

TEST REPORT

Report Number: R15310046-E1

Applicant : Sony Corporation
1-7-1 Konan Minato-Ku
Tokyo, 108-0075, Japan

FCC ID : PY7-13187R
PY7-76709C
PY7-54773M
PY7-27433F

EUT Description : GSM/WCDMA/LTE/5G Phone with BT, DTS/UNII a/b/g/n/ac/ax/be,
GPS, WPT & NFC

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C: 2024

Date Of Issue:
2024-07-22

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2024-06-20	Initial Issue	Charles Moody
V2	2024-06-27	Editorial Changes to Section 6	Charles Moody
V3	2024-07-22	Added FCC ID: PY7-27433F due to similarity to other IDs. Added clarifying information regarding test reduction cases.	Jeff Moser

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Sony Corporation
1-7-1 Konan Minato-ku
Tokyo, 108-0075, Japan

EUT DESCRIPTION: GSM/WCDMA/LTE/5G Phone with BT, DTS/UNII a/b/g/n/ac/ax/be,
GPS, WPT & NFC

SERIAL NUMBER: QV7700AVL3, QV7700NWLQ

SAMPLE RECEIPT DATE: 2023-12-26 TO 2024-01-29

DATE TESTED: 2024-06-04 TO 2024-06-11

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C: 2024	See Section 2

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

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

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document.

Approved & Released
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Jeff Moser
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Consumer Technology Division

2. TEST RESULTS SUMMARY

Below is a list of the data provided by the customer:

- 1) Antenna gain and type (see section 6.3)
- 2) Cable loss (see sections 9.3 and 9.4)

FCC Clause	Requirement	Result	Comment
See Comment	Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
15.247 (a) (2)	6dB BW	Compliant	None
15.247 (b) (3)	Output Power		
See Comment	Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	PSD	See Comment	See Note 1
15.247 (d)	Conducted Spurious Emissions	Compliant	None
15.209, 15.205	Radiated Emissions	See Comment	See Note 1
15.207	AC Mains Conducted Emissions		

NOTE 1: Full testing of the 2.4 WLAN radio was performed previously and can be found in UL report R15110020-E7. This report covers the 802.11be portion of testing. 802.11be was compared to 802.11ax and both modes found to behave the same. Section 8 includes a spotcheck comparison between the 802.11ax and 802.11be modes for PSD, Output Power, 6dB BW, Conducted Bandedge/Spurious Emissions, and Radiated Bandedge/Spurious Emissions. Additionally, full testing for 802.11be output power, 6dB BW, Conducted Spurious Emissions, and Radiated Bandedge was performed and found to be **compliant**.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC 47 CFR Part 2, FCC 47 CFR Part 15, ANSI C63.10-2020, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, certification # 0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
<input type="checkbox"/>	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	825374
<input checked="" type="checkbox"/>	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A		27265	

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

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

5.2. DECISION RULES

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

5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U _{Lab}
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	1.22%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	1.94 dB
All emissions, radiated	6.01 dB
Conducted Emissions (0.150-30MHz) - LISN	3.40 dB
Temperature	0.57°C
Humidity	3.39%
DC Supply voltages	1.70%

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

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a GSM/WCDMA/LTE/5G Phone with BT, DTS,/UNII a/b/g/n/ac/ax/be, GPS, WPT & NFC. This report covers the full emissions testing of the 2.4 WLAN radio.

6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

2.4GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2Tx			
2412 - 2462	802.11be EHT20 52T + 26T	22.59	181.55
2412 - 2462	802.11be EHT20 106T + 26T	24.89	308.32

6.3. TEST REDUCTIONS CASES

Radiated Spurious Emissions from 1-18 GHz were performed on the worst-case 802.11ax mode while transmitting at 802.11be. This was found to be 52T at 2437MHz. Additionally, the worst-case multi-RU 802.11be mode, based on worst-case average power, was tested. This was found to be 106T+26T at 2457MHz.

Radiated Band Edge Emissions were performed on the worst-case 802.11ax mode while transmitting at 802.11be. This was found to be 106T at 2457 MHz. Additionally, all multi-RU modes were tested at low, high, and all power stepped channels.

6dB BW was tested at the worst-case 802.11ax mode while transmitting at 802.11be. This was found to be 26T at 2462 MHz. Additionally, all multi-RU modes were tested at low, middle and high channels.

Full output power was taken at the 802.11be multi-RU modes as well as a spotcheck between the worst case 802.11ax mode while transmitting at 802.11be. This was found to be 242T at 2422 MHz.

PSD was tested at the worst-case 802.11ax mode while transmitting at 802.11be. This was found to be 52T at 2462 MHz. No additional PSD testing was performed as all multi-RU modes have a larger bandwidth than non-multi-RU and therefore, the non-multi-RU can be considered worst case.

Conducted Spurious and Bandedge emissions were spotchecked at the worst case 802.11ax mode while transmitting at 802.11be. This was found to be 52T, 2412 MHz. Additionally, all multi-RU modes were tested at low, middle, and high channels, at the mid channel power setting.

Due to preliminary investigations and similarity of the 802.11ax vs 802.11be results of the above test data, full emissions testing of the 2.4 WLAN radio for worst case Radiated emissions below 1GHz, above 18GHz, power line conducted emissions and full conducted testing were leveraged from the 802.11ax report, R15110020-E7.

6.4. MODEL DIFFERENCES

The hardware of WLAN 2.4GHz, WLAN 5GHz, Bluetooth, GPS, NFC and WPT is identical among PY7-13187R, PY7-76709C, PY7-54773M and PY7-27433F. Therefore, the test data of WLAN 2.4GHz, WLAN 5GHz, Bluetooth, GPS, NFC and WPT for PY7-13187R may also represent PY7-76709C and PY7-54773M

6.5. DESCRIPTION OF AVAILABLE ANTENNAS

Chain	Designation in Documentation	Type	Frequency Range (MHz)	Maximum Gain (dBi)
0	WLAN Main/Bluetooth#1	Loop	2402-2480	-1.02
1	WLAN Sub/Bluetooth#2	Monopole	2402-2480	-2.69

6.6. SOFTWARE AND FIRMWARE

The test utility software used during testing was 0.220.

6.7. WORST-CASE CONFIGURATION AND MODE

Please refer to UL Report number: R15110020-E7 for the full emissions testing of the 2.4 WLAN radio for worst case Radiated emissions below 1GHz, above 18GHz, power line conducted emissions and full conducted testing. This report only covers the 802.11be portion of testing as described in Section 2 and Section 6.3.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

Worst-case data rates as provided by the client were:

802.11be EHT20 mode: MCS0 (Nss=1)

Based on pretesting, all testing performed in 2Tx mode (NSS=1), where power per chain is equivalent to the 1Tx power on each chain. This allows 2Tx testing to cover all 1Tx testing.

6.8. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Power Adapter	Sony	XQZ-UC1	3223W09206247	--
Headphones	Sony	--	--	--
Support Laptop	Lenovo	Yoga 7 16IAP7	PF49WDF9	--

I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB-C	USB	<3M	Connects EUT to Power Adapter
2	3.5mm	1	AUX	Non-Shielded	<3M	Connected to Headphones

TEST SETUP

The EUT is connected to a support laptop prior to testing to configure the radio. Test software exercised the radio card. For testing, the EUT was connected to the power adapter.

SETUP DIAGRAMS

Please refer to R15310046-EP1 for setup diagrams

7. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

6 dB BW: ANSI C63.10 Subclause -11.8.1

Output Power: ANSI C63.10 Subclause -11.9.2.3.1 Method PKPM1 Peak-reading power meter
ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a
gated RF average-reading power meter)

PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

Radiated emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11 and 6.10.4

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1 and 6.10.5

General Radiated Spurious Emissions: ANSI C63.10 Section 6.3 to 6.6

8. 802.11ax vs 802.11be Comparison

8.1. REFERENCE DETAIL

Equipment Class	Report Title
DTS (2.4 WLAN)	R15110020-E7 FCC 2.4 WLAN REPORT

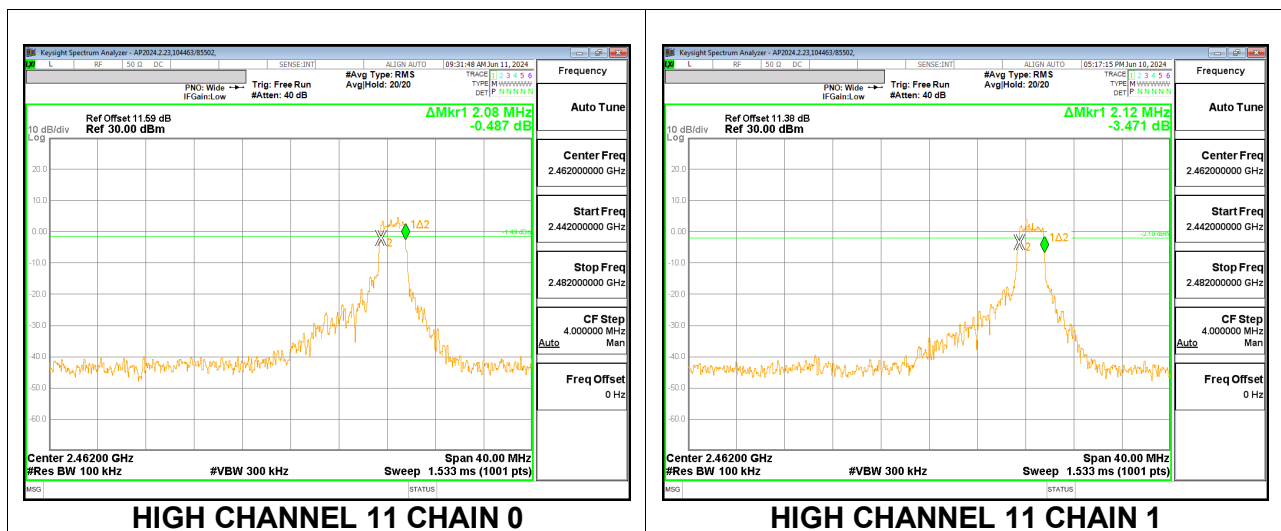
Plots within this report only includes the 802.11be spotcheck data. 802.11ax data included in the table in section 8.2 can be found in the report referenced above.

8.2. DATA COMPARISON

SPOT CHECK RESULTS				
Technology	Test Item	Channel	802.11ax Reading	802.11be Reading
2.4 WLAN 26T	6dB BW	2462	2.12	2.08
2.4 WLAN 242T	Pk Power	2422	25.10	25.05
	Av Power		16.71	16.66
2.4 WLAN 52T	PSD	2462	-5.369	-3.879
	CBE	2412	-29.276	-28.827
	CSE		-30.854	-31.162
	RSE	2437	47.89	46.26
2.4 WLAN 106T	RBE	2457	37.49 (av)	32.5 (av)

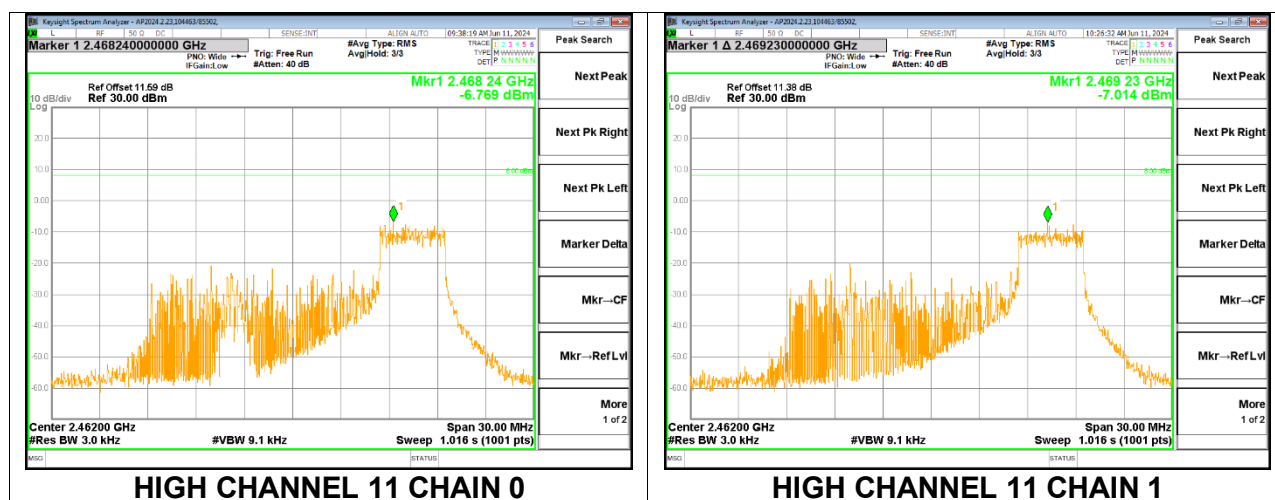
8.3. SPOT CHECK DATA

8.3.1. 6dB BANDWIDTH



Worst case (lowest bandwidth, chain 0) 6dB Bandwidth data is included in the table in section 6.2.

8.3.2. POWER SPECTRAL DENSITY



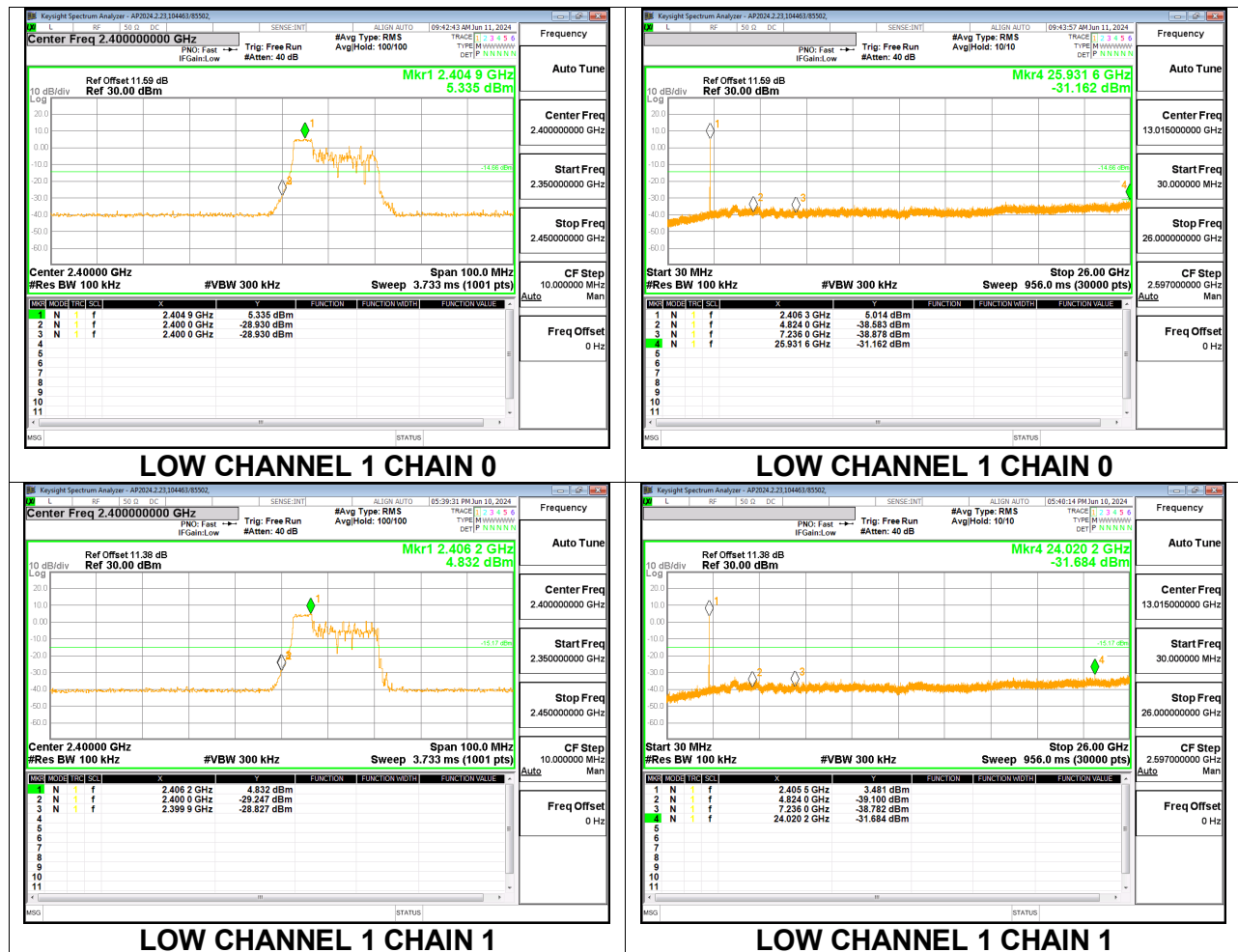
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
--------------------	------	--

Channel	Frequency (MHz)	Chain 0 Meas (dBm/ 3kHz)	Chain 1 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)
High 11	2462	-6.769	-7.014	-3.879

PSD reported in section 8.2 is the summed two chain data calculated using the following equation: $10\log(10^{(C0 \text{ PSD}/10)} + 10^{(C1 \text{ PSD}/10)})$

Duty Cycle used in calculating the DC Correction factor can be found in section 10.1.

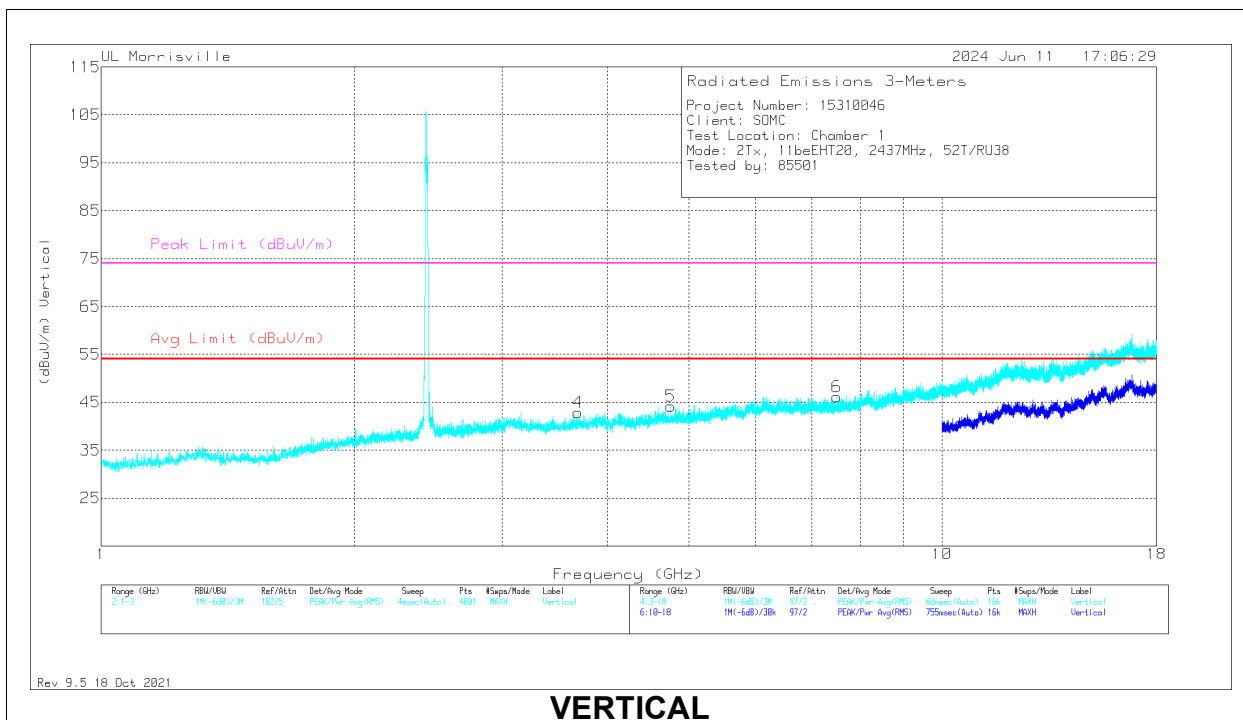
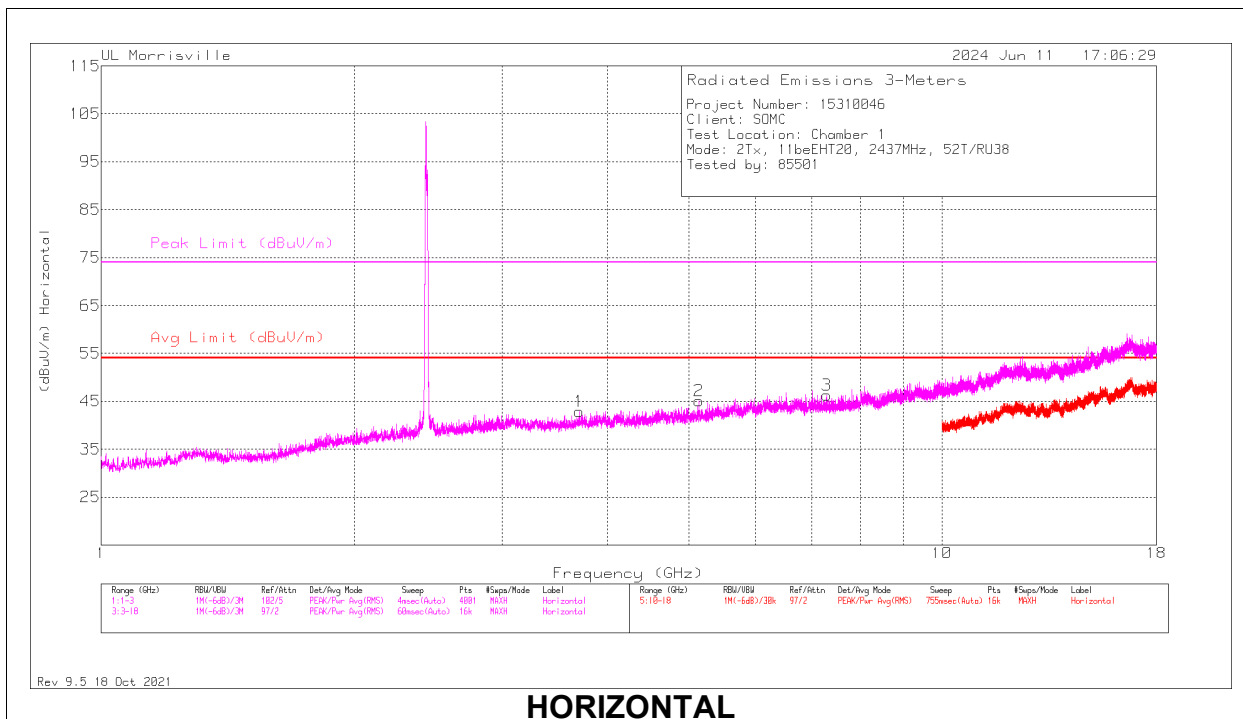
8.3.3. CONDUCTED BANDEDGE/SPURIOUS EMISSIONS



Worst case margin for CBE (Chain 1) and for CSPUR (Chain 0) was included in the table in section 8.2.

8.3.4. RADIATED SPURIOUS EMISSIONS

MID CHANNEL 6 RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 3.70125	42.38	Pk	33.1	-32.6	42.88	54	-11.12	74	-31.12	0-360	100	H
2	* ** 5.1375	41.68	Pk	34.2	-30.8	45.08	54	-8.92	74	-28.92	0-360	100	H
3	* ** 7.29563	37.96	Pk	35.7	-27.4	46.26	54	-7.74	74	-27.74	0-360	100	H
4	* ** 3.69094	42.71	Pk	33.1	-32.9	42.91	54	-11.09	74	-31.09	0-360	200	V
5	* ** 4.75594	41.27	Pk	34	-31.1	44.17	54	-9.83	74	-29.83	0-360	200	V
6	* ** 7.49813	38.25	Pk	35.6	-27.7	46.15	54	-7.85	74	-27.85	0-360	200	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

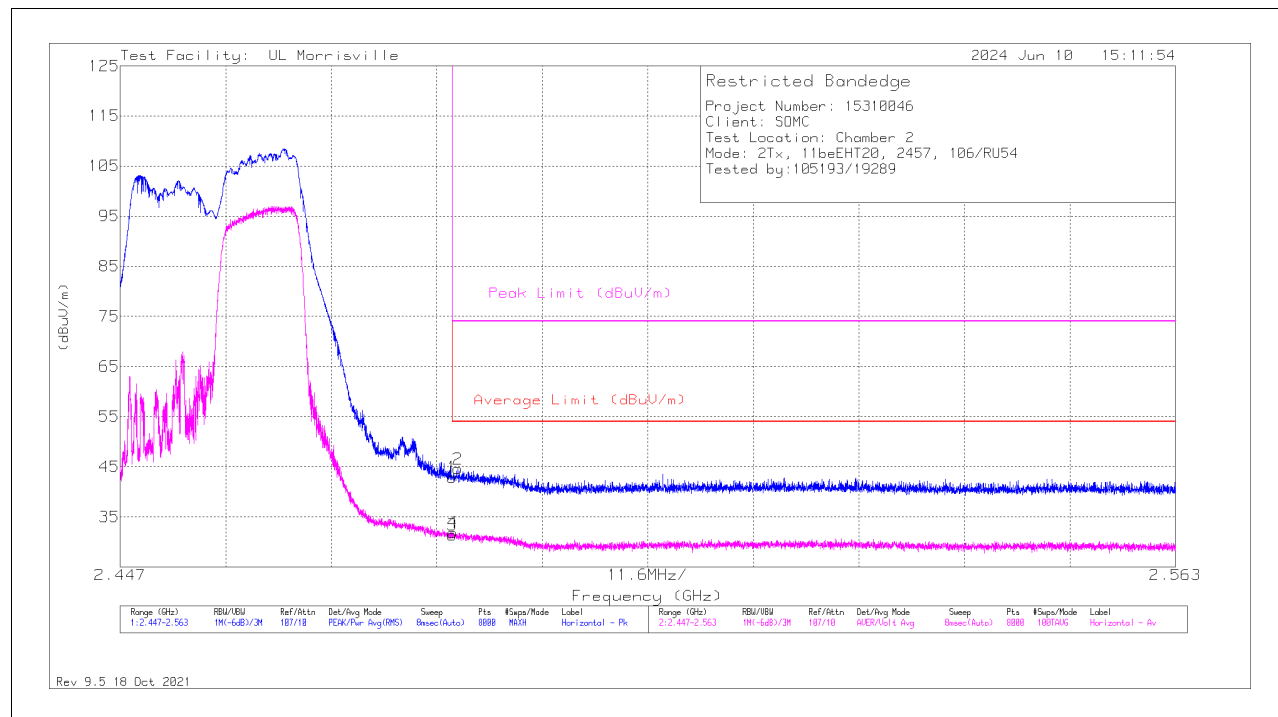
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

8.3.5. RADIATED BANDEDGE EMISSIONS

BANDEDGE (HIGH CHANNEL 10)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	86408 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.4835	34.72	Pk	32.5	-24.3	42.92	-	-	74	-31.08	74	109	H
2	*** 2.48411	36.38	Pk	32.5	-24.3	44.58	-	-	74	-29.42	74	109	H
3	*** 2.4835	23.18	ADV	32.5	-24.3	31.38	54	-22.62	-	-	74	109	H
4	*** 2.48359	23.65	ADV	32.5	-24.3	31.85	54	-22.15	-	-	74	109	H

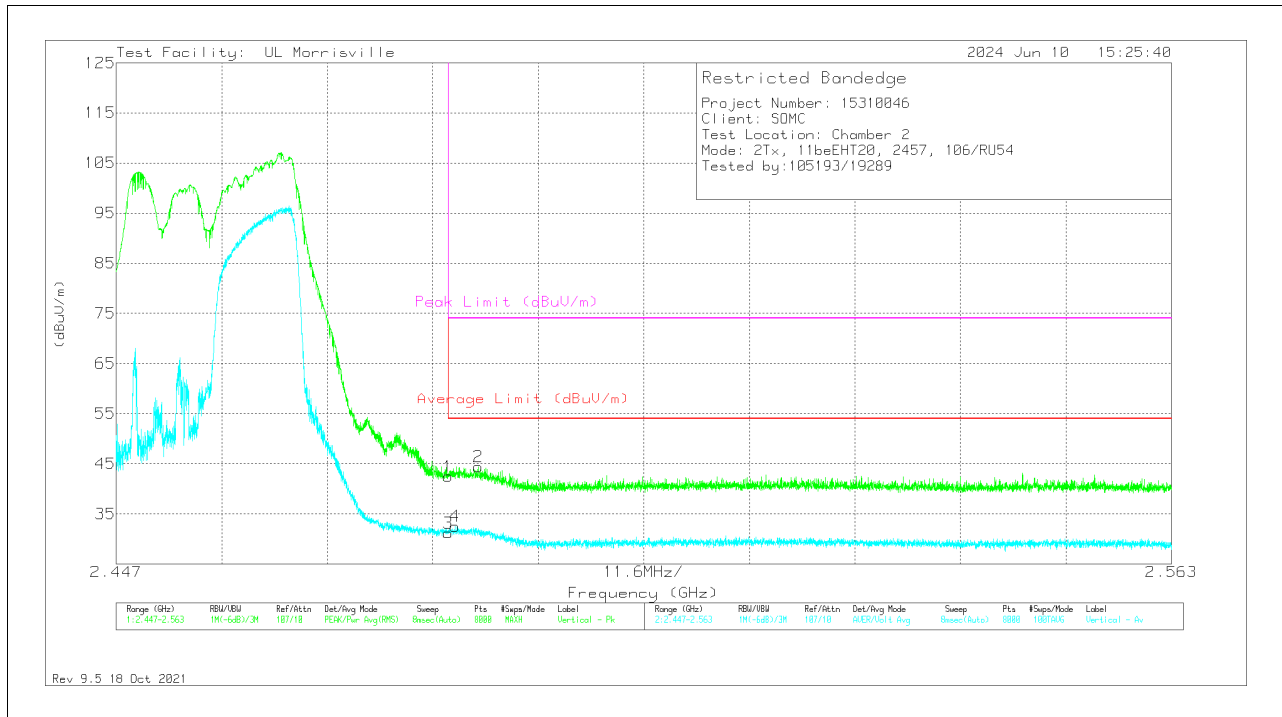
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	86408 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	34.26	Pk	32.5	-24.3	42.46	-	-	74	-31.54	124	291	V
2	* ** 2.48678	36.31	Pk	32.5	-24.4	44.41	-	-	74	-29.59	124	291	V
3	* ** 2.4835	22.98	ADV	32.5	-24.3	31.18	54	-22.82	-	-	124	291	V
4	* ** 2.48427	24.3	ADV	32.5	-24.3	32.5	54	-21.5	-	-	124	291	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

9. TEST AND MEASUREMENT EQUIPMENT

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
90411	Spectrum Analyzer	Keysight Technologies	N9030A	2023-08-02	2024-08-02
-	DC Power Supply	Keysight	E3633A	NA	NA
12001	Power Sensor	Boonton	RTP5008	2023-08-01	2024-08-01
11835	Power Sensor	Boonton	RTP5008	2023-08-01	2024-08-01
	Software				
Power Software	Boonton Power Analyzer	Boonton	Version 3.0.13.0	NA	NA
SOFTEMI	Antenna Port Software	UL	Version 2022.8.16	NA	NA
	Attenuators				
226561	SMA Coaxial 10dB Attenuator 25MHz-18GHz	CentricRF	C18S2-10	2024-02-29	2025-02-28
226562	SMA Coaxial 10dB Attenuator 25MHz-18GHz	CentricRF	C18S2-10	2024-04-11	2025-04-11
	Cables				
CBL028	SMA Cable	Sucoflex	104PEA	2024-02-16	2025-02-16
CBL029	SMA Cable	Sucoflex	104PEA	2024-02-16	2025-02-16

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 1)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
135143	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2024-02-07	2026-02-07
	Gain-Loss Chains				
91979	Gain-loss string: 1-18GHz	Various	Various	2024-05-08	2025-05-08
	Receiver & Software				
206496	Spectrum Analyzer	Rohde & Schwarz	ESW44	2023-07-19	2024-07-19
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
241205	Environmental Meter	Fisher Scientific	15-077-963	2023-09-05	2025-09-05

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 2)

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
86408	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2023-06-19	2025-06-19
	Gain-Loss Chains				
91977	Gain-loss string: 1-18GHz	Various	Various	2024-05-10	2025-05-10
	Receiver & Software				
197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2024-03-05	2025-03-05
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
200540	Environmental Meter	Fisher Scientific	15-077-963	2023-07-19	2025-07-19

10. ANTENNA PORT TEST RESULTS

10.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

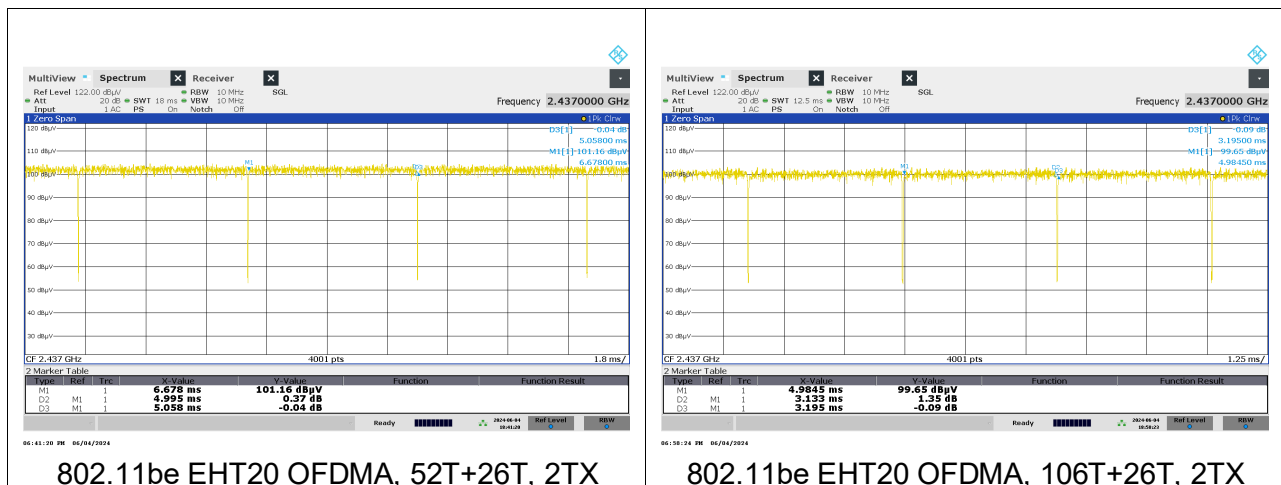
PROCEDURE

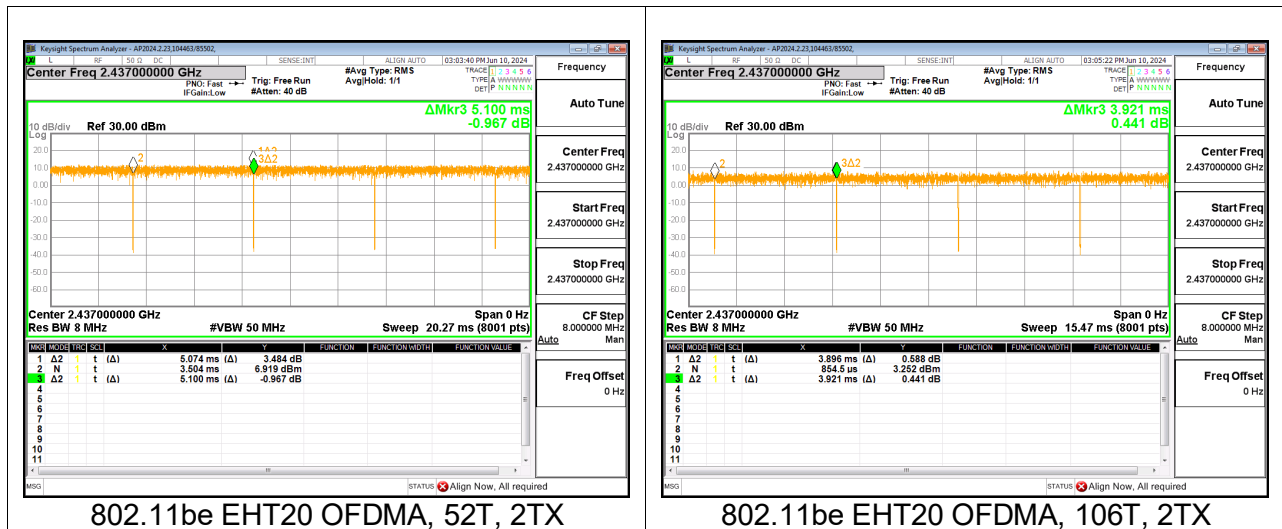
KDB 558074 D01 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
802.11be EHT20 OFDMA, 52T+26T	4.995	5.058	0.988	98.75%	0.00	0.010
802.11be EHT20 OFDMA, 106T+26T	3.133	3.195	0.981	98.06%	0.00	0.010
802.11be EHT20 OFDMA, 52T	5.074	5.100	0.995	99.49%	0.00	0.010
802.11be EHT20 OFDMA, 106T	3.896	3.921	0.994	99.36%	0.00	0.010

DUTY CYCLE PLOTS





10.2. 6 dB BANDWIDTH LIMITS

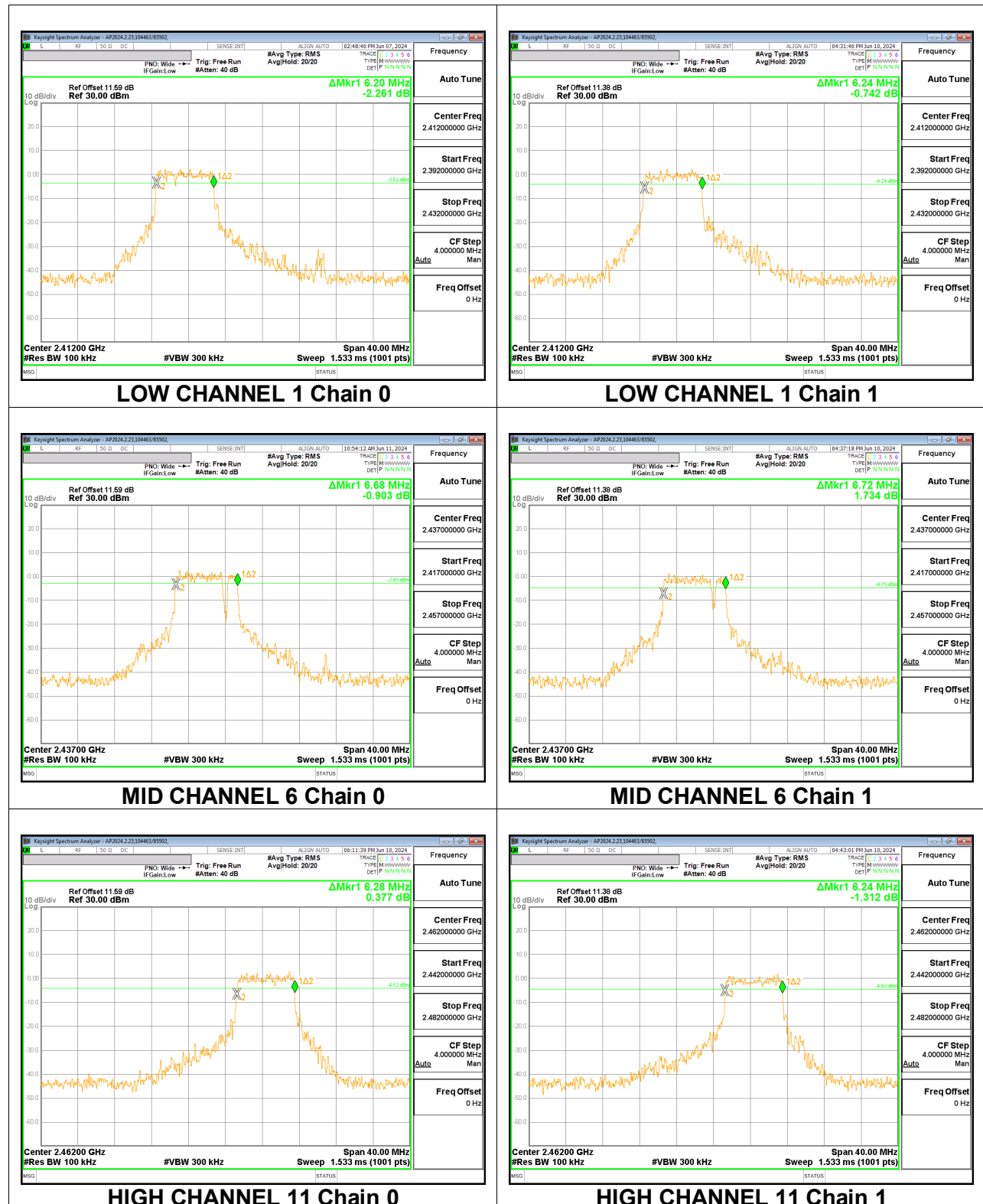
FCC §15.247 (a) (2)
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

10.2.1. 802.11be EHT20 MODE 2TX

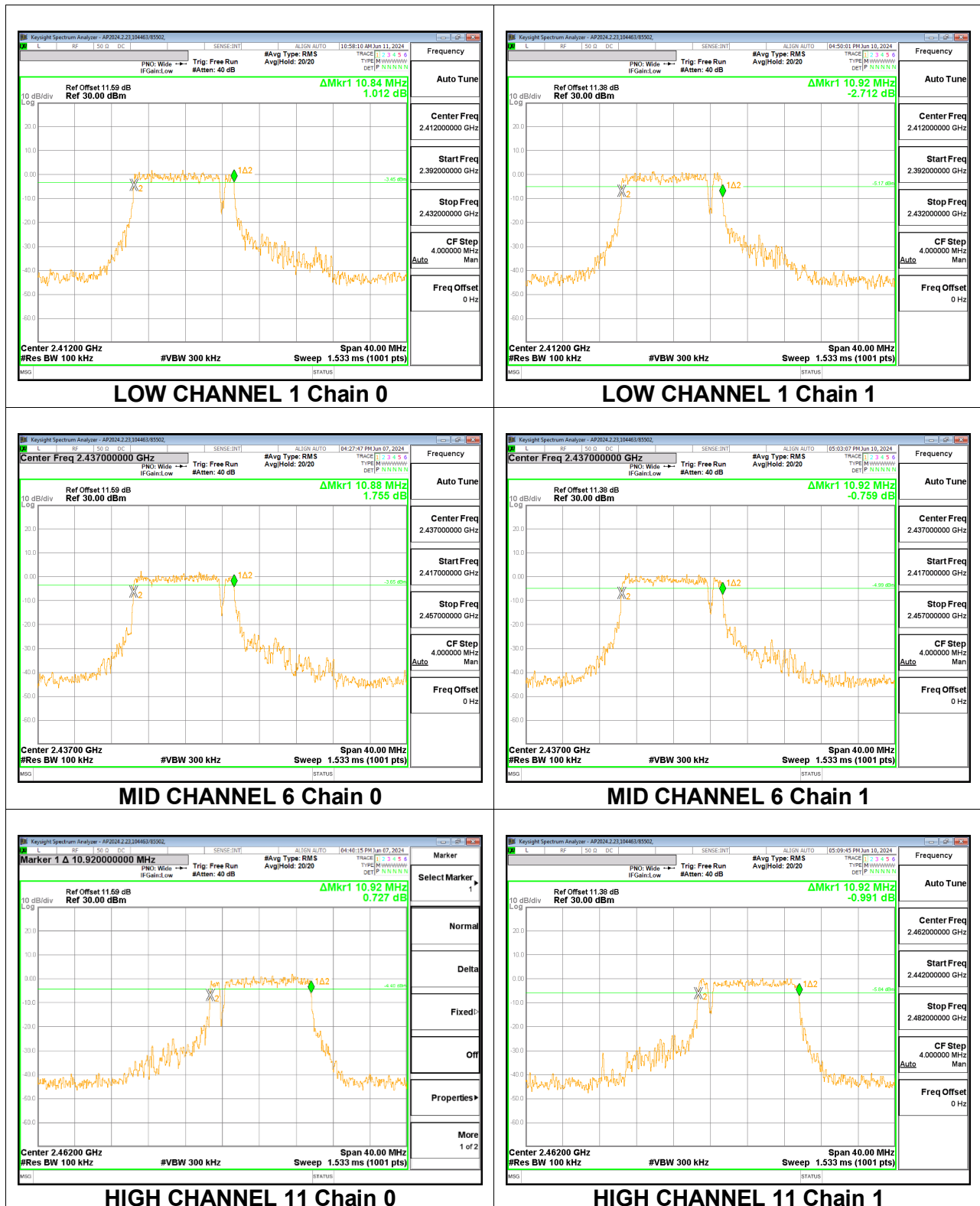
2TX CHAIN 0 + CHAIN 1 MODE: 52T+26T

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low 1	2412	6.20	6.24	0.5
Mid 6	2437	6.68	6.72	0.5
High 11	2462	6.28	6.24	0.5



2TX CHAIN 0 + CHAIN 1 MODE: 106T+26T

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low 1	2412	10.84	10.92	0.5
Mid 6	2437	10.88	10.92	0.5
High 11	2462	10.92	10.92	0.5



10.3. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The transmitter output is connected to a peak power meter.

The cable assembly insertion loss for testing of 11.59 dB (including 9.69dB pad and 1.9dB cable) for Chain 0 and 11.38dB (including 9.71dB pad and 1.67 dB cable) for Chain 1 was entered as an offset in the power meter to allow for a peak reading of power.

DIRECTIONAL ANTENNA GAIN

Tx chains are uncorrelated for power. The directional gains are as follows:

Band (GHz)	Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)	Correlated Chains Directional Gain (dBi)
2.4	-1.02	-2.69	-1.78	1.20

Directional gains for MIMO operations were determined using KDB662911 D01 Section F (2)(d)(i) and (ii) for unequal antenna gains, with equal transmit powers. The directional gains are calculated using the formulas for uncorrelated and correlated transmissions across the two transmit antennas.

- (i) Correlated gain = $10\log((10^{G1/20} + 10^{G2/20})^2 / N_{Ant})$
- (ii) Uncorrelated gain = $10\log((10^{G1/10} + 10^{G2/10}) / N_{Ant})$

Sample calculation, using 2 antennas:

Correlated gain = $10\log(10^{-1.02/20} + 10^{-2.69/20})^2 / 2) = 1.20\text{dBi}$

Uncorrelated gain = $10\log(10^{-1.02/10} + 10^{-2.69/10}) / 2) = -1.78\text{dBi}$

RESULTS

10.3.1. 802.11be EHT20 MODE

2TX CHAIN 0 + CHAIN 1 MODE: 52T+26T

Test Engineer:	104463/85502, 104412/21193
Test Date:	2024-06-04

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	Max Power (dBm)
Low 1	2412	-1.78	30.00	30.00
Low 2	2417	-1.78	30.00	30.00
Mid 6	2437	-1.78	30.00	30.00
High 11	2462	-1.78	30.00	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	15.93	15.58	18.77	30.00	-11.23
Low 2	2417	19.63	19.39	22.52	30.00	-7.48
Mid 6	2437	19.62	18.86	22.27	30.00	-7.73
High 11	2462	19.81	19.34	22.59	30.00	-7.41

2TX CHAIN 0 + CHAIN 1 MODE: 106T+26T

Test Engineer:	104463/85502, 104412/21193
Test Date:	2024-06-04

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	Max Power (dBm)
Low 1	2412	-1.78	30.00	30.00
Mid 6	2437	-1.78	30.00	30.00
High 10	2457	-1.78	30.00	30.00
High 11	2462	-1.78	30.00	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	21.75	21.42	24.60	30.00	-5.40
Mid 6	2437	22.13	21.62	24.89	30.00	-5.11
High 10	2457	21.59	21.63	24.62	30.00	-5.38
High 11	2462	21.70	21.21	24.47	30.00	-5.53

10.4. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

The transmitter output is connected to a gated average power meter.

The cable assembly insertion loss for testing of 11.59 dB (including 9.69B pad and 1.9dB cable) for Chain 0 and 11.38dB (including 9.71dB pad and 1.67 dB cable) for Chain 1 was entered as an offset in the power meter to allow for a gated average reading of power.

10.4.1. 802.11be EHT20 MODE

2TX CHAIN 0 + CHAIN 1 MODE: 52T+26T

Test Engineer:	104463/85502, 104412/21193
Test Date:	2024-06-04

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low 1	2412	8.44	7.99	11.23
Low 2	2417	12.22	11.86	15.05
Mid 6	2437	12.01	11.25	14.66
High 11	2462	12.17	11.65	14.92

2TX CHAIN 0 + CHAIN 1 MODE: 106T+26T

Test Engineer:	104463/85502, 104412/21193
Test Date:	2024-06-04

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low 1	2412	13.73	13.32	16.54
Mid 6	2437	13.84	13.52	16.70
High 10	2457	13.65	13.52	16.59
High 11	2462	13.43	13.11	16.29

10.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (e)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

Refer to UL Report 15110020-E7 for all PSD testing.

10.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (d)

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

PROCEDURE

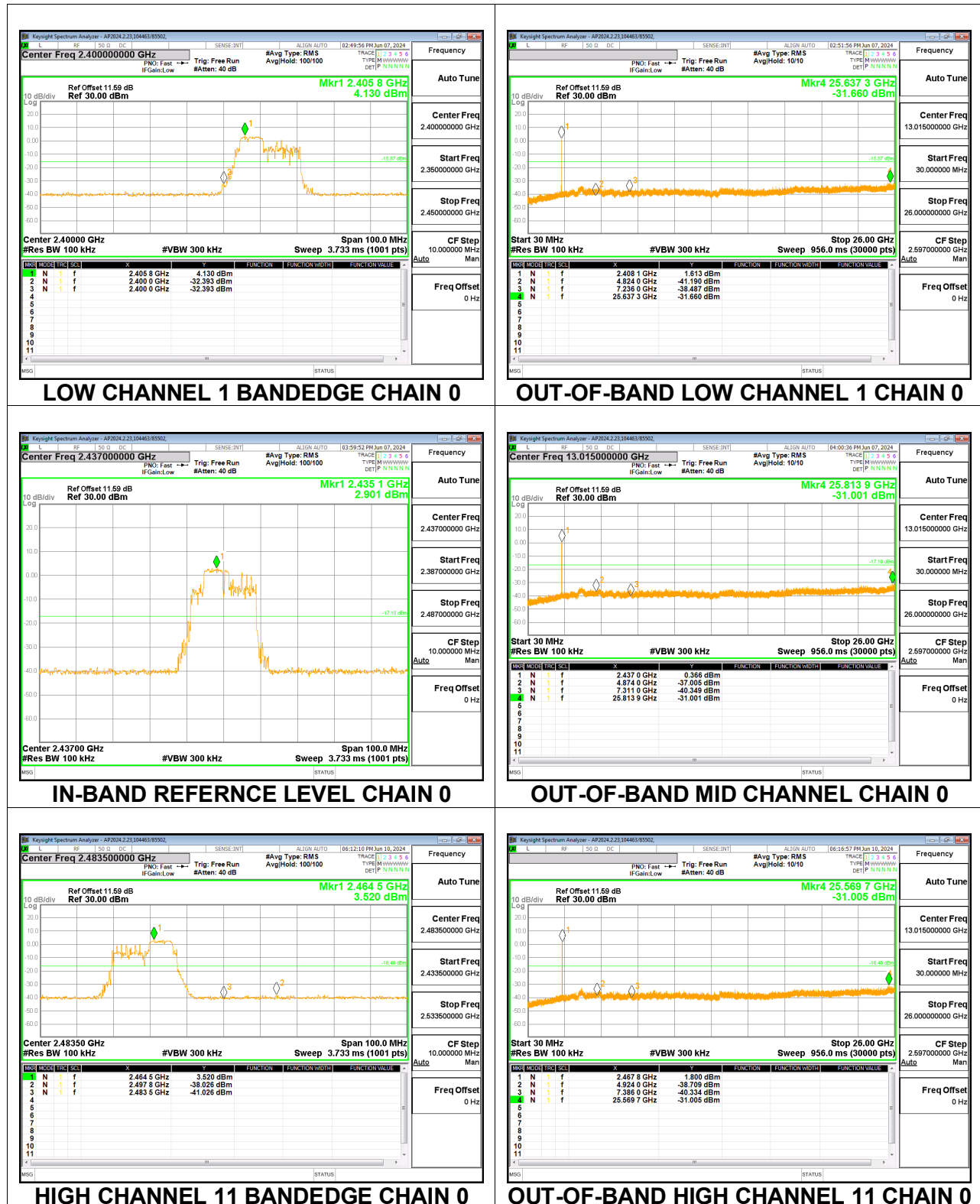
Output power was measured based on the use of peak measurement, therefore the required attenuation is -20 dBc.

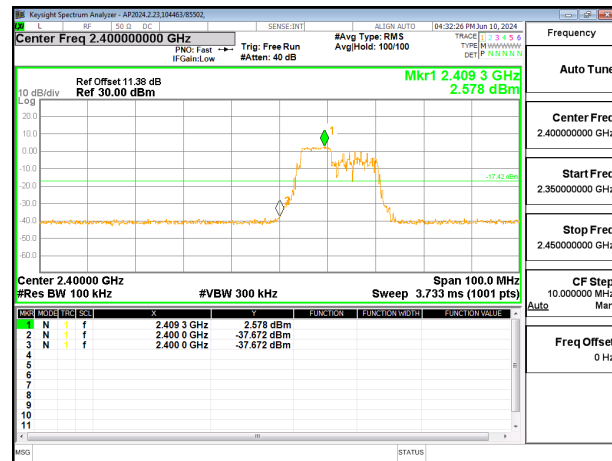
NOTE: All testing was performed at mid channel power to prevent the need for stepping on the inner channels.

RESULTS

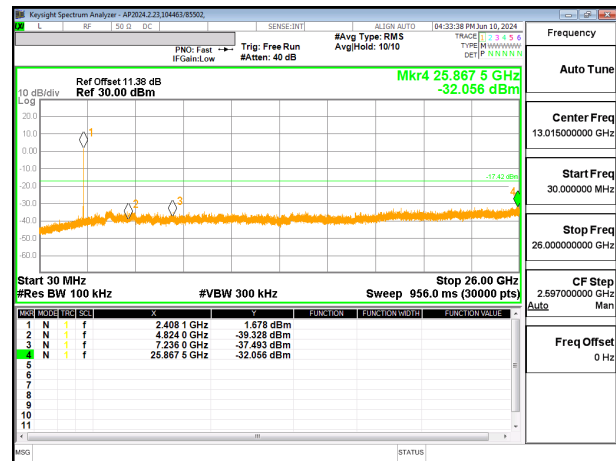
10.6.1. 802.11be EHT20 MODE 2TX

2TX Chain 0 + Chain 1 MODE: 52T+26T

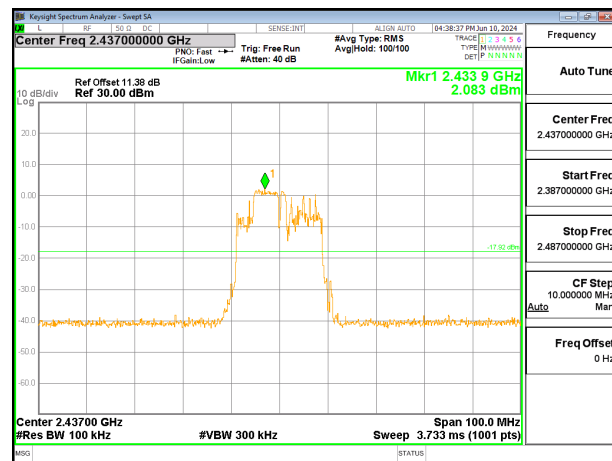




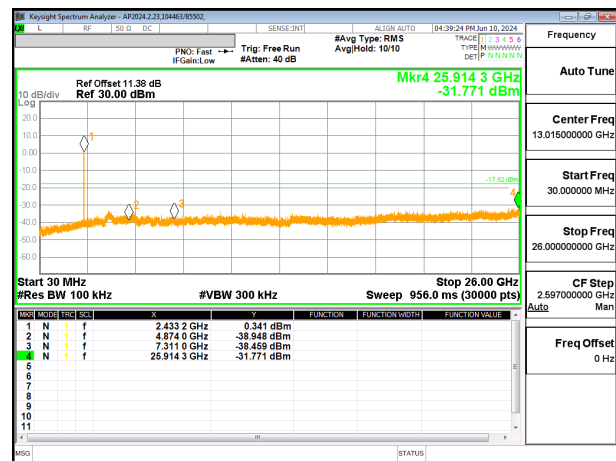
LOW CHANNEL 1 BANDEDGE CHAIN 1



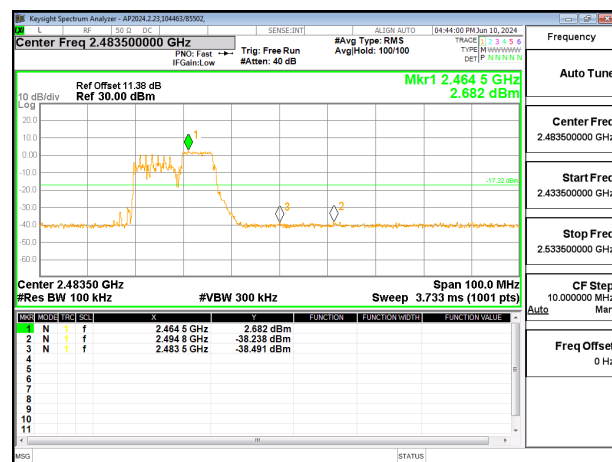
OUT-OF-BAND LOW CHANNEL 1 CHAIN 1



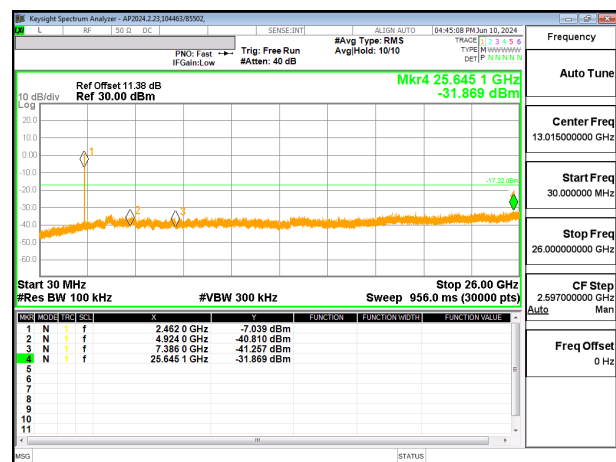
IN-BAND REFERENCE LEVEL CHAIN 1



OUT-OF-BAND MID CHANNEL 1 CHAIN 1

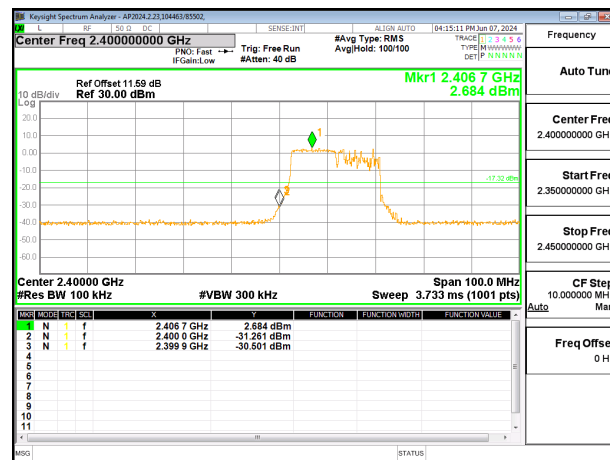


HIGH CHANNEL 11 BANDEDGE CHAIN 1

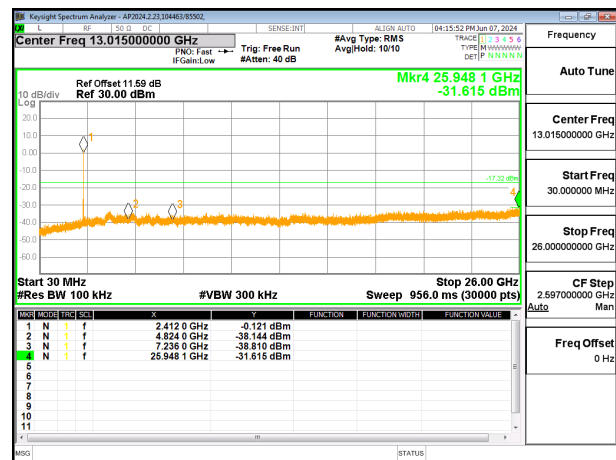


OUT-OF-BAND HIGH CHANNEL 11 CHAIN 1

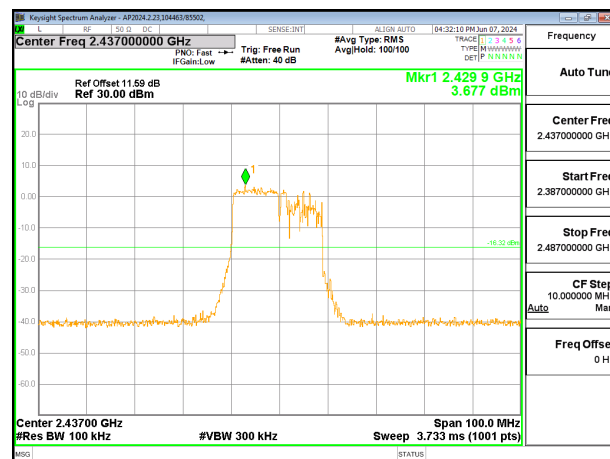
2TX Chain 0 + Chain 1 MODE: 106T+26T



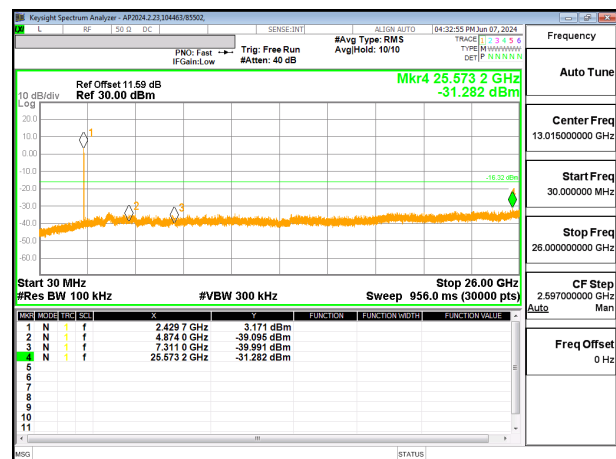
LOW CHANNEL 1 BANDEDGE CHAIN 0



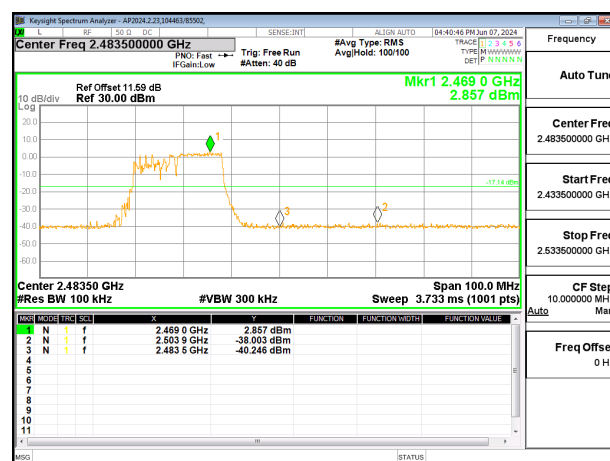
OUT-OF-BAND LOW CHANNEL 1 CHAIN 0



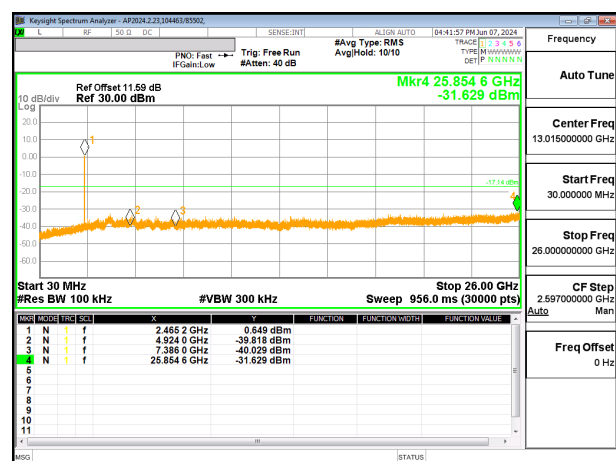
IN-BAND REFERENCE LEVEL CHAIN 0



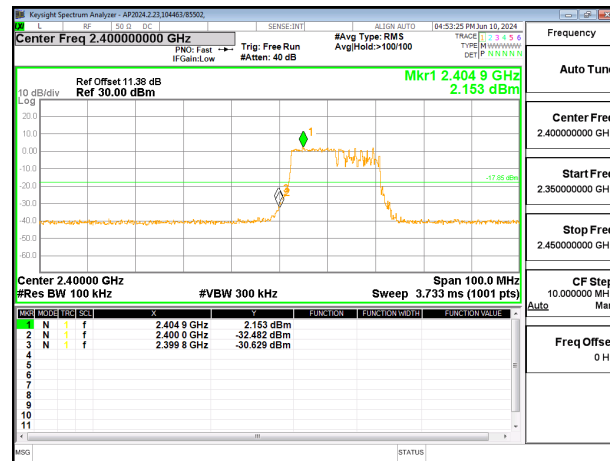
OUT-OF-BAND MID CHANNEL CHAIN 0



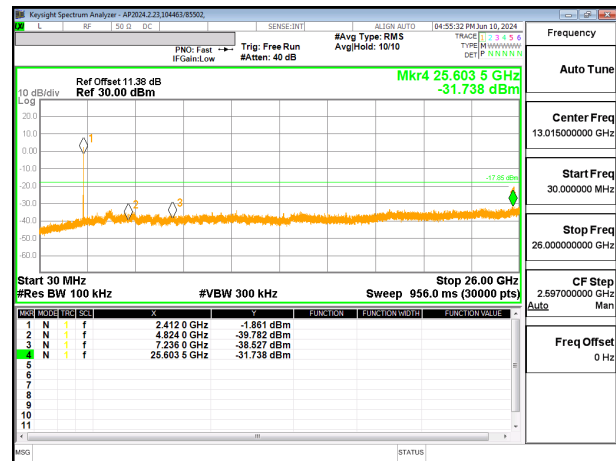
HIGH CHANNEL 11 BANDEDGE CHAIN 0



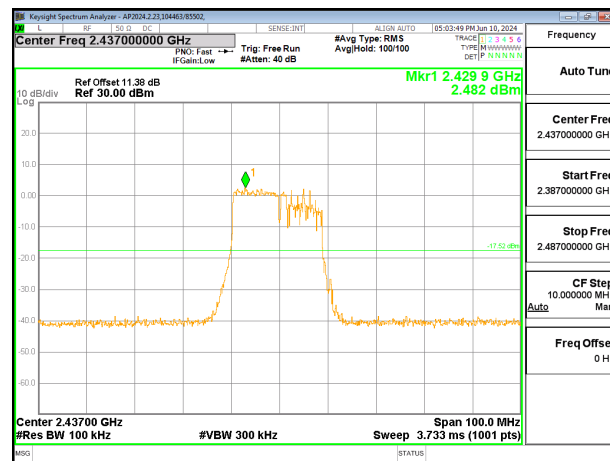
OUT-OF-BAND HIGH CHANNEL 11 CHAIN 0



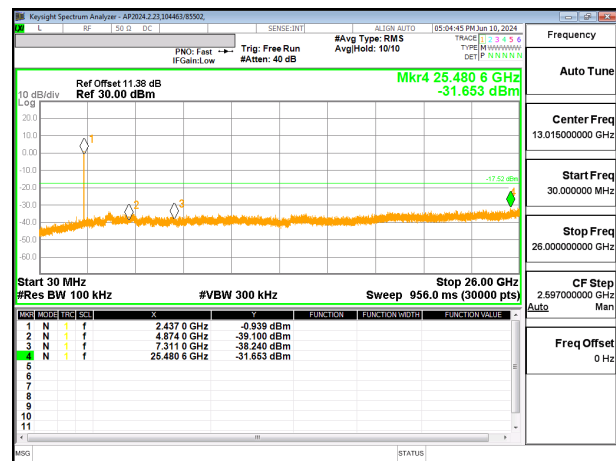
LOW CHANNEL 1 BANDEDGE CHAIN 1



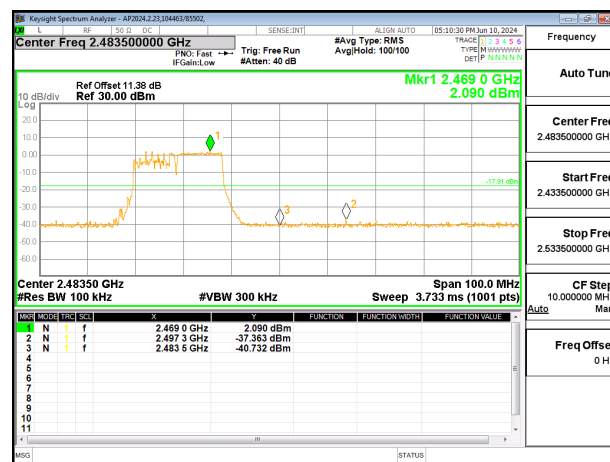
OUT-OF-BAND LOW CHANNEL 1 CHAIN 1



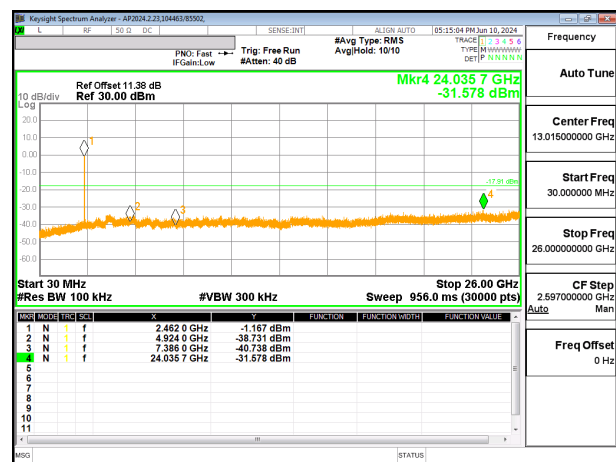
IN-BAND REFERENCE LEVEL CHAIN 1



OUT-OF-BAND MID CHANNEL 1 CHAIN 1



HIGH CHANNEL 11 BANDEDGE CHAIN 1



OUT-OF-BAND HIGH CHANNEL 11 CHAIN 1

11. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3MHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for linear voltage averaging measurements

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions can be found in UL Report R15110020-E7

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

Based on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

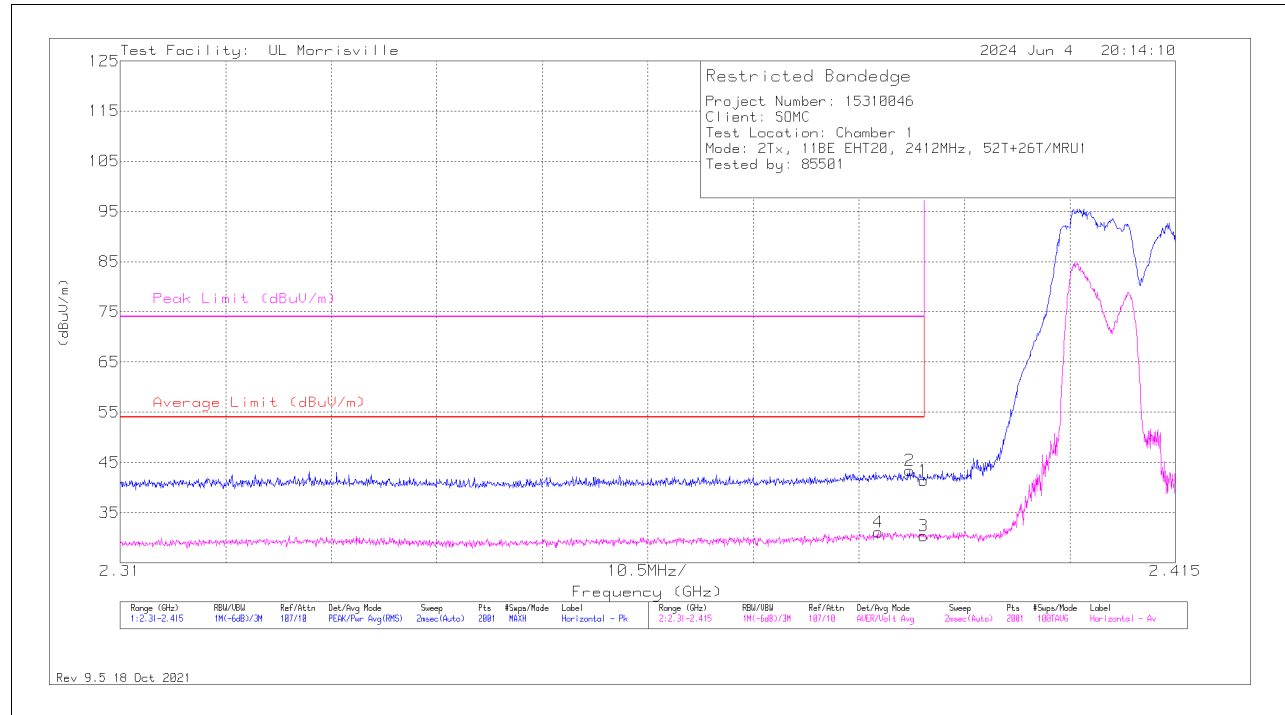
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

11.1. TRANSMITTER ABOVE 1 GHz

11.1.1. TX ABOVE 1 GHz 802.11be EHT20 MODE IN THE 2.4GHz BAND 2TX Chain 0 + Chain 1 MODE: 52T+26T

BANDEDGE (LOW CHANNEL 1)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	135143 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.38996	33.52	Pk	31.9	-24	41.42	-	-	74	-32.58	345	263	H
2	* ** 2.38854	35.51	Pk	31.9	-24	43.41	-	-	74	-30.59	345	263	H
3	* ** 2.38996	22.46	ADV	31.9	-24	30.36	54	-23.64	-	-	345	263	H
4	* ** 2.38544	23.08	ADV	31.9	-23.9	31.08	54	-22.92	-	-	345	263	H

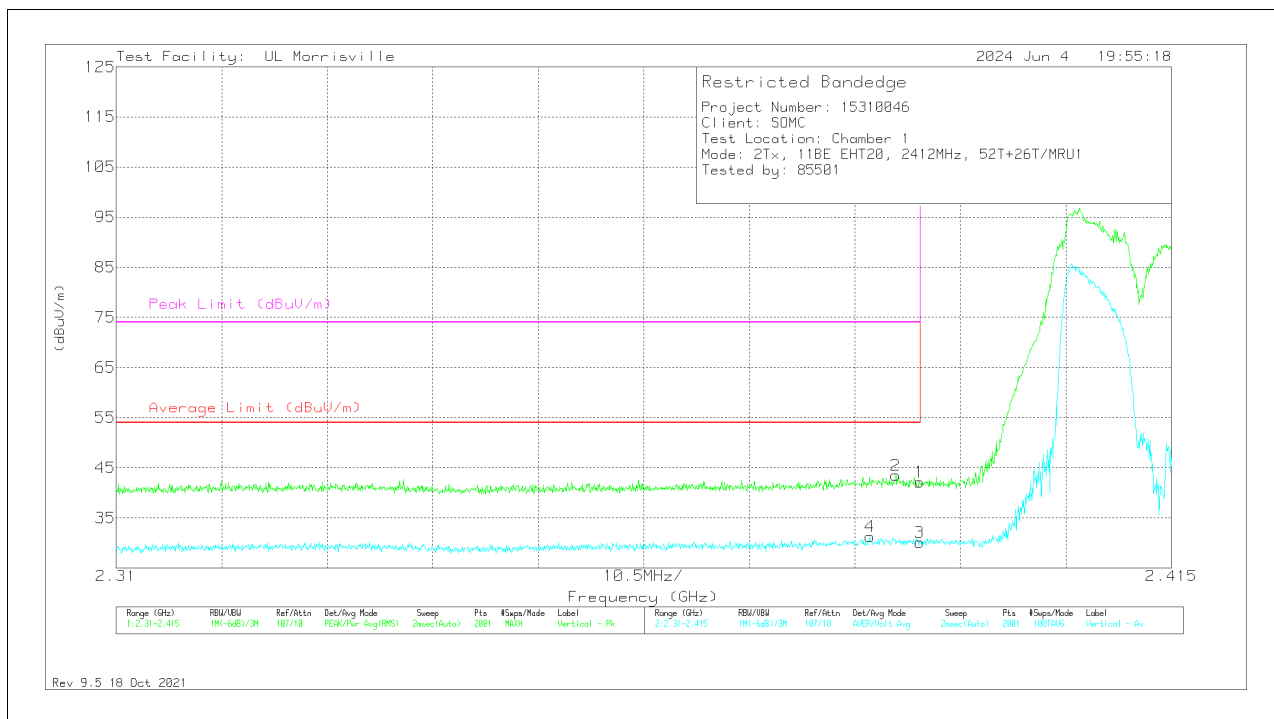
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	135143 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.38996	34.29	Pk	31.9	-24	42.19	-	-	74	-31.81	180	288	V
2	* ** 2.38754	35.46	Pk	31.9	-23.9	43.46	-	-	74	-30.54	180	288	V
3	* ** 2.38996	22.17	ADV	31.9	-24	30.07	54	-23.93	-	-	180	288	V
4	* ** 2.38502	23.38	ADV	31.9	-24	31.28	54	-22.72	-	-	180	288	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

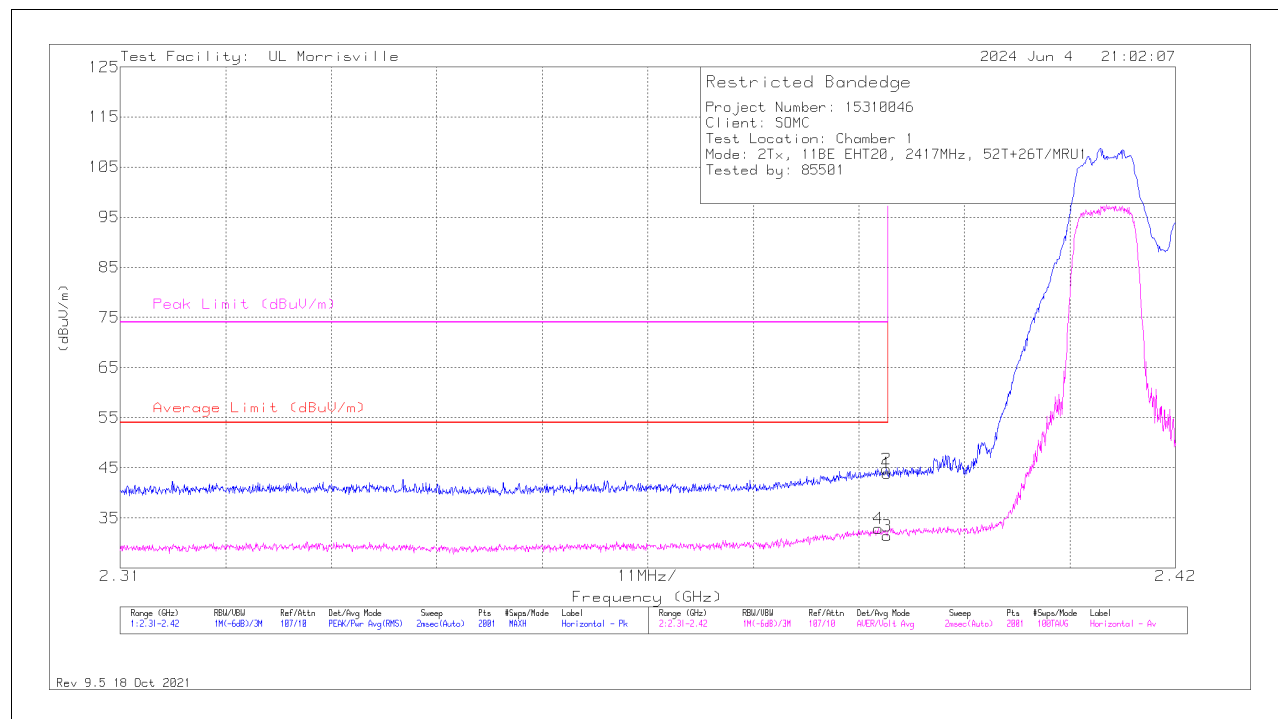
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

BANDEDGE (LOW CHANNEL 2)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	135143 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.38997	36.02	Pk	31.9	-24	43.92	-	-	74	-30.08	135	370	H
2	* ** 2.38986	36.82	Pk	31.9	-24	44.72	-	-	74	-29.28	135	370	H
3	* ** 2.38997	23.53	ADV	31.9	-24	31.43	54	-22.57	-	-	135	370	H
4	* ** 2.38904	24.96	ADV	31.9	-24	32.86	54	-21.14	-	-	135	370	H

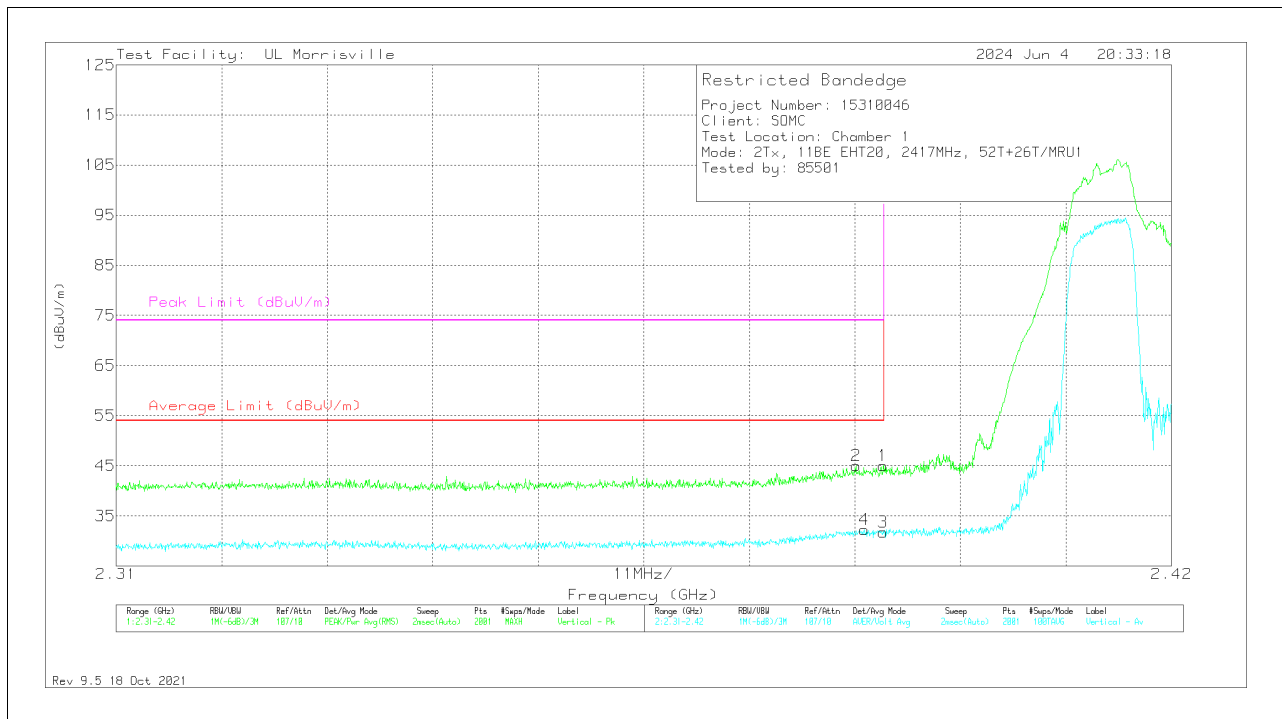
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	135143 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.38997	37.12	Pk	31.9	-24	45.02	-	-	74	-28.98	160	293	V
2	*** 2.38711	37.06	Pk	31.9	-23.9	45.06	-	-	74	-28.94	160	293	V
3	*** 2.38997	23.9	ADV	31.9	-24	31.8	54	-22.2	-	-	160	293	V
4	*** 2.38799	24.22	ADV	31.9	-23.9	32.22	54	-21.78	-	-	160	293	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

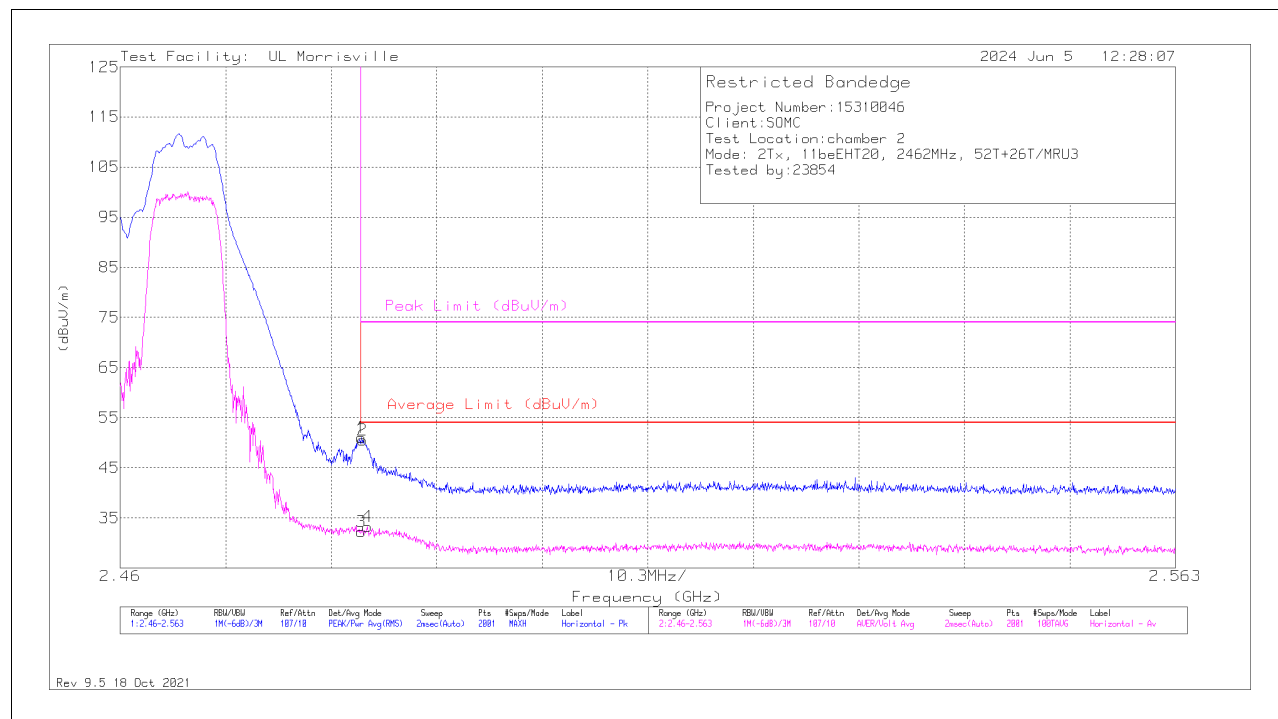
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

BANDEDGE (HIGH CHANNEL 11)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	86408 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.48354	43	Pk	32.5	-24.5	51	-	-	74	-23	255	134	H
2	* ** 2.48364	42.49	Pk	32.5	-24.5	50.49	-	-	74	-23.51	255	134	H
3	* ** 2.48354	24.3	ADV	32.5	-24.5	32.3	54	-21.7	-	-	255	134	H
4	* ** 2.48415	25.25	ADV	32.5	-24.5	33.25	54	-20.75	-	-	255	134	H

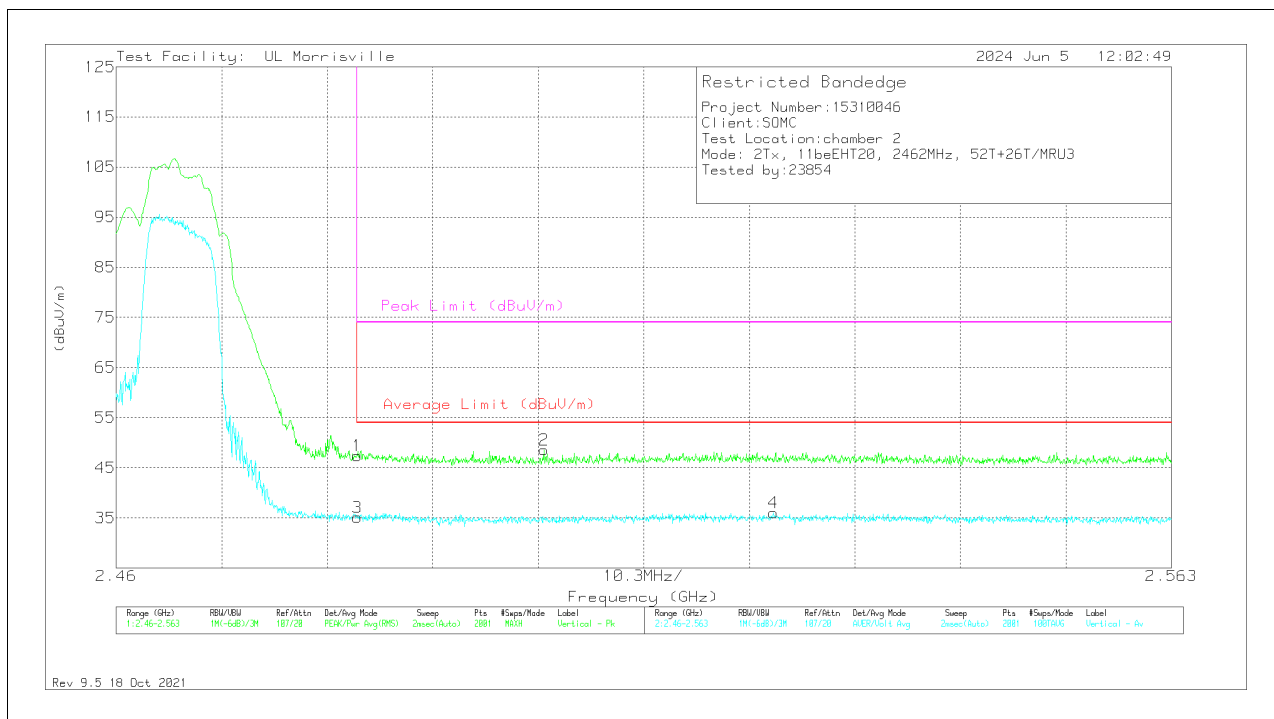
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	86408 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.48354	39.43	Pk	32.5	-24.5	47.43	-	-	74	-26.57	344	380	V
2	** 2.50177	40.88	Pk	32.5	-24.8	48.58	-	-	74	-25.42	344	380	V
3	* ** 2.48354	27.07	ADV	32.5	-24.5	35.07	54	-18.93	-	-	344	379	V
4	** 2.52417	28.27	ADV	32.5	-24.8	35.97	54	-18.03	-	-	344	379	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

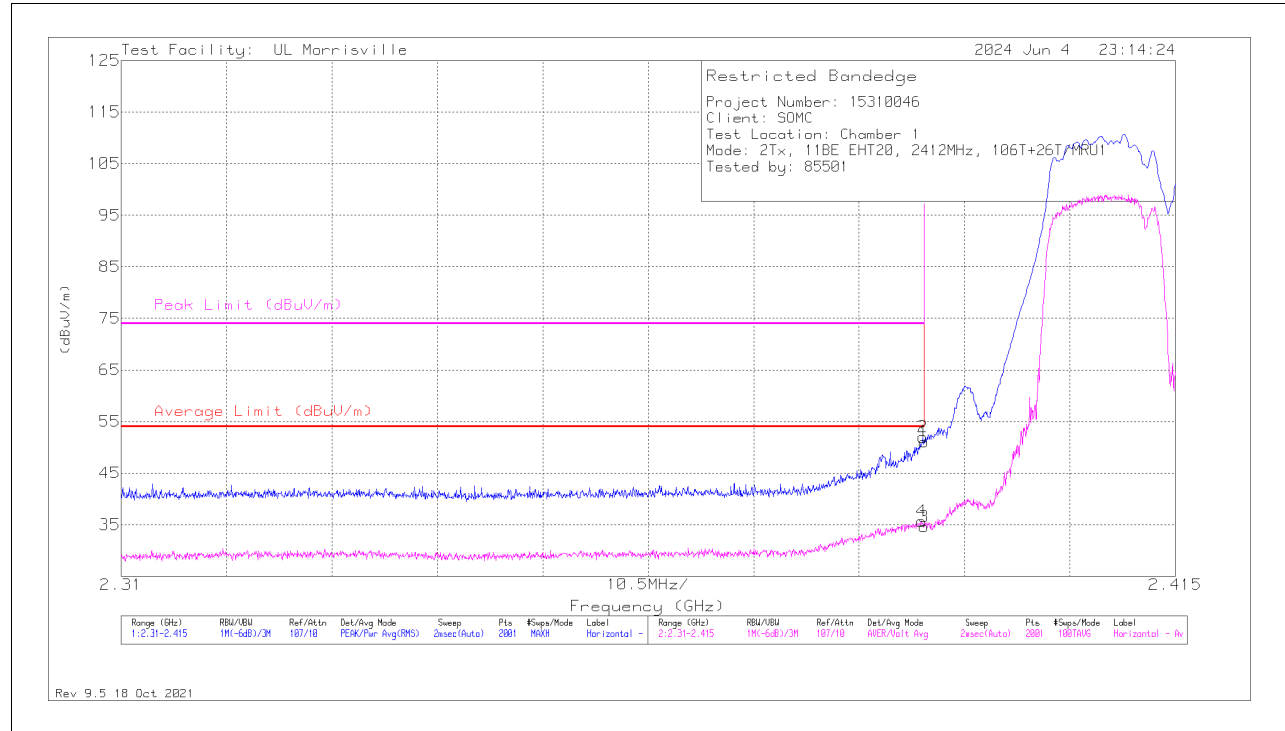
Pk - Peak detector

ADV - Linear Voltage Average

2TX Chain 0 + Chain 1 MODE: 106T+26T

BANDEDGE (LOW CHANNEL 1)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	135143 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.38996	43.16	Pk	31.9	-24	51.06	-	-	74	-22.94	113	105	H
2	*** 2.38985	44.09	Pk	31.9	-24	51.99	-	-	74	-22.01	113	105	H
3	*** 2.38996	26.68	ADV	31.9	-24	34.58	54	-19.42	-	-	113	105	H
4	*** 2.38975	27.76	ADV	31.9	-24	35.66	54	-18.34	-	-	113	105	H

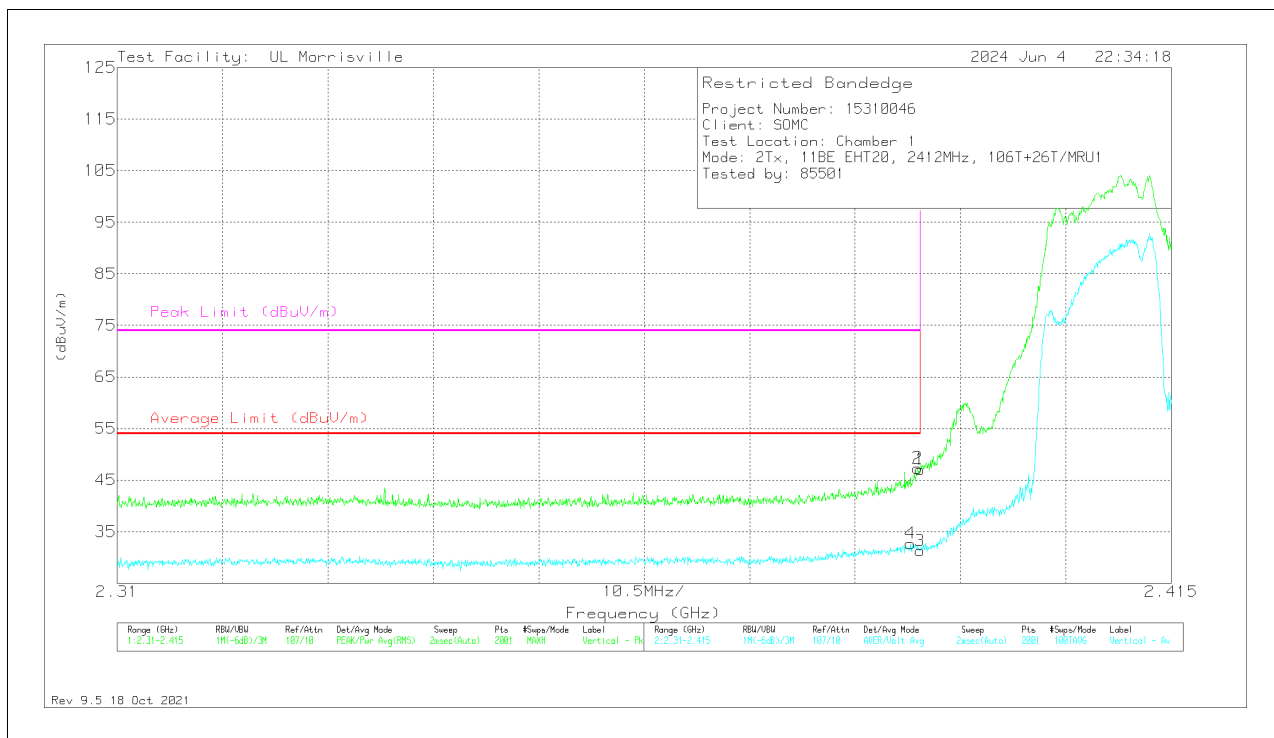
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	135143 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.38996	39.15	Pk	31.9	-24	47.05	-	-	74	-26.95	23	107	V
2	*** 2.38975	39.39	Pk	31.9	-24	47.29	-	-	74	-26.71	23	107	V
3	*** 2.38996	23.41	ADV	31.9	-24	31.31	54	-22.69	-	-	23	107	V
4	*** 2.38901	24.81	ADV	31.9	-24	32.71	54	-21.29	-	-	23	107	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

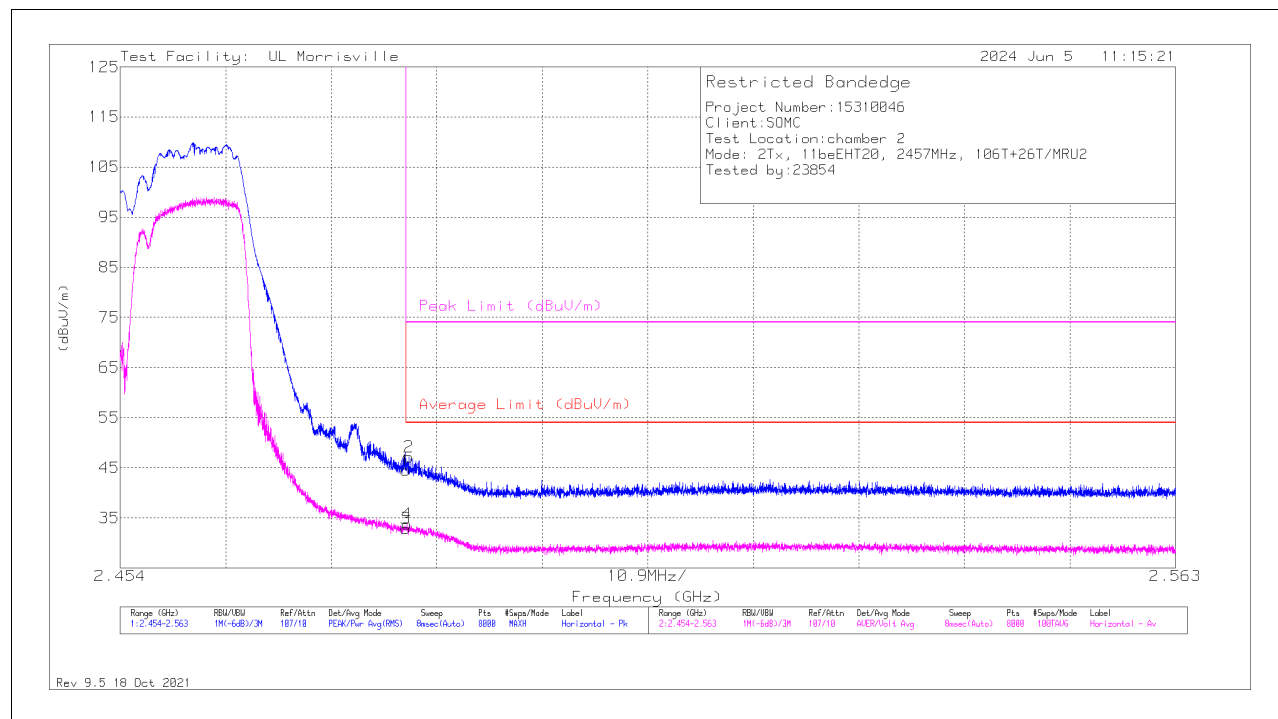
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

BANDEDGE (HIGH CHANNEL 10)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	86408 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	36.46	Pk	32.5	-24.5	44.46	-	-	74	-29.54	196	174	H
2	* ** 2.4838	39.1	Pk	32.5	-24.5	47.1	-	-	74	-26.9	196	174	H
3	* ** 2.4835	24.91	ADV	32.5	-24.5	32.91	54	-21.09	-	-	196	174	H
4	* ** 2.48363	25.75	ADV	32.5	-24.5	33.75	54	-20.25	-	-	196	174	H

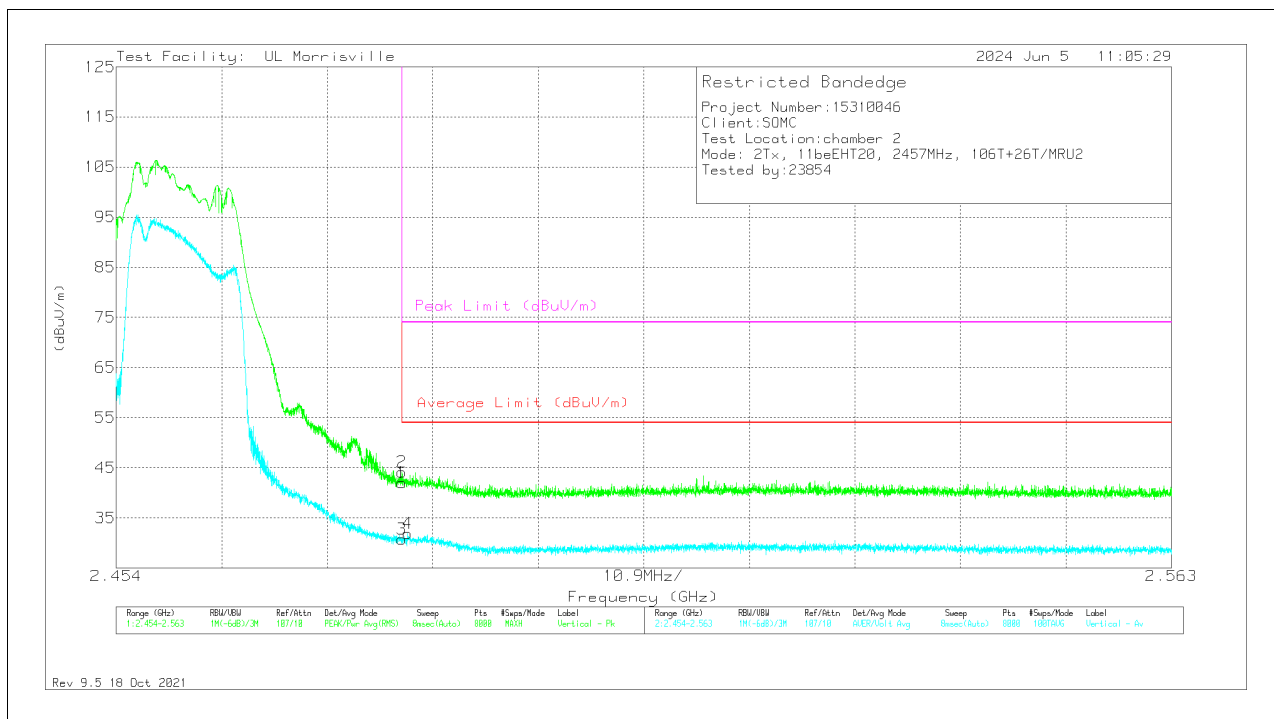
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	86408 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	33.99	Pk	32.5	-24.5	41.99	-	-	74	-32.01	335	332	V
2	* ** 2.48352	36.13	Pk	32.5	-24.5	44.13	-	-	74	-29.87	335	332	V
3	* ** 2.4835	22.79	ADV	32.5	-24.5	30.79	54	-23.21	-	-	335	332	V
4	* ** 2.48412	23.85	ADV	32.5	-24.5	31.85	54	-22.15	-	-	335	332	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

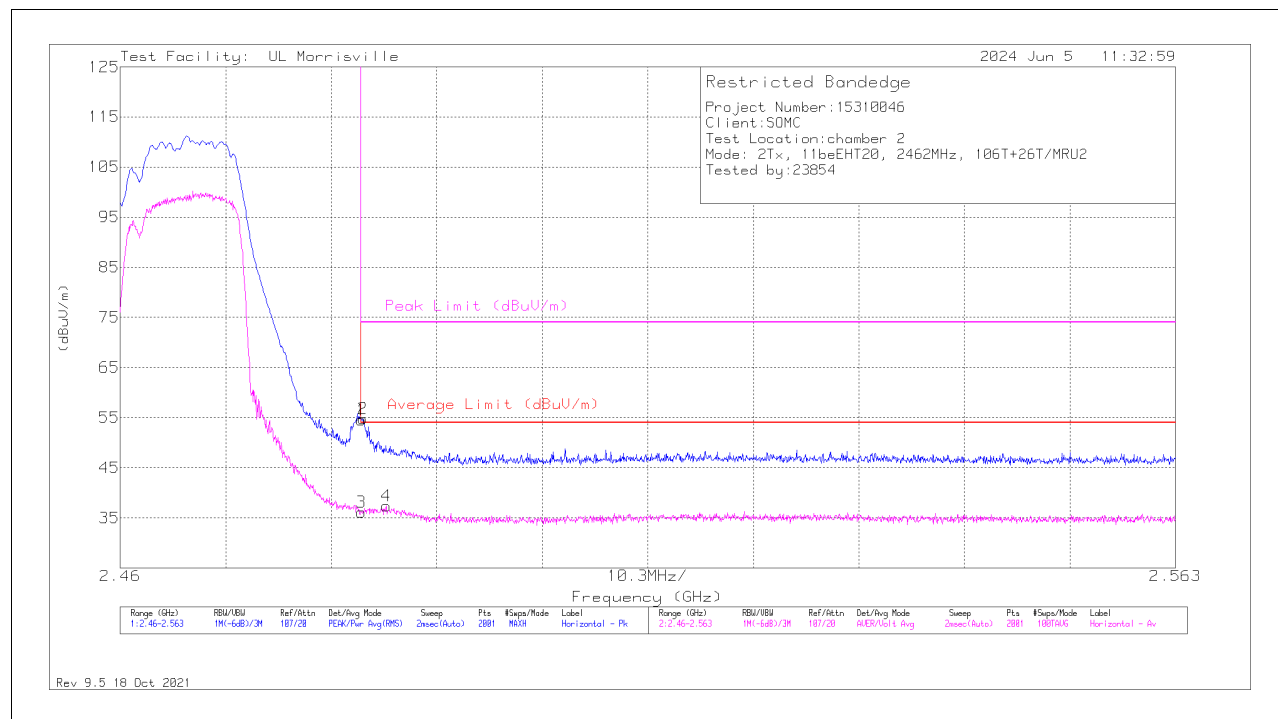
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

BANDEDGE (HIGH CHANNEL 11)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	86408 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.48354	46.56	Pk	32.5	-24.5	54.56	-	-	74	-19.44	251	109	H
2	* ** 2.48369	46.76	Pk	32.5	-24.5	54.76	-	-	74	-19.24	251	109	H
3	* ** 2.48354	28.09	ADV	32.5	-24.5	36.09	54	-17.91	-	-	251	109	H
4	* ** 2.48596	29.45	ADV	32.5	-24.6	37.35	54	-16.65	-	-	251	109	H

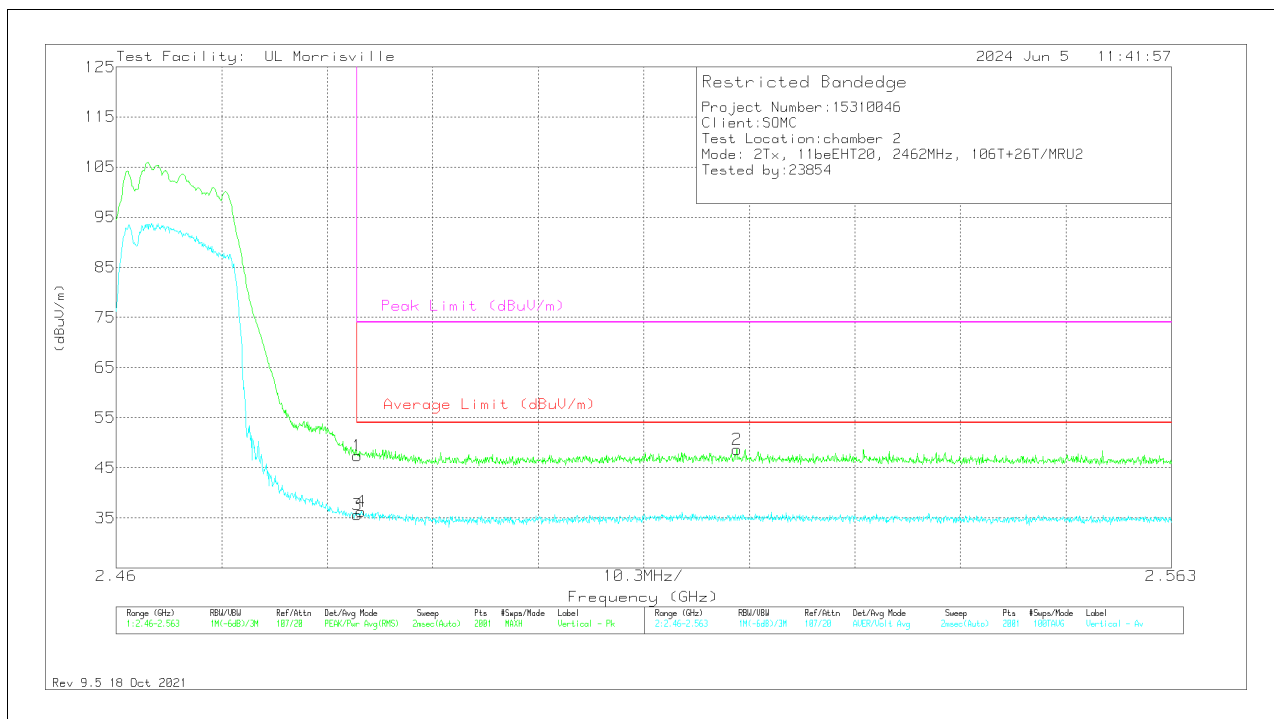
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	86408 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.48354	39.36	Pk	32.5	-24.5	47.36	-	-	74	-26.64	320	373	V
2	** 2.52062	40.89	Pk	32.5	-24.7	48.69	-	-	74	-25.31	320	373	V
3	* ** 2.48354	27.61	ADV	32.5	-24.5	35.61	54	-18.39	-	-	320	373	V
4	* ** 2.4839	28.29	ADV	32.5	-24.5	36.29	54	-17.71	-	-	320	373	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

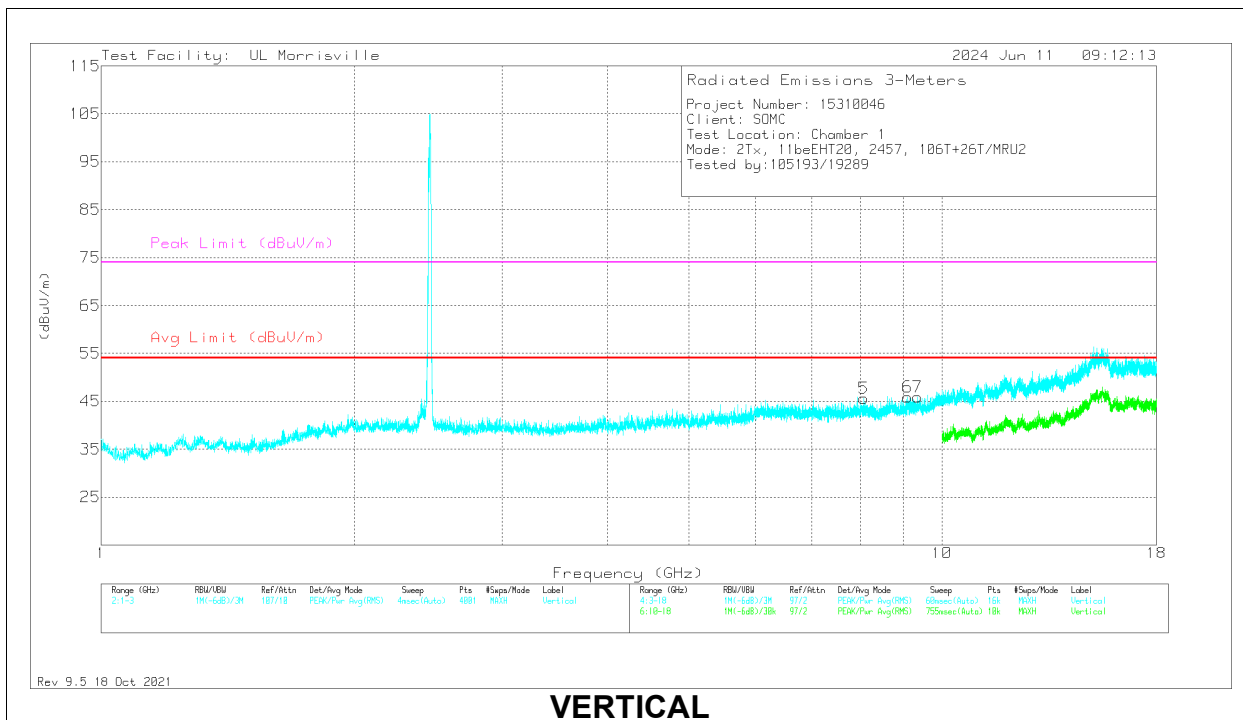
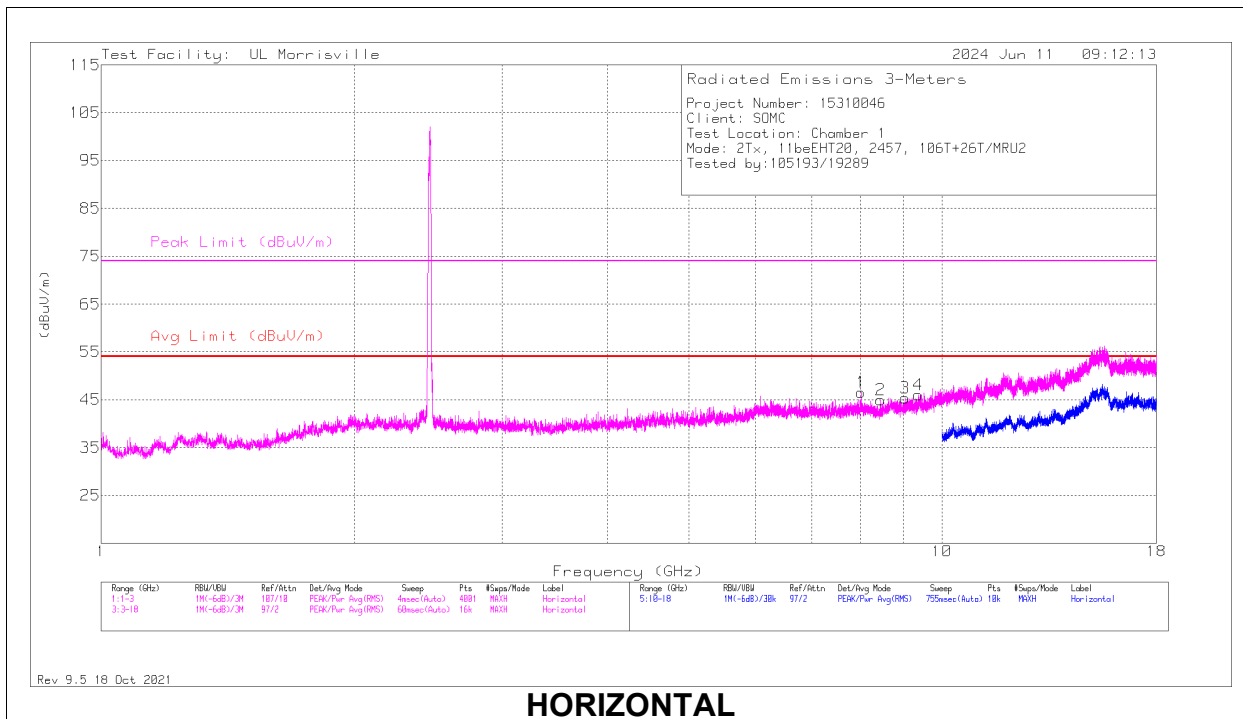
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

HARMONICS AND SPURIOUS EMISSIONS

HIGH CHANNEL 10 RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	86408 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* ** 8.45344	35	Pk	35.8	-25.8	45	54	-9	74	-29	0-360	101	H
3	* ** 9.04969	35.02	Pk	35.9	-25.6	45.32	54	-8.68	74	-28.68	0-360	200	H
4	* ** 9.37406	35.4	Pk	36.1	-25.5	46	54	-8	74	-28	0-360	200	H
5	* ** 8.07188	36.4	Pk	35.8	-26.6	45.6	54	-8.4	74	-28.4	0-360	200	V
6	* ** 9.11063	34.71	Pk	35.9	-24.7	45.91	54	-8.09	74	-28.09	0-360	200	V
7	* ** 9.36281	35.58	Pk	36.1	-25.8	45.88	54	-8.12	74	-28.12	0-360	200	V
1	8.01188	37.32	Pk	35.9	-26.7	46.52	54	-7.48	74	-27.48	0-360	101	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

12. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 [*]	56 to 46 [*]
0.5-5	56	46
5-30	60	50

^{*} Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both lines.

RESULTS

Refer to UL Report 15110020-E7 for all AC Power Line Conducted Emissions testing.

13. SETUP PHOTOS

Please refer to R15310046-EP1 for setup photos