



CERTIFICATION TEST REPORT

Report Number: 13812998-E3V2

Applicant : APPLE, INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A

Model : A2657

Brand : Apple

FCC ID : BCGA2657

EUT Description : Network adapter

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

Date Of Issue:

April 19, 2022

Prepared by:

UL VERIFICATION SERVICES

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	4/8/2022	Initial Issue	Gerardo Abrego
V2	4/19/2022	Updated equipment list and removed incorrect wording	Tri Pham

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A

EUT DESCRIPTION: Network adapter

MODEL: A2657

BRAND: Apple

SERIAL NUMBER: Conducted: C32GWVVWD4
Radiated: QPGPH3PVYM

SAMPLE RECEIPT DATE: January 22, 2022

DATE TESTED: February 2, 2022 – March 17, 2022

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies

UL Verification Services Inc. 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For
UL Verification Services Inc. By:



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Consumer Technology Division
UL Verification Services Inc.

Prepared By:



Abrego Gerardo
Test Engineer
Consumer Technology Division
UL Verification Services Inc.

2. TEST RESULTS SUMMARY

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

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

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01.

4. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by A2LA, Certificate Number 0751.05, 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 1: 47173 Benicia Street Fremont, CA 94538, U.S.A	US0104	2324A	550739
<input checked="" type="checkbox"/>	Building 2: 47266 Benicia Street Fremont, CA 94538, U.S.A	US0104	22541	550739
<input checked="" type="checkbox"/>	Building 4: 47658 Kato Rd Fremont, CA 94538, U.S.A	US0104	2324B	550739

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}
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.84 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.29 dB

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + 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 Network Adapter. It has an integral battery, two Gigabit Ethernet port, lightning connector and antenna. The device supports IEEE 802.11b/g/n radio, Bluetooth radio, and NFC. Network Adapter comes with 32 GB memory storage and 1GB RAM.

6.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	BLE 1M	6.74	4.72
2404 - 2478	BLE 2M	6.75	4.73

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

The radio utilizes an antenna with a maximum gain of 2.9 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 19F47.

6.5. WORST-CASE CONFIGURATION AND MODE

High power and low power mode has same target power and both modes were investigated and it was determined that high power mode was the worst case, therefore, all final testing was performed using high power mode.

EUT was investigated in three orthogonal orientations X(Flatbed),Y(Portrait) and Z (Landscape), It was determined Y (Landscape) was the worst case orientation, therefore, all final radiated testing was performed with the EUT in Y (Landscape) orientation.

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.

For Radiated harmonic emissions and band edge between 1GHz and 18GHz were performed with the EUT and charger set to transmit based on the target power.

For below 1GHz, EUT was connecting to both Laptop and Switch/Router via ethernet cable as the worst case. There were no emissions found below 30MHz within 20dB of the limit

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Apple	Macbook Pro	C02P41RZG086	FCC DoC
Laptop AC/DC adapter	Liteon Technology	PA-1450-BA1	B123	NA
AC/DC Adapter	Apple	A1385	D292365CDYADHLHC3	NA
10dB Fixed Attenuator	Pasternack	PE7087-10	Label ID: 178584	N/A

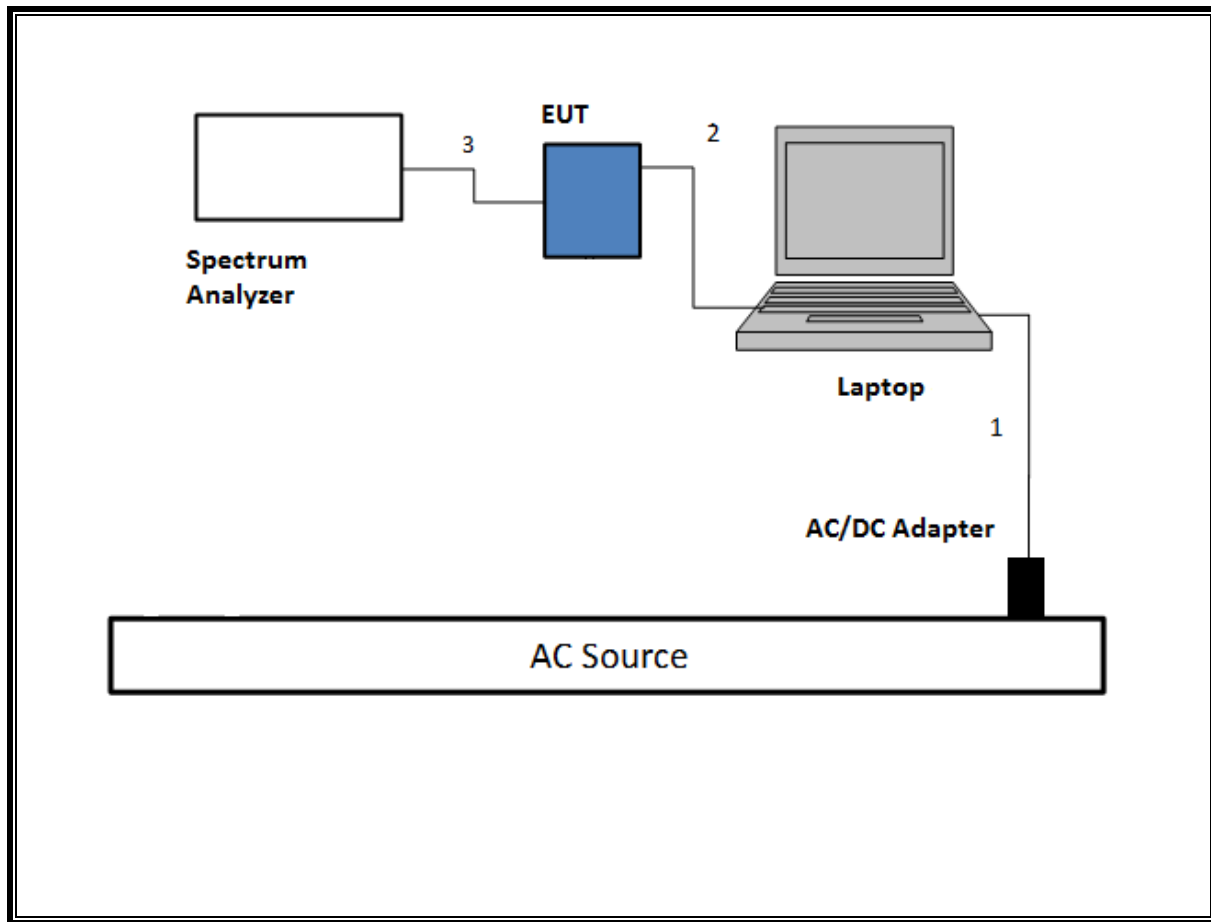
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-Shielded	2	N/A
2	USB	1	USB-C	Shielded	1	N/A
3	Antenna	1	SMA	Un-Shielded	0.2	To spectrum Analyzer

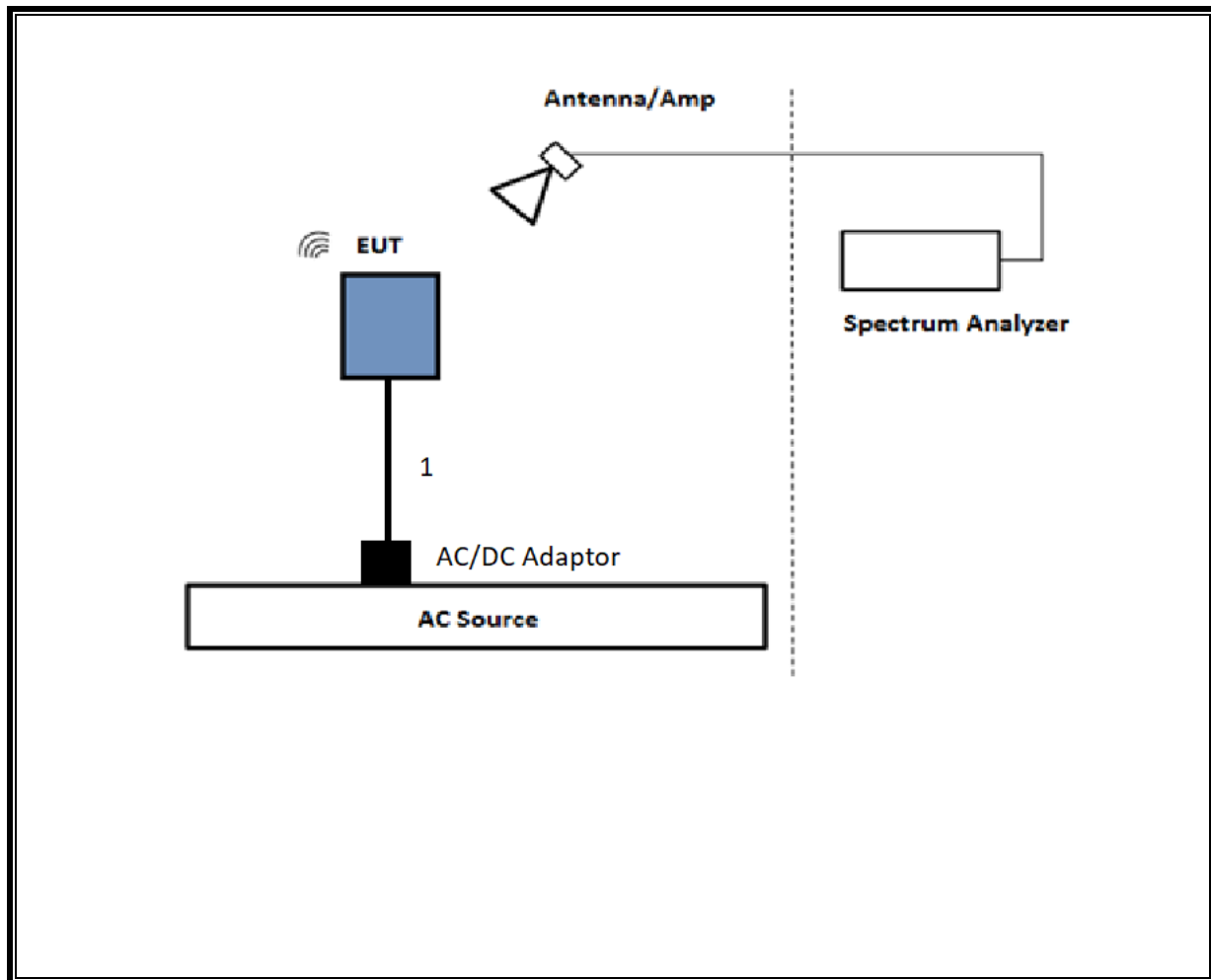
TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the radio card.

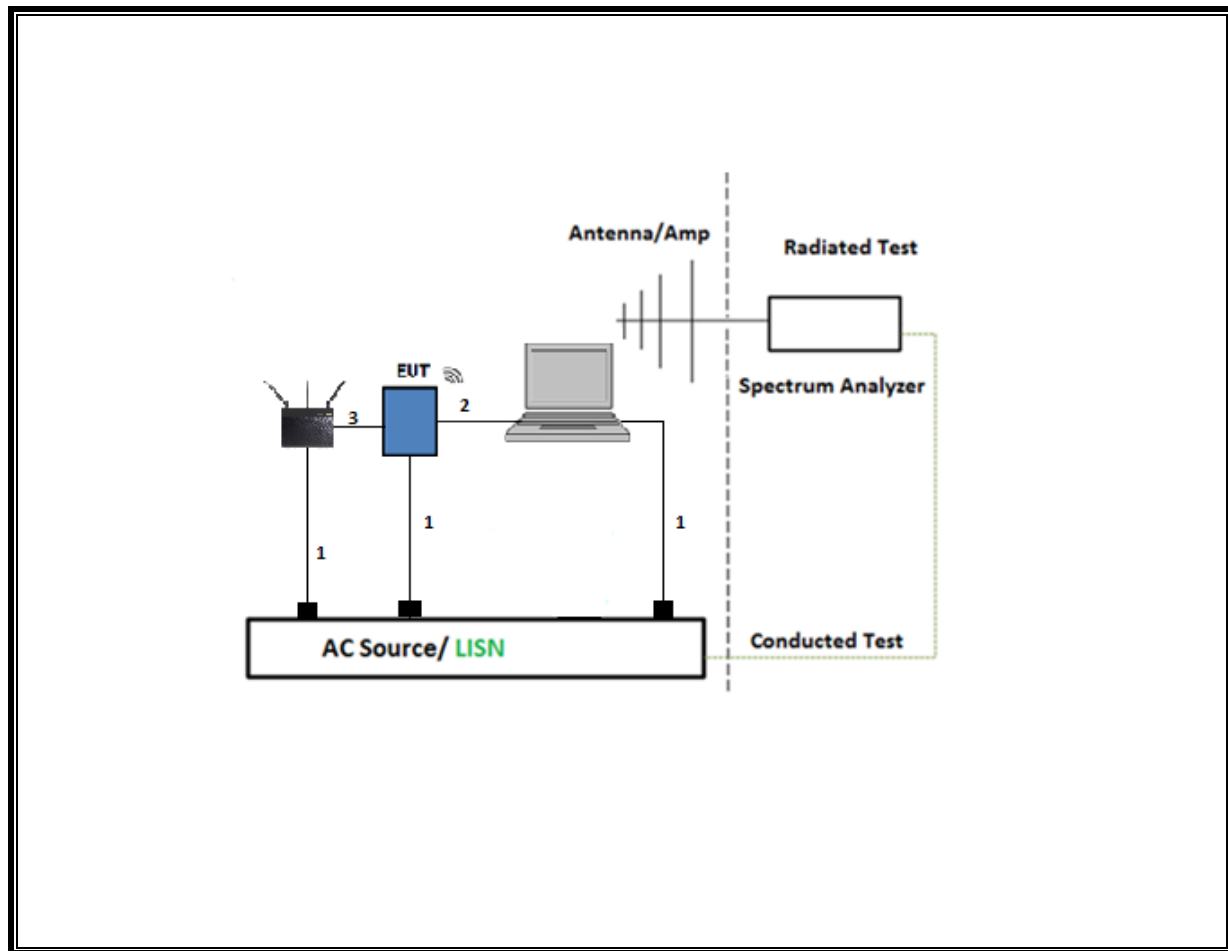
SETUP DIAGRAM FOR CONDUCTED TESTS



SETUP DIAGRAM FOR RADIATED TESTS ABOVE 1 GHz



SETUP DIAGRAM FOR BELOW 1GHz and AC LINE CONDUCTED TEST



7. MEASUREMENT METHOD

On Time and Duty Cycle: KDB 558074 D01 v05r02, Section 6.

6 dB BW: ANSI C63.10 Subclause -11.8.1 RBW \geq DTS BW

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 Measurement using gated average power meter.

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

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1 & Clause 13

Conducted emissions in restricted frequency bands: ANSI C63.10 Subclause -11.12.2

Band-edge: ANSI C63.10 Subclause -11.13.3.2 & Clause 13: Integration method -Peak detection

Band-edge: ANSI C63.10 Subclause -11.13.3.3 & Clause 13: Integration method -Trace averaging with continuous transmission at full power

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

Radiated emissions non-restricted frequency bands ANSI C63.10 Subclause -11.11 & Clause 13

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4 & 13

8. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
Amplifier, 100MHz-18GHz	AMPLICAL	AMP0.1G18-47-20	PRE0197319	04/08/2022	04/08/2021
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	175953	02/08/2023	02/08/2022
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB1	82258	10/01/2022	10/01/2021
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179367	02/17/2023	02/17/2022
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	90757	02/03/2023	02/03/2022
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	T341	02/02/2023	02/02/2022
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	200895	10/13/2022	10/13/2021
RF Amplifier, 1-18GHz	AMPLICAL	AMP0.1G18-47-20	172123	02/12/2023	02/12/2022
Antenna, BroadBand Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	174373	12/14/2022	12/14/2021
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	170648	02/10/2023	02/10/2022
Antenna Horn, 18 to 26GHz	ARA	SWH-28	81139	05/25/2022	05/25/2021
Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	04/19/2022	04/19/2021
Antenna, Passive Loop 9KHz-30MHz	Electro-Metric	EM-6872	170016	06/08/2022	06/08/2021

AC Line Conducted					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESR	T1436	02/21/2023	02/21/2022
LISN for Conducted Emissions CISPR-16	FISCHER CUSTOM COMMUNICATIONS	FCC-LISN-50/250-25-2-01-480V	175765	01/26/2023	01/26/2022
UL AUTOMATION SOFTWARE					
Radiated Software	UL	UL EMC	Ver 9.5, Mar 6, 2020		
Conducted Software	UL	UL EMC	2020.2.26		
AC Line Conducted Software	UL	UL EMC	Ver 9.5, February 21, 2020		

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

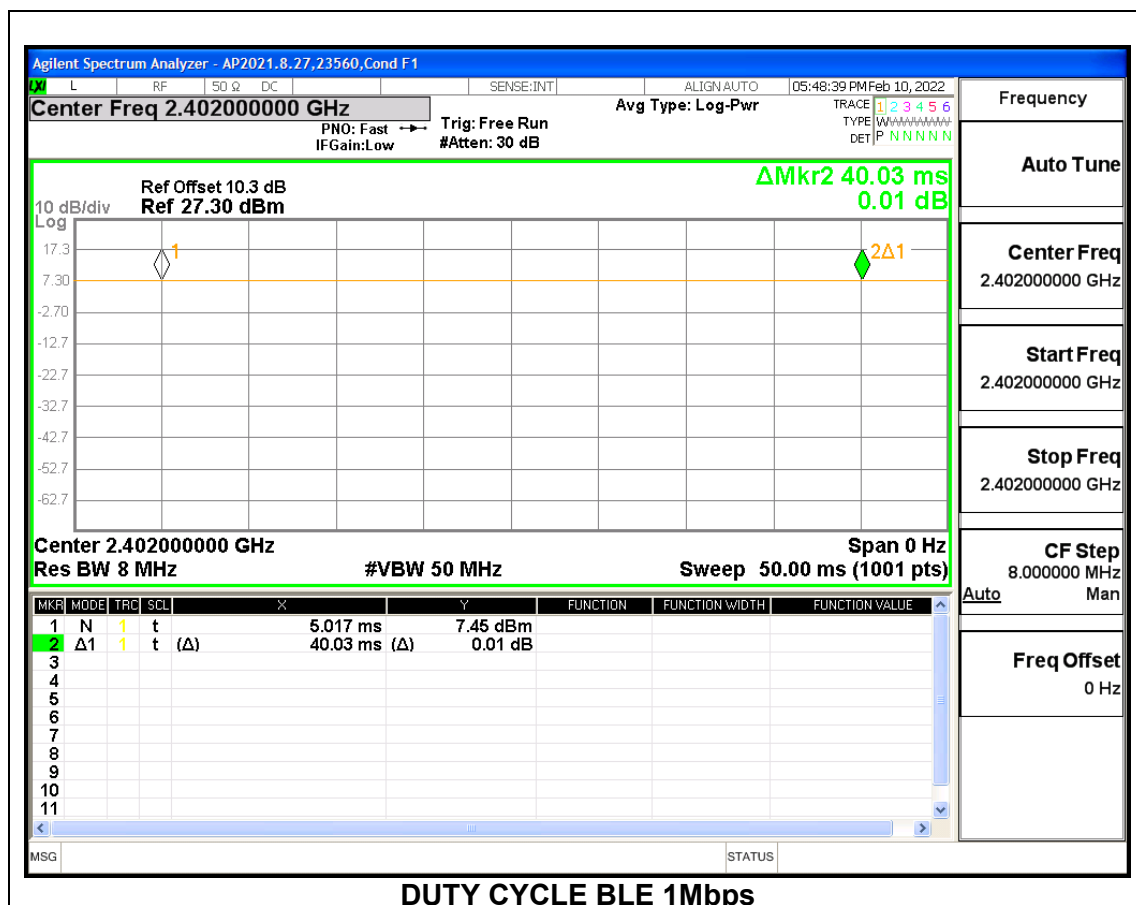
PROCEDURE

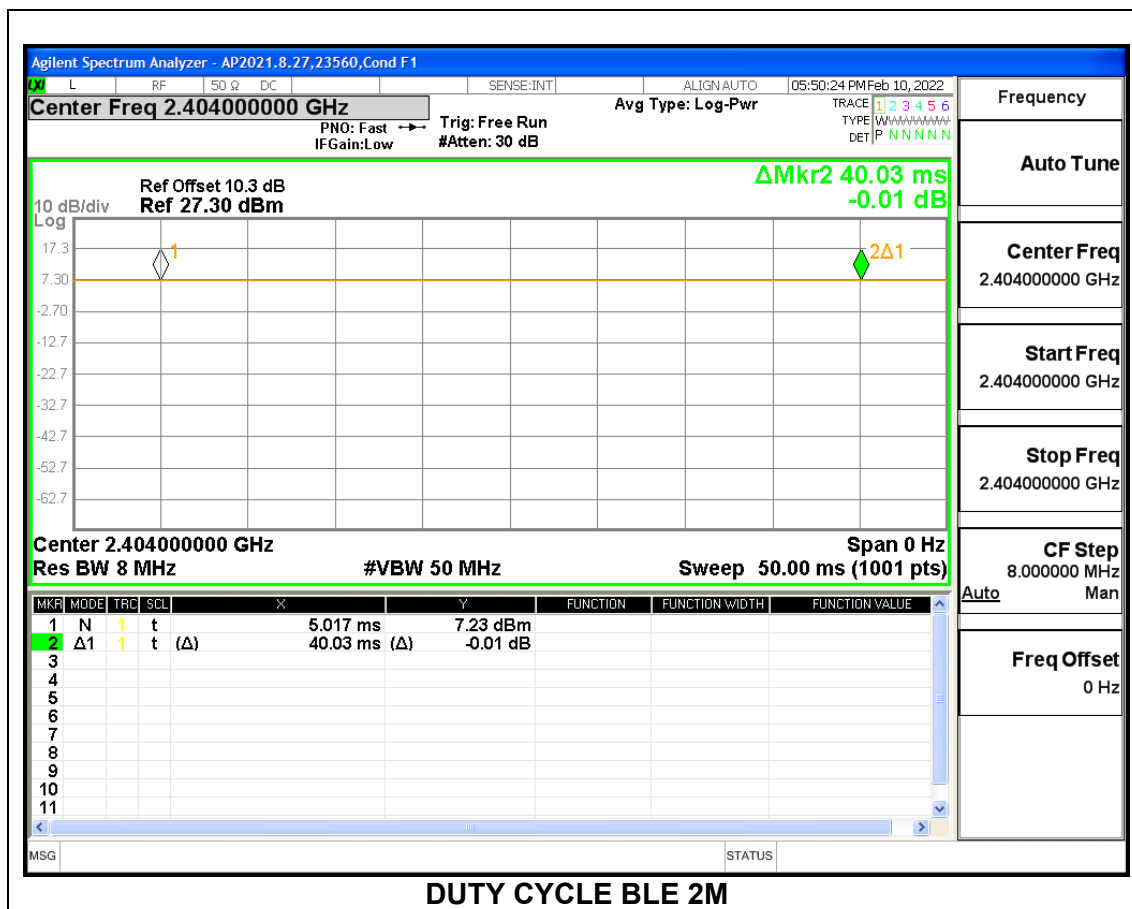
KDB 558074 Zero-Span Spectrum Analyzer Method.

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 1Mbps	40.030	40.030	1.000	100.00	0.00	0.010
BLE 2Mbps	40.030	40.030	1.000	100.00	0.00	0.010

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	1.0244
Middle	2440	1.0285
High	2480	1.0276



9.2.2. BLE (2Mbps)

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2404	2.0605
Middle	2440	2.0518
High	2478	2.0521



9.3. 6 dB BANDWIDTH

LIMITS

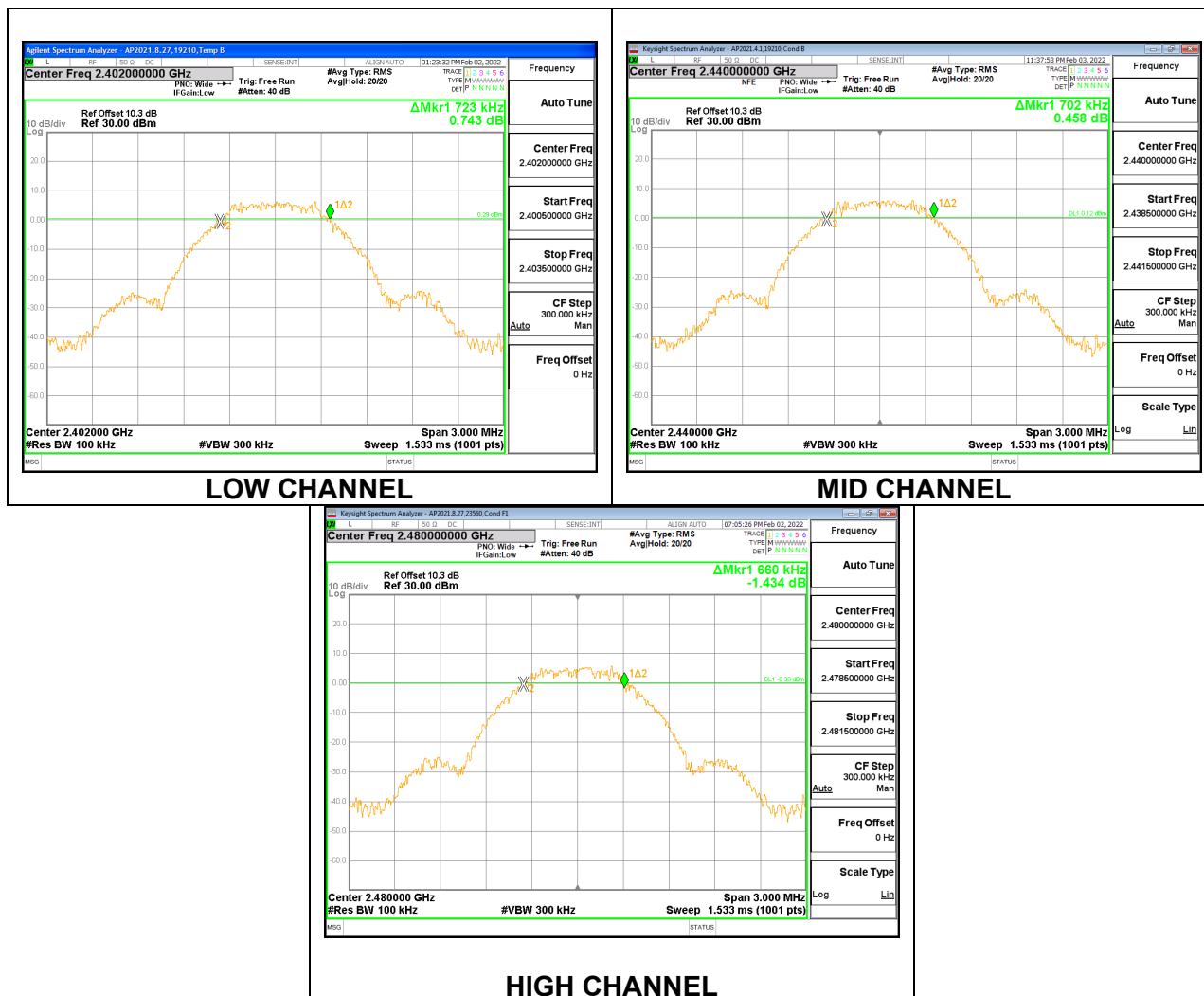
FCC §15.247 (a) (2)

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

RESULTS

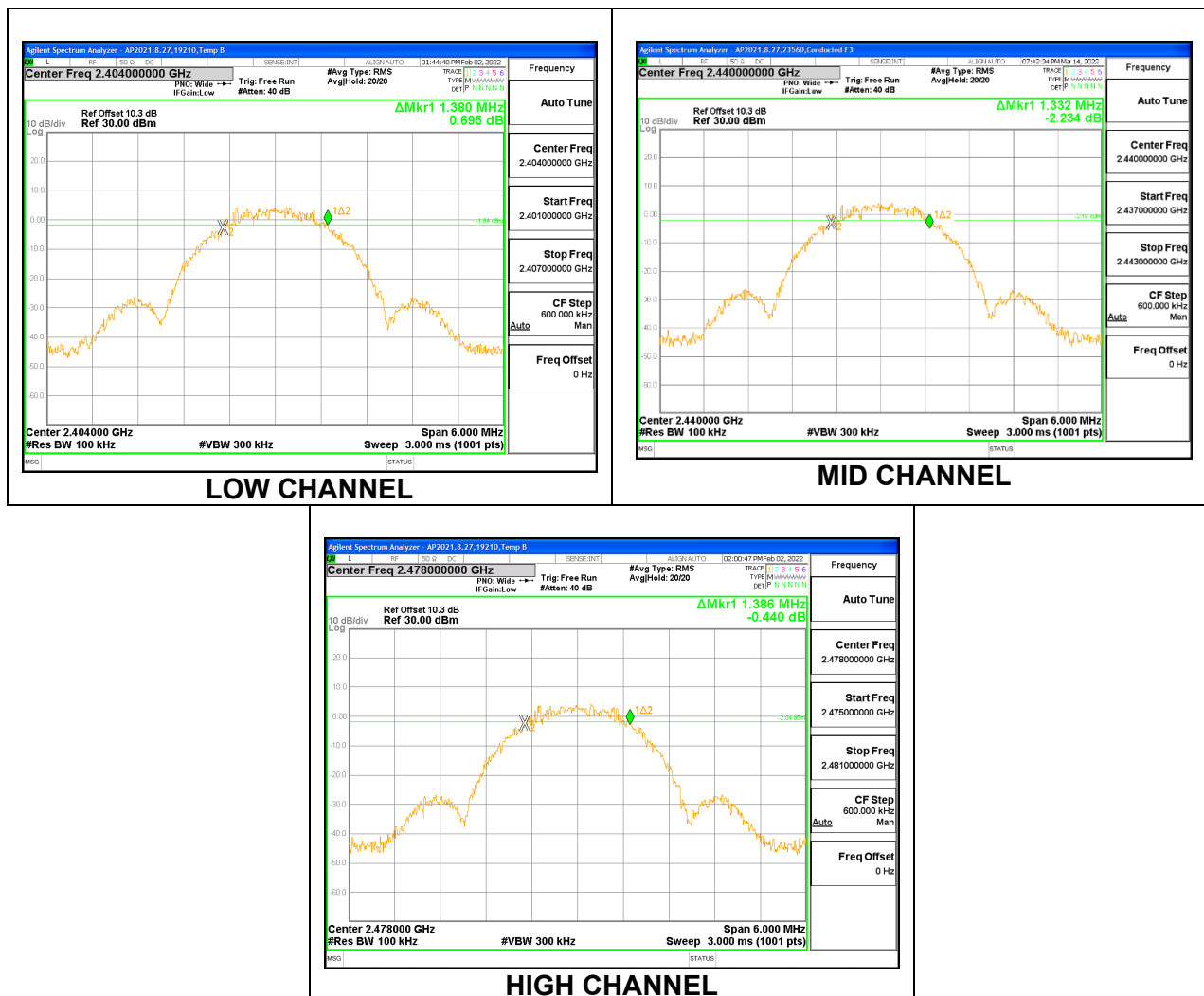
9.3.1. BLE (1Mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.7230	0.5
Middle	2440	0.7020	0.5
High	2480	0.6600	0.5



9.3.2. BLE (2Mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2404	1.3800	0.5
Middle	2440	1.3320	0.5
High	2478	1.3860	0.5



9.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

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 power meter.

The cable assembly insertion loss of 10.3 dB (including 10 dB pad and 0.3 dB cable) was entered as an offset in the power meter to allow for a peak reading of power.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband power sensor. Peak output power was read directly from power meter.

RESULTS

9.4.1. BLE (1Mbps)

Tested By:	23560
Date:	2/28/2022

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	6.74	30	-23.260
Middle	2440	6.66	30	-23.340
High	2480	6.49	30	-23.510

9.4.2. BLE (2Mbps)

Tested By:	23560
Date:	2/28/2022

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2404	6.75	30	-23.250
Middle	2440	6.69	30	-23.310
High	2478	6.49	30	-23.510

9.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.3 dB (including 10 dB pad and 0.3 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband power sensor. Gated average output power was read directly from power meter.

RESULTS

9.5.1. BLE (1Mbps)

Tested By:	23560
Date:	2/28/2022

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	6.66
Middle	2440	6.60
High	2480	6.41

9.5.2. BLE (2Mbps)

Tested By:	23560
Date:	2/28/2022

Channel	Frequency (MHz)	AV power (dBm)
Low	2404	6.67
Middle	2440	6.59
High	2478	6.39

9.6. POWER SPECTRAL DENSITY

LIMITS

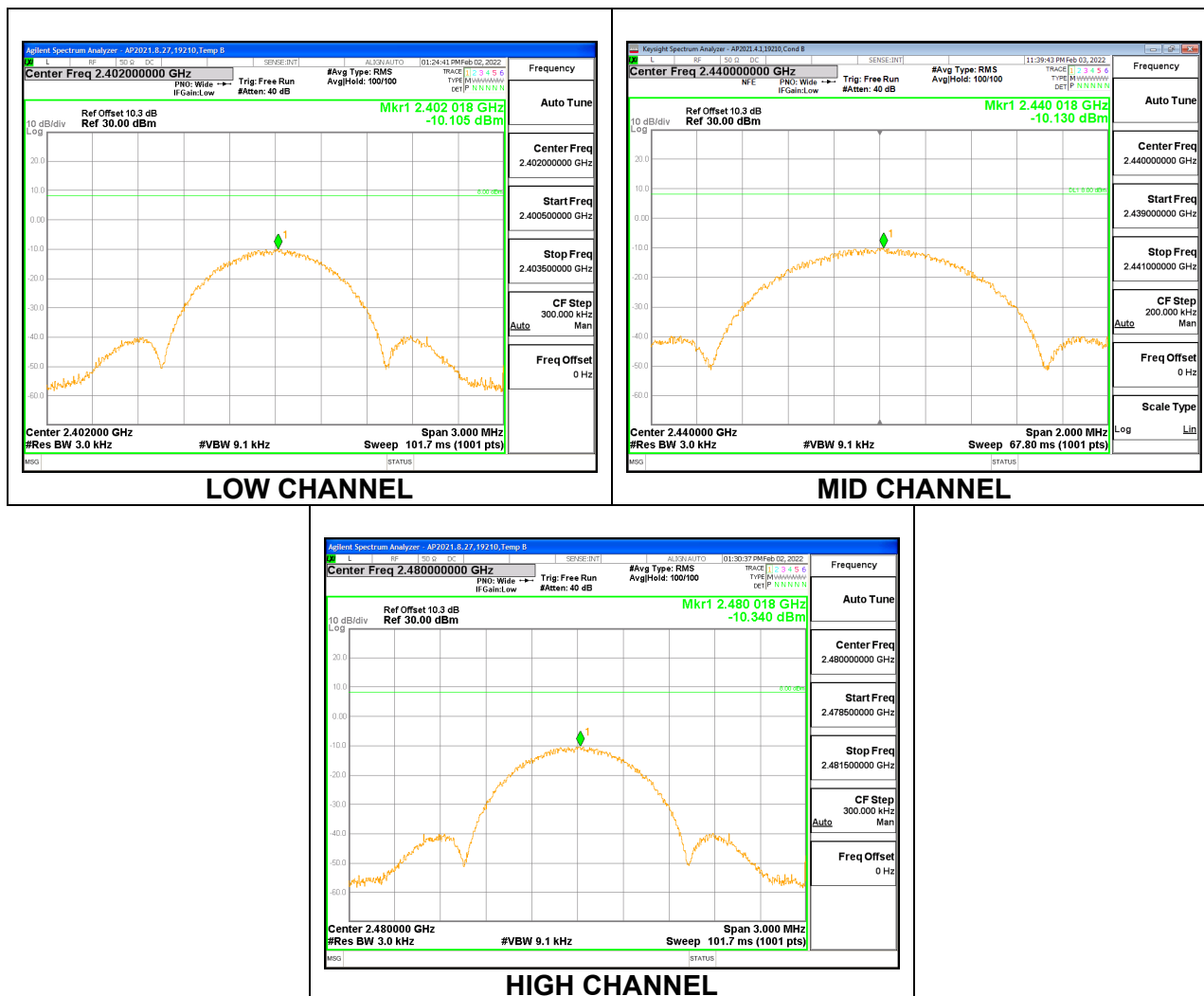
FCC §15.247 (e)

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

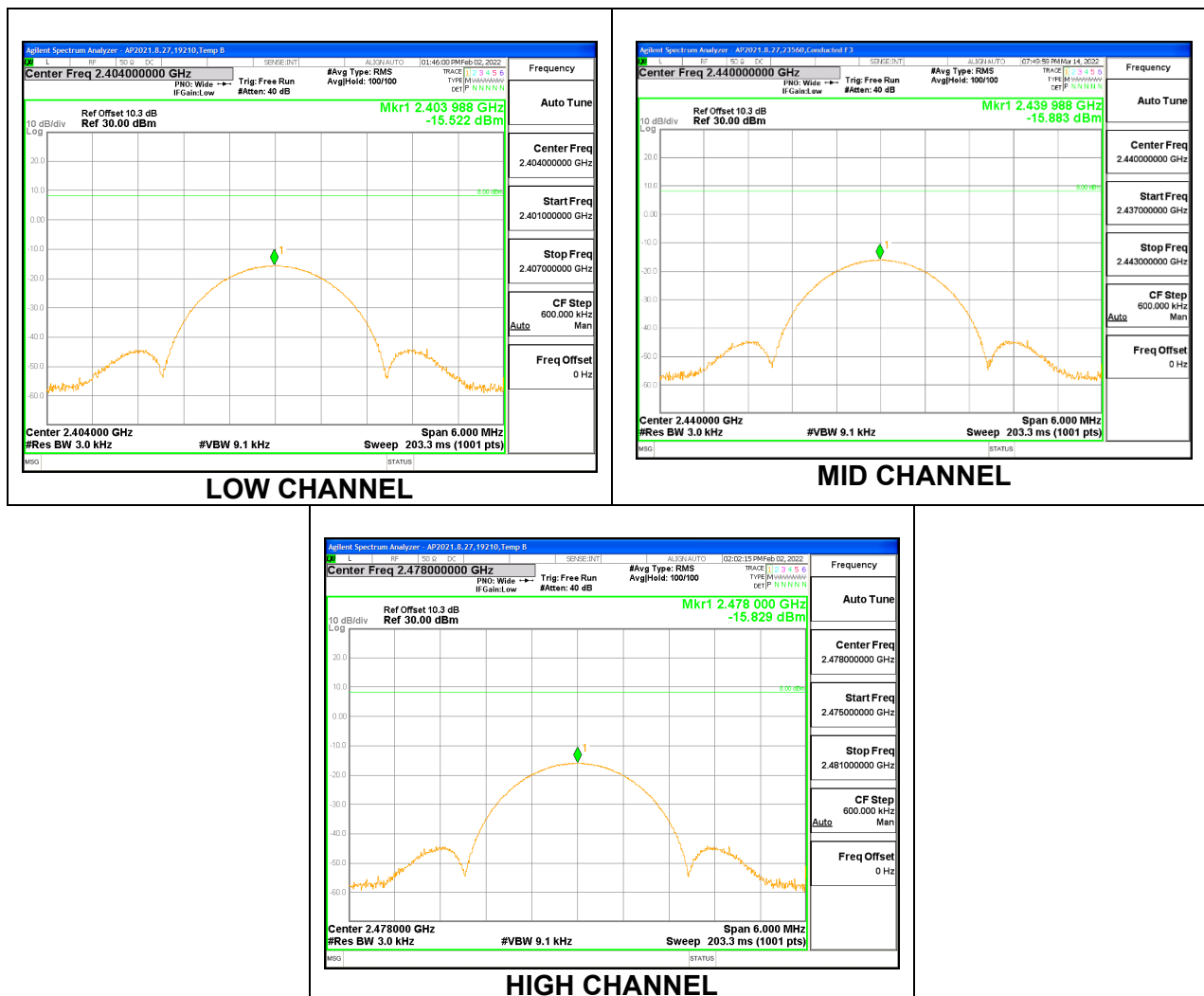
9.6.1. BLE (1Mbps)

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-10.105	8	-18.11
Middle	2440	-10.130	8	-18.13
High	2480	-10.340	8	-18.34



9.6.2. BLE (2Mbps)

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2404	-15.522	8	-23.52
Middle	2440	-15.883	8	-23.88
High	2478	-15.829	8	-23.83



9.7. CONDUCTED SPURIOUS EMISSIONS

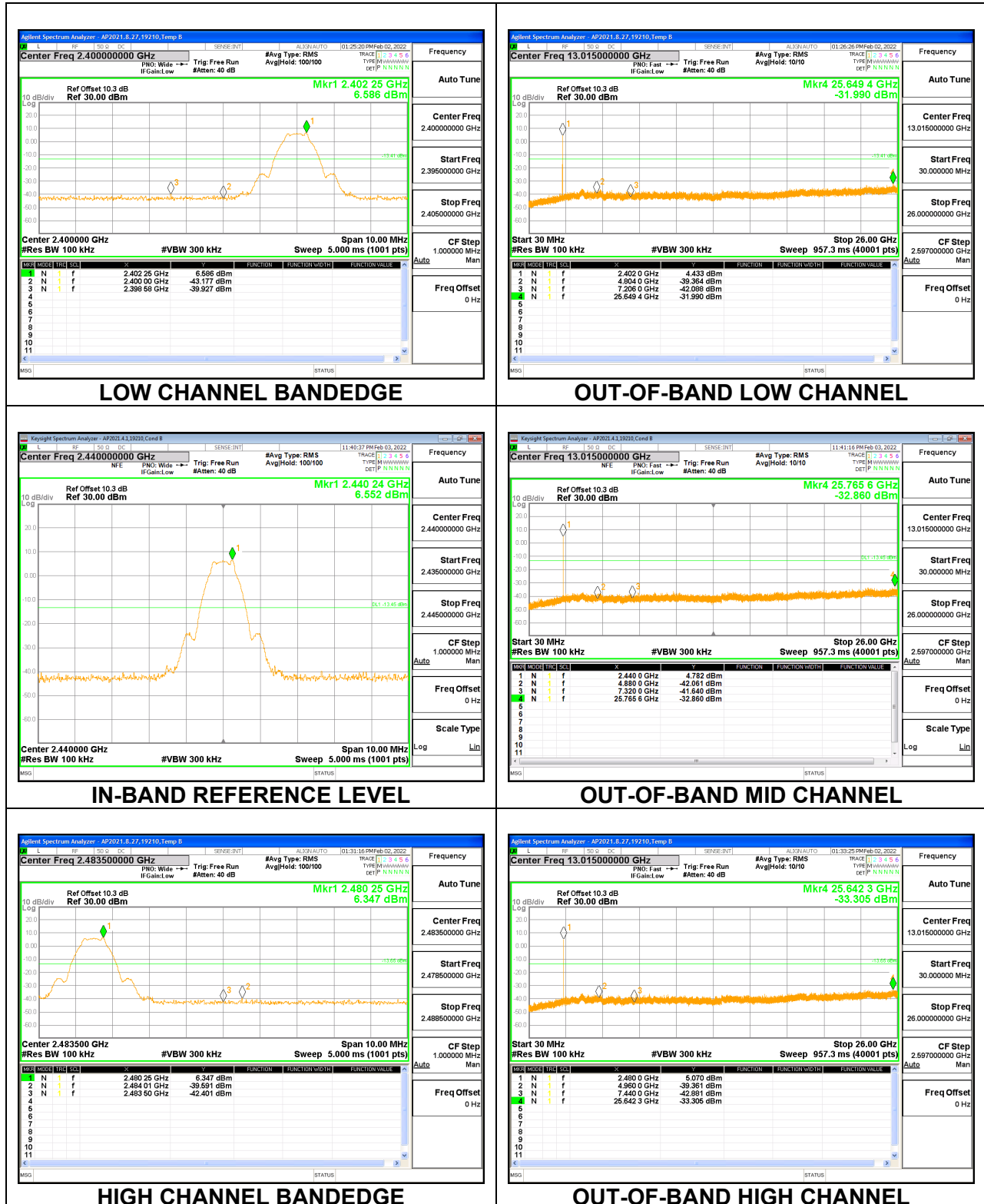
LIMITS

FCC §15.247 (d)

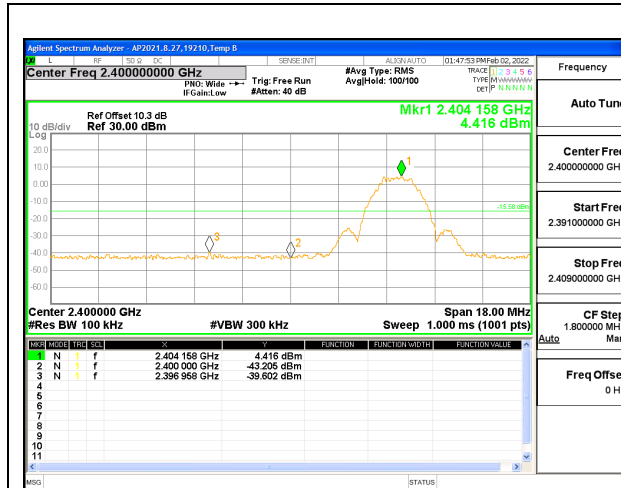
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

RESULTS

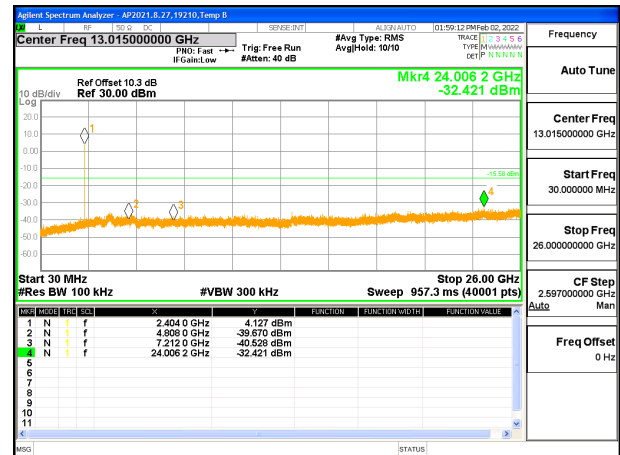
9.7.1. BLE (1Mbps)



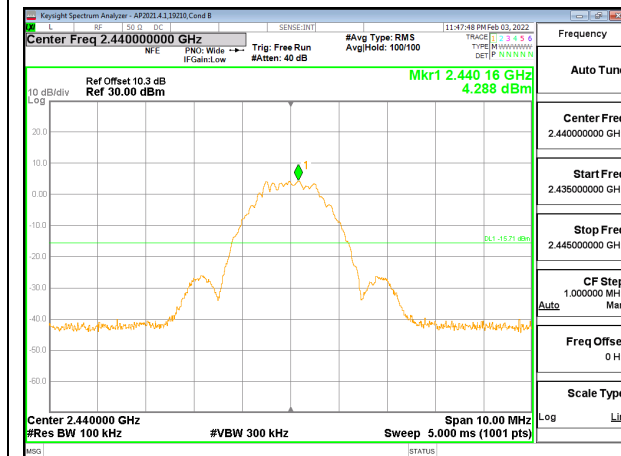
9.7.2. BLE (2Mbps)



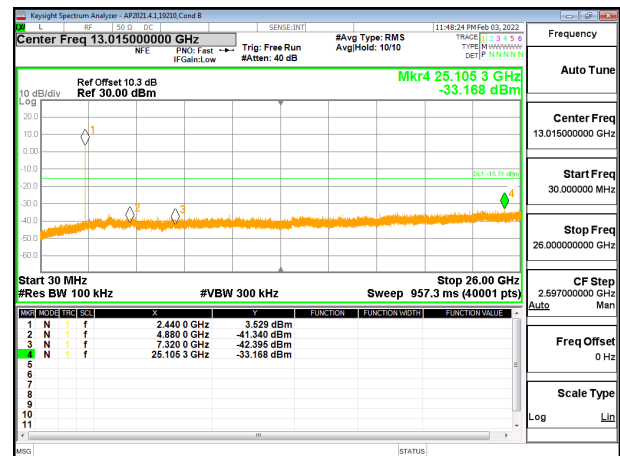
LOW CHANNEL BANDEDGE



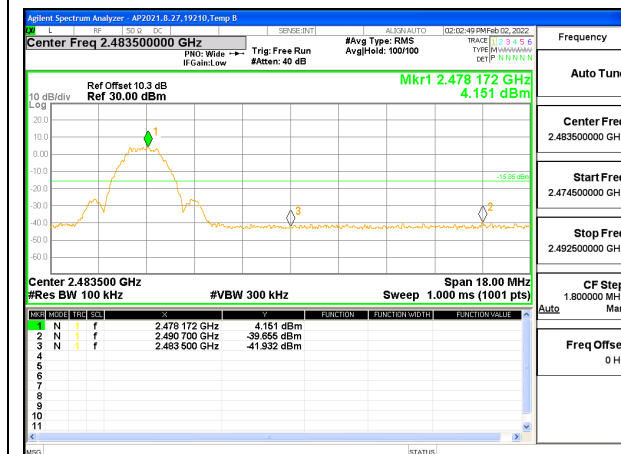
OUT-OF-BAND LOW CHANNEL



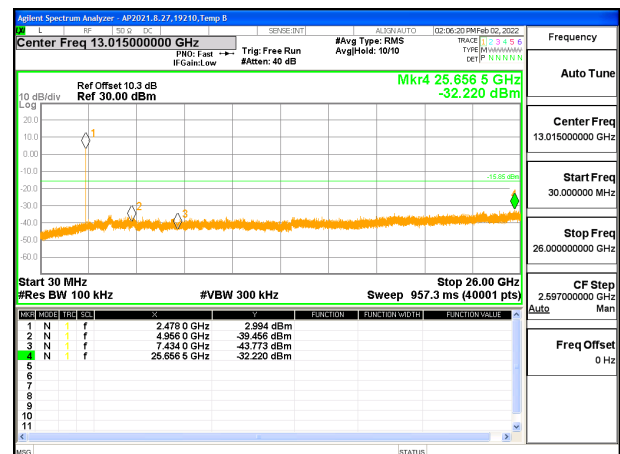
IN-BAND REFERENCE LEVEL



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

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. Peak detection is used unless otherwise noted as quasi-peak.

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz 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 average 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.

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

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.

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

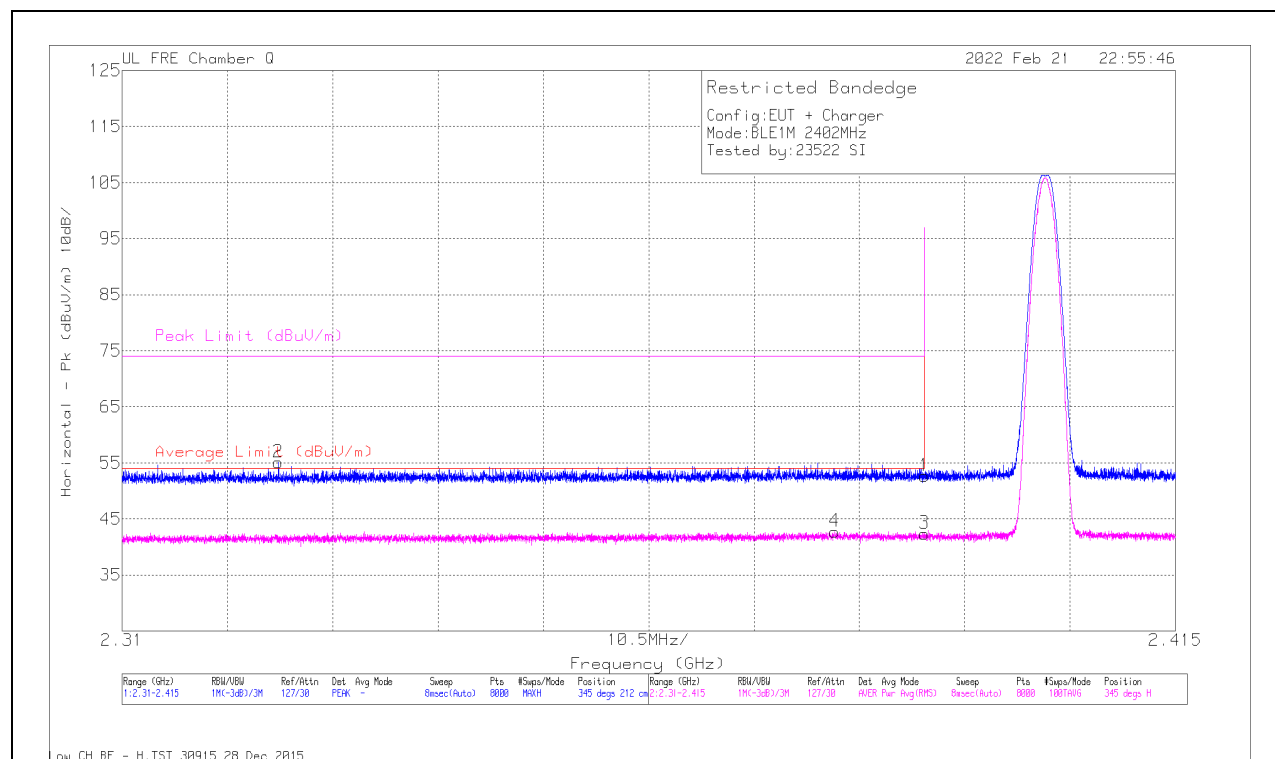
RESULTS

10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (1Mbps)

BANDEDGE (LOW CHANNEL)

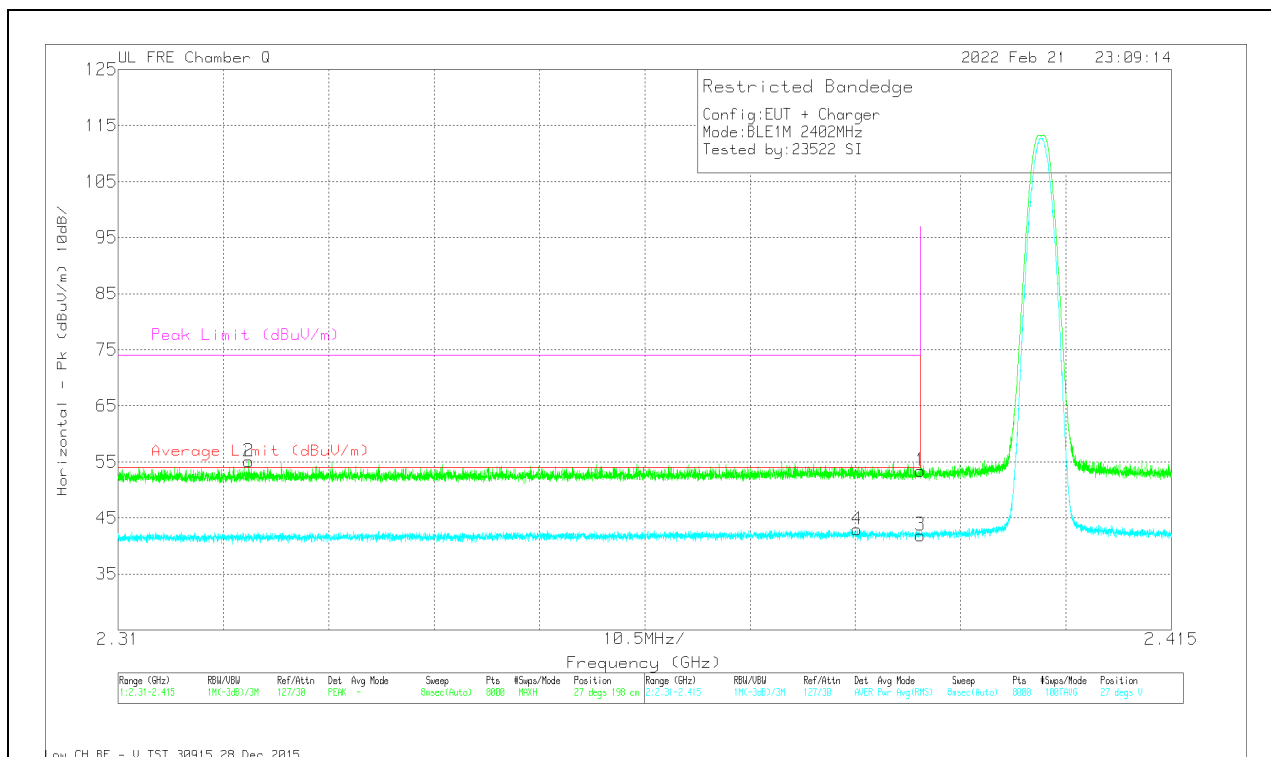
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200895 (dB/m)	Amp/Cbl/Filt r/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	2.39	55.05	Pk	31.9	-34.3	52.65	-	-	74	-21.35	345	212	H
2	2.325582	57.68	Pk	31.8	-34.4	55.08	-	-	74	-18.92	345	212	H
3	2.39	44.77	RMS	31.9	-34.3	42.37	54	-11.63	-	-	345	212	H
4	2.38103	45.12	RMS	32	-34.4	42.72	54	-11.28	-	-	345	212	H

Pk - Peak detector
RMS - RMS detection

VERTICAL RESULT

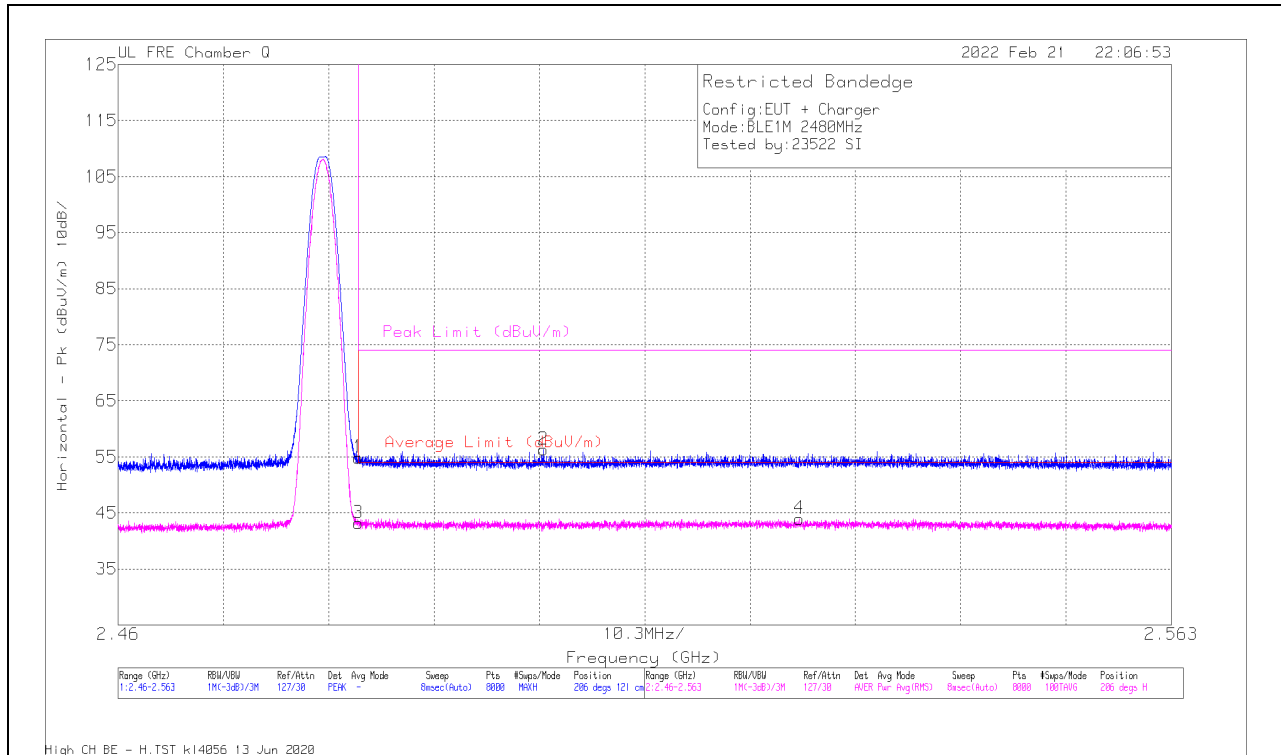


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200895 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.39	55.79	Pk	31.9	-34.3	53.39	-	-	74	-20.61	27	198	V
2	2.323022	57.66	Pk	31.8	-34.4	55.06	-	-	74	-18.94	27	198	V
3	2.39	44.3	RMS	31.9	-34.3	41.9	54	-12.1	-	-	27	198	V
4	2.383669	45.34	RMS	32	-34.4	42.94	54	-11.06	-	-	27	198	V

Pk - Peak detector
RMS - RMS detection

BANDEDGE (HIGH CHANNEL)

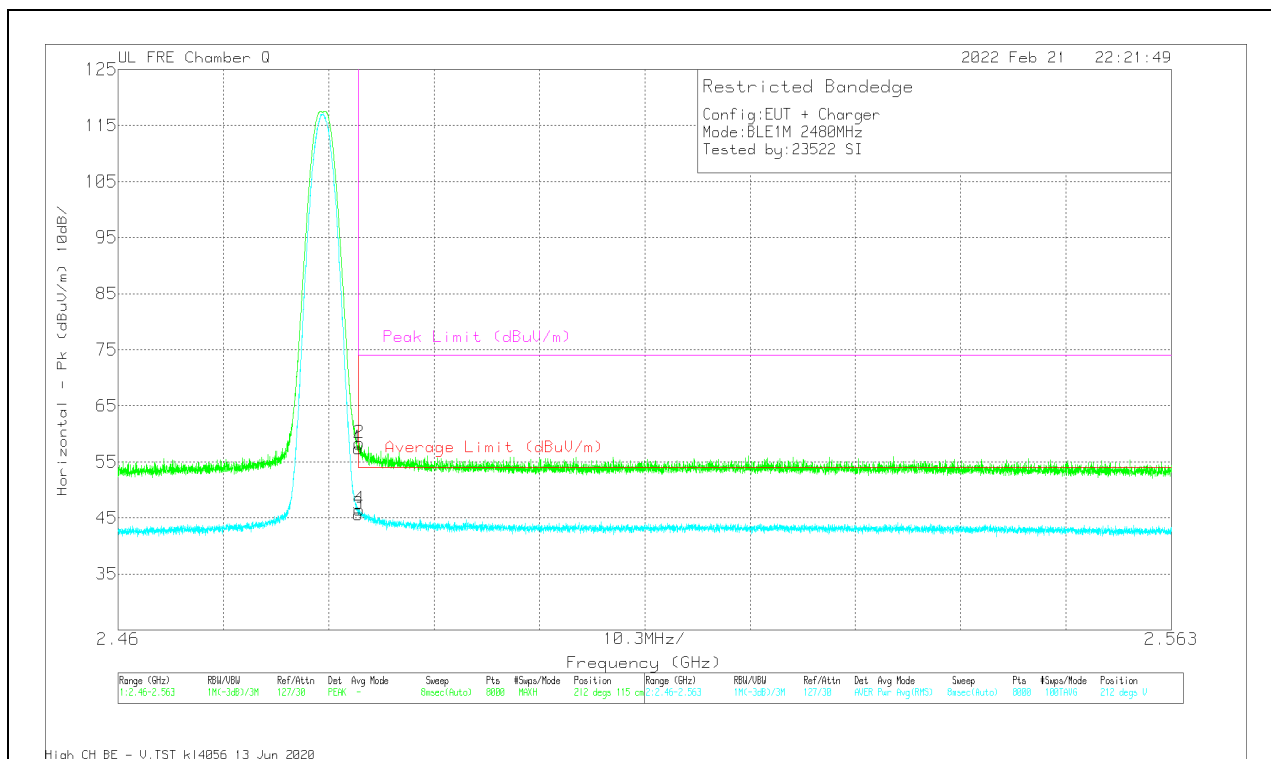
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200895 (dB/m)	Amp/Cbl/Fit/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	2.4835	56.55	Pk	32.6	-34.3	54.85	-	-	74	-19.15	206	121	H
2	2.501606	57.77	Pk	32.7	-34.2	56.27	-	-	74	-17.73	206	121	H
3	2.4835	44.87	RMS	32.6	-34.3	43.17	54	-10.83	-	-	206	121	H
4	2.526613	45.46	RMS	32.7	-34.2	43.96	54	-10.04	-	-	206	121	H

Pk - Peak detector
RMS - RMS detection

VERTICAL RESULT

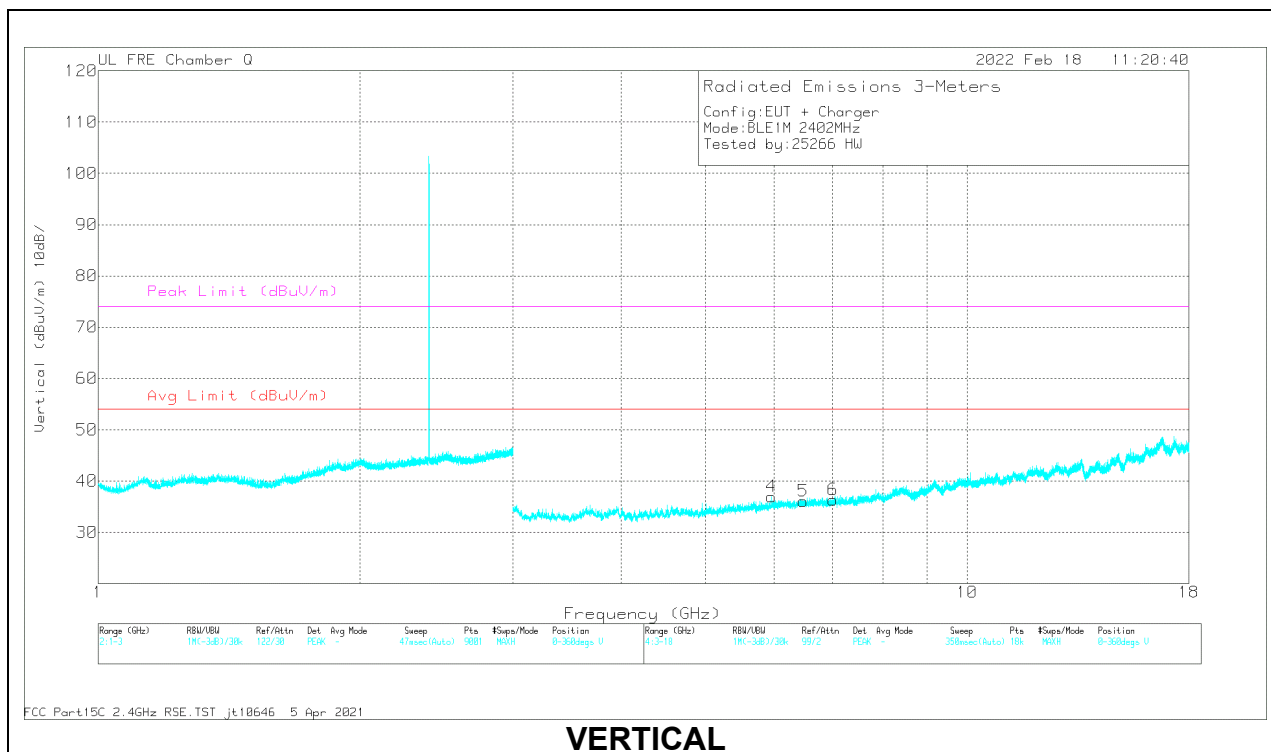
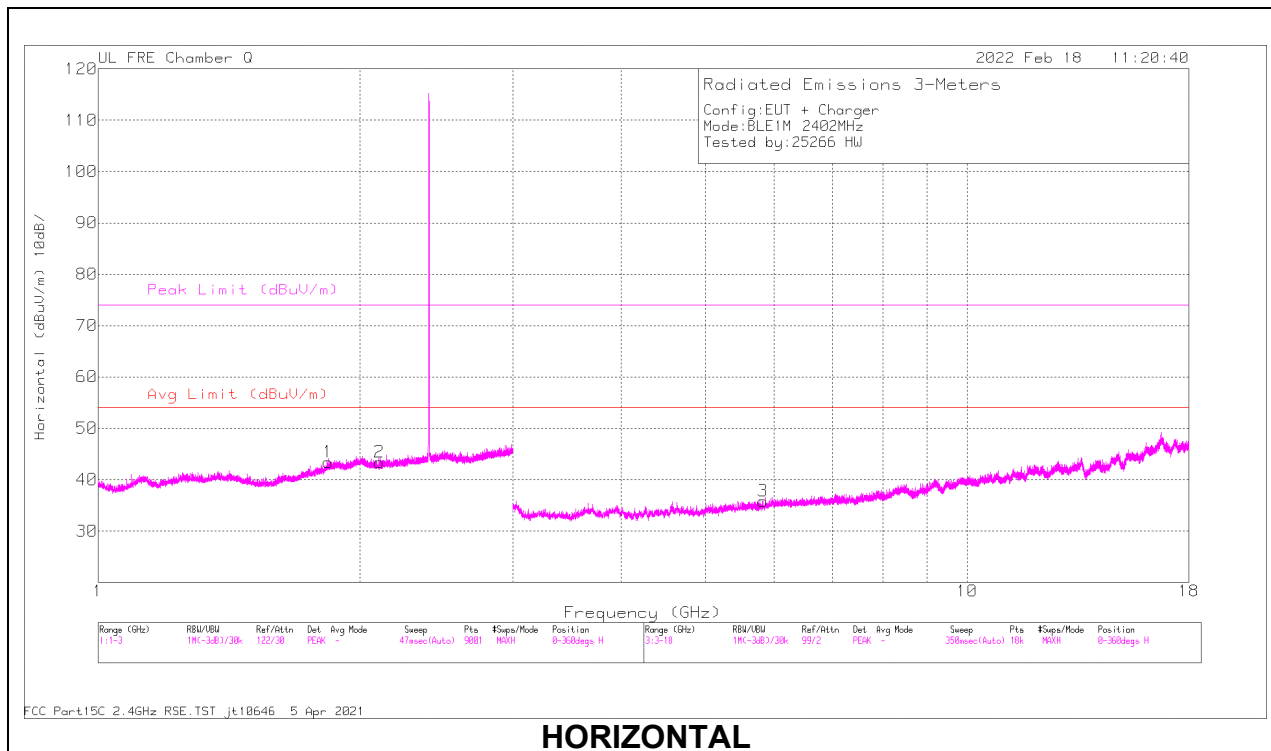


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200895 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.4835	59.12	Pk	32.6	-34.3	57.42	-	-	74	-16.58	212	115	V
2	2.483578	60.03	Pk	32.6	-34.3	58.33	-	-	74	-15.67	212	115	V
3	2.4835	47.31	RMS	32.6	-34.3	45.61	54	-8.39	-	-	212	115	V
4	2.483578	48.19	RMS	32.6	-34.3	46.49	54	-7.51	-	-	212	115	V

Pk - Peak detector
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS

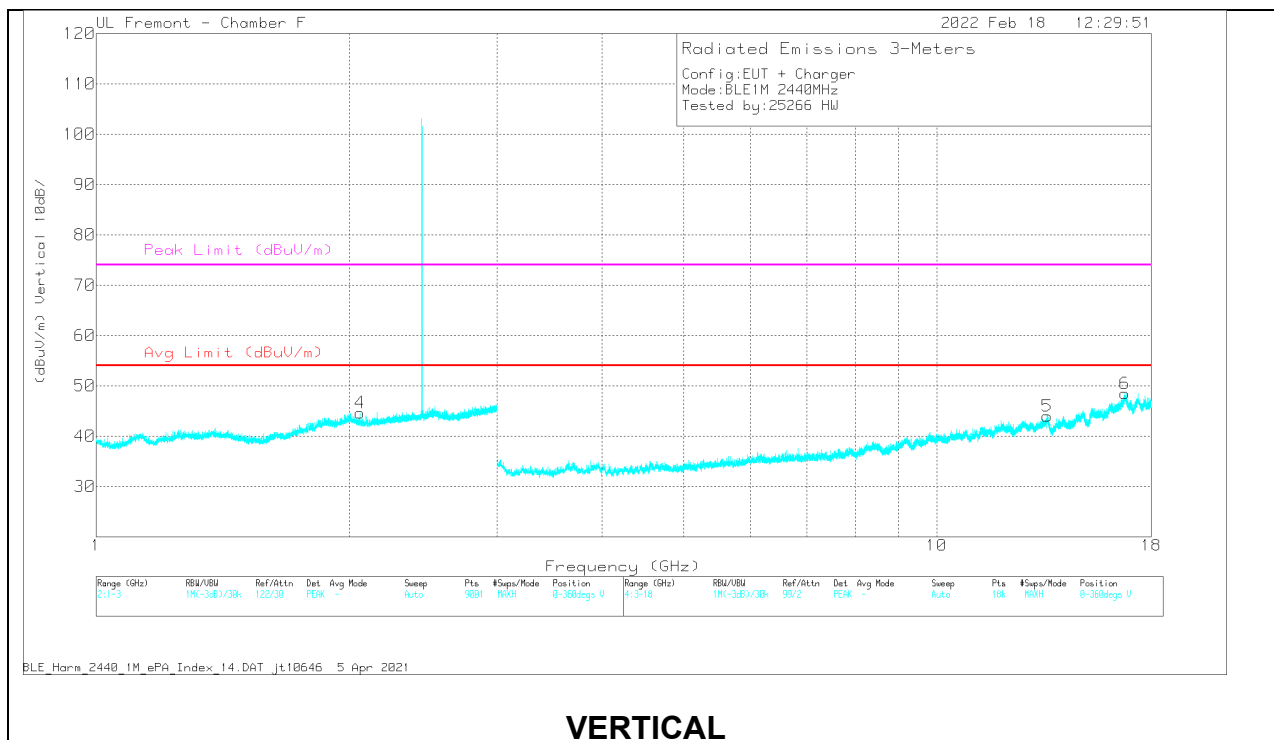
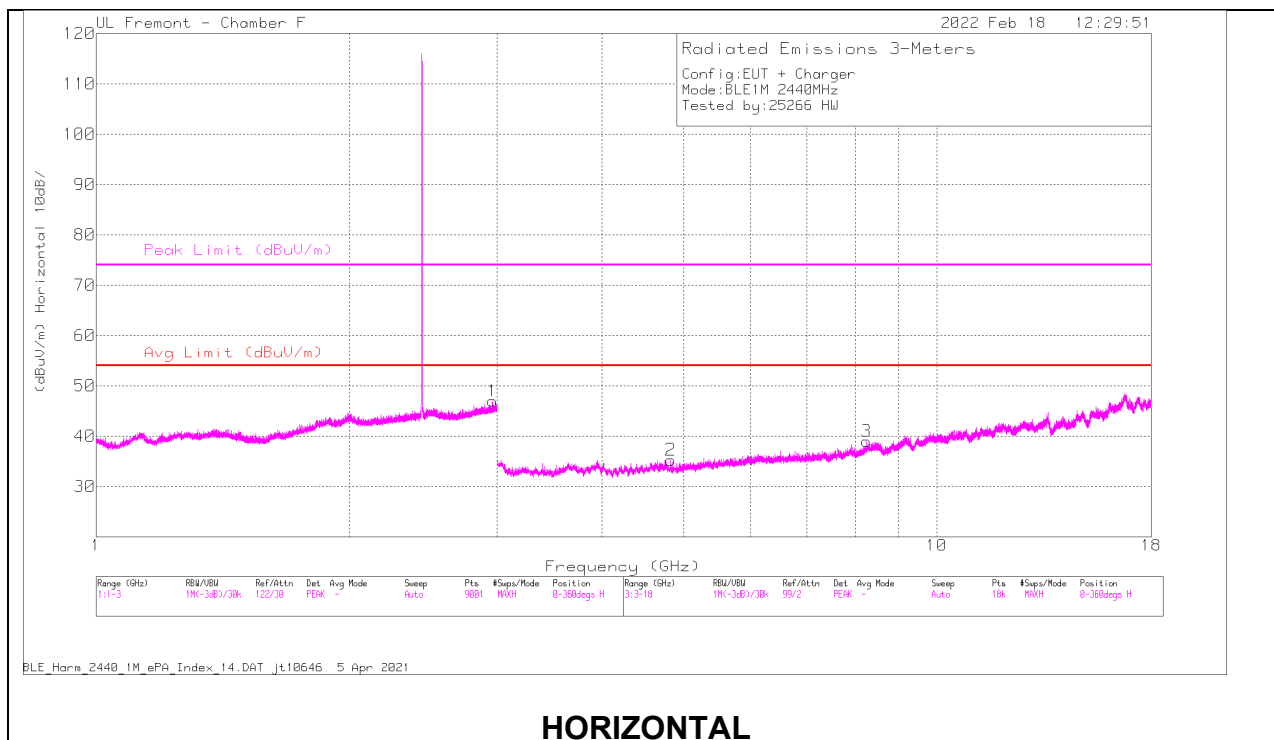


RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200895 (dB/m)	Amp/Cbl/Fil tr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.840348	57.54	PK2	30.7	-34.8	53.44	74	-20.56	360	100	H
2	2.109032	57.47	PK2	30.9	-34.5	53.87	74	-20.13	360	100	H
3	5.821227	49.76	PK2	34.9	-39.1	45.56	74	-28.44	360	100	H
4	5.957441	49.29	PK2	35.2	-38.6	45.89	74	-28.11	360	100	V
5	6.477933	48.76	PK2	35.6	-38.3	46.06	74	-27.94	360	100	V
6	7.005189	48.64	PK2	35.7	-38	46.34	74	-27.66	360	100	V

PK2 - KDB558074 Method: Maximum Peak
MAV1 - KDB558074 Option 1 Maximum RMS Average

MID CHANNEL RESULTS



RADIATED EMISSIONS

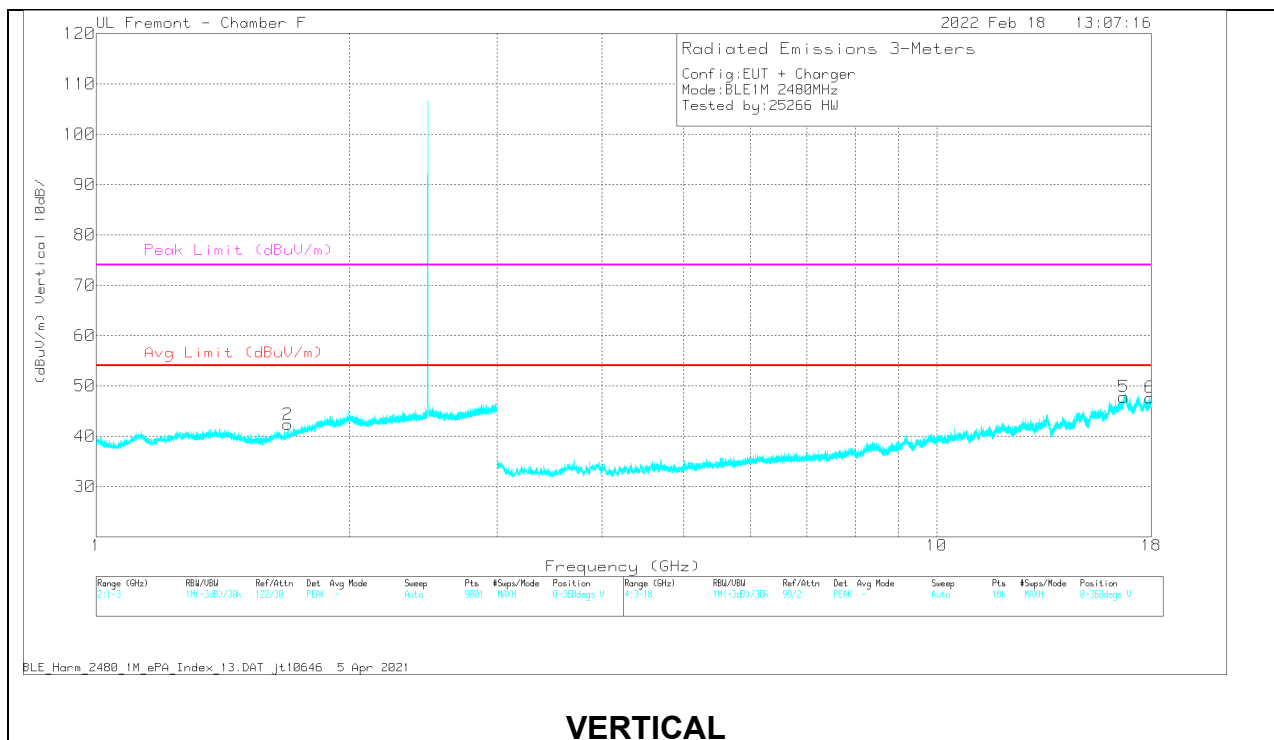
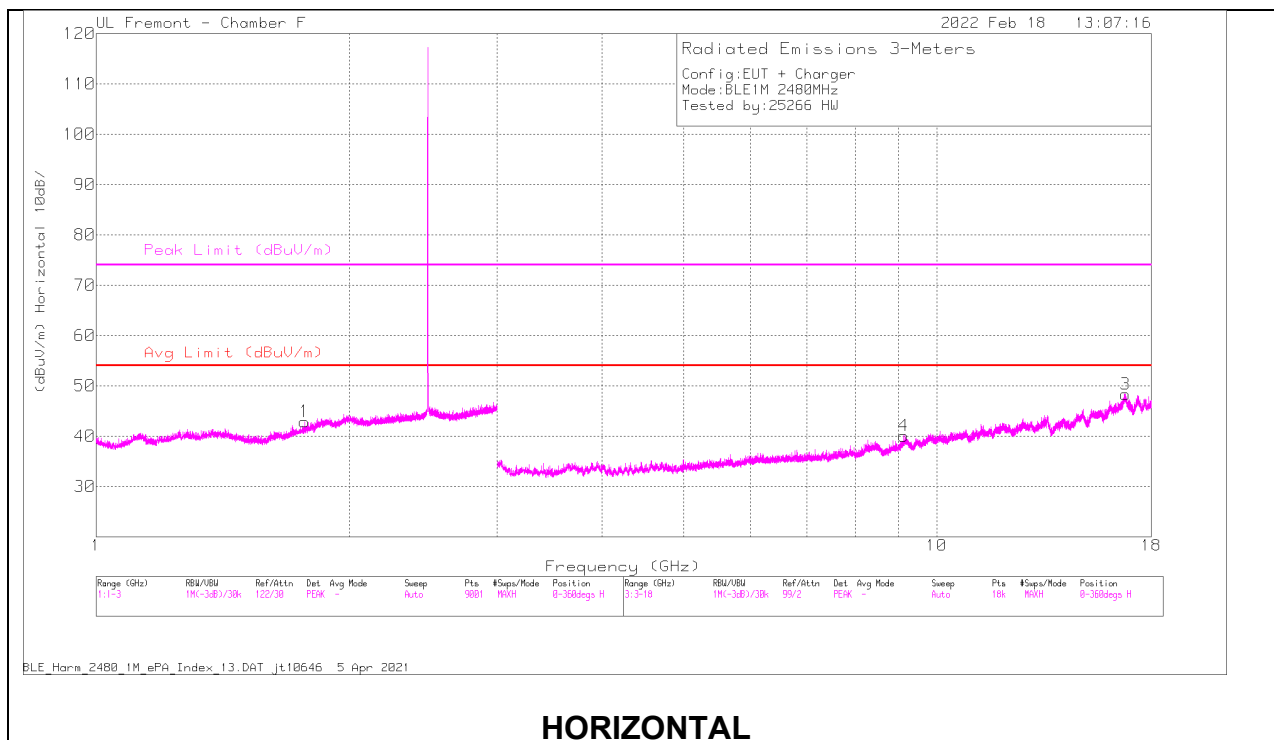
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200895 (dB/m)	Amp/Cbl/ Filt/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.965931	56.98	PK2	32.6	-33.5	56.08	-	-	-	-	52	312	H
2	* 4.826351	51.7	PK2	34	-41.2	44.5	-	-	74	-29.5	10	208	H
	* 4.826647	39.41	MAv1	34	-41.2	32.21	54	-21.79	-	-	10	208	H
3	* 8.249524	47.88	PK2	36	-36.2	47.68	-	-	74	-26.32	98	390	H
	* 8.245816	36.53	MAv1	36	-36.2	36.33	54	-17.67	-	-	98	390	H
4	2.060226	56.82	PK2	31.1	-34.5	53.42	-	-	-	-	231	266	V
5	13.531377	46.95	PK2	38.9	-32.2	53.65	-	-	-	-	160	118	V
6	16.751378	48.5	PK2	41.8	-32.2	58.1	-	-	-	-	8	240	V

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200895 (dB/m)	Amp/Cbl/Ftr/Pa d (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.769542	56.72	PK2	29.6	-34.9	51.42	-	-	-	-	300	128	H
2	* 9.139201	48.42	PK2	36.3	-35.7	49.02	-	-	74	-24.98	159	199	H
	* 9.137926	36.85	MAv1	36.3	-35.7	37.45	54	-16.55	-	-	159	199	H
3	16.769942	48.11	PK2	41.8	-32.5	57.41	-	-	-	-	355	116	H
4	* 1.691124	57.04	PK2	28.7	-35	50.74	-	-	74	-23.26	208	280	V
	* 1.690864	45.14	MAv1	28.7	-35	38.84	54	-15.16	-	-	208	280	V
5	* 17.943855	47.18	PK2	41.2	-31.8	56.58	-	-	74	-17.42	18	226	V
	* 17.946608	35.46	MAv1	41.3	-31.9	44.86	54	-9.14	-	-	18	226	V
6	16.697294	47.64	PK2	41.7	-32.1	57.24	-	-	-	-	168	334	V

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

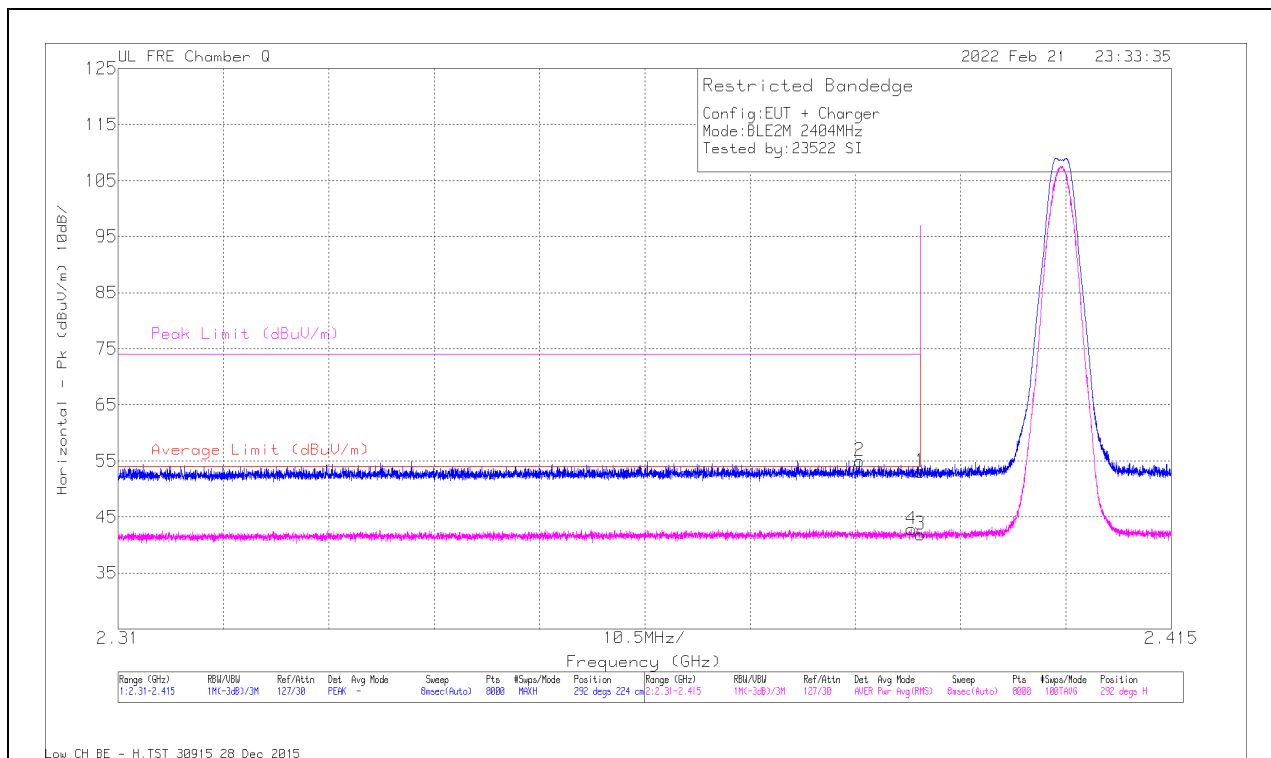
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

10.2.2. BLE (2Mbps)

BANDEDGE (LOW CHANNEL)

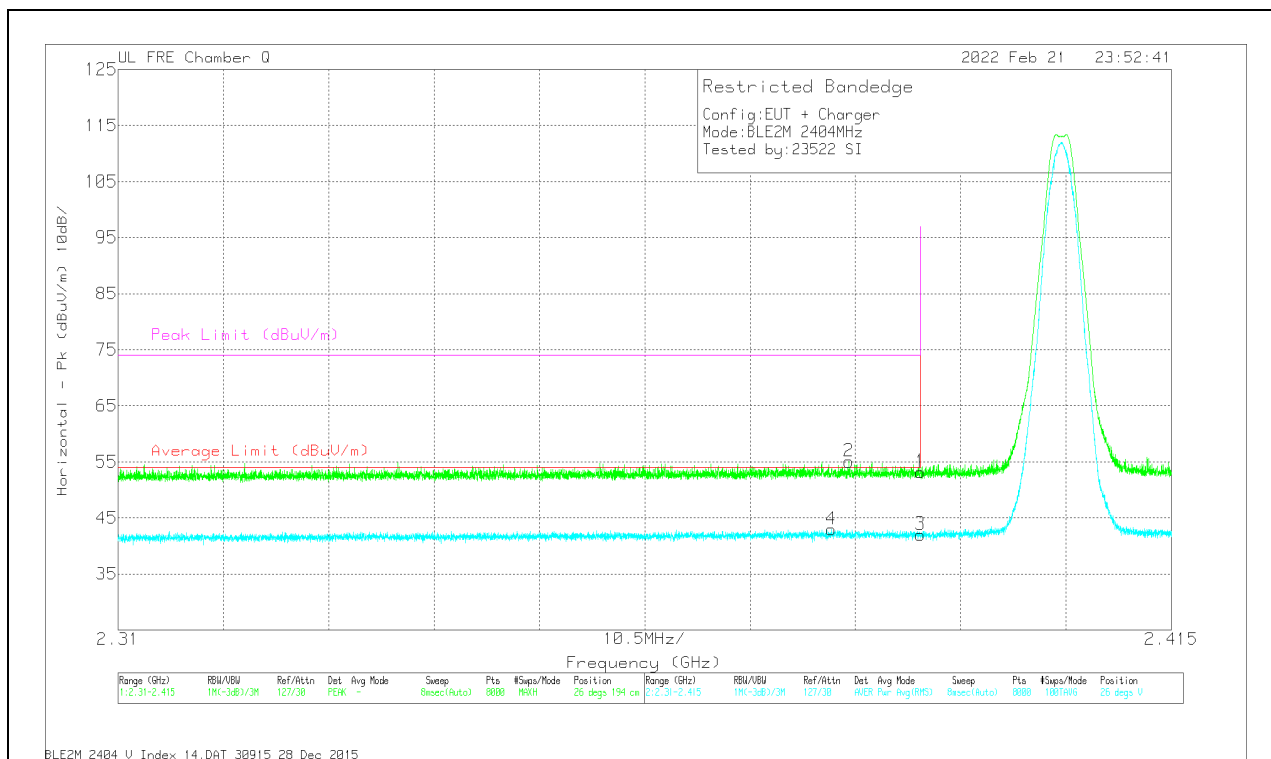
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200895 (dB/m)	Amp/Cbl/Fil tr/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	2.39	55.49	Pk	31.9	-34.3	53.09	-	-	74	-20.91	292	224	H
2	2.383905	57.4	Pk	32	-34.4	55	-	-	74	-19	292	224	H
3	2.39	44.3	RMS	31.9	-34.3	41.9	54	-12.1	-	-	292	224	H
4	2.389077	45.32	RMS	31.9	-34.4	42.82	54	-11.18	-	-	292	224	H

Pk - Peak detector
RMS - RMS detection

VERTICAL RESULT

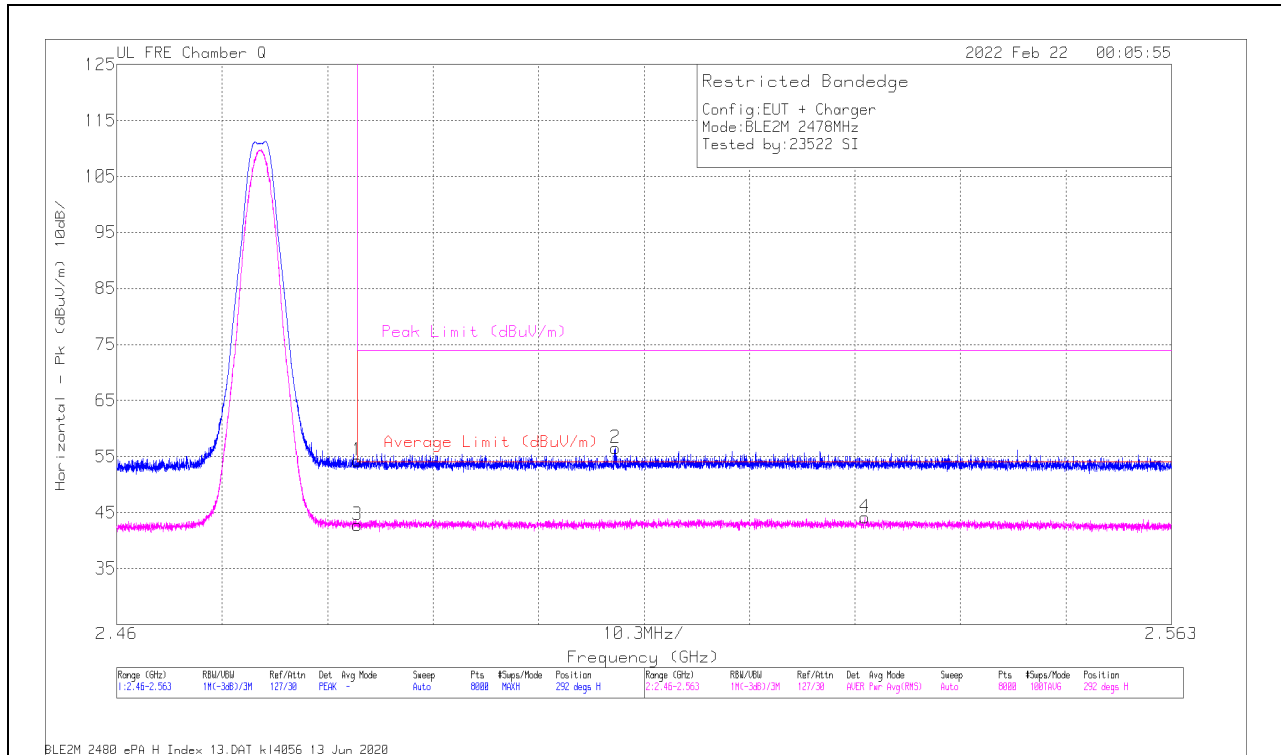


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200895 (dB/m)	Amp/Cbl/Fil tr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.39	55.55	Pk	31.9	-34.3	53.15	-	-	74	-20.85	26	194	V
2	2.382842	57.45	Pk	32	-34.4	55.05	-	-	74	-18.95	26	194	V
3	2.39	44.4	RMS	31.9	-34.3	42	54	-12	-	-	26	194	V
4	2.381083	45.35	RMS	32	-34.4	42.95	54	-11.05	-	-	26	194	V

Pk - Peak detector
RMS - RMS detection

BANDEDGE (HIGH CHANNEL)

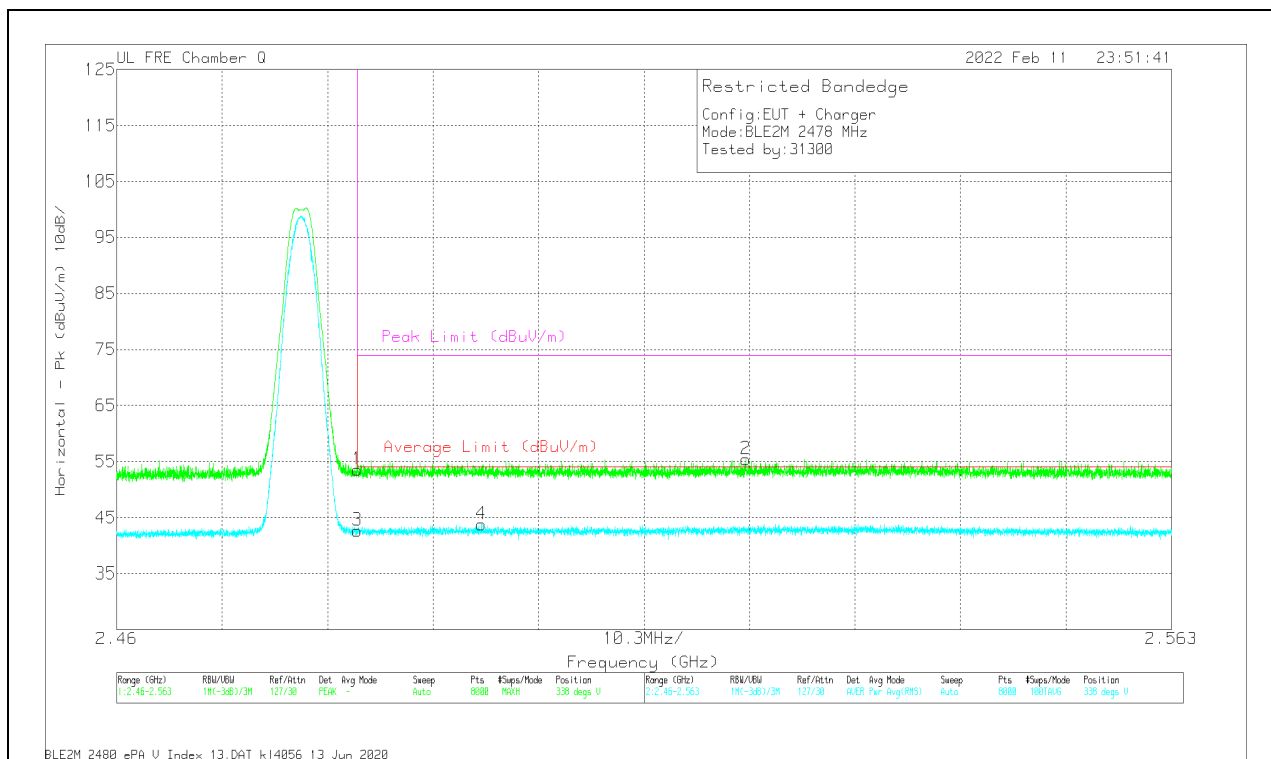
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200895 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarization
1	2.4835	56.02	Pk	32.6	-34.3	54.32	-	-	74	-19.68	292	262	H
2	2.508701	58.05	Pk	32.7	-34.2	56.55	-	-	74	-17.45	292	262	H
3	2.4835	44.5	RMS	32.6	-34.3	42.8	54	-11.2	-	-	292	262	H
4	2.533051	45.61	RMS	32.7	-34.2	44.11	54	-9.89	-	-	292	262	H

Pk - Peak detector
RMS - RMS detection

VERTICAL RESULT

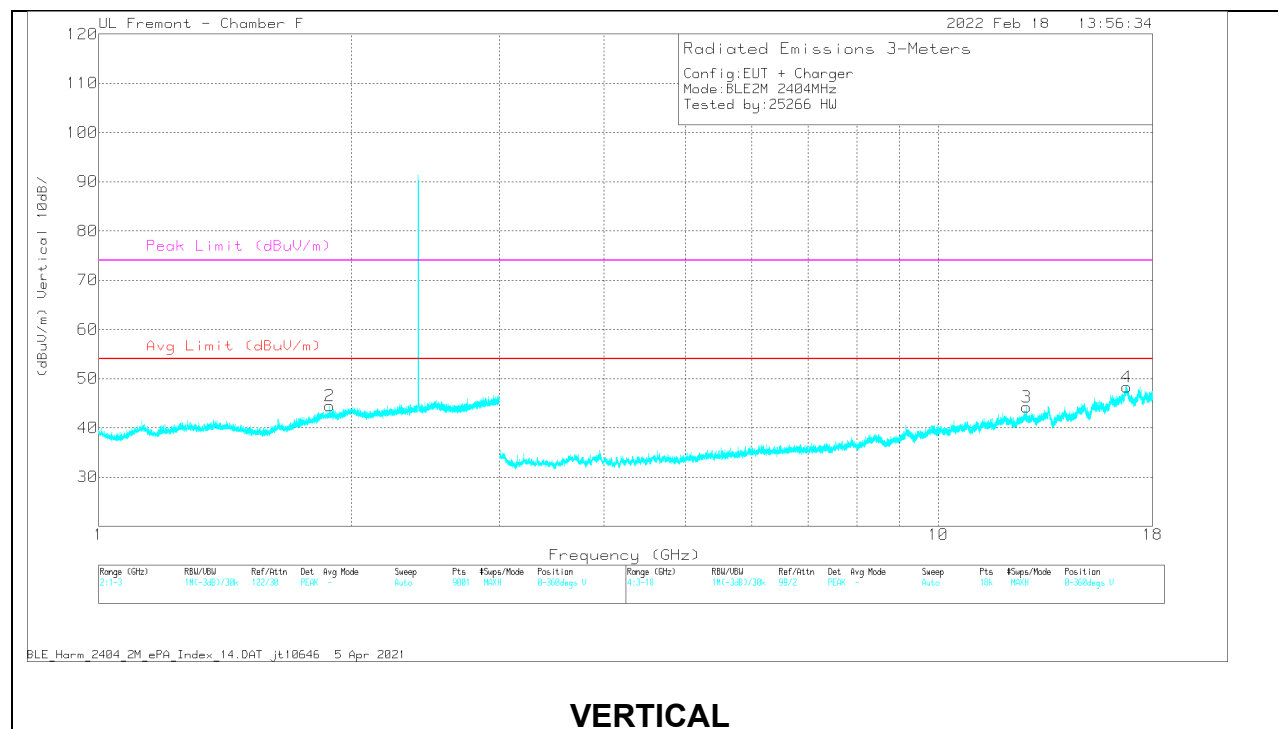
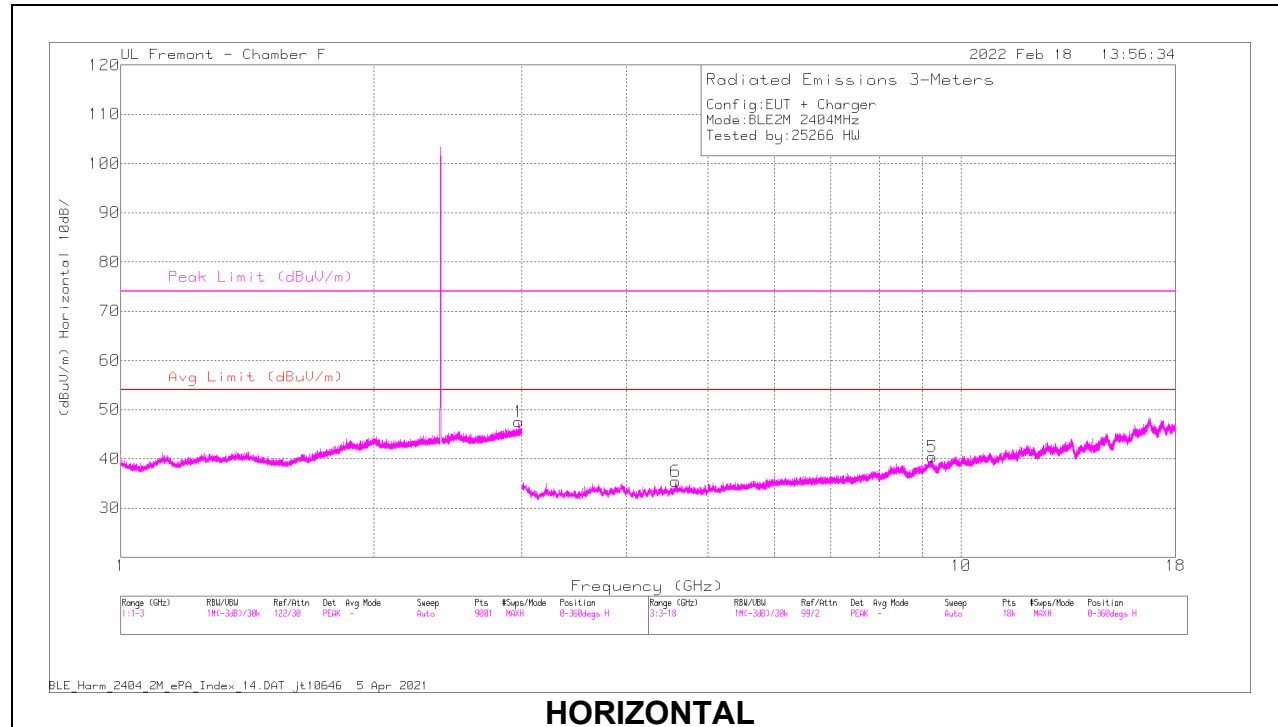


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200895 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.4835	55.29	Pk	32.6	-34.4	53.49	-	-	74	-20.51	338	221	V
2	2.521436	56.94	Pk	32.8	-34.3	55.44	-	-	74	-18.56	338	221	V
3	2.4835	44.42	RMS	32.6	-34.4	42.62	54	-11.38	-	-	338	221	V
4	2.495618	45.42	RMS	32.7	-34.3	43.82	54	-10.18	-	-	338	221	V

Pk - Peak detector
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

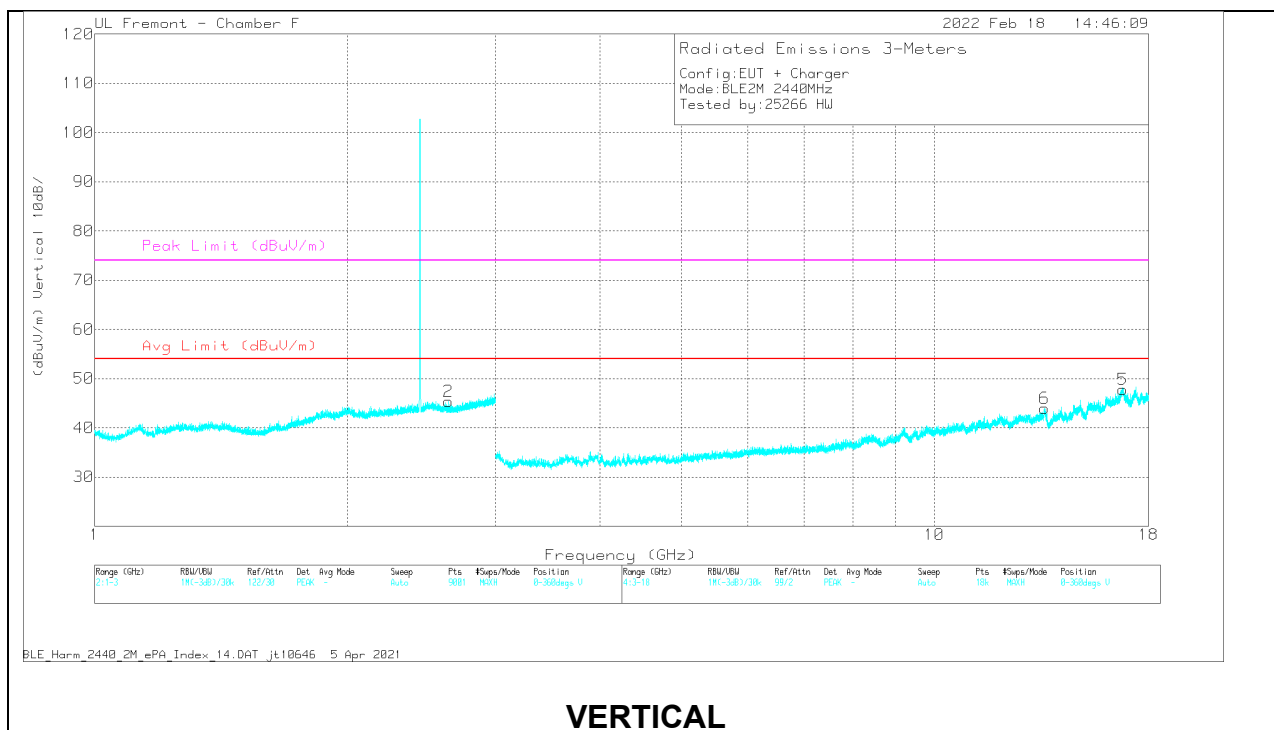
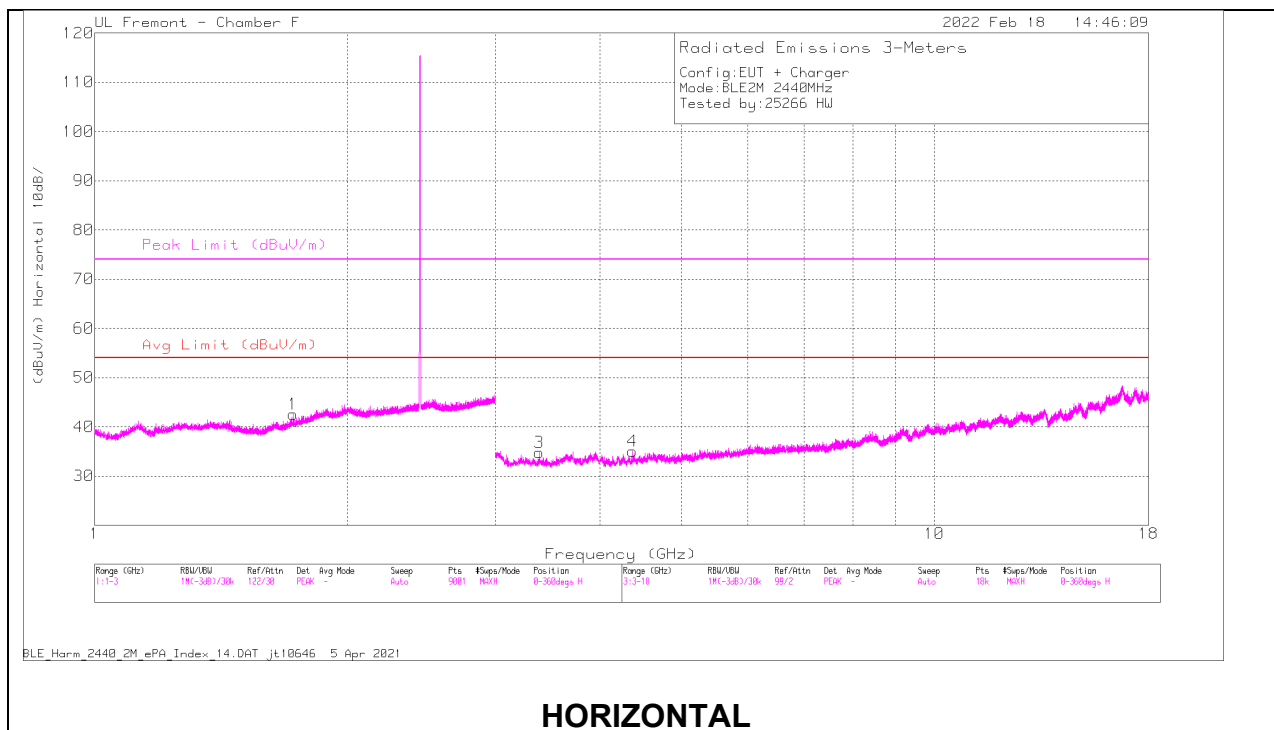
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200895 (dB/m)	Amp/Cbl /Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.977956	56.98	PK2	32.7	-33.4	56.28	-	-	-	-	207	319	H
2	1.886215	57.25	PK2	31.1	-34.7	53.65	-	-	-	-	358	235	V
3	12.746663	47.17	PK2	39.4	-34.4	52.17	-	-	-	-	63	270	V
4	16.764312	47.8	PK2	41.8	-32.4	57.2	-	-	-	-	132	194	V
6	* 4.575979	52.08	PK2	34.1	-41.5	44.68	-	-	74	-29.32	145	155	H
	* 4.575792	40.41	MAv1	34.1	-41.5	33.01	54	-20.99	-	-	145	155	H
5	9.240587	48.4	PK2	36.3	-35.2	49.5	-	-	-	-	317	272	H

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

MID CHANNEL RESULTS

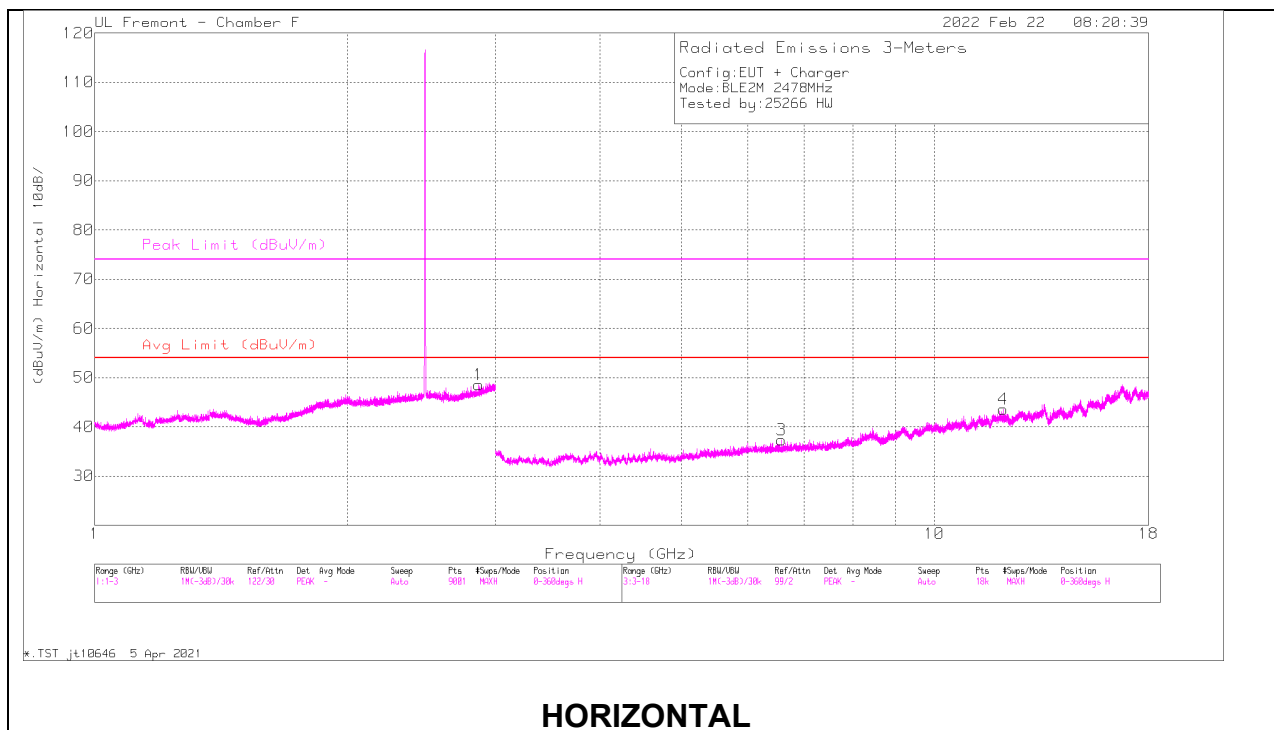


RADIATED EMISSIONS

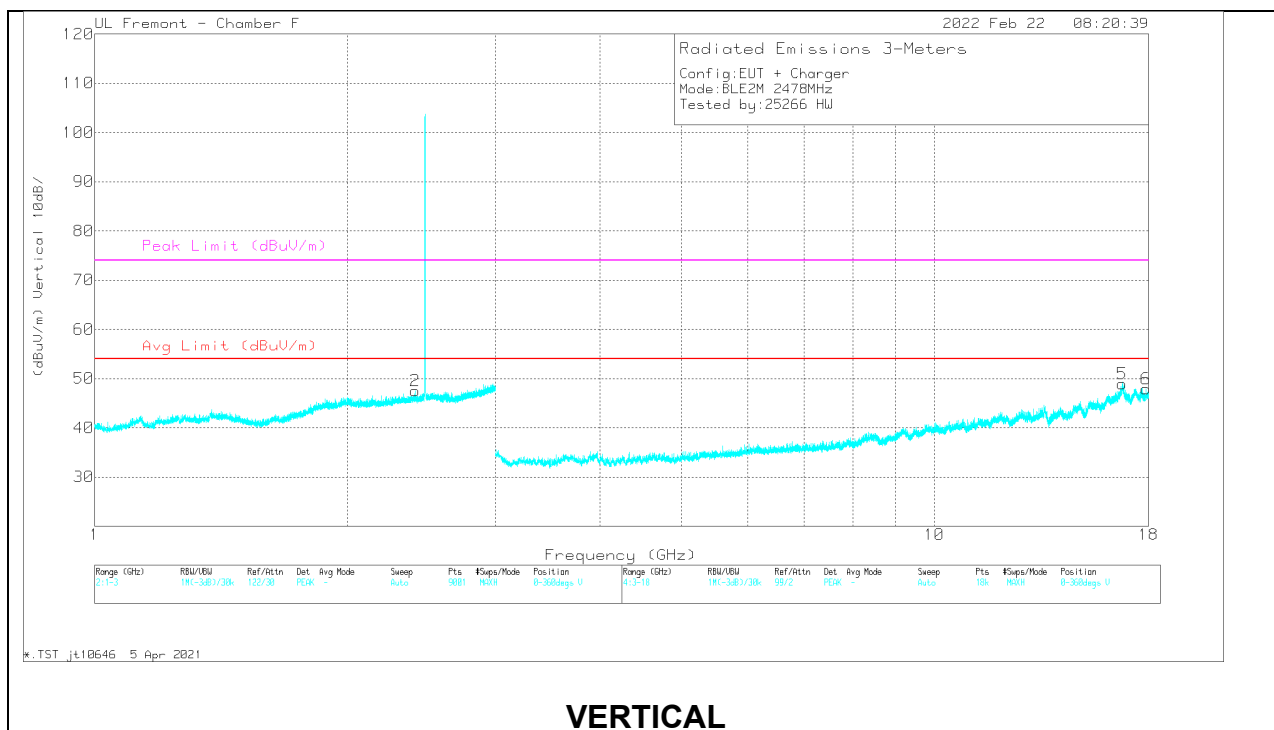
Markers	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200895 (dB/m)	Amp/Cb I/Filtr/Pa d (dB)	Correct ed Readin g (dBuV/ m)	Avg Limit (dBuV/ m)	Margin (dB)	Peak Limit (dBuV/ m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.719287	45.27	MAv1	29.3	-34.9	39.67	54	-14.33	-	-	345	187	H
	1.721927	56.76	PK2	29.3	-35	51.06	-	-	74	-22.94	345	187	H
2	2.635287	44.76	MAv1	31.7	-33.9	42.56	-	-	-	-	303	336	V
	2.635651	56.82	PK2	31.7	-33.9	54.62	-	-	-	-	303	336	V
3	3.385187	40.3	MAv1	32.6	-41.1	31.8	-	-	-	-	258	135	H
	3.386138	51.98	PK2	32.6	-41.2	43.38	-	-	-	-	258	135	H
4	4.374522	51.58	PK2	33.7	-41.3	43.98	-	-	74	-30.02	223	183	H
	4.376359	40.05	MAv1	33.7	-41.4	32.35	54	-21.65	-	-	223	183	H
6	13.525927	46.46	PK2	39	-32.3	53.16	-	-	-	-	185	236	V
	13.526502	35.1	MAv1	39	-32.3	41.8	-	-	-	-	185	236	V
5	16.766421	36.25	MAv1	41.8	-32.4	45.65	-	-	-	-	87	234	V
	16.767412	48.3	PK2	41.8	-32.4	57.7	-	-	-	-	87	234	V

PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 200895 (dB/m)	Amp/Cbl/Fit r/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	2.405547	58.79	PK2	32	-34.3	56.49	-	-	-	-	165	344	V
1	*2.865684	58.92	PK2	32.2	-33.7	57.42	-	-	74	-16.58	347	276	H
	*2.86741	47.32	MAv1	32.3	-33.7	45.92	54	-8.08	-	-	347	276	H
3	6.577546	48.38	PK2	35.6	-38.3	45.68	-	-	-	-	40	400	H
4	*12.074169	48.13	PK2	39	-35.1	52.03	-	-	74	-21.97	257	369	H
	*12.075496	36.25	MAv1	39	-35	40.25	54	-13.75	-	-	257	369	H
5	16.758822	48.41	PK2	41.8	-32.3	57.91	-	-	-	-	174	178	V
6	*17.869848	47.66	PK2	41.3	-31.7	57.26	-	-	74	-16.74	212	323	V
	*17.868133	35.62	MAv1	41.4	-31.8	45.22	54	-8.78	-	-	212	323	V

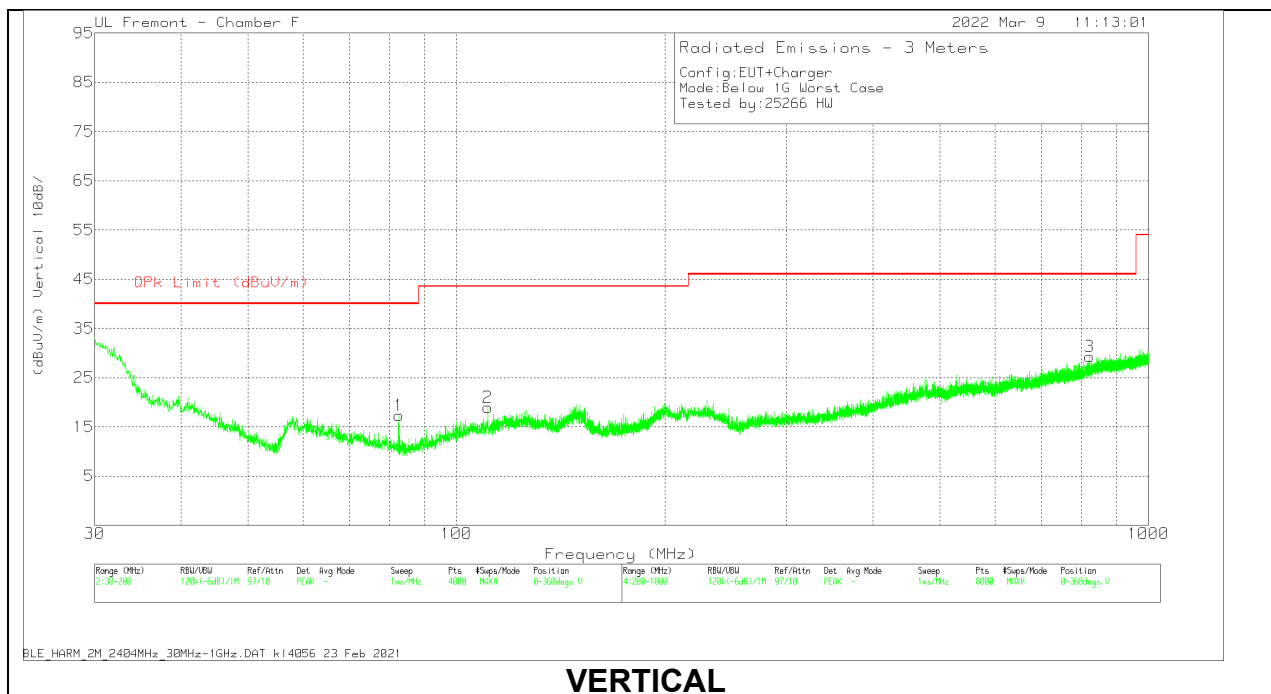
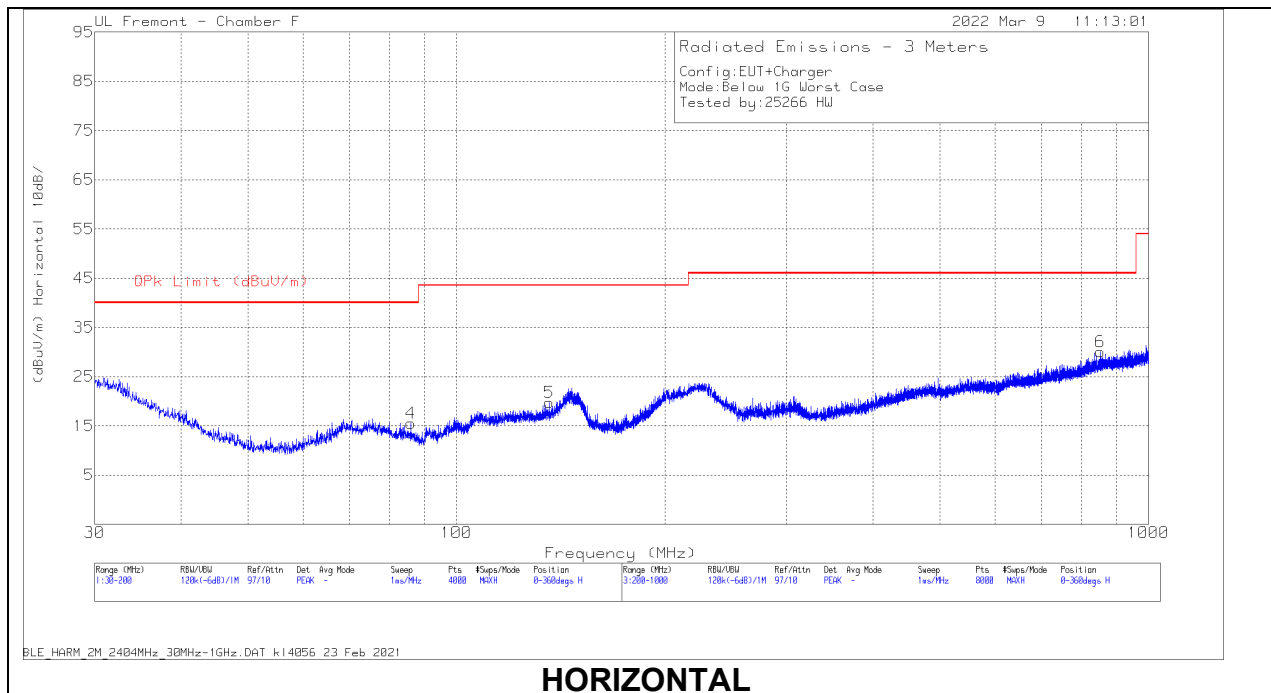
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

10.2.3. WORST CASE BELOW 1 GHz

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



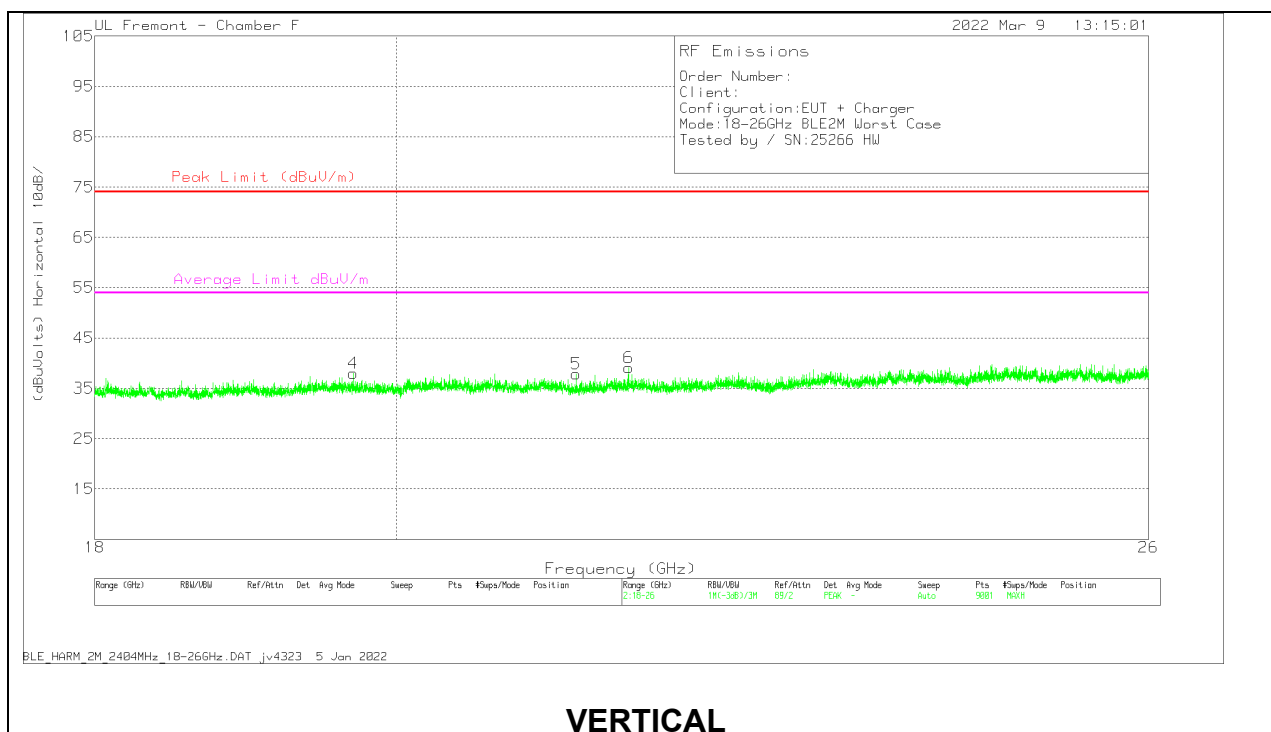
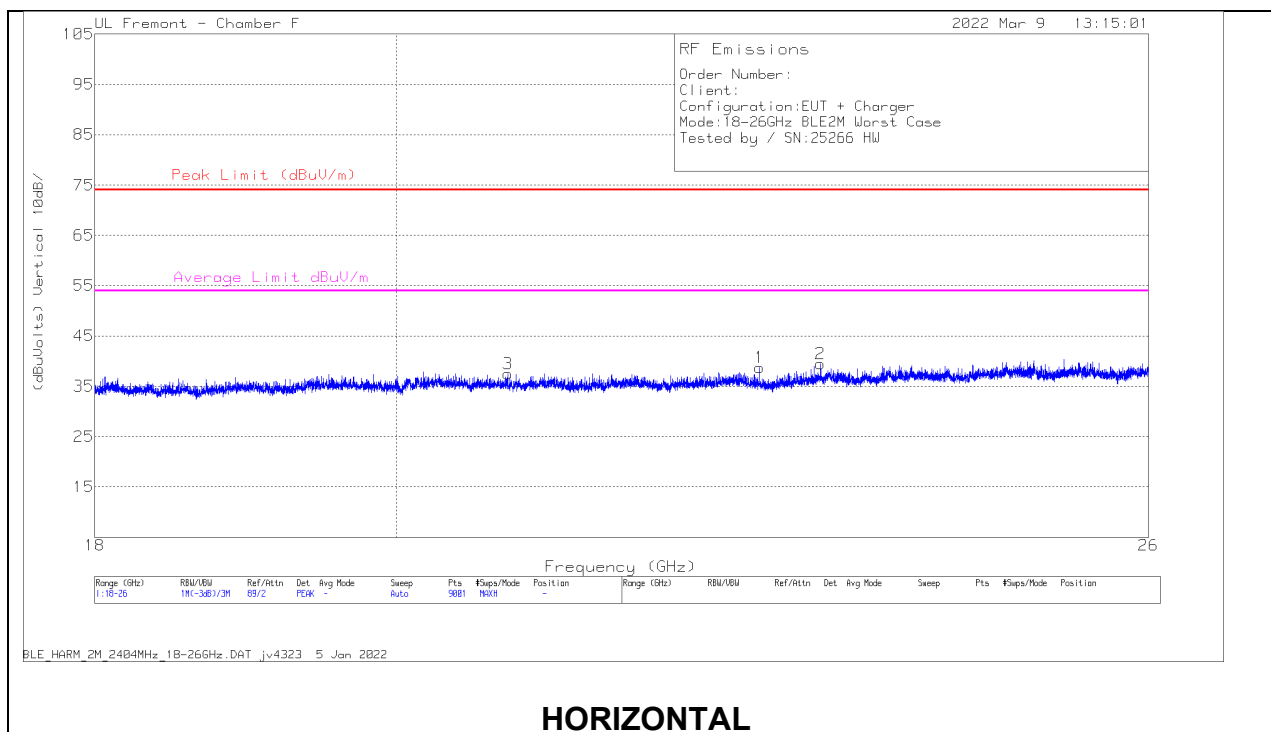
Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	174373 AF (dB/m)	Amp Cbl (Db)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	82.6286	25.1	Qp	13.1	-32	6.2	40	-33.8	230	338	V
4	85.8169	26.56	Qp	13	-31.9	7.66	40	-32.34	133	266	H
2	111.026	22.23	Qp	18.4	-31.8	8.83	43.52	-34.69	257	147	V
5	136.108	25.31	Qp	19	-31.6	12.71	43.52	-30.81	71	237	H
3	822.181	20.63	Qp	27.1	-28.9	18.83	46.02	-27.19	189	261	V
6	850.885	20.82	Qp	27.3	-28.8	19.32	46.02	-26.7	30	310	H

Qp - Quasi-Peak detector

10.3. WORST CASE 18-26 GHz

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



18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 81139 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVols)	Peak Limit (dBuV/m)	PK Margin (dB)	Average Limit dBuV/m	Margin (dB)	Polarity
1	22.69979	59.99	Pk	34.1	-57.8	-9.5	26.79	74	-47.21	54	-27.21	H
	22.69951	68.86	Avg	34.1	-57.8	-9.5	35.66	-	-	54	-18.34	
2	23.18928	60.09	Pk	34.3	-57.1	-9.5	27.79	74	-46.21	54	-26.21	H
	23.1894	69.51	Avg	34.3	-57.1	-9.5	37.21	-	-	54	-16.79	
3	20.79204	59.34	Pk	33.8	-56.8	-9.5	26.84	74	-47.16	54	-27.16	H
	20.79354	68.1	Avg	33.8	-56.8	-9.5	35.6	-	-	54	-18.4	
4	19.69758	58.74	Pk	33.5	-56.5	-9.5	26.24	74	-47.76	54	-27.76	V
	19.69791	67.36	Avg	33.5	-56.5	-9.5	34.86	-	-	54	-19.14	
5	21.29134	59.31	Pk	33.7	-57.3	-9.5	26.21	74	-47.79	54	-27.79	V
	21.29163	67.79	Avg	33.7	-57.2	-9.5	34.79	-	-	54	-19.21	
6	21.68727	60.52	Pk	33.9	-57.5	-9.5	27.42	74	-46.58	54	-26.58	V
	21.68523	68.92	Avg	33.9	-57.5	-9.5	35.82	-	-	54	-18.18	

Pk - Peak detector

11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

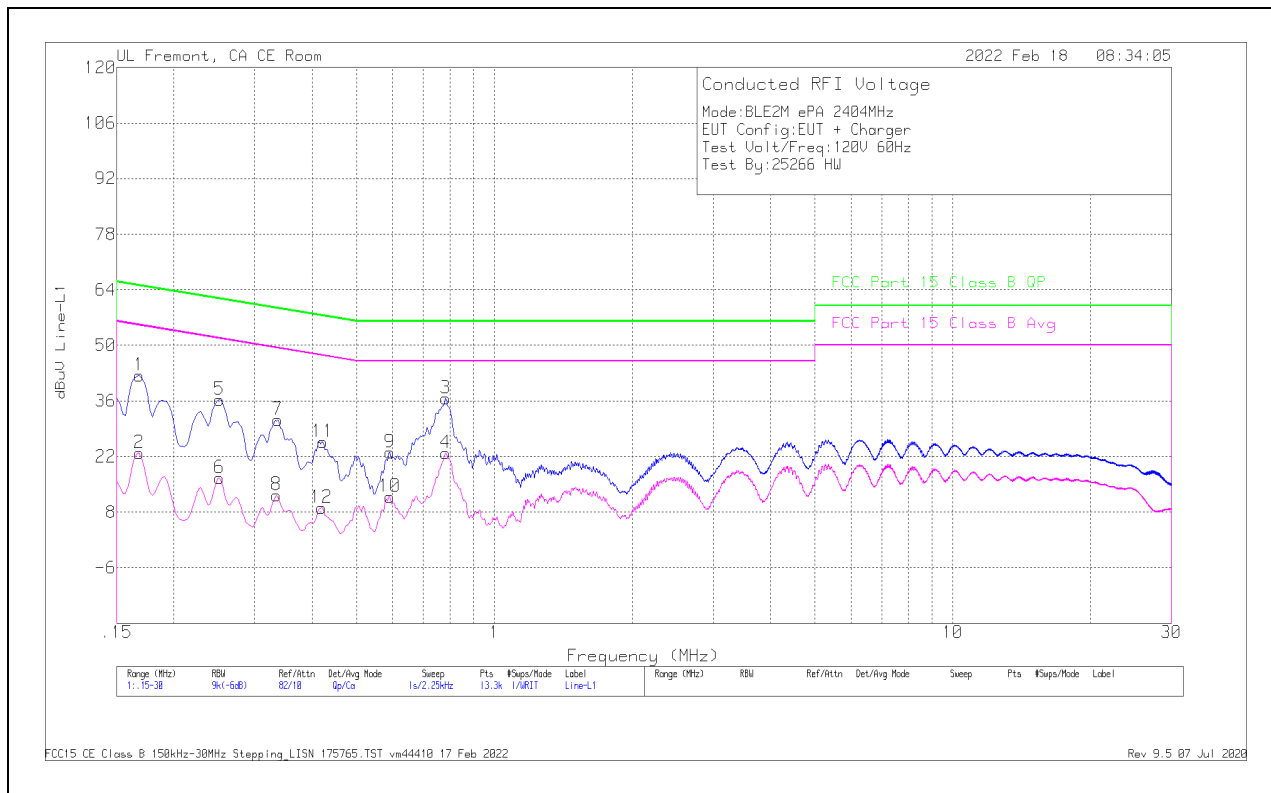
Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

RESULTS

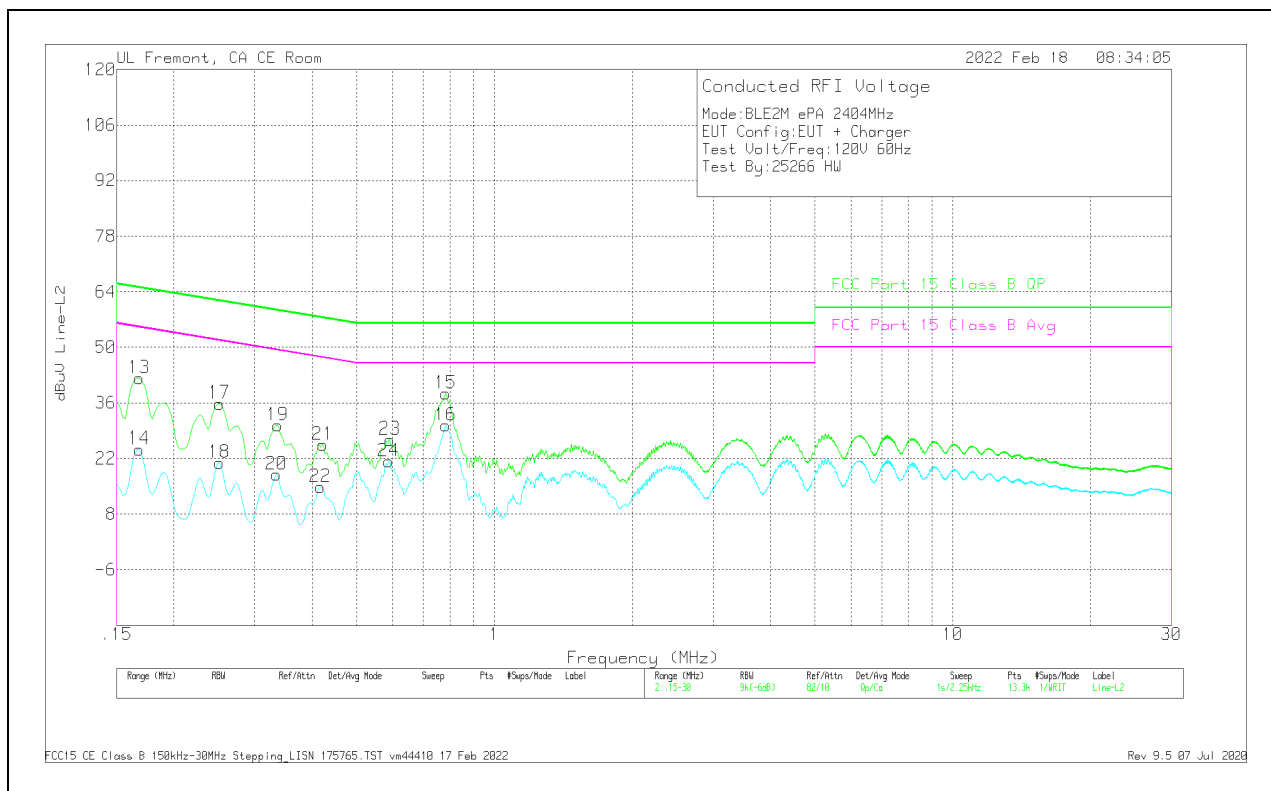
11.1. AC Power Line

LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	175765 LISN L1	C1&C3 cable	TekBox Limiter TBFL1 Model 207	Corrected Reading dBuV	FCC Part 15 Class B QP	QP Margin (dB)	FCC Part 15 Class B Avg	Av(CISPR) Margin (dB)
2	.168	13.4	Ca	.1	0	9.4	22.9	-	-	55.06	-32.16
4	.78225	13.53	Ca	0	.1	9.3	22.93	-	-	46	-23.07
6	.25125	7.3	Ca	0	0	9.3	16.6	-	-	51.72	-35.12
8	.3345	3	Ca	0	0	9.3	12.3	-	-	49.34	-37.04
10	.591	2.47	Ca	0	.1	9.3	11.87	-	-	46	-34.13
12	.42	-.3	Ca	0	0	9.3	9	-	-	47.45	-38.45
1	.168	32.86	Qp	.1	0	9.4	42.36	65.06	-22.7	-	-
3	.78225	27.23	Qp	0	.1	9.3	36.63	56	-19.37	-	-
5	.25125	26.96	Qp	0	0	9.3	36.26	61.72	-25.46	-	-
7	.33675	21.99	Qp	0	0	9.3	31.29	59.28	-27.99	-	-
9	.591	13.7	Qp	0	.1	9.3	23.1	56	-32.9	-	-
11	.42225	16.42	Qp	0	0	9.3	25.72	57.4	-31.68	-	-

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	175765 LISN L2	C2&C3 cable	TekBox Limiter TBFL1 Model 207	Corrected Reading dBuV	FCC Part 15 Class B QP	QP Margin (dB)	FCC Part 15 Class B Avg	Av(CISPR) Margin (dB)
14	.168	14.84	Ca	.1	0	9.4	24.34	-	-	55.06	-30.72
16	.78225	20.93	Ca	0	.1	9.3	30.33	-	-	46	-15.67
18	.25125	11.64	Ca	0	0	9.3	20.94	-	-	51.72	-30.78
20	.3345	8.72	Ca	0	0	9.3	18.02	-	-	49.34	-31.32
22	.41775	5.52	Ca	0	0	9.3	14.82	-	-	47.49	-32.67
24	.58875	11.9	Ca	0	.1	9.3	21.3	-	-	46	-24.7
13	.168	32.8	Qp	.1	0	9.4	42.3	65.06	-22.76	-	-
15	.78225	28.94	Qp	0	.1	9.3	38.34	56	-17.66	-	-
17	.25125	26.56	Qp	0	0	9.3	35.86	61.72	-25.86	-	-
19	.33675	21.12	Qp	0	0	9.3	30.42	59.28	-28.86	-	-
21	.42225	16.21	Qp	0	0	9.3	25.51	57.4	-31.89	-	-
23	.591	17.38	Qp	0	.1	9.3	26.78	56	-29.22	-	-

12. SETUP PHOTOS

Please refer to 13812998-EP1 for setup photos

END OF TEST REPORT