



# TEST REPORT

**Report Number. :** R13976514-E3

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

**Model :** NU320

**FCC ID :** 2AKMG-NU320L

**EUT Description :** IQbuds 2 PRO Hearing Aid – Left

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

**Date Of Issue:**  
2021-11-17

**Prepared by:**  
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## REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2021-11-10	Initial Issue	Niklas Haydon
V2	2021-11-17	Revisions in sections 9.2, 9.3.2, 10, and 11.	Brian T. Kiewra

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# 1. ATTESTATION OF TEST RESULTS

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

**EUT DESCRIPTION:** IQbuds 2 PRO Hearing Aid – Left

**MODEL:** NU320

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

**SAMPLE RECEIPT DATE:** 2021-09-09

**DATE TESTED:** 2021-09-10 to 2021-10-21

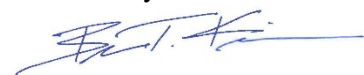
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5 + A2	Complies

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.

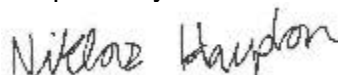
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Approved & Released For  
UL LLC. By:



Brian Kiewra  
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Consumer Technology Division  
UL LLC.

Prepared By:



Niklas Haydon  
Operations Leader  
Consumer Technology Division  
UL LLC.

## 2. TEST RESULTS SUMMARY

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	Complies	None.
15.247 (b)(1)	RSS-247 (5.4) (b)	Output Power	Complies	None.
See Comment		Average Power	Reporting purposes only	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, Certificate Number 0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

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

## 5. DECISION RULES AND MEASUREMENT UNCERTAINTY

### 5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

### 5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

### 5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	1.22%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	1.94 dB
All emissions, radiated	6.01 dB
Conducted Emissions (0.150-30MHz) - LISN	3.40 dB
Temperature	0.57°C
Humidity	3.39%
DC Supply voltages	1.70%
Time	3.39%

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

### 5.4. SAMPLE CALCULATION

#### RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

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

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

#### MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

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

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



## 6. EQUIPMENT UNDER TEST

### 6.1. EUT DESCRIPTION

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

### 6.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	8.96	7.87
2402 - 2480	Enhanced DQPSK	7.30	5.37
2402 - 2480	Enhanced 8PSK	7.80	6.03

### 6.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

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

### 6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was Version 1.0.0

### 6.5. WORST-CASE CONFIGURATION AND MODE

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

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

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

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

Worst-case data rates as were:

GFSK mode: DH5

8PSK mode: 3-DH5

DQPSK mode: 3-DH5

## 6.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

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

### I/O CABLES

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

### TEST SETUP

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

### SETUP DIAGRAMS

Please refer to R13976514-EP1 for setup diagrams.

## 7. TEST AND MEASUREMENT EQUIPMENT

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

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

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	<b>0.009-30MHz</b>				
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2021-08-19	2022-08-19
	<b>30-1000 MHz</b>				
AT0075	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2020-10-27	2021-10-27
	<b>1-18 GHz</b>				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2021-05-03	2022-05-03
	<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	2021-07-09	2022-07-09
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2021-07-09	2022-07-09
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2021-07-09	2022-07-09
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2021-07-09	2022-07-09
	<b>Receiver &amp; Software</b>				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-10	2022-03-10
SA0026	Spectrum Analyzer	Agilent	N9030A	2021-07-26	2022-07-26
SOFTEMI	EMI Software	UL	Version 9.5 (09 August 2021)		
	<b>Additional Equipment used</b>				
9911-4442	Near Field Probe	EMCO	7405	NA	NA
HI0095	Environmental Meter	Fisher Scientific	06-662-4	2020-01-21	2022-01-21

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA0025	Spectrum Analyzer	Keysight Technologies	N9030A	2021-04-01	2022-04-01
PWM005 (PRE0136341)	RF Power Meter	Keysight Technologies	N1912A	2021-07-27	2022-07-26
PWS003	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2021-05-27	2022-05-27
HI0092	Environmental Meter	Fisher Scientific	160938893	2020-09-23	2021-09-23
SOFTEMI	Antenna Port Software	UL	Version 2021.08.18 Version 2021.09.30	NA	NA

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2021-04-05	2022-04-05
HI0091	Environmental Meter	Fisher Scientific	15-077-963	2021-07-12	2022-07-12
LISN003	LISN, 50-ohm/50-uH, 250uH 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50/250-25-2-01	2021-08-16	2022-08-16
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2021-08-17	2022-08-17
ATA222	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2021-04-05	2022-04-05
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (04 Mar 2021)		

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## 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.

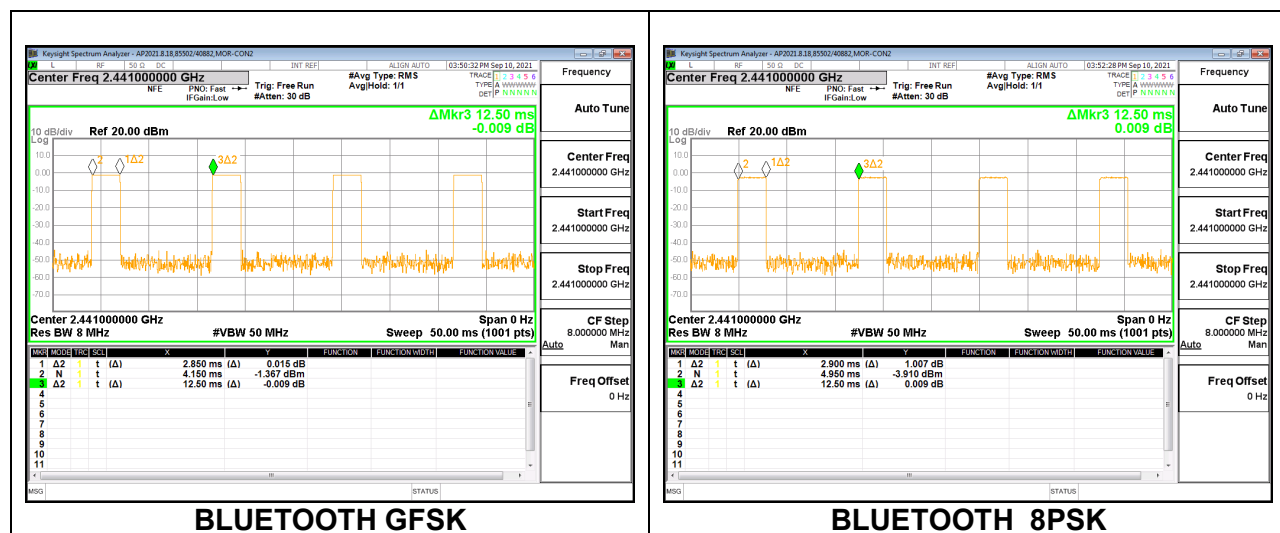
#### PROCEDURE

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	2.85	12.50	0.228	22.80	12.84	0.351
Bluetooth 8PSK	2.90	12.50	0.232	23.20	12.69	0.345

#### DUTY CYCLE PLOTS



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

### **LIMITS**

None; for reporting purposes only.

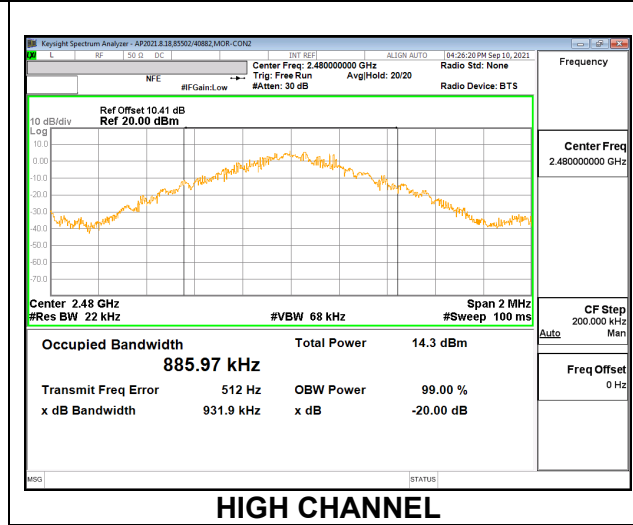
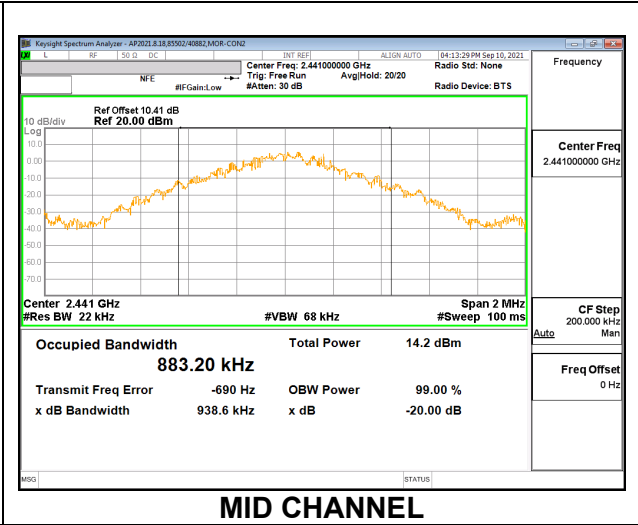
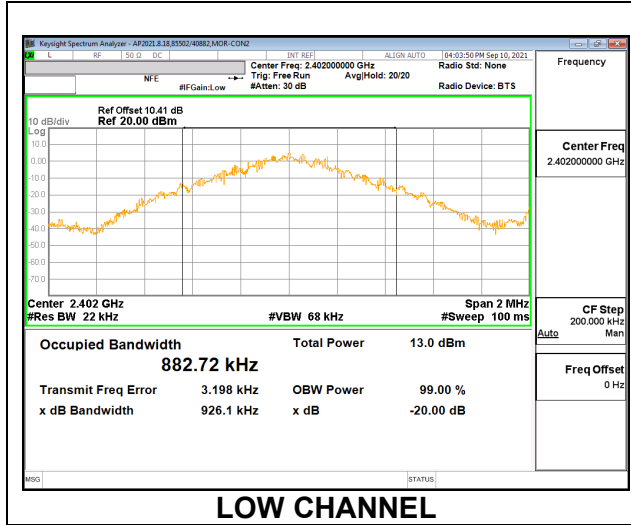
### **TEST PROCEDURE**

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

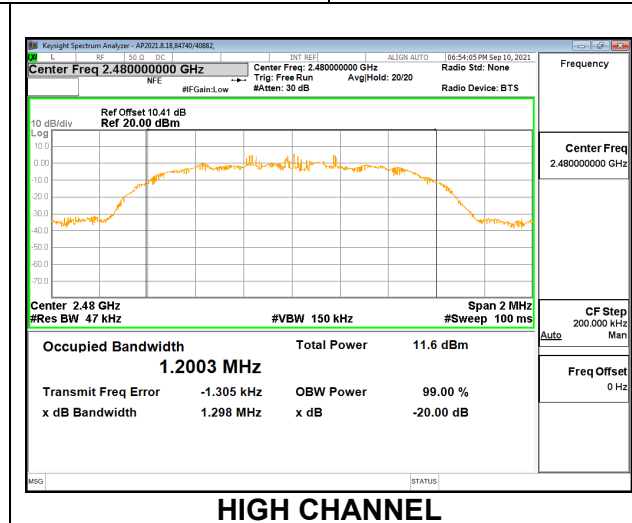
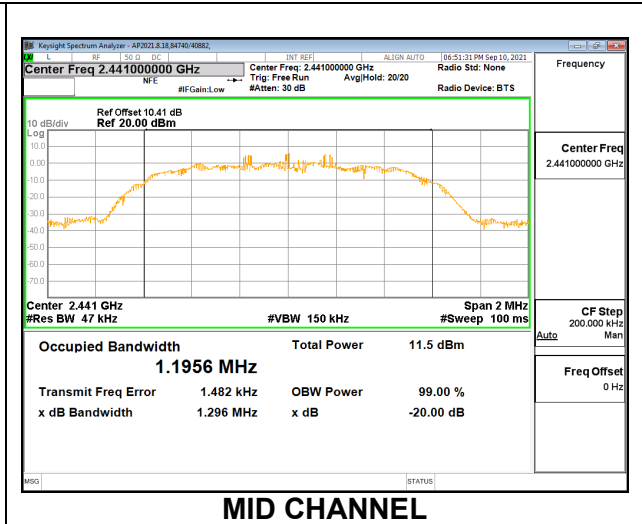
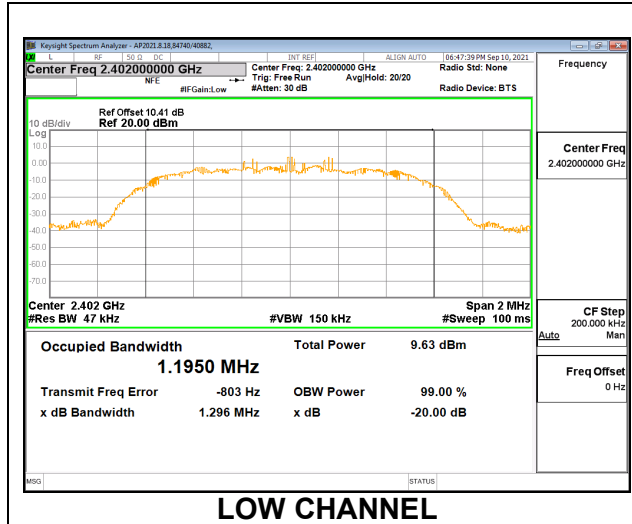
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.9261	0.8827
Mid	2441	0.9386	0.8832
High	2480	0.9319	0.8860





## 9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.296	1.195
Mid	2441	1.296	1.196
High	2480	1.298	1.200



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### **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.

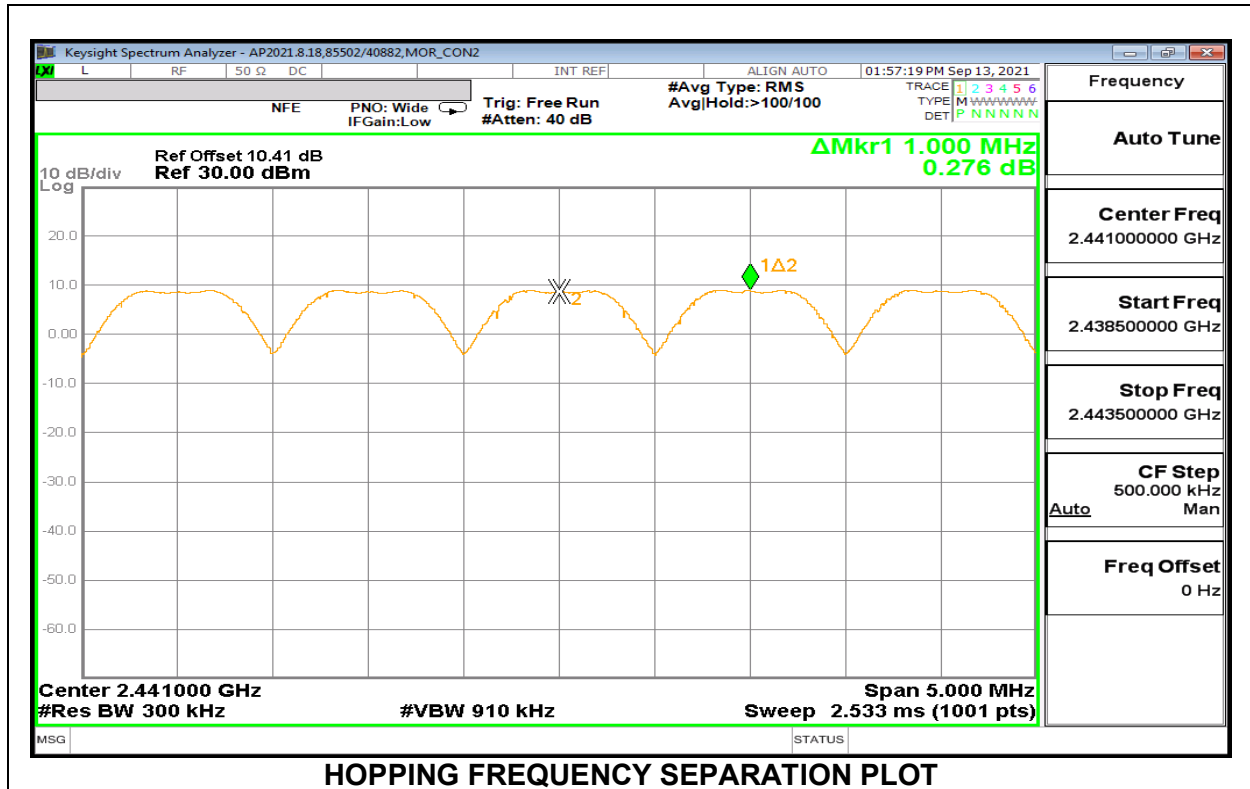
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

#### **TEST PROCEDURE**

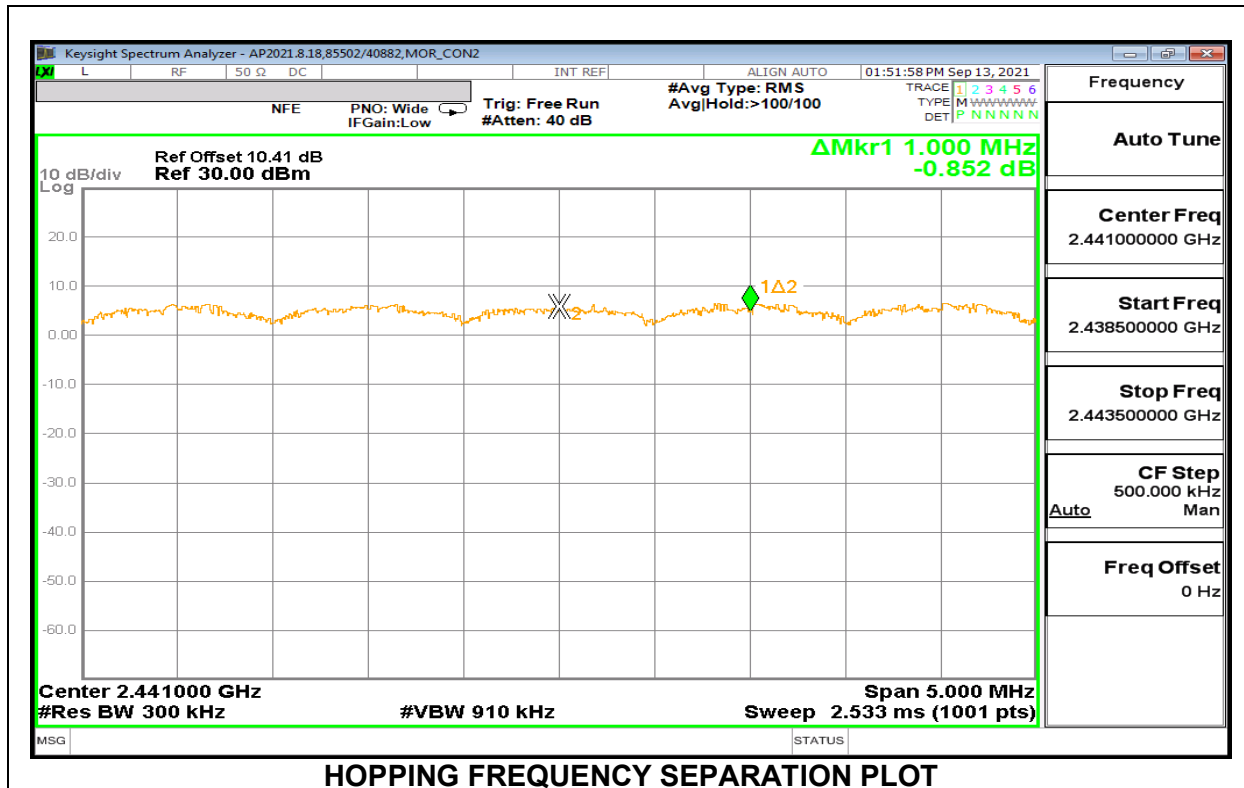
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to  $VBW \geq RBW$ . The sweep time is coupled.

#### **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 (1.195 MHz). However, the output power is less than 125 mW and the channel separation is greater than 2/3 the 20 dB bandwidth (797 kHz).

Ch. A (MHz)	Ch. B (MHz)	Ch. 1 to Ch. 2 Sep. (MHz)	20 dB BW (MHz)	2/3 20 dB BW (MHz)	Margin (MHz)
2441	2442	1.000	1.296	0.864	-0.136

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## **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.

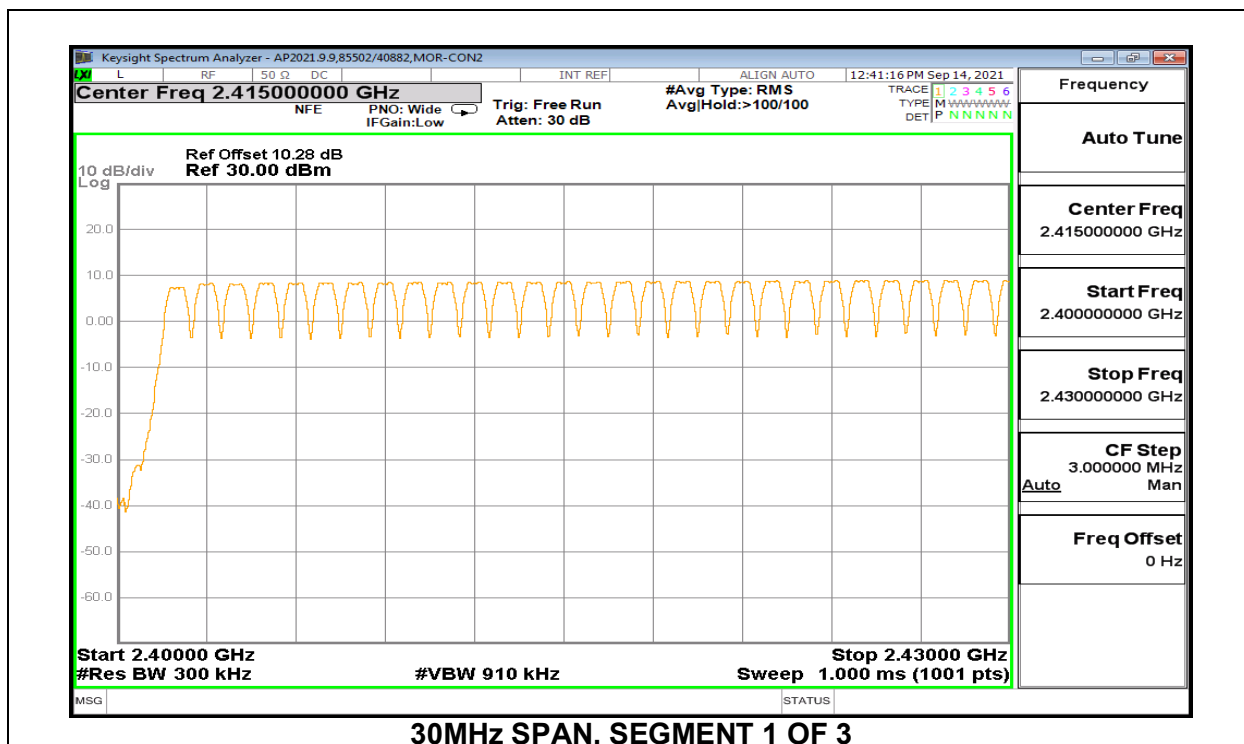
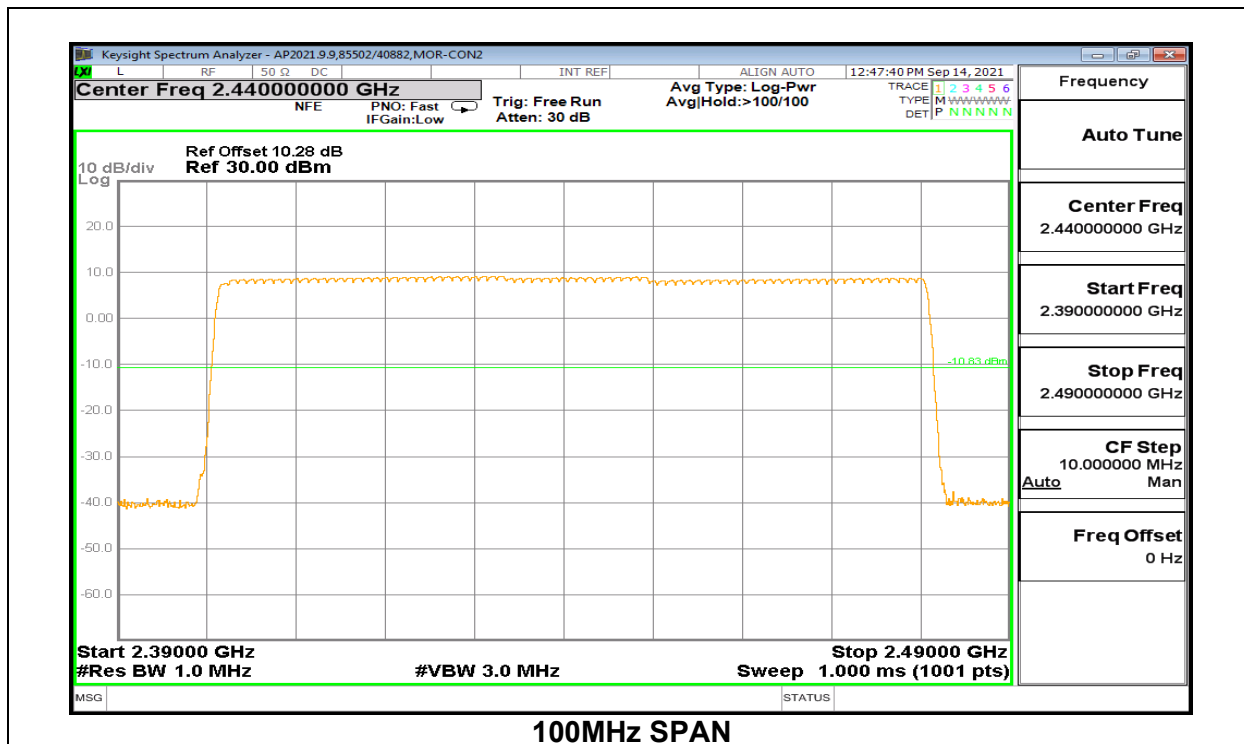
### **TEST PROCEDURE**

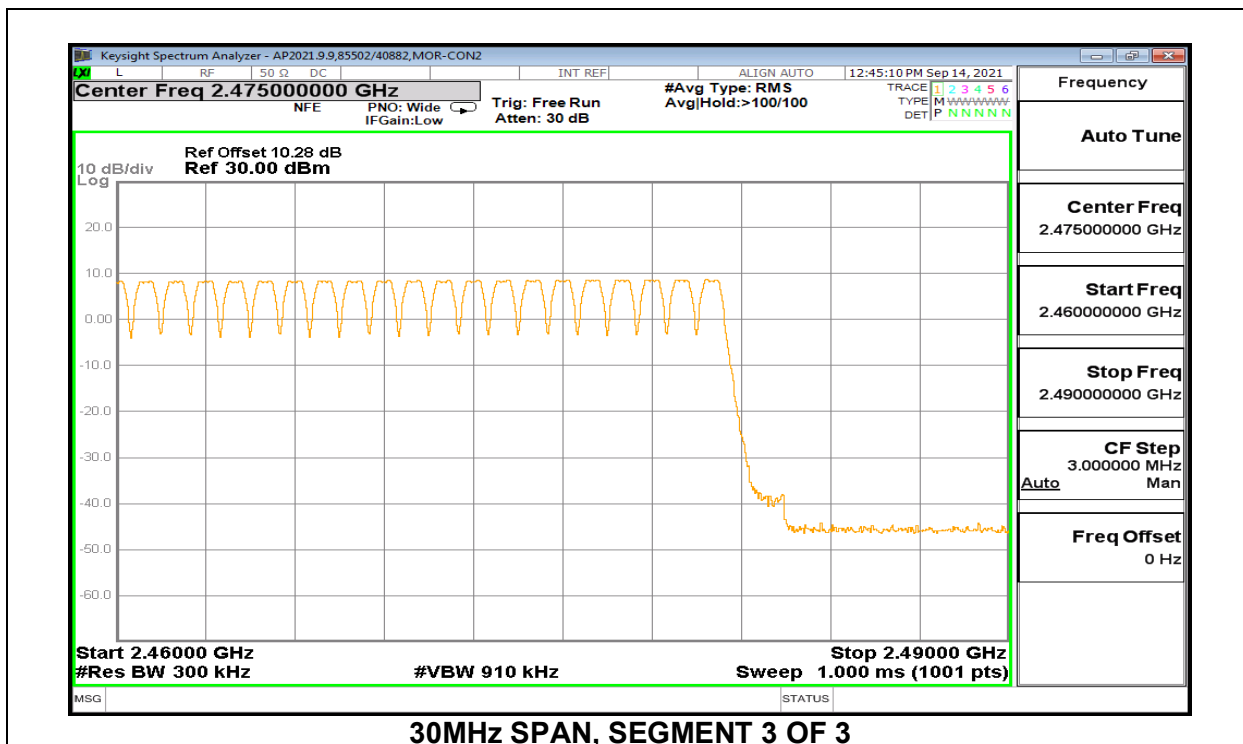
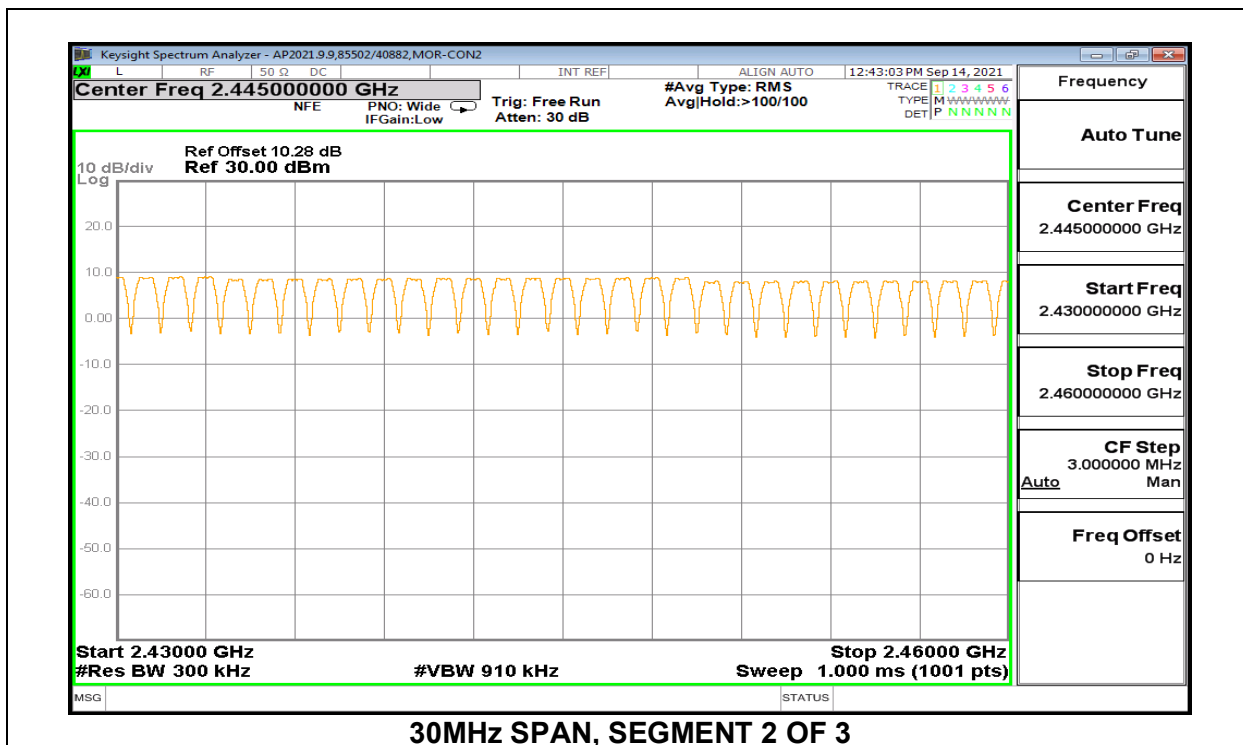
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps for visibility of the entire span. Then, smaller spans are set to more clearly identify the channels. The RBW is set to 30% of the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

### **RESULTS**

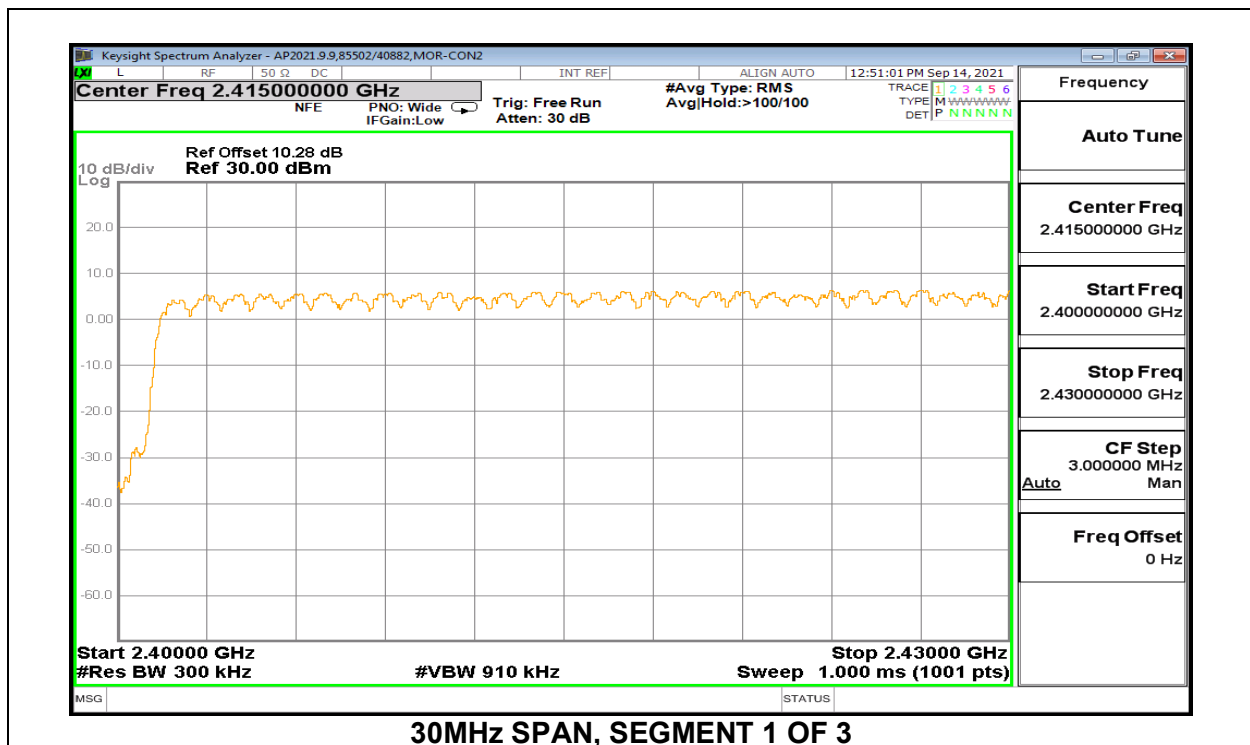
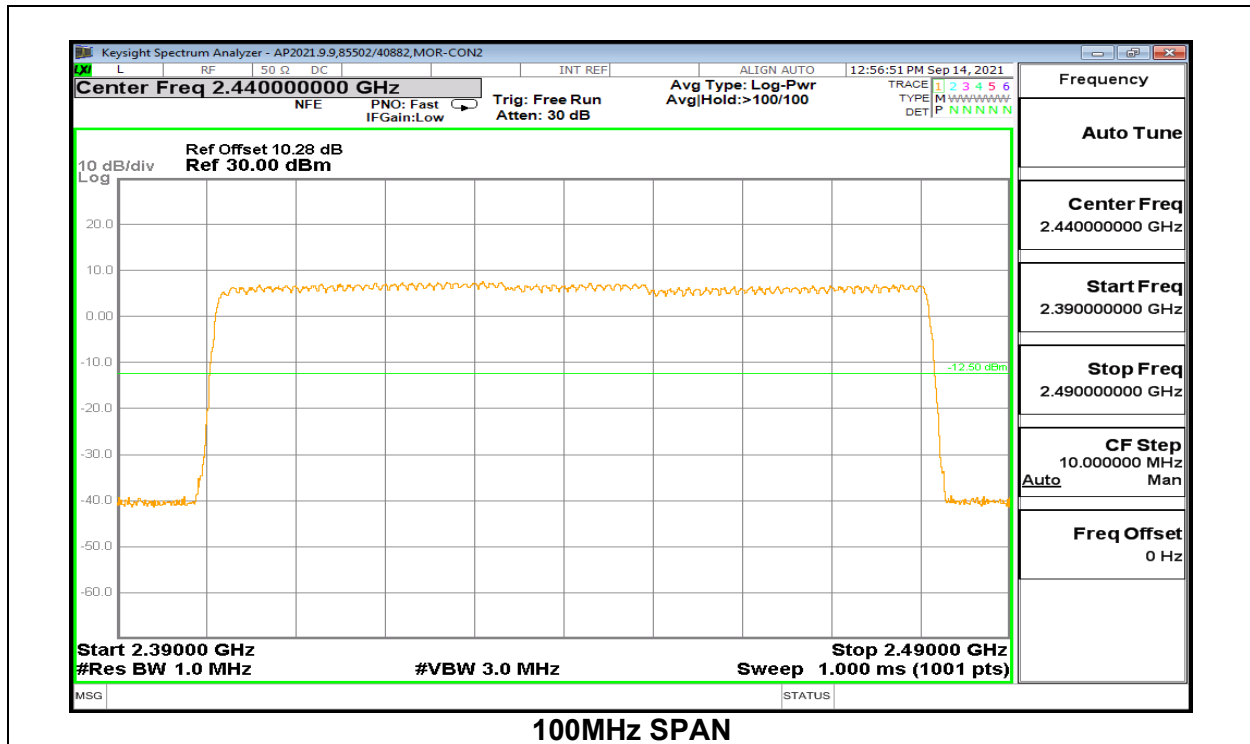
Normal Mode: 79 Channels Observed

### 9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

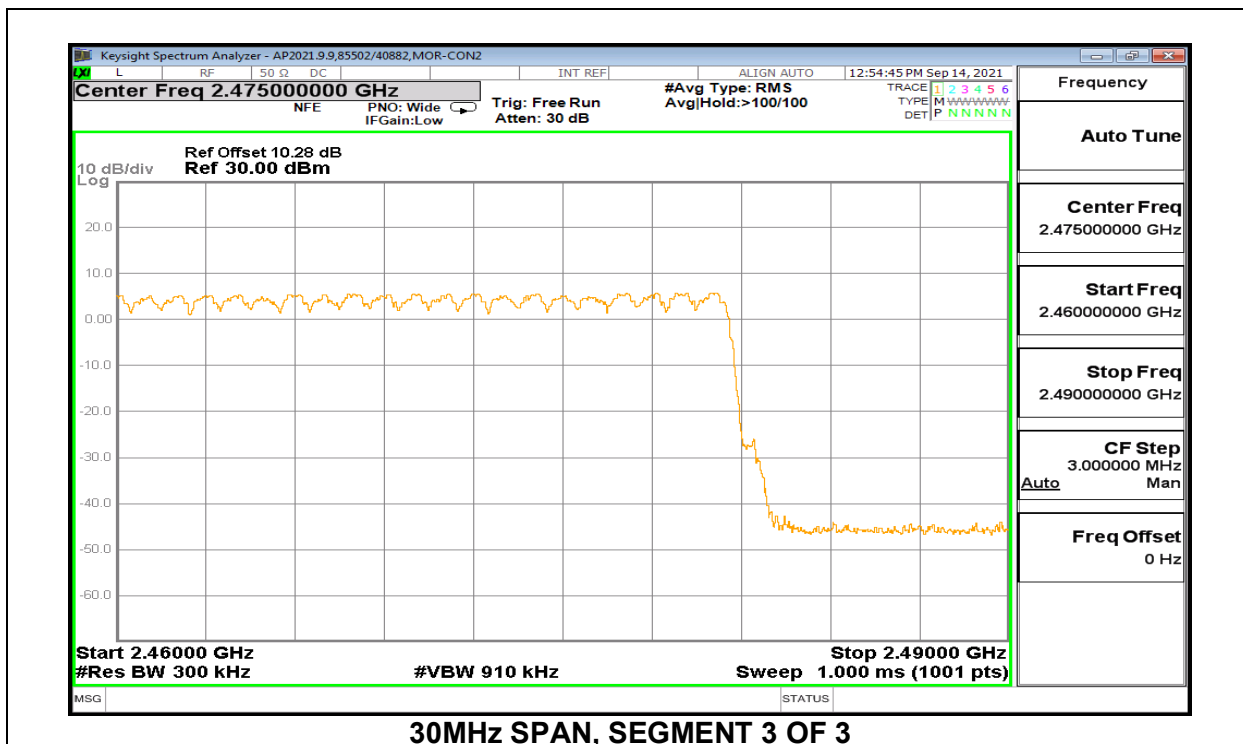
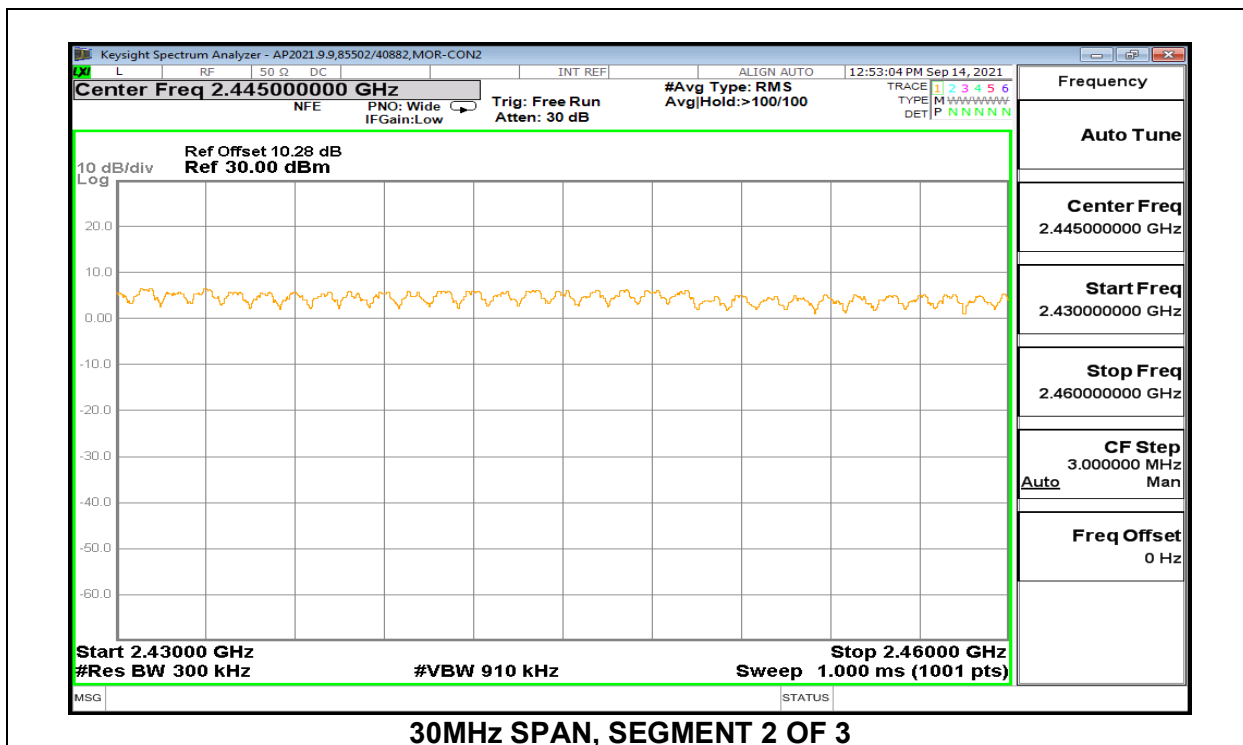




### 9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION







## **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.

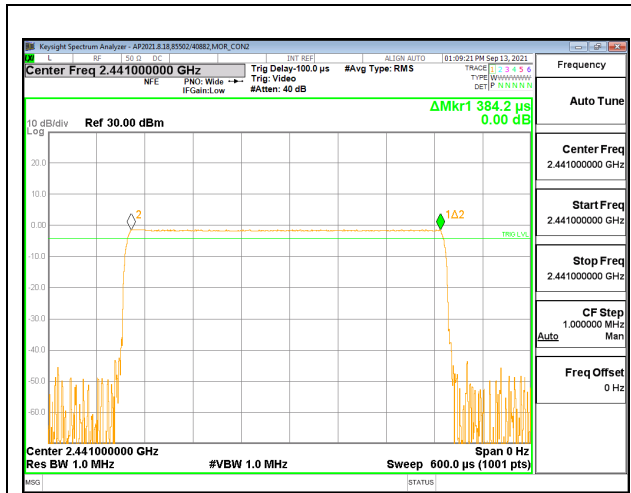
The average time of occupancy in the specified 3.16 second period (79 channels \* 0.4 s) is equal to  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$ .

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

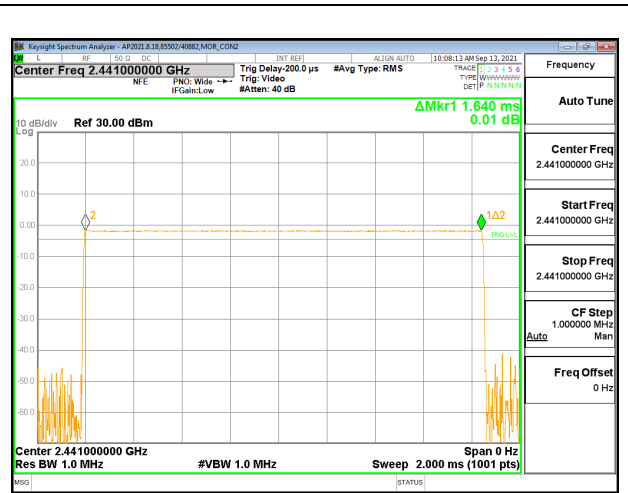
### **RESULTS**

### 9.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

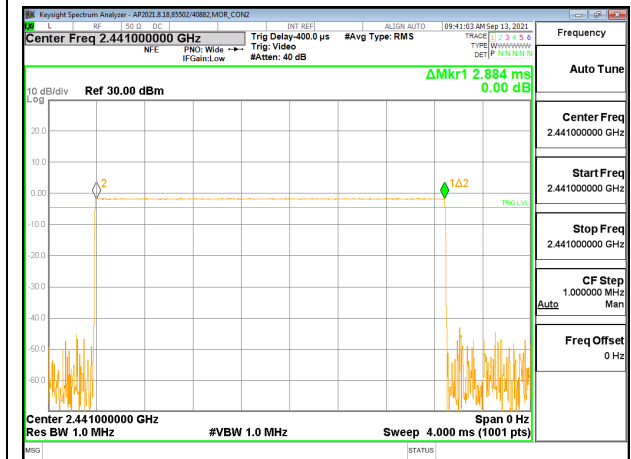
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
<b>GFSK Normal Mode</b>					
DH1	0.38	32	0.1229	0.4	-0.2771
DH3	1.64	17	0.2788	0.4	-0.1212
DH5	2.88	9	0.2596	0.4	-0.1404
<b>GFSK AFH Mode</b>					
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.3842	8	0.03074	0.4	-0.3693
DH3	1.64	4.25	0.06970	0.4	-0.3303
DH5	2.884	2.25	0.06489	0.4	-0.3351



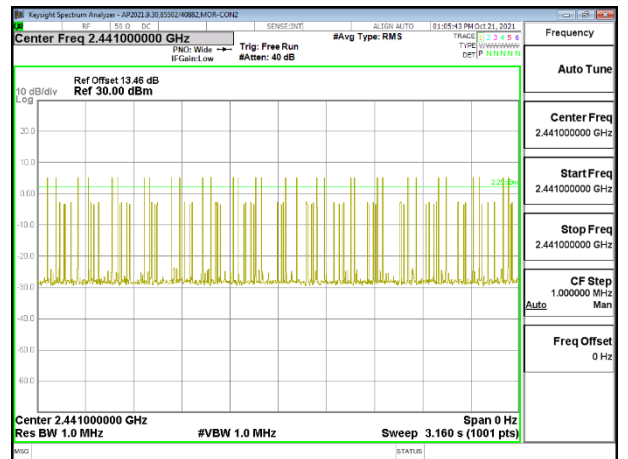
**PULSE WIDTH – DH1**



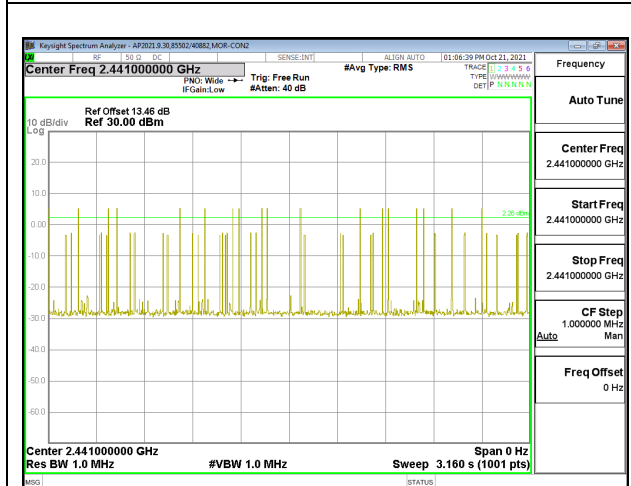
**PULSE WIDTH – DH3**



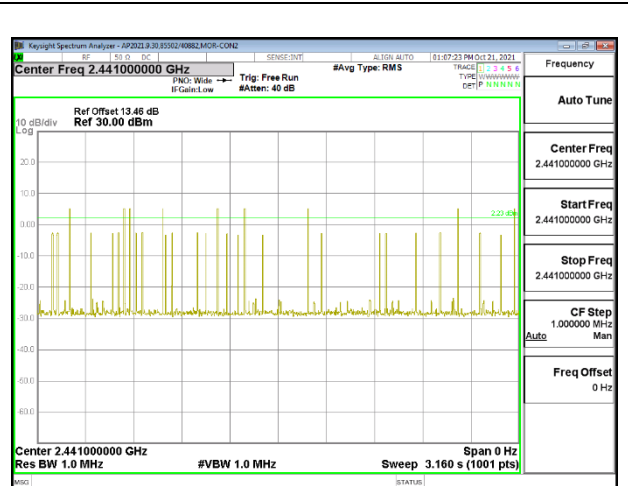
**PULSE WIDTH – DH5**



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



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

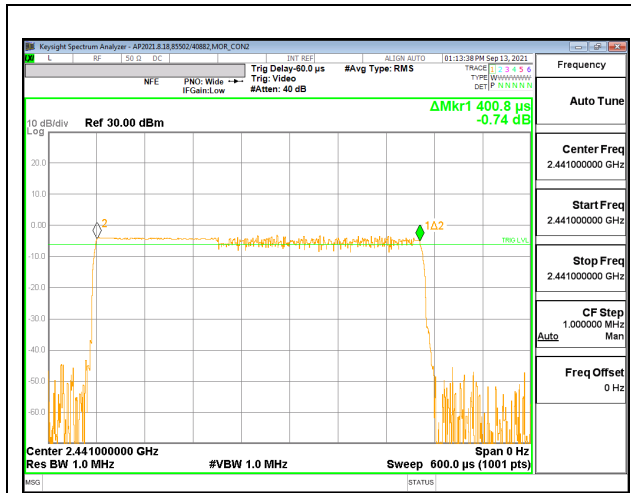


**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5**

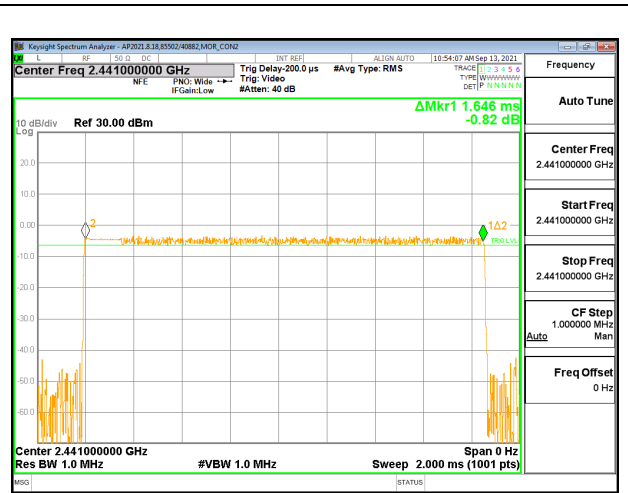
### 9.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

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	0.40	31	0.124248	0.4	-0.2758
3DH3	1.65	18	0.29628	0.4	-0.1037
3DH5	2.89	11	0.31768	0.4	-0.0823

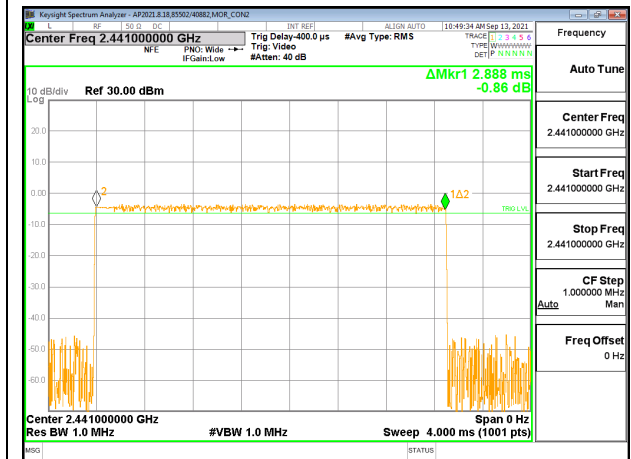
Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate demonstrates compliance with channel occupancy when AFH is employed.



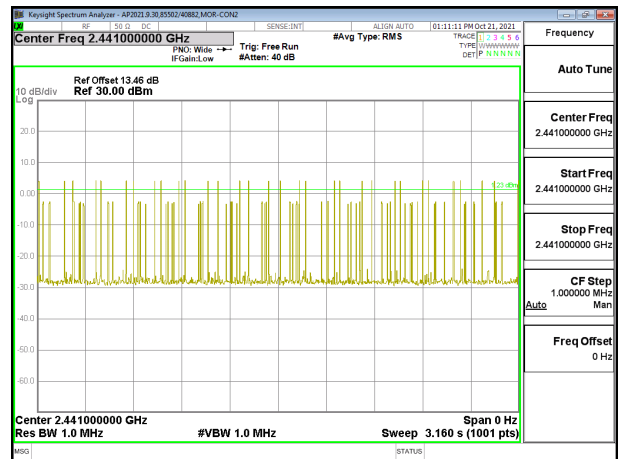
**PULSE WIDTH – 3DH1**



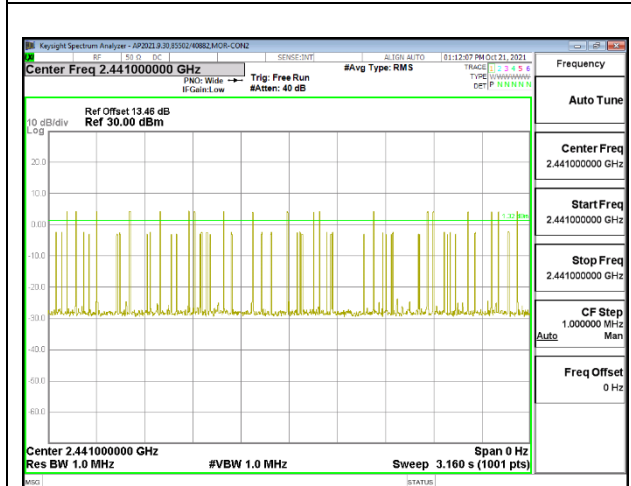
**PULSE WIDTH – 3DH3**



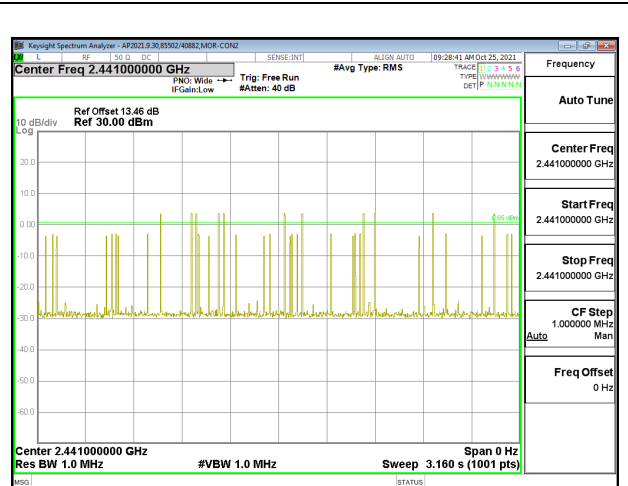
**PULSE WIDTH – 3DH5**



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

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

### RESULTS

#### 9.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

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

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.69	30	-22.31
Middle	2441	8.80	30	-21.2
High	2480	8.96	30	-21.04

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

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

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	6.25	21	-14.75
Middle	2441	7.76	21	-13.24
High	2480	7.80	21	-13.2

### 9.6.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

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

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	5.62	21	-15.38
Middle	2441	7.06	21	-13.94
High	2480	7.30	21	-13.7



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

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

### RESULTS

#### 9.7.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

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

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.43
Middle	2441	8.60
High	2480	8.76

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

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

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	3.30
Middle	2441	5.00
High	2480	5.06

### 9.7.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

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

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	3.21
Middle	2441	4.82
High	2480	5.02

---

## **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.

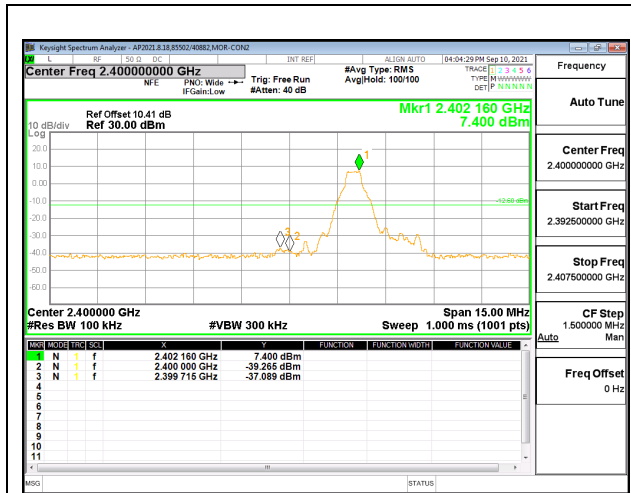
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

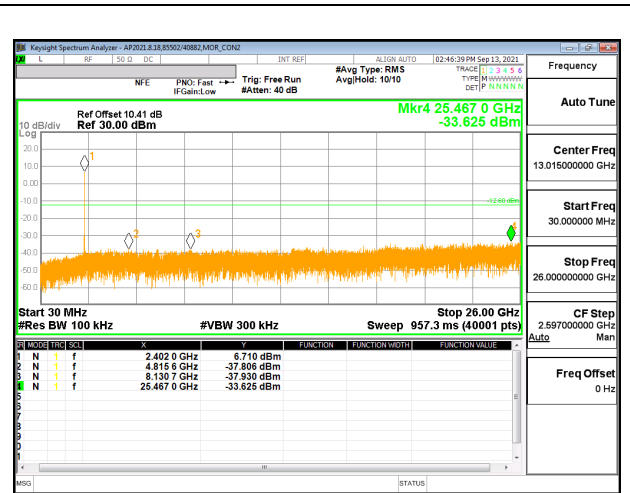
### **RESULTS**

### 9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

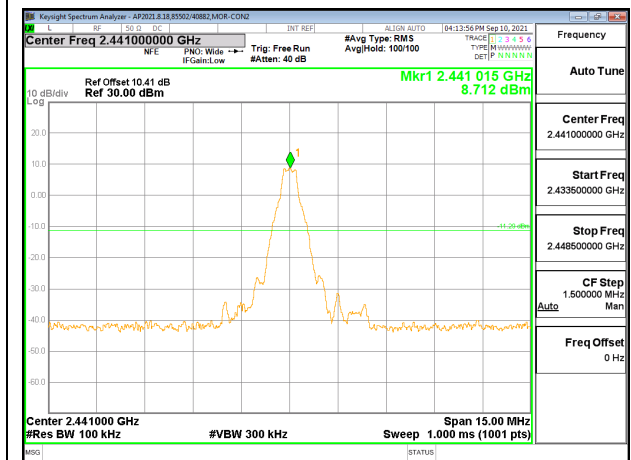
#### Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING



LOW CHANNEL BANDEDGE



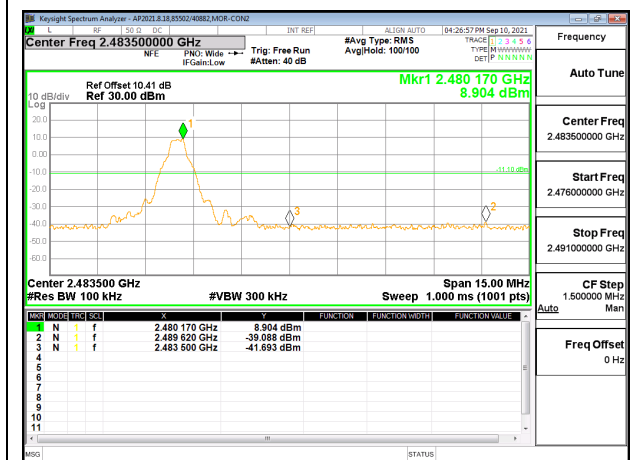
OUT-OF-BAND LOW CHANNEL



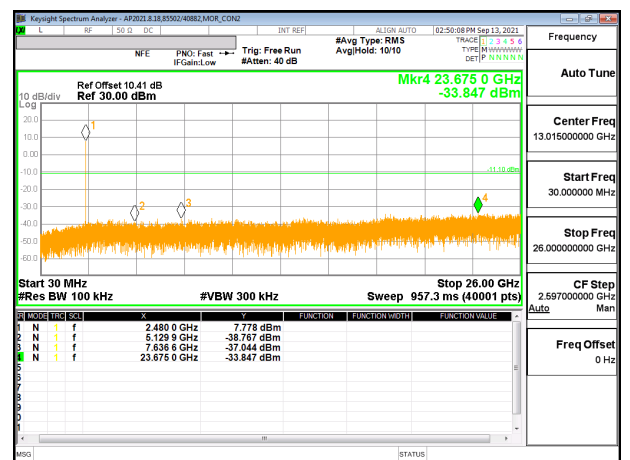
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL

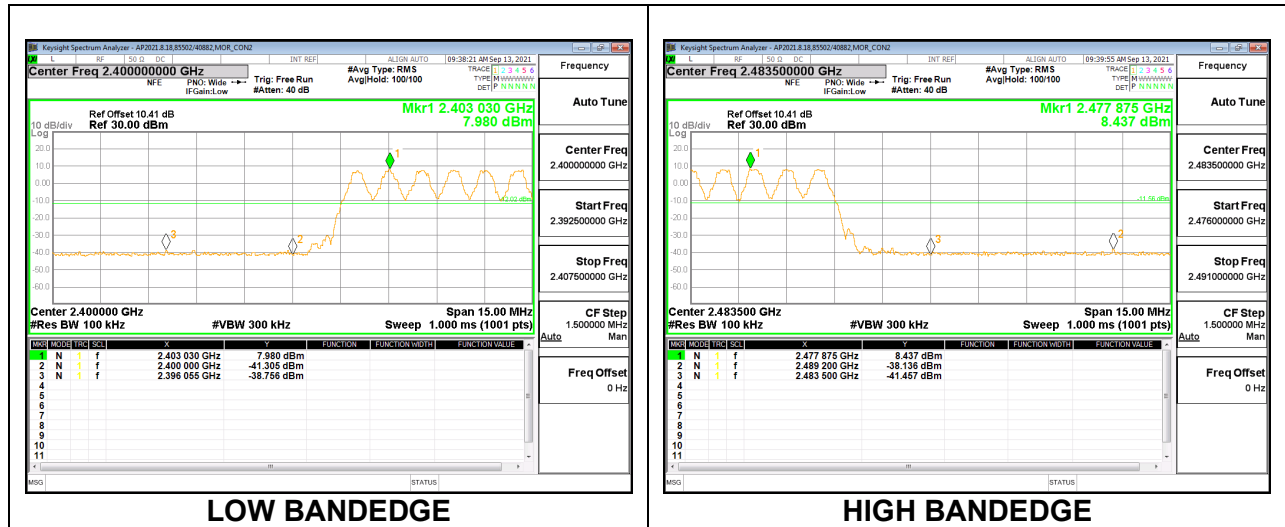


HIGH CHANNEL BANDEDGE



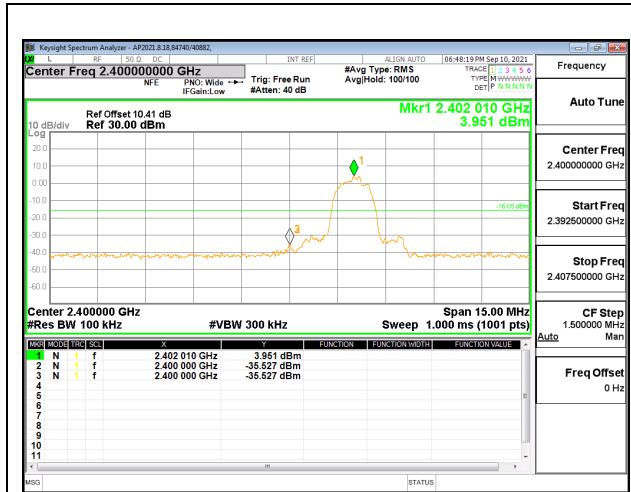
OUT-OF-BAND HIGH CHANNEL

**Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**

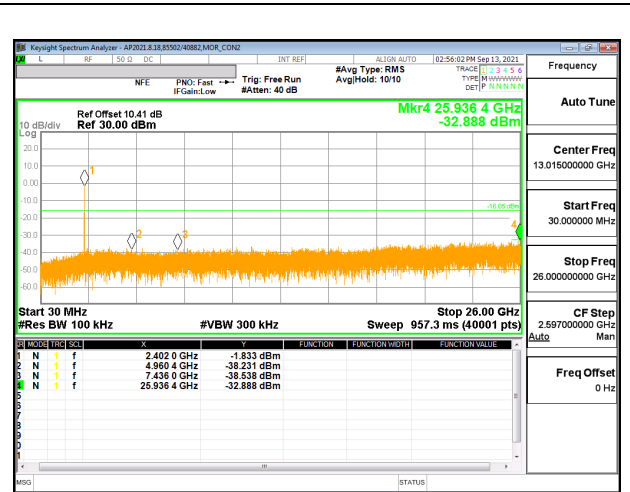


## 9.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

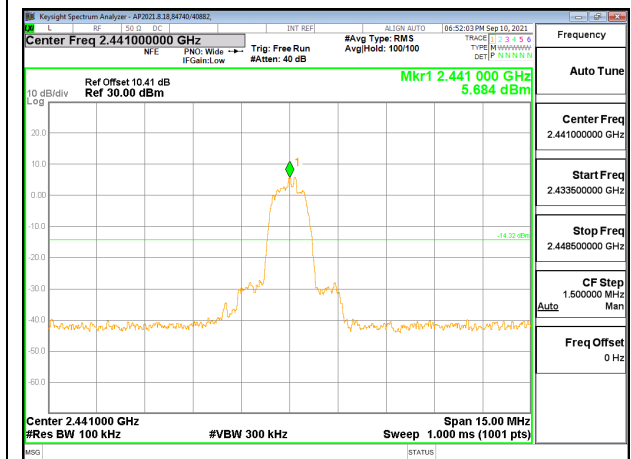
### Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING



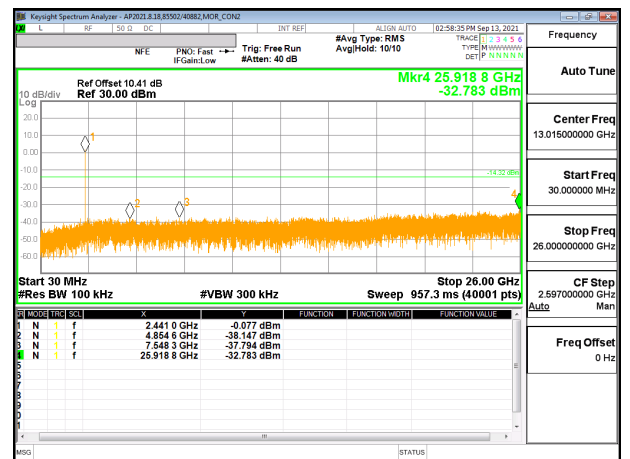
**LOW CHANNEL BANDEDGE**



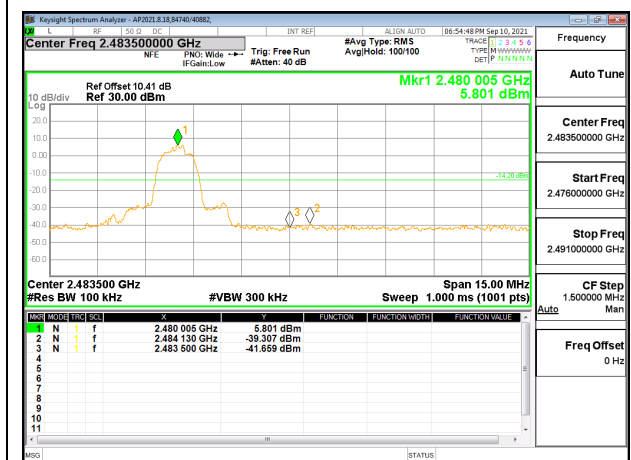
**OUT-OF-BAND LOW CHANNEL**



**IN-BAND REFERENCE LEVEL**



**OUT-OF-BAND MID CHANNEL**

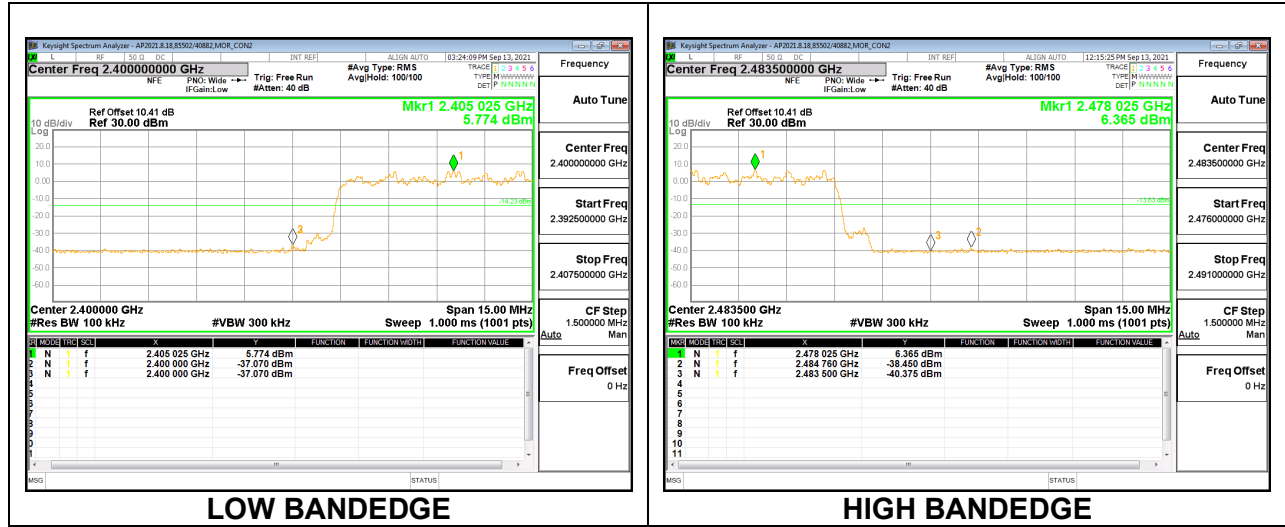


**HIGH CHANNEL BANDEDGE**



**OUT-OF-BAND HIGH CHANNEL**

**Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**



## 10. RADIATED TEST RESULTS

### LIMITS

FCC §15.205 and §15.209  
 RSS-GEN, Section 8.9 and 8.10.

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

### TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak or average (9-90kHz and 110-490kHz).

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements.

For this test program, The DCCF was then subtracted from the peak value. The DCCF was calculated based on the worst case on-time when the device transmits DH5 packets and operates on 20 channels (5/1600 s per hop = 3.125 ms per channel). In this mode, the device will have a maximum of 2 hops on a channel in 100ms or 2x 3.125 ms = 6.25 ms on any channel. Therefore,  $20\log(6.25 / 100) = -24\text{dB}$ .

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.

**KDB 558074 D01 15.247 Meas Guidance v05r01**

Use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can be satisfied. The average radiated field strength is calculated by subtracting the DCCF from the maximum radiated field strength level as determined through measurement. The maximum radiated field strength level represents the worst-case (maximum amplitude) RMS measurement of the emission(s) during continuous transmission (i.e., not including any time intervals during which the transmitter is off or is transmitting at a reduced power level). It is also acceptable to apply the DCCF to a measurement performed with a peak detector instead of the specified RMS power averaging detector. Note that Section 15.35(c) specifies that the DCCF shall represent the worst-case (greatest duty cycle) over any 100 msec transmission period.

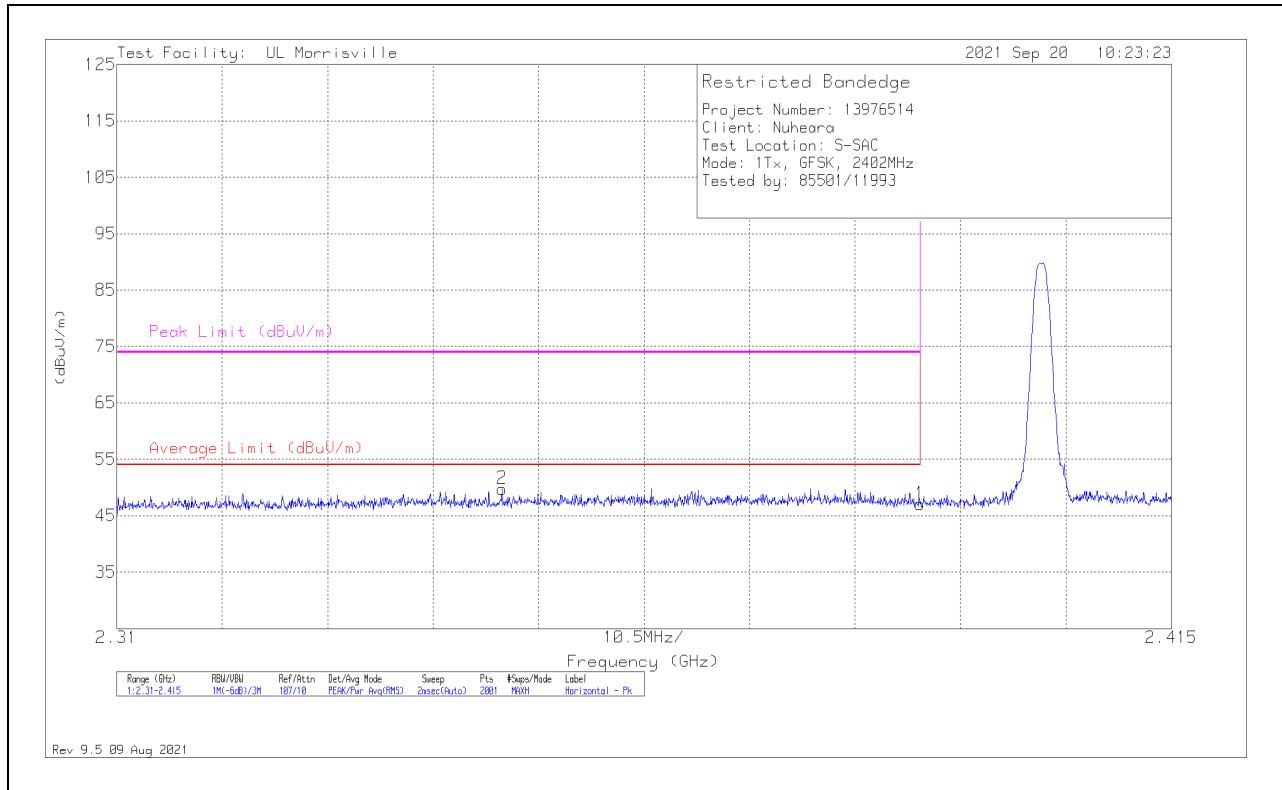
NOTE 1: The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table), using the free space impedance of 377 Ohms. For example the measurement at frequency X kHz resulted in a level of Y dBuV/m, which is equivalent to  $Y - 51.5 = Z$  dBuA/m, which has the same margin, W dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

## 10.1. TRANSMITTER ABOVE 1 GHz

### 10.1.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

#### BANDEDGE (LOW CHANNEL)

#### HORIZONTAL RESULT



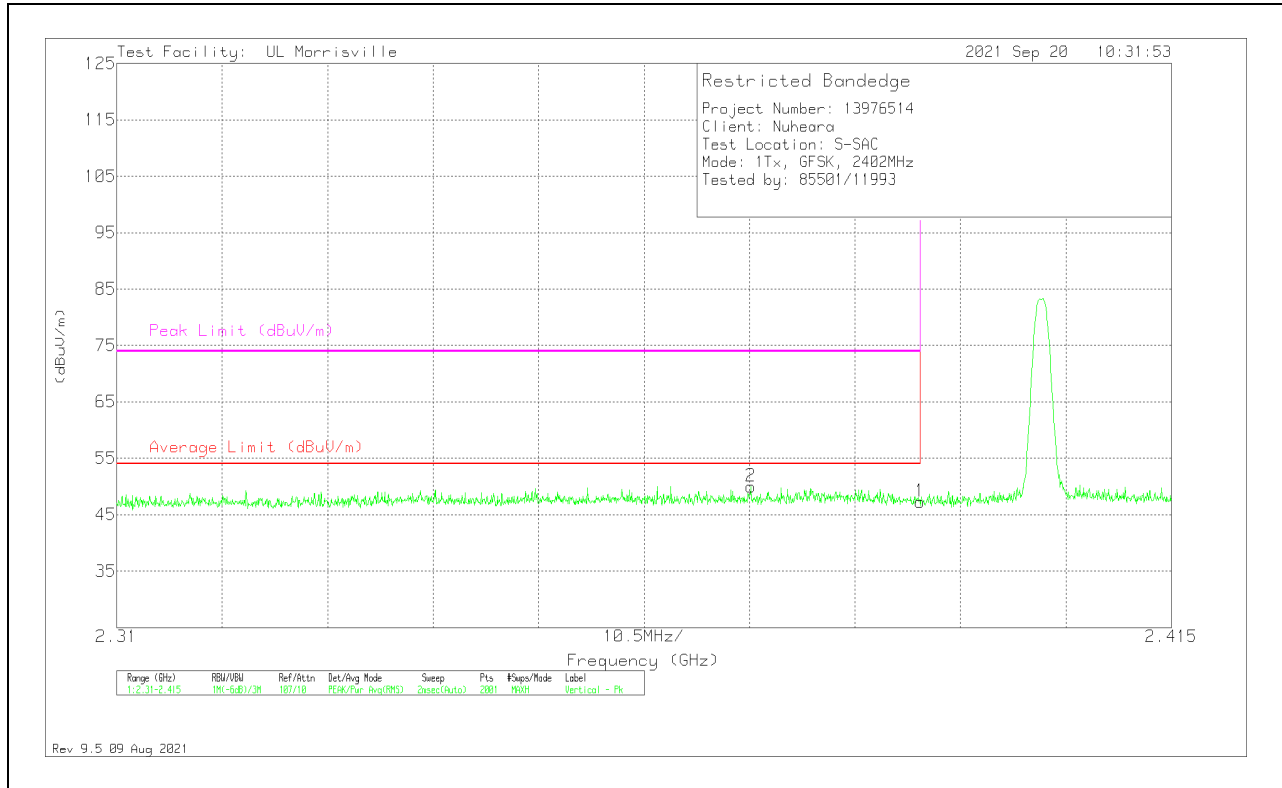
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.38996	39.13	Pk	31.9	-24	0	47.03	-	-	74	-26.97	79	114	H
2	*** 2.34838	42.06	Pk	32.1	-24.4	0	49.76	-	-	74	-24.24	79	114	H
1	*** 2.38996	39.13	Pk	31.9	-24	-24	23.03	54	-30.97	-	-	79	114	H
2	*** 2.34838	42.06	Pk	32.1	-24.4	-24	25.76	54	-28.24	-	-	79	114	H

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

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

Pk - Peak detector

### VERTICAL RESULT

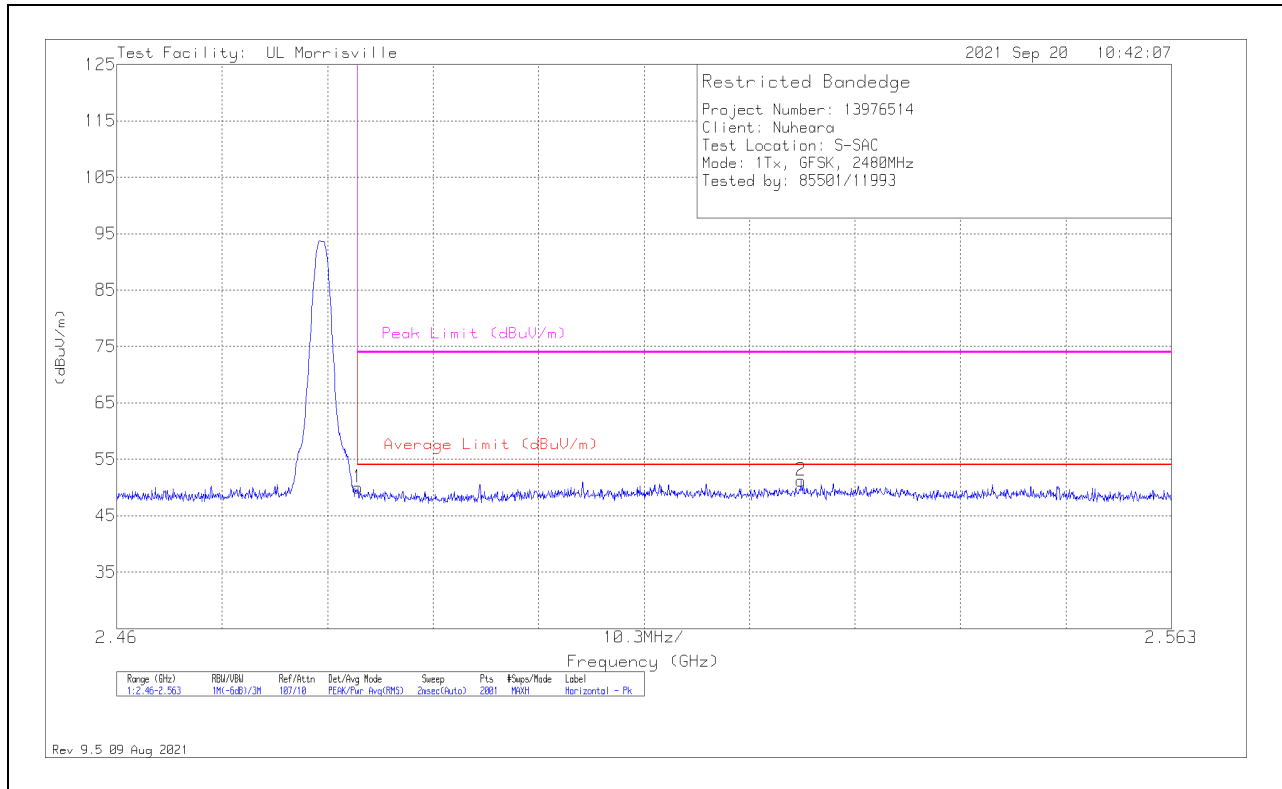


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.38996	39.44	Pk	31.9	-24	0	47.34	-	-	74	-26.66	21	203	V
2	* ** 2.37316	41.72	Pk	32.3	-24	0	50.02	-	-	74	-23.98	21	203	V
1	* ** 2.38996	39.44	Pk	31.9	-24	-24	23.34	54	-30.66	-	-	21	203	V
2	* ** 2.37316	41.72	Pk	32.3	-24	-24	26.02	54	-27.96	-	-	21	203	V

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

**BANDEDGE (HIGH CHANNEL)**

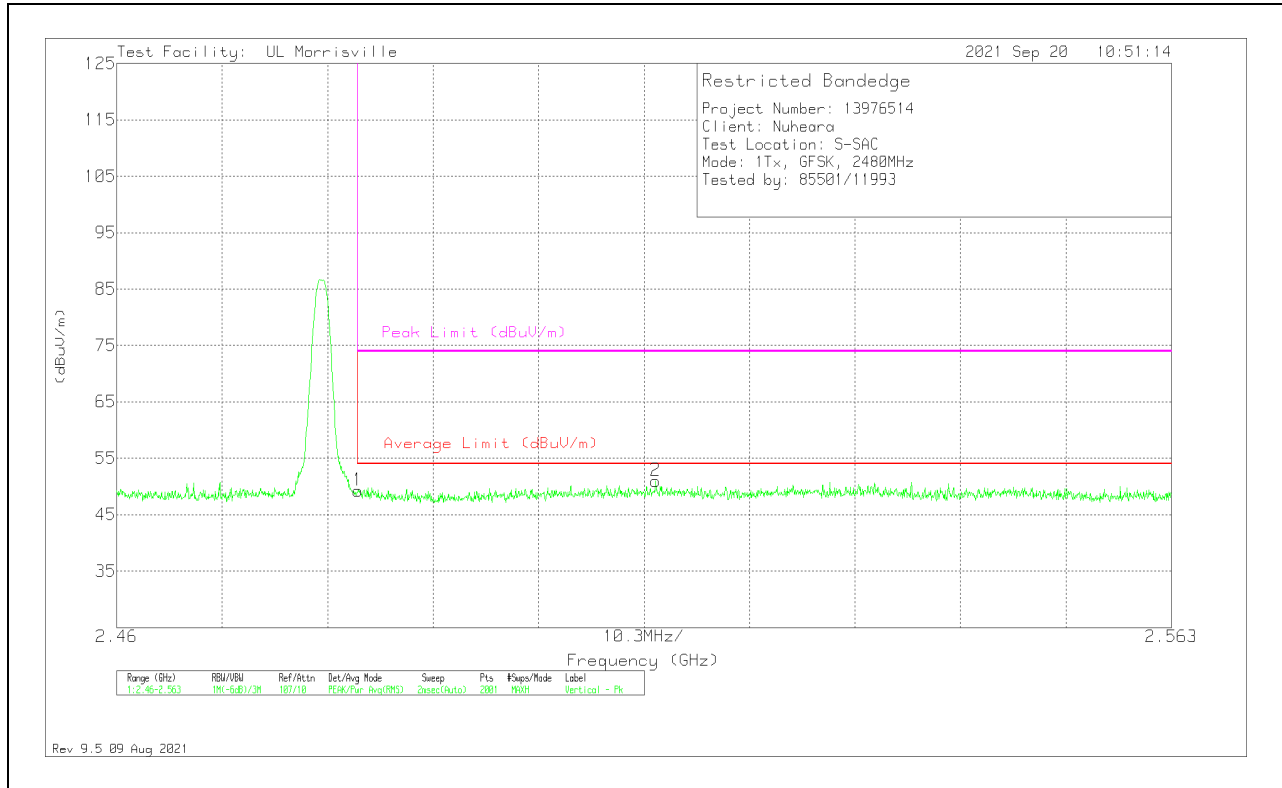
**HORIZONTAL RESULT**



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Pad (dB)	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	41.26	Pk	32.5	-23.8	0	49.96	-	-	74	-24.04	58	132	H
2	** 2.52685	42.18	Pk	32.9	-23.9	0	51.18	-	-	74	-22.82	58	132	H
1	* ** 2.48354	41.26	Pk	32.5	-23.8	-24	25.96	54	-28.04	-	-	58	132	H
2	** 2.52685	42.18	Pk	32.9	-23.9	-24	27.18	54	-26.82	-	-	58	132	H

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

### VERTICAL RESULT

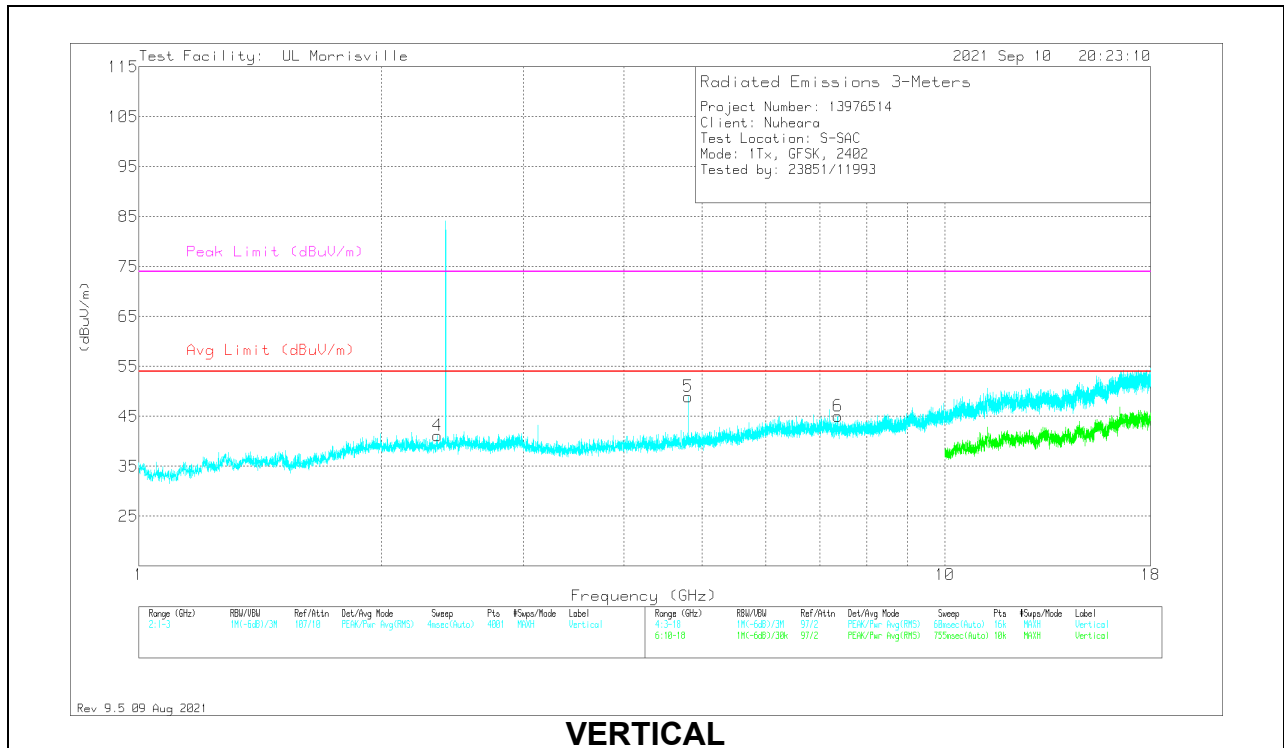
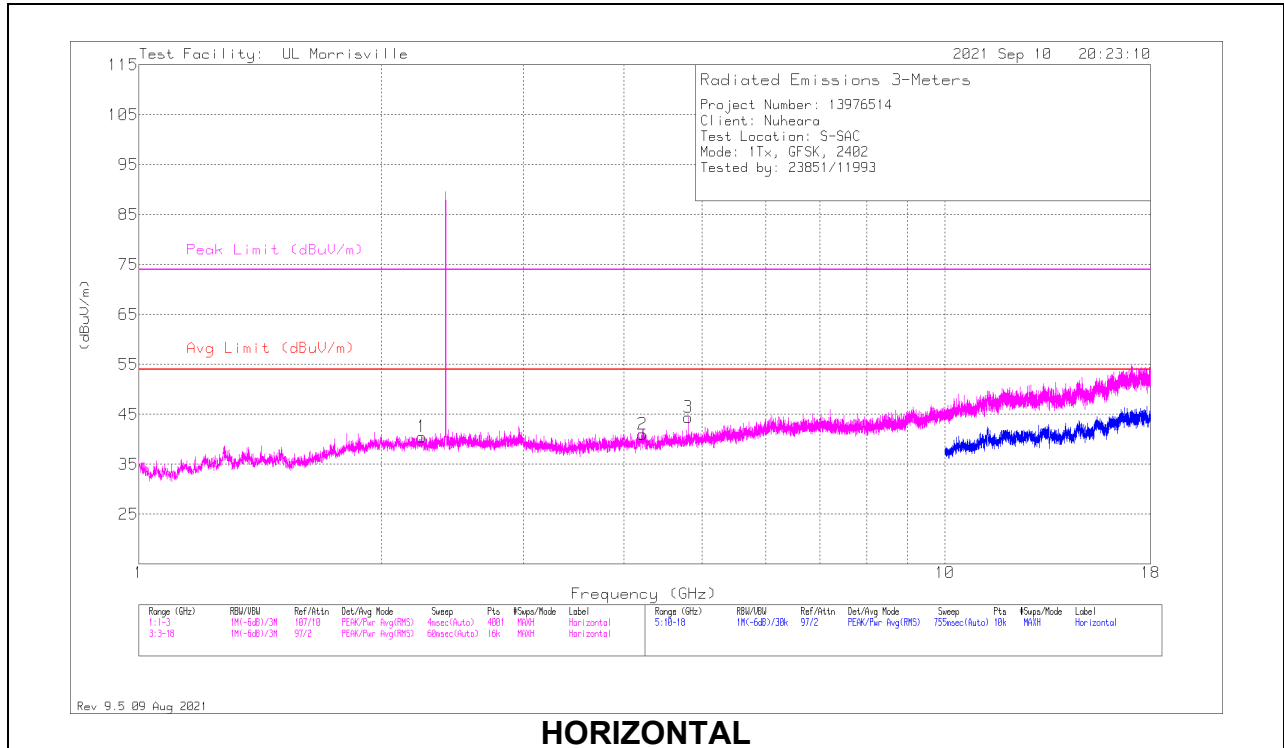


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.48354	40.53	Pk	32.5	-23.8	0	49.23	-	-	74	-24.77	7	354	V
2	** 2.51263	41.9	Pk	32.7	-23.6	0	51	-	-	74	-23	7	354	V
1	* ** 2.48354	40.53	Pk	32.5	-23.8	-24	25.23	54	-28.77	-	-	7	354	V
2	** 2.51263	41.9	Pk	32.7	-23.6	-24	27	54	-27	-	-	7	354	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	AT0072 (dB/m)	Amp/Cbl/Filtr (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	*** 4.21594	38.24	Pk	33.7	-30.9	0	41.04	54	-12.96	74	-32.96	0-360	101	H
3	*** 4.80375	40.94	Pk	34.1	-30.6	0	44.44	54	-9.56	74	-29.56	0-360	101	H
5	*** 4.80245	26.79	PK2	34.1	-30.5	0	30.39	-	-	74	-43.61	156	101	V
	*** 4.80245	26.79	PK2	34.1	-30.5	-24	6.39	54	-47.61	-	-	156	101	V
6	*** 7.36406	36.03	Pk	35.7	-26.7	0	45.03	54	-8.97	74	-28.97	0-360	200	V
1	*** 2.2435	32.35	Pk	31.8	-23.6	0	40.55	54	-13.45	74	-33.45	0-360	199	H
4	*** 2.3465	33.4	Pk	32.1	-24.4	0	41.1	54	-12.9	74	-32.9	0-360	101	V

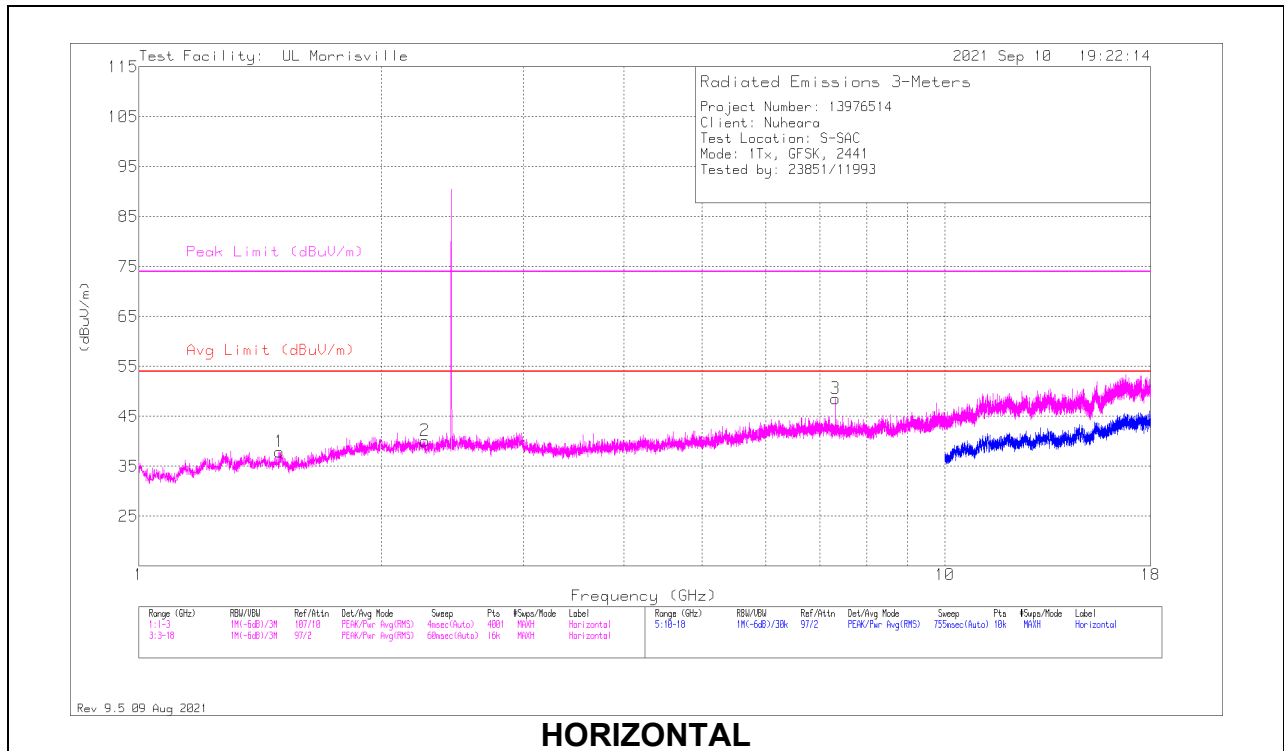
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

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

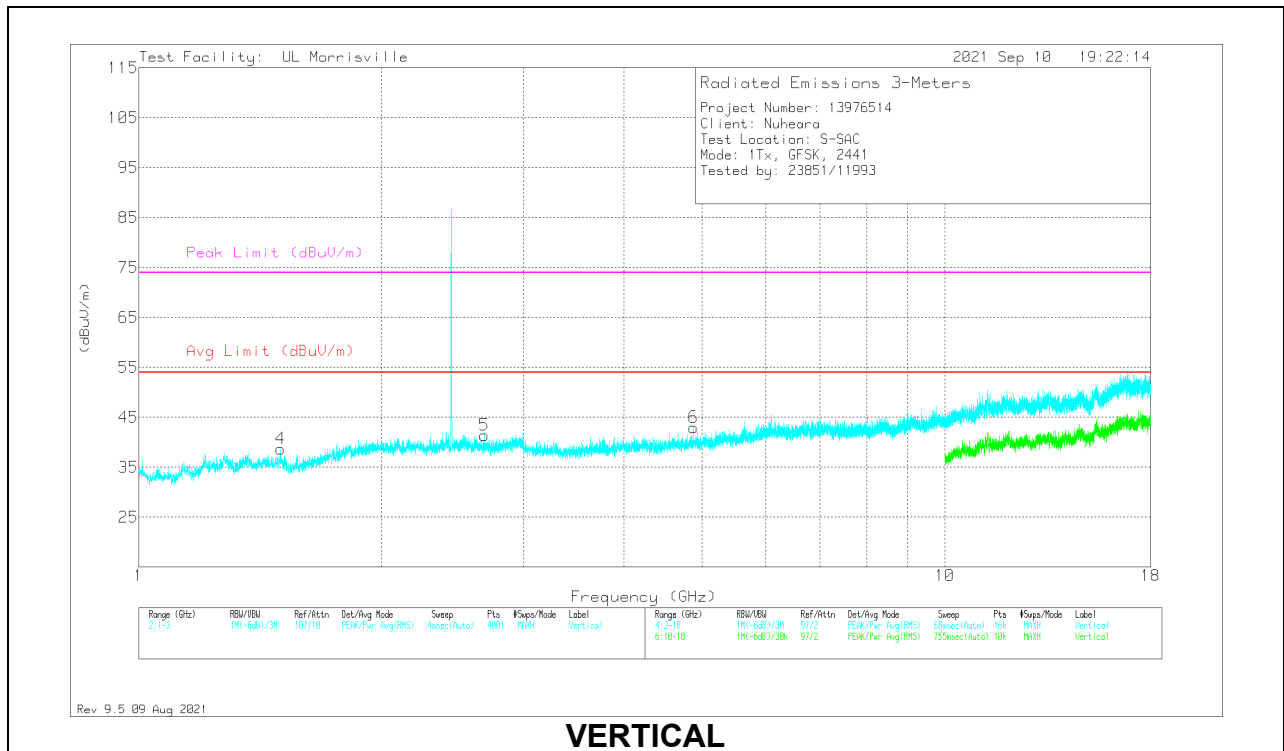
Pk - Peak detector

PK2 - Maximum Peak

### MID CHANNEL RESULTS



### HORIZONTAL



### VERTICAL



**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 1.495	32.17	Pk	28.4	-22.7	0	37.87	54	-16.13	74	-36.13	0-360	101	H
2	*** 2.2635	32.33	Pk	31.8	-24	0	40.13	54	-13.87	74	-33.87	0-360	199	H
4	*** 1.4985	32.91	Pk	28.6	-22.8	0	38.71	54	-15.29	74	-35.29	0-360	101	V
5	*** 2.684	34.67	Pk	32.6	-25.8	0	41.47	54	-12.53	74	-32.53	0-360	199	V
6	*** 4.88156	38.93	Pk	34.2	-30.2	0	42.93	54	-11.07	74	-31.07	0-360	101	V
3	*** 7.32257	42.35	PK2	35.7	-26.9	0	51.15	-	-	74	-22.85	225	112	H
	*** 7.32257	42.35	PK2	35.7	-26.9	-24	27.15	54	-26.85	-	-	225	112	H

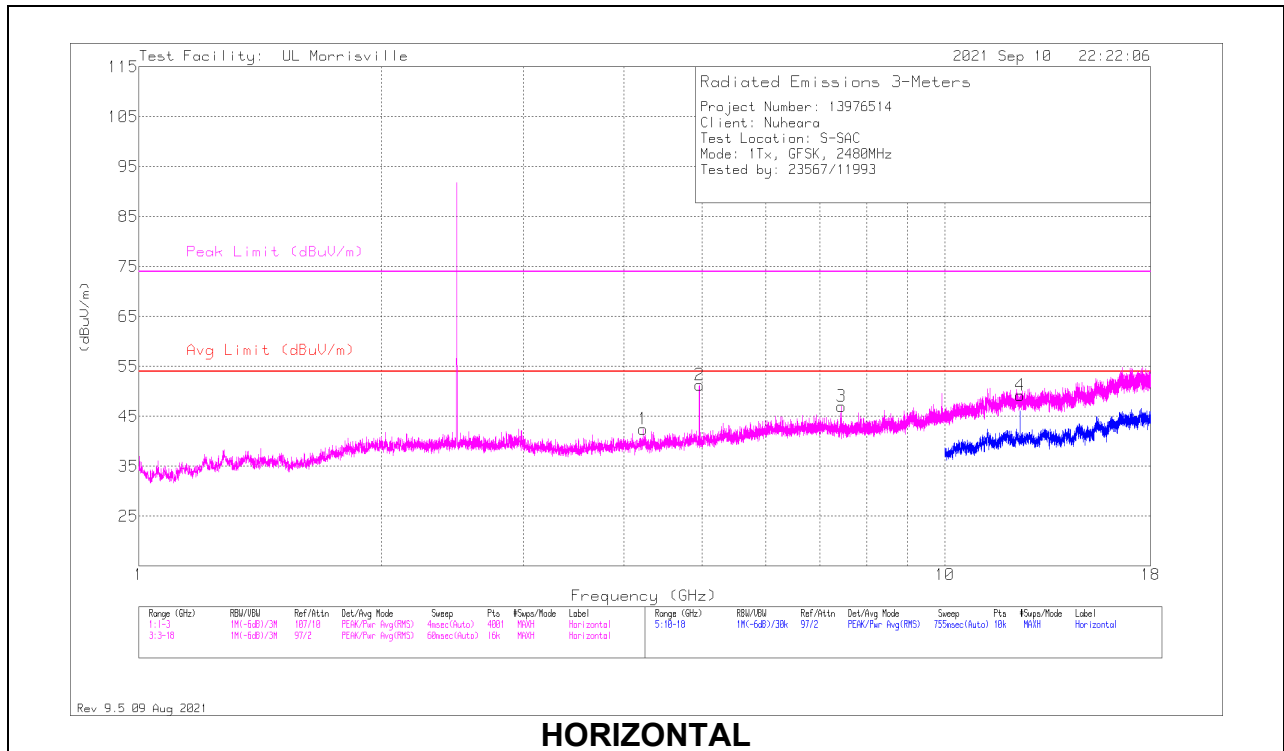
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

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

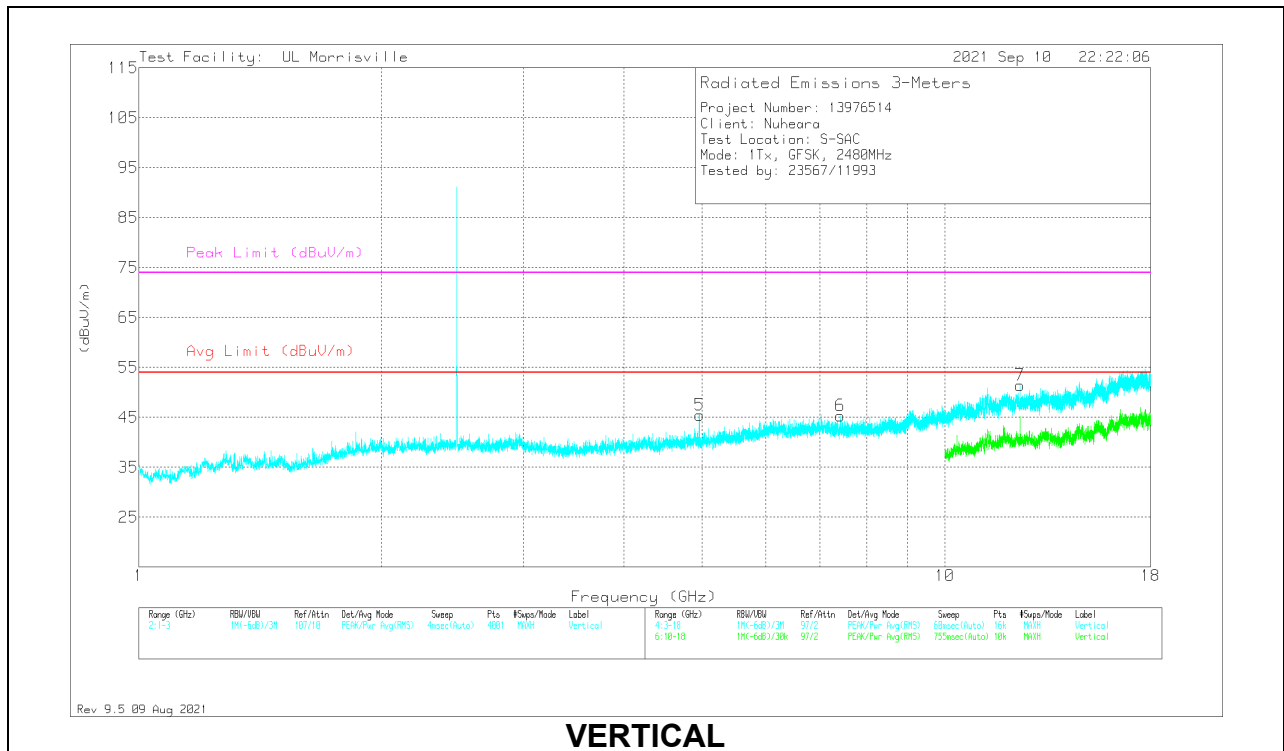
Pk - Peak detector

PK2 - Maximum Peak

### HIGH CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* ** 4.96088	30.58	PK2	34	-30.5	0	34.08	-	-	74	-39.92	289	108	H
	* ** 4.96088	30.58	PK2	34	-30.5	-24	10.08	54	-43.92	-	-	289	108	H
4	* ** 12.40069	38.36	PK2	38.8	-23.1	0	54.06	-	-	74	-19.94	356	108	H
	* ** 12.40069	38.36	PK2	38.8	-23.1	-24	30.06	54	-23.94	-	-	356	108	H
7	* ** 12.40092	38.01	PK2	38.8	-23.1	0	53.71	-	-	74	-20.29	3	271	V
	* ** 12.40092	38.01	PK2	38.8	-23.1	-24	29.71	54	-24.29	-	-	3	271	V
1	* ** 4.22063	39.43	Pk	33.7	-30.7	0	42.43	54	-11.57	74	-31.57	0-360	101	H
3	* ** 7.44	38.84	Pk	35.6	-27.4	0	47.04	54	-6.96	74	-26.96	0-360	101	H
5	* ** 4.96031	41.92	Pk	34	-30.5	0	45.42	54	-8.58	74	-28.58	0-360	200	V
6	* ** 7.42219	36.36	Pk	35.6	-26.7	0	45.26	54	-8.74	74	-28.74	0-360	101	V

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

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

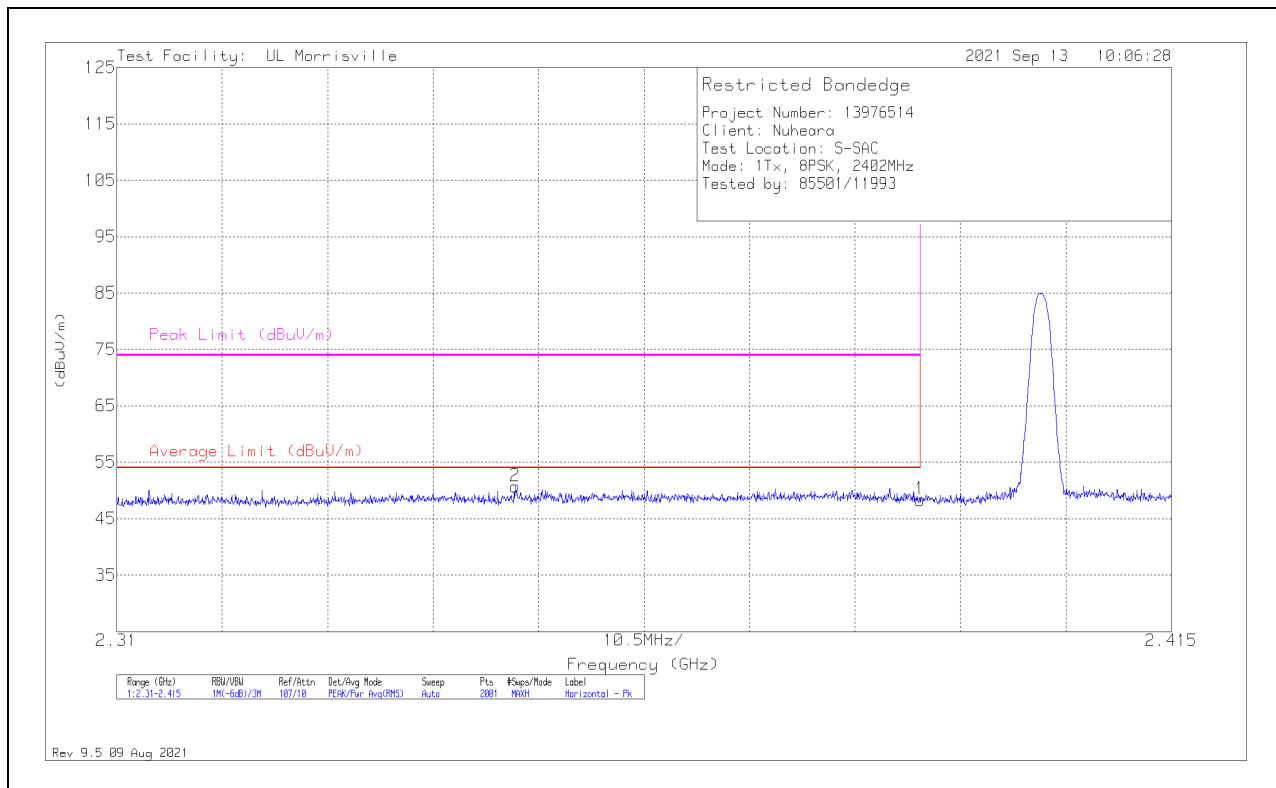
Pk - Peak detector

PK2 - Maximum Peak

## 10.1.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

### BANDEDGE (LOW CHANNEL)

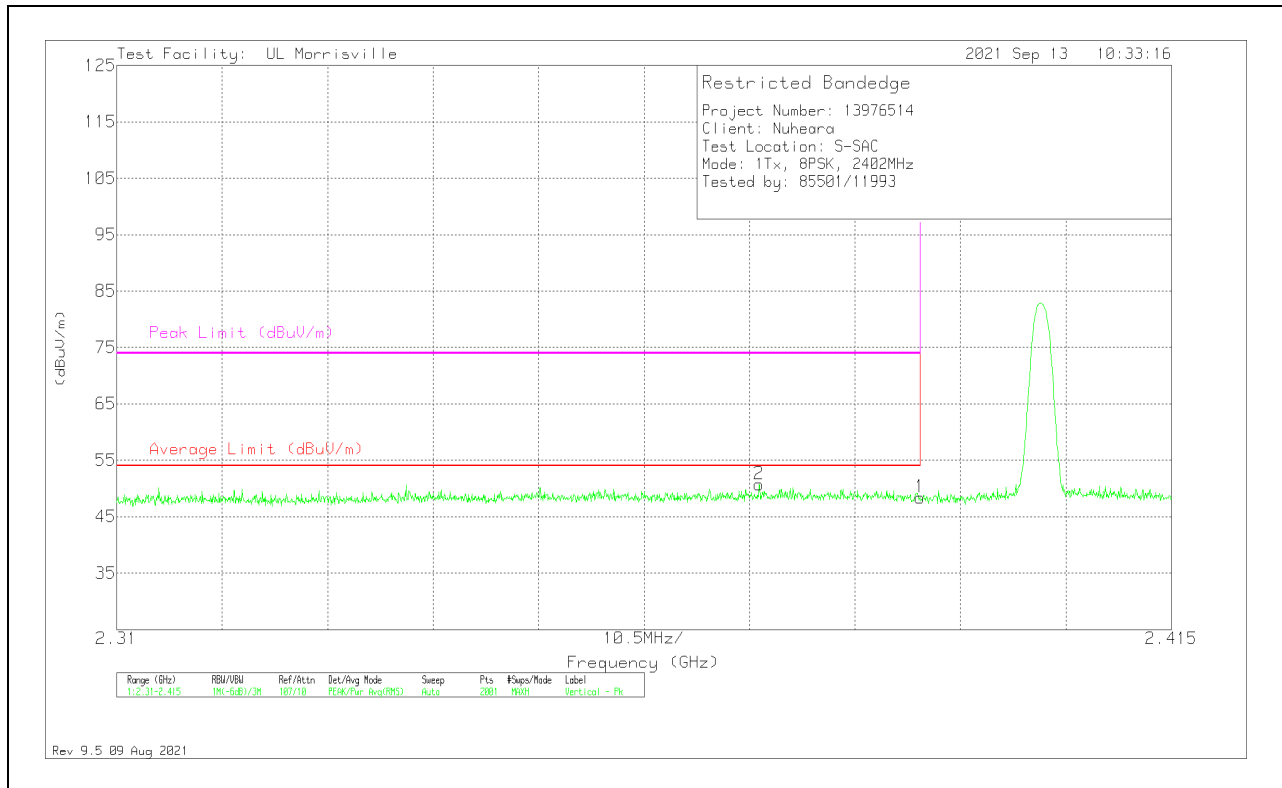
### HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.38996	40.44	Pk	31.9	-24	0	48.34	-	-	74	-25.66	267	265	H
2	*** 2.34969	42.86	Pk	32.2	-24.3	0	50.76	-	-	74	-23.24	267	265	H
1	*** 2.38996	40.44	Pk	31.9	-24	-24	24.34	54	-29.66	-	-	267	265	H
2	*** 2.34969	42.86	Pk	32.2	-24.3	-24	26.76	54	-27.24	-	-	267	265	H

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

### VERTICAL RESULT

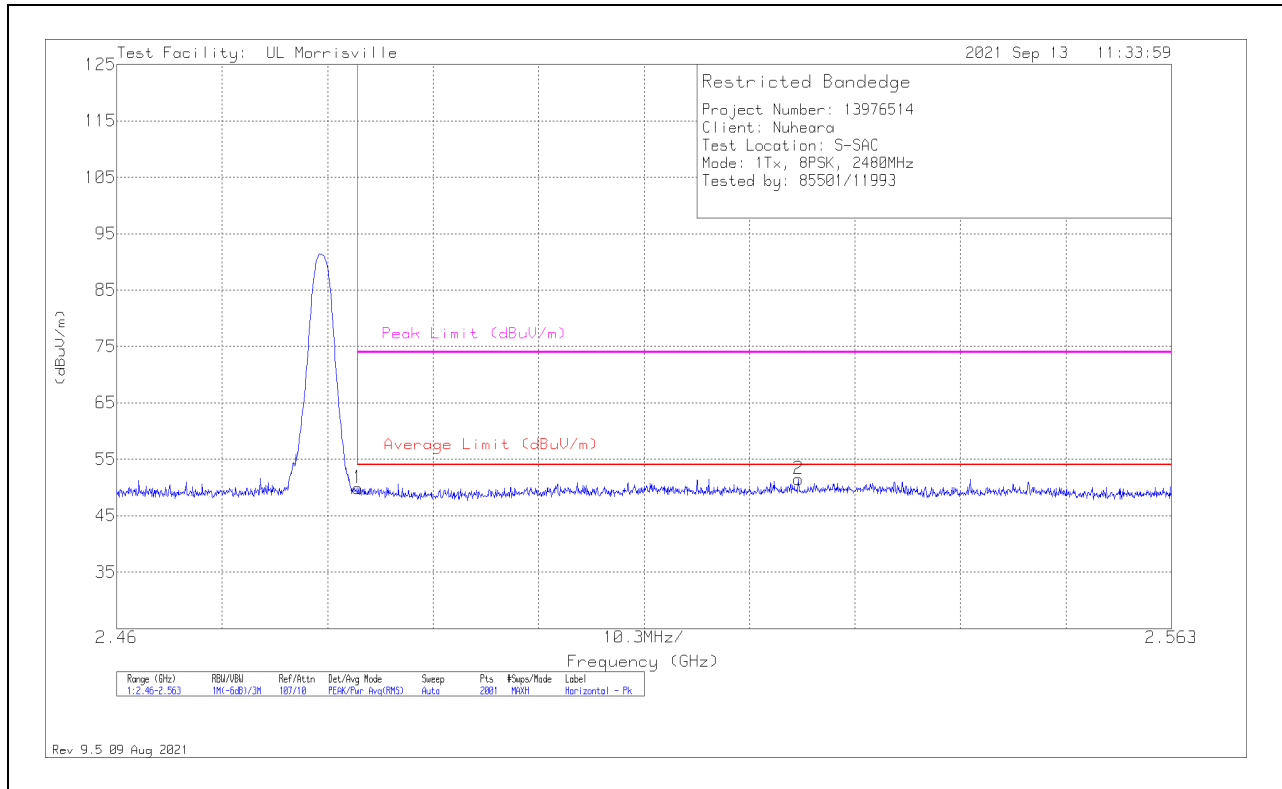


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.38996	40.45	Pk	31.9	-24	0	48.35	-	-	74	-25.65	146	388	V
2	*** 2.37395	42.5	Pk	32.3	-24.1	0	50.7	-	-	74	-23.3	146	388	V
1	*** 2.38996	40.45	Pk	31.9	-24	-24	24.35	54	-29.65	-	-	146	388	V
2	*** 2.37395	42.5	Pk	32.3	-24	-24	26.7	54	-27.3	-	-	146	388	V

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

**BANDEDGE (HIGH CHANNEL)**

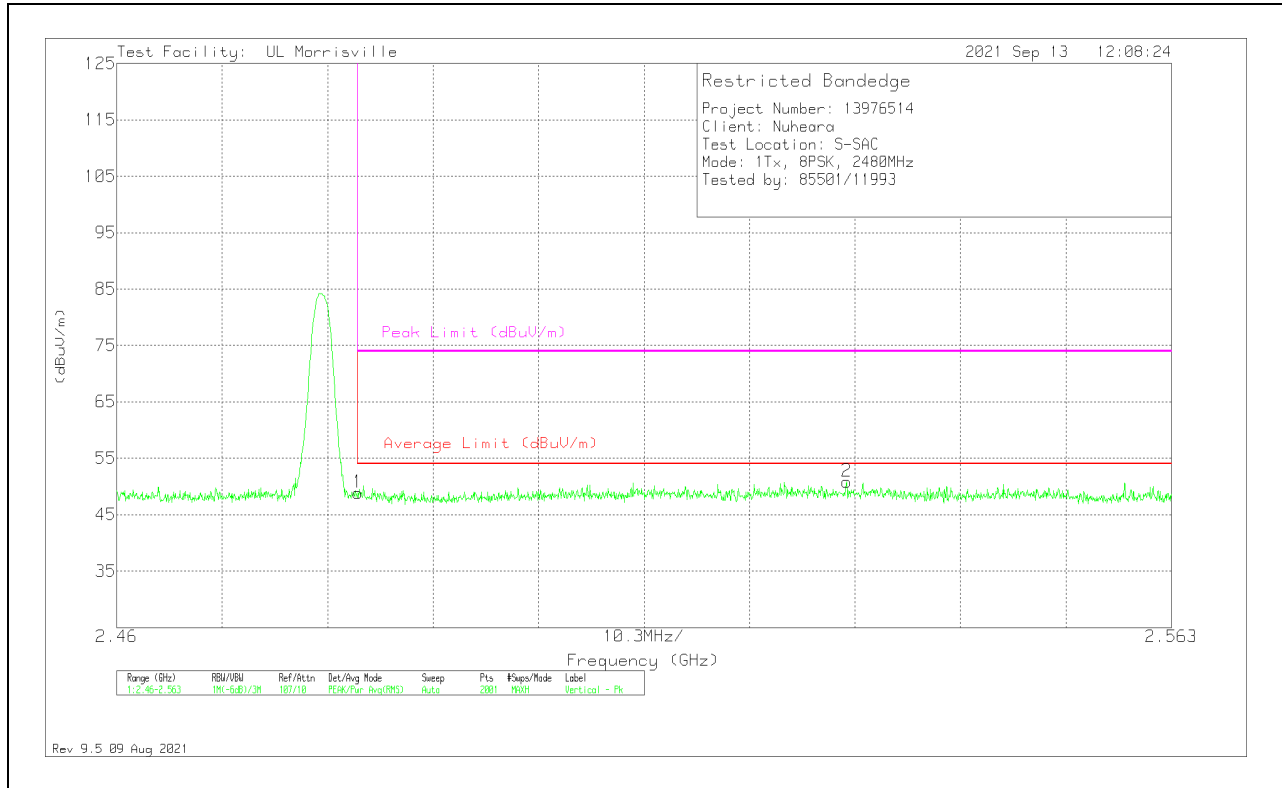
**HORIZONTAL RESULT**



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Pad (dB)	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	41.19	Pk	32.5	-23.8	0	49.89	-	-	74	-24.11	53	130	H
2	** 2.52659	42.37	Pk	32.9	-23.8	0	51.47	-	-	74	-22.53	53	130	H
1	*** 2.48354	41.19	Pk	32.5	-23.8	-24	25.89	54	-28.11	-	-	53	130	H
2	** 2.52659	42.37	Pk	32.9	-23.8	-24	27.47	54	-26.53	-	-	53	130	H

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

### VERTICAL RESULT

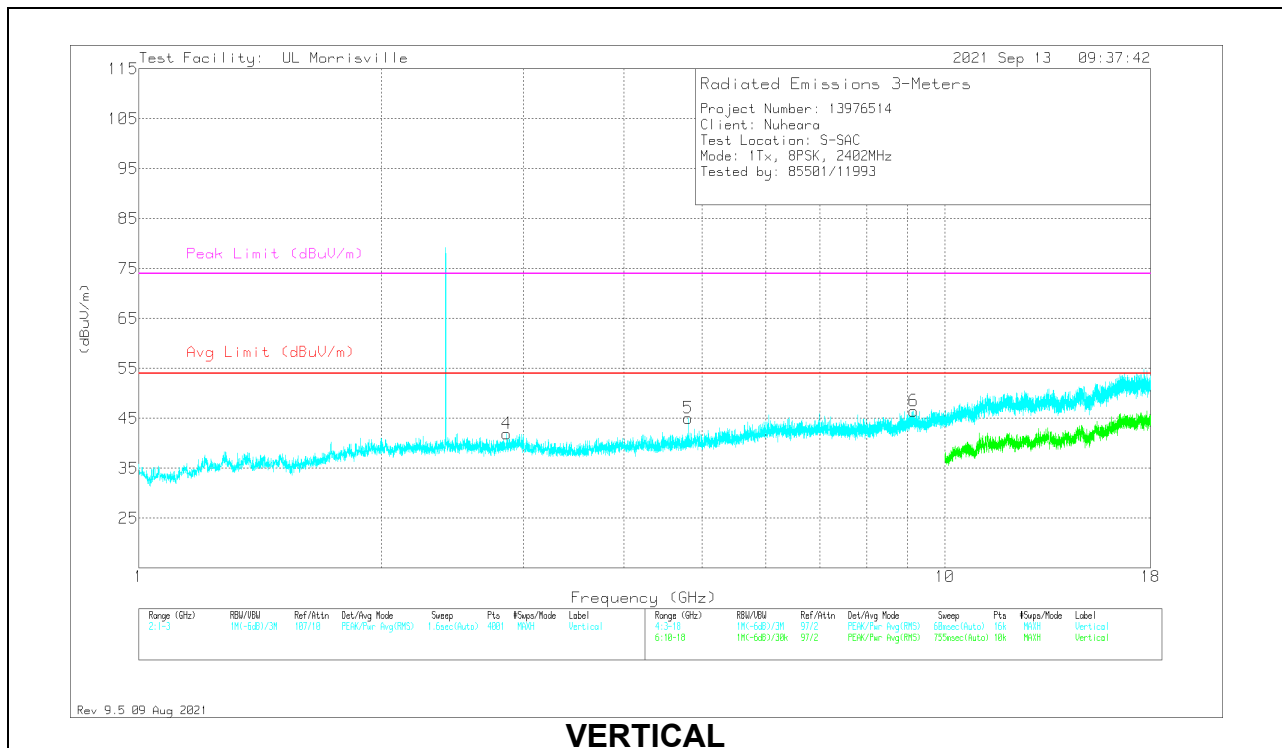
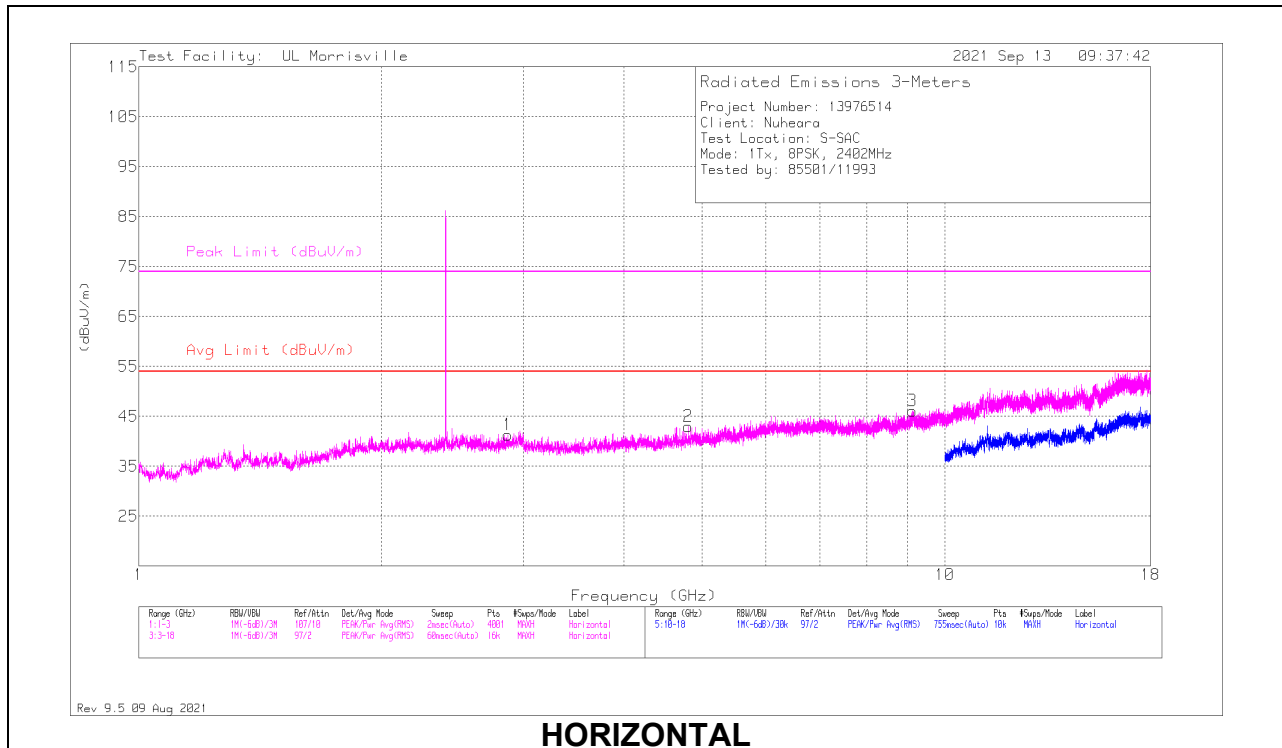


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.48354	40.15	Pk	32.5	-23.8	0	48.85	-	-	74	-25.15	8	315	V
2	** 2.53128	41.81	Pk	33.1	-24.1	0	50.81	-	-	74	-23.19	8	315	V
1	* ** 2.48354	40.15	Pk	32.5	-23.8	-24	24.85	54	-29.15	-	-	8	315	V
2	** 2.53128	41.81	Pk	33.1	-24.1	-24	26.81	54	-27.19	-	-	8	315	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**

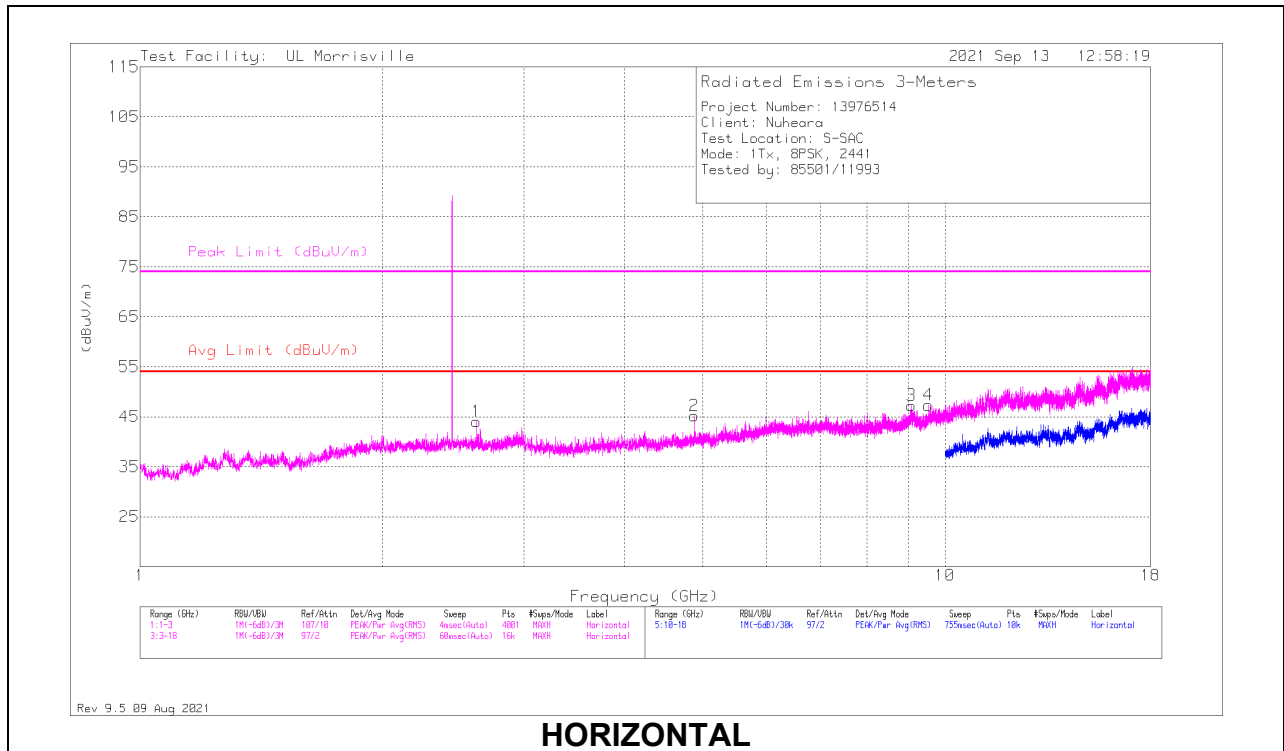
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.8695	34.66	Pk	32.5	-25.9	0	41.26	54	-12.74	74	-32.74	0-360	101	H
4	* ** 2.859	35.11	Pk	33	-26.2	0	41.91	54	-12.09	74	-32.09	0-360	101	V
2	* ** 4.80375	39.47	Pk	34.1	-30.6	0	42.97	54	-11.03	74	-31.03	0-360	199	H
5	* ** 4.80375	41.55	Pk	34.1	-30.6	0	45.05	54	-8.95	74	-28.95	0-360	101	V
3	* ** 9.11531	35.4	Pk	36.3	-25.6	0	46.1	54	-7.9	74	-27.9	0-360	199	H
6	* ** 9.14156	35.34	Pk	36.3	-25.2	0	46.44	54	-7.56	74	-27.56	0-360	101	V

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

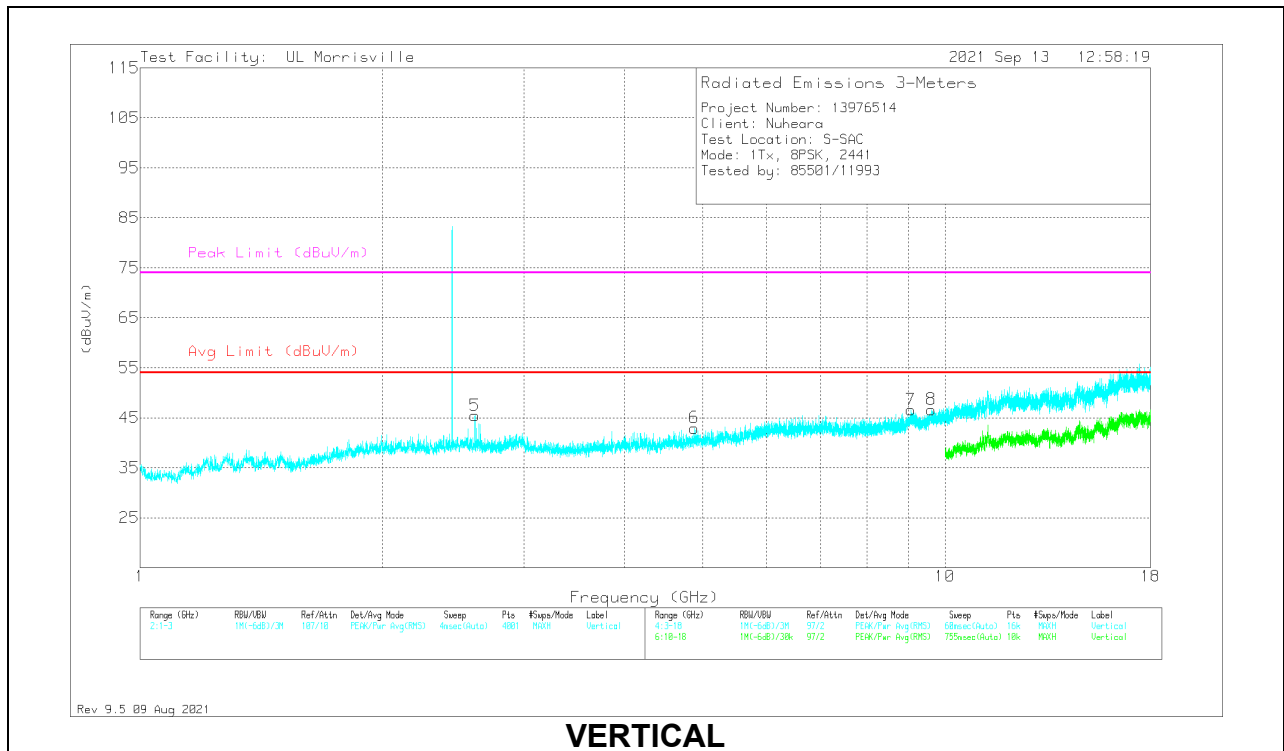
\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

### MID CHANNEL RESULTS



### HORIZONTAL



### VERTICAL

**RADIATED EMISSIONS**

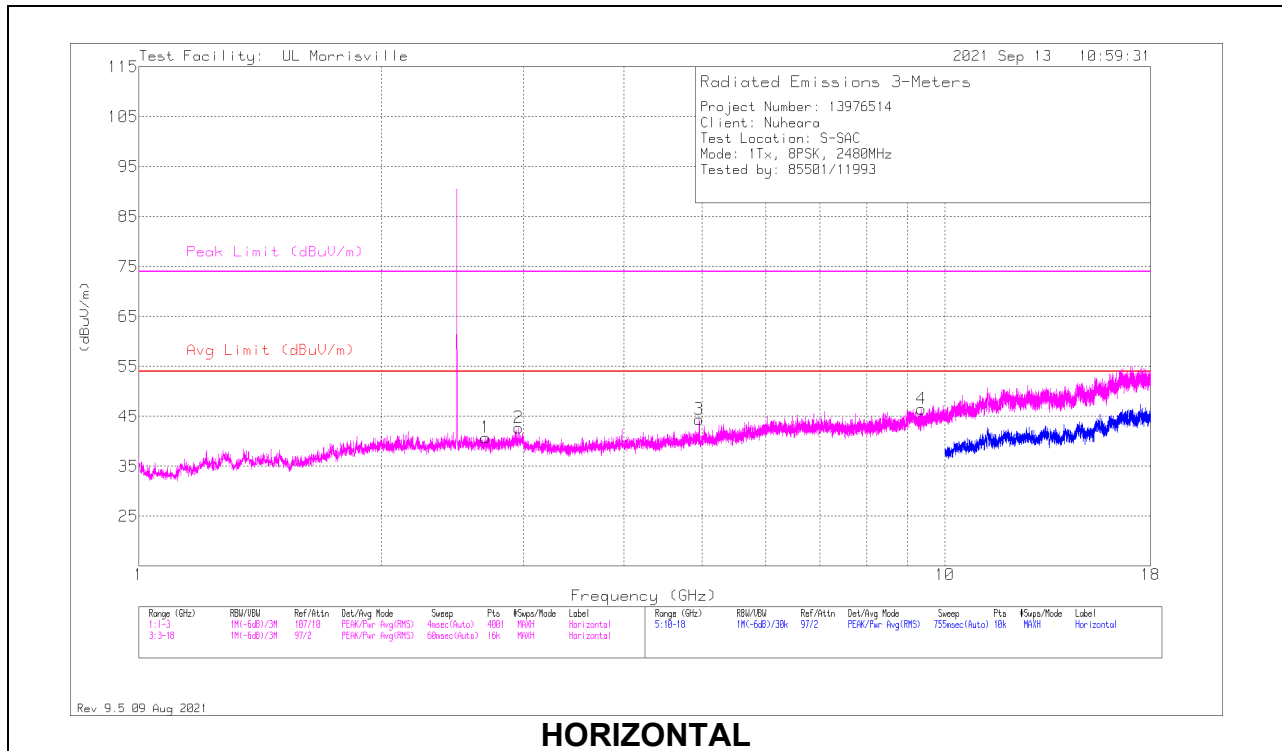
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	** 2.618	36.83	Pk	32.5	-25.3	44.03	54	-9.97	74	-29.97	0-360	101	H
5	** 2.606	38.21	Pk	32.4	-25.2	45.41	54	-8.59	74	-28.59	0-360	101	V
2	** 4.88156	41.15	Pk	34.2	-30.2	45.15	54	-8.85	74	-28.85	0-360	101	H
6	** 4.88156	38.95	Pk	34.2	-30.2	42.95	54	-11.05	74	-31.05	0-360	101	V
7	** 9.07031	35.76	Pk	36.3	-25.5	46.56	54	-7.44	74	-27.44	0-360	199	V
3	** 9.08906	36.54	Pk	36.3	-25.6	47.24	54	-6.76	74	-26.76	0-360	101	H
4	9.54094	36.3	Pk	36.8	-25.8	47.3	-	-	-	-	0-360	199	H
8	9.62344	35.43	Pk	36.9	-25.7	46.63	-	-	-	-	0-360	101	V

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

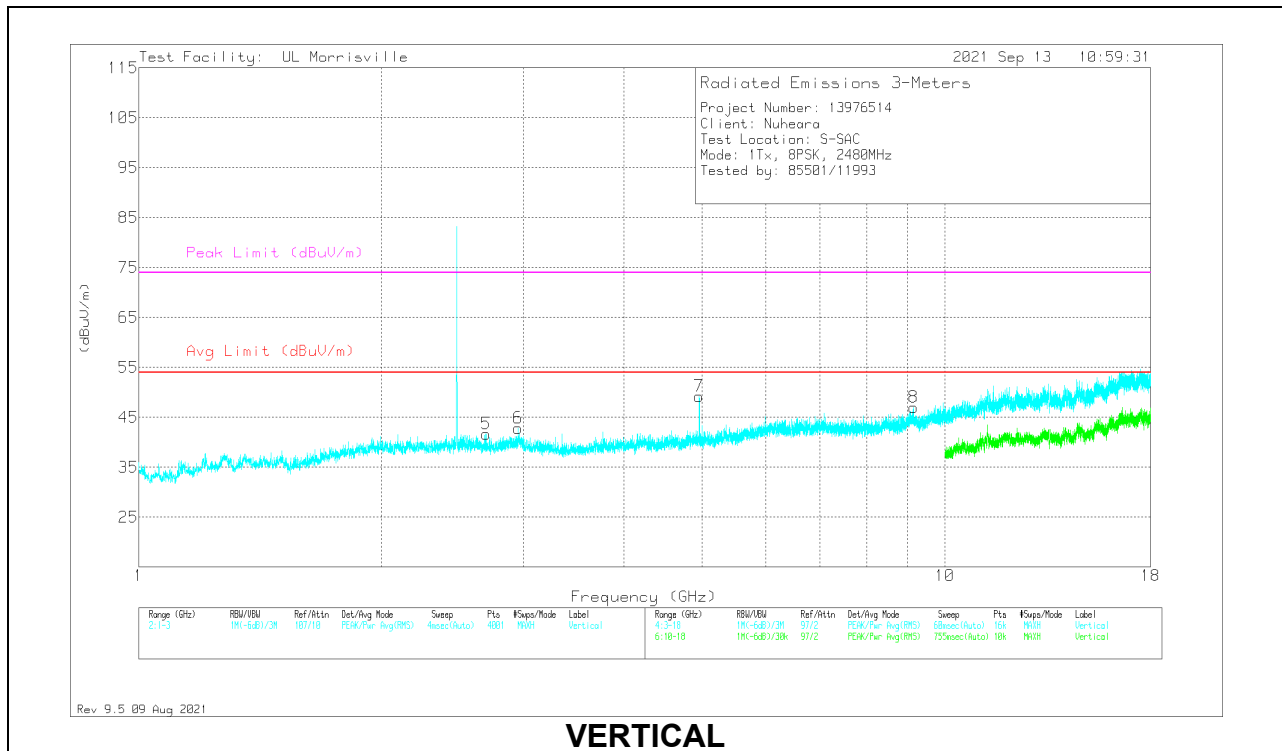
\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

### HIGH CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.694	34.3	Pk	32.5	-26	0	40.8	54	-13.2	74	-33.2	0-360	101	H
5	*** 2.696	34.94	Pk	32.5	-25.8	0	41.64	54	-12.36	74	-32.36	0-360	101	V
6	2.955	35.53	Pk	33.3	-26	0	42.83	54	-11.17	74	-31.17	0-360	101	V
2	2.962	34.89	Pk	33.4	-25.6	0	42.69	54	-11.31	74	-31.31	0-360	101	H
3	** 4.95938	40.96	Pk	34	-30.5	0	44.46	54	-9.54	74	-29.54	0-360	101	H
7	*** 4.95919	29.83	PK2	34	-30.5	0	33.33	-	-	74	-40.67	272	105	V
	*** 4.95919	29.83	PK2	34	-30.5	-24	9.33	54	-44.67	-	-	272	105	V
8	** 9.15094	35.8	Pk	36.3	-25.1	0	47	54	-7	74	-27	0-360	200	V
4	*** 9.34875	35.87	Pk	36.5	-25.9	0	46.47	54	-7.53	74	-27.53	0-360	101	H

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

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

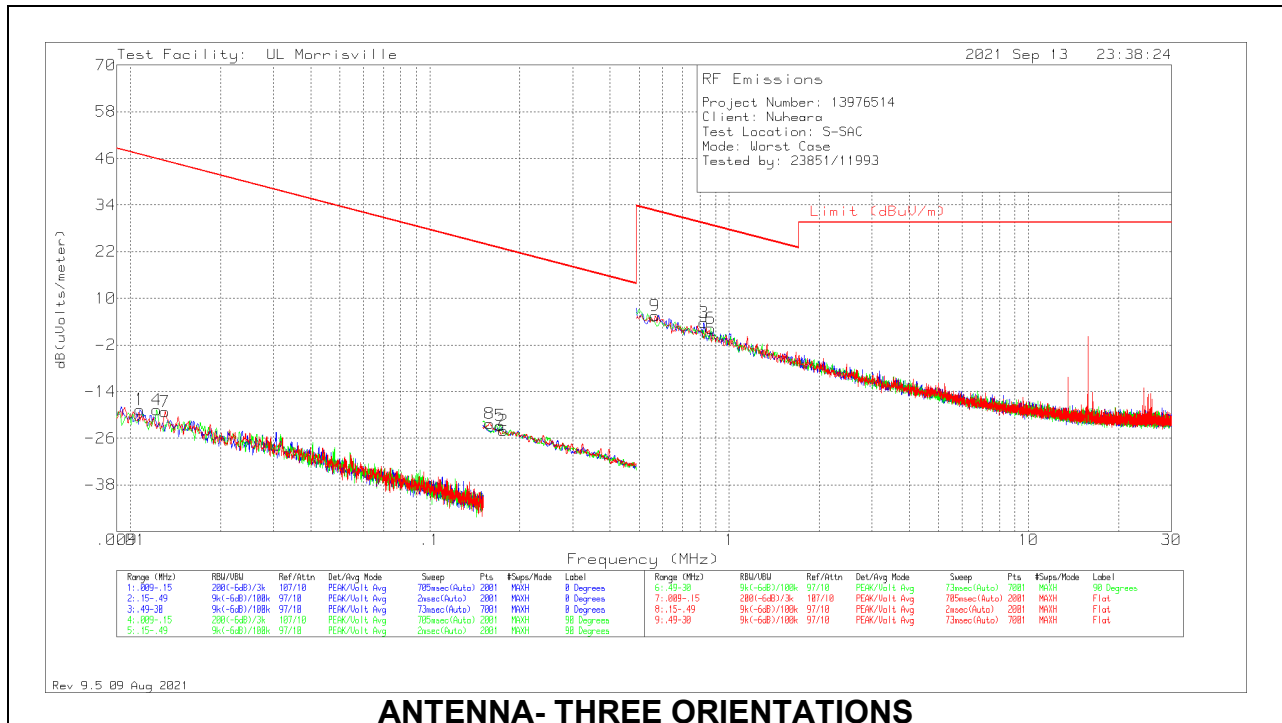
Pk - Peak detector

PK2 - Maximum Peak

## 10.2. WORST CASE BELOW 30MHZ

Note for below 30 MHz scans: All measurements were made at a test distance of 3 m. The measured data was extrapolated from the test distance (3m) to the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were  $40 \cdot \log(\text{test distance} / \text{specification distance})$ .

### SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



### ANTENNA- THREE ORIENTATIONS

**Below 30MHz Data**

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	.01078	43.18	Pk	18.1	.1	-80	-18.62	46.96	-65.58	0-360	401	On
2	.17567	44.72	Pk	11.2	.1	-80	-23.98	22.71	-46.69	0-360	401	On
3	.82306	32.19	Pk	11.3	.2	-40	3.69	29.3	-25.61	0-360	401	On
4	.01227	43.84	Pk	17.4	.1	-80	-18.66	45.83	-64.49	0-360	401	Off
5	.17193	45.94	Pk	11.2	.1	-80	-22.76	22.9	-45.66	0-360	401	Off
6	.86944	30.75	Pk	11.3	.2	-40	2.25	28.82	-26.57	0-360	401	Off
7	.01305	43.61	Pk	17.1	.1	-80	-19.19	45.29	-64.48	0-360	401	Flat
8	.15825	46.5	Pk	11.2	.1	-80	-22.2	23.62	-45.82	0-360	401	Flat
9	.56589	34.16	Pk	11.2	.2	-40	5.56	32.55	-26.99	0-360	401	Flat

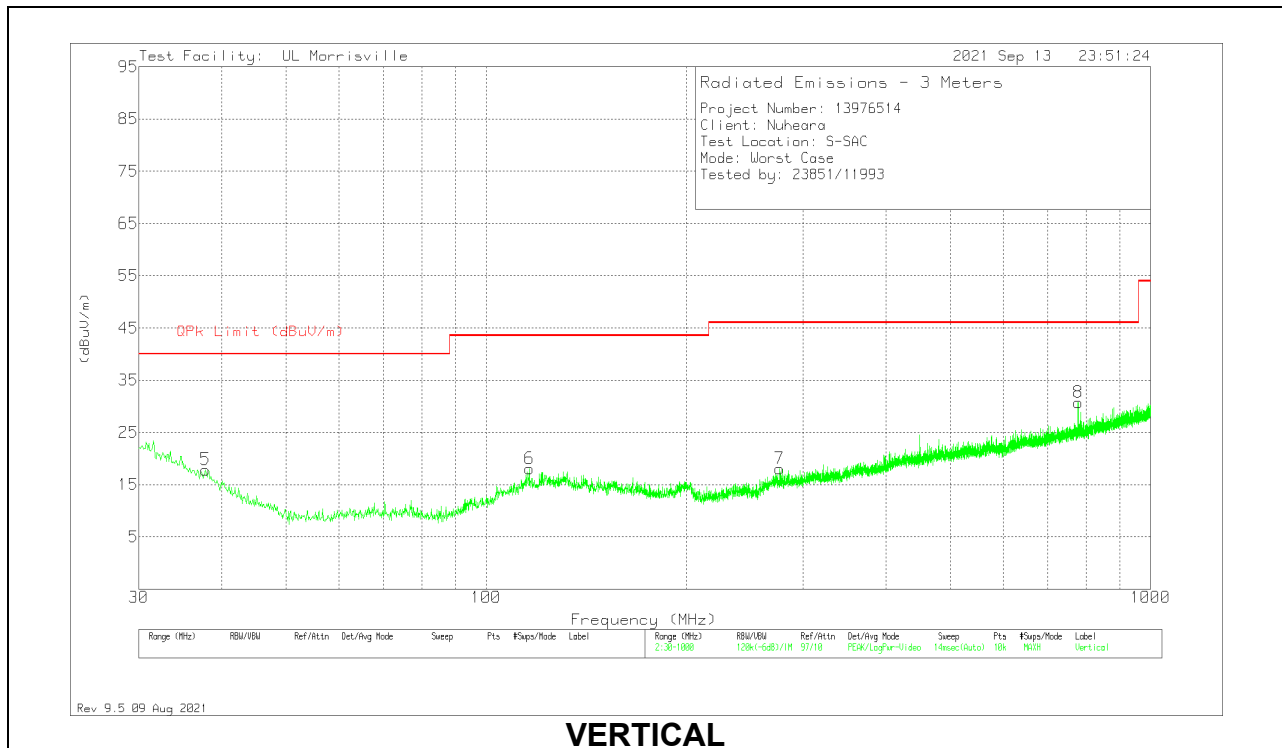
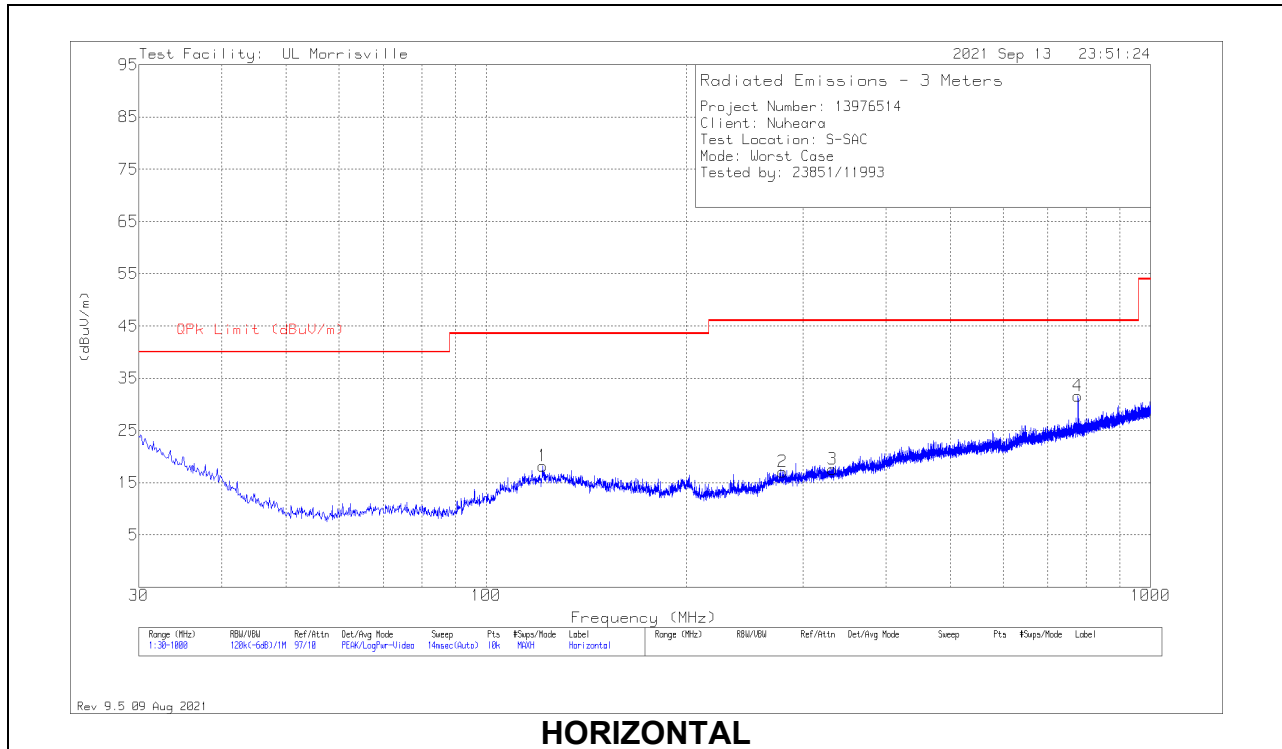
Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uAmps/meter)	Limit (dBuA/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	.01078	43.18	Pk	-33.4	.1	-80	-70.12	-4.54	-65.58	0-360	401	On
2	.17567	44.72	Pk	-40.3	.1	-80	-75.48	-28.79	-46.69	0-360	401	On
3	.82306	32.19	Pk	-40.2	.2	-40	-47.81	-22.2	-25.61	0-360	401	On
4	.01227	43.84	Pk	-34.1	.1	-80	-70.16	-5.67	-64.49	0-360	401	Off
5	.17193	45.94	Pk	-40.3	.1	-80	-74.26	-28.6	-45.66	0-360	401	Off
6	.86944	30.75	Pk	-40.2	.2	-40	-49.25	-22.68	-26.57	0-360	401	Off
7	.01305	43.61	Pk	-34.4	.1	-80	-70.69	-6.21	-64.48	0-360	401	Flat
8	.15825	46.5	Pk	-40.3	.1	-80	-73.7	-27.88	-45.82	0-360	401	Flat
9	.56589	34.16	Pk	-40.3	.2	-40	-45.94	-18.95	-26.99	0-360	401	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	* ** 121.665	28.23	Pk	20.1	-30.2	18.13	43.52	-25.39	0-360	199	H
2	* ** 279.387	26.48	Pk	19.4	-28.8	17.08	46.02	-28.94	0-360	399	H
3	* ** 332.349	25.98	Pk	20.1	-28.5	17.58	46.02	-28.44	0-360	101	H
4	** 777.87	30.92	Pk	27.2	-26.5	31.62	46.02	-14.4	0-360	299	H
5	* ** 37.76	27.77	Pk	21.5	-31.4	17.87	40	-22.13	0-360	299	V
6	* ** 116.136	28.61	Pk	19.7	-30.3	18.01	43.52	-25.51	0-360	199	V
7	* ** 276.38	27.56	Pk	19.4	-28.9	18.06	46.02	-27.96	0-360	199	V
8	** 777.967	30.06	Pk	27.2	-26.5	30.76	46.02	-15.26	0-360	199	V

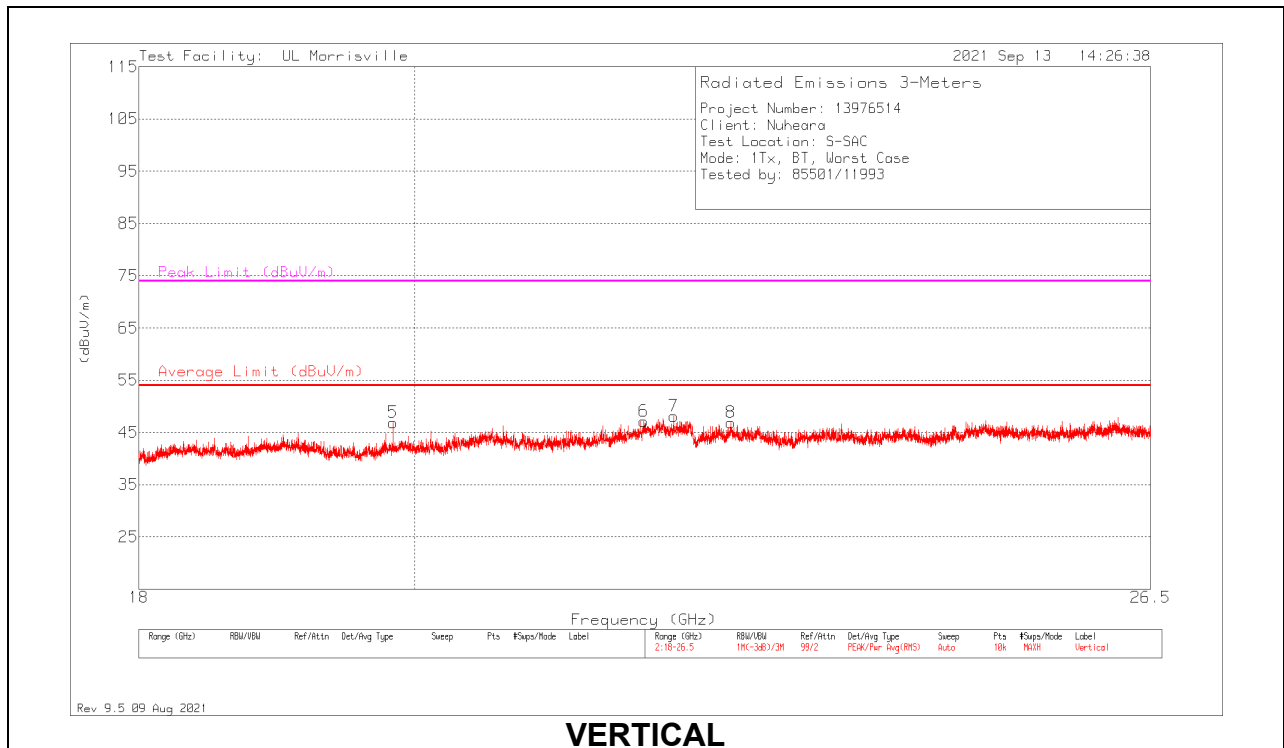
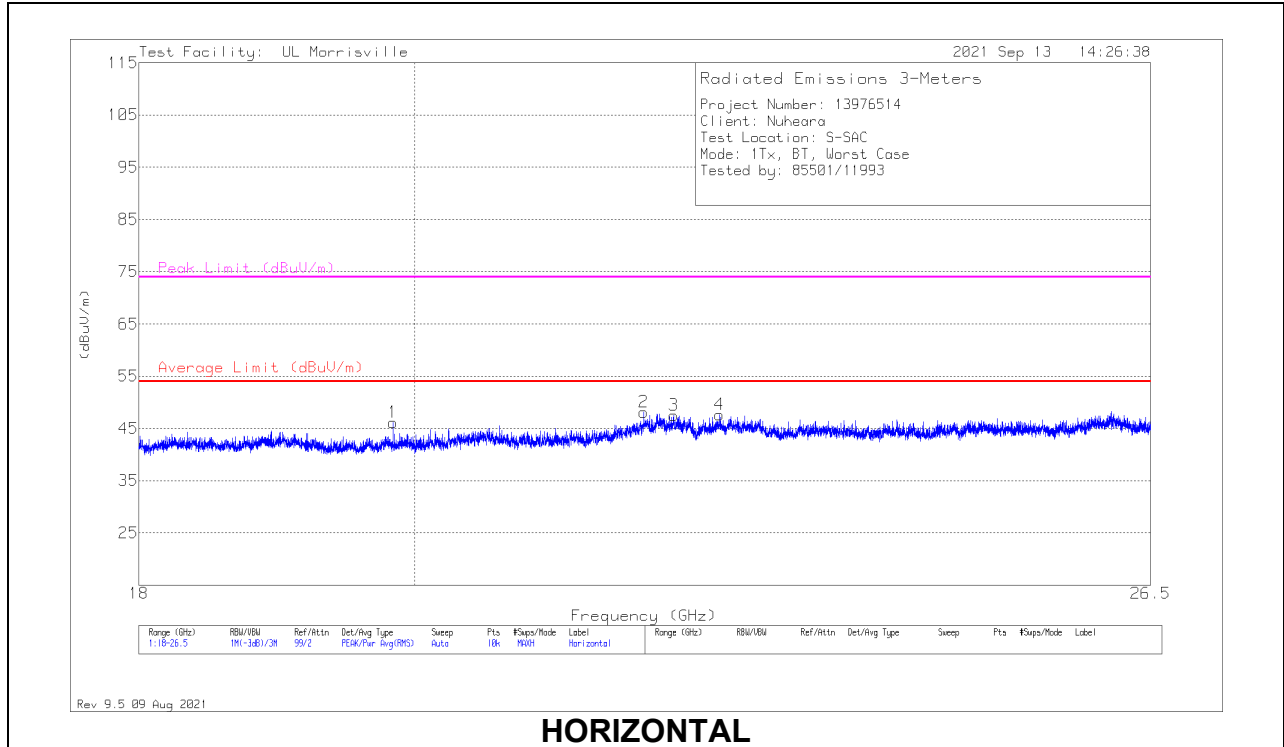
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

\*\* - 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)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 19.83667	50.64	Pk	33.6	-38.1	0	46.14	54	-7.86	74	-27.86	0-360	250	H
3	* ** 22.08469	48.62	Pk	36.8	-37.9	0	47.52	54	-6.48	74	-26.48	0-360	101	H
4	* ** 22.47225	48.75	Pk	36.5	-37.6	0	47.65	54	-6.35	74	-26.35	0-360	101	H
5	* ** 19.83667	51.42	Pk	33.6	-38.1	0	46.92	54	-7.08	74	-27.08	0-360	101	V
7	* ** 22.08538	49.75	PK2	36.8	-37.9	0	48.65	-	-	74	-25.35	32	334	V
	* ** 22.08538	49.75	PK2	36.8	-37.9	-24	24.65	54	-29.35	-	-	32	334	V
8	* ** 22.57169	47.84	Pk	36.2	-37.2	0	46.84	54	-7.16	74	-27.16	0-360	201	V
6	21.83057	48.57	Pk	36.6	-38.1	0	47.07	-	-	74	-26.93	0-360	101	V
2	21.83142	49.37	Pk	36.6	-37.9	0	48.07	-	-	74	-25.93	0-360	250	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

## 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 C63.10.

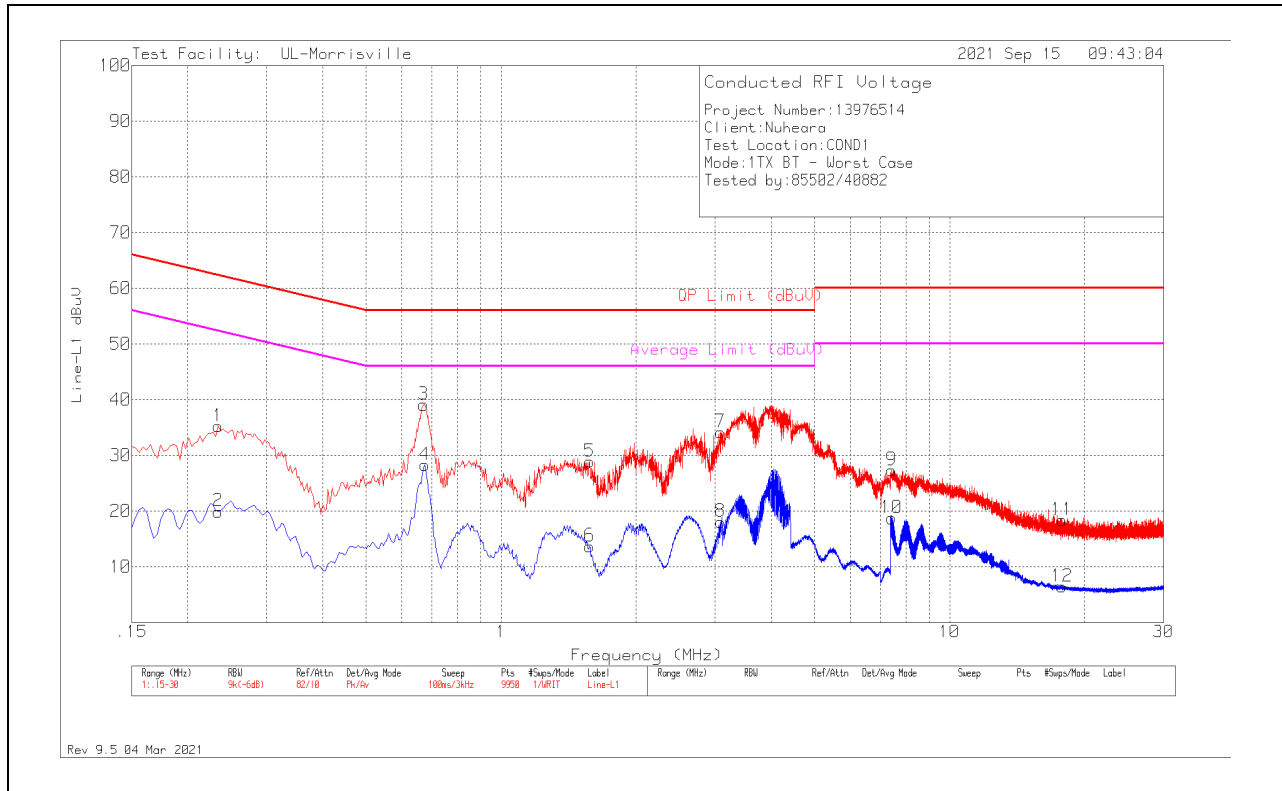
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

### RESULTS

### 11.1.1. AC Power Line Norm

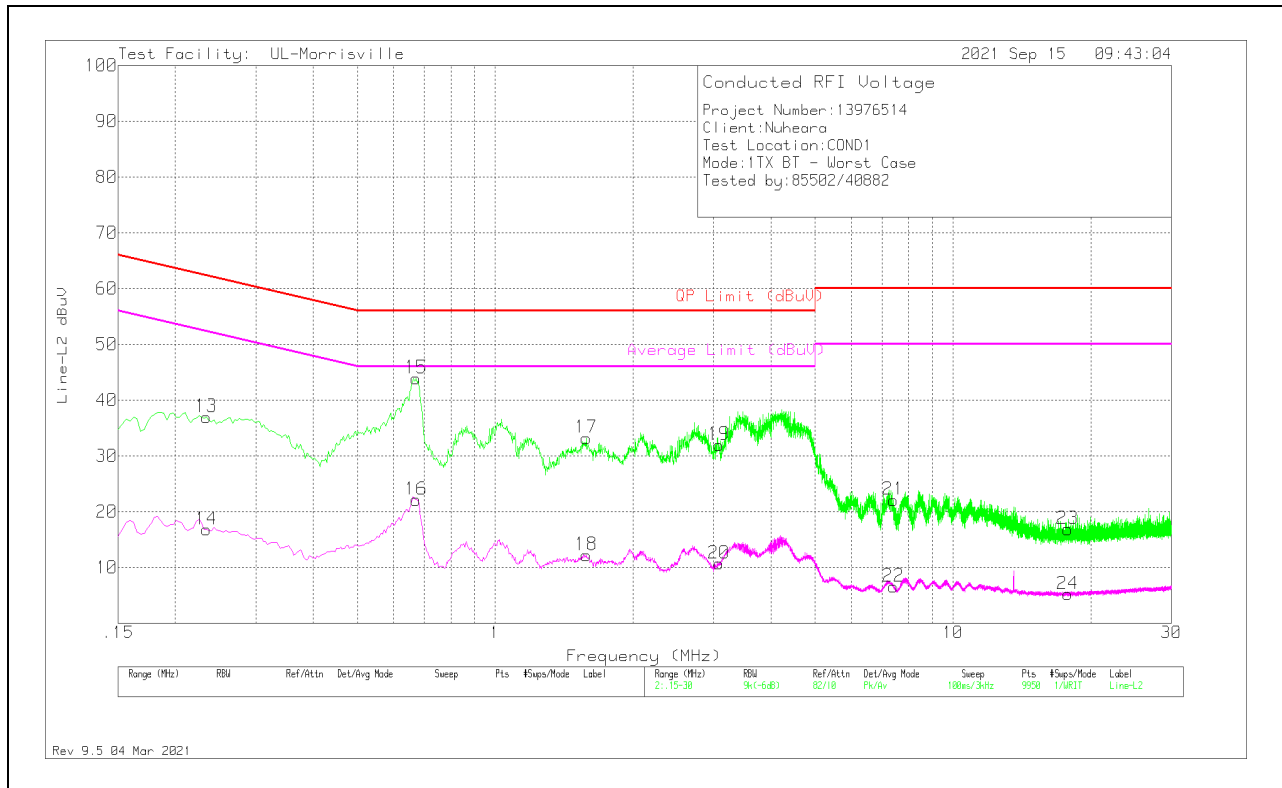
### LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN_wc_VCF	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.234	25.32	Pk	.1	9.8	35.22	62.31	-27.09	-	-
2	.234	10.04	Av	.1	9.8	19.94	-	-	52.31	-32.37
3	.672	29.3	Pk	0	9.8	39.1	56	-16.9	-	-
4	.675	18.48	Av	0	9.8	28.28	-	-	46	-17.72
5	1.575	19.08	Pk	0	9.8	28.88	56	-27.12	-	-
6	1.575	3.9	Av	0	9.8	13.7	-	-	46	-32.3
7	3.081	24.38	Pk	0	9.8	34.18	56	-21.82	-	-
8	3.081	8.3	Av	0	9.8	18.1	-	-	46	-27.9
10	7.422	8.65	Av	.1	10	18.75	-	-	50	-31.25
9	7.425	17.24	Pk	.1	10	27.34	60	-32.66	-	-
12	17.793	-3.75	Av	.1	10.1	6.45	-	-	50	-43.55
11	17.796	8.19	Pk	.1	10.1	18.39	60	-41.61	-	-

Pk - Peak detector  
 Av - Average detector

### LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN_wc_VCF	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
13	.234	27.1	Pk	.1	9.8	37	62.31	-25.31	-	-
14	.234	6.93	Av	.1	9.8	16.83	-	-	52.31	-35.48
15	.672	34.12	Pk	0	9.8	43.92	56	-12.08	-	-
16	.672	12.36	Av	0	9.8	22.16	-	-	46	-23.84
17	1.581	23.43	Pk	0	9.8	33.23	56	-22.77	-	-
18	1.581	2.44	Av	0	9.8	12.24	-	-	46	-33.76
19	3.081	22.19	Pk	0	9.8	31.99	56	-24.01	-	-
20	3.081	.91	Av	0	9.8	10.71	-	-	46	-35.29
22	7.41	-3.5	Av	.1	10	6.6	-	-	50	-43.4
21	7.416	12.04	Pk	.1	10	22.14	60	-37.86	-	-
23	17.805	6.7	Pk	.1	10.1	16.9	60	-43.1	-	-
24	17.808	-4.95	Av	.1	10.1	5.25	-	-	50	-44.75

Pk - Peak detector  
 Av - Average detector

## **12. SETUP PHOTOS**

Please refer to R13976514-EP1 for setup photos.

**END OF TEST REPORT**