CERTIFICATION TEST REPORT

Report Number. : R13135764-E1

Applicant	:	Nurvv Limited Thames House, 5 Church Street Twickenham, TW1 3NJ, UK
Model	:	NR1 (Left)
FCC ID	:	2ARGD-NR1
EUT Description	:	Running Tracking/Monitoring/Coaching Device
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5

Date Of Issue:
2019-12-30

Prepared by:
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12 Laboratory Dr.
Research Triangle Park, NC 27709 U.S.A.
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NVLAP TESTING

NVLAP Lab code: 200246-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
--	--	Initial Issue	--

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Nurvv Limited
Thames House, 5 Church Street
Twickenham, TW1 3NJ, UK

EUT DESCRIPTION: Running tracking/monitoring/coaching device

MODEL NAME: NR1 (Left)

SERIAL NUMBER: No4CF7CA (radiated and line conducted)
1MPSP 1901 000582 (antenna port conducted)

DATE TESTED: 2019-12-17 to 2019-12-19

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

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Approved & Released For
UL LLC By:

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Project Engineer
Consumer Technology Division
UL LLC

Prepared By:

Niklas Haydon
Engineer
Consumer Technology Division
UL LLC

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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, KDB 558074 D01 15.247 Meas Guidance v05r02, RSS-GEN Issue 5, and RSS-247 Issue 2.

3. FACILITIES AND ACCREDITATION

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

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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 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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	2.00%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	2.50 dB
All emissions, radiated	4.88 dB
Conducted Emissions (0.150-30MHz) - LISN	3.07 dB
Temperature	2.26°C
Humidity	6.79%
DC Supply voltages	1.70%
Time	3.39%

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

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5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is a running tracking, monitoring, and coaching device for the left sole with BLE and GPS radios. This report covers the BLE radio.

5.2. 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	4.51	2.82

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes chip antenna, with a maximum gain of 2.09 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was v3081r.

5.5. WORST-CASE CONFIGURATION AND MODE

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

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

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, and on a charger or on the sole. It was determined that Y orientation on the charger was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation on the charger.

The EUT only supports 1mbps, therefore all testing was done at 1mbps.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Power supply	Bose	S008AHU0500160	072381Z60770084AE	N/A
Power supply	Bose	PSA05F-050QBT1	064184Z42943910AE	N/A

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB	1	Micro-USB	USB	<3	None
2	UART	1	USB	USB	<3	For test setup only

TEST SETUP

Test software placed the radio into the necessary modes for testing.

SETUP DIAGRAMS

Please refer to R13135764-EP1 for setup diagrams.

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6. MEASUREMENT METHOD

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

6 dB BW: ANSI C63.10 Subclause -11.8.2 RBW ≤ 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 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

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

Out-of-band emissions in non-restricted bands: ANSI C63.10-2013 Section 11.11 & 6.10.4

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

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

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

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7. TEST AND MEASUREMENT EQUIPMENT

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

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

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	**(Loop Ant.)**			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2019-08-08	2020-08-08
	30-1000 MHz				
AT0073	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2019-008-08	2020-08-08
	1-18 GHz				
AT0067	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2019-03-22	2020-03-22
	Gain-Loss Chains				
N-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2019-05-02	2020-05-02
N-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2019-05-02	2020-05-02
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2019-03-15	2020-03-15
	Receiver & Software				
SA0026	Spectrum Analyzer	Agilent	N9030A	2019-03-19	2020-03-19
SOFTEMI	EMI Software	UL	Version 9.5 (2019-06-12)	NA	NA
	Additional Equipment used				
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27

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

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	18-40 GHz				
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2019-11-07	2020-11-07
	Gain-Loss Chains				
S62/AMP017/ CBL269426-001	Gain-loss string: 18-40GHz	Huber+Suhner Miteq MegaPhase	SUCOFLEX 102EA TTA1840-35-HG NC12-K1K1-216	2019-03-21	2020-03-21
	Receiver & Software				
SA0027 (18-40GHz RSE)	Spectrum Analyzer	Agilent	N9030A	2019-05-15	2020-05-15
SOFTEMI	EMI Software	UL	Version 9.5 (2019-06-12)	NA	NA
	Additional Equipment used				
s/n 181474409	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27

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Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Conducted Room 2				
T177 (PRE0079253)	Spectrum Analyzer	Agilent Technologies	E4446A	2019-04-22	2020-04-22
PWM002 (PRE0137344)	RF Power Meter	Keysight Technologies	N1911A	2019-08-23	2020-08-23
PWS002 (PRE0137348)	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2019-08-23	2020-08-23
SN 181474341	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27
SOFTEMI	EMC Software	UL	Version 10.3 (2019-09-24)	NA	NA

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CDECABLE001	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2019-07-10	2020-07-10
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2019-05-29	2020-05-29
s/n 181562858	Environmental Meter	Fisher Scientific	14-650-118	2018-09-04	2020-09-04
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
TL001	Transient Limiter, 0.009-30MHz	Com-Power	LIT-930A	2019-05-29	2020-05-29
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (2019-06-12)	NA	NA

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8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

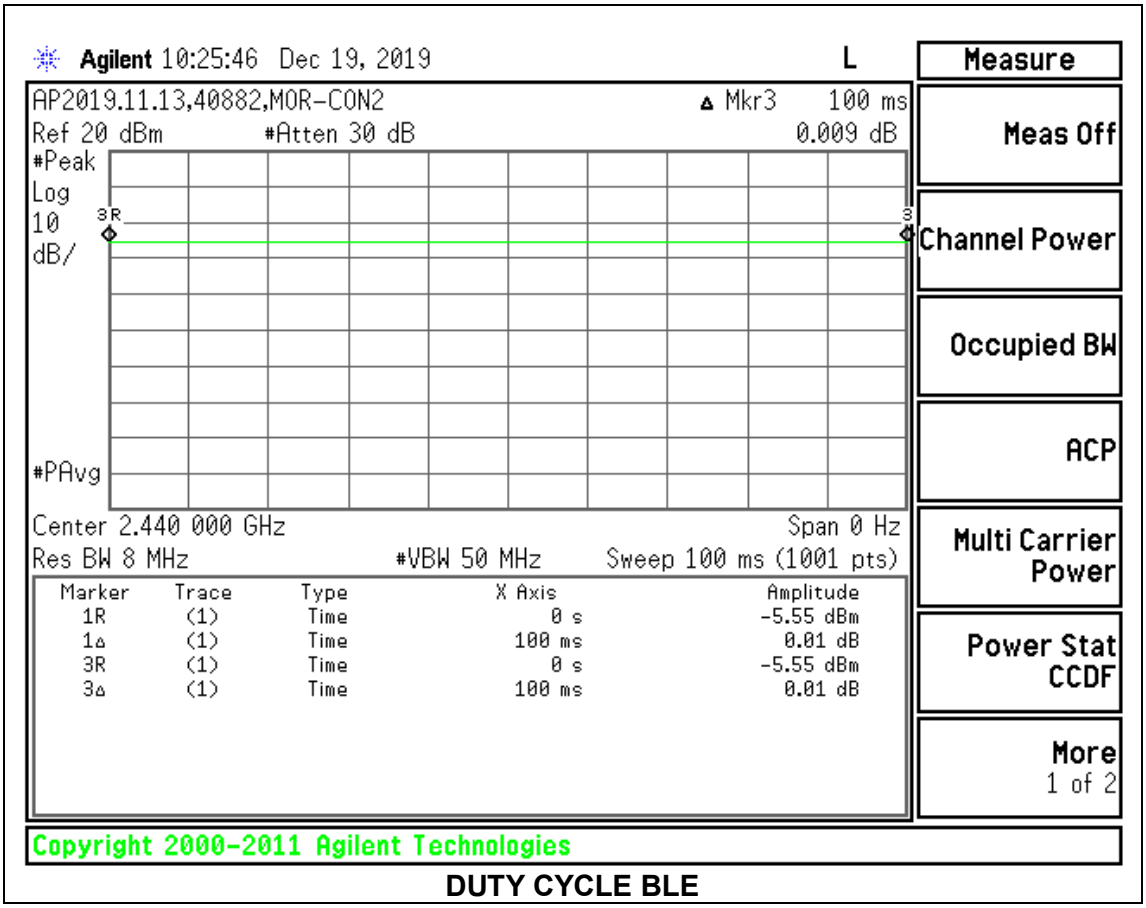
PROCEDURE

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	100.00	100.00	1.000	100.00%	0.00	0.010

DUTY CYCLE PLOTS



DUTY CYCLE BLE

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8.2. 99% BANDWIDTH

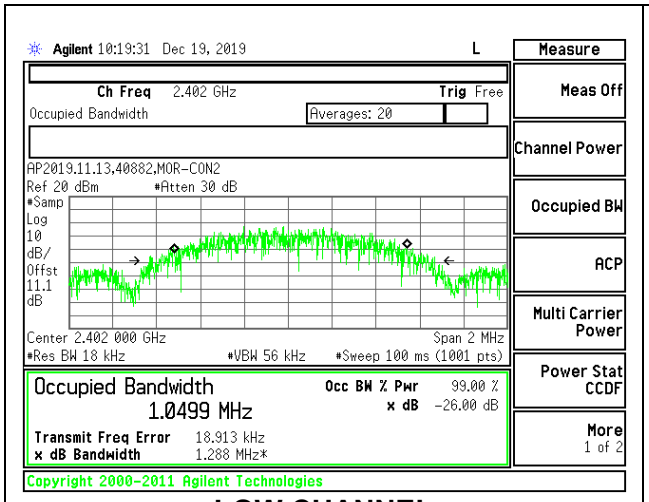
LIMITS

None; for reporting purposes only.

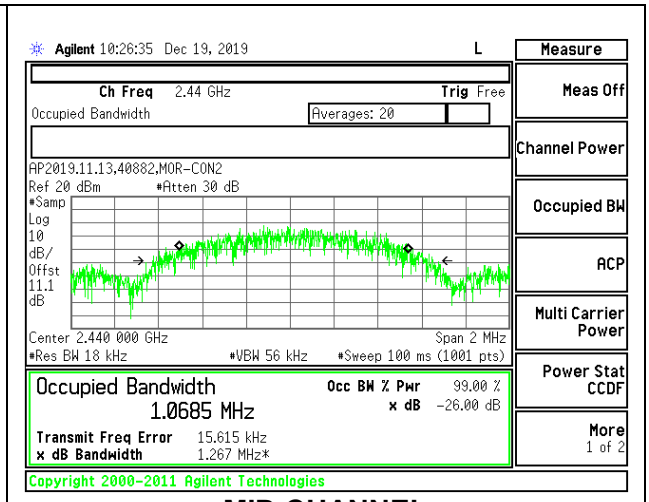
RESULTS

8.2.1. BLE (1Mbps)

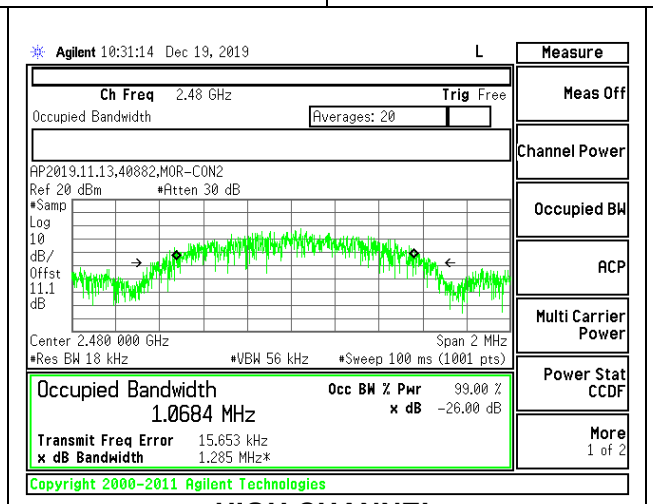
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.050
Middle	2440	1.069
High	2480	1.068



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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8.3. 6 dB BANDWIDTH

LIMITS

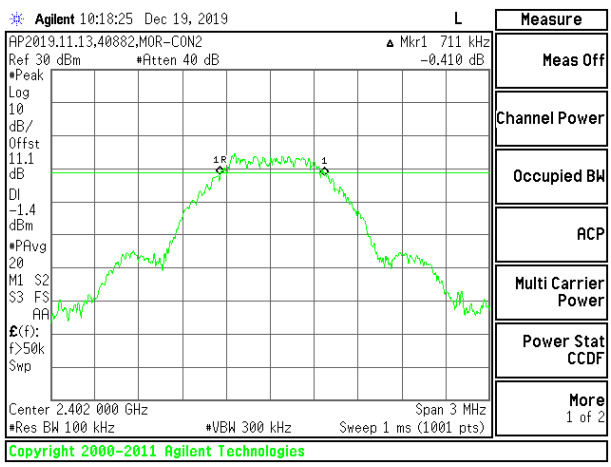
FCC §15.247 (a) (2)
RSS-247 5.2 (a)

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

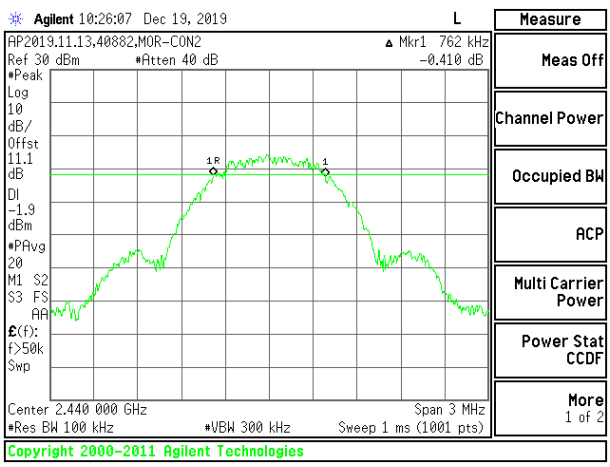
RESULTS

8.3.1. BLE (1Mbps)

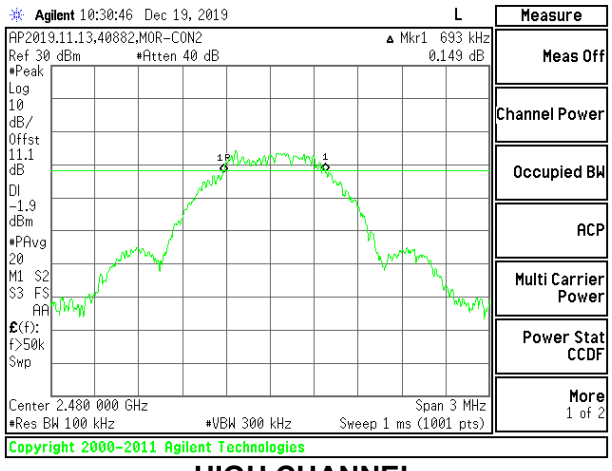
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.711	0.5
Middle	2440	0.762	0.5
High	2480	0.693	0.5



LOW CHANNEL



MID CHANNEL



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8.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)
RSS-247 5.4 (d)

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

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.13 dB (including 10 dB pad and 1.13 dB cable) was entered as an offset in the power meter to allow for a peak reading of power.

RESULTS

8.4.1. BLE (1Mbps)

Tested By:	40882
Date:	2019-12-19

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	4.51	30	-25.490
Middle	2440	4.28	30	-25.720
High	2480	4.10	30	-25.900

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8.5. 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 11.13 dB (including 10 dB pad and 1.13 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

8.5.1. BLE (1Mbps)

Tested By:	40882
Date:	2019-12-19

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	4.33
Middle	2440	4.19
High	2480	4.04

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8.6. POWER SPECTRAL DENSITY

LIMITS

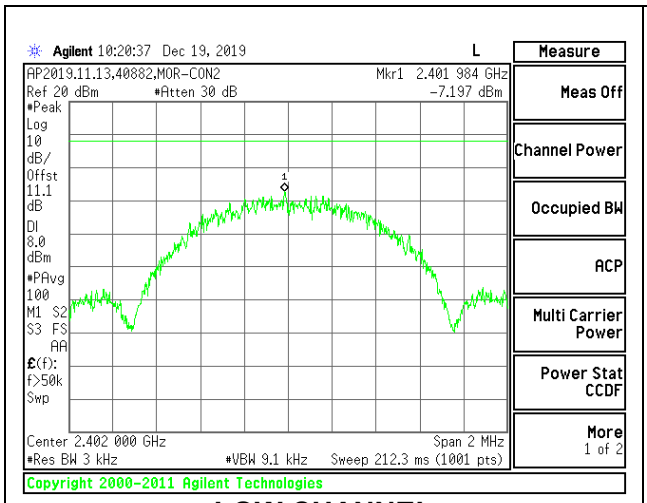
FCC §15.247 (e)
RSS-247 (5.2) (b)

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

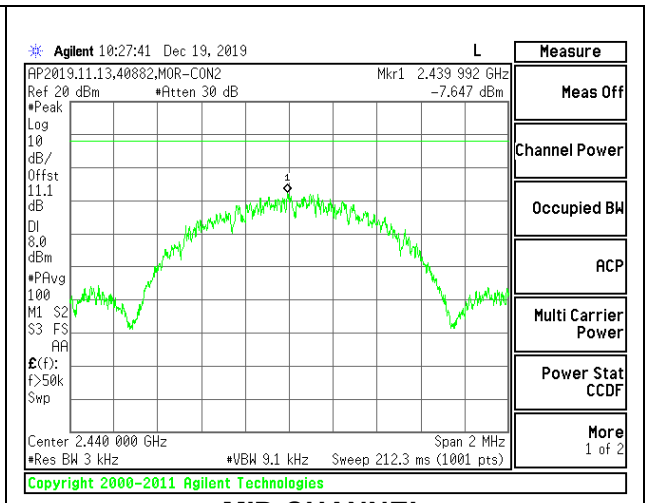
RESULTS

8.6.1. BLE (1Mbps)

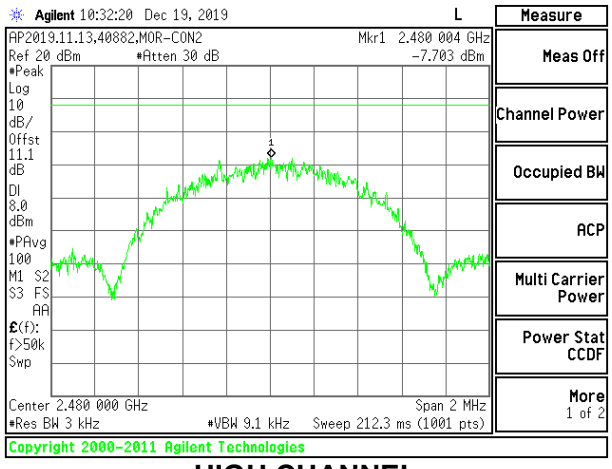
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-7.20	8	-15.20
Middle	2440	-7.65	8	-15.65
High	2480	-7.70	8	-15.70



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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8.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)
RSS-247 5.5

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

RESULTS

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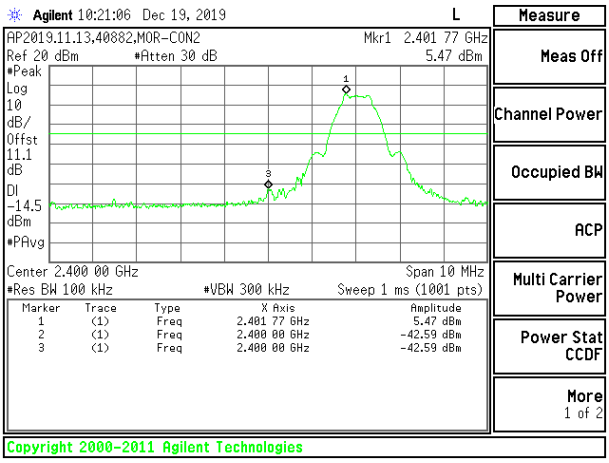
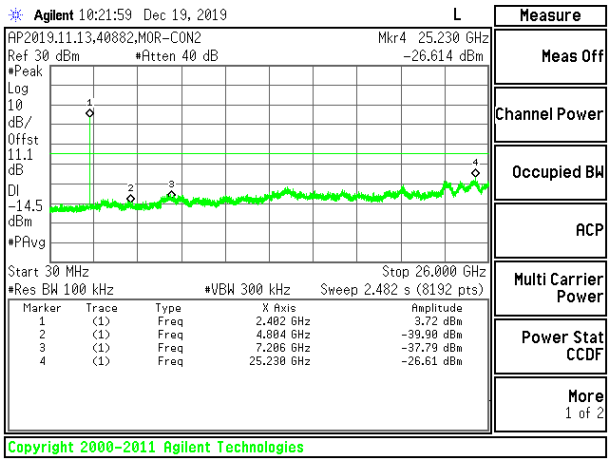
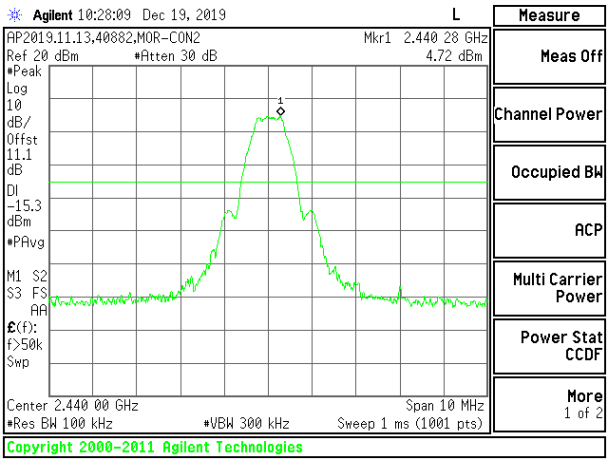
8.7.1. BLE (1Mbps)



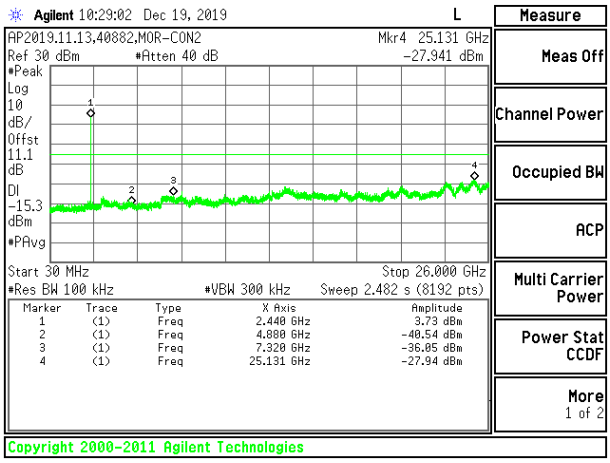
LOW CHANNEL BANDEDGE



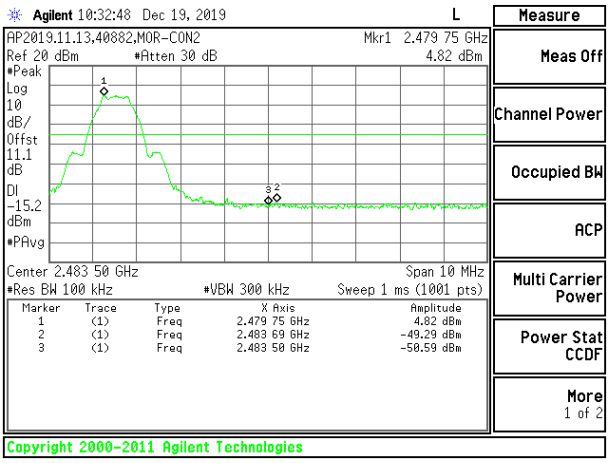
OUT-OF-BAND LOW CHANNEL



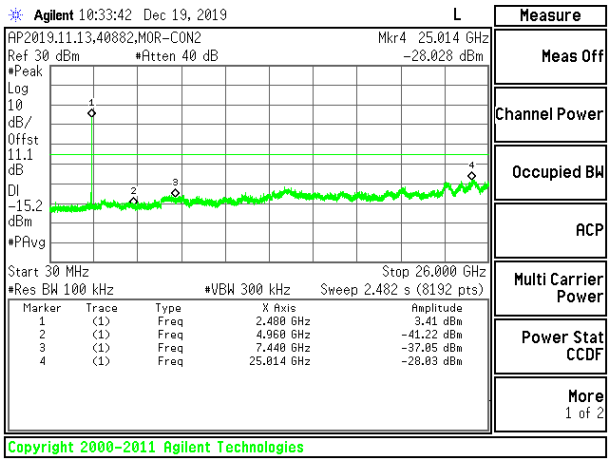
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

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 120 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements for the 30-1000 MHz range, 9 kHz for peak detection measurements or 9 kHz for quasi-peak detection measurements for the 0.15-30 MHz range and 200 Hz for peak detection measurements or 200 Hz for quasi-peak detection measurements for the 9 to 150 kHz 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 average measurements above 1GHz, the resolution bandwidth and video bandwidth are set as described in ANSI C63.10:2013 for the applicable measurement. The particular averaging method used for this test program was voltage averaging.

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).

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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.

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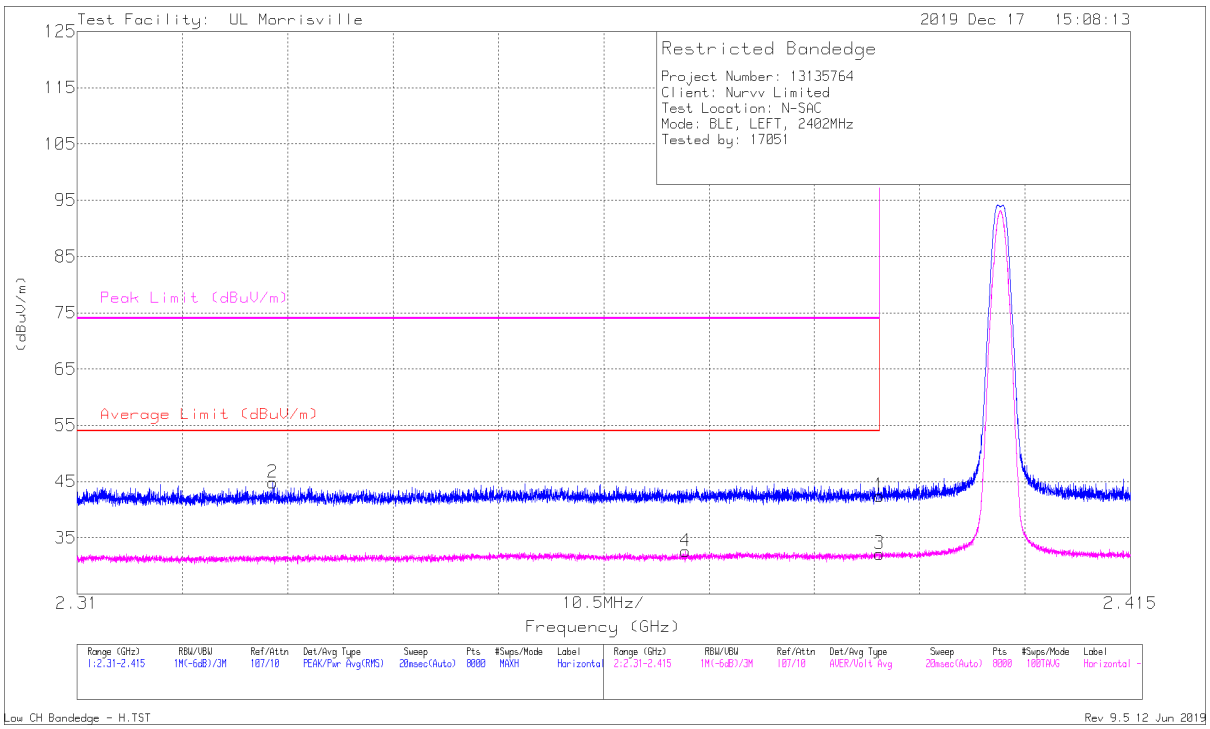
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BLE (1Mbps)

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Fltr/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	34.84	Pk	32	-24.4	42.44	-	-	74	-31.56	200	248	H
2	* 2.32952	37.51	Pk	31.7	-24.4	44.81	-	-	74	-29.19	200	248	H
3	* 2.39	24.56	ADV	32	-24.4	32.16	54	-21.84	-	-	200	248	H
4	* 2.37065	25.2	ADV	31.9	-24.5	32.6	54	-21.4	-	-	200	248	H

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

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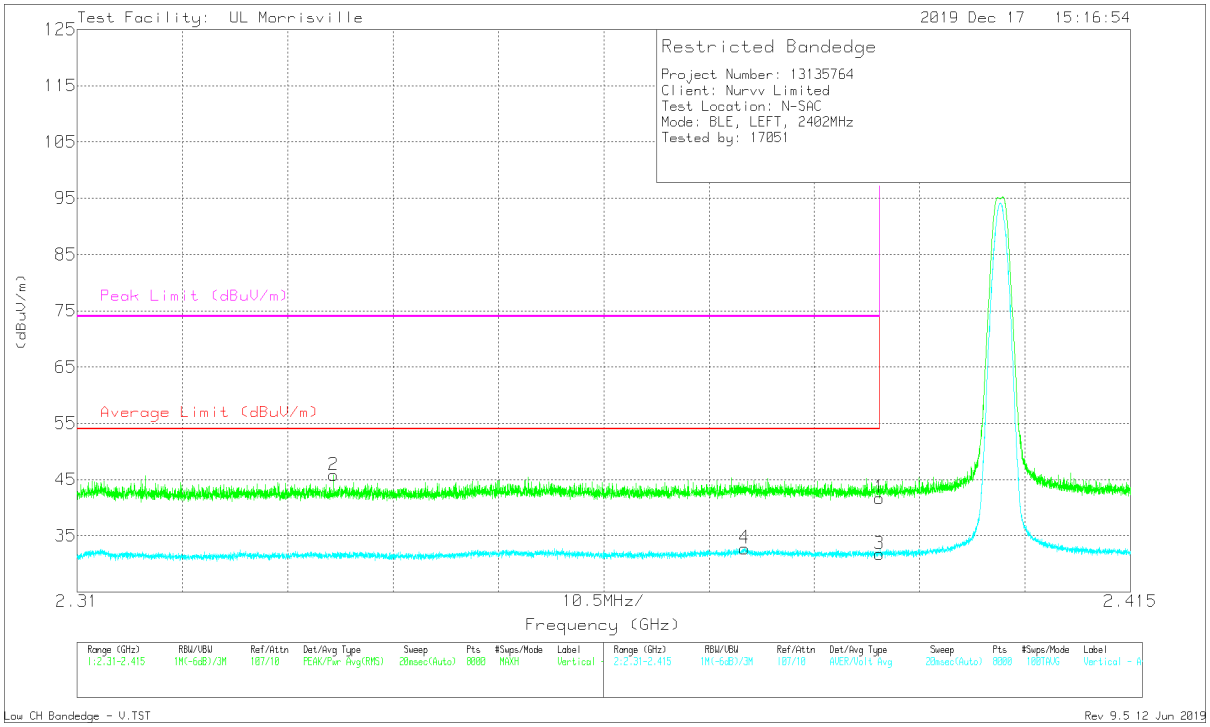
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Fltr/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	34.14	Pk	32	-24.4	41.74	-	-	74	-32.26	335	146	V
2	* 2.33557	38.48	Pk	31.7	-24.4	45.78	-	-	74	-28.22	335	146	V
3	* 2.39	24.14	ADV	32	-24.4	31.74	54	-22.26	-	-	335	146	V
4	* 2.37655	25.26	ADV	31.9	-24.4	32.76	54	-21.24	-	-	335	146	V

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

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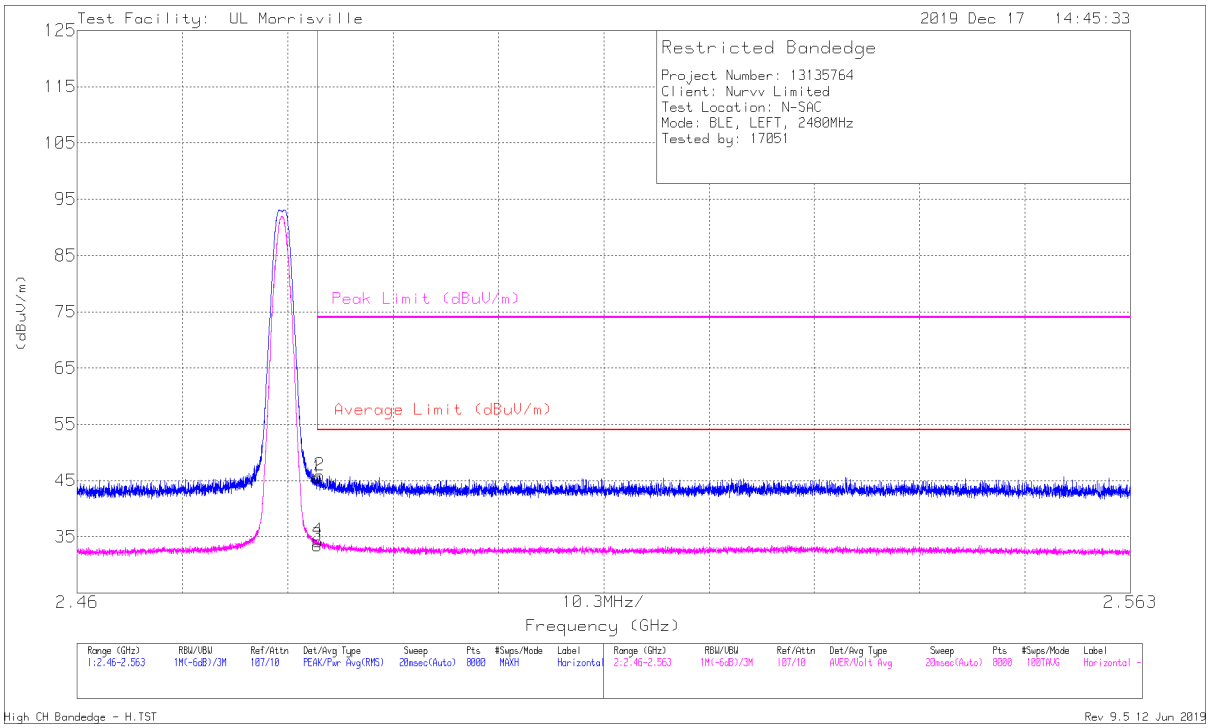
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Fltr/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	37.43	Pk	32.4	-24.3	45.53	-	-	74	-28.47	205	163	H
2	* 2.48373	37.79	Pk	32.4	-24.3	45.89	-	-	74	-28.11	205	163	H
3	* 2.4835	25.35	ADV	32.4	-24.3	33.45	54	-20.55	-	-	205	163	H
4	* 2.48354	26.14	ADV	32.4	-24.3	34.24	54	-19.76	-	-	205	163	H

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

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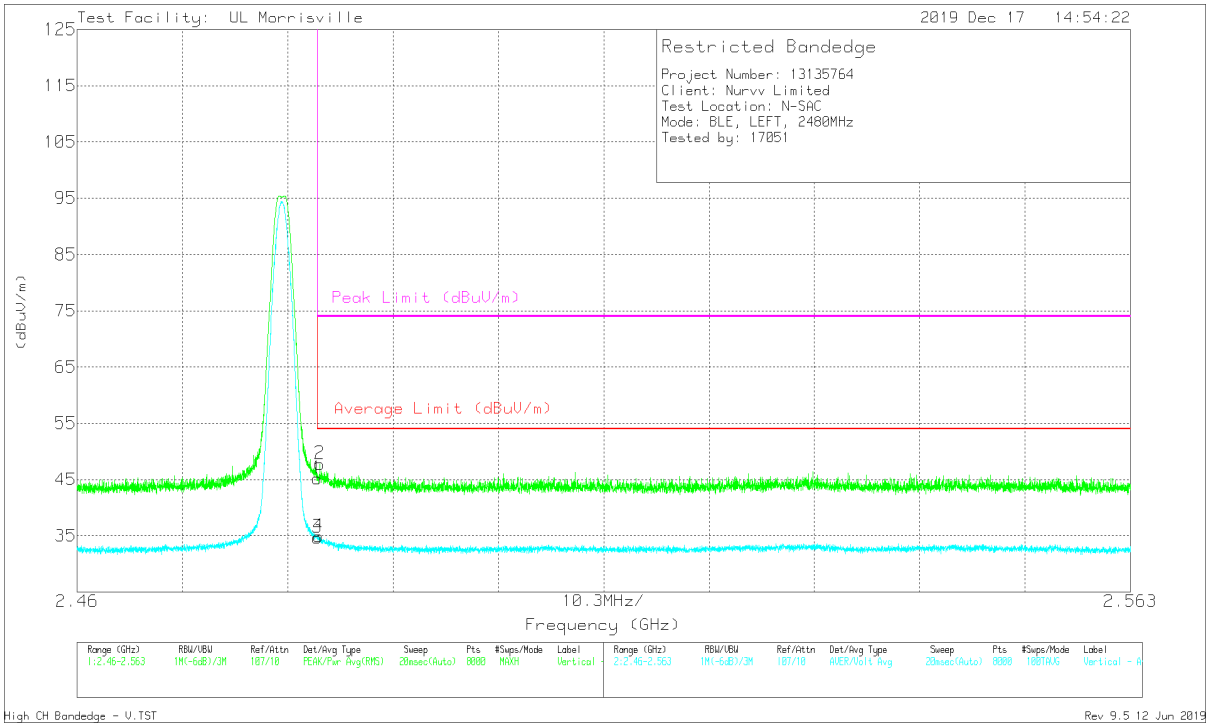
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Fltr/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	37.09	Pk	32.4	-24.3	45.19	-	-	74	-28.81	348	165	V
2	* 2.48372	39.67	Pk	32.4	-24.3	47.77	-	-	74	-26.23	348	165	V
3	* 2.4835	26.6	ADV	32.4	-24.3	34.7	54	-19.3	-	-	348	164	V
4	* 2.48359	26.8	ADV	32.4	-24.3	34.9	54	-19.1	-	-	348	164	V

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

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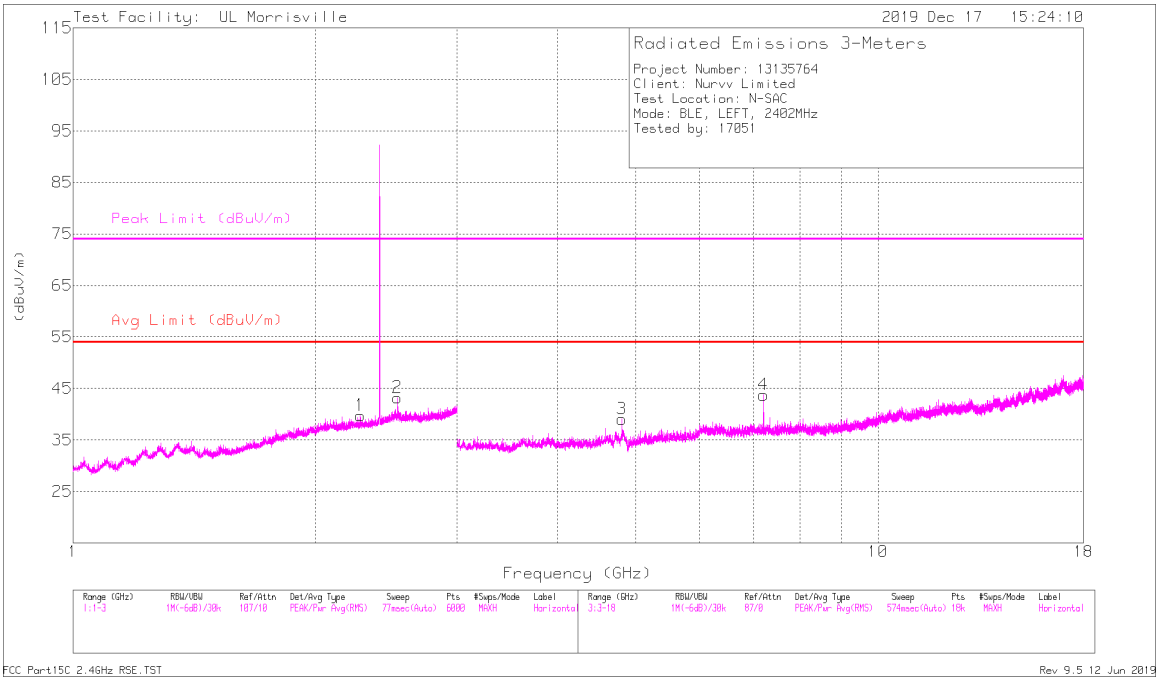
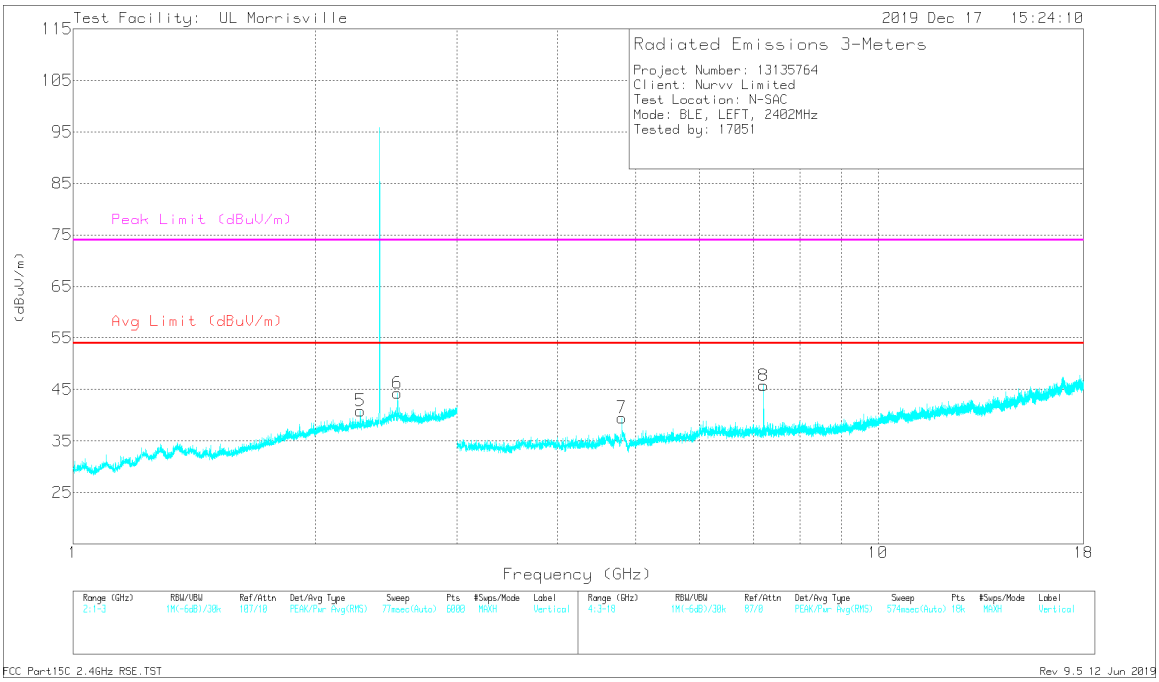
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.2742	39.47	PK2	31.8	-24.3	46.97	-	-	74	-27.03	40	195	H
* 2.2741	27.51	ADV	31.8	-24.3	35.01	54	-18.99	-	-	40	195	H
* 2.274	39.76	PK2	31.8	-24.3	47.26	-	-	74	-26.74	352	100	V
* 2.27409	29.61	ADV	31.8	-24.3	37.11	54	-16.89	-	-	352	100	V
* 4.80472	44.22	PK2	34.1	-31.6	46.72	-	-	74	-27.28	72	203	H
* 4.80435	33.21	ADV	34.1	-31.6	35.71	54	-18.29	-	-	72	203	H
* 4.80444	45.78	PK2	34.1	-31.6	48.28	-	-	74	-25.72	237	100	V
* 4.80425	35.97	ADV	34.1	-31.6	38.47	54	-15.53	-	-	237	100	V

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

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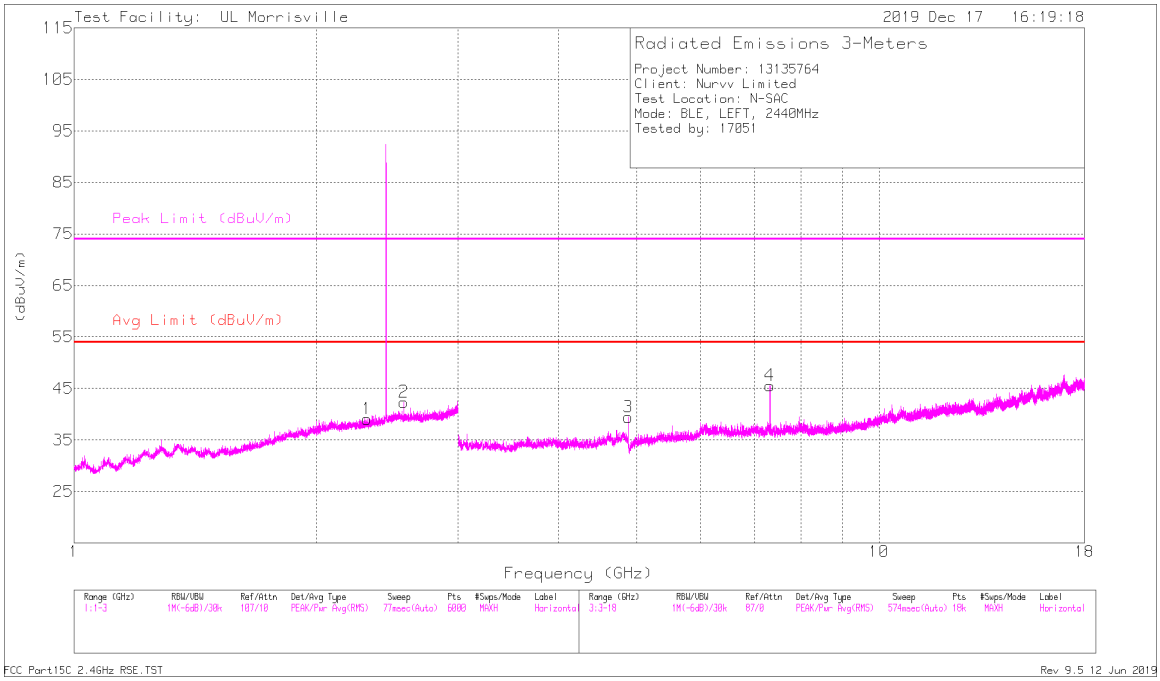
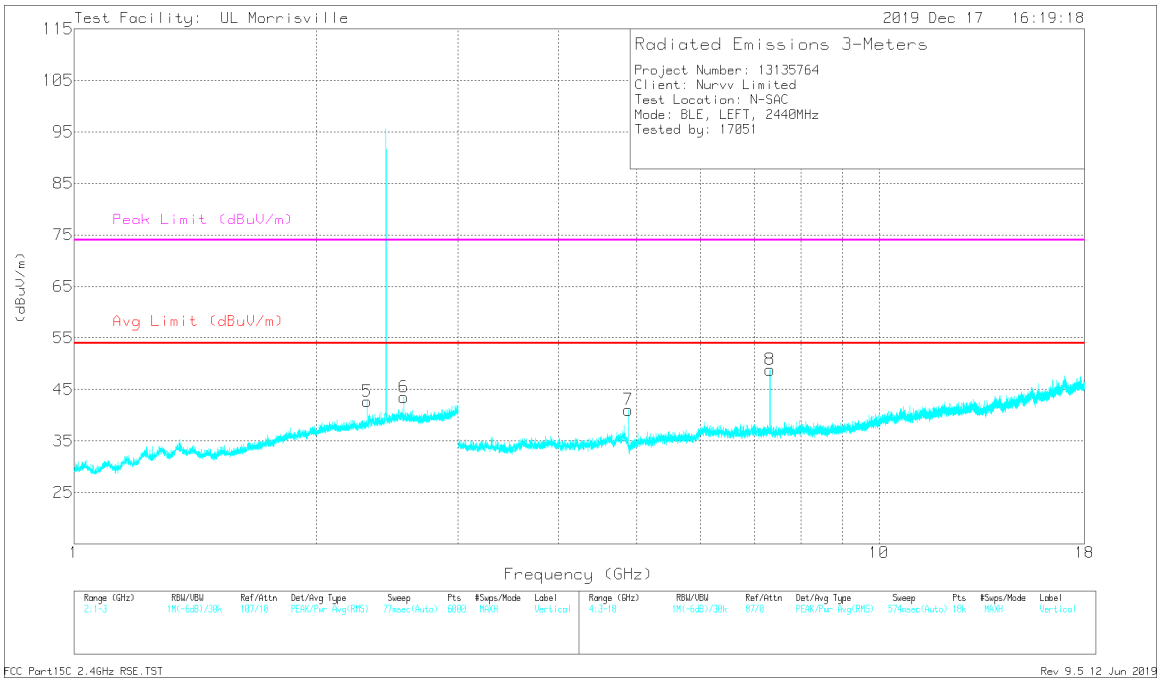
MID CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.31149	39.44	PK2	31.7	-24.4	46.74	-	-	74	-27.26	226	399	H
* 2.31203	28.15	ADV	31.7	-24.4	35.45	54	-18.55	-	-	226	399	H
* 2.31224	42.39	PK2	31.7	-24.4	49.69	-	-	74	-24.31	355	109	V
* 2.31204	32.06	ADV	31.7	-24.4	39.36	54	-14.64	-	-	355	109	V
* 4.87949	44.57	PK2	33.9	-31.3	47.17	-	-	74	-26.83	89	267	H
* 4.87991	35.03	ADV	33.9	-31.3	37.63	54	-16.37	-	-	89	267	H
* 7.31937	44.39	PK2	35.6	-29.2	50.79	-	-	74	-23.21	110	100	H
* 7.31934	35.31	ADV	35.6	-29.2	41.71	54	-12.29	-	-	110	100	H
* 4.87982	44.41	PK2	33.9	-31.3	47.01	-	-	74	-26.99	229	138	V
* 4.87993	35.49	ADV	33.9	-31.3	38.09	54	-15.91	-	-	229	138	V
* 7.3208	46.91	PK2	35.6	-29.2	53.31	-	-	74	-20.69	83	124	V
* 7.32067	38.78	ADV	35.6	-29.2	45.18	54	-8.82	-	-	83	124	V

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

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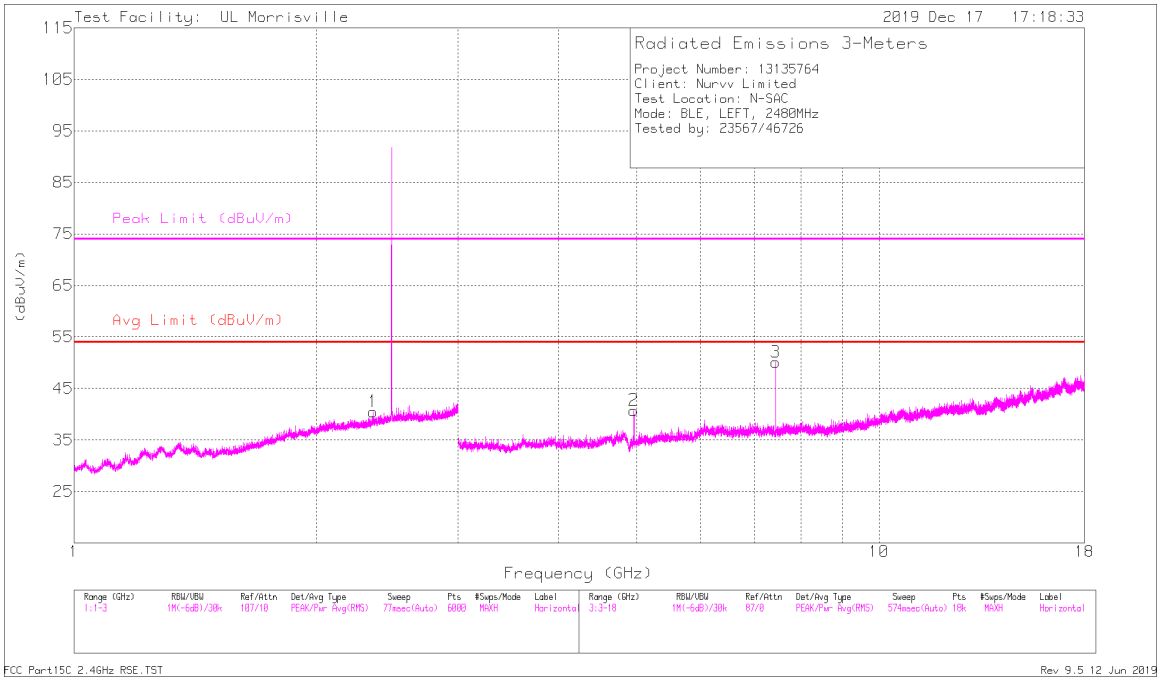
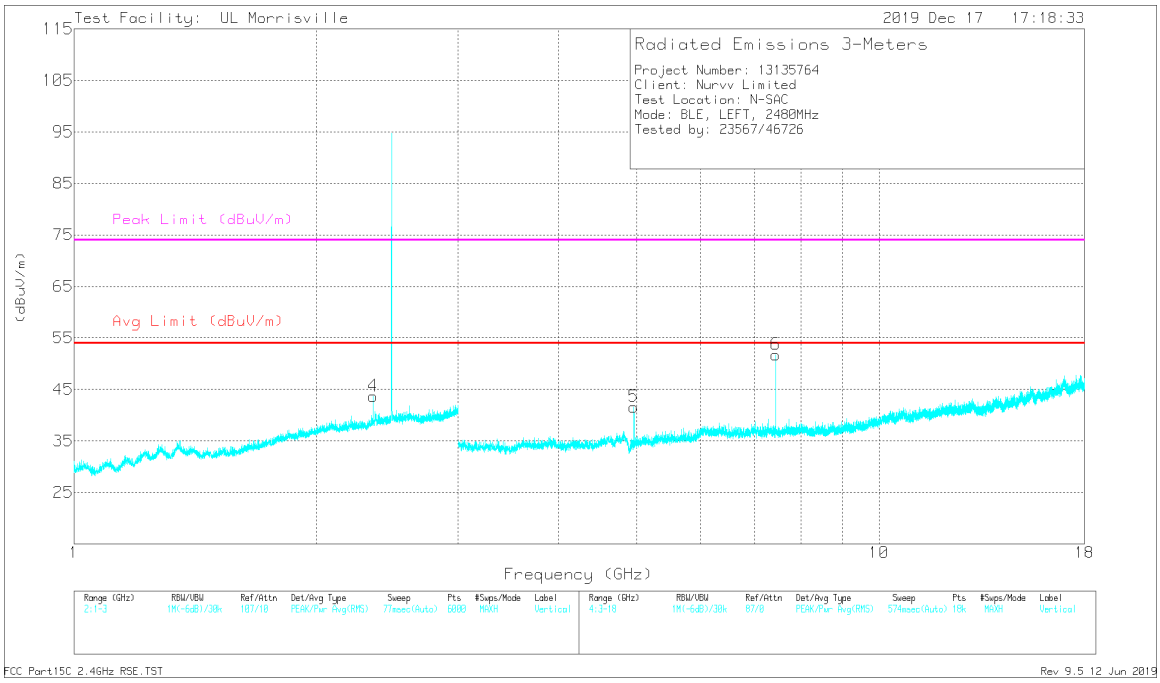
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Fltr/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	* 2.35223	40.43	PK2	31.8	-24.4	47.83	-	-	74	-26.17	212	333	H
	* 2.35201	30.71	ADV	31.8	-24.4	38.11	54	-15.89	-	-	212	333	H
4	* 2.35239	40.69	PK2	31.8	-24.4	48.09	-	-	74	-25.91	0	205	V
	* 2.35196	30.96	ADV	31.8	-24.4	38.36	54	-15.64	-	-	0	205	V
2	* 4.95963	43.57	PK2	33.9	-32.3	45.17	-	-	74	-28.83	101	255	H
	* 4.95995	35.13	ADV	33.9	-32.3	36.73	54	-17.27	-	-	101	255	H
3	* 7.43929	46.39	PK2	35.6	-29.2	52.79	-	-	74	-21.21	101	102	H
	* 7.44077	38.79	ADV	35.6	-29.2	45.19	54	-8.81	-	-	101	102	H
5	* 4.95959	44.79	PK2	33.9	-32.3	46.39	-	-	74	-27.61	219	138	V
	* 4.96	36.33	ADV	33.9	-32.3	37.93	54	-16.07	-	-	219	138	V
6	* 7.43919	48.46	PK2	35.6	-29.2	54.86	-	-	74	-19.14	80	195	V
	* 7.44066	41.25	ADV	35.6	-29.2	47.65	54	-6.35	-	-	80	195	V

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

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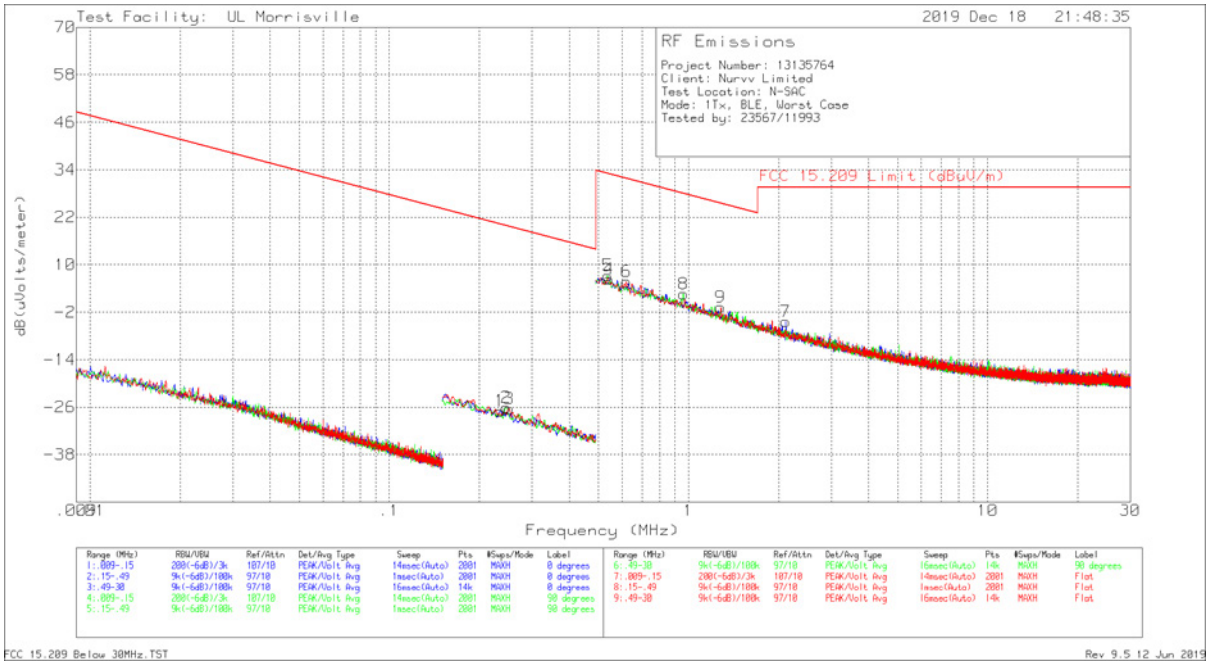
9.3. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)

Note: 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).



ANTENNA- THREE ORIENTATIONS

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 QP/Avg Limit (dBuV/m)	FCC 15.209 Pk Limit (dBuV/m)	Worst-case Margin (dB)	Azimuth (Degs)
1	.23458	41.93	Pk	11	.1	-80	-26.97	20.2	40.2	-47.17	0-360
2	.2458	42.82	Pk	11	.1	-80	-26.08	19.79	39.79	-45.87	0-360
3	.25132	42.46	Pk	11	.1	-80	-26.44	19.6	39.6	-46.04	0-360
5	.53638	36.14	Pk	11	.1	-40	7.24	33.01	-	-25.77	0-360
4	.5427	35.3	Pk	11	.1	-40	6.4	32.91	-	-26.51	0-360
6	.6207	34.6	Pk	11	.1	-40	5.7	31.75	-	-26.05	0-360
8	.96219	31.39	Pk	11	.2	-40	2.59	27.94	-	-25.35	0-360
9	1.2805	28	Pk	11.1	.2	-40	-.7	25.46	-	-26.16	0-360
7	2.11527	24.24	Pk	11.2	.2	-40	-4.36	29.54	-	-33.9	0-360

Pk - Peak detector

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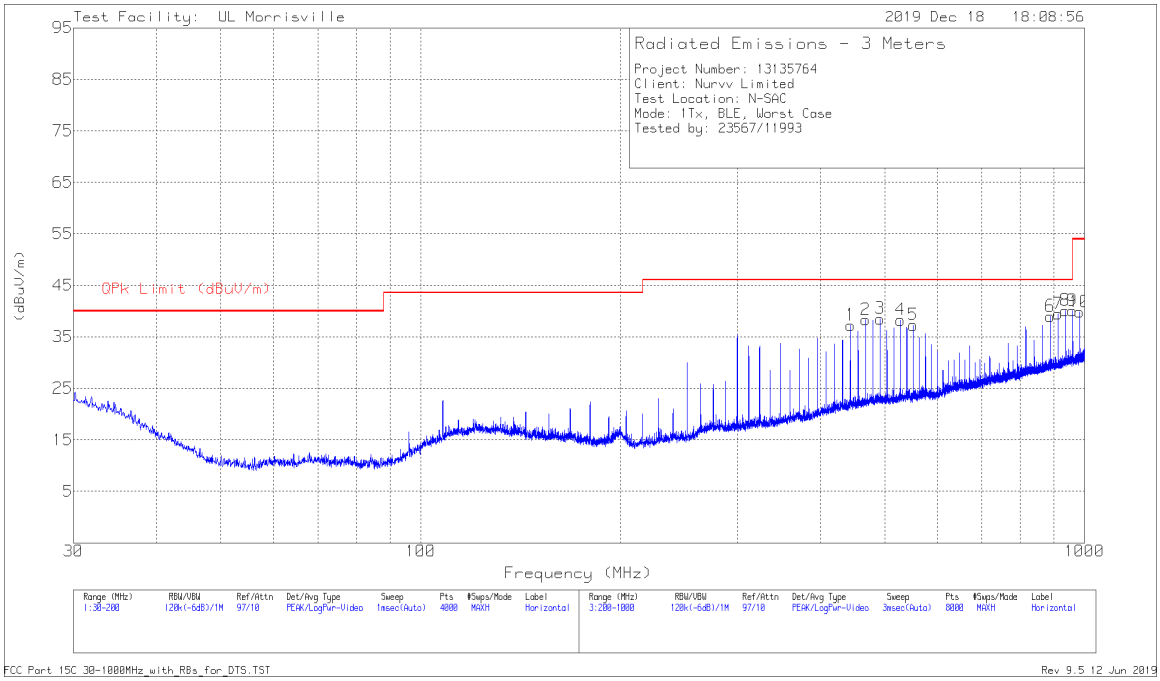
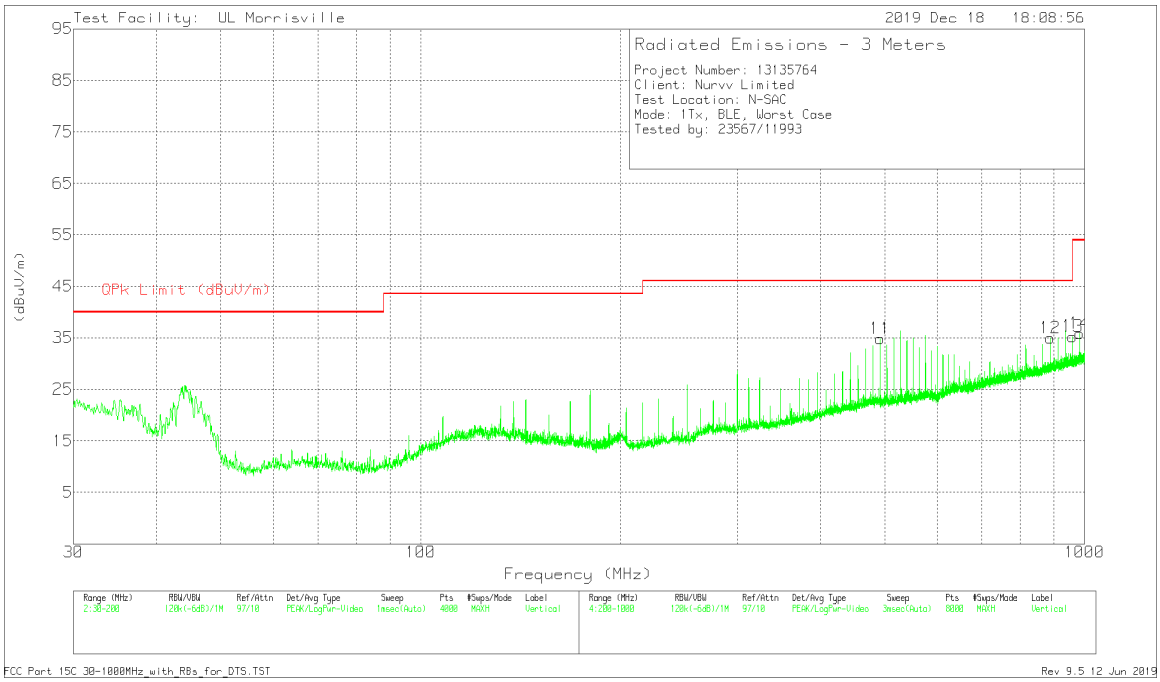
9.4. WORST CASE BELOW 1 GHZ

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



HORIZONTAL



VERTICAL

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Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0073 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	492.038	43.32	Pk	23.8	-28.6	38.52	46.02	-7.5	0-360	102	H
6	887.9894	37.29	Pk	28.2	-26.5	38.99	46.02	-7.03	0-360	102	H
7	911.9925	37.27	Pk	28.4	-26.2	39.47	46.02	-6.55	0-360	102	H
9	* 960.1423	22.11	Qp	29	-25.6	25.51	53.97	-28.46	134	132	H
10	* 984.0019	36.06	Pk	29.1	-25.3	39.86	53.97	-14.11	0-360	102	H
11	492.038	39.65	Pk	23.8	-28.6	34.85	46.02	-11.17	0-360	199	V
12	887.9894	33.24	Pk	28.2	-26.5	34.94	46.02	-11.08	0-360	101	V
13	959.9988	31.86	Pk	29	-25.6	35.26	46.02	-10.76	0-360	101	V
14	* 984.0019	32.03	Pk	29.1	-25.3	35.83	53.97	-18.14	0-360	101	V
1	444.0317	43.16	Pk	22.7	-28.6	37.26	46.02	-8.76	0-360	102	H
2	468.0348	43.64	Pk	23.4	-28.7	38.34	46.02	-7.68	0-360	102	H
4	527.9426	42.68	Pk	23.9	-28.3	38.28	46.02	-7.74	0-360	102	H
5	552.0458	41.28	Pk	24.2	-28.2	37.28	46.02	-8.74	0-360	199	H
8	935.9957	37.22	Pk	28.8	-25.9	40.12	46.02	-5.9	0-360	102	H

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

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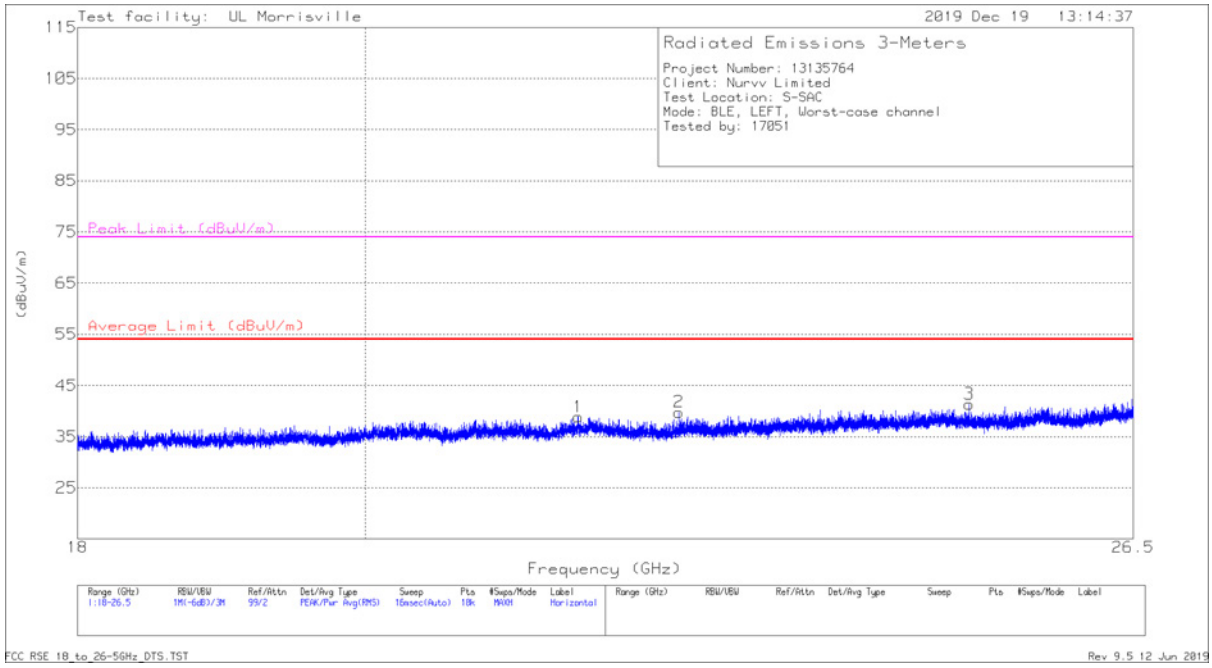
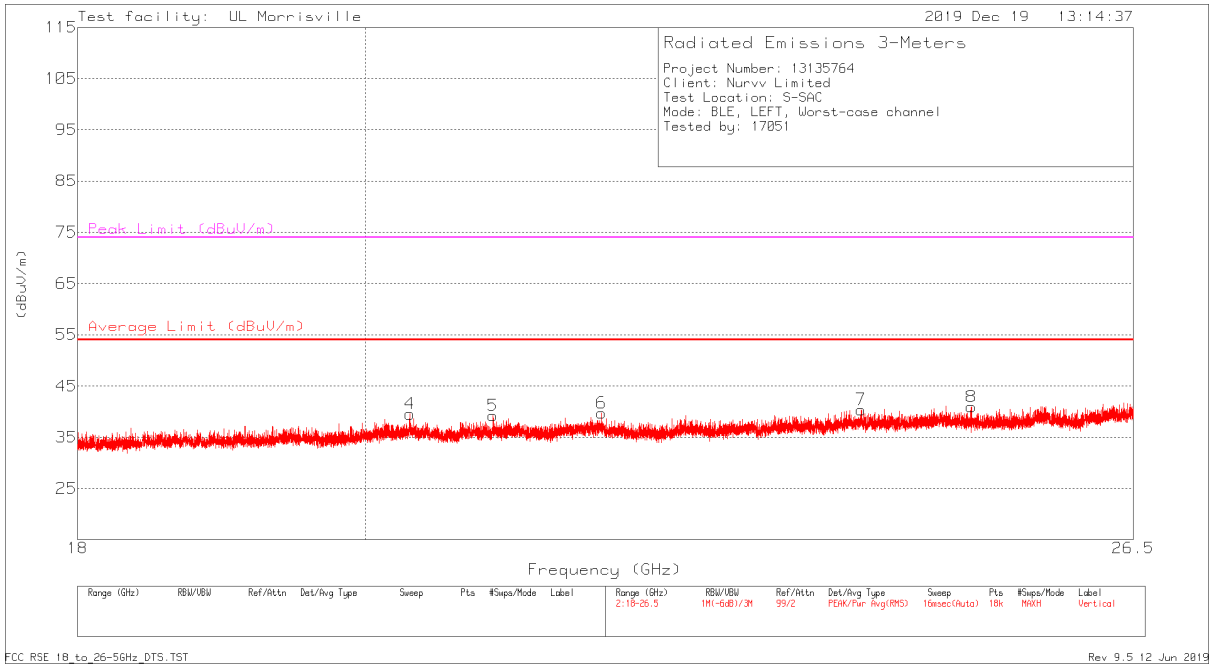
9.5. WORST CASE 18-26 GHZ

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



HORIZONTAL



VERTICAL

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18 – 26GHz DATA

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
2	* 22.43394	40.69	Pk	33.6	-34.5	39.79	54	-14.21	74	-34.21	0-360	148	H
4	* 20.33196	40.96	Pk	33.1	-34.5	39.56	54	-14.44	74	-34.44	0-360	152	V
5	* 20.95911	40.6	Pk	33.3	-34.7	39.2	54	-14.8	74	-34.8	0-360	298	V
7	* 23.98291	39.68	Pk	34.1	-33.4	40.38	54	-13.62	74	-33.62	0-360	298	V
1	21.62545	39.98	Pk	33.4	-34.5	38.88	54	-15.12	74	-35.12	0-360	198	H
6	21.80963	40.52	Pk	33.5	-34.3	39.72	54	-14.28	74	-34.28	0-360	202	V
3	24.9548	40.07	Pk	34.5	-33.2	41.37	54	-12.63	74	-32.63	0-360	298	H
8	24.97416	39.64	Pk	34.5	-33.2	40.94	54	-13.06	74	-33.06	0-360	252	V

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

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10. 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.

RESULTS

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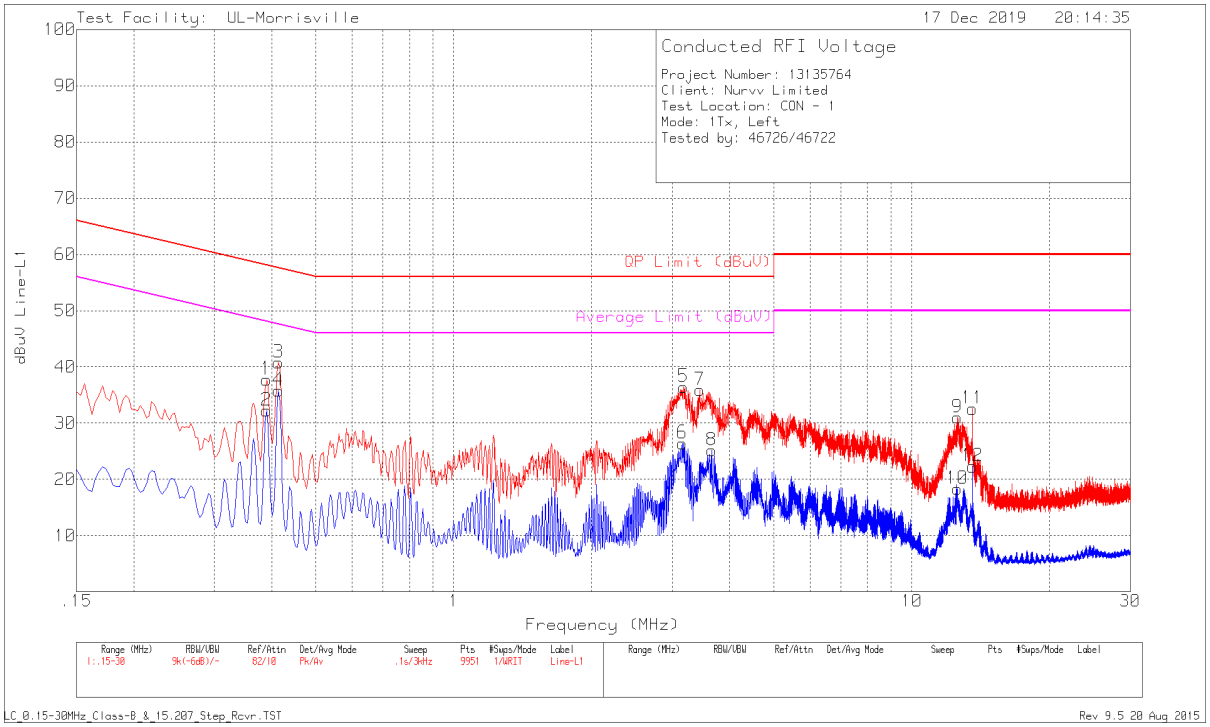
LINE 1 RESULTS



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	.39	27.68	Pk	.1	10	37.78	58.06	-20.28	-	-
2	.39	22.14	Av	.1	10	32.24	-	-	48.06	-15.82
3	.414	30.71	Pk	.1	10	40.81	57.57	-16.76	-	-
4	.414	25.72	Av	.1	10	35.82	-	-	47.57	-11.75
5	3.177	26.23	Pk	.1	10.1	36.43	56	-19.57	-	-
6	3.15	16.22	Av	.1	10.1	26.42	-	-	46	-19.58
7	3.441	25.67	Pk	.1	10.1	35.87	56	-20.13	-	-
8	3.654	14.98	Av	.1	10.1	25.18	-	-	46	-20.82
9	12.579	20.55	Pk	.1	10.4	31.05	60	-28.95	-	-
10	12.573	7.83	Av	.1	10.4	18.33	-	-	50	-31.67
11	13.56	22.06	Pk	.1	10.4	32.56	60	-27.44	-	-
12	13.56	11.81	Av	.1	10.4	22.31	-	-	50	-27.69

Pk - Peak detector
Av - Average detection

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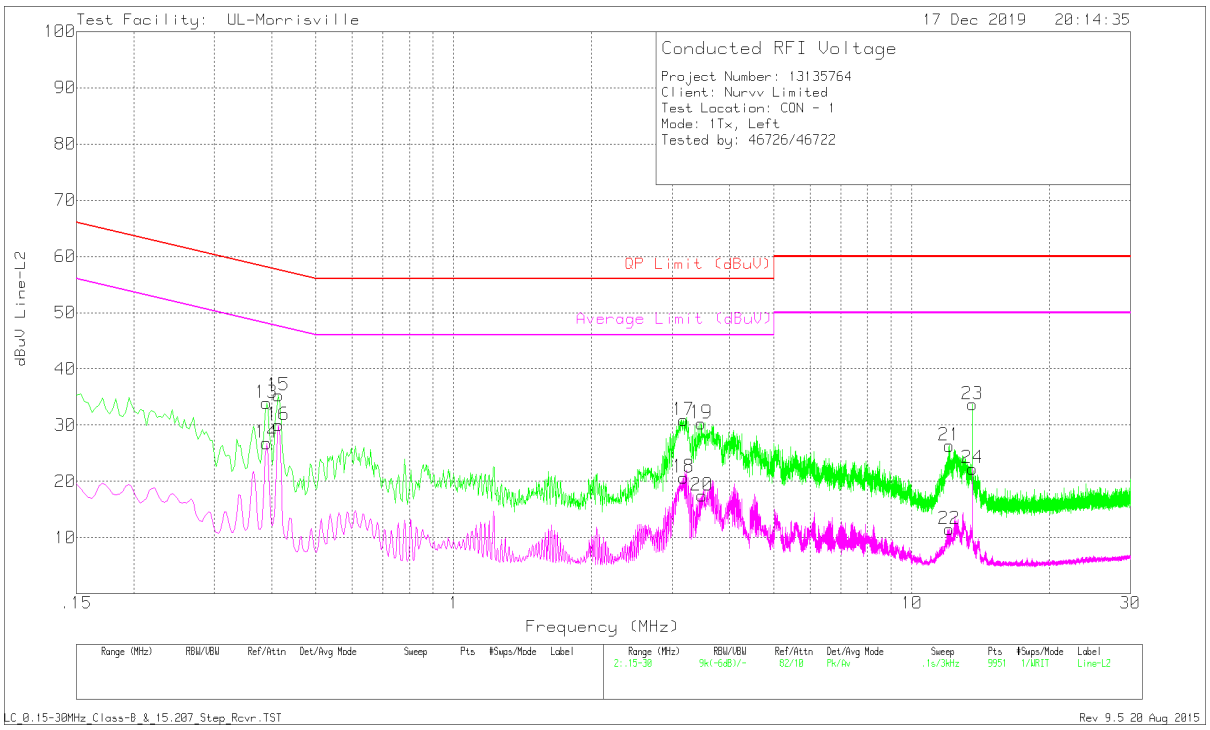
LINE 2 RESULTS



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	.39	23.82	Pk	.1	10	33.92	58.06	-24.14	-	-
14	.39	16.72	Av	.1	10	26.82	-	-	48.06	-21.24
15	.414	25.18	Pk	.1	10	35.28	57.57	-22.29	-	-
16	.414	19.91	Av	.1	10	30.01	-	-	47.57	-17.56
17	3.171	20.81	Pk	0	10.1	30.91	56	-25.09	-	-
18	3.177	10.6	Av	0	10.1	20.7	-	-	46	-25.3
19	3.471	20.23	Pk	0	10.1	30.33	56	-25.67	-	-
20	3.483	7.4	Av	0	10.1	17.5	-	-	46	-28.5
21	12.06	15.84	Pk	.1	10.4	26.34	60	-33.66	-	-
22	12.06	1.02	Av	.1	10.4	11.52	-	-	50	-38.48
23	13.56	23.18	Pk	.1	10.4	33.68	60	-26.32	-	-
24	13.56	11.8	Av	.1	10.4	22.3	-	-	50	-27.7

Pk - Peak detector
Av - Average detection

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11. SETUP PHOTOS

Please refer to R13135764-EP1 for setup photos.

END OF TEST REPORT

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