



CERTIFICATION TEST REPORT

Report Number. : 12554903-E7V3

Applicant : Dish Technologies LLC
9601 Meridian Blvd
Englewood, CO, 80112
USA

Model : 433

FCC ID : DKN433M

EUT Description : IoT 433MHz Module

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

Date Of Issue:

February 6, 2019

Prepared by:

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NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	01/28/2019	Initial Issue	---
V2	01/31/2019	Updated Section 9	E.Yu
V3	02/06/2019	Updated Section 7.4	E.Yu

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Dish Technologies LLC
9601 Meridian Blvd
Englewood, CO, 80112
USA

EUT DESCRIPTION: IoT 433MHz Module

MODEL: 433

SERIAL NUMBER: 1-005

DATE TESTED: JANUARY 9 - 12, 2019

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 NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

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Prepared By:



Eric Yu
Test Engineer
Consumer Technology Division
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2. 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.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street	47658 Kato Rd
☐ Chamber A (ISED:2324B-1)	☐ Chamber D (ISED:22541-1)	☒ Chamber I (ISED:2324A-5)
☒ Chamber B (ISED:2324B-2)	☐ Chamber E (ISED:22541-2)	☒ Chamber J (ISED:2324A-6)
☐ Chamber C (ISED:2324B-3)	☐ Chamber F (ISED:22541-3)	☐ Chamber K (ISED:2324A-1)
	☐ Chamber G (ISED:22541-4)	☐ Chamber L (ISED:2324A-3)
	☐ Chamber H (ISED:22541-5)	

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. 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.
 $36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an IoT 433MHz Module.

5.2. MAXIMUM OUTPUT E-POWER

The transmitter has the maximum peak and average radiated field strengths as follows:

Frequency Range (MHz)	Mode	Field Strength Peak (dBuV/m)	Field Strength Average (dBuV/m)
433.019	25kHz Channel Spacing	97.02	80.30
433.043	50kHz Channel Spacing	96.97	74.18

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a dipole antenna, with a maximum gain of 2.6 dBi.

5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was FCC v0.2.1

The test utility software used during testing was RabbitMQ SPI Console.

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission below 30MHz was performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

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.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List			
Description	Manufacturer	Model	Serial Number
Laptop	HP	EliteBook 8470p	CNU342CL9Z
Laptop AC/DC Adapter	HP	PPP009L-E	PA-1650-32HJ
Module test card	Dish technologies LLC	N/A	N/A
DC Power Supply	PHIHONG	AM05A-050B	N/A

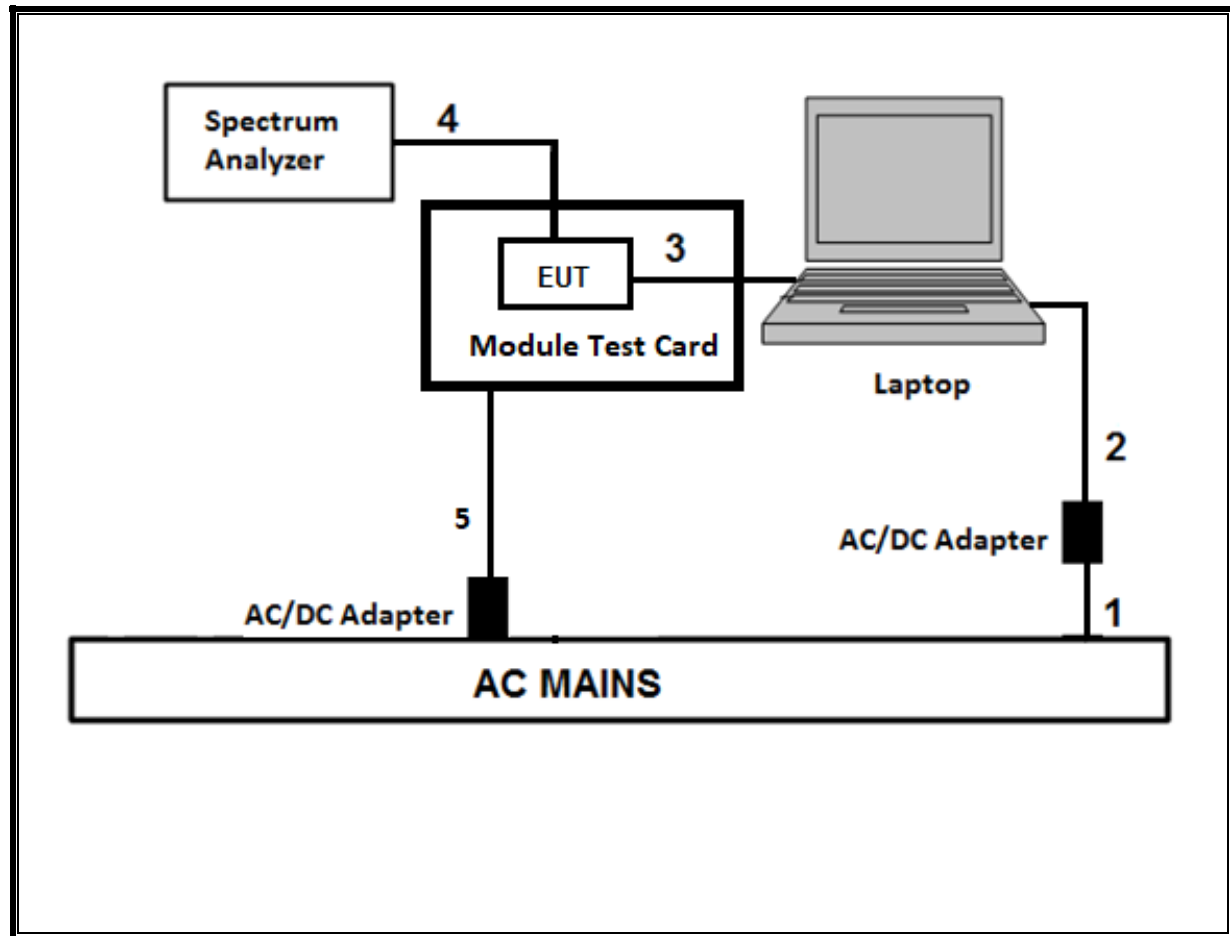
I/O CABLES (CONDUCTED TEST)

Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Unshielded	1.8	AC Mains to AC/DC Adapter
2	DC	1	DC	Unshielded	1.8	AC/DC Adapter to Laptop
3	USB	1	USB-Serial	Shielded	0.5	EUT to Laptop
4	Antenna	1	SMA	unshielded	0.25	To spectrum analyzer
5	DC	1	DC	unshielded	1.5	Adapter to Module test card

TEST SETUP- ANTENNA PORT CONDUCTED TESTS

The EUT is connected with a host laptop computer by USB to Serial cable, and powered by AC adapter during the tests. Test software exercised the radio.

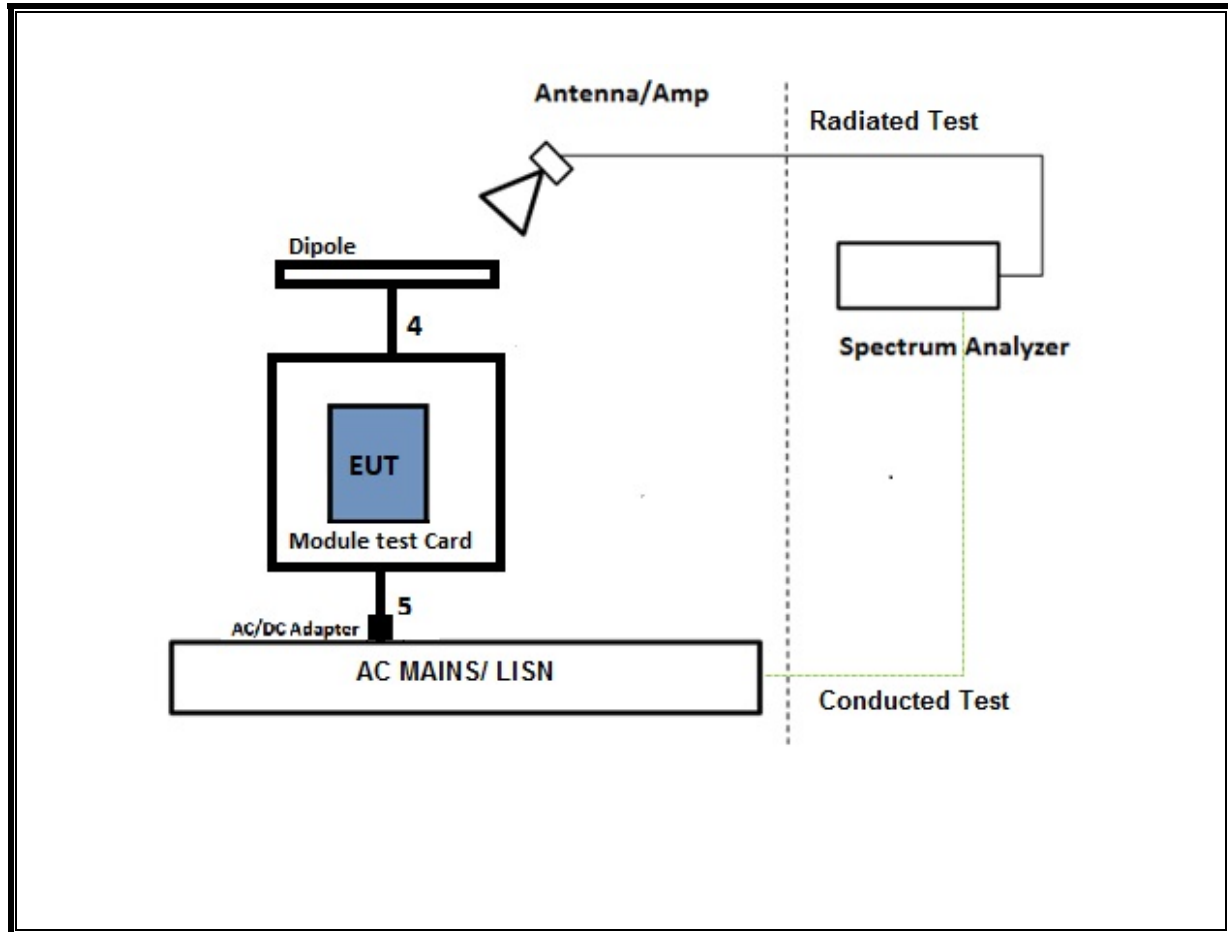
SETUP DIAGRAM FOR TESTS



TEST SETUP- AC LINE CONDUCTED TEST AND RADIATED EMISSIONS TEST

The EUT is powered by AC adapter during the tests. Test software exercised the radio.

SETUP DIAGRAM FOR TESTS



6. 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	Asset	Cal Due
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T862	05/24/2019
RF Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	171460	08/01/2019
EMI TEST RECEIVER	Rohde&Schwarz	ESW44	PRE0179367	04/28/2019
Hybrid Antenna, 30MHz to 3GHz	SunAR rf motion	JB3	PRE0181575	08/01/2019
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	PRE0180174	05/31/2019
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179372	05/04/2019
Antenna, Active Loop 9KHz to 30MHz	ETS-Lindgren	6502	T757	09/25/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1454	01/08/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T339	09/11/2019
AC Line Conducted				
EMI Receiver	Rohde & Schwarz	ESR	T1436	02/21/2019
LISN for Conducted Emissions CISPR-16	FCC INC.	FCC LISN 50/250	T1310	06/15/2019
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5, June 22, 2018	
Antenna Port Software	UL	UL RF	Ver 8.8.1, Sep 26, 2018	
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015	

NOTES:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

7. ANTENNA PORT TEST RESULTS

7.1. 20 dB BANDWIDTH

LIMITS

FCC §15.231 (c)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

TEST PROCEDURE

ANSI C63.10

The transmitter output is connected to the spectrum analyzer.

20dB Bandwidth: The RBW is set to 1% to 5% of OBW. The VBW is set to 3 times the RBW. The sweep time is coupled. Bandwidth is determined at the points 20 dB down from the modulated carrier.

RESULTS

7.1.1. 25 kHz Spacing Mode:

20dB Bandwidth

Channel	Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
Low	433.025	18.94	1082.56	-1063.62
Middle	434	18.96	1085.00	-1066.04
High	434.975	18.75	1087.44	-1068.69

Test Engineer: 10629, RL



7.1.2. 50 kHz Spacing Mode:

20dB Bandwidth

Channel	Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
Low	433.05	21.44	1082.63	-1061.19
Middle	434	21.72	1085.00	-1063.28
High	434.95	21.97	1087.38	-1065.41

Test Engineer: 10629, RL



7.2. ON TIME AND DUTY CYCLE

LIMITS

FCC §15.35 (c)

The measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to Supplier's Declaration of Conformity.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer or radiated field strength. The RBW is set to 8MHz and the VBW is set to 50MHz. The sweep time is coupled and the span is set to 0 Hz.

CALCULATION

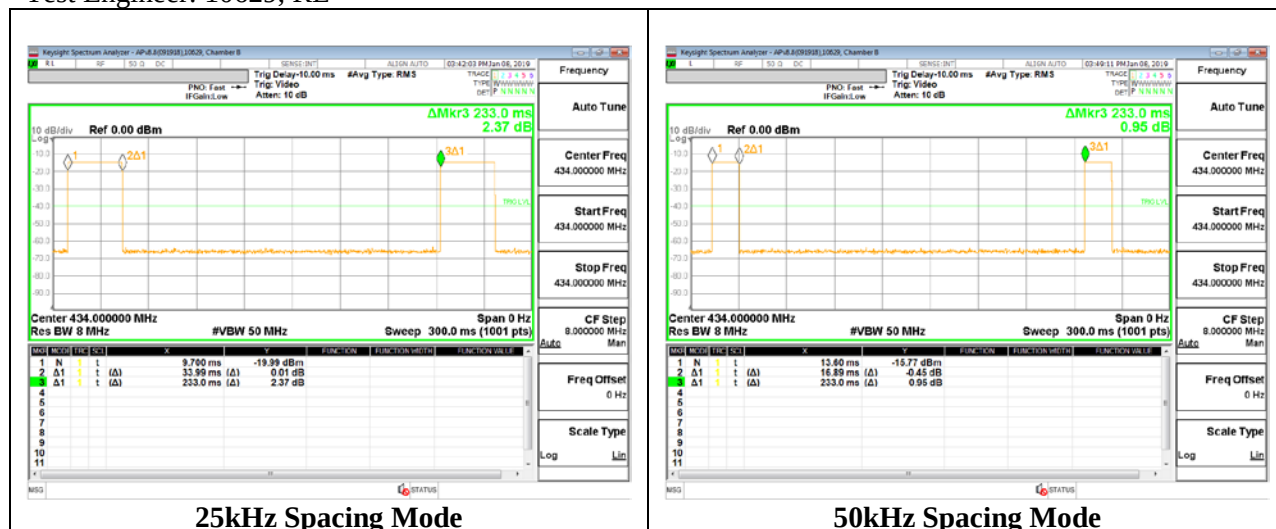
Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is determined by dividing the total maximum "ON time" by the period of the pulse train.

RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
25kHz Spacing	33.9900	233.0000	0.146	14.59%	16.72
50kHz Spacing	16.8900	233.0000	0.072	7.25%	22.79

DUTY CYCLE PLOT

Test Engineer: 10629, RL



7.3. TRANSMISSION TIME

LIMITS

FCC §15.231 (a) (1)

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

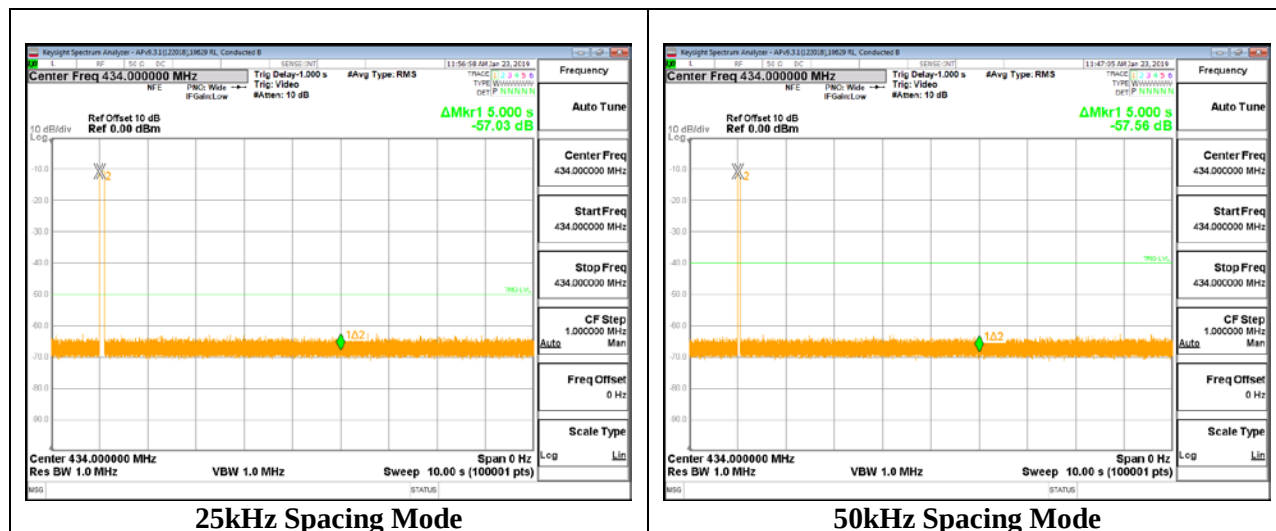
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer or radiated field strength. The RBW is set to 1MHz and the VBW is set to 1MHz. The sweep time is set to 10 seconds and the span is set to 0 Hz.

RESULTS

No non-compliance noted.

Test Engineer: 10629, RL



7.4. RADIATED EMISSIONS

FCC §15.231 (b)

In addition to the provisions of § 15.205, the field strength of emissions from Intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	¹ 1,250 to 3,750	¹ 125 to 375
174-260	3,750	375
260-470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

¹Linear interpolation

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

1 Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
2 Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz and 150 cm for 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.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and add duty cycle factor for average measurements. Please refer to test report section 7.2 for duty cycle factor information. Note: The pre-scan measurements above 1GHz the VBW is set to 30 kHz.

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.

RESULTS

7.4.1. FUNDAMENTAL FREQUENCY RADIATED EMISSION

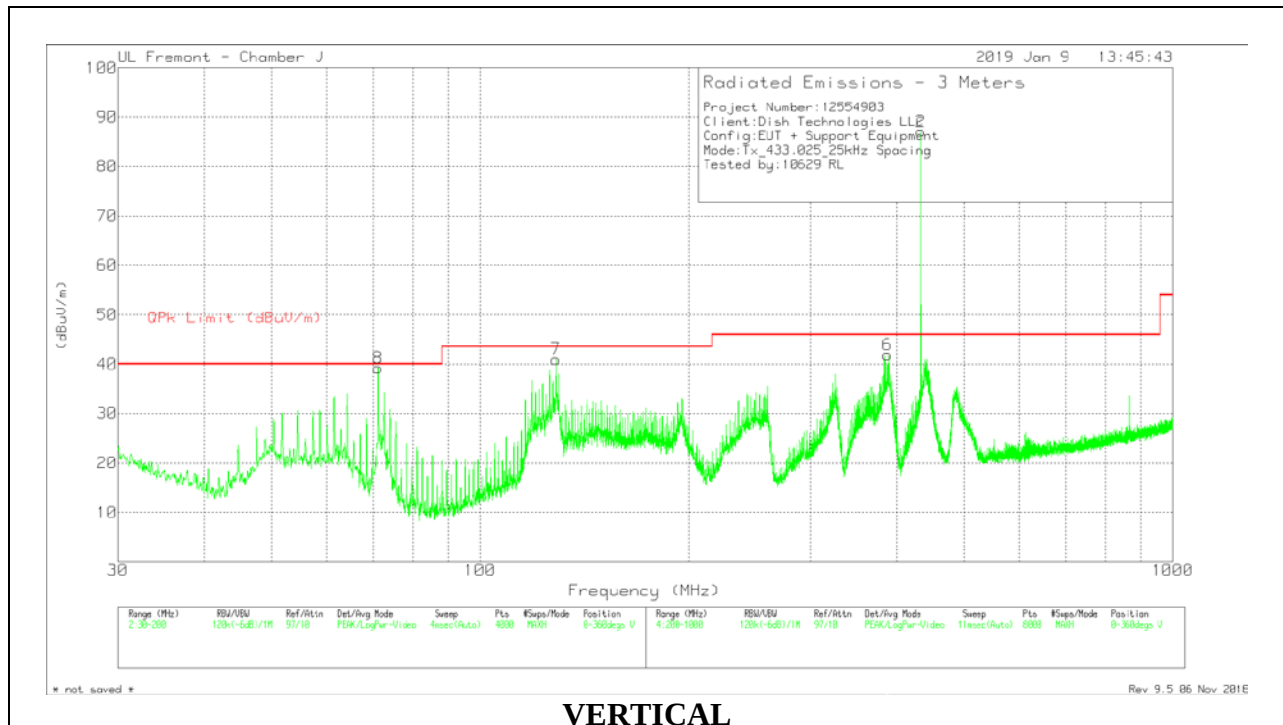
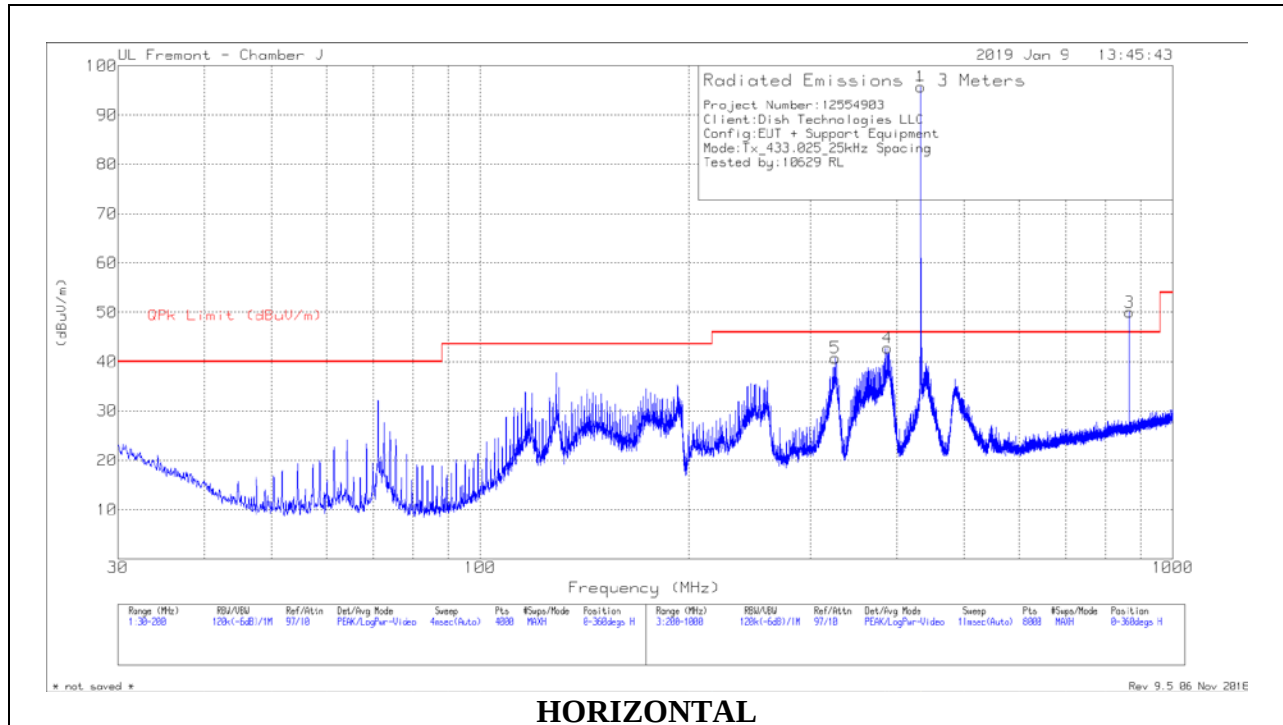
Test Engineer: 10629, RL
Date: 01/07/2019

Frequency (MHz)	Meter Reading (dBuV/m)	Det	AF PRE0181575 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Ave Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
25kHz Channel Spacing Mode												
433.019	104.12	Pk	22.5	-29.6	97.02	100.8	-3.78	-	-	170	122	H
		Ave			80.3	-	-	80.8	-0.5	170	122	H
433.021	90.55	Pk	22.5	-29.6	83.45	100.8	-17.35	-	-	116	150	V
		Ave			66.73	-	-	80.8	-14.07	116	150	V
433.996	104	Pk	22.5	-29.6	96.9	100.8	-3.9	-	-	174	120	H
		Ave			80.18	-	-	80.8	-0.62	174	120	H
433.994	90.33	Pk	22.5	-29.6	83.23	100.8	-17.57	-	-	113	150	V
		Ave			66.51	-	-	80.8	-14.29	113	150	V
434.98	103.86	Pk	22.5	-29.6	96.76	100.8	-4.04	-	-	171	124	H
		Ave			80.04	-	-	80.8	-0.76	171	124	H
434.979	90.37	Pk	22.5	-29.6	83.27	100.8	-17.53	-	-	112	230	V
		Ave			66.55	-	-	80.8	-14.25	112	230	V
50kHz Channel Spacing Mode												
433.043	104.07	Pk	22.5	-29.6	96.97	100.8	-3.83	-	-	173	123	H
		Ave			74.18	-	-	80.8	-6.62	173	123	H
433.045	90.41	Pk	22.5	-29.6	83.31	100.8	-17.49	-	-	114	149	V
		Ave			60.52	-	-	80.8	-20.28	114	149	V
433.997	103.99	Pk	22.5	-29.6	96.89	100.8	-3.91	-	-	173	122	H
		Ave			74.1	-	-	80.8	-6.7	173	122	H
43.009	90.38	Pk	22.5	-29.6	83.28	100.8	-17.52	-	-	116	149	V
		Ave			60.49	-	-	80.8	-20.31	116	149	V
434.945	103.87	Pk	22.5	-29.6	96.77	100.8	-4.03	-	-	174	122	H
		Ave			73.98	-	-	80.8	-6.82	174	122	H
434.946	90.29	Pk	22.5	-29.6	83.19	100.8	-17.61	-	-	114	152	V
		Ave			60.4	-	-	80.8	-20.4	114	152	V
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration												

7.4.2. HARMONICS AND SPURIOUS EMISSIONS BELOW 1GHz

7.4.2.1. 25 kHz Spacing Mode:

Low Channel Result



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181575 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7	* 128.6255	52.05	Pk	19.7	-30.7	41.05	-	-	0-360	101	V
8	71.2782	56.59	Pk	13.9	-31.2	39.29	-	-	0-360	101	V
1	**433.0303	102.8	Pk	22.5	-29.6	95.7	-	-	0-360	101	H
3	866.0866	49.77	Pk	27.8	-27.6	49.97	-	-	0-360	101	H
4	387.3243	51.46	Pk	21	-29.7	42.76	-	-	0-360	198	H
5	* 325.8164	50.81	Pk	19.8	-29.9	40.71	-	-	0-360	101	H
2	**433.0303	94.2	Pk	22.5	-29.6	87.1	-	-	0-360	198	V
6	387.2243	50.59	Pk	21	-29.7	41.89	-	-	0-360	101	V

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

** Fundamental frequency

Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181575 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
387.3464	52.6	Pk	21	-29.7	43.9	-	-	-	-	-	-	100	225	H
387.3464	49.07	Qp	21	-29.7	40.37	-	-	-	-	46.02	-5.65	100	225	H
71.3262	56.94	Pk	13.9	-31.2	39.64	-	-	-	-	-	-	70	102	V
71.3262	56.3	Qp	13.9	-31.2	39	-	-	-	-	40	-1	70	102	V
387.3922	52.48	Pk	21	-29.8	43.68	-	-	-	-	-	-	33	107	V
387.3922	49.65	Qp	21	-29.8	40.85	-	-	-	-	46.02	-5.17	33	107	V
* 325.8677	53.74	Pk	19.8	-29.9	43.64	-	-	-	-	-	-	232	108	H
* 325.8677	50.57	Qp	19.8	-29.9	40.47	-	-	-	-	46.02	-5.55	232	108	H
* 128.6691	52.6	Pk	19.7	-30.7	41.6	-	-	-	-	-	-	315	101	V
* 128.6691	51.42	Qp	19.7	-30.7	40.42	-	-	-	-	43.52	-3.1	315	101	V
**866.0614	50.63	Pk	27.8	-27.6	50.83	80.8	-29.97	-	-	-	-	354	100	H
***866.0614		Av			34.11	-	-	60.8	-26.69	-	-	354	100	H

Pk - Peak detector

Qp - Quasi-Peak detector

Av – Average Reading

Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF

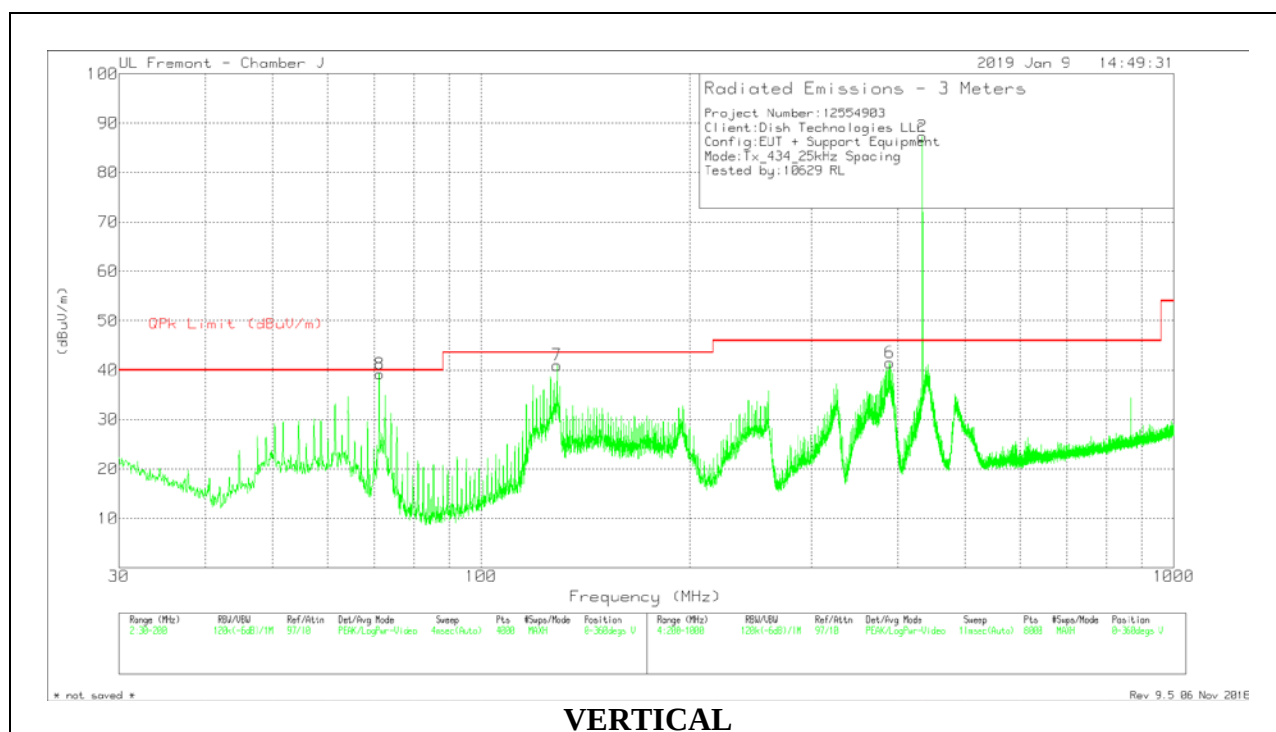
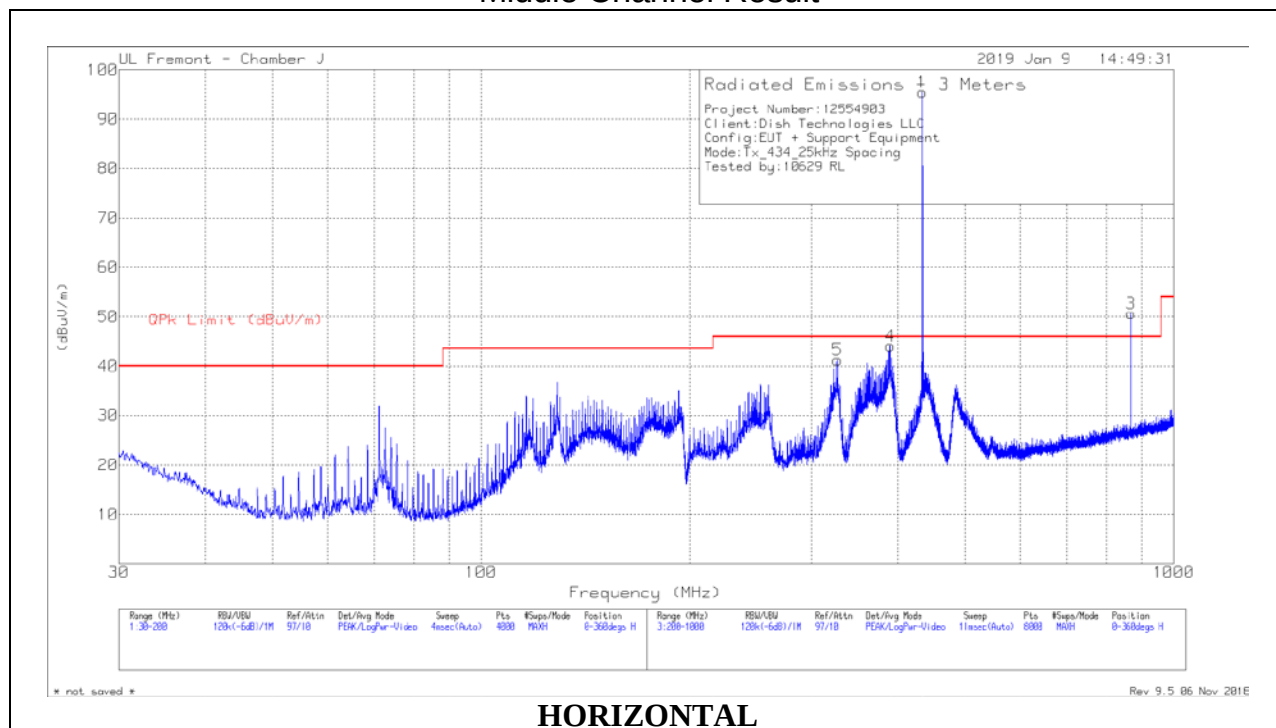
* Indicates frequency in CFR15.205 -Restricted Band

** Harmonics of fundamental 433.025 MHz

***Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is 0.1459

Refer to section 7.2 for duty cycle factor calculation (-16.72dB)

Middle Channel Result



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181575 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7	* 128.668	52.06	Pk	19.7	-30.7	41.06	-	-	0-360	101	V
8	71.3207	56.55	Pk	13.9	-31.2	39.25	-	-	0-360	101	V
1	**433.9304	102.62	Pk	22.5	-29.6	95.52	-	-	0-360	101	H
3	867.9868	50.41	Pk	27.8	-27.6	50.61	-	-	0-360	101	H
4	390.1247	52.73	Pk	21.1	-29.8	44.03	-	-	0-360	198	H
5	* 327.1165	51.39	Pk	19.8	-29.9	41.29	-	-	0-360	101	H
2	**433.9304	94.41	Pk	22.5	-29.6	87.31	-	-	0-360	198	V
6	388.7245	50.27	Pk	21.1	-29.8	41.57	-	-	0-360	101	V

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

** Fundamental frequency

Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181575 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
390.1928	53.59	Pk	21.1	-29.8	44.89	-	-	-	-	-	-	211	101	H
390.1928	50.08	Qp	21.1	-29.8	41.38	-	-	-	-	46.02	-4.64	211	101	H
71.3135	55.91	Pk	13.9	-31.2	38.61	-	-	-	-	-	-	75	117	V
71.3135	55.3	Qp	13.9	-31.2	38	-	-	-	-	40	-2	75	117	V
388.7696	52.33	Pk	21.1	-29.8	43.63	-	-	-	-	-	-	33	102	V
388.7696	48.9	Qp	21.1	-29.8	40.2	-	-	-	-	46.02	-5.82	33	102	V
* 327.244	52.83	Pk	19.8	-29.9	42.73	-	-	-	-	-	-	228	106	H
* 327.244	49.86	Qp	19.8	-29.9	39.76	-	-	-	-	46.02	-6.26	228	106	H
* 128.6493	52.51	Pk	19.7	-30.7	41.51	-	-	-	-	-	-	299	101	V
* 128.6493	50.95	Qp	19.7	-30.7	39.95	-	-	-	-	43.52	-3.57	299	101	V
**868.0069	50.47	Pk	27.8	-27.6	50.67	80.8	-30.13	-	-	-	-	356	241	H
**868.0069		Av			33.95	-	-	60.8	-26.85	-	-	356	241	H

Pk - Peak detector

Qp - Quasi-Peak detector

Av – Average Reading

Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF

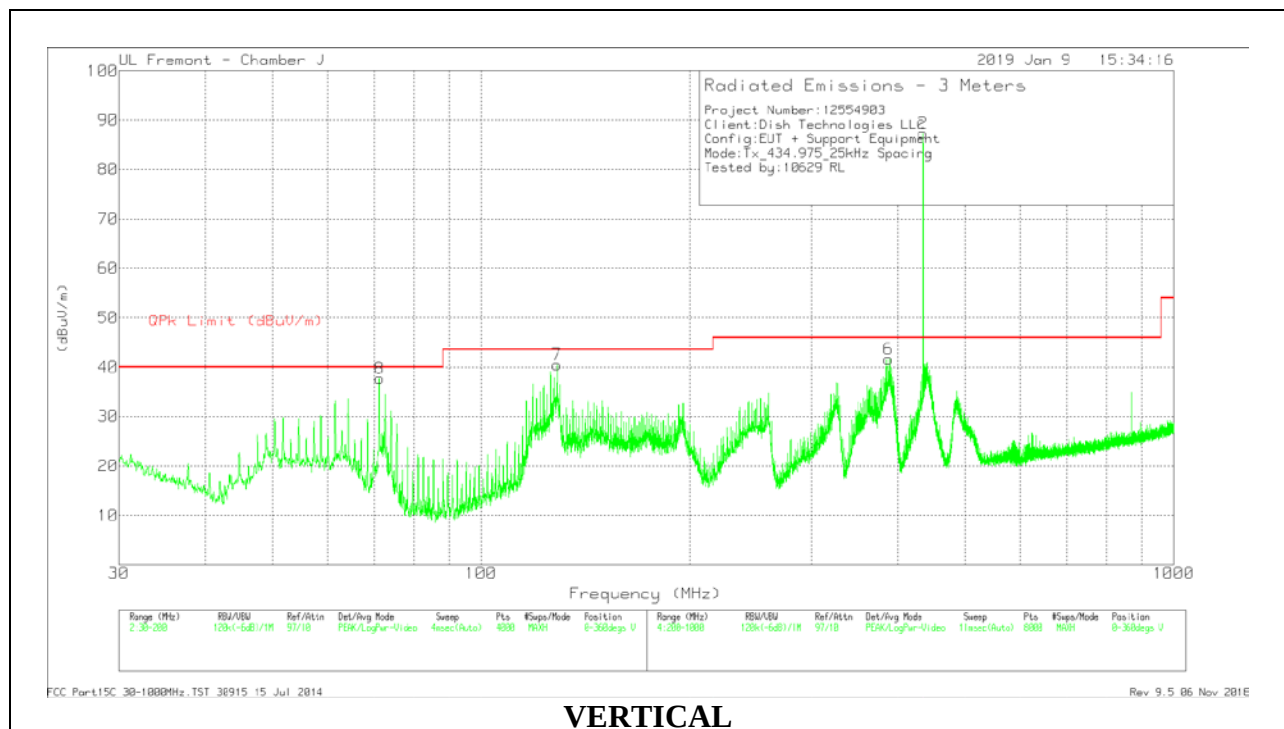
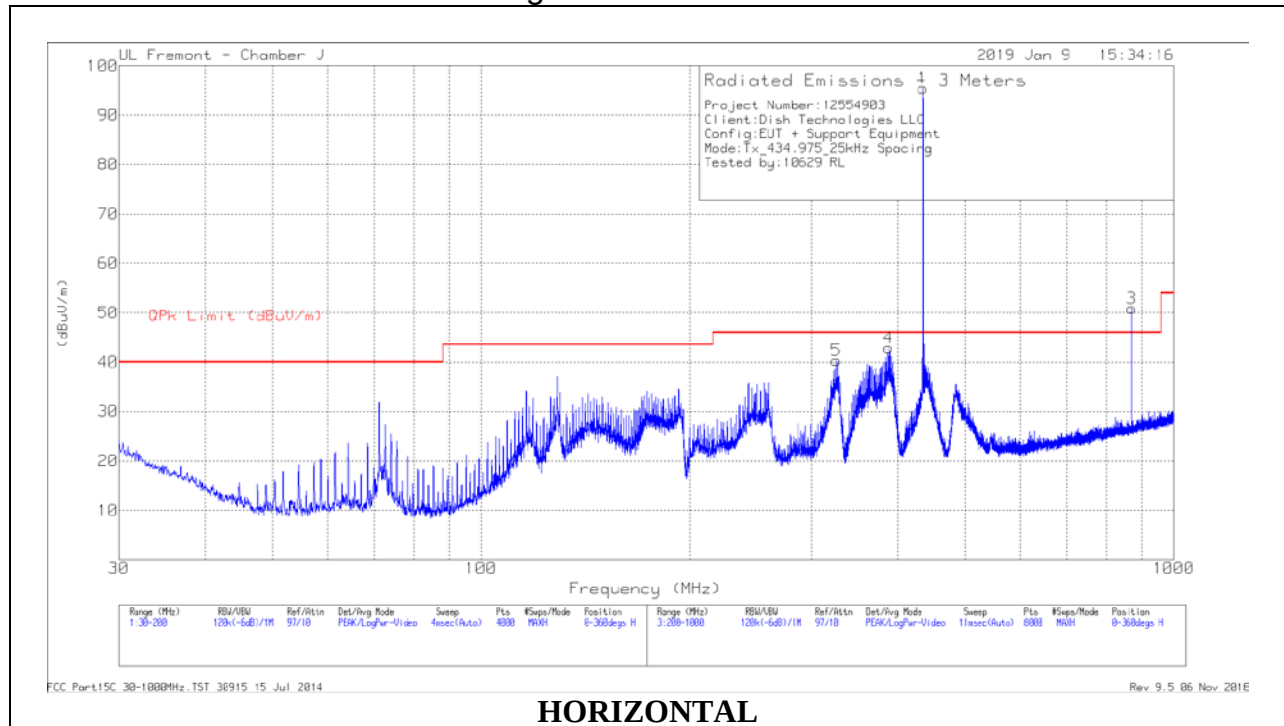
* Indicates frequency in CFR15.205 -Restricted Band

** Harmonics of fundamental 434 MHz

***Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is 0.1459

Refer to section 7.2 for duty cycle factor calculation (-16.72dB)

High Channel Result



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181575 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7	* 128.668	51.48	Pk	19.7	-30.7	40.48	-	-	0-360	101	V
8	71.3207	55.03	Pk	13.9	-31.2	37.73	-	-	0-360	101	V
1	**434.9305	102.54	Pk	22.5	-29.6	95.44	-	-	0-360	101	H
3	869.9871	50.74	Pk	27.8	-27.6	50.94	-	-	0-360	101	H
4	387.3243	51.6	Pk	21	-29.7	42.9	-	-	0-360	198	H
5	* 325.8164	50.42	Pk	19.8	-29.9	40.32	-	-	0-360	101	H
2	**434.9305	94.46	Pk	22.5	-29.6	87.36	-	-	0-360	198	V
6	387.3243	50.39	Pk	21	-29.7	41.69	-	-	0-360	101	V

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

** Fundamental frequency

Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181575 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
387.4356	53.62	Pk	21	-29.8	44.82	-	-	-	-	-	-	139	211	H
387.4356	50.41	Qp	21	-29.8	41.61	-	-	-	-	46.02	-4.41	139	211	H
71.3231	57.24	Pk	13.9	-31.2	39.94	-	-	-	-	-	-	66	104	V
71.3231	56.62	Qp	13.9	-31.2	39.32	-	-	-	-	40	-68	66	104	V
387.4192	52.26	Pk	21	-29.8	43.46	-	-	-	-	-	-	28	110	V
387.4192	49.1	Qp	21	-29.8	40.3	-	-	-	-	46.02	-5.72	28	110	V
* 128.6714	52.61	Pk	19.7	-30.7	41.61	-	-	-	-	-	-	314	102	V
* 128.6714	51.17	Qp	19.7	-30.7	40.17	-	-	-	-	43.52	-3.35	314	102	V
* 325.8643	53.34	Pk	19.8	-29.9	43.24	-	-	-	-	-	-	229	105	H
* 325.8643	50.13	Qp	19.8	-29.9	40.03	-	-	-	-	46.02	-5.99	229	105	H
**869.9596	51.08	Pk	27.8	-27.6	51.28	80.8	-29.52	-	-	-	-	356	238	H
***869.9596		Av			34.56	-	-	60.8	-26.24	-	-	356	238	H

Pk - Peak detector

Qp - Quasi-Peak detector

Av – Average Reading

Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is 0.1459

Refer to section 7.2 for duty cycle factor calculation (-16.72dB)

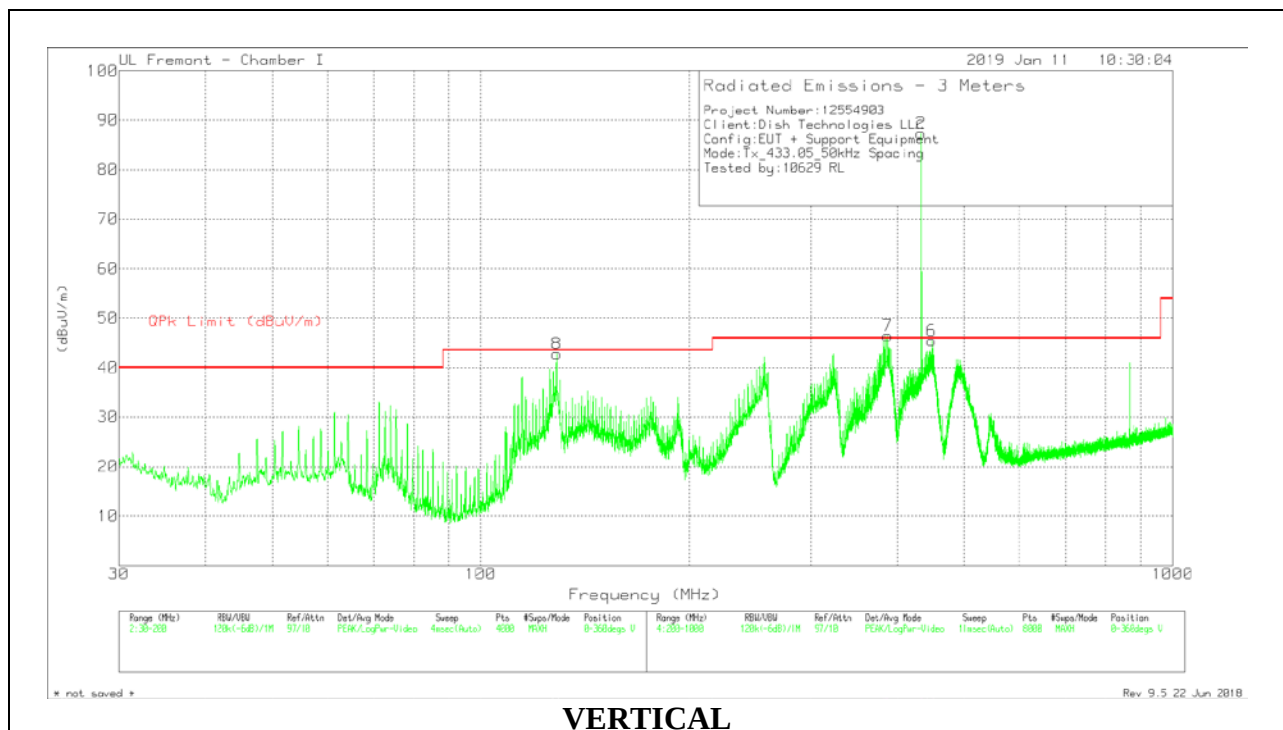
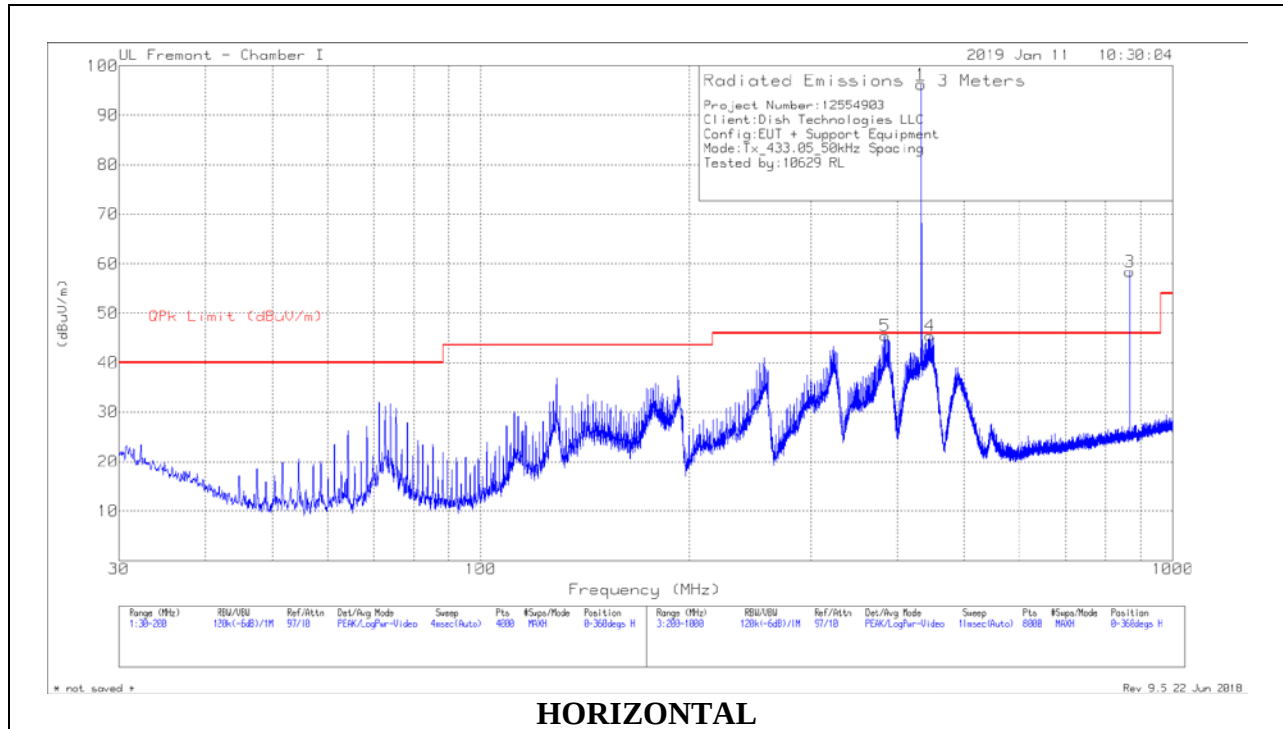
Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF

* Indicates frequency in CFR15.205 -Restricted Band

** Harmonics of fundamental 434.975 MHz

7.4.2.2. 50 kHz Spacing Mode:

Low Channel Result



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0184971 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
8	* 128.6255	53.79	Pk	19.6	-30.6	42.79	-	-	0-360	102	V
1	**433.0303	103.08	Pk	22.5	-29.4	96.18	-	-	0-360	102	H
3	866.0866	58.25	Pk	27.7	-27.6	58.35	-	-	0-360	102	H
4	445.932	52.18	Pk	22.6	-29.3	45.48	-	-	0-360	102	H
5	384.524	53.99	Pk	21	-29.5	45.49	-	-	0-360	102	H
2	**433.0303	94.22	Pk	22.5	-29.4	87.32	-	-	0-360	199	V
6	448.7323	52.24	Pk	22.6	-29.4	45.44	-	-	0-360	101	V
7	387.2243	54.92	Pk	21	-29.5	46.42	-	-	0-360	101	V

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

** Fundamental frequency

Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0184971 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
384.5413	55.41	Pk	21	-29.5	46.91	-	-	-	-	-	-	172	105	H
384.5413	52.51	Qp	21	-29.5	44.01	-	-	-	-	46.02	-2.01	172	105	H
445.9737	52.96	Pk	22.6	-29.3	46.26	-	-	-	-	-	-	247	102	H
445.9737	49.31	Qp	22.6	-29.3	42.61	-	-	-	-	46.02	-3.41	247	102	H
387.3333	57.26	Pk	21	-29.5	48.76	-	-	-	-	-	-	249	118	V
387.3237	54.02	Qp	21	-29.5	45.52	-	-	-	-	46.02	-5	249	118	V
448.8106	51.87	Pk	22.6	-29.4	45.07	-	-	-	-	-	-	233	113	V
448.8106	48.11	Qp	22.6	-29.4	41.31	-	-	-	-	46.02	-4.71	233	113	V
* 128.6274	54.8	Pk	19.6	-30.6	43.8	-	-	-	-	-	-	240	107	V
* 128.6274	53.23	Qp	19.6	-30.6	42.23	-	-	-	-	43.52	-1.29	240	107	V
**866.0919	58.63	Pk	27.7	-27.6	58.73	80.8	-22.07	-	-	-	-	18	100	H
***866.0919		Av			35.94	-	-	60.8	-24.86	-	-	18	100	H

Pk - Peak detector

Qp - Quasi-Peak detector

Av – Average Reading

Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF

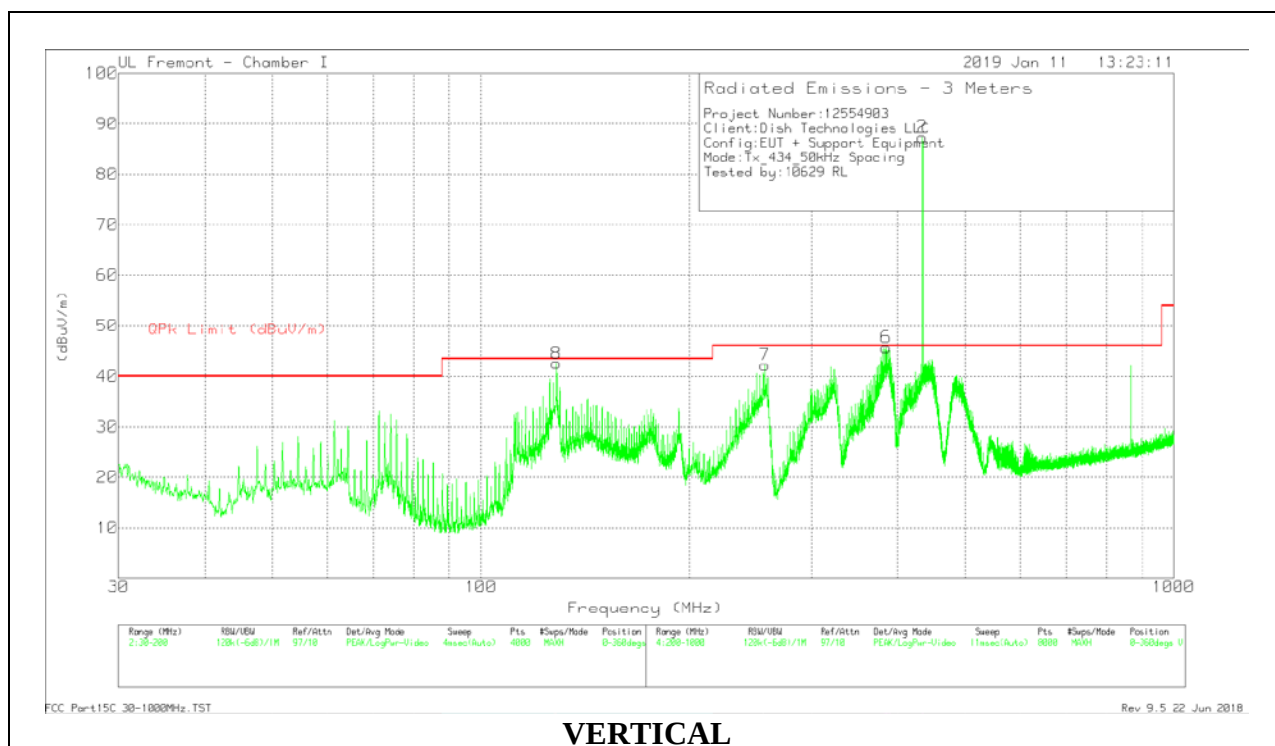
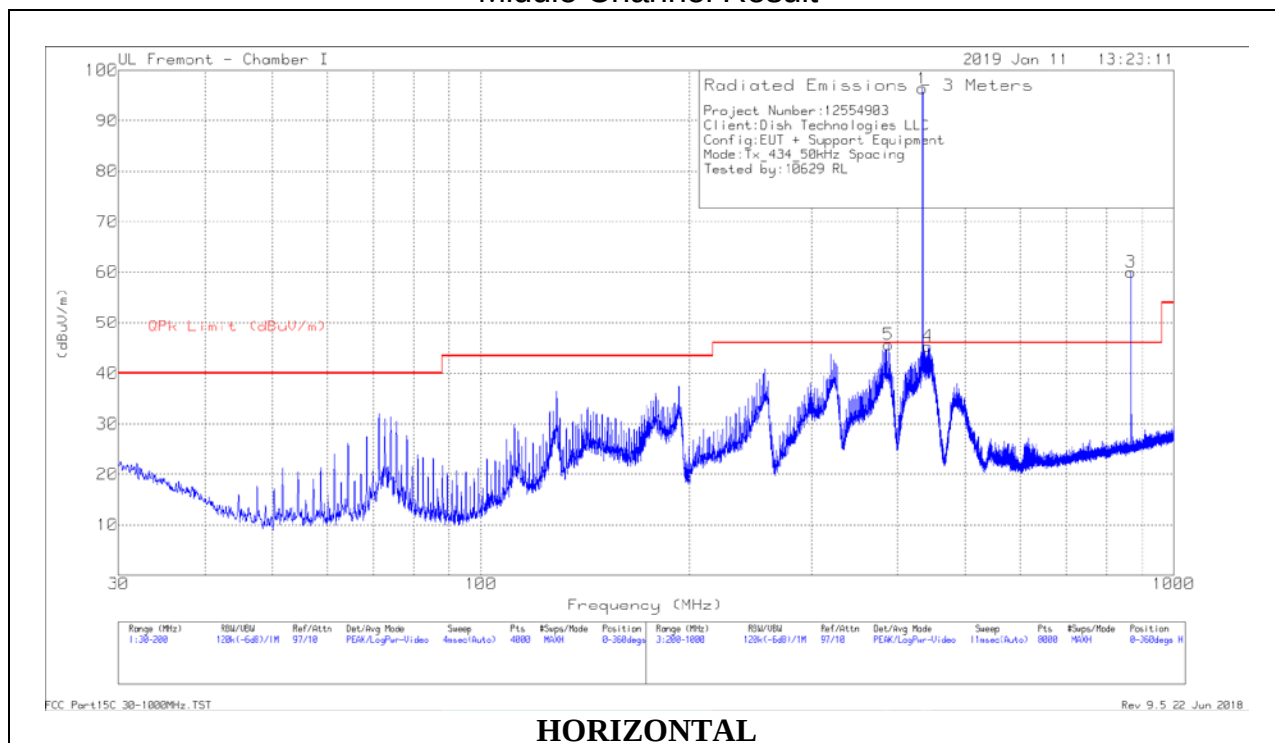
* Indicates frequency in CFR15.205 -Restricted Band

** Harmonics of fundamental 433.05 MHz

***Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is 0.0725

Refer to section 7.2 for duty cycle factor calculation (-22.79dB)

Middle Channel Result



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0184971 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
8	* 128.6255	53.57	Pk	19.6	-30.6	42.57	-	-	0-360	101	V
1	**433.9304	103.26	Pk	22.5	-29.4	96.36	-	-	0-360	101	H
3	867.9868	60.06	Pk	27.6	-27.6	60.06	-	-	0-360	101	H
4	441.8314	52.13	Pk	22.6	-29.4	45.33	-	-	0-360	101	H
5	387.2243	54.16	Pk	21	-29.5	45.66	-	-	0-360	101	H
2	**433.9304	94.23	Pk	22.5	-29.4	87.33	-	-	0-360	199	V
6	384.524	54.22	Pk	21	-29.5	45.72	-	-	0-360	101	V
7	* 257.2074	54.57	Pk	17.6	-29.9	42.27	-	-	0-360	101	V

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

** Fundamental frequency

Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0184971 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
387.3364	55.23	Pk	21	-29.5	46.73	-	-	-	-	-	-	169	100	H
387.3781	52.79	Qp	21	-29.5	44.29	-	-	-	-	46.02	-1.73	169	100	H
441.8865	54.03	Pk	22.6	-29.4	47.23	-	-	-	-	-	-	240	101	H
441.8865	50.33	Qp	22.6	-29.4	43.53	-	-	-	-	46.02	-2.49	240	101	H
384.5657	57.84	Pk	21	-29.5	49.34	-	-	-	-	-	-	256	125	V
384.5657	54.99	Qp	21	-29.5	46.49	-	-	-	-	46.02	.47	256	125	V
* 128.6322	55.1	Pk	19.6	-30.6	44.1	-	-	-	-	-	-	237	101	V
* 128.6322	53.43	Qp	19.6	-30.6	42.43	-	-	-	-	43.52	-1.09	237	101	V
* 257.299	55.96	Pk	17.7	-29.9	43.76	-	-	-	-	-	-	5	102	V
* 257.299	53.06	Qp	17.7	-29.9	40.86	-	-	-	-	46.02	-5.16	5	102	V
**867.9844	60.26	Pk	27.6	-27.6	60.26	80.8	-20.54	-	-	-	-	215	241	H
***867.9844		Av			37.47	-	-	60.8	-23.33	-	-	215	241	H

Pk - Peak detector

Qp - Quasi-Peak detector

Av – Average Reading

Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF

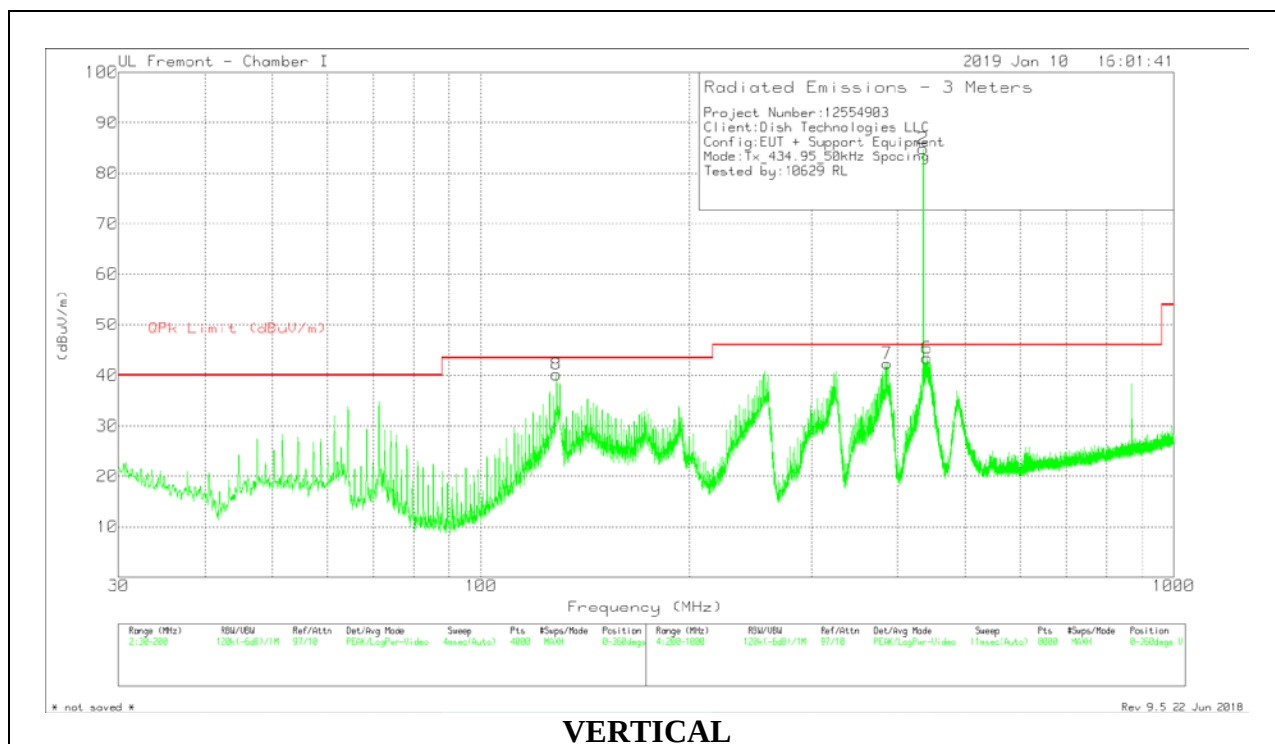
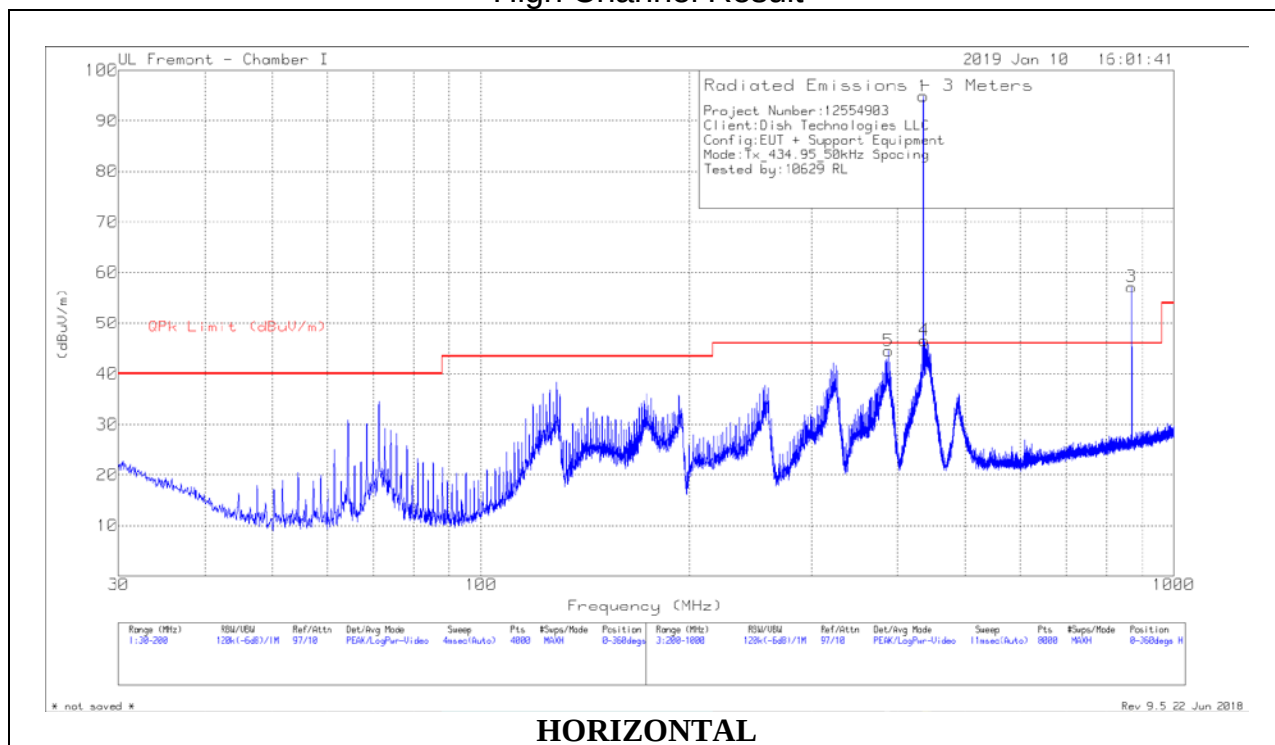
* Indicates frequency in CFR15.205 -Restricted Band

** Harmonics of fundamental 434 MHz

***Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is 0.0725

Refer to section 7.2 for duty cycle factor calculation (-22.79dB)

High Channel Result



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0184971 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
8	* 128.6255	51.16	Pk	19.6	-30.6	40.16	-	-	0-360	101	V
1	**434.9305	101.76	Pk	22.5	-29.4	94.86	-	-	0-360	101	H
3	869.8871	57.11	Pk	27.7	-27.6	57.21	-	-	0-360	101	H
4	436.3307	53.47	Pk	22.5	-29.4	46.57	-	-	0-360	199	H
5	387.3243	53.06	Pk	21	-29.5	44.56	-	-	0-360	101	H
2	**434.9305	91.76	Pk	22.5	-29.4	84.86	-	-	0-360	199	V
6	440.4313	50.35	Pk	22.5	-29.4	43.45	-	-	0-360	102	V
7	385.8242	50.87	Pk	21	-29.5	42.37	-	-	0-360	102	V

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

** Fundamental frequency

Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0184971 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
387.3507	54.77	Pk	21	-29.5	46.27	-	-	-	-	-	-	190	100	H
387.3507	51.5	Qp	21	-29.5	43	-	-	-	-	46.02	-3.02	190	100	H
436.3274	54.98	Pk	22.5	-29.4	48.08	-	-	-	-	-	-	213	251	H
436.3274	52.08	Qp	22.5	-29.4	45.18	-	-	-	-	46.02	-0.84	213	251	H
385.9604	52.15	Pk	21	-29.5	43.65	-	-	-	-	-	-	15	108	V
385.9604	48.64	Qp	21	-29.5	40.14	-	-	-	-	46.02	-5.88	15	108	V
440.4997	54.14	Pk	22.5	-29.4	47.24	-	-	-	-	-	-	245	109	V
440.4997	50.34	Qp	22.5	-29.4	43.44	-	-	-	-	46.02	-2.58	245	109	V
* 128.6557	52.02	Pk	19.6	-30.6	41.02	-	-	-	-	-	-	203	109	V
* 128.6557	50.67	Qp	19.6	-30.6	39.67	-	-	-	-	43.52	-3.85	203	109	V
**869.8857	58.22	Pk	27.7	-27.6	58.32	80.8	-22.48	-	-	-	-	207	239	H
***869.8857		Av			34.56	-	-	60.8	-26.24	-	-	207	239	H

Pk - Peak detector

Qp - Quasi-Peak detector

Av – Average Reading

Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF

* Indicates frequency in CFR15.205 -Restricted Band

** Harmonics of fundamental 434.95 MHz

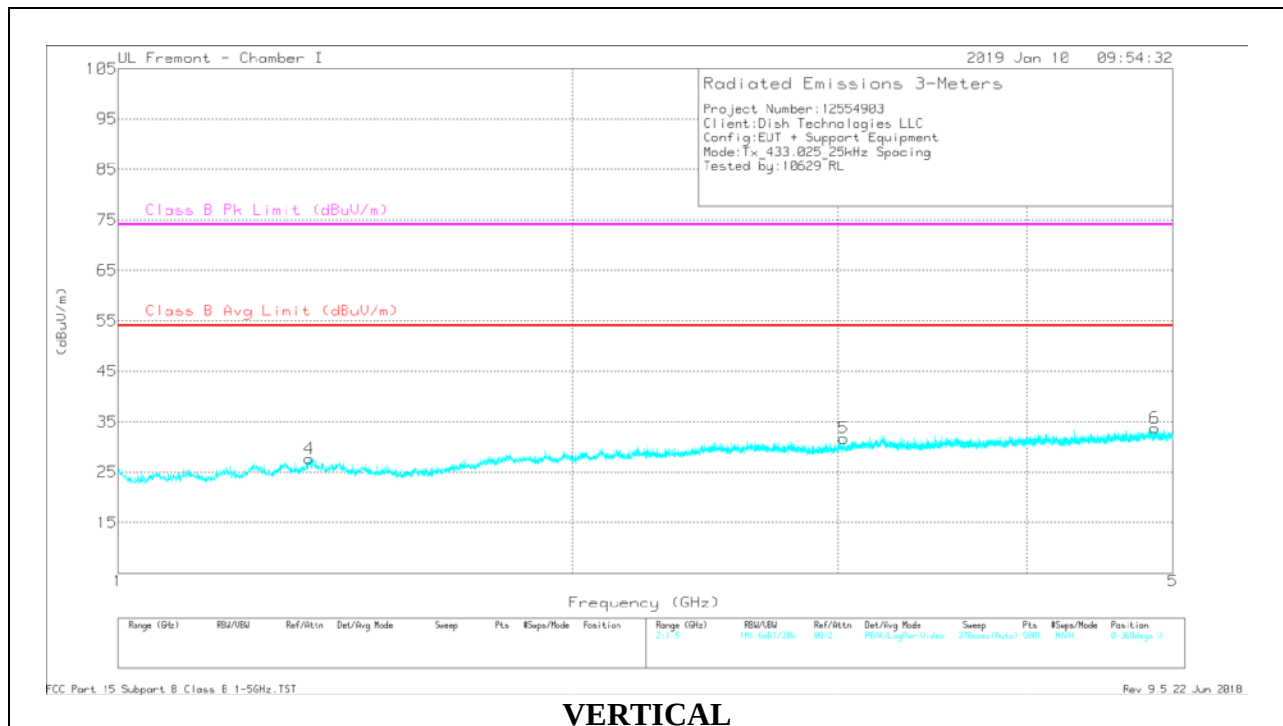
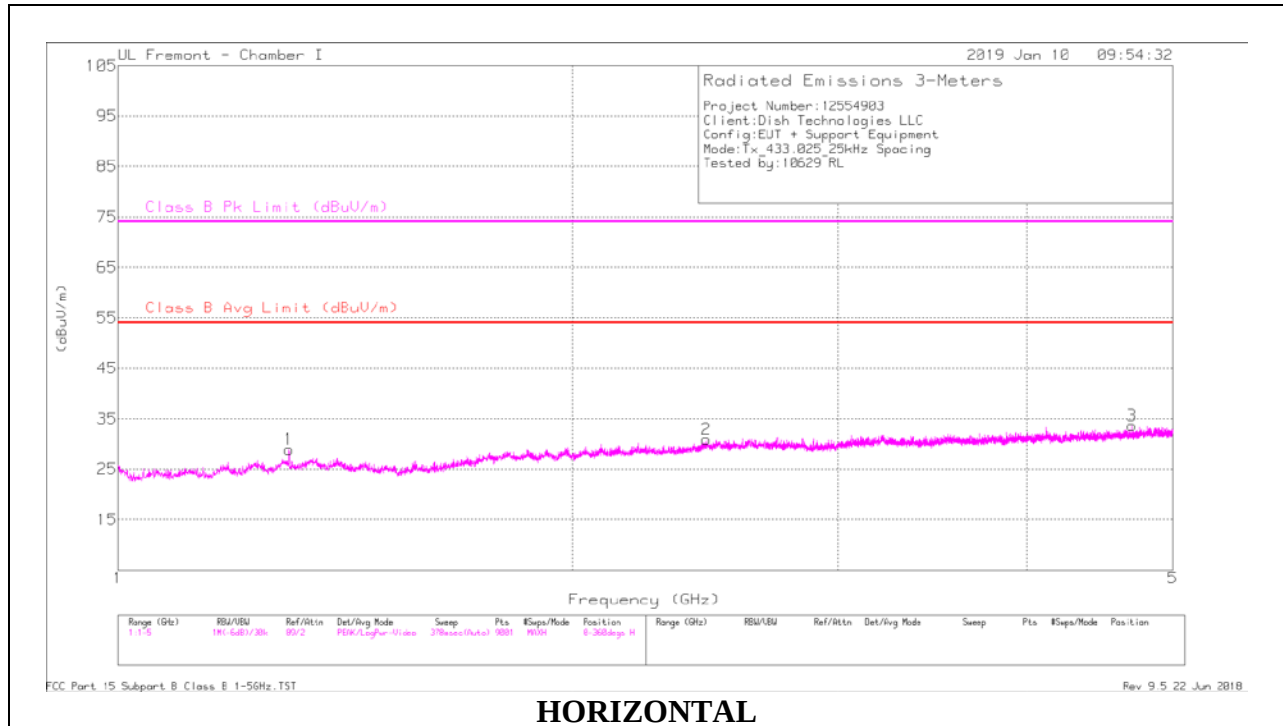
***Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is 0.0725

Refer to section 7.2 for duty cycle factor calculation (-22.79dB)

7.4.3. HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz

7.4.3.1. 25kHz Spacing Mode

Low Channel Result



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.299	33.57	Avg	29.2	-33.9	28.87	-	-	-	-	0-360	100	H
2	2.455	30.63	Avg	32.2	-31.9	30.93	-	-	-	-	0-360	199	H
3	4.7	29.28	Avg	33.8	-29.4	33.68	-	-	-	-	0-360	199	H
4	1.339	32.18	Avg	29.3	-33.8	27.68	-	-	-	-	0-360	198	V
5	3.026	30.52	Avg	32.5	-31.3	31.72	-	-	-	-	0-360	98	V
6	4.865	28.45	Avg	34.1	-28.8	33.75	-	-	-	-	0-360	198	V

Avg - Video bandwidth < Resolution bandwidth

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.455	42.23	Pk	32.2	-31.9	42.53	-	-	74	-31.47	85	163	H
		Av			25.81	54	-28.19	-	-	85	163	H
3.026	40.25	Pk	32.5	-31.3	41.45	-	-	74	-32.55	290	319	V
		Av			24.73	54	-29.27	-	-	290	319	V
*4.7	39.41	Pk	33.8	-29.4	43.81	-	-	74	-30.19	285	100	H
		Av			27.09	54	-26.91	-	-	285	100	H
*1.339	31.08	Pk	29.3	-33.8	26.58	-	-	74	-47.42	268	133	V
		Av			9.86	54	-44.12	-	-	268	133	V
*4.867	39.58	Pk	34.1	-28.8	44.88	-	-	74	-29.12	113	351	V
		Av			28.16	54	-25.84	-	-	113	351	V
**1.299	45.69	Pk	29.2	-33.9	40.99	-	-	74	-33.01	134	244	H
		Av			24.27	54	-29.73	-	-	134	244	H

Pk - Peak detector

Av – Average Reading

Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is 0.1459

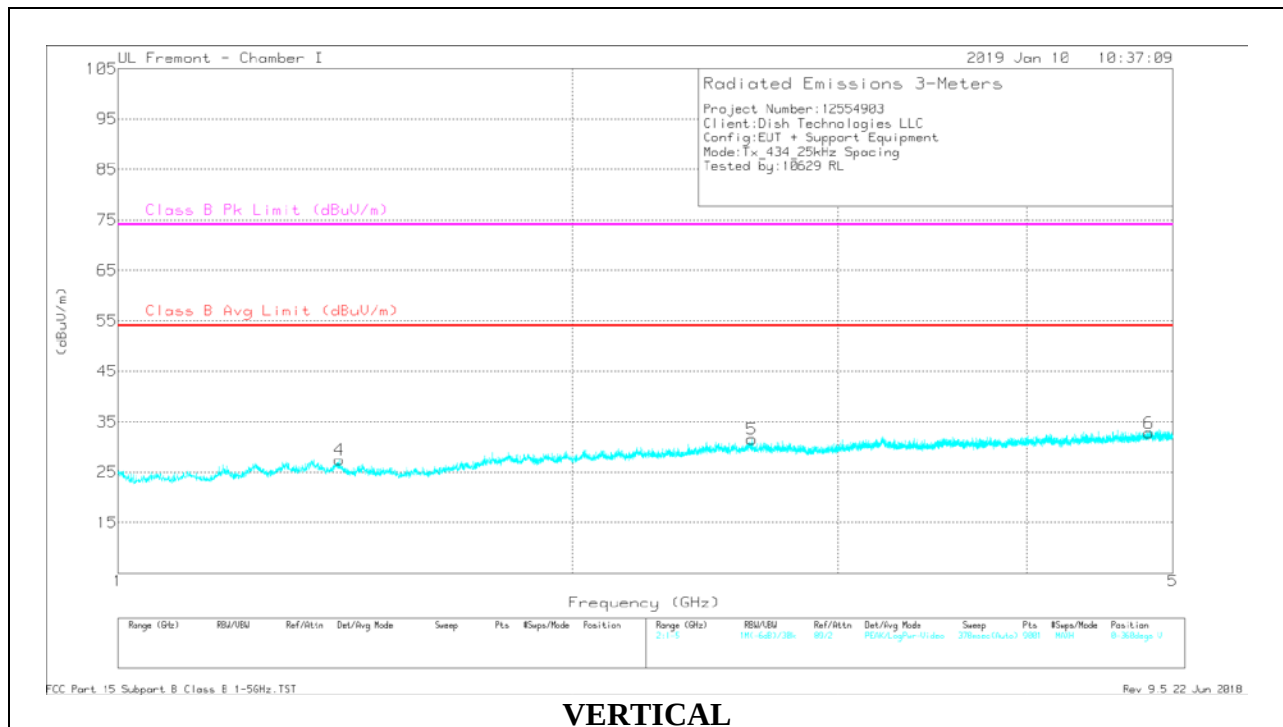
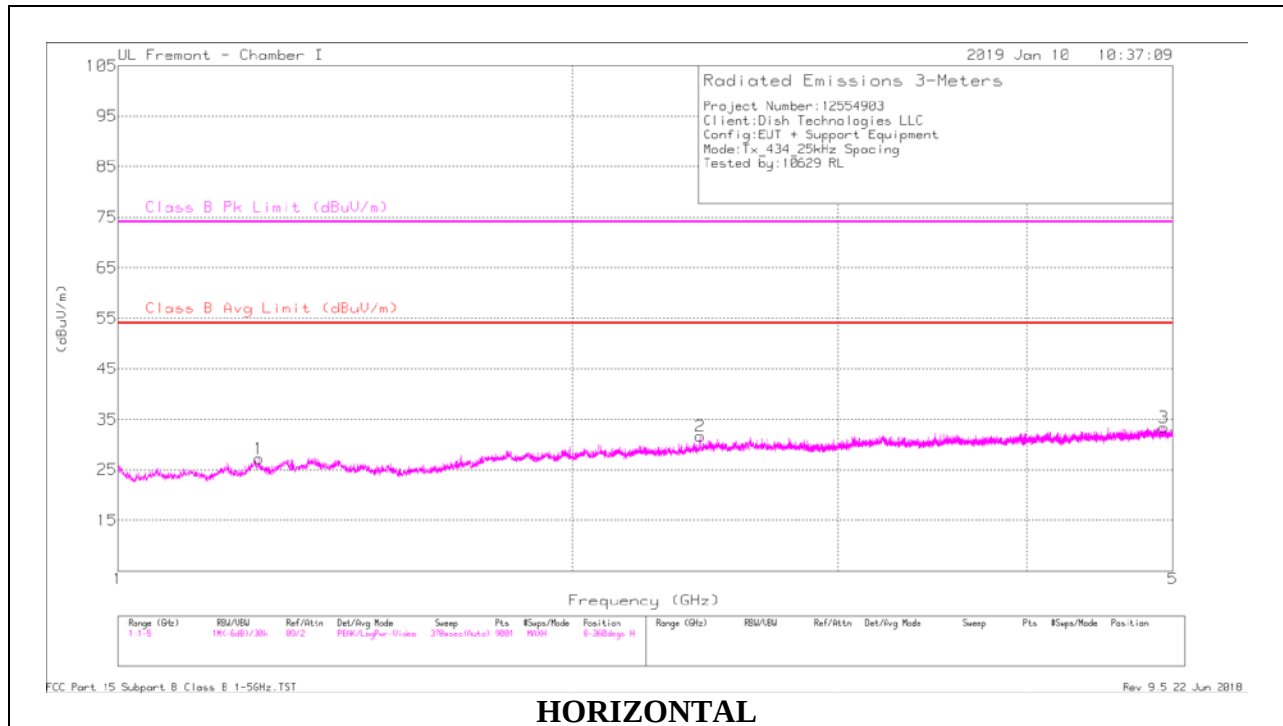
Refer to section 7.2 for duty cycle factor calculation (-16.72dB)

Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF

* Indicates frequency in CFR15.205 -Restricted Band

** Harmonics of fundamental 433.025 MHz

Middle Channel Result



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.24	32.24	Avg	28.9	-34	27.14	-	-	-	-	0-360	302	H
2	2.43	31.51	Avg	32.2	-32	31.71	-	-	-	-	0-360	399	H
3	4.936	28.34	Avg	34.2	-29.2	33.34	-	-	-	-	0-360	302	H
4	1.401	32.18	Avg	29	-33.7	27.48	-	-	-	-	0-360	302	V
5	2.631	30.27	Avg	32.6	-31.3	31.57	-	-	-	-	0-360	302	V
6	4.821	27.61	Avg	34.2	-29	32.81	-	-	-	-	0-360	200	V

Avg - Video bandwidth < Resolution bandwidth

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.43	41.08	Pk	32.2	-32	41.28	-	-	74	-32.72	236	236	H
		Av			24.56	54	-29.44	-	-	236	236	H
2.632	40.9	Pk	32.6	-31.3	42.2	-	-	74	-31.8	268	142	V
		Av			25.48	54	-28.52	-	-	268	142	V
*4.936	38.95	Pk	34.2	-29.2	43.95	-	-	74	-30.05	41	342	H
		Av			27.23	54	-26.77	-	-	41	342	H
*1.401	42.79	Pk	29	-33.7	38.09	-	-	74	-35.91	237	154	V
		Av			21.37	54	-32.63	-	-	237	154	V
*4.822	39.18	Pk	34.2	-29	44.38	-	-	74	-29.62	211	376	V
		Av			27.66	54	-26.34	-	-	211	376	V
**1.302	45.24	Pk	29.2	-33.9	40.54	-	-	74	-33.46	136	242	H
		Av			23.82	54	-30.18	-	-	136	242	H

Pk - Peak detector

Av – Average Reading

Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is 0.1459

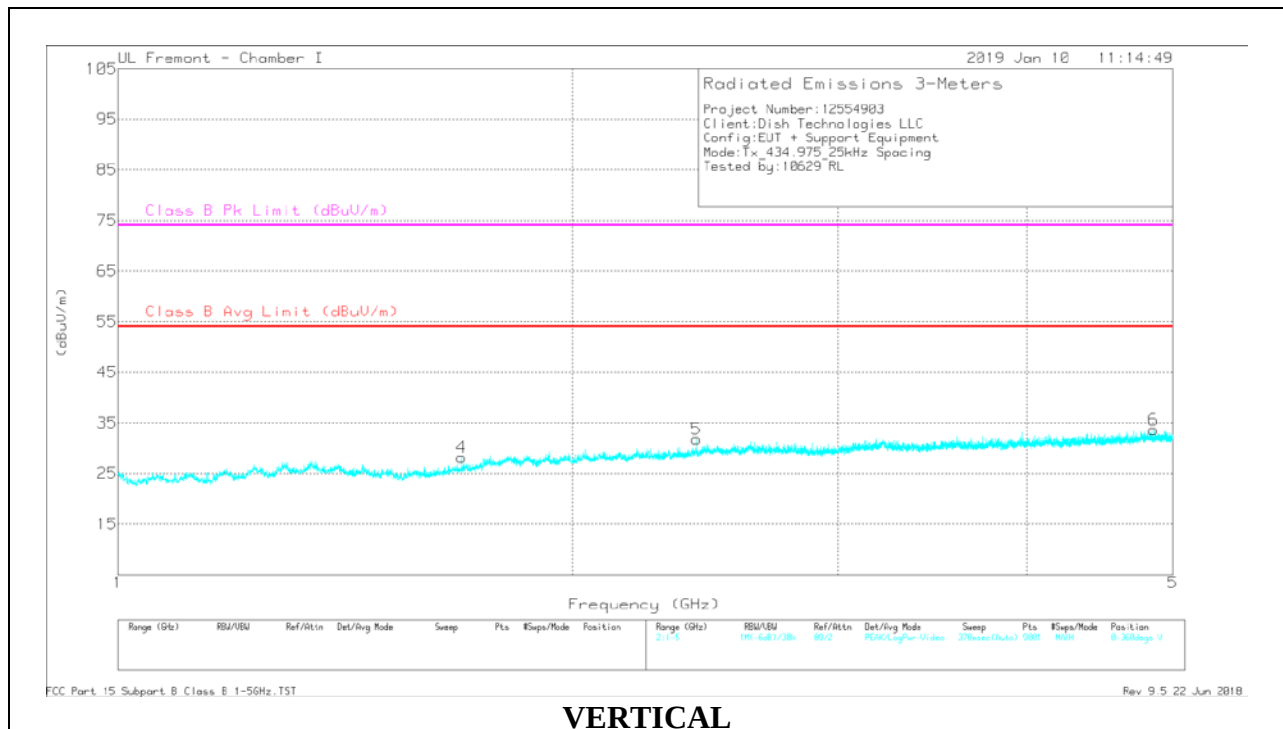
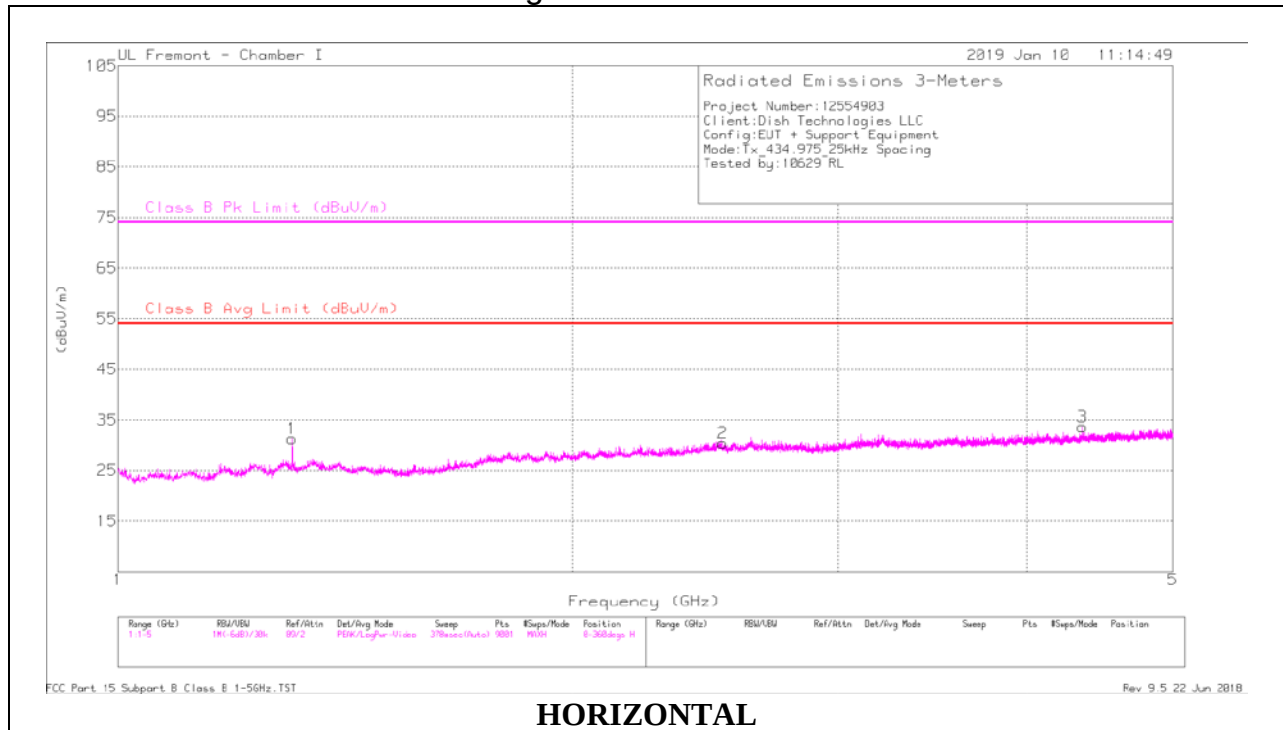
Refer to section 7.2 for duty cycle factor calculation (-16.72dB)

Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF

* Indicates frequency in CFR15.205 -Restricted Band

** Harmonics of fundamental 434 MHz

High Channel Result



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.304	35.84	Avg	29.3	-33.8	31.34	-	-	-	-	0-360	300	H
2	2.516	29.78	Avg	32.4	-31.8	30.38	-	-	-	-	0-360	300	H
3	4.356	29.41	Avg	33.7	-29.5	33.61	-	-	-	-	0-360	399	H
4	1.688	32.08	Avg	29.1	-33	28.18	-	-	-	-	0-360	198	V
5	2.417	31.78	Avg	32.1	-32.1	31.78	-	-	-	-	0-360	100	V
6	4.854	28.4	Avg	34.2	-28.9	33.7	-	-	-	-	0-360	198	V

Avg - Video bandwidth < Resolution bandwidth

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.518	41.63	Pk	32.4	-31.7	42.33	-	-	74	-31.67	287	118	H
		Av			25.61	54	-28.39	-	-	287	118	H
2.416	41.15	Pk	32.1	-32.1	41.15	-	-	74	-32.85	207	106	V
		Av			24.43	54	-29.57	-	-	207	106	V
*4.355	38.71	Pk	33.7	-29.5	42.91	-	-	74	-31.09	182	150	H
		Av			26.19	54	-27.81	-	-	182	150	H
*1.688	41.33	Pk	29.1	-33	37.43	-	-	74	-36.57	350	374	V
		Av			20.71	54	-33.29	-	-	350	374	V
*4.854	38.57	Pk	34.2	-28.9	43.87	-	-	74	-30.13	280	299	V
		Av			27.15	54	-26.85	-	-	280	299	V
**1.305	44.35	Pk	29.3	-33.8	39.85	-	-	74	-34.15	138	241	H
		Av			23.13	54	-30.87	-	-	138	241	H

Pk - Peak detector

Av – Average Reading

Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is 0.1459

Refer to section 7.2 for duty cycle factor calculation (-16.72dB)

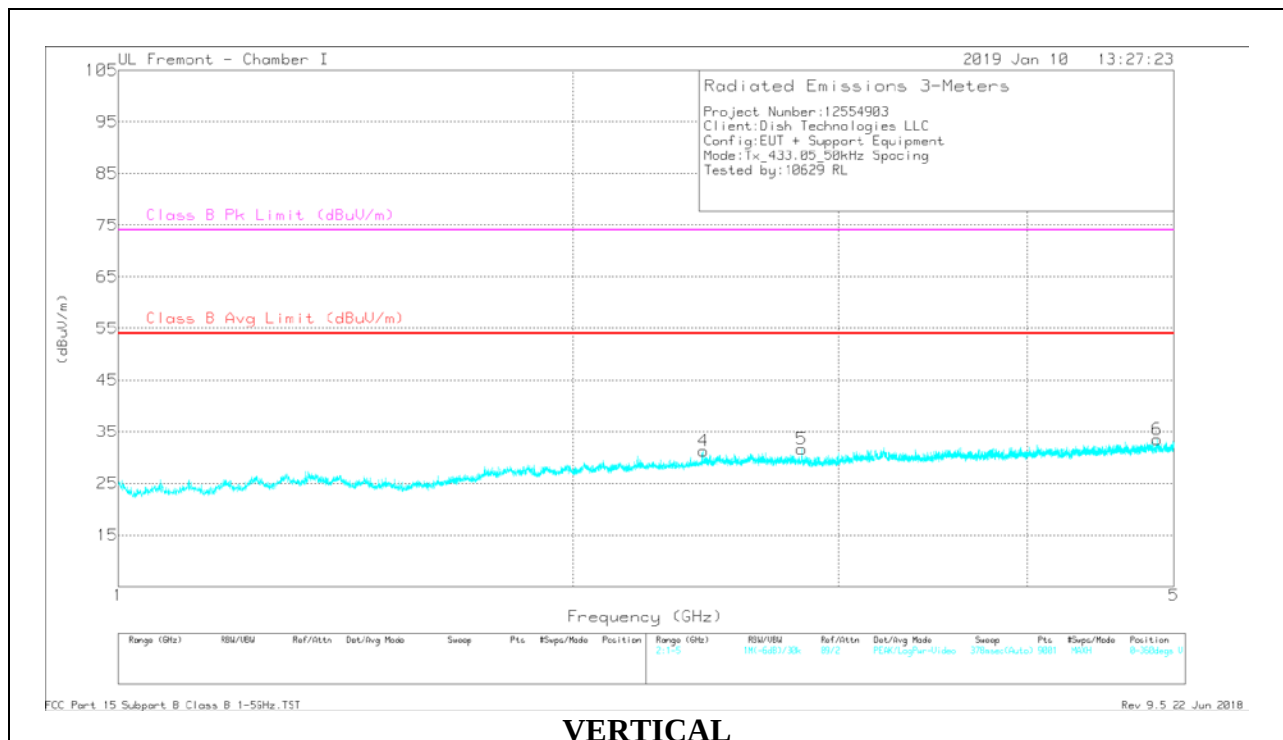
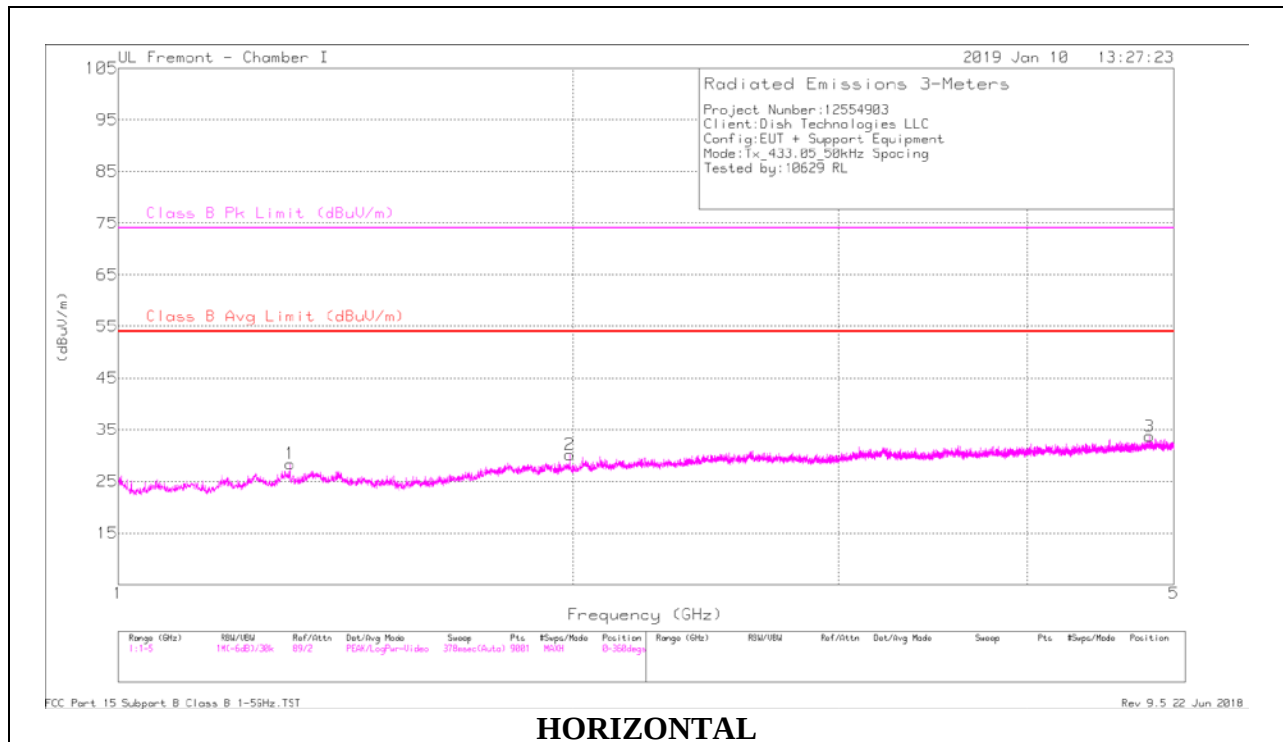
Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF

* Indicates frequency in CFR15.205 -Restricted Band

** Harmonics of fundamental 434.975 MHz

7.4.3.2. 50kHz Spacing Mode

Low Channel Result



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.299	33.12	Avg	29.2	-33.9	28.42	54	-25.58	-	-	0-360	299	H
2	1.99	32	Avg	30.9	-32.7	30.2	54	-23.8	-	-	0-360	299	H
3	4.82	28.5	Avg	34.2	-29	33.7	54	-20.3	-	-	0-360	202	H
4	2.44	31.07	Avg	32.2	-32	31.27	54	-22.73	-	-	0-360	198	V
5	2.836	30.94	Avg	32.2	-31.5	31.64	54	-22.36	-	-	0-360	100	V
6	4.876	28.21	Avg	34.2	-28.9	33.51	54	-20.49	-	-	0-360	198	V

Avg - Video bandwidth < Resolution bandwidth

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.993	41.73	Pk	30.9	-32.7	39.93	-	-	74	-34.07	19	363	H
		Av			17.14	54	-36.86	-	-	19	363	H
2.442	41.02	Pk	32.2	-32	41.22	-	-	74	-32.78	122	173	V
		Av			18.43	54	-35.57	-	-	122	173	V
*4.821	38.4	Pk	34.2	-29	43.6	-	-	74	-30.4	358	128	H
		Av			20.81	54	-33.19	-	-	358	128	H
*2.837	30.06	Pk	32.2	-31.5	30.76	-	-	74	-43.24	218	354	V
		Av			7.97	54	-46.03	-	-	218	354	V
*4.877	38.56	Pk	34.2	-28.9	43.86	-	-	74	-30.14	136	140	V
		Av			21.07	54	-32.93	-	-	136	140	V
**1.299	44.73	Pk	29.2	-33.9	40.03	-	-	74	-33.97	136	243	H
		Av			17.24	54	-36.76	-	-	136	243	H

Pk - Peak detector

Av – Average Reading

Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is 0.0725

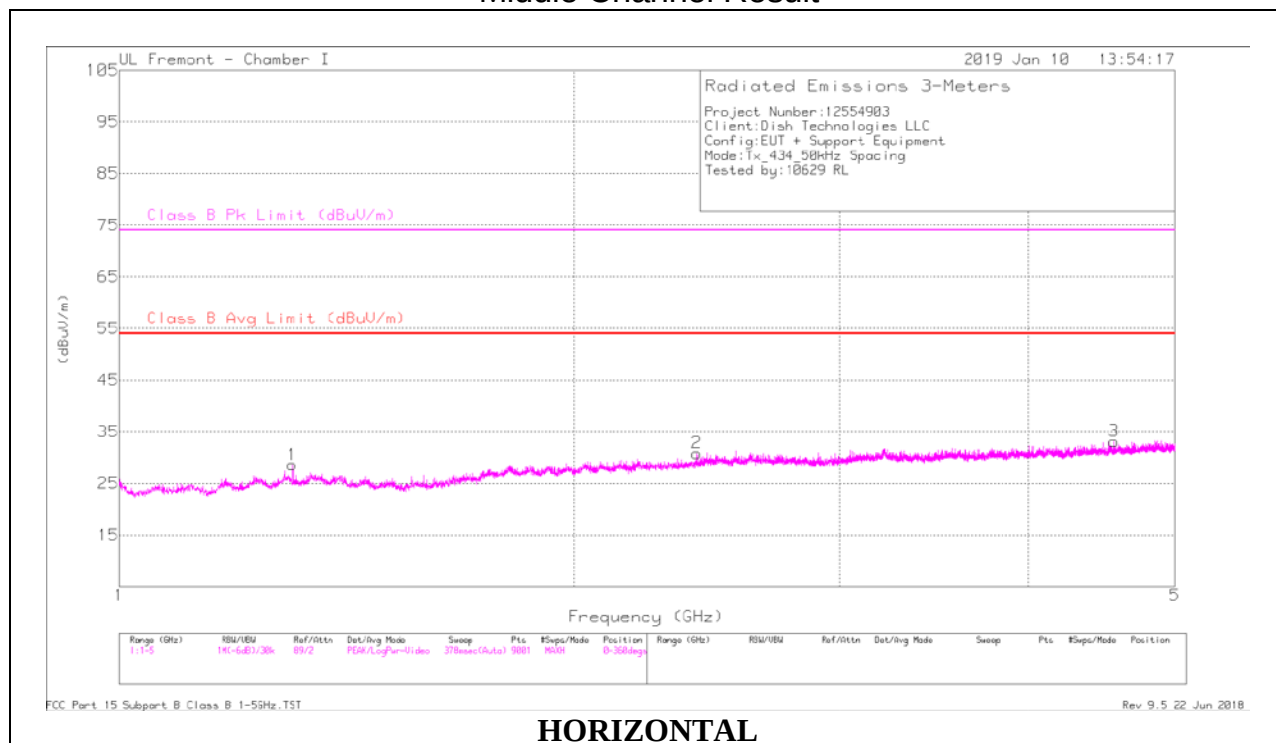
Refer to section 7.2 for duty cycle factor calculation (-22.79dB)

Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF

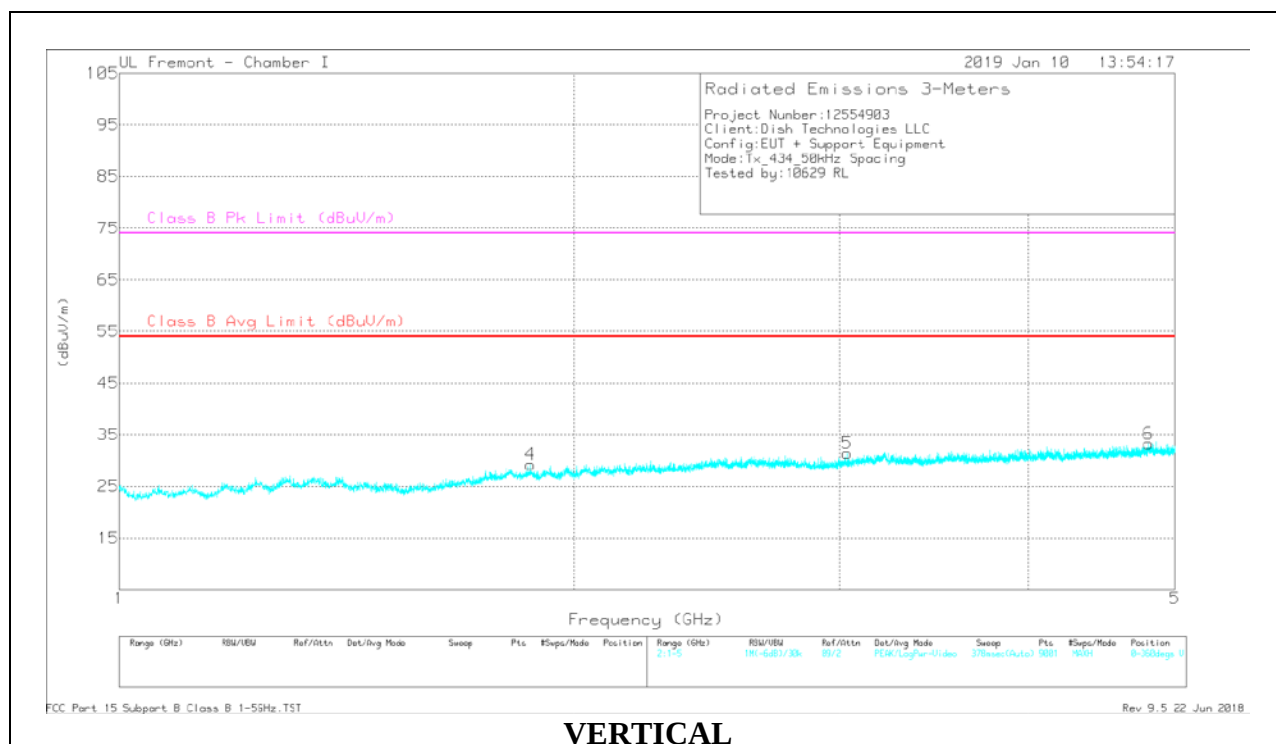
* Indicates frequency in CFR15.205 -Restricted Band

** Harmonics of fundamental 433.05 MHz

Middle Channel Result



HORIZONTAL



VERTICAL

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.302	33.29	Avg	29.2	-33.9	28.59	54	-25.41	-	-	0-360	102	H
2	2.413	30.87	Avg	32.1	-32.1	30.87	54	-23.13	-	-	0-360	198	H
3	4.56	28.68	Avg	33.9	-29.4	33.18	54	-20.82	-	-	0-360	102	H
4	1.872	31.26	Avg	30.8	-32.8	29.26	54	-24.74	-	-	0-360	199	V
5	3.034	30.11	Avg	32.5	-31.2	31.41	54	-22.59	-	-	0-360	199	V
6	4.806	27.86	Avg	34.2	-28.8	33.26	54	-20.74	-	-	0-360	199	V

Avg - Video bandwidth < Resolution bandwidth

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.414	40.97	Pk	32.1	-32.1	40.97	-	-	74	-33.03	187	267	H
		Av			18.18	54	-35.82	-	-	187	267	H
1.872	41.78	Pk	30.8	-32.8	39.78	-	-	74	-34.22	340	287	V
		Av			16.99	54	-37.01	-	-	340	287	V
3.035	39.75	Pk	32.5	-31.2	41.05	-	-	74	-32.95	250	144	V
					18.26	54	-35.74	-	-	250	144	V
*4.56	38.57	Pk	33.9	-29.4	43.07	-	-	74	-30.93	3	226	H
		Av			20.28	54	-33.72	-	-	3	226	H
*4.807	37.71	Pk	34.2	-28.8	43.11	-	-	74	-30.89	265	150	V
		Av			20.32	54	-33.68	-	-	265	150	V
**1.302	44.86	Pk	29.2	-33.9	40.16	-	-	74	-33.84	139	241	H
		Av			17.37	54	-36.63	-	-	139	241	H

Pk - Peak detector

Av – Average Reading

Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is 0.0725

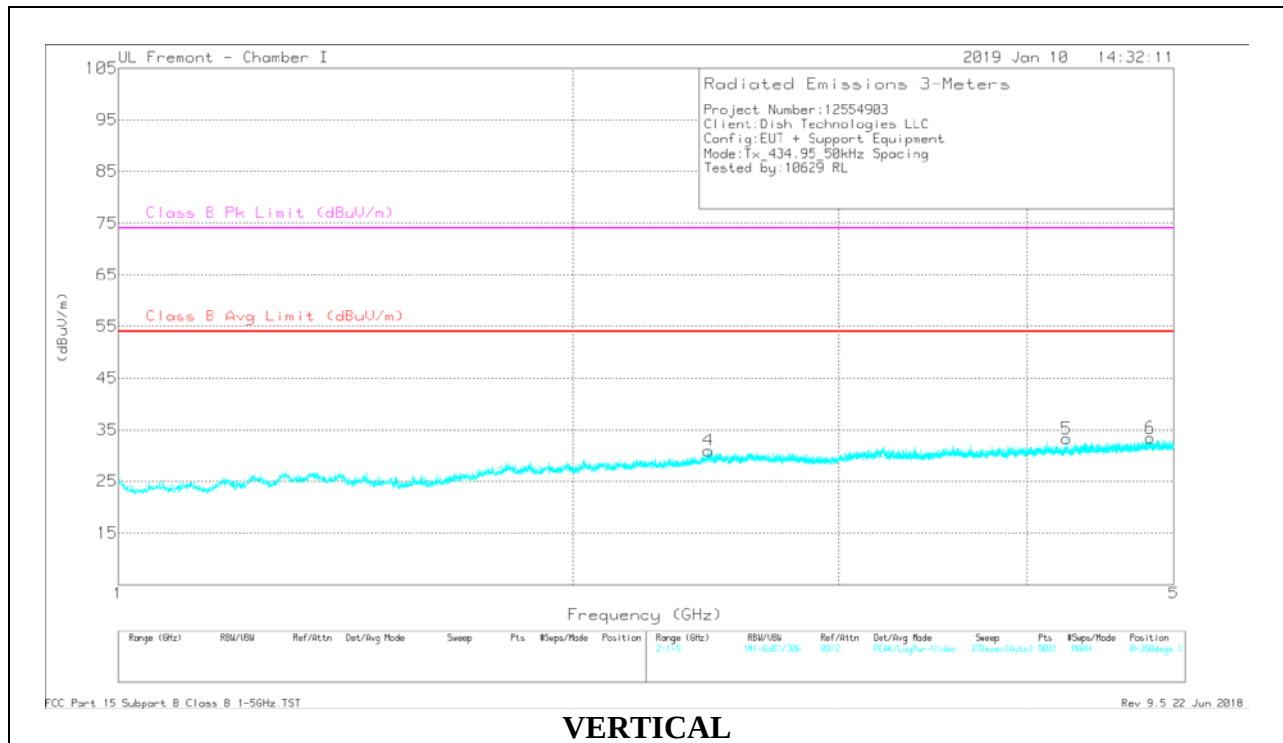
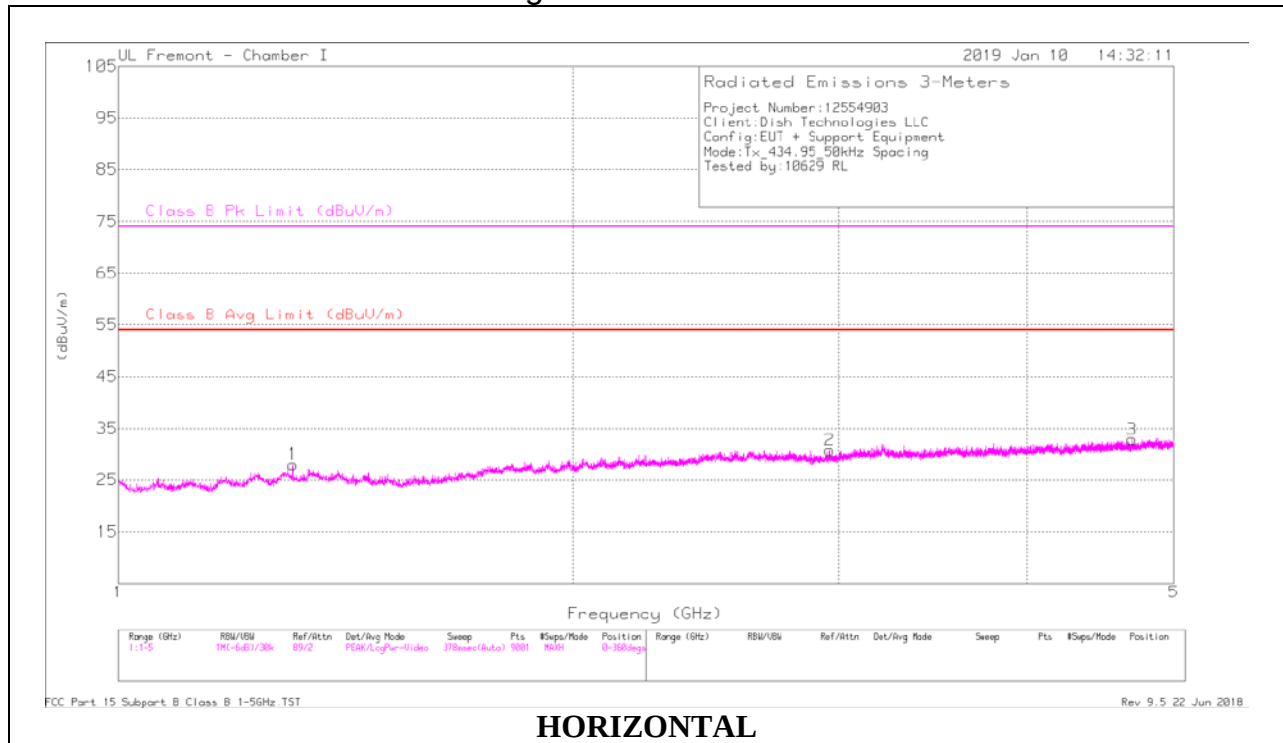
Refer to section 7.2 for duty cycle factor calculation (-22.79dB)

Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF

* Indicates frequency in CFR15.205 -Restricted Band

** Harmonics of fundamental 434MHz

High Channel Result



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.305	32.55	Avg	29.3	-33.8	28.05	54	-25.95	-	-	0-360	102	H
2	2.96	30.17	Avg	31.9	-31.3	30.77	54	-23.23	-	-	0-360	198	H
3	4.694	28.13	Avg	33.9	-29.2	32.83	54	-21.17	-	-	0-360	102	H
4	2.459	30.69	Avg	32.2	-31.9	30.99	54	-23.01	-	-	0-360	198	V
5	4.248	29.56	Avg	33.3	-29.6	33.26	54	-20.74	-	-	0-360	198	V
6	4.827	28.3	Avg	34.2	-29.1	33.4	54	-20.6	-	-	0-360	102	V

Avg - Video bandwidth < Resolution bandwidth

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.961	39.97	Pk	31.9	-31.3	40.57	-	-	74	-33.43	330	261	H
		Av			17.78	54	-36.22	-	-	330	261	H
2.457	40.95	Pk	32.2	-31.9	41.25	-	-	74	-32.75	137	100	V
		Av			18.46	54	-35.54	-	-	137	100	V
*4.694	39.18	Pk	33.9	-29.2	43.88	-	-	74	-30.12	28	173	H
		Av			21.09	54	-32.91	-	-	28	173	H
*4.246	38.9	Pk	33.3	-29.6	42.6	-	-	74	-31.4	156	278	V
		Av			19.81	54	-34.19	-	-	156	278	V
*4.826	39.32	Pk	34.2	-29.1	44.42	-	-	74	-29.58	31	391	V
		Av			21.63	54	-32.37	-	-	31	391	V
**1.305	43.96	Pk	29.3	-33.8	39.46	-	-	74	-34.54	136	247	H
		Av			16.67	54	-37.33	-	-	136	247	H

Pk - Peak detector

Av – Average Reading

Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is 0.0725

Refer to section 7.2 for duty cycle factor calculation (-22.79dB)

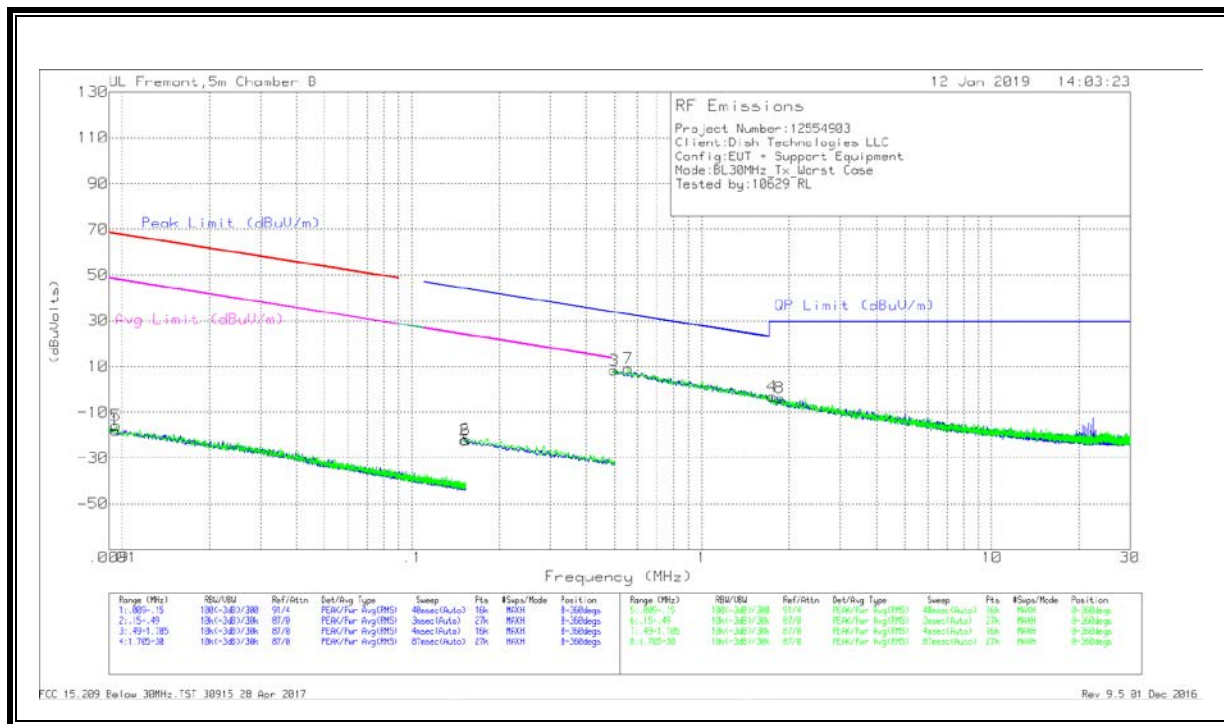
Note: Radiated peak result is based on 100% duty cycle sample; average reading = peak reading + DCCF

* Indicates frequency in CFR15.205 -Restricted Band

** Harmonics of fundamental 434.95 MHz

7.4.4. WORST-CASE BELOW 30 MHz

7.4.4.1. 25kHz Spacing Mode



Trace Markers

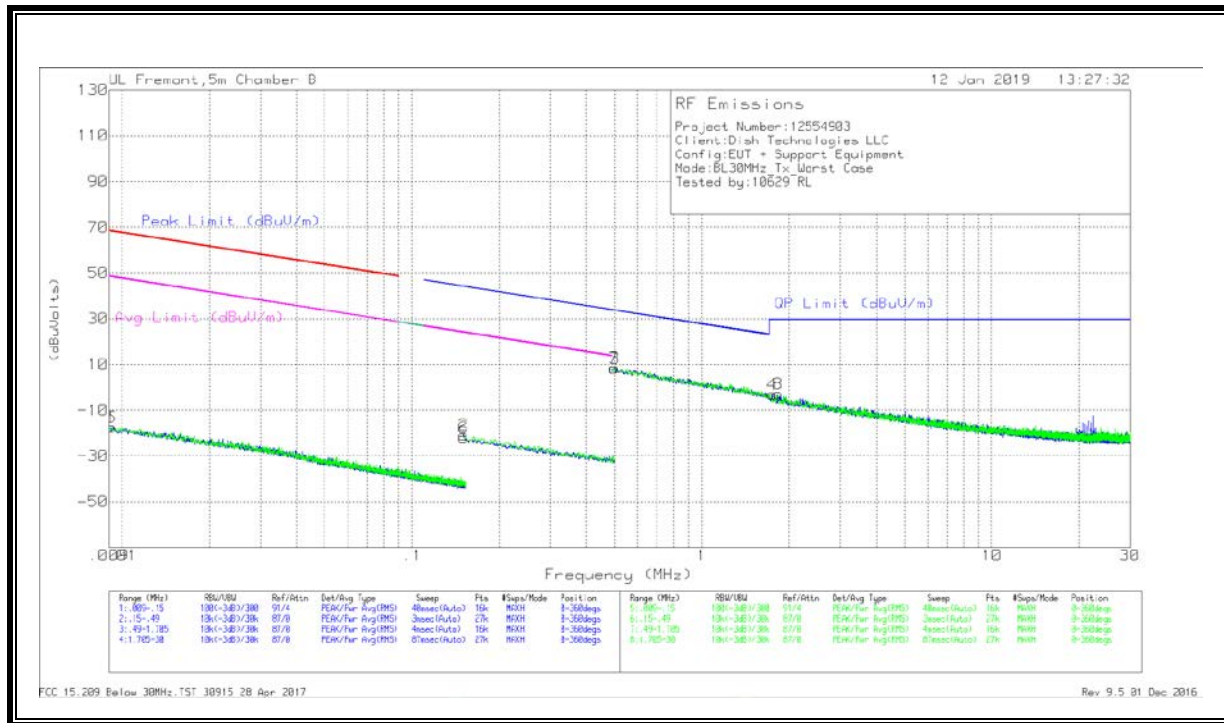
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuV)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.00947	42.05	Pk	20	.1	-80	-17.85	68.06	-85.91	48.06	-65.91	-	-	0-360
5	.00954	44.01	Pk	20	.1	-80	-15.89	67.99	-83.88	47.99	-63.88	-	-	0-360
2	.15178	46.46	Pk	11.3	0	-80	-22.24	44	-66.24	24	-46.24	-	-	0-360
6	.1538	46.54	Pk	11.3	.1	-80	-22.06	43.88	-65.94	23.88	-45.94	-	-	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuV)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.4995	37.27	Pk	11.1	.1	-40	8.47	-	-	-	-	33.63	-25.16	0-360
7	.55574	37.89	Pk	11.1	.1	-40	9.09	-	-	-	-	32.71	-23.62	0-360
4	1.74378	25.51	Pk	11.3	.2	-40	-2.99	-	-	-	-	29.5	-32.49	0-360
8	1.85539	24.79	Pk	11.3	.2	-40	-3.71	-	-	-	-	29.5	-33.21	0-360

Pk - Peak detector

7.4.4.2. 50kHz Spacing Mode



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.00923	42.22	Pk	20.3	.1	-80	-17.38	68.28	-85.66	48.28	-65.66	-	-	0-360
5	.00923	42.29	Pk	20.3	.1	-80	-17.31	68.29	-85.6	48.29	-65.6	-	-	0-360
2	.1506	47.71	Pk	11.3	0	-80	-20.99	44.07	-65.06	24.07	-45.06	-	-	0-360
6	.15094	46.7	Pk	11.3	0	-80	-22	44.05	-66.05	24.05	-46.05	-	-	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
7	.49619	37.1	Pk	11.1	.1	-40	8.3	-	-	-	-	33.69	-25.39	0-360
3	.5003	37.28	Pk	11.1	.1	-40	8.48	-	-	-	-	33.62	-25.14	0-360
4	1.74378	25.51	Pk	11.3	.2	-40	-2.99	-	-	-	-	29.5	-32.49	0-360
8	1.83024	25.66	Pk	11.3	.2	-40	-2.84	-	-	-	-	29.5	-32.34	0-360

Pk - Peak detector

8. AC POWER LINE CONDUCTED EMISSIONS

LIMIT

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	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.

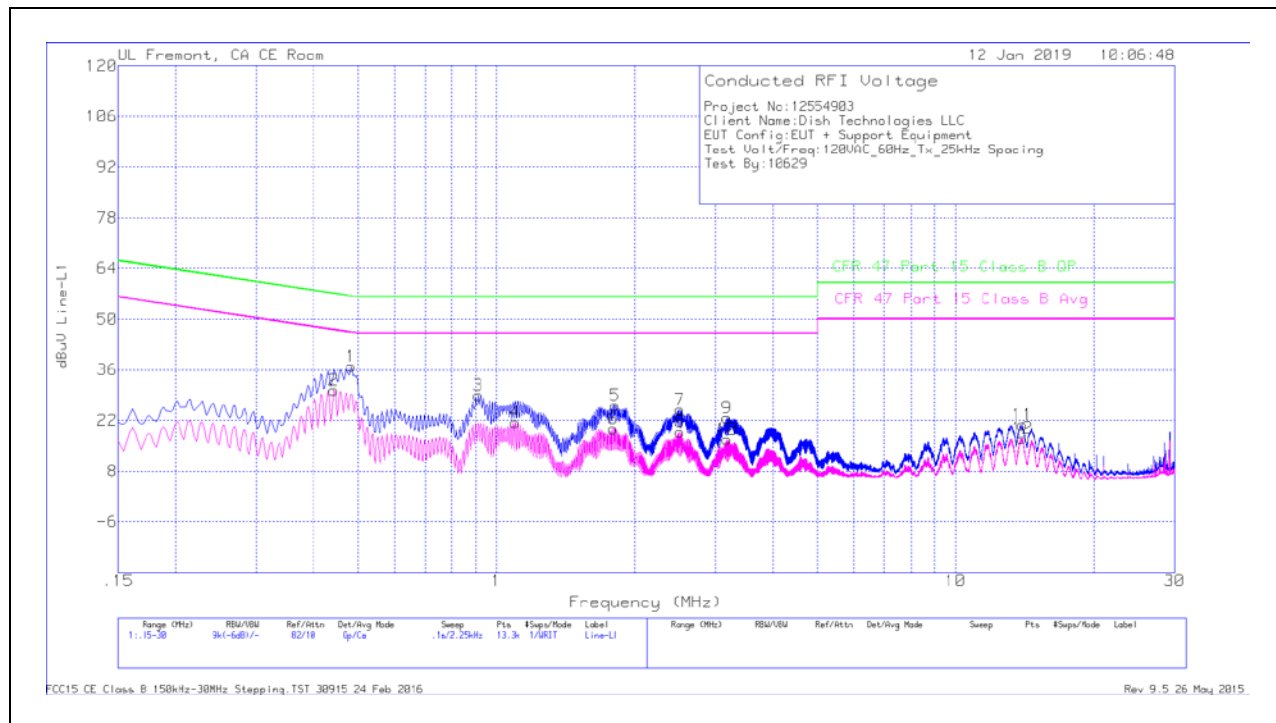
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both Line 1 (HOT) and Line 2 (NEUTRAL).

RESULTS

8.1. 25kHz Spacing Mode

LINE 1 RESULTS

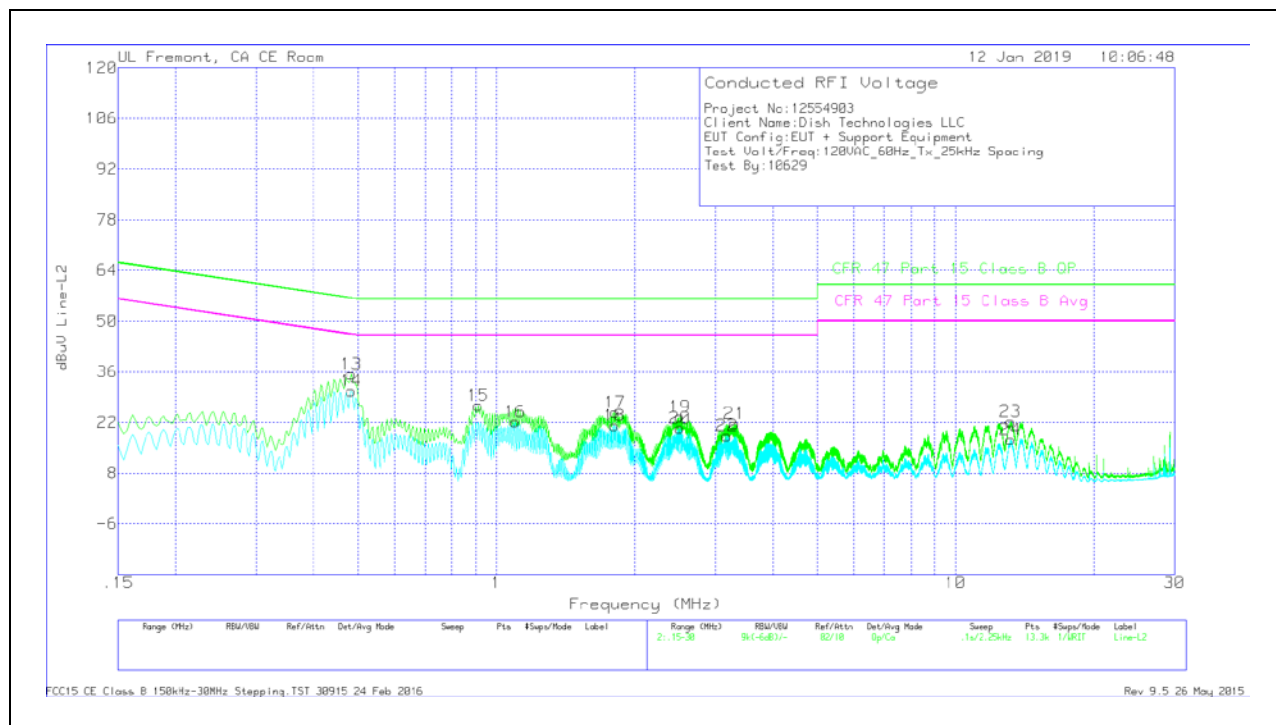


Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.483	26.82	Qp	0	0	10.1	36.92	56.29	-19.37	-	-
2	.4425	20.26	Ca	0	0	10.1	30.36	-	-	47.01	-16.65
3	.91275	18.94	Qp	0	0	10.1	29.04	56	-26.96	-	-
4	1.0995	11.23	Ca	0	.1	10.1	21.43	-	-	46	-24.57
5	1.81275	16.06	Qp	0	.1	10.1	26.26	56	-29.74	-	-
6	1.79925	9.61	Ca	0	.1	10.1	19.81	-	-	46	-26.19
7	2.51025	14.71	Qp	0	.1	10.1	24.91	56	-31.09	-	-
8	2.51025	8.61	Ca	0	.1	10.1	18.81	-	-	46	-27.19
9	3.18075	12.48	Qp	0	.1	10.1	22.68	56	-33.32	-	-
10	3.18075	6.53	Ca	0	.1	10.1	16.73	-	-	46	-29.27
11	13.983	10.23	Qp	.1	.3	10.2	20.83	60	-39.17	-	-
12	13.98075	6.46	Ca	.1	.3	10.2	17.06	-	-	50	-32.94

Qp - Quasi-Peak detector

Ca - CISPR average detection

LINE 2 RESULTS

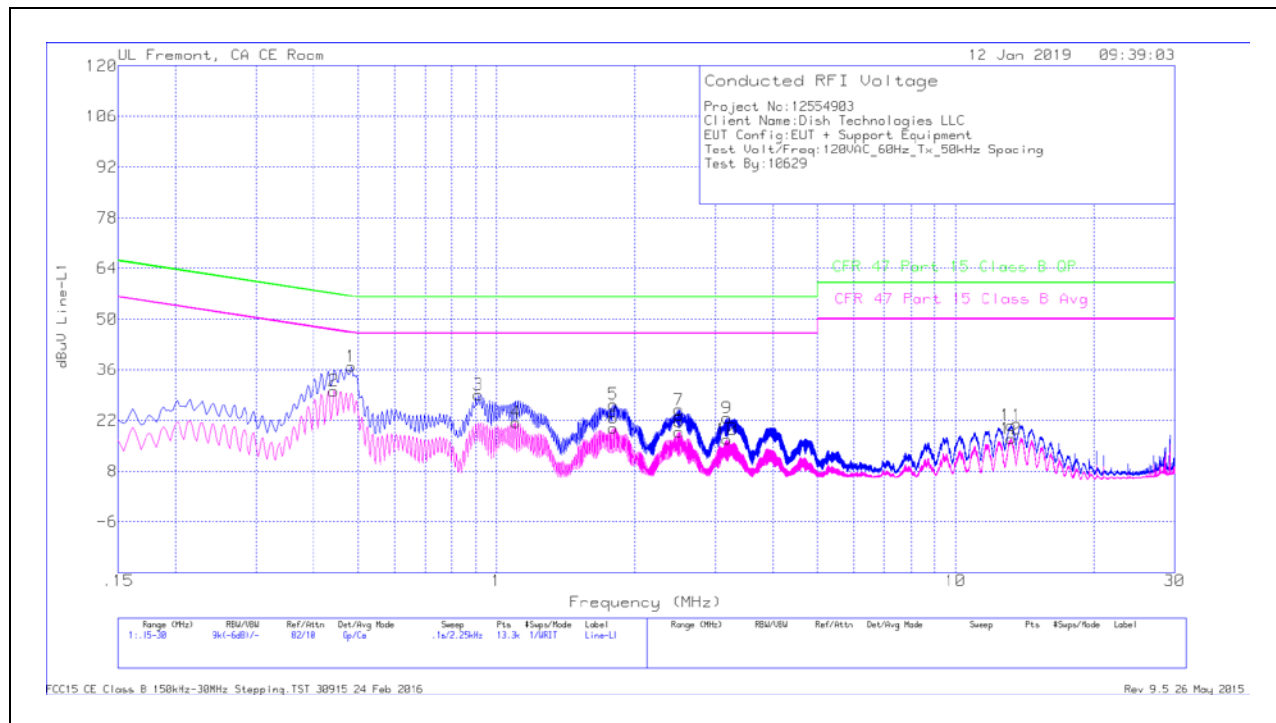


Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
13	.483	25.35	Qp	0	0	10.1	35.45	56.29	-20.84	-	-
14	.483	20.67	Ca	0	0	10.1	30.77	-	-	46.29	-15.52
15	.91275	16.53	Qp	0	.1	10.1	26.73	56	-29.27	-	-
16	1.0995	11.97	Ca	0	.1	10.1	22.17	-	-	46	-23.83
17	1.81275	14.55	Qp	0	.1	10.1	24.75	56	-31.25	-	-
18	1.8105	10.92	Ca	0	.1	10.1	21.12	-	-	46	-24.88
19	2.51025	13.41	Qp	0	.1	10.1	23.61	56	-32.39	-	-
20	2.51025	10.27	Ca	0	.1	10.1	20.47	-	-	46	-25.53
21	3.3	11.4	Qp	0	.1	10.1	21.6	56	-34.4	-	-
22	3.18075	8.24	Ca	0	.1	10.1	18.44	-	-	46	-27.56
23	13.164	11.77	Qp	.1	.2	10.2	22.27	60	-37.73	-	-
24	13.164	6.77	Ca	.1	.2	10.2	17.27	-	-	50	-32.73

Qp - Quasi-Peak detector
Ca - CISPR average detection

8.2. 50kHz Spacing Mode

LINE 1 RESULTS

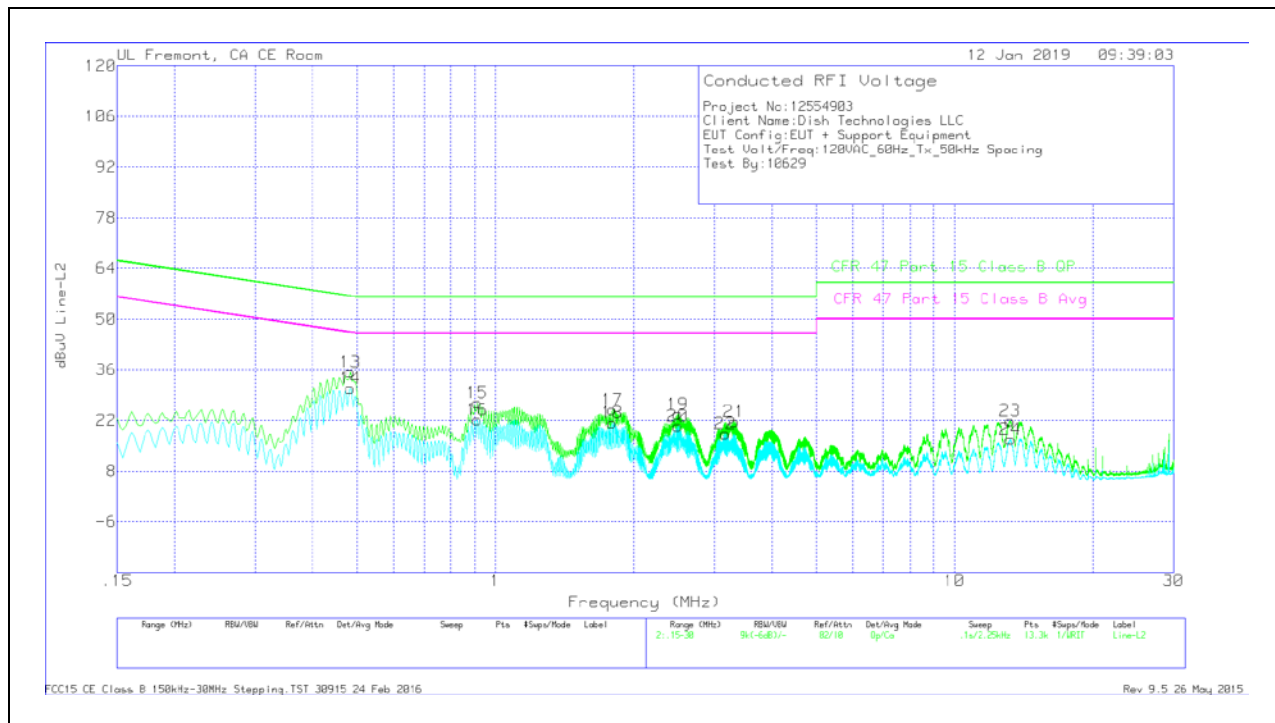


Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.483	26.85	Qp	0	0	10.1	36.95	56.29	-19.34	-	-
2	.4425	20.13	Ca	0	0	10.1	30.23	-	-	47.01	-16.78
3	.91275	19.02	Qp	0	0	10.1	29.12	56	-26.88	-	-
4	1.10175	11.28	Ca	0	.1	10.1	21.48	-	-	46	-24.52
5	1.79925	16.25	Qp	0	.1	10.1	26.45	56	-29.55	-	-
6	1.79925	9.75	Ca	0	.1	10.1	19.95	-	-	46	-26.05
7	2.49675	14.72	Qp	0	.1	10.1	24.92	56	-31.08	-	-
8	2.49675	8.63	Ca	0	.1	10.1	18.83	-	-	46	-27.17
9	3.183	12.53	Qp	0	.1	10.1	22.73	56	-33.27	-	-
10	3.183	6.55	Ca	0	.1	10.1	16.75	-	-	46	-29.25
11	13.2	10.12	Qp	.1	.2	10.2	20.62	60	-39.38	-	-
12	13.2135	6.55	Ca	.1	.2	10.2	17.05	-	-	50	-32.95

Qp - Quasi-Peak detector

Ca - CISPR average detection

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
13	.483	25.34	Qp	0	0	10.1	35.44	56.29	-20.85	-	-
14	.483	20.7	Ca	0	0	10.1	30.8	-	-	46.29	-15.49
15	.91275	16.62	Qp	0	.1	10.1	26.82	56	-29.18	-	-
16	.91275	11.95	Ca	0	.1	10.1	22.15	-	-	46	-23.85
17	1.79925	14.84	Qp	0	.1	10.1	25.04	56	-30.96	-	-
18	1.79925	11.2	Ca	0	.1	10.1	21.4	-	-	46	-24.6
19	2.49675	13.53	Qp	0	.1	10.1	23.73	56	-32.27	-	-
20	2.49675	10.31	Ca	0	.1	10.1	20.51	-	-	46	-25.49
21	3.31575	11.51	Qp	0	.1	10.1	21.71	56	-34.29	-	-
22	3.16725	8.24	Ca	0	.1	10.1	18.44	-	-	46	-27.56
23	13.2315	11.42	Qp	.1	.2	10.2	21.92	60	-38.08	-	-
24	13.23375	6.31	Ca	.1	.2	10.2	16.81	-	-	50	-33.19

Qp - Quasi-Peak detector
Ca - CISPR average detection