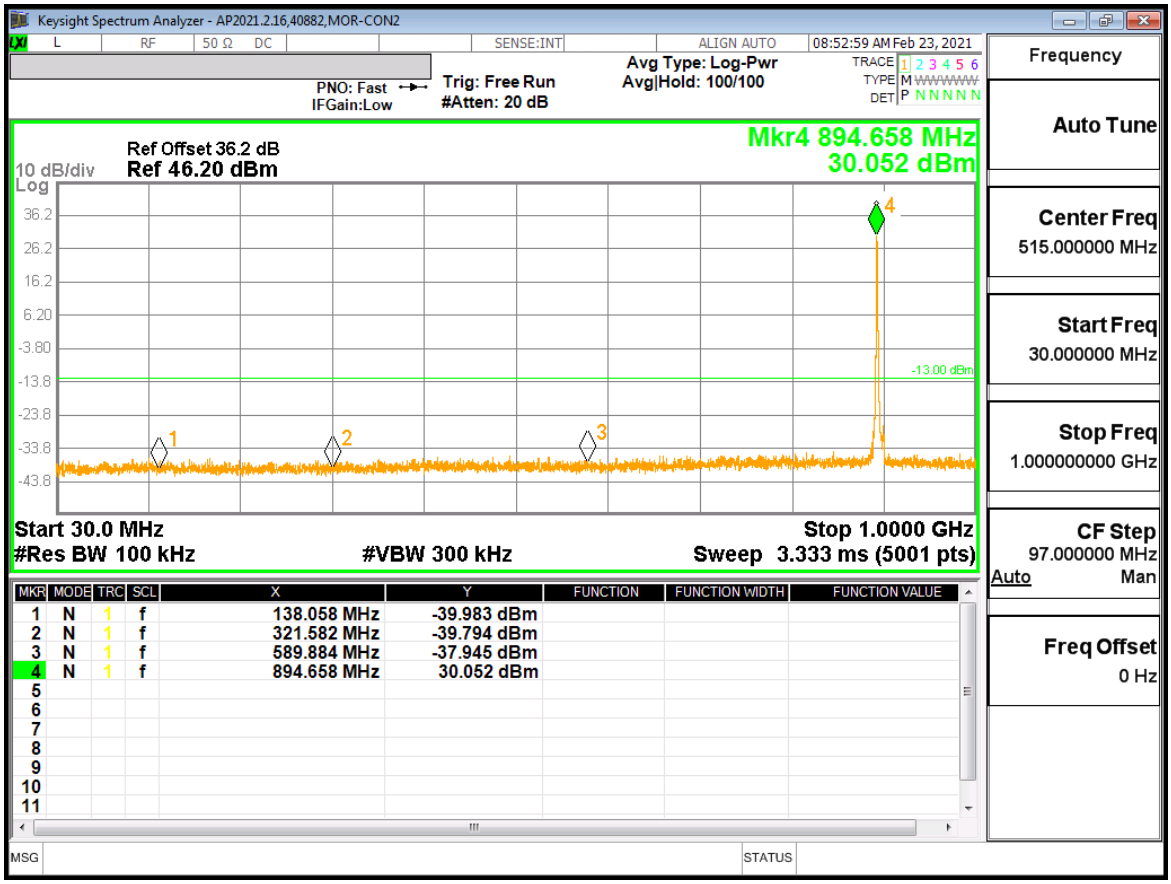
Packet Size: 1024

Packet Size: 1536

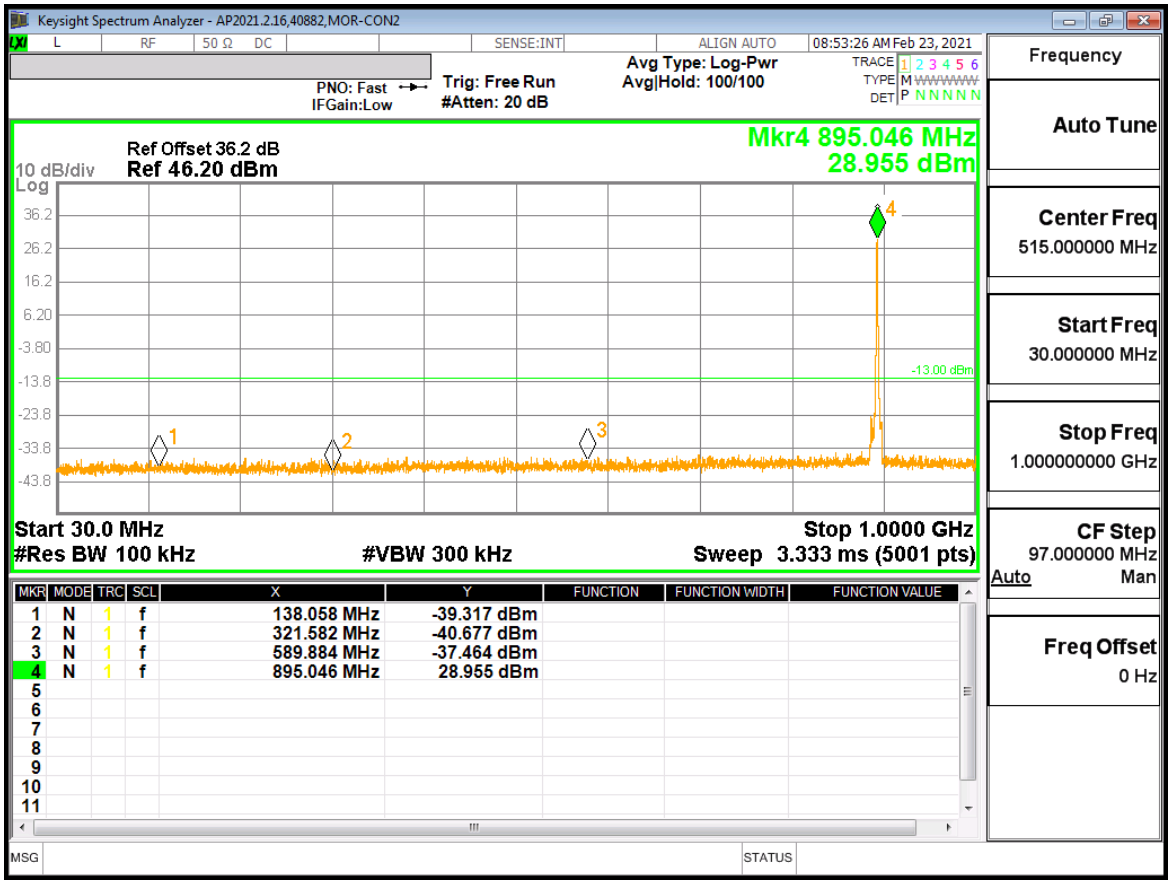


Packet Size: 2048

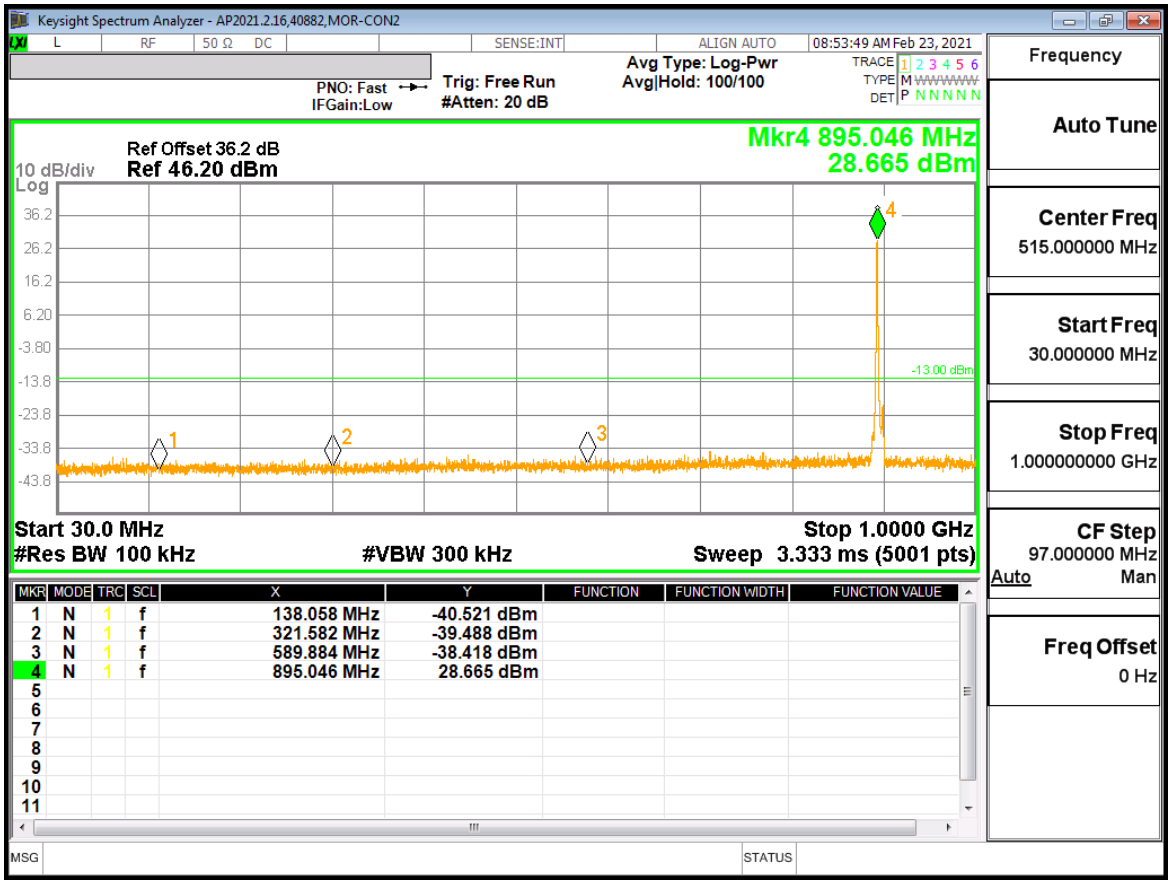
Packet Size: 3072



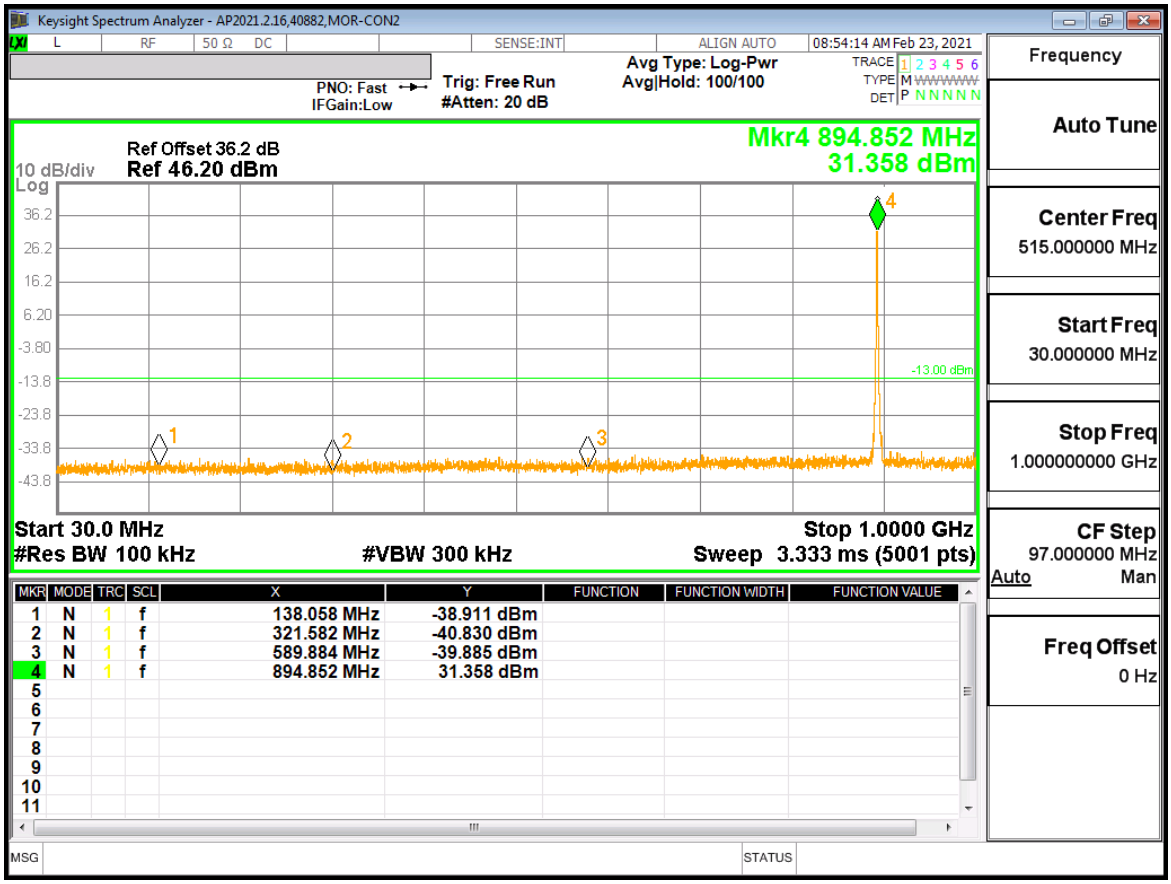
Packet Size: 4096



Packet Size: 6144

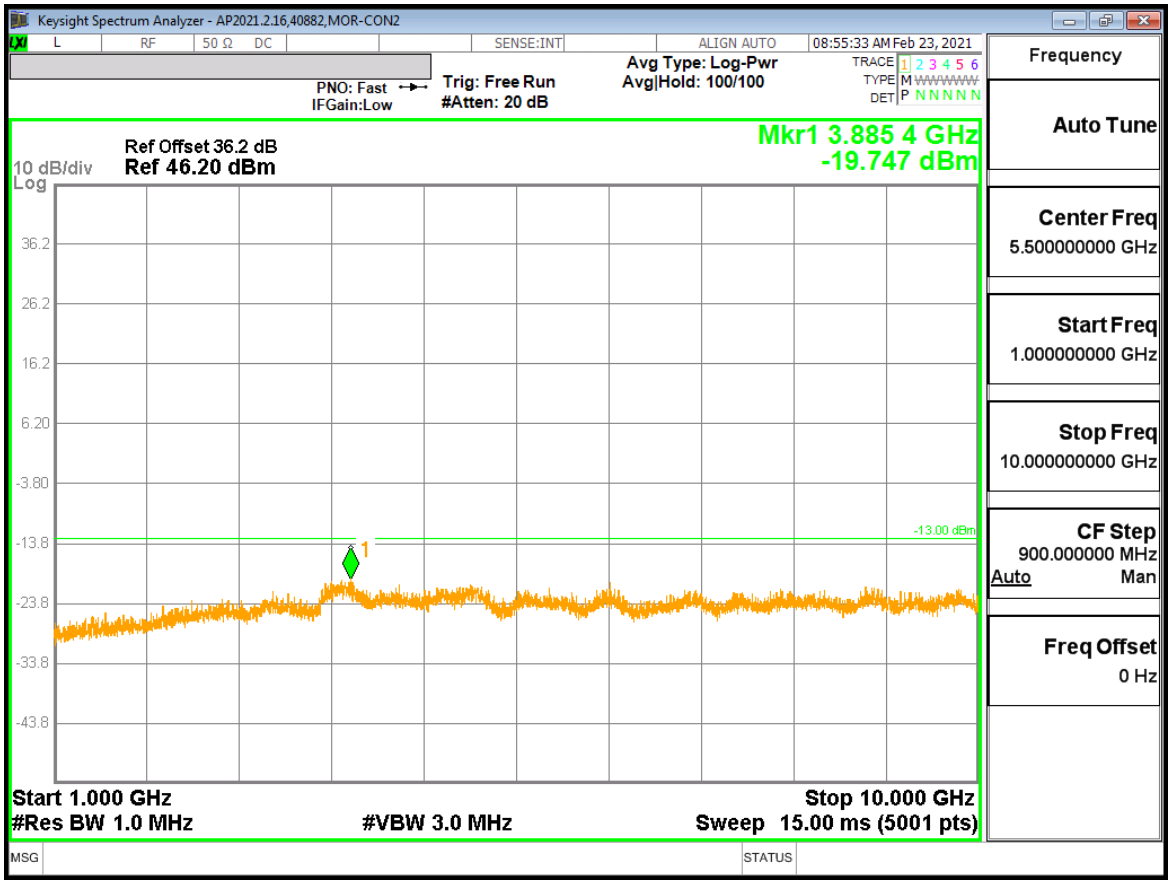


Packet Size: 8192

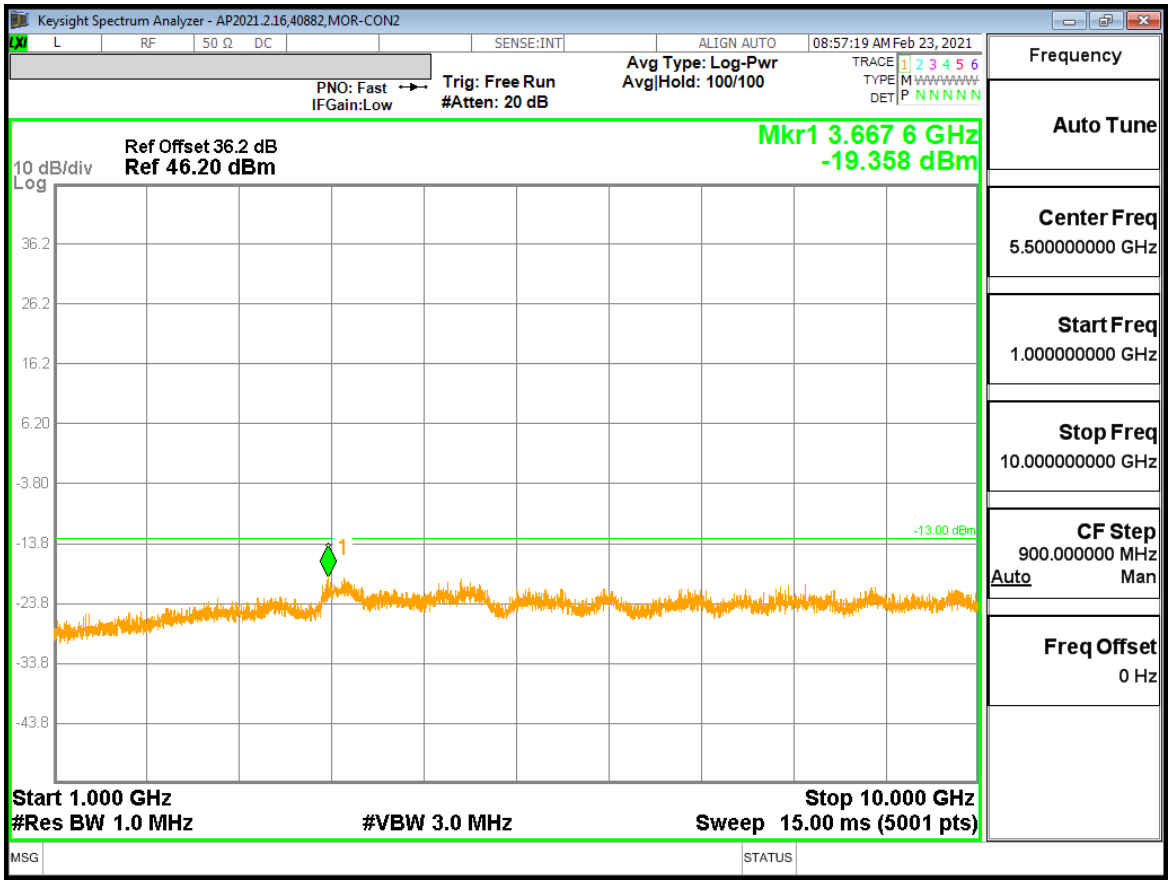


Packet Size: 12288

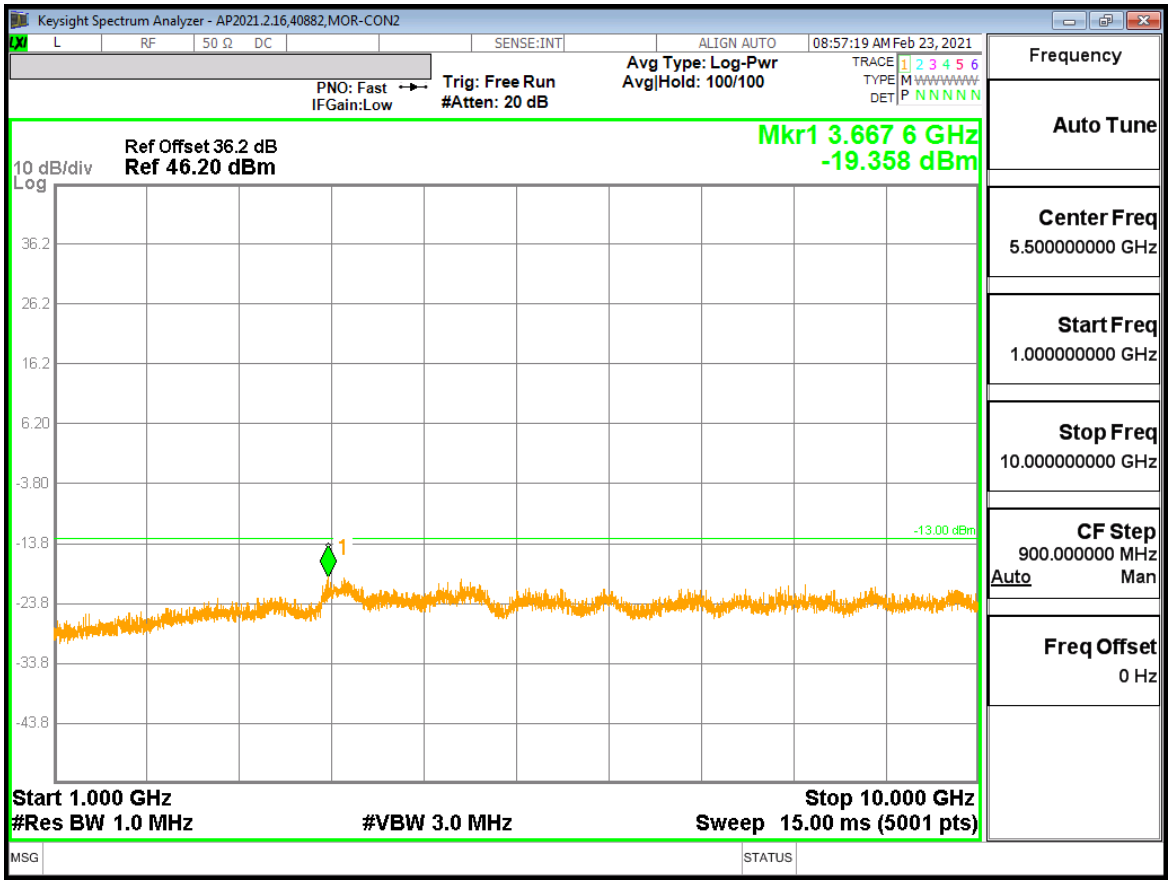
1-10GHz



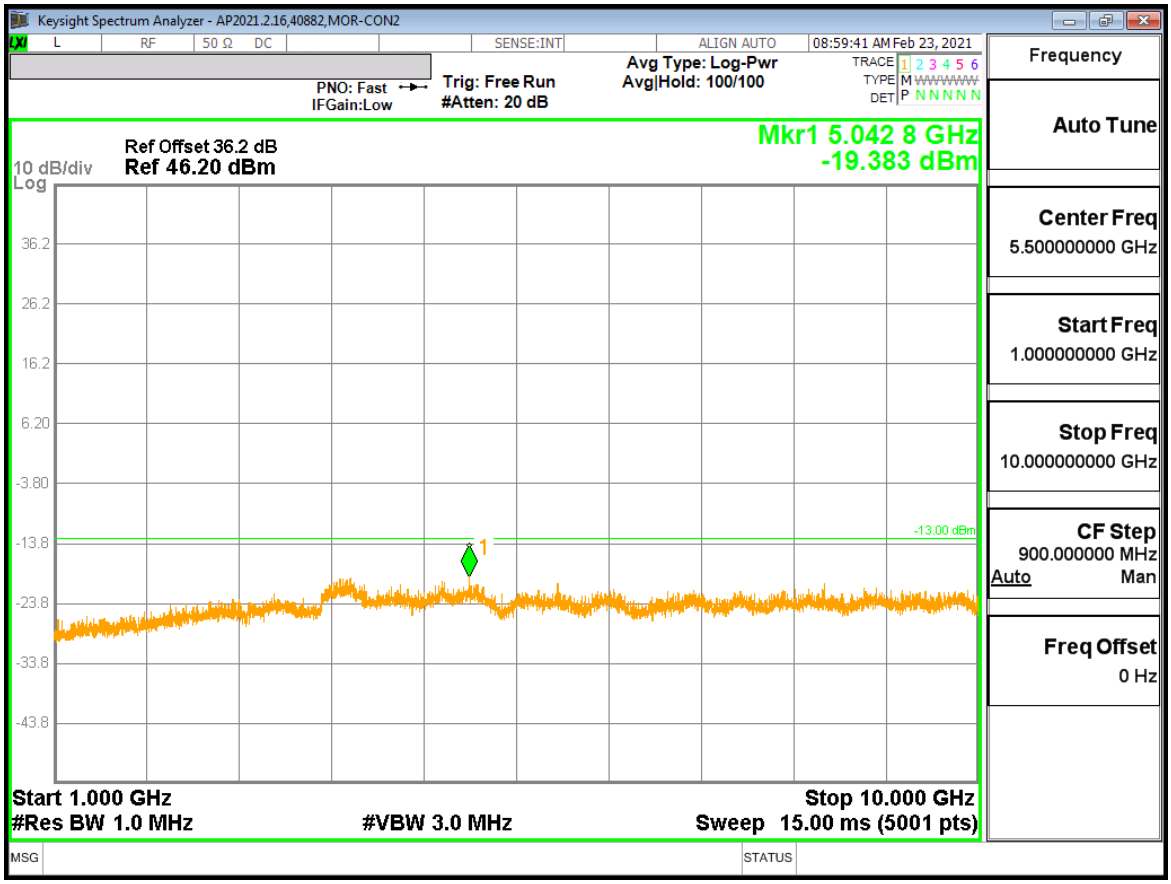
Packet Size: 128



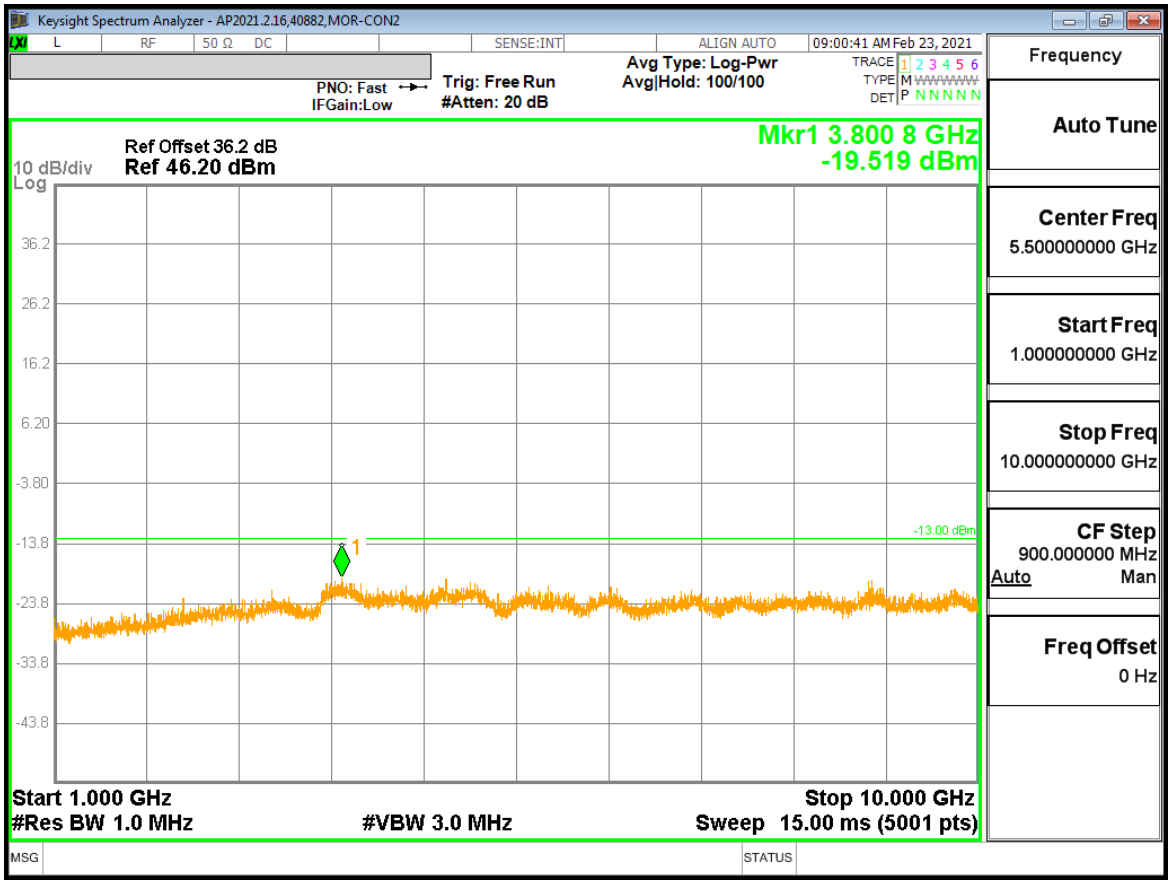
Packet Size: 256



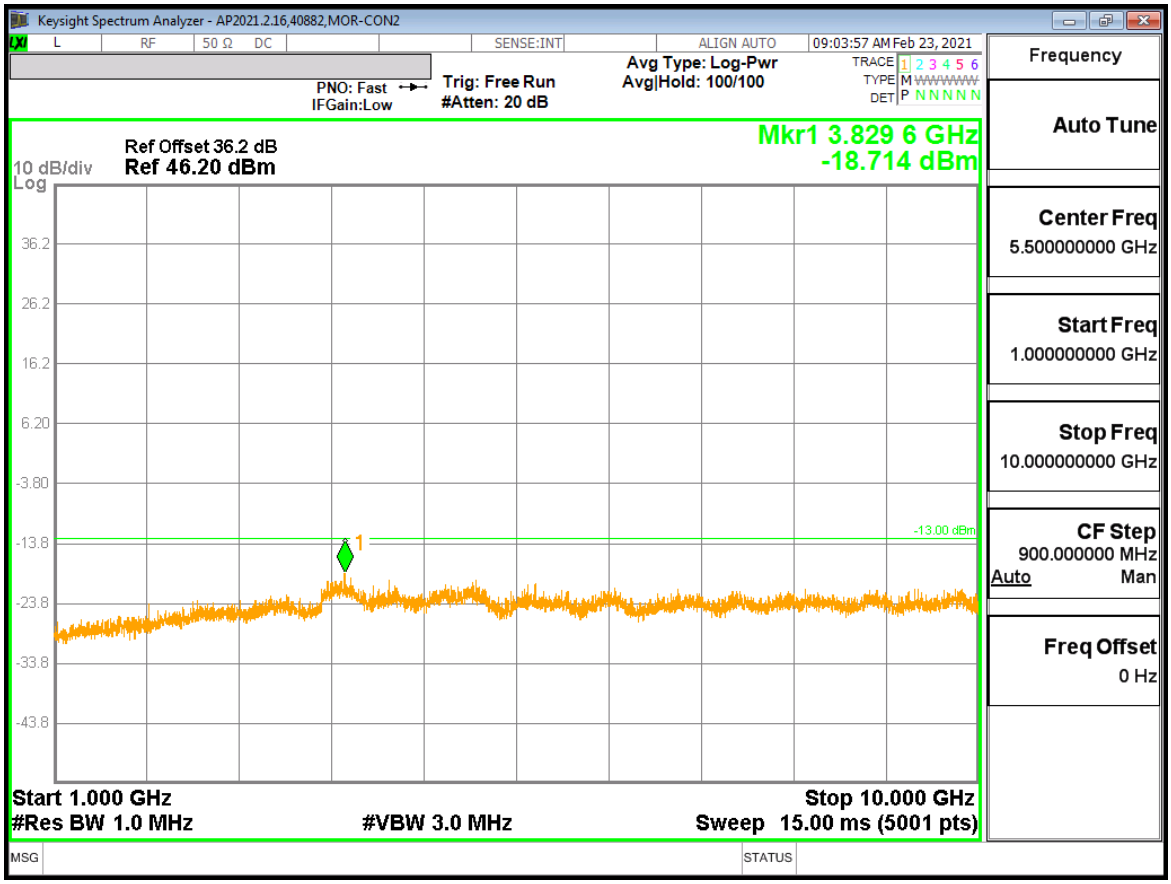
Packet Size: 512



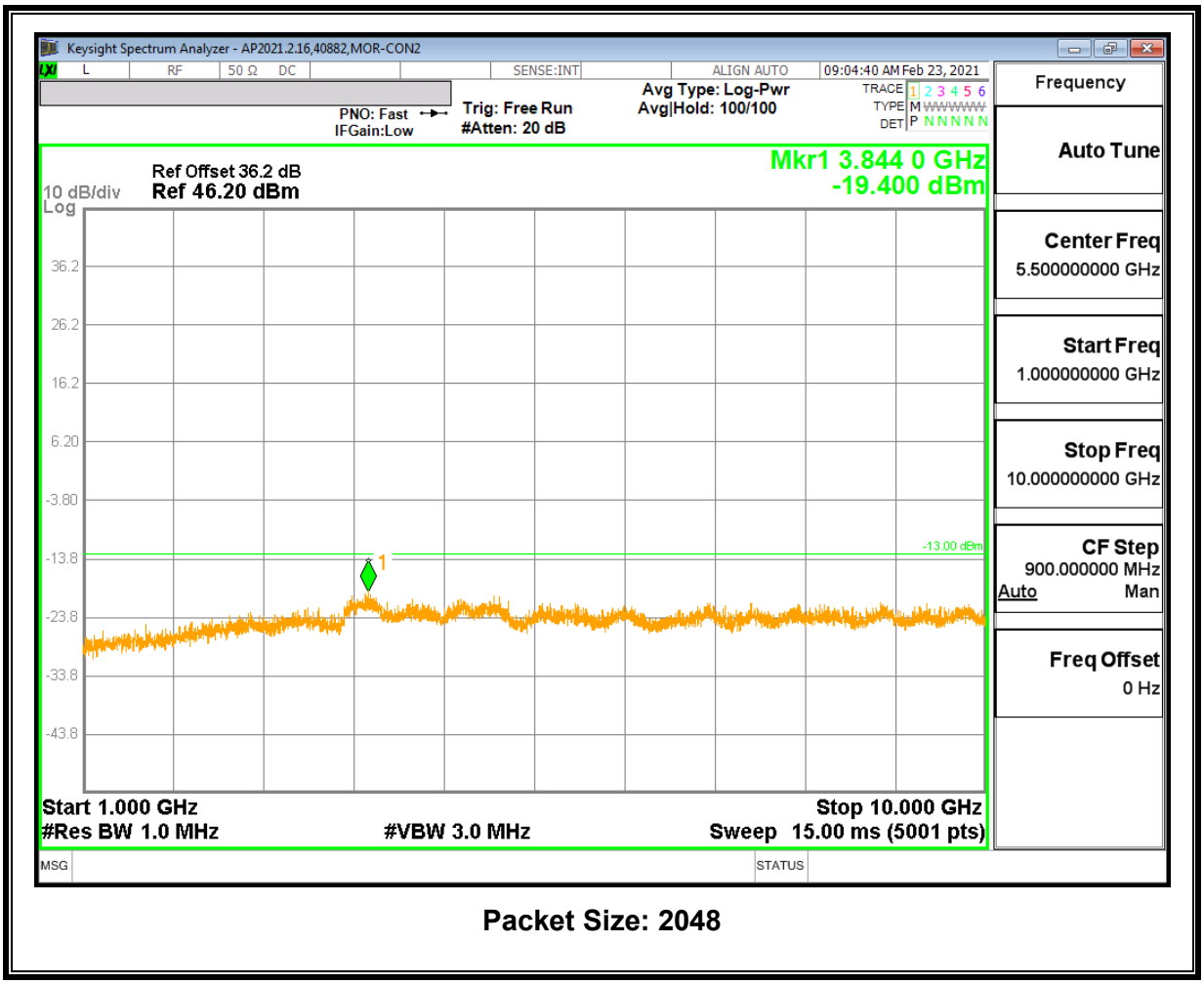
Packet Size: 768



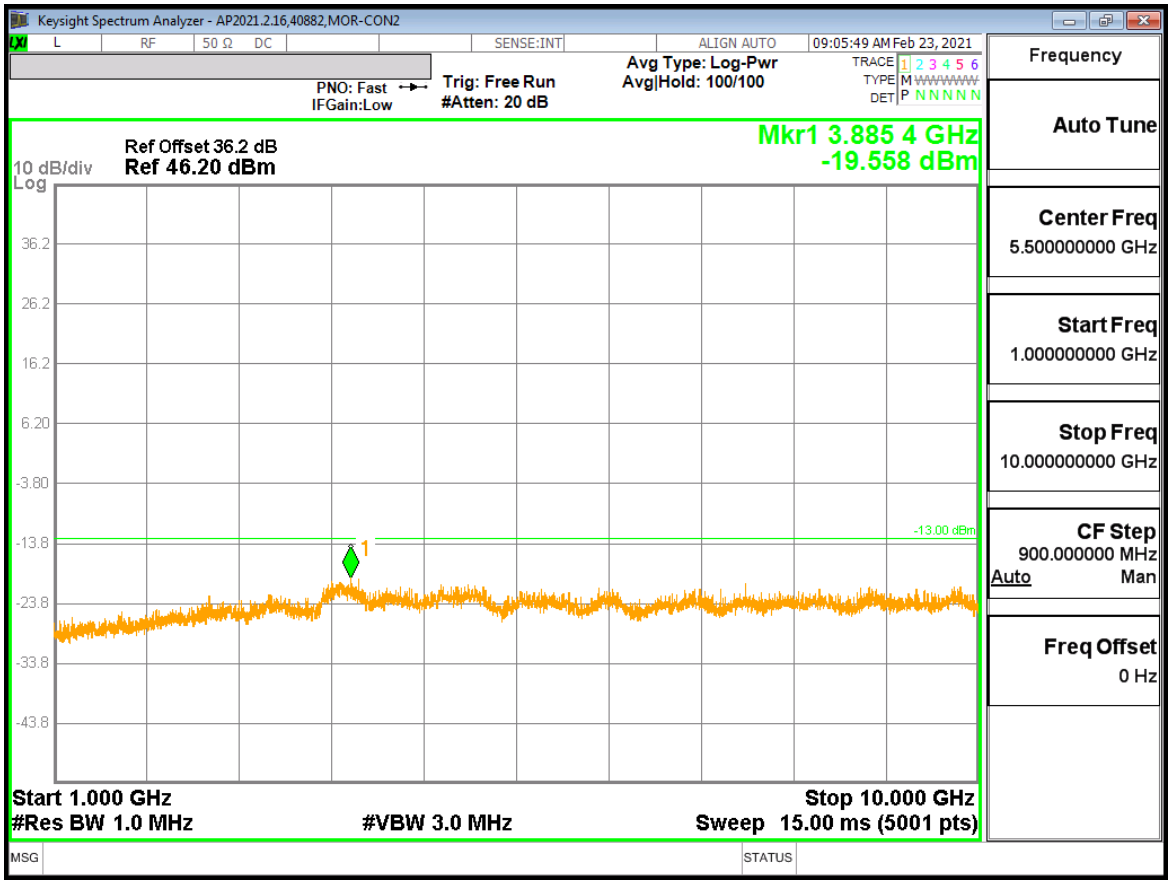
Packet Size: 1024



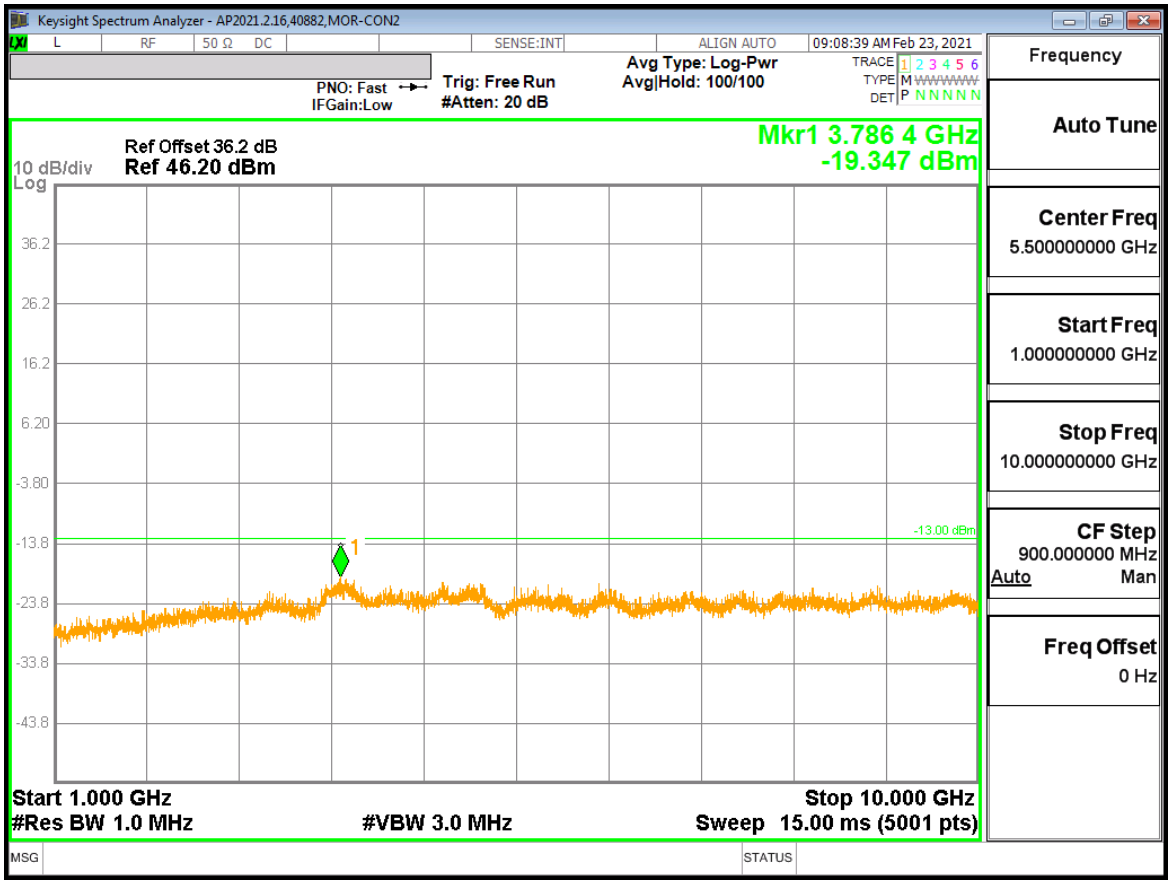
Packet Size: 1536



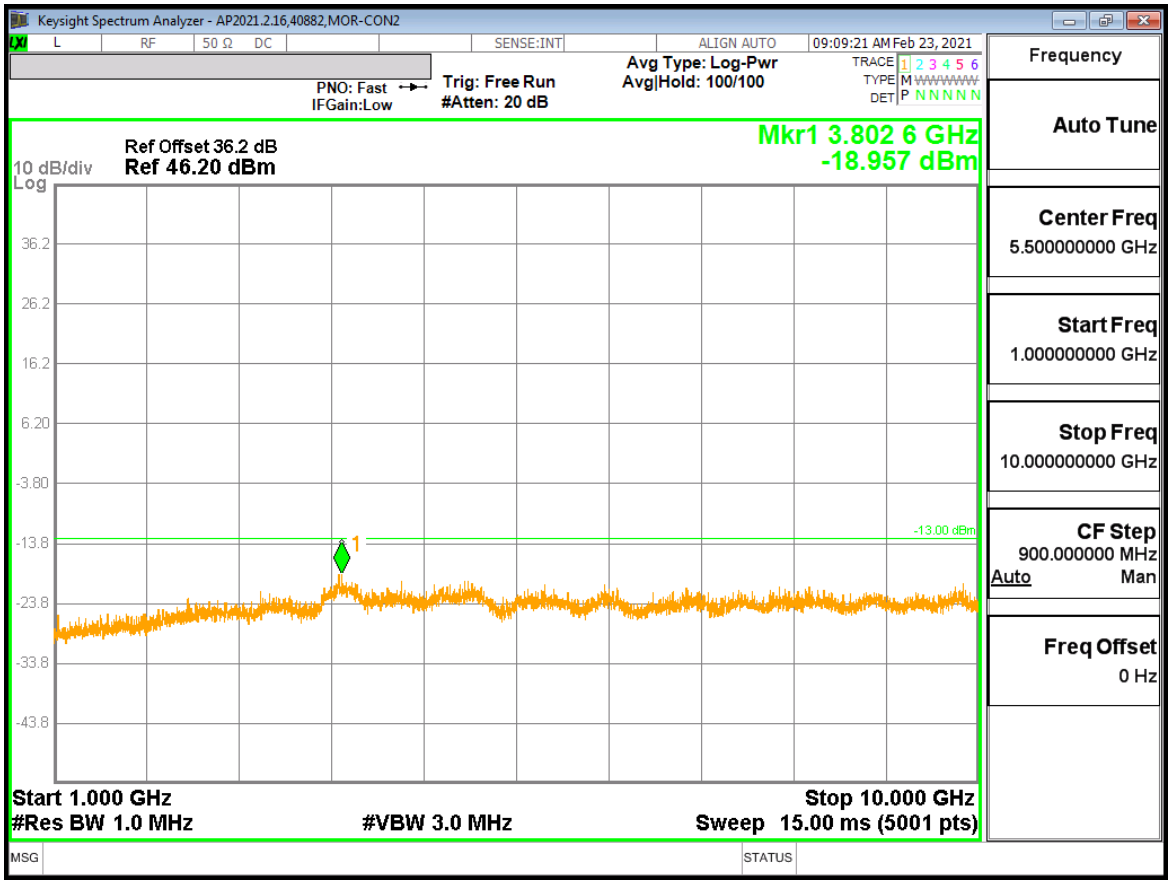
Packet Size: 2048



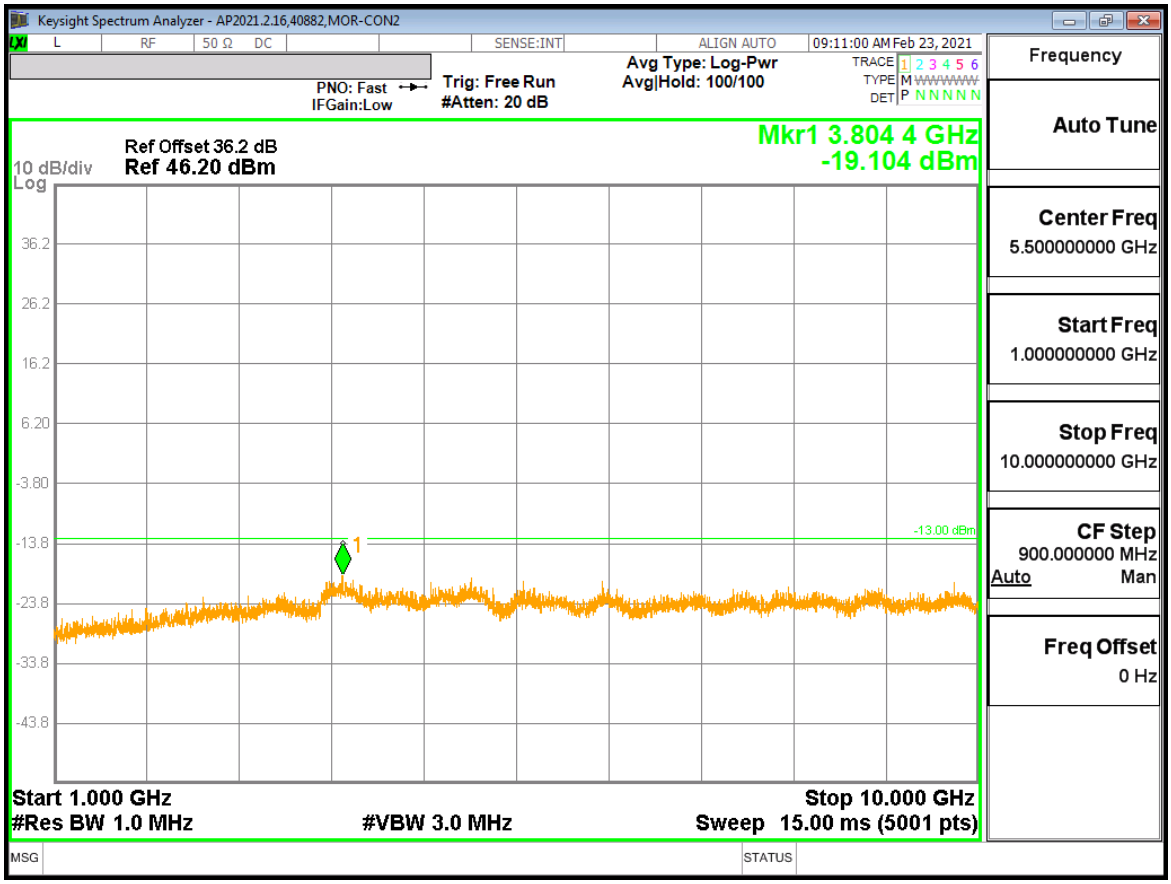
Packet Size: 3072



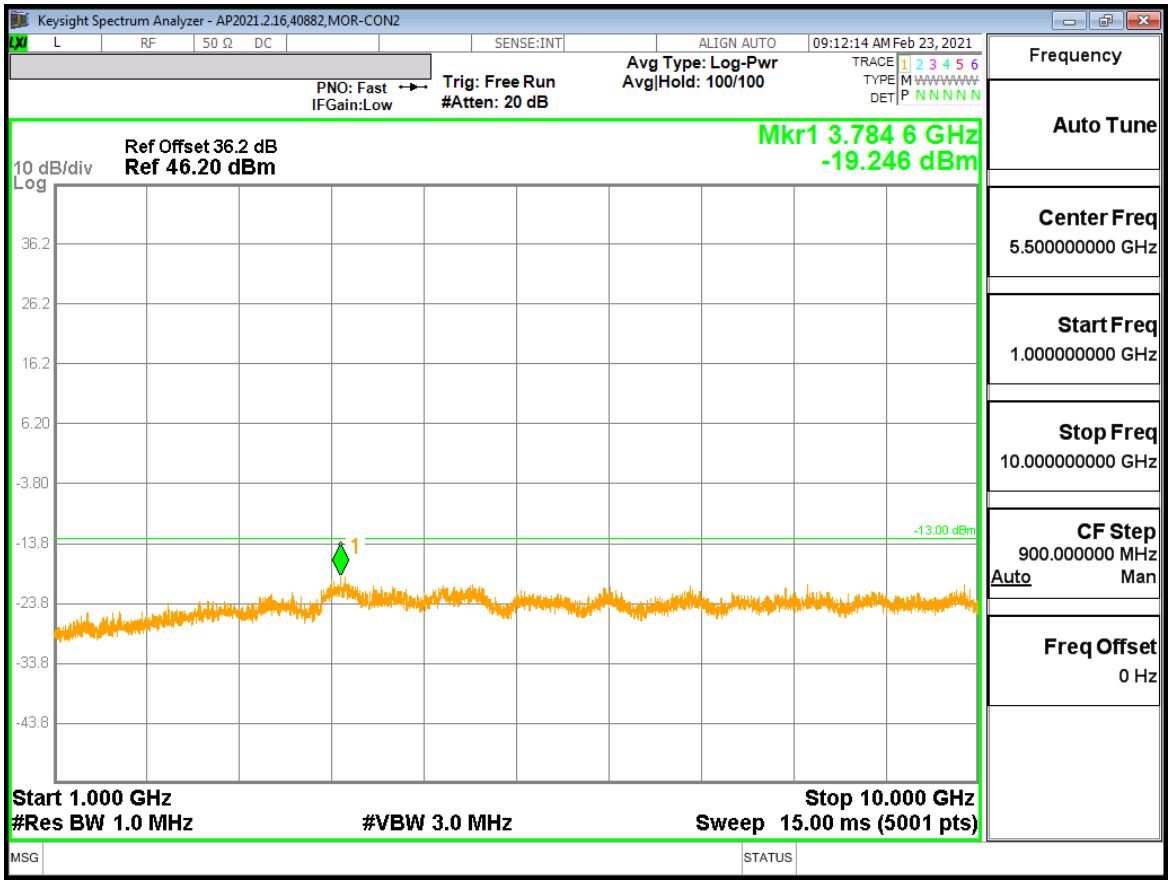
Packet Size: 4096



Packet Size: 6144



Packet Size: 8192



Packet Size: 12288

9. RADIATED TEST RESULTS

This report contains data provided by the applicant which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

9.1 FIELD STRENGTH OF SPURIOUS RADIATION ABOVE 1GHz

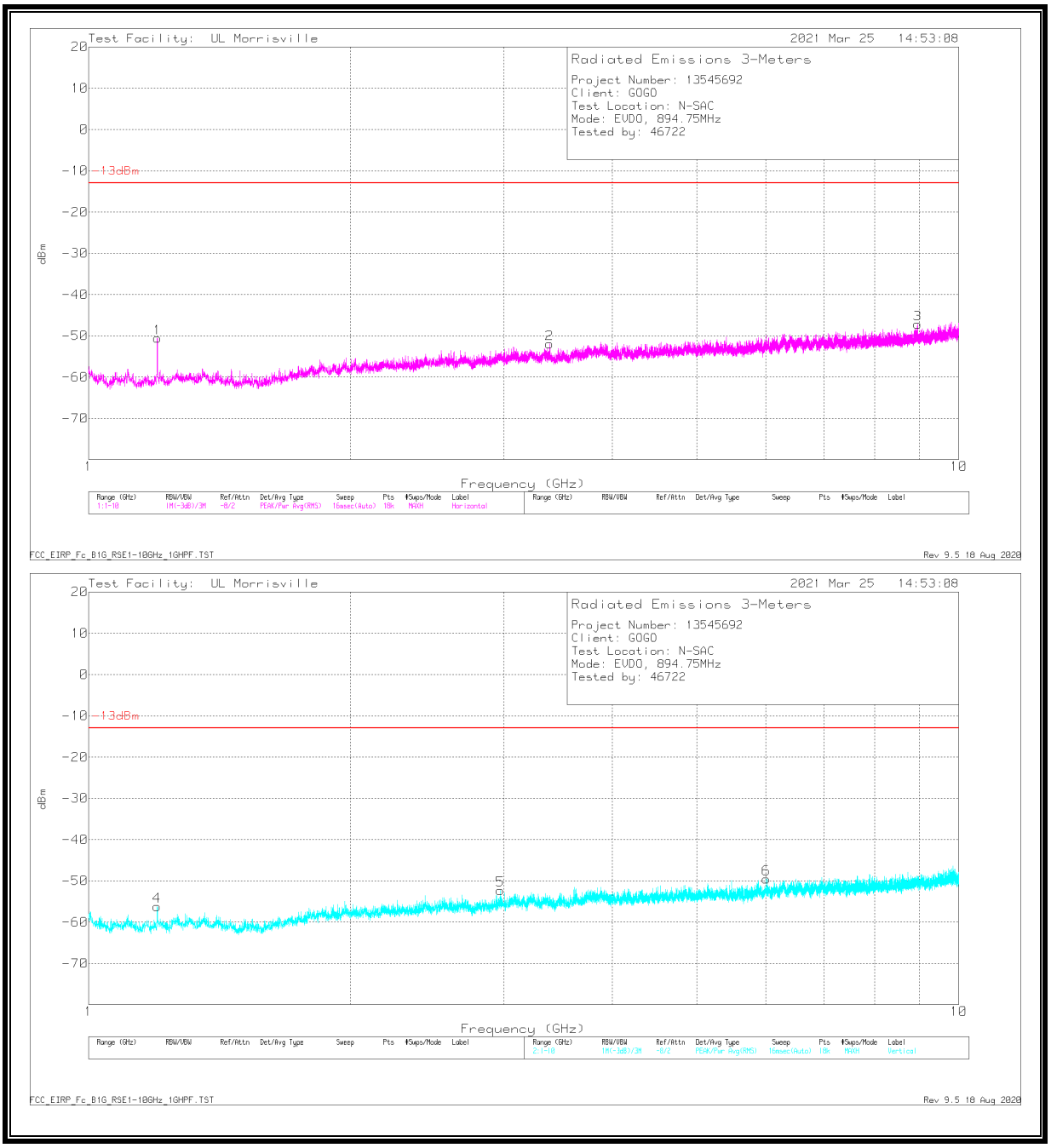
TEST PROCEDURE

KDB 971168 D01 v03r01/D02 v02/r01
All tests above 1GHz were done with a Resolution Bandwidth of 1MHz, and a Video Bandwidth of 3MHz.

LIMITS

FCC: §22.861 (a)
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB.

RESULTS



Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Fliter (dB)	CF (dB)	Corrected Reading dBm	-13dBm	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	1.19949	-60.34	Pk	28.7	-36.9	.6	11.8	-56.14	-13	-43.14	0-360	300	V
1	1.19999	-54.78	Pk	28.7	-36.9	.6	11.8	-50.58	-13	-37.58	0-360	101	H
5	2.97089	-63.54	Pk	32.8	-33.8	.5	11.8	-52.24	-13	-39.24	0-360	300	V
2	3.38737	-63.86	Pk	33	-33.4	.5	11.8	-51.96	-13	-38.96	0-360	200	H
6	6.00772	-64.93	Pk	35.1	-31.9	.4	11.8	-49.53	-13	-36.53	0-360	101	V
3	8.97205	-66.78	Pk	36.4	-29.1	.5	11.8	-47.18	-13	-34.18	0-360	101	H

Pk - Peak detector

9.2 FIELD STRENGTH OF SPURIOUS RADIATION BELOW 1GHz

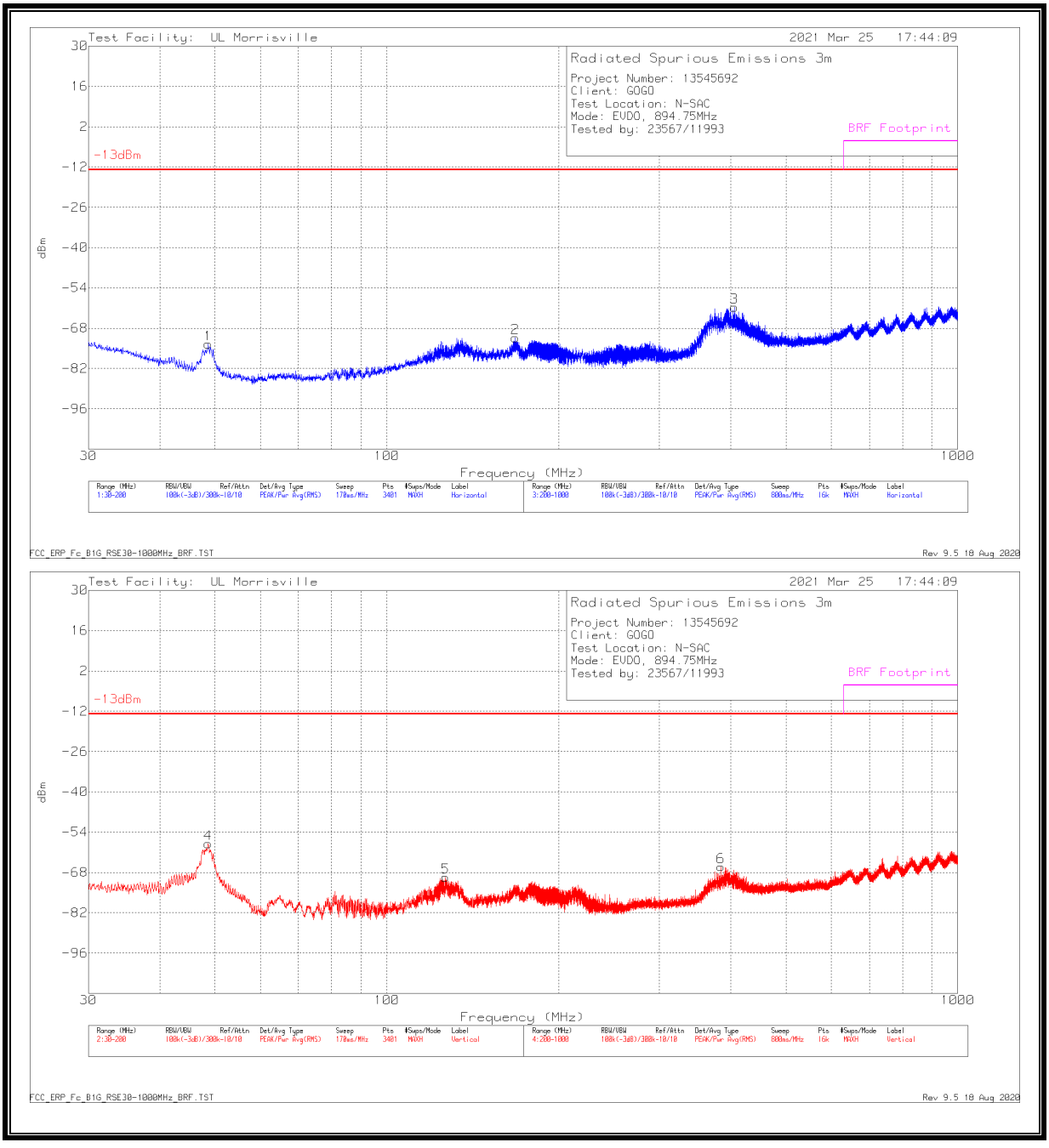
TEST PROCEDURE

KDB 971168 D01 v03r01/D02 v02/r01
All tests below 1GHz were done with a Resolution Bandwidth of 100kHz, and a Video Bandwidth of 300kHz.

LIMITS

FCC: §22.917 (a)
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB.

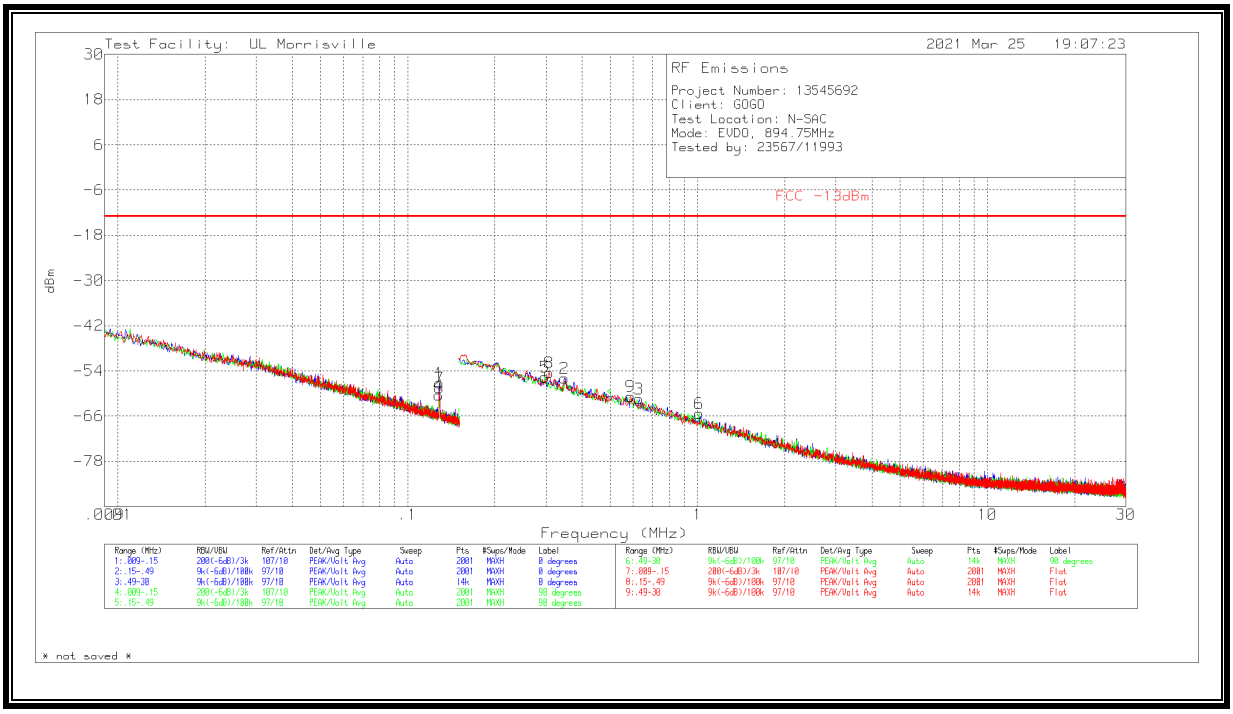
RESULTS: 30MHz to 1000MHz



Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AT0074 (dB/m)	Amp/Cbl (dB)	Filter (dB)	Conversion Factor (dB)	Corrected Reading dBm	-13dBm	Margin (dB)	BRF Footprint	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	48.6	-66.73	Pk	14.5	-31.1	.1	9.7	-73.53	-13	-60.53	-	-	0-360	400	H
4	48.65	-51.16	Pk	14.4	-31.1	.1	9.7	-58.06	-13	-45.06	-	-	0-360	100	V
5	126.7	-69.58	Pk	20	-30.1	.3	9.7	-69.68	-13	-56.68	-	-	0-360	100	V
2	167.8	-69.96	Pk	18.1	-29.6	.5	9.7	-71.26	-13	-58.26	-	-	0-360	199	H
6	384.3	-69.41	Pk	21.1	-27.9	.5	9.7	-66.01	-13	-53.01	-	-	0-360	101	V
3	406.15	-64.92	Pk	22	-27.9	.5	9.7	-60.62	-13	-47.62	-	-	0-360	100	H

Pk - Peak detector

RESULTS: Below 30MHz



Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AT0079 (dB/m)	Cbl (dB)	Corrected Reading dBm	FCC -13dBm	Margin (dB)	Azimuth (Degs)
4	.12835	-71.53	Pk	10.9	.1	-60.53	-13	-47.53	0-360
1	.12856	-68.24	Pk	10.9	.1	-57.24	-13	-44.24	0-360
7	.12864	-69.52	Pk	10.9	.1	-58.52	-13	-45.52	0-360
5	.29765	-66.51	Pk	10.7	.1	-55.71	-13	-42.71	0-360
8	.30725	-65.36	Pk	10.7	.1	-54.56	-13	-41.56	0-360
2	.34771	-66.72	Pk	10.7	.1	-55.92	-13	-42.92	0-360
9	.58697	-71.84	Pk	10.8	.2	-60.84	-13	-47.84	0-360
3	.62913	-72.4	Pk	10.8	.2	-61.4	-13	-48.4	0-360
6	1.01068	-76.56	Pk	11	.2	-65.36	-13	-52.36	0-360

Pk - Peak detector

10. SETUP PHOTOS

Refer to R13545693-EP1 for Setup Diagrams and photos.

END OF REPORT