

TEST REPORT

Report Number: R15062263-E1

Applicant : SMART Technologies ULC
Suite 600, 214-11 Ave SW
Calgary, AB T2R 0K1, Canada

Model : PQX-2

Contains FCC ID : QCI-PQXMOD1

Contains IC : 4302A-PQXMOD1

EUT Description : Electronic Pen

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C:2023
ISED RSS-247 ISSUE 3: 2023
ISED RSS-GEN ISSUE 5 + A2:2021

Date Of Issue:
2024-02-20

Prepared by:
UL LLC
12 Laboratory Dr.
Research Triangle Park, NC 27709 U.S.A.
TEL: (919) 549-1400



REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2024-01-30	Initial Issue	Charles Moody
V2	2024-02-20	Revised Technical Information	Charles Moody

TABLE OF CONTENTS

REPORT REVISION HISTORY	2
TABLE OF CONTENTS	3
1. ATTESTATION OF TEST RESULTS	5
2. TEST RESULTS SUMMARY	6
3. TEST METHODOLOGY	6
4. FACILITIES AND ACCREDITATION	6
5. DECISION RULES AND MEASUREMENT UNCERTAINTY	7
5.1. METROLOGICAL TRACEABILITY	7
5.2. DECISION RULES.....	7
5.3. MEASUREMENT UNCERTAINTY.....	7
5.4. SAMPLE CALCULATION	7
6. EQUIPMENT UNDER TEST	8
6.1. EUT DESCRIPTION	8
6.2. MAXIMUM OUTPUT POWER.....	8
6.3. DESCRIPTION OF AVAILABLE ANTENNAS	8
6.4. SOFTWARE AND FIRMWARE.....	8
6.5. WORST-CASE CONFIGURATION AND MODE.....	8
6.6. DESCRIPTION OF TEST SETUP.....	9
7. MEASUREMENT METHOD.....	10
8. TEST AND MEASUREMENT EQUIPMENT	11
9. ON TIME AND DUTY CYCLE.....	13
9.1. AVERAGE POWER.....	14
9.1.1. BLE (1Mbps).....	14
10. RADIATED TEST RESULTS	15
10.1. LIMITS AND PROCEDURE.....	15
10.2. TRANSMITTER ABOVE 1 GHZ.....	17
10.2.1. BLE (1Mbps)	17
10.3. WORST CASE BELOW 30MHZ.....	27
10.4. WORST CASE BELOW 1 GHZ.....	30
10.5. WORST CASE 18-26 GHZ.....	32

11. SETUP PHOTOS	34
-------------------------------	-----------

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SMART Technologies ULC
Suite 600, 214-11 Ave SW
Calgary, AB T2R 0K1, Canada

EUT DESCRIPTION: Electronic Pen

MODEL: PQX-2

SERIAL NUMBER: Sample #1

SAMPLE RECEIPT DATE: 2024-01-05

DATE TESTED: 2024-01-08 TO 2024-01-10

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C: 2023	See section 2
ISED RSS-247 Issue 3: 2023	See section 2
ISED RSS-GEN Issue 5 + A2: 2021	See section 2

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 Inc. By:



Jeff Moser
Operations Manager
Consumer, Medical and IT Segment
UL LLC

Prepared By:



Charles Moody
Electrical Engineer
Consumer, Medical and IT Segment
UL LLC

2. TEST RESULTS SUMMARY

This report contains data provided by the applicant which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

Below is a list of the data provided by the customer:

1. Antenna gain and type (see section 6.4)
2. Supported data rates (see section 6.6)

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	Not Performed	Refer to Note 1
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW		
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power		
See Comment		Average power	Reporting purposes only	
15.247 (e)	RSS-247 5.2 (b)	PSD	Not Performed	
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions		
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Complies	None
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	N/A	EUT is battery operated only.

Note 1: This test report covers a Class 2 Permissive Change to a device which has undergone a change to the original enclosure. This change includes the addition of an LED to the enclosure of the unit. For this report, only radiated emissions testing was performed. Additionally, average output power was measured and recorded for reporting purposes only. This was done to verify the output power from the original enclosure, as well as to find the worst case channel for below 1GHz and above 18GHz emissions.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC 47 CFR Part 2, FCC 47 CFR Part 15: 2023, 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 3.

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	825374
<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	U _{LAB}
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
All emissions, radiated	6.01 dB

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

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable} \\ &\text{Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The PQX-2 is an electronic pen, integrated with the PQXMOD1 BLE radio module to be used in correspondence with the QX/RX Series interactive flat panel display. This report covers the full radiated emissions testing of the PQXMOD1 BLE radio.

6.2. MAXIMUM OUTPUT POWER

This test report covers a Class 2 Permissive Change to a device which has undergone a change to the original enclosure. This change includes the addition of an LED to the enclosure of the unit. Only radiated emissions testing was performed. With the exception of average power to verify continued power output between the original enclosure and the PQX-2, power measurements are not covered in this report.

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

The radio utilizes a Chip antenna, with a maximum gain of 3 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 5.1.0 for average power testing and 2.9.9.190 for radiated testing.

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 the highest average output power 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 at the only supported data rate of 1Mbps.

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

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	HP	Elitebook 840 G6	5CG925B25F	-

I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	Mini-USB	Unshielded	<1m	USB to program EUT

TEST SETUP

For average power testing, a support laptop was connected to the EUT to configure the radio. For radiated testing, the EUT is a preconfigured sample that allows the channel to be changed by pressing a built-in button on the device. Therefore, no support equipment was used for testing.

SETUP DIAGRAMS

Please refer to R15062263-EP1 for setup diagrams

7. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10 Subclause – 11.6

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

Radiated Emissions Restricted Frequency Bands: ANSI C63.10 Subclause -11.12.1, 6.10.5

General Radiated Spurious Emissions: ANSI C63.10-2013 Section 6.3 to 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 – Chamber 4)

Equip. ID	Description	Manufacturer/ Brand	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
135144	Active Loop Antenna	ETS-Lindgren	6502	2023-01-17	2024-01-17
	30-1000 MHz				
90629	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2023-01-06	2024-01-31
	1-18 GHz				
89509	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2023-05-23	2025-05-23
	18-40 GHz				
204704	Horn Antenna, 18-26.5GHz	Com-Power	AH-826	2023-07-20	2025-07-20
	Gain-Loss Chains				
207638	Gain-loss string: 0.009-30MHz	Various	Various	2023-09-18	2024-09-18
207639	Gain-loss string: 25-1000MHz	Various	Various	2023-09-18	2024-09-18
207640	Gain-loss string: 1-18GHz	Various	Various	2023-05-17	2024-05-17
225795	Gain-loss string: 18-40GHz	Various	Various	2023-05-17	2024-05-17
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2023-04-10	2024-04-10
90416	Spectrum Analyzer	Keysight	N9030A	2023-06-09	2024-06-30
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
241204	Environmental Meter	Fisher Scientific	15-077-963	2023-09-05	2025-09-05

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Common Equipment				
	Conducted Room 1				
238710	Environmental Meter	Fisher Scientific	15-077-963	2023-06-27	2024-06-27
211057	Real-Time Peak Power Sensor 50MHz to 8GHz	Boonton	RTP5000	2023-08-01	2024-08-01
Power Software	Boonton Power Analyzer	Boonton	Version 3.0.13.0	NA	NA
	Attenuators				
226560	SMA Coaxial 10dB Attenuator 25MHz-18GHz	CentricRF	C18S2-10	2023-02-16	2024-02-16
226561	SMA Coaxial 10dB Attenuator 25MHz-18GHz	CentricRF	C18S2-10	2023-02-16	2024-02-16
	Cables				
CBL030	SMA Male to SMA Male Cable Using PE-P141 Coax - 12"	Pasternack	Sucoflex 104PEA	2023-06-27	2024-06-27
CBL091	Micro-Coax UTiFLEX Cable Assembly, Low Loss,40Ghz	Carlisle Interconnect Technologies	UFA147A-2-0360- 200200	2023-02-17	2024-02-17

9. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

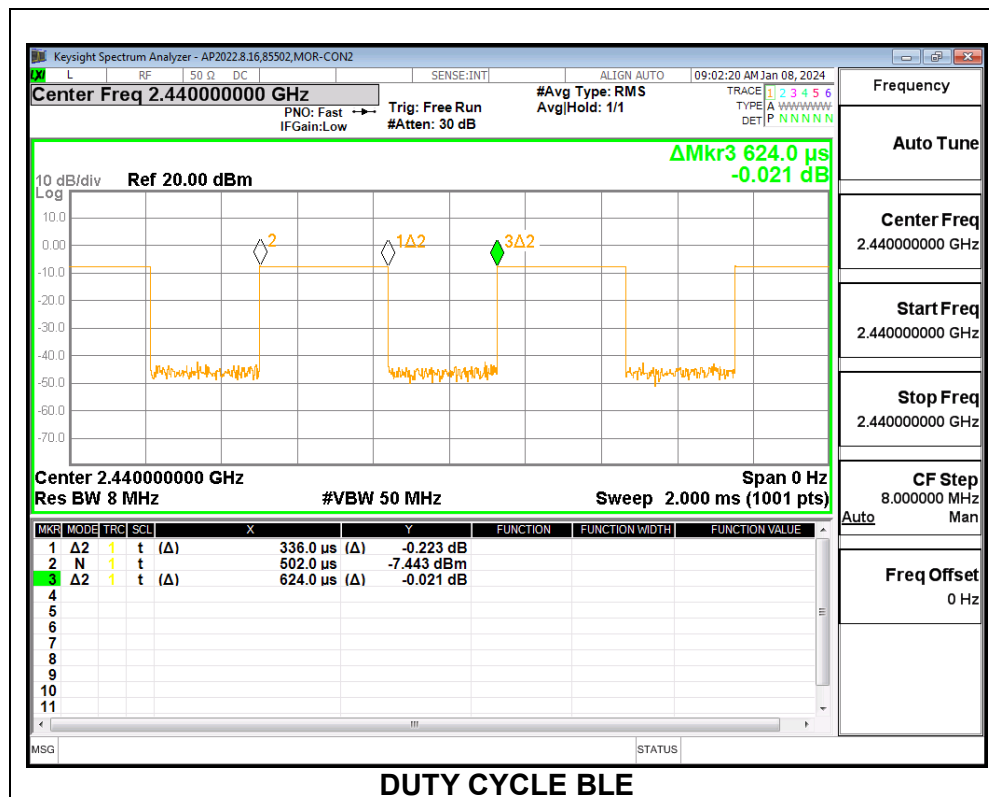
ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)
2.4GHz Band				
BLE	0.336	0.624	0.538	53.85

*Note: The manufacturer has declared an operational duty cycle of 9.02% over a 100ms window for the BLE Radio. The correction factor, therefore, would be $20\log(1/0.0902) = 20.90$ dB. Using KDB 558074 D01 Answer 3 (a), a duty cycle correction will be subtracted from the Peak reading to derive an Average reading. See calculation below.

Duty Cycle Correction Factor = $20 \cdot \log(1/DC) = 20 \cdot \log(1/0.0902) = 20.90$ dB

DUTY CYCLE PLOTS



9.1. 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 10.53 dB (including a 9.71dB pad, 0.57dB test cable and 0.25 dB EUT 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. Gated average output power was read directly from power meter.

RESULTS

9.1.1. BLE (1Mbps)

Tested By:	85502
Date:	2024-01-08

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	3.60
Middle	2440	3.38
High	2480	-1.06

10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uA/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

RSS-GEN, Section 8.9 and 8.10.

Frequency Range (MHz)	Field Strength Limit (uA/m) at 3 m	Field Strength Limit (dBuA/m) at 3 m
0.009-0.490	6.37/F(kHz) @ 300 m	-
0.490-1.705	63.7/F(kHz) @ 30 m	-
1.705 - 30	0.08 @ 30m	-
Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
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 3 MHz 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. For average measurements, the DC Correction factor was applied to peak 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 average output power was used.

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

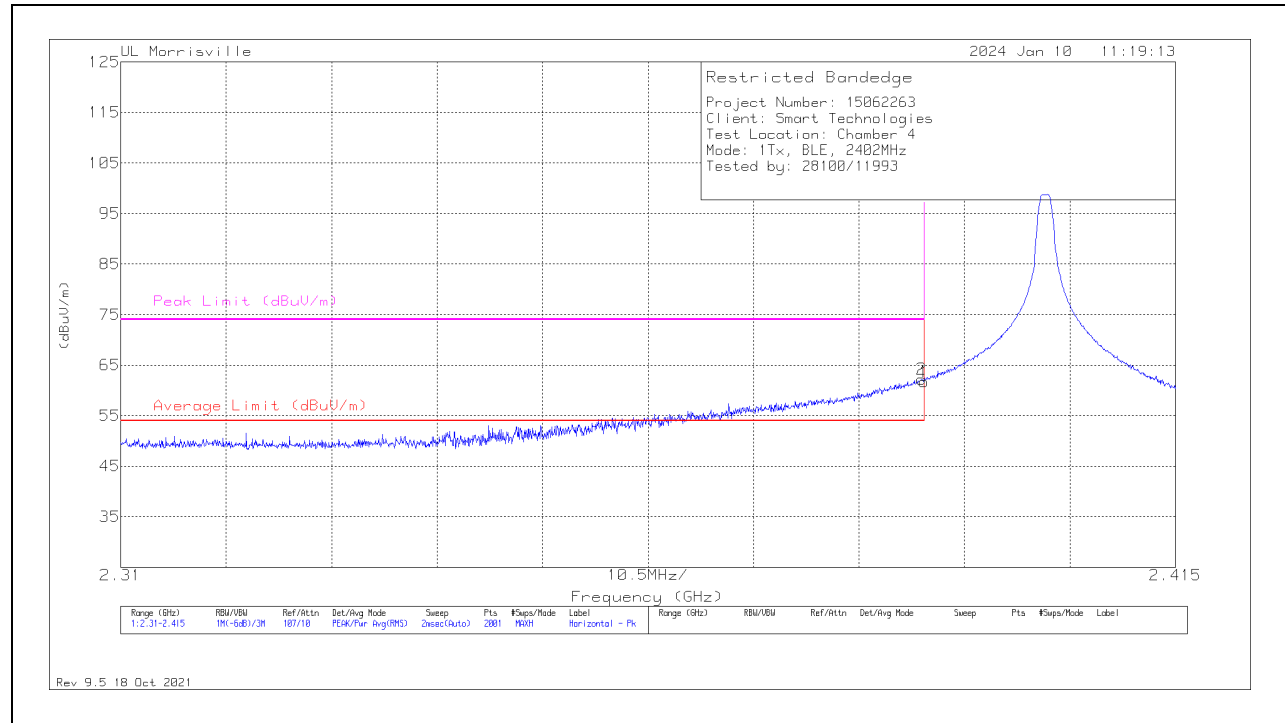
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (1Mbps)

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



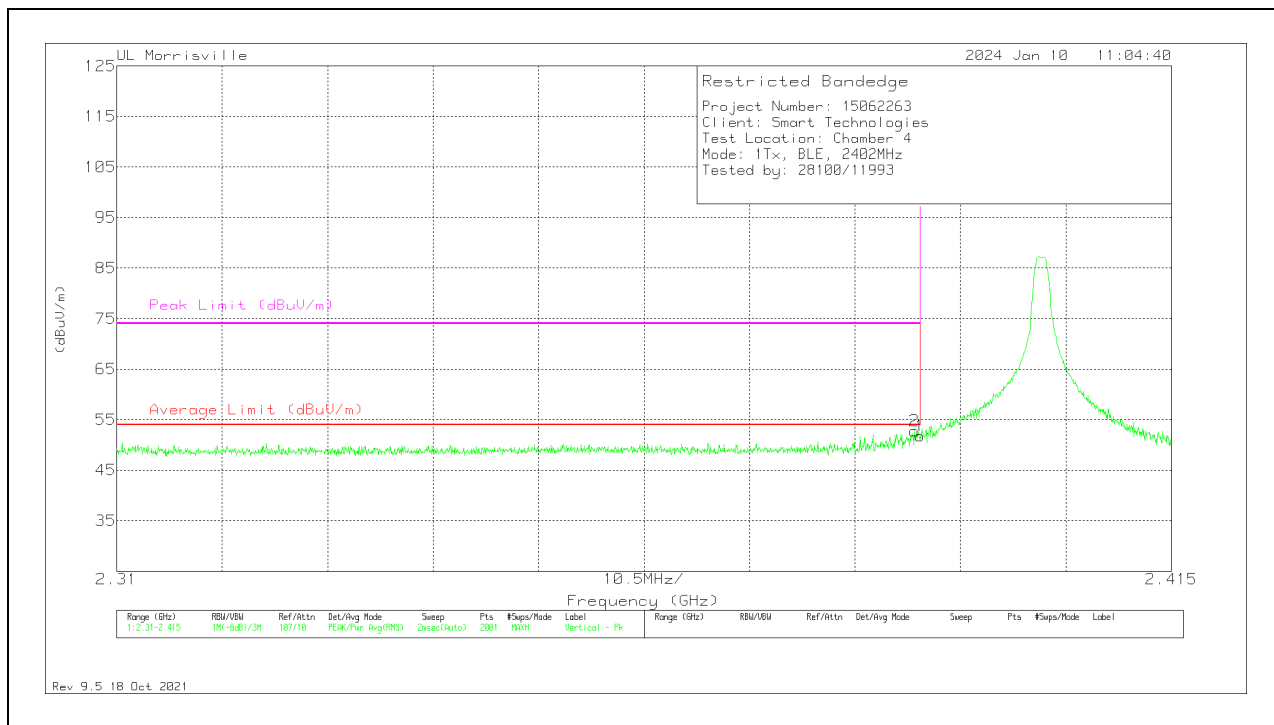
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.38996	42.91	Pk	32	-13.2	0	61.71	-	-	74	-12.29	254	115	H
1	*** 2.38996	42.91	Pk	32	-13.2	-20.90	40.81	54	-13.19	-	-	254	115	H
2	*** 2.38975	43.36	Pk	32	-13.2	0	62.16	-	-	74	-11.84	254	115	H
2	*** 2.38975	43.36	Pk	32	-13.2	-20.90	41.26	54	-12.74	-	-	254	115	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	89509 ACF (dB/m)	Gain/Loss (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	*** 2.38996	32.97	Pk	32	-13.2	0	51.77	-	-	74	-22.23	106	391	V
1	*** 2.38996	32.97	Pk	32	-13.2	-20.90	30.87	54	-23.13	-	-	106	391	V
2	*** 2.38943	33.97	Pk	32	-13.2	0	52.77	-	-	74	-21.23	106	391	V
2	*** 2.38943	33.97	Pk	32	-13.2	-20.90	31.87	54	-22.13	-	-	106	391	V

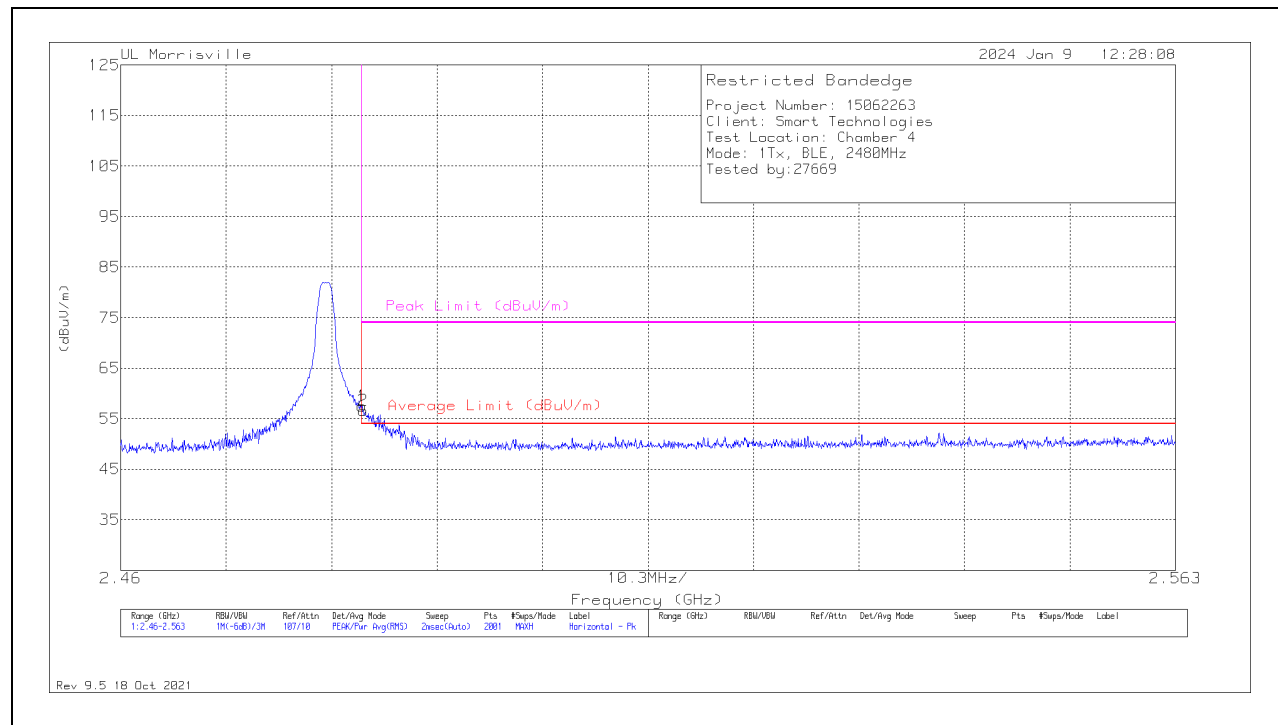
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



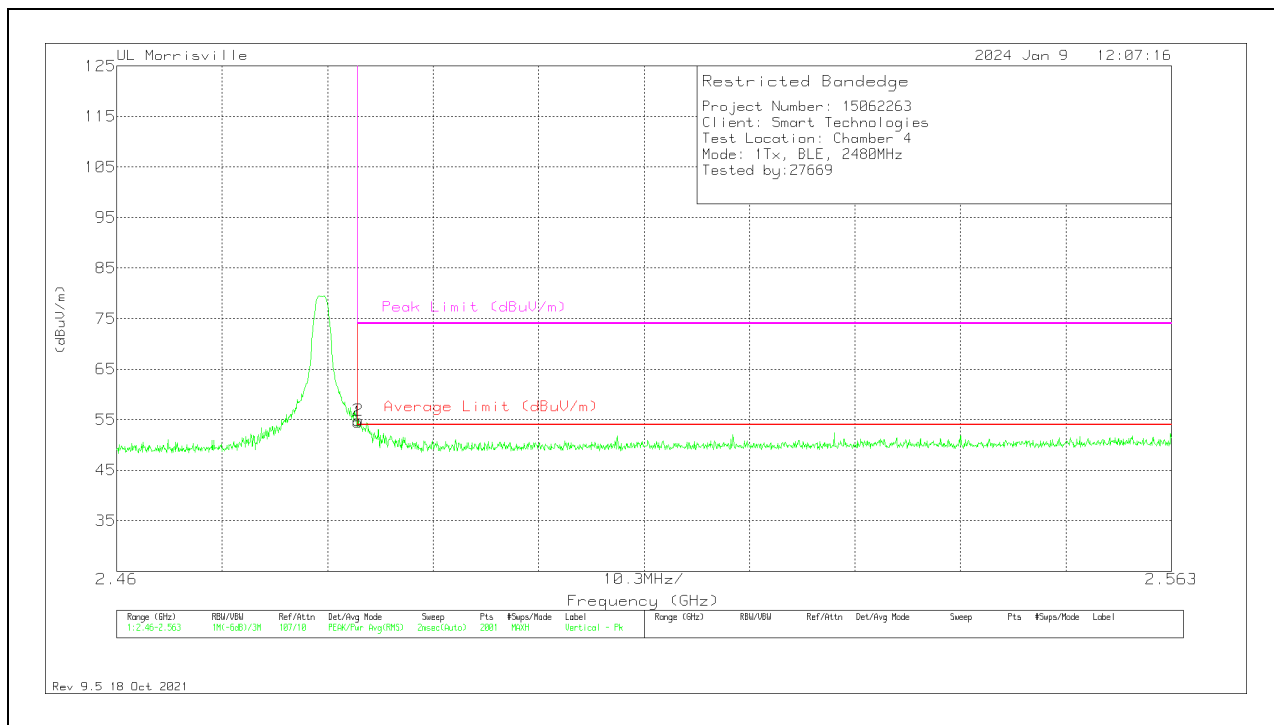
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.48354	38.09	Pk	32.3	-12.9	0	57.49	-	-	74	-16.51	76	115	H
1	*** 2.48354	38.09	Pk	32.3	-12.9	-20.90	36.59	54	-17.41	-	-	76	115	H
2	*** 2.48369	37.21	Pk	32.3	-12.9	0	56.61	-	-	74	-17.39	76	115	H
2	*** 2.48369	37.21	Pk	32.3	-12.9	-20.90	35.71	54	-18.29	-	-	76	115	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	89509 ACF (dB/m)	Gain/Loss (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	*** 2.48354	35.06	Pk	32.3	-12.9	0	54.46	-	-	74	-19.54	124	367	V
1	*** 2.48354	35.06	Pk	32.3	-12.9	-20.90	33.56	54	-20.44	-	-	124	367	V
2	*** 2.48359	35.48	Pk	32.3	-12.9	0	54.88	-	-	74	-19.12	124	367	V
2	*** 2.48359	35.48	Pk	32.3	-12.9	-20.90	33.98	54	-20.02	-	-	124	367	V

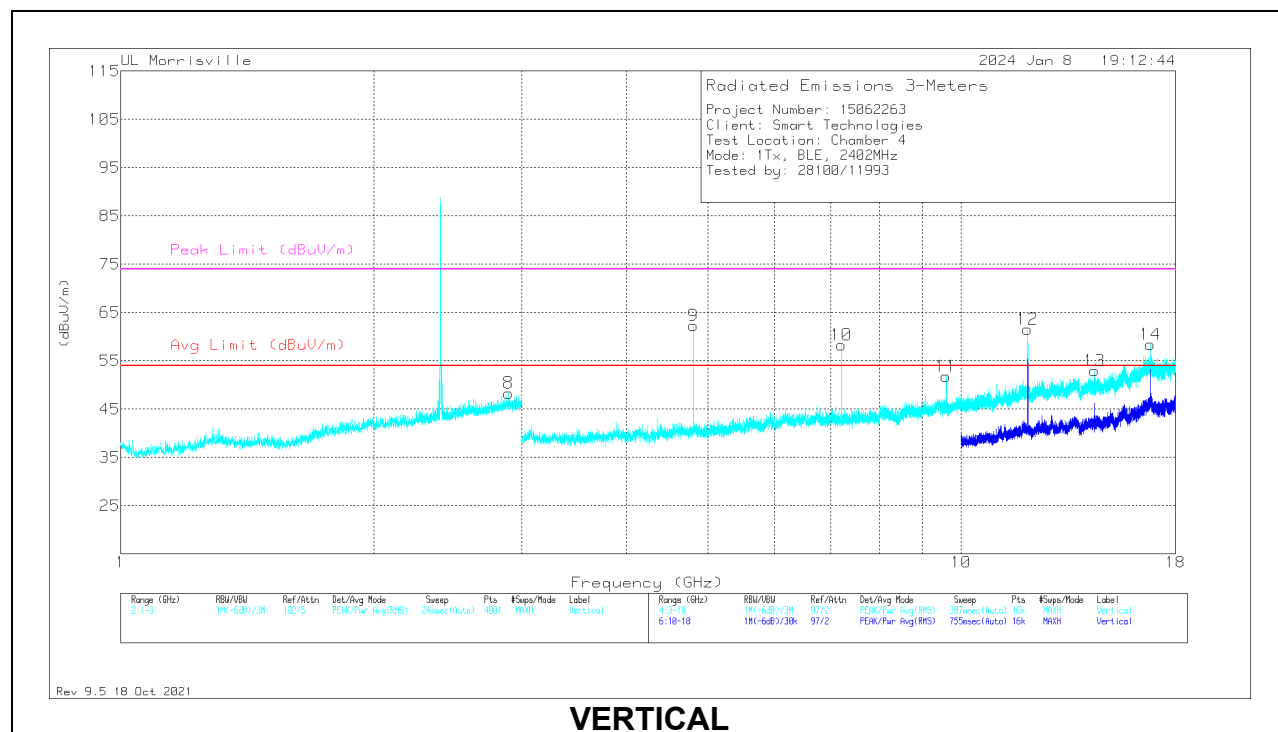
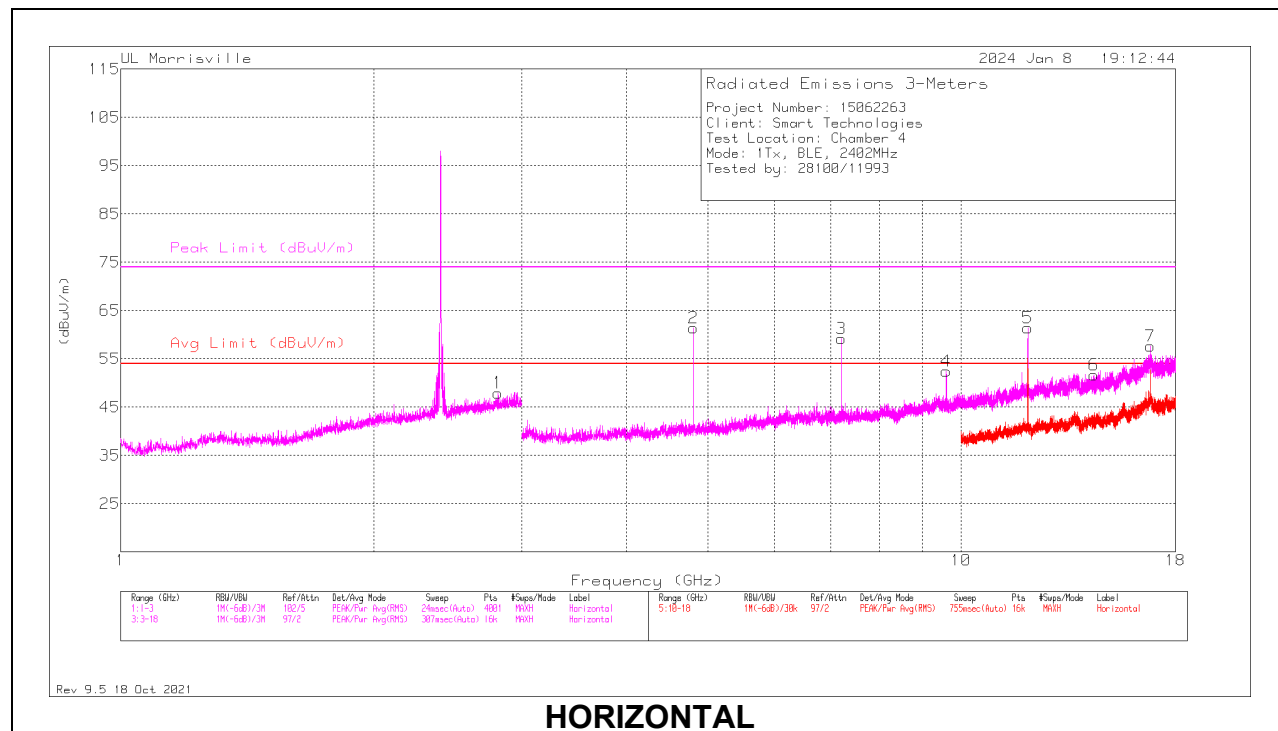
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (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	*** 2.8135	27.67	Pk	32.5	-12.2	0	47.97	54	-6.03	74	-26.03	0-360	100	H
8	*** 2.8913	28.57	PK2	32.5	-12.1	0	48.97	-	-	74	-25.03	131	182	V
8	*** 2.8913	28.57	PK2	32.5	-12.1	-20.90	28.07	54	-25.93	-	-	131	182	V
2	*** 4.80348	59.89	PK2	34.1	-31.7	0	62.29	-	-	74	-11.71	345	112	H
2	*** 4.80348	59.89	PK2	34.1	-31.7	-20.90	41.39	54	-12.61	-	-	345	112	H
5	*** 12.01114	48.36	PK2	38.7	-23.6	0	63.46	-	-	74	-10.54	120	103	H
5	*** 12.01114	48.36	PK2	38.7	-23.6	-20.90	42.56	54	-11.44	-	-	120	103	H
9	*** 4.80448	59.96	PK2	34.1	-31.7	0	62.36	-	-	74	-11.64	112	108	V
9	*** 4.80448	59.96	PK2	34.1	-31.7	-20.90	41.46	54	-12.54	-	-	112	108	V
12	*** 12.01133	45.78	PK2	38.7	-23.6	0	60.88	-	-	74	-13.12	54	115	V
12	*** 12.01133	45.78	PK2	38.7	-23.6	-20.90	39.98	54	-14.02	-	-	54	115	V
10	7.20563	50.75	Pk	35.6	-28	0	58.35	-	-	-	-	0-360	200	V
3	7.20656	51.6	Pk	35.6	-28	0	59.2	-	-	-	-	0-360	100	H
11	9.60656	40.25	Pk	36.8	-25.2	0	51.85	-	-	-	-	0-360	200	V
4	9.6075	40.92	Pk	36.8	-25.3	0	52.42	-	-	-	-	0-360	100	H
6	14.40656	33.84	Pk	39.3	-21.5	0	51.64	-	-	-	-	0-360	100	H
13	14.41406	35.65	Pk	39.3	-22	0	52.95	-	-	-	-	0-360	200	V
14	16.81219	36.13	Pk	41.9	-19.6	0	58.43	-	-	-	-	0-360	200	V
7	16.81313	35.5	Pk	41.9	-19.7	0	57.7	-	-	-	-	0-360	100	H

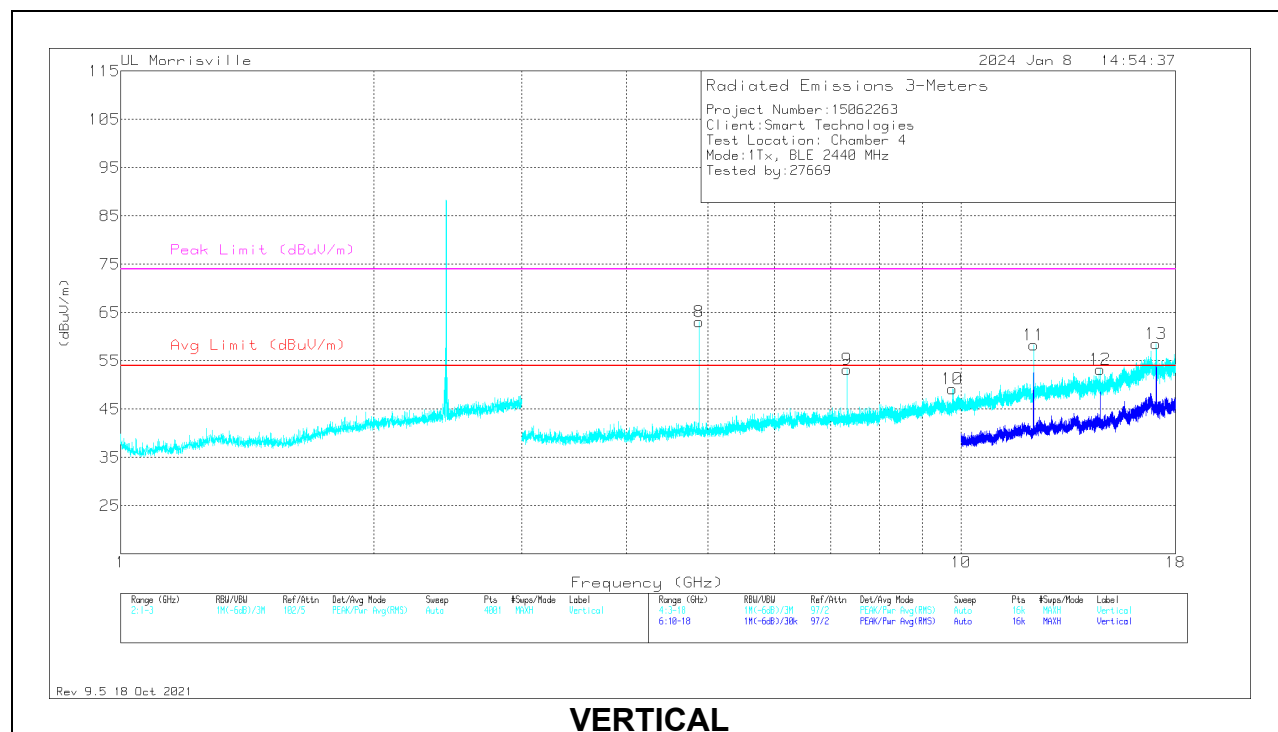
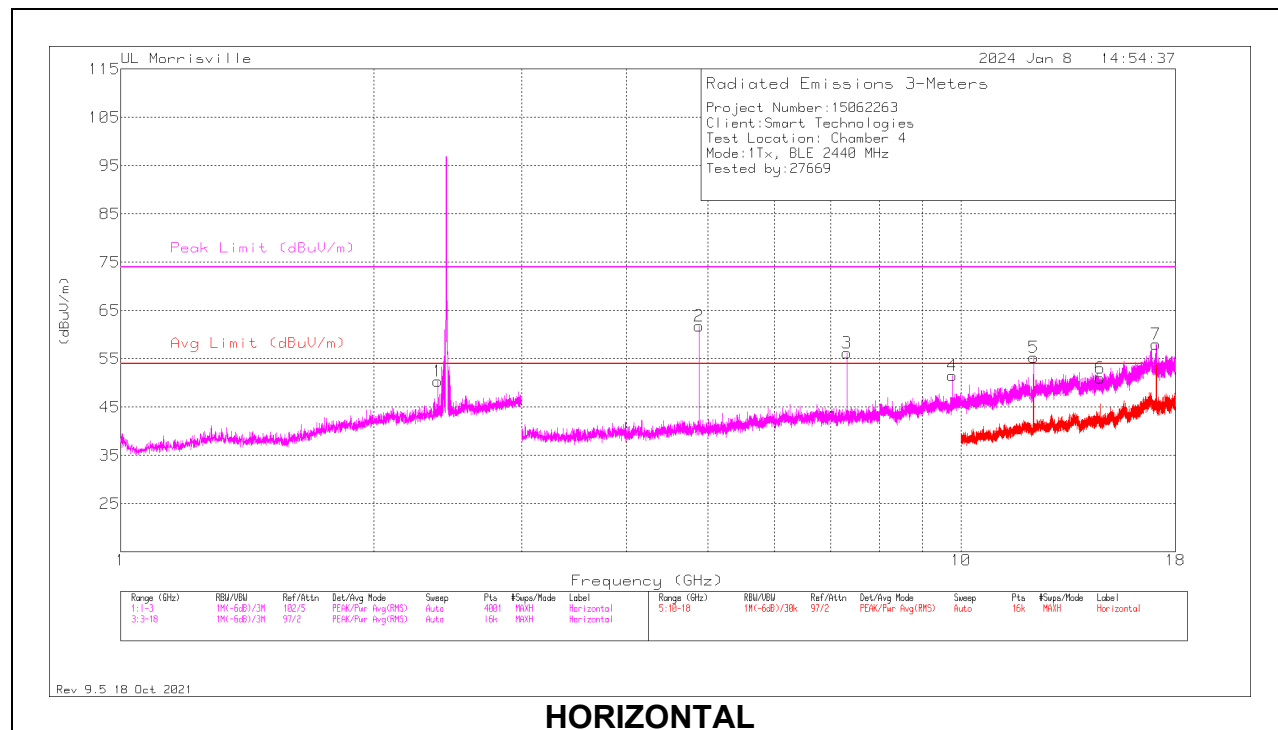
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

PK2 - Maximum Peak

MID CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (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	* ** 2.38536	35.5	PK2	32	-13.2	0	54.3	-	-	74	-19.7	261	128	H
1	* ** 2.38536	35.5	PK2	32	-13.2	-20.90	33.4	54	-20.60	-	-	261	128	H
2	* ** 4.87952	60.01	PK2	34	-31.4	0	62.61	-	-	74	-11.39	345	116	H
2	* ** 4.87952	60.01	PK2	34	-31.4	-20.90	41.71	54	-12.29	-	-	345	116	H
3	* ** 7.32073	50.9	PK2	35.6	-28.1	0	58.4	-	-	74	-15.6	22	102	H
3	* ** 7.32073	50.9	PK2	35.6	-28.1	-20.90	37.5	54	-16.50	-	-	22	102	H
5	* ** 12.20114	42.84	PK2	38.9	-23.4	0	58.34	-	-	74	-15.66	120	107	H
5	* ** 12.20114	42.84	PK2	38.9	-23.4	-20.90	37.44	54	-16.56	-	-	120	107	H
8	* ** 4.87955	59.89	PK2	34	-31.4	0	62.49	-	-	74	-11.51	108	116	V
8	* ** 4.87955	59.89	PK2	34	-31.4	-20.90	41.59	54	-12.41	-	-	108	116	V
9	* ** 7.31938	48.27	PK2	35.6	-28	0	55.87	-	-	74	-18.13	28	103	V
9	* ** 7.31938	48.27	PK2	35.6	-28	-20.90	34.97	54	-19.03	-	-	28	103	V
11	* ** 12.20127	43.08	PK2	38.9	-23.4	0	58.58	-	-	74	-15.42	235	110	V
11	* ** 12.20127	43.08	PK2	38.9	-23.4	-20.90	37.68	54	-16.32	-	-	235	110	V
4	9.76125	40.26	Pk	36.9	-25.6	0	51.56	-	-	-	-	0-360	100	H
10	9.76125	37.88	Pk	36.9	-25.6	0	49.18	-	-	-	-	0-360	200	V
6	14.63906	33.69	Pk	39.6	-22.3	0	50.99	-	-	-	-	0-360	100	H
12	14.63906	35.88	Pk	39.6	-22.3	0	53.18	-	-	-	-	0-360	200	V
7	17.07844	36.78	Pk	41.6	-20.3	0	58.08	-	-	-	-	0-360	100	H
13	17.07844	37.24	Pk	41.6	-20.3	0	58.54	-	-	-	-	0-360	200	V

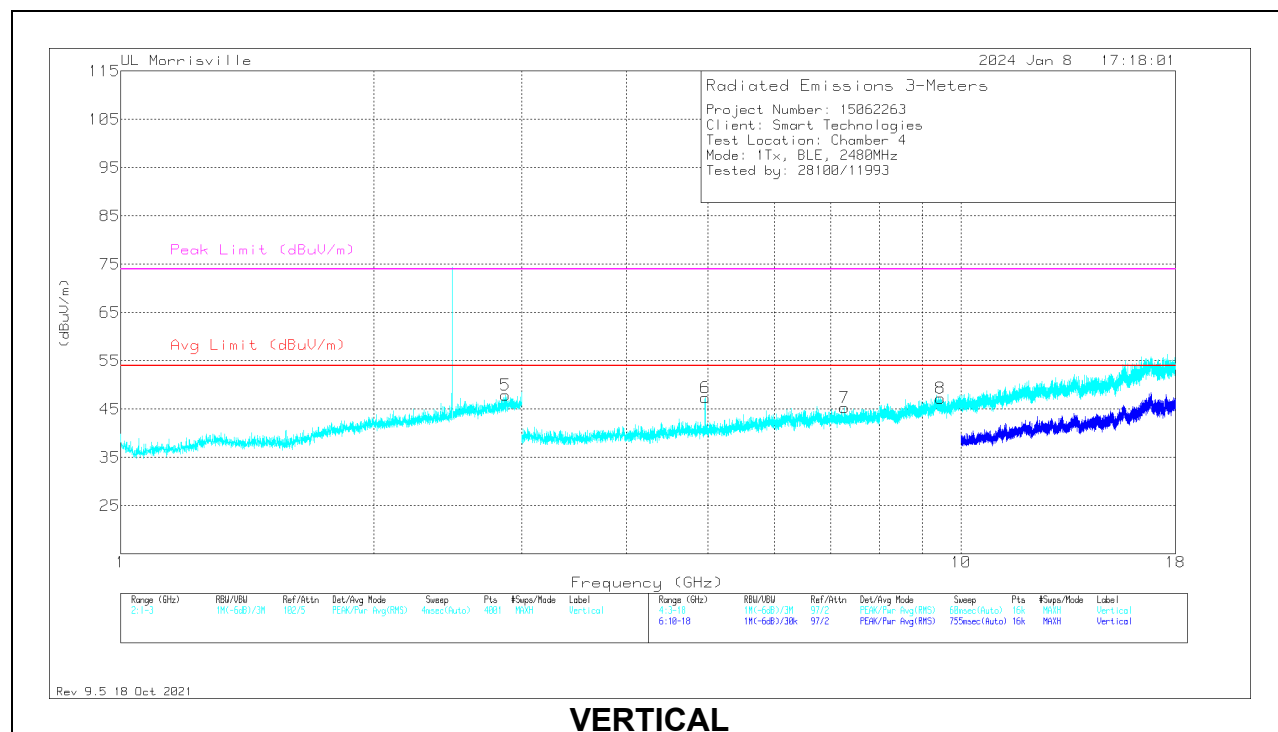
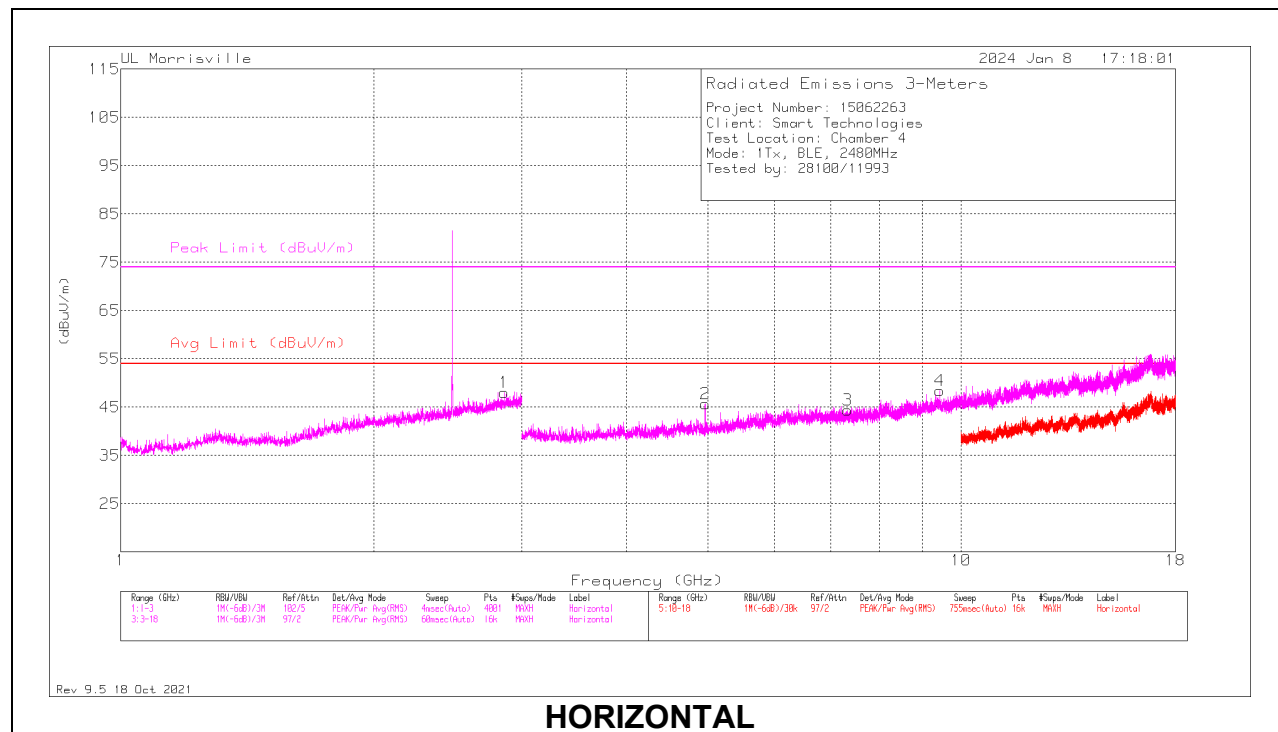
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

PK2 - Maximum Peak

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (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	* ** 2.8574	28.82	PK2	32.4	-12.1	0	49.12	-	-	74	-24.88	80	178	H
1	* ** 2.8574	28.82	PK2	32.4	-12.1	-20.90	28.22	54	-25.78	-	-	80	178	H
5	* ** 2.87	27.55	Pk	32.4	-12.1	0	47.85	54	-6.15	74	-26.15	0-360	200	V
2	* ** 4.96031	43.2	Pk	33.9	-31.4	0	45.7	54	-8.3	74	-28.3	0-360	100	H
3	* ** 7.33313	36.35	Pk	35.6	-27.5	0	44.45	54	-9.55	74	-29.55	0-360	100	H
4	* ** 9.43115	36.99	PK2	36.7	-25.7	0	47.99	-	-	74	-26.01	95	157	H
4	* ** 9.43115	36.99	PK2	36.7	-25.7	-20.90	27.09	54	-26.91	-	-	95	157	H
6	* ** 4.96031	44.84	Pk	33.9	-31.4	0	47.34	54	-6.66	74	-26.66	0-360	200	V
7	* ** 7.26469	37.75	Pk	35.6	-28	0	45.35	54	-8.65	74	-28.65	0-360	200	V
8	* ** 9.44625	36.48	Pk	36.7	-25.9	0	47.28	54	-6.72	74	-26.72	0-360	200	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

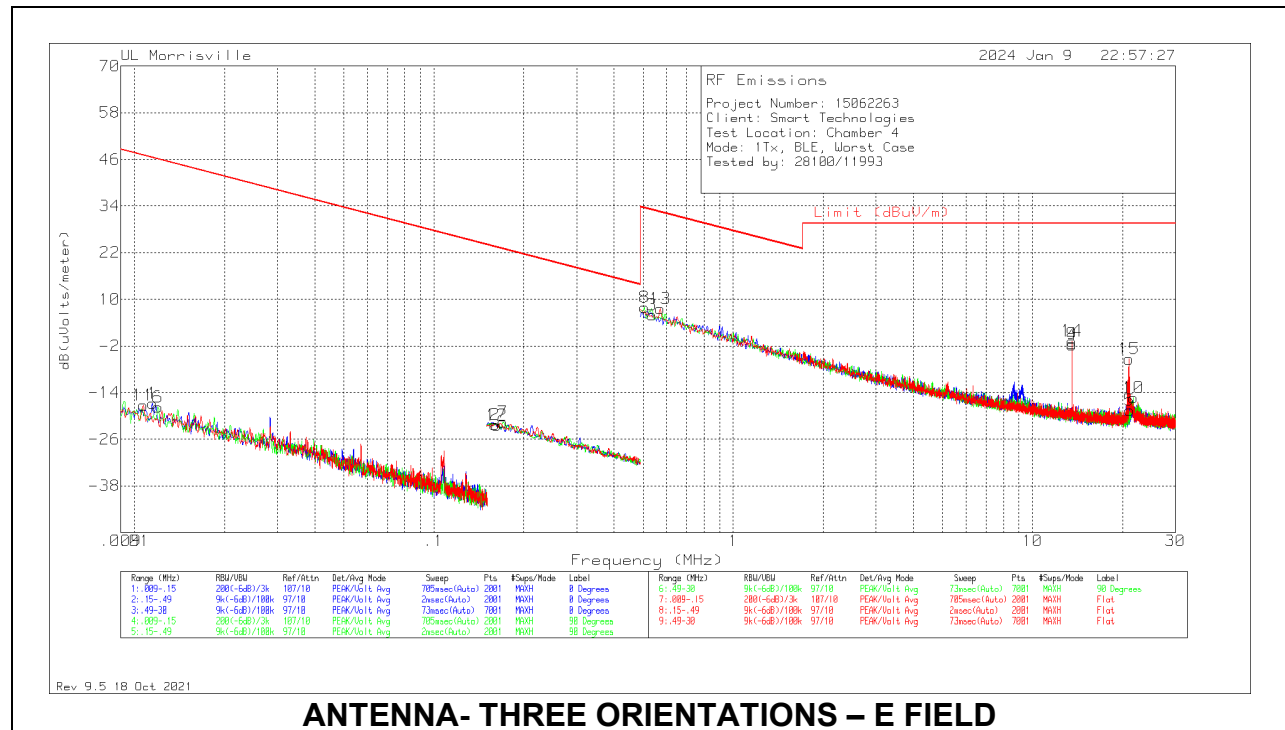
Pk - Peak detector

PK2 - Maximum Peak

10.3. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)

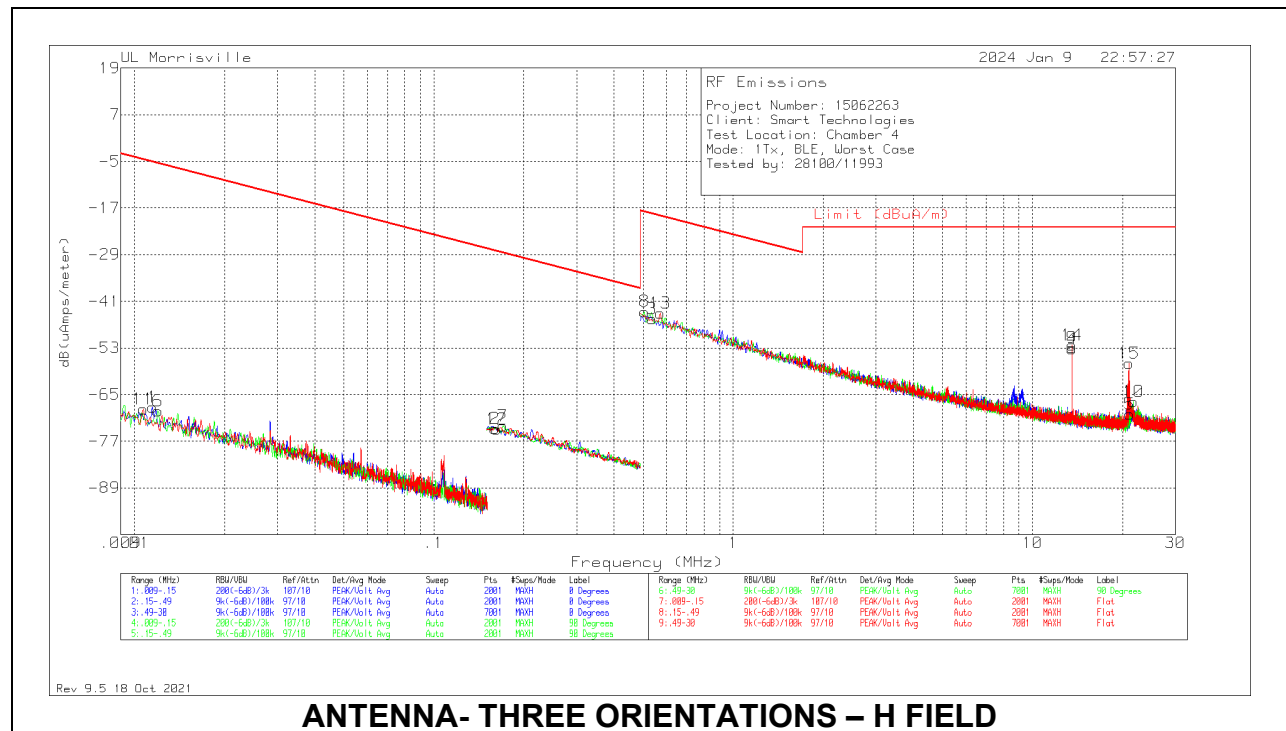
Note: All measurements were made at a test distance of 3 m. The measured data was extrapolated from the test distance (3m) to the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance 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).



Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	135144 (dB/m)	Gain/Loss (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	QP/AV Limit (dBuV/m)	PK Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Loop Angle
11	.0107	43.72	Pk	19	0	-80	-17.28	47.01	67.01	-64.29	0-360	Flat
1	.01149	44.69	Pk	18.6	0	-80	-16.71	46.4	66.4	-63.11	0-360	0 degs
6	.01198	43.85	Pk	18.4	0	-80	-17.75	46.03	66.03	-63.78	0-360	90 degs
2	.15986	45.54	Pk	12.2	0	-80	-22.26	23.53	43.53	-45.79	0-360	0 degs
12	.16199	45.38	Pk	12.2	0	-80	-22.42	23.41	43.41	-45.83	0-360	Flat
7	.17023	46.21	Pk	12.2	0	-80	-21.59	22.98	42.98	-44.57	0-360	90 degs
8	.50686	35.56	Pk	12.2	.1	-40	7.86	33.51	-	-25.65	0-360	90 degs
3	.53638	33.68	Pk	12.2	.1	-40	5.98	33.01	-	-27.03	0-360	0 degs
13	.5701	35.23	Pk	12.2	.1	-40	7.53	32.48	-	-24.95	0-360	Flat
4	13.5596	27.32	Pk	10.6	.4	-40	-1.68	29.54	-	-31.22	0-360	0 degs
9	13.5596	27.61	Pk	10.6	.4	-40	-1.39	29.54	-	-30.93	0-360	90 degs
14	13.5596	28.29	Pk	10.6	.4	-40	-.71	29.54	-	-30.25	0-360	Flat
15	21.00084	24.42	Pk	9.6	.6	-40	-5.38	29.54	-	-34.92	0-360	Flat
5	21.08094	11.32	Pk	9.6	.6	-40	-18.48	29.54	-	-48.02	0-360	0 degs
10	21.67118	14.63	Pk	9.5	.6	-40	-15.27	29.54	-	-44.81	0-360	90 degs

Pk - Peak detector



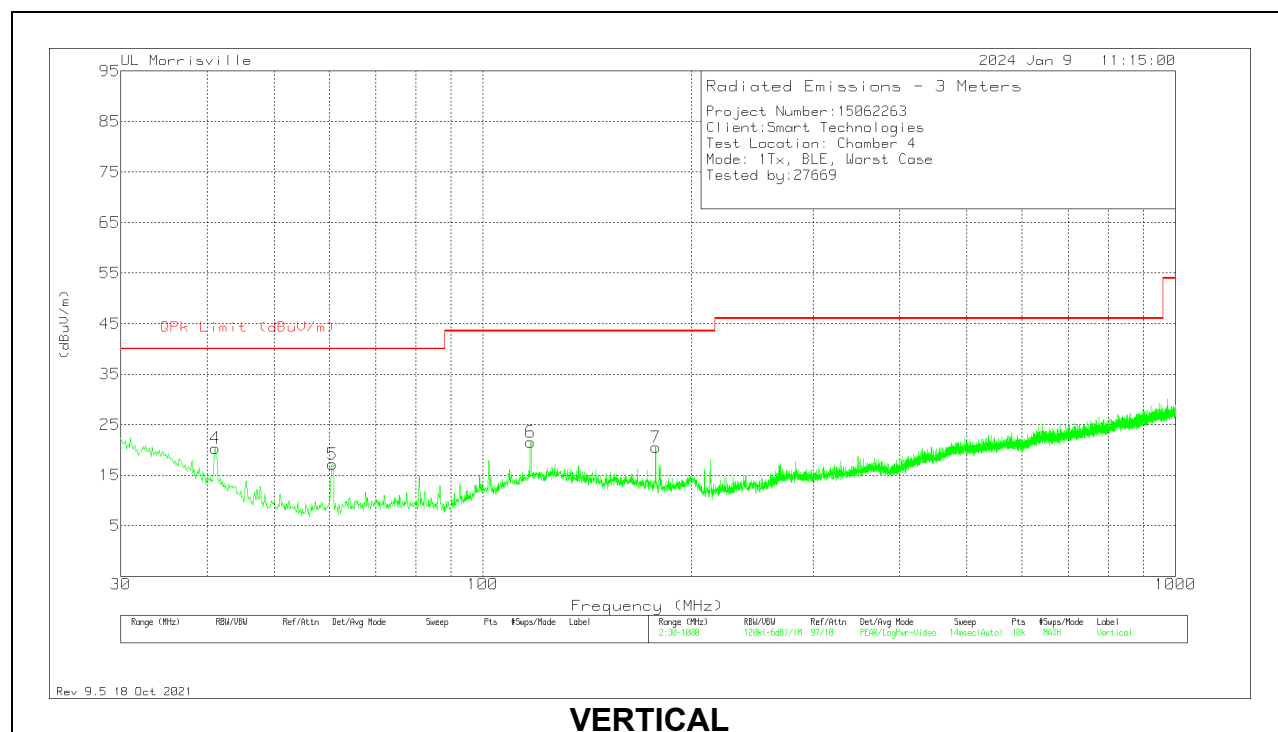
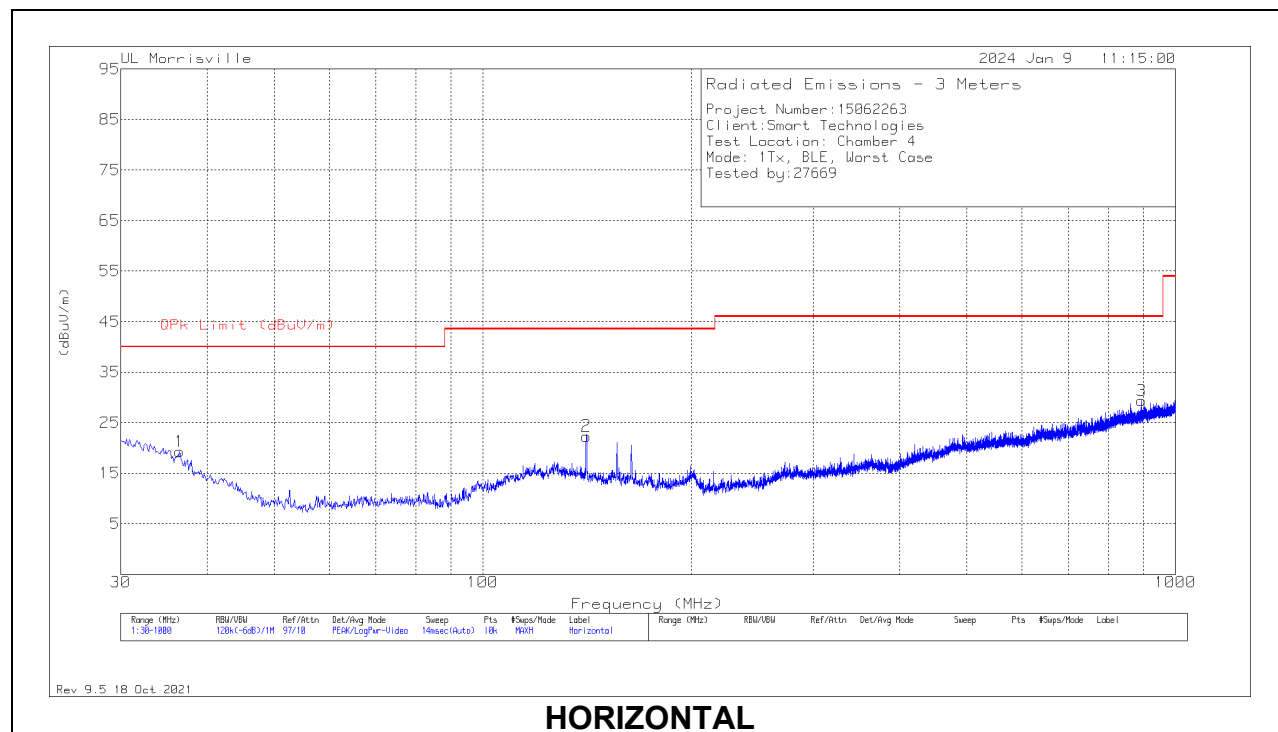
Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	135144 (dB/m)	Gain/Loss (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uAmps/meter)	QP/AV Limit (dBuA/m)	PK Limit (dBuA/m)	Margin (dB)	Azimuth (Degs)	Loop Angle
11	.0107	43.72	Pk	-32.5	0	-80	-68.78	-4.49	15.51	-64.29	0-360	Flat
1	.01149	44.69	Pk	-32.9	0	-80	-68.21	-5.1	14.90	-63.11	0-360	0 degs
6	.01198	43.85	Pk	-33.1	0	-80	-69.25	-5.47	14.53	-63.78	0-360	90 degs
2	.15986	45.54	Pk	-39.3	0	-80	-73.76	-27.97	-7.97	-45.79	0-360	0 degs
12	.16199	45.38	Pk	-39.3	0	-80	-73.92	-28.09	-8.09	-45.83	0-360	Flat
7	.17023	46.21	Pk	-39.3	0	-80	-73.09	-28.52	-8.52	-44.57	0-360	90 degs
8	.50686	35.56	Pk	-39.3	.1	-40	-43.64	-17.99	-	-25.65	0-360	90 degs
3	.53638	33.68	Pk	-39.3	.1	-40	-45.52	-18.49	-	-27.03	0-360	0 degs
13	.5701	35.23	Pk	-39.3	.1	-40	-43.97	-19.02	-	-24.95	0-360	Flat
4	13.5596	27.32	Pk	-40.9	.4	-40	-53.18	-21.96	-	-31.22	0-360	0 degs
9	13.5596	27.61	Pk	-40.9	.4	-40	-52.89	-21.96	-	-30.93	0-360	90 degs
14	13.5596	28.29	Pk	-40.9	.4	-40	-52.21	-21.96	-	-30.25	0-360	Flat
15	21.00084	24.42	Pk	-41.9	.6	-40	-56.88	-21.96	-	-34.92	0-360	Flat
5	21.08094	11.32	Pk	-41.9	.6	-40	-69.98	-21.96	-	-48.02	0-360	0 degs
10	21.67118	14.63	Pk	-42	.6	-40	-66.77	-21.96	-	-44.81	0-360	90 degs

Pk - Peak detector

10.4. WORST CASE BELOW 1 GHZ

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



Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	90629 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	** 893.785	28.58	Pk	28.2	-27.4	29.38	46.02	-16.64	0-360	100	H
6	* ** 117.203	33.09	Pk	19.8	-31.3	21.59	43.52	-21.93	0-360	100	V
1	36.499	29.02	Pk	22.4	-32.1	19.32	40	-20.68	0-360	100	H
4	41.058	33.35	Pk	19	-32	20.35	40	-19.65	0-360	100	V
5	60.652	35.18	Pk	13.8	-31.8	17.18	40	-22.82	0-360	100	V
2	140.968	34.54	Pk	19	-31.2	22.34	43.52	-21.18	0-360	100	H
7	177.634	34.08	Pk	17.5	-31	20.58	43.52	-22.94	0-360	100	V

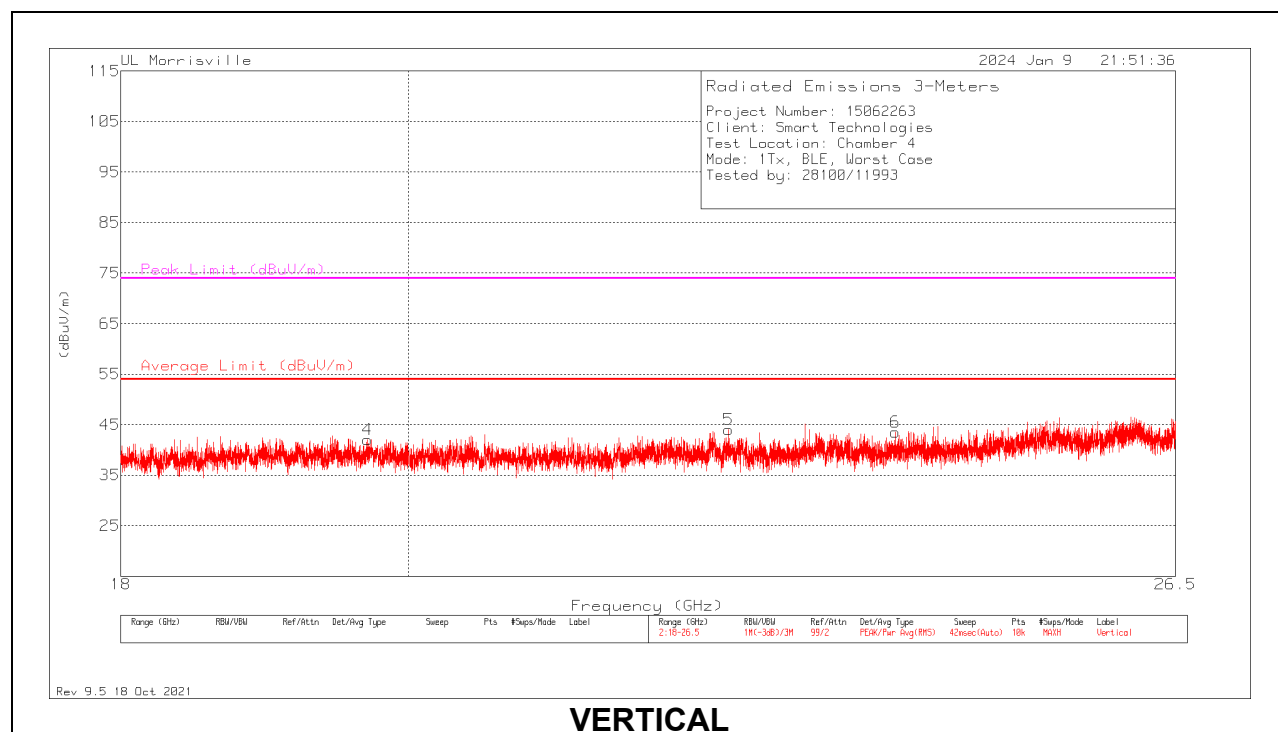
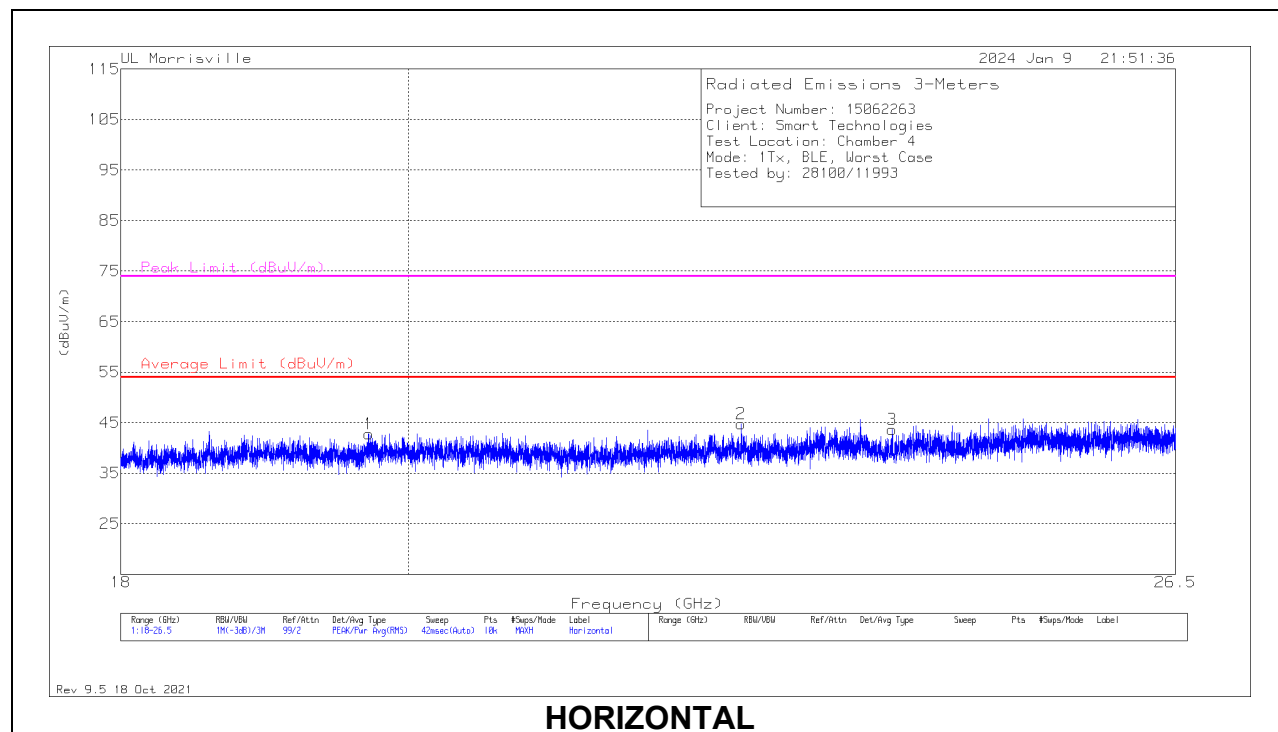
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - 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	204704 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 19.71377	49.32	Pk	33.2	-39.8	42.72	54	-11.28	74	-31.28	0-360	100	H
2	* ** 22.60066	48.65	Pk	34.3	-38.2	44.75	54	-9.25	74	-29.25	0-360	200	H
3	* ** 23.88429	46	Pk	34.4	-36.7	43.7	54	-10.3	74	-30.3	0-360	150	H
4	* ** 19.70612	48.18	Pk	33.2	-39.4	41.98	54	-12.02	74	-32.02	0-360	300	V
5	* ** 22.49695	48.39	Pk	34.2	-38.6	43.99	54	-10.01	74	-30.01	0-360	300	V
6	* ** 23.91149	45.23	Pk	34.4	-36.1	43.53	54	-10.47	74	-30.47	0-360	300	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

11. SETUP PHOTOS

Please refer to R15062263-EP1 for setup photos.

END OF TEST REPORT