TEST REPORT

Report Number: R13359833-E1

Applicant	:	Oxford Nanopore Technologies Ltd Gosling Building, Edmund Halley Road Oxford Science Park Oxford, OX4 4DQ United Kingdom
Model	:	ONT-07-01191-00
FCC ID	:	2ARGS-P3310
IC	:	26200-P3310
EUT Description	:	BT/BLE/WLAN (2.4GHz and 5GHz) Radio Module
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5 +A1:2019

Date of Issue:
2020-08-28

Prepared by:
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NVLAP TESTING

NVLAP Lab code: 200246-0

REPORT REVISION HISTORY

Ver.	Issue Date	Revisions	Revised By
1	2020-08-28	Initial Issue	Brian T. Kiewra

UL LLC
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Oxford Nanopore Technologies Ltd
Gosling Building, Edmund Halley Road
Oxford Science Park
Oxford, OX4 4DQ
United Kingdom

EUT DESCRIPTION: BT/BLE/WLAN (2.4GHz and 5GHz) Radio Module

MODEL: ONT-07-01191-00

SERIAL NUMBER: 0325117192382

DATE TESTED: 2020-08-03 to 2020-08-17

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5 +A1:2019	Complies

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

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

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. government.

Approved & Released
For UL LLC By:

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Staff Engineer
Consumer Technology Division
UL Verification Services Inc.

Prepared By:

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Project Engineer
Consumer Technology Division
UL LLC

2. TEST RESULTS SUMMARY

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

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, RSS-GEN Issue 5 +A1:2019, and RSS-247 Issue 2.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Drive, Research Triangle Park, NC 27709, USA and 2800 Perimeter Park Dr., Suite B, Morrisville, NC 27560, USA. 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.

12 Laboratory Dr.	2800 Perimeter Park Dr.
Site Code: 2180C	
☐ Chamber A RTP	☐ North Chamber
☐ Chamber C RTP	☒ South Chamber

The above test sites and facilities are covered under FCC Test Firm Registration # 703469. Chambers above are covered under Industry Canada company address and respective code.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0.

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, 0.15 to 30 MHz	±3.07 dB
Worst Case Radiated Disturbance, 9kHz to 26GHz	±4.88 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 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 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 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

UL LLC
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6. DESCRIPTION OF C2PC

The purpose of this class 2 permission change report is to demonstrate that the radio module maintains compliancy when used with an antenna different from the original submission. Therefore, full radiated and AC mains testing were performed.

7. EQUIPMENT UNDER TEST

7.1. EUT DESCRIPTION

The EUT is a BT/BLE/WLAN (2.4GHz and 5GHz) Radio Module.
This report covers BLE.

7.2. MAXIMUM OUTPUT POWER

The purpose of this class 2 permission change report is to demonstrate that the radio module maintains compliancy when used with an antenna different from the original submission. Therefore, power measurements are not covered in this report. It is the responsibility of the manufacturer to ensure that the power settings used under this evaluation and in the field, yield the same or less maximum power as in the report.

7.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes 2 identical PCB patch antennas, with a maximum gain of 3.73 dBi in 2.4GHz band and 5.18 dBi in 5GHz band.

7.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was fw_bcmdhd_mfg_7.35.221.18.bin.
The test utility software used during testing was wl for WiFi, hcitool for Bluetooth & Bluetooth Low-Energy.

7.5. WORST-CASE CONFIGURATION AND MODE

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

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

BT/BLE radio transmits on EUT chain 0 antenna.

The fundamental of the EUT was investigated with the chain 0 antenna in three orthogonal orientations X,Y,Z, it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the chain 0 antenna in Z orientation.

7.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Dell	E6330	59R7PX1	NA
AC Adapter	FSP	FSP065-10AABA	H9221000252	NA

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	Mains	1	Barrel	Mains	<3m	Connected to DC power supply
2	ENET	1	RJ45	I/O	<3m	Connected to laptop outside chamber

SETUP DIAGRAMS

Please refer to R13359833-EP1 for setup diagram

8. TEST AND MEASUREMENT EQUIPMENT

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

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
0.009-30MHz (Loop Ant.)					
AT0059	Active Loop Antenna	EMCO	6502	2020-08-06	2021-08-06
30-1000 MHz					
AT0081	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2019-11-20	2020-11-20
1-18 GHz					
AT0067	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-04-28	2021-04-28
18-40 GHz					
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2019-11-07	2020-11-07
AT0077	Horn Antenna, 26-40GHz	ARA	MWH-2640/B	2019-11-07	2020-11-07
Gain-Loss Chains					
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2020-07-10	2021-07-10
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2020-07-10	2021-07-10
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-07-06	2021-07-06
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2020-07-07	2021-07-07
Receiver & Software					
SA0025	Spectrum Analyzer	Agilent	N9030A	2020-03-17	2021-03-17
SA0026	Spectrum Analyzer	Agilent	N9030A	2020-06-24	2021-06-24
SOFTEMI	EMI Software	UL	Version 9.5 (2019-06-12)		
Additional Equipment used					
s/n 200037635	Environmental Meter	Fisher Scientific	06-662-4	2020-1-22	2022-01-22
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
BRF004	5.5GHz notch filter, 2W, F_{high} =18GHz	Micro-Tronics	BRM50716-01	2020-02-19	2021-02-19

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2020-03-26	2021-03-26
HI0090	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2019-08-19	2020-08-19
75141 (PRE0101521)	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2019-08-20	2020-08-20
ATA222	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2020-03-26	2021-03-26
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (2015-08-20)		
Miscellaneous (if needed)					
LISN008	LISN, 50-ohm/50-uH, 2-conductor, 25A (For support gear only.)	Solar Electronics	8012-50-R-24-BNC	2020-08-08	2021-08-08

9. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10 Section 11.6

Out-of-band emissions in non-restricted bands: ANSI C63.10-2013 Section 11.11

Out-of-band emissions in restricted bands: ANSI C63.10-2013 Section 11.12.1 & 6.10.5

General Radiated Emissions: ANSI C63.10:2013 Sections 6.3 through 6.6

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

10. ON TIME AND DUTY CYCLE

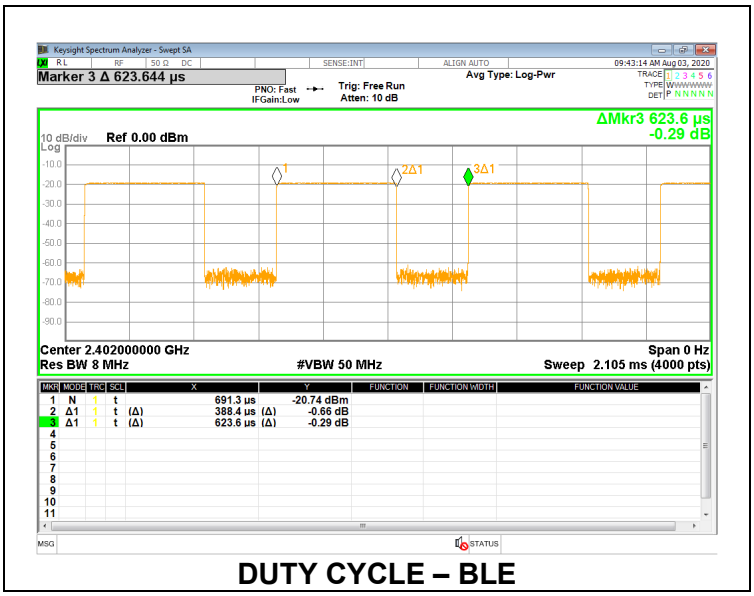
LIMITS

None; for reporting purposes only.

PROCEDURE

ANSI C63.10 Zero-Span Spectrum Analyzer Method.

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
2.4GHz Band					
BLE	0.3884	0.6236	0.623	62.28%	4.11



DUTY CYCLE – BLE

11. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209
RSS-GEN, Section 8.9 and 8.10.

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 in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak.

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 voltage 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.

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

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

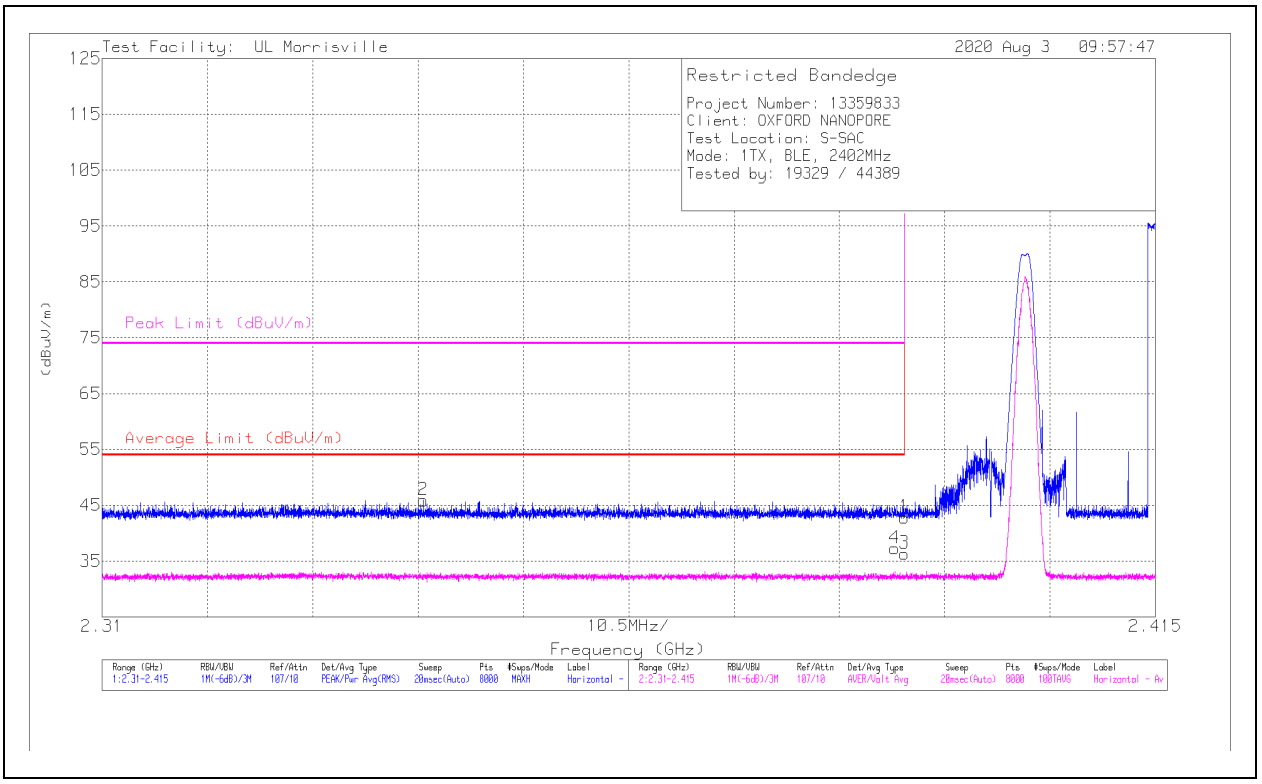
KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

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

11.1. TRANSMITTER ABOVE 1 GHz

BANDEDGE (LOW CHANNEL)

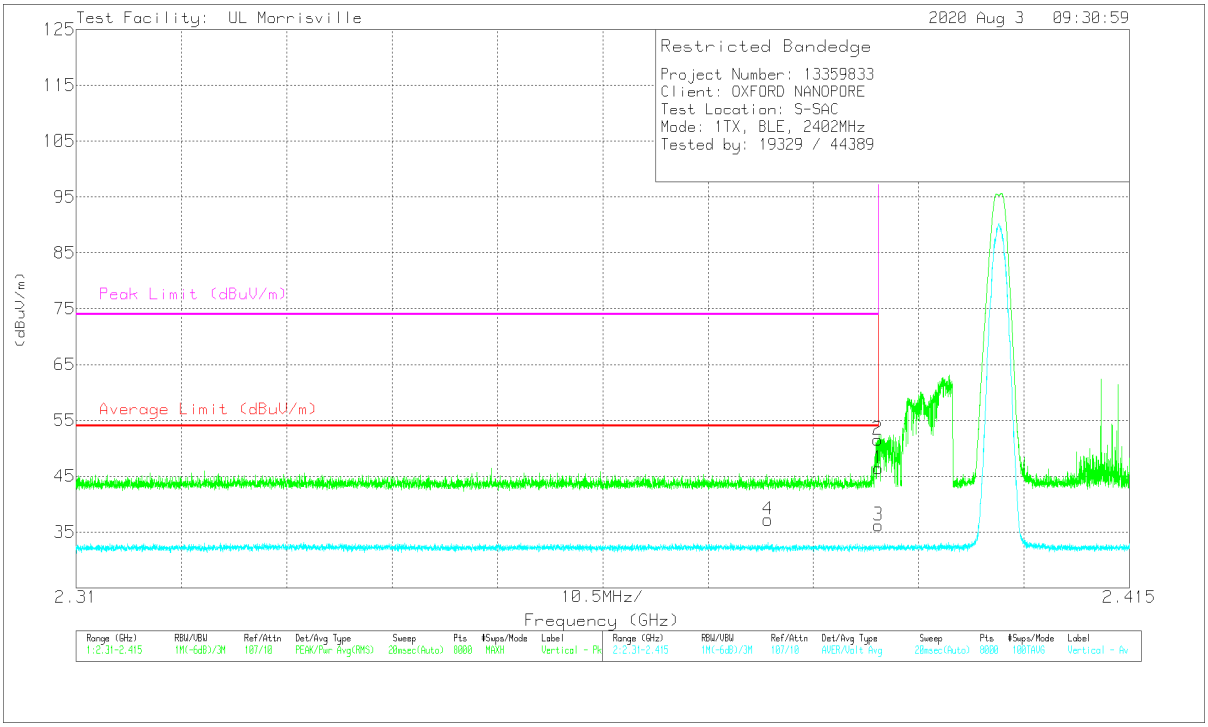
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (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	34.73	Pk	32.1	-24	0	42.83	-	-	74	-31.17	100	345	H
2	* ** 2.34199	37.49	Pk	32.2	-23.8	0	45.89	-	-	74	-28.11	100	345	H
3	* ** 2.39	24.15	ADV	32.1	-24	4.11	36.36	54	-17.64	-	-	100	345	H
4	* ** 2.38901	25.07	ADV	32.1	-24	4.11	37.28	54	-16.72	-	-	100	345	H

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

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (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	38.31	Pk	32.1	-24	0	46.41	-	-	74	-27.59	104	305	V
2	* ** 2.3899	43.48	Pk	32.1	-24	0	51.58	-	-	74	-22.42	104	305	V
3	* ** 2.39	24	ADV	32.1	-24	4.11	36.21	54	-17.79	-	-	104	305	V
4	* ** 2.37898	24.82	ADV	32.2	-23.9	4.11	37.23	54	-16.77	-	-	104	305	V

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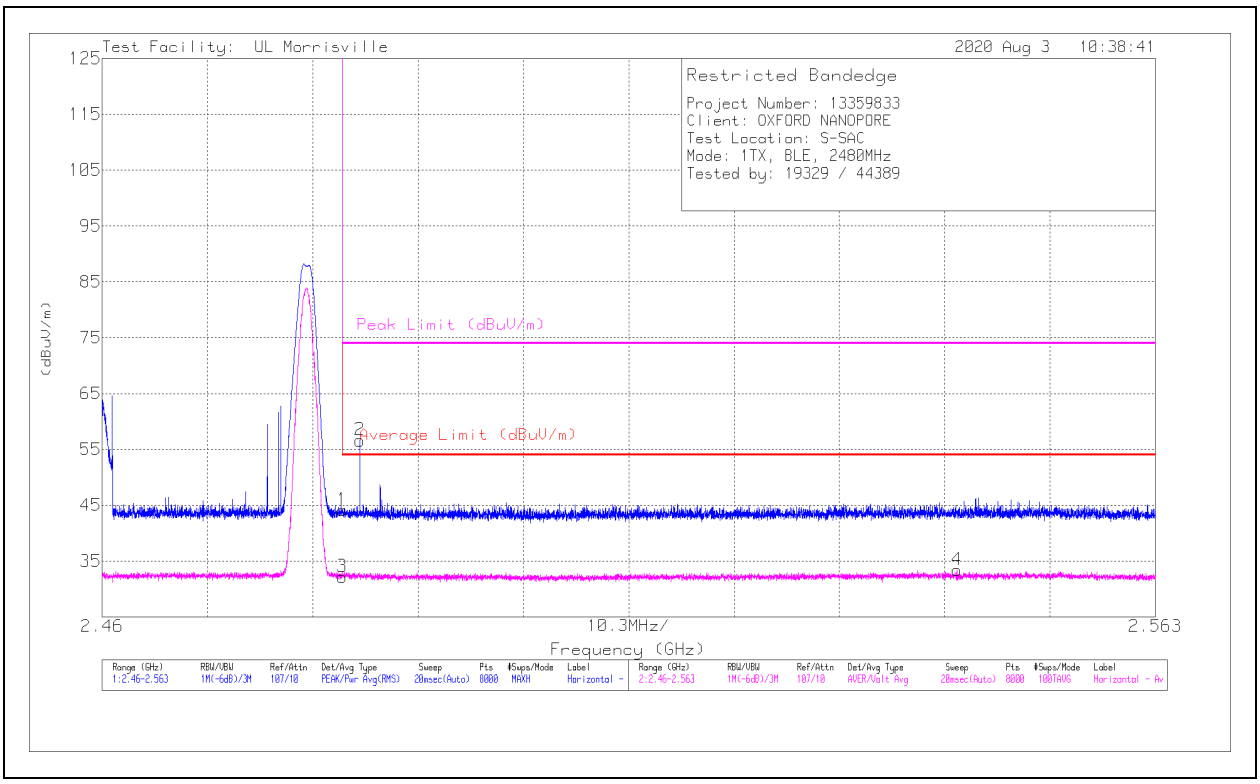
Pk - Peak detector
ADV - Linear Voltage Average

BANDEDGE (HIGH CHANNEL)

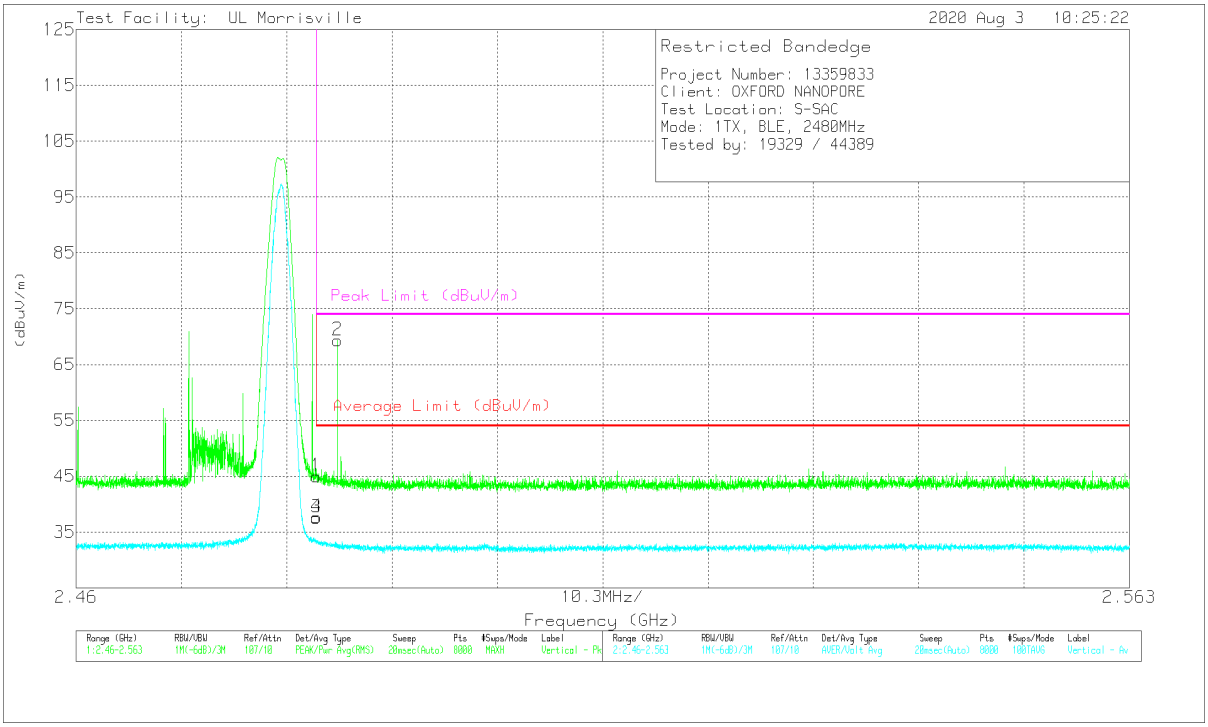
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	36.11	Pk	32.4	-24.4	0	44.11	-	-	74	-29.89	168	217	H
2	* ** 2.4852	48.71	Pk	32.4	-24.5	0	56.61	-	-	74	-17.39	168	217	H
3	* ** 2.4835	20.04	ADV	32.4	-24.4	4.11	32.15	54	-21.85	-	-	168	217	H
4	** 2.5436	21.55	ADV	32.6	-24.9	4.11	33.36	54	-20.64	-	-	168	217	H

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

VERTICAL RESULT

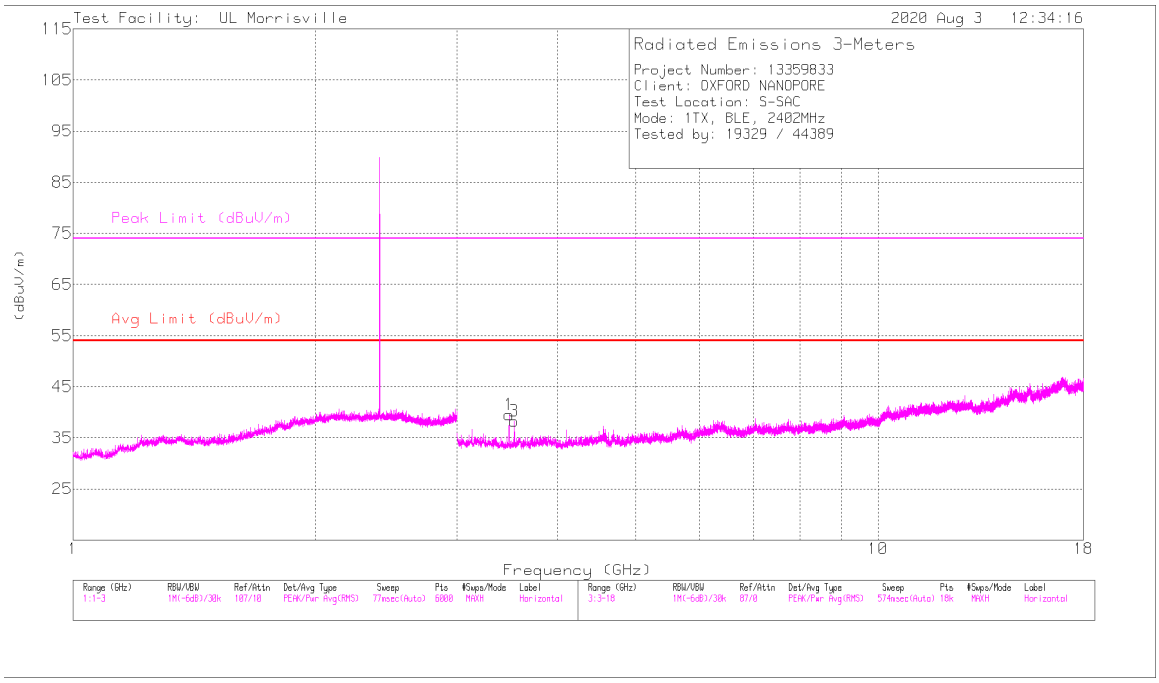


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	37	Pk	32.4	-24.4	0	45	-	-	74	-29	112	122	V
2	* ** 2.48557	61.45	Pk	32.4	-24.5	0	69.35	-	-	74	-4.65	112	122	V
3	* ** 2.4835	25.47	ADV	32.4	-24.4	4.11	37.58	54	-16.42	-	-	112	122	V
4	* ** 2.48351	25.56	ADV	32.4	-24.4	4.11	37.67	54	-16.33	-	-	112	122	V

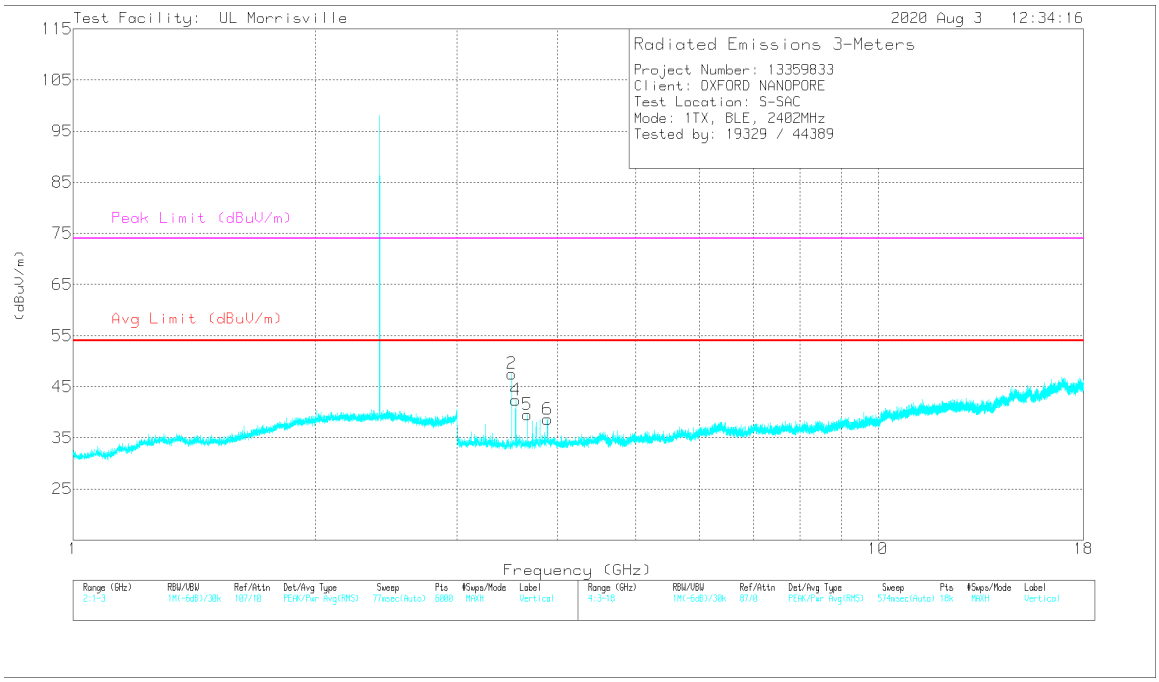
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
Pk - Peak detector
ADV - Linear Voltage Average

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



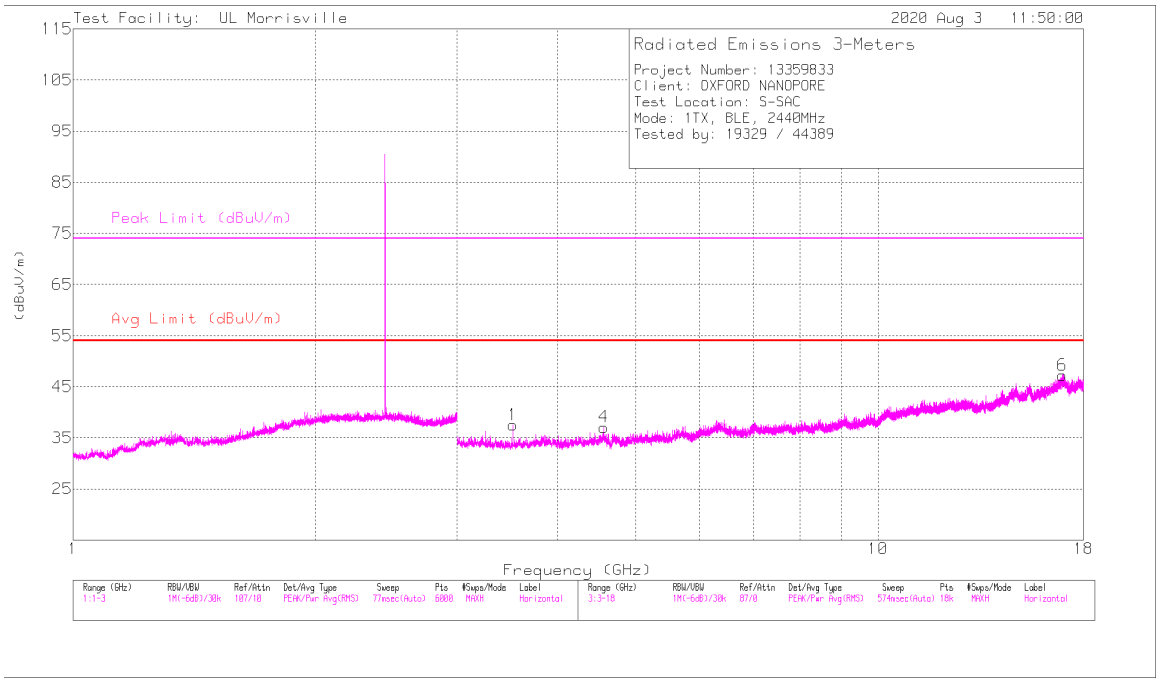
VERTICAL

RADIATED EMISSIONS

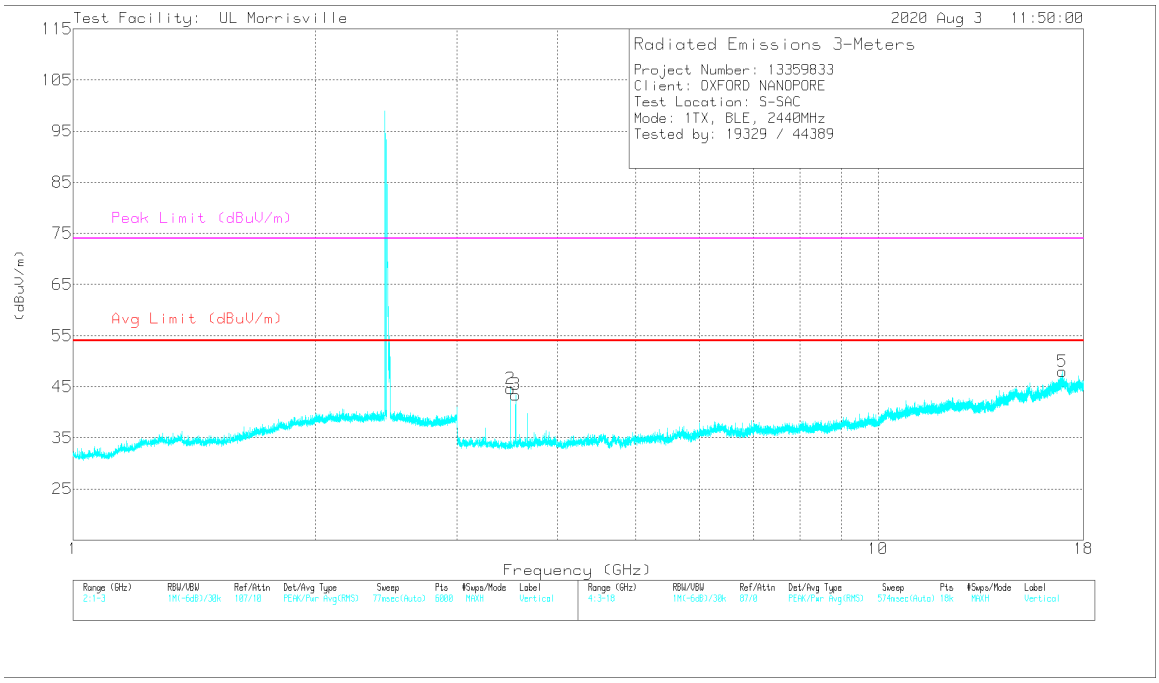
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* ** 3.53341	41.18	PK2	32.8	-32.6	0	41.38	-	-	74	-32.62	339	192	H
	* ** 3.53415	28.1	ADV	32.8	-32.6	4.11	32.41	54	-21.59	-	-	339	192	H
2	* ** 3.50693	41.16	PK2	32.8	-32.9	0	41.06	-	-	74	-32.94	16	145	V
	* ** 3.50671	29.23	ADV	32.8	-32.9	4.11	33.24	54	-20.76	-	-	16	145	V
4	* ** 3.54644	41.15	PK2	32.9	-32.4	0	41.65	-	-	74	-32.35	154	318	V
	* ** 3.54677	27.79	ADV	32.9	-32.4	4.11	32.4	54	-21.6	-	-	154	318	V
5	* ** 3.66675	42.56	PK2	33.1	-32.2	0	43.46	-	-	74	-30.54	145	283	V
	* ** 3.6669	27.43	ADV	33.1	-32.2	4.11	32.44	54	-21.56	-	-	145	283	V
6	* ** 3.88444	40.53	PK2	33.4	-32	0	41.93	-	-	74	-32.07	0	217	V
	* ** 3.88465	27.14	ADV	33.4	-32	4.11	32.65	54	-21.35	-	-	0	217	V
1	3.48003	39.6	Pk	32.8	-32.9	0	39.5	-	-	-	-	0-360	101	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK2 - Maximum Peak
ADV - Linear Voltage Average
Pk - Peak detector

MID CHANNEL RESULTS



HORIZONTAL



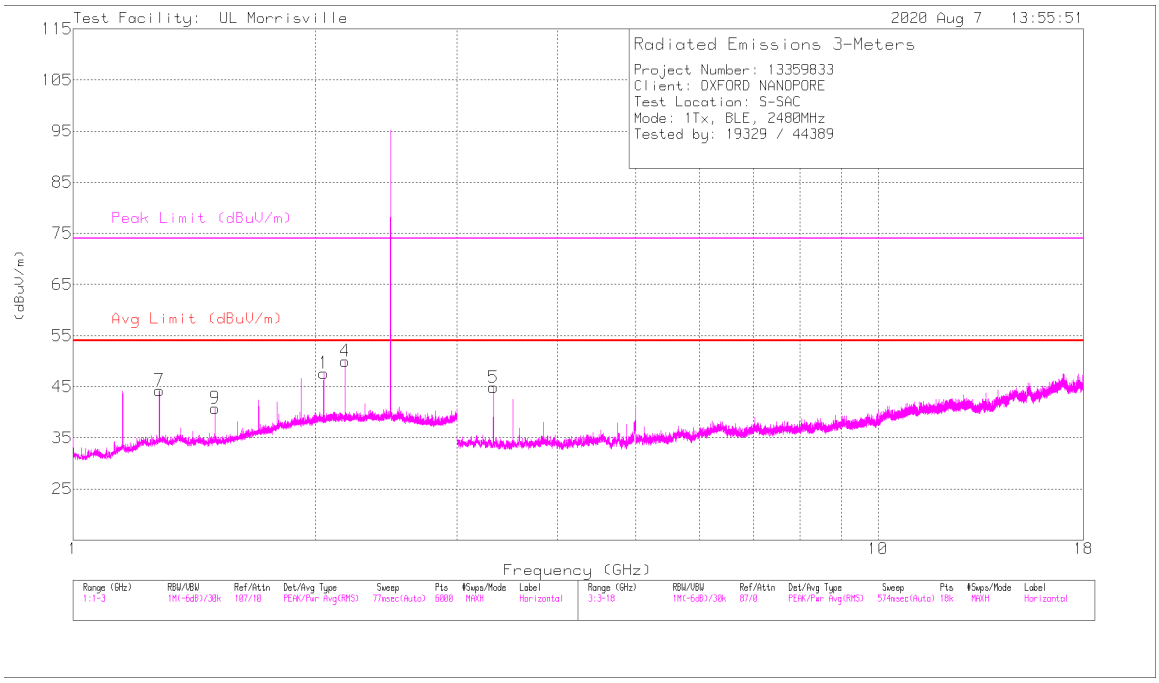
VERTICAL

RADIATED EMISSIONS

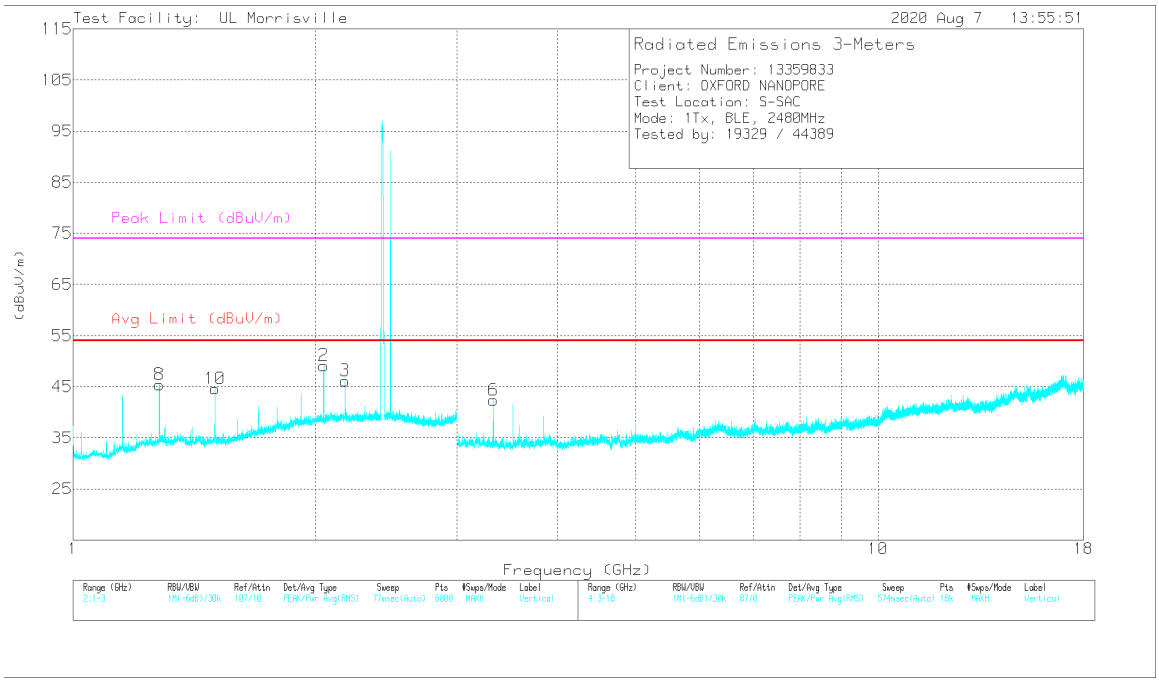
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 3.51903	42.4	PK2	32.8	-32.8	0	42.4	-	-	74	-31.6	165	348	H
	* ** 3.5193	28.2	ADV	32.8	-32.8	4.11	32.31	54	-21.69	-	-	165	348	H
4	* ** 4.56054	40.45	PK2	34	-31.3	0	43.15	-	-	74	-30.85	269	368	H
	* ** 4.56003	26.8	ADV	34	-31.3	4.11	33.61	54	-20.39	-	-	269	368	H
3	* ** 3.54712	40.49	PK2	32.9	-32.4	0	40.99	-	-	74	-33.01	287	364	V
	* ** 3.54624	27.7	ADV	32.9	-32.4	4.11	32.31	54	-21.69	-	-	287	364	V
2	3.49336	44.7	Pk	32.8	-32.9	0	44.6	-	-	-	-	0-360	200	V
5	16.94661	29.86	Pk	42	-23.9	0	47.96	-	-	-	-	0-360	200	V
6	16.95161	29.13	Pk	42	-23.9	0	47.23	-	-	-	-	0-360	101	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK2 - Maximum Peak
ADV - Linear Voltage Average
Pk - Peak detector

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7	* 1.28003	42.73	PK2	29.1	-23.2	0	48.63	-	-	74	-25.37	191	161	H
	* 1.28	38.38	ADV	29.1	-23.2	4.11	48.39	54	-5.61	-	-	191	161	H
9	* ** 1.50004	40.57	PK2	28	-22.4	0	46.17	-	-	74	-27.83	194	108	H
	* ** 1.49996	33.6	ADV	28	-22.4	4.11	43.31	54	-10.69	-	-	194	108	H
8	* 1.27998	42.87	PK2	29.1	-23.2	0	48.77	-	-	74	-25.23	219	238	V
	* 1.28001	38.7	ADV	29.1	-23.2	4.11	48.71	54	-5.29	-	-	219	238	V
10	* ** 1.50005	42.59	PK2	28	-22.4	0	48.19	-	-	74	-25.81	191	103	V
	* ** 1.50001	36.57	ADV	28	-22.4	4.11	46.28	54	-7.72	-	-	191	103	V
2	2.04784	40.24	Pk	31.7	-22.8	0	49.14	-	-	-	-	0-360	200	V
1	2.04818	38.75	Pk	31.7	-22.8	0	47.65	-	-	-	-	0-360	200	H
3	2.17586	37.27	Pk	32	-23.1	0	46.17	-	-	-	-	0-360	200	V
4	2.1762	41.09	Pk	32	-23.1	0	49.99	-	-	-	-	0-360	200	H
5	3.32752	44.46	Pk	32.9	-32.5	0	44.86	-	-	-	-	0-360	101	H
6	3.32752	41.96	Pk	32.9	-32.5	0	42.36	-	-	-	-	0-360	200	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK2 - Maximum Peak
ADV - Linear Voltage Average
Pk - Peak detector

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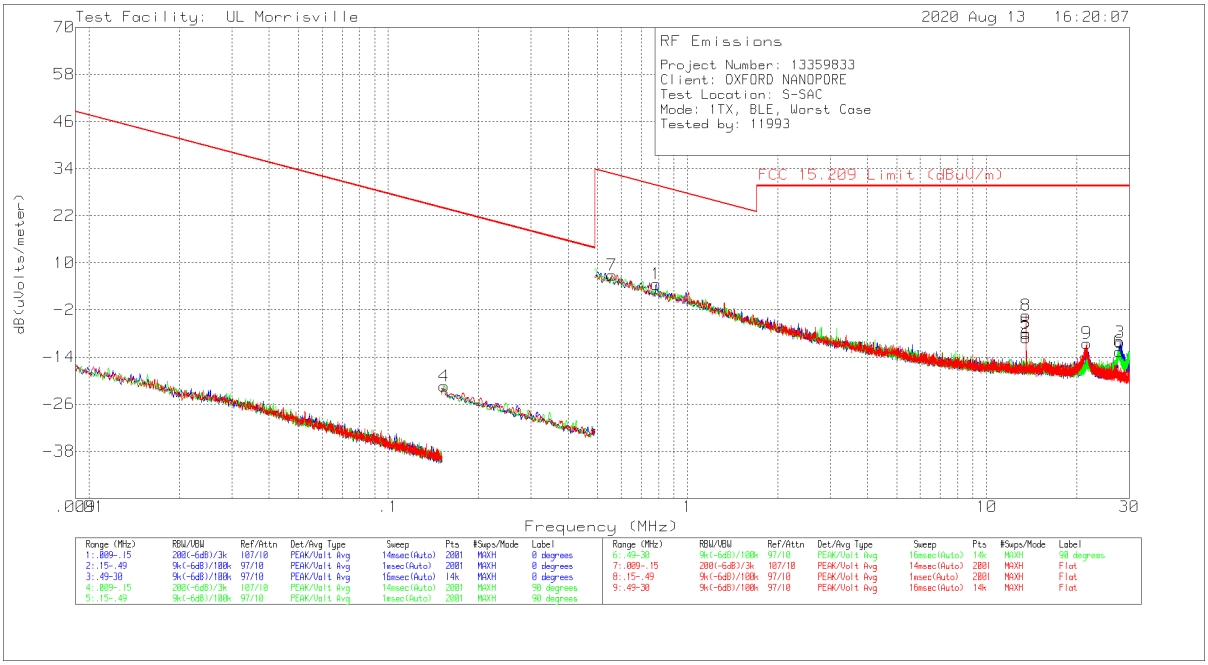
11.2. WORST CASE CONFIGURATION RADIATED

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)

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

The below 30 MHz limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency 153.66 kHz resulted in a level of -21.47 dBuV/m, which is equivalent to -21.47 - 51.5 = -72.97 dBuA/m, which has the same margin, -45.34 dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

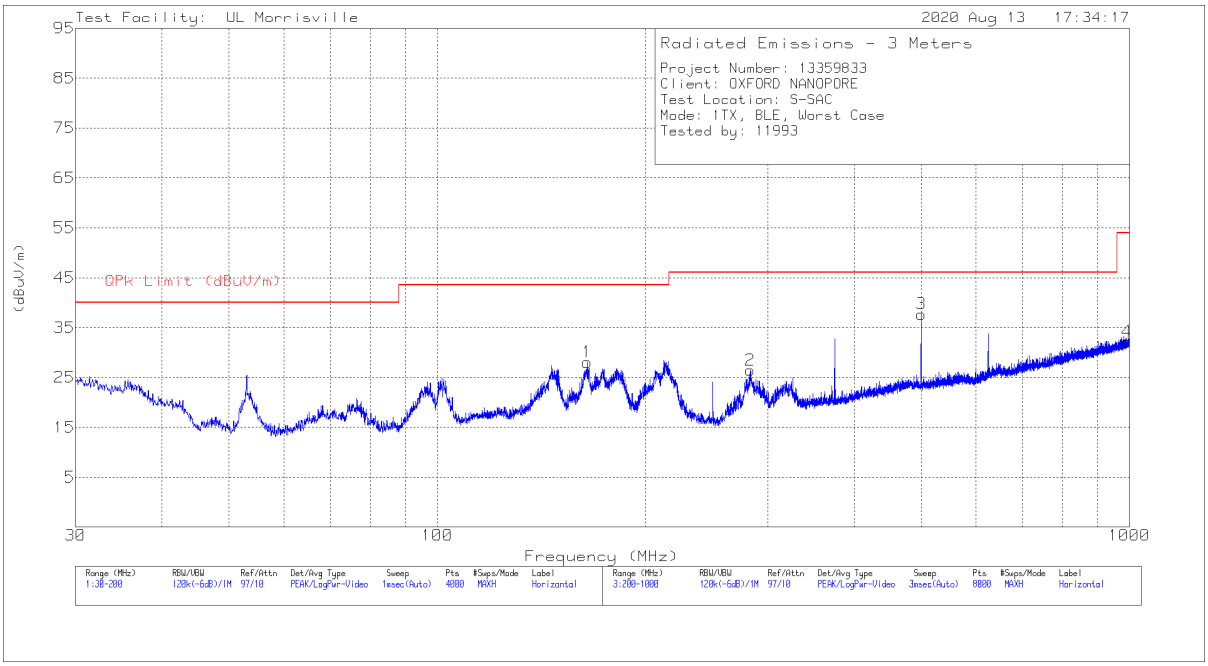


ANTENNA- THREE ORIENTATIONS

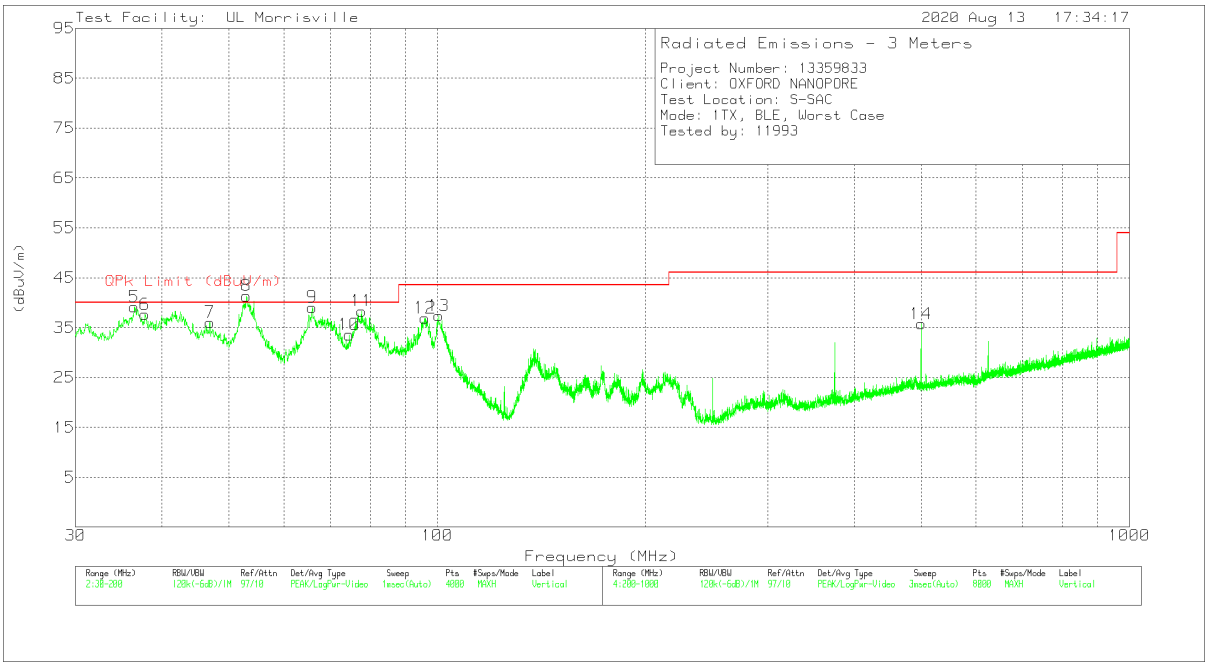
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0059 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 QP/AV Limit (dBuV/m)	FCC 15.209 PK Limit (dBuV/m)	Worst-Case Margin (dB)	Azimuth (Degs)	Antenna Facw
4	.15366	48.03	Pk	10.4	.1	-80	-21.47	23.87	43.87	-45.34	0-360	Off
7	.55956	36.36	Pk	10.4	.1	-40	6.86	32.65	-	-25.79	0-360	Flat
1	.78512	34.04	Pk	10.3	.2	-40	4.54	29.71	-	-25.17	0-360	On
8	13.5596	25.1	Pk	10.8	.7	-40	-3.4	29.54	-	-32.94	0-360	Flat
2	13.56065	19.33	Pk	10.8	.7	-40	-9.17	29.54	-	-38.71	0-360	On
5	13.56065	20.49	Pk	10.8	.7	-40	-8.01	29.54	-	-37.55	0-360	Off
9	21.648	18.48	Pk	10.1	.9	-40	-10.52	29.54	-	-40.06	0-360	Flat
6	27.81811	17.83	Pk	8.5	1.1	-40	-12.57	29.54	-	-42.11	0-360	Off
3	27.8687	20.21	Pk	8.4	1.1	-40	-10.29	29.54	-	-39.83	0-360	On

Pk - Peak detector

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



HORIZONTAL

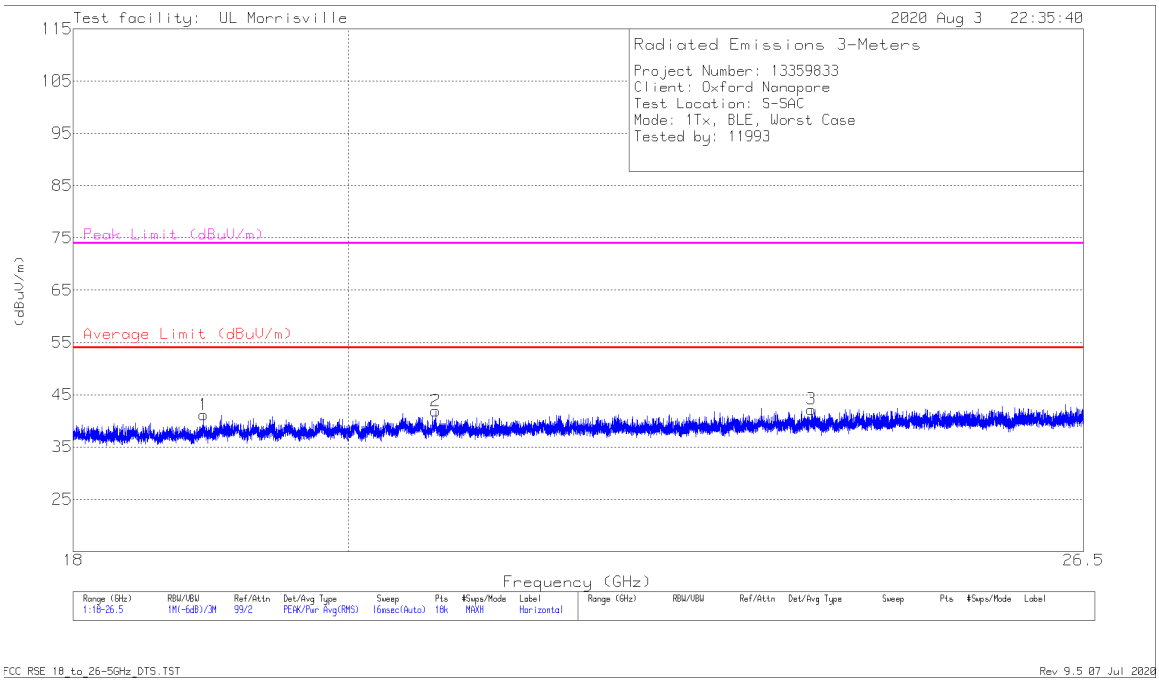


VERTICAL

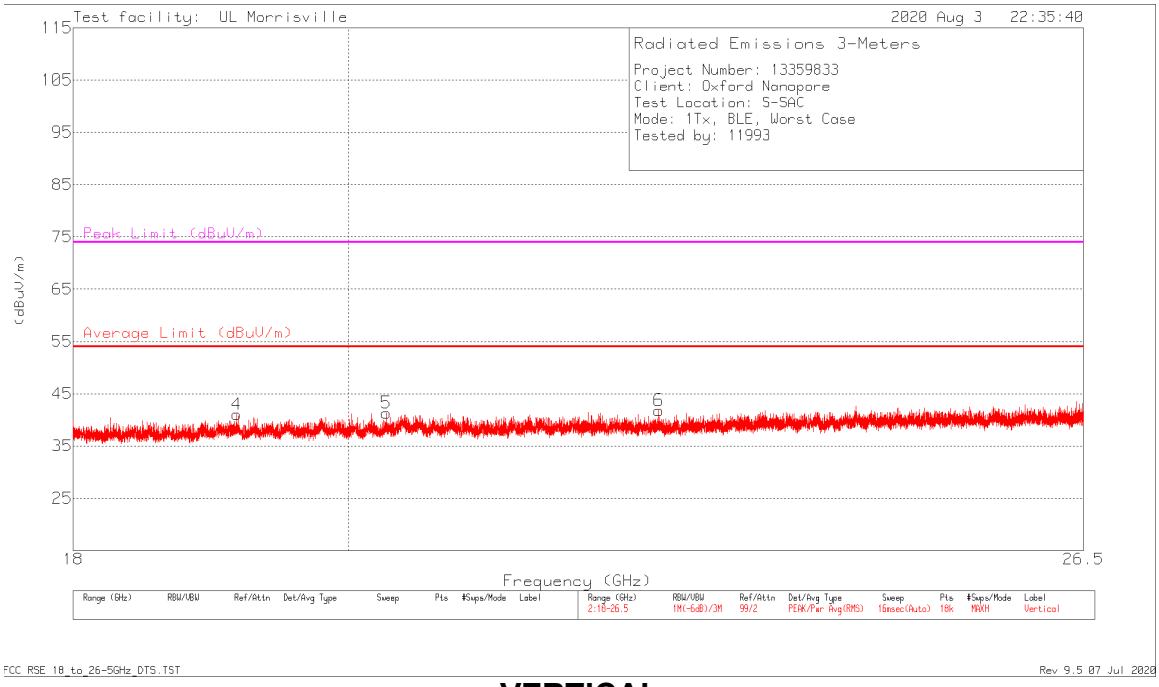
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0081 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 164.7599	39.75	Pk	18.2	-29.9	28.05	43.52	-15.47	0-360	199	H
6	* ** 37.8287	40.55	Qp	21.7	-31.4	30.85	40	-9.15	153	117	V
10	* ** 74.594	50.17	Pk	14.3	-30.9	33.57	40	-6.43	0-360	101	V
2	* ** 283.3108	35.94	Pk	19.4	-28.9	26.44	46.02	-19.58	0-360	101	H
3	** 500.039	41.71	Pk	23.7	-27.7	37.71	46.02	-8.31	0-360	200	H
4	* ** 992.103	27.15	Pk	29.3	-24.3	32.15	53.97	-21.82	0-360	300	H
14	** 500.039	39.74	Pk	23.7	-27.7	35.74	46.02	-10.28	0-360	101	V
5	36.5042	47.83	Pk	22.7	-31.4	39.13	-	-	0-360	101	V
7	46.9194	51.95	Pk	15.4	-31.3	36.05	-	-	0-360	101	V
8	52.9985	59.06	Pk	13.5	-31.2	41.36	-	-	0-360	101	V
9	66.0068	55.78	Pk	14.3	-31	39.08	-	-	0-360	101	V
11	77.7399	55.14	Pk	14.1	-30.9	38.34	-	-	0-360	101	V
12	96.0621	52.14	Pk	15.4	-30.6	36.94	-	-	0-360	101	V
13	100.5257	51.41	Pk	16.6	-30.6	37.41	-	-	0-360	101	V

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

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



HORIZONTAL



VERTICAL

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0076 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 18.92041	47.76	Pk	32.7	-39.3	41.16	54	-12.84	74	-32.84	0-360	101	H
2	* ** 20.67954	47.6	Pk	33	-38.7	41.9	54	-12.1	74	-32.1	0-360	149	H
3	* ** 23.87854	46.7	Pk	34.1	-38.6	42.2	54	-11.8	74	-31.8	0-360	200	H
4	* ** 19.16173	47.44	Pk	32.7	-39.1	41.04	54	-12.96	74	-32.96	0-360	251	V
5	* ** 20.29276	46.8	Pk	33.1	-38.6	41.3	54	-12.7	74	-32.7	0-360	150	V
6	* ** 22.52414	47.39	Pk	33.6	-39.2	41.79	54	-12.21	74	-32.21	0-360	101	V

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

12. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)
RSS-Gen 8.8

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

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

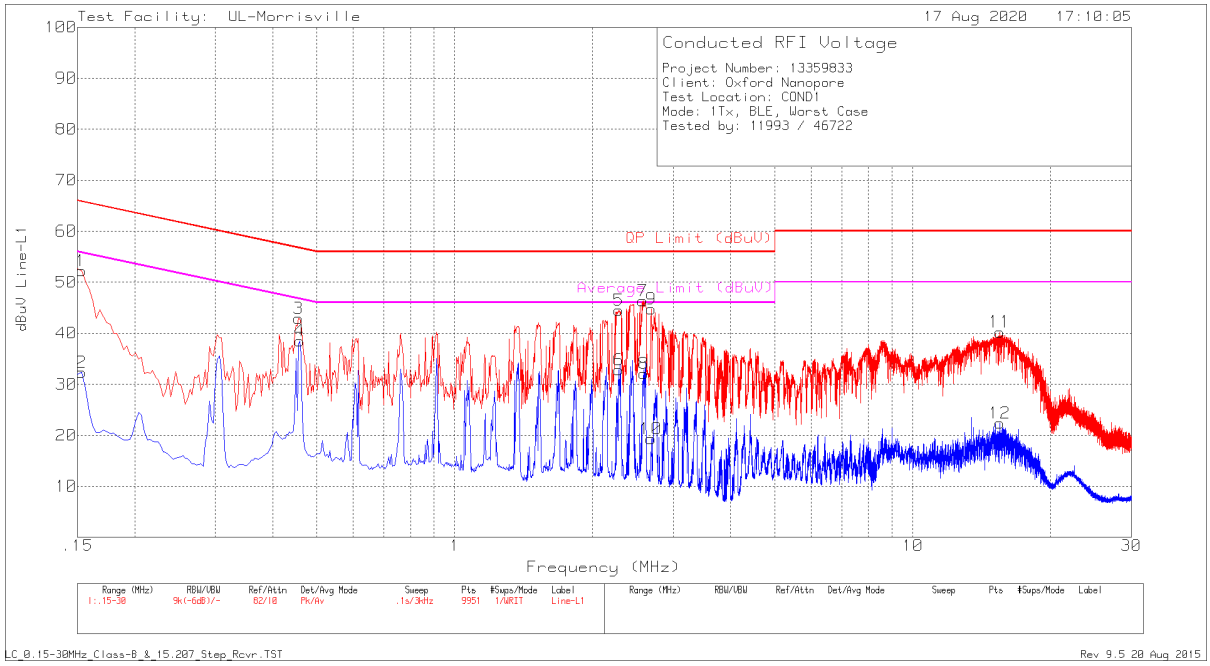
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

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

Line conducted data is recorded for both lines.

12.1.1. AC POWER LINE NORM

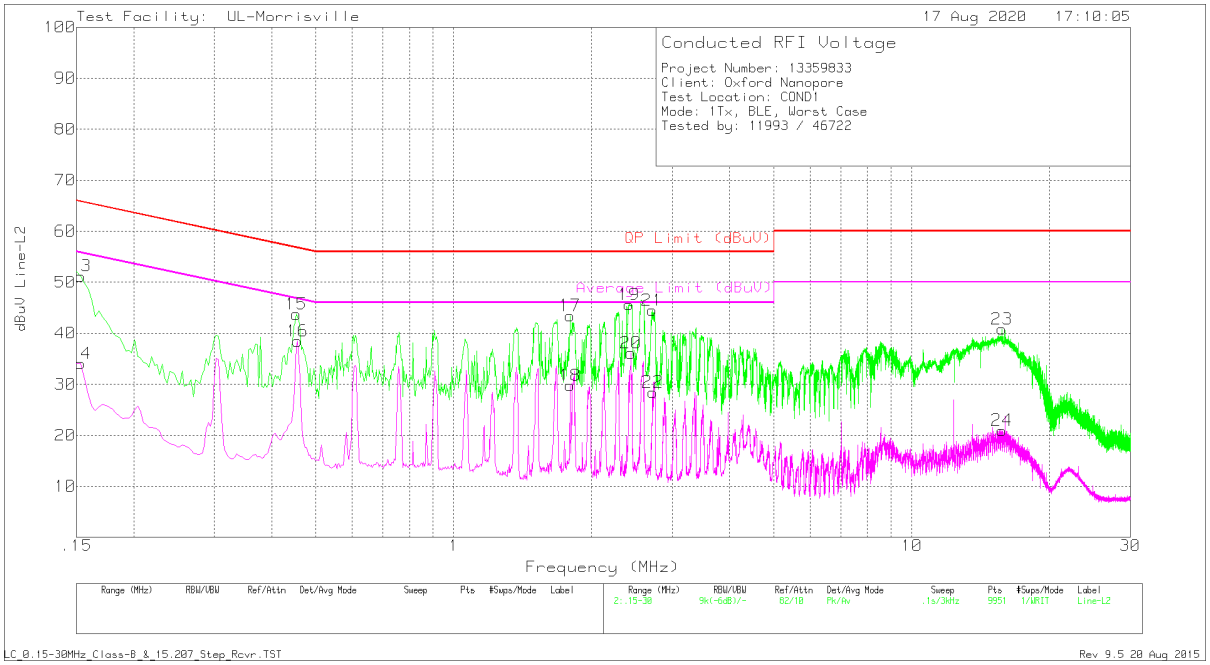
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.153	42.32	Pk	.2	9.7	52.22	65.84	-13.62	-	-
2	.153	22.45	Av	.2	9.7	32.35	-	-	55.84	-23.49
3	.456	32.99	Pk	.1	9.8	42.89	56.77	-13.88	-	-
4	.459	28.64	Av	.1	9.8	38.54	-	-	46.71	-8.17
5	2.28	34.72	Pk	0	9.8	44.52	56	-11.48	-	-
6	2.28	23.04	Av	0	9.8	32.84	-	-	46	-13.16
7	2.574	36.52	Pk	0	9.8	46.32	56	-9.68	-	-
8	2.583	22.32	Av	0	9.8	32.12	-	-	46	-13.88
9	2.688	34.98	Pk	0	9.8	44.78	56	-11.22	-	-
10	2.682	9.49	Av	0	9.8	19.29	-	-	46	-26.71
11	15.48	30.07	Pk	.1	10.1	40.27	60	-19.73	-	-
12	15.477	12.21	Av	.1	10.1	22.41	-	-	50	-27.59

Pk - Peak detector
Av - Average detection

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
13	.153	41.32	Pk	.2	9.7	51.22	65.84	-14.62	-	-
14	.153	24.13	Av	.2	9.7	34.03	-	-	55.84	-21.81
15	.453	33.83	Pk	.1	9.8	43.73	56.82	-13.09	-	-
16	.456	28.55	Av	.1	9.8	38.45	-	-	46.77	-8.32
17	1.794	33.66	Pk	0	9.8	43.46	56	-12.54	-	-
18	1.794	19.98	Av	0	9.8	29.78	-	-	46	-16.22
19	2.415	35.85	Pk	0	9.8	45.65	56	-10.35	-	-
20	2.436	26.31	Av	0	9.8	36.11	-	-	46	-9.89
21	2.709	34.68	Pk	0	9.8	44.48	56	-11.52	-	-
22	2.721	18.67	Av	0	9.8	28.47	-	-	46	-17.53
23	15.735	30.62	Pk	.1	10.1	40.82	60	-19.18	-	-
24	15.738	10.76	Av	.1	10.1	20.96	-	-	50	-29.04

Pk - Peak detector
Av - Average detection

13. SETUP PHOTOS

Please refer to R13359833-EP1 for setup photos

END OF TEST REPORT