



TEST REPORT

Report Number. : R13337971-E5

Applicant : Raspberry Pi (Trading) Ltd
Maurice Wilkes Building
Cowley Road
Cambridge
CB4 0DS
United Kingdom

Model : RPI-RM0 (Gamma)

FCC ID : 2ABCB-RPIRM0

IC : 20953-RPIRM0

EUT Description : Bluetooth and WiFi radio module

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

Date Of Issue:
2020-10-23

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2020-10-09	Initial Issue	Niklas Haydon
V2	2020-10-23	Added conducted emissions (mains) data	Mike Antola

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Raspberry Pi (Trading) Ltd
Maurice Wilkes Building
Cowley Road
Cambridge
CB4 0DS, United Kingdom

EUT DESCRIPTION: Bluetooth and WiFi radio module

MODEL: RPI-RM0 (Gamma)

SERIAL NUMBER: Non-serialized

SAMPLE RECEIVE DATE: 2020-07-10

DATE TESTED: 2020-09-08 to 2020-10-21

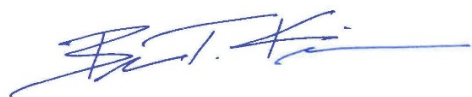
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	Complies

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.

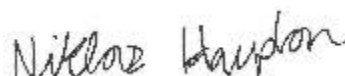
This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim 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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UL LLC

Prepared By:



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Consumer Technology Division
UL LLC

2. TEST RESULTS SUMMARY

FCC Clause	ISED Clause	Requirement	Result	Comment
ANSI C63.10 Section 11.6.		Duty Cycle	Not performed in this report.	Refer to UL VS LTD report UL-RPT-RP13337971-1216A.
ANSI C63.10 Section 6.9.3.	RSS-GEN 6.7	99% OBW		
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW		
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power		
ANSI C63.10, Section 11.9.2.3.2.		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	Compliant.	None.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5, 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, 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

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	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	1.82%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	1.94 dB
All emissions, radiated	4.88 dB
Conducted Emissions (0.150-30MHz) - LISN	3.40 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%.

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.

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

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a Bluetooth and WiFi radio module. The PMN and HVIN = Raspberry Pi RM0.

6.2. POWER SETTINGS USED FOR TESTING

The power setting for the testing in this report were set default in the test firmware. Please refer to UL VS LTD report UL-RPT-RP13337971-1216A for measured power.

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an integrated antenna with a maximum gain of 3.5dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT hardware during testing was v1.0.
The EUT software during testing was v1.0.

6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz and above 18GHz 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, high channels and inner channels where required.

The fundamental of the EUT was investigated with 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 both antennas in the Z orientation.

Worst-case data rates as declared by the client were:

BLE: 1 Mbps

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Description	Manufacturer	Model	Serial Number
AC/DC Adapter	Raspberry Pi	KSA-15E-051300HK	3037350
Raspberry Pi Board	Raspberry Pi	Raspberry Pi 4 Model B	3157590

I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	Mains	IEC	< 3M	Feeds AC/DC adapter
2	DC	1	DC plug	2-wire	< 3M	Powers EUT from AC/DC adapter

TEST SETUP

Test software exercised the radio card of the EUT.

SETUP DIAGRAM

Please refer to R13337971-EP1 for setup diagrams.

7. MEASUREMENT METHOD

Emissions in restricted frequency bands: ANSI C63.10: 2013 Subclause -11.12.1 and 6.10.5

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

On Time and Duty Cycle: ANSI C63.10: 2013 Section 11.6

AC Power Line Conducted Emissions: ANSI C63.10:2013 Sections 6.2

8. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Radiated Disturbance Emissions (E-field) – Chamber C

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
AT0062	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS-Lindgren	3117	2020-01-30	2021-01-30
	Gain-Loss Chains				
C-SAC02	Gain-loss string: 1-18GHz	Various	Various	2020-03-03	2021-03-03
C-SAC02 Path 7	Gain-loss string 1-7GHz	Various	Various	2020-04-03	2021-04-03
	Receiver & Software				
SA0018	Spectrum Analyzer	Agilent	PXA (N9030A)	2020-03-02	2021-03-02
SOFTEMI	EMI Software	UL	Version 9.5 (2020-07-07)	NA	NA
	Additional Equipment used				
HI0085	Temp/Humid/Pressure Meter	EXTECH	SD700	2020-04-20	2021-04-30

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South 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				
AT0081	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2019-11-20	2020-11-20
	18-40 GHz				
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/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-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
SOFTEMI	EMI Software	UL	Version 9.5 (2020-07-07)	NA	NA
	Additional Equipment used				
s/n 200037635	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22

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
HI0091	Environmental Meter	Fisher Scientific	14-650-118	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	2020-08-18	2021-08-18
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2020-08-18	2021-08-18
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)		
SOFTEMI	EMI Software	UL	Version 9.5 (2020-07-07)		
CDECABLE001	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2020-08-08	2021-08-08

NOTES:

1. For equipment listed above that was calibrated during the testing period, please note the equipment was used for testing after calibration.
2. For equipment listed above that has a calibration due date during the testing period, the testing was completed before the equipment expiration date.

9. DUTY CYCLE

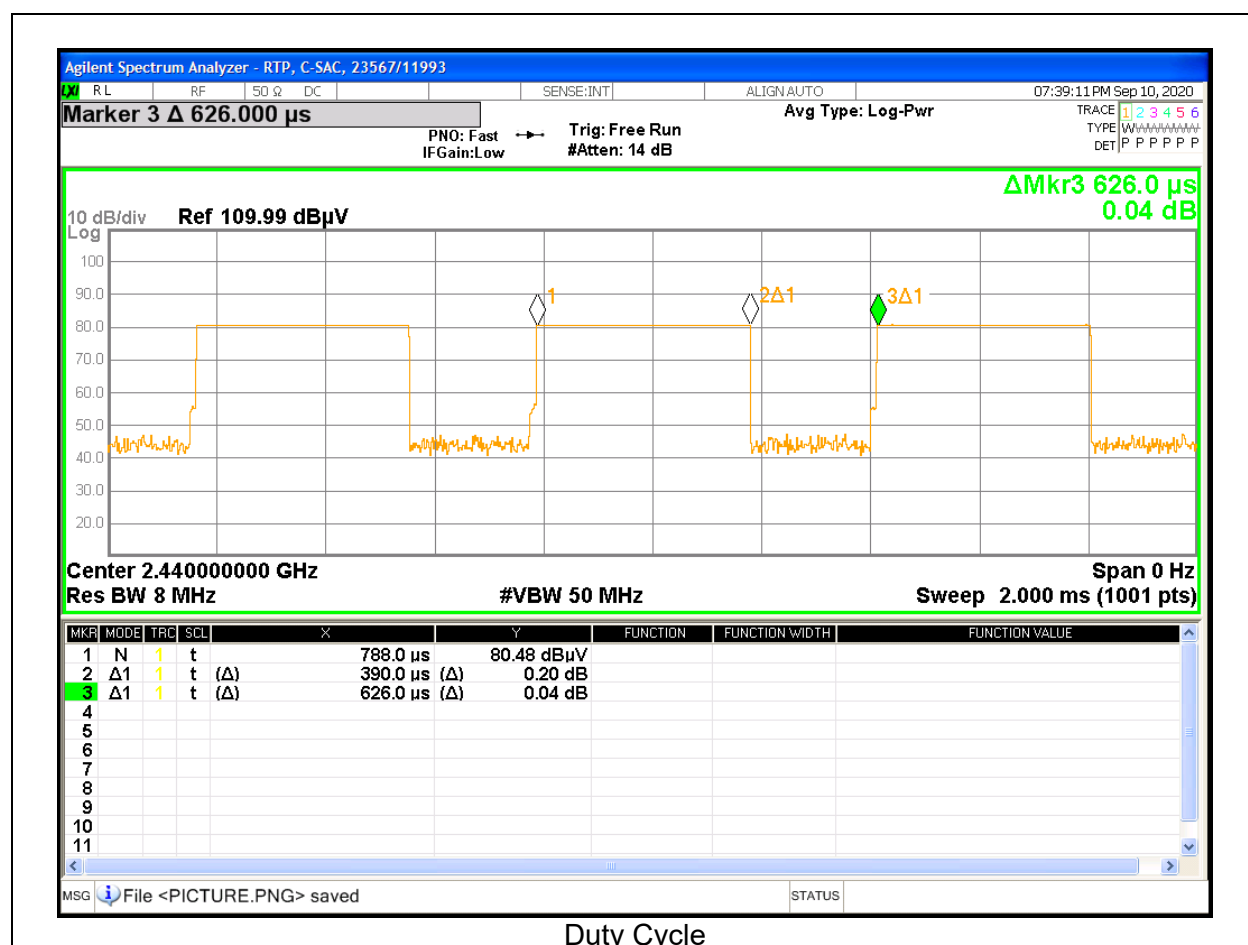
LIMITS

None, for reporting purposes only

TEST PROCEDURE

ANSI C63.10 Zero Span Method.

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Voltage Averaging Duty Cycle Correction Factor (dB)
2.4GHz Band					
BLE 1mbps	0.390	0.626	0.623	62.30%	4.11



10. 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 average measurements. Linear voltage averaging used for this project.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the low, middle, high channels and inner channels where required in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

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

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

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

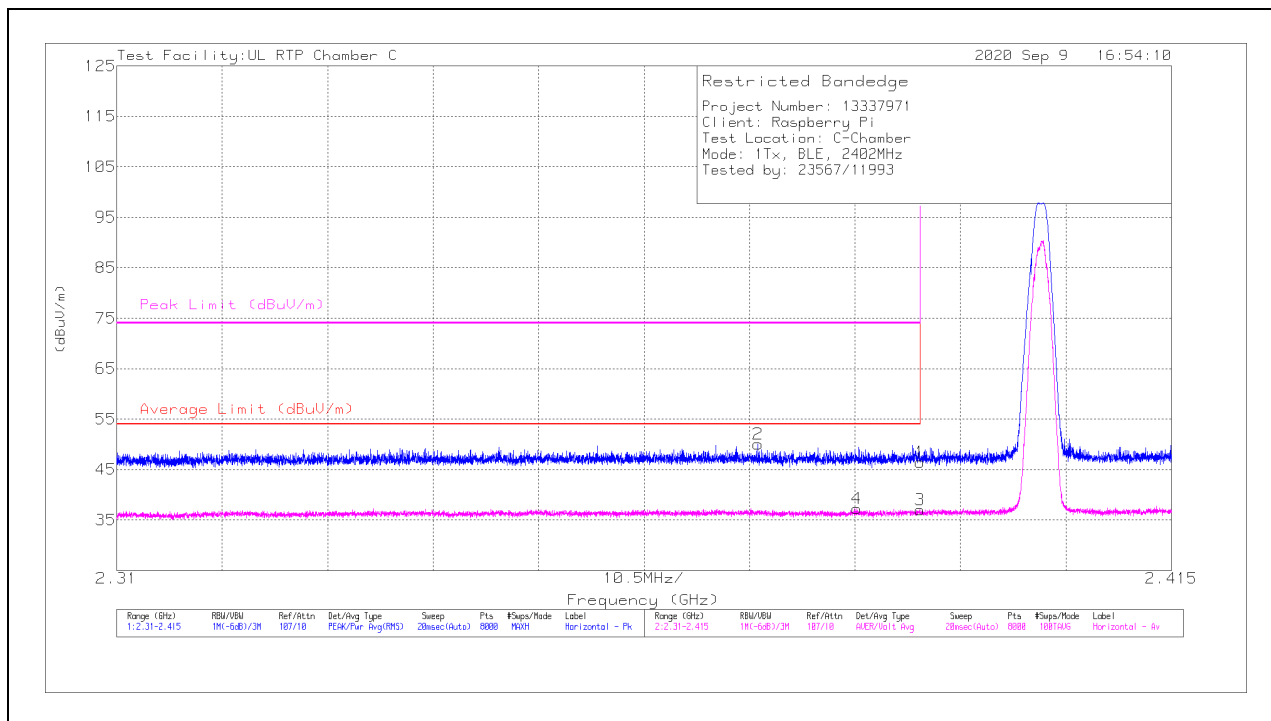
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

10.1. TRANSMITTER ABOVE 1 GHz

1TX Antenna 1 MODE

BANDEDGE (LOW CHANNEL, 2402 MHz)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/Filtr/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	32.57	Pk	32.1	-18.2	0	46.47	-	-	74	-27.53	86	336	H
2	* ** 2.37385	36.26	Pk	32	-18.2	0	50.06	-	-	74	-23.94	86	336	H
3	* ** 2.39	18.95	ADV	32.1	-18.2	4.11	36.96	54	-17.04	-	-	86	336	H
4	* ** 2.38368	19.39	ADV	32	-18.2	4.11	37.30	54	-16.70	-	-	86	336	H

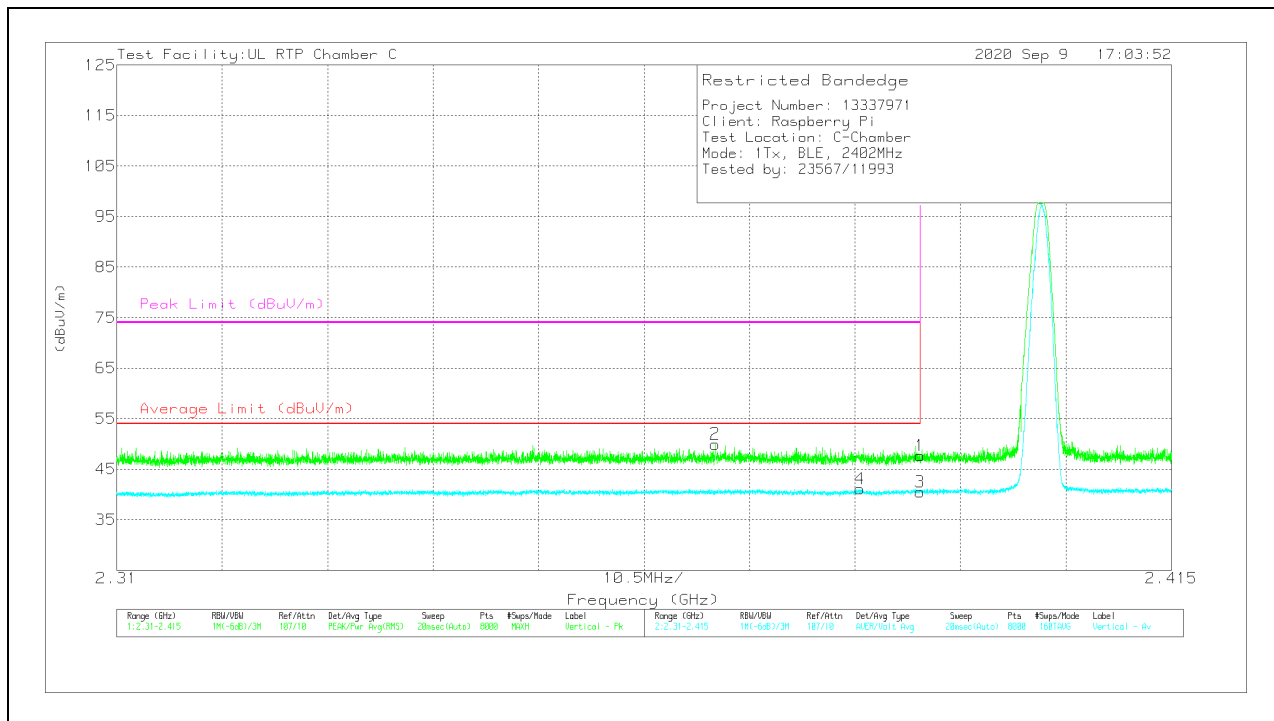
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/Filtr/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	33.83	Pk	32.1	-18.2	0	47.73	-	-	74	-26.27	219	133	V
2	* ** 2.36957	36.18	Pk	32	-18.2	0	49.98	-	-	74	-24.02	219	133	V
3	* ** 2.39	22.53	ADV	32.1	-18.2	4.11	40.54	54	-13.46	-	-	219	133	V
4	* ** 2.38397	23.17	ADV	32	-18.2	4.11	41.08	54	-12.92	-	-	219	133	V

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

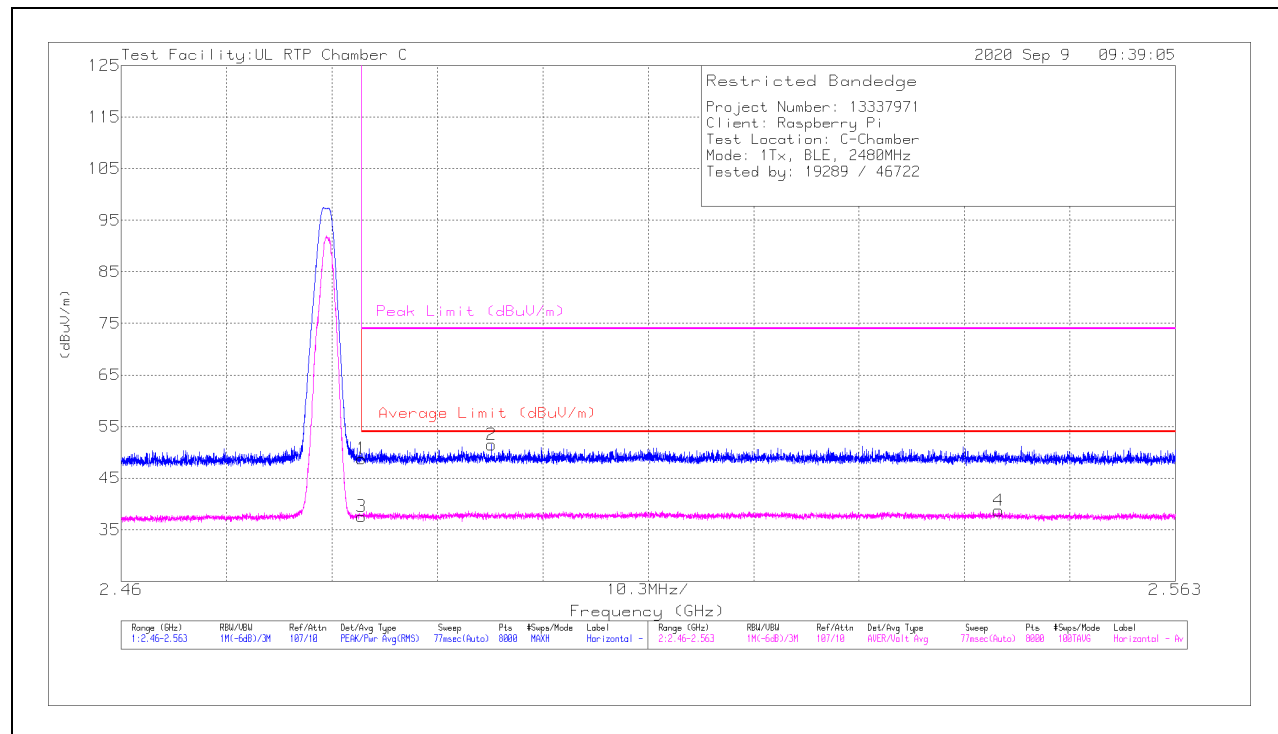
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

BANDEDGE (HIGH CHANNEL, 2480 MHz)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/Filtr/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	34.17	Pk	32.6	-18	0	48.77	-	-	74	-25.23	93	281	H
2	* ** 2.4962	36.8	Pk	32.7	-18	0	51.5	-	-	74	-22.5	93	281	H
3	* ** 2.4835	18.85	ADV	32.6	-18	4.11	37.56	54	-16.44	-	-	93	281	H
4	** 2.54572	19.7	ADV	32.5	-17.6	4.11	38.71	54	-15.29	-	-	93	281	H

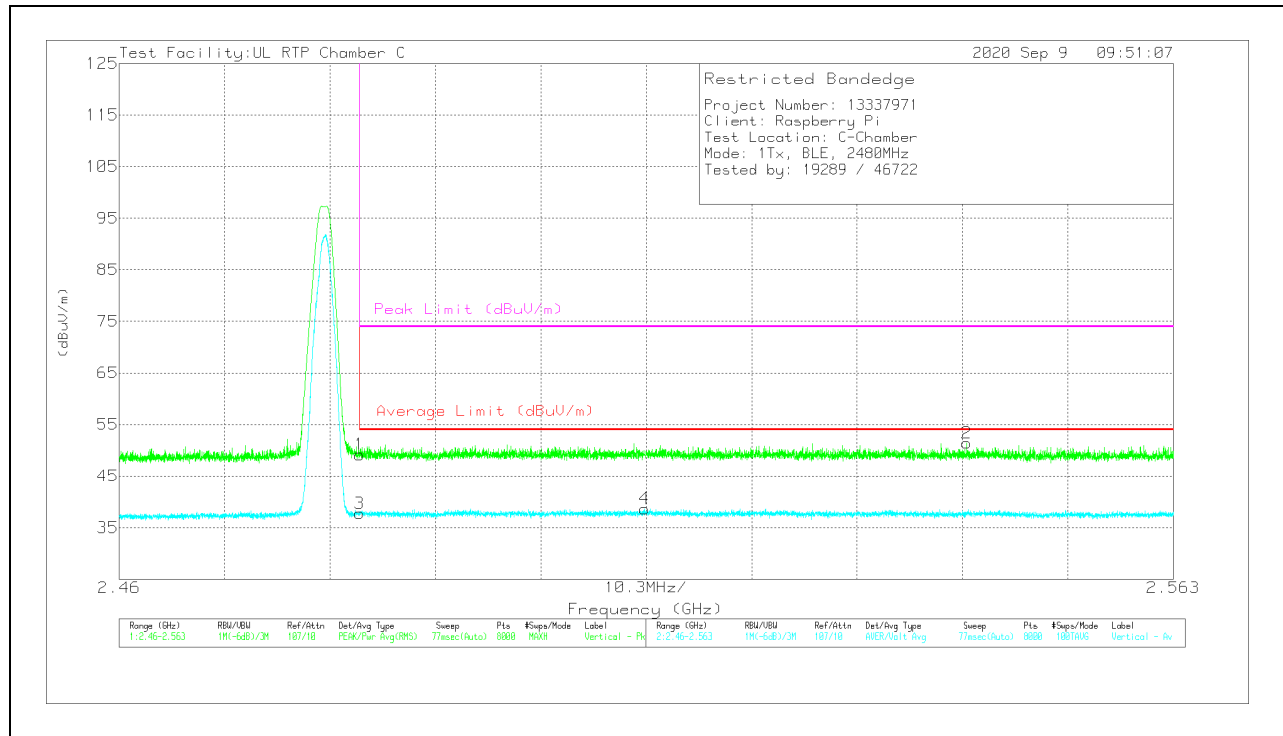
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/Filtr/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	34.57	Pk	32.6	-18	0	49.17	-	-	74	-24.83	224	119	V
2	** 2.5428	36.6	Pk	32.5	-17.7	0	51.4	-	-	74	-22.6	224	119	V
3	* ** 2.4835	19.07	ADV	32.6	-18	4.11	37.78	54	-16.22	-	-	224	118	V
4	** 2.51135	19.67	ADV	32.7	-17.8	4.11	38.68	54	-15.32	-	-	224	118	V

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

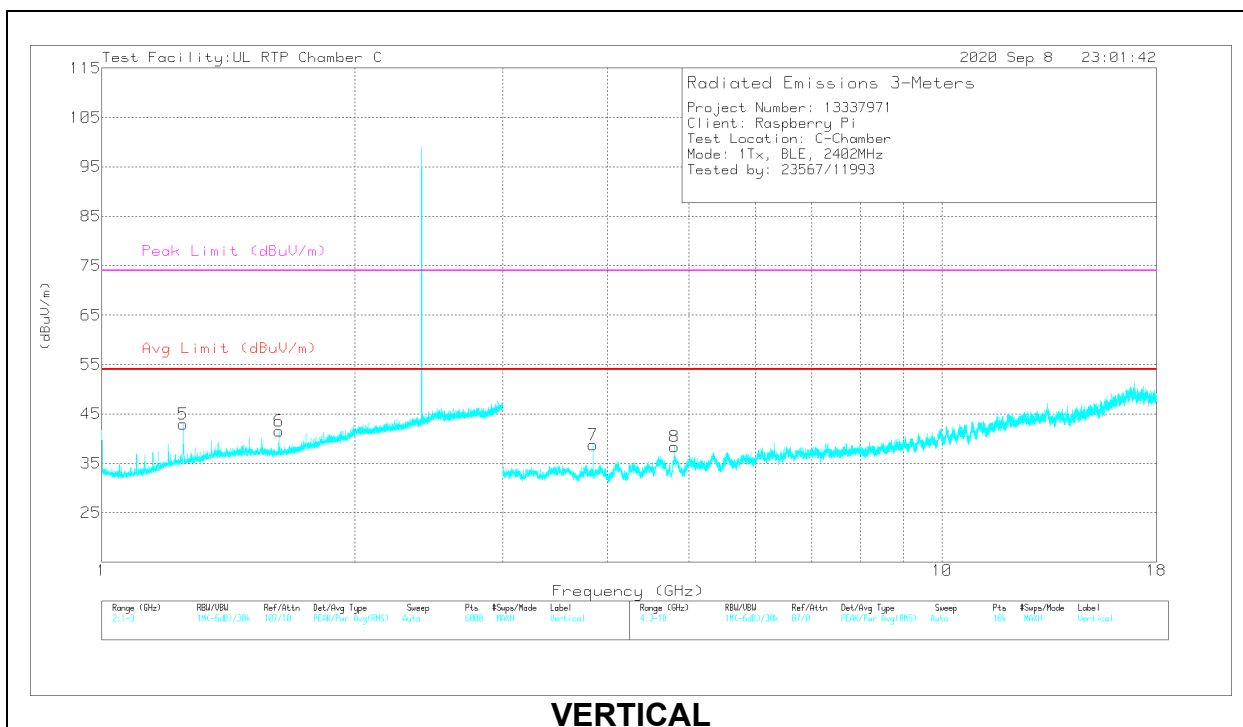
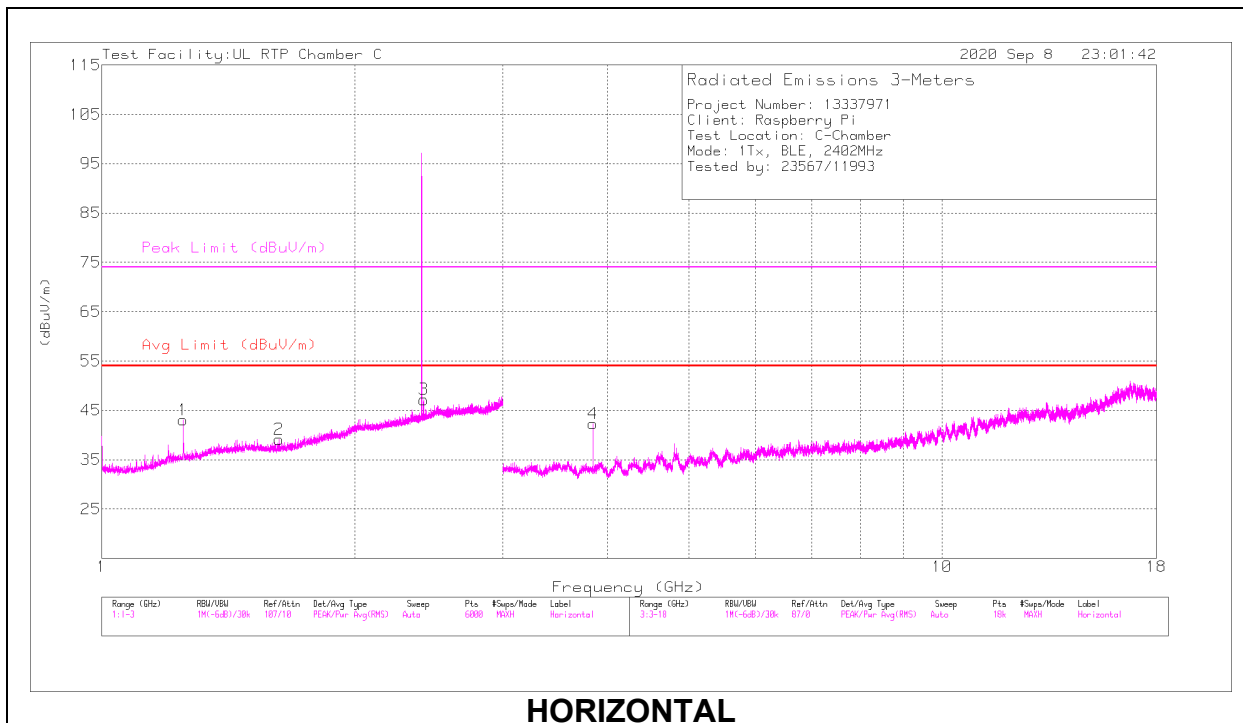
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL, 2402 MHz RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/Filtr/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	* 1.25004	38.52	PK2	28.6	-20.4	0	46.72	-	-	74	-27.28	245	150	H
	* 1.25003	31.84	ADV	28.6	-20.4	4.11	44.15	54	-9.85	-	-	245	150	H
2	*** 1.51163	35.16	PK2	27.9	-17.9	0	45.16	-	-	74	-28.84	309	116	H
	*** 1.62488	24.17	ADV	28.5	-18.8	4.11	37.98	54	-16.02	-	-	309	116	H
5	* 1.24988	38.46	PK2	28.6	-20.4	0	46.66	-	-	74	-27.34	130	104	V
	* 1.25001	30.75	ADV	28.6	-20.4	4.11	43.06	54	-10.94	-	-	130	104	V
6	*** 1.62488	38.36	PK2	28.5	-18.8	0	48.06	-	-	74	-25.94	274	118	V
	*** 1.62488	28.75	ADV	28.5	-18.8	4.11	42.56	54	-11.44	-	-	274	118	V
4	*** 3.84289	62.52	PK2	33.5	-49.2	0	46.82	-	-	74	-27.18	274	107	H
	*** 3.84324	54.23	ADV	33.5	-49.2	4.11	42.64	54	-11.36	-	-	274	107	H
7	*** 3.84298	59.56	PK2	33.5	-49.2	0	43.86	-	-	74	-30.14	0	106	V
	*** 3.84318	49.64	ADV	33.5	-49.2	4.11	38.05	54	-15.95	-	-	0	106	V
8	*** 4.80356	58.86	PK2	34.1	-47.7	0	45.26	-	-	74	-28.74	360	106	V
	*** 4.80365	46	ADV	34.1	-47.8	4.11	36.41	54	-17.59	-	-	360	106	V
3	2.41557	33.29	Pk	32.1	-18.2	0	47.19	-	-	-	-	0-360	200	H

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

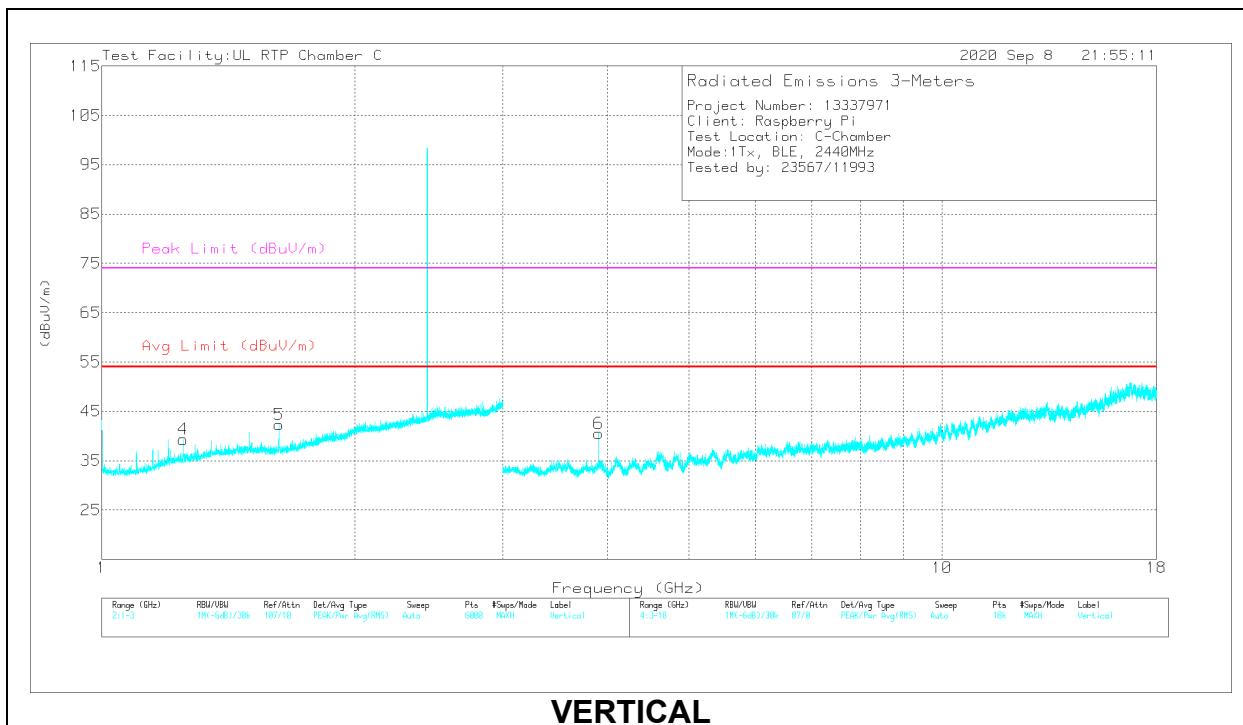
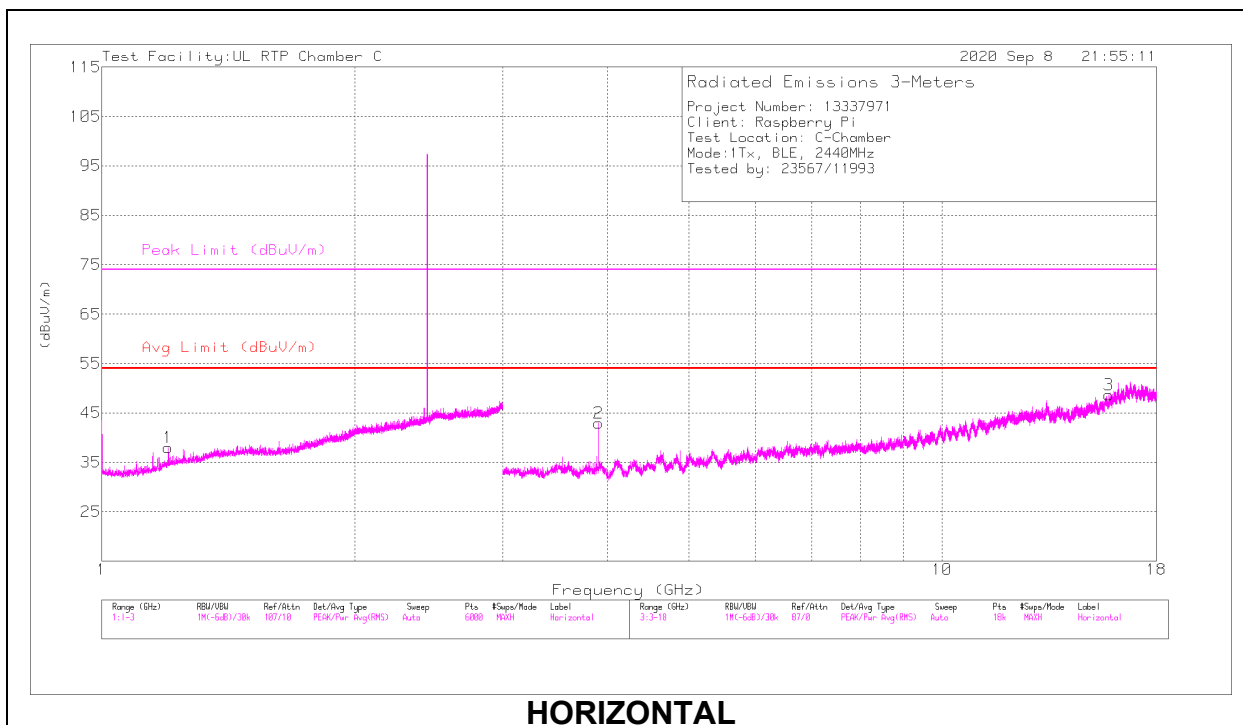
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK2 - Maximum Peak

ADV - Linear Voltage Average

Pk - Peak detector

MID CHANNEL, 2440 MHz RESULTS



RADIATED EMISSIONS

	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/Fitr/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	* ** 1.19995	36.52	PK2	28.1	-20.5	0	44.12	-	-	74	-29.88	221	102	H
	* ** 1.20007	26.97	ADV	28.1	-20.5	4.11	38.68	54	-15.32	-	-	221	102	H
4	* 1.24985	36.87	PK2	28.6	-20.4	0	45.07	-	-	74	-28.93	313	281	V
	* 1.25004	27.32	ADV	28.6	-20.4	4.11	39.63	54	-14.37	-	-	313	281	V
5	* ** 1.62413	37.54	PK2	28.4	-18.8	0	47.14	-	-	74	-26.86	280	130	V
	* ** 1.62488	29.08	ADV	28.5	-18.8	4.11	42.89	54	-11.11	-	-	280	130	V
2	* ** 3.90391	63.83	PK2	33.5	-49.2	0	48.13	-	-	74	-25.87	278	101	H
	* ** 3.90405	56.47	ADV	33.5	-49.1	4.11	44.98	54	-9.02	-	-	278	101	H
3	* ** 15.78884	48.5	PK2	40.8	-34.9	0	54.4	-	-	74	-19.6	49	387	H
	* ** 15.78868	35.37	ADV	40.8	-35	4.11	45.28	54	-8.72	-	-	49	387	H
6	* ** 3.90401	60.71	PK2	33.5	-49.1	0	45.11	-	-	74	-28.89	19	101	V
	* ** 3.904	51.63	ADV	33.5	-49.1	4.11	40.14	54	-13.86	-	-	19	101	V

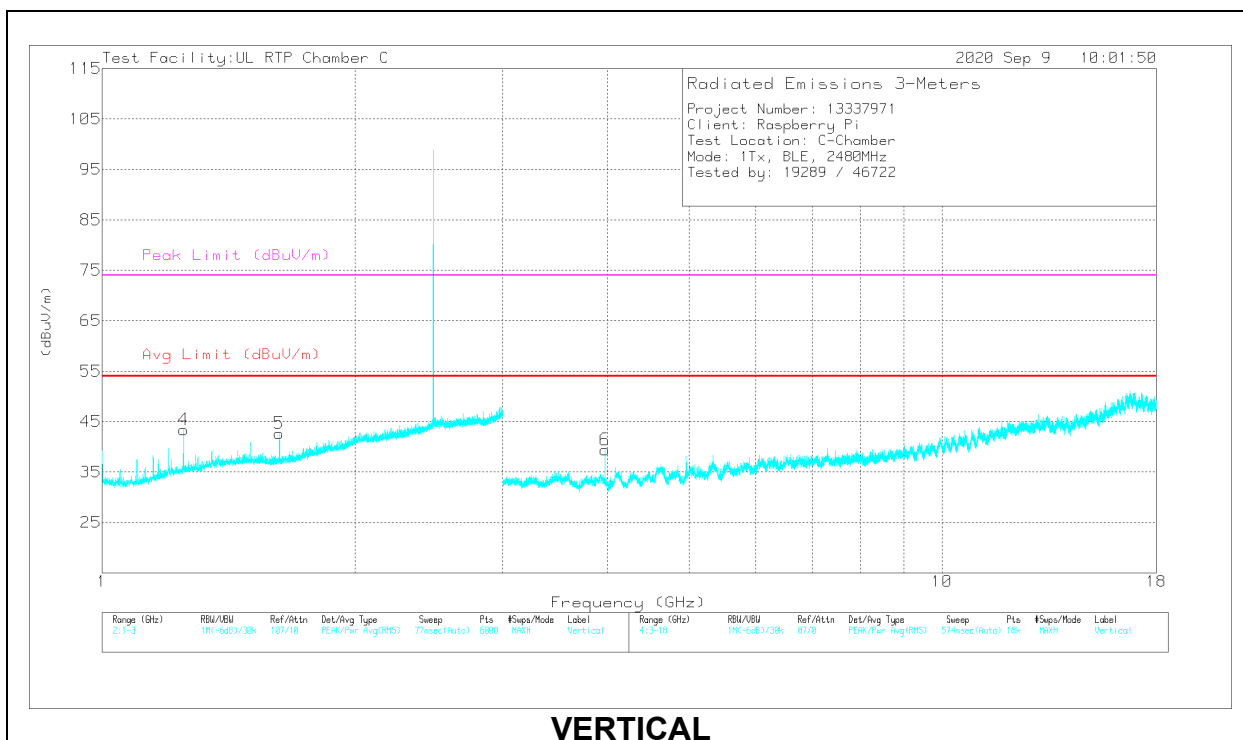
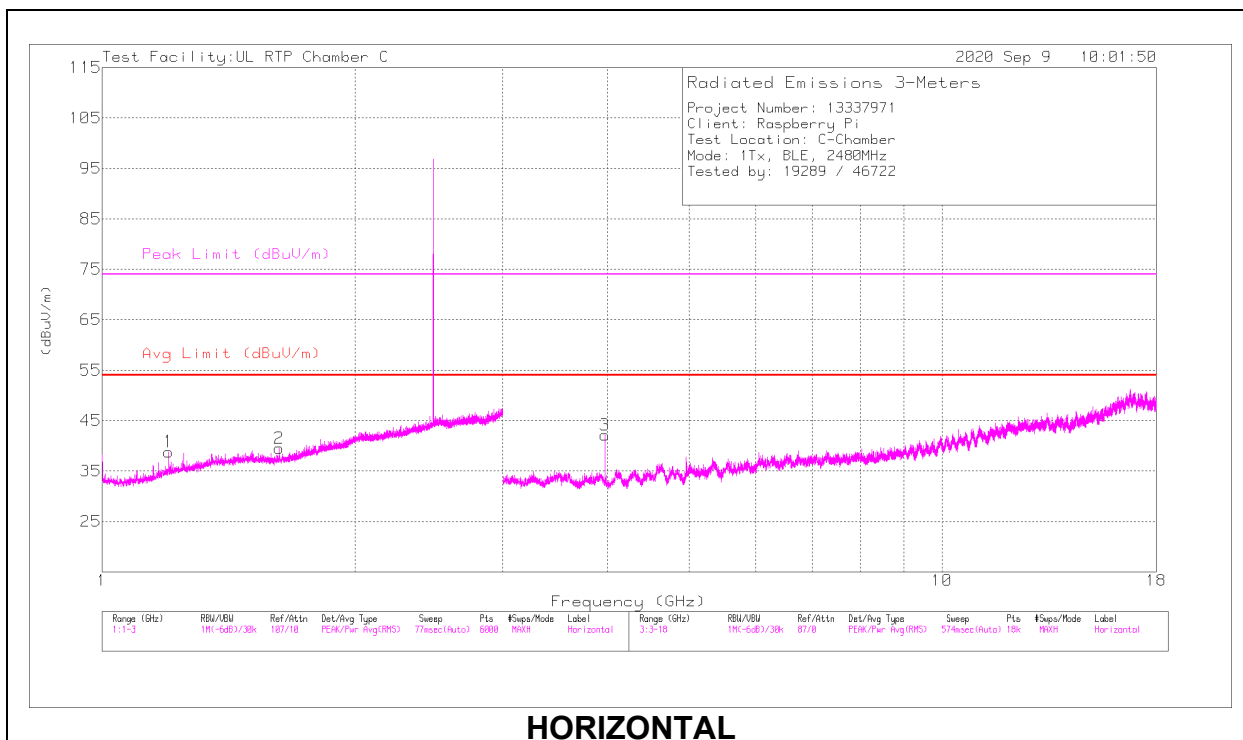
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK2 - Maximum Peak

ADV - Linear Voltage Average

HIGH CHANNEL, 2480 MHz RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/Filtr/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	*** 1.20005	36.81	PK2	28.1	-20.5	0	44.41	-	-	74	-29.59	245	153	H
	*** 1.19999	27.57	ADV	28.1	-20.5	4.11	39.28	54	-14.72	-	-	245	153	H
2	*** 1.62526	37.08	PK2	28.5	-18.9	0	46.68	-	-	74	-27.32	230	258	H
	*** 1.62502	26.34	ADV	28.5	-18.8	4.11	40.15	54	-13.85	-	-	230	258	H
4	* 1.25032	38.39	PK2	28.6	-20.4	0	46.59	-	-	74	-27.41	356	152	V
	* 1.25	30.61	ADV	28.6	-20.4	4.11	42.92	54	-11.08	-	-	356	152	V
5	*** 1.62516	39	PK2	28.5	-18.8	0	48.7	-	-	74	-25.3	136	182	V
	*** 1.62504	30.2	ADV	28.5	-18.8	4.11	44.01	54	-9.99	-	-	136	182	V
3	*** 3.9681	60.17	PK2	33.5	-48.3	0	45.37	-	-	74	-28.63	105	101	H
	*** 3.96804	52.38	ADV	33.5	-48.3	4.11	41.69	54	-12.31	-	-	105	101	H
6	*** 3.968	59.35	PK2	33.5	-48.3	0	44.55	-	-	74	-29.45	170	104	V
	*** 3.96806	51.27	ADV	33.5	-48.3	4.11	40.58	54	-13.42	-	-	170	104	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK2 - Maximum Peak

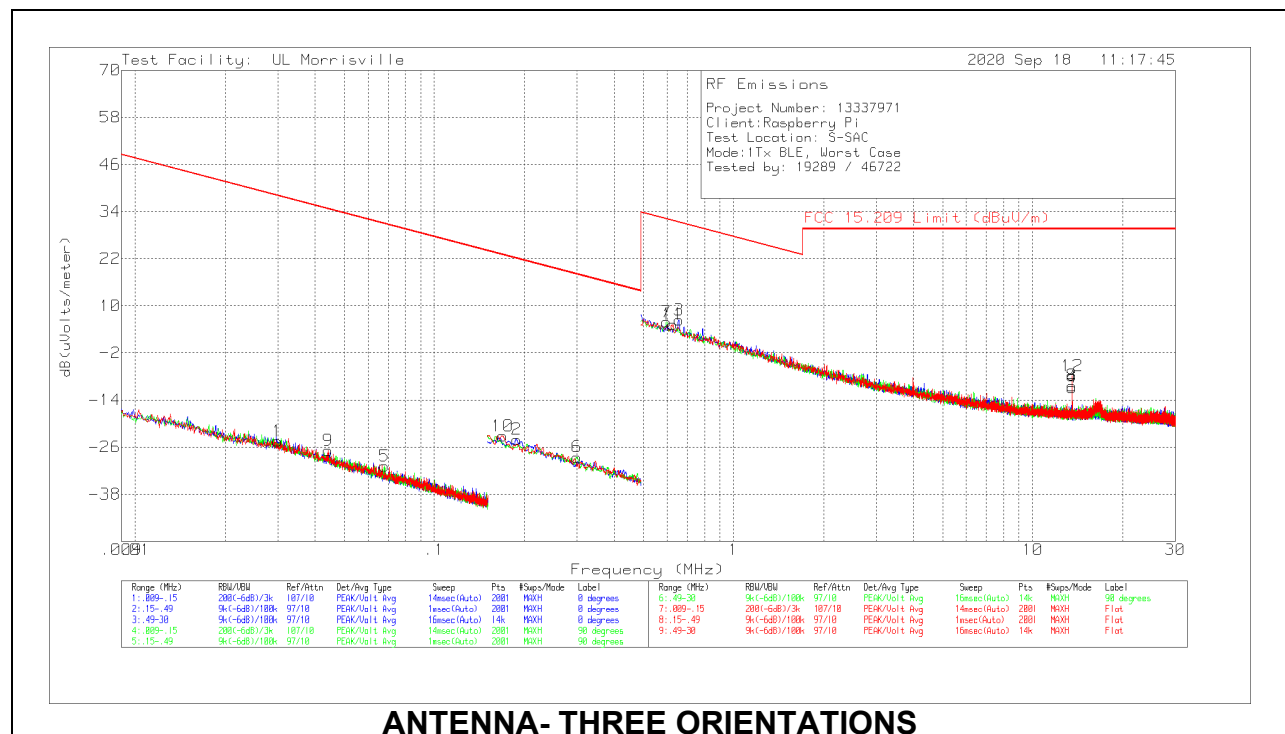
ADV - Linear Voltage Average

10.2. WORST CASE BELOW 30MHZ

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).

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 29.95 kHz resulted in a level of -24.46 dBuV/m, which is equivalent to $-24.46 - 51.5 = -75.96$ dBuA/m, which has the same margin, -62.54 dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)

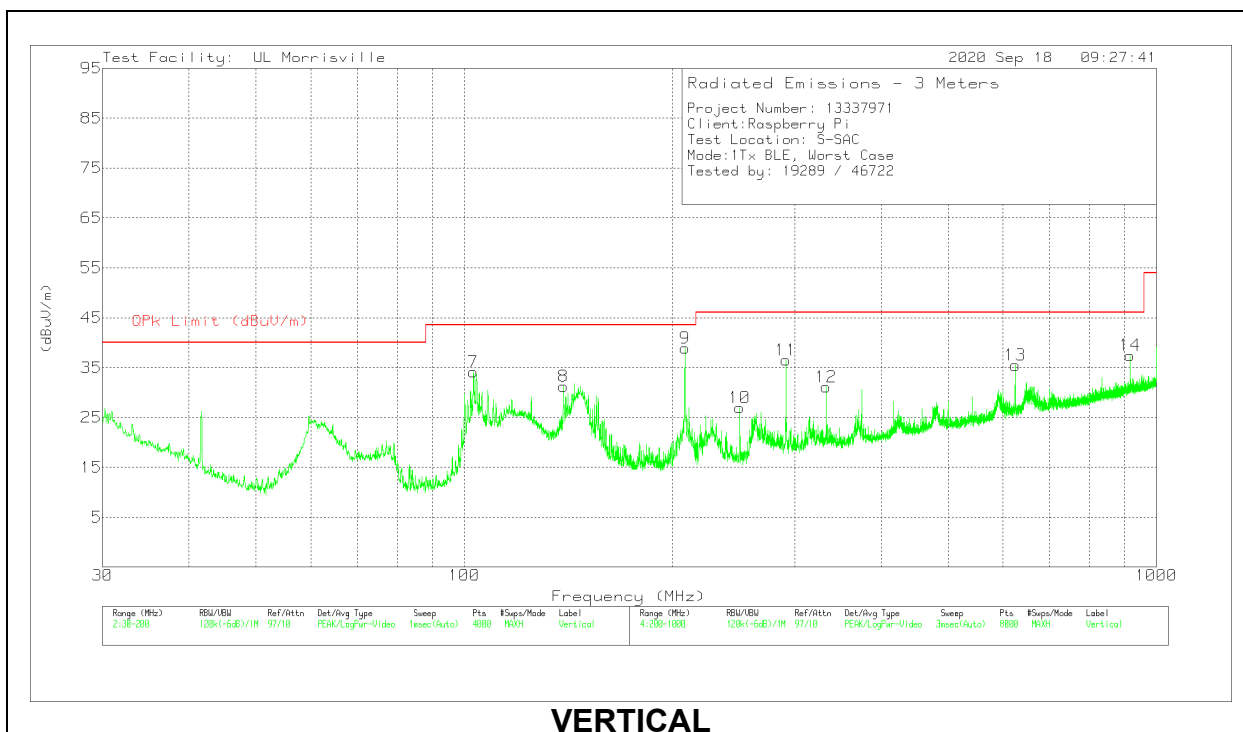
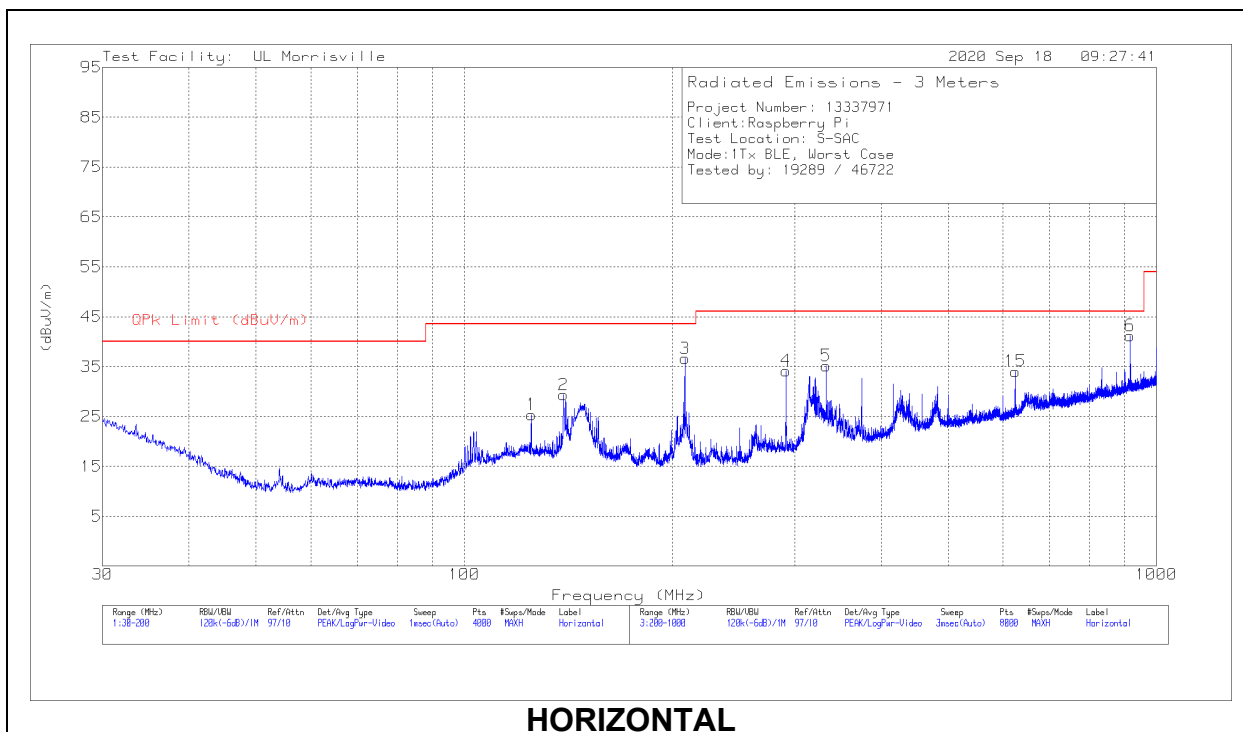


Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 QP/Avg Limit (dBuV/m)	FCC 15.209 Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.02995	42.14	Pk	13.3	.1	-80	-24.46	38.08	58.08	-62.54	0-360
9	.04422	41.01	Pk	12	.1	-80	-26.89	34.69	54.69	-61.58	0-360
5	.06829	37.73	Pk	11.3	.1	-80	-30.87	30.92	50.92	-61.79	0-360
10	.16921	45.95	Pk	10.8	.1	-80	-23.15	23.04	43.04	-46.19	0-360
2	.18842	45.04	Pk	10.8	.1	-80	-24.06	22.1	42.1	-46.16	0-360
6	.29935	40.67	Pk	10.7	.1	-80	-28.53	18.08	38.08	-46.61	0-360
7	.59751	34.87	Pk	10.8	.2	-40	5.87	32.08	-	-26.21	0-360
11	.62702	34.29	Pk	10.8	.2	-40	5.29	31.66	-	-26.37	0-360
3	.65653	35.38	Pk	10.8	.2	-40	6.38	31.26	-	-24.88	0-360
12	13.5596	21	Pk	10.4	.7	-40	-7.9	29.54	-	-37.44	0-360
4	13.56171	18.1	Pk	10.4	.7	-40	-10.8	29.54	-	-40.34	0-360
8	13.56171	18.58	Pk	10.4	.7	-40	-10.32	29.54	-	-39.86	0-360

Pk - Peak detector

10.3. WORST CASE BELOW 1 GHZ



Below 1GHz DATA

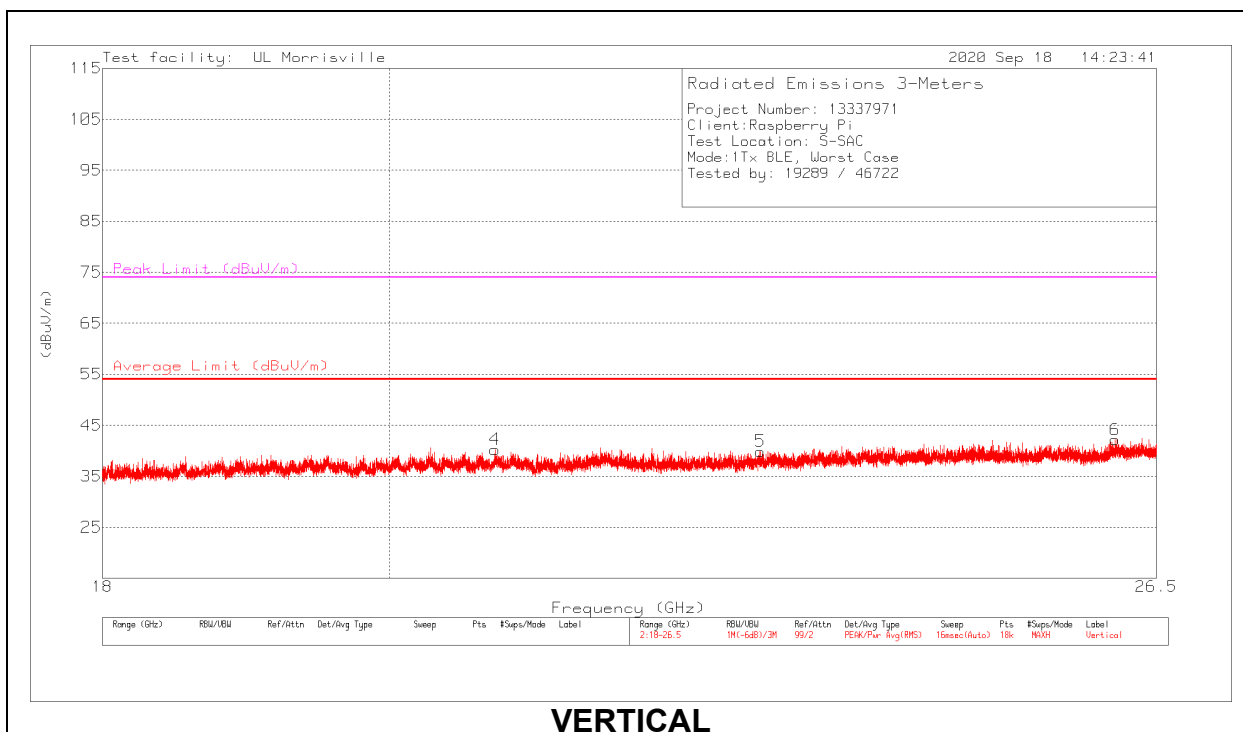
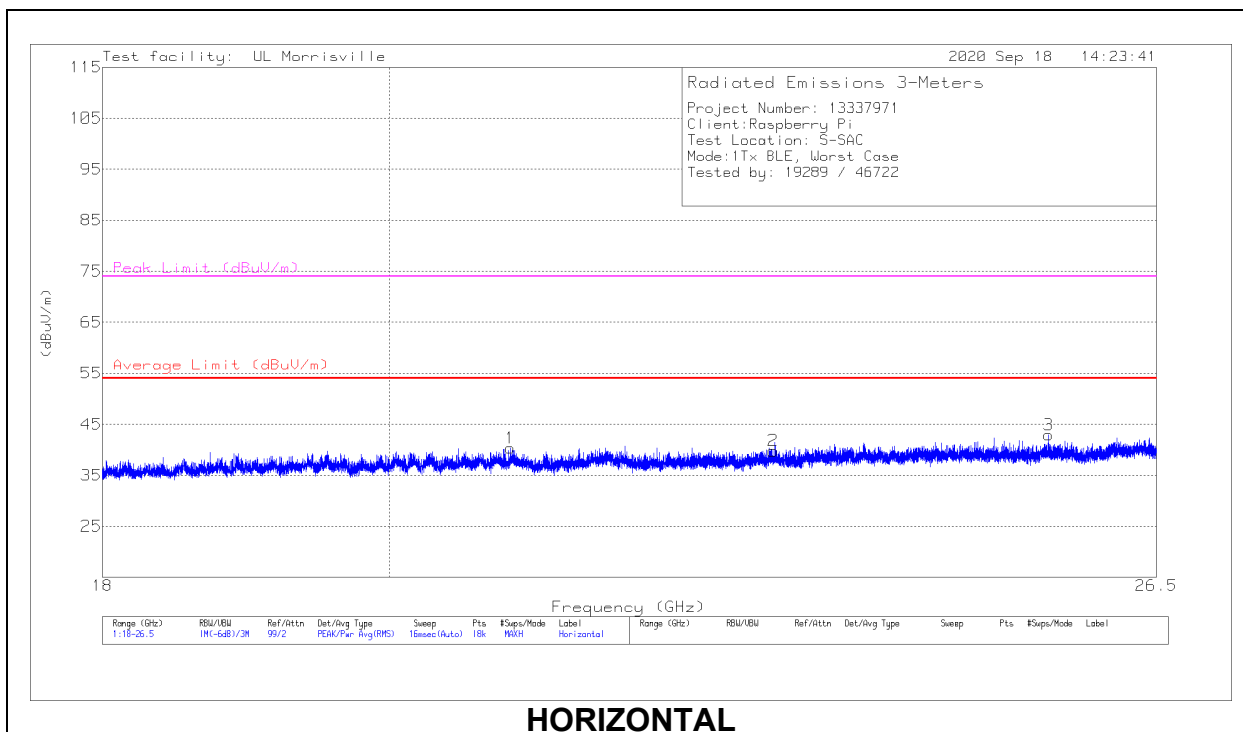
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0081 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 125.0121	35.58	Pk	20.1	-30.3	25.38	43.52	-18.14	0-360	199	H
5	* ** 333.3173	43.78	Pk	20.1	-28.7	35.18	46.02	-10.84	0-360	101	H
10	* ** 250.0065	38.47	Pk	17.6	-29.1	26.97	46.02	-19.05	0-360	200	V
12	* ** 333.3173	39.69	Pk	20.1	-28.7	31.09	46.02	-14.93	0-360	200	V
7	103.1189	47.42	Pk	17.2	-30.5	34.12	-	-	0-360	101	V
8	139.0832	42.14	Pk	19.2	-30.1	31.24	-	-	0-360	101	V
2	139.1682	40.23	Pk	19.2	-30.1	29.33	-	-	0-360	199	H
3	208.3011	49.45	Pk	16.6	-29.4	36.65	-	-	0-360	200	H
9	208.3011	51.73	Pk	16.6	-29.4	38.93	-	-	0-360	101	V
4	291.7119	43.68	Pk	19.3	-28.8	34.18	-	-	0-360	200	H
11	291.7119	46	Pk	19.3	-28.8	36.5	-	-	0-360	200	V
15	625.0553	35.87	Pk	25.4	-27.2	34.07	-	-	0-360	300	H
13	625.0553	37.26	Pk	25.4	-27.2	35.46	-	-	0-360	101	V
6	916.6932	38.11	Pk	28.5	-25.4	41.21	-	-	0-360	101	H
14	916.6932	34.35	Pk	28.5	-25.4	37.45	-	-	0-360	200	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

10.4. WORST CASE 18-26 GHZ



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
1	* ** 20.90574	46.31	Pk	33.2	-39.2	40.31	54	-13.69	74	-33.69	0-360	101	H
2	* ** 23.0233	44.9	Pk	33.8	-38.9	39.8	54	-14.2	74	-34.2	0-360	249	H
4	* ** 20.78862	46.17	Pk	33.1	-39	40.27	54	-13.73	74	-33.73	0-360	299	V
5	* ** 22.91516	45.1	Pk	33.8	-39	39.9	54	-14.1	74	-34.1	0-360	101	V
3	25.47191	46.12	Pk	34.5	-37.7	42.92	54	-11.08	74	-31.08	0-360	249	H
6	26.1	44.86	Pk	34.8	-37.5	42.16	54	-11.84	74	-31.84	0-360	250	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

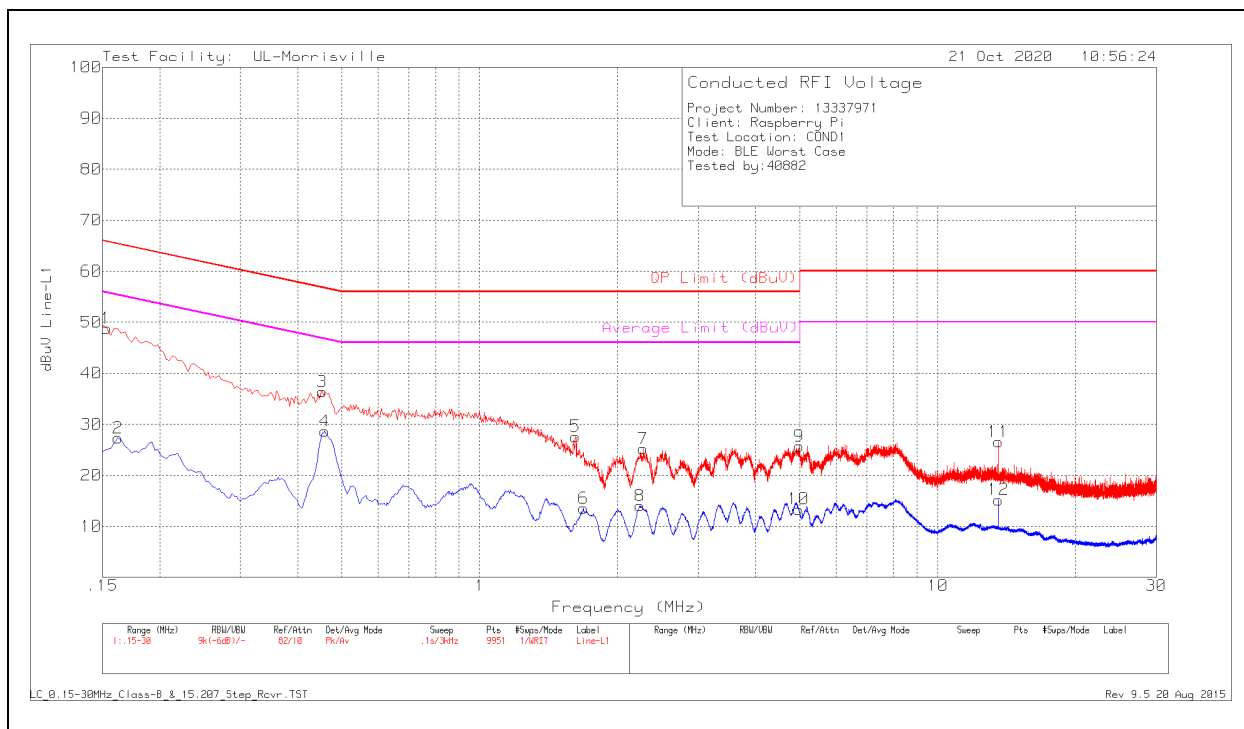
FCC §15.207 (a)
RSS-Gen 8.8

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

* Decreases with the logarithm of the frequency.

RESULTS

LINE 1 RESULTS



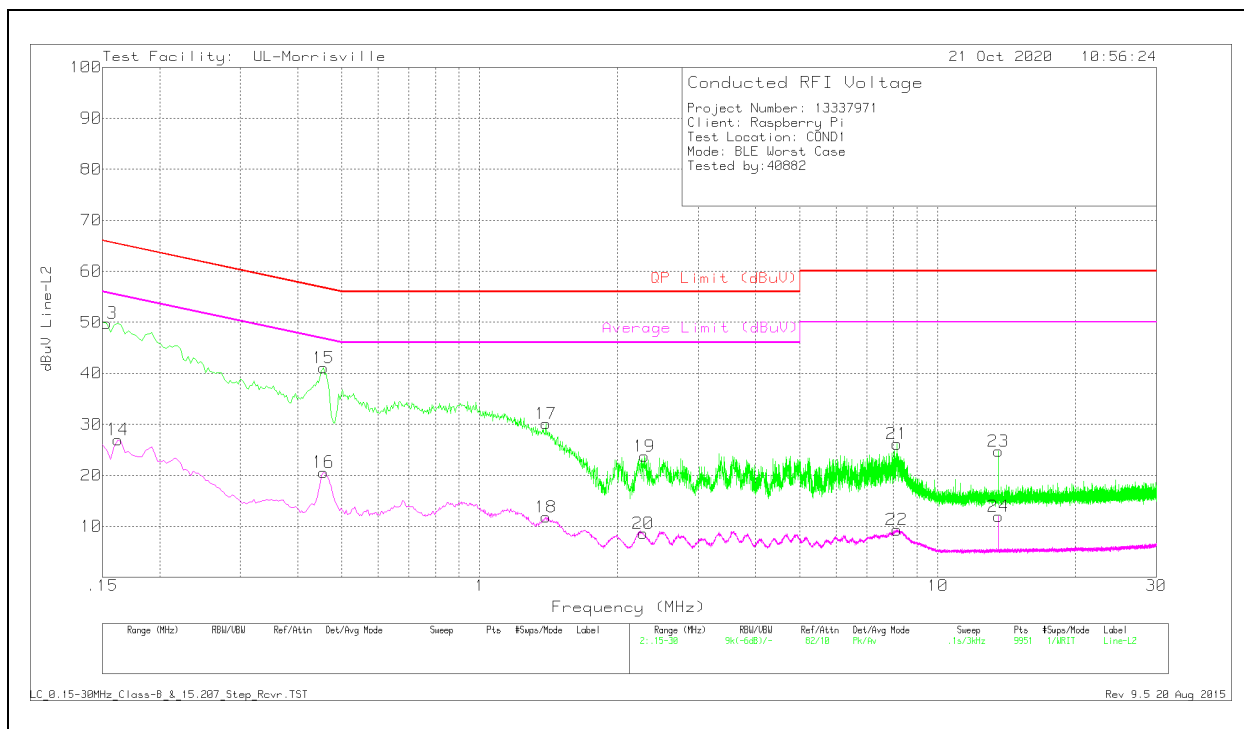
Range 1: Line-L1 .15 - 30MHz

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	38.89	Pk	.2	9.7	48.79	65.84	-17.05	-	-
2	.162	17.4	Av	.2	9.7	27.3	-	-	55.36	-28.06
3	.453	26.51	Pk	.1	9.8	36.41	56.82	-20.41	-	-
4	.459	18.78	Av	.1	9.8	28.68	-	-	46.71	-18.03
5	1.617	17.8	Pk	0	9.8	27.6	56	-28.4	-	-
6	1.683	3.77	Av	0	9.8	13.57	-	-	46	-32.43
7	2.274	15.41	Pk	0	9.8	25.21	56	-30.79	-	-
8	2.235	4.2	Av	0	9.8	14	-	-	46	-32
9	4.974	15.82	Pk	0	9.9	25.72	56	-30.28	-	-
10	4.968	3.46	Av	0	9.9	13.36	-	-	46	-32.64
11	13.56	16.49	Pk	.1	10	26.59	60	-33.41	-	-
12	13.56	5.1	Av	.1	10	15.2	-	-	50	-34.8

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	39.94	Pk	.2	9.7	49.84	65.84	-16	-	-
14	.162	17.08	Av	.2	9.7	26.98	-	-	55.36	-28.38
15	.456	31.19	Pk	.1	9.8	41.09	56.77	-15.68	-	-
16	.456	10.7	Av	.1	9.8	20.6	-	-	46.77	-26.17
17	1.395	20.36	Pk	0	9.8	30.16	56	-25.84	-	-
18	1.395	2.04	Av	0	9.8	11.84	-	-	46	-34.16
19	2.289	13.91	Pk	0	9.8	23.71	56	-32.29	-	-
20	2.274	-1.2	Av	0	9.8	8.6	-	-	46	-37.4
21	8.151	16.05	Pk	.1	10	26.15	60	-33.85	-	-
22	8.133	-7.8	Av	.1	10	9.32	-	-	50	-40.68
23	13.56	14.63	Pk	.1	10	24.73	60	-35.27	-	-
24	13.56	1.82	Av	.1	10	11.92	-	-	50	-38.08

Pk - Peak detector

Av - Average detection

Qp - Quasi-peak detection

Ca - CISPR average detection

12. SETUP PHOTOS

Please refer to R13337971-EP1 for setup photos.

END OF TEST REPORT