



TEST REPORT

Report Number. : R13694045-E7

Applicant : Trek Bicycle Company
801 West Madison Street
Waterloo, WI, 53594 U.S.A

Model : 5252795

FCC ID : 2AHXD-5252795

IC : 21334-5252795

EUT Description : Trek Commuter Pro RT Bicycle Light

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C: 2021
ISED RSS-247 ISSUE 2: 2017
ISED RSS-GEN ISSUE 5 + A2:2021

Date Of Issue:
2021-11-23

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2021-10-21	Initial Issue	Haley Ackun
V2	2021-10-26	Added AC Line test method	Haley Ackun
V3	2021-11-23	Added new Bandege Data	Haley Ackun

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Trek Bicycle Company
801 West Madison Street
Waterloo, WI 53594, USA

EUT DESCRIPTION: Trek Commuter Pro RT Bicycle Light

MODEL: 5252795

SERIAL NUMBER: S21260015

SAMPLE RECEIPT DATE: 2021-08-16

DATE TESTED: 2021-09-01 TO 2021-09-21 & 2021-11-22

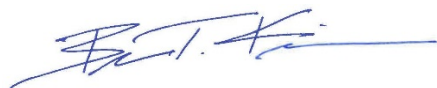
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C: 2021	Complies
ISED RSS-247 Issue 2: 2017	Complies
ISED RSS-GEN Issue 5 + A2: 2021	Complies

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 For
UL LLC. By:



Brian Kiewra
Project Engineer
Consumer Technology Division
UL LLC.

Prepared By:



Haley Ackun
Laboratory Engineer
Consumer Technology Division
UL LLC.

2. TEST RESULTS SUMMARY

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
-	RSS-GEN 6.7	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW	Complies	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Complies	None.
See Comment		Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	RSS-247 5.2 (b)	PSD	Complies	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions	Complies	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Complies	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Complies	None.

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

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15: 2021, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + A2: 2021, and RSS-247 Issue 2: 2017.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by a2La, cert. # 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	703469
<input checked="" type="checkbox"/>	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A	US0067	27265	703469

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	UNCERTAINTY
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%
Time	3.39%

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

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Final Voltage (dBuV)} = \text{Measured Voltage (dBuV)} + \text{Cable Loss (dB)} + \text{Limiter Factor (dB)} + \text{LISN Insertion Loss.}$$

$$36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$$

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a bicycle light, that supports BLE and ANT+. This report covers testing performed for BLE only.

6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

BLE 1 Mbps

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	BLE	0.32	1.08

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an antenna, with a maximum gain of 0 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 0.9.7.
The test utility software used during testing was nRF Connect V3.6.1.

6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

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

The EUT supports one data rate; therefore all final radiated emissions were performed with the EUT transmitting at 1 Mbps.

All final radiated emissions testing was performed with the EUT connected to a power supply as the worst-case scenario.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Power Supply	ANKER	A2013	AC2LK30B17201280	-
Power Supply	Amazon	B0773J79KC	-	-
Laptop	Lenovo	T450s	PC-OBHFNX	PD97265NGU
Laptop Charger	Lenovo	ADLX65NCC2A	11S36200284ZZ2003CKT9R	-
Laptop	HP	11-ah112dx	5CD8294MZY	-
AC Adapter	iClever	TC02	TC02W0033202400124	-

I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	1	1	I/O	I/O	< 1m	Connects EUT to Power Supply
2	2	1	UART	I/O	<1m	Connects EUT to laptop for programming

TEST SETUP

Test software exercised the radio card.

SETUP DIAGRAMS

Please refer to R13694045-EP1 for setup diagrams

7. MEASUREMENT METHOD

Duty Cycle: ANSI C63.10 Section 11.6

6 dB BW: ANSI C63.10 Subclause -11.8.1

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter
Output Power: 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)

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

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

General Radiated Spurious Emissions: ANSI C63.10-2013 Section 6.3-6.6

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

8. TEST AND MEASUREMENT EQUIPMENT

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

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

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2021-08-19	2022-08-19
	30-1000 MHz				
AT0066	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB1	2021-02-19	2022-02-19
	1-18 GHz				
AT0078	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-11-19	2021-11-19
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2021-05-03	2022-05-03
	18-40 GHz				
AT0063	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2020-10-30	2021-10-30
	Gain-Loss Chains				
N-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2021-07-20	2022-07-20
N-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2021-07-20	2022-07-20
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2021-07-20	2022-07-20
N-SAC04	Gain-loss string: 18-40GHz	Various	Various	2021-07-20	2022-07-20
	Receiver & Software				
197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-30	2022-03-30
SOFTEMI	EMI Software	UL	Version 9.5 (09 Aug 2021 & 18 Oct 2021)		
	Additional Equipment used				
s/n 200037635	Environmental Meter	Fisher Scientific	06-662-4	2020-01-21	2022-01-21

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

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2021-05-03	2022-05-03
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-10	2022-03-10
SOFTEMI	EMI Software	UL	Version 9.5 (24 Jun 2021)		
	Additional Equipment used				
s/n 200037635	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22

Test Equipment Used - Wireless Conducted Measurement Equipment

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
HI0091	Environmental Meter	Fisherbrand	15-077-963	2021-04-12	2022-04-12
PWM005	RF Power Meter	Keysight Technologies	N1912A	2021-07-27	2022-07-27
PWS003	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2021-05-27	2022-05-27
SA0025	Spectrum Analyzer	Keysight Technologies	N9030A	2021-04-01	2022-04-01
SOFTEMI	Antenna Port Software	UL	Version 2021.08.18	NA	NA

Test Equipment Used - Line-Conducted Emissions – Voltage (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2021-04-05	2022-04-05
HI0091	Environmental Meter	Fisher Scientific	15-077-963	2021-07-12	2022-07-12
LISN003	LISN, 50-ohm/50-uH, 250uH 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50/250-25-2-01	2021-08-16	2022-08-16
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2021-08-17	2022-08-17
ATA222	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2021-04-05	2022-04-05
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (04 Mar 2021)		
	Miscellaneous (if needed)				
CDECABLE001	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2021-09-13	2022-09-13

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

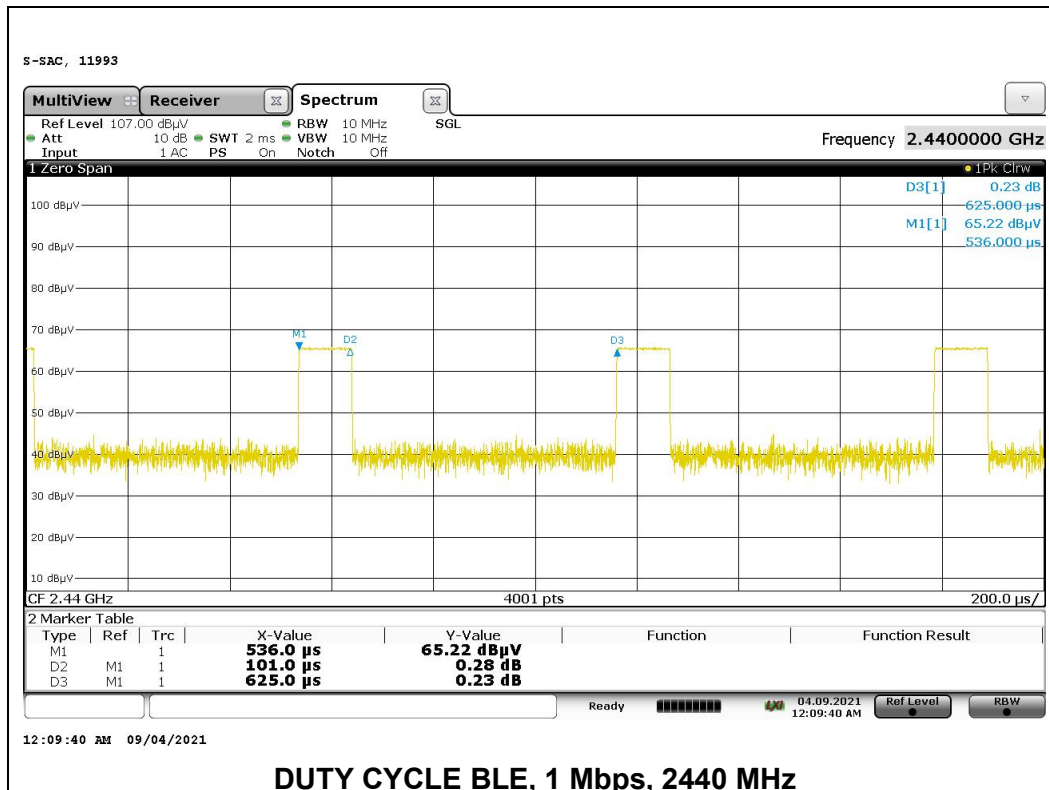
KDB 558074 Zero-Span Spectrum Analyzer Method.

ANSI C63.10 Section 11.6

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						
BLE 1 Mbps	0.101	0.625	0.162	16.16%	15.83	9.901

DUTY CYCLE PLOTS



9.2. 99% BANDWIDTH

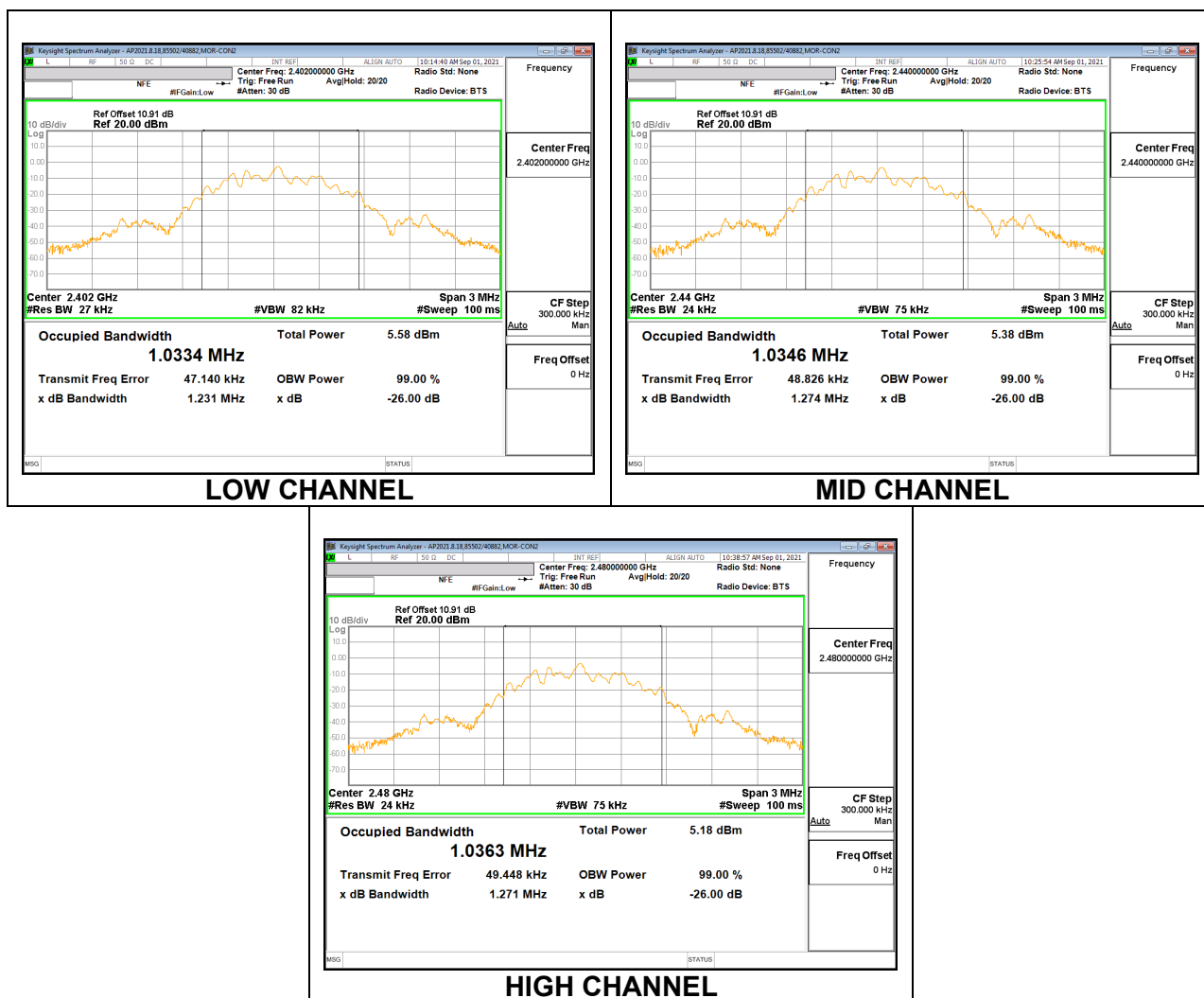
LIMITS

None; for reporting purposes only.

RESULTS

9.2.1. BLE (1Mbps)

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0334
Middle	2440	1.0346
High	2480	1.0363



9.3. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

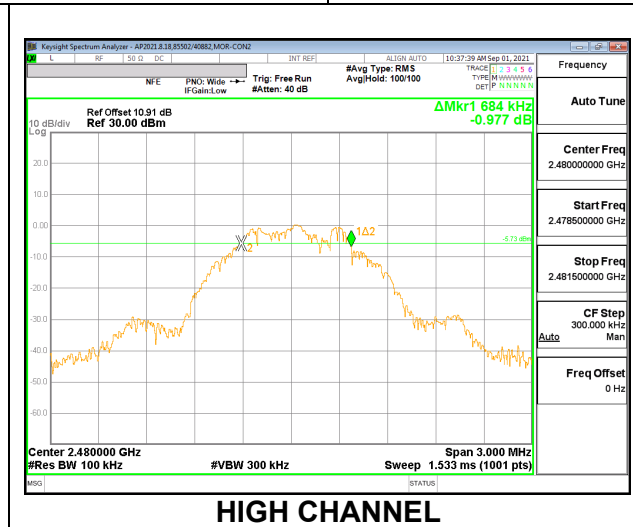
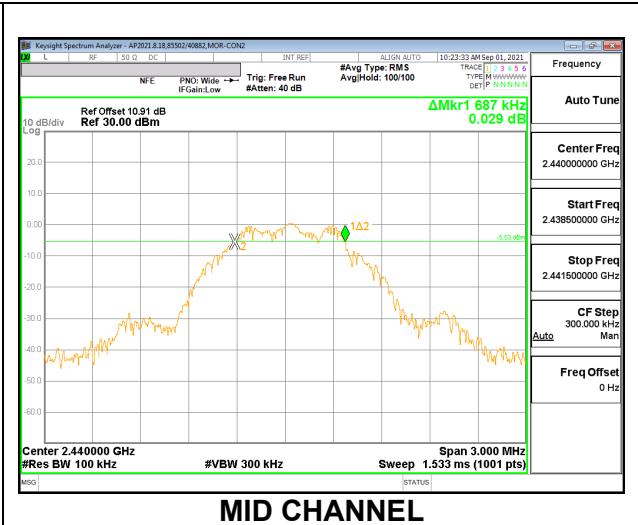
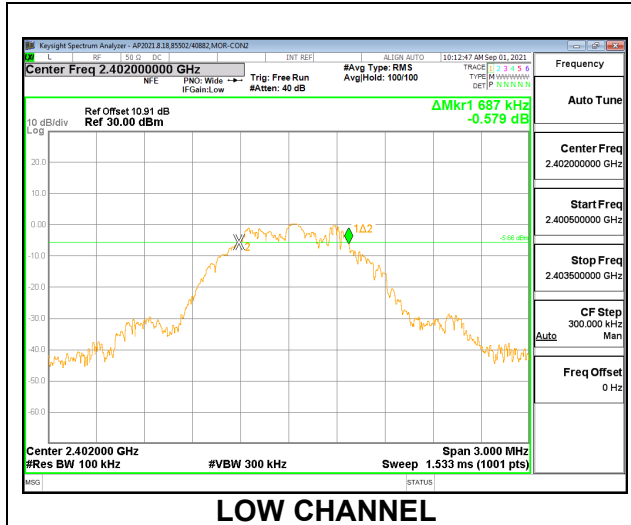
RSS-247 5.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

9.3.1. BLE (1Mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6870	0.5
Middle	2440	0.6870	0.5
High	2480	0.6840	0.5



9.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a peak power meter.

The cable assembly insertion loss of 11.19 dB (10.00dB pad and 1.19dB cable) was entered as an offset in the power meter.

RESULTS

9.4.1. BLE (1Mbps)

Tested By:	85502/40882
Date:	2021-09-01

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	0.30	30	-29.700
Middle	2440	0.32	30	-29.680
High 2	2480	0.23	30	-29.770

9.5. 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 of 11.19 dB (10.00dB pad and 1.19dB cable) was entered as an offset in the power meter.

RESULTS

9.5.1. BLE (1Mbps)

Tested By:	85502/40882
Date:	2021-09-01

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	0.18
Middle	2440	0.14
High 2	2480	0.09

9.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

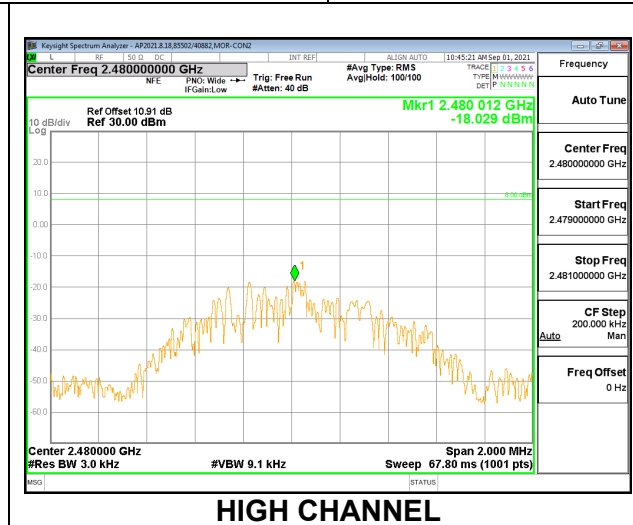
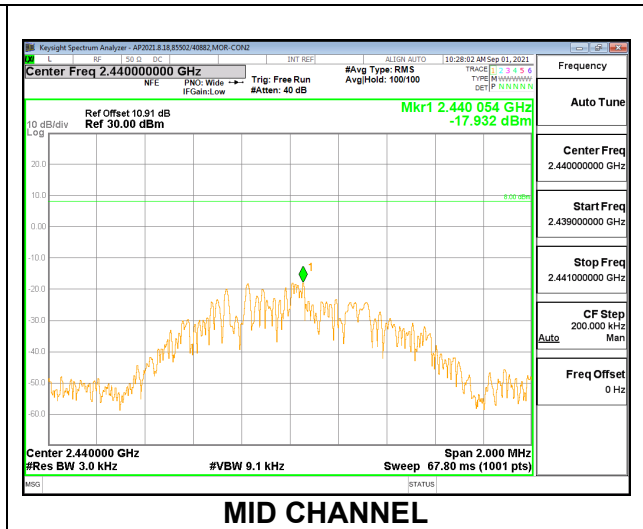
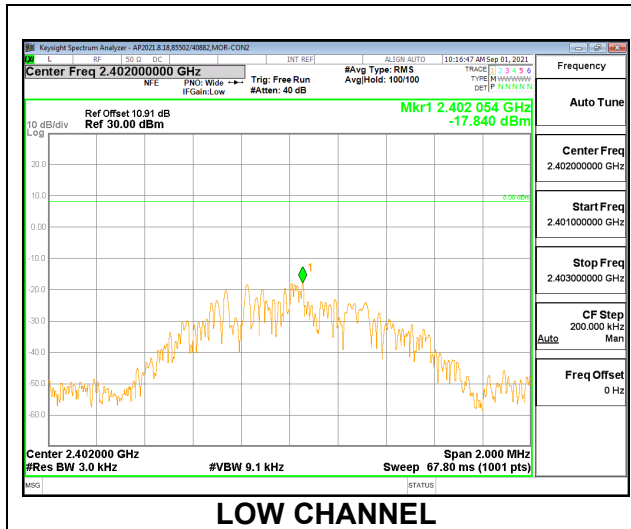
RSS-247 (5.2) (b)

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

9.6.1. BLE (1Mbps)

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-17.840	8	-25.84
Middle	2440	-17.932	8	-25.93
High	2480	-18.029	8	-26.03



9.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

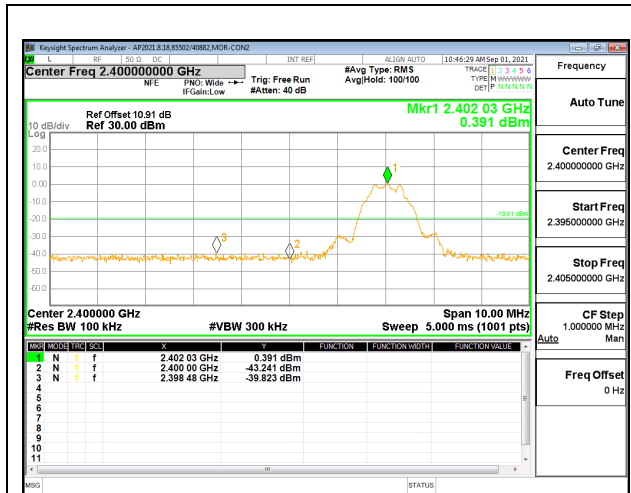
FCC §15.247 (d)

RSS-247 5.5

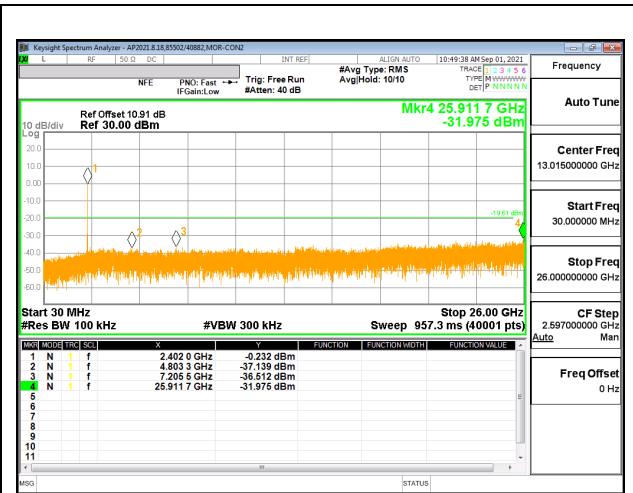
Output power was measured based on the use of a peak measurement, therefore the required attenuation is -20 dBc.

RESULTS

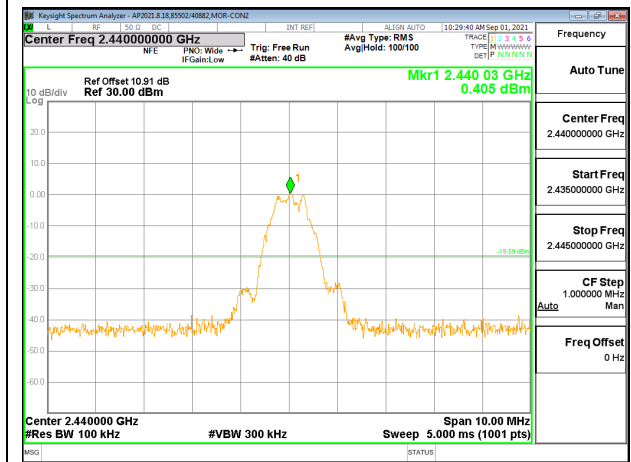
9.7.1. BLE (1Mbps)



LOW CHANNEL BANDEDGE



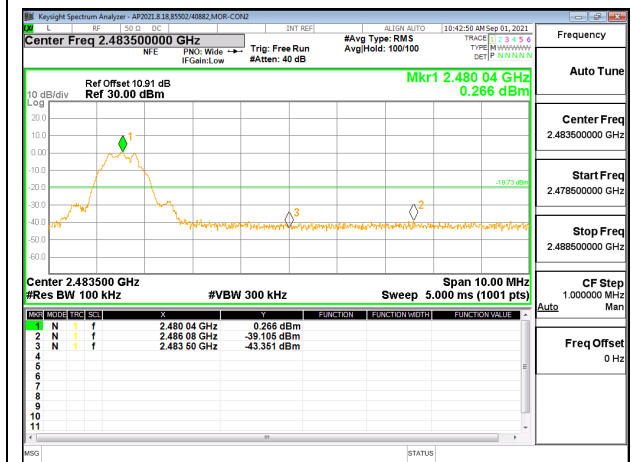
OUT-OF-BAND LOW CHANNEL



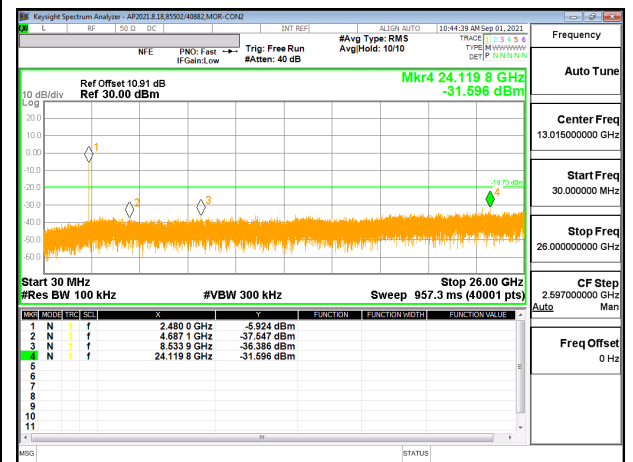
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

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

RSS-GEN, Section 8.9 and 8.10.

Frequency Range (MHz)	Field Strength Limit (uA/m) at 3 m	Field Strength Limit (dBuA/m) at 3 m
0.009-0.490	6.37/F(kHz) @ 300 m	-
0.490-1.705	63.7/F(kHz) @ 30 m	-
1.705 - 30	0.08 @ 30m	-
Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
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 80 cm above the ground plane for measurement below 1GHz; 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 measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak or average (9-90kHz and 110-490kHz).

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz 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, the channel with the highest output power was tested.

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.

3D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel).

Base 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.

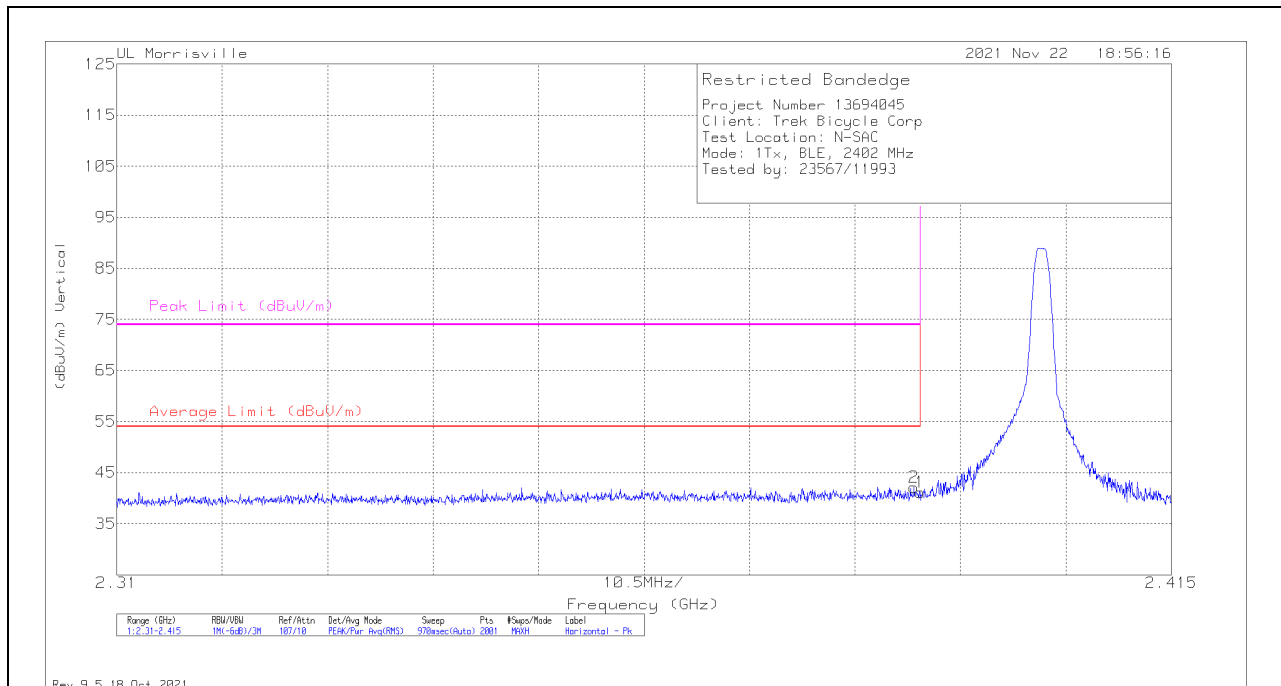
10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (1Mbps)

Antenna 1

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



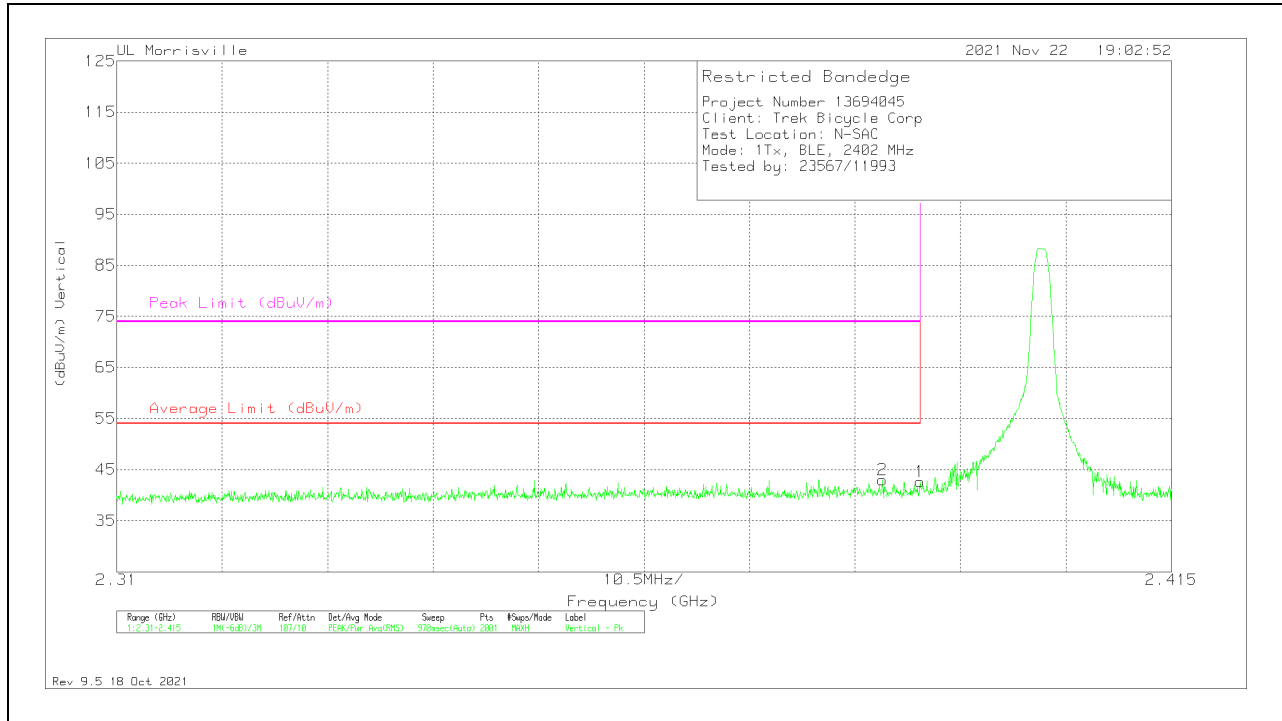
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.38996	33.23	Pk	32.2	-24.3	41.13	54	-12.87	74	-32.87	281	321	H
2	*** 2.38938	34.29	Pk	32.2	-24.3	42.19	54	-11.81	74	-31.81	281	321	H

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

VERTICAL RESULT

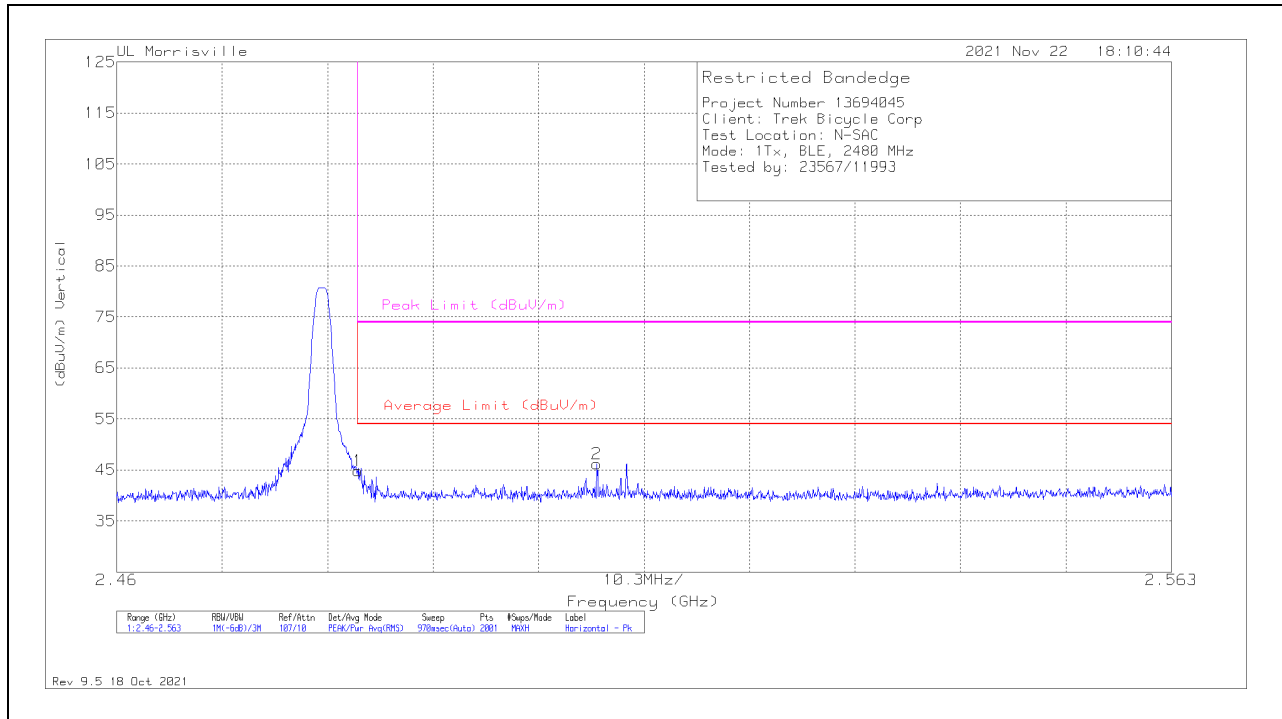


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.38996	34.76	Pk	32.2	-24.3	42.66	54	-11.34	74	-31.34	204	336	V
2	* ** 2.38623	35.16	Pk	32.2	-24.4	42.96	54	-11.04	74	-31.04	204	336	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 ** - indicates frequency in Taiwan NCC LP0002 Restricted Band
 Pk - Peak detector

BANDEDGE (HIGH CHANNEL)

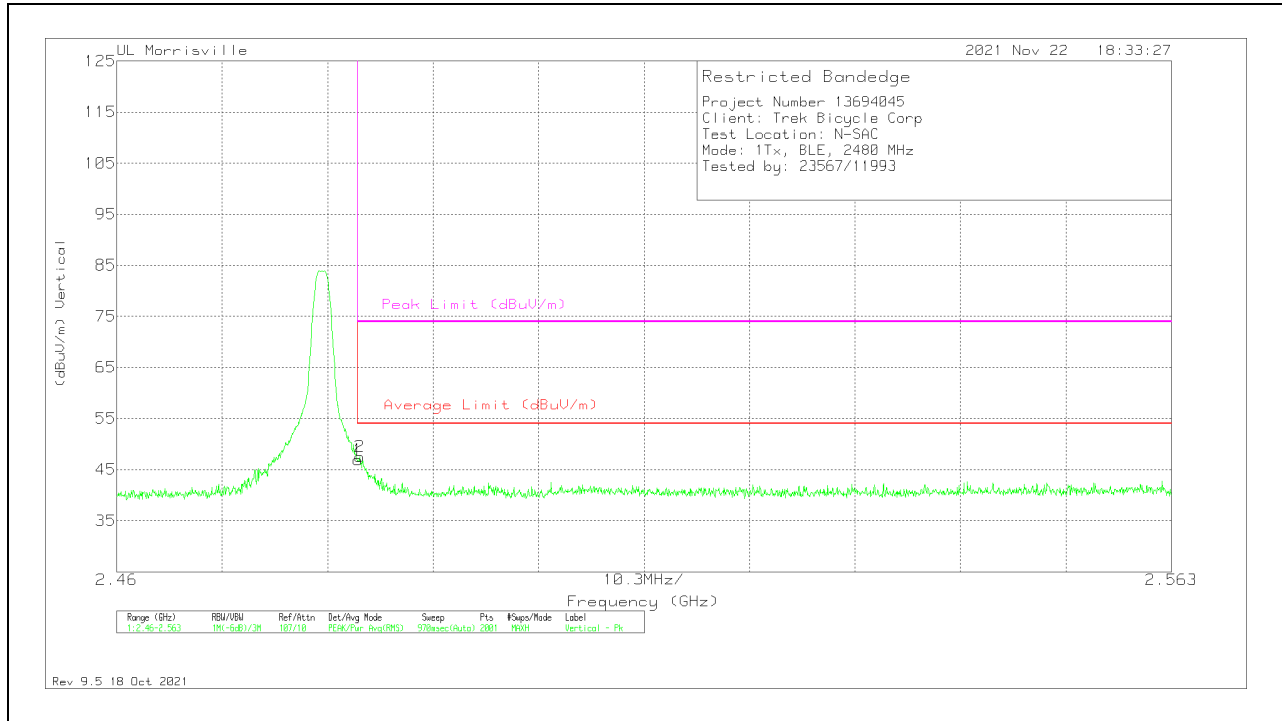
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Pad (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	37.17	Pk	32.3	-24.6	44.87	54	-9.13	74	-29.13	35	116	H
2	** 2.50687	37.99	Pk	32.4	-24.2	46.19	54	-7.81	74	-27.81	35	116	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 ** - indicates frequency in Taiwan NCC LP0002 Restricted Band
 Pk - Peak detector

VERTICAL RESULT

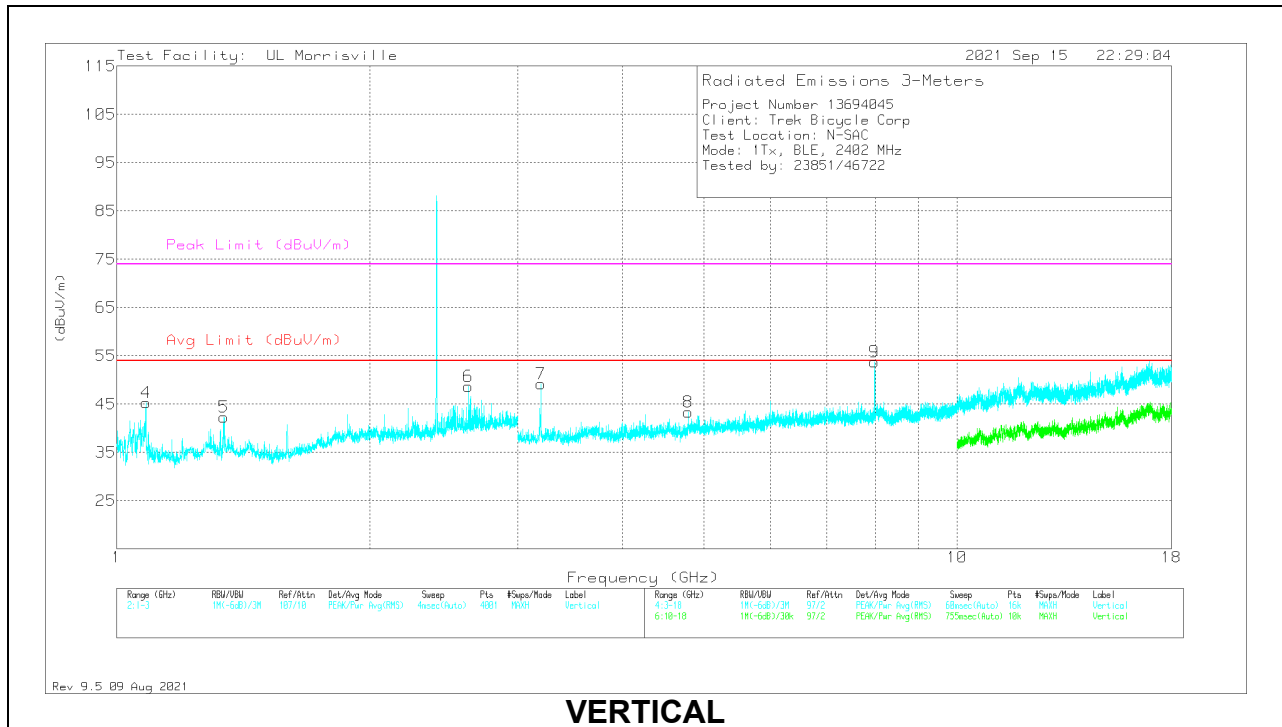
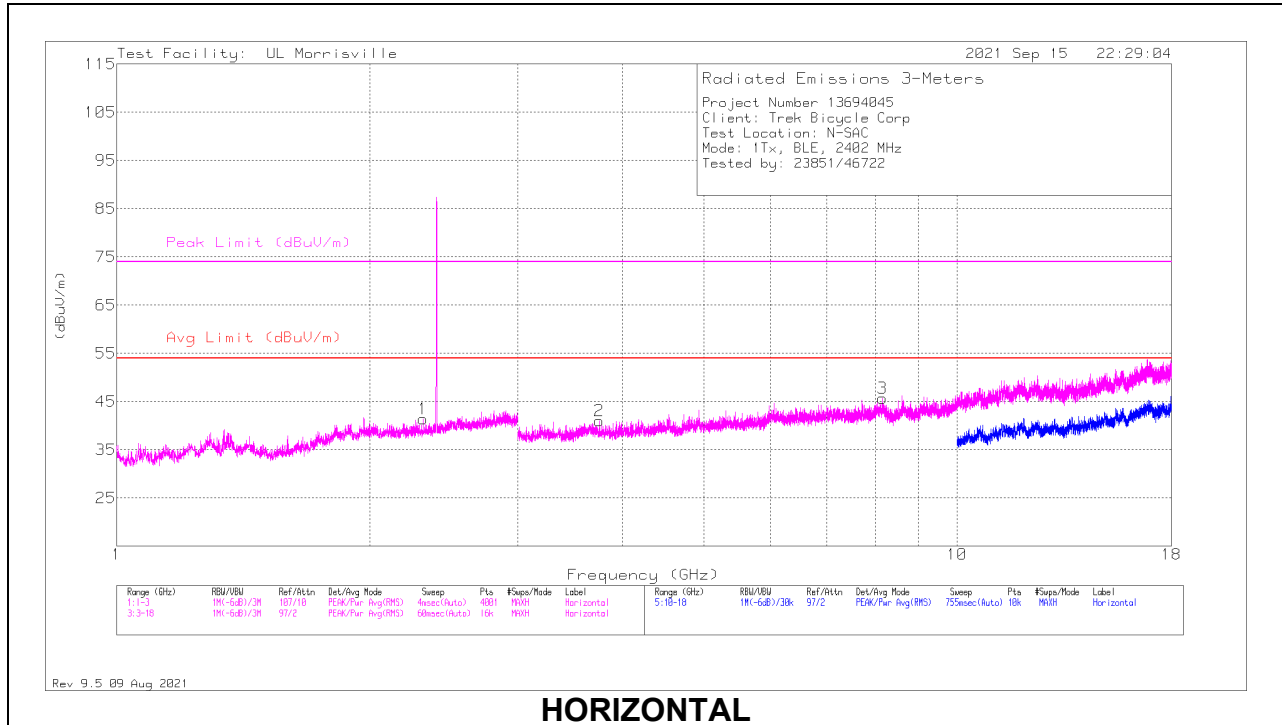


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.48354	39.17	Pk	32.3	-24.6	46.87	54	-7.13	74	-27.13	192	312	V
2	* ** 2.48374	39.79	Pk	32.3	-24.6	47.49	54	-6.51	74	-26.51	192	312	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 ** - indicates frequency in Taiwan NCC LP0002 Restricted Band
 Pk - Peak detector

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (db/m)	Amp/Cbl/Filtr (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	*** 3.75188	40.5	Pk	33.5	-33	0	41	54	-13	74	-33	0-360	101	H
8	*** 4.78781	40.81	Pk	34	-31.4	0	43.41	54	-10.59	74	-30.59	0-360	200	V
3	*** 8.14969	38.52	Pk	35.9	-28.7	0	45.72	54	-8.28	74	-28.28	0-360	101	H
7	3.19875	49.44	Pk	32.9	-33.1	0	49.24	-	-	-	-	0-360	101	V
9	7.97156	46.15	Pk	35.9	-28.3	0	53.75	-	-	-	-	0-360	101	V
1	*** 2.3155	34.11	Pk	31.7	-24.4	0	41.41	54	-12.59	74	-32.59	0-360	101	H
4	*** 1.083	44.96	Pk	27.3	-26.9	0	45.36	54	-8.64	74	-28.64	0-360	200	V
5	*** 1.342	38.49	Pk	29.2	-25.4	0	42.29	54	-11.71	74	-31.71	0-360	200	V
6	** 2.62284	40.09	PK2	32.4	-24.3	0	48.19	-	-	74	-25.81	349	271	V
	** 2.62379	21.98	ADV	32.4	-24.3	15.83	45.91	54	-8.09	-	-	349	271	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

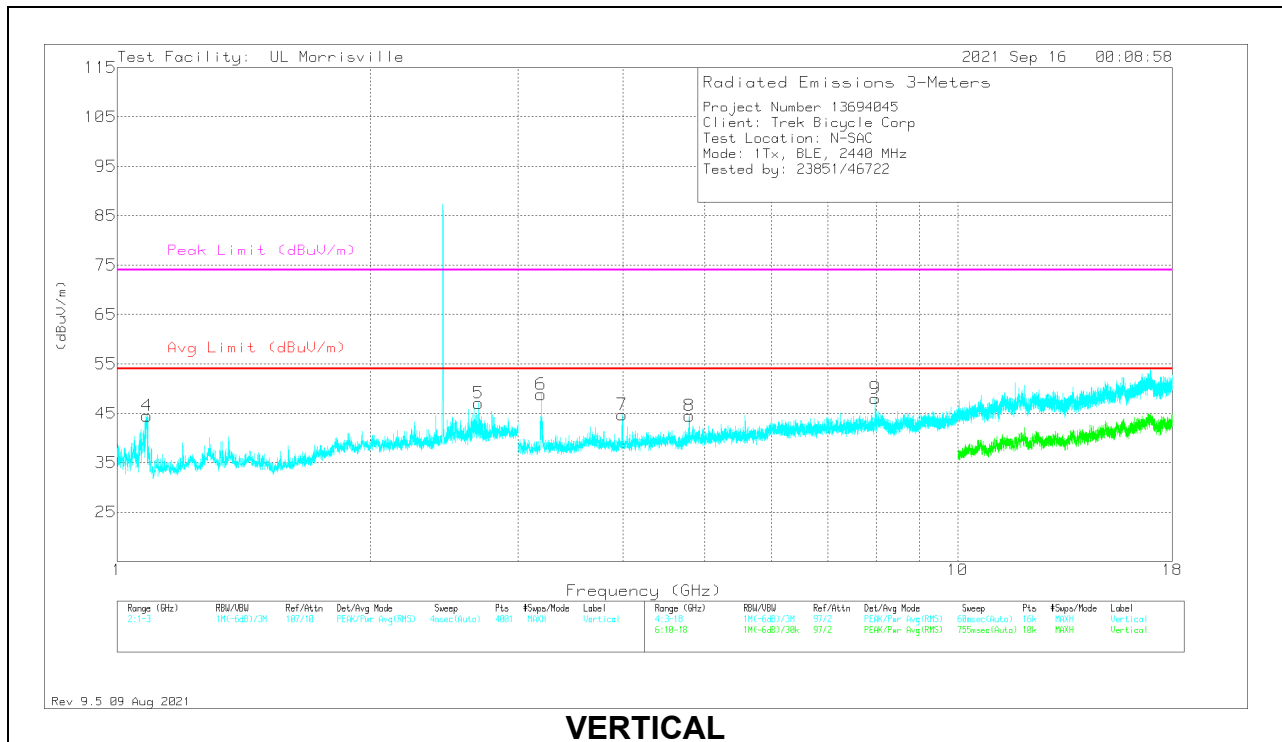
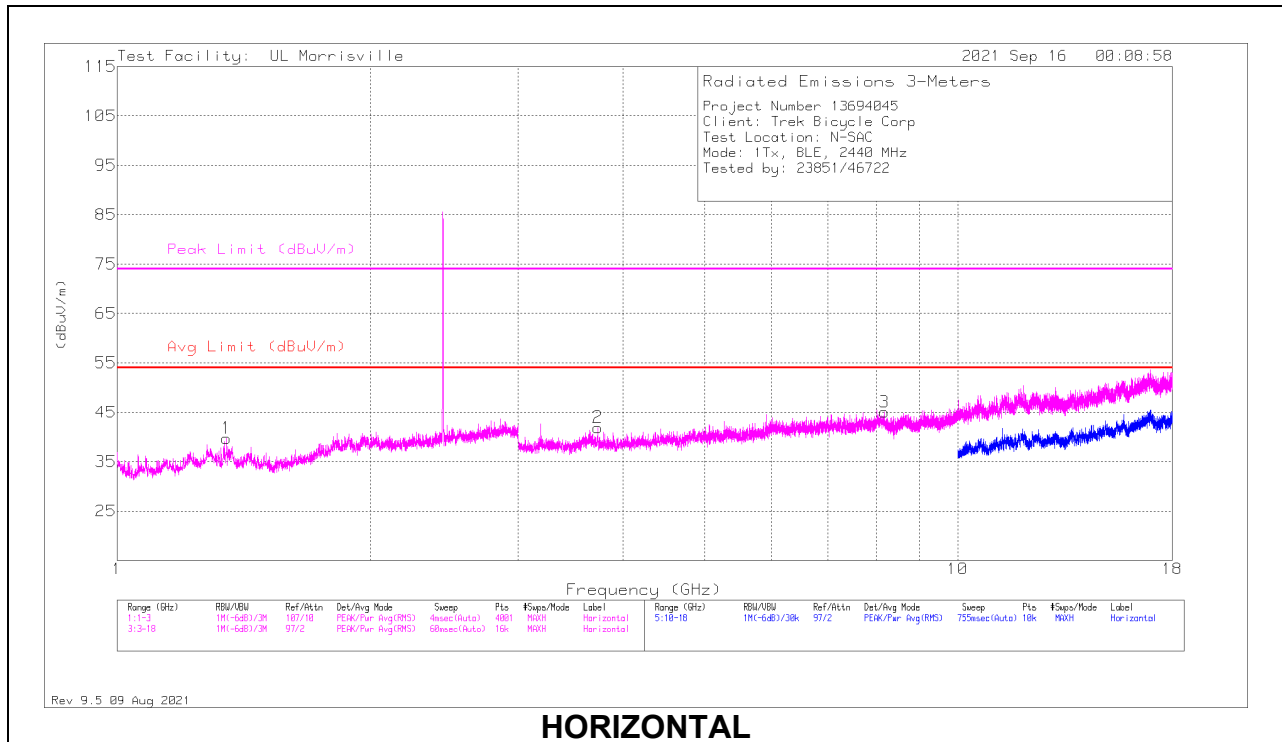
Pk - Peak detector

PK2 - Maximum Peak

ADV - Linear Voltage Average

*Note: The DCCF of 15.83 was added after scan was performed.

MID CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (db/m)	Amp/Cbl/Fltr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	*** 3.73219	40.82	Pk	33.4	-32.3	41.92	54	-12.08	74	-32.08	0-360	101	H
7	*** 3.98719	43.99	Pk	33.2	-32.5	44.69	54	-9.31	74	-29.31	0-360	101	V
8	*** 4.79344	41.9	Pk	34.1	-31.5	44.5	54	-9.5	74	-29.5	0-360	101	V
3	*** 8.17594	37.95	Pk	35.9	-28.8	45.05	54	-8.95	74	-28.95	0-360	200	H
6	3.19313	48.93	Pk	32.9	-33	48.83	-	-	-	-	0-360	101	V
9	7.97719	40.31	Pk	35.9	-28.2	48.01	-	-	-	-	0-360	200	V
1	*** 1.349	36.33	Pk	29.1	-25.7	39.73	54	-14.27	74	-34.27	0-360	200	H
4	*** 1.085	44.2	Pk	27.4	-27.1	44.5	54	-9.5	74	-29.5	0-360	101	V
5	*** 2.691	38.75	Pk	32.5	-24.2	47.05	54	-6.95	74	-26.95	0-360	101	V

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

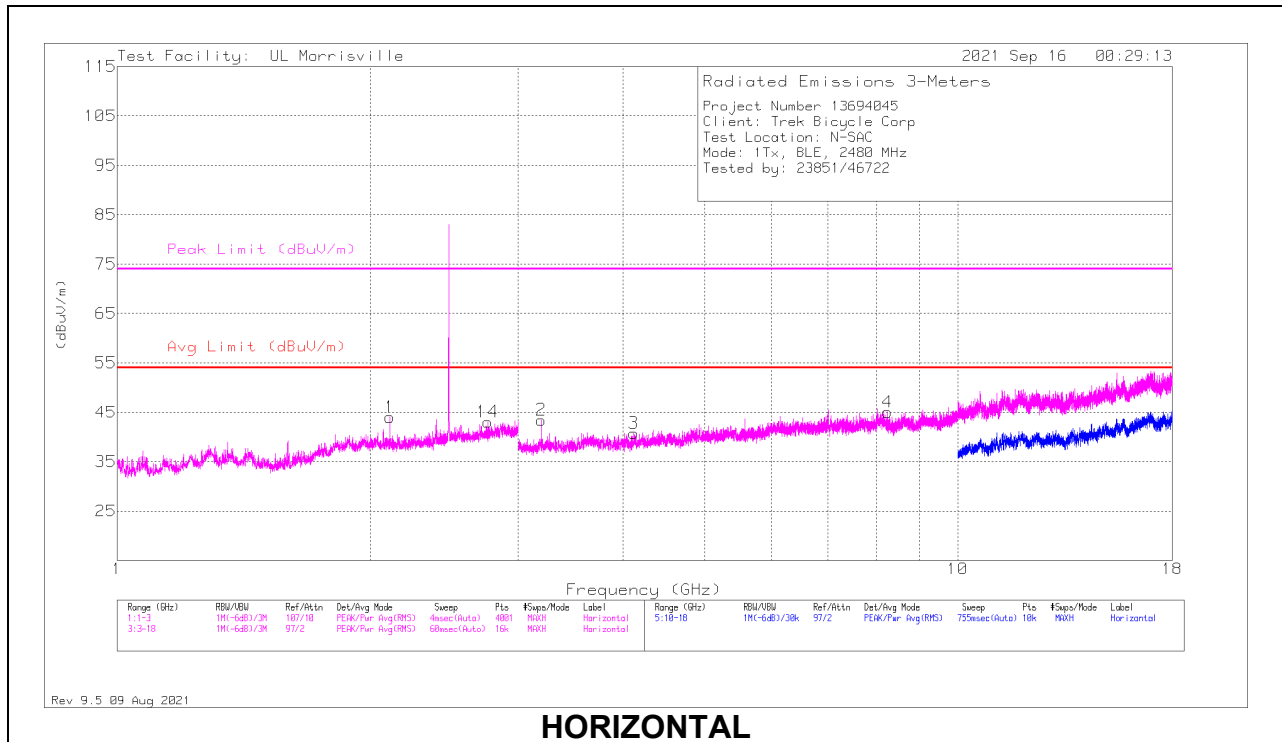
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

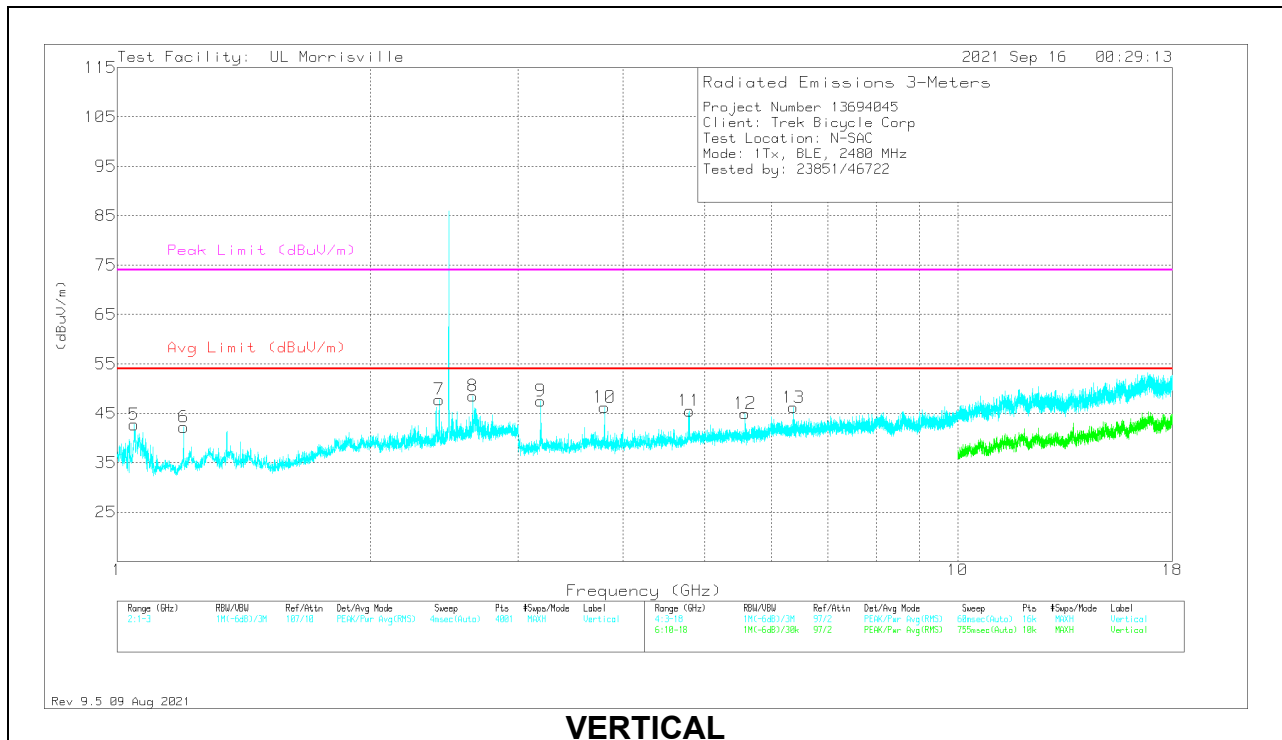
PK2 - Maximum Peak

ADV - Linear Voltage Average

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (db/m)	Amp/Cbl/Fltr (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	*** 4.1175	40.25	Pk	33.3	-32.8	0	40.75	54	-13.25	74	-33.25	0-360	200	H
4	*** 8.25094	38.02	Pk	35.9	-28.9	0	45.02	54	-8.98	74	-28.98	0-360	101	H
10	*** 3.79969	45.73	Pk	33.4	-32.9	0	46.23	54	-7.77	74	-27.77	0-360	200	V
11	*** 4.79438	43.01	Pk	34.1	-31.6	0	45.51	54	-8.49	74	-28.49	0-360	200	V
14	*** 2.759	34.53	Pk	32.6	-24.1	0	43.03	54	-10.97	74	-30.97	0-360	101	H
9	3.18844	47.31	Pk	32.9	-32.7	0	47.51	-	-	-	-	0-360	200	V
2	3.19594	43.63	Pk	32.9	-33.1	0	43.43	-	-	-	-	0-360	101	H
12	5.58469	42.65	Pk	34.6	-32.3	0	44.95	-	-	-	-	0-360	101	V
13	6.37594	40.5	Pk	35.6	-29.9	0	46.2	-	-	-	-	0-360	101	V
1	** 2.111	37	Pk	31.6	-24.6	0	44	54	-10	-	-	0-360	101	H
5	*** 1.0475	42.82	Pk	27	-27.1	0	42.72	54	-11.28	74	-31.28	0-360	101	V
6	*** 1.1995	39.7	Pk	28.6	-26.1	0	42.2	54	-11.8	74	-31.8	0-360	101	V
8	** 2.6506	39.68	PK2	32.6	-24.1	0	48.18	-	-	-74	-25.82	324	283	V
	** 2.64856	21.78	ADV	32.6	-24.1	15.83	46.11	54	-7.89	-	-	324	283	V
7	2.416	40.59	Pk	32	-24.8	0	47.79	-	-	-	-	0-360	101	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

PK2 - Maximum Peak

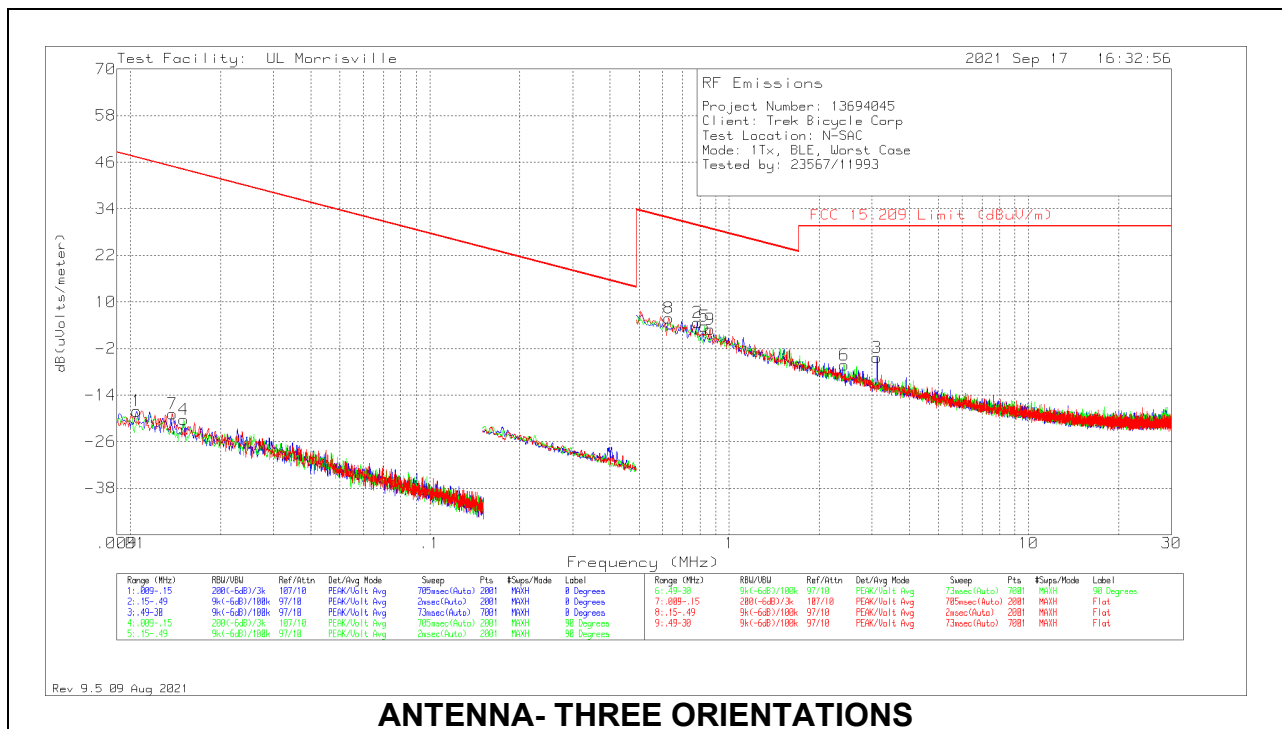
ADV - Linear Voltage Average

*Note: The DCCF of 15.83 was added after scan was performed.

10.3. WORST CASE BELOW 30MHZ

Note for below 30 MHz scans: All measurements were made at a test distance of 3 m. The measured data was extrapolated from the test distance (3m) to the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were 40*Log (test distance / specification distance).

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION E-FIELD)



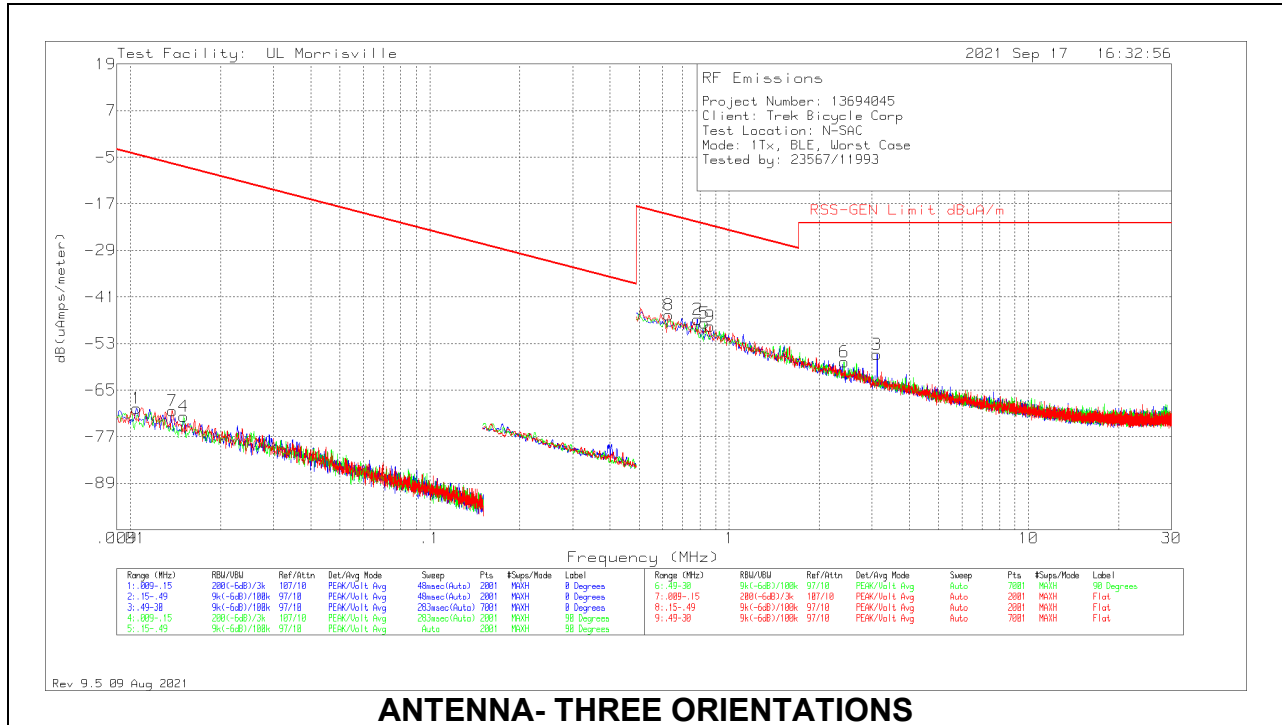
ANTENNA- THREE ORIENTATIONS

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 Qp/Av Limit (dBuV/m)	FCC 15.209 Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	.01049	43.57	Pk	18.2	.1	-80	-18.13	47.19	67.19	-65.32	0-360	100	0 degs
7	.01379	44.19	Pk	16.8	.1	-80	-18.91	44.81	64.81	-63.72	0-360	404	Flat
4	.01504	43.44	Pk	16.2	.1	-80	-20.26	44.06	64.06	-64.32	0-360	100	90 degs
8	.62913	34.29	Pk	11.3	.2	-40	5.79	31.63	-	-25.84	0-360	404	Flat
2	.78512	33.2	Pk	11.3	.2	-40	4.7	29.71	-	-25.01	0-360	100	0 degs
5	.82728	32.21	Pk	11.3	.2	-40	3.71	29.25	-	-25.54	0-360	100	90 degs
9	.86522	31.4	Pk	11.3	.2	-40	2.9	28.86	-	-25.96	0-360	404	Flat
6	2.42093	22.04	Pk	11.4	.3	-40	-6.26	29.54	-	-35.8	0-360	100	90 degs
3	3.11657	24	Pk	11.4	.3	-40	-4.3	29.54	-	-33.84	0-360	100	0 degs

Pk - Peak detector

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION H-FIELD)



ANTENNA- THREE ORIENTATIONS

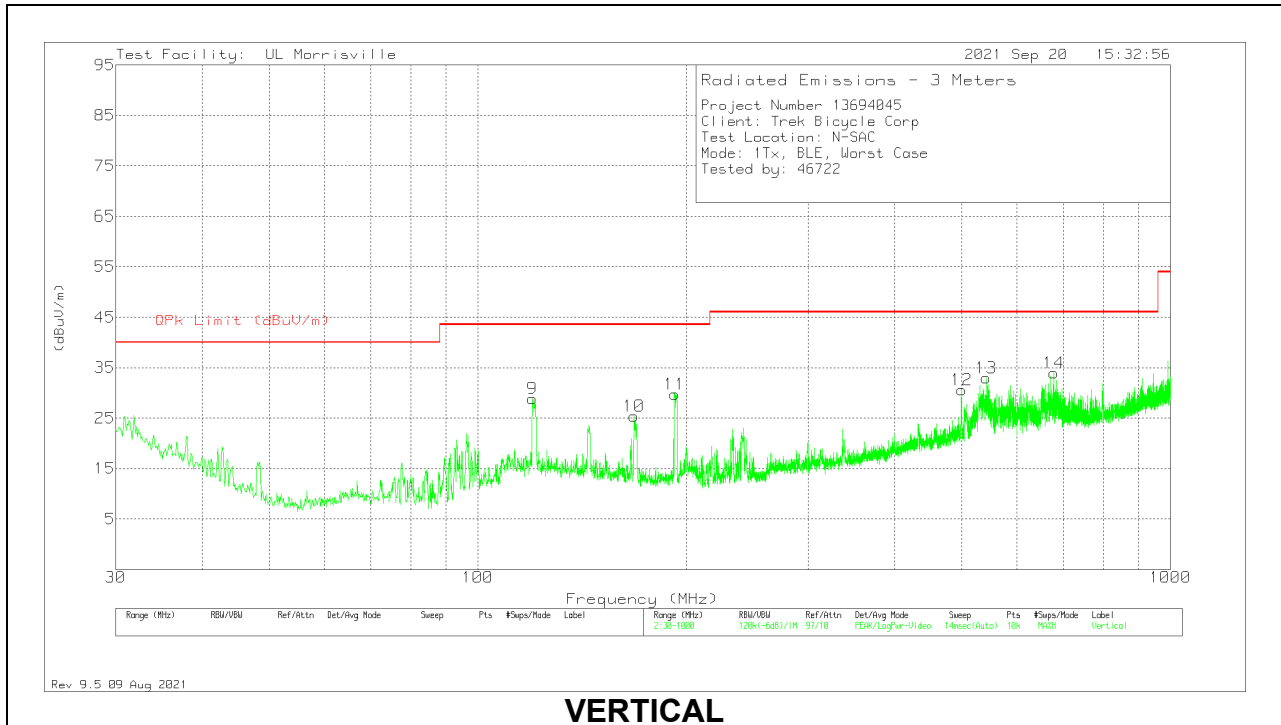
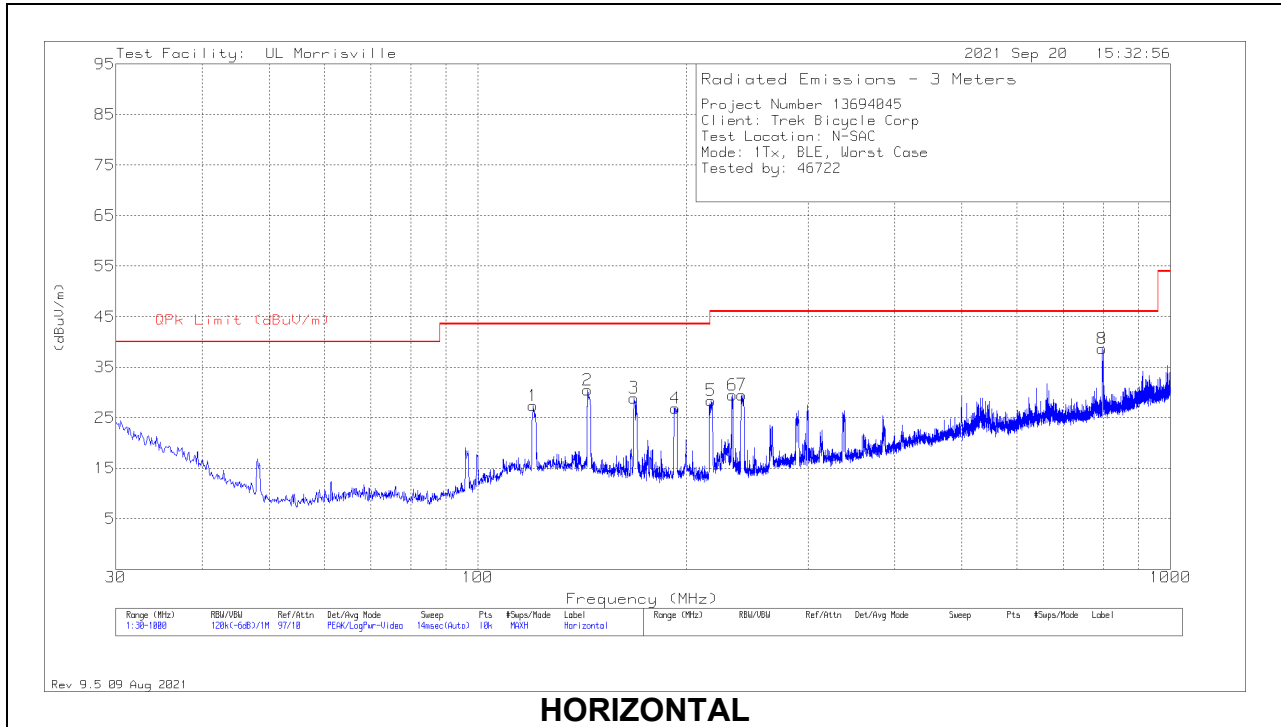
Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uAmps/meter)	RSS-GEN Qp/Av Limit (dBuA/m)	RSS-GEN Pk Limit (dBuA/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	.01049	43.57	Pk	-33.3	.1	-80	-69.63	-4.31	15.69	-65.32	0-360	100	0 degs
7	.01379	44.19	Pk	-34.7	.1	-80	-70.41	-6.69	13.31	-63.72	0-360	404	Flat
4	.01504	43.44	Pk	-35.3	.1	-80	-71.76	-7.44	12.56	-64.32	0-360	100	90 degs
8	.62913	34.29	Pk	-40.2	.2	-40	-45.71	-19.87	-	-25.84	0-360	404	Flat
2	.78512	33.2	Pk	-40.2	.2	-40	-46.8	-21.79	-	-25.01	0-360	100	0 degs
5	.82728	32.21	Pk	-40.2	.2	-40	-47.79	-22.25	-	-25.54	0-360	100	90 degs
9	.86522	31.4	Pk	-40.2	.2	-40	-48.6	-22.64	-	-25.96	0-360	404	Flat
6	2.42093	22.04	Pk	-40.1	.3	-40	-57.76	-21.96	-	-35.8	0-360	100	90 degs
3	3.11657	24	Pk	-40.1	.3	-40	-55.8	-21.96	-	-33.84	0-360	100	0 degs

Pk - Peak detector

10.4. WORST CASE BELOW 1 GHZ

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)



Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0066 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 120.21	37.86	Pk	19.5	-30	27.36	43.52	-16.16	0-360	299	H
3	* ** 168.031	41.02	Pk	17.7	-29.8	28.92	43.52	-14.6	0-360	200	H
7	* ** 240.296	40.74	Pk	17.7	-28.9	29.54	46.02	-16.48	0-360	99	H
8	** 797.27	36.7	Pk	27.6	-25.6	38.7	46.02	-7.32	0-360	200	H
9	* ** 119.822	39.4	Pk	19.5	-30	28.9	43.52	-14.62	0-360	100	V
10	* ** 168.031	37.53	Pk	17.7	-29.8	25.43	43.52	-18.09	0-360	100	V
12	** 499.868	33.41	Pk	24.1	-26.9	30.61	46.02	-15.41	0-360	100	V
2	144.072	41.38	Pk	18.9	-29.8	30.48	-	-	0-360	200	H
11	192.378	41.68	Pk	17.6	-29.5	29.78	-	-	0-360	100	V
4	192.863	38.83	Pk	17.6	-29.6	26.83	-	-	0-360	99	H
5	217.307	40.92	Pk	16.7	-29.2	28.42	-	-	0-360	99	H
6	233.215	40.93	Pk	17.4	-28.9	29.43	-	-	0-360	99	H
13	542.16	35.49	Pk	24.5	-27	32.99	-	-	0-360	100	V
14	679.027	34.19	Pk	26.3	-26.5	33.99	-	-	0-360	100	V

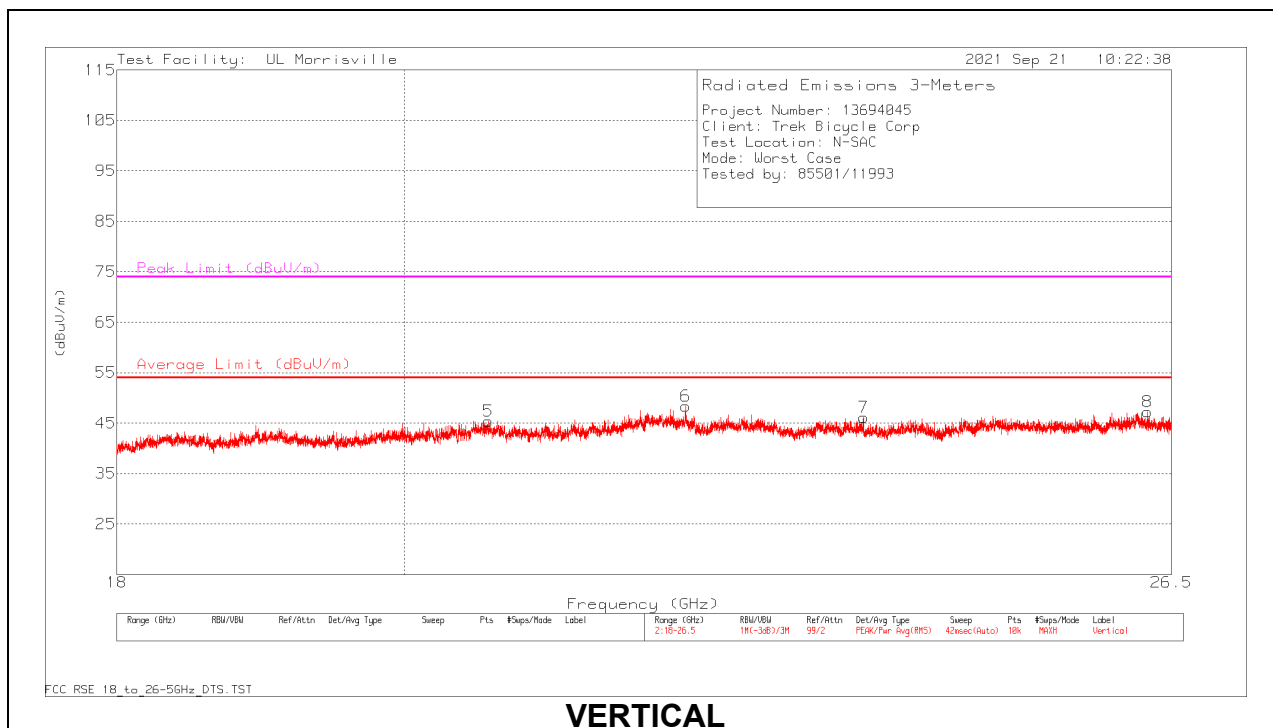
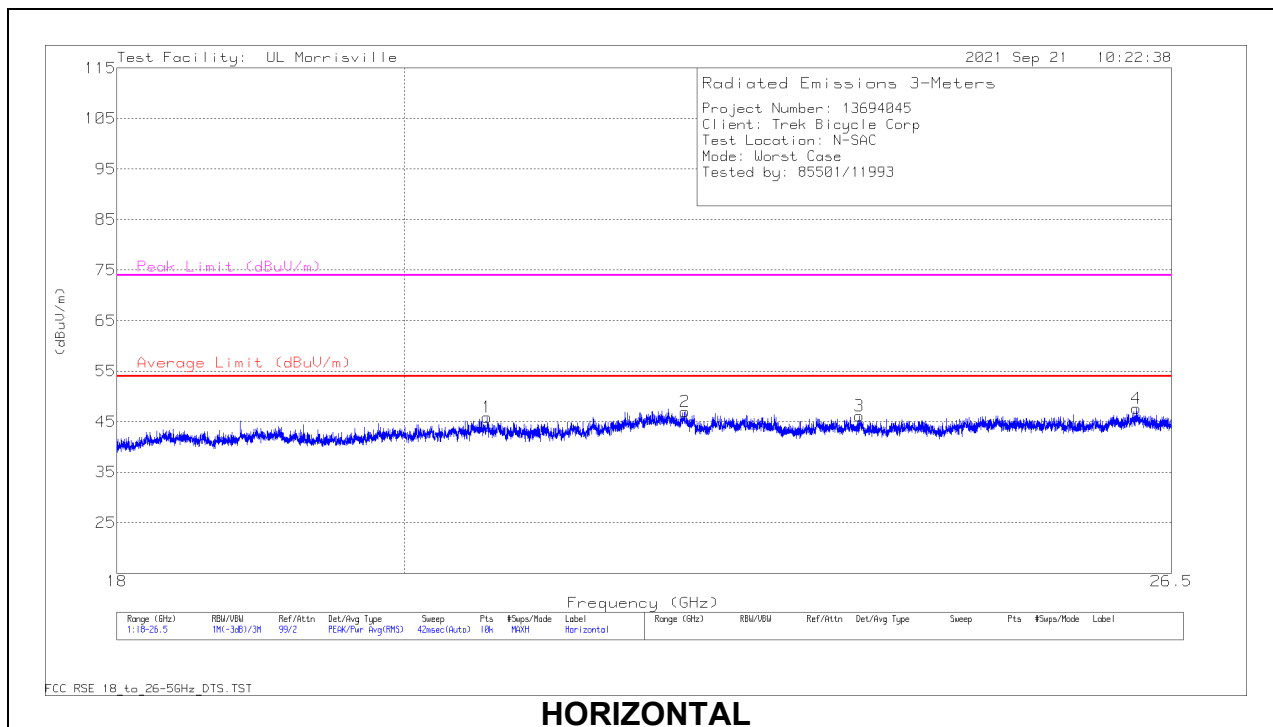
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

10.5. WORST CASE 18-26 GHZ

SPURIOUS EMISSIONS 18-26 GHz (WORST-CASE CONFIGURATION)



18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0063 AF (dB/m)	Amp/Cbl (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 20.61774	51.03	Pk	33.9	-39.1	0	45.83	54	-8.17	74	-28.17	0-360	249	H
2	* ** 22.17053	49.79	Pk	36.7	-39.5	0	46.99	54	-7.01	74	-27.01	0-360	249	H
3	* ** 23.63154	50.23	Pk	34.9	-39	0	46.13	54	-7.87	74	-27.87	0-360	150	H
5	* ** 20.62539	50.35	Pk	34	-39	0	45.35	54	-8.65	74	-28.65	0-360	151	V
6	* ** 22.17616	50.28	PK2	36.7	-39.6	0	47.38	-	-	74	-26.62	165	294	V
	* ** 22.17488	37.32	ADV	36.7	-39.7	15.83	50.15	54	-3.85	-	-	165	294	V
7	* ** 23.66978	50.36	Pk	34.9	-39.1	0	46.16	54	-7.84	74	-27.84	0-360	300	V
4	26.16003	49.34	Pk	35.4	-37.1	0	47.64	54	-6.36	74	-26.36	0-360	249	H
8	26.27052	49.28	Pk	35.4	-37.4	0	47.28	54	-6.72	74	-26.72	0-360	151	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

PK2 - Maximum Peak

ADV - Linear Voltage Average

*Note: The DCCF of 15.83 was added after scan was performed.

11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

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 40cm from the vertical ground plane and 80cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

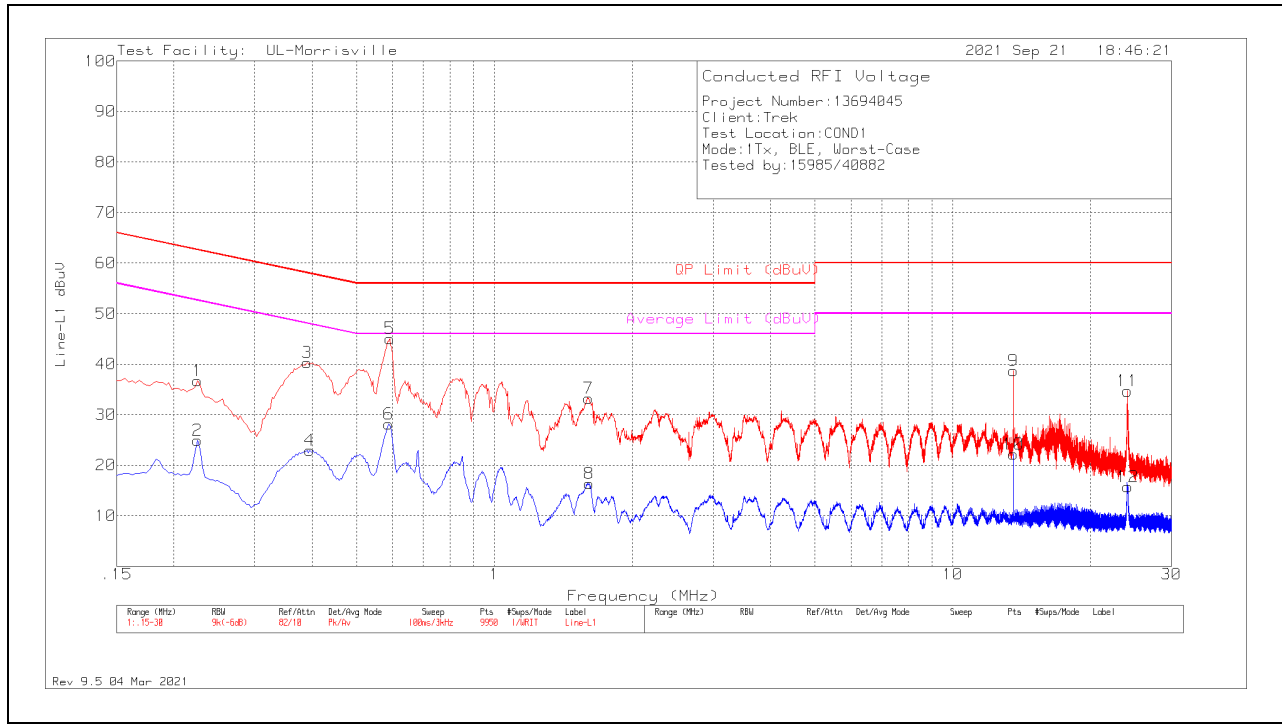
The receiver is set to a resolution bandwidth of 9kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

11.1.1. AC Power Line Norm

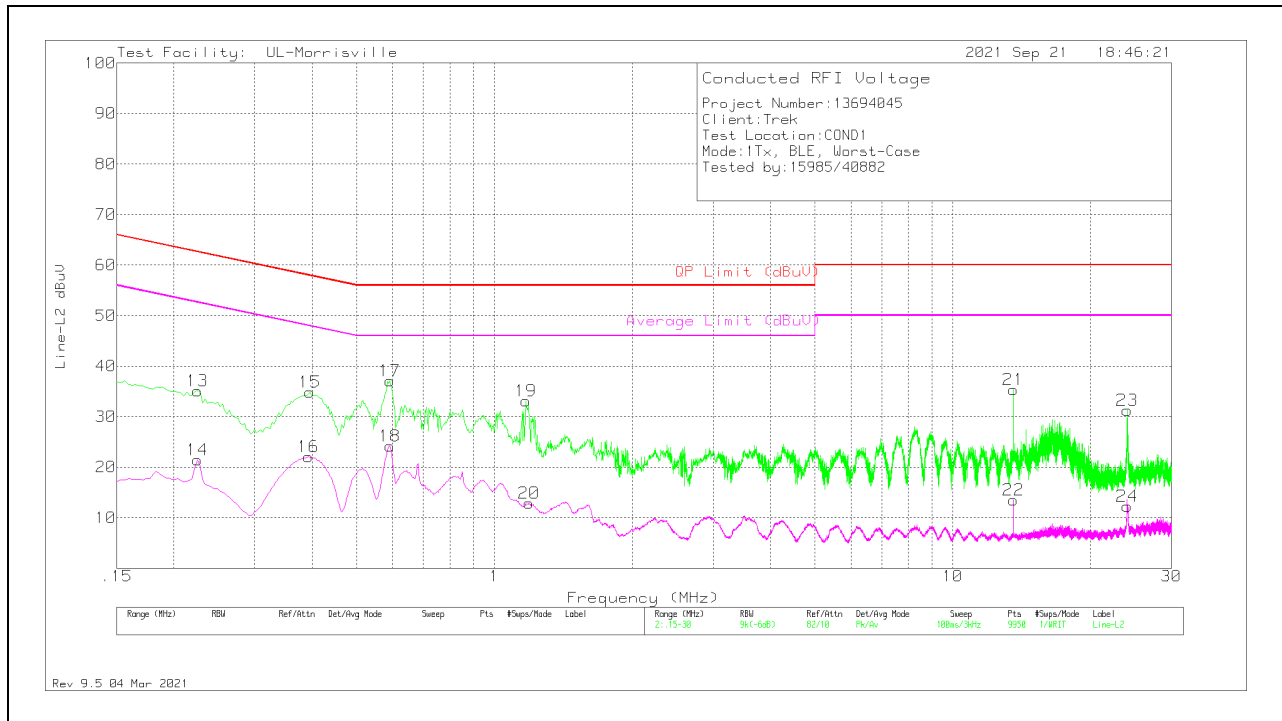
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN_wc_VCF	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.225	26.85	Pk	.1	9.8	36.75	62.63	-25.88	-	-
2	.225	14.97	Av	.1	9.8	24.87	-	-	52.63	-27.76
3	.39	30.45	Pk	.1	9.8	40.35	58.06	-17.71	-	-
4	.396	13.05	Av	.1	9.8	22.95	-	-	47.94	-24.99
6	.588	18.35	Av	0	9.8	28.15	-	-	46	-17.85
5	.591	35.29	Pk	0	9.8	45.09	56	-10.91	-	-
7	1.605	23.48	Pk	0	9.8	33.28	56	-22.72	-	-
8	1.608	6.58	Av	0	9.8	16.38	-	-	46	-29.62
9	13.56	28.54	Pk	.1	10.1	38.74	60	-21.26	-	-
10	13.563	11.94	Av	.1	10.1	22.14	-	-	50	-27.86
11	24.087	24.27	Pk	.2	10.2	34.67	60	-25.33	-	-
12	24.102	5.29	Av	.2	10.2	15.69	-	-	50	-34.31

Pk - Peak detector
 Av - Average detection

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN_wc_VCF	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
13	.225	25.24	Pk	.1	9.8	35.14	62.63	-27.49	-	-
14	.225	11.59	Av	.1	9.8	21.49	-	-	52.63	-31.14
16	.393	12.2	Av	.1	9.8	22.1	-	-	48	-25.9
15	.396	24.95	Pk	.1	9.8	34.85	57.94	-23.09	-	-
17	.591	27.31	Pk	0	9.8	37.11	56	-18.89	-	-
18	.591	14.32	Av	0	9.8	24.12	-	-	46	-21.88
19	1.17	23.35	Pk	0	9.8	33.15	56	-22.85	-	-
20	1.191	3.09	Av	0	9.8	12.89	-	-	46	-33.11
21	13.56	25.14	Pk	.1	10.1	35.34	60	-24.66	-	-
22	13.563	3.27	Av	.1	10.1	13.47	-	-	50	-36.53
23	24.027	20.89	Pk	.2	10.2	31.29	60	-28.71	-	-
24	24.027	1.9	Av	.2	10.2	12.3	-	-	50	-37.7

Pk - Peak detector
 Av - Average detection

12. SETUP PHOTOS

Please refer to R13694045-EP1 for setup photos

END OF TEST REPORT