



# **TEST REPORT**

**Report Number. :** R13541206-E2

**Applicant :** Microsoft Corporation  
One Microsoft Way  
Redmond, WA 98052-6399  
USA

**Model :** 1964

**FCC ID :** C3K1964

**IC :** 3048A-1964

**EUT Description :** Portable Computing Device

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

**Date Of Issue:**  
2021-08-06

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## REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
v1	2021-05-25	Initial Issue	Niklas Haydon
V2	2021-08-06	Editorial Revisions	Brian T. Kiewra

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** Microsoft Corporation  
One Microsoft Way  
Redmond, WA 98052-6399  
USA

**EUT DESCRIPTION:** Portable Computing Device

**MODEL:** 1964

**SERIAL NUMBER:** 0F0002Z211200C (radiated)  
0F000AN211200C (radiated)  
0F0008Z211200C (radiated)  
0F0003K211200C (antenna port conducted)  
0F0003W211200C (antenna port conducted)  
0F0003V211200C (antenna port conducted)

**SAMPLE RECEIPT DATE:** 2021-04-12

**DATE TESTED:** 2021-04-12 to 2021-04-26

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

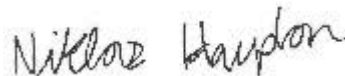
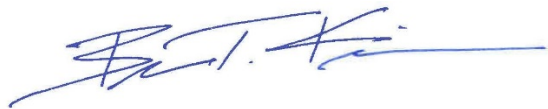
UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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 any agency of the U.S. government.

Approved & Released For  
UL LLC By:

Prepared By:



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Brian T. Kiewra  
Project Engineer  
Consumer Technology Division  
UL LLC

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Niklas Haydon  
Operations Leader  
Consumer Technology Division  
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.

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	Per ANSI C63.10, Section 11.6.
See Comment	RSS-GEN 6.7	20dB BW/99% OBW	Reporting purposes only	ANSI C63.10 Sections 6.9.2 and 6.9.3
15.247 (a)(1)	RSS-247 (5.1) (b)	Hopping Frequency Separation	Complies	None.
15.247 (a)(1)(iii)	RSS-247 (5.1) (d)	Number of Hopping Channels	Complies	None.
15.247 (a)(1)(iii)	RSS-247 (5.1) (d)	Average Time of Occupancy	Reporting purposes only	None.
15.247 (b)(1)	RSS-247 (5.4) (b)	Output Power	Complies	None.
See Comment		Average Power	Complies	Per ANSI C63.10, Section 11.9.2.3.2.
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, certification #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 checked="" type="checkbox"/>	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	703469
<input checked="" type="checkbox"/>	Building: 2800 Perimeter Park Dr Morrisville, NC 27560, U.S.A			



## 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 portable computing device. This report covers the BT radio in the device.

### 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	Basic GFSK	10.23	10.54
2402 - 2480	Enhanced DQPSK	9.00	7.94
2402 - 2480	Enhanced 8PSK	9.21	8.34

Note: GFSK, DQPSK, 8PSK average power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on these modes to showing compliance. For average power data please refer to section 4.7.

### 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 3.9 dBi.

### 6.1. SOFTWARE AND FIRMWARE

OS: Windows Build 19041.vb\_release 191206-1406  
Test tool version 22.35020.0.0-01924  
WLAN driver 22.20.0.5  
BT driver 22.30.0.4

## **6.2. 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 power spectral density 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 the three available configurations (A, B and C as described in the test setup photos). Where a configuration can be portable it was also investigated in three orthogonal orientations (X, Y, Z) modes. It was determined that A configuration was the worst-case configuration orientation; therefore, all final radiated testing was performed with the EUT in configuration A.

All radios that can transmit simultaneously have been evaluated for radiated for all possible combinations of transmission and found to be in compliance.

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

GFSK mode: DH5  
8PSK mode: 3-DH5

### 6.3. DESCRIPTION OF TEST SETUP

#### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
USB Hub	J5create	JCA374	AY2A1904000477	NA
USB Hub	J5create	JCA374	AY3A2010013253	NA
USB Hub	J5create	JCD383	DL3A1903011541	NA
USB Hub	J5create	JCD383	FY5A2010034764	NA
Earbuds	Sony	MDR-EX14AP	NA	NA
Earbuds	Sony	MDR-EX14AP	NA	NA
Earbuds	JVC	HA-FXL	NA	NA
Power Supply	Microsoft	1706	0D130U0HD210C	NA
Power Supply	Microsoft	1706	0D130U0GX310C	N/A
Power Supply	Microsoft	1706	0D130U0HD710C	N/A
Power Supply	Microsoft	1706	0D130U0GU310C	N/A
Power Supply	Microsoft	1706	0D130U0HDL10C	N/A

#### I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Mains	1	12-pin	Mains	<3	Goes to ac/dc adapter
2	USB-C	2	USB-C	USB	<3	

#### TEST SETUP

Test software on the EUT exercised the radio card.

#### SETUP DIAGRAMS

Please refer to R13541206-EP1 for setup diagrams.

## 7. TEST AND MEASUREMENT EQUIPMENT

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

### Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
<b>Conducted Room 1</b>					
SA0025	Spectrum Analyzer	Agilent	N9030A	2021-04-01	2022-04-01
PWM002	RF Power Meter	Keysight Technologies	N1911A	2020-07-31	2021-07-31
PWS001	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2020-05-27	2021-05-27
PWS002	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2020-07-31	2021-07-31
HI0090	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
SOFTEMI	Antenna Port Software	UL	Version 2021.4.9 2021.4.13	NA	NA
<b>Conducted Room 2</b>					
SA0027	Spectrum Analyzer	Keysight Technologies	N9030A	2020-06-10	2021-06-10
PWM004	RF Power Meter	Keysight Technologies	N1911A	2020-07-31	2021-07-31
PWS002	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2020-07-31	2021-07-31
HI0091	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
SOFTEMI	Antenna Port Software	UL	Version 2021.4.9 2021.4.13	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	14-650-118	2020-06-26	2021-06-26
LISN003	LISN, 50-ohm/50-uH, 250uH 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50/250-25-2-01	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	2021-04-05	2022-04-05
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (04 Mar 21)		

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	<b>1-18 GHz</b>				
AT0062	HORN Antenna	ETS-Lindgren	3117	2021-02-03	2022-02-03
	<b>Gain-Loss Chains</b>				
C-SAC02	Gain-loss string: 1-18GHz	Various	Various	2021-04-15	2022-04-15
	<b>Receiver &amp; Software</b>				
206496	Spectrum Analyzer	Rohde & Schwarz	ESW44	2020-03-09	2022-03-09
SOFTEMI	EMI Software	UL	Version 9.5 (04 Mar 21)	NA	NA
	<b>Additional Equipment used</b>				
HI0085	Temp/Humid/Pressure Meter	EXTECH	SD700	2020-04-20	2021-04-30

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	<b>1-18 GHz</b>				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-04-27	2021-04-27
	<b>Gain-Loss Chains</b>				
N-SAC03	Gain-loss string: 1- 18GHz	Various	Various	2020-07-28	2021-07-28
	<b>Receiver &amp; Software</b>				
197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-30	2022-03-30
SOFTEMI	EMI Software	UL	Version 9.5 (04 Mar 2021)		
	<b>Additional Equipment used</b>				
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2020-08-06	2021-08-06

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	<b>0.009-30MHz</b>				
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2020-08-20	2021-08-20
	<b>30-1000 MHz</b>				
AT0075	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2020-10-27	2021-10-27
	<b>18-40 GHz</b>				
AT0063	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2020-10-30	2021-10-30
	<b>Gain-Loss Chains</b>				
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
	<b>Receiver &amp; Software</b>				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-10	2022-03-10
SOFTEMI	EMI Software	UL	Version 9.5 (04 Mar 2021)		
	<b>Additional Equipment used</b>				
s/n 200037635	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22

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.

## 8. MEASUREMENT METHODS

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

Occupied BW (20dB): ANSI C63.10-2013 Section 6.9.2

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

Carrier Frequency Separation: ANSI C63.10-2013 Section 7.8.2

Number of Hopping Frequencies: ANSI C63.10-2013 Section 7.8.3

Time of Occupancy (Dwell Time): ANSI C63.10-2013 Section 7.8.4

Peak Output Power: ANSI C63.10-2013 Section 7.8.5

Conducted Spurious Emissions: ANSI C63.10-2013 Section 7.8.8

Conducted Band-Edge: ANSI C63.10-2013 Section 6.10.4 and 7.8.6

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4

Radiated Spurious Emissions 30-1000MHz: ANSI C63.10-2013 Section 6.3 and 6.5

Radiated Spurious Emissions above 1GHz: ANSI C63.10-2013 Section 6.3 and 6.6

Radiated Band-edge: ANSI C63.10-2013 Section 6.10.5

AC Power-line conducted emissions: ANSI C63.10-2013, Section 6.2.



## 9. ANTENNA PORT TEST RESULTS

### 9.1. ON TIME AND DUTY CYCLE

#### LIMITS

None; for reporting purposes only.

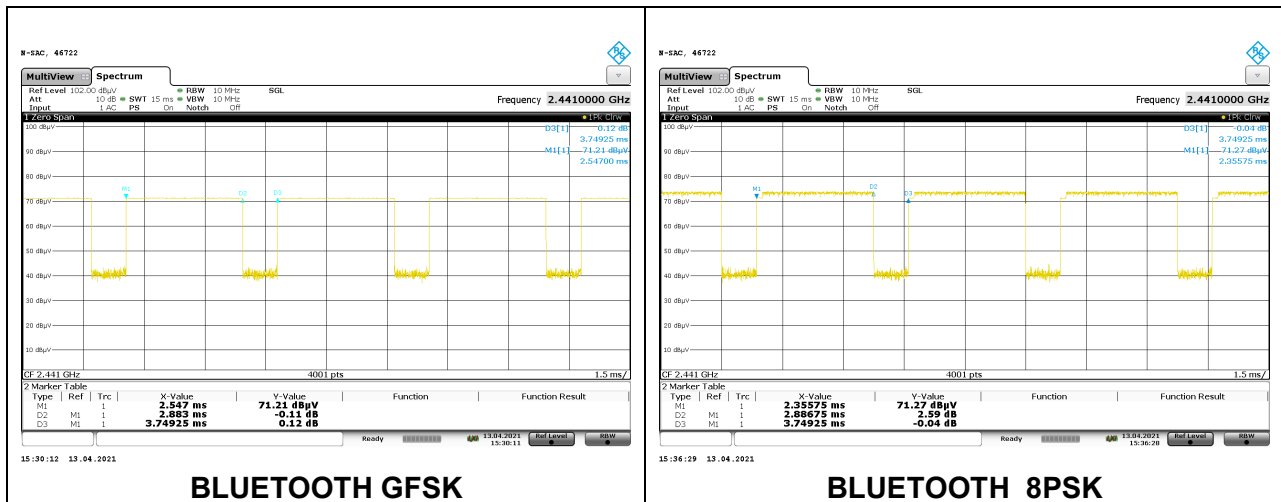
#### PROCEDURE

ANSI C63.10, Section 11.6 : 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/T Minimum VBW (kHz)
Bluetooth GFSK	2.88	3.75	0.769	76.9%	1.14	0.347
Bluetooth 8PSK	2.89	3.75	0.770	77.0%	1.14	0.346

#### DUTY CYCLE PLOTS



## **9.2. 20 dB AND 99% BANDWIDTH**

### **LIMITS**

None; for reporting purposes only.

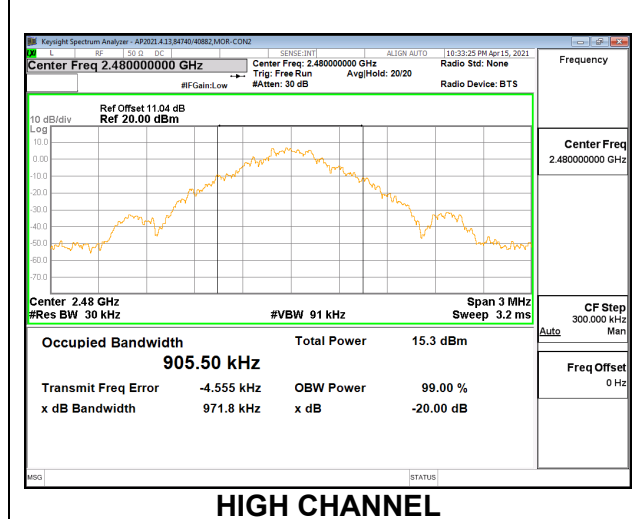
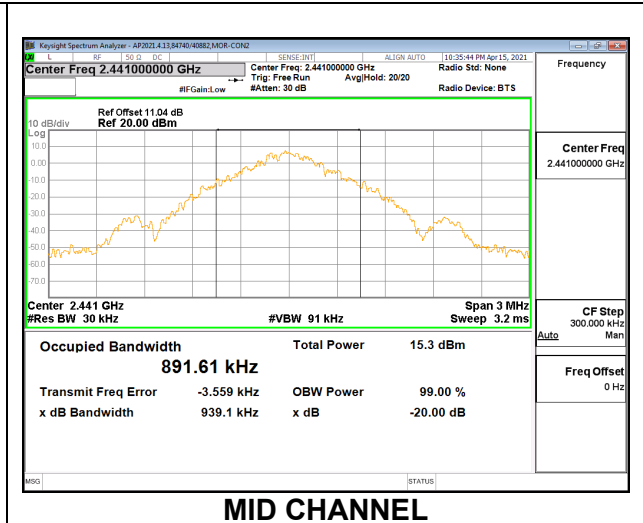
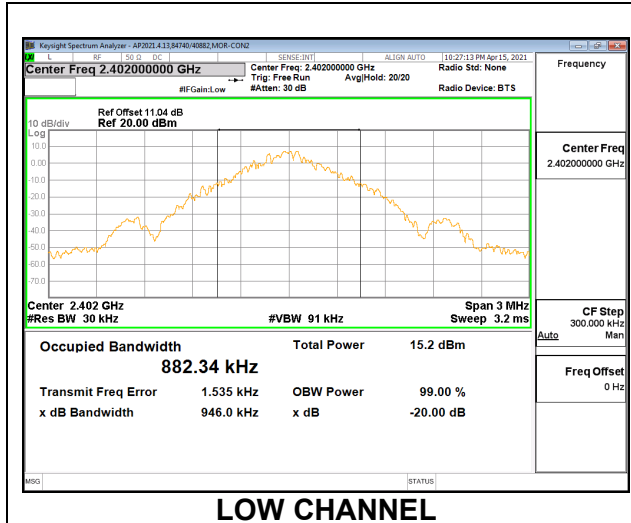
### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1\%$  of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

### **RESULTS**

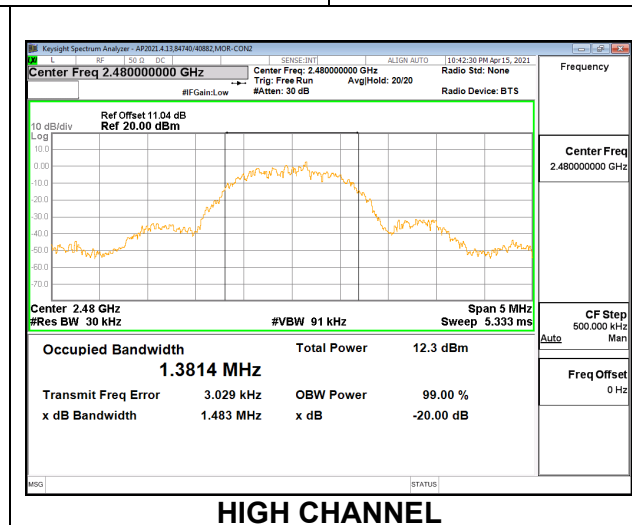
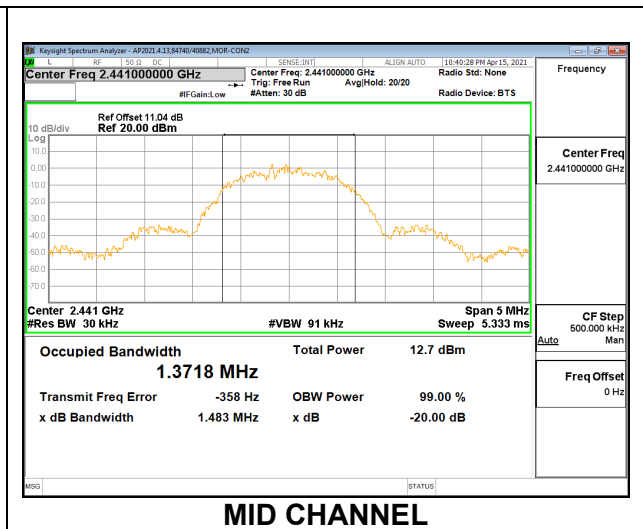
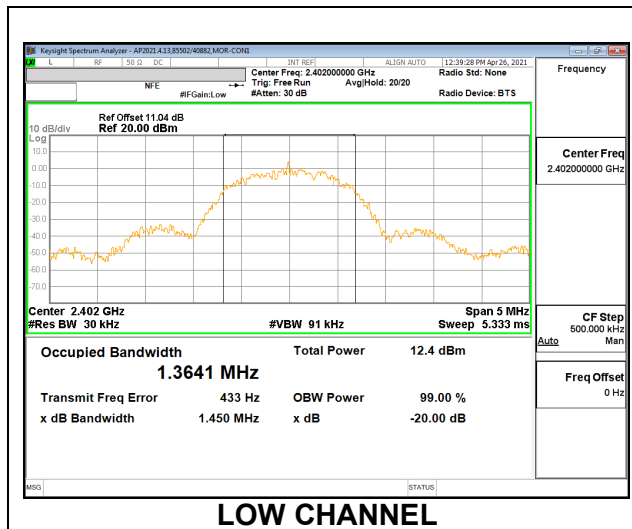
### 9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.946	0.882
Mid	2441	0.939	0.892
High	2480	0.972	0.906



## 9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.450	1.3641
Mid	2441	1.483	1.3718
High	2480	1.483	1.3814



### **9.3. HOPPING FREQUENCY SEPARATION**

#### **LIMITS**

FCC §15.247 (a) (1)

RSS-247 (5.1) (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

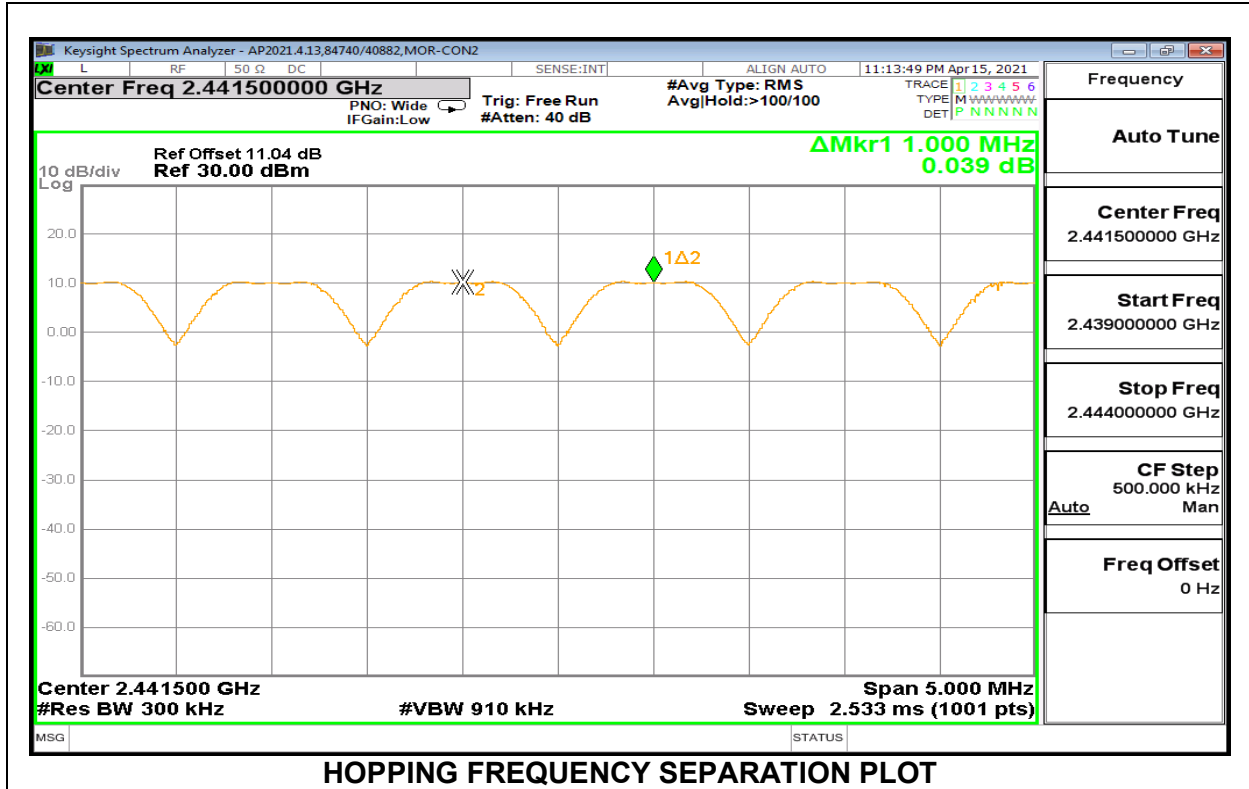
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

#### **TEST PROCEDURE**

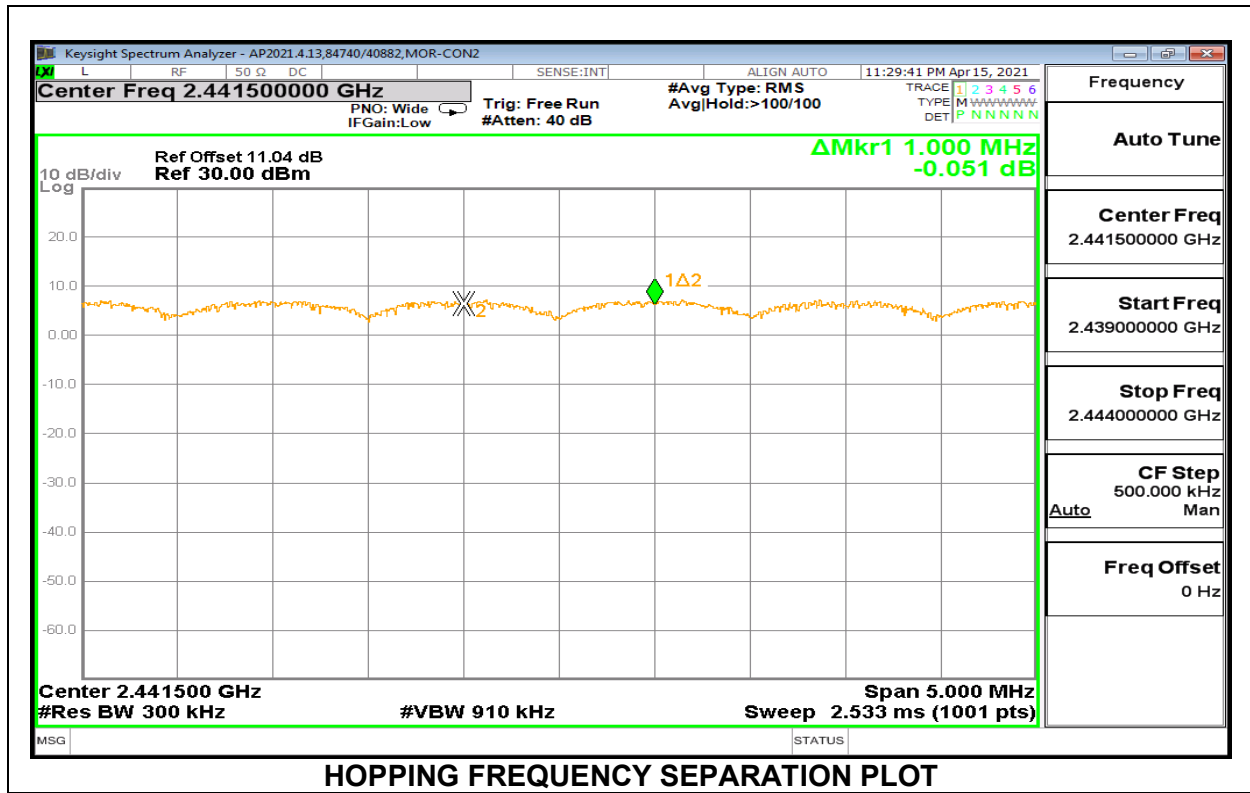
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to  $VBW \geq RBW$ . The sweep time is coupled.

#### **RESULTS**

### 9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



### 9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



Note – The channel hopping separation of 1MHz is less than the 20 dB bandwidth (1.483 MHz). However, the output power is less than 125 mW and the channel separation is greater than 2/3 the 20 dB bandwidth (989 kHz).

Ch. A	Ch. B	Ch. 1 to Ch. 2 Sep.	20 dB BW	2/3 20 dB BW	Margin
(MHz)	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
2441	2442	1.000	1.483	0.989	-0.011

## **9.4. NUMBER OF HOPPING CHANNELS**

### **LIMITS**

FCC §15.247 (a) (1) (iii)

RSS-247 (5.1) (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

### **TEST PROCEDURE**

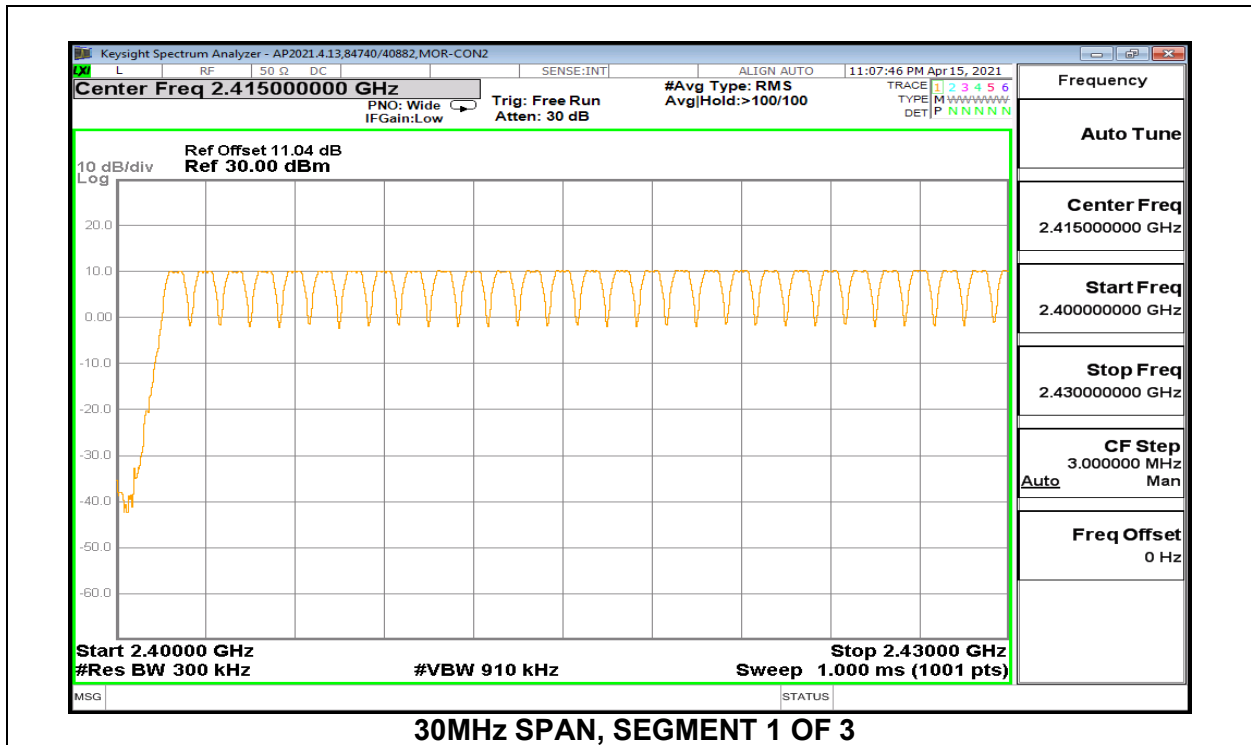
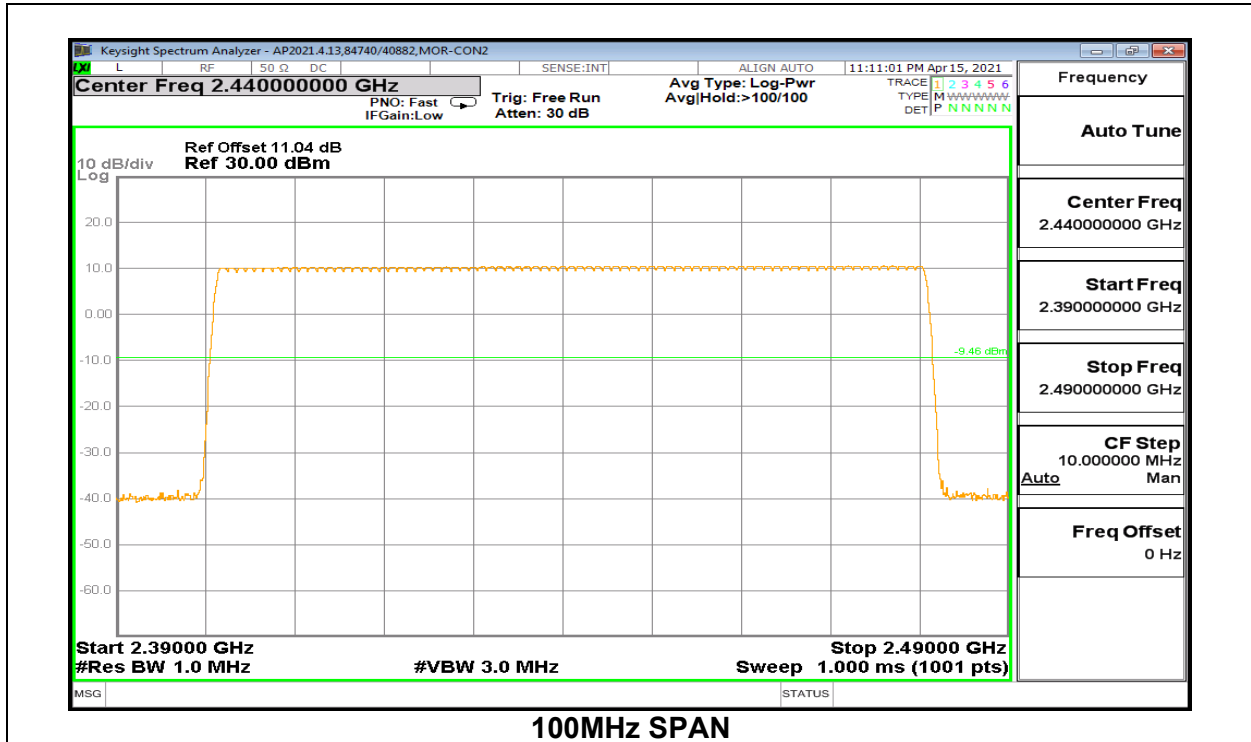
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps for visibility of the entire span. Then, smaller spans are set to more clearly identify the channels. The RBW is set to 30% of the channel spacing (approx. 300kHz). The analyzer is set to Max Hold.

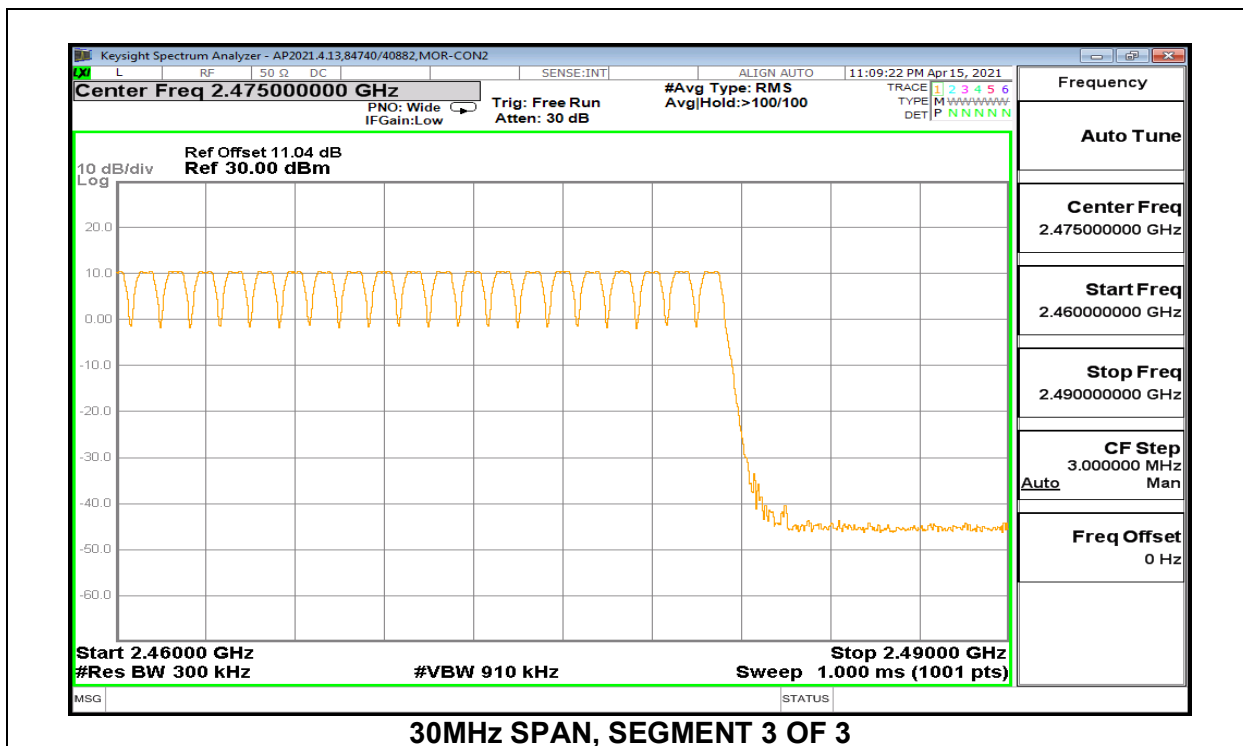
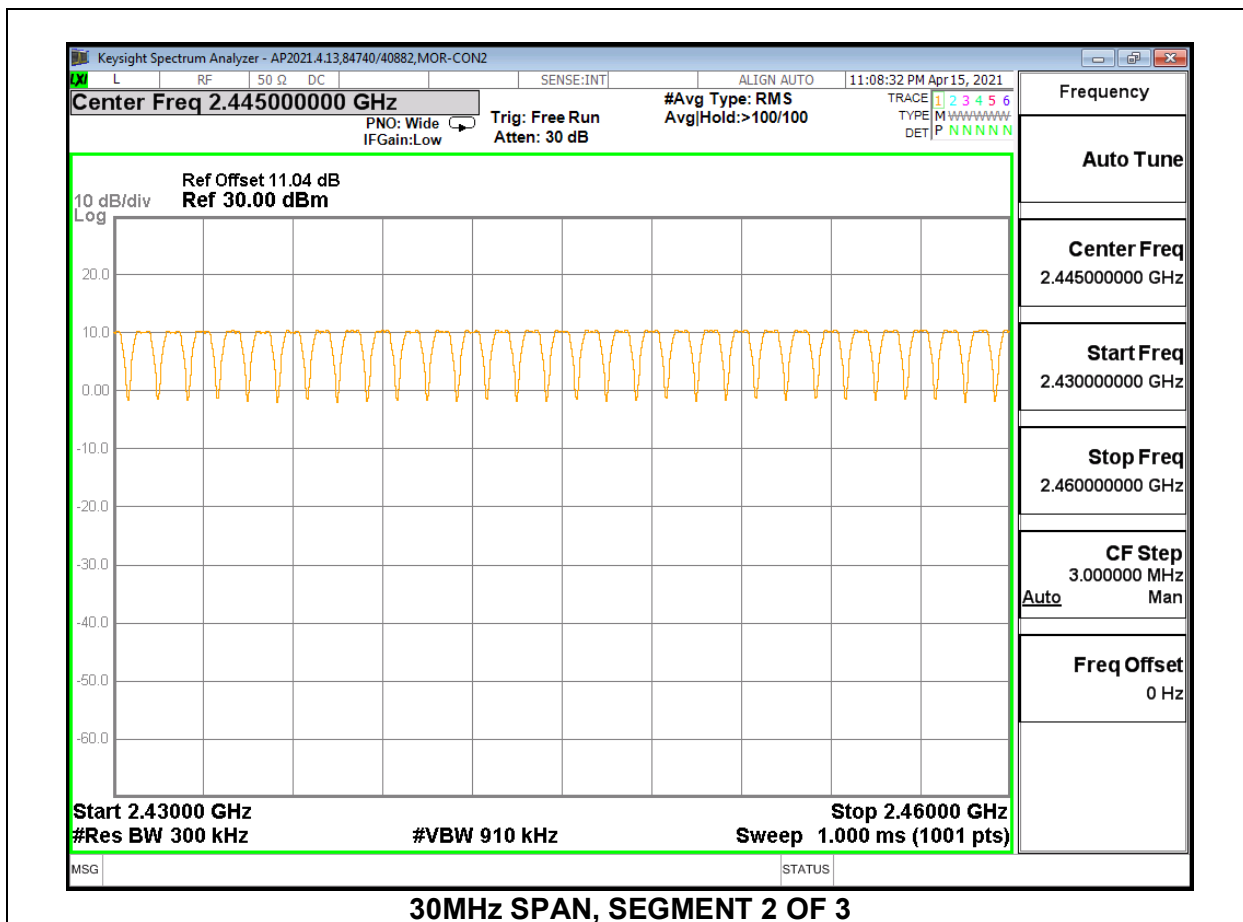
### **RESULTS**

Normal Mode: 79 Channels Observed

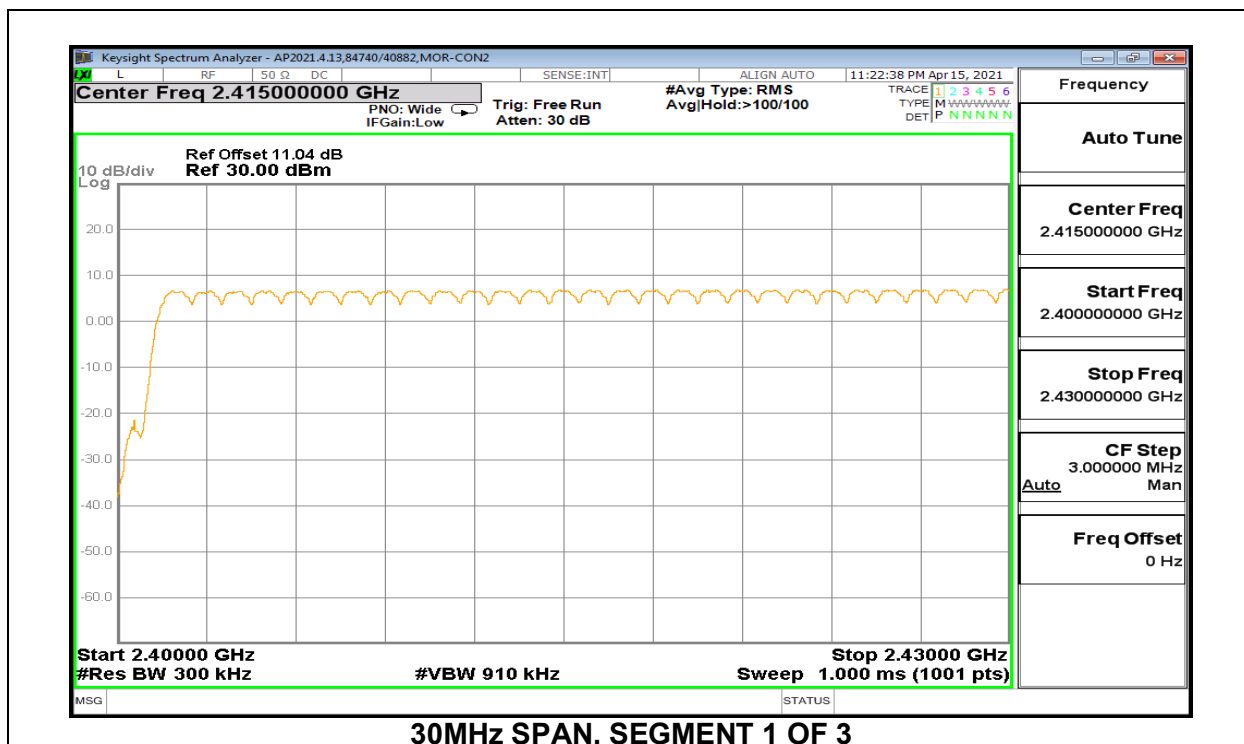
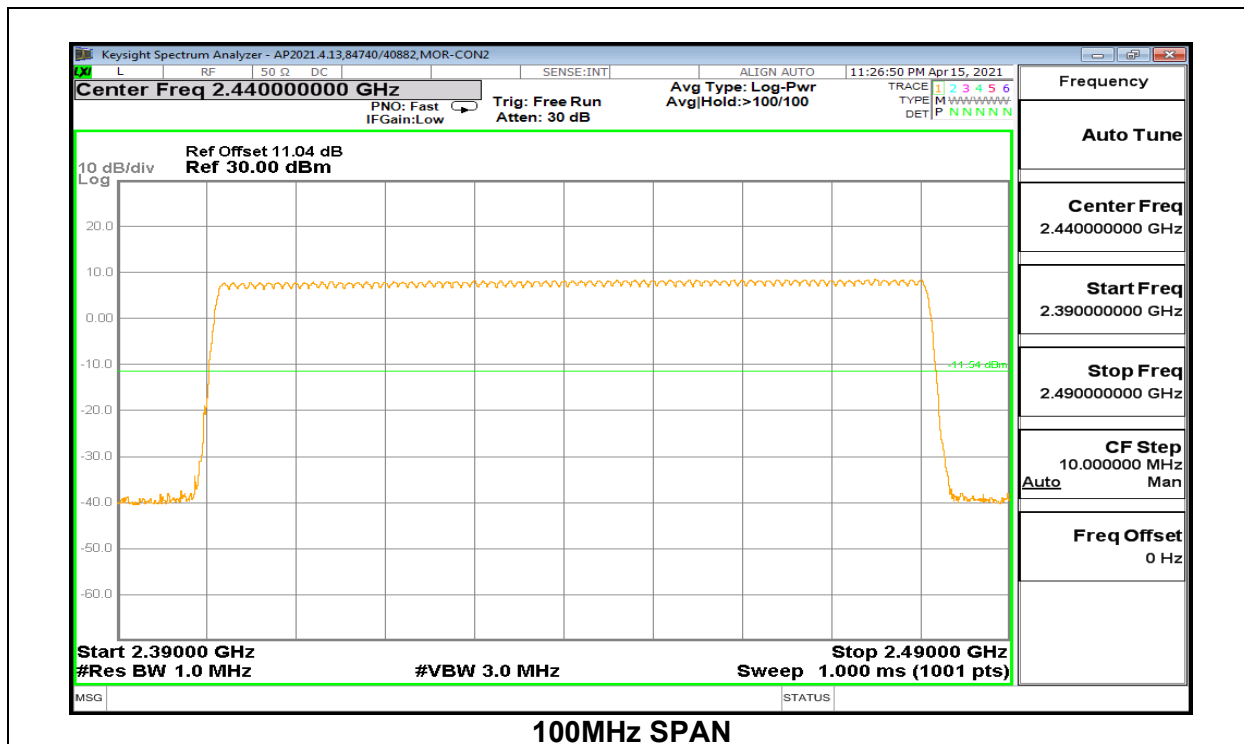


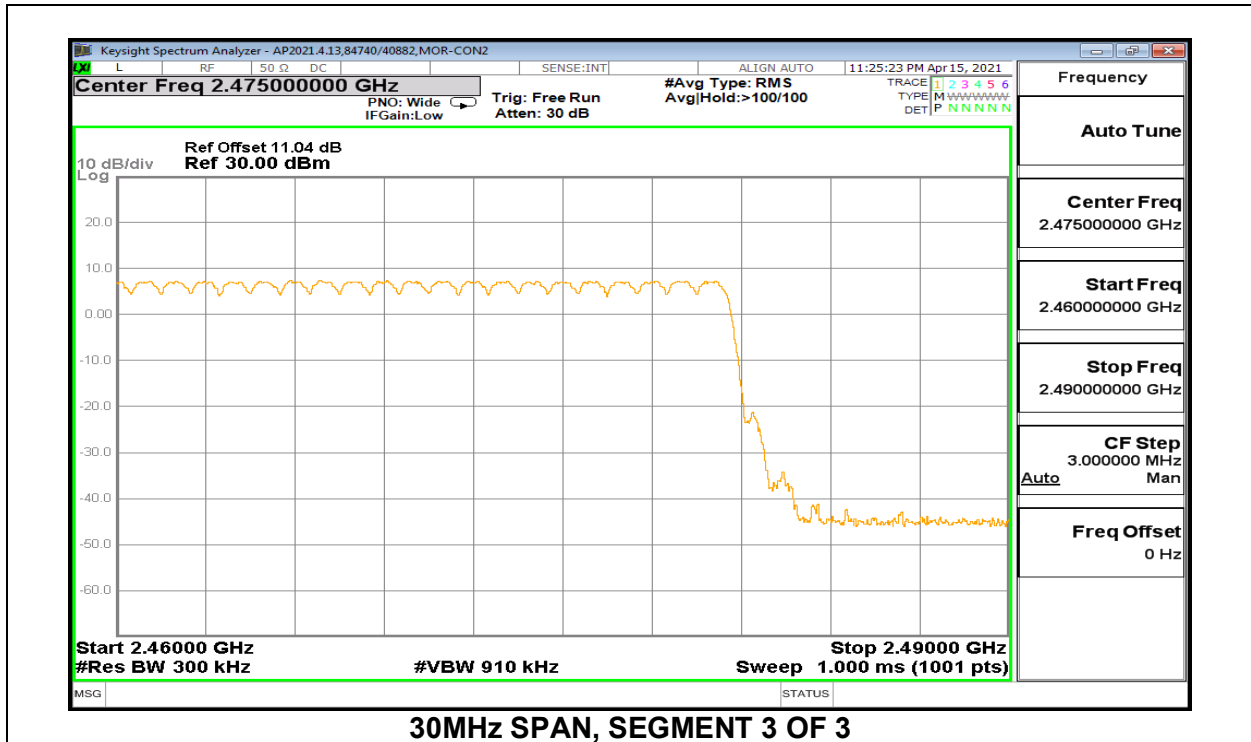
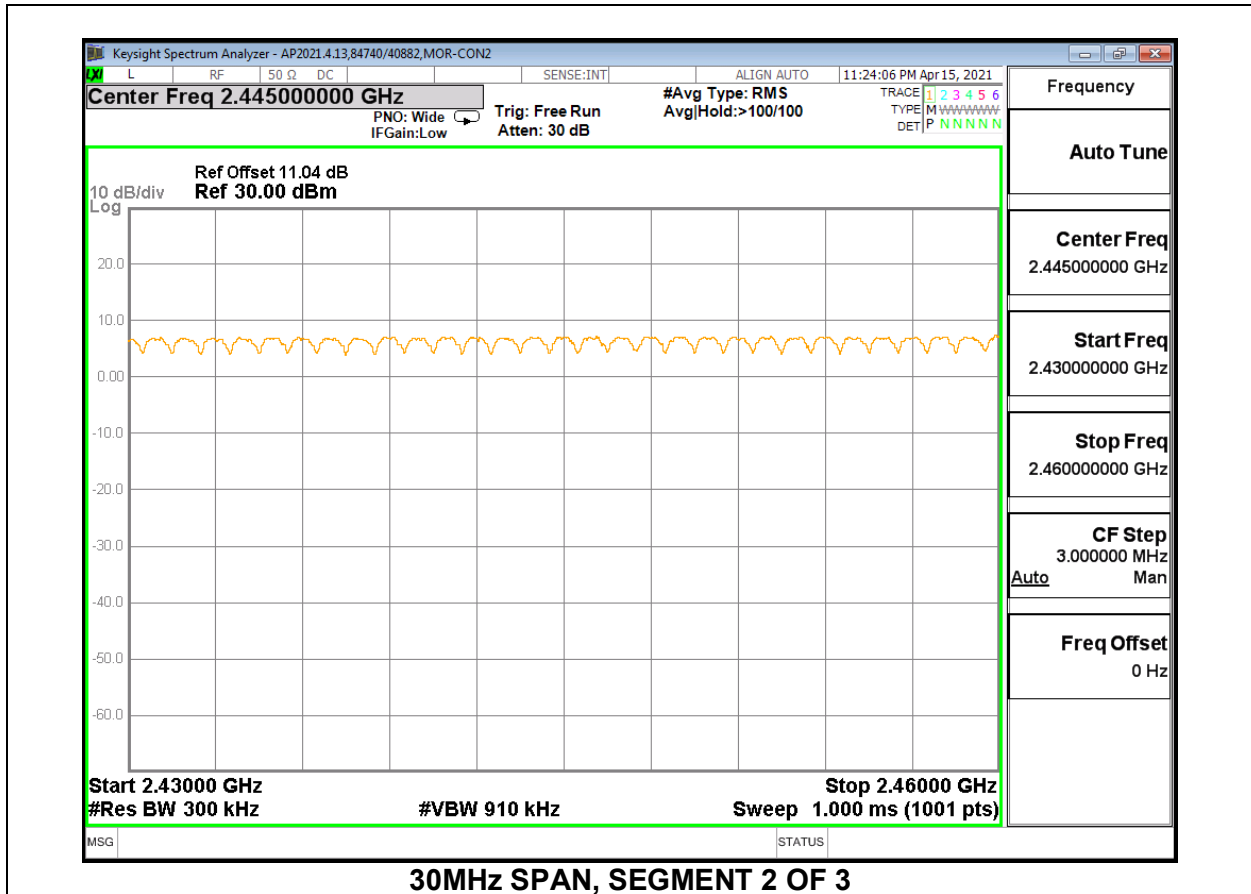
### 9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION





### 9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION





## **9.5. AVERAGE TIME OF OCCUPANCY**

### **LIMITS**

FCC §15.247 (a) (1) (iii)

RSS-247 (5.1) (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

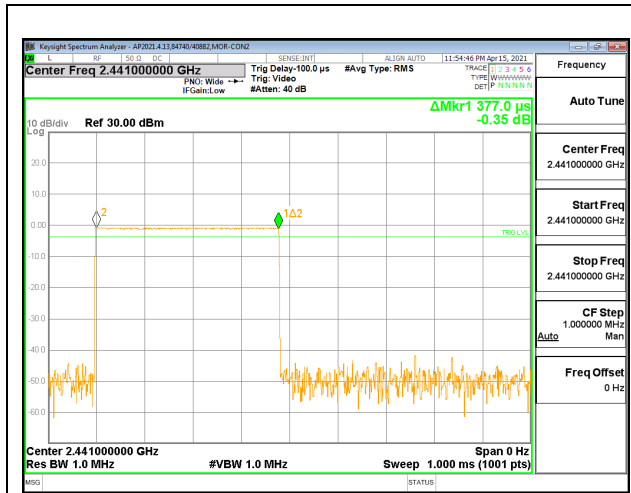
The average time of occupancy in the specified 3.16 second period (79 channels \* 0.4 s) is equal to  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$ .

For AFH mode, the average time of occupancy in the specified 8 second period (20 channels \* 0.4 seconds) is equal to  $10 * (\# \text{ of pulses in } 0.8 \text{ s}) * \text{ pulse width}$ .

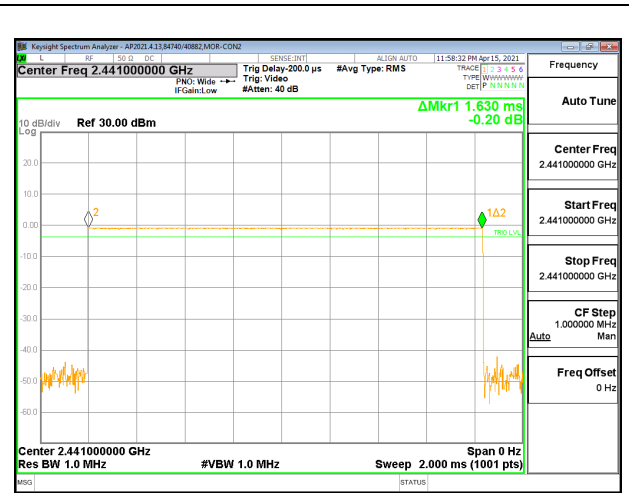
### **RESULTS**

### 9.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

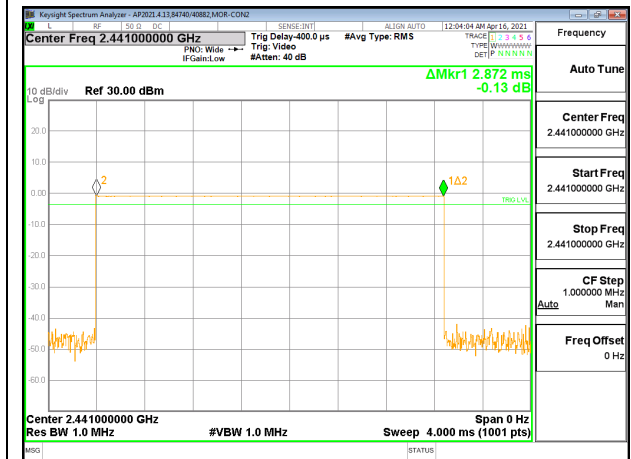
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
<b>GFSK Normal Mode</b>					
DH1	0.377	31	0.1169	0.4	-0.2831
DH3	1.630	22	0.3586	0.4	-0.0414
DH5	2.872	9	0.2585	0.4	-0.1415
<b>GFSK AFH Mode</b>					
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.377	7.75	0.02922	0.4	-0.3708
DH3	1.63	5.5	0.08965	0.4	-0.3104
DH5	2.872	2.25	0.06462	0.4	-0.3354



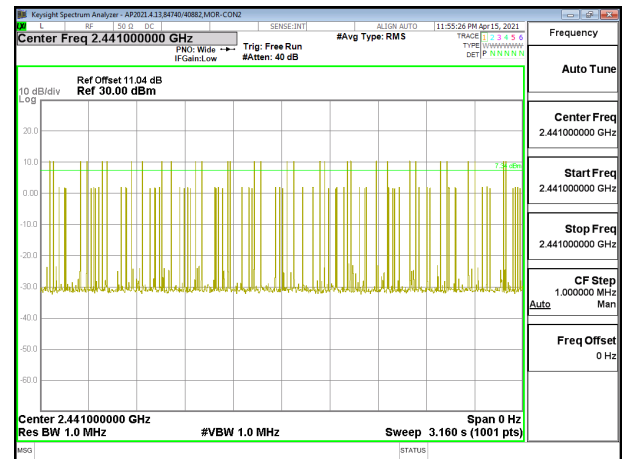
**PULSE WIDTH – DH1**



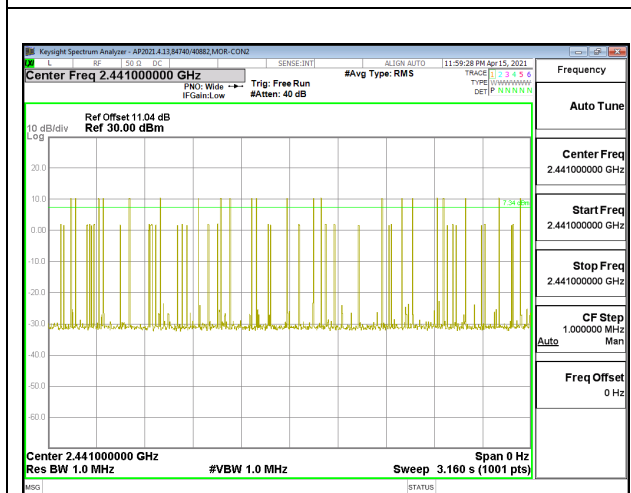
**PULSE WIDTH – DH3**



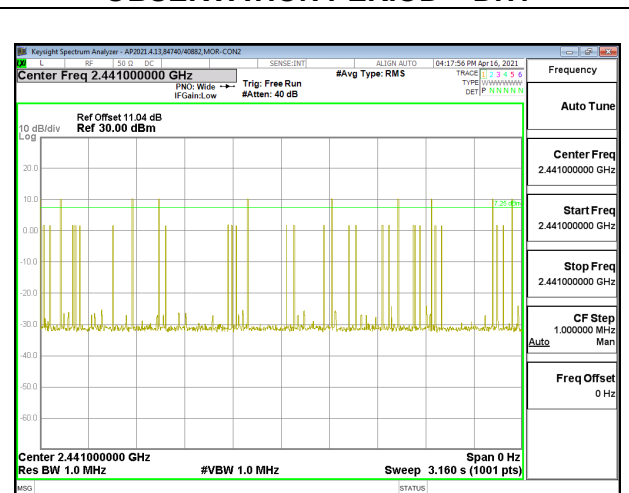
**PULSE WIDTH – DH5**



**NUMBER OF PULSES IN 3.16 SECOND  
 OBSERVATION PERIOD – DH1**



**NUMBER OF PULSES IN 3.16 SECOND  
 OBSERVATION PERIOD – DH3**



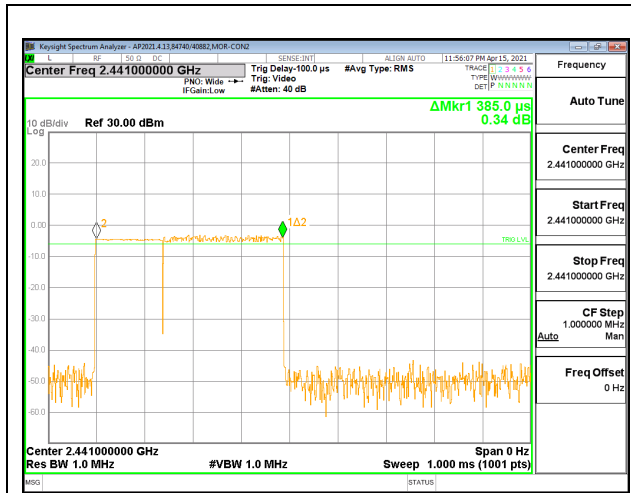
**NUMBER OF PULSES IN 3.16 SECOND  
 OBSERVATION PERIOD – DH5**

### 9.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

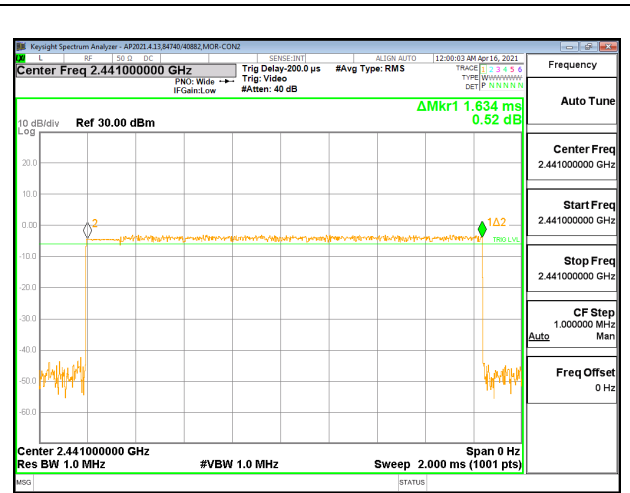
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK Normal Mode					
3DH1	0.385	32	0.1232	0.4	-0.2768
3DH3	1.634	18	0.29412	0.4	-0.1059
3DH5	2.88	8	0.2304	0.4	-0.1696

Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate demonstrates compliance with channel occupancy when AFH is employed.

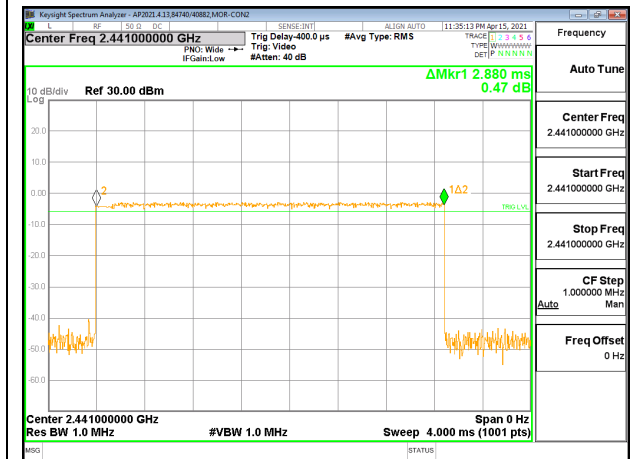




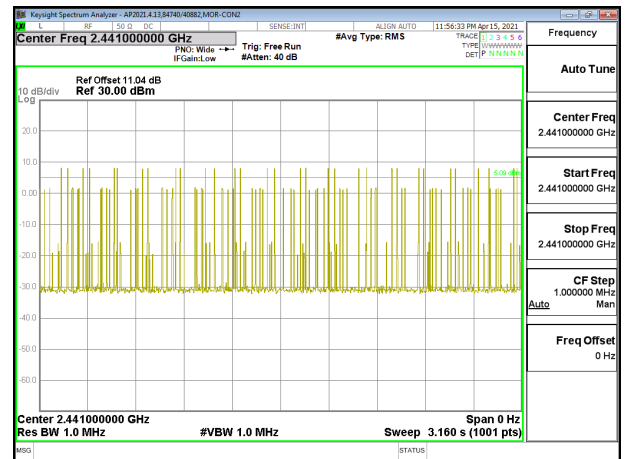
**PULSE WIDTH – 3DH1**



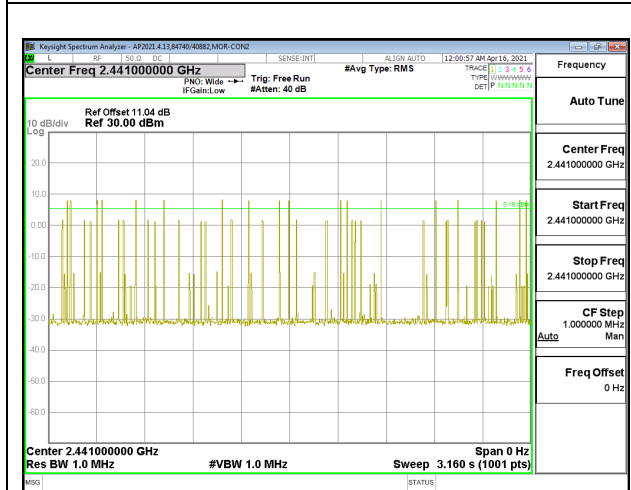
**PULSE WIDTH – 3DH3**



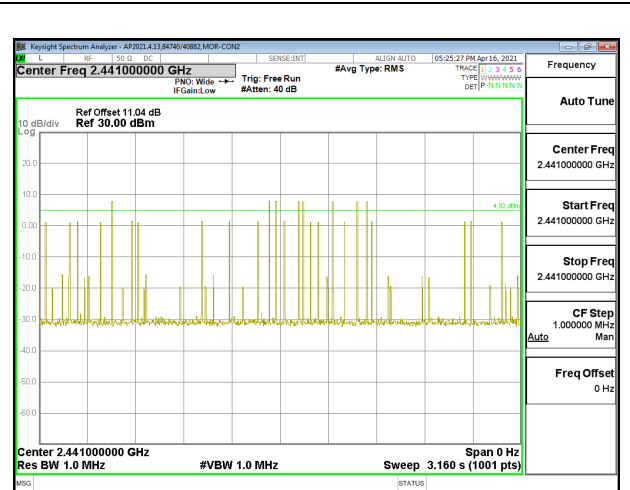
**PULSE WIDTH – 3DH5**



**NUMBER OF PULSES IN 3.16 SECOND  
 OBSERVATION PERIOD – 3DH1**



**NUMBER OF PULSES IN 3.16 SECOND  
 OBSERVATION PERIOD – 3DH3**



**NUMBER OF PULSES IN 3.16 SECOND  
 OBSERVATION PERIOD – 3DH5**

## **9.6. OUTPUT POWER**

### **LIMITS**

§15.247 (b) (1)

RSS-247 (5.4) (b)

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts

### **TEST PROCEDURE**

Measurements perform using a wideband gated RF power meter.

The cable assembly insertion loss of 11.04 dB (including 9.77 dB pad and 1.27 dB cable) was entered as an offset in the power meter and peak power was measured.

### **RESULTS**

### 9.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	84740/40882
Date:	2021-04-15

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.87	30	-20.13
Middle	2441	10.00	30	-20.00
High	2480	10.23	30	-19.77

### 9.6.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	84740/40882
Date:	2021-04-15

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	8.74	21	-12.26
Middle	2441	8.87	21	-12.13
High	2480	9.21	21	-11.79

### 9.6.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	84740/40882
Date:	2021-04-15

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	8.56	21	-12.44
Middle	2441	8.68	21	-12.32
High	2480	9.00	21	-12.00

## **9.7. AVERAGE POWER**

### **LIMITS**

None; for reporting purposes only

### **TEST PROCEDURE**

Measurements perform using a wideband gated RF power meter.

The cable assembly insertion loss of 11.04 dB (including 9.77 dB pad and 1.27 dB cable) was entered as an offset in the power meter and gated average power was measured.

### **RESULTS**

### 9.7.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	84740/40882
Date	2021-04-15

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	9.80
Middle	2441	9.92
High	2480	10.18

### 9.7.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	84740/40882
Date	2021-04-15

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.24
Middle	2441	6.41
High	2480	6.78

### 9.7.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	84740/40882
Date	2021-04-15

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.23
Middle	2441	6.42
High	2480	6.78

## **9.8. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

FCC §15.247 (d)

RSS-247 5.5

Limit = -20 dBc

### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

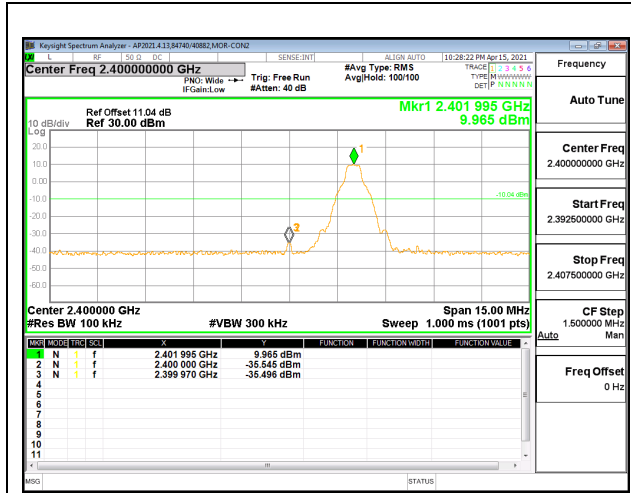
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode and non-hopping mode.

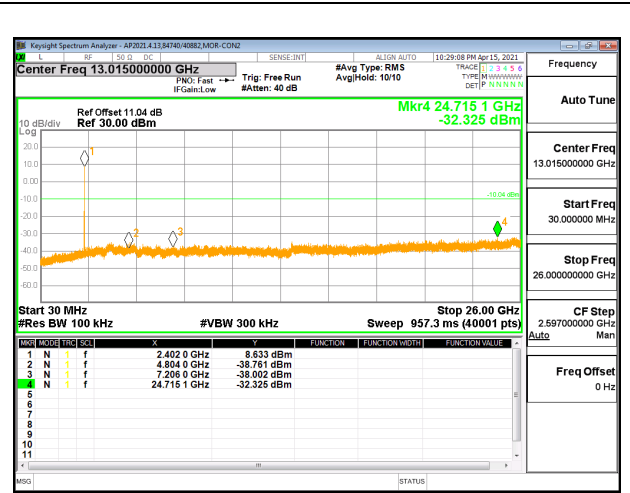
### **RESULTS**

## 9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

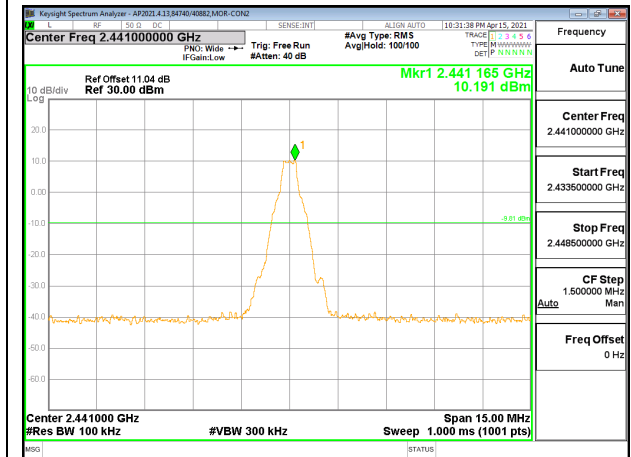
### Antenna A SPURIOUS EMISSIONS, NON-HOPPING



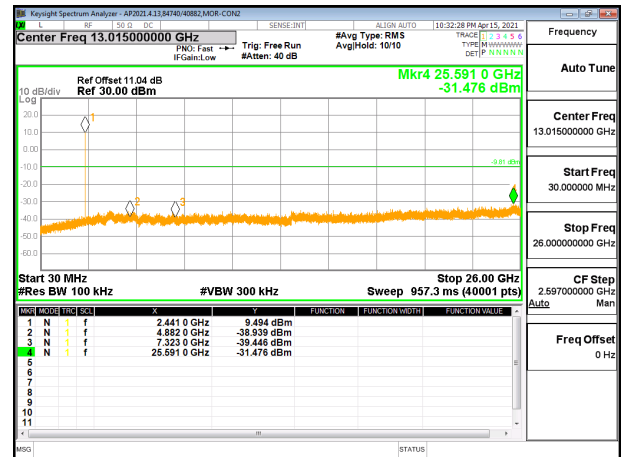
LOW CHANNEL BANDEDGE



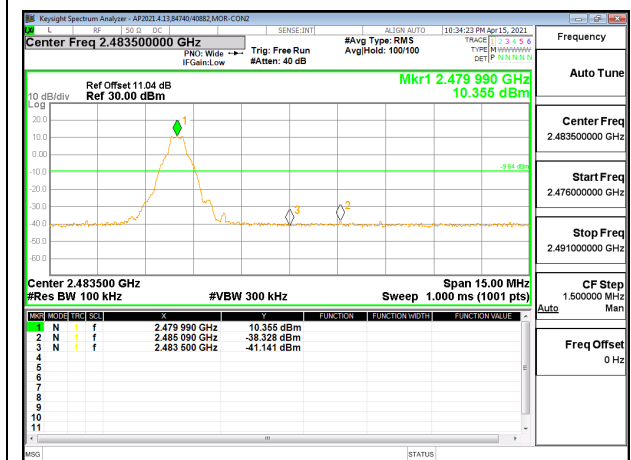
OUT-OF-BAND LOW CHANNEL



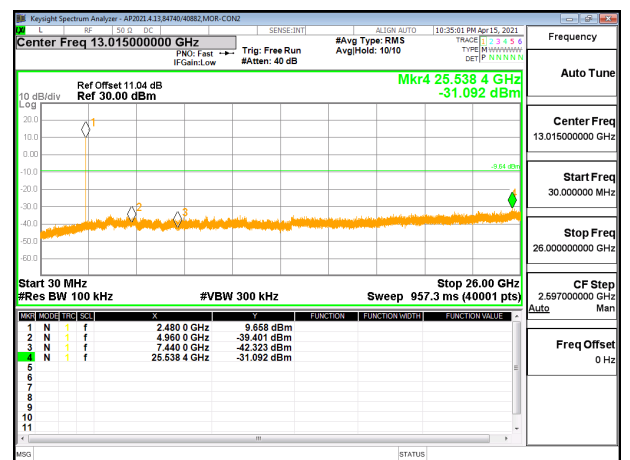
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL

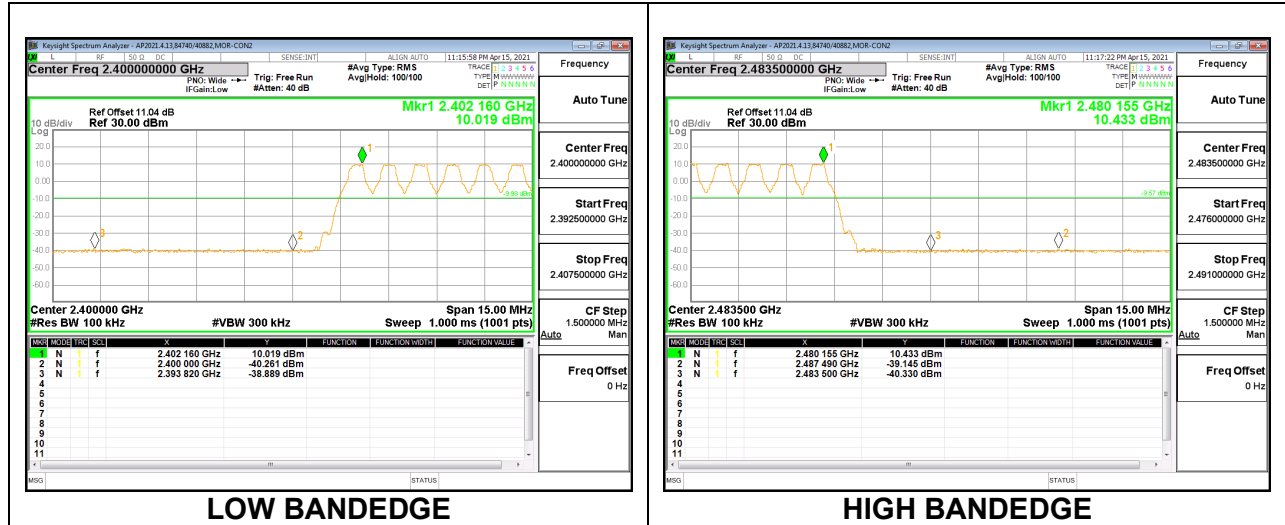


HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

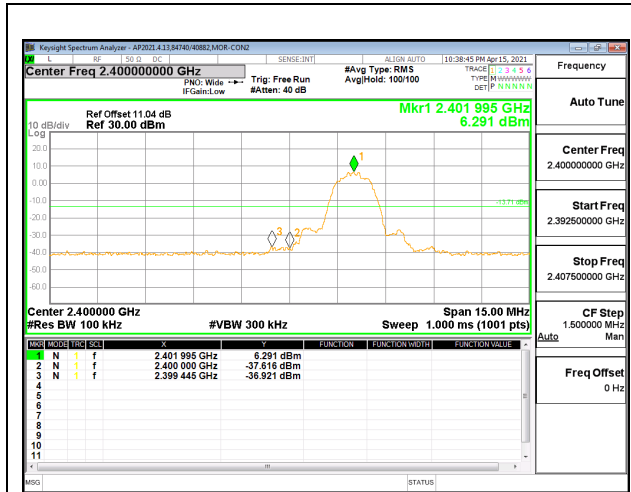
**Antenna A SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**



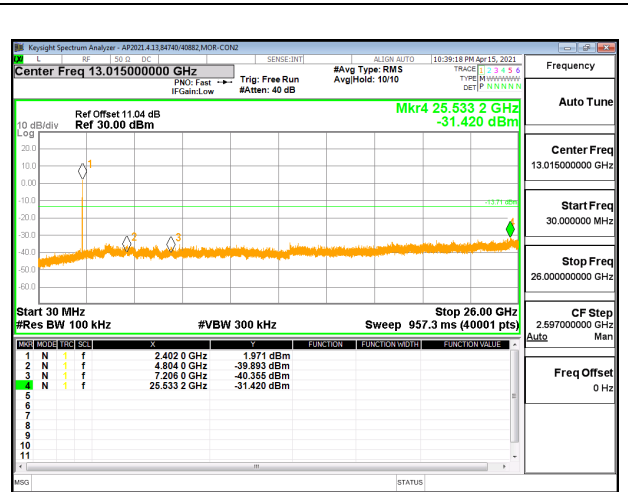


## 9.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

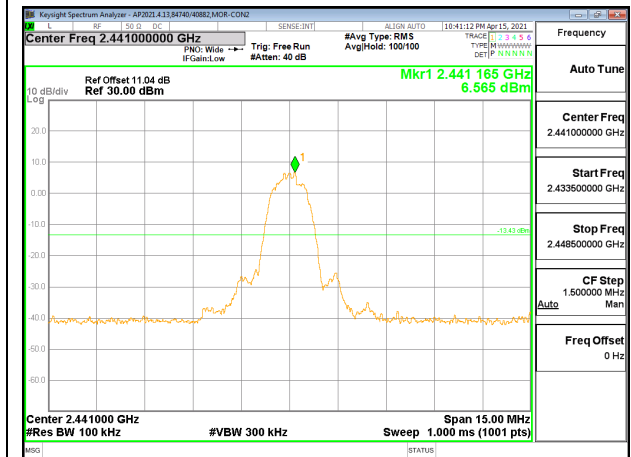
### Antenna A SPURIOUS EMISSIONS, NON-HOPPING



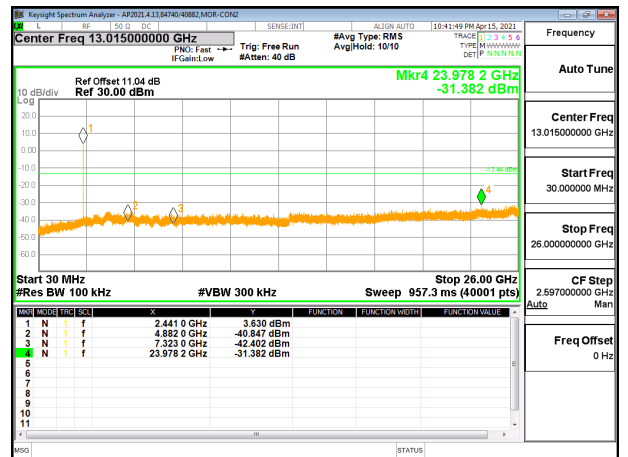
LOW CHANNEL BANDEDGE



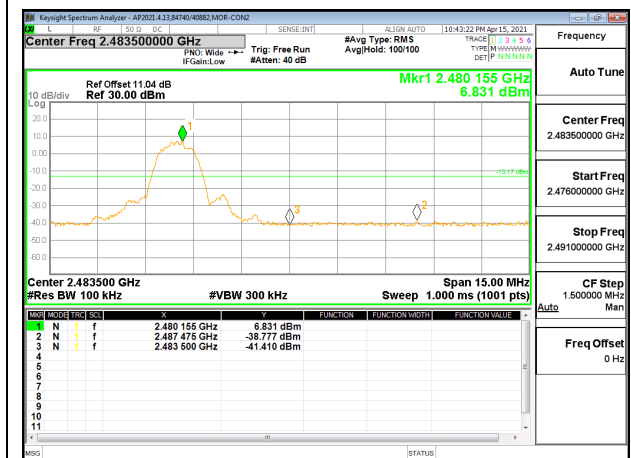
OUT-OF-BAND LOW CHANNEL



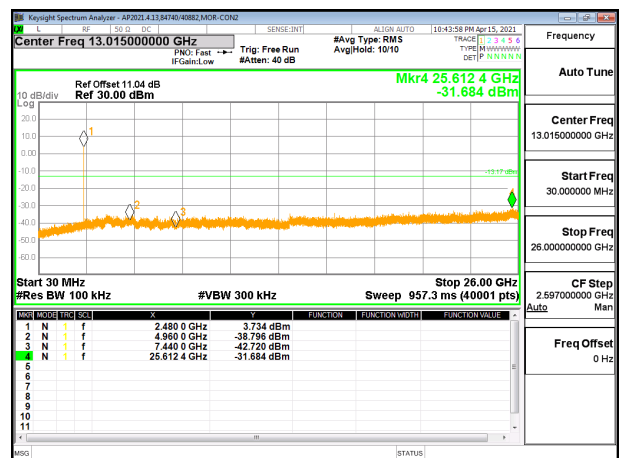
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL

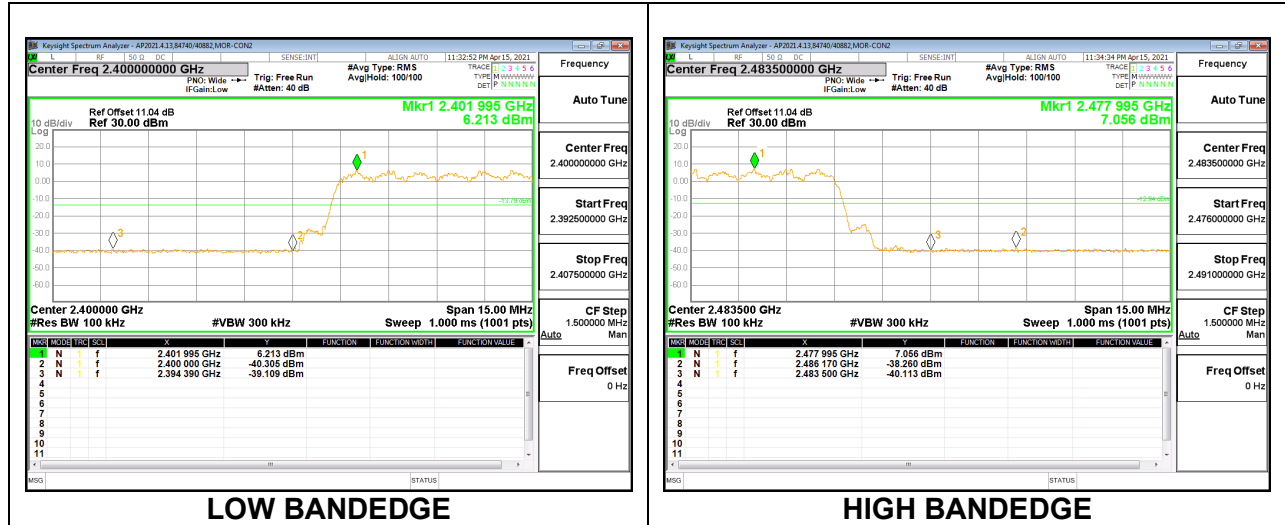


HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

**Antenna A SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**



## 10. RADIATED TEST RESULTS

### LIMITS

FCC §15.205 and §15.209

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

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	-

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 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for 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**

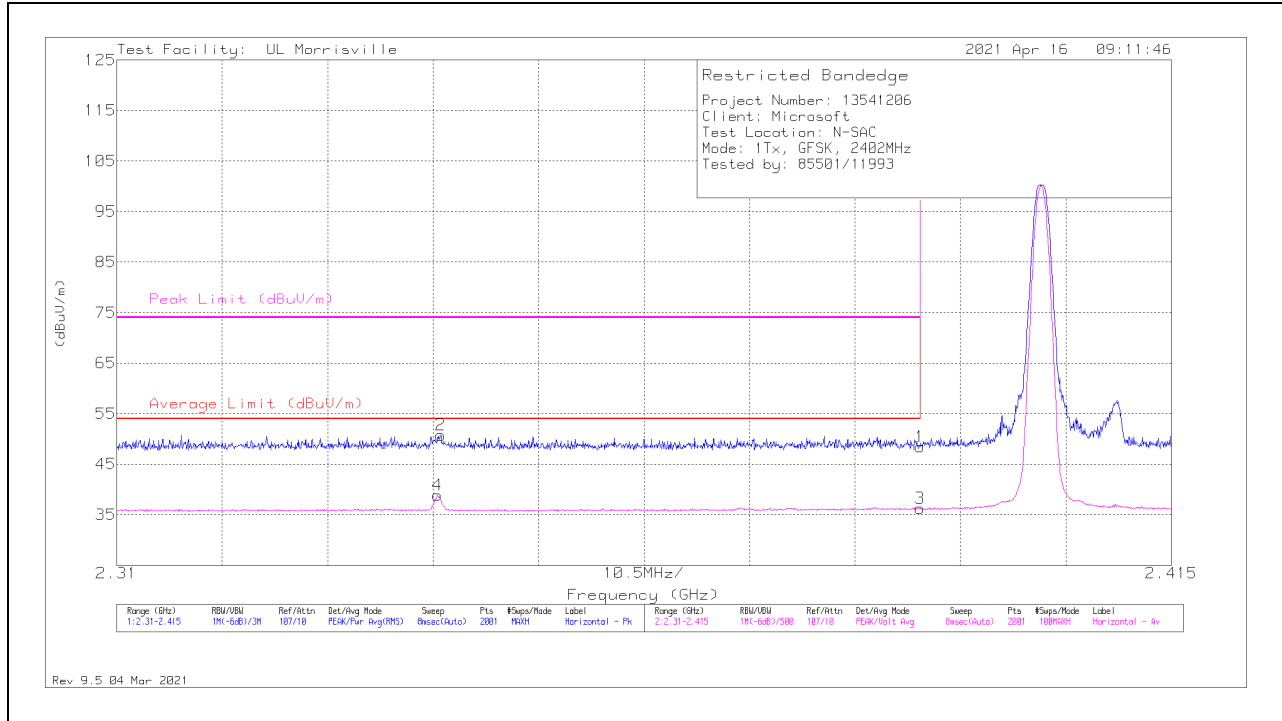
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

## 10.1. TRANSMITTER ABOVE 1 GHz

### 10.1.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

#### BANDEDGE (LOW CHANNEL)

#### HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/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	41.03	Pk	31.8	-24.4	48.43	-	-	74	-25.57	25	126	H
2	* ** 2.34224	43.53	Pk	31.7	-24.5	50.73	-	-	74	-23.27	25	126	H
3	* ** 2.38996	28.83	V1TV	31.8	-24.4	36.23	54	-17.77	-	-	25	126	H
4	* ** 2.34192	31.69	V1TV	31.7	-24.5	38.89	54	-15.11	-	-	25	126	H

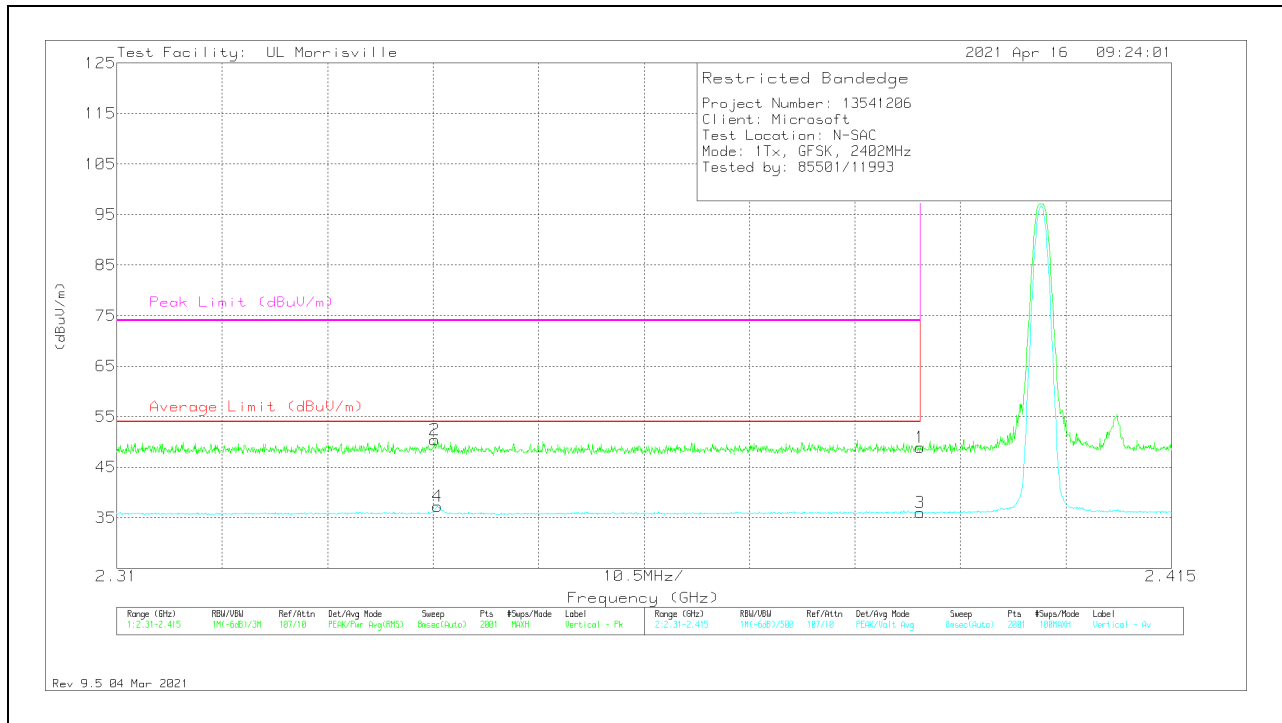
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

V1TV - VB=1/Ton, Linear Voltage Average

### VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/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	41.57	Pk	31.8	-24.4	48.97	-	-	74	-25.03	51	256	V
2	* ** 2.34166	43.2	Pk	31.7	-24.5	50.4	-	-	74	-23.6	51	256	V
3	* ** 2.38996	28.57	V1TV	31.8	-24.4	35.97	54	-18.03	-	-	51	256	V
4	* ** 2.34192	30.06	V1TV	31.7	-24.5	37.26	54	-16.74	-	-	51	256	V

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

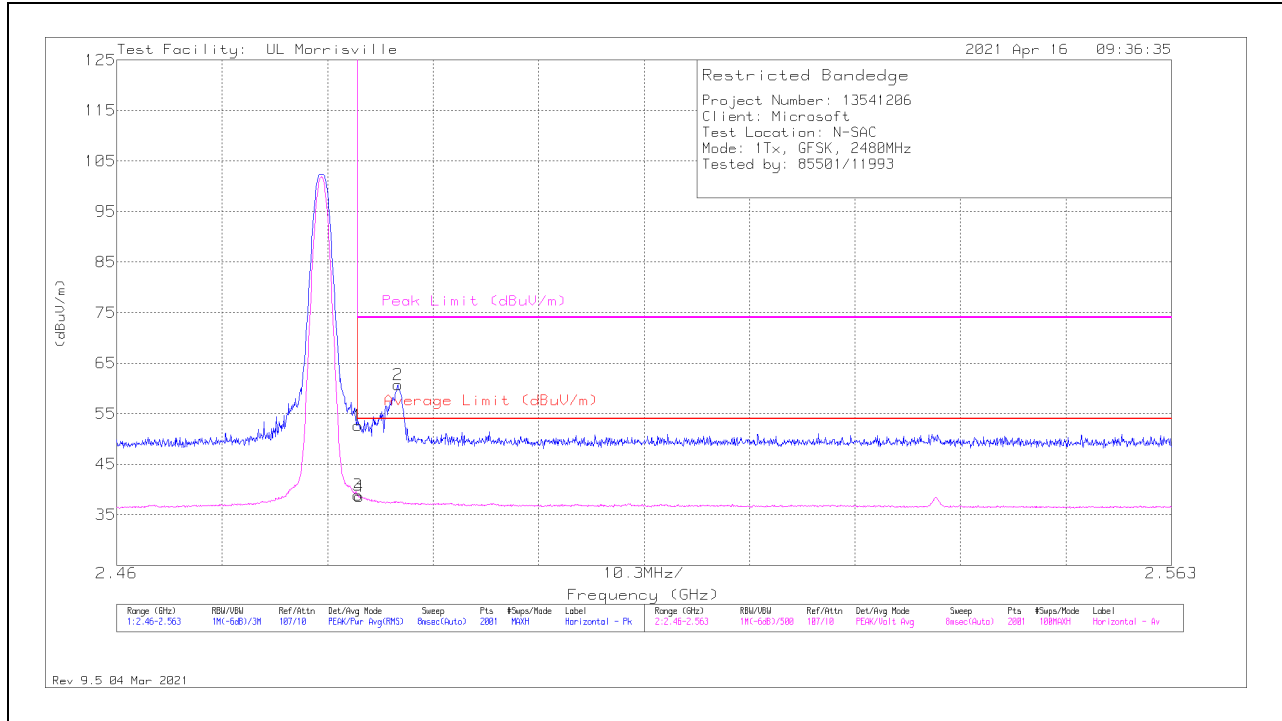
\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

V1TV - VB=1/Ton, Linear Voltage Average

**BANDEDGE (HIGH CHANNEL)**

**HORIZONTAL RESULT**



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/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	44.47	Pk	32.4	-24.2	52.67	-	-	74	-21.33	28	121	H
2	* ** 2.48745	52.37	Pk	32.5	-24.2	60.67	-	-	74	-13.33	28	121	H
3	* ** 2.48354	30.69	V1TV	32.4	-24.2	38.89	54	-15.11	-	-	28	121	H
4	* ** 2.48369	30.42	V1TV	32.4	-24.2	38.62	54	-15.38	-	-	28	121	H

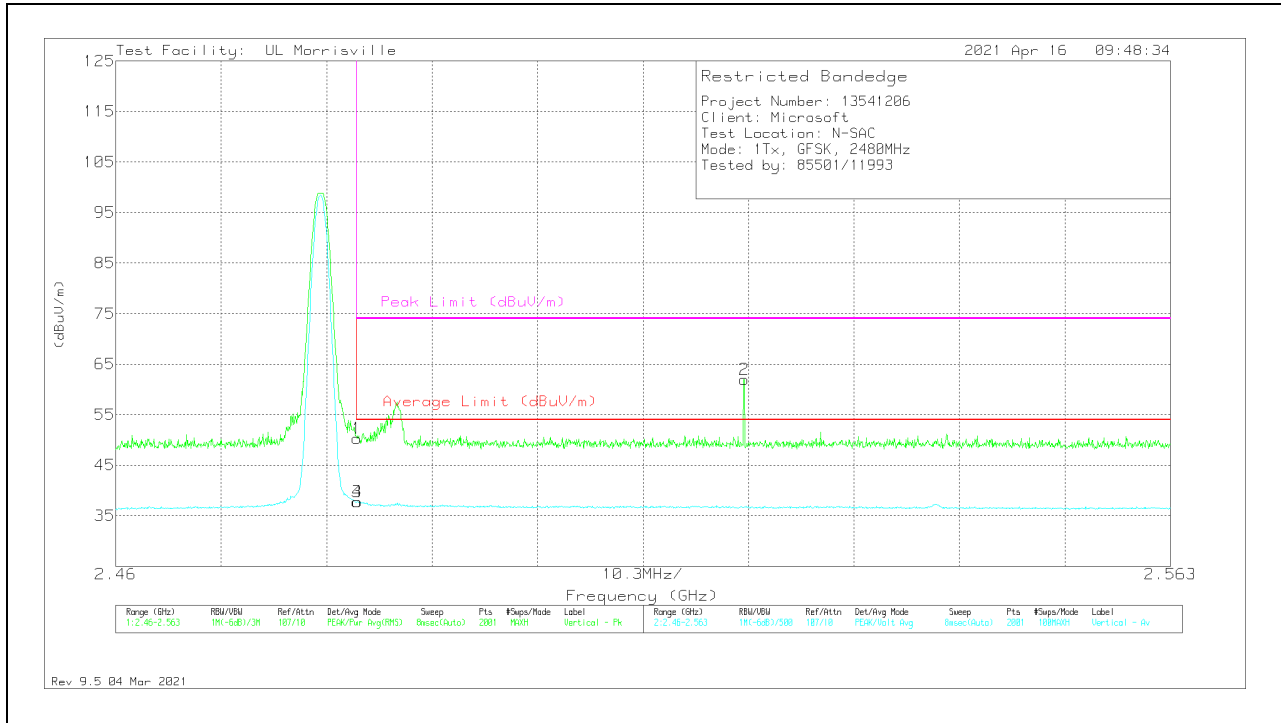
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

V1TV - VB=1/Ton, Linear Voltage Average

### VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/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	42.12	Pk	32.4	-24.2	50.32	-	-	74	-23.68	50	326	V
2	** 2.52139	53.69	Pk	32.5	-24.2	61.99	-	-	74	-12.01	50	326	V
3	* ** 2.48354	29.53	V1TV	32.4	-24.2	37.73	54	-16.27	-	-	50	326	V
4	* ** 2.48364	29.6	V1TV	32.4	-24.2	37.8	54	-16.2	-	-	50	326	V

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

\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

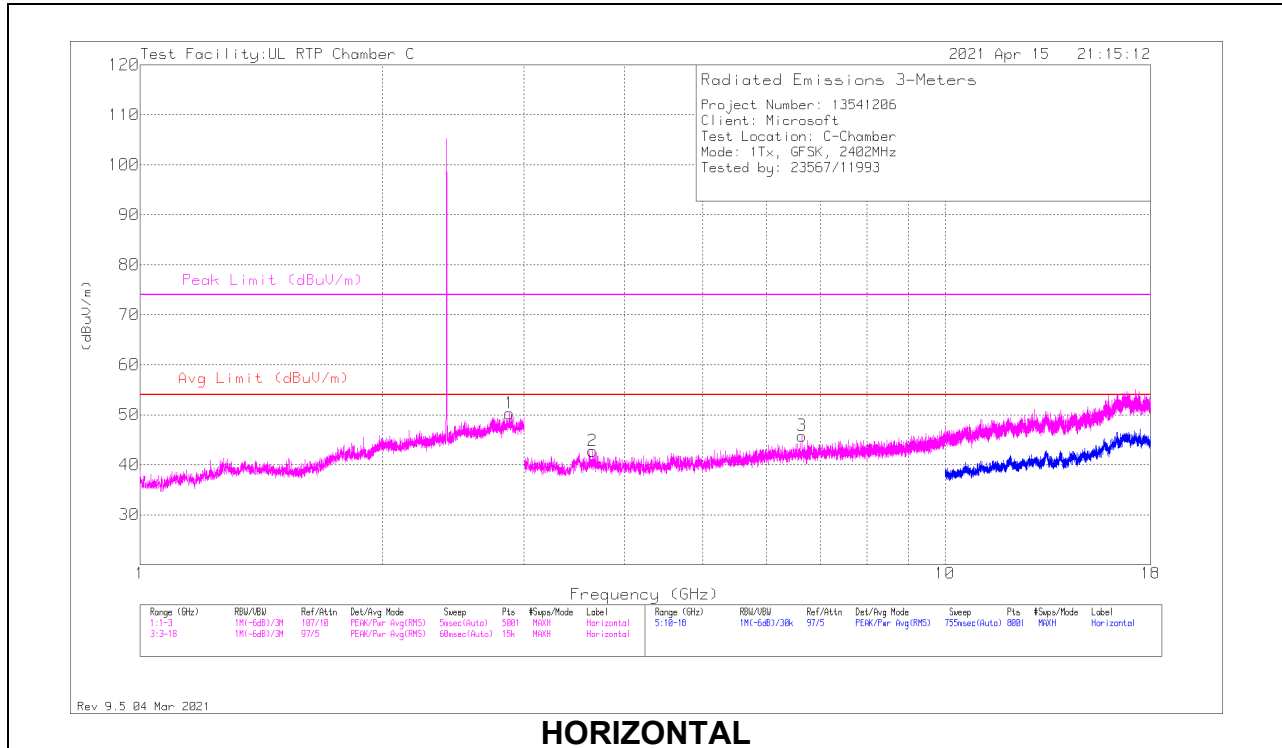
Pk - Peak detector

V1TV - VB=1/Ton, Linear Voltage Average

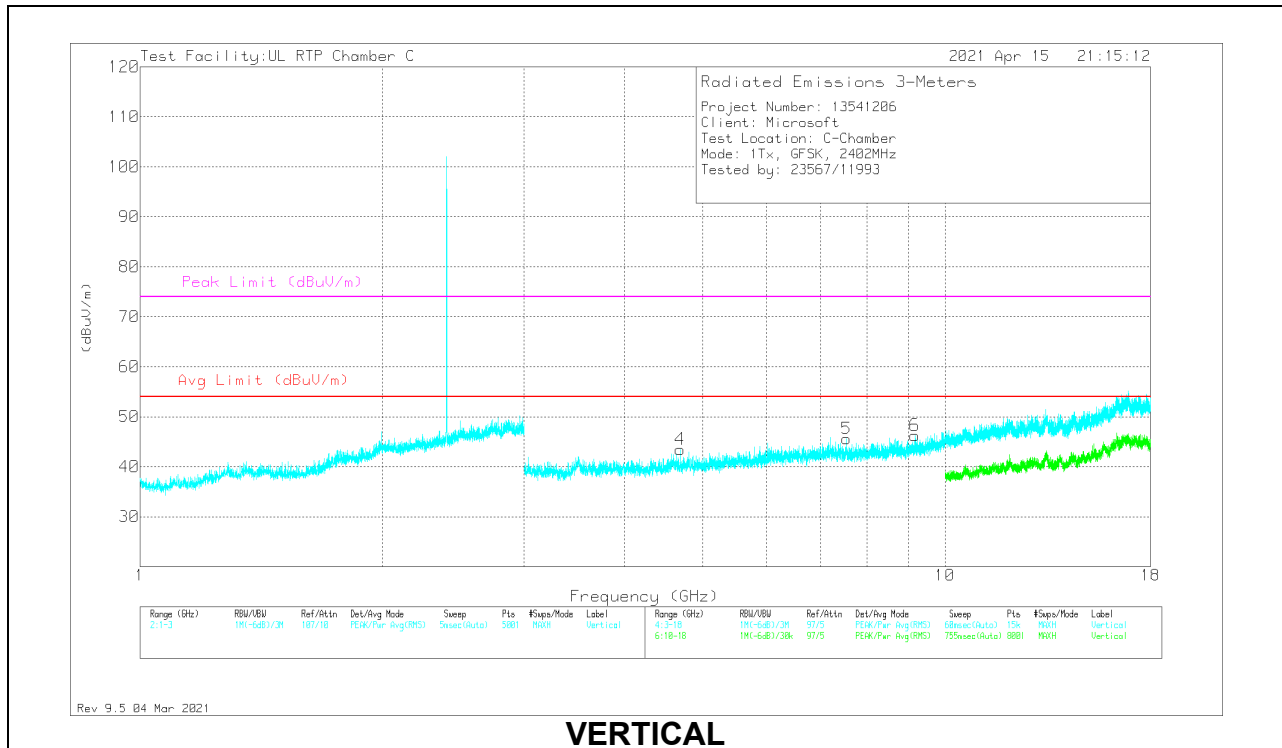


# HARMONICS AND SPURIOUS EMISSIONS

## LOW CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/Filtr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.878	34.92	PK2	32.5	-16.7	50.72	-	-	74	-23.28	3	267	H
	*** 2.87733	20.05	V1TV	32.5	-16.6	35.95	54	-18.05	-	-	3	267	H
2	*** 3.65	57.36	Pk	33.3	-47.9	42.76	54	-11.24	74	-31.24	0-360	200	H
4	*** 4.688	56.45	Pk	34.2	-47.2	43.45	54	-10.55	74	-30.55	0-360	200	V
5	*** 7.544	53.09	Pk	35.9	-43.4	45.59	54	-8.41	74	-28.41	0-360	101	V
6	*** 9.173	52.54	Pk	36.4	-42.7	46.24	54	-7.76	74	-27.76	0-360	101	V
3	6.646	55.18	Pk	35.8	-45.2	45.78	-	-	-	-	0-360	101	H

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

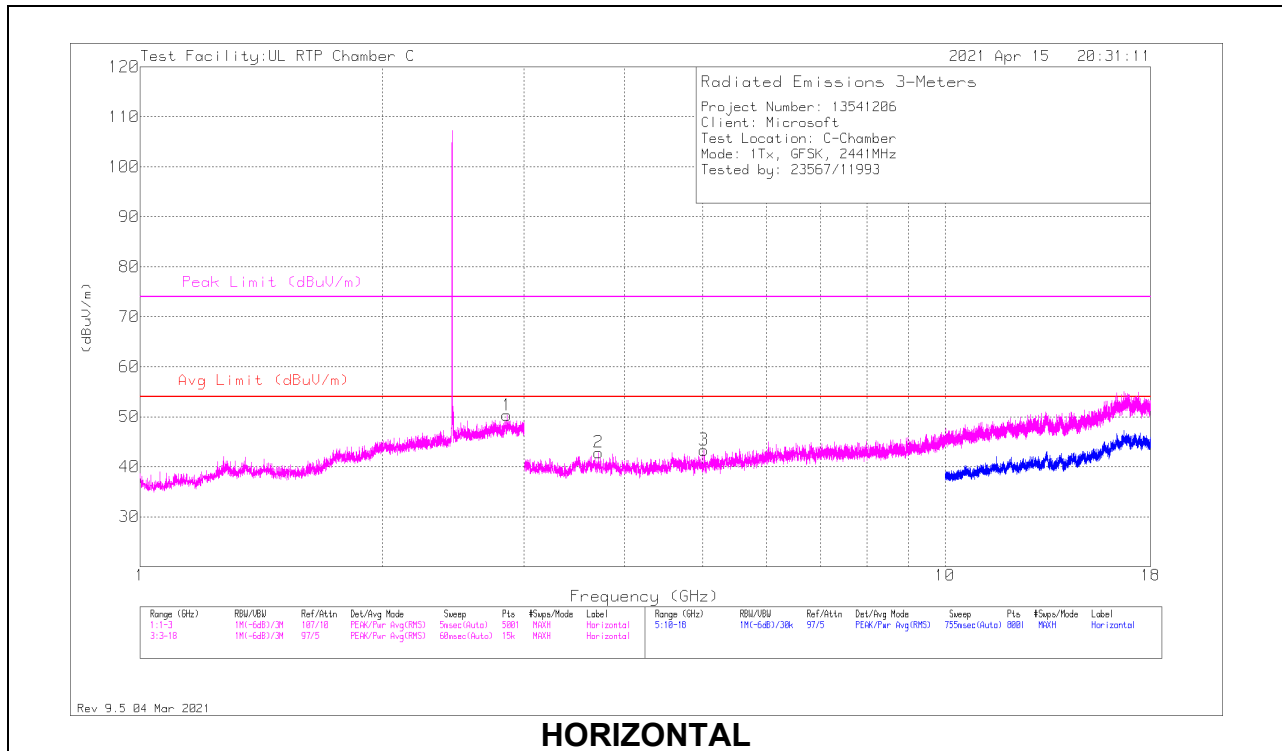
\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

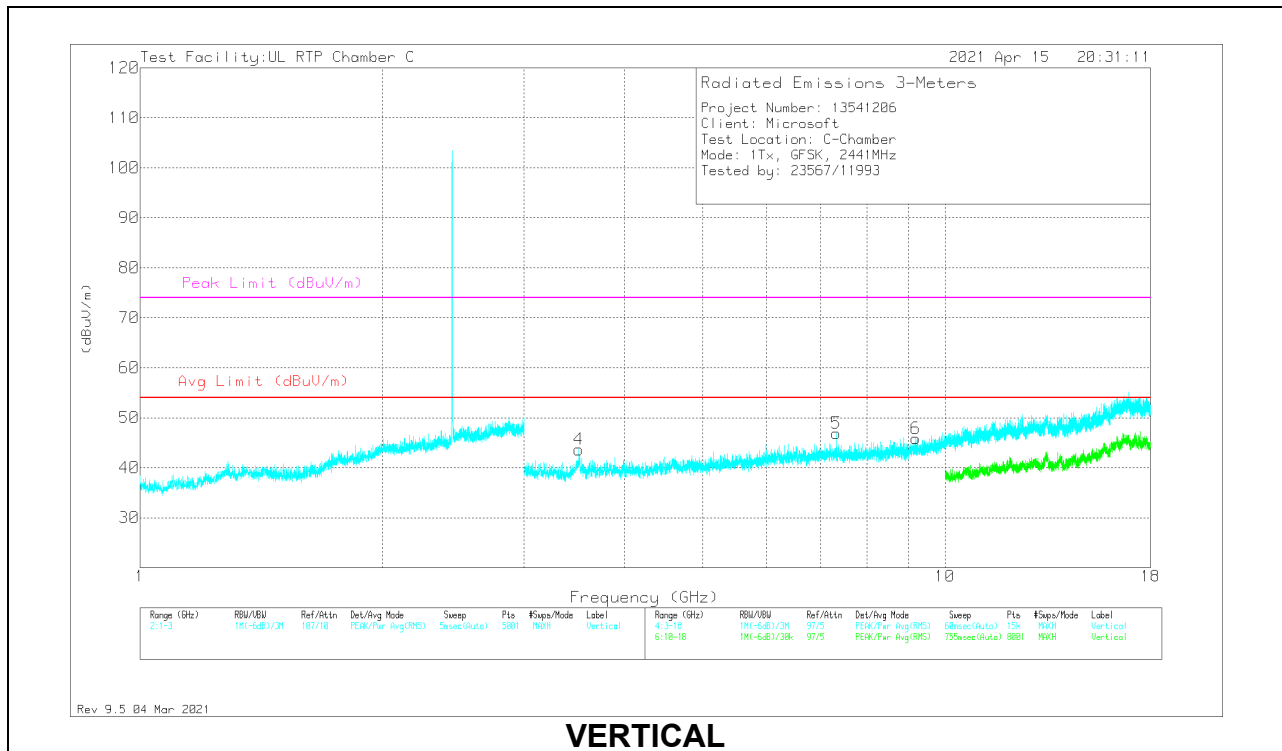
PK2 - Maximum Peak

V1TV - VB=1/Ton, Linear Voltage Average

### MID CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/Fitr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.85571	34.29	PK2	32.5	-16.7	50.09	-	-	74	-23.91	14	260	H
	* ** 2.85646	20.02	V1TV	32.5	-16.7	35.82	54	-18.18	-	-	14	260	H
2	* ** 3.711	57.55	Pk	33.3	-48	42.85	54	-11.15	74	-31.15	0-360	101	H
3	* ** 5.015	56.75	Pk	34	-47.4	43.35	54	-10.65	74	-30.65	0-360	101	H
4	* ** 3.506	56.54	Pk	34.2	-47.1	43.64	54	-10.36	74	-30.36	0-360	101	V
5	* ** 7.323	54.87	Pk	35.9	-43.9	46.87	54	-7.13	74	-27.13	0-360	101	V
6	* ** 9.197	52.03	Pk	36.4	-42.6	45.83	54	-8.17	74	-28.17	0-360	200	V

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

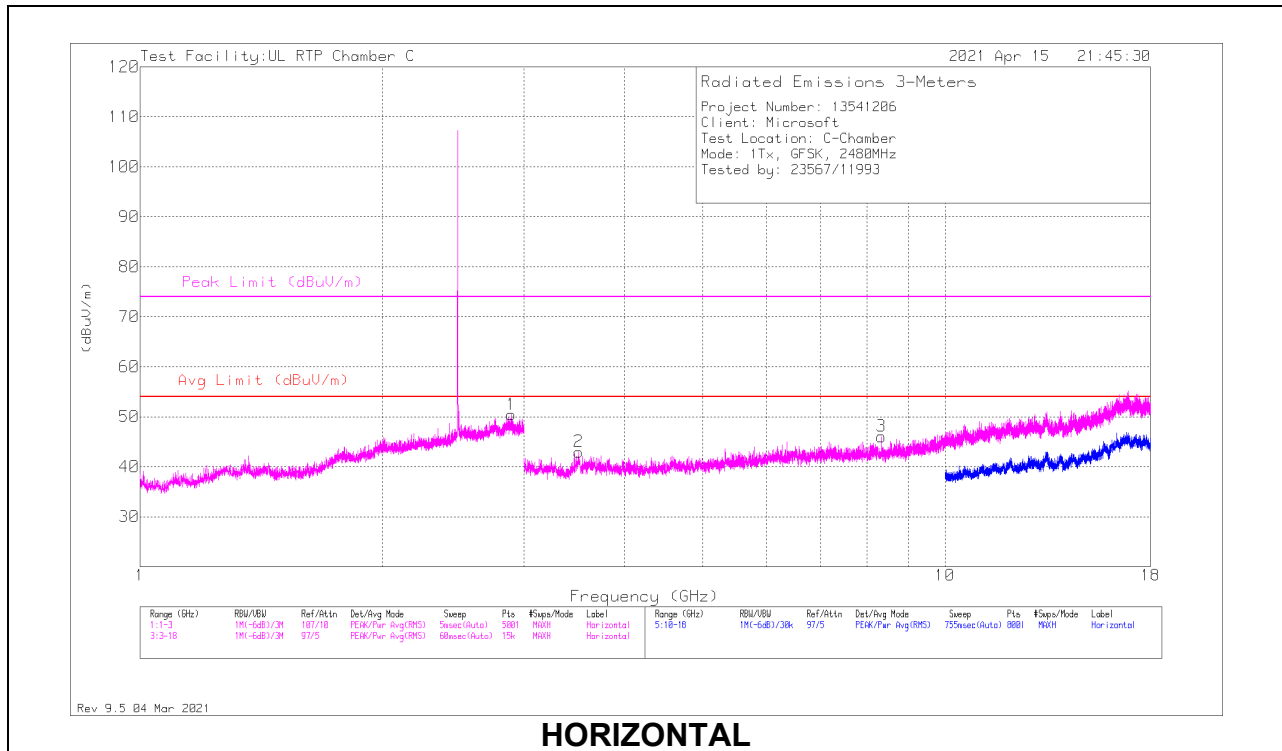
\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

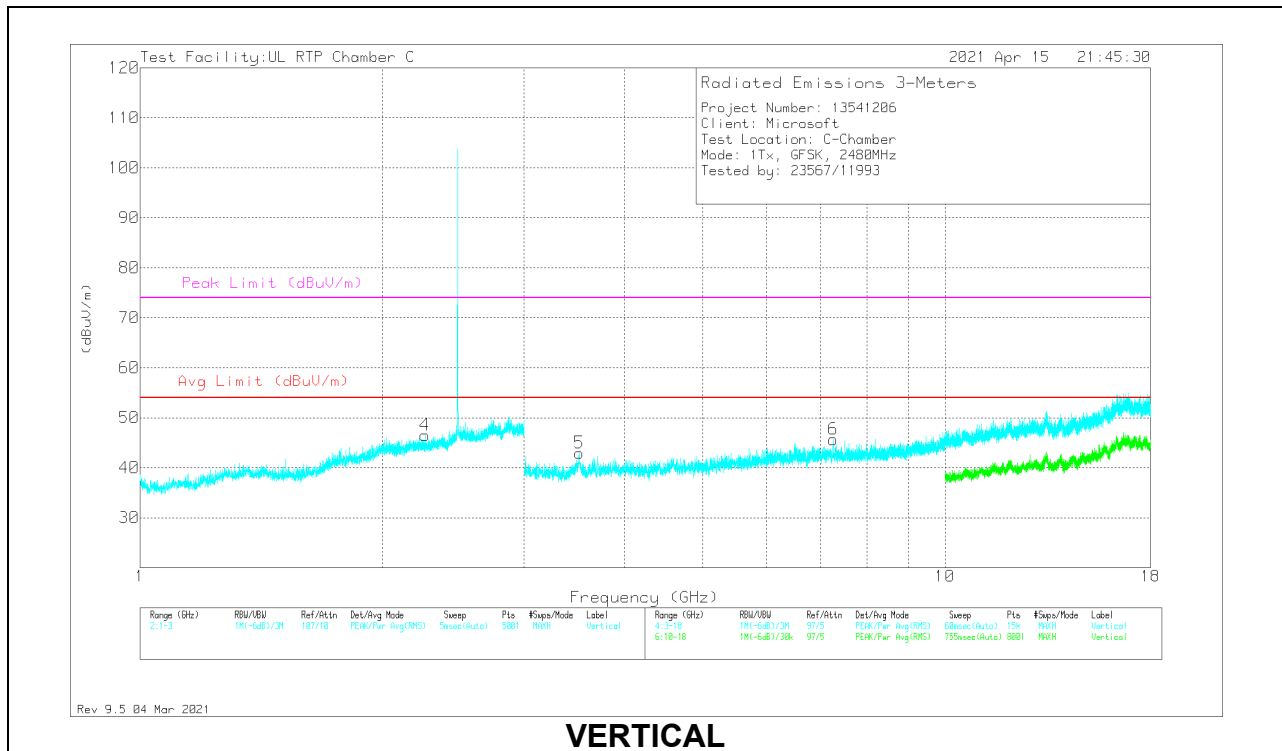
PK2 - Maximum Peak

V1TV - VB=1/Ton, Linear Voltage Average

### HIGH CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/Filtr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.89061	34.07	PK2	32.6	-16.7	49.97	-	-	74	-24.03	320	269	H
	* ** 2.89265	20.47	V1TV	32.6	-16.7	36.37	54	-17.63	-	-	320	269	H
4	* ** 2.2592	32.91	Pk	31.8	-18.2	46.51	54	-7.49	74	-27.49	0-360	101	V
2	* ** 3.506	55.88	Pk	34.2	-47.1	42.98	54	-11.02	74	-31.02	0-360	101	H
3	* ** 8.337	52.45	Pk	36	-42.4	46.05	54	-7.95	74	-27.95	0-360	101	H
5	* ** 3.511	56.24	Pk	34.1	-47.4	42.94	54	-11.06	74	-31.06	0-360	200	V
6	* ** 7.26	54.27	Pk	35.9	-44.5	45.67	54	-8.33	74	-28.33	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

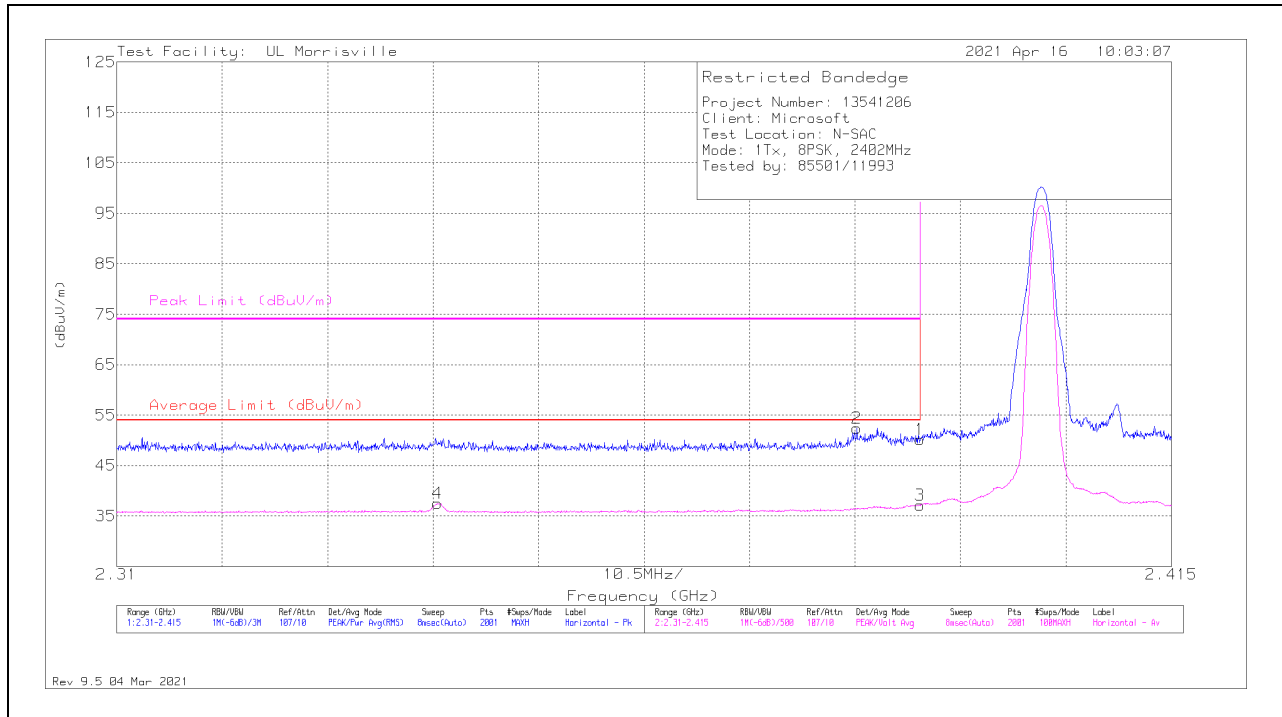
PK2 - Maximum Peak

V1TV - VB=1/Ton, Linear Voltage Average

## 10.1.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

### BANDEDGE (LOW CHANNEL)

### HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/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	42.77	Pk	31.8	-24.4	50.17	-	-	74	-23.83	29	125	H
2	* ** 2.38366	45.01	Pk	31.8	-24.4	52.41	-	-	74	-21.59	29	125	H
3	* ** 2.38996	29.73	V1TV	31.8	-24.4	37.13	54	-16.87	-	-	29	125	H
4	* ** 2.34192	30.31	V1TV	31.7	-24.5	37.51	54	-16.49	-	-	29	125	H

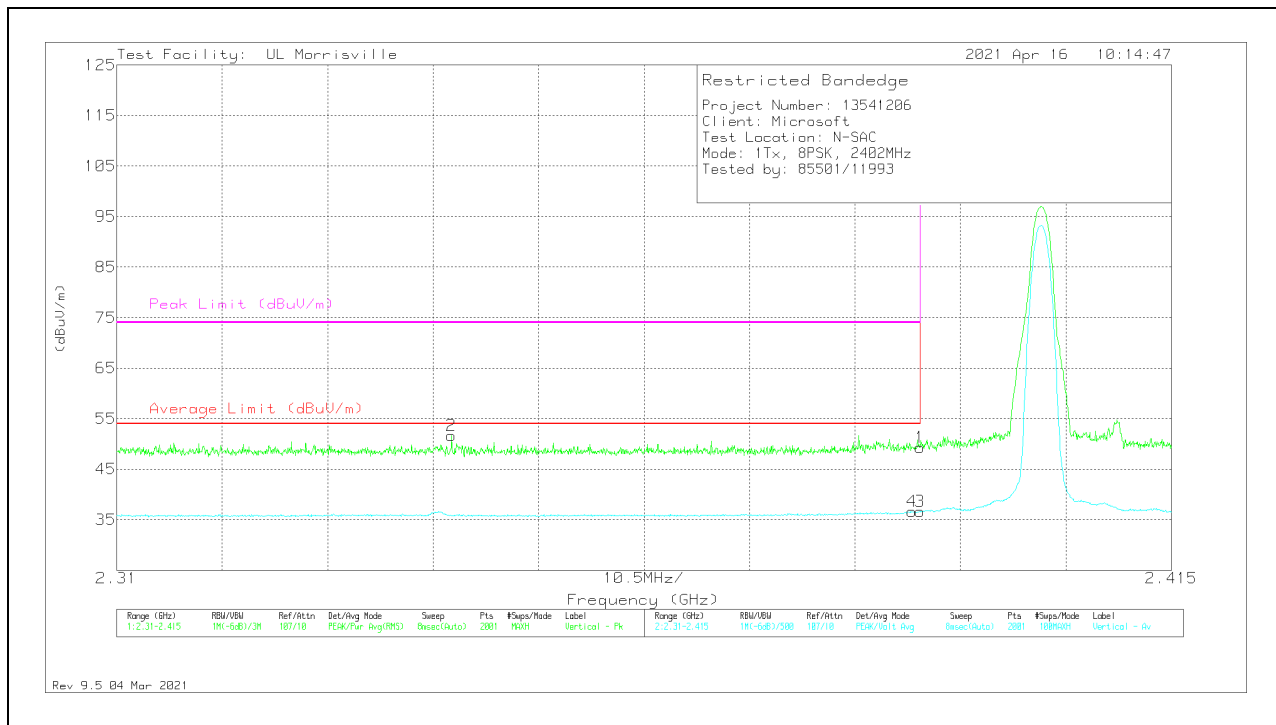
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

V1TV - VB=1/Ton, Linear Voltage Average

### VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/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	41.88	Pk	31.8	-24.4	49.28	-	-	74	-24.72	54	256	V
2	* ** 2.34334	44.45	Pk	31.7	-24.5	51.65	-	-	74	-22.35	54	256	V
3	* ** 2.38996	29.28	V1TV	31.8	-24.4	36.68	54	-17.32	-	-	54	256	V
4	* ** 2.38917	29.28	V1TV	31.8	-24.4	36.68	54	-17.32	-	-	54	256	V

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

\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

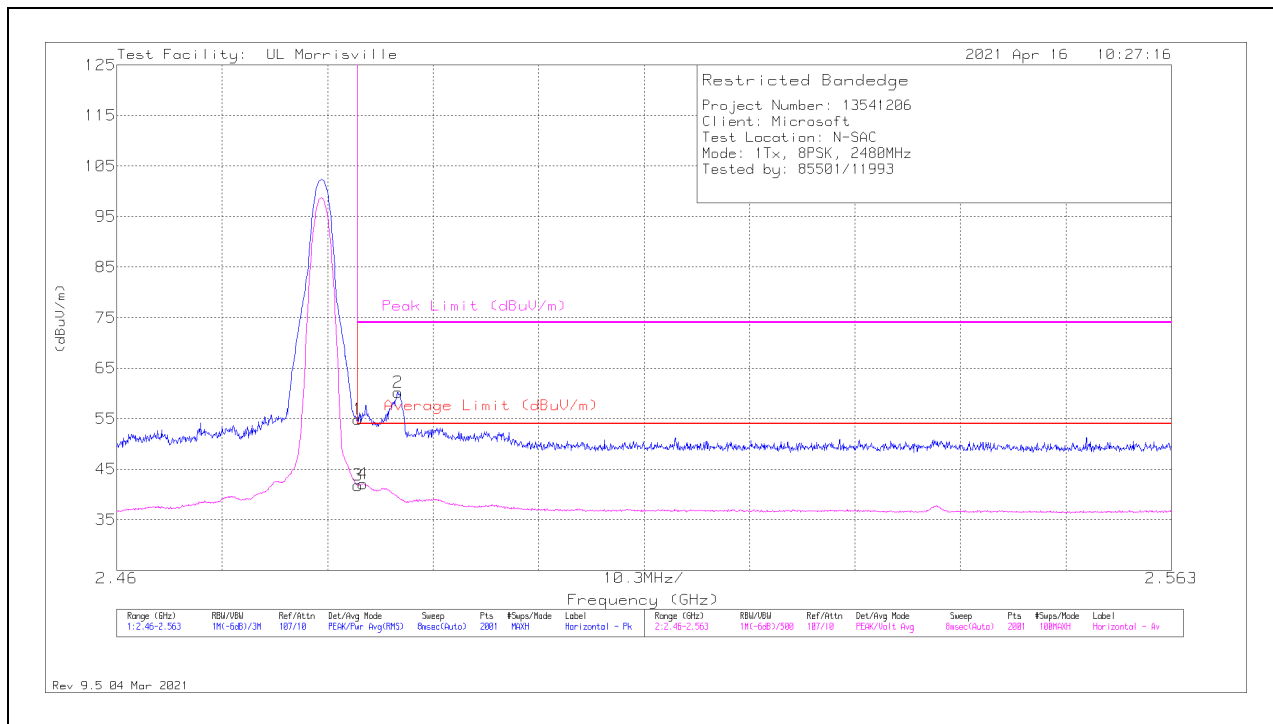
Pk - Peak detector

V1TV - VB=1/Ton, Linear Voltage Average



### BANDEDGE (HIGH CHANNEL)

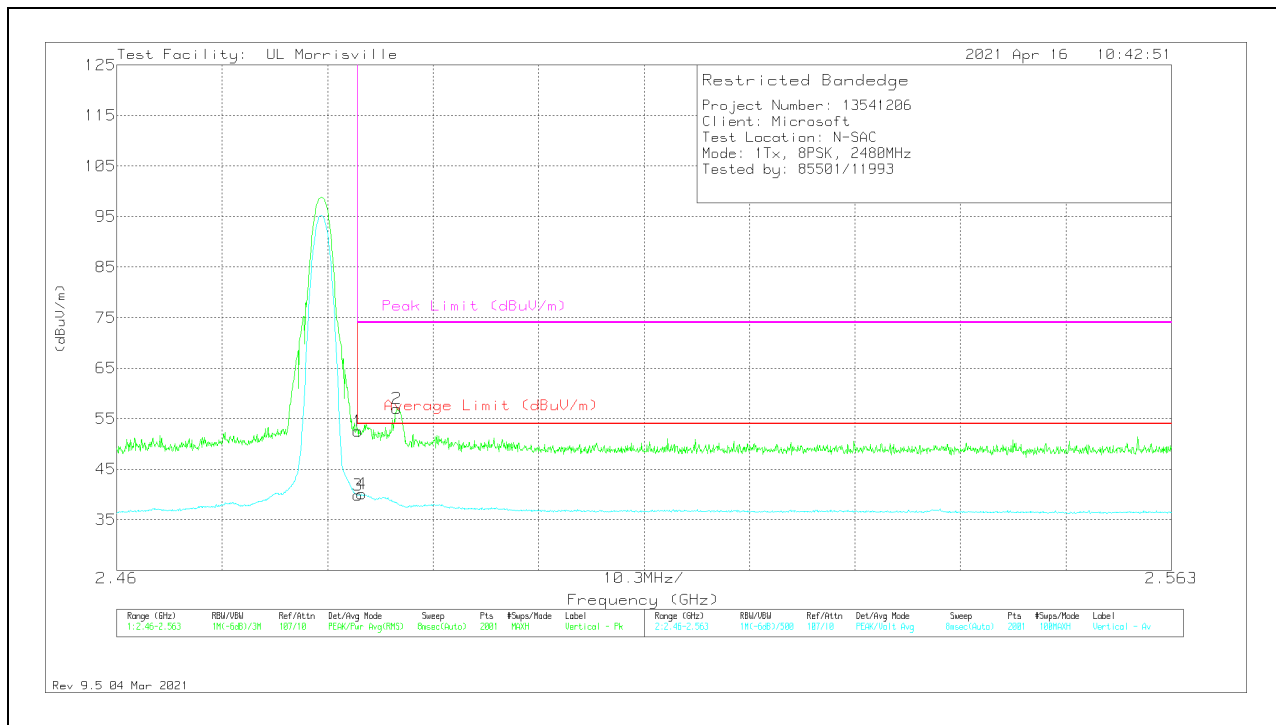
### HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/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	46.7	Pk	32.4	-24.2	54.9	-	-	74	-19.1	27	121	H
2	* ** 2.48745	51.95	Pk	32.5	-24.2	60.25	-	-	74	-13.75	27	121	H
3	* ** 2.48354	33.59	V1TV	32.4	-24.2	41.79	54	-12.21	-	-	27	121	H
4	* ** 2.48405	33.92	V1TV	32.4	-24.2	42.12	54	-11.88	-	-	27	121	H

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 \*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band  
 Pk - Peak detector  
 V1TV - VB=1/Ton, Linear Voltage Average

### VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/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	44.29	Pk	32.4	-24.2	52.49	-	-	74	-21.51	51	325	V
2	* ** 2.48735	48.68	Pk	32.5	-24.2	56.98	-	-	74	-17.02	51	325	V
3	* ** 2.48354	31.62	V1TV	32.4	-24.2	39.82	54	-14.18	-	-	51	325	V
4	* ** 2.48395	31.9	V1TV	32.4	-24.2	40.1	54	-13.9	-	-	51	325	V

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

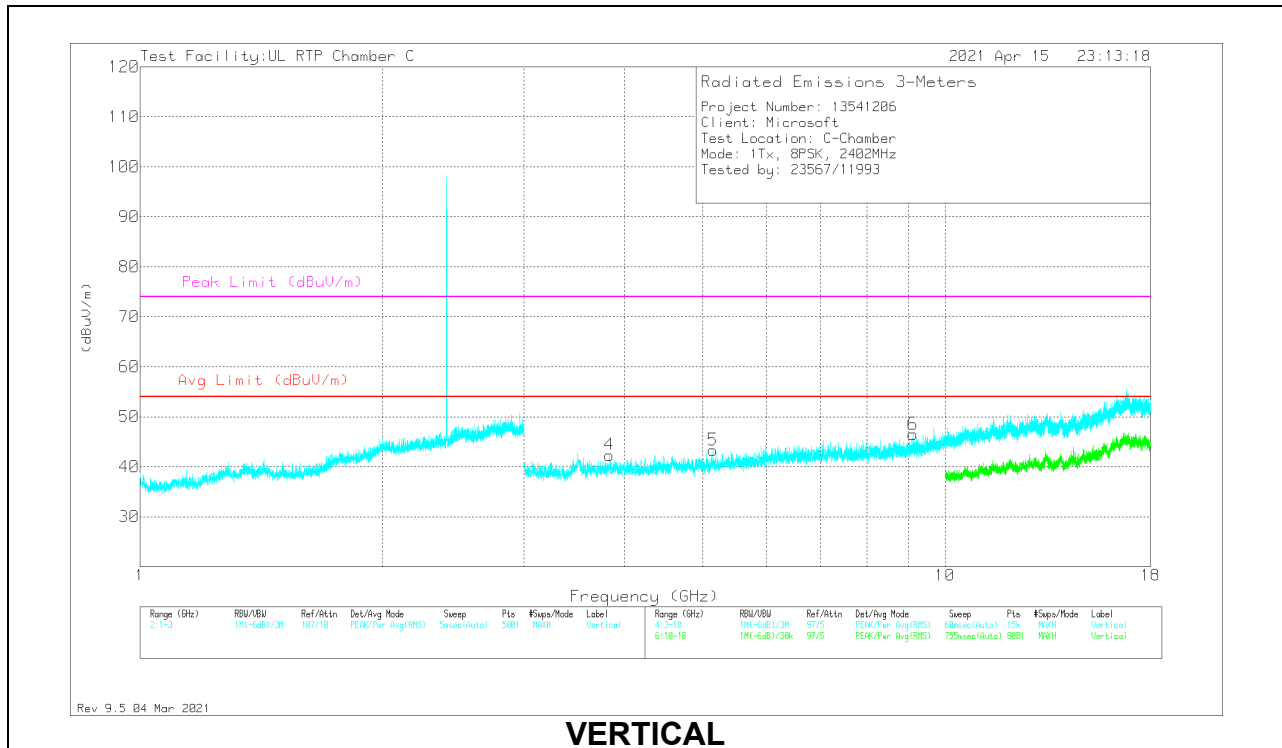
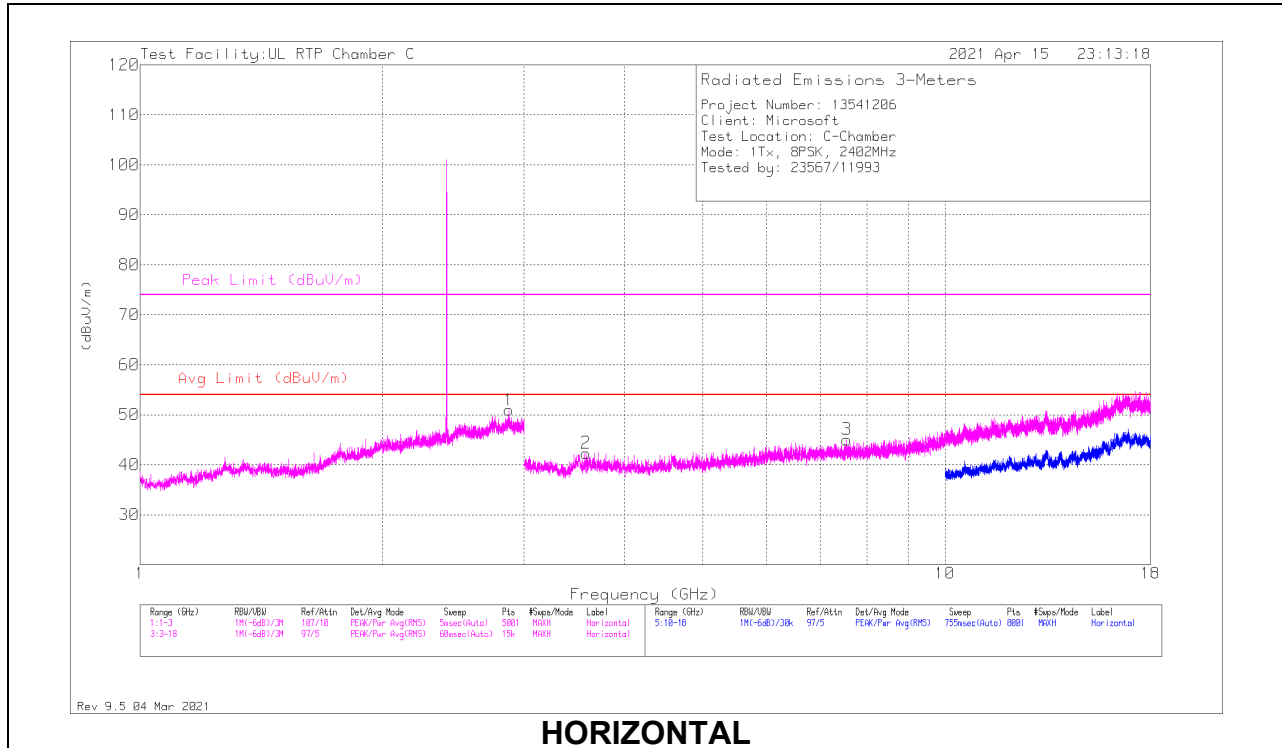
\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

V1TV - VB=1/Ton, Linear Voltage Average

# HARMONICS AND SPURIOUS EMISSIONS

## LOW CHANNEL RESULTS



**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/Filtr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.87478	34.61	PK2	32.5	-16.6	50.51	-	-	74	-23.49	97	242	H
	* ** 2.8759	20.18	V1TV	32.5	-16.6	36.08	54	-17.92	-	-	97	242	H
2	* ** 3.582	58.01	Pk	33.2	-48.9	42.31	54	-11.69	74	-31.69	0-360	101	H
3	* ** 7.55	52.52	Pk	36	-43.5	45.02	54	-8.98	74	-28.98	0-360	200	H
4	* ** 3.828	56.25	Pk	33.5	-47.4	42.35	54	-11.65	74	-31.65	0-360	200	V
5	* ** 5.145	55.01	Pk	34.3	-46	43.31	54	-10.69	74	-30.69	0-360	101	V
6	* ** 9.125	52.3	Pk	36.4	-42.2	46.5	54	-7.5	74	-27.5	0-360	101	V

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

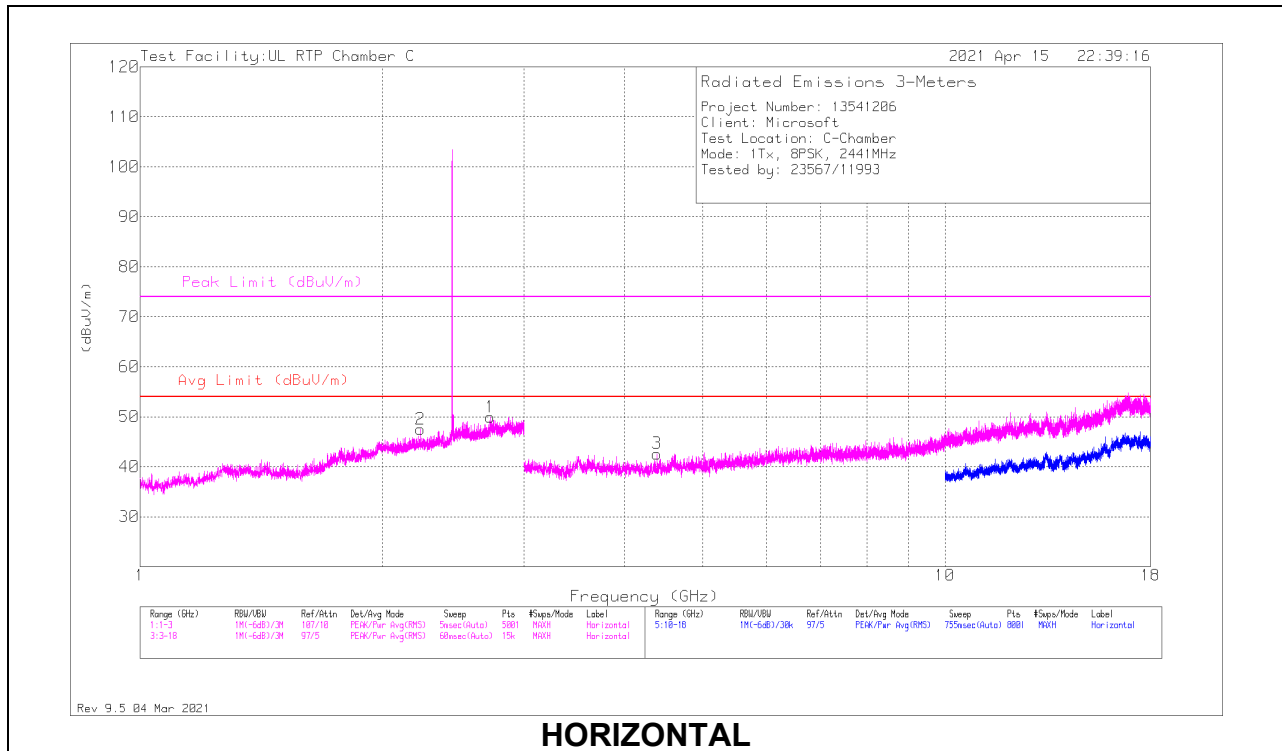
\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

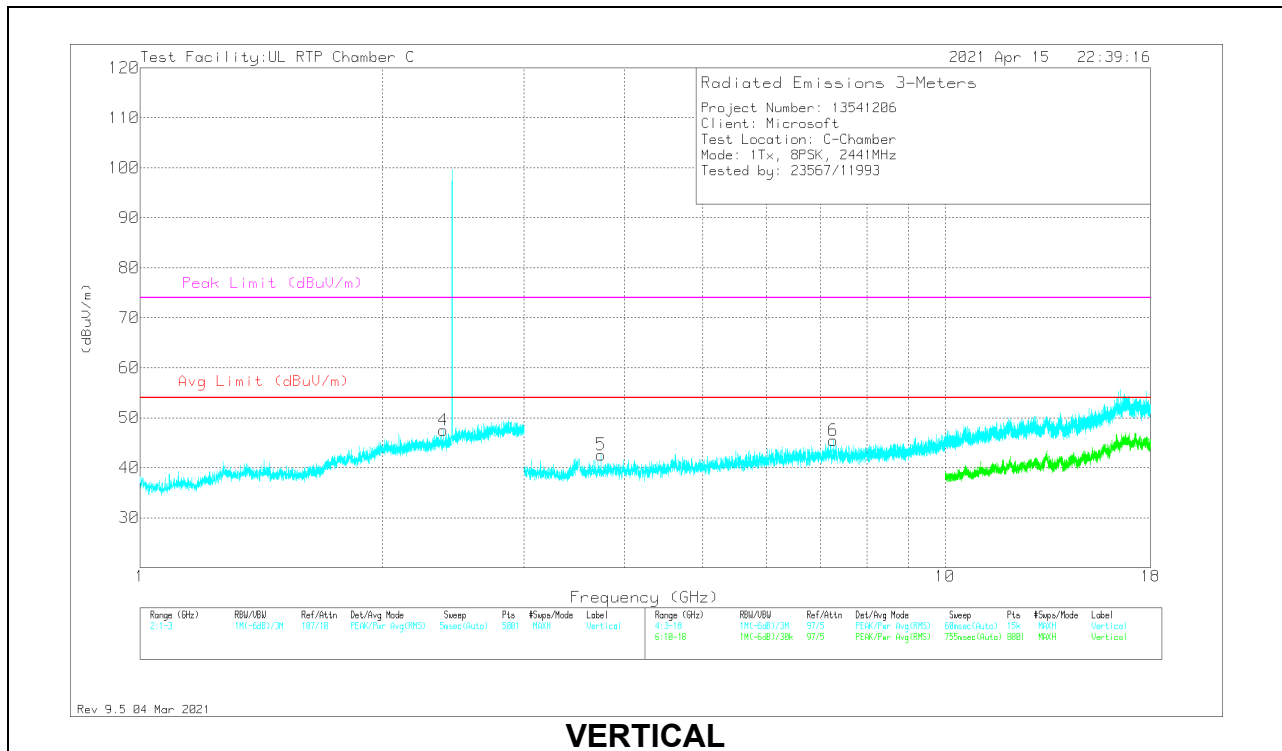
PK2 - Maximum Peak

V1TV - VB=1/Ton, Linear Voltage Average

### MID CHANNEL RESULTS



### HORIZONTAL



### VERTICAL

**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/Filtr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.72241	34.34	PK2	32.4	-17.1	49.64	-	-	74	-24.36	131	159	H
	* ** 2.72263	20.14	V1TV	32.4	-17.1	35.44	54	-18.56	-	-	131	159	H
2	* ** 2.23	33.79	Pk	32	-18.3	47.49	54	-6.51	74	-26.51	0-360	199	H
4	* ** 2.3808	33.68	Pk	32.1	-18.3	47.48	54	-6.52	74	-26.52	0-360	200	V
3	* ** 4.388	55.8	Pk	33.8	-47	42.6	54	-11.4	74	-31.4	0-360	200	H
5	* ** 3.737	57.48	Pk	33.4	-48.3	42.58	54	-11.42	74	-31.42	0-360	200	V
6	* ** 7.264	53.95	Pk	35.9	-44.4	45.45	54	-8.55	74	-28.55	0-360	200	V

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

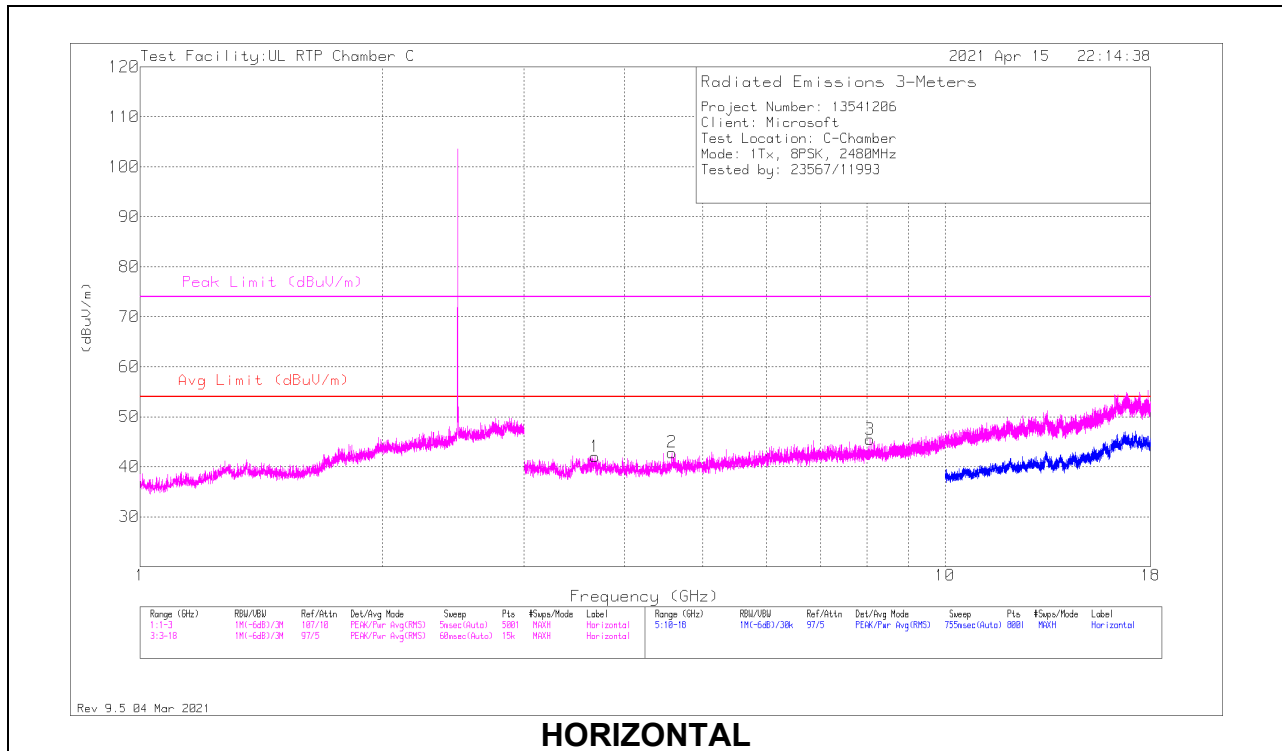
\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

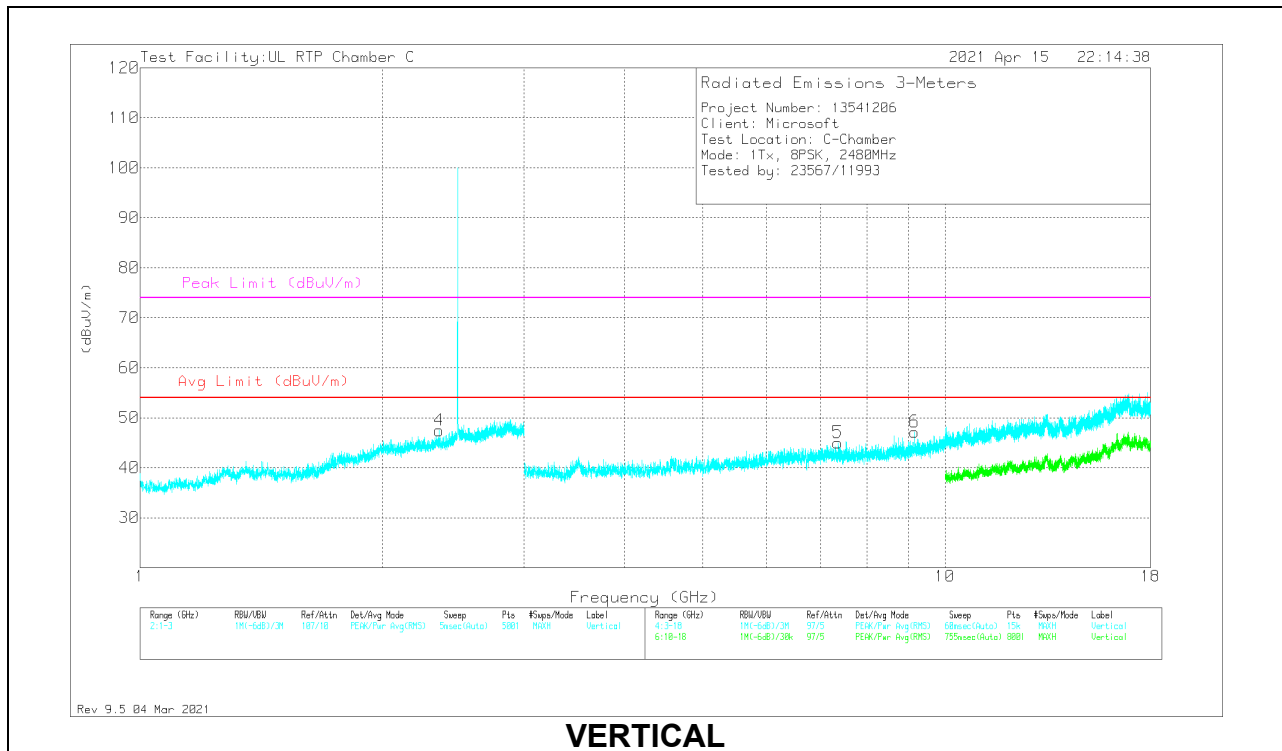
PK2 - Maximum Peak

V1TV - VB=1/Ton, Linear Voltage Average

### HIGH CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/Filtr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	*** 2.352	33.56	Pk	32	-18.1	47.46	54	-6.54	74	-26.54	0-360	200	V
1	*** 3.676	56.71	Pk	33.3	-48	42.01	54	-11.99	74	-31.99	0-360	200	H
2	*** 4.582	54.66	Pk	34.3	-46.1	42.86	54	-11.14	74	-31.14	0-360	101	H
3	*** 8.073	53.05	Pk	36	-43.6	45.45	54	-8.55	74	-28.55	0-360	101	H
5	*** 7.359	53.31	Pk	35.9	-44.2	45.01	54	-8.99	74	-28.99	0-360	200	V
6	*** 9.17	53.37	Pk	36.4	-42.6	47.17	54	-6.83	74	-26.83	0-360	200	V

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

\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

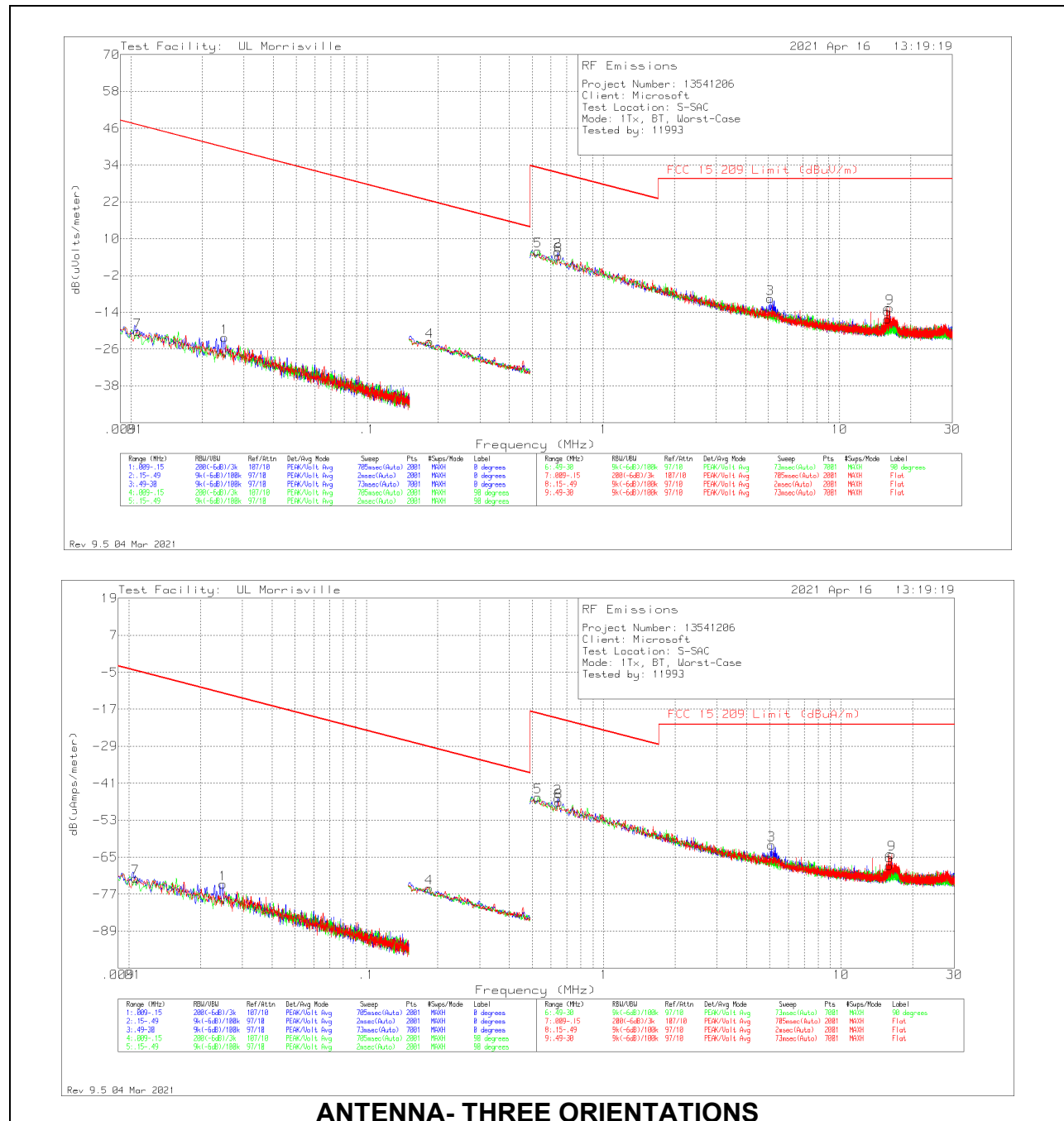
Pk - Peak detector



## 10.2. 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  $40 \cdot \text{Log}(\text{test distance} / \text{specification distance})$ .

### 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 Avg/QP Limit (dBuV/m)	FCC 15.209 Pk Limit (dBuV/m)	Worst-Case Margin (dB)	Azimuth (Degs)	Antenna Face
1	.02483	44.19	Pk	13.5	.1	-80	-22.21	39.7	59.7	-61.91	0-360	On
2	.64178	34.75	Pk	10.8	.2	-40	5.75	31.46	-	-25.71	0-360	On
3	5.08544	19.04	Pk	11	.4	-40	-9.56	29.54	-	-39.1	0-360	On
4	.18375	45.58	Pk	10.8	.1	-80	-23.52	22.32	42.32	-45.84	0-360	Off
5	.52794	35.07	Pk	10.8	.1	-40	5.97	33.15	-	-27.18	0-360	Off
6	15.95007	12.57	Pk	10.3	.8	-40	-16.33	29.54	-	-45.87	0-360	Off
7	.01063	41.97	Pk	17.6	.1	-80	-20.33	47.07	67.07	-67.4	0-360	Flat
8	.64599	33.43	Pk	10.8	.2	-40	4.43	31.4	-	-26.97	0-360	Flat
9	16.32951	16.3	Pk	10.3	.8	-40	-12.6	29.54	-	-42.14	0-360	Flat

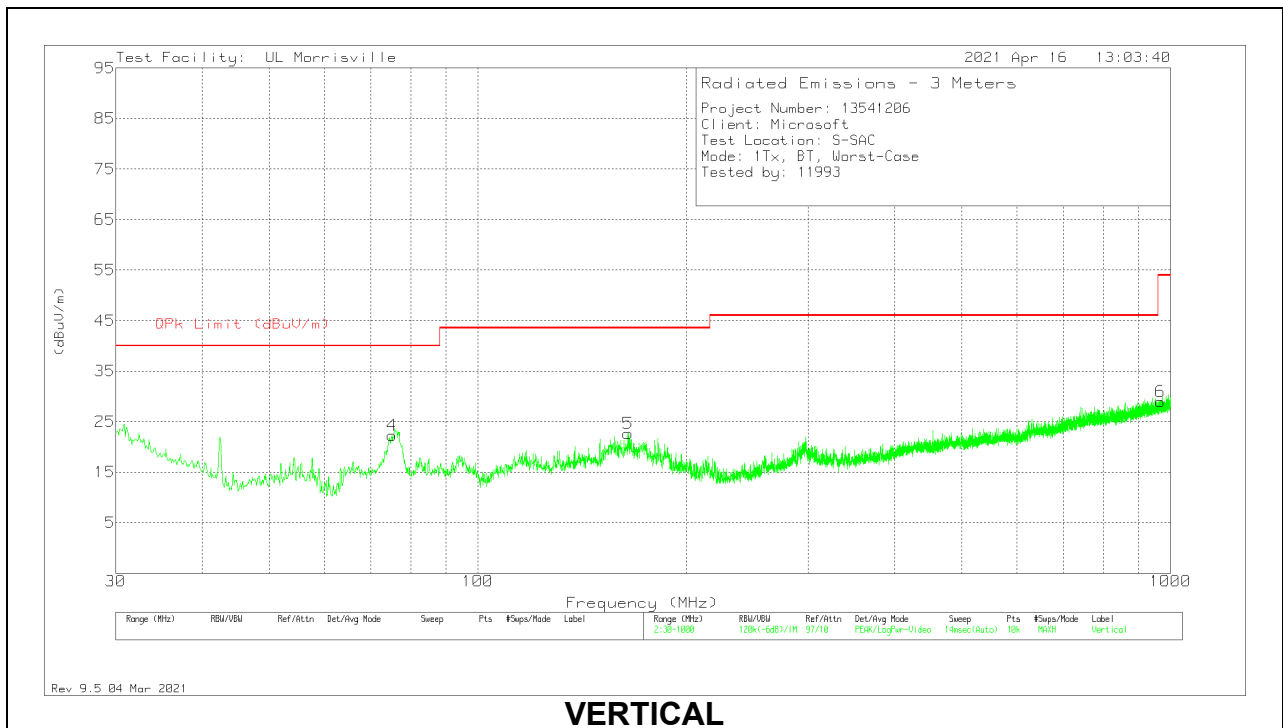
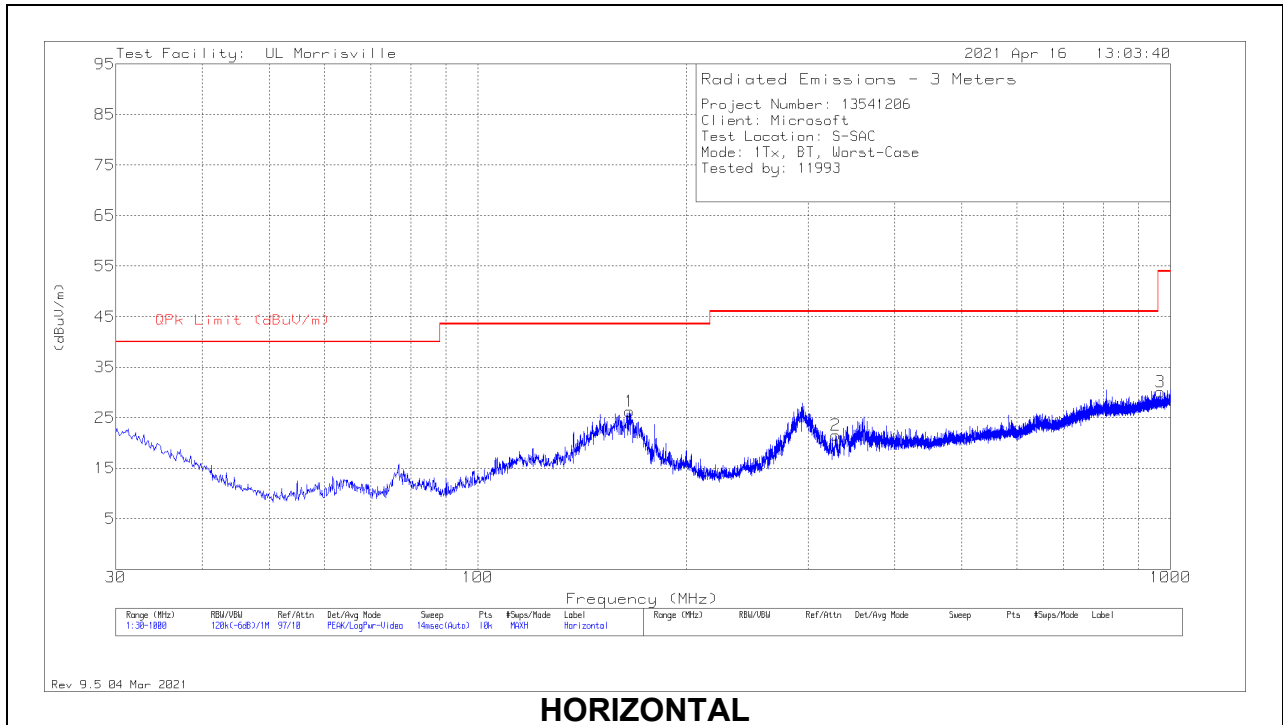
Pk - Peak detection

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uAmps/meter)	RSS-GEN Avg/QP Limit (dBuA/m)	RSS-GEN Pk Limit (dBuA/m)	Worst-Case Margin (dB)	Azimuth (Degs)	Antenna Face
1	.02483	44.19	Pk	-38	.1	-80	-73.71	-11.8	8.2	-61.91	0-360	On
2	.64178	34.75	Pk	-40.7	.2	-40	-45.75	-20.04	-	-25.71	0-360	On
3	5.08544	19.04	Pk	-40.5	.4	-40	-61.06	-21.96	-	-39.1	0-360	On
4	.18375	45.58	Pk	-40.7	.1	-80	-75.02	-29.18	-9.18	-45.84	0-360	Off
5	.52794	35.07	Pk	-40.7	.1	-40	-45.53	-18.35	-	-27.18	0-360	Off
6	15.95007	12.57	Pk	-41.2	.8	-40	-67.83	-21.96	-	-45.87	0-360	Off
7	.01063	41.97	Pk	-33.9	.1	-80	-71.83	-4.43	16.57	-67.4	0-360	Flat
8	.64599	33.43	Pk	-40.7	.2	-40	-47.07	-20.1	-	-26.97	0-360	Flat
9	16.32951	16.3	Pk	-41.2	.8	-40	-64.1	-21.96	-	-42.14	0-360	Flat

Pk - Peak detector

### 10.3. WORST CASE BELOW 1 GHZ

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



**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	* ** 165.509	37.88	Pk	18.3	-29.9	26.28	43.52	-17.24	0-360	199	H
2	* ** 328.857	30.02	Pk	20.1	-28.6	21.52	46.02	-24.5	0-360	101	H
3	* ** 966.438	25.83	Pk	29.1	-24.8	30.13	53.97	-23.84	0-360	101	H
4	* ** 75.105	38.85	Pk	14.3	-30.9	22.25	40	-17.75	0-360	101	V
5	* ** 164.733	34.3	Pk	18.3	-29.9	22.7	43.52	-20.82	0-360	101	V
6	* ** 967.311	24.46	Pk	29.2	-24.7	28.96	53.97	-25.01	0-360	199	V

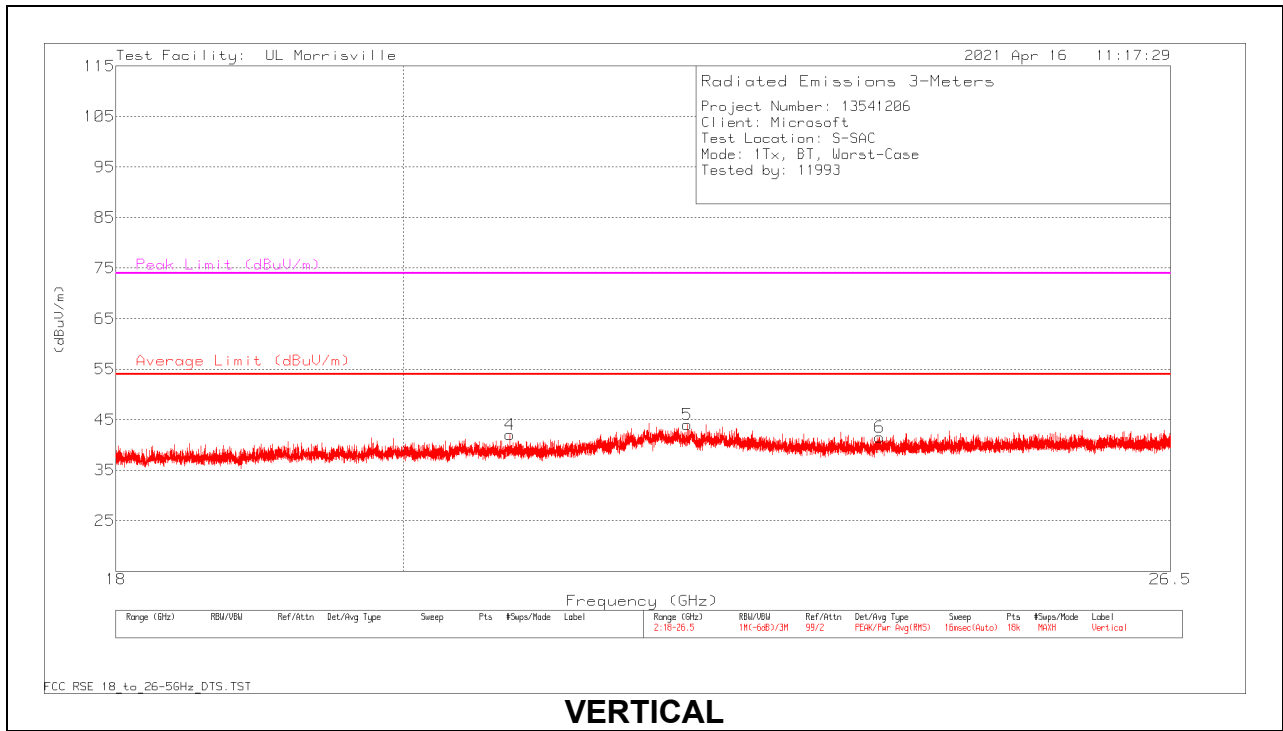
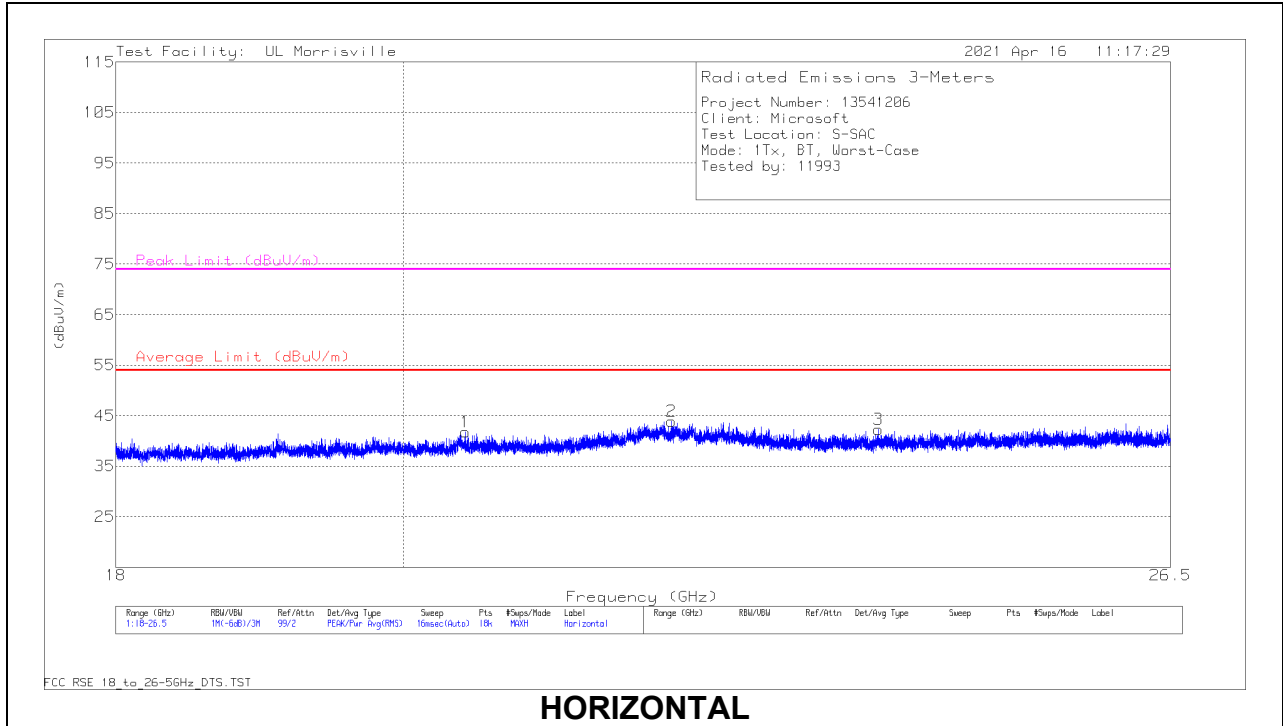
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

### 10.4. WORST CASE 18-26 GHZ

#### 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)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 20.46136	46.89	Pk	34	-39.1	41.79	54	-12.21	74	-32.21	0-360	200	H
2	* ** 22.07172	46.44	Pk	36.8	-39.4	43.84	54	-10.16	74	-30.16	0-360	249	H
3	* ** 23.80912	45.76	Pk	34.8	-38.3	42.26	54	-11.74	74	-31.74	0-360	249	H
4	* ** 20.79901	46.86	Pk	34	-38.8	42.06	54	-11.94	74	-31.94	0-360	101	V
5	* ** 22.19545	46.82	Pk	36.7	-39.5	44.02	54	-9.98	74	-29.98	0-360	151	V
6	* ** 23.81904	45.32	Pk	34.8	-38.6	41.52	54	-12.48	74	-32.48	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.

### TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

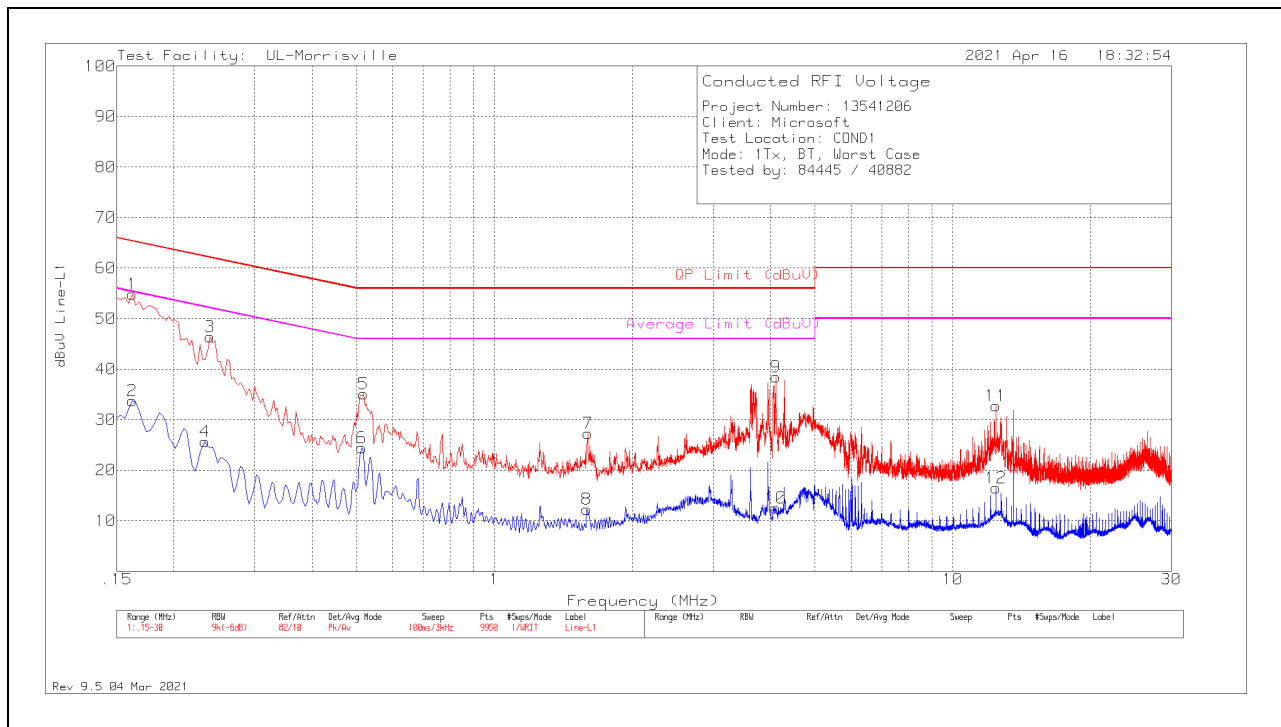
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

### RESULTS

### 11.1.1. AC Power Line

#### LINE 1 RESULTS

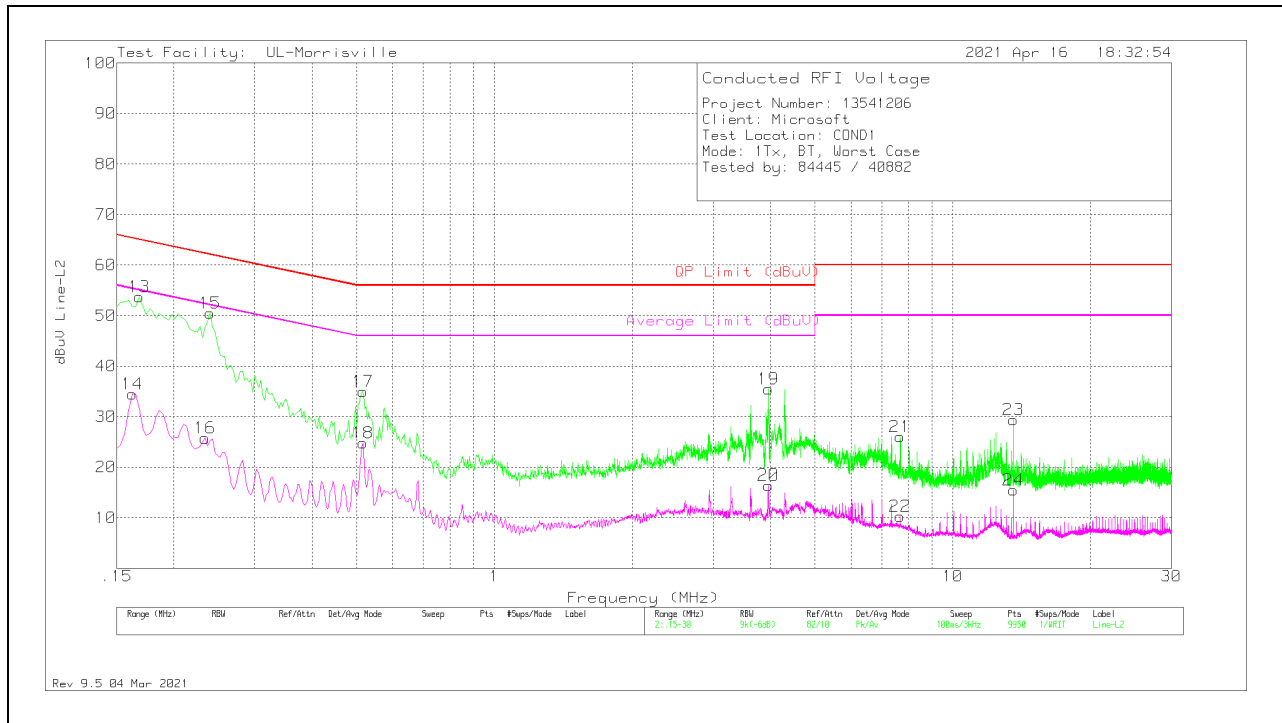


Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.162	44.89	Pk	.2	9.8	54.89	65.36	-10.47	-	-
2	.162	23.75	Av	.2	9.8	33.75	-	-	55.36	-21.61
4	.234	15.72	Av	.1	9.8	25.62	-	-	52.31	-26.69
3	.24	36.55	Pk	.1	9.8	46.45	62.1	-15.65	-	-
6	.513	14.65	Av	0	9.8	24.45	-	-	46	-21.55
5	.519	25.26	Pk	0	9.8	35.06	56	-20.94	-	-
8	1.59	2.51	Av	0	9.8	12.31	-	-	46	-33.69
7	1.599	17.45	Pk	0	9.8	27.25	56	-28.75	-	-
9	4.113	28.6	Pk	0	9.9	38.5	56	-17.5	-	-
10	4.113	2.65	Av	0	9.9	12.55	-	-	46	-33.45
11	12.411	22.67	Pk	.1	10	32.77	60	-27.23	-	-
12	12.417	6.35	Av	.1	10	16.45	-	-	50	-33.55

Pk - Peak detector



### 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)
14	.162	24.52	Av	.2	9.8	34.52	-	-	55.36	-20.84
13	.168	43.69	Pk	.2	9.8	53.69	65.06	-11.37	-	-
16	.234	15.83	Av	.1	9.8	25.73	-	-	52.31	-26.58
15	.24	40.62	Pk	.1	9.8	50.52	62.1	-11.58	-	-
17	.516	25.03	Pk	.1	9.8	34.93	56	-21.07	-	-
18	.516	14.95	Av	.1	9.8	24.85	-	-	46	-21.15
19	3.96	25.58	Pk	0	9.9	35.48	56	-20.52	-	-
20	3.96	6.51	Av	0	9.9	16.41	-	-	46	-29.59
22	7.677	.13	Av	.1	10	10.23	-	-	50	-39.77
21	7.68	15.95	Pk	.1	10	26.05	60	-33.95	-	-
23	13.56	19.22	Pk	.1	10.1	29.42	60	-30.58	-	-
24	13.56	5.24	Av	.1	10.1	15.44	-	-	50	-34.56

Pk - Peak detector  
 Av - Average detection

## 12. SETUP PHOTOS

Please refer to R13541206-EP1 for setup photos.

**END OF TEST REPORT**