



TEST REPORT

Report Number: R13976514-E2

Applicant : Nuheara Limited
190 Aberdeen St
Northbridge, Western Australia, 6003, Australia

Model : NU320

FCC ID : 2AKMG-NU320L

EUT Description : IQbuds 2 PRO Hearing Aid – Left

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 2
ISED RSS-GEN ISSUE 5 + A2

Date Of Issue:
2021-11-10

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2021-10-05	Initial Issue	Niklas Haydon
V2	2021-11-10	Corrected duty cycle for above 18GHz testing, new 2440MHz RSE scan data, updated equipment list	Niklas Haydon

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Nuheara Limited
190 Aberdeen St
Northbridge, Western Australia, 6003, Australia

EUT DESCRIPTION: IQbuds 2 PRO Hearing Aid – Left

MODEL: NU320

SERIAL NUMBER: PC2132S107K0 (Serial on charging case)
PC2132S10800 (Serial on charging case)
PL2132S105T0 (Hearing aid)
PL2132S10BC0 (Hearing aid)

SAMPLE RECEIPT DATE: 2021-09-09

DATE TESTED: 2021-09-10 to 2021-11-10

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5 + A2	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.

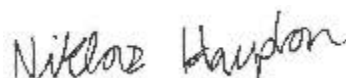
This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the U.S. government.

Approved & Released For
UL LLC. By:



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Consumer Technology Division
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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	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW	Complies	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Complies	None.
See Comment		Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	RSS-247 5.2 (b)	PSD	Complies	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions	Complies	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Complies	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Complies	None.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + A2, and RSS-247 Issue 2.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, Certificate Number 0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
<input type="checkbox"/>	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	703469
<input checked="" type="checkbox"/>	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A		27265	

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	1.22%
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	6.01 dB
Conducted Emissions (0.150-30MHz) - LISN	3.40 dB
Temperature	0.57°C
Humidity	3.39%
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:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Final Voltage (dBuV)} = \text{Measured Voltage (dBuV)} + \text{Cable Loss (dB)} + \text{Limiter Factor (dB)} + \text{LISN Insertion Loss.}$$

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

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a left hearing aid with BT/BLE and NFMI radios. This report covers the BLE radio.

6.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	BLE	4.28	2.68

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

The radio utilizes an PIFA antenna, with a maximum gain of -9 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was Version 1.0.0

6.5. 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, it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

The EUT operates at 1Mbps only.

The EUT operates on battery or in the charging case. It was determined by performing fundamental field strength and spurious emissions that battery was worst case. For radiated emissions only battery data is included. For power line conducted emissions the EUT was in the charging case.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List			
Description	Manufacturer	Model	Serial Number
Lenovo	Lenovo	Yoga12	SL10G59251
AC Adapter	Lenovo	ADLX45NCC3A	080-513-0880
Laptop	HP	14-dk1xxx	5CG016B4XM

I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
None						

TEST SETUP

A test laptop with test software connected to the EUT exercised the radio card.

SETUP DIAGRAMS

Please refer to R13976514-EP1 for setup diagrams.

7. MEASUREMENT METHOD

Duty Cycle: ANSI C63.10 Section 11.6

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

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter

Output Power: ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

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

Emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11 and 6.10.4

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

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

General Radiated Spurious Emissions: ANSI C63.10-2013 Section 6.3-6.6

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 Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2021-08-19	2022-08-19
	30-1000 MHz				
AT0075	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2020-10-27	2021-10-27
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2021-05-03	2022-05-03
	18-40 GHz				
AT0063	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2020-10-30	2021-10-30
	Gain-Loss Chains				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2021-07-09	2022-07-09
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2021-07-09	2022-07-09
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2021-07-09	2022-07-09
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2021-07-09	2022-07-09
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-10	2022-03-10
SA0026	Spectrum Analyzer	Agilent	N9030A	2021-07-26	2022-07-26
SOFTEMI	EMI Software	UL	Version 9.5 (09 August 2021)		
	Additional Equipment used				
HI0095	Environmental Meter	Fisher Scientific	06-662-4	2020-01-21	2022-01-21

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA0025	Spectrum Analyzer	Keysight Technologies	N9030A	2021-04-01	2022-04-01
PWM005 (PRE0136341)	RF Power Meter	Keysight Technologies	N1912A	2021-07-27	2022-07-26
PWS003	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2021-05-27	2022-05-27
HI0092	Environmental Meter	Fisher Scientific	160938893	2020-09-23	2021-09-23
SOFTEMI	Antenna Port Software	UL	Version 2021.08.18	NA	NA

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	2021-04-05	2022-04-05
HI0091	Environmental Meter	Fisher Scientific	15-077-963	2021-07-12	2022-07-12
LISN003	LISN, 50-ohm/50-uH, 250uH 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50/250-25-2-01	2021-08-16	2022-08-16
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2021-08-17	2022-08-17
ATA222	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2021-04-05	2022-04-05
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (04 Mar 2021)		

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

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
AT0078	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-11-19	2021-11-19
	Gain-Loss Chains				
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2021-07-20	2022-07-20
	Receiver & Software				
197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-30	2022-03-30
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2021-09-27	2022-09-27

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

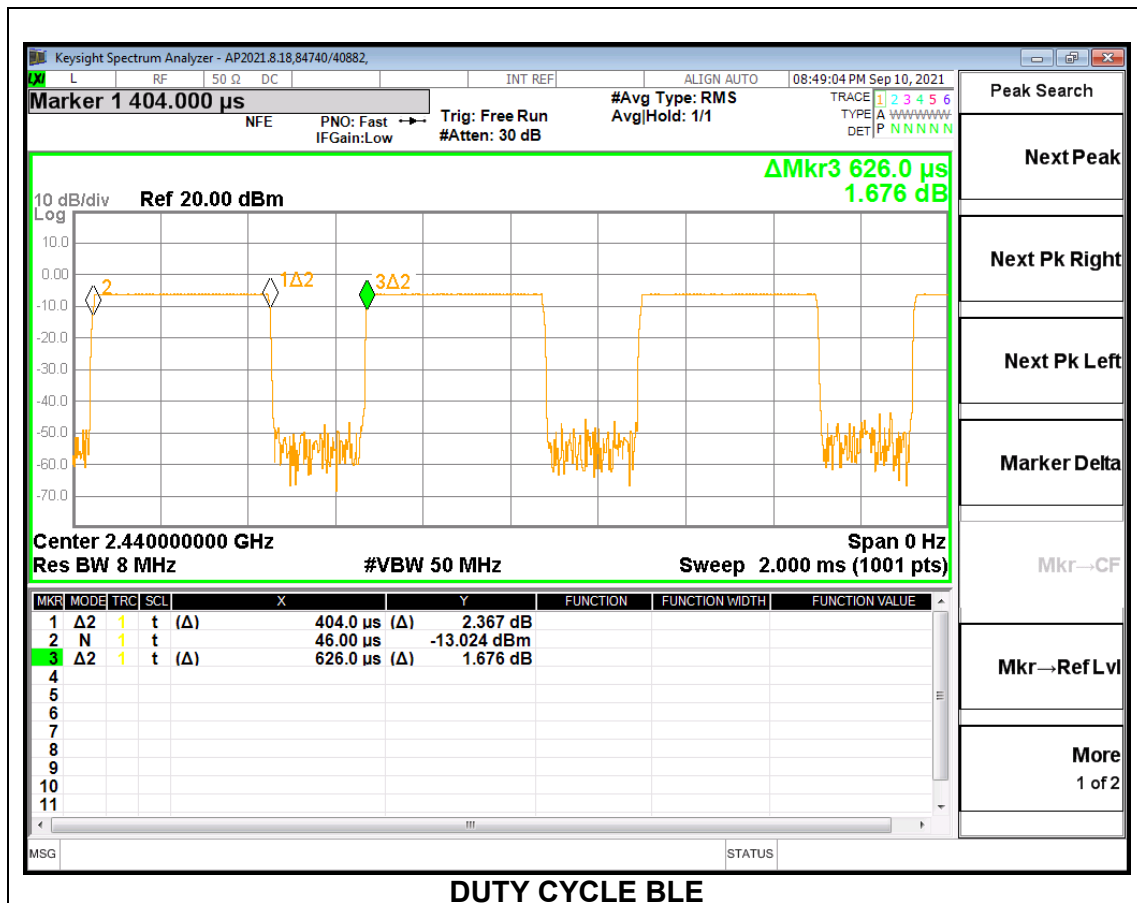
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
BLE	0.404	0.626	0.645	64.54	3.80	2.475

DUTY CYCLE PLOTS



9.2. 99% BANDWIDTH

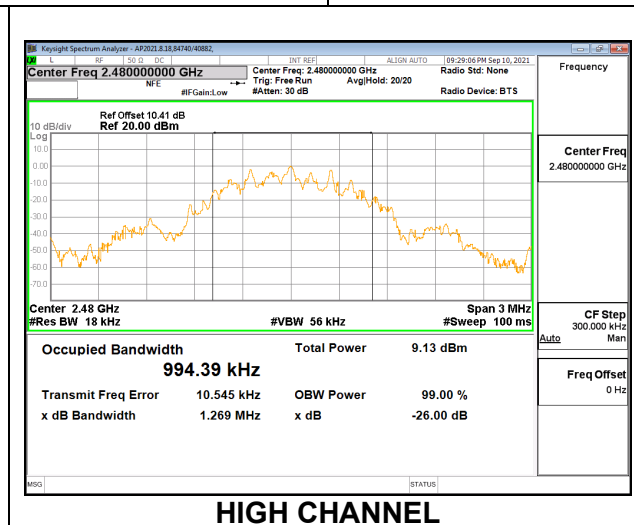
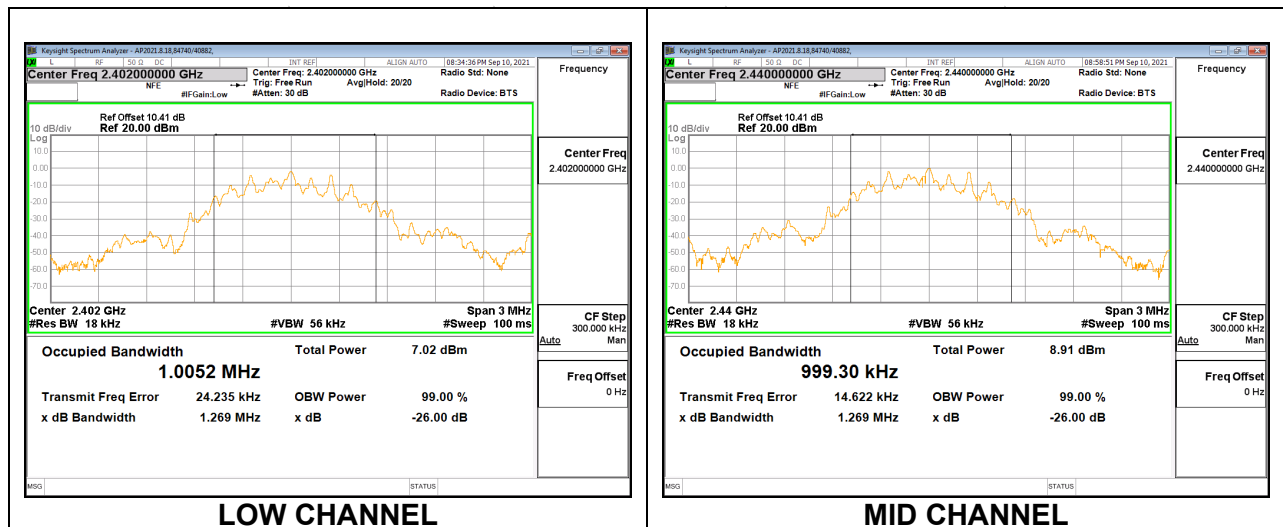
LIMITS

None; for reporting purposes only.

RESULTS

9.2.1. BLE (1Mbps)

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0052
Middle	2440	0.9993
High	2480	0.9944



9.3. 6 dB BANDWIDTH

LIMITS

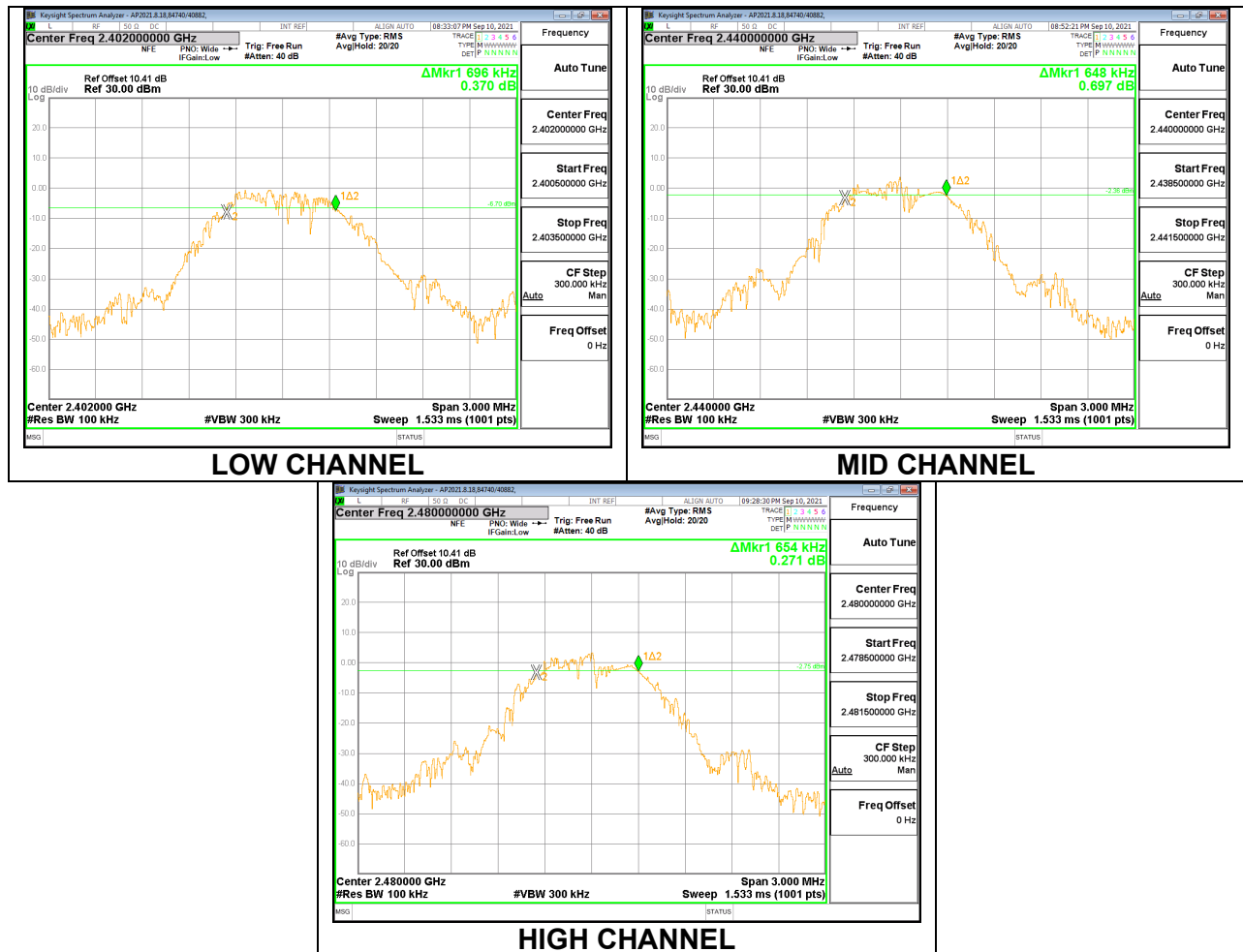
FCC §15.247 (a) (2)
 RSS-247 5.2 (a)

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

RESULTS

9.3.1. BLE (1Mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.696	0.5
Middle	2440	0.648	0.5
High	2480	0.654	0.5



9.4. 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 10.41 dB (including 10 dB pad and 0.41 dB cable) was entered as an offset in the power meter.

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

RESULTS

9.4.1. BLE (1Mbps)

Tested By:	85502/40882
Date:	2021-09-10

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	4.16	30	-25.84
Middle	2440	4.07	30	-25.93
High	2480	4.28	30	-25.72

9.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a gated average power meter.

The cable assembly insertion loss of 10.41 dB (including 10 dB pad and 0.41 dB cable) was entered as an offset in the power meter.

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

RESULTS

9.5.1. BLE (1Mbps)

Tested By:	85502/40882
Date:	2021-09-10

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	3.68
Middle	2440	3.62
High	2480	3.83

9.6. POWER SPECTRAL DENSITY

LIMITS

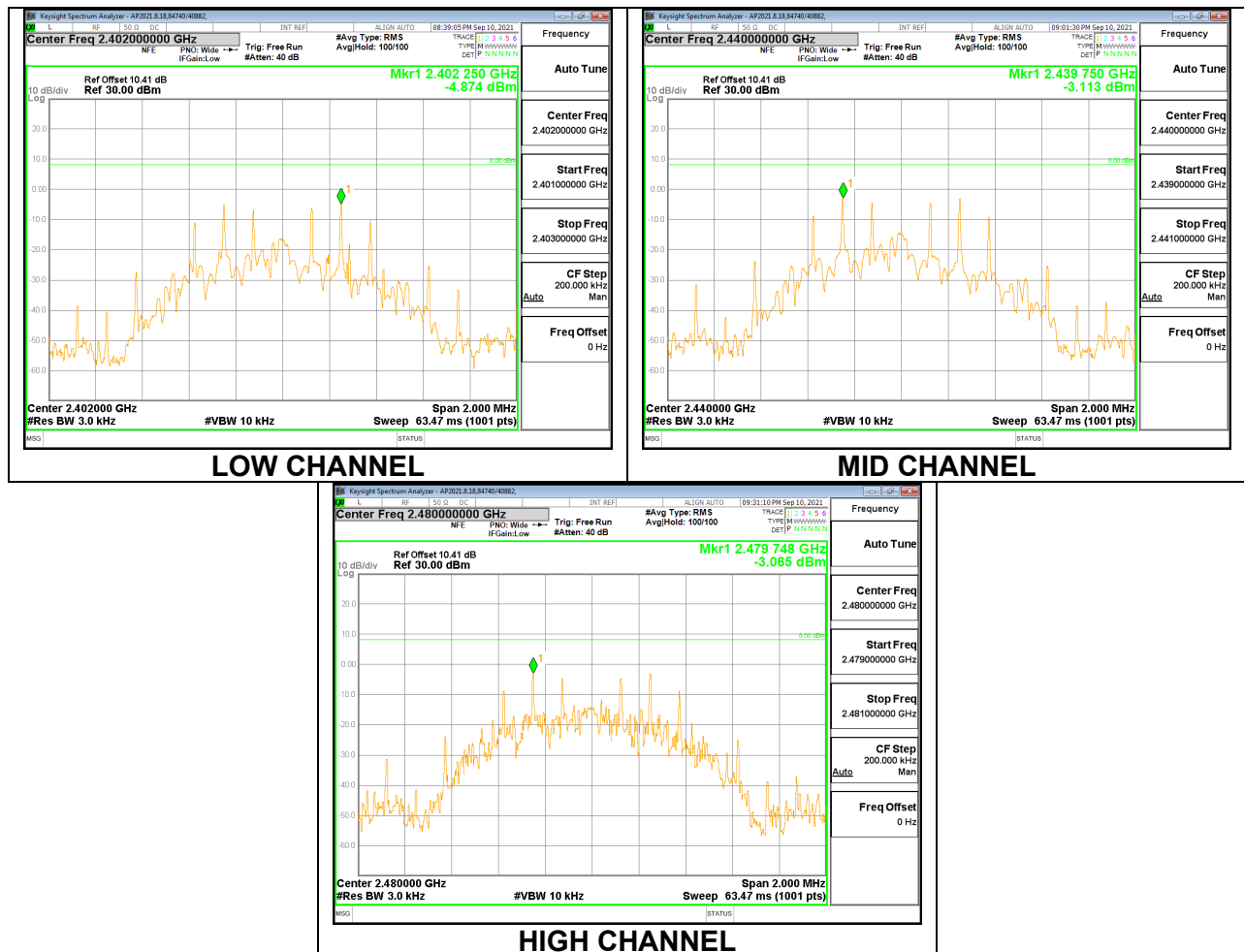
FCC §15.247 (e)
 RSS-247 (5.2) (b)

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

9.6.1. BLE (1Mbps)

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-4.87	8	-12.87
Middle	2440	-3.11	8	-11.11
High	2480	-3.07	8	-11.07



9.7. CONDUCTED SPURIOUS EMISSIONS

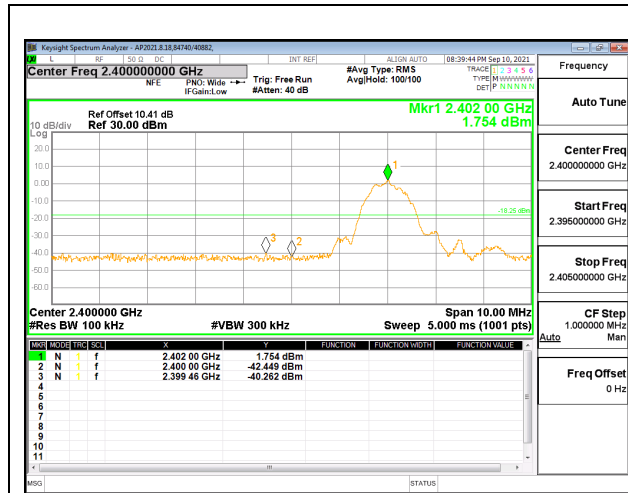
LIMITS

FCC §15.247 (d)
RSS-247 5.5

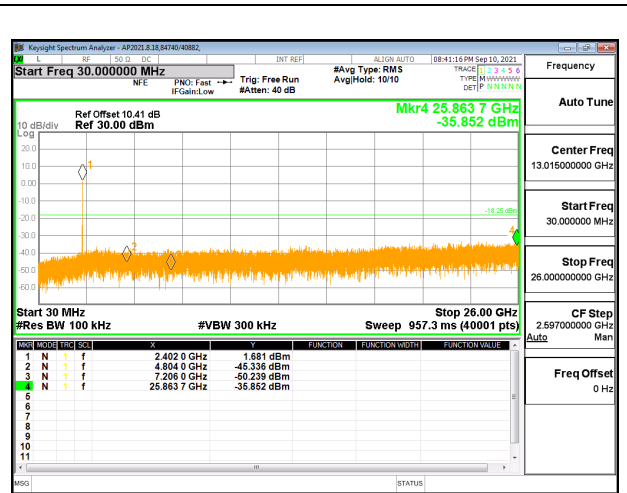
Output power was measured based on the use of a peak measurement, therefore the required attenuation is -20 dBc.

RESULTS

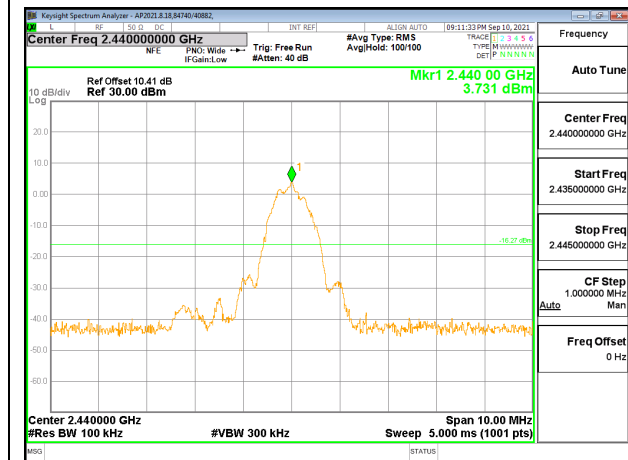
9.7.1. BLE (1Mbps)



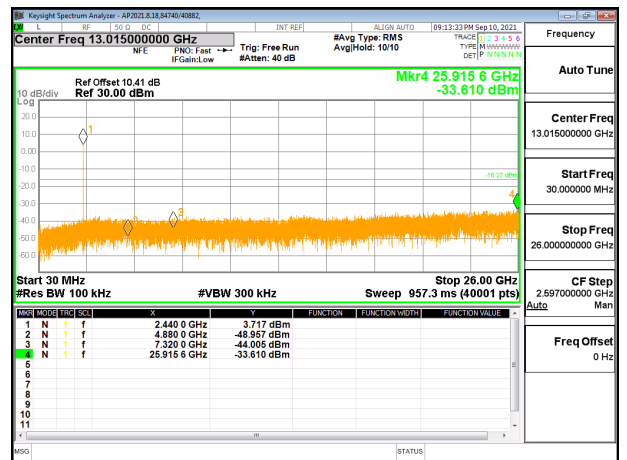
LOW CHANNEL BANDEDGE



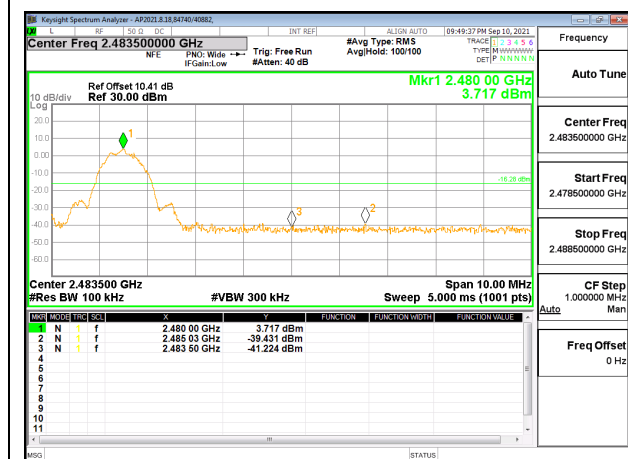
OUT-OF-BAND LOW CHANNEL



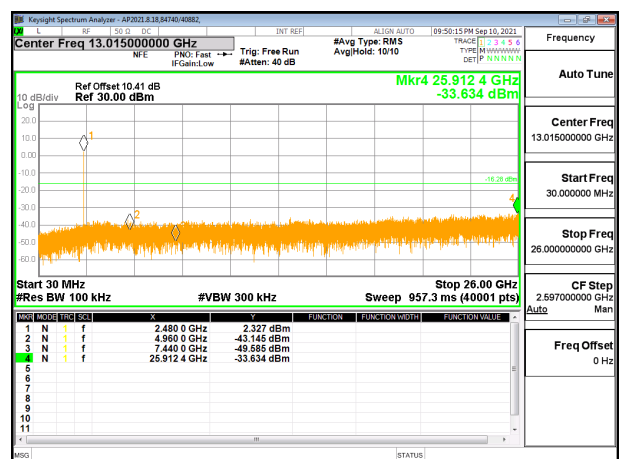
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

10. RADIATED TEST RESULTS

10.1. 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 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 or average (9-90kHz and 110-490kHz).

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.

NOTE: The 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 377 Ohms. For example the measurement at frequency X kHz resulted in a level of Y dBuV/m, which is equivalent to $Y - 51.5 = Z$ dBuA/m, which has the same margin, W dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (1Mbps)

Antenna 1

BANDEDGE (LOW CHANNEL)

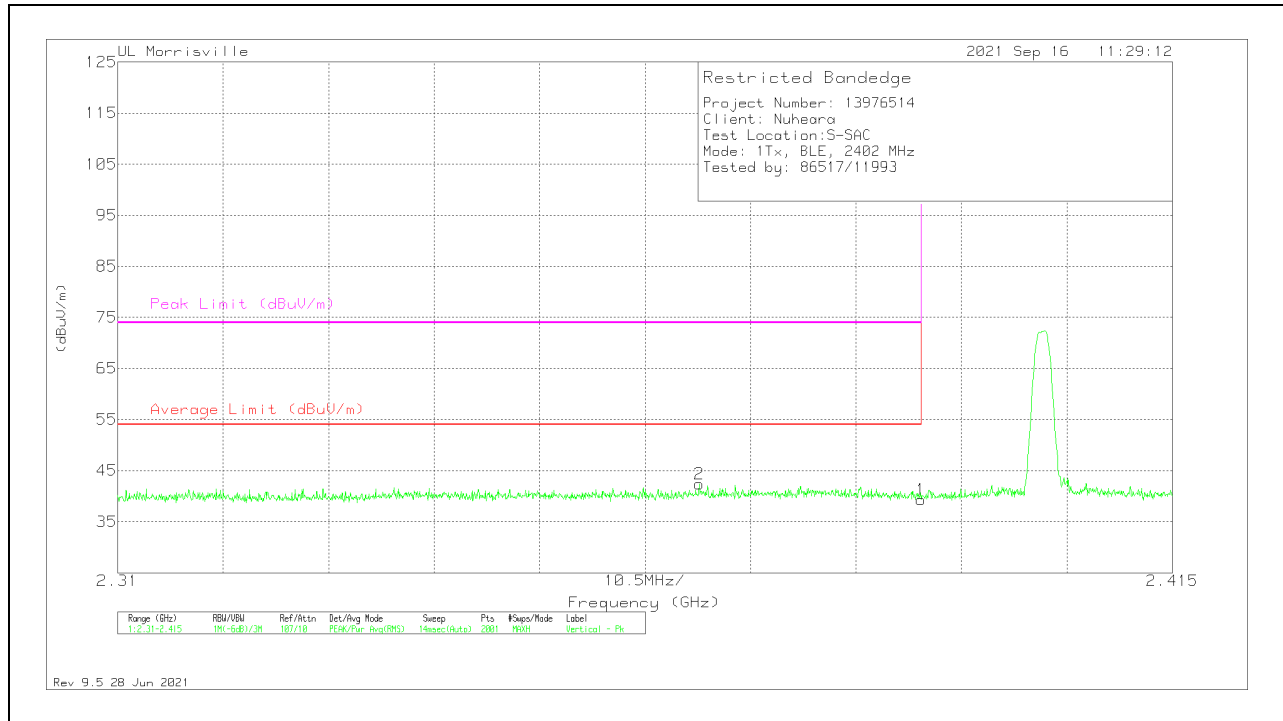
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/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	* ** 2.38996	33.8	Pk	31.9	-24.1	41.6	-	-	74	-32.4	161	307	H
	* ** 2.38996	33.8	Pk	31.9	-24.1	41.6	54	-12.4	-	-	161	307	H
2	* ** 2.36303	33.59	Pk	32.2	-24.3	41.49	-	-	74	-32.51	161	307	H
	* ** 2.36303	33.59	Pk	32.2	-24.3	41.49	54	-12.51	-	-	161	307	H

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

VERTICAL RESULT

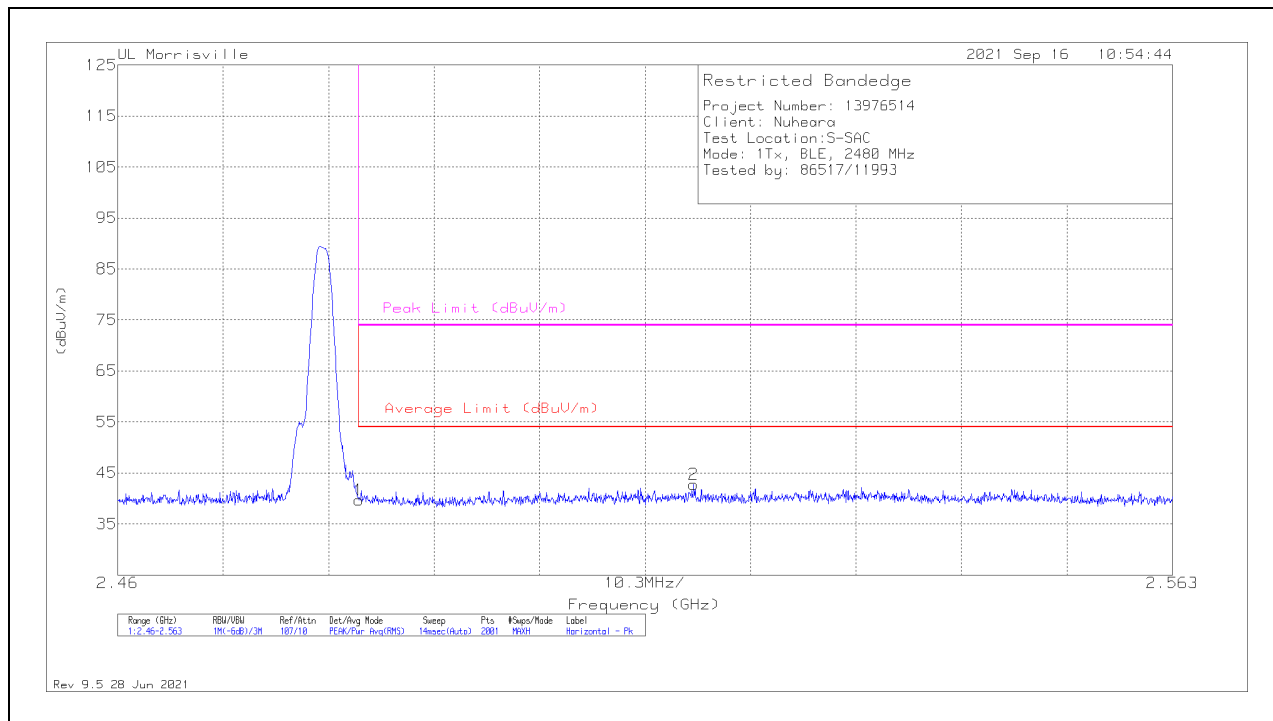


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.38996	31.5	Pk	31.9	-24.1	39.3	-	-	74	-34.7	55	358	V
	* ** 2.38996	31.5	Pk	31.9	-24.1	39.3	54	-14.7	-	-	55	358	V
2	* ** 2.36791	34.16	Pk	32.2	-24	42.36	-	-	74	-31.64	55	358	V
	* ** 2.36791	34.16	Pk	32.2	-24	42.36	54	-11.64	-	-	55	358	V

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

BANDEDGE (HIGH CHANNEL)

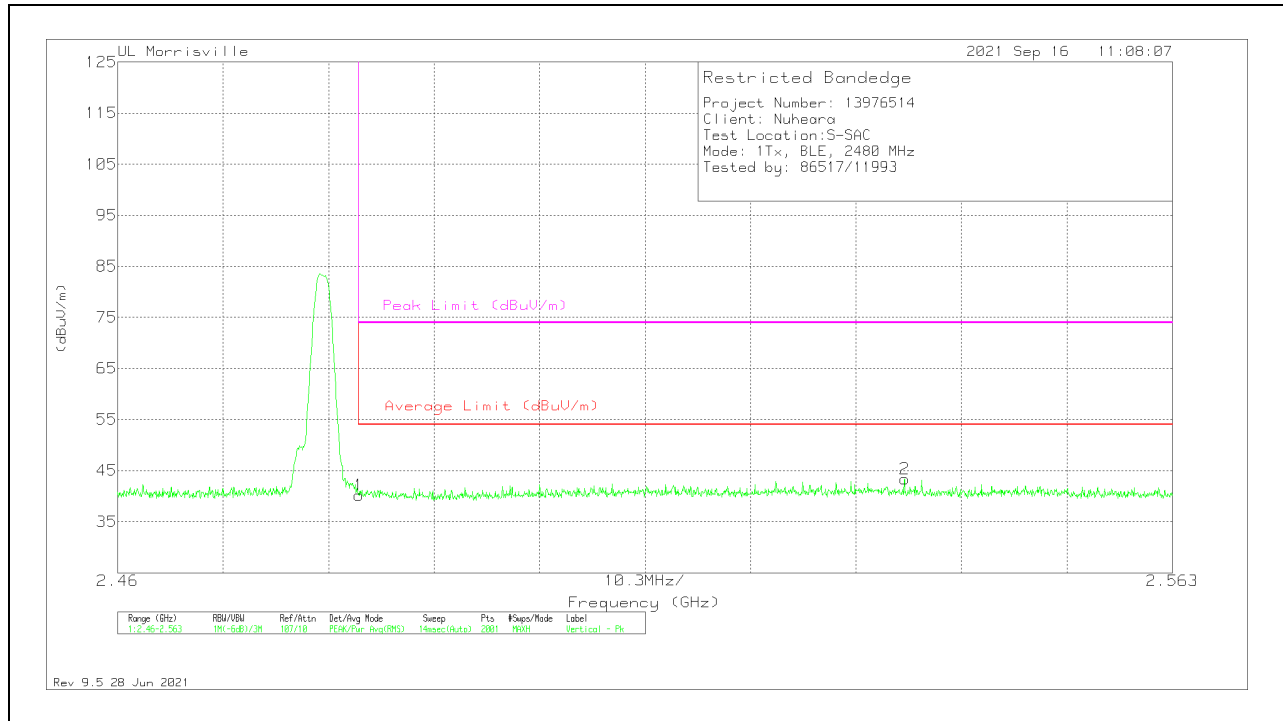
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/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	* ** 2.48354	31.75	Pk	32.5	-24.6	39.65	-	-	74	-34.35	66	129	H
	* ** 2.48354	31.75	Pk	32.5	-24.6	39.65	54	-14.35	-	-	66	129	H
2	** 2.51624	34.83	Pk	32.6	-24.7	42.73	-	-	74	-31.27	66	129	H
	** 2.51624	34.83	Pk	32.6	-24.7	42.73	54	-11.27	-	-	66	129	H

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

VERTICAL RESULT

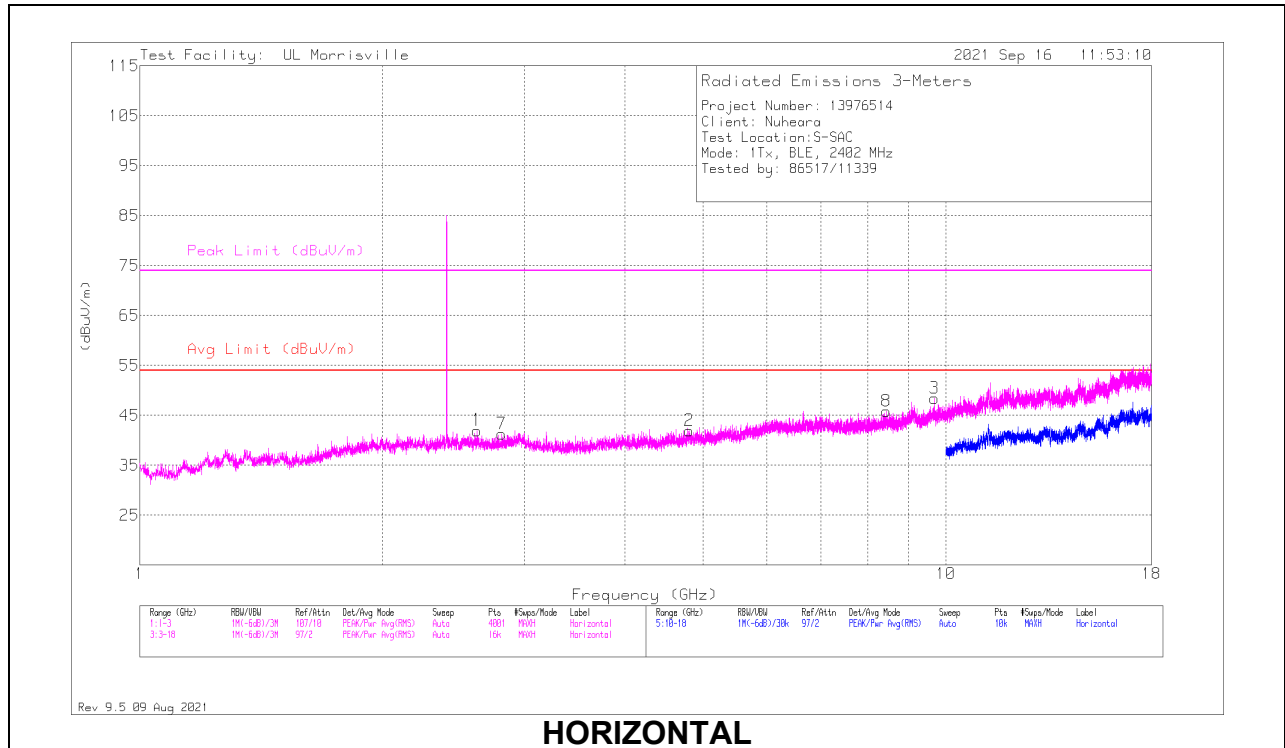


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.48354	32.31	Pk	32.5	-24.6	40.21	-	-	74	-33.79	8	355	V
	* ** 2.48354	32.31	Pk	32.5	-24.6	40.21	54	-13.79	-	-	8	355	V
2	** 2.53684	35.51	Pk	32.8	-25	43.31	-	-	74	-30.69	8	355	V
	** 2.53684	35.51	Pk	32.8	-25	43.31	54	-10.69	-	-	8	355	V

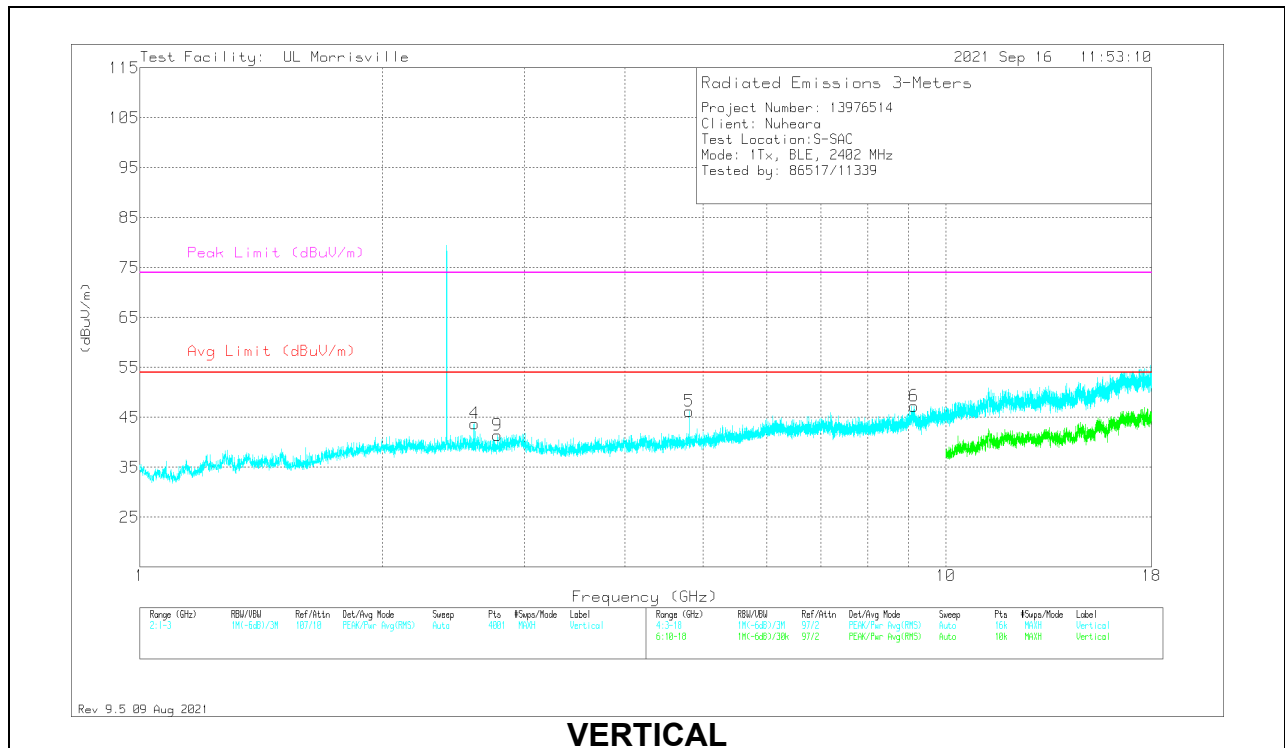
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 ** - indicates frequency in Taiwan NCC LP0002 Restricted Band
 Pk - Peak detector
 ADV - Linear Voltage Average

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

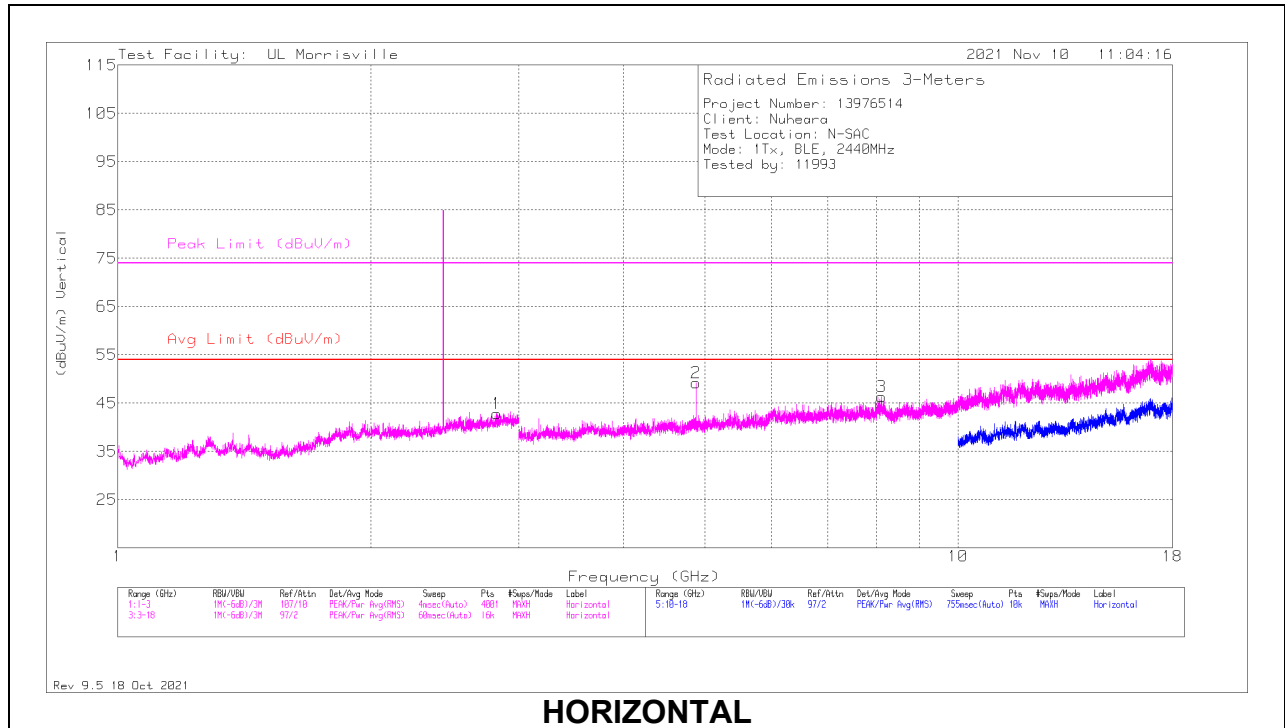
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* ** 4.80375	38.49	Pk	34.1	-30.6	0	41.99	54	-12.01	74	-32.01	0-360	200	H
5	* ** 4.80375	42.7	Pk	34.1	-30.6	0	46.2	54	-7.8	74	-27.8	0-360	101	V
8	* ** 8.44031	36.39	Pk	35.9	-26.5	0	45.79	54	-8.21	74	-28.21	0-360	101	H
6	* ** 9.13031	36.28	Pk	36.3	-25.3	0	47.28	54	-6.72	74	-26.72	0-360	101	V
3	9.68438	36.73	Pk	36.9	-25.2	0	48.43	-	-	-	-	0-360	101	H
1	** 2.621	34.7	Pk	32.6	-25.3	0	42	54	-12	74	-32	0-360	101	H
7	* ** 2.81	34.65	Pk	32.5	-25.9	0	41.25	54	-12.75	74	-32.75	0-360	199	H
4	** 2.6025	36.68	Pk	32.5	-25.4	0	43.78	54	-10.22	74	-30.22	0-360	199	V
9	* ** 2.78	34.87	Pk	32.4	-25.8	0	41.47	54	-12.53	74	-32.53	0-360	101	V

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

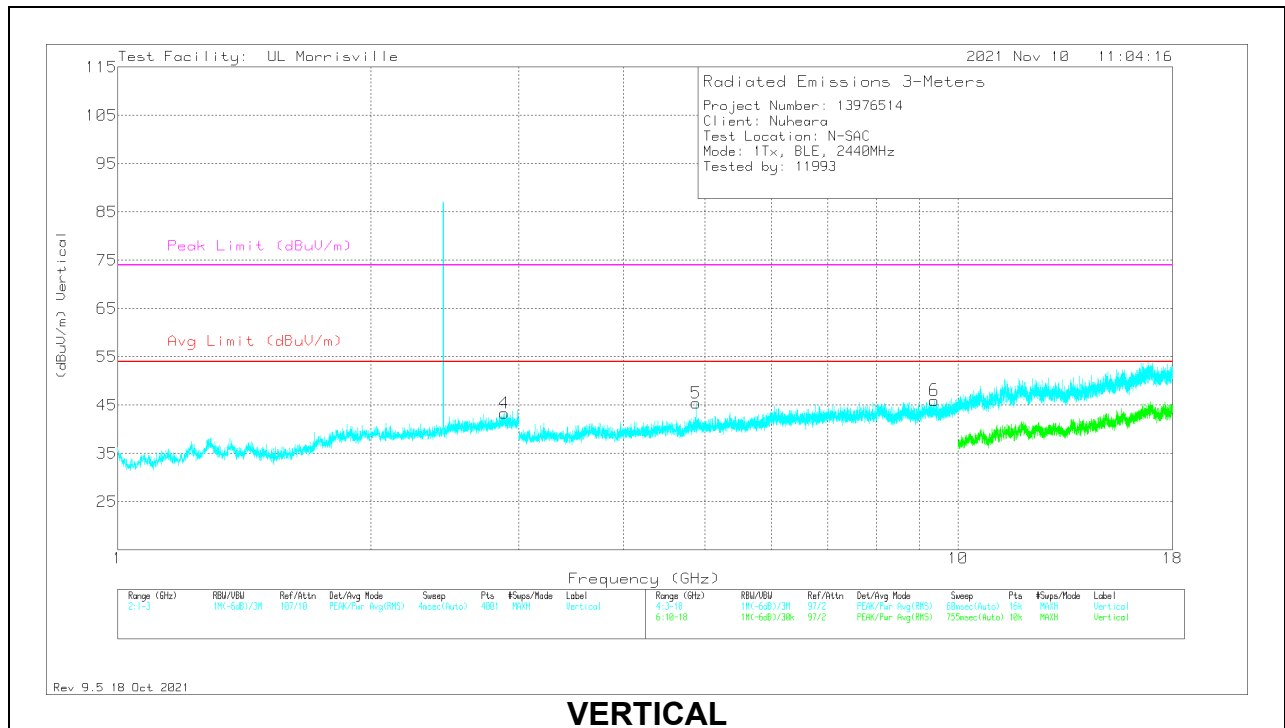
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (db/m)	Amp/Cbl/Filtr (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	*** 2.824	34.17	Pk	32.6	-23.9	0	42.87	54	-11.13	74	-31.13	0-360	200	H
4	** 2.8865	34.16	Pk	32.6	-23.4	0	43.36	54	-10.64	74	-30.64	0-360	101	V
5	*** 4.87875	42.97	Pk	34.2	-31.7	0	45.47	54	-8.53	74	-28.53	0-360	200	V
2	*** 4.88045	49.22	PK2	34.2	-31.6	0	51.82	-	-	74	-22.18	204	107	H
	*** 4.87991	39.3	ADV	34.2	-31.6	3.8	45.7	54	-8.3	-	-	204	107	H
3	*** 8.10656	38.54	Pk	35.9	-28.1	0	46.34	54	-7.66	74	-27.66	0-360	101	H
6	*** 9.37781	37.62	Pk	36.3	-27.9	0	46.02	54	-7.98	74	-27.98	0-360	101	V

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

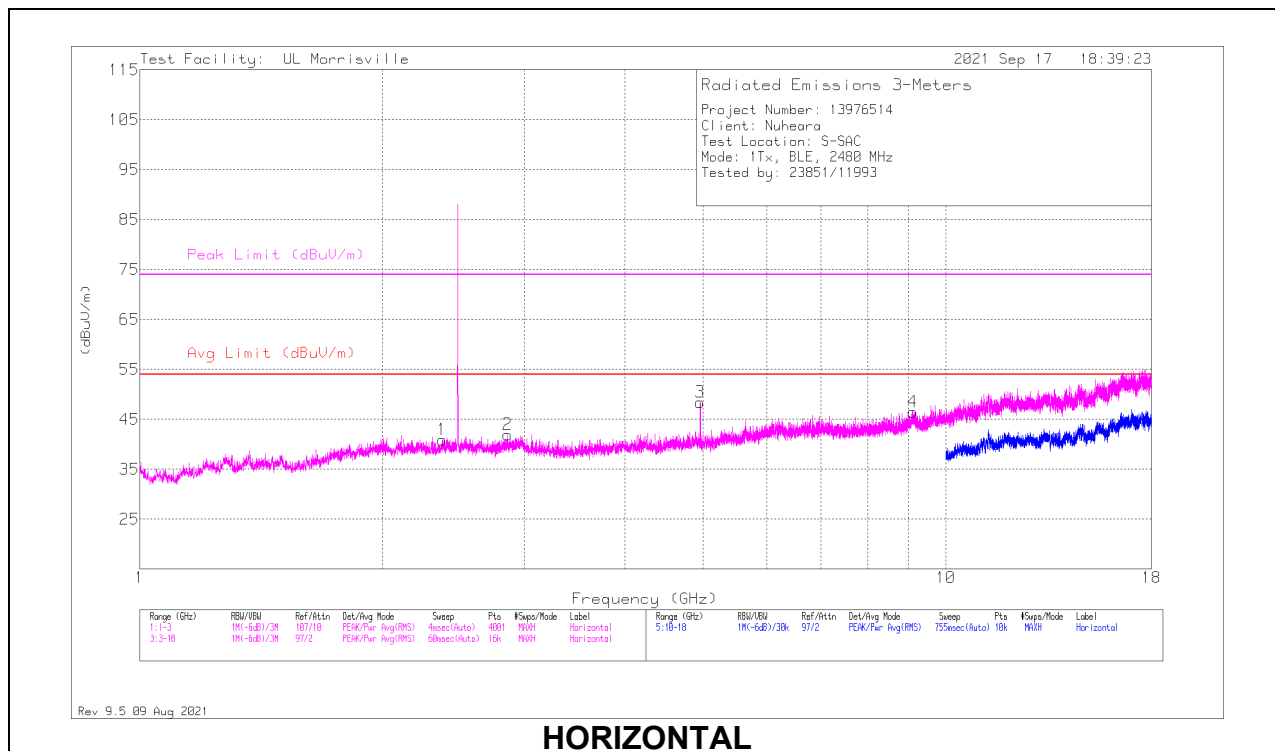
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

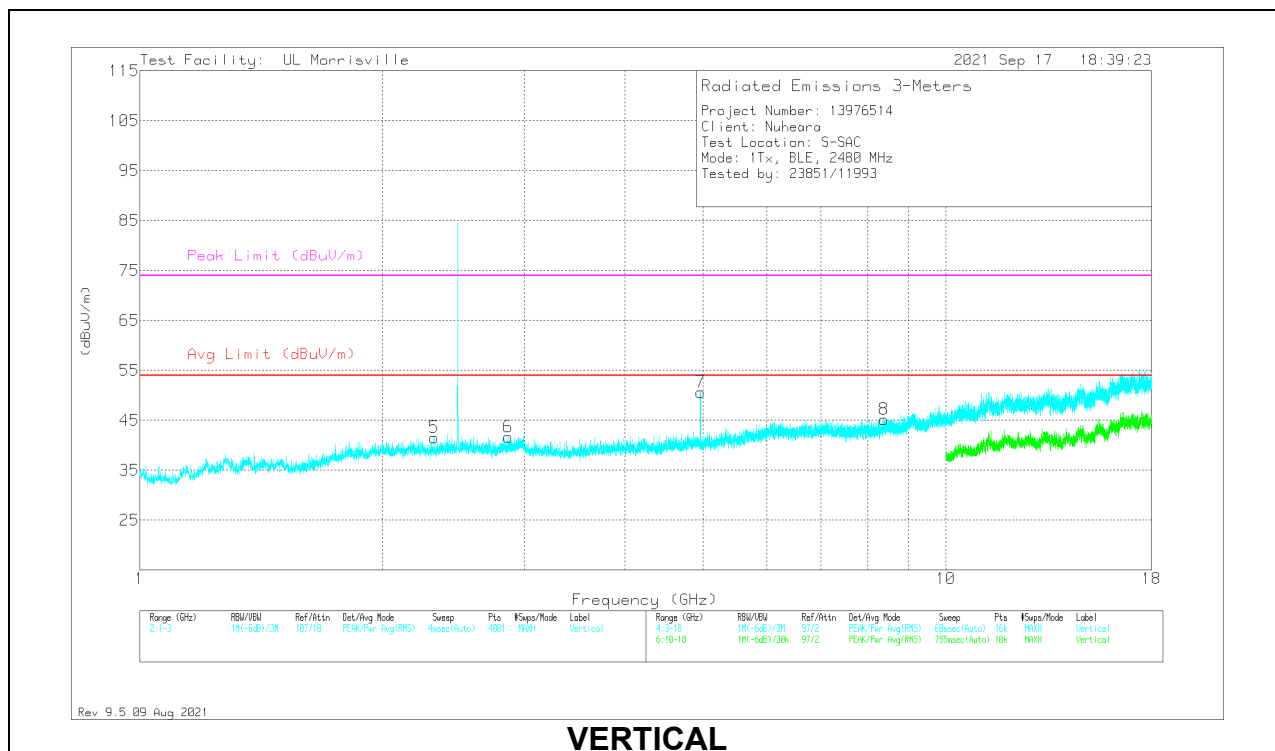
PK2 - Maximum Peak

ADV - Linear Voltage Average

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr (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	* ** 4.95951	47.45	PK2	34	-30.5	0	50.95	-	-	74	-23.05	277	106	H
	* ** 4.95969	37.9	ADV	34	-30.5	3.8	45.2	54	-8.8	-	-	277	106	H
7	* ** 4.95944	48.92	PK2	34	-30.5	0	52.42	-	-	74	-21.58	274	104	V
	* ** 4.96012	39.59	ADV	34	-30.5	3.8	46.89	54	-7.11	-	-	274	104	V
8	* ** 8.37469	36.21	Pk	35.8	-26.8	0	45.21	54	-8.79	74	-28.79	0-360	101	V
4	* ** 9.09844	35.49	Pk	36.3	-25.3	0	46.49	54	-7.51	74	-27.51	0-360	101	H
1	* ** 2.371	32.68	Pk	32.2	-24	0	40.88	54	-13.12	74	-33.12	0-360	101	H
2	* ** 2.862	34.99	Pk	32.9	-26	0	41.89	54	-12.11	74	-32.11	0-360	200	H
5	* ** 2.3205	33.83	Pk	31.7	-24	0	41.53	54	-12.47	74	-32.47	0-360	101	V
6	* ** 2.864	35.01	Pk	32.8	-26.1	0	41.71	54	-12.29	74	-32.29	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

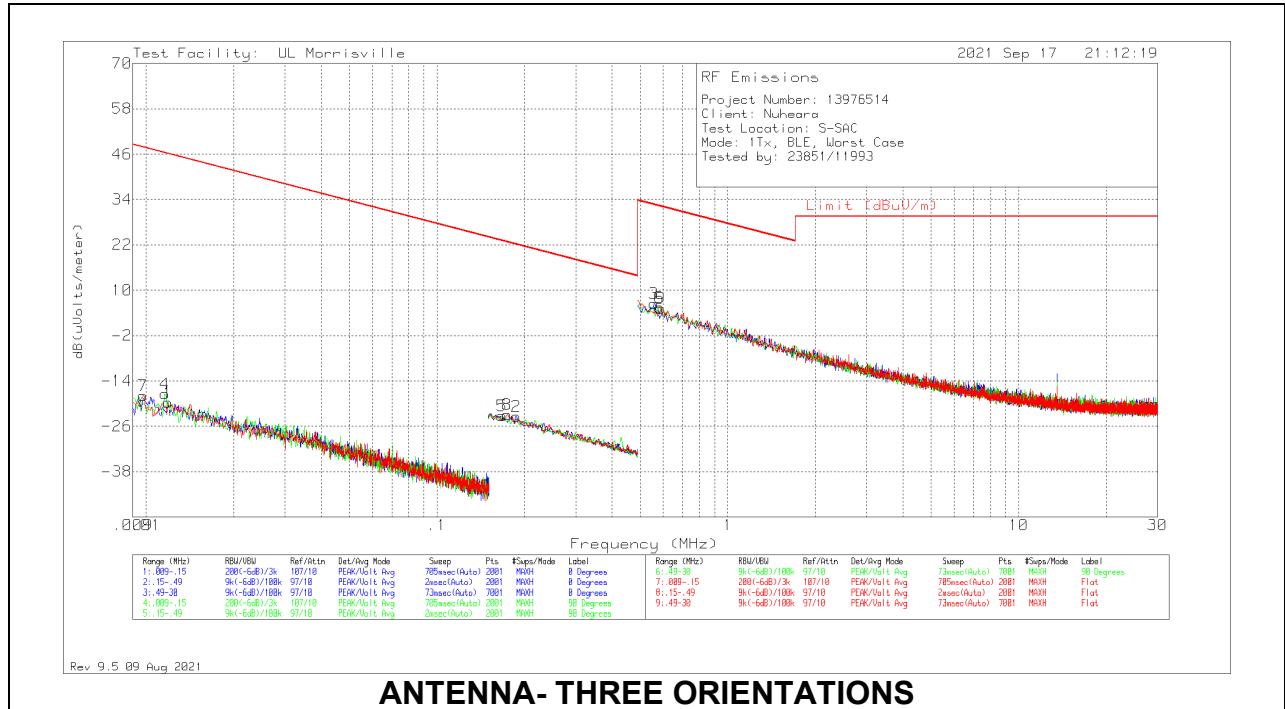
PK2 - Maximum Peak

ADV - Linear Voltage Average

10.3. WORST CASE BELOW 30MHZ

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 $40 \cdot \log(\text{test distance} / \text{specification distance})$.

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



ANTENNA- THREE ORIENTATIONS

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	QP/AV Limit (dBuV/m)	PK Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	.01191	42.66	Pk	17.6	.1	-80	-19.64	46.09	66.09	-65.73	0-360	342	On
2	.18732	45.29	Pk	11.2	.1	-80	-23.41	22.15	42.15	-45.56	0-360	342	On
3	.55746	35.02	Pk	11.2	.2	-40	6.42	32.68	-	-26.26	0-360	342	On
4	.01163	44.76	Pk	17.7	.1	-80	-17.44	46.3	66.3	-63.74	0-360	342	Off
5	.16734	45.53	Pk	11.2	.1	-80	-23.17	23.13	43.13	-46.3	0-360	342	Off
6	.58275	34.12	Pk	11.2	.2	-40	5.52	32.29	-	-26.77	0-360	342	Off
7	.00978	43.38	Pk	18.6	.1	-80	-17.92	47.8	67.8	-65.72	0-360	342	Flat
8	.17465	45.87	Pk	11.2	.1	-80	-22.83	22.76	42.76	-45.59	0-360	342	Flat
9	.58697	33.79	Pk	11.2	.2	-40	5.19	32.23	-	-27.04	0-360	342	Flat

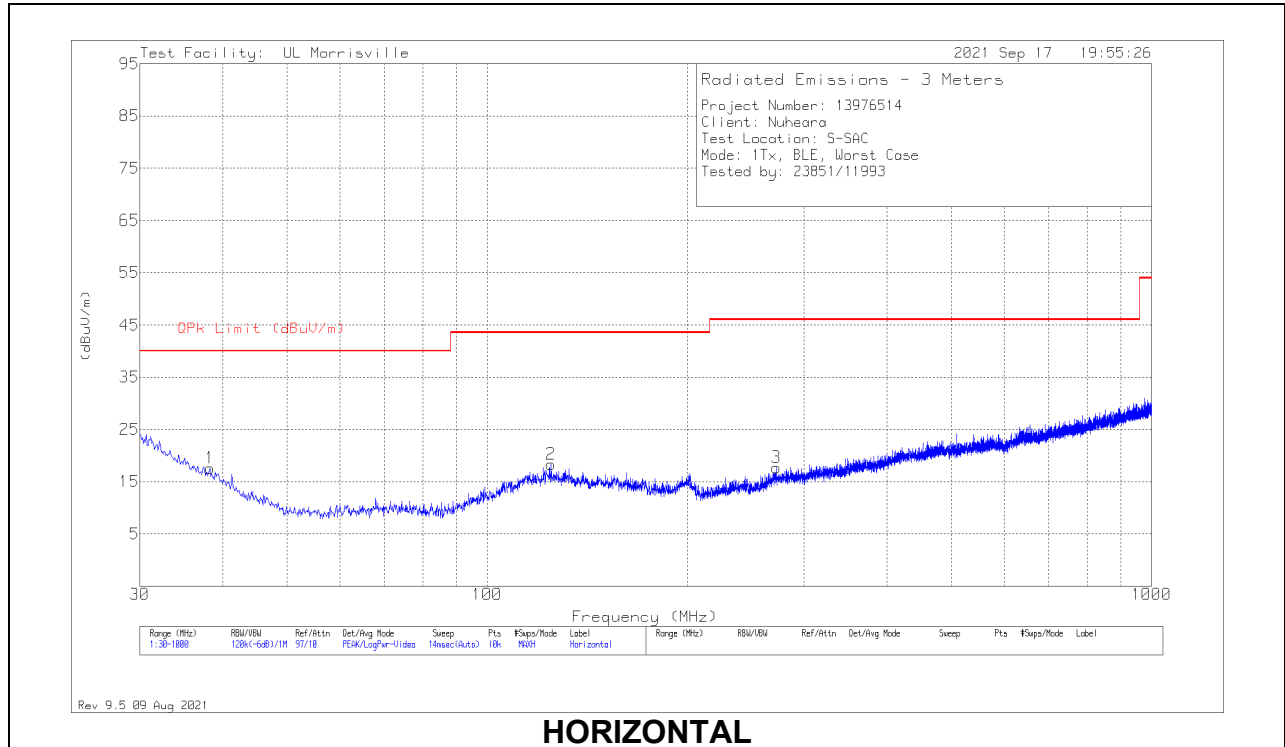
Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uAmps/meter)	QP/AV Limit (dBuA/m)	PK Limit (dBuA/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	.01191	42.66	Pk	-33.9	.1	-80	-71.14	-5.41	14.59	-65.73	0-360	342	On
2	.18732	45.29	Pk	-40.3	.1	-80	-74.91	-29.35	-9.35	-45.56	0-360	342	On
3	.55746	35.02	Pk	-40.3	.2	-40	-45.08	-18.82	-	-26.26	0-360	342	On
4	.01163	44.76	Pk	-33.8	.1	-80	-68.94	-5.2	14.8	-63.74	0-360	342	Off
5	.16734	45.53	Pk	-40.3	.1	-80	-74.67	-28.37	-8.37	-46.3	0-360	342	Off
6	.58275	34.12	Pk	-40.3	.2	-40	-45.98	-19.21	-	-26.77	0-360	342	Off
7	.00978	43.38	Pk	-32.9	.1	-80	-69.42	-3.7	16.3	-65.72	0-360	342	Flat
8	.17465	45.87	Pk	-40.3	.1	-80	-74.33	-28.74	-8.74	-45.59	0-360	342	Flat
9	.58697	33.79	Pk	-40.3	.2	-40	-46.31	-19.27	-	-27.04	0-360	342	Flat

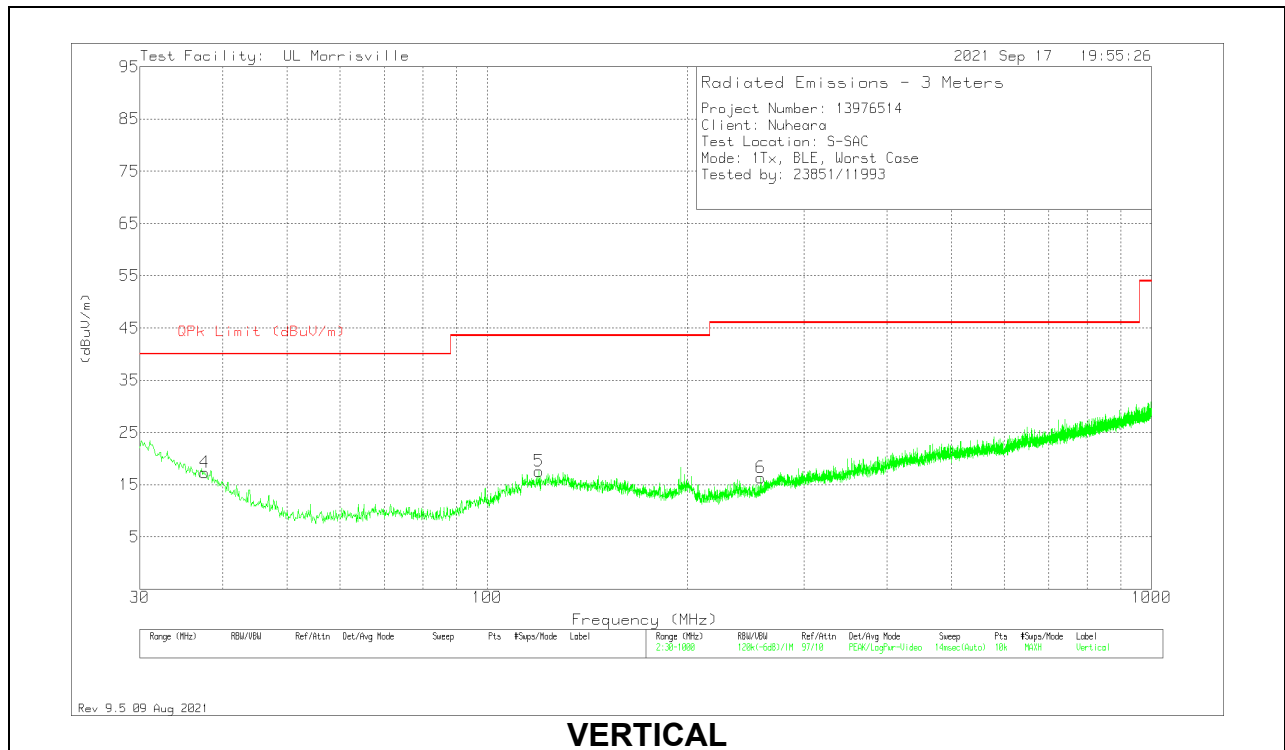
Pk - Peak detector

10.4. WORST CASE BELOW 1 GHZ

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



HORIZONTAL



VERTICAL

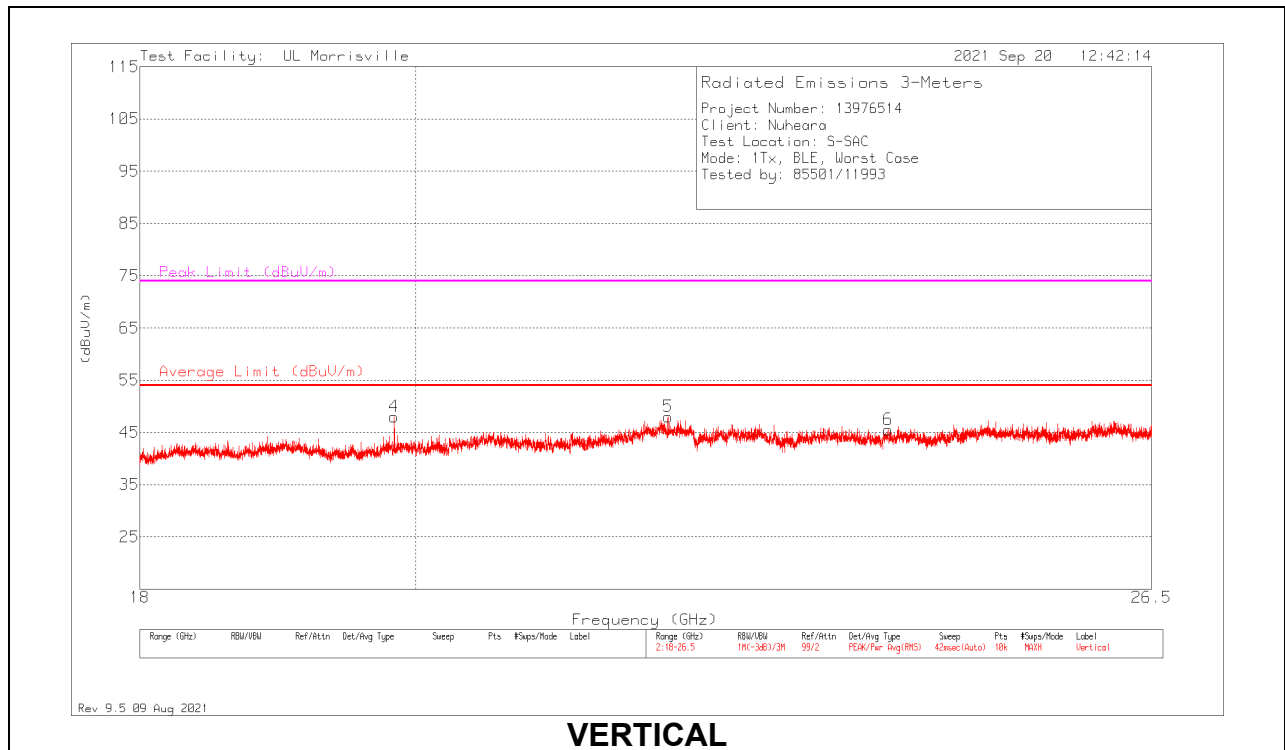
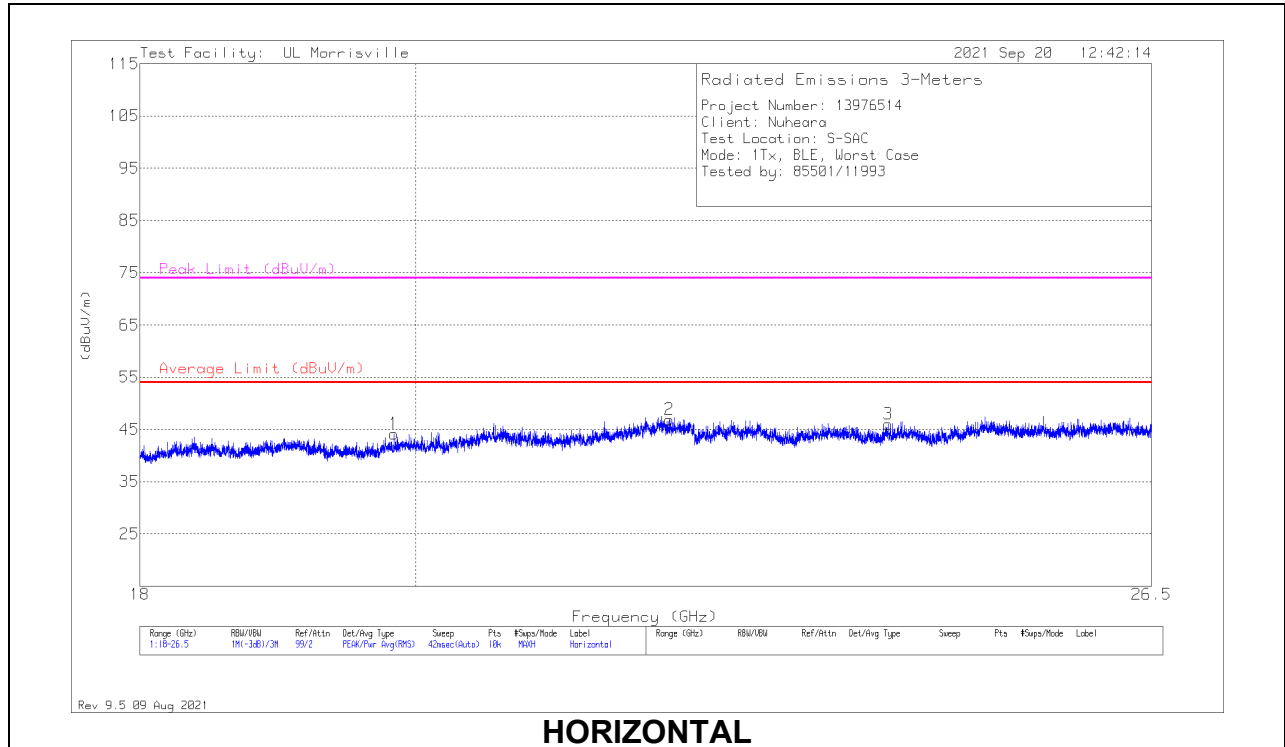
Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0075 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 38.245	27.76	Pk	21.1	-31.3	17.56	40	-22.44	0-360	199	H
2	* ** 124.769	28.42	Pk	20.1	-30.2	18.32	43.52	-25.2	0-360	101	H
3	* ** 272.5	27.3	Pk	19.3	-28.9	17.7	46.02	-28.32	0-360	299	H
4	* ** 37.566	27.16	Pk	21.6	-31.4	17.36	40	-22.64	0-360	299	V
5	* ** 119.725	27.81	Pk	20	-30.3	17.51	43.52	-26.01	0-360	101	V
6	* ** 258.241	27.77	Pk	17.7	-29.1	16.37	46.02	-29.65	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

10.5. WORST CASE 18-26 GHZ

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



18 – 26GHz Data

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0063 AF (dB/m)	Amp/Cbl (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 19.83752	48.64	Pk	33.6	-38.1	0	44.14	54	-9.86	74	-29.86	0-360	300	H
2	* ** 22.0405	48.03	Pk	36.9	-38.1	0	46.83	54	-7.17	74	-27.17	0-360	101	H
3	* ** 23.963	47.95	PK	34.9	-36.9	0	45.95	54	-8.05	74	-28.05	0-360	250	H
4	* ** 19.83693	54.84	PK2	33.6	-38.1	0	50.34	-	-	74	-23.66	341	115	V
	* ** 19.83708	43.36	ADV	33.6	-38.1	3.8	42.66	54	-11.34	-	-	341	115	V
5	* ** 22.02719	48.96	PK2	37	-37.6	0	48.36	-	-	74	-25.64	176	285	V
	* ** 22.02561	35.61	ADV	37	-37.5	3.8	38.91	54	-15.09	-	-	176	285	V
6	* ** 23.96045	47.53	Pk	34.9	-36.9	0	45.53	54	-8.47	74	-28.47	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

PK2 - Maximum Peak

ADV - Linear Voltage Average

11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)
RSS-Gen 8.8

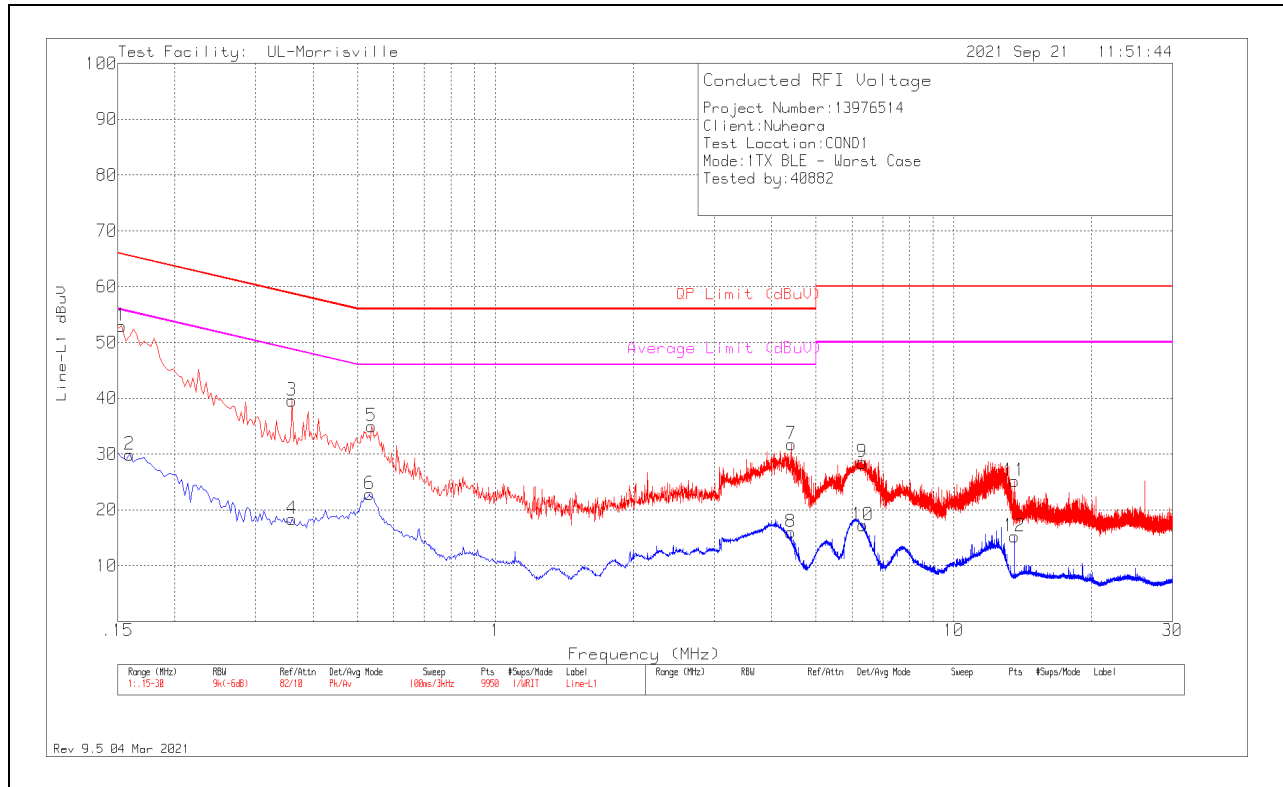
Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

RESULTS

11.1.1. AC Power Line Norm

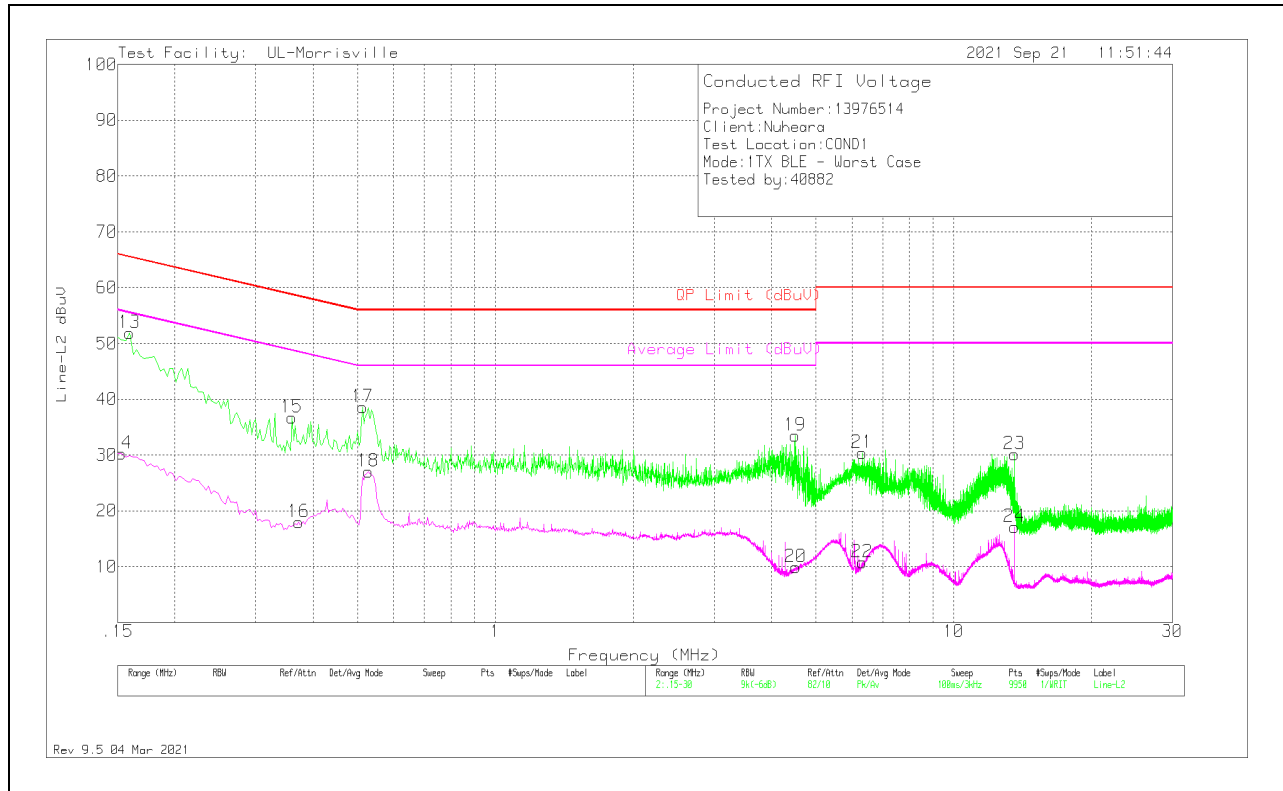
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN_wc_VCF	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.153	42.95	Pk	.2	9.8	52.95	65.84	-12.89	-	-
2	.159	19.91	Av	.2	9.8	29.91	-	-	55.52	-25.61
3	.36	29.69	Pk	.1	9.8	39.59	58.73	-19.14	-	-
4	.36	8.43	Av	.1	9.8	18.33	-	-	48.73	-30.4
6	.531	12.99	Av	0	9.8	22.79	-	-	46	-23.21
5	.537	25.18	Pk	0	9.8	34.98	56	-21.02	-	-
8	4.416	6.09	Av	0	9.9	15.99	-	-	46	-30.01
7	4.419	21.81	Pk	0	9.9	31.71	56	-24.29	-	-
9	6.312	18.36	Pk	.1	10	28.46	60	-31.54	-	-
10	6.33	7.1	Av	.1	10	17.2	-	-	50	-32.8
11	13.56	14.99	Pk	.1	10.1	25.19	60	-34.81	-	-
12	13.56	5	Av	.1	10.1	15.2	-	-	50	-34.8

Pk - Peak detector
 AV – Average detector

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN_wc_VCF	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
14	.153	20.27	Av	.2	9.8	30.27	-	-	55.84	-25.57
13	.159	41.85	Pk	.2	9.8	51.85	65.52	-13.67	-	-
15	.36	26.78	Pk	.1	9.8	36.68	58.73	-22.05	-	-
16	.372	8.04	Av	.1	9.8	17.94	-	-	48.46	-30.52
17	.513	28.83	Pk	0	9.8	38.63	56	-17.37	-	-
18	.528	17.28	Av	0	9.8	27.08	-	-	46	-18.92
19	4.509	23.61	Pk	0	9.9	33.51	56	-22.49	-	-
20	4.518	.02	Av	0	9.9	9.92	-	-	46	-36.08
22	6.306	.62	Av	.1	10	10.72	-	-	50	-39.28
21	6.315	20.28	Pk	.1	10	30.38	60	-29.62	-	-
24	13.56	6.86	Av	.1	10.1	17.06	-	-	50	-32.94
23	13.563	19.94	Pk	.1	10.1	30.14	60	-29.86	-	-

Pk - Peak detector
 AV – Average detector

12. SETUP PHOTOS

Please refer to R13976514-EP1 for setup photos.

END OF TEST REPORT