



Electromagnetic Compatibility Test Report

Tests Performed on an Aclara Technologies, LLC

Dual Band Edge Gateway, Model: Y84110-221

Radiometrics Document RP-9861A



<i>Product Detail:</i>		
FCC ID: LLB2021006		
IC: 4546A-2021006		
Equipment type: 450-470, 901-902 MHz Transceiver		
<i>Test Standards:</i>		
US CFR Title 47, Chapter I, FCC Part 24 and 90		
FCC Parts 2, 15, and 90 CFR Title 47: 2024		
<i>Tests Performed For:</i>		<i>Test Facility:</i>
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<i>Test Dates:</i>		
September 21, to November 20, 2023		
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0	March 13, 2024	
1	March 14, 2024	Joseph Strzelecki



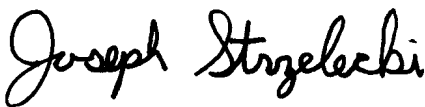
Table of Contents

1.0 ADMINISTRATIVE DATA	3
2.0 TEST SUMMARY AND RESULTS	3
3.0 EQUIPMENT UNDER TEST (EUT) DETAILS.....	4
3.1 EUT Description	4
4.0 TESTED SYSTEM DETAILS	4
4.1 Tested System Configuration	4
4.2 Operating Conditions of EUT	5
4.3 Special Accessories	5
4.4 Equipment Modifications	5
5.0 TEST SPECIFICATIONS AND RELATED DOCUMENTS	5
6.0 RADIOMETRICS' TEST FACILITIES.....	5
7.0 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS	6
8.0 CERTIFICATION	6
9.0 TEST EQUIPMENT TABLE	6
10.0 TEST SECTIONS	7
10.1 AC Conducted Emissions.....	7
10.2 Peak Output Power	10
10.3 Emissions Masks.....	12
10.3.1 FCC Part 90 Masks.....	12
10.3.2 FCC Part 24 Masks.....	16
10.3.3 Conducted Spurious Emissions	18
10.3.4 Conducted Spurious Emissions (Part 24).....	19
10.4 Occupied Bandwidth	19
10.5 Field Strength of Unwanted Spurious Radiation	22
10.5.1 Test Procedures	22
Figure 1. Drawing of Radiated Emissions Setup	23
10.5.2 Test Limits	24
10.5.3 Spurious Radiated Emissions Test Results.....	24
10.5.4 Spurious Radiated Emissions Test Results (Part 24)	26
10.6 Frequency Stability.....	27
10.6.1 Frequency Stability Vs Temperature	27
10.6.2 Frequency Stability Vs Supply Voltage.....	27
10.6.3 Test Results for Frequency Stability.....	28
10.7 Transient Frequency Behavior.....	29
10.7.1 Test method.....	29
10.7.2 Limits of transient frequency	30
10.7.3 Test Results.....	30
10.7.4 Results for Time Periods t1, t2, and t3	31
10.7.5 Results for Time Period between t2 and t3.....	33
10.7.6 Results for Time Period t3.....	35
10.8 Radiated Emissions (Receive Mode).....	37
10.8.1 Radiated Emissions Field Strength Sample Calculation	38
10.8.2 Spurious Radiated Emissions Test Results (Receive Mode)	38
11.0 MEASUREMENT INSTRUMENTATION UNCERTAINTY	40
12.0 REVISION HISTORY	41

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1.0 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i> An Aclara Technologies LLC., Dual Band Edge Gateway Model: Y84110-221; Serial Numbers: 00:1D:24:00:03:8F:44:04 These will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics:</i> July 14, 2023	<i>Test Dates:</i> September 21 to November 20, 2023
<i>Test Report Written and Authorized By:</i> Joseph Strzelecki Senior EMC Engineer	<i>Test Witnessed By:</i> The tests were not witnessed by personnel from Aclara Technologies, LLC
<i>Radiometrics' Personnel Responsible for Test:</i>	
 03/08/2024 Date Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE Chris E. Dalessio EMC Technician	

2.0 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Dual Band Edge Gateway, Model Y84110-221, 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	Test Result
RF Power Output	450-470 MHz	2.1046 & 90.205	Pass
Occupied Bandwidth Test; Emissions Masks	450-470 MHz	2.1049 & 90.209	Pass
Spurious RF Conducted Emissions	1-4700 MHz	2.1051 & 90.210	Pass
Conducted Emissions, AC Mains	0.15 - 30 MHz	15.249 & 15.207	Pass
Field Strength of Spurious Radiation	30-4700 MHz	2.1053	Pass
Frequency Vs. Temperature	450-470 MHz	2.1055 & 90.213	Pass
Frequency Vs. Voltage	450-470 MHz	2.1055 & 90.213	Pass
Transient Frequency Behavior	450-470 MHz	90.214	Pass



3.0 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a Dual Band Edge Gateway. The EUT is a 451-468 & 901-902 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:

Modulated Signal Parameters	450-470 MHz Band	901-902 MHz Band
Data Rate (symbols/second)	5000	20000
Inner Deviation (Hz)	800	3200
Transmission Duration (seconds)	0.8528	0.4138
Modulation Type	4GFSK	4GFSK
Encoding Type (Bits/Symbol)	2	2
Outer Deviation (Hz)	2400	9600
Number of Data Bits	8528	16552
Bit Rate (Bits/second)	10000	40000
Licensed Bandwidth (Hz)	12500	50000

Antennas:

Manufacturer	Model	Gain	Description/ Type
The Antenna Company	AC94541-01N	2.3 dBi for 450-470MHz 5.0 dBi for 901-941MHz	Linearly polarized antenna, 50-ohm, multiband

Range of operation:

Frequency Range (MHz)
451 – 453
456 – 462
467 - 467.5375
467.5375 - 468
901 - 902

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. The 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	Dual Band Edge Gateway	E	Aclara Technologies	Y84110-221	00:1D:24:00:03:8F:44:04
2	Switching power supply	E	Phihong	PSAC24A-120L6	P64601881A2

Model Number	Firmware
Y84110-221	132-2021-008-SWP-V4.00.55

The firmware of the EUT during the tests is identical to what would be released, except it allows for transmissions to continue for longer 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	2023	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
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 absorbers. 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.	01/04/23
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	03/01/23
ANT-66	ETS-Lindgren	Horn Antenna	3115	62580	1.0-18GHz	24 Mo.	03/16/23
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.	01/26/23
ANT-80	AH Systems	Bicon Antenna	SAS-540	294	20-330MHz	24 Mo.	01/26/23
ATT-53	Weinschel	Attenuator (20 dB)	23-20-34	CG7857	DC-18 GHz	24 Mo	02/17/21
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.	02/02/23
HPF-01	Solar	High Pass Filter	7930-100	HPF-1	0.15-30MHz	24 Mo.	03/07/22
HPF-07	Mini-Circuits	High Pass Filter	VHF-1500+	31121	1.7-10 GHz	24 Mo.	05/23/22
HPF-09	Mini-Circuits	High Pass Filter	SHP-700+	RUU75101737	700-5000MHz	24 Mo.	10/05/22



RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
LSN-01	Electrometrics	50 uH LISN	FCC/VDE 50/2	1001	0.01-30MHz	24 Mo.	09/21/23
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/84562 A	33330A00135 3410A00178	30Hz-6GHz	24 Mo.	11/08/23
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.	02/06/23
SIG-30	Rohde Schwarz	Signal Generator	SMC100A	102914	9k-3.2GHz	36 Mo.	12/18/20 12/18/23
SIG-21	HP / Agilent	Signal Generator	8341B	2910A02352	0.01-20 GHz	36 Mo.	10/01/21
SIG-31	Rohde Schwarz	Vector Signal Generator	SMJ 100A	101395	100kHz-6GHz	36 Mo.	09/22/23
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.	11/22/22

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.

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

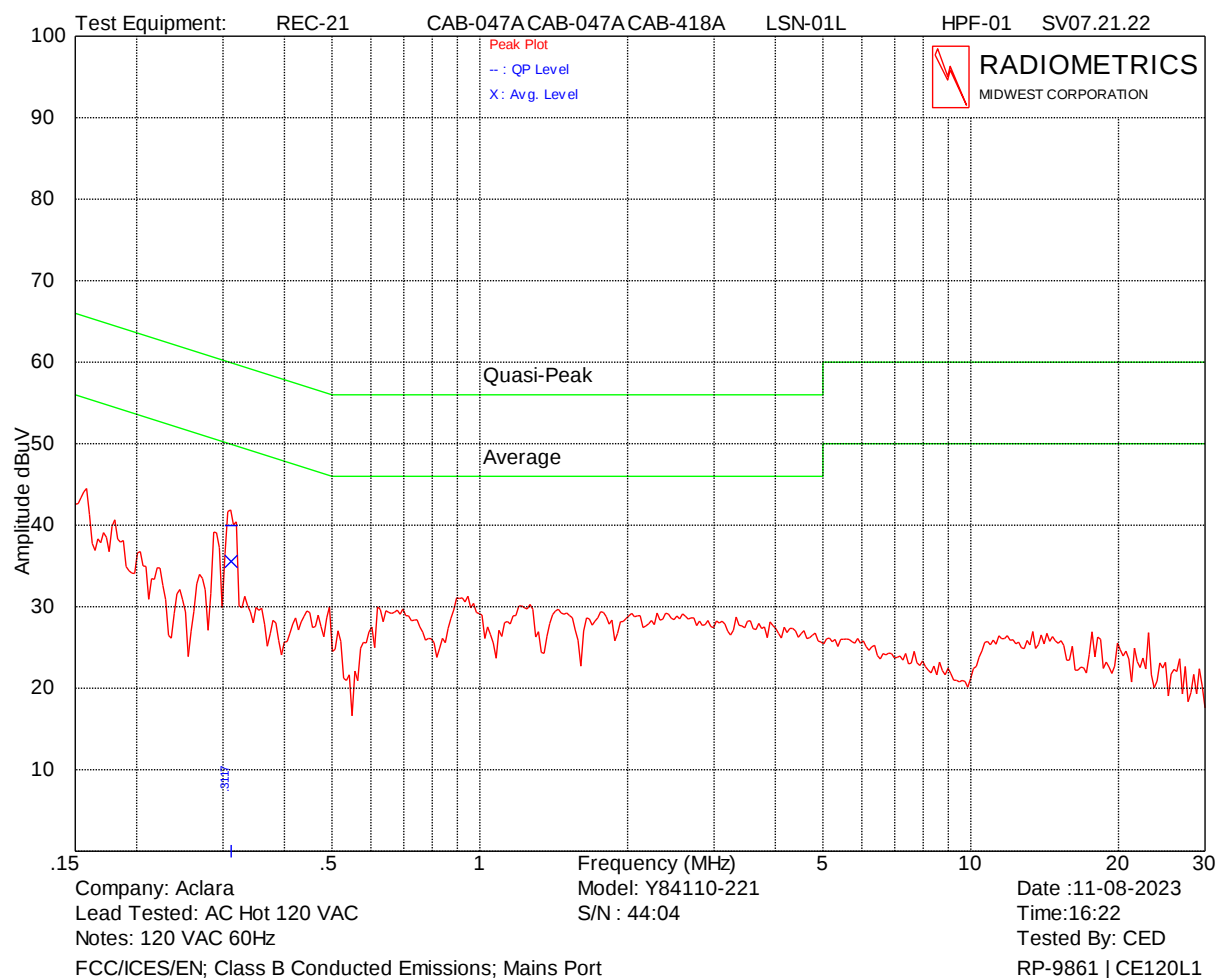
Frequency Range (MHz)	Class B Limits (dBuV)	
	Quasi-Peak	Average
0.150 - 0.50*	66 - 56	56 - 46
0.5 – 5.0	56	46
5.0 - 30	60	50
* The limit decreases linearly with the logarithm of the frequency in this range.		



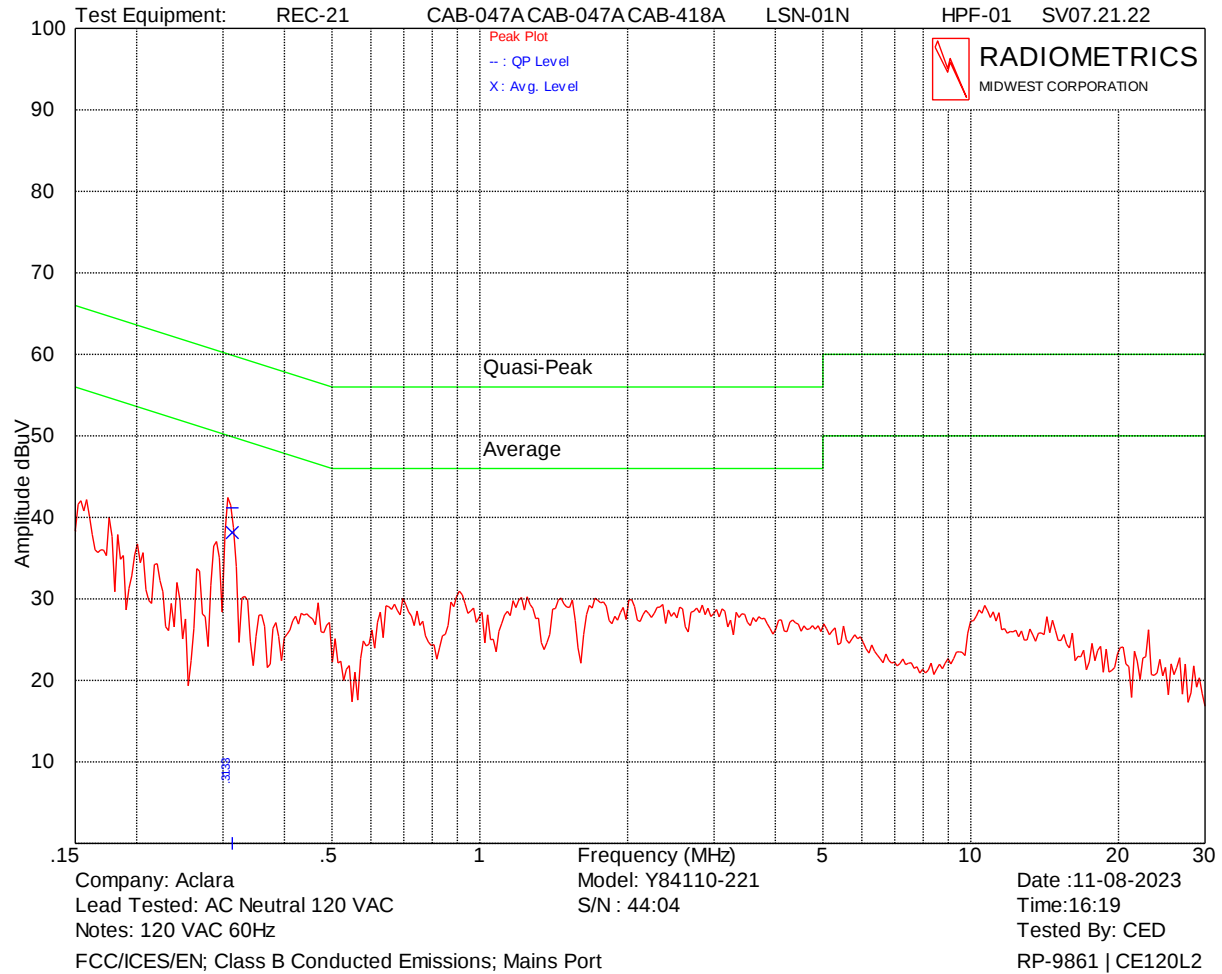
The initial step in collecting conducted data is a peak detector scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from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

Model	Y84110-221	Specification	FCC part 15.207
Serial Number	00:1D:24:00:03:8F:44:04	Test Date	November 8, 2023
Test Personnel	Joseph Strzelecki	Test Location	Chamber F
Test Equipment	EMI Receiver (REC-21) (LSN-01)		

Judgement: Pass by at least 6 dB.



Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.312	40.0	59.9	35.5	49.9	14.4



Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.313	41.2	59.9	38.1	49.9	11.7



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 appropriate power attenuator.

Model	Y84110-221; S/N: 00:1D:24:00:03:8F:44:04	Specification	FCC part 90.205 & 24
Test Location	Chamber B	Test Date	November 15, 2023
Test Personnel	Joseph Strzelecki		
Test Equipment	Spectrum Analyzer REC-21		

TX Freq MHz	Reading dBm	Atten & Cable	Total dBm	Peak Power Watts	Antenna Gain dBi	ERP Watts
451.000	15.40	14.15	29.55	0.902	5.0	1.738
458.000	15.20	14.15	29.35	0.861	5.0	1.660
468.000	14.90	14.20	29.10	0.813	5.0	1.567
901.500	14.40	14.30	28.70	0.741	5.0	1.429

Judgement: Pass

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

The fundamental emission ERP limit is 7 watts (38.5 dBm) for 901.5 MHz.

Note that in decibel units:

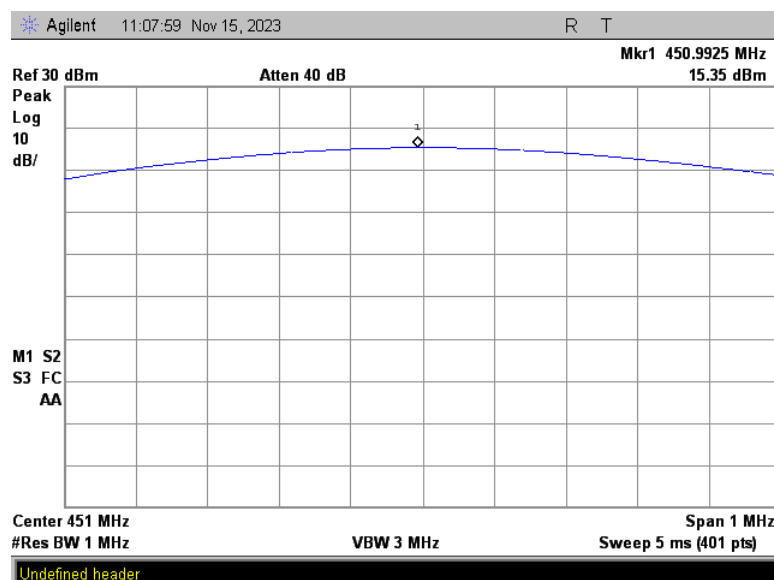
$$\text{ERP} = \text{EIRP} - 2.15 = \text{P} + \text{G} - 2.15$$

where:

P = transmitter output power in dB(W)

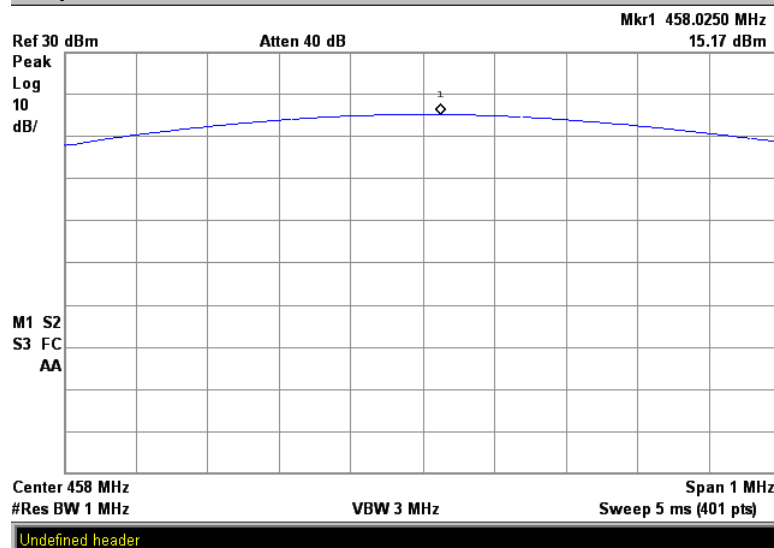
G = Gain of the transmitting antenna in dBi

5 dBi is the maximum gain allowed by the product specification.

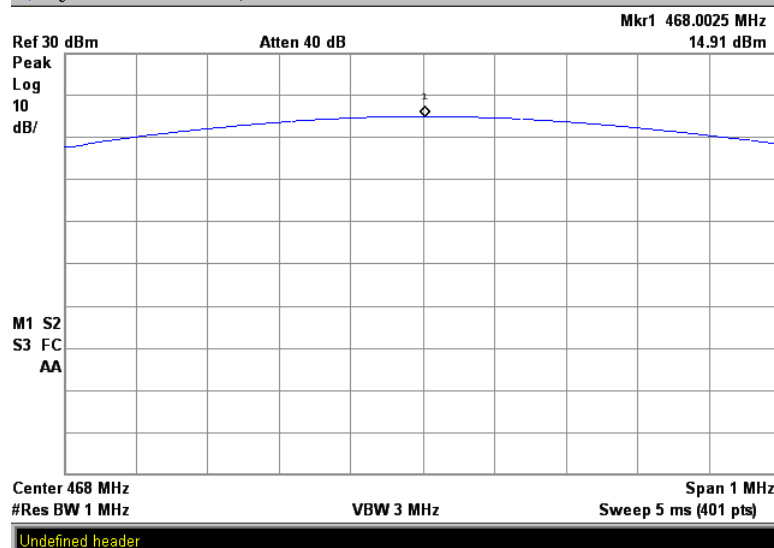




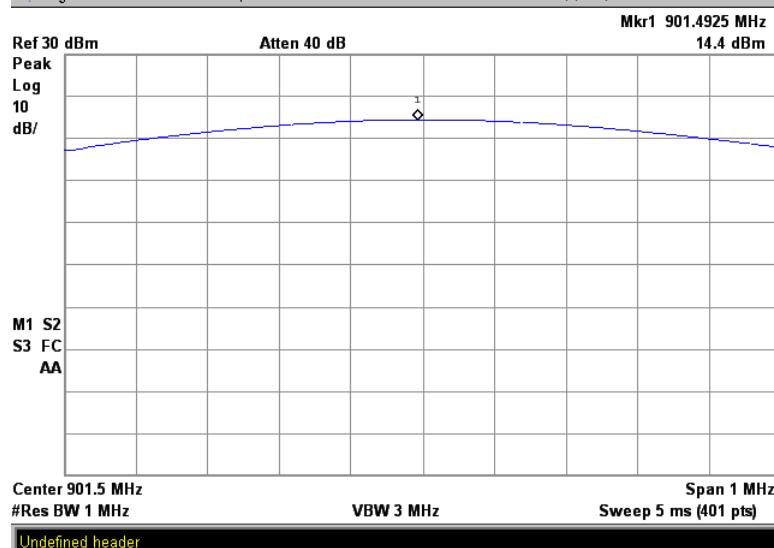
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10.3 Emissions Masks

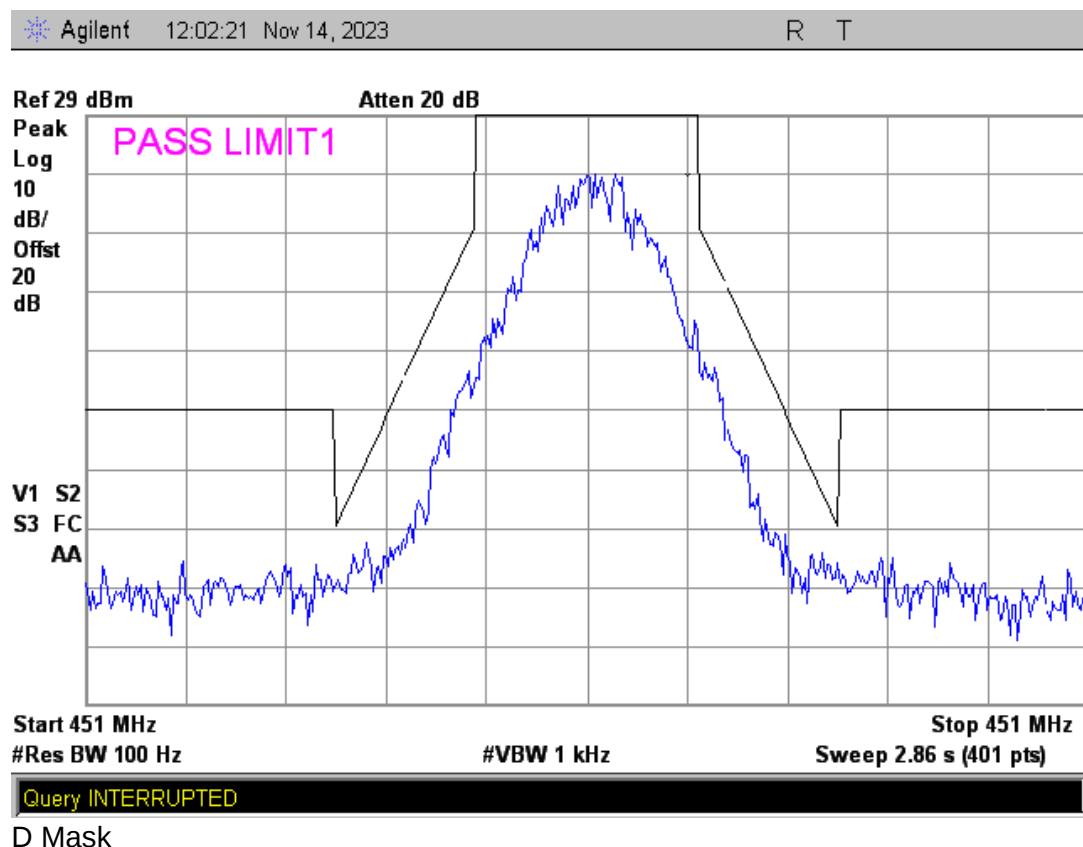
Model	Y84110-221 S/N: 00:1D:24:00:03:8F:44:04	Specification	FCC Part 90.209 & 90.210
Test Location	Chamber B	Test Date	10/14/2023
Test Personnel	Joseph Strzelecki		
Test Equipment	Spectrum Analyzer (REC-21), (REC-44)		

10.3.1 FCC Part 90 Masks

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 f_0 to 5.625 kHz removed from f_0 : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88 \text{ kHz})$ dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log(P)$ dB.

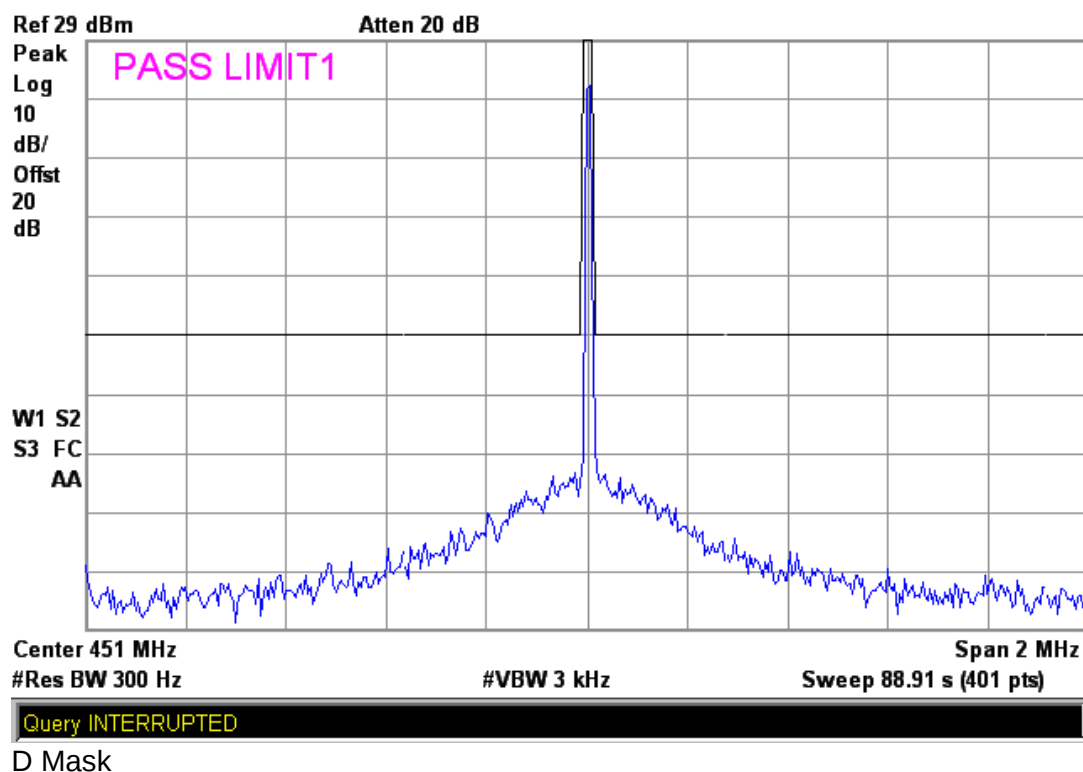
For all Frequencies beyond 25 kHz from the center of the transmit frequency, the worst-case limit was used. The red line is a 50-dB reduction from carrier based on 1 watt.





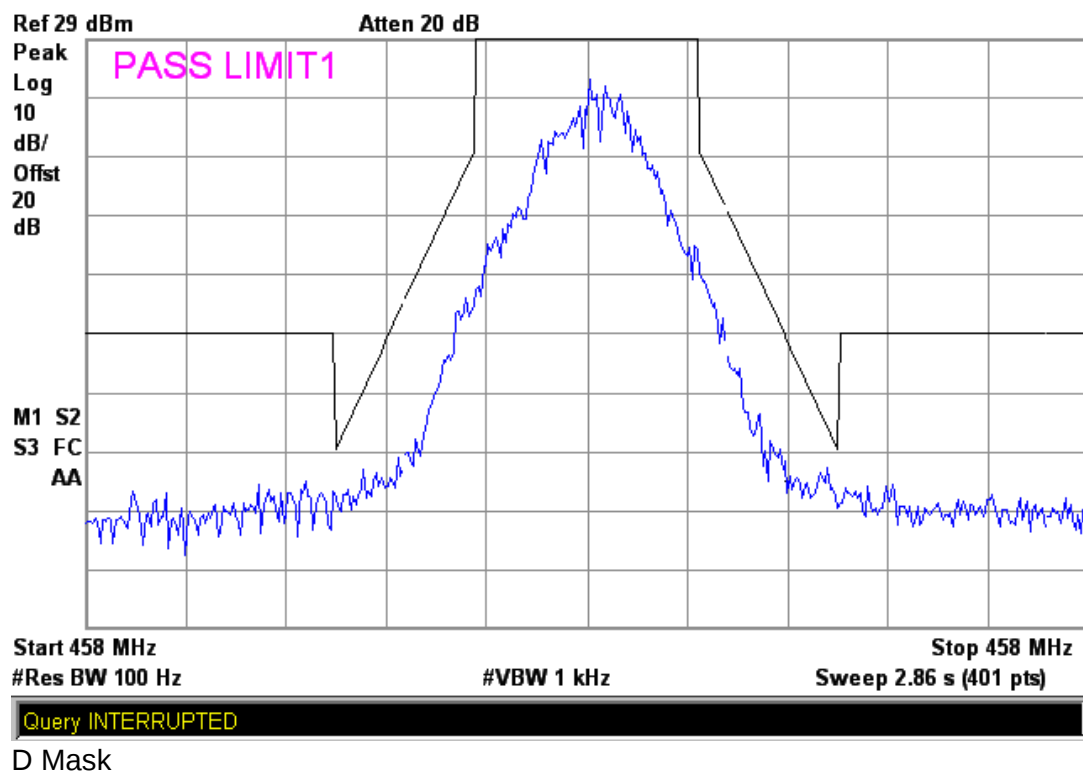
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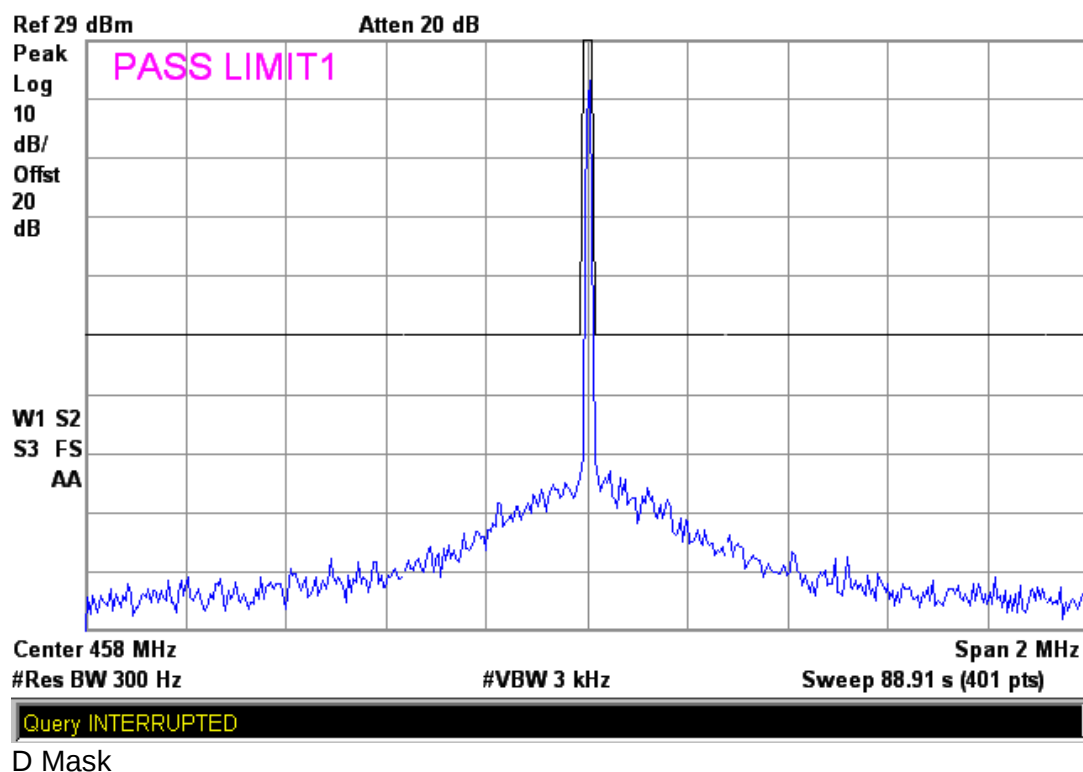
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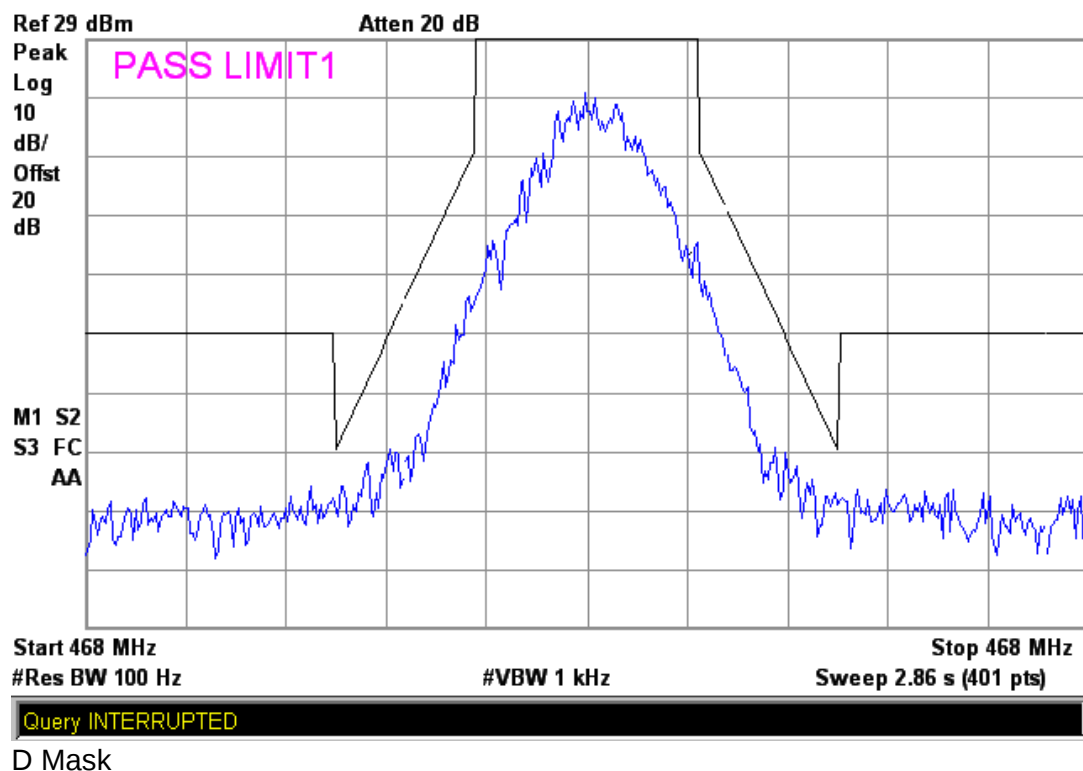
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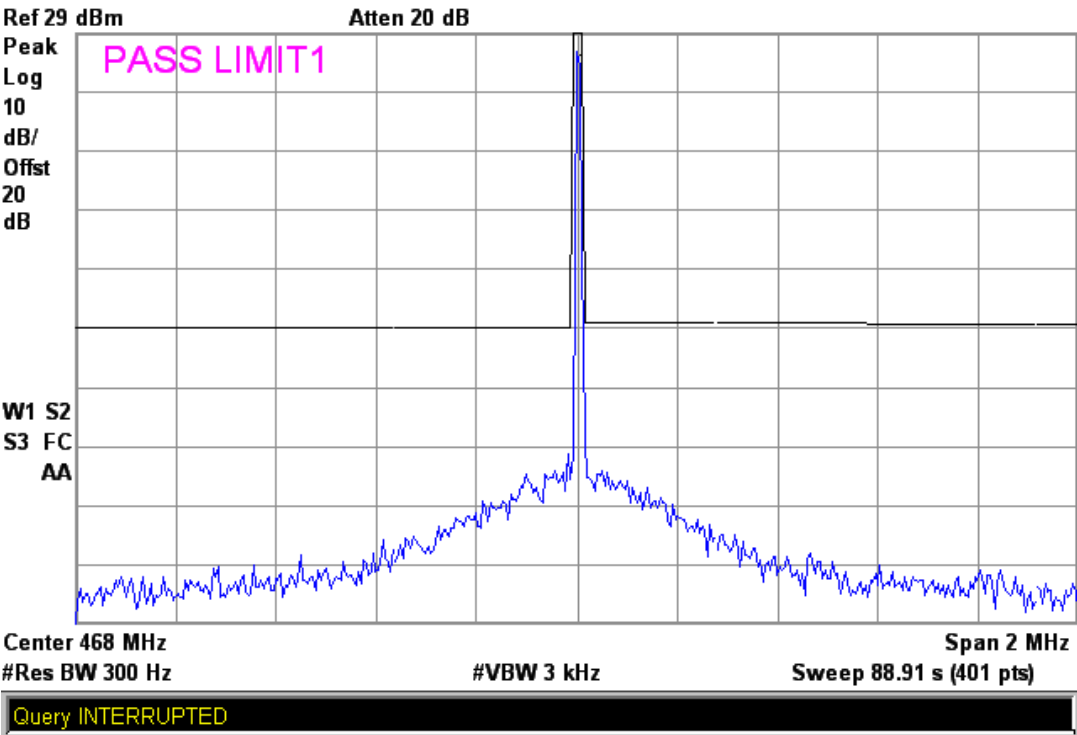
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 Agilent 13:10:05 Nov 14, 2023

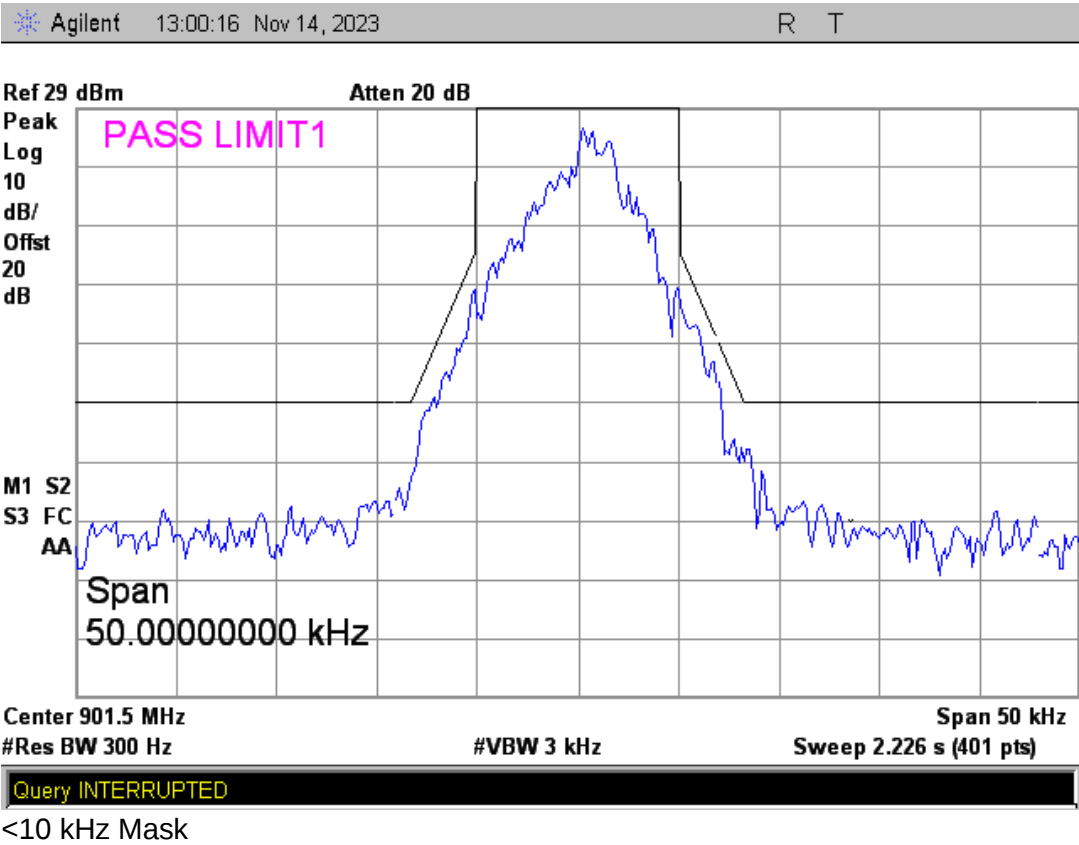
R T



D Mask
Judgement: Pass

10.3.2 FCC Part 24 Masks

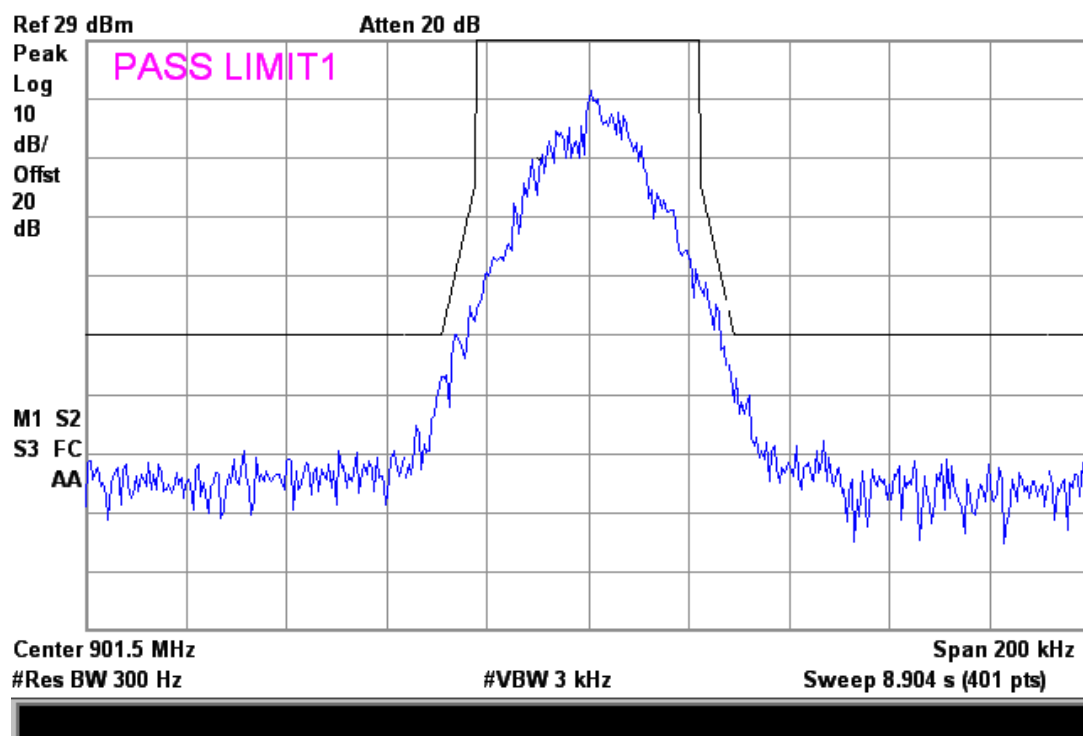
The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize. The emissions Mask is from FCC part 24.133.





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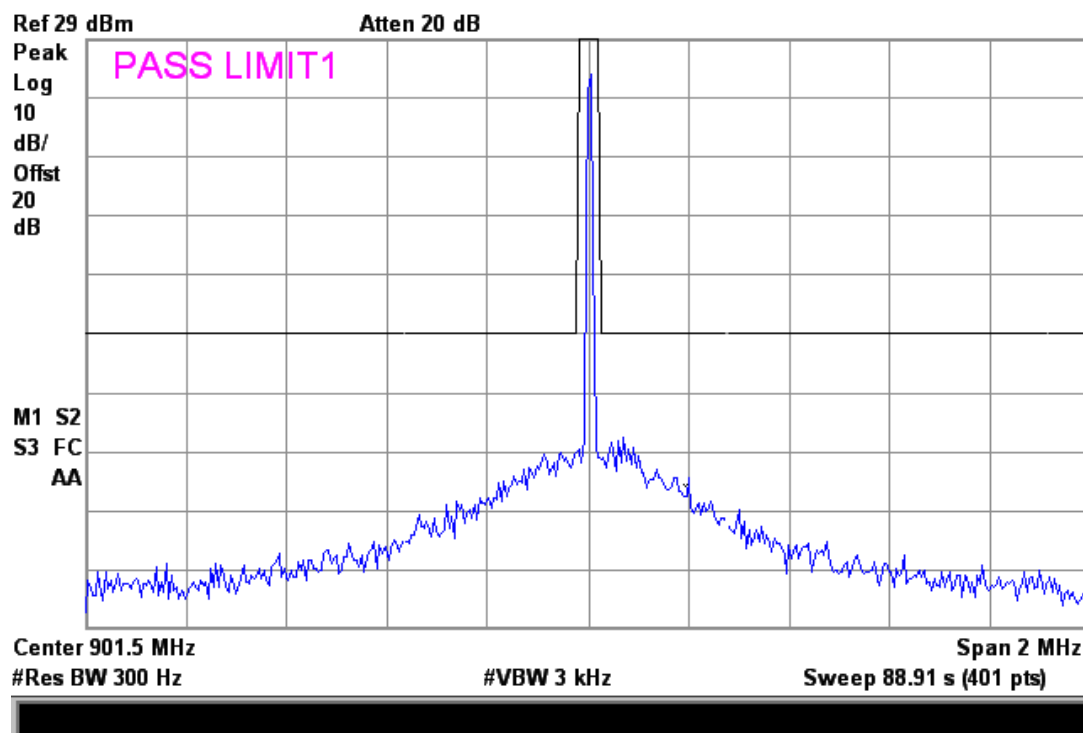
R T



>10 kHz Mask; 45 kHz Authorized Bandwidth

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R T



>10 kHz Mask; 45 kHz Authorized Bandwidth

Judgement: Pass

**10.3.3 Conducted Spurious Emissions**

Model	Y84110-221	Specification	FCC Part 90.210
Serial Number	00:1D:24:00:03:8F:44:04	Test Date	November 14, 2023
Test Personnel	Joseph Strzelecki	Test Location	Chamber B
Test Equipment	EMI Receiver (REC-44); High pass filter (HPF-09) for testing 450-470 MHz		

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

Freq. Tx MHz	Harm #	Tested Freq. MHz	Rec Reading dBm	HPF Attn. Factor dB	Ext. Atten. Factor dB	Cable Loss dB	Total Power dBm	Power Limit dBm	Margin Under Limit dB
451.000	2	902.000	-67.8	0.6	14.1	0.1	-53.0	-20.0	33.0
451.000	3	1353.000	-62.6	0.6	14.1	0.2	-47.7	-20.0	27.7
451.000	4	1804.000	-78.1	0.6	14.2	0.2	-63.1	-20.0	43.1
451.000	5	2255.000	-78.0	0.7	14.2	0.2	-62.9	-20.0	42.9
451.000	6	2706.000	-75.9	0.7	14.2	0.2	-60.8	-20.0	40.8
451.000	7	3157.000	-78.0	0.8	14.2	0.2	-62.8	-20.0	42.8
451.000	8	3608.000	-74.4	0.9	14.3	0.3	-58.9	-20.0	38.9
451.000	9	4059.000	-75.5	1.5	14.3	0.3	-59.4	-20.0	39.4
451.000	10	4510.000	-76.4	1.5	14.4	0.3	-60.2	-20.0	40.2
458.000	2	916.000	-73.6	0.6	14.1	0.1	-58.8	-20.0	38.8
458.000	3	1374.000	-62.9	0.6	14.1	0.2	-48.0	-20.0	28.0
458.000	4	1832.000	-78.0	0.6	14.2	0.2	-63.0	-20.0	43.0
458.000	5	2290.000	-78.0	0.7	14.2	0.2	-62.9	-20.0	42.9
458.000	6	2748.000	-76.0	0.7	14.2	0.2	-60.9	-20.0	40.9
458.000	7	3206.000	-78.0	0.8	14.2	0.2	-62.8	-20.0	42.8
458.000	8	3664.000	-72.8	0.9	14.3	0.3	-57.3	-20.0	37.3
458.000	9	4122.000	-74.6	1.5	14.3	0.3	-58.5	-20.0	38.5
458.000	10	4580.000	-78.0	1.5	14.4	0.3	-61.8	-20.0	41.8
468.000	2	936.000	-66.4	1.0	14.2	0.2	-51.0	-20.0	31.0
468.000	3	1404.000	-64.0	0.5	14.2	0.2	-49.1	-20.0	29.1
468.000	4	1872.000	-78.0	0.6	14.3	0.2	-62.9	-20.0	42.9
468.000	5	2340.000	-78.0	1.3	14.4	0.3	-62.0	-20.0	42.0
468.000	6	2808.000	-78.0	2.3	14.3	0.3	-61.1	-20.0	41.1
468.000	7	3276.000	-75.2	2.4	14.5	0.3	-58.0	-20.0	38.0
468.000	8	3744.000	-73.8	3.8	14.6	0.4	-55.0	-20.0	35.0
468.000	9	4212.000	-78.0	4.4	14.7	0.4	-58.5	-20.0	38.5
468.000	10	4680.000	-78.0	5.5	14.9	0.5	-57.1	-20.0	37.1

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

Judgment: Passed by at least 10 dB.

**10.3.4 Conducted Spurious Emissions (Part 24)**

Model	Y84110-221	Specification	FCC Part 24
Serial Number	00:1D:24:00:03:8F:44:04	Test Date	November 14, 2023
Test Personnel	Joseph Strzelecki	Test Location	Chamber B
Test Equipment	EMI Receiver (REC-44); High pass filter (HPF-07) for testing 901-902 MHz		

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

Freq. Tx MHz	Harm #	Tested Freq. MHz	Rec Reading dBm	HPF Attn. Factor dB	Ext. Atten. Factor dB	Cable Loss dB	Total Power dBm	Power Limit dBm	Margin Under Limit dB
901.500	2	1803.000	-45.2	0.8	14.2	0.2	-30.0	-20.0	10.0
901.500	3	2704.500	-71.7	0.5	14.2	0.2	-56.8	-20.0	36.8
901.500	4	3606.000	-73.4	0.6	14.3	0.3	-58.2	-20.0	38.2
901.500	5	4507.500	-70.4	1.3	14.4	0.3	-54.4	-20.0	34.4
901.500	6	5409.000	-75.3	2.3	14.3	0.4	-58.3	-20.0	38.3
901.500	7	6310.500	-78.0	2.4	14.5	0.5	-60.6	-20.0	40.6
901.500	8	7212.000	-78.0	3.8	14.6	0.6	-59.0	-20.0	39.0
901.500	9	8113.500	-78.0	4.4	14.7	0.7	-58.2	-20.0	38.2
901.500	10	9015.000	-78.0	5.5	14.9	0.8	-56.8	-20.0	36.8

The fundamental emission ERP limit is 7 watts (38.5 dBm) for 901.5 MHz.

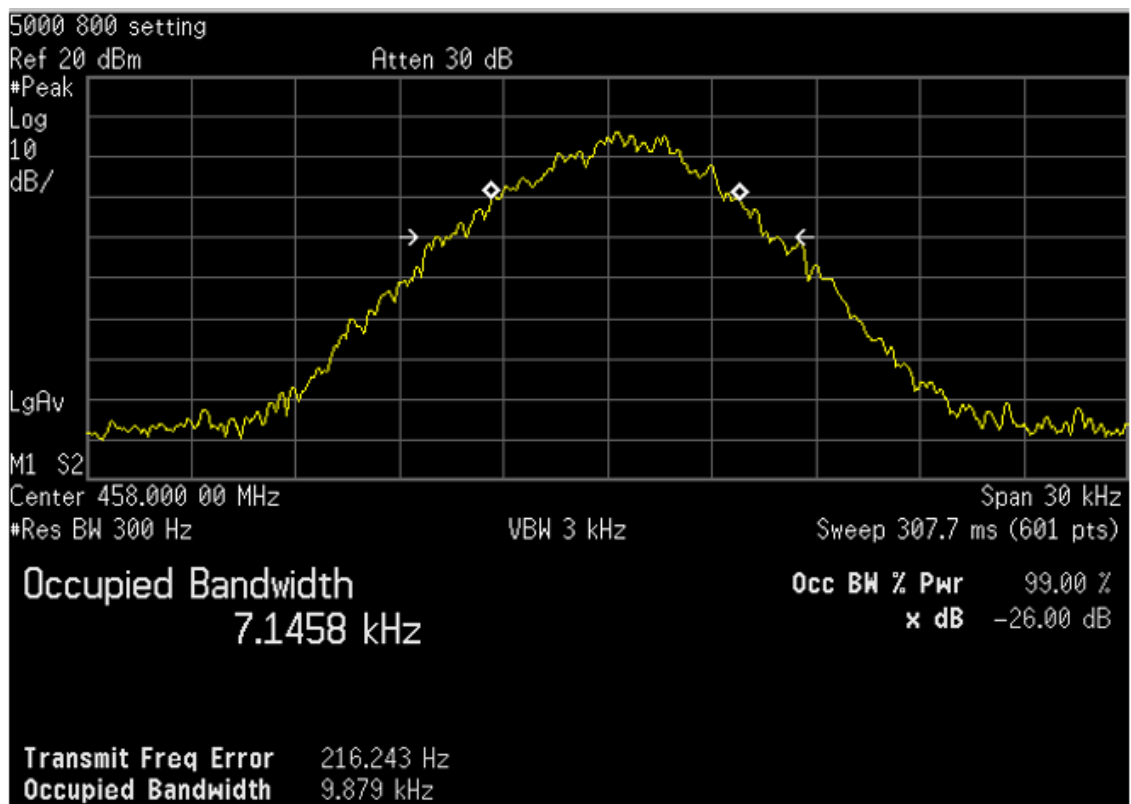
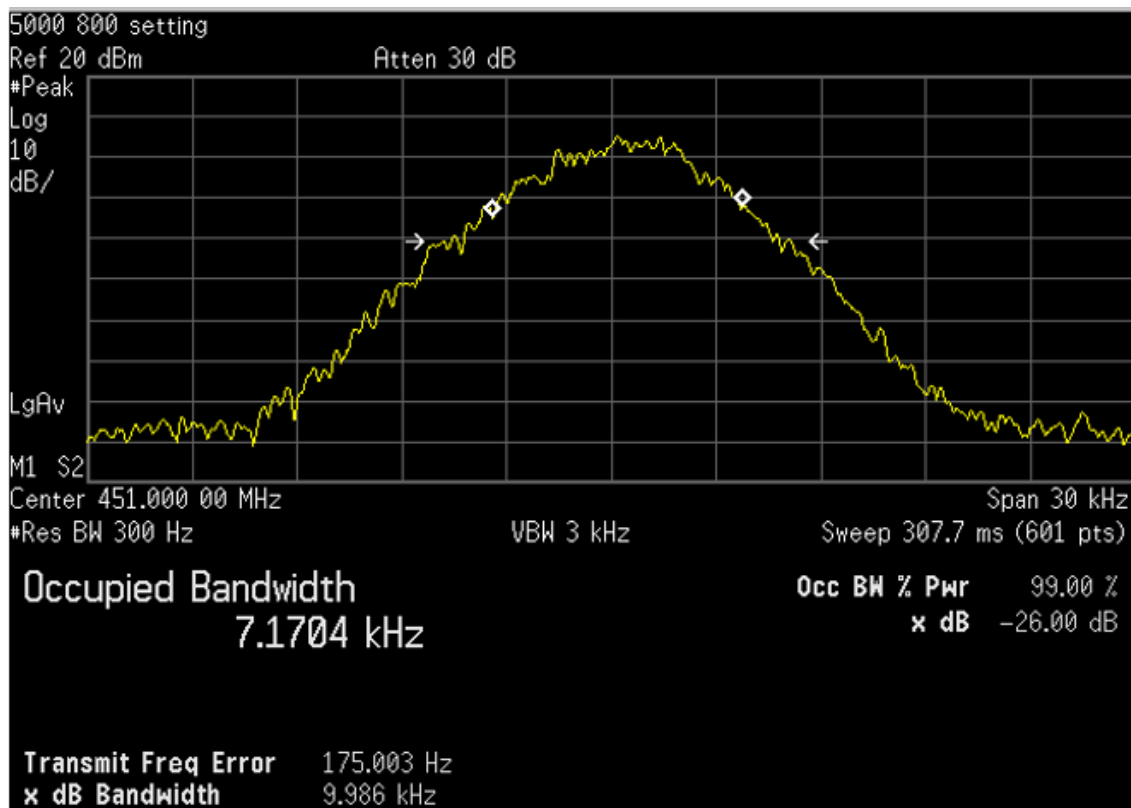
Judgment: Passed by at least 10 dB.

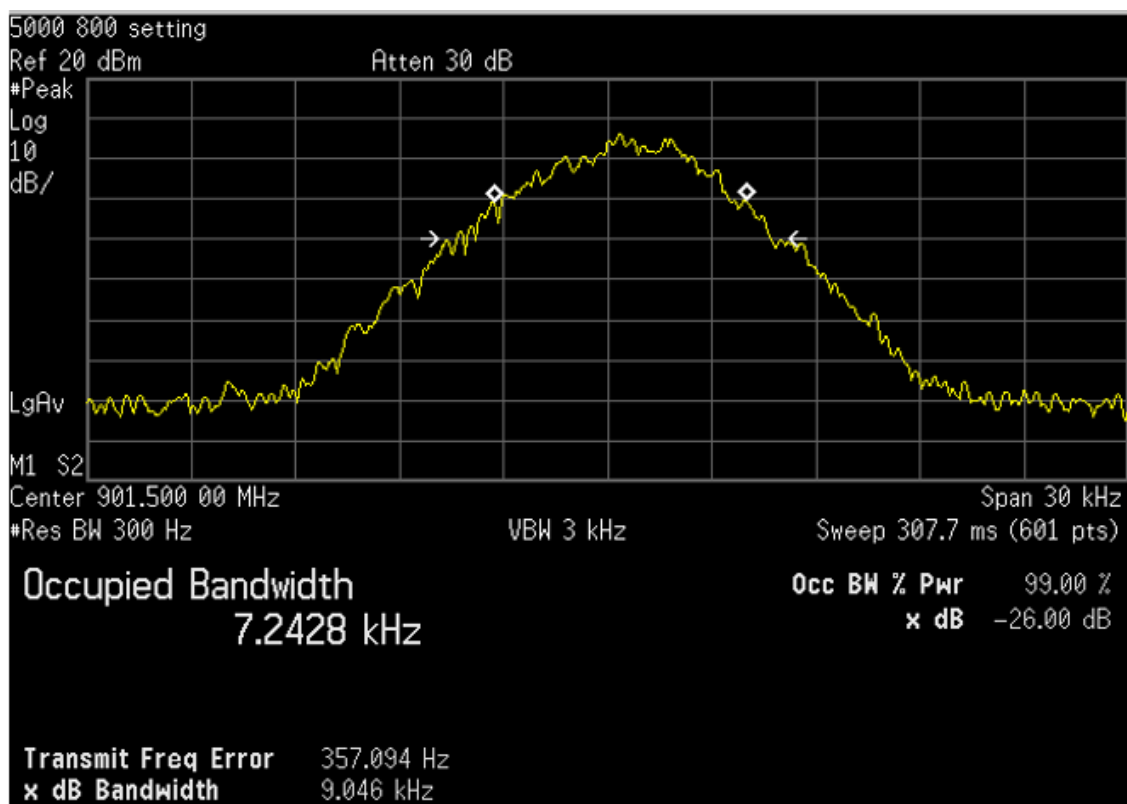
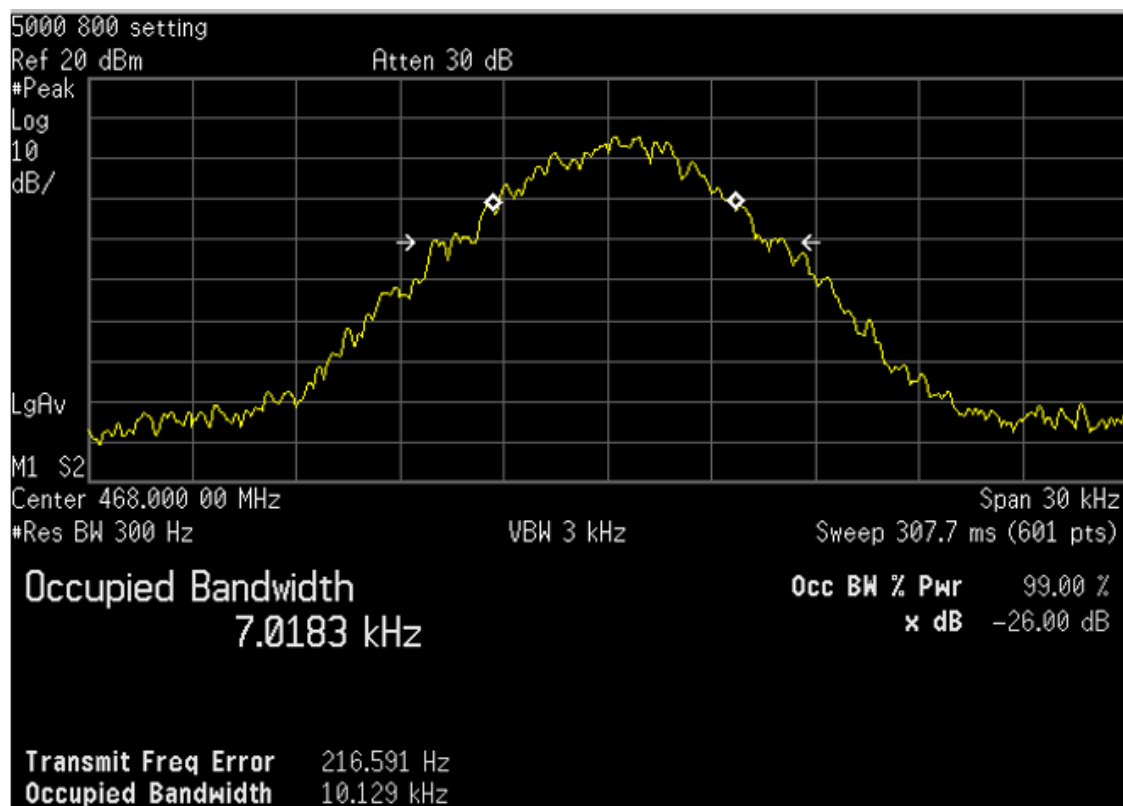
Note for the 900 MHz band, the part 24 limit is -13 dBm.

10.4 Occupied Bandwidth

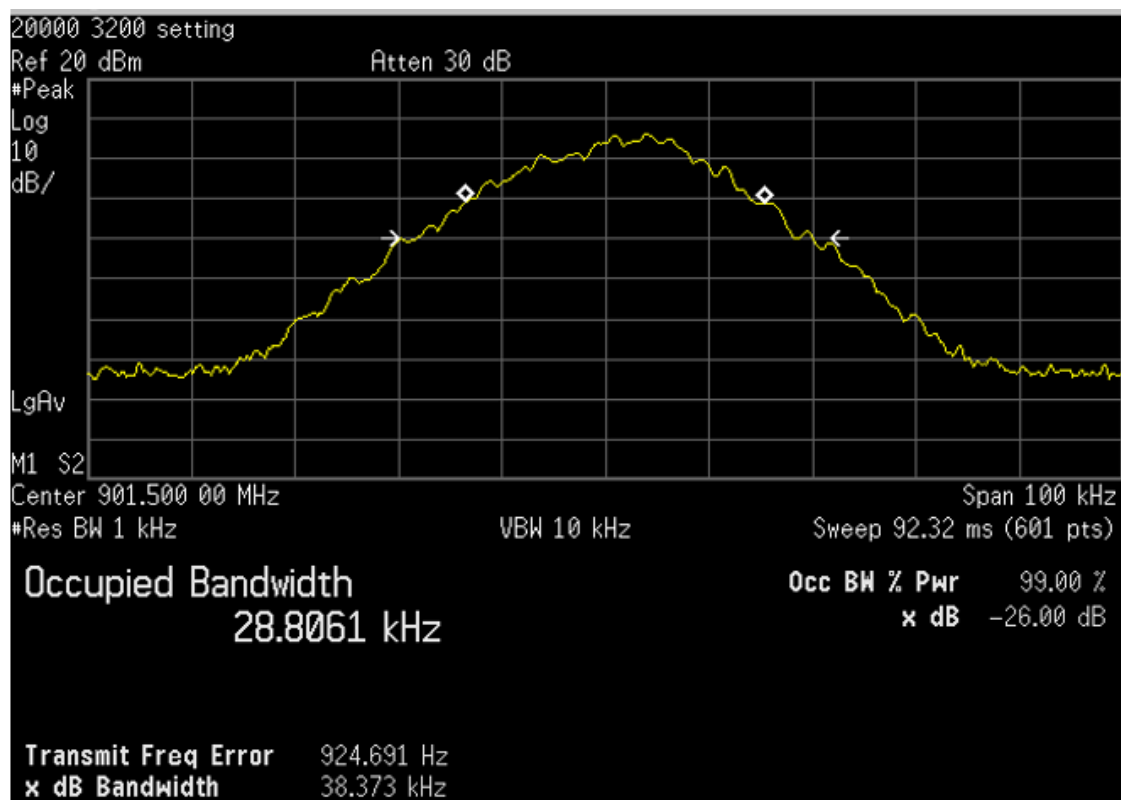
Model	Y84110-221	Specification	FCC Part 90 & 24
Serial Number	00:1D:24:00:03:8F:44:04	Test Date	November 20, 2023
Test Personnel	Joseph Strzelecki	Test Location	Chamber B
Test Equipment	EMI Receiver (REC-44)		

	99% OBW (kHz)
Channel	kHz
451 MHz	7.170
458 MHz	7.146
468 MHz	7.018
901.5 MHz	28.806





901.5 MHz; 10 kHz



901.5 MHz; >10 kHz setting

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:

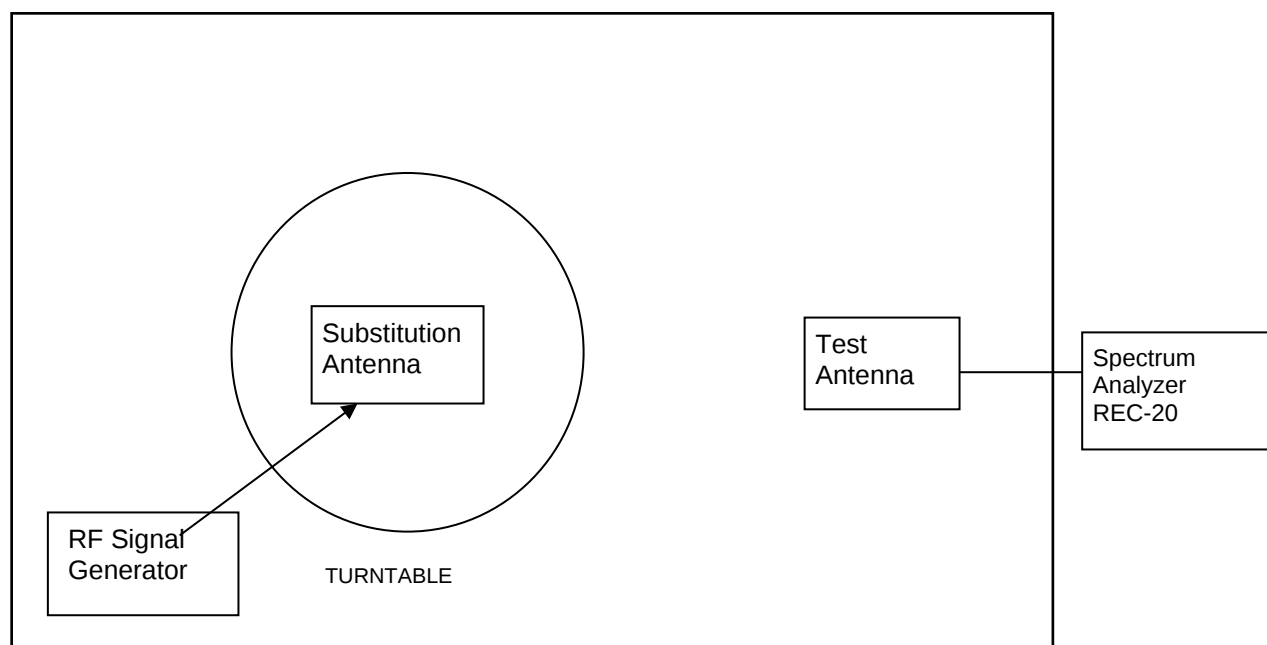
- 1) Resolution Bandwidth = 100 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1 GHz.
- 2) Video Bandwidth = 300 kHz for spurious emissions below 1 GHz, and 3 MHz for spurious emissions above 1 GHz.
- 3) Sweep Speed slow enough to maintain measurement calibration.
- 4)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

$$Pd(\text{dBm}) = Pg(\text{dBm}) - \text{cable loss (dB)} + \text{antenna gain (dB)}$$

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 (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log(P)$ dB.

Since by mathematical definition, $P(\text{dBm}) - (50 + 10 \times \text{LOG}(P(W))) = -20$ 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	Y84110-221	Specification	FCC Part 90.210
Serial Number	00:1D:24:00:03:8F:44:04	Test Date	November 15-16, 2023
Test Distance	3 Meters	Notes	Transmit Mode
Test Personnel	Chris Dalessio		

	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	451.000	902.00	-54.4	-46.6	-20.0	34.4	26.6
3	451.000	1353.00	-52.5	-41.5	-20.0	32.5	21.5
4	451.000	1804.00	-43.3	-51.2	-20.0	23.3	31.2
5	451.000	2255.00	-45.5	-45.4	-20.0	25.5	25.4
6	451.000	2706.00	-39.4	-46.9	-20.0	19.4	26.9
7	451.000	3157.00	-45.8	-45.0	-20.0	25.8	25.0
8	451.000	3608.00	-36.7	-38.7	-20.0	16.7	18.7
9	451.000	4059.00	-44.4	-44.6	-20.0	24.4	24.6
10	451.000	4510.00	-49.5	-51.2	-20.0	29.5	31.2
2	458.000	916.00	-53.0	-46.3	-20.0	33.0	26.3
3	458.000	1374.00	-56.6	-46.9	-20.0	36.6	26.9
4	458.000	1832.00	-41.8	-43.3	-20.0	21.8	23.3
5	458.000	2290.00	-38.2	-42.4	-20.0	18.2	22.4
6	458.000	2748.00	-44.0	-47.1	-20.0	24.0	27.1



	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
7	458.000	3206.00	-52.5	-50.3	-20.0	32.5	30.3
8	458.000	3664.00	-52.4	-53.2	-20.0	32.4	33.2
9	458.000	4122.00	-52.7	-51.7	-20.0	32.7	31.7
10	458.000	4580.00	-53.3	-51.5	-20.0	33.3	31.5
2	468.000	936.00	-58.5	-46.1	-20.0	38.5	26.1
3	468.000	1404.00	-55.7	-45.1	-20.0	35.7	25.1
4	468.000	1872.00	-37.5	-41.2	-20.0	17.5	21.2
5	468.000	2340.00	-38.6	-39.8	-20.0	18.6	19.8
6	468.000	2808.00	-51.3	-48.3	-20.0	31.3	28.3
7	468.000	3276.00	-50.5	-51.8	-20.0	30.5	31.8
8	468.000	3744.00	-52.1	-52.5	-20.0	32.1	32.5
9	468.000	4212.00	-52.5	-52.1	-20.0	32.5	32.1
10	468.000	4680.00	-51.4	-50.6	-20.0	31.4	30.6

Non-Harmonic frequencies

Freq MHz	Detector	Ant Pol	EUT dBm	Limit dBm	Margin dB
60.3	P	H	-55.1	-20.0	35.1
71.2	P	H	-59.4	-20.0	39.4
110.8	P	H	-52.0	-20.0	32.0
149.9	P	H	-59.8	-20.0	39.8
250.1	P	H	-53.9	-20.0	33.9
300.0	P	H	-61.8	-20.0	41.8
500.0	P	H	-64.1	-20.0	44.1
875.4	P	H	-59.6	-20.0	39.6
1583.6	P	H	-59.4	-20.0	39.4
1802.8	P	H	-54.9	-20.0	34.9
3349.3	P	H	-55.0	-20.0	35.0
4272.3	P	H	-51.1	-20.0	31.1
4840.8	P	H	-51.3	-20.0	31.3
37.1	P	V	-61.0	-20.0	41.0
45.7	P	V	-68.5	-20.0	48.5
56.1	P	V	-49.1	-20.0	29.1
58.8	P	V	-50.0	-20.0	30.0
66.3	P	V	-55.2	-20.0	35.2
111.6	P	V	-48.8	-20.0	28.8
124.9	P	V	-58.1	-20.0	38.1
149.9	P	V	-61.0	-20.0	41.0
250.0	P	V	-54.4	-20.0	34.4
300.0	P	V	-63.2	-20.0	43.2
472.7	P	V	-60.7	-20.0	40.7
625.1	P	V	-60.9	-20.0	40.9
665.7	P	V	-61.1	-20.0	41.1
805.8	P	V	-57.8	-20.0	37.8
874.9	P	V	-59.5	-20.0	39.5
1980.0	P	V	-56.3	-20.0	36.3
3119.1	P	V	-56.3	-20.0	36.3
3515.5	P	V	-54.1	-20.0	34.1



Freq MHz	Detector	Ant Pol	EUT dBm	Limit dBm	Margin dB
3721.7	P	V	-53.7	-20.0	33.7
3882.9	P	V	-52.2	-20.0	32.2
4507.5	P	V	-49.6	-20.0	29.6

No other radiated emissions were detected within 10 dB of the limits from 30 MHz to 9.2 GHz.

Judgment: Passed by at least 10 dB.

10.5.4 Spurious Radiated Emissions Test Results (Part 24)

Model	Y84110-221	Specification	FCC Part 24
Serial Number	00:1D:24:00:03:8F:44:04	Test Date	November 16-17, 2023
Test Distance	3 Meters	Notes	Transmit Mode
Test Personnel	Chris Dalessio		

	Tx	Measured	Equivalent Radiated power into Dipole			Margin Under Limit	
Harmonic #	Freq MHz	Freq MHz	Vertical dBm	Horizontal dBm	Limit dBm	Vertical dB	Horizontal dB
2	901.500	1803.00	-41.5	-50.0	-20.0	21.5	30.0
3	901.500	2704.50	-39.7	-46.4	-20.0	19.7	26.4
4	901.500	3606.00	-35.7	-37.6	-20.0	15.7	17.6
5	901.500	4507.50	-48.6	-49.4	-20.0	28.6	29.4
6	901.500	5409.00	-47.5	-49.0	-20.0	27.5	29.0
7	901.500	6310.50	-53.6	-52.7	-20.0	33.6	32.7
8	901.500	7212.00	-50.0	-49.7	-20.0	30.0	29.7
9	901.500	8113.50	-50.0	-48.6	-20.0	30.0	28.6
10	901.500	9015.00	-47.5	-47.6	-20.0	27.5	27.6

Non-Harmonic frequencies

Freq MHz	Detector	Ant Pol	EUT dBm	Limit dBm	Margin dB
39.3	P	H	-70.4	-20.0	50.4
58.8	P	H	-63.5	-20.0	43.5
106.8	P	H	-67.7	-20.0	47.7
163.2	P	H	-69.6	-20.0	49.6
250.0	P	H	-55.0	-20.0	35.0
300.0	P	H	-59.2	-20.0	39.2
500.0	P	H	-64.6	-20.0	44.6
525.0	P	H	-65.7	-20.0	45.7
575.1	P	H	-64.8	-20.0	44.8
625.1	P	H	-62.8	-20.0	42.8
750.3	P	H	-64.6	-20.0	44.6
874.9	P	H	-58.5	-20.0	38.5
1188.2	P	H	-60.7	-20.0	40.7
2747.7	P	H	-55.0	-20.0	35.0
3206.2	P	H	-54.4	-20.0	34.4
3818.8	P	H	-52.1	-20.0	32.1
4695.7	P	H	-51.7	-20.0	31.7
5518.5	P	H	-49.0	-20.0	29.0
5905.9	P	H	-50.0	-20.0	30.0



Freq MHz	Detector	Ant Pol	EUT dBm	Limit dBm	Margin dB
6670.7	P	H	-48.2	-20.0	28.2
7825.8	P	H	-44.0	-20.0	24.0
55.9	P	V	-49.5	-20.0	29.5
66.3	P	V	-54.7	-20.0	34.7
98.4	P	V	-56.8	-20.0	36.8
106.8	P	V	-52.5	-20.0	32.5
124.9	P	V	-57.6	-20.0	37.6
159.6	P	V	-57.1	-20.0	37.1
200.1	P	V	-59.1	-20.0	39.1
250.0	P	V	-53.0	-20.0	33.0
695.7	P	V	-57.3	-20.0	37.3
874.9	P	V	-58.9	-20.0	38.9
1980.0	P	V	-55.4	-20.0	35.4
2806.8	P	V	-55.9	-20.0	35.9
3876.9	P	V	-51.2	-20.0	31.2
4824.8	P	V	-51.7	-20.0	31.7
5472.5	P	V	-48.7	-20.0	28.7
6475.5	P	V	-49.3	-20.0	29.3
7201.2	P	V	-45.3	-20.0	25.3
7873.9	P	V	-43.6	-20.0	23.6

No other radiated emissions were detected within 10 dB of the limits from 30 MHz to 9.2 GHz.

Judgment: Passed by at least 10 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	Y84110-221 S/N: 00:1D:24:00:03:8F:44:04	Specification	FCC Part 90.213
Test Personnel	Chris D'Alessio	Test Date	11/10/2023
		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
102.0	458.000189	458.000112	77	0.17
108.0	458.000207	458.000112	95	0.21
114.0	458.000225	458.000112	113	0.25
120.0	458.000148	458.000112	36	0.08
126.0	458.000232	458.000112	120	0.26
132.0	458.000237	458.000112	125	0.27
138.0	458.000240	458.000112	128	0.28

Temp	Measured Freq	Nominal Freq:	Deviation	
Deg C	(MHz)	at 20 Deg C	Hz	PPM
50	458.000542	458.000112	430	0.94
40	458.000203	458.000112	91	0.20
30	458.000118	458.000112	6	0.01
20	458.000150	458.000112	38	0.08
10	458.000051	458.000112	-61	-0.13
0	458.000078	458.000112	-34	-0.07
-10	458.000005	458.000112	-107	-0.23
-20	457.999989	458.000112	-123	-0.27
-30	457.999749	458.000112	-363	-0.79



Nominal Frequency	901.500 MHz
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Volts	Freq.	Nominal Freq:	Deviation	
VDC	(MHz)	at 3.2 VDC	Hz	PPM
102.0	901.500338	901.500230	108	0.12
108.0	901.500418	901.500230	188	0.21
114.0	901.500417	901.500230	187	0.21
120.0	901.500475	901.500230	245	0.27
126.0	901.500482	901.500230	252	0.28
132.0	901.500484	901.500230	254	0.28
138.0	901.500482	901.500230	252	0.28

Temp	Measured Freq	Nominal Freq:	Deviation	
Deg C	(MHz)	at 23 Deg C	Hz	PPM
50	901.500550	901.500230	320	0.35
40	901.500460	901.500230	230	0.26
30	901.500133	901.500230	-97	-0.11
20	901.500220	901.500230	-10	-0.01
10	901.500189	901.500230	-41	-0.05
0	901.500117	901.500230	-113	-0.13
-10	901.500048	901.500230	-182	-0.20
-20	901.499701	901.500230	-529	-0.59
-30	901.499603	901.500230	-627	-0.70

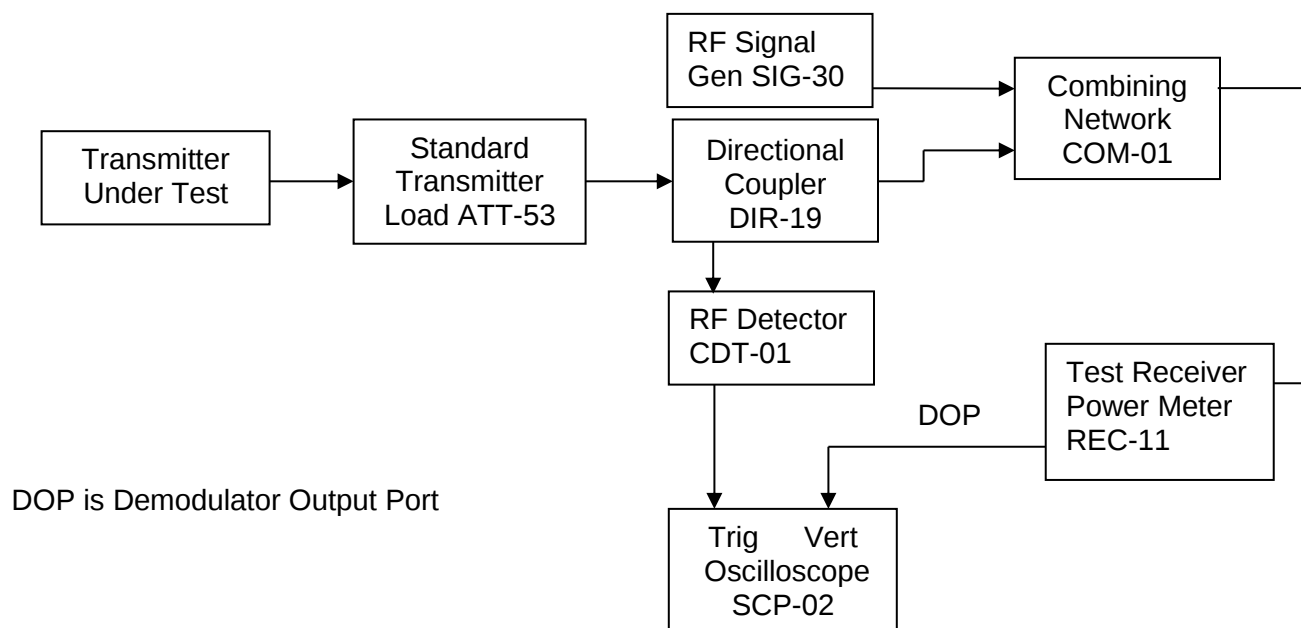
Test Requirements: Limit is 2.5 ppm

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.



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_{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	Y84110-221 S/N: 00:1D:24:00:03:8F:44:04	Specification	FCC part 90.214
Test Location	Chamber C	Test Date	
Test Personnel	Joseph Strzelecki		



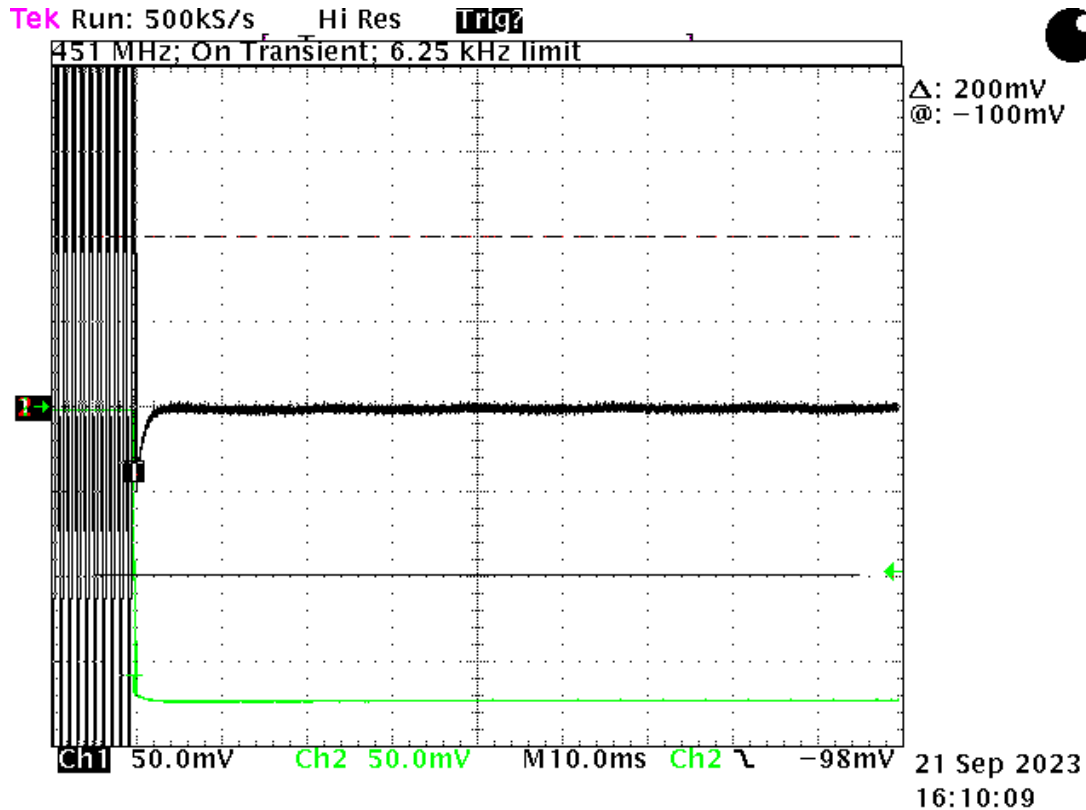
Freq MHz	Channel BW	Limits for Time interval/Freq difference						Test Result
		t ₁		t ₂		t ₃		
		mSec	kHz	mSec	kHz	mSec	kHz	
450.025	12.5	10	12.5	25	6.25	10	12.5*	Pass
460.000	12.5	10	12.5	25	6.25	10	12.5*	Pass
469.975	12.5	10	12.5	25	6.25	10	12.5*	Pass

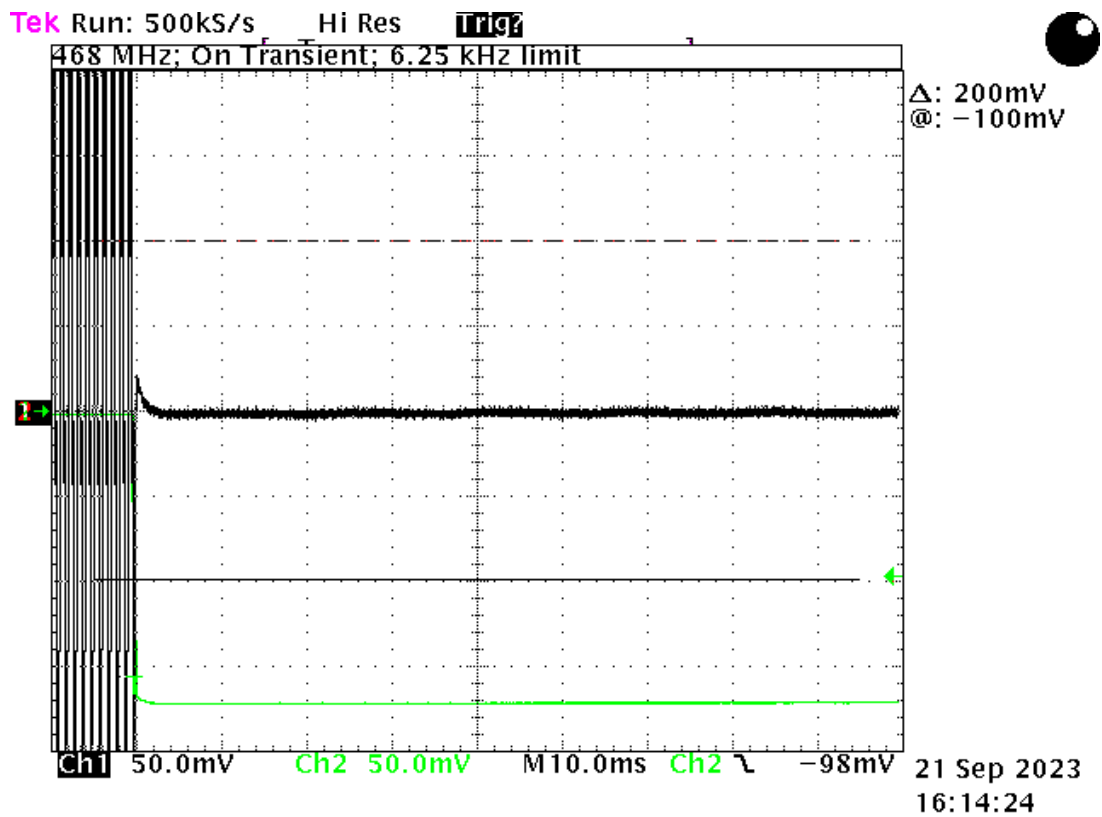
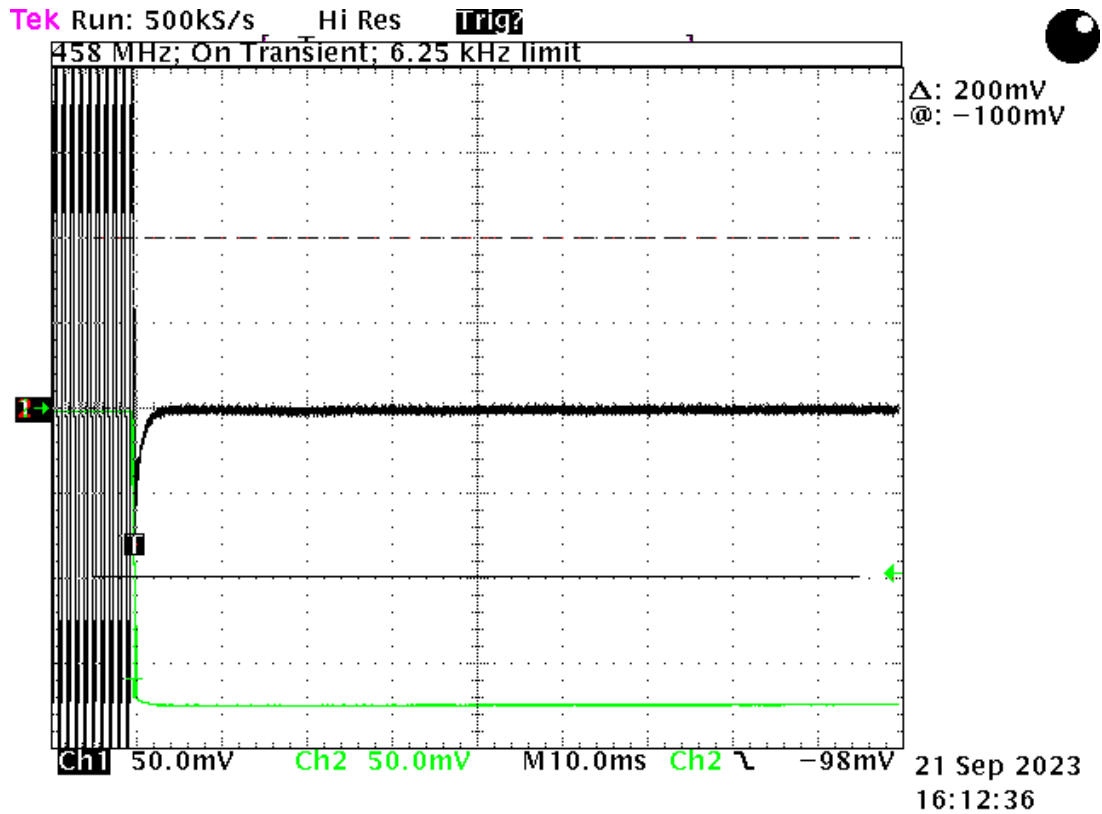
Judgement: Pass

*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.

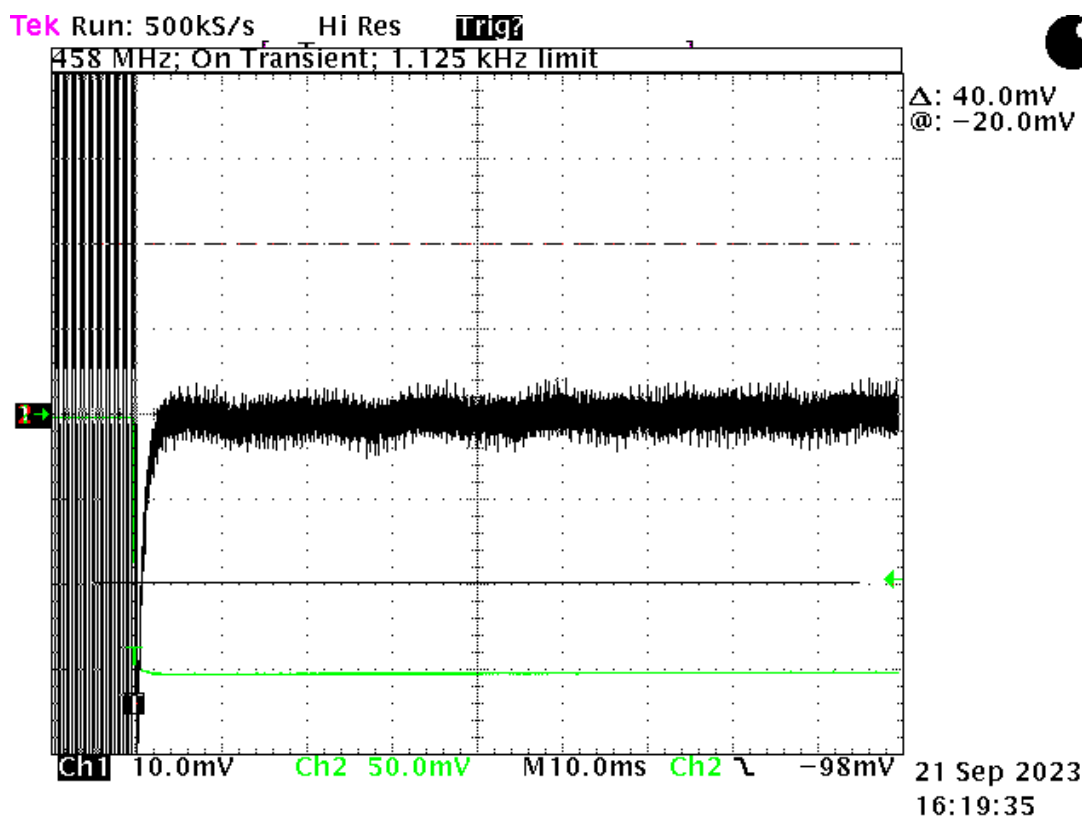
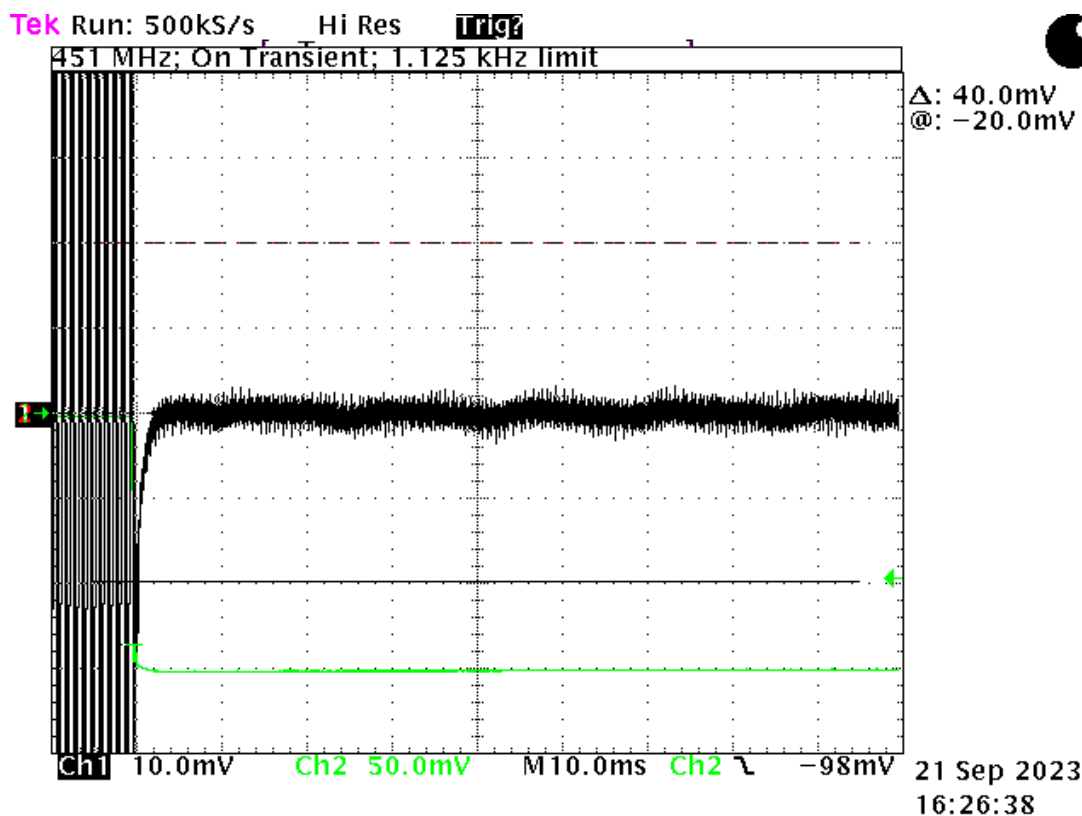


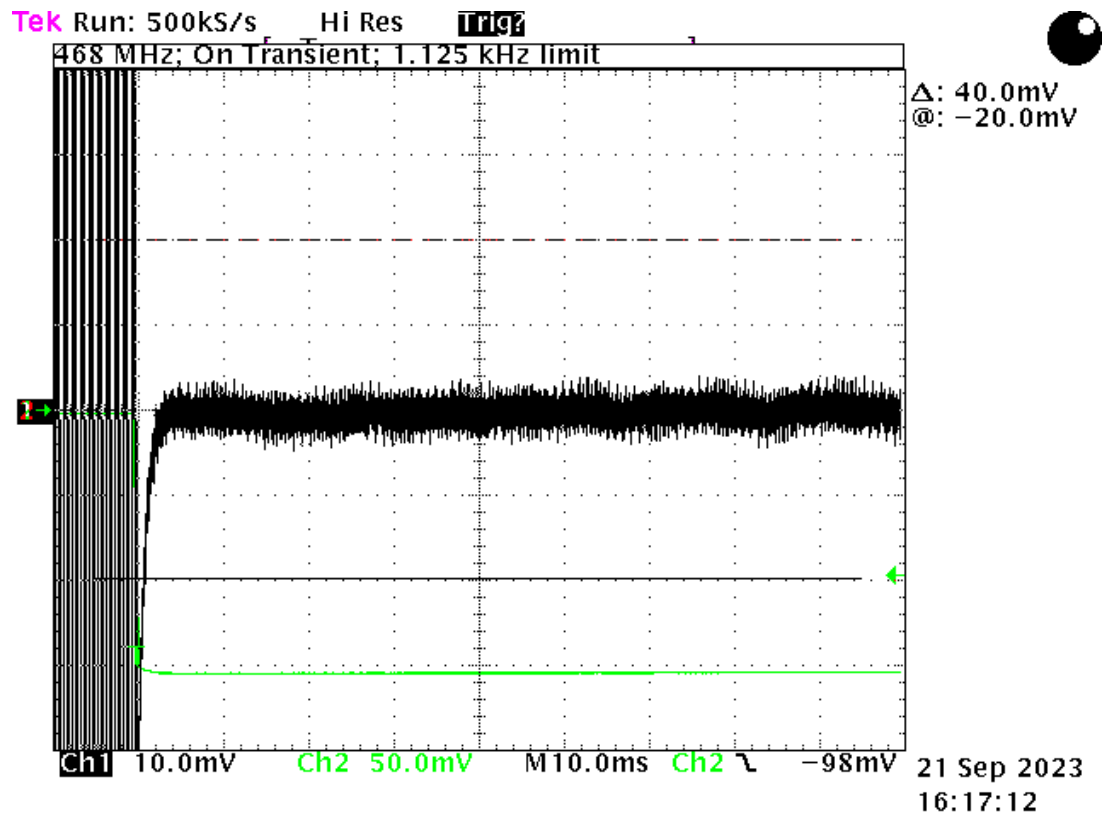




10.7.5 Results for Time Period between t2 and t3

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 $450 \text{ MHz} * 2.5 \text{ ppm}$ or 1125 Hz.

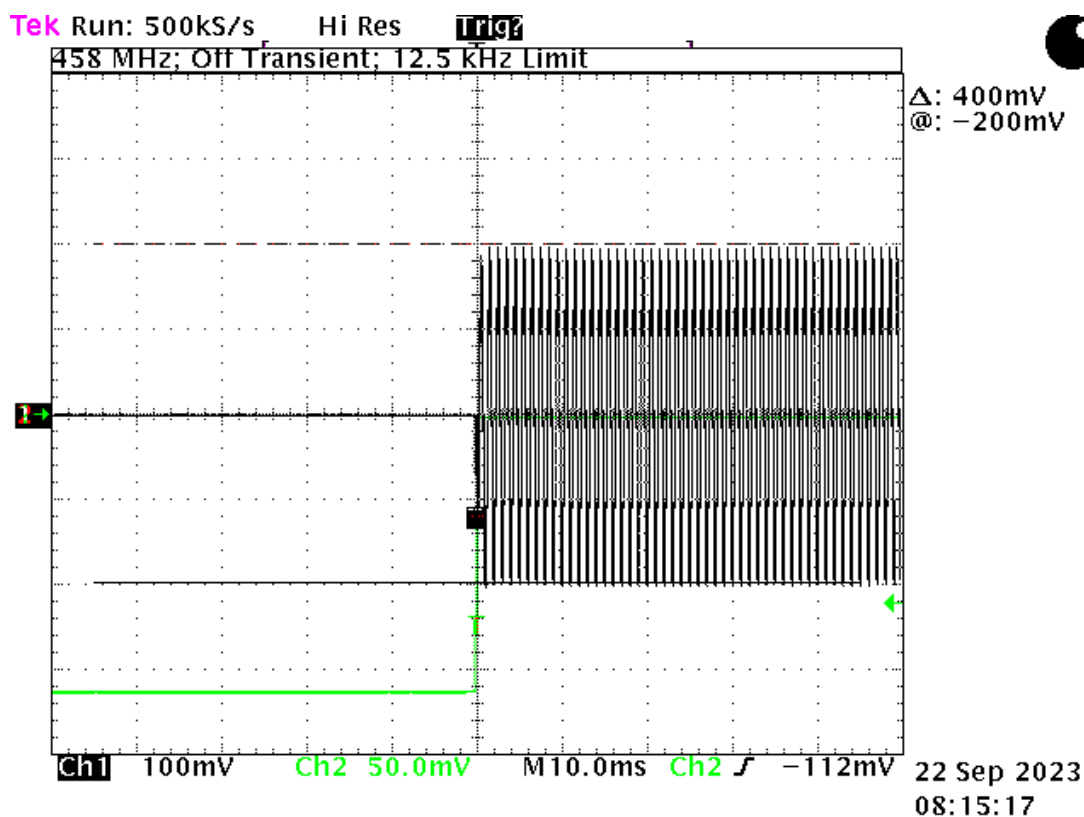
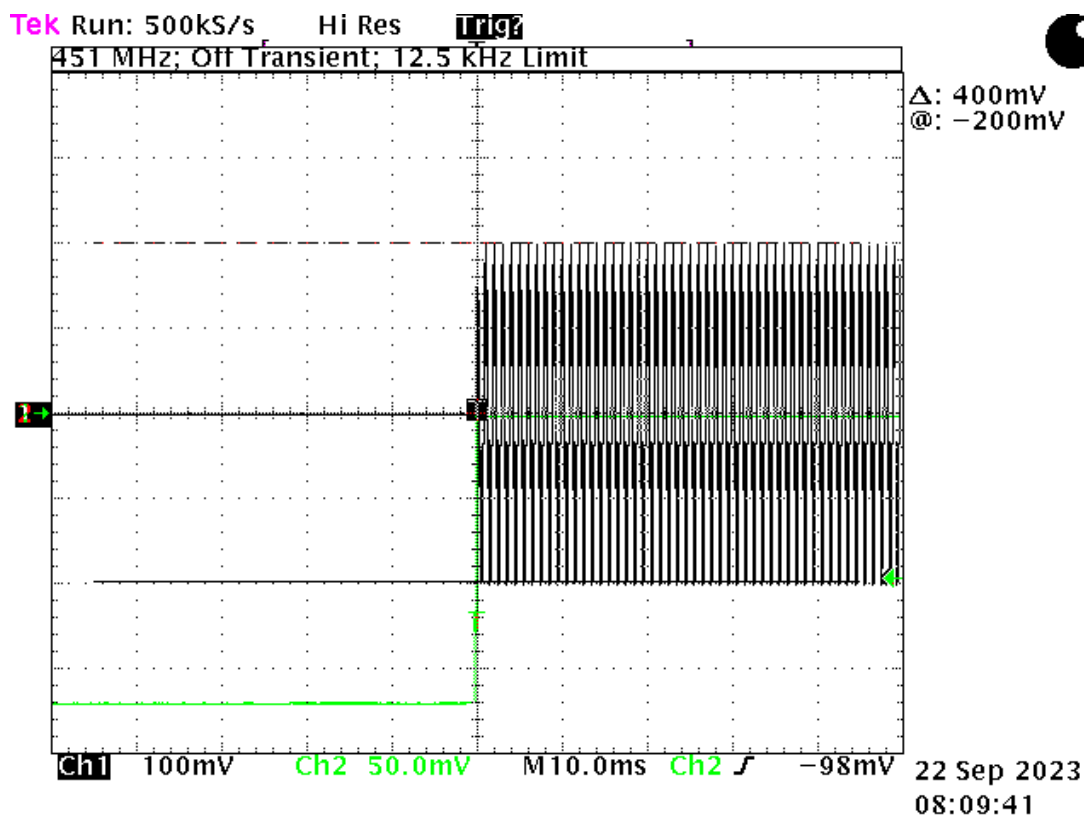


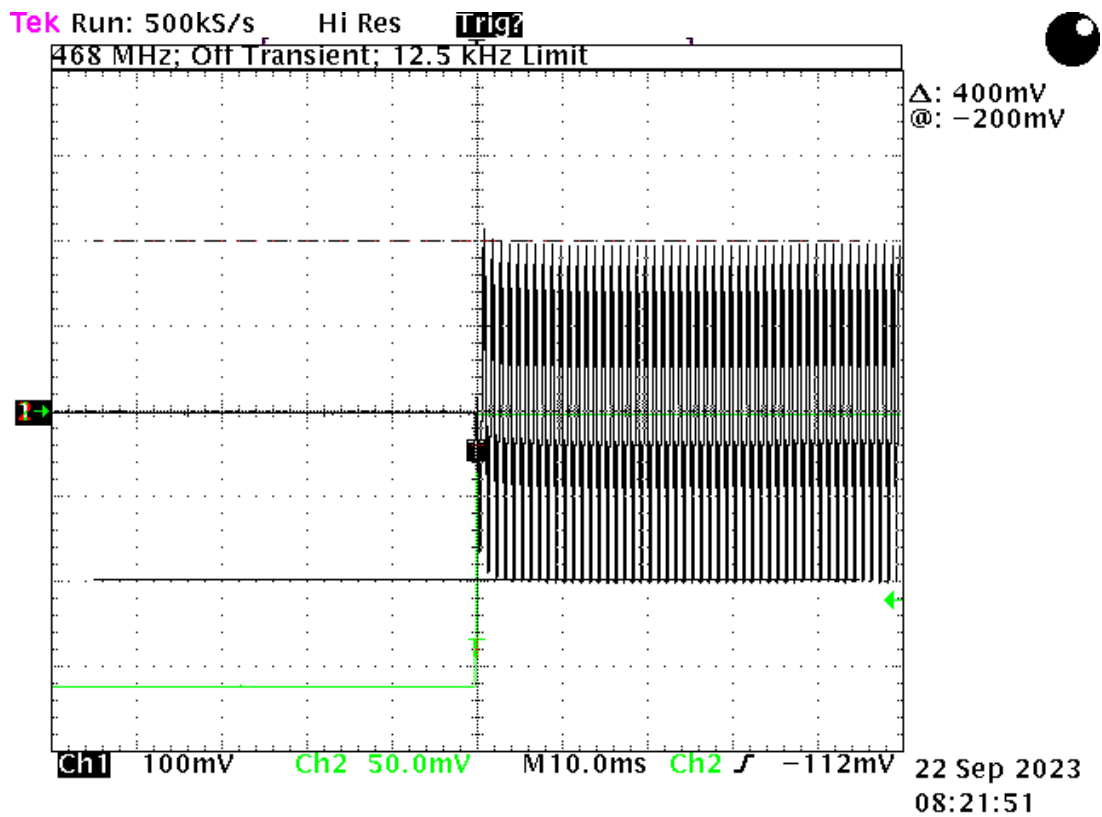
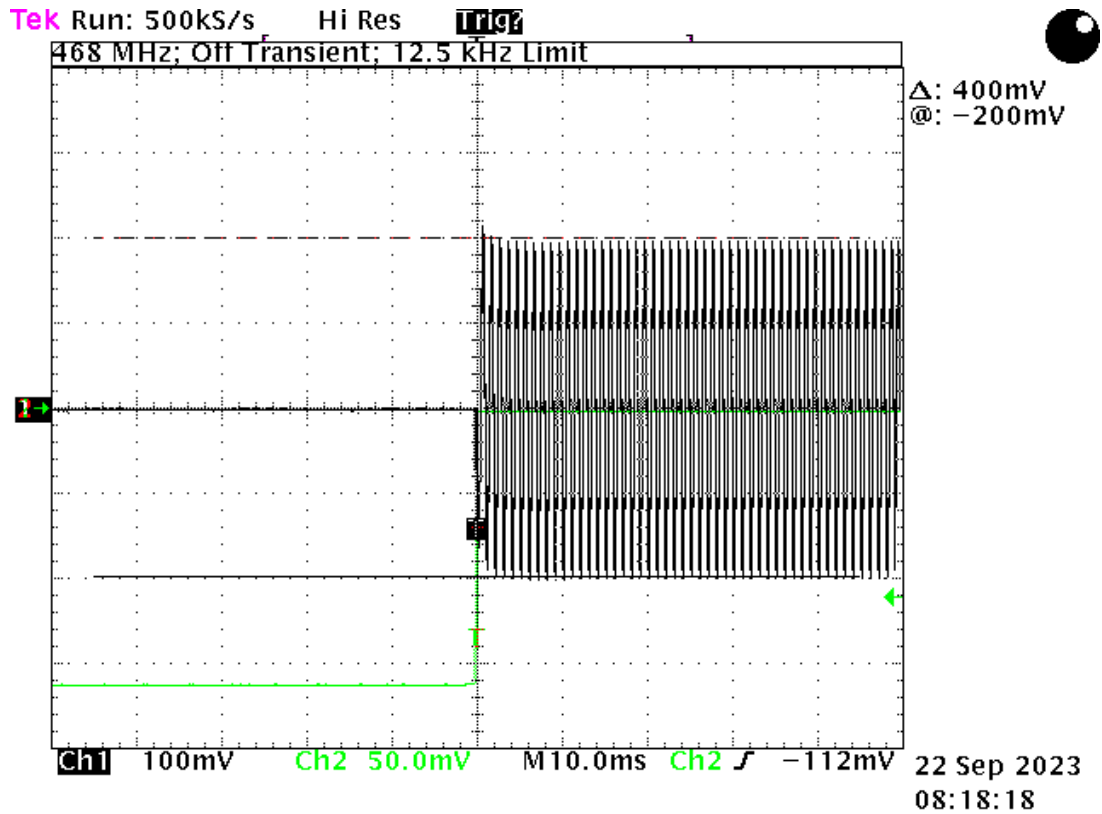


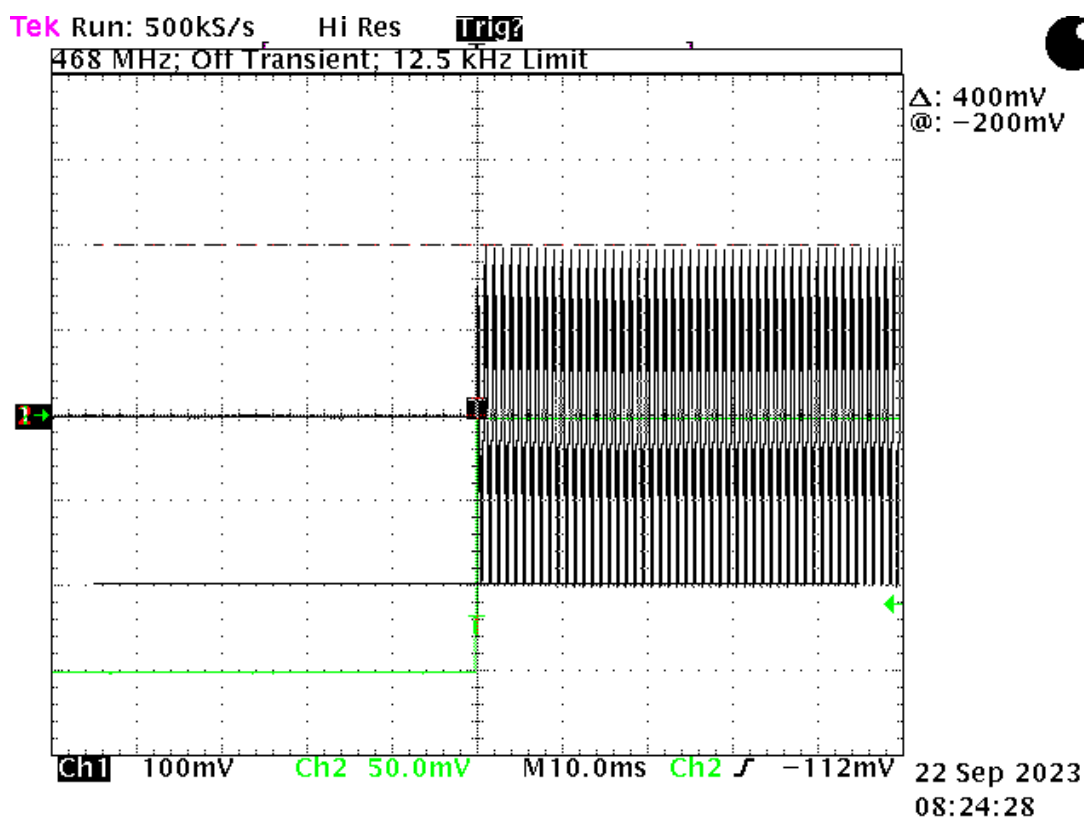


10.7.6 Results for Time Period t3

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.







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 5000 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	Y84110-221 S/N: 00:1D:24:00:03:8F:44:04	Specification	FCC Part 15 Subpart B
Test Distance	3 Meters	Test Date	November 17, 2023
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		

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
33.3	9.0	P	H	12.3	0.6	0.0	21.9	40.0	18.1	
58.8	21.5	P	H	9.0	0.8	0.0	31.3	40.0	8.7	
64.7	12.5	P	H	8.8	0.8	0.0	22.1	40.0	17.9	
80.9	5.7	P	H	9.0	1.0	0.0	15.7	40.0	24.3	
98.4	13.5	P	H	10.0	1.1	0.0	24.6	43.5	18.9	
104.8	17.6	P	H	10.4	1.1	0.0	29.1	43.5	14.4	
124.9	8.6	P	H	11.7	1.2	0.0	21.5	43.5	22.0	
145.0	10.0	P	H	12.5	1.3	0.0	23.8	43.5	19.7	
149.9	10.7	P	H	12.6	1.3	0.0	24.6	43.5	18.9	
168.7	19.4	P	H	13.0	1.4	0.0	33.8	43.5	9.7	
181.1	10.8	P	H	13.5	1.5	0.0	25.8	43.5	17.7	
186.9	10.1	P	H	13.7	1.5	0.0	25.3	43.5	18.2	
200.1	14.0	P	H	14.2	1.5	0.0	29.7	43.5	13.8	
225.1	8.1	P	H	14.8	1.6	0.0	24.5	46.0	21.5	
250.0	20.0	P	H	11.9	1.7	0.0	33.6	46.0	12.4	
272.5	17.6	P	H	12.7	1.8	0.0	32.1	46.0	13.9	
300.0	18.0	P	H	14.0	1.9	0.0	33.9	46.0	12.1	
349.9	17.5	P	H	14.4	2.1	0.0	34.0	46.0	12.0	
415.0	11.3	P	H	15.6	2.3	0.0	29.2	46.0	16.8	
498.0	8.6	P	H	17.4	2.5	0.0	28.5	46.0	17.5	
581.1	16.4	P	H	18.6	2.7	0.0	37.7	46.0	8.3	
746.7	9.9	P	H	20.9	3.1	0.0	33.9	46.0	12.1	
799.8	7.3	P	H	21.3	3.2	0.0	31.8	46.0	14.2	
849.8	4.7	P	H	22.3	3.3	0.0	30.3	46.0	15.7	
912.9	8.4	P	H	22.9	3.4	0.0	34.7	46.0	11.3	
996.0	7.0	P	H	24.0	3.6	0.0	34.6	54.0	19.4	
1188.2	38.0	P	H	24.9	-32.0	0.0	30.9	74.0	43.1	1
1391.4	41.2	P	H	25.0	-31.8	0.0	34.4	74.0	39.6	1
1583.6	38.5	P	H	25.4	-31.5	0.0	32.4	74.0	41.6	1
1682.7	37.3	P	H	26.1	-31.5	0.0	31.9	74.0	42.1	1



Freq. MHz	Meter Reading dBuV	Decet.	Ant. Pol.	Ant Factor	Cable & Amp Factors	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
1988.0	38.0	P	H	27.3	-31.1	0.0	34.2	74.0	39.8	1
2250.3	36.8	P	H	27.9	-30.8	0.0	33.9	74.0	40.1	1
2533.5	36.3	P	H	28.5	-30.3	0.0	34.5	74.0	39.5	1
2807.8	39.5	P	H	29.2	-29.8	0.0	38.9	74.0	35.1	1
3091.1	35.3	P	H	30.4	-29.4	0.0	36.3	74.0	37.7	1
3483.5	36.9	P	H	31.2	-28.7	0.0	39.4	74.0	34.6	1
3758.8	35.4	P	H	32.4	-28.4	0.0	39.4	74.0	34.6	1
4261.3	36.0	P	H	32.4	-27.5	0.0	40.9	74.0	33.1	1
4892.9	33.8	P	H	33.5	-26.4	0.0	40.9	74.0	33.1	1
34.0	14.4	P	V	12.3	0.6	0.0	27.3	40.0	12.7	
43.5	19.7	P	V	10.1	0.7	0.0	30.5	40.0	9.5	
51.0	24.0	P	V	9.3	0.8	0.0	34.1	40.0	5.9	
58.8	31.2	P	V	9.0	0.8	0.0	41.0	40.0	-1.0	
58.8	27.0	Q	V	9.0	0.8	0.0	36.8	40.0	3.2	
64.7	18.8	P	V	8.8	0.8	0.0	28.4	40.0	11.6	
81.3	19.9	P	V	9.1	1.0	0.0	30.0	40.0	10.0	
85.5	18.6	P	V	9.2	1.0	0.0	28.8	40.0	11.2	
110.8	32.5	P	V	10.9	1.1	0.0	44.5	43.5	-1.0	
110.8	27.9	Q	V	10.9	1.1	0.0	39.9	43.5	3.6	
124.9	28.0	P	V	11.7	1.2	0.0	40.7	43.5	2.8	
124.9	27.0	Q	V	11.7	1.2	0.0	39.9	43.5	3.6	
138.4	17.3	P	V	12.3	1.3	0.0	30.9	43.5	12.6	
149.9	19.8	P	V	12.6	1.3	0.0	33.7	43.5	9.8	
159.6	17.7	P	V	12.8	1.4	0.0	31.9	43.5	11.6	
179.3	14.8	P	V	13.3	1.5	0.0	29.6	43.5	13.9	
183.5	12.8	P	V	13.5	1.5	0.0	27.8	43.5	15.7	
200.1	16.7	P	V	14.2	1.5	0.0	32.4	43.5	11.1	
226.7	16.5	P	V	14.9	1.6	0.0	33.0	46.0	13.0	
250.0	23.5	P	V	11.9	1.7	0.0	37.1	46.0	8.9	
272.2	16.8	P	V	12.7	1.8	0.0	31.3	46.0	14.7	
300.0	17.0	P	V	14.0	1.9	0.0	32.9	46.0	13.1	
349.9	12.9	P	V	14.4	2.1	0.0	29.4	46.0	16.6	
357.0	7.2	P	V	14.4	2.1	0.0	23.7	46.0	22.3	
407.2	11.0	P	V	15.5	2.2	0.0	28.7	46.0	17.3	
415.0	17.3	P	V	15.6	2.3	0.0	35.2	46.0	10.8	
436.4	9.0	P	V	16.1	2.3	0.0	27.4	46.0	18.6	
498.0	15.0	P	V	17.4	2.5	0.0	34.9	46.0	11.1	
581.1	14.7	P	V	18.6	2.7	0.0	36.0	46.0	10.0	
647.6	8.2	P	V	19.6	2.8	0.0	30.6	46.0	15.4	
716.2	7.9	P	V	21.0	3.0	0.0	31.9	46.0	14.1	
750.3	7.7	P	V	20.9	3.1	0.0	31.7	46.0	14.3	
799.8	7.1	P	V	21.3	3.2	0.0	31.6	46.0	14.4	
912.9	6.0	P	V	22.9	3.4	0.0	32.3	46.0	13.7	
996.0	4.5	P	V	24.0	3.6	0.0	32.1	54.0	21.9	
1170.2	38.3	P	V	24.8	-32.0	0.0	31.1	74.0	42.9	1
1282.3	38.5	P	V	24.9	-32.0	0.0	31.4	74.0	42.6	1
1404.4	41.8	P	V	25.0	-31.8	0.0	35.0	74.0	39.0	1
1632.6	37.4	P	V	25.7	-31.5	0.0	31.6	74.0	42.4	1
1723.7	39.5	P	V	26.4	-31.4	0.0	34.5	74.0	39.5	1
1992.0	42.5	P	V	27.3	-31.1	0.0	38.7	74.0	35.3	1
2167.2	37.8	P	V	27.7	-30.9	0.0	34.6	74.0	39.4	1
2607.6	36.4	P	V	28.7	-30.1	0.0	35.0	74.0	39.0	1
2807.8	40.7	P	V	29.2	-29.8	0.0	40.1	74.0	33.9	1

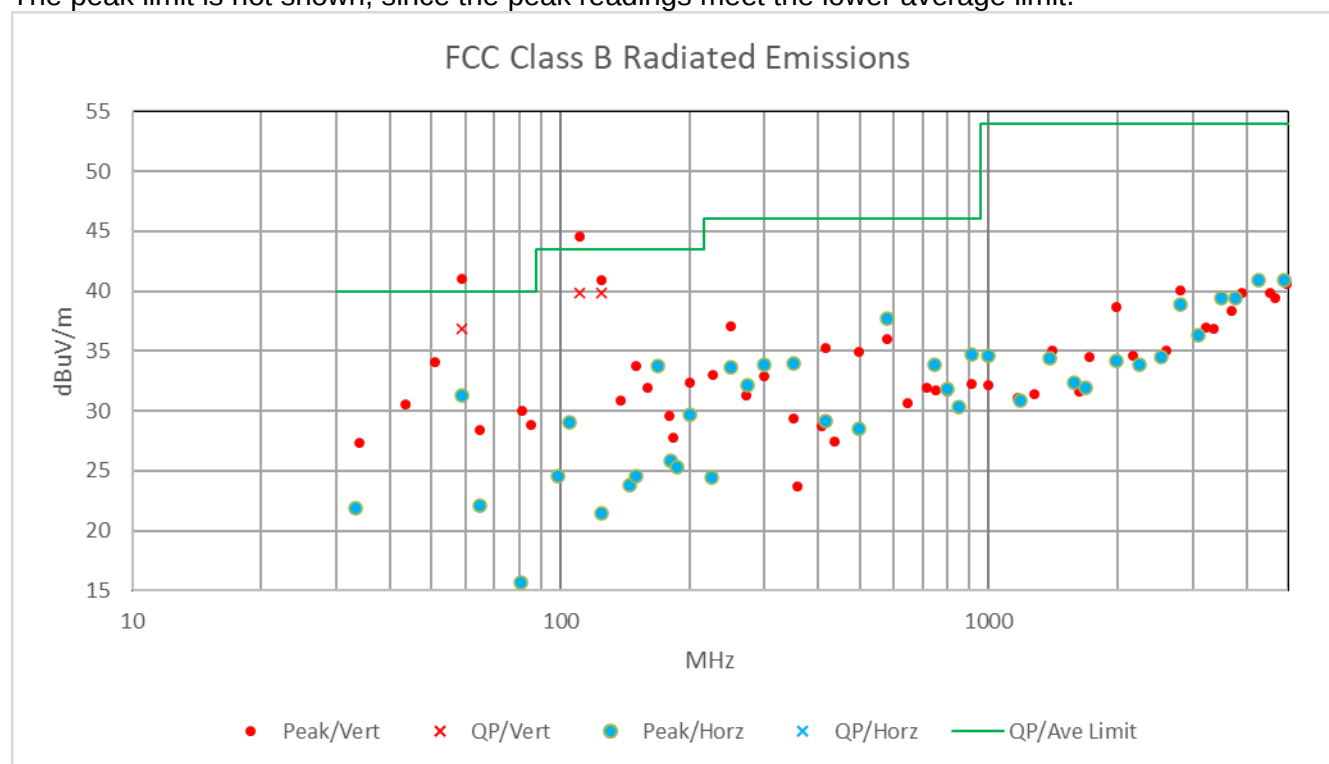


Freq. MHz	Meter Reading dBuV	Decet.	Ant. Pol.	Ant Factor	Cable & Amp Factors	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
3224.2	35.2	P	V	31.0	-29.2	0.0	37.0	74.0	37.0	1
3347.3	34.6	P	V	31.2	-28.9	0.0	36.9	74.0	37.1	1
3697.7	34.8	P	V	32.0	-28.5	0.0	38.3	74.0	35.7	1
3912.9	35.2	P	V	32.8	-28.2	0.0	39.8	74.0	34.2	1
4526.5	34.2	P	V	33.0	-27.3	0.0	39.9	74.0	34.1	1
4679.7	33.0	P	V	33.3	-26.9	0.0	39.4	74.0	34.6	1
4948.9	33.4	P	V	33.5	-26.3	0.0	40.6	74.0	33.4	1

Note 1; Peak reading meeting the average limit, so the average reading is not required.

Judgment: Pass by 3.2 dB

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

12.0 REVISION HISTORY

RP-9861A Revisions:			
Rev.	Affected Sections	Description	Rationale
1	3.1	Expanded ranges on Frequency Table	Consistency with ranges listed in Part 90