Electromagnetic Compatibility Test Report

Tests Performed on an Aclara Technologies, LLC

RF Endpoint, Models: Y84092-1 and Y84580-2

Radiometrics Document RP-9704

ACCREDITED
TESTING CERT #1495.01

Product Detail:	
FCC ID: LLBY84092-1 IC: 4546A-Y840921 Equipment type: 450-470 MHz Transceiver	
Test Standards:	
US CFR Title 47, Chapter I, FCC Part 2 and 90 FCC Parts 2, 15, and 90 CFR Title 47: 2022 IC RSS-119 Issue 12: 2015 IC RSS-GEN Issue 5: 2018	
Tests Performed For:	*Test Facility:*
Aclara Technologies, LLC 77 Westport Plaza Drive, Suite 500 Saint Louis, MO 63146	**Radiometrics Midwest Corporation** 12 Devonwood Avenue Romeoville, IL 60446 Phone: (815) 293-0772
Test Dates:	
September 28 thru November 3, 2022	

Document RP-9704 Revisions:

Rev.	Issue Date	Affected Sections	Revised By
0	November 7, 2022		
1	November 10, 2022	3.1, 3.1.1, 5.0, 10.1, 10.4 & 10.8.2	Joseph Strzelecki

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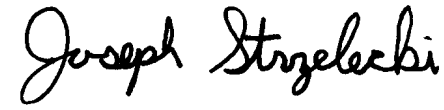
1.0 ADMINISTRATIVE DATA

Equipment Under Test:	
An Aclara Technologies LLC., RF Endpoint Models: Y84092-1 and Y84580-2; Serial Numbers: 00:1D:24:00:01:0E:06:61, 00:1D:24:00:01:13:FC:83 These will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics:	*Test Dates:*
September 26, 2022	September 28 to November 3, 2022
Test Report Written and Authorized By:	*Test Witnessed By:*
Joseph Strzelecki Senior EMC Engineer	The tests were not witnessed by personnel from Aclara Technologies, LLC
Radiometrics' Personnel Responsible for Test:	
 11/07/2022 Date Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE Richard L. Tichgelaar EMC Technician Chris E. Dalessio EMC Technician	

2.0 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is an RF Endpoint, Models Y84092-1 and Y84580-2, manufactured by Aclara Technologies, LLC. The detailed test results are presented in a separate section. The following is a summary of the test results.

Transmitter Requirements

Environmental Phenomena	Frequency Range	FCC Sections	RSS 119 Section	Test Result
RF Power Output	450-470 MHz	2.1046 & 90.205	5.4	Pass
Occupied Bandwidth Test; Emissions Masks	450-470 MHz	2.1049 & 90.209	5.5	Pass
Spurious RF Conducted Emissions	1-4700 MHz	2.1051 & 90.210	5.8	Pass
Conducted Emissions, AC Mains	0.15 - 30 MHz	15.249 & 15.207	RSS-GEN 8.8	Pass
Field Strength of Spurious Radiation	30-4700 MHz	2.1053	5.3	Pass
Frequency Vs. Temperature	450-470 MHz	2.1055 & 90.213	5.3	Pass
Frequency Vs. Voltage	450-470 MHz	2.1055 & 90.213	5.3	Pass
Transient Frequency Behavior	450-470 MHz	90.214	5.9	Pass

3.0 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is an RF Endpoint. The EUT is a 450-470 MHz transceiver, manufactured by Aclara Technologies, LLC. The RF communications link is encrypted in both directions. The EUT was in good working condition during the tests, with no known defects.

Modulated Signal Parameters:

Data Rate	9600 Baud
Encoding	Reed-Solomon (255, 239)
Number of Data Bits	1448 bits max
Transmission Duration	151mS
Modulation	4GFSK with +/-3.0kHz Dev

Antennas used:

Manufacturer	Model	Gain	Description/ Type
Pulse	W3424	2.2 dBi	Dipole antenna, 50-ohm, 450-470 MHz, with U.FL connection
World Products	WPANT40042-C1B	2.2 dBi	Dipole antenna, 50-ohm, 450-470 MHz, with U.FL connection

Frequency Range (MHz)	Applicability
450-454	X
454-456	
456-462.5375	X
462.5375-462.7375*	
462.7375-467.5375	X
467.5375-467.7375	X
467.7375-470	X

This device will only be used in the designated Frequency Ranges above that are marked with an X. The same frequencies will be used in the USA and Canada.

3.1.1 Product Family

The following table is the product family list.

Model Number	Description
Y84580-2	**Tested Sample:** The RA6E1 uses a Renesas RA6 family microcontroller in place of the NXP Kinetis K family of microcontrollers. The RA6E1 uses a TI boost converter instead of a Maxim boost converter.
Y84092-1	**Tested Sample:** The K24 uses an NXP Kinetis K family of microcontroller. The K24 Version uses a Maxim boost converter.

1. The functions of both versions are the same.
2. The clocks, tuning circuits, antennas, RF power, and modulation remained unchanged.
3. The radio parameters are the same in all products.
4. The changes are not in the radio section of the product.

4.0 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations. The identification for all equipment, used in the tested system, is:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	RF Endpoint	E	Aclara Technologies	Y84092-1	00:1D:24:00:01:0E:06:61
2	RF Endpoint	E	Aclara Technologies	Y84580-2	00:1D:24:00:01:13:FC:83

Model Number	Firmware
Y84092-1	1.74
Y84580-2	3.00

The firmware of the EUT during the tests is identical to what would be released, except it allows for transmissions to continue for long periods of time, as required for the regulatory tests.

4.2 Operating Conditions of EUT

The EUT was in a normal operating mode during the tests. All circuits were activated during the tests. Power was supplied with a new battery.

The EUT operational software was Tera Term version 4.105 in conjunction with a windows PC. The settings used are as follows: The power setting was 7 and the modulation was set to 4GFSK.

4.3 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

4.4 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

5.0 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2021	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 & 90 - Radio Frequency Devices
ANSI C63.4-2014	2014	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
TIA-603-E	2016	Land Mobile FM or PM Communications Equipment – Measurement and Performance Standards
IC RSS-Gen Issue 5	2018	General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen)
IC RSS-119 Issue 12	2015	Radio Transmitters and Receivers Operating in the Land Mobile and Fixed Services in the Frequency Range 27.41-960 MHz
ANSI C63.26	2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

6.0 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 2017 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.org).

The following is a list of shielded enclosures located in Romeoville, Illinois used during the tests:

Chamber A: Is an anechoic chamber that measures 24' L X 12' W X 12' H. The walls and ceiling are fully lined with ferrite absorber tiles. The floor has a 10' x 10' section of ferrite absorber tiles located in the center. Panashield of Rowayton, Connecticut manufactured the chamber. The enclosure is NAMAS certified.

Chamber B: Is a shielded enclosure that measures 20' L X 12' W X 8' H. Erik A. Lindgren & Associates of Chicago, Illinois manufactured the enclosure.

Chamber E: Is a custom-made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber.

Test Station F: Is an area that measures approximately 10' D X 12' W X 10' H. The floor and back wall are metal shielded. This area is used for conducted emissions measurements.

A separate ten-foot long, brass plated, steel ground rod attached via a 6-inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

The FCC has accepted these sites as test site number US1065. The FCC test site Registration Number is 732175. Details of the site characteristics are on file with the Industry Canada as site number IC3124A.

7.0 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8.0 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

9.0 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	01/04/22
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	01/29/21
ANT-66	ETS-Lindgren	Horn Antenna	3115	62580	1.0-18GHz	24 Mo.	03/11/21
ANT-68	EMCO	Log Periodic Antenna	93146	9604-4456	200-1000MHz	24 Mo.	02/07/22
ANT-79	AH Systems	Bicon Antenna	SAS-540	793	20-330MHz	24 Mo.	01/05/21
ANT-80	AH Systems	Bicon Antenna	SAS-540	294	20-330MHz	24 Mo.	01/05/21
ATT-53	Weinschel	Attenuator (20 dB)	23-20-34	CG7857	DC-18 GHz	12 Mo	12/17/21
CDT-01	Wiltron	Crystal RF Detector	75N50	CDT-01	DC-18GHz	N/A	NCR
COM-01	Anaren	Coupler	10023-3	COM-01	250-1000MHz	N/A	NCR
DIR-19	Narda	Directional Coupler	3000-10	01174	200-500MHz	N/A	NCR
DMM-09	Fluke	DMM	15B	12220951	DC-500 Hz	24 Mo.	01/22/21
HPF-01	Solar	High Pass Filter	7930-100	HPF-1	0.15-30MHz	24 Mo.	03/07/22
LSN-01	Electrometrics	50 uH LISN	FCC/VDE 50/2	1001	0.01-30MHz	24 Mo.	08/23/21
PWM-01	Boonton	Power Meter	4230	22503	50kHz-18GHz	24 Mo.	02/12/22
REC-11	HP / Agilent	Spectrum Analyzer	E7405A	US39110103	9Hz-26.5GHz	24 Mo.	05/05/22
REC-20	HP / Agilent	Spectrum Analyzer	85460A/84562A	33330A00135 3410A00178	30Hz-6GHz	24 Mo.	08/18/21
REC-21	Agilent	Spectrum Analyzer	E7405A	MY45118341	9kHz-26.5 GHz	24 Mo.	02/24/22
REC-44	Agilent	Spectrum Analyzer	E4440A	US40420673	3Hz-26.5GHz	24 Mo.	03/31/22
SCP-02	Tektronix	Oscilloscope	TDS784A	B040258	DC-1GHz	24 Mo.	01/22/21
SIG-30	Rohde Schwarz	Signal Generator	SMC100A	102914	9k-3.2GHz	36 Mo.	12/18/20
SIG-31	Rohde Schwarz	Vector Signal Generator	SMJ 100A	101395	100kHz-6GHz	36 Mo.	09/08/20
TC-01	GS Blue M Electric	Temperature Chamber	ETC-04S-E	0003-ETC-201	-40 to 100 Deg C	24 Mo.	10/14/22
THM-02	Fluke	Temp/Humid Meter	971	93490471	N/A	24 Mo.	11/30/20

Note: All calibrated equipment is subject to periodic checks.
NCR – No Calibration Required. Device monitored by calibrated equipment. N/A: Not Applicable.

10.0 TEST SECTIONS

10.1 AC Conducted Emissions

The tests and limits are in accordance with FCC section 15.207 and RSS Gen section 8.8.

A computer-controlled analyzer was used to perform the conducted emissions measurements. The frequency range was divided into 500 subranges equally spaced on a logarithmic scale. The computer recorded the peak of each subrange. This data was then plotted on a semi-log graph generated by the computer. Adjusting the positions of the cables and orientation of the test system then maximizes the highest emissions.

Mains Conducted emission measurements were performed using a 50 Ohm/50 uH Line Impedance Stabilization Network (LISN) as the pick-up device. Measurements were repeated on both leads within the power cord. If the EUT power cord exceeded 80 cm in length, the excess length of the power cord was made into a 30 to 40 cm bundle near the center of the cord. The LISN was placed on the floor at the base of the test platform and electrically bonded to the ground plane.

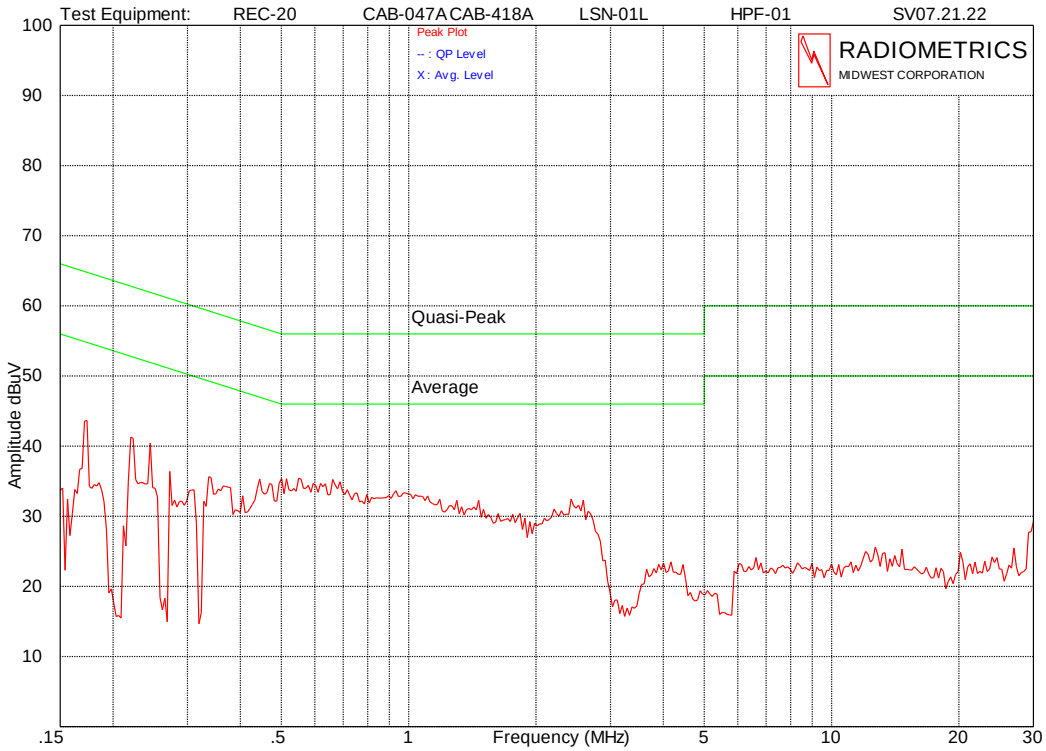
FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBuV)	
	Quasi-Peak	Average
0.150 - 0.50*	66 - 56	56 - 46
0.5 – 5.0	56	46
5.0 - 30	60	50
* The limit decreases linearly with the logarithm of the frequency in this range.		

The initial step in collecting conducted data is a peak detector scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from the EUT power supply, after testing all modes of operation. The Amplitude is the final corrected value with cable and LISN Loss.

Model	Y84092-1 Y84580-2	Specification	FCC part 15.207 RSS-GEN Section 8.8
Serial Number	00:1D:24:00:01:0E:06:61 00:1D:24:00:01:13:FC:83	Test Date	10/31/2022
Test Personnel	Joseph Strzelecki	Test Location	Chamber F
Test Equipment	EMI Receiver (REC-20) (LSN-01)		

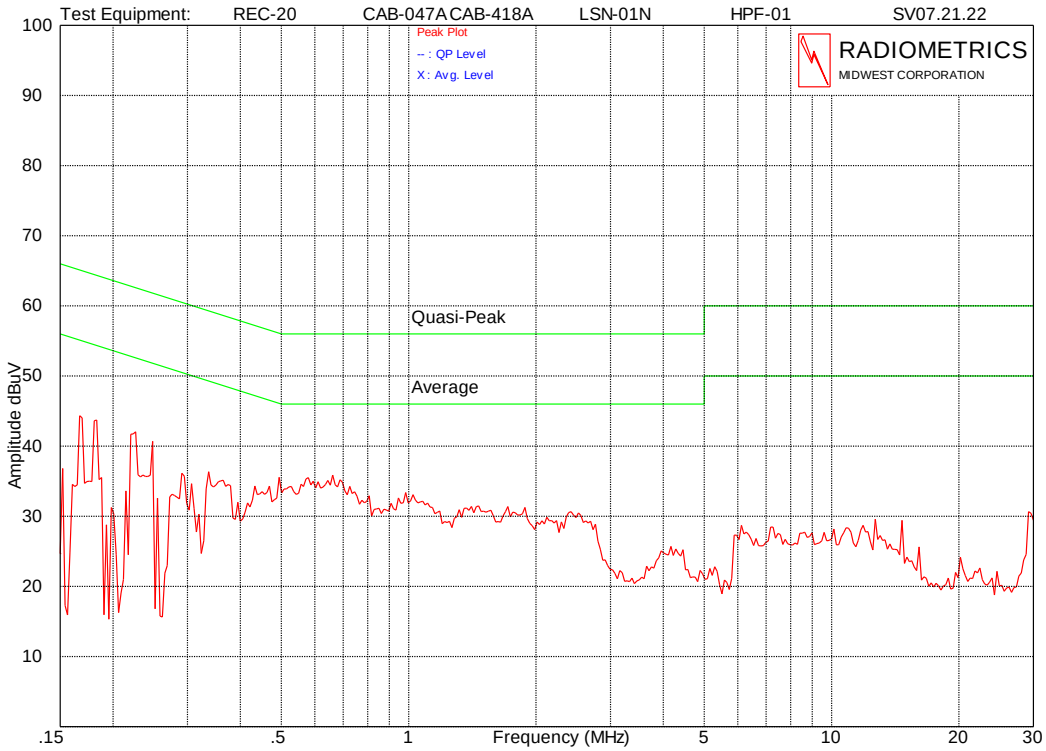
Judgement: Pass by at least 6 dB.



Company: Aclara
Lead Tested: AC Hot 120 VAC
Notes:
FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: Y84092-1
S/N : 0E:06:61

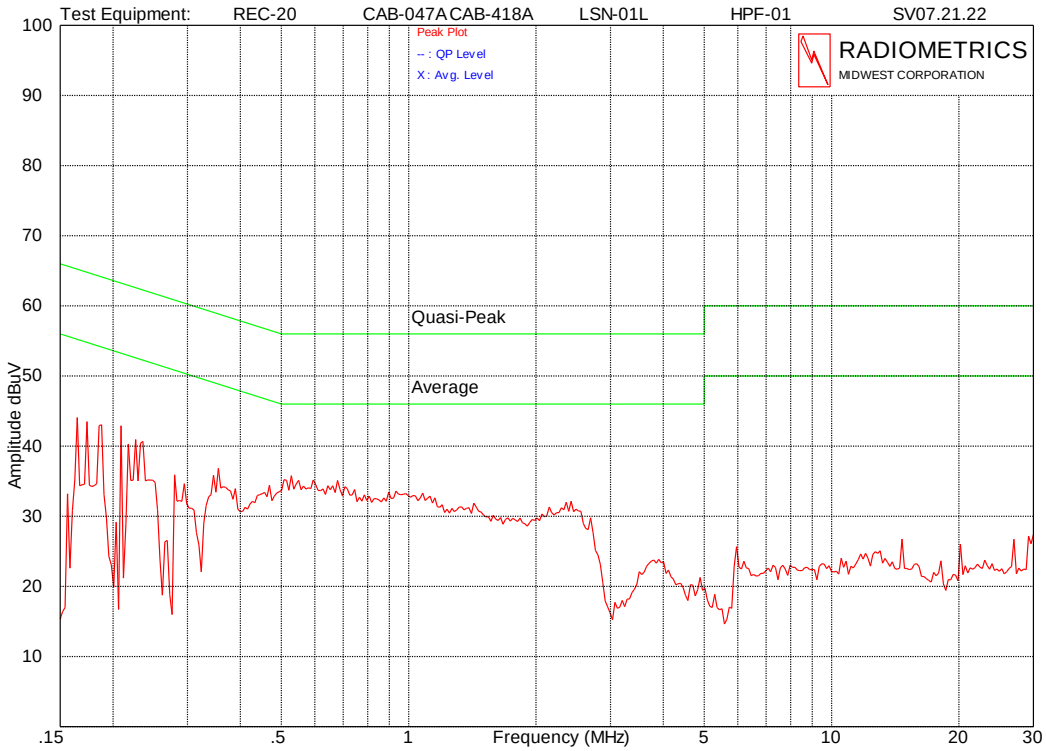
Date :10-31-2022
Time:13:32
Tested By: JRS
RP-9704 | L1-1



Company: Aclara
Lead Tested: AC Neutral 120 VAC
Notes:
FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: Y84092-1
S/N : 0E:06:61

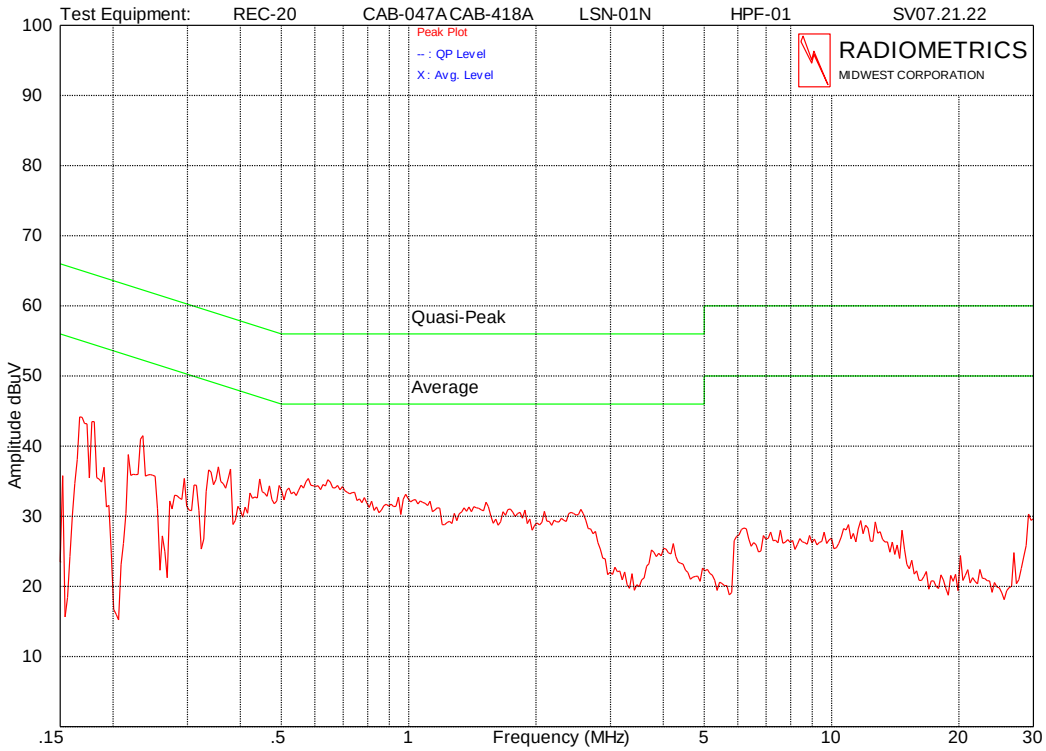
Date :10-31-2022
Time:13:43
Tested By: JRS
RP-9704 | L2-1



Company: Aclara
Lead Tested: AC Hot 120 VAC
Notes:
FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: Y84580-2
S/N : 13:FC:83

Date :10-31-2022
Time:16:01
Tested By: JRS
RP-9704 | L1-2



Company: Aclara
Lead Tested: AC Neutral 120 VAC
Notes:
FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: Y84580-2
S/N : 13:FC:83

Date :10-31-2022
Time:16:20
Tested By: JRS
RP-9704 | L2-2

10.2 Peak Output Power

The peak power was measured by connecting the EUT antenna port to the power meter via a low loss coaxial cable and an appropiate power attenuator.

Model	Y84092-1; S/N: 00:1D:24:00:01:0E:06:61 Y84580-2; S/N: 00:1D:24:00:01:13:FC:83	Specification	FCC part 90.205 RSS-119 Section 5.4
Test Location	Chamber B	Test Date	10-19 & 10-20-2022
Test Personnel	Joseph Strzelecki		
Test Equipment	Power meter (PWM-01)		

Model	TX Freq MHz	Reading dBm	Atten & Cable	Total dBm	Peak Power Watts	Antenna Gain dBi	ERP Watts
Y84092-1	450.0250	9.55	20.2	29.75	0.944	2.2	0.955
Y84092-1	460.0000	9.56	20.2	29.76	0.946	2.2	0.957
Y84092-1	469.9750	9.68	20.2	29.88	0.973	2.2	0.984
Y84580-2	450.0250	9.75	20.2	29.95	0.989	2.2	1.000
Y84580-2	460.0000	9.75	20.2	29.95	0.989	2.2	1.000
Y84580-2	469.9750	10.05	20.2	30.25	1.059	2.2	1.072

Judgement: Pass
The fundamental emission ERP limit is 100 watts (50 dBm) for an 8 km service area radius.

Note that in decibel units:
ERP = EIRP - 2.15 = P+G-2.15
where:
P = transmitter output power in dB(W)
G = Gain of the transmitting antenna in dBi
3 dBi is the maximum gain allowed by the product specification.

10.3 Occupied Bandwidth; Emissions Masks

Model	Y84092-1; S/N: 00:1D:24:00:01:0E:06:61 Y84580-2; S/N: 00:1D:24:00:01:13:FC:83	Specification	FCC Part 90.209 & 90.210 RSS-119 Section 5.5
Test Location	Chamber B	Test Date	10/20 & 11/03/2022
Test Personnel	Joseph Strzelecki		
Test Equipment	Spectrum Analyzer (REC-21), (REC-43)		

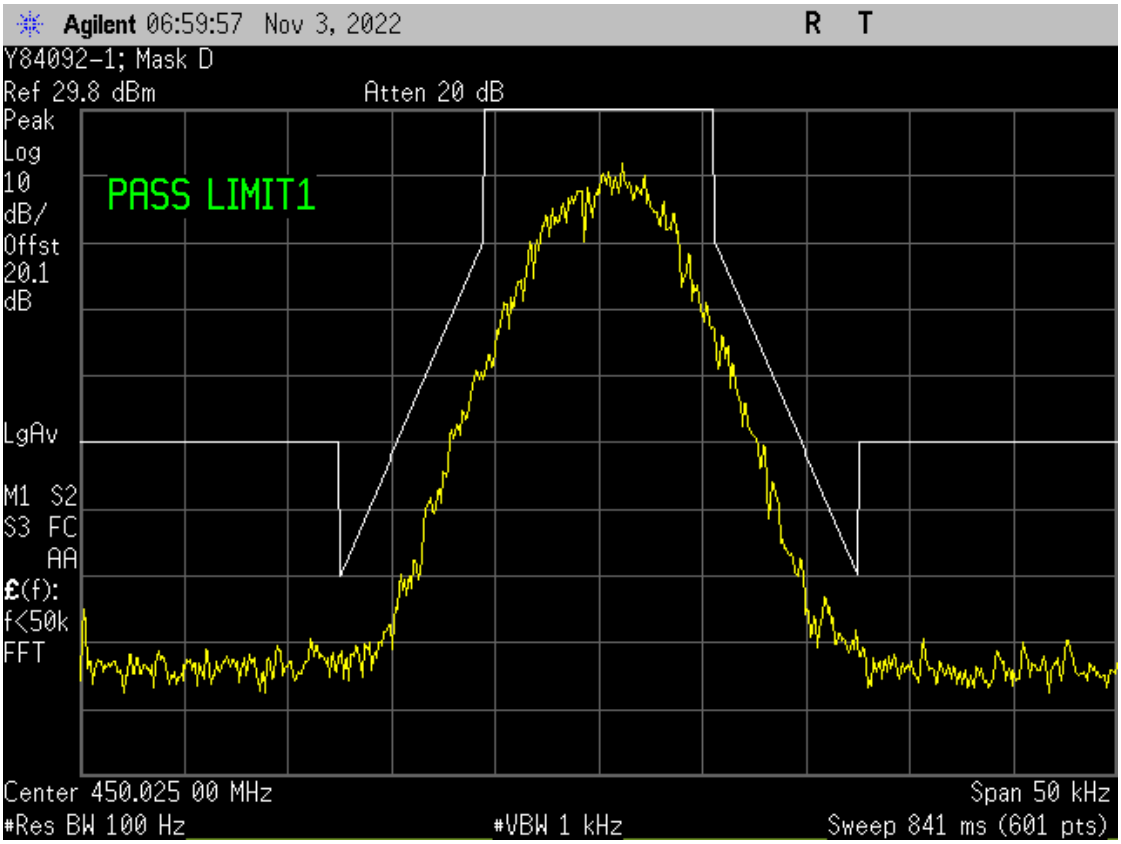
The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize. All Channels are 12.5 kHz. The emissions Mask D is from FCC part 90.210.

(1) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(fd −2.88 kHz) dB.

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB.

For all Frequencies beyond 25 kHz from the center of the transmit frequency, the worst-case limit was used. The red line is a 50-dB reduction from carrier based on 1 watt.



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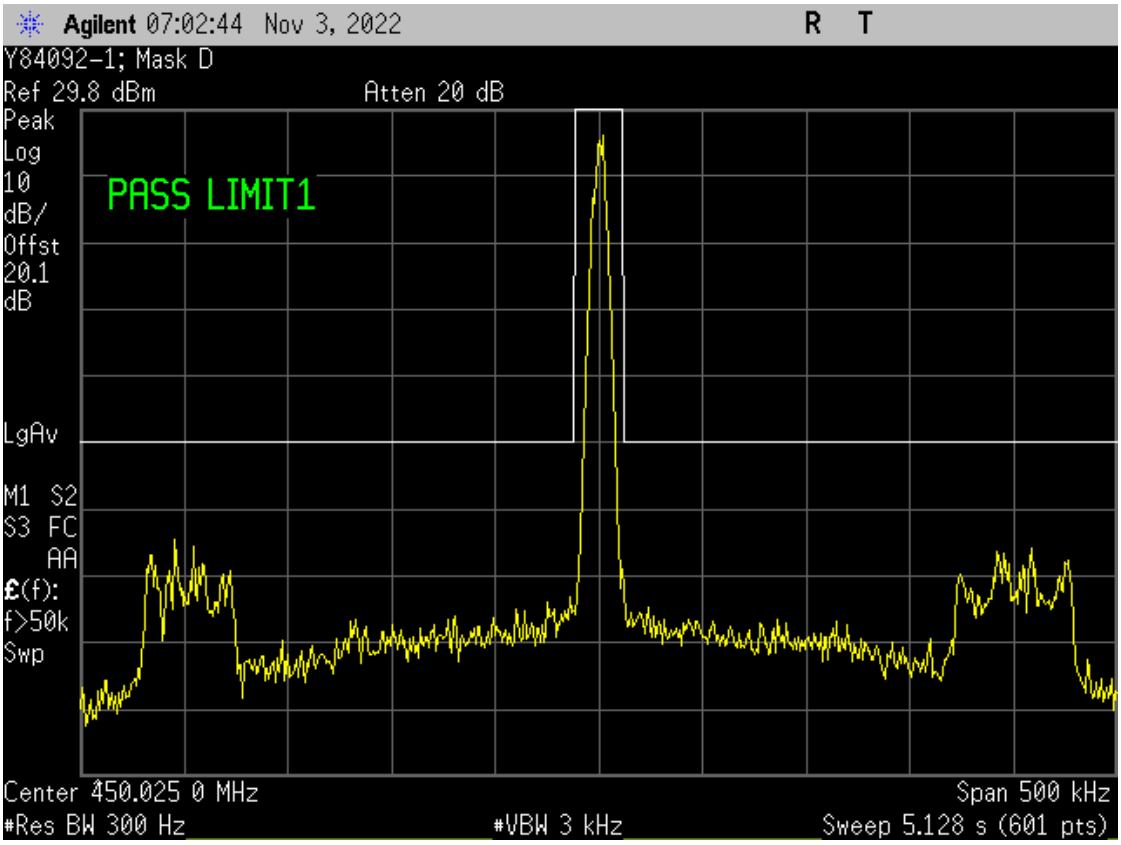

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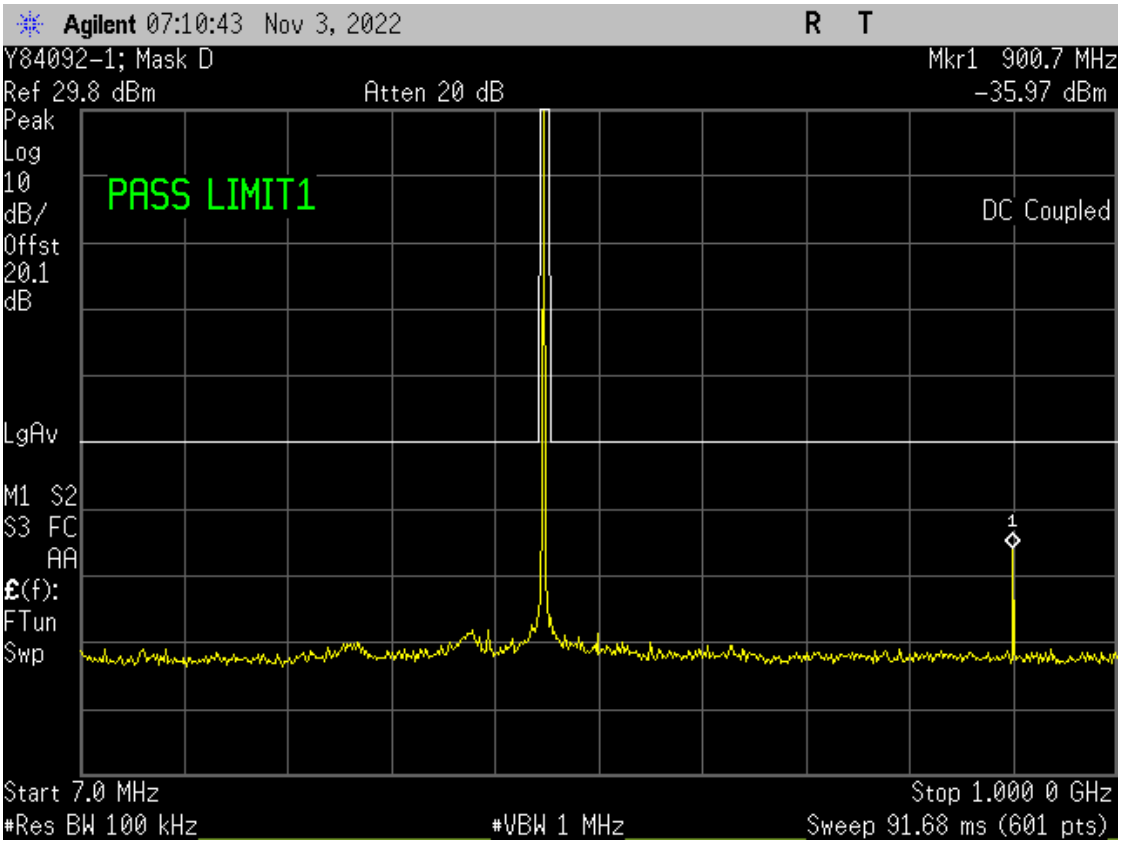

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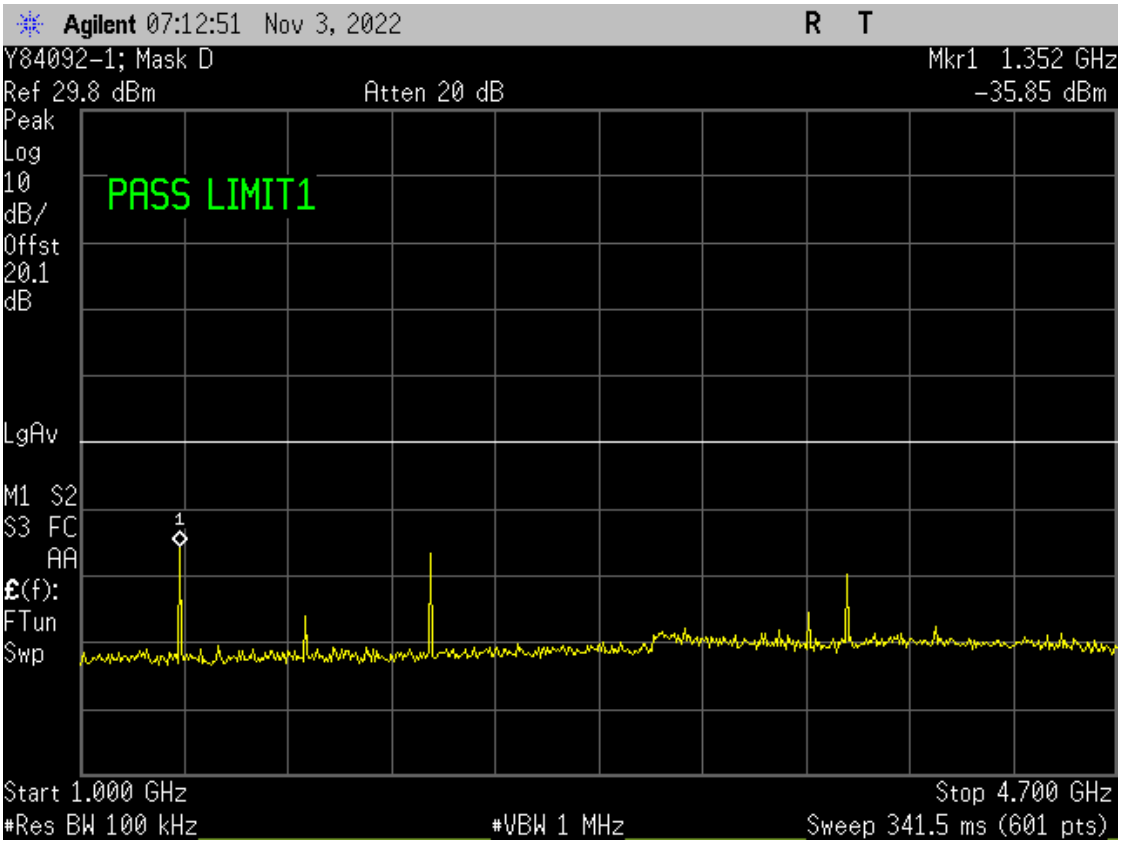

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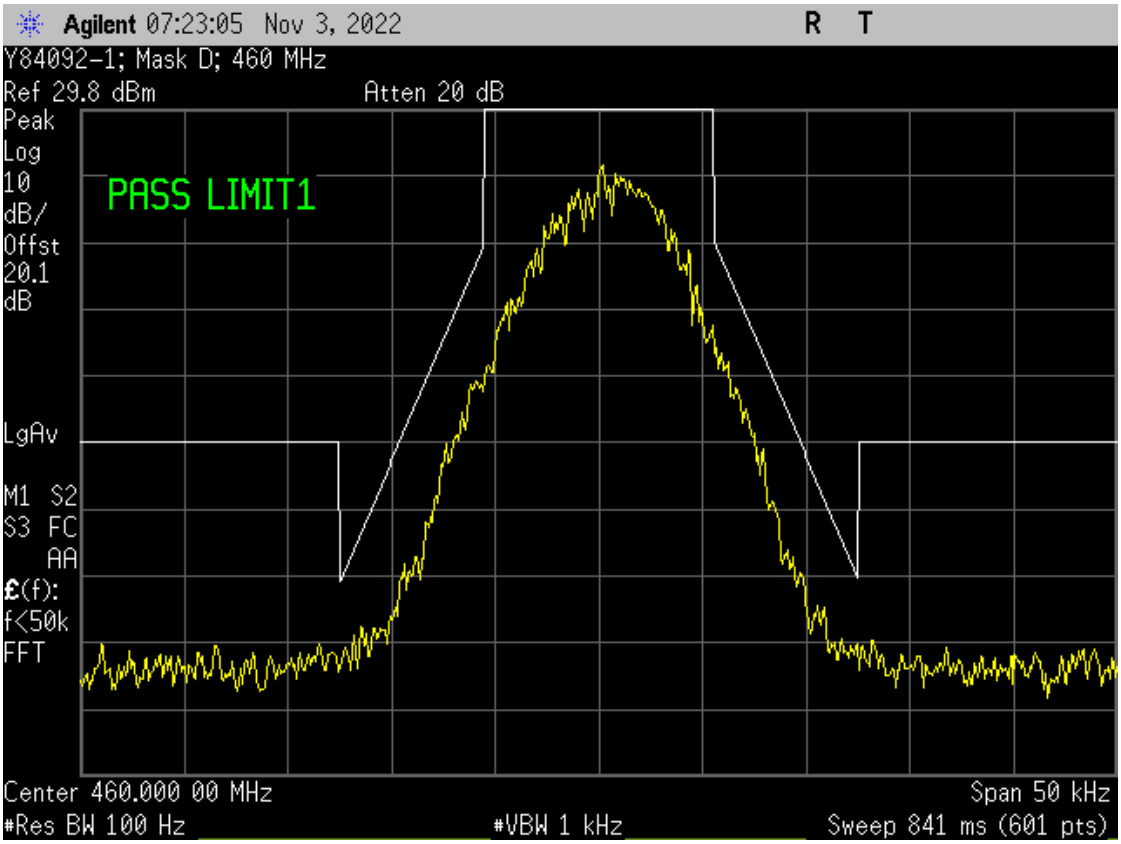

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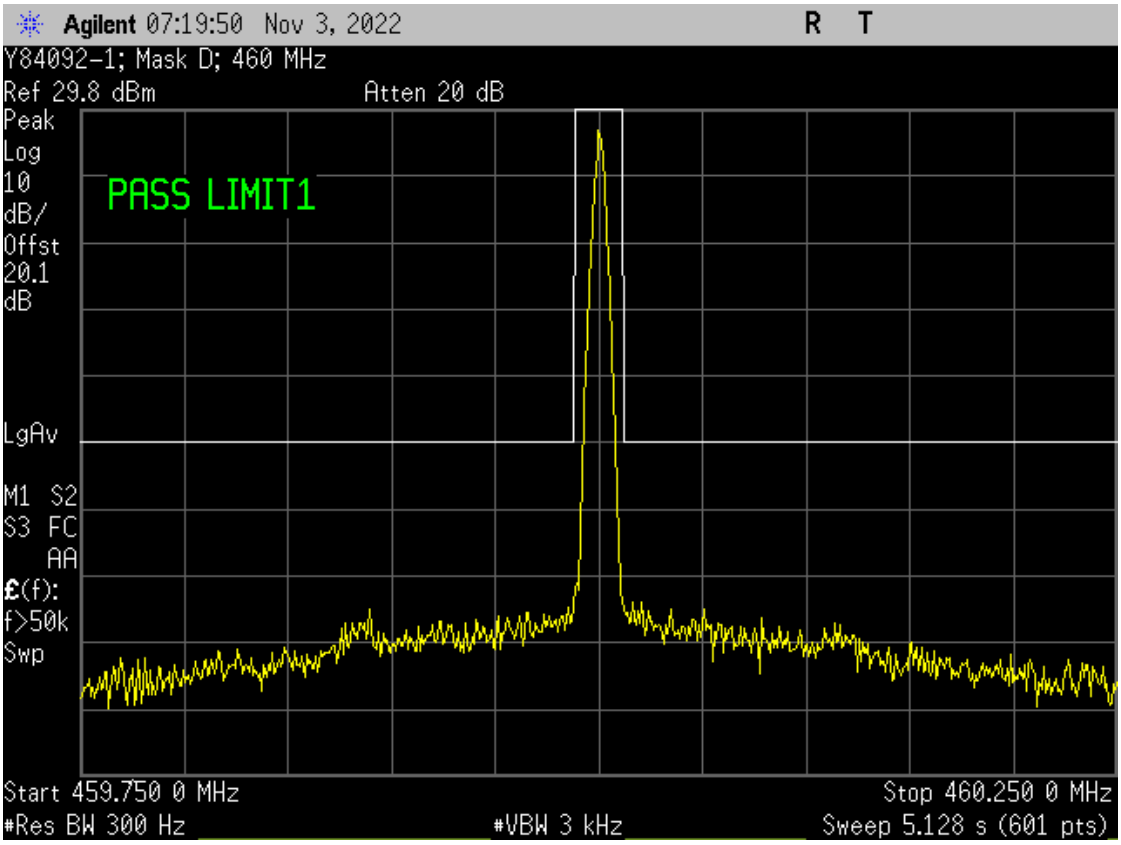

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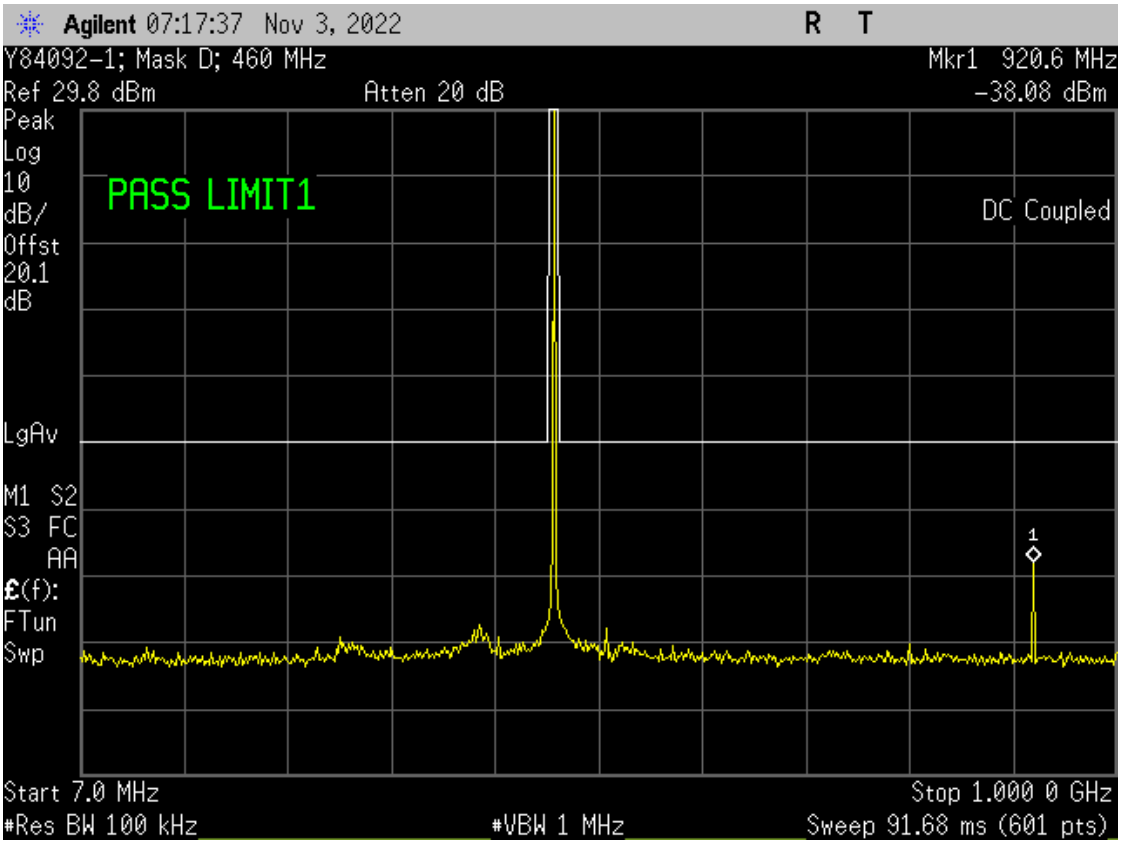

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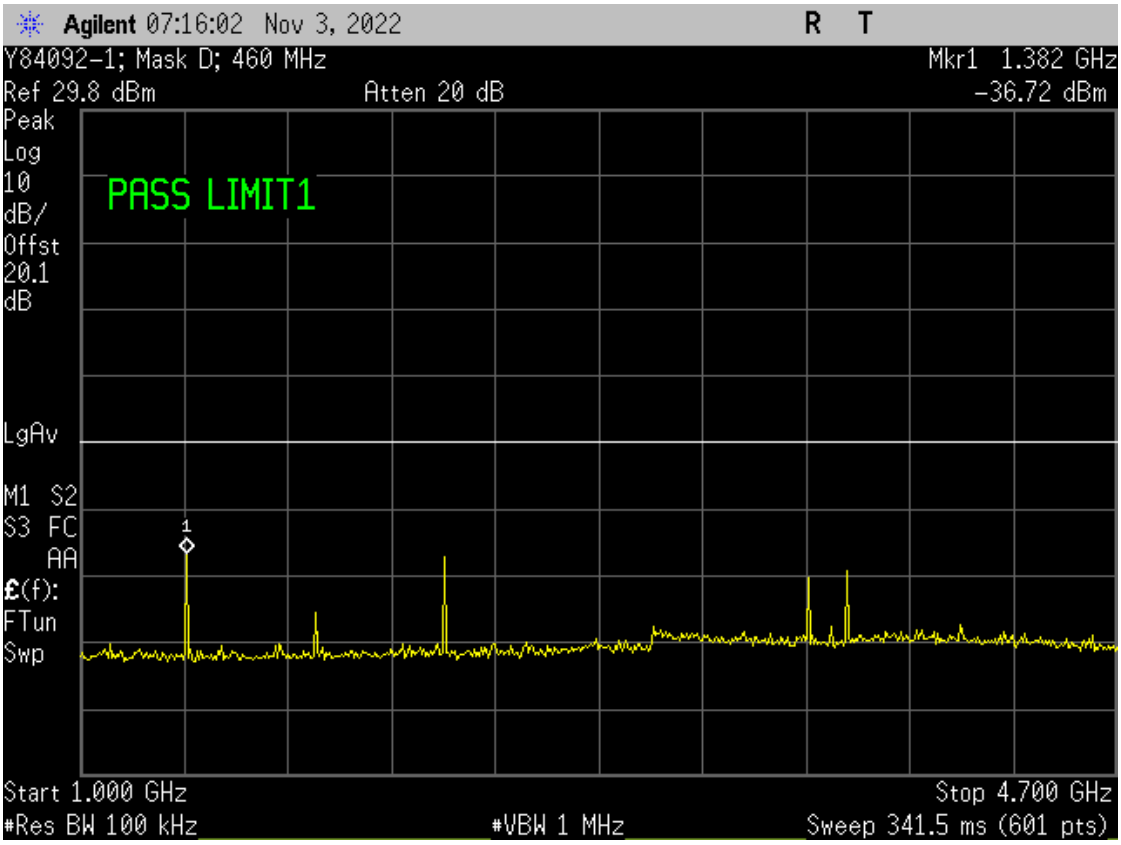

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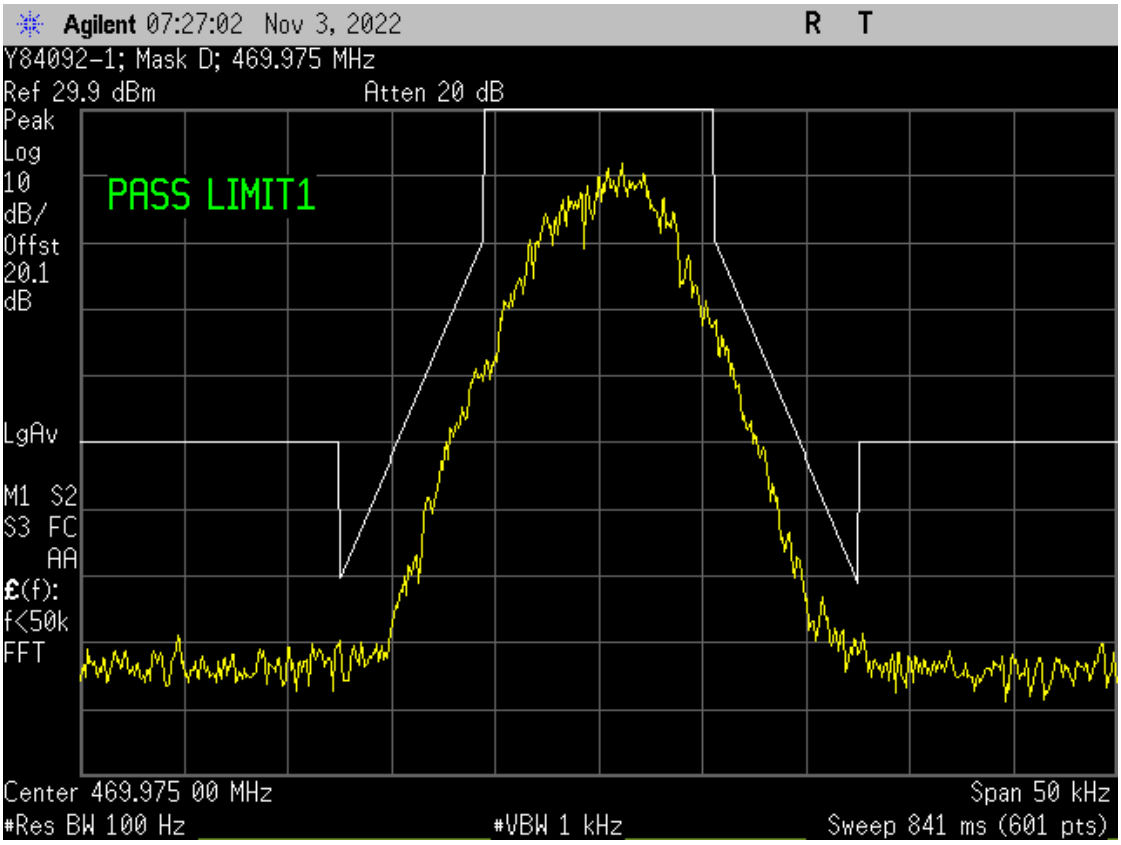

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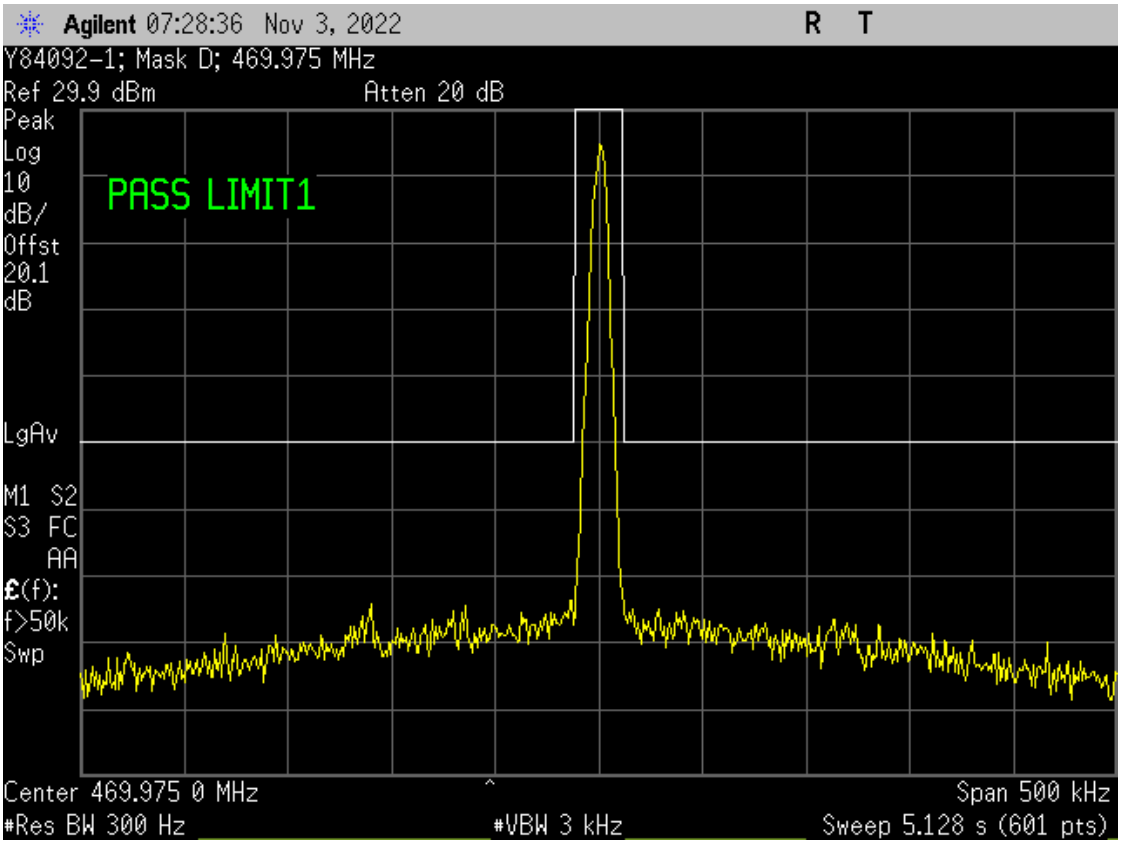

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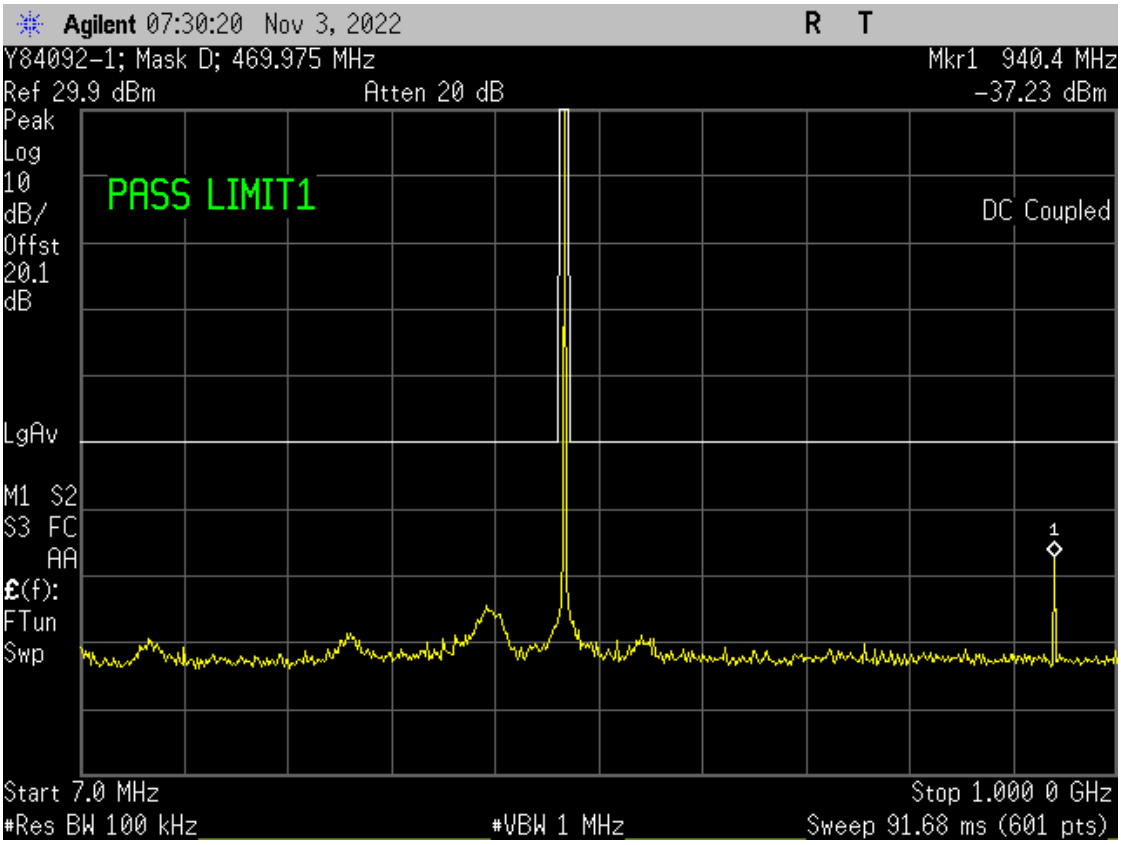
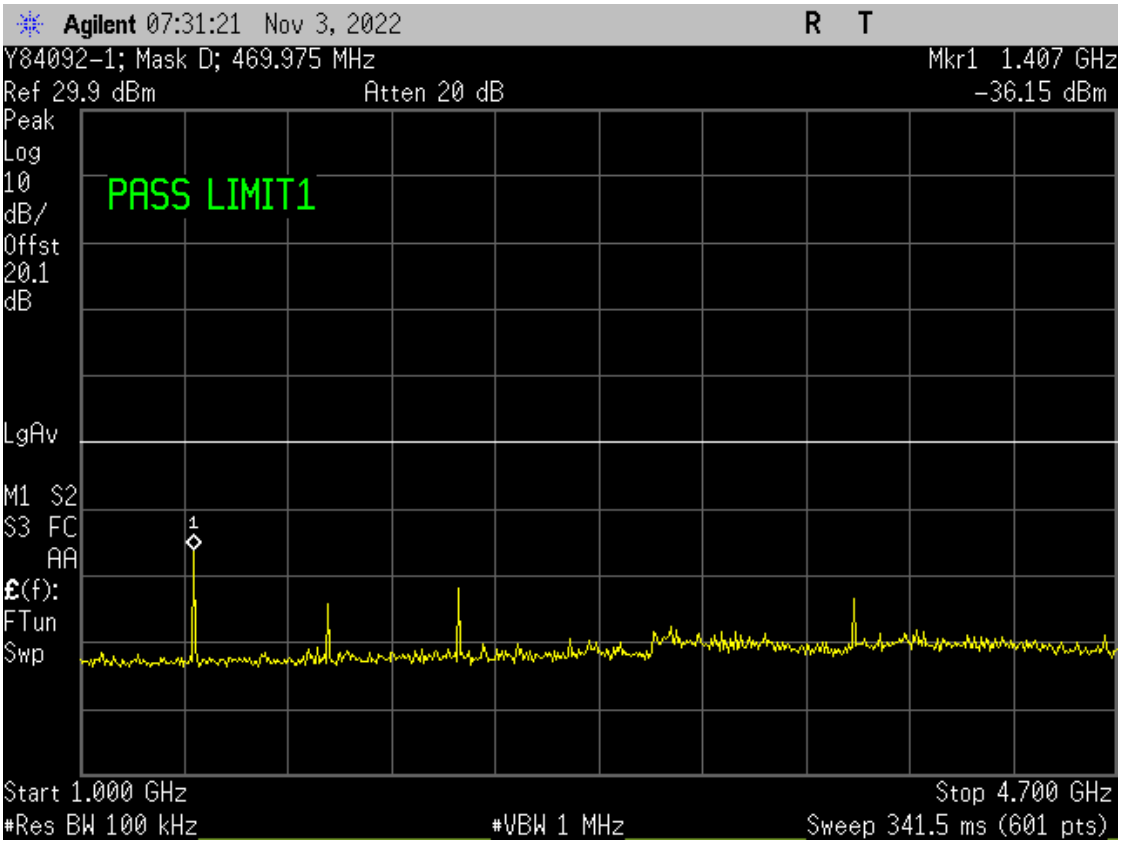


Y84092-1



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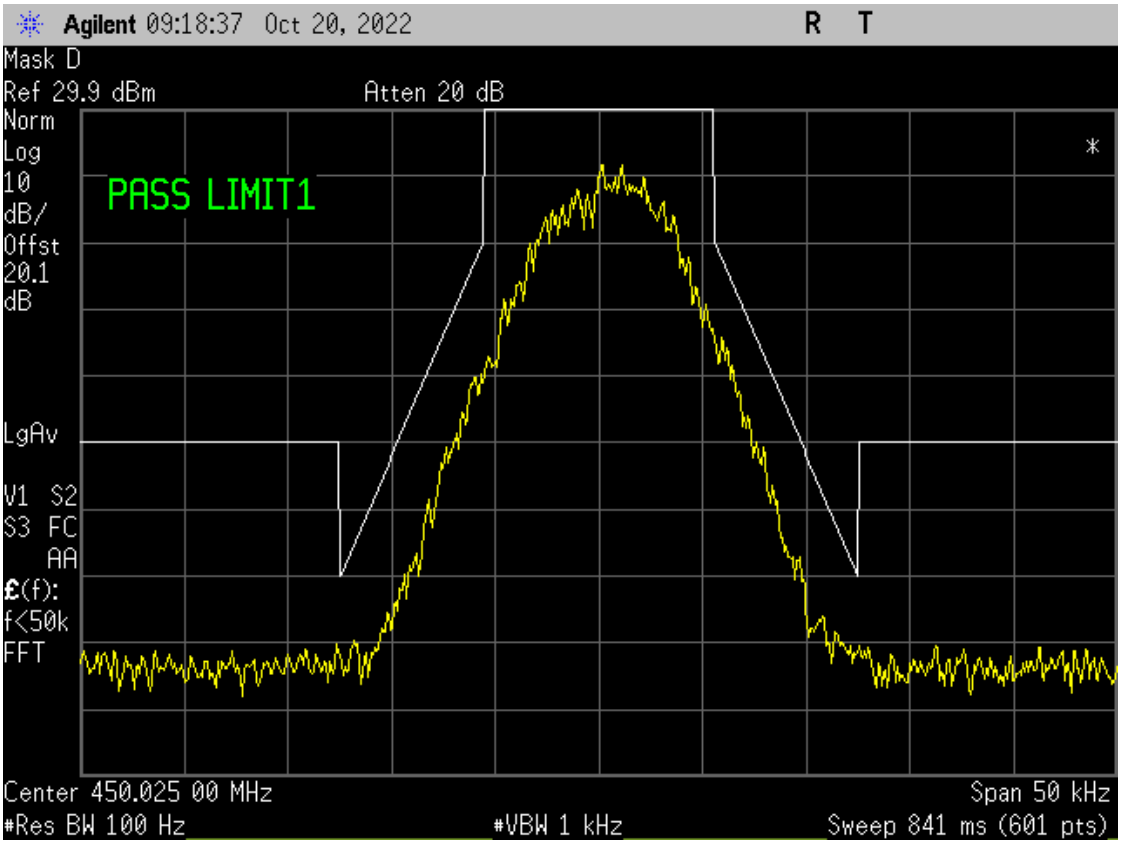

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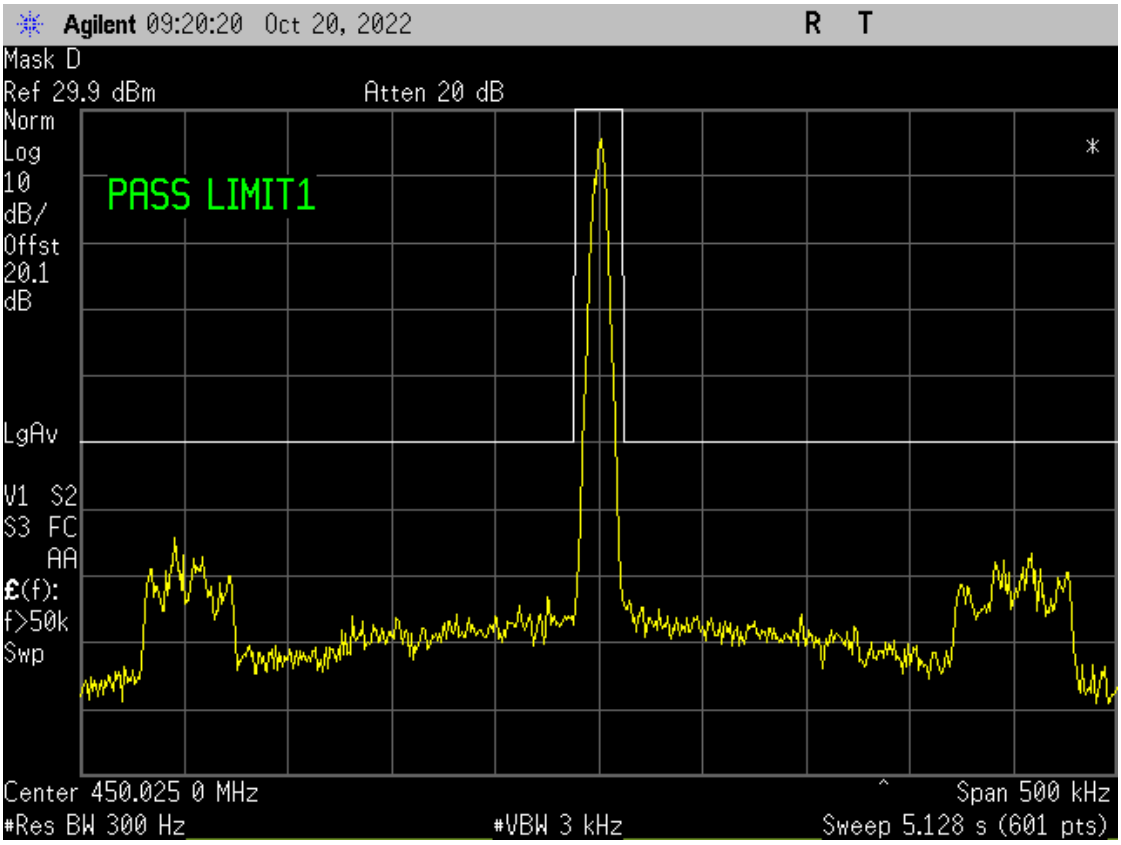

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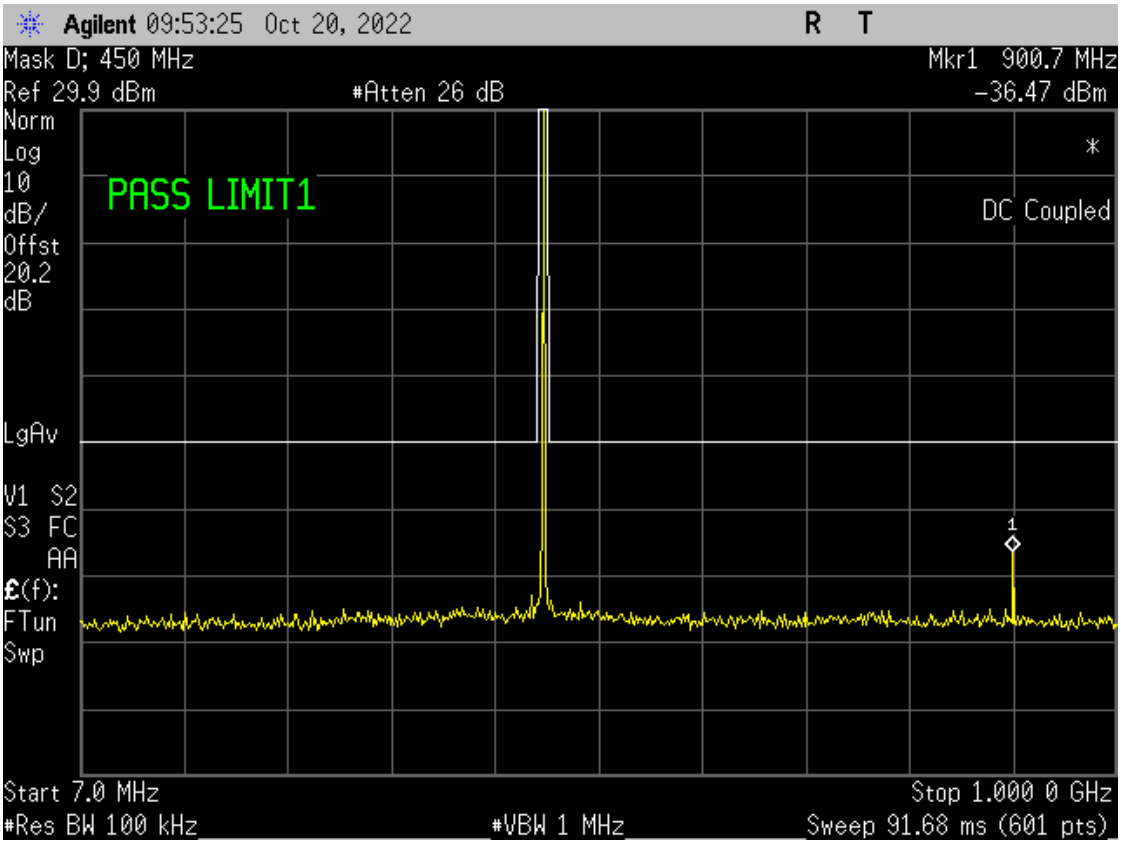

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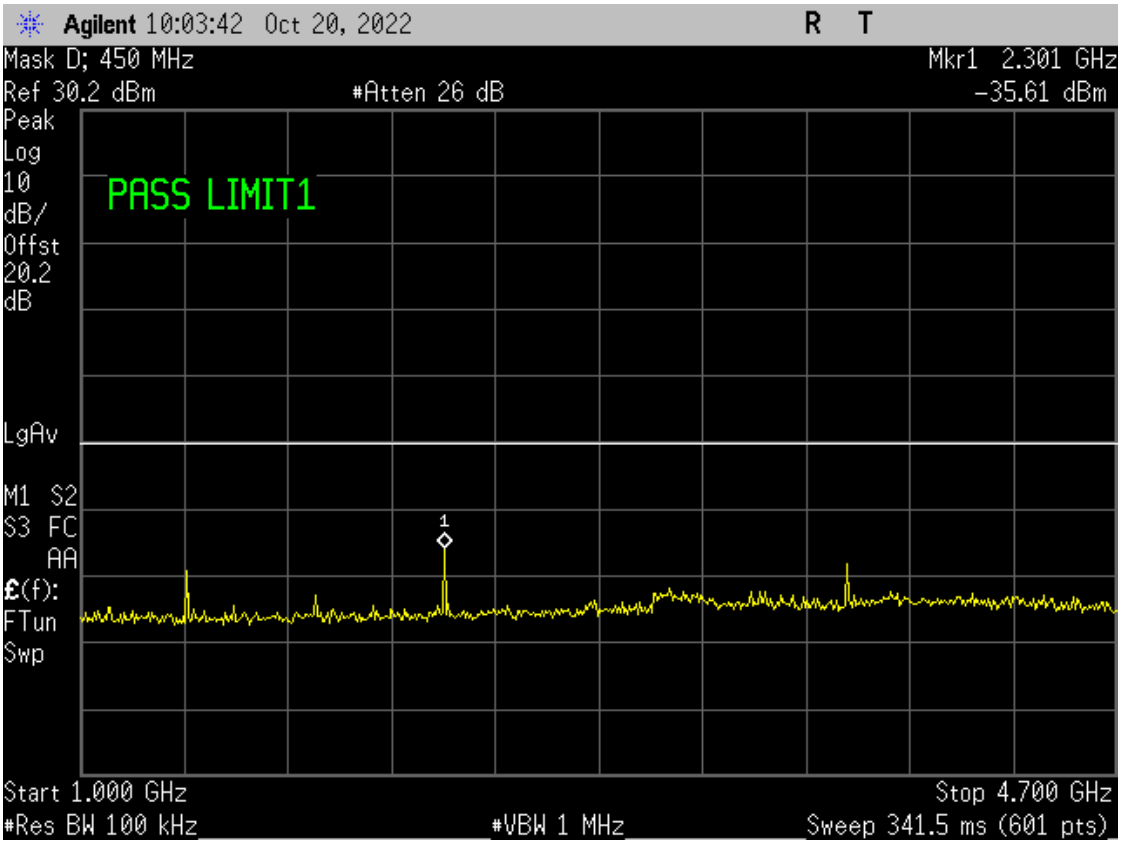

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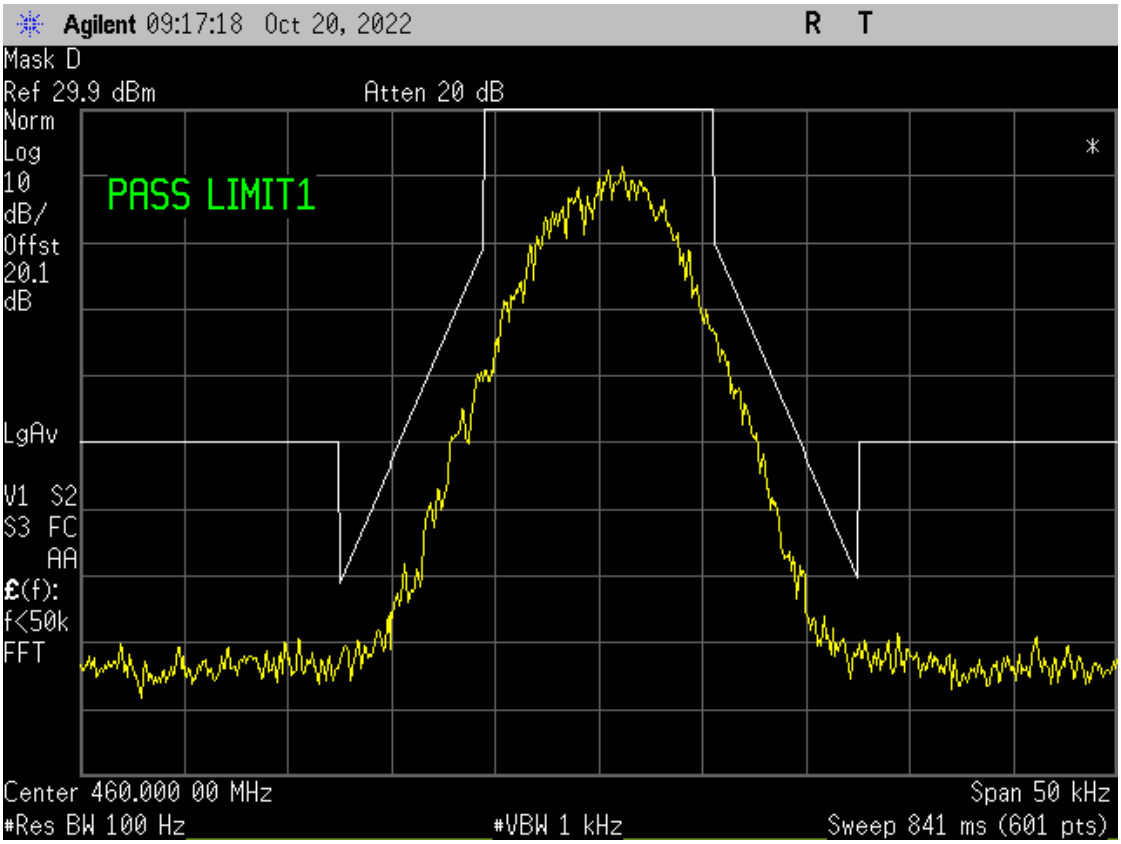

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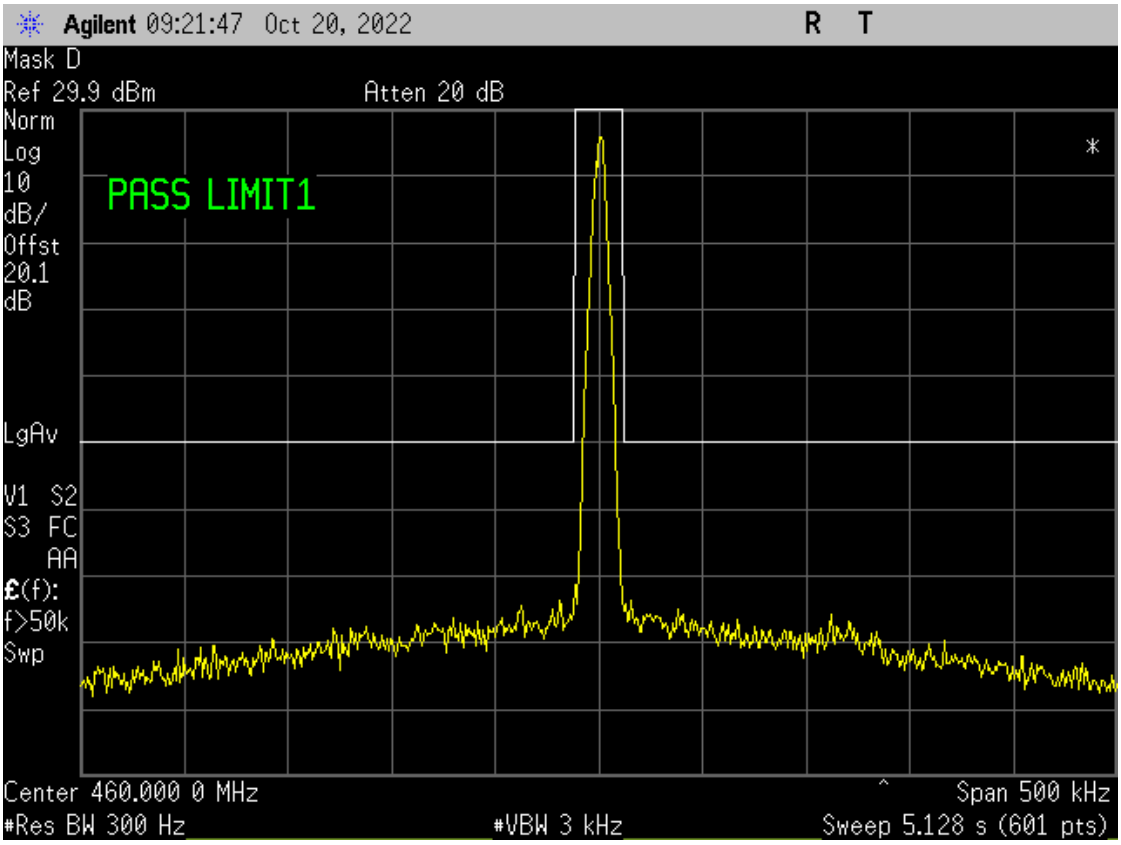

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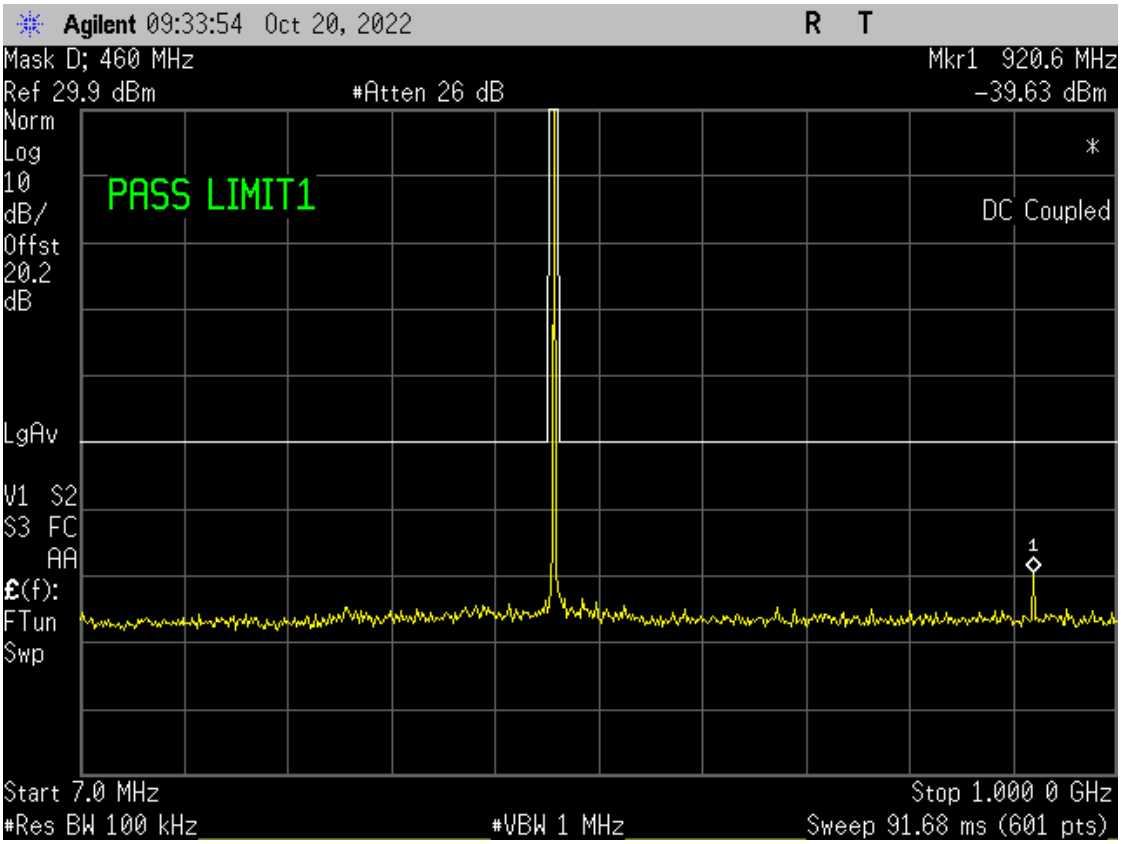

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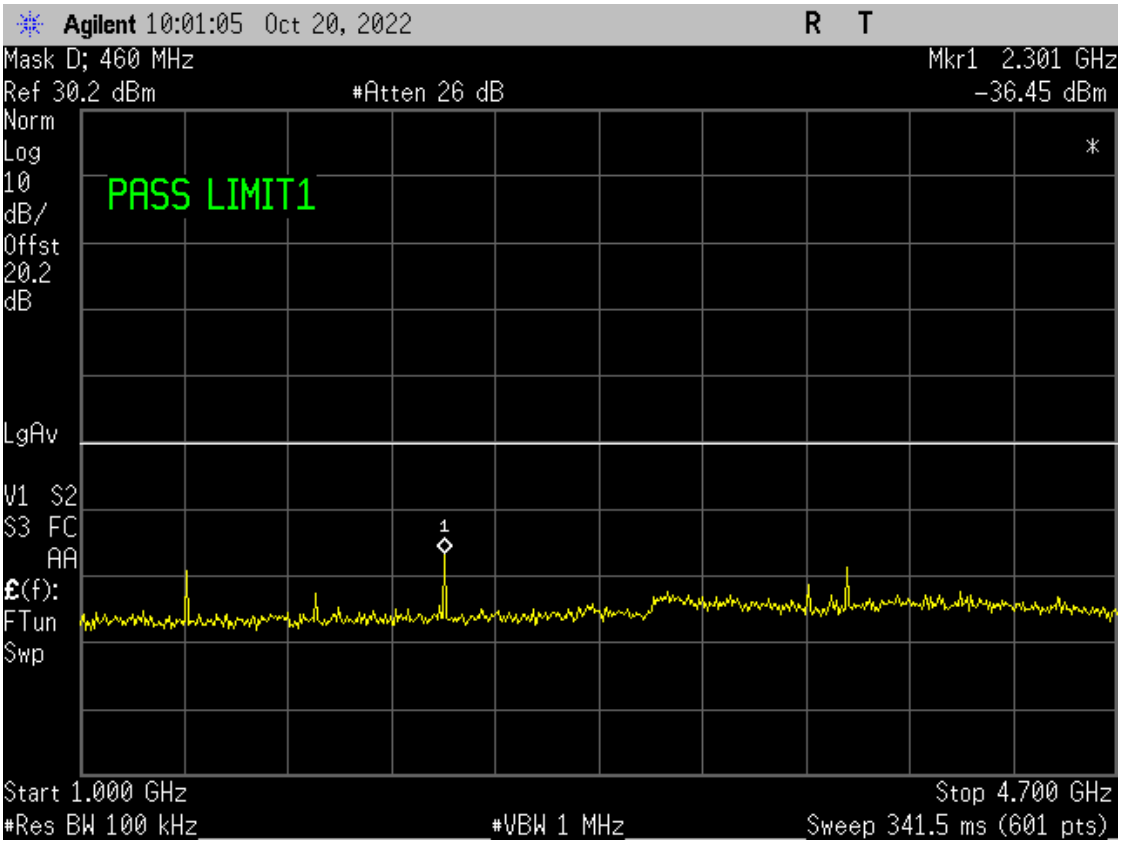

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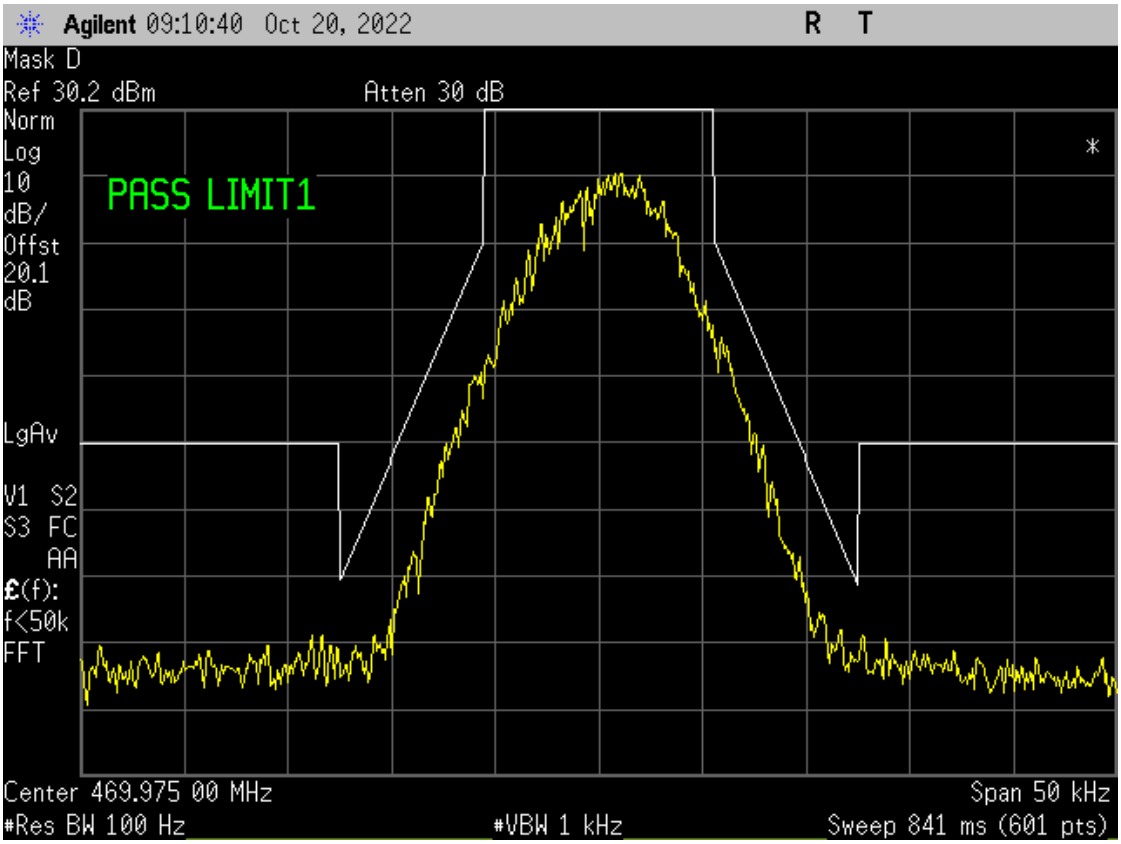

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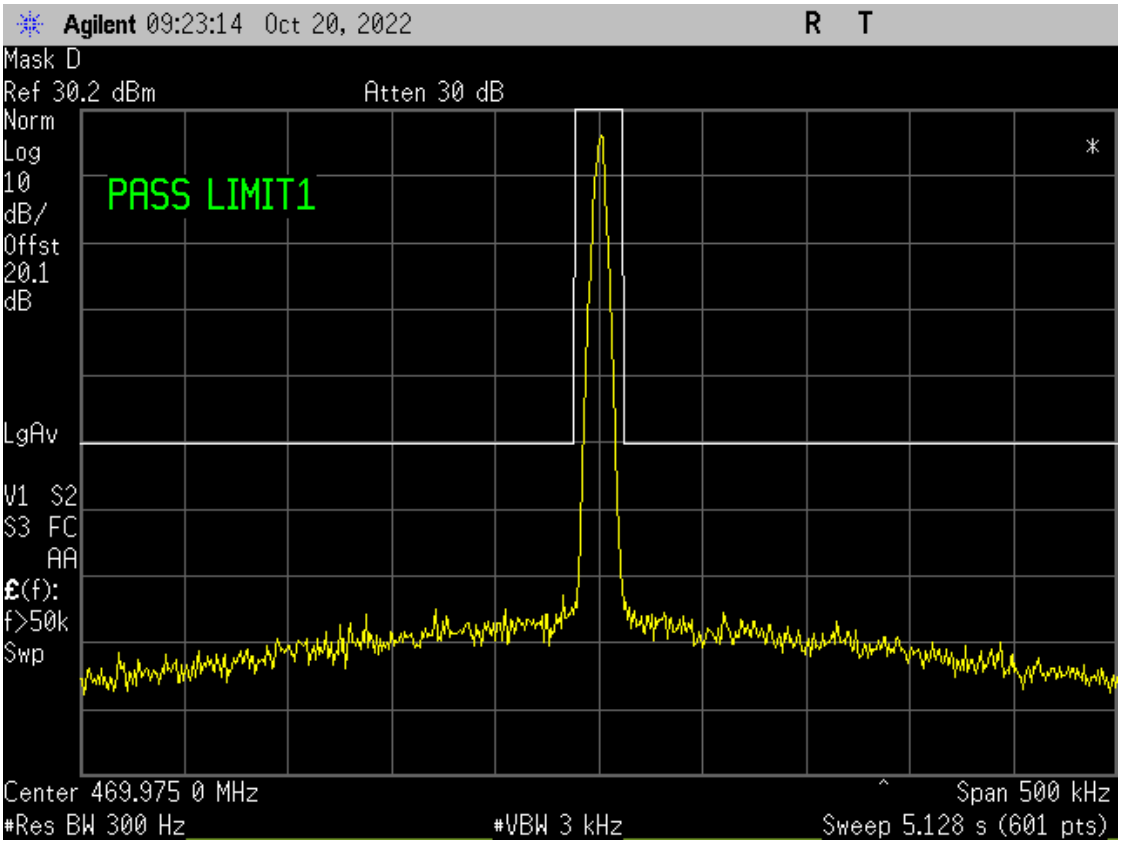

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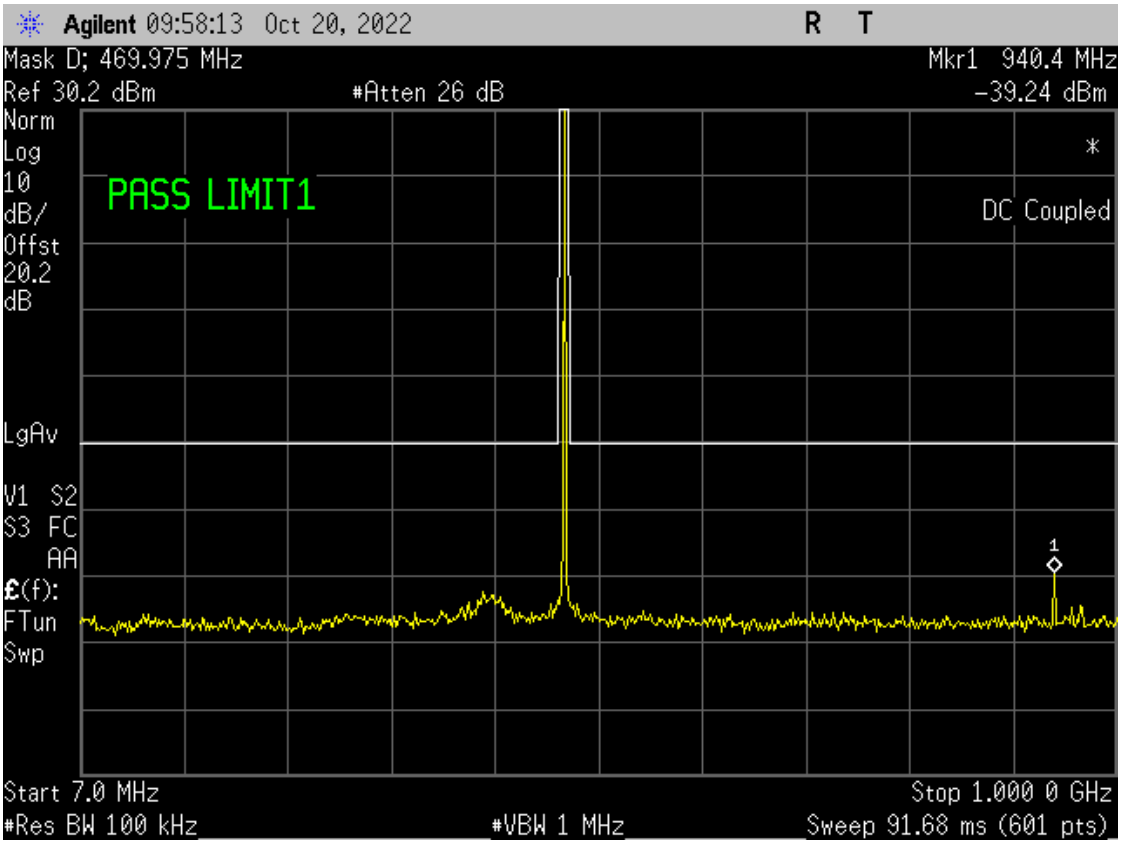

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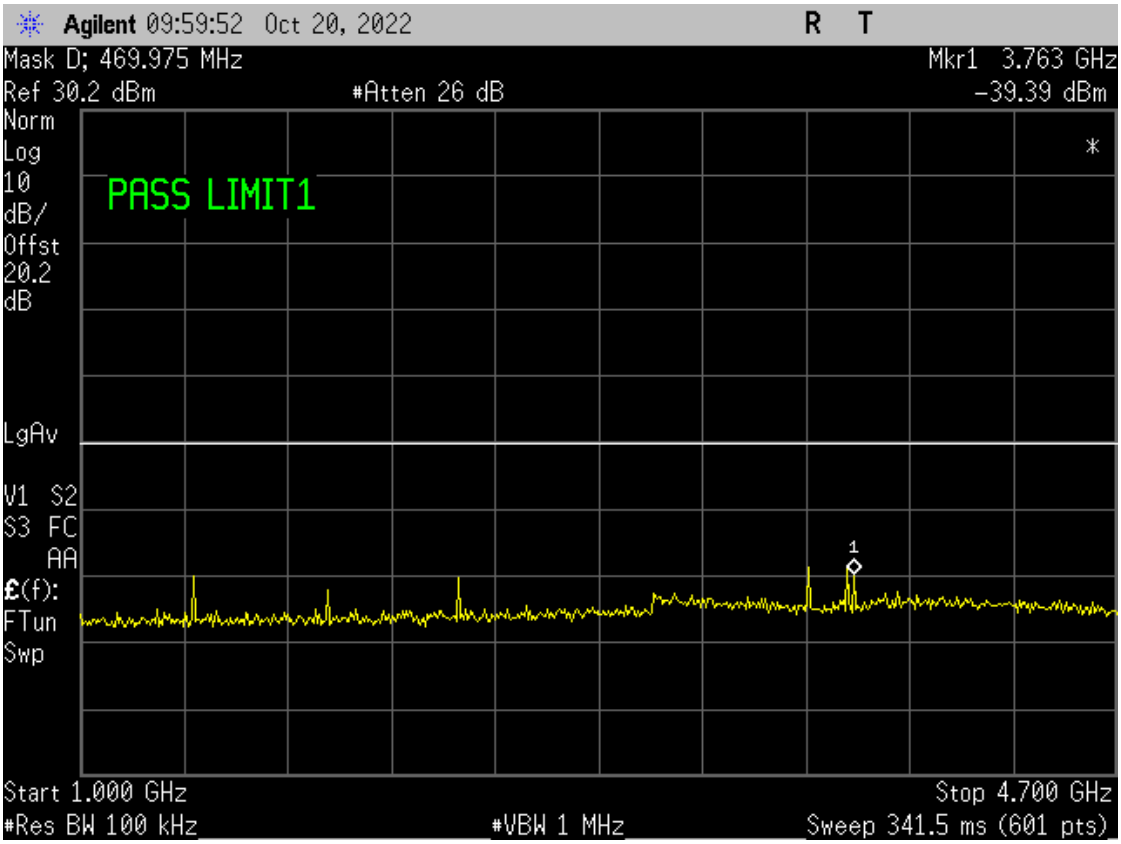


Y84580-2
Judgement: Pass

10.3.1 Conducted Spurious Emissions

Model	Y84092-1 Y84580-2	Specification	FCC Part 90.210 RSS-119 Section 5.5
Serial Number	00:1D:24:00:01:0E:06:61 00:1D:24:00:01:13:FC:83	Test Date	10/19 & 10/20/2022
Test Personnel	Richard Tichgelaar	Test Location	Chamber B
Test Equipment	EMI Receiver (REC-21)		

This is a direct measurement from the Antenna port to the EMI Receiver

Y84092-1

Freq. Tx	Harm	Tested Freq.	Rec Reading	HPF-09 Attn. Factor	Ext. Atten. Factor	Cable Loss	Total Power	Power Limit	Margin Under Limit
MHz	#	MHz	dBm	dB	dB	dB	dBm	dBm	dB
450.0250	2	900.0500	-69.2	0.4	19.9	0.3	-48.6	-20.0	28.6
450.0250	3	1350.0750	-67.6	0.4	19.9	0.4	-46.9	-20.0	26.9
450.0250	4	1800.1000	-73.1	0.4	19.9	0.5	-52.3	-20.0	32.3
450.0250	5	2250.1250	-59.4	0.5	19.9	0.5	-38.5	-20.0	18.5
450.0250	6	2700.1500	-85.8	0.6	19.9	0.6	-64.7	-20.0	44.7
450.0250	7	3150.1750	-80.0	0.5	19.9	0.7	-58.9	-20.0	38.9
450.0250	8	3600.2000	-71.2	0.8	19.9	0.7	-49.8	-20.0	29.8
450.0250	9	4050.2250	-72.3	1.0	19.9	0.8	-50.6	-20.0	30.6
450.0250	10	4500.2500	-77.0	1.0	19.9	0.8	-55.3	-20.0	35.3
460.0000	2	920.0000	-76.1	0.4	19.9	0.3	-55.5	-20.0	35.5
460.0000	3	1380.0000	-70.4	0.4	19.9	0.4	-49.7	-20.0	29.7
460.0000	4	1840.0000	-71.2	0.4	19.9	0.5	-50.4	-20.0	30.4
460.0000	5	2300.0000	-65.6	0.5	19.9	0.5	-44.7	-20.0	24.7
460.0000	6	2760.0000	-73.0	0.6	19.9	0.6	-51.9	-20.0	31.9
460.0000	7	3220.0000	-73.3	0.5	19.9	0.7	-52.2	-20.0	32.2
460.0000	8	3680.0000	-69.1	0.8	19.9	0.7	-47.7	-20.0	27.7
460.0000	9	4140.0000	-70.4	1.0	19.9	0.8	-48.7	-20.0	28.7
460.0000	10	4600.0000	-75.1	1.0	19.9	0.8	-53.4	-20.0	33.4
469.9750	2	939.9500	-66.3	0.4	19.9	0.3	-45.7	-20.0	25.7
469.9750	3	1409.9250	-69.4	0.4	19.9	0.4	-48.7	-20.0	28.7
469.9750	4	1879.9000	-70.7	0.4	19.9	0.5	-49.9	-20.0	29.9
469.9750	5	2349.8750	-69.9	0.5	19.9	0.5	-49.0	-20.0	29.0
469.9750	6	2819.8500	-86.1	0.6	19.9	0.6	-65.0	-20.0	45.0
469.9750	7	3289.8250	-76.9	0.5	19.9	0.7	-55.8	-20.0	35.8
469.9750	8	3759.8000	-67.4	0.8	19.9	0.7	-46.0	-20.0	26.0
469.9750	9	4229.7750	-74.4	1.0	19.9	0.8	-52.7	-20.0	32.7
469.9750	10	4699.7500	-85.3	1.0	19.9	0.8	-63.6	-20.0	43.6

Model: Y84580-2

Freq. Tx	Harm	Tested Freq.	Rec Reading	HPF-09 Attn. Factor	Ext. Atten. Factor	Cable Loss	Total Power	Power Limit	Margin Under Limit
MHz	#	MHz	dBm	dB	dB	dB	dBm	dBm	dB
450.0250	2	900.0500	-51.7	0.4	14.1	0.3	-36.9	-20.0	16.9
450.0250	3	1350.0750	-55.3	0.4	14.1	0.4	-40.4	-20.0	20.4
450.0250	4	1800.1000	-63.3	0.4	14.2	0.5	-48.2	-20.0	28.2
450.0250	5	2250.1250	-51.8	0.5	14.3	0.5	-36.5	-20.0	16.5
450.0250	6	2700.1500	-75.1	0.6	14.3	0.6	-59.6	-20.0	39.6
450.0250	7	3150.1750	-72.1	0.5	14.3	0.7	-56.6	-20.0	36.6
450.0250	8	3600.2000	-64.8	0.8	14.3	0.7	-49.0	-20.0	29.0
450.0250	9	4050.2250	-66.9	1.0	14.4	0.8	-50.7	-20.0	30.7
450.0250	10	4500.2500	-67.7	1.0	14.4	0.8	-51.5	-20.0	31.5
460.0000	2	920.0000	-60.2	0.4	14.1	0.3	-45.4	-20.0	25.4
460.0000	3	1380.0000	-56.4	0.4	14.1	0.4	-41.5	-20.0	21.5
460.0000	4	1840.0000	-62.1	0.4	14.2	0.5	-47.0	-20.0	27.0
460.0000	5	2300.0000	-51.9	0.5	14.3	0.5	-36.6	-20.0	16.6
460.0000	6	2760.0000	-74.9	0.6	14.3	0.6	-59.4	-20.0	39.4
460.0000	7	3220.0000	-70.7	0.5	14.3	0.7	-55.2	-20.0	35.2
460.0000	8	3680.0000	-65.5	0.8	14.3	0.7	-49.7	-20.0	29.7
460.0000	9	4140.0000	-65.9	1.0	14.4	0.8	-49.7	-20.0	29.7
460.0000	10	4600.0000	-68.8	1.0	14.4	0.8	-52.6	-20.0	32.6
469.9750	2	939.9500	-60.7	0.4	14.1	0.3	-45.9	-20.0	25.9
469.9750	3	1409.9250	-56.6	0.4	14.1	0.4	-41.7	-20.0	21.7
469.9750	4	1879.9000	-59.9	0.4	14.2	0.5	-44.8	-20.0	24.8
469.9750	5	2349.8750	-57.5	0.5	14.3	0.5	-42.2	-20.0	22.2
469.9750	6	2819.8500	-70.6	0.6	14.3	0.6	-55.1	-20.0	35.1
469.9750	7	3289.8250	-66.9	0.5	14.3	0.7	-51.4	-20.0	31.4
469.9750	8	3759.8000	-59.8	0.8	14.3	0.7	-44.0	-20.0	24.0
469.9750	9	4229.7750	-68.1	1.0	14.4	0.8	-51.9	-20.0	31.9
469.9750	10	4699.7500	-71.5	1.0	14.4	0.8	-55.3	-20.0	35.3

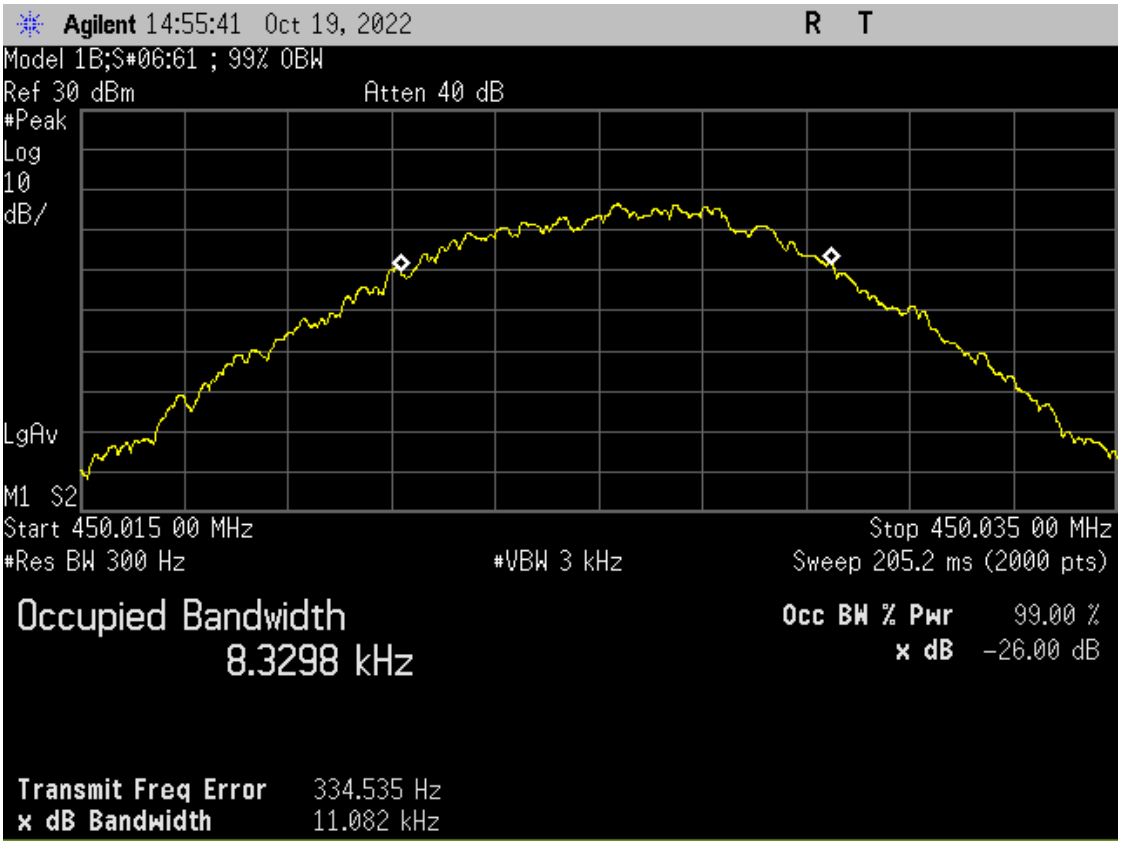
The fundamental emission ERP limit is 100 watts (50 dBm) for an 8 km service area radius.

Judgment: Passed by at least 10 dB.

10.4 Occupied Bandwidth

Model	Y84092-1 Y84580-2	Specification	FCC Part 90 RSS-GEN Section 6.7
Serial Number	00:1D:24:00:01:0E:06:61 00:1D:24:00:01:13:FC:83	Test Date	10/19/2022
Test Personnel	Joseph Strzelecki	Test Location	Chamber B
Test Equipment	EMI Receiver (REC-44)		

	99% OBW (kHz)	
Channel	Y84092-1	Y84580-2
450.0250	8.3298	8.3250
460.0000	8.3405	8.2940
469.9875	8.3413	8.3061



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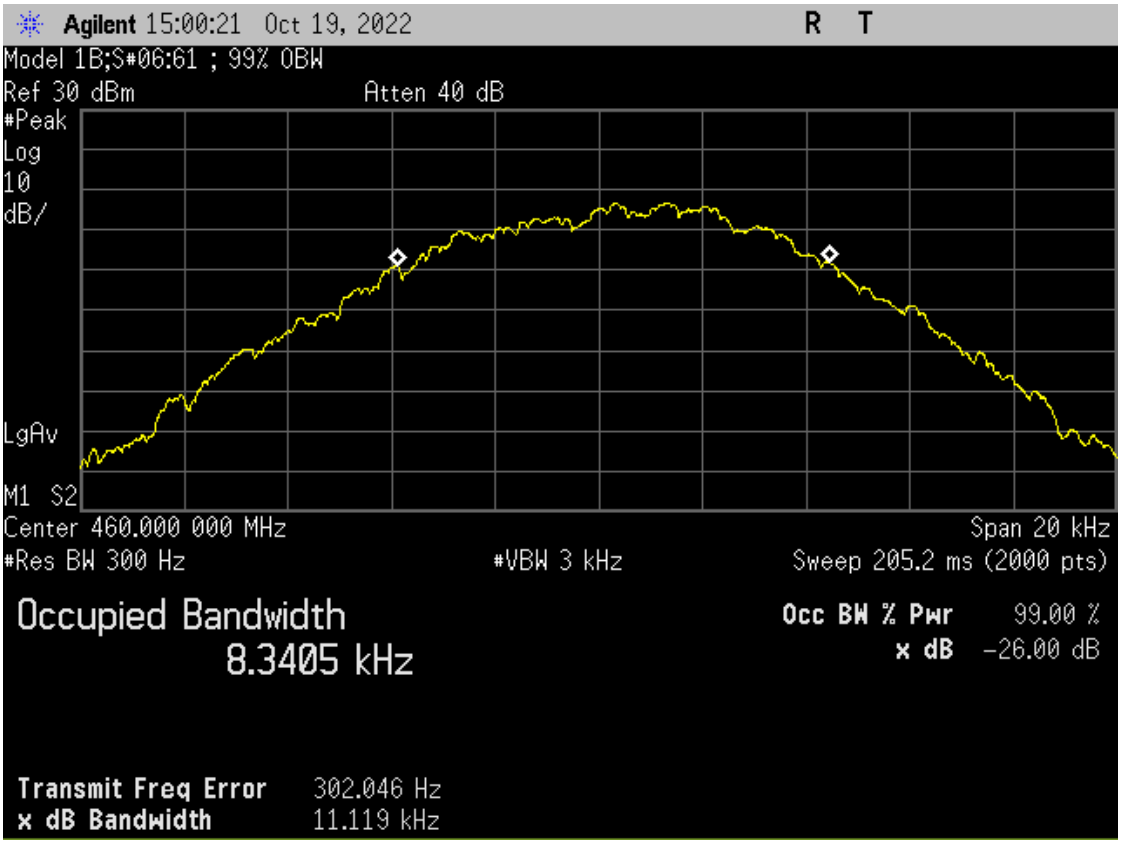

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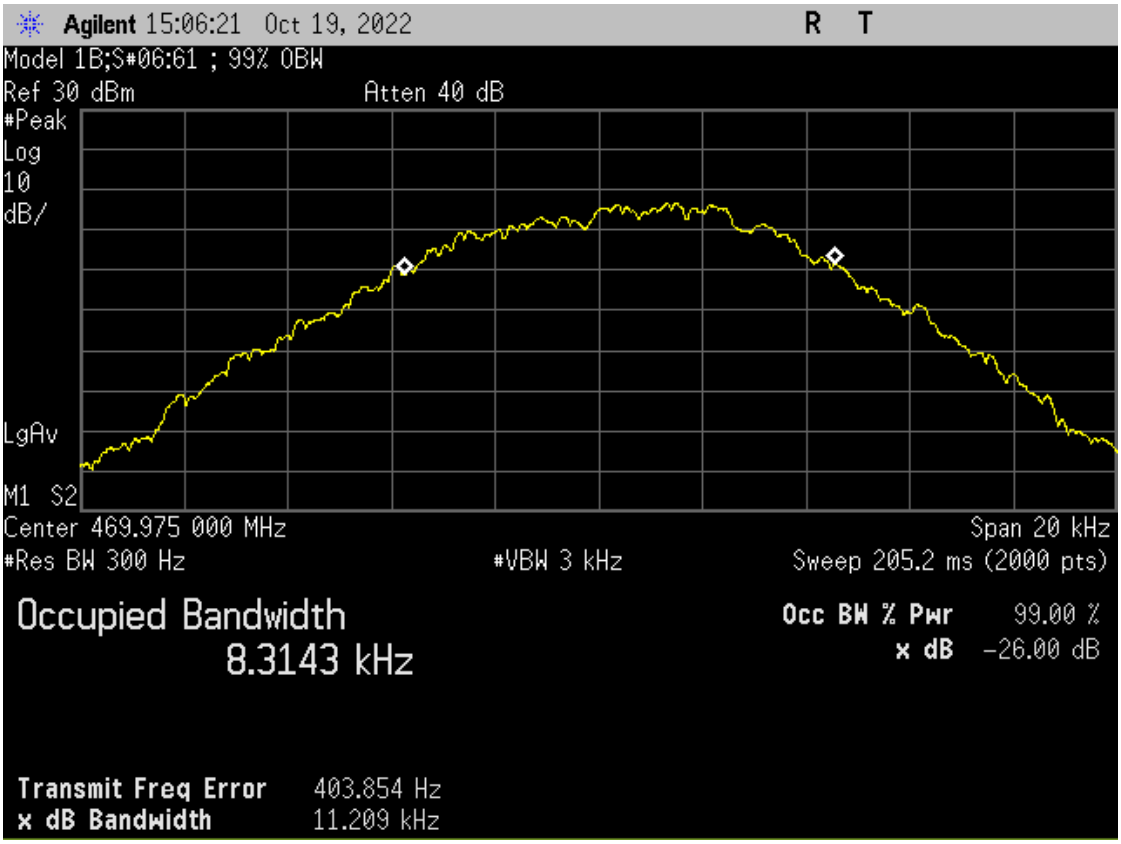

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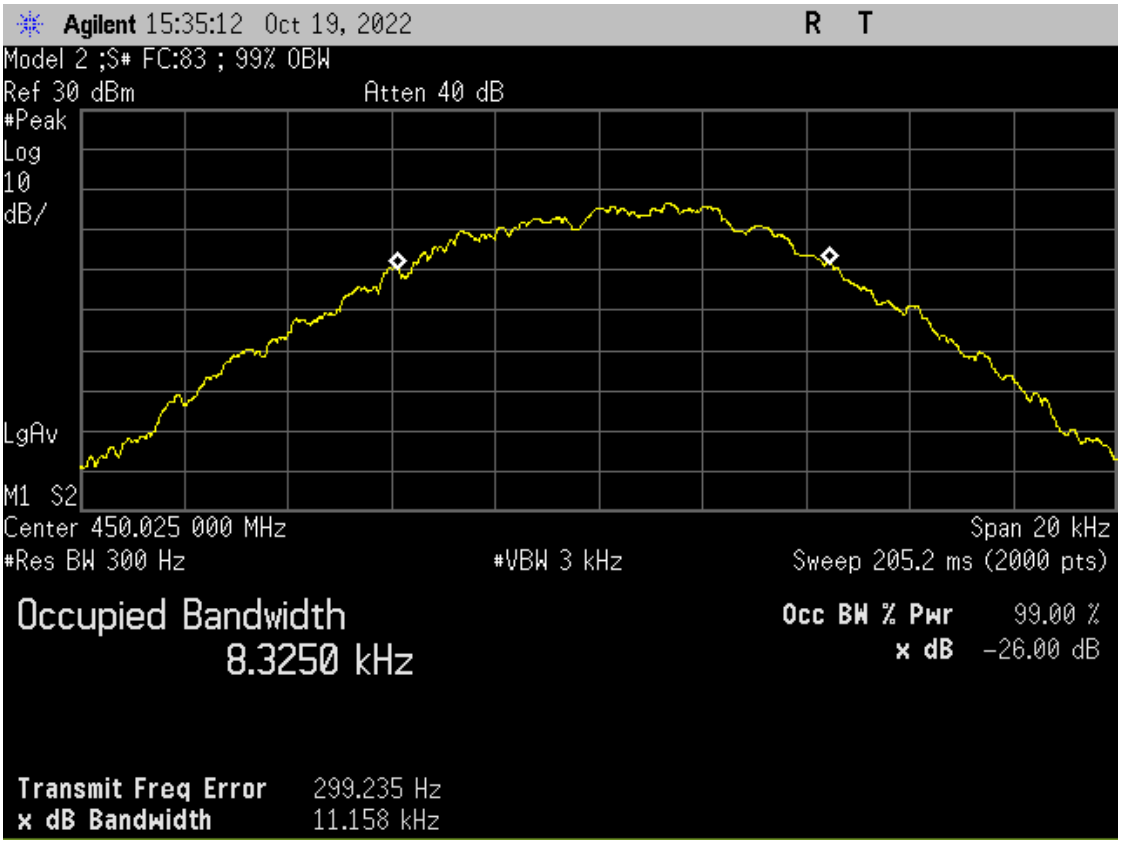

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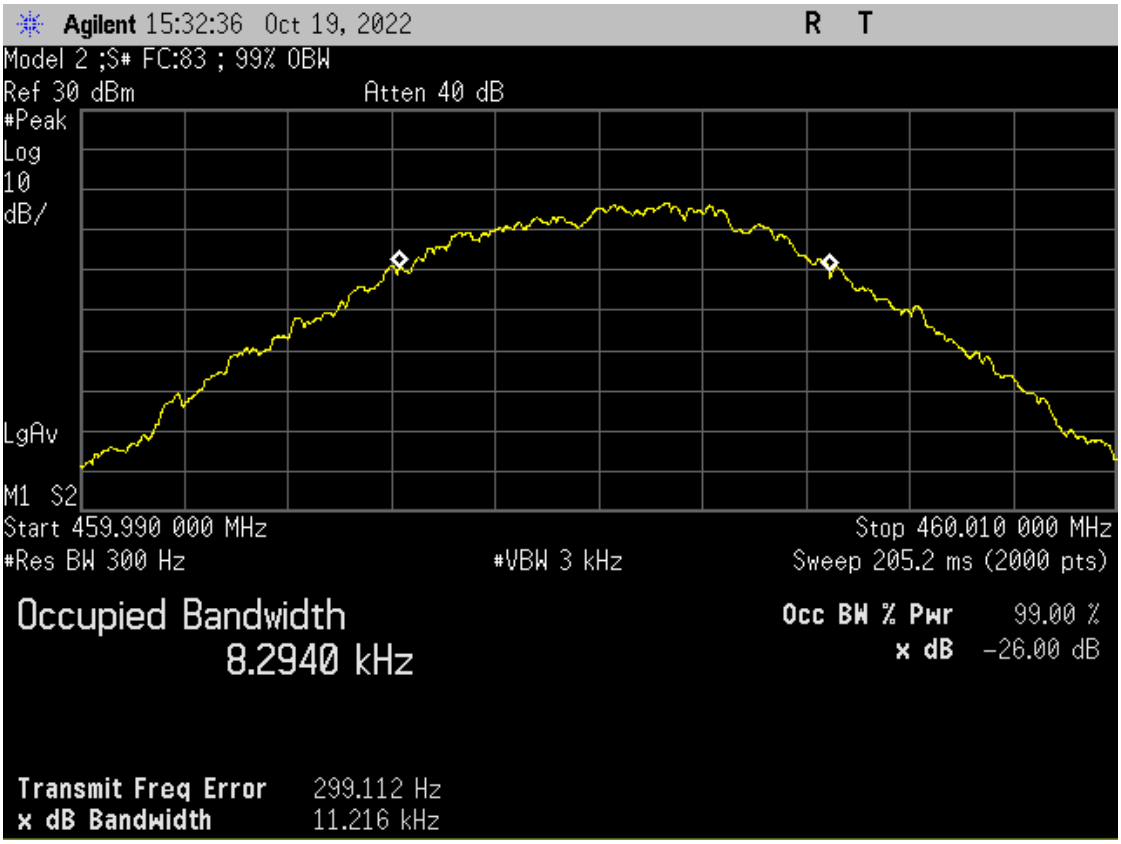

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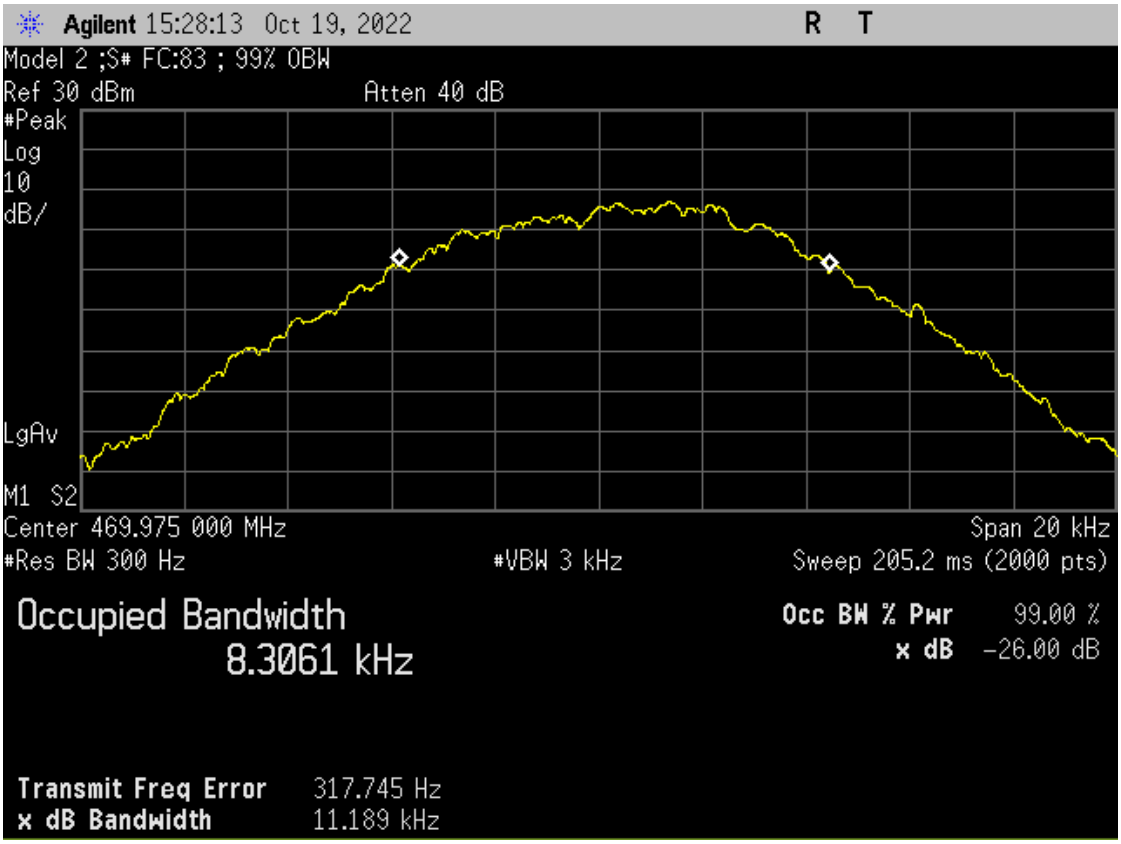


Y84580-2

10.5 Field Strength of Unwanted Spurious Radiation

10.5.1 Test Procedures

Radiated emission measurements in the Restricted bands were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists. From 30 to 4700 MHz, a spectrum analyzer with a preselector was used for measurement. Radiated emissions measurements were performed at the anechoic chamber at a test distance of 3 meters. The entire frequency range from 30 to 4700 MHz was slowly scanned and the emissions in the restricted frequency bands were recorded. Measurements were performed using the peak detector function.

The spectrum analyzer was adjusted for the following settings:

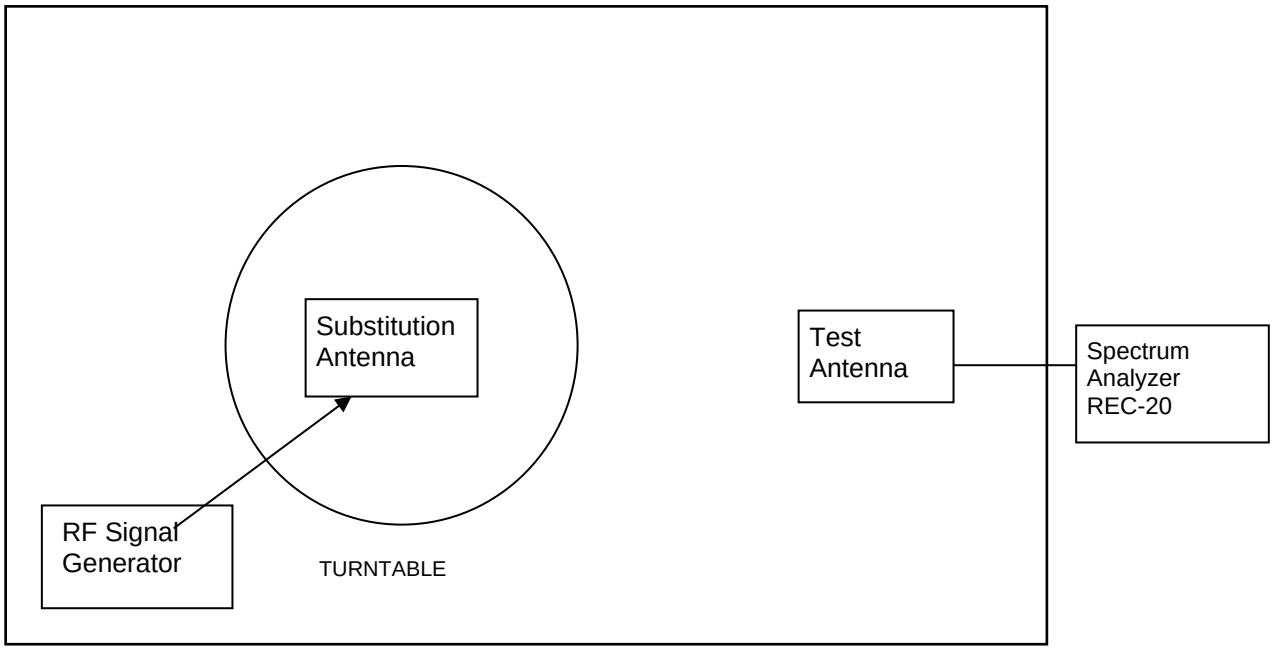
1) Resolution Bandwidth = 100 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1GHz.
2) Video Bandwidth = 300 kHz for spurious emissions below 1 GHz, and 3 MHz for spurious emissions above 1 GHz.
3) Sweep Speed slow enough to maintain measurement calibration.
4) Detector Mode = Positive Peak.

The transmitter to be tested was placed on the turntable in the standard test site, or an FCC listed site compliant with ANSI C63.4. The transmitter is transmitting into a non-radiating load that is placed on the turntable. Measurements were made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier. The transmitter was keyed during the tests.

For each spurious frequency, the test antenna was raised and lowered from 1 m to 4m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Then the turntable was rotated 360° to determine the maximum reading. This procedure was repeated to obtain the highest possible reading. This maximum reading was recorded.

Each measurement was repeated for each spurious frequency with the test antenna polarized vertically.

Figure 1. Drawing of Radiated Emissions Setup



ANSI C63.4 Listed Test Site

Notes:
- Test Antenna height varied from 1 to 4 meters
- Distance from antenna to tested system is 3 meters
- Not to Scale

Frequency MHz	Test Antenna	Substitution Antenna	Receiver to Coupler	Signal Generator
30 - 200	ANT-80	ANT-79	REC-20	SIG-31
200 - 1000	ANT-68	ANT-06	REC-20	SIG-31
1000-5000	ANT-36	ANT-13	REC-20	SIG-31

The transmitter was removed and replaced with a broadband substitution antenna. The substitution antenna is calibrated so that the gain relative to a dipole is known. The center of the substitution antenna was approximately at the same location as the center of the transmitter.

The substitution antenna was fed at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, the test antenna was raised and lowered to obtain a maximum reading at the spectrum analyzer. The level of the signal generator output was adjusted until the previously recorded maximum reading for this set of conditions was obtained.

The measurements were repeated with both antennas horizontally and vertically polarized for each spurious frequency.

The power in dBm into a was calculated by reducing the substitution readings obtained above by the loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula:
Pd(dBm) = *Pg*(dBm) – *cable loss* (dB) + *antenna gain* (dB)

where:
Pd is the dipole equivalent power and
Pg is the generator output power into the substitution antenna.

10.5.2 Test Limits

Any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB.

Since by mathematical definition, P(dBm) – (50+10xLOG(P(W))) = -20 dBm, the limit for spurious emissions was set to -20 dBm equivalent radiated power. P(W) = Power in watts.

10.5.3 Spurious Radiated Emissions Test Results

Model	Y84092-1	Specification	FCC Part 90.210 RSS-119 Section 5.8
Serial Number	00:1D:24:00:01:0E:06:61	Test Date	09/28 & 9/29/2022
Test Distance	3 Meters	Notes	Transmit Mode
Test Personnel	Chris Dalessio		

Y84092-1

	Tx	Measured	Equivalent Radiated power into Dipole			Margin Under Limit	
Harmonic	Freq	Freq	Vertical	Horizontal	Limit	Vertical	Horizontal
#	MHz	MHz	dBm	dBm	dBm	dB	dB
2	450.0250	900.05	-40.0	-33.7	-20.0	20.0	13.7
3	450.0250	1350.08	-35.0	-36.3	-20.0	15.0	16.3
4	450.0250	1800.10	-33.9	-34.1	-20.0	13.9	14.1
5	450.0250	2250.13	-30.8	-29.4	-20.0	10.8	9.4
6	450.0250	2700.15	-48.1	-48.3	-20.0	28.1	28.3
7	450.0250	3150.18	-43.3	-42.3	-20.0	23.3	22.3
8	450.0250	3600.20	-44.6	-40.3	-20.0	24.6	20.3
9	450.0250	4050.23	-43.4	-38.4	-20.0	23.4	18.4
10	450.0250	4500.25	-41.1	-40.2	-20.0	21.1	20.2
2	460.0000	920.00	-34.7	-37.4	-20.0	14.7	17.4
3	460.0000	1380.00	-39.4	-42.7	-20.0	19.4	22.7
4	460.0000	1840.00	-38.8	-30.6	-20.0	18.8	10.6

	Tx	Measured	Equivalent Radiated power into Dipole			Margin Under Limit	
Harmonic	Freq	Freq	Vertical	Horizontal	Limit	Vertical	Horizontal
#	MHz	MHz	dBm	dBm	dBm	dB	dB
5	460.0000	2300.00	-38.8	-32.3	-20.0	18.8	12.3
6	460.0000	2760.00	-48.5	-45.8	-20.0	28.5	25.8
7	460.0000	3220.00	-43.9	-41.3	-20.0	23.9	21.3
8	460.0000	3680.00	-41.3	-31.1	-20.0	21.3	11.1
9	460.0000	4140.00	-41.2	-33.0	-20.0	21.2	13.0
10	460.0000	4600.00	-40.6	-41.3	-20.0	20.6	21.3
2	469.9750	939.95	-38.3	-38.4	-20.0	18.3	18.4
3	469.9750	1409.93	-36.8	-37.0	-20.0	16.8	17.0
4	469.9750	1879.90	-35.1	-32.9	-20.0	15.1	12.9
5	469.9750	2349.88	-43.2	-36.2	-20.0	23.2	16.2
6	469.9750	2819.85	-53.9	-54.3	-20.0	33.9	34.3
7	469.9750	3289.83	-44.1	-42.0	-20.0	24.1	22.0
8	469.9750	3759.80	-51.8	-49.3	-20.0	31.8	29.3
9	469.9750	4229.78	-42.1	-37.2	-20.0	22.1	17.2
10	469.9750	4699.75	-49.1	-47.6	-20.0	29.1	27.6

Y84092-1
Non-Harmonic frequencies

Freq MHz	Detector	Ant Pol	EUT dBm	Limit dBm	Margin dB
399.4	P	H	-56.9	-20.0	36.9
490.8	P	H	-54.2	-20.0	34.2
667.5	P	H	-55.1	-20.0	35.1
745.0	P	H	-54.0	-20.0	34.0
868.8	P	H	-52.8	-20.0	32.8
975.0	P	H	-51.9	-20.0	31.9
2883.9	P	H	-56.4	-20.0	36.4
3865.9	P	H	-54.4	-20.0	34.4
4860.1	P	H	-52.2	-20.0	32.2
299.3	P	V	-52.9	-20.0	32.9
339.6	P	V	-47.9	-20.0	27.9
417.1	P	V	-54.8	-20.0	34.8
510.0	P	V	-57.7	-20.0	37.7
558.8	P	V	-56.7	-20.0	36.7
570.0	P	V	-32.0	-20.0	12.0
606.3	P	V	-38.1	-20.0	18.1
635.0	P	V	-54.5	-20.0	34.5
760.0	P	V	-43.2	-20.0	23.2
800.0	P	V	-37.1	-20.0	17.1
991.3	P	V	-54.7	-20.0	34.7
1942.9	P	V	-59.4	-20.0	39.4
2931.9	P	V	-56.6	-20.0	36.6
3735.7	P	V	-55.3	-20.0	35.3
4106.1	P	V	-54.8	-20.0	34.8
4808.8	P	V	-52.5	-20.0	32.5

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	Tx	Measured	Equivalent Radiated power into Dipole			Margin Under Limit	
Harmonic	Freq	Freq	Vertical	Horizontal	Limit	Vertical	Horizontal
#	MHz	MHz	dBm	dBm	dBm	dB	dB
2	450.0250	900.05	-33.2	-34.9	-20.0	13.2	14.9
3	450.0250	1350.08	-39.7	-41.1	-20.0	19.7	21.1
4	450.0250	1800.10	-48.7	-49.0	-20.0	28.7	29.0
5	450.0250	2250.13	-37.5	-35.8	-20.0	17.5	15.8
6	450.0250	2700.15	-51.0	-51.4	-20.0	31.0	31.4
7	450.0250	3150.18	-48.7	-48.3	-20.0	28.7	28.3
8	450.0250	3600.20	-44.6	-43.6	-20.0	24.6	23.6
9	450.0250	4050.23	-46.8	-48.9	-20.0	26.8	28.9
10	450.0250	4500.25	-47.7	-48.0	-20.0	27.7	28.0
2	460.0000	920.00	-29.6	-33.8	-20.0	9.6	13.8
3	460.0000	1380.00	-38.5	-38.1	-20.0	18.5	18.1
4	460.0000	1840.00	-38.6	-39.3	-20.0	18.6	19.3
5	460.0000	2300.00	-37.0	-34.7	-20.0	17.0	14.7
6	460.0000	2760.00	-50.0	-49.3	-20.0	30.0	29.3
7	460.0000	3220.00	-45.8	-43.7	-20.0	25.8	23.7
8	460.0000	3680.00	-48.1	-46.3	-20.0	28.1	26.3
9	460.0000	4140.00	-47.3	-46.9	-20.0	27.3	26.9
10	460.0000	4600.00	-44.9	-43.0	-20.0	24.9	23.0
2	469.9750	939.95	-30.9	-34.8	-20.0	10.9	14.8
3	469.9750	1409.93	-32.0	-35.6	-20.0	12.0	15.6
4	469.9750	1879.90	-35.6	-35.9	-20.0	15.6	15.9
5	469.9750	2349.88	-37.8	-32.6	-20.0	17.8	12.6
6	469.9750	2819.85	-49.1	-49.1	-20.0	29.1	29.1
7	469.9750	3289.83	-43.3	-38.5	-20.0	23.3	18.5
8	469.9750	3759.80	-42.4	-40.3	-20.0	22.4	20.3
9	469.9750	4229.78	-43.9	-39.6	-20.0	23.9	19.6
10	469.9750	4699.75	-44.8	-43.4	-20.0	24.8	23.4

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Non-Harmonic frequencies

Freq MHz	Detector	Ant Pol	EUT dBm	Limit dBm	Margin dB
378.4	P	H	-57.6	-20.0	37.6
481.3	P	H	-55.2	-20.0	35.2
511.5	P	H	-54.0	-20.0	34.0
877.4	P	H	-57.7	-20.0	37.7
954.5	P	H	-57.9	-20.0	37.9
1979.0	P	H	-58.1	-20.0	38.1
2505.5	P	H	-57.5	-20.0	37.5
3720.7	P	H	-55.6	-20.0	35.6
4417.4	P	H	-55.1	-20.0	35.1
4721.7	P	H	-53.3	-20.0	33.3
4859.9	P	H	-53.2	-20.0	33.2
375.1	P	V	-58.0	-20.0	38.0
430.1	P	V	-57.4	-20.0	37.4
445.0	P	V	-54.9	-20.0	34.9
511.5	P	V	-49.1	-20.0	29.1
569.1	P	V	-49.5	-20.0	29.5

Freq MHz	Detector	Ant Pol	EUT dBm	Limit dBm	Margin dB
799.3	P	V	-51.1	-20.0	31.1
842.8	P	V	-55.5	-20.0	35.5
971.5	P	V	-53.5	-20.0	33.5
3595.6	P	V	-55.7	-20.0	35.7
3882.9	P	V	-54.6	-20.0	34.6
4232.2	P	V	-55.5	-20.0	35.5
4500.5	P	V	-53.3	-20.0	33.3
4806.8	P	V	-52.1	-20.0	32.1

No other radiated emissions were detected within 10 dB of the limits from 30 MHz to 4.7 GHz.

Judgment: Passed by 9.4 dB.

10.6 Frequency Stability

10.6.1 Frequency Stability Vs Temperature

The chamber was then set to the lowest temperature. The transmitter was in the chamber and allowed to stabilize for 15 minutes. The transmitter was then keyed, and the frequency was recorded. The chamber was then incremented in 10°C steps with a minimum of 15-minute stabilization period for each temperature measurement. The transmitter was off during the temperature transitions.

10.6.2 Frequency Stability Vs Supply Voltage

The EUT was allowed to stabilize with the nominal primary power supply voltage applied. The primary input voltage was varied from the lowest to the highest rated levels specified by the manufacturer. Frequency readings were taken at increments of 0.2 VDC, tested to Battery End point.

10.6.3 Test Results for Frequency Stability

Model	Y84092-1; S/N: 00:1D:24:00:01:0E:06:61 Y84580-2; S/N: 00:1D:24:00:01:13:FC:83	Specification	FCC Part 90.213 RSS-119 Section 5.3
Test Personnel	Richard Tichgelaar	Test Date	10/19 & 10/20/2022
		Test Location	Station F
Test Equipment	Spectrum Analyzer (REC-20); Freq. Counter(CNT-01); Temperature Chamber TC-01; Digital Multimeter (DMM-11)		
Notes	15 minutes at each Temperature; 1 min at each voltage		
Nominal Frequency	460.000 MHz		

Volts	Freq.	Nominal Freq:	Deviation	
VDC	(MHz)	at 3.2 VDC	Hz	PPM
204.0	460.000095	460.000100	-5	-0.01
216.0	460.000108	460.000100	8	0.02
228.0	460.000100	460.000100	0	0.00
240.0	460.000110	460.000100	10	0.02
252.0	460.000090	460.000100	-10	-0.02
264.0	460.000093	460.000100	-7	-0.02
276.0	460.000090	460.000100	-10	-0.02

Temp	Measured Freq	Nominal Freq:	Deviation	
Deg C	(MHz)	at 20 Deg C	Hz	PPM
50	460.000260	460.000100	160	0.35
40	460.000295	460.000100	195	0.42
30	460.000240	460.000100	140	0.30
20	460.000110	460.000100	10	0.02
10	460.000075	460.000100	-25	-0.05
0	459.999969	460.000100	-131	-0.28
-10	459.999910	460.000100	-190	-0.41
-20	460.000005	460.000100	-95	-0.21

Test Requirements: Limit is 2.5 ppm

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Nominal Frequency	460.000 MHz

Volts	Freq.	Nominal Freq:	Deviation	
VDC	(MHz)	at 3.2 VDC	Hz	PPM
204.0	460.000095	460.000170	25	0.05
216.0	460.000108	460.000170	38	0.08
228.0	460.000100	460.000170	30	0.07
240.0	460.000110	460.000170	40	0.09
252.0	460.000090	460.000170	20	0.04
264.0	460.000093	460.000170	23	0.05
276.0	460.000190	460.000170	20	0.04

Temp	Measured Freq	Nominal Freq:	Deviation	
Deg C	(MHz)	at 20 Deg C	Hz	PPM
50	460.000221	460.000170	51	0.11
40	460.000178	460.000170	8	0.02
30	460.000191	460.000170	21	0.05
20	460.000214	460.000170	44	0.10
10	460.000207	460.000170	37	0.08
0	460.000165	460.000170	-5	-0.01
-10	460.000127	460.000170	-43	-0.09
-20	459.999993	460.000170	-177	-0.38

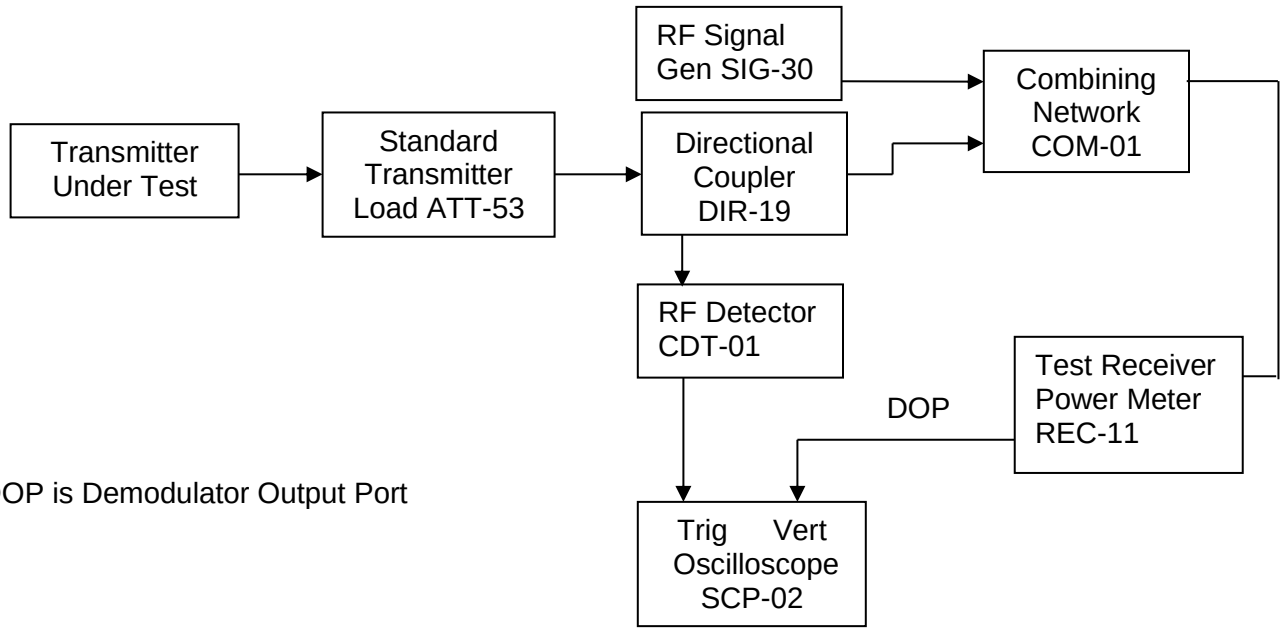
Test Requirements: Limit is 2.5 ppm

Judgement: Pass

10.7 Transient Frequency Behavior

10.7.1 Test method

The test was performed in accordance with TIA-603-D Section 2.2.19.3 Alternate Method of Measurement (Using a Test Receiver). The equipment was connected as shown below.



DOP is Demodulator Output Port

10.7.2 Limits of transient frequency

Time intervals [1,2]	Maximum Frequency Difference [3]	421 to 512 MHz Equipment Operating on 12.5 kHz Channels
t_1 [4]	±12.5 kHz	10.0 mSec
t_2	±6.25 kHz	25.0 mSec
t_3 [4]	±12.5 kHz	10.0 mSec

[1] t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

t_1 is the time period immediately following t_{on}.

t_2 is the time period immediately following t_1.

t_3 is the time period from the instant when the transmitter is turned off until t_{off}.

t_{off} is the instant when the 1 kHz test signal starts to rise.

[2] During the time from the end of $t_2$to the beginning of t_3, the frequency difference must not exceed the limits specified in § 90.213.

[3] Difference between the actual transmitter frequency and the assigned transmitter frequency.

[4] If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

10.7.3 Test Results

Model	Y84092-1; S/N: 00:1D:24:00:01:0E:06:61 Y84580-2; S/N: 00:1D:24:00:01:13:FC:83	Specification	FCC part 90.214 RSS-119 Section 5.9
Test Location	Chamber C	Test Date	10/25/2022
Test Personnel	Joseph Strzelecki; Rich Tichgelaar		

Freq MHz	Channel BW	Limits for Time interval/Freq difference						Test Result
		t_1		t_2		t_3		
		mSec	kHz	mSec	kHz	mSec	kHz	
450.025	12.5	10	12.5	25	6.25	10	12.5*	Pass
460.000	12.5	10	12.5	25	6.25	10	12.5*	Pass
469.975	12.5	10	12.5	25	6.25	10	12.5*	Pass

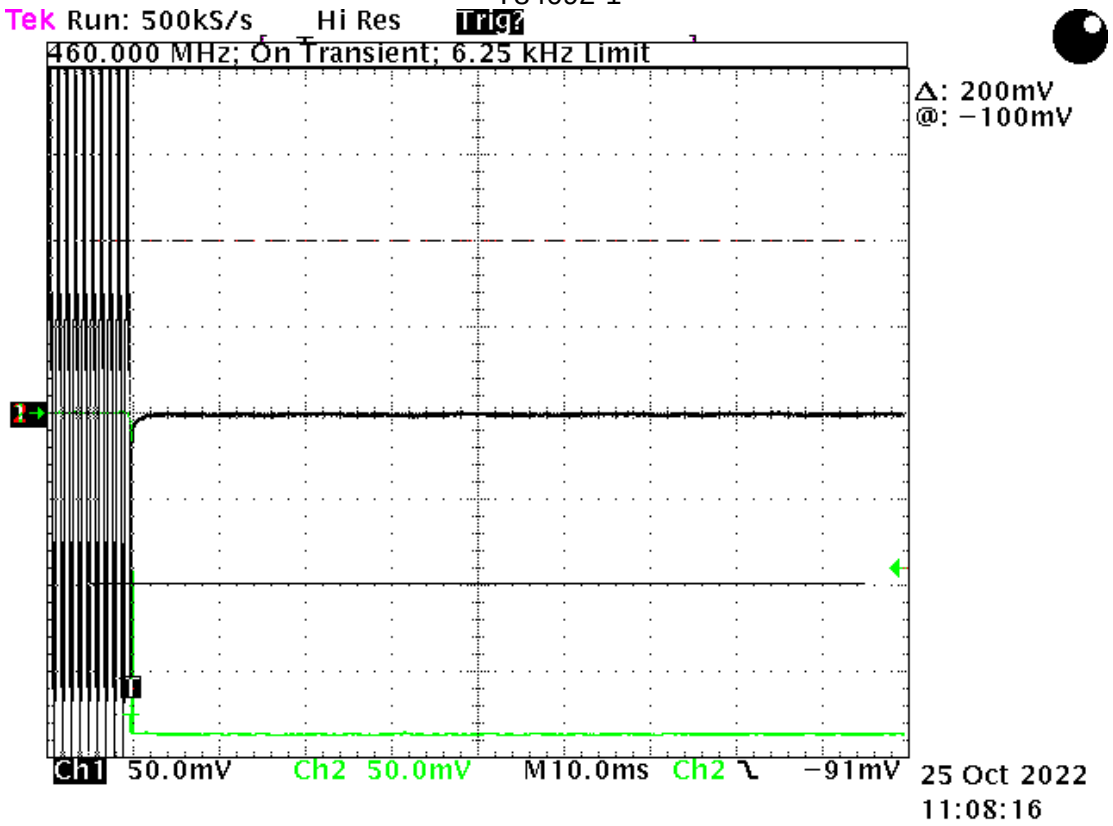
Judgement: Pass

*Since the transmitter carrier output power is less than 6 watts, the frequency difference during the t3 time period may exceed the maximum frequency difference for this time period.

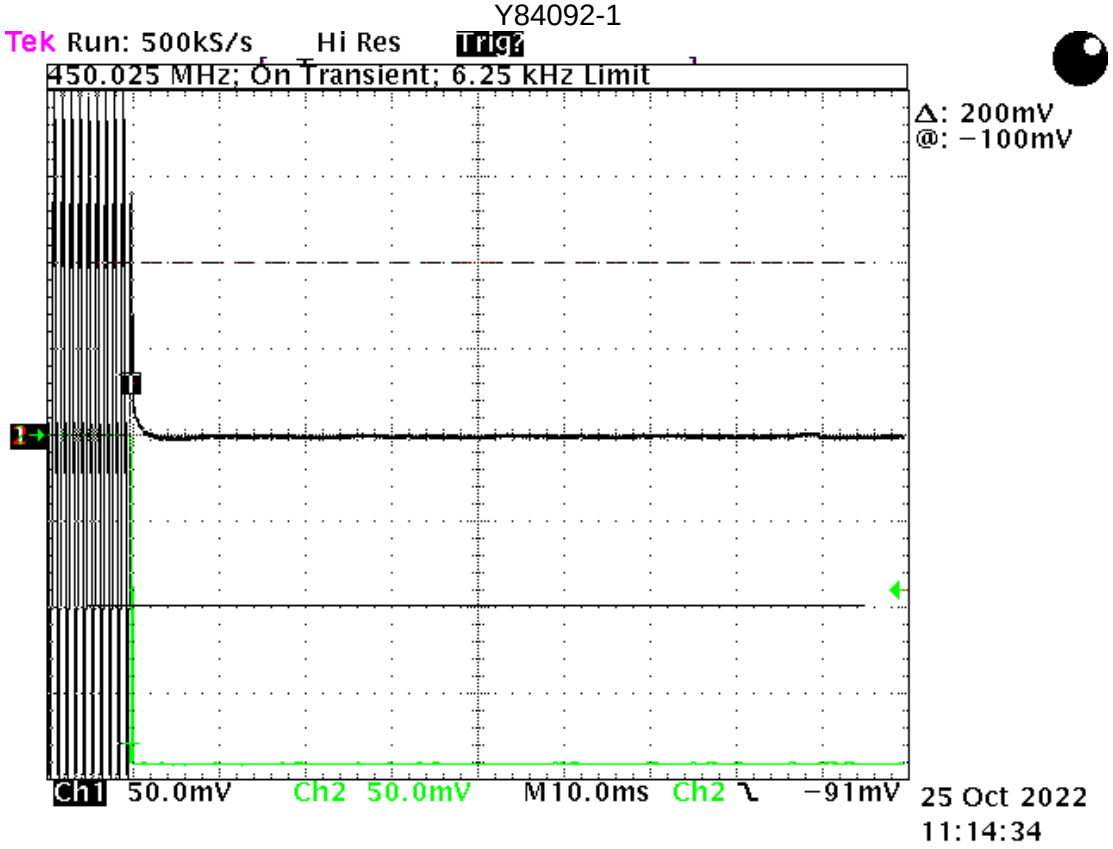
10.7.4 Results for Time Periods t1, t2, and t3

The EUT passed the 6.25 kHz limit, so the 12.5 limit is not shown.

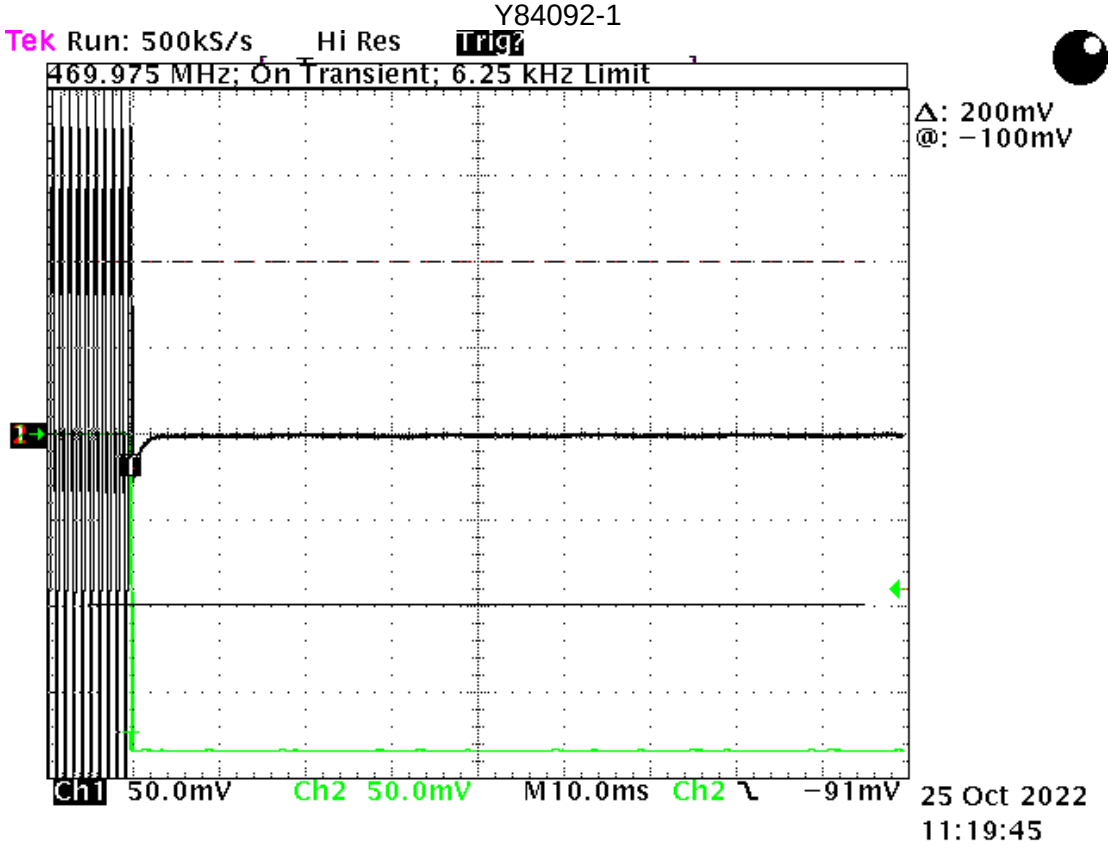
Y84092-1



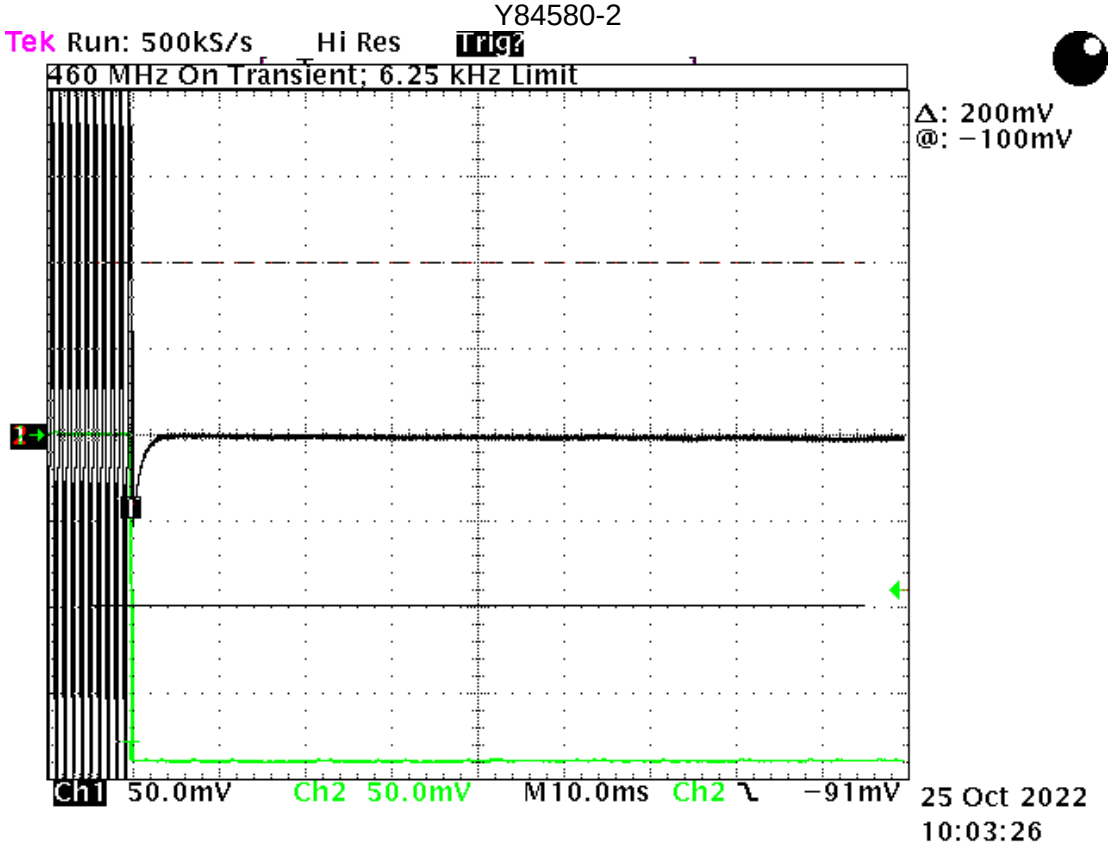
Y84092-1



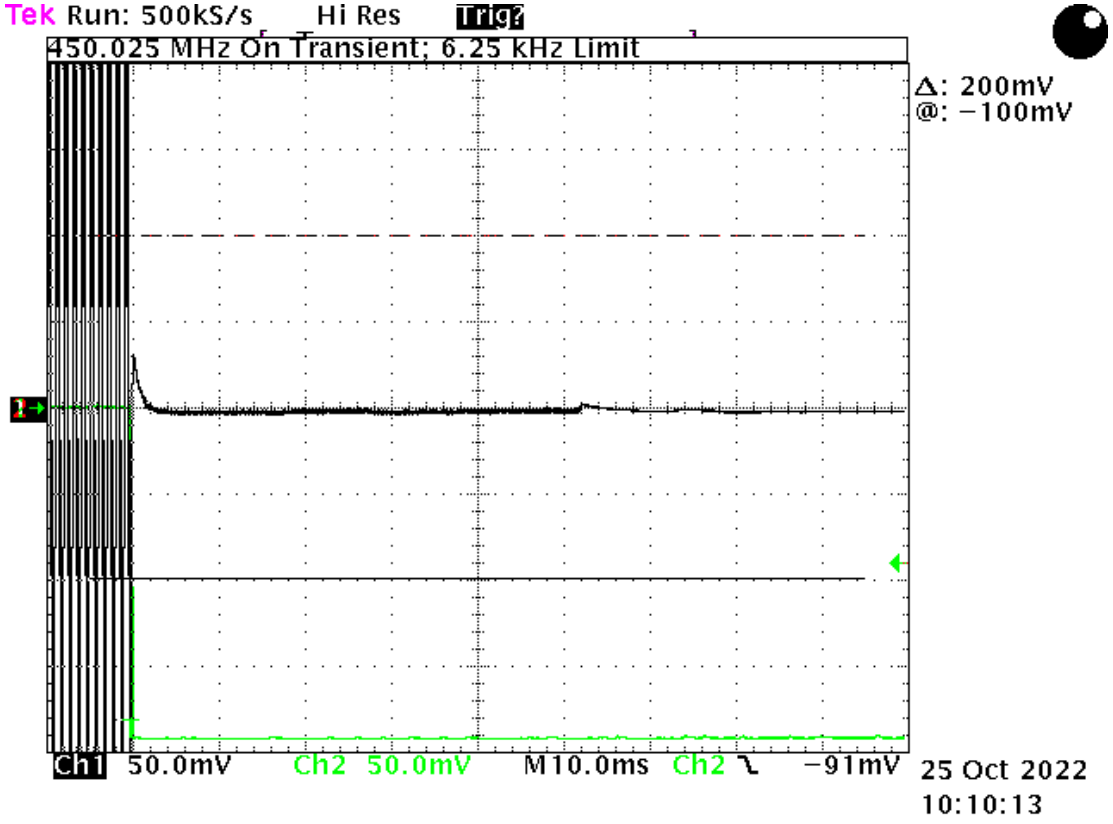
Y84092-1



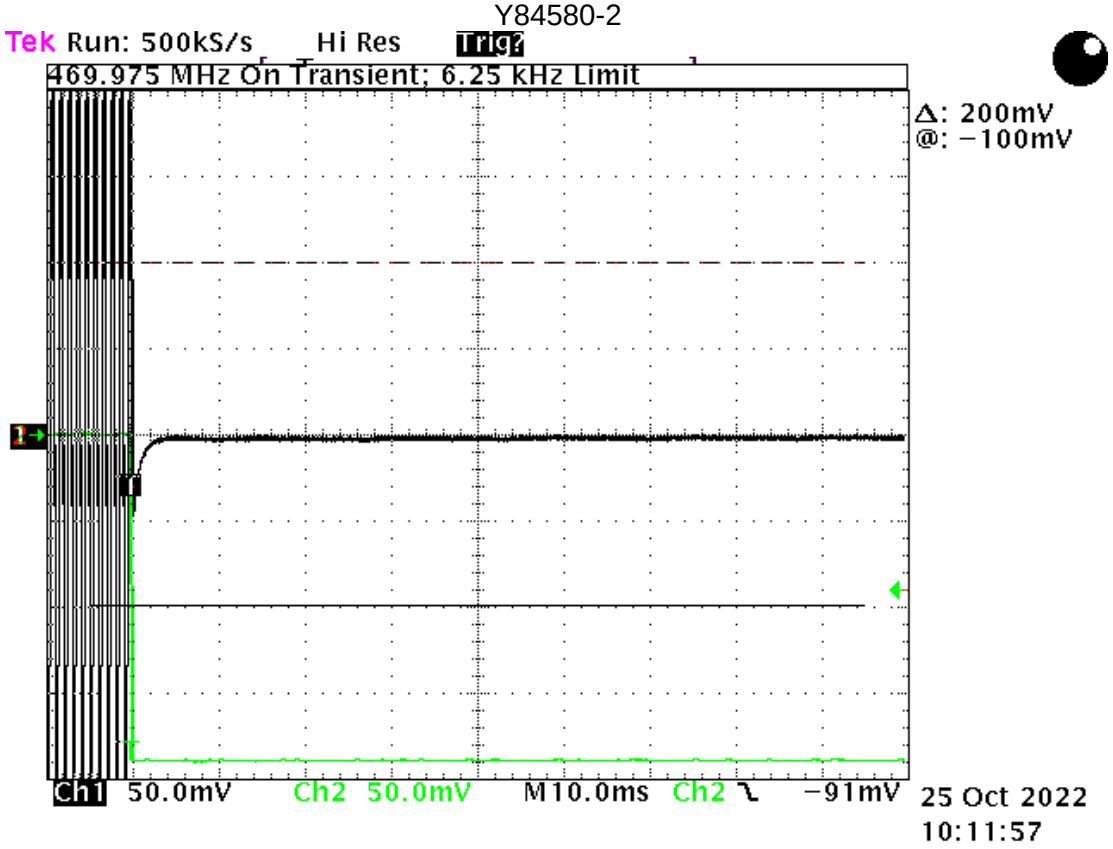
Y84580-2



Y84580-2



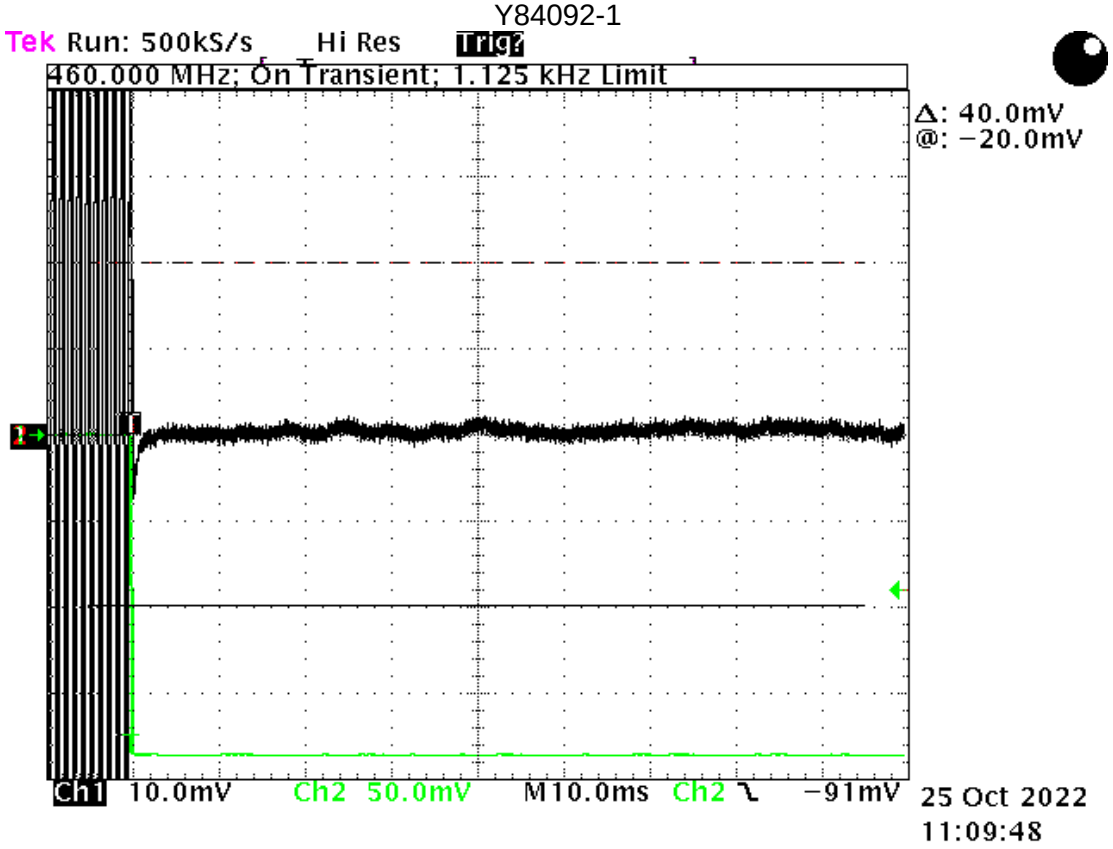
Y84580-2



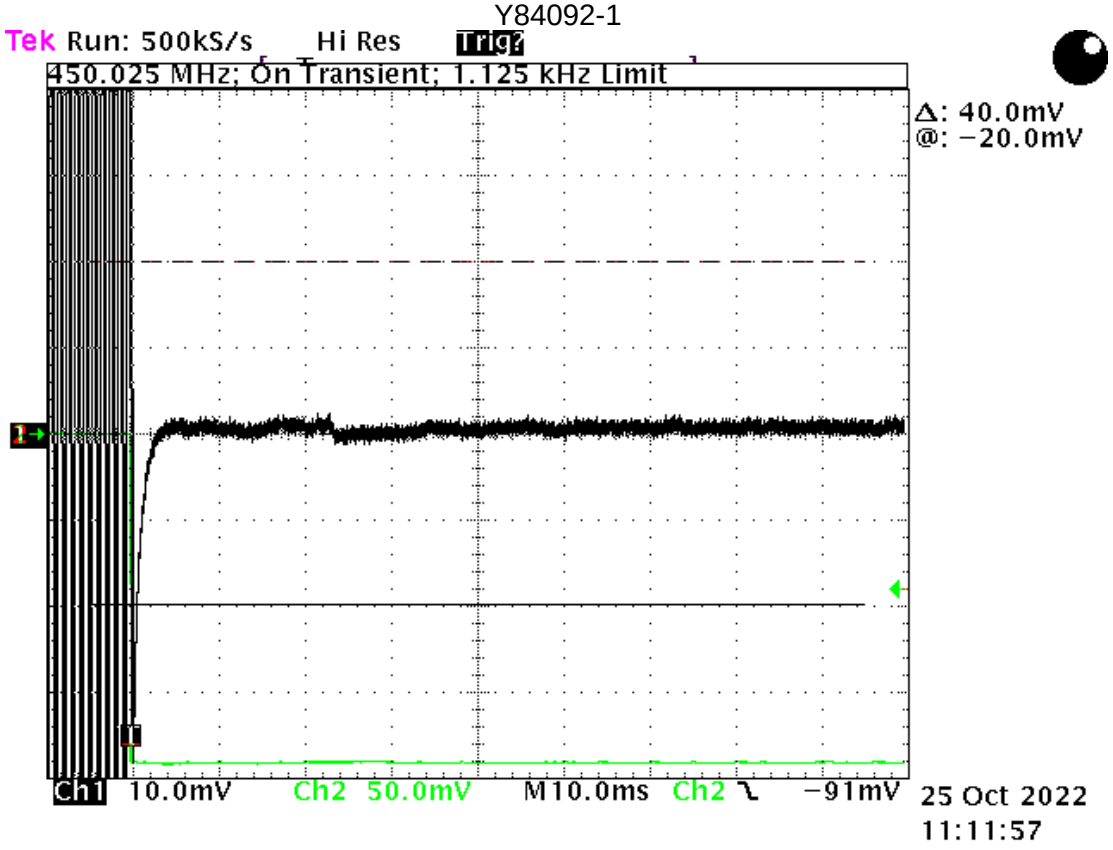
10.7.5 Results for Time Period between t2 and t3

The limit between t2 and t3 on all the scope traces are calculated for the 450 MHz Channel since this is the lowest limit. This limit is 450 MHz * 2.5 ppm or 1125 Hz.

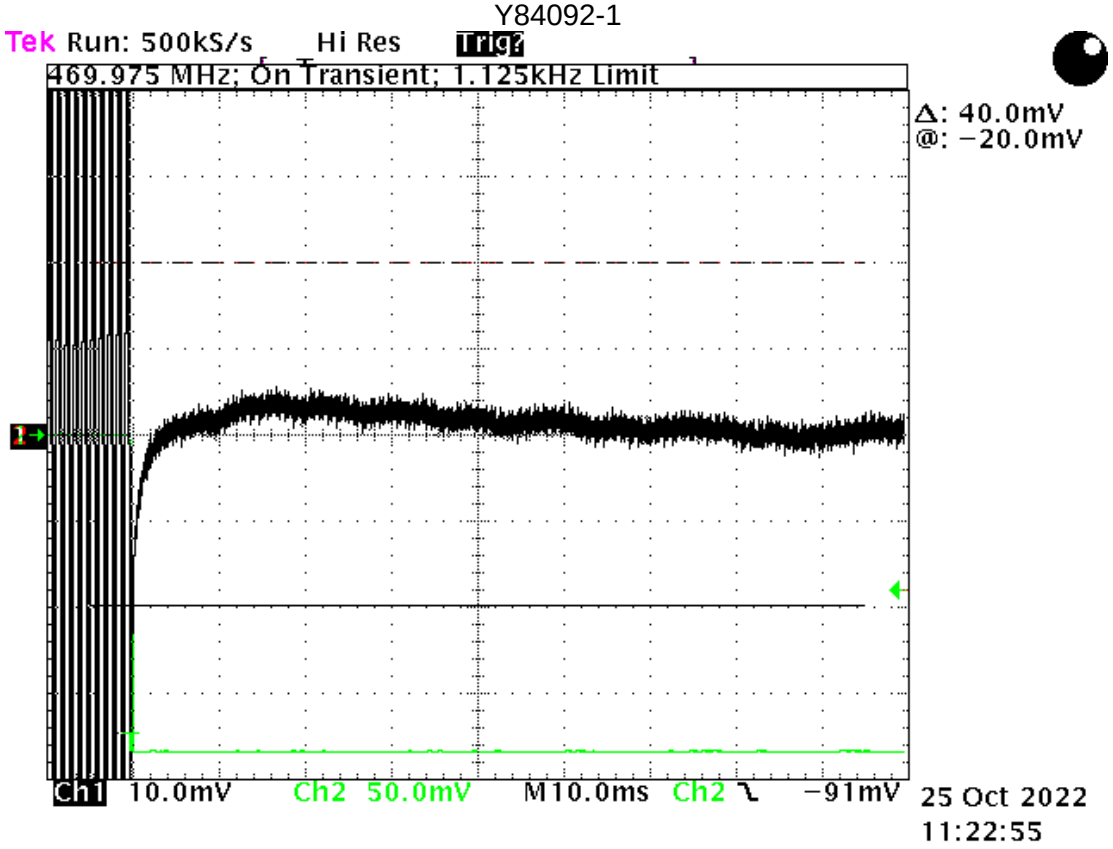
Y84092-1



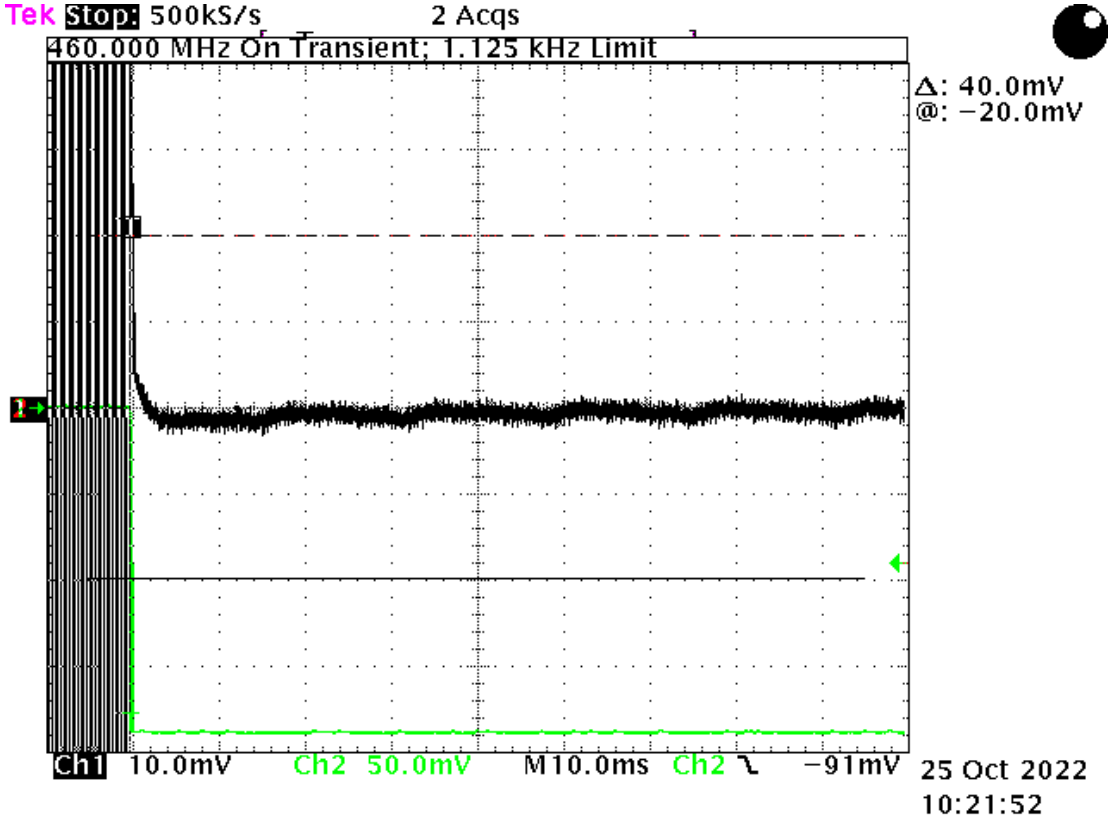
Y84092-1



Y84092-1



Y84580-2



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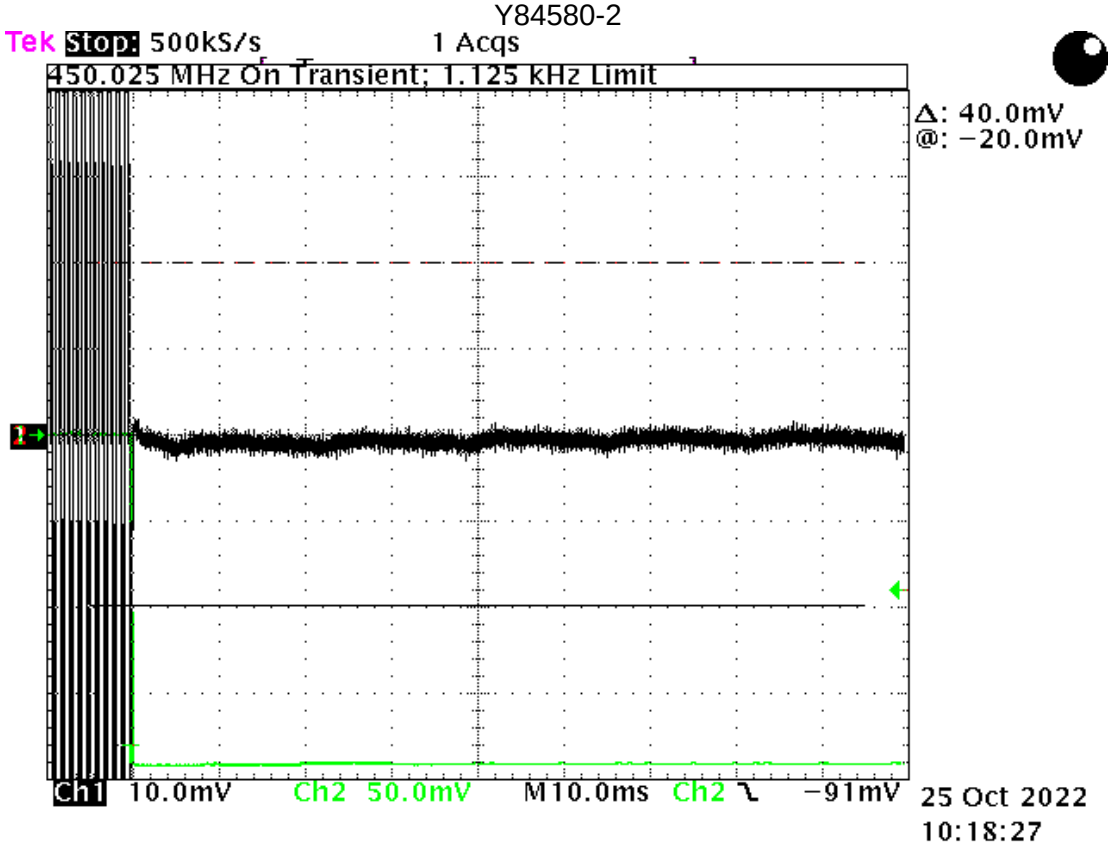
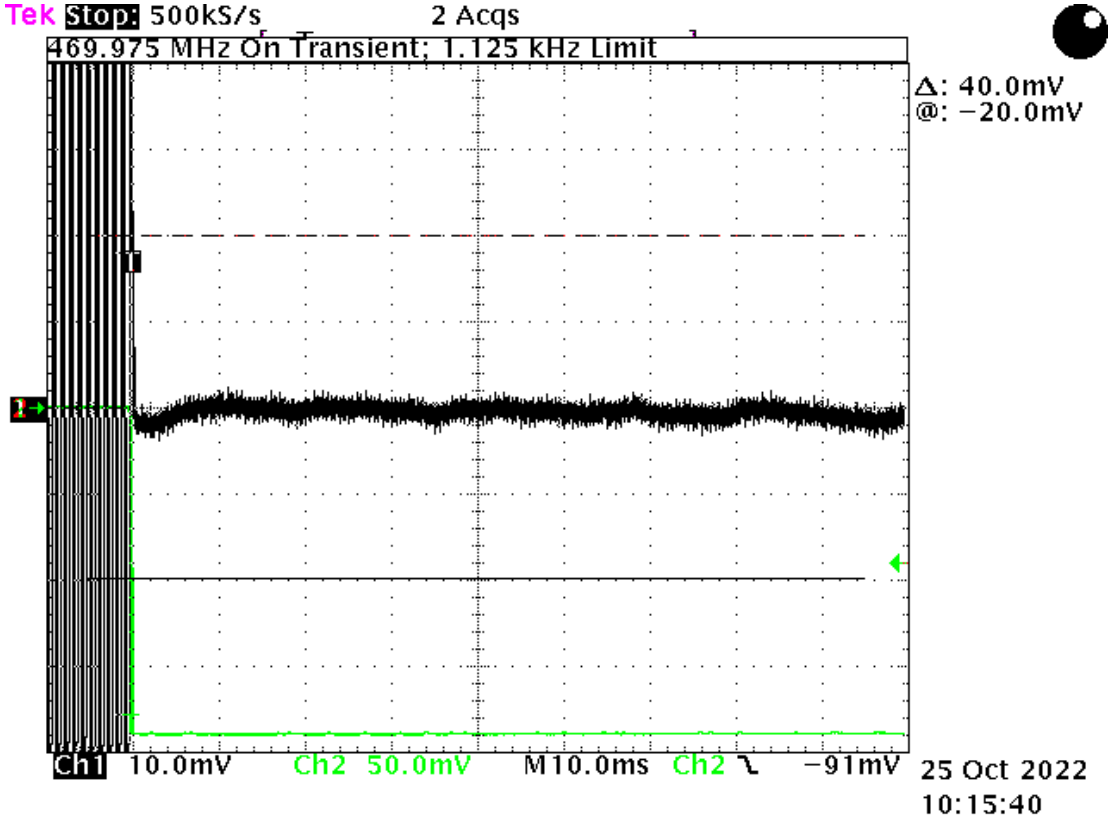


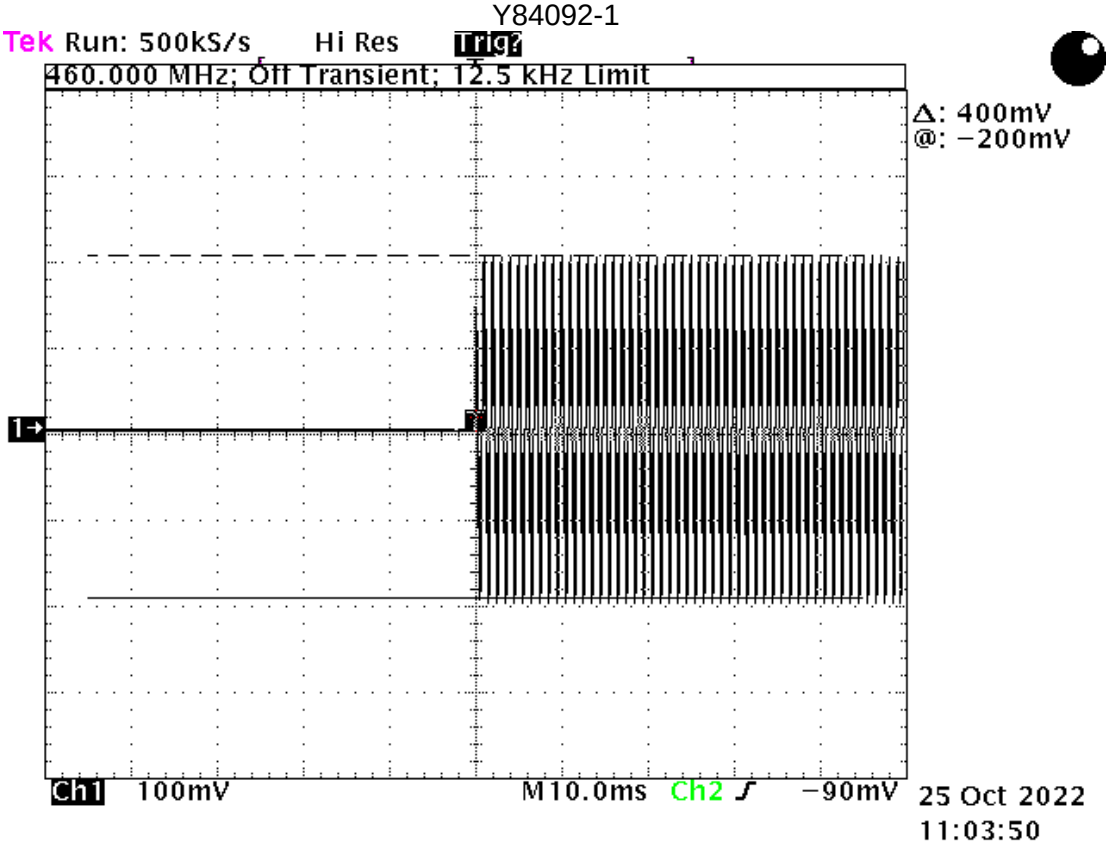
Y84580-2



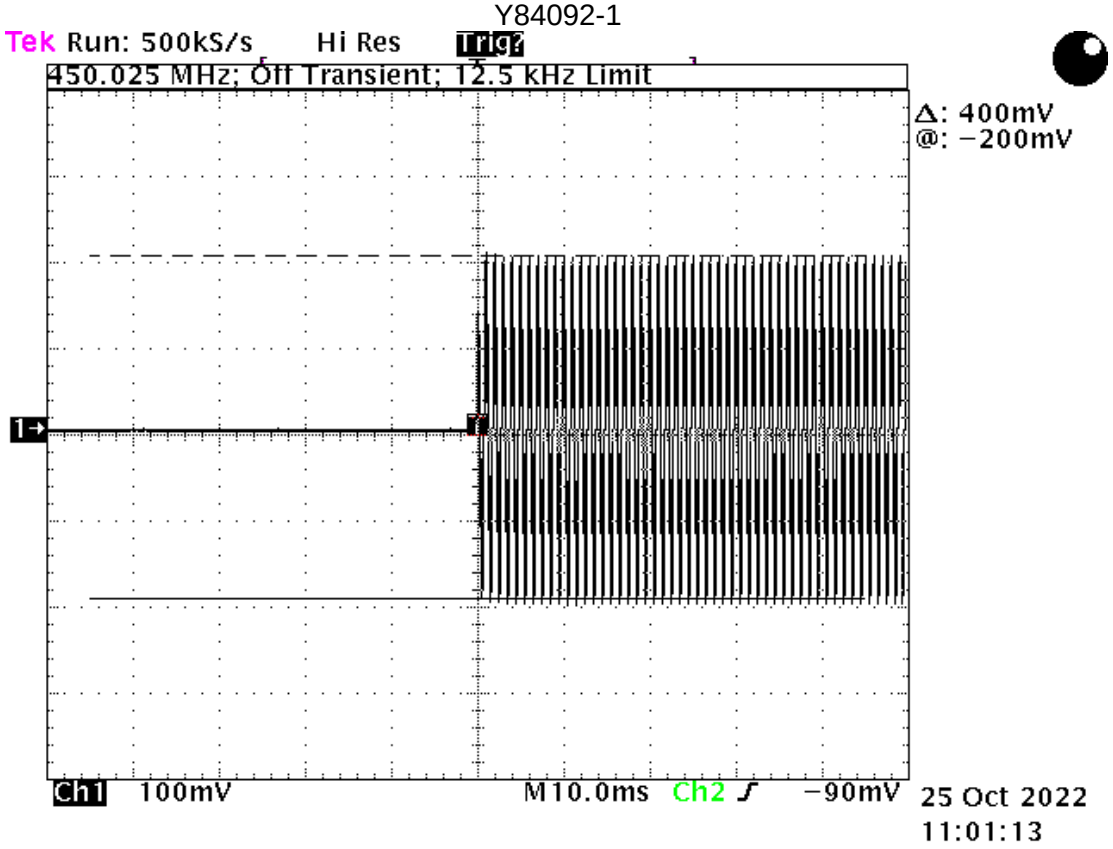
10.7.6 Results for Time Period t3

Since the transmitter carrier output power is less than 6 watts, the frequency difference during the t3 time period may exceed the maximum frequency difference for this time period.

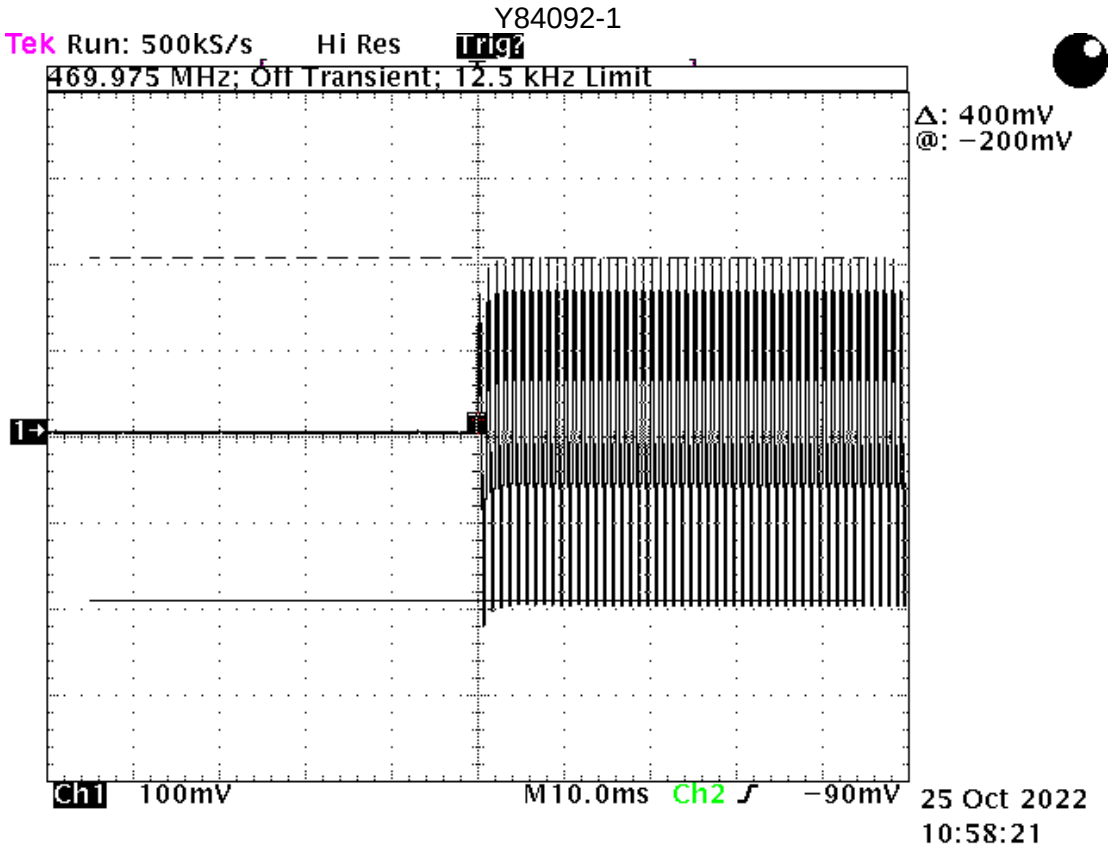
Y84092-1



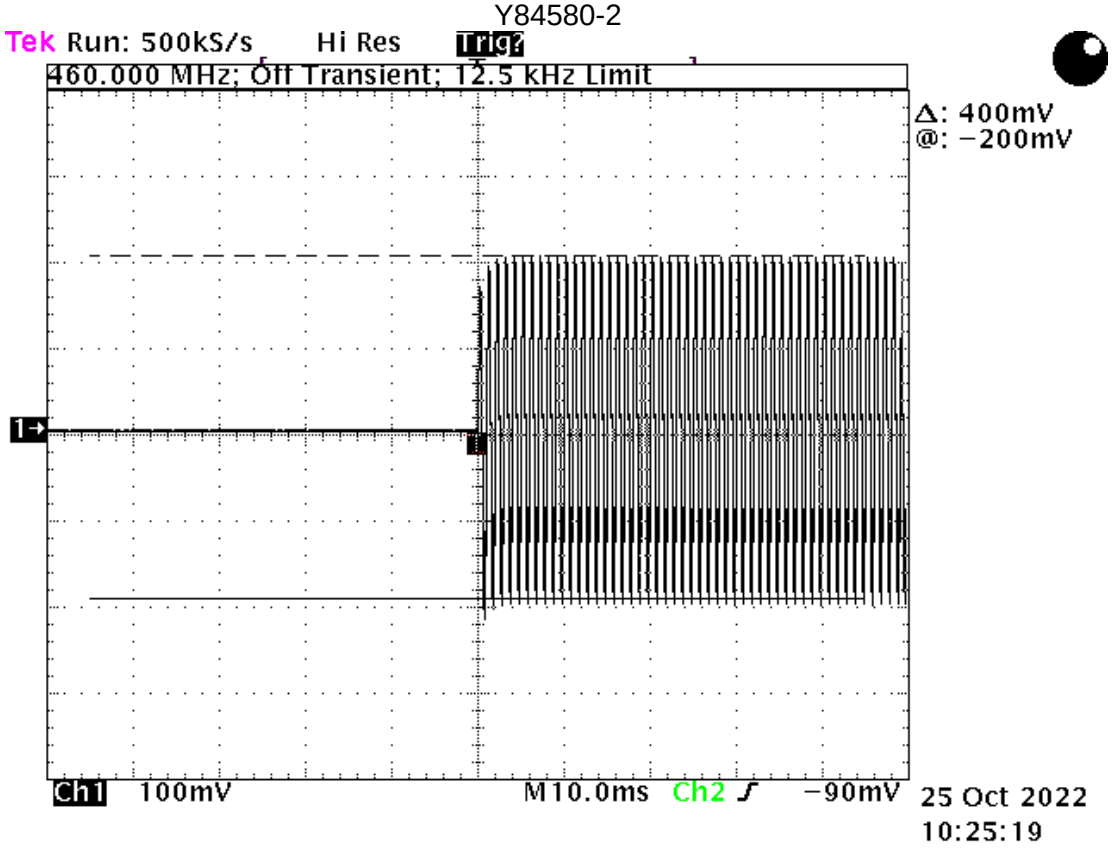
Y84092-1



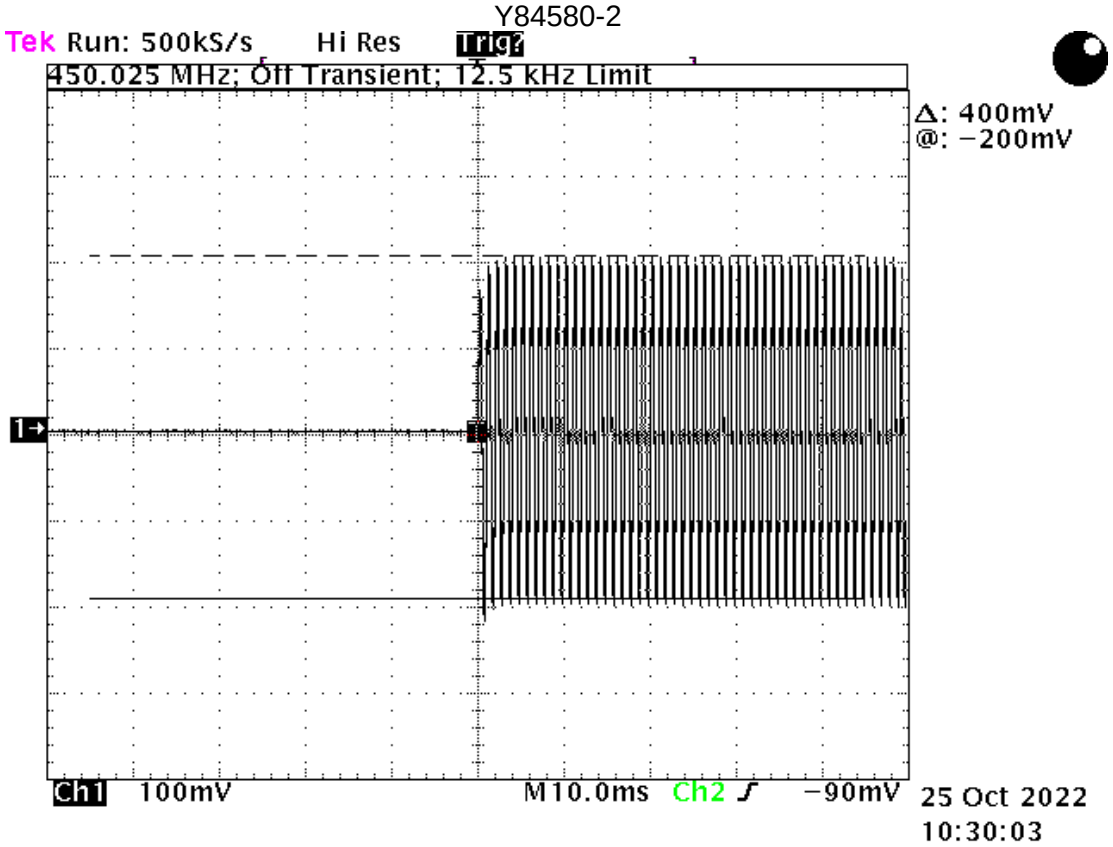
Y84092-1

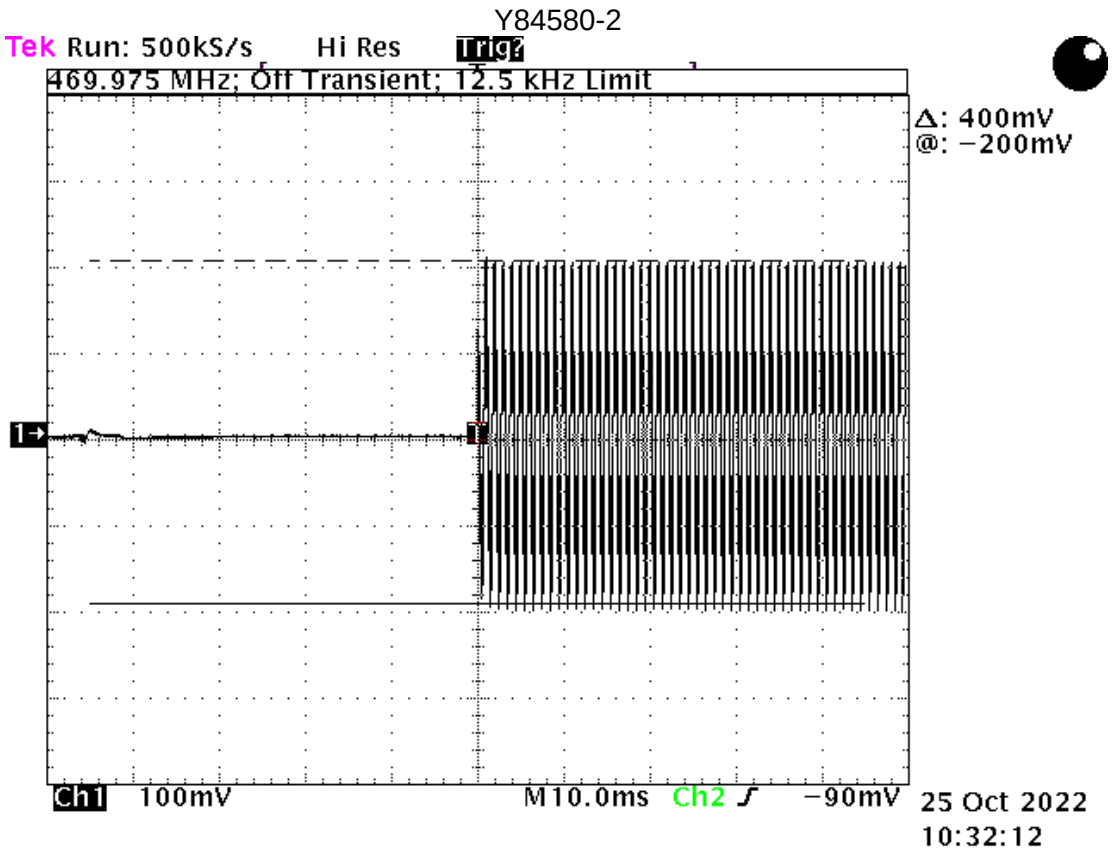


Y84580-2



Y84580-2





10.8 Radiated Emissions (Receive Mode)

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. The radiated emission measurements were performed with a spectrum analyzer. The bandwidth used from 150 kHz to 30 MHz is 9 or 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. Above 1 GHz, a 1 MHz bandwidth is used. A 10-dB linearity check is performed prior to start of testing in order to determine if an overload condition exists.

From 30 to 2000 MHz, an Anritsu spectrum analyzer was used. Final radiated emissions measurements were performed inside of an anechoic chamber at a test distance of 3 meters. The anechoic chamber is designated as Chamber E. This Chamber meets the Site Attenuation requirements of ANSI C63.4 and CISPR 16-1. Chamber E is located at 12 Devonwood Ave. Romeoville, Illinois EMI test lab.

The entire frequency range from 30 to 2000 MHz was slowly scanned with attention paid to those frequency ranges which appeared high. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst-case emissions were recorded. All measurements may be performed using either the peak, average or quasi-peak detector functions. If the peak detector data exceeds or is marginally close to the limits, the measurements are repeated using a quasi-peak detector or average function as required by the specification for final determination of compliance.

The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground.

10.8.1 Radiated Emissions Field Strength Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

FS = RA + AF + CF - AG

Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

10.8.2 Spurious Radiated Emissions Test Results (Receive Mode)

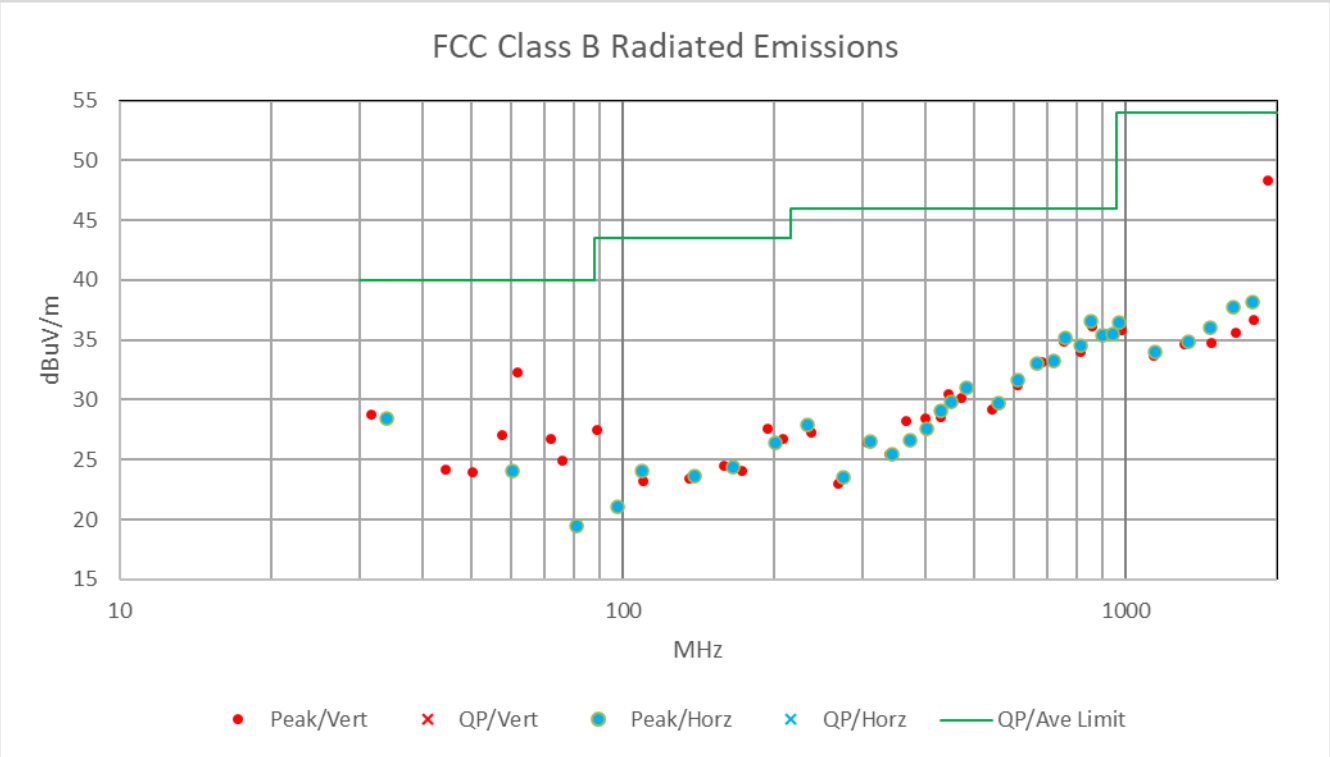
Model	Y84092-1; S/N: 00:1D:24:00:01:0E:06:61 Y84580-2; S/N: 00:1D:24:00:01:13:FC:83	Specification	FCC Part 15 Subpart B & RSS-Gen Section 7.3
Test Distance	3 Meters	Test Date	September 29-30, 2022
Tested by	Chris E. Dalessio		
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; P = peak; Q = QP		
Notes	Corr. Factors = Cable Loss – Preamp Gain		
Configuration	Receive Mode		

Y84092-1

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor	Cable & Amp Factors	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
33.9	15.1	P	H	12.7	0.6	0.0	28.4	40.0	11.6	
60.4	14.1	P	H	9.2	0.8	0.0	24.1	40.0	15.9	
80.8	9.3	P	H	9.3	0.9	0.0	19.5	40.0	20.5	
98.0	9.8	P	H	10.2	1.1	0.0	21.1	43.5	22.4	
109.0	12.1	P	H	10.9	1.1	0.0	24.1	43.5	19.4	
139.4	9.8	P	H	12.5	1.3	0.0	23.6	43.5	19.9	
165.4	9.9	P	H	13.1	1.4	0.0	24.4	43.5	19.1	
200.7	10.5	P	H	14.4	1.5	0.0	26.4	43.5	17.1	
233.3	11.2	P	H	15.0	1.7	0.0	27.9	46.0	18.1	
275.3	9.0	P	H	12.7	1.8	0.0	23.5	46.0	22.5	
310.0	9.5	P	H	15.1	1.9	0.0	26.5	46.0	19.5	
342.7	9.2	P	H	14.3	2.0	0.0	25.5	46.0	20.5	
371.7	10.0	P	H	14.5	2.1	0.0	26.6	46.0	19.4	
402.6	10.0	P	H	15.4	2.2	0.0	27.6	46.0	18.4	
428.4	10.9	P	H	15.9	2.3	0.0	29.1	46.0	16.9	
449.8	11.0	P	H	16.5	2.3	0.0	29.8	46.0	16.2	
481.3	11.4	P	H	17.2	2.4	0.0	31.0	46.0	15.0	
558.8	8.9	P	H	18.2	2.6	0.0	29.7	46.0	16.3	
610.0	10.2	P	H	18.7	2.7	0.0	31.6	46.0	14.4	
665.0	9.6	P	H	20.5	2.9	0.0	33.0	46.0	13.0	
721.3	9.4	P	H	20.9	3.0	0.0	33.3	46.0	12.7	
760.0	11.1	P	H	21.1	3.0	0.0	35.2	46.0	10.8	
812.5	9.8	P	H	21.5	3.2	0.0	34.5	46.0	11.5	
853.8	11.1	P	H	22.3	3.2	0.0	36.6	46.0	9.4	
900.0	9.3	P	H	22.8	3.3	0.0	35.4	46.0	10.6	
941.3	9.0	P	H	23.1	3.4	0.0	35.5	46.0	10.5	
970.0	9.5	P	H	23.5	3.5	0.0	36.5	54.0	17.5	
1142.5	42.5	P	H	25.6	-34.1	0.0	34.0	74.0	40.0	1
1332.5	43.0	P	H	26.0	-34.1	0.0	34.9	74.0	39.1	1

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor	Cable & Amp Factors	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
1475.0	44.4	P	H	25.7	-34.1	0.0	36.0	74.0	38.0	1
1637.5	45.7	P	H	26.2	-34.2	0.0	37.7	74.0	36.3	1
1787.5	44.8	P	H	27.4	-34.0	0.0	38.2	74.0	35.8	1
31.7	14.8	P	V	13.4	0.6	0.0	28.8	40.0	11.2	
44.4	13.1	P	V	10.4	0.7	0.0	24.2	40.0	15.8	
50.4	13.5	P	V	9.7	0.7	0.0	23.9	40.0	16.1	
57.6	16.9	P	V	9.3	0.8	0.0	27.0	40.0	13.0	
62.0	22.2	P	V	9.3	0.8	0.0	32.3	40.0	7.7	
72.0	16.5	P	V	9.3	0.9	0.0	26.7	40.0	13.3	
75.9	14.7	P	V	9.3	0.9	0.0	24.9	40.0	15.1	
89.1	16.8	P	V	9.7	1.0	0.0	27.5	43.5	16.0	
110.1	11.1	P	V	11.0	1.1	0.0	23.2	43.5	20.3	
136.1	9.7	P	V	12.4	1.3	0.0	23.4	43.5	20.1	
159.3	10.2	P	V	12.9	1.4	0.0	24.5	43.5	19.0	
172.5	9.4	P	V	13.3	1.4	0.0	24.1	43.5	19.4	
194.6	11.9	P	V	14.2	1.5	0.0	27.6	43.5	15.9	
209.0	10.5	P	V	14.6	1.6	0.0	26.7	43.5	16.8	
236.6	10.5	P	V	15.1	1.7	0.0	27.3	46.0	18.7	
269.0	8.8	P	V	12.4	1.8	0.0	23.0	46.0	23.0	
307.5	9.5	P	V	15.0	1.9	0.0	26.4	46.0	19.6	
339.0	9.1	P	V	14.3	2.0	0.0	25.4	46.0	20.6	
365.4	11.7	P	V	14.4	2.1	0.0	28.2	46.0	17.8	
398.8	10.8	P	V	15.4	2.2	0.0	28.4	46.0	17.6	
428.4	10.4	P	V	15.9	2.3	0.0	28.6	46.0	17.4	
445.4	11.8	P	V	16.4	2.3	0.0	30.5	46.0	15.5	
470.6	10.7	P	V	17.0	2.4	0.0	30.1	46.0	15.9	
542.5	8.7	P	V	17.9	2.6	0.0	29.2	46.0	16.8	
610.0	9.8	P	V	18.7	2.7	0.0	31.2	46.0	14.8	
683.8	9.4	P	V	20.8	2.9	0.0	33.1	46.0	12.9	
752.5	11.0	P	V	20.9	3.0	0.0	34.9	46.0	11.1	
815.0	9.3	P	V	21.5	3.2	0.0	34.0	46.0	12.0	
856.3	10.6	P	V	22.3	3.2	0.0	36.1	46.0	9.9	
911.3	9.2	P	V	22.9	3.4	0.0	35.5	46.0	10.5	
980.0	8.7	P	V	23.6	3.5	0.0	35.8	54.0	18.2	
1135.0	42.3	P	V	25.5	-34.1	0.0	33.7	74.0	40.3	1
1312.5	42.7	P	V	26.0	-34.1	0.0	34.6	74.0	39.4	1
1482.5	43.2	P	V	25.7	-34.1	0.0	34.8	74.0	39.2	1
1655.0	43.4	P	V	26.3	-34.1	0.0	35.6	74.0	38.4	1
1797.5	43.3	P	V	27.4	-34.0	0.0	36.7	74.0	37.3	1
1922.5	54.0	P	V	28.1	-33.8	0.0	48.3	74.0	25.7	1

Note 1; Peak reading meeting the average limit, so the average reading is not required.
Judgment: Pass by at least 7.7 dB



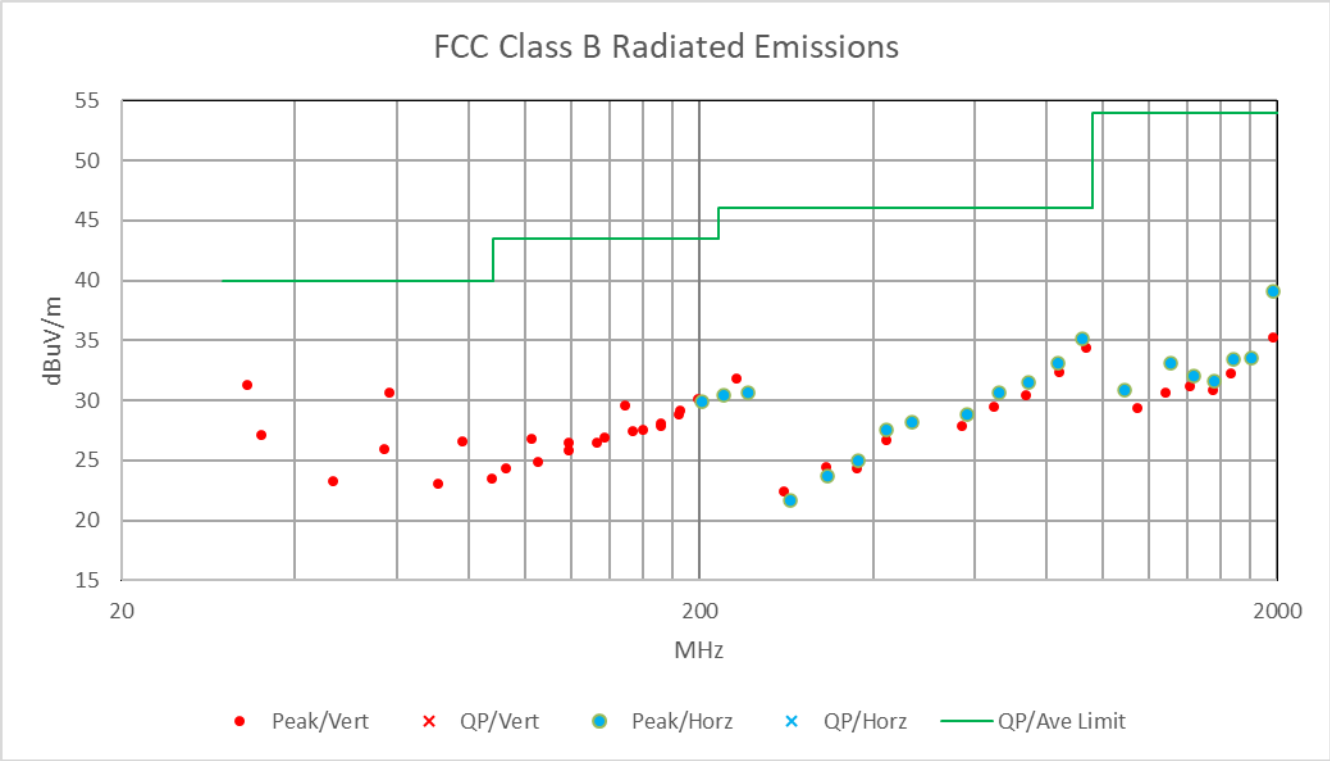
Radiated emissions in a graphical format. The above chart is the same data as the previous table.

Y84580-2

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor	Cable & Amp Factors	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
201.9	14.0	P	H	14.4	1.5	0.0	29.9	43.5	13.6	
220.7	13.9	P	H	14.9	1.6	0.0	30.4	46.0	15.6	
242.6	13.7	P	H	15.2	1.7	0.0	30.6	46.0	15.4	
287.6	6.4	P	H	13.5	1.8	0.0	21.7	46.0	24.3	
333.8	7.4	P	H	14.3	2.0	0.0	23.7	46.0	22.3	
377.4	8.2	P	H	14.7	2.1	0.0	25.0	46.0	21.0	
422.3	9.6	P	H	15.7	2.3	0.0	27.6	46.0	18.4	
465.9	8.8	P	H	17.0	2.4	0.0	28.2	46.0	17.8	
581.6	7.5	P	H	18.6	2.7	0.0	28.8	46.0	17.2	
661.7	7.4	P	H	20.4	2.9	0.0	30.7	46.0	15.3	
744.7	7.5	P	H	20.9	3.1	0.0	31.5	46.0	14.5	
835.3	7.9	P	H	21.9	3.3	0.0	33.1	46.0	12.9	
922.4	8.7	P	H	23.0	3.4	0.0	35.1	46.0	10.9	
1088.1	37.6	P	H	24.5	-31.2	0.0	30.9	74.0	43.1	1
1312.3	39.3	P	H	25.1	-31.3	0.0	33.1	74.0	40.9	1
1435.4	38.1	P	H	25.0	-31.1	0.0	32.0	74.0	42.0	1
1556.6	37.2	P	H	25.2	-30.8	0.0	31.6	74.0	42.4	1
1677.7	38.3	P	H	25.6	-30.5	0.0	33.4	74.0	40.6	1
1804.8	37.2	P	H	26.7	-30.4	0.0	33.5	74.0	40.5	1
1969.0	41.8	P	H	27.6	-30.3	0.0	39.1	74.0	34.9	1
33.1	17.8	P	V	12.9	0.6	0.0	31.3	40.0	8.7	
34.9	14.0	P	V	12.5	0.6	0.0	27.1	40.0	12.9	
46.4	12.5	P	V	10.1	0.7	0.0	23.3	40.0	16.7	
57.0	15.9	P	V	9.3	0.8	0.0	26.0	40.0	14.0	
58.3	20.6	P	V	9.3	0.8	0.0	30.7	40.0	9.3	
70.7	12.9	P	V	9.3	0.9	0.0	23.1	40.0	16.9	
78.0	16.3	P	V	9.3	1.0	0.0	26.6	40.0	13.4	

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor	Cable & Amp Factors	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
87.5	12.9	P	V	9.6	1.0	0.0	23.5	40.0	16.5	
92.6	13.4	P	V	9.9	1.0	0.0	24.3	43.5	19.2	
102.6	15.2	P	V	10.5	1.1	0.0	26.8	43.5	16.7	
105.4	13.1	P	V	10.7	1.1	0.0	24.9	43.5	18.6	
118.7	13.8	P	V	11.5	1.2	0.0	26.5	43.5	17.0	
118.9	13.1	P	V	11.5	1.2	0.0	25.8	43.5	17.7	
133.1	13.0	P	V	12.2	1.3	0.0	26.5	43.5	17.0	
137.1	13.2	P	V	12.4	1.3	0.0	26.9	43.5	16.6	
148.8	15.6	P	V	12.7	1.3	0.0	29.6	43.5	13.9	
153.7	13.3	P	V	12.8	1.3	0.0	27.4	43.5	16.1	
159.9	13.1	P	V	13.0	1.4	0.0	27.5	43.5	16.0	
171.4	13.2	P	V	13.3	1.4	0.0	27.9	43.5	15.6	
172.0	13.4	P	V	13.3	1.4	0.0	28.1	43.5	15.4	
184.6	13.6	P	V	13.7	1.5	0.0	28.8	43.5	14.7	
185.5	13.9	P	V	13.8	1.5	0.0	29.2	43.5	14.3	
199.5	14.3	P	V	14.3	1.5	0.0	30.1	43.5	13.4	
232.4	15.1	P	V	15.0	1.7	0.0	31.8	46.0	14.2	
280.3	7.5	P	V	13.1	1.8	0.0	22.4	46.0	23.6	
332.0	8.3	P	V	14.2	2.0	0.0	24.5	46.0	21.5	
375.9	7.6	P	V	14.6	2.1	0.0	24.3	46.0	21.7	
422.0	8.7	P	V	15.7	2.3	0.0	26.7	46.0	19.3	
470.0	8.6	P	V	17.1	2.4	0.0	28.1	46.0	17.9	
570.1	6.8	P	V	18.4	2.7	0.0	27.9	46.0	18.1	
647.6	7.1	P	V	19.6	2.8	0.0	29.5	46.0	16.5	
736.2	6.3	P	V	21.0	3.1	0.0	30.4	46.0	15.6	
838.8	7.1	P	V	22.0	3.3	0.0	32.4	46.0	13.6	
934.4	7.8	P	V	23.1	3.5	0.0	34.4	46.0	11.6	
1149.1	36.2	P	V	24.5	-31.3	0.0	29.4	74.0	44.6	1
1282.3	36.7	P	V	25.2	-31.2	0.0	30.7	74.0	43.3	1
1413.4	37.1	P	V	25.2	-31.1	0.0	31.2	74.0	42.8	1
1551.6	36.5	P	V	25.2	-30.8	0.0	30.9	74.0	43.1	1
1664.7	37.5	P	V	25.4	-30.6	0.0	32.3	74.0	41.7	1
1809.8	37.1	P	V	26.8	-30.3	0.0	33.6	74.0	40.4	1
1966.0	37.9	P	V	27.6	-30.3	0.0	35.2	74.0	38.8	1

The peak limit is not shown, since the peak readings meet the lower average limit.



11.0 MEASUREMENT INSTRUMENTATION UNCERTAINTY

Measurement	Uncertainty
Radiated Emissions, E-field, 3 meters, 30 to 200 MHz	3.3 dB
Radiated Emissions, E-field, 3 meters, 200 to 1000 MHz	4.9 dB
Radiated Emissions, E-field, 3 meters, 1 to 18 GHz	4.8 dB
99% Occupied Bandwidth using REC-43	1% of frequency span
Conducted power PWM-01 at 460 MHz	0.14 dB
Amplitude measurement 1-5000 MHz	1.5 dB
Temperature THM-02	0.6 Deg. C

The uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2 in accordance with CISPR 16-4-2.