CERTIFICATION TEST REPORT

Report Number. : R13441612R-E1

Applicant	:	Bose Corporation 100 The Mountain Road Framingham, MA 01701, USA
Model	:	109R
FCC ID	:	A94109R
IC	:	3232A-109R
EUT Description	:	Wireless Headset
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C 2020 ISED RSS-247 ISSUE 2 2017 ISED RSS-GEN ISSUE 5+Amendment 1 2019

Date Of Issue:
2020-11-22

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

NVLAP TESTING

NVLAP Lab code: 200246-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2020-10-30	Initial Issue	Cristian Melara
2	2020-11-22	Revised 8PSK power limit to 21dBm (125mW) since the 8PSK 20dB BW is larger than frequency separation.	Brian T. Kiewra

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Bose Corporation
1 New York Avenue
Framingham, MA 01701, USA

EUT DESCRIPTION: Wireless Headset

MODEL: 109R

SERIAL NUMBER: 083102U02350003AE, 083102u02530009AE

DATE TESTED: 2020-10-07 to 2020-10-15

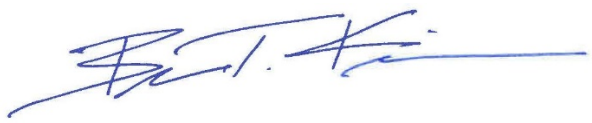
APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C 2020	Complies
ISED RSS-247 Issue 2 2017	Complies
ISED RSS-GEN Issue 5+Amendment 1 2019	Complies

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

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

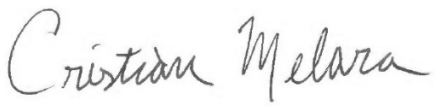
This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim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

Approved & Released For
UL LLC By:



Brian Kiewra
Project Engineer
Consumer Technology Division
UL LLC

Prepared By:



Cristian Melara
Engineer
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	Compliant	None.
15.247 (a)(1)(iii)	RSS-247 (5.1) (d)	Number of Hopping Channels	Compliant	None.
15.247 (a)(1)(iii)	RSS-247 (5.1) (d)	Average Time of Occupancy	Compliant	None.
15.247 (b)(1)	RSS-247 (5.4) (b)	Output Power	Compliant	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	Compliant	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Compliant	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Compliant	None.

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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 v05r01, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5+Amendment 1, and RSS-247 Issue 2.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Drive, Research Triangle Park, North Carolina, USA and 2800 Perimeter Park Dr., Suite B, Morrisville, North Carolina, USA. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

12 Laboratory Dr.	2800 Perimeter Park Dr.
Site Code: 2180C	
☐ Chamber A RTP	☒ North Chamber
☐ Chamber C RTP	☐ South Chamber

The above test sites and facilities are covered under FCC Test Firm Registration # 703469. Chambers above are covered under Industry Canada company address and respective code.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

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

5.2. DECISION RULES

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

5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	1.82%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	1.94 dB
All emissions, radiated	4.88 dB
Conducted Emissions (0.150-30MHz) - LISN	3.07 dB
Temperature	2.26°C
Humidity	6.79%
DC Supply voltages	1.70%
Time	3.39%

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

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a left earbud of a wireless headset with a BT/BLE transceiver.

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	8.73	7.46
2402 - 2480	Enhanced DQPSK	10.40	10.96
2402 - 2480	Enhanced 8PSK	10.80	12.02

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

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an IFA monopole antenna, with a maximum gain of -0.6 dBi

6.4. SOFTWARE AND FIRMWARE

The firmware version installed in the EUT during testing was 0.7.13.

The driver version installed in the EUT during testing was Qualcomm Technologies International, Ltd. 107.0.0.0

The test utility software used during testing was BlueSuite 3.3.4.

6.5. WORST-CASE CONFIGURATION AND MODE

Battery and charging configurations were both investigated. The battery configuration was used as worst case for radiated testing.

For radiated spurious harmonics emissions testing, both earbuds were tested at same time on different channels. This particular testing covers the right earbud only.

Radiated emissions below 1GHz, above 18GHz, and power line conducted emissions 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.

All testing performed in GFSK and 8PSK modes. 8PSK mode represents DQPSK and is considered equivalent or worst-case. Note – Power and Average Time of Occupancy were performed in DQPSK mode.

Worst-case data rates/packet sizes were:

GFSK mode: DH5
DQPSK mode: 2-DH5
8PSK mode: 3-DH5

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6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	ThinkPad T450	PC0A2UQT	NA

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB-C	1	USB-C	USB	<3m	Cable used for charging dock

TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the radio.

SETUP DIAGRAMS

Please refer to R13441612R-E1 for setup diagrams

7. TEST AND MEASUREMENT EQUIPMENT

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

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

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	**(Loop Ant.)**			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2020-08-20	2021-08-20
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2020-07-27	2021-07-27
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-04-27	2021-04-27
	18-40 GHz				
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2019-11-07	2020-11-07
	Gain-Loss Chains				
N-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2020-07-29	2021-07-29
N-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2020-07-29	2021-07-29
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-07-28	2021-07-28
N-SAC04	Gain-loss string: 18-40GHz	Various	Various	2020-07-31	2021-07-31
	Receiver & Software				
SOFTEMI	EMI Software	UL	Version 9.5 (2019-06-15)	NA	NA
	Additional Equipment used				
s/n 200037610	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22

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Test Equipment Used - Wireless Conducted Measurement Equipment

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Common Equipment				
	Conducted Room 2				
SA007 (PRE0126407	Spectrum Analyzer	Keysight Technologies	N9030A	2020-06-10	2021-06-10
72822 (PRE0101715)	Spectrum Analyzer	Agilent Technologies	E4446A	2020-01-02	2021-01-21
HI0090 (PRE0191271)	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
76021	DC Regulated Power Supply	CircuitSpecialists .Com	CSI3005X5	NA	NA
SOFTEMI	EMC Software	UL	Version 2020.9.1	NA	NA
	Additional Equipment used				
T177 (PRE0079253)	Spectrum Analyzer	Agilent Technologies	E4446A	2020-04-30	2021-04-30
MM0167 (PRE0126458)	True RMS Multimeter	Agilent	U1232A	2020-08-05	2021-08-05
PWS001 (PRE0137347)	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2020-05-27	2021-05-27
PWM002 (PRE0137344)	RF Power Meter	Keysight Technologies	N1911A	2020-07-31	2021-07-31

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

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2020-03-26	2021-03-26
HI0091	Environmental Meter	Fisher Scientific	14-650-118	2020-06-26	2021-06-26
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2020-08-18	2021-08-18
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2020-08-18	2021-08-18
ATA222	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2020-03-26	2021-03-26
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (2019-06-15)	NA	NA

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

Band-Edge: ANSI C63.10-2013 Section 7.8.6, 6.10.4 and 6.10.5

Out-of-band emissions in restricted bands: ANSI C63.10-2013 Section 6.3-6.6

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

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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	0.768	76.8%	1.15	0.347
Bluetooth QPSK	2.89	3.75	0.771	77.1%	1.13	0.346
Bluetooth 8PSK	2.89	3.75	0.771	77.1%	1.13	0.346

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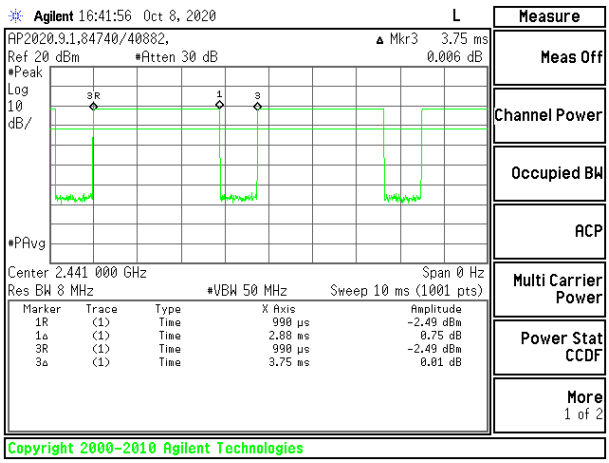
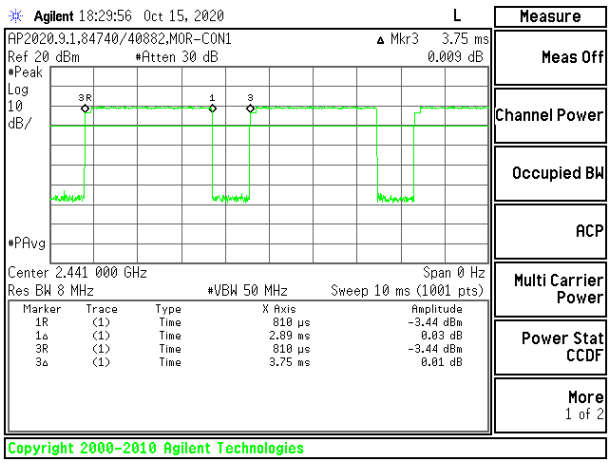
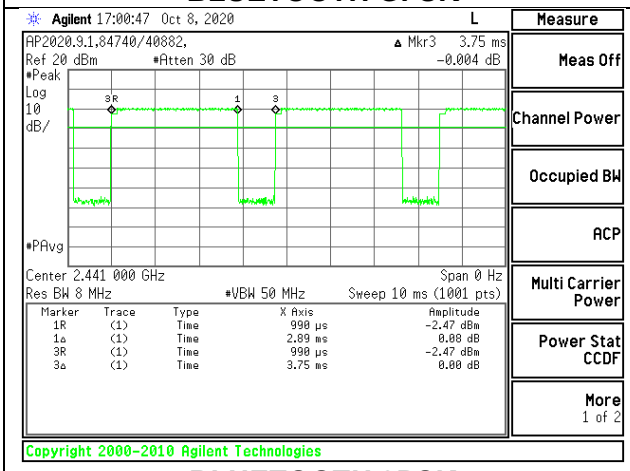
DUTY CYCLE PLOTS



BLUETOOTH GFSK



BLUETOOTH QPSK



BLUETOOTH 8PSK

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9.2. 20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

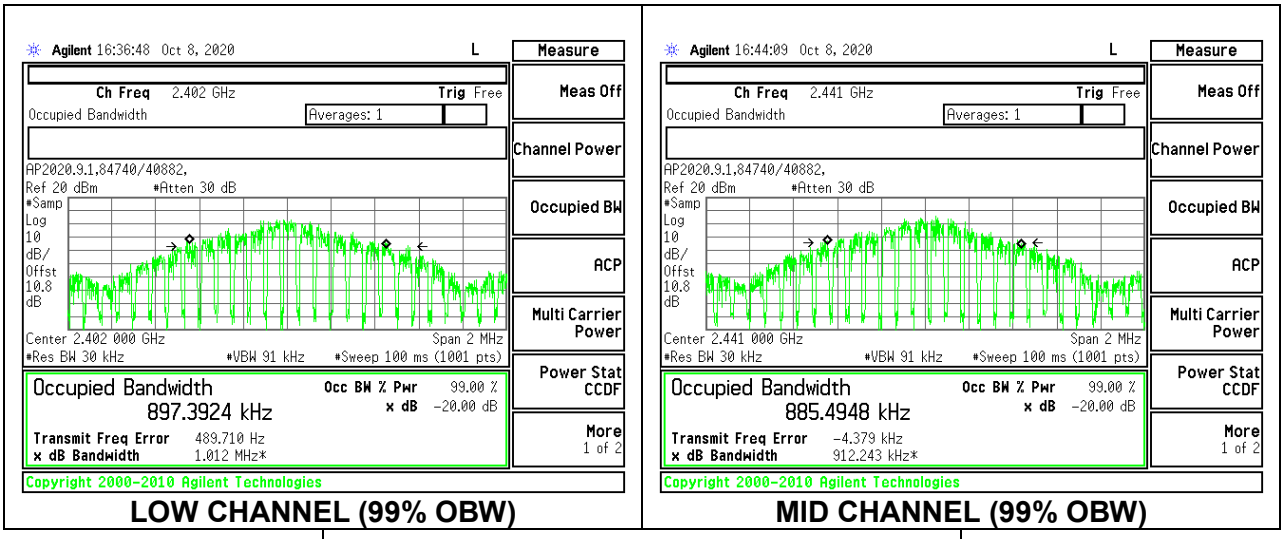
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1-5% of the 20 dB bandwidth and the 99% Occupied Bandwidth. The VBW is set to ≥ 3x RBW. The sweep time is coupled.

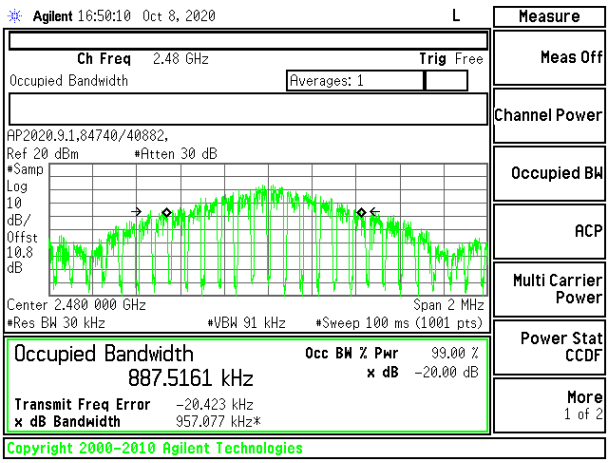
RESULTS

9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

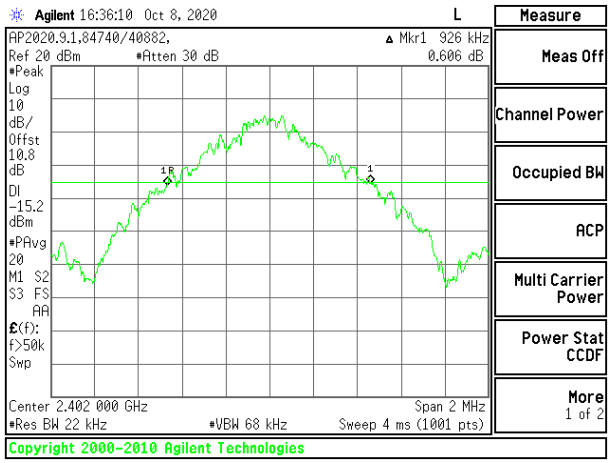
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.926	0.897
Mid	2441	0.950	0.885
High	2480	0.948	0.887



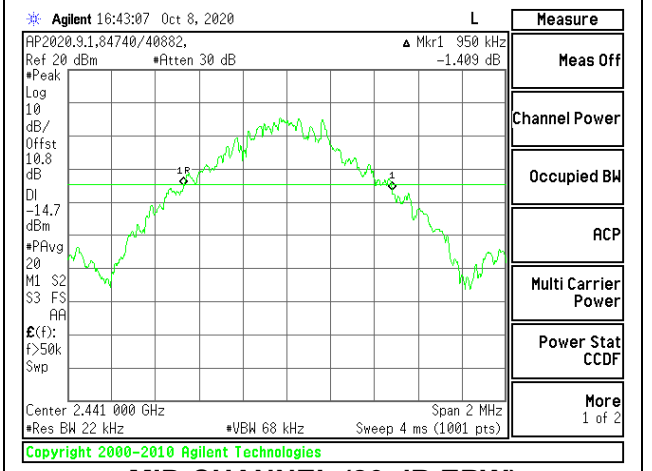
LOW CHANNEL (99% OBW) **MID CHANNEL (99% OBW)**



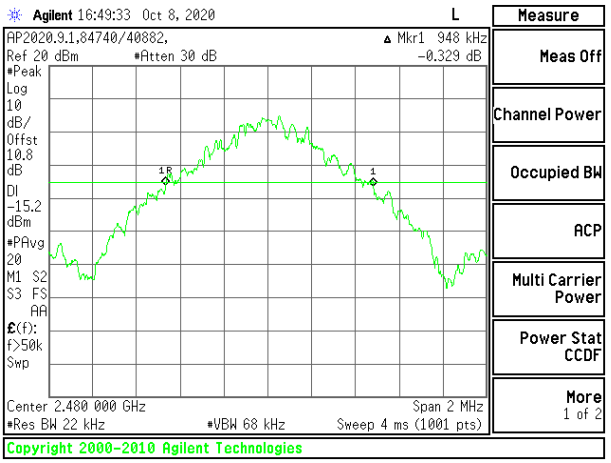
HIGH CHANNEL(99% OBW)



LOW CHANNEL (20 dB EBW)



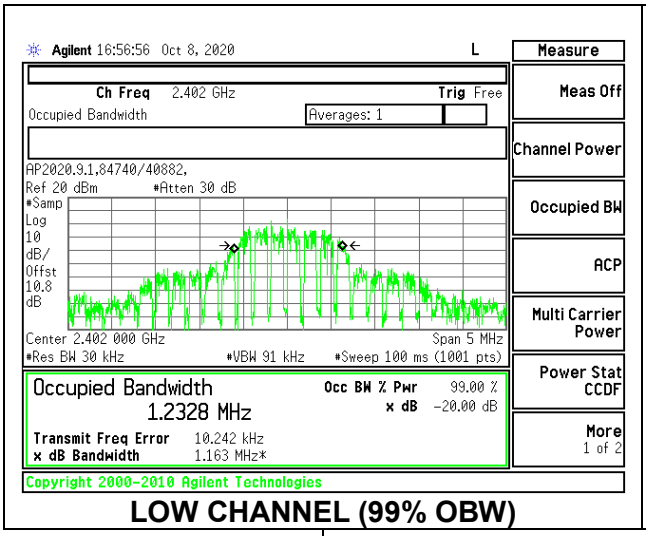
MID CHANNEL (20 dB EBW)



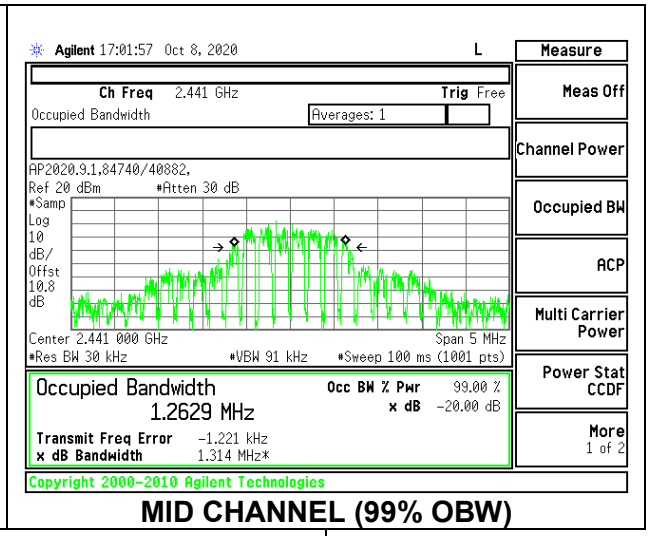
HIGH CHANNEL (20 dB EBW)

9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

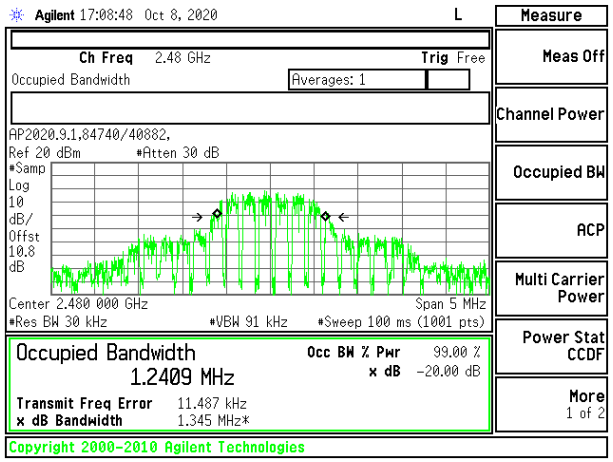
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.334	1.233
Mid	2441	1.308	1.263
High	2480	1.342	1.241



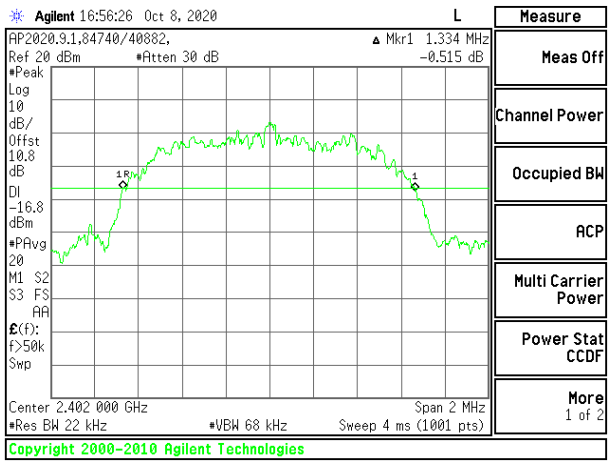
LOW CHANNEL (99% OBW)



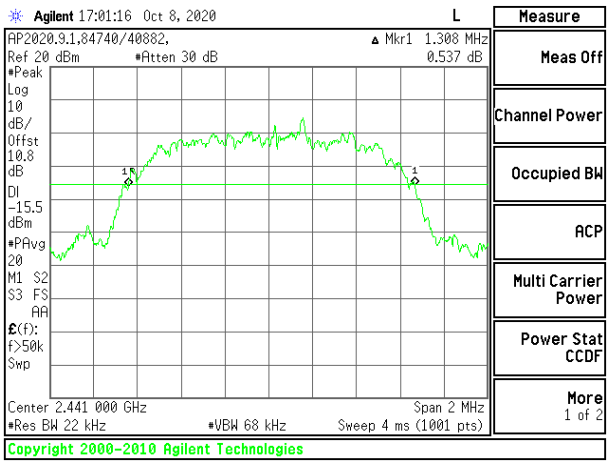
MID CHANNEL (99% OBW)



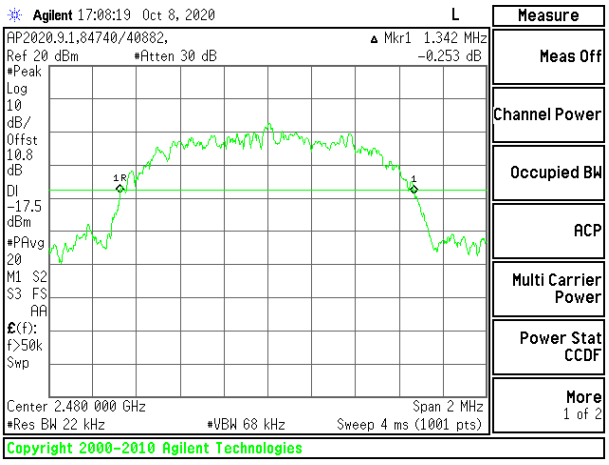
HIGH CHANNEL (99% OBW)



LOW CHANNEL (20 dB EBW)



MID CHANNEL (20 dB EBW)



HIGH CHANNEL (20 dB EBW)

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 hoping channel, whichever is greater.

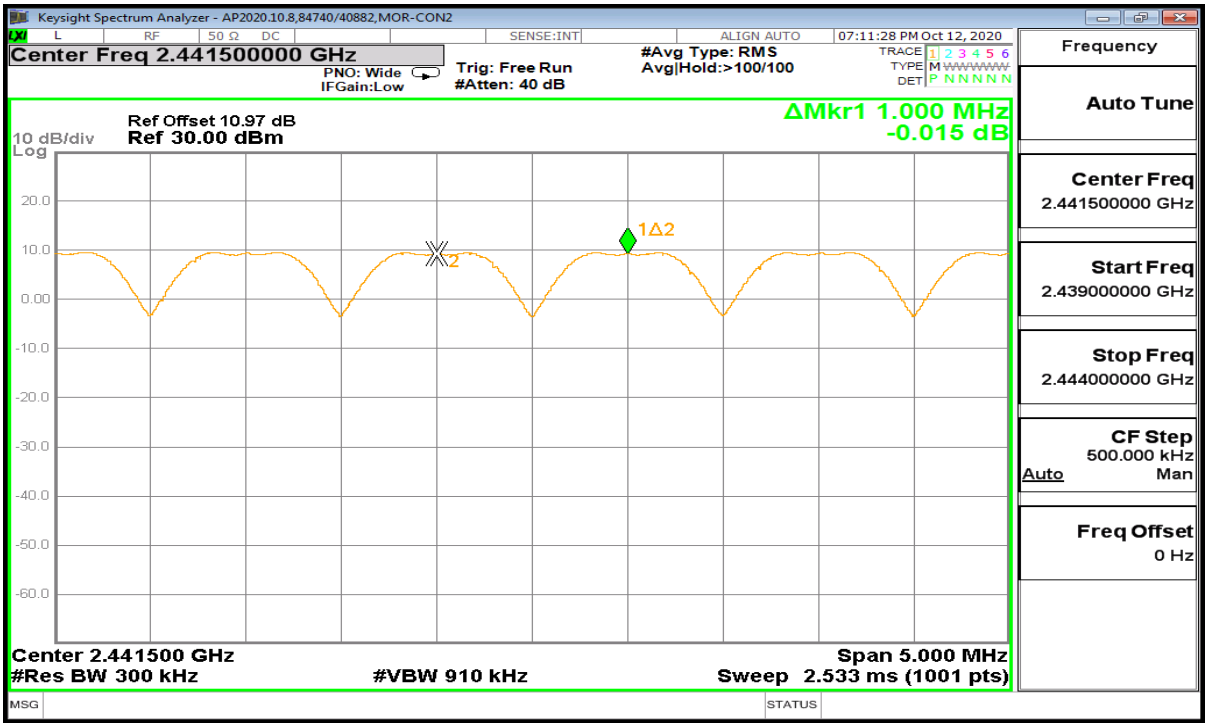
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz (approx. 30% of channel spacing) and the VBW is set to VBW >= RBW. The sweep time is coupled.

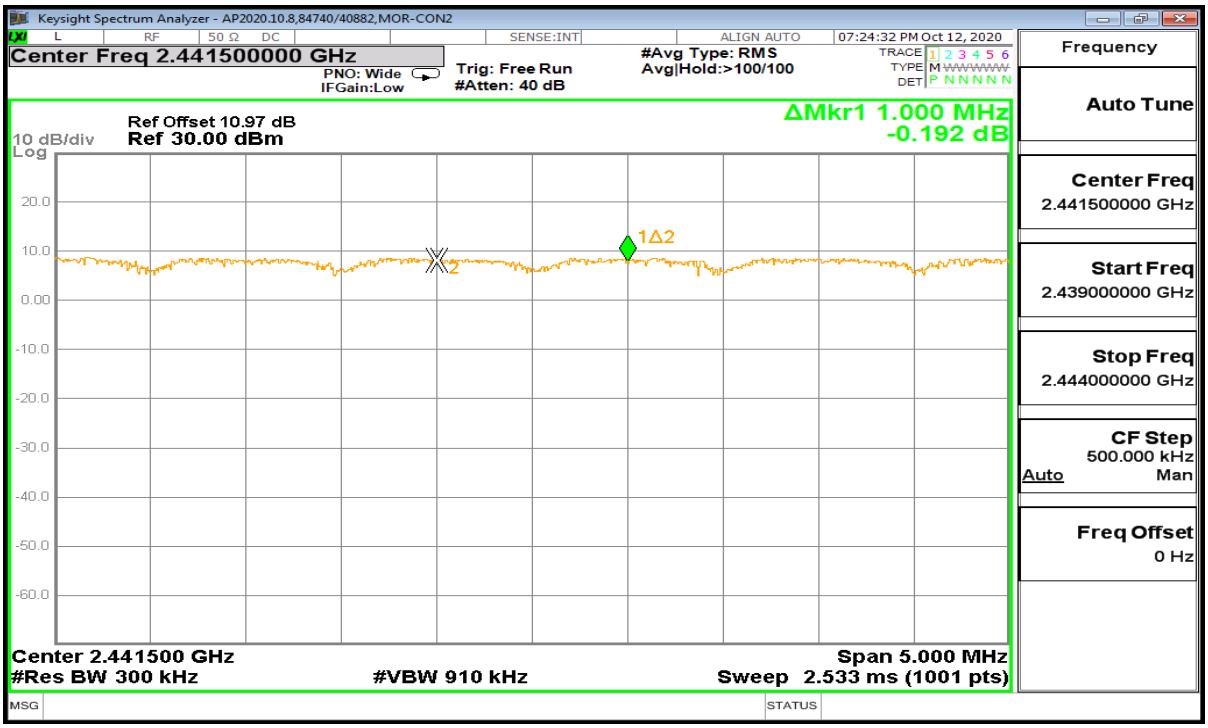
RESULTS

9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



HOPPING FREQUENCY SEPARATION PLOT

9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



HOPPING FREQUENCY SEPARATION PLOT

Note – The channel hopping separation of 1MHz is less than the 20 dB bandwidth (approx. 1.34 MHz). However, the output power is less than 125 mW and the channel separation is greater than 2/3 the 20 dB bandwidth (approx. 895 kHz).

Ch. A (MHz)	Ch. B (MHz)	Ch. 1 to Ch. 2 Sep. (MHz)	Max. 20 dB BW (MHz)	2/3 20 dB BW (MHz)	Margin (MHz)
2441	2442	1.000	1.342	0.895	-0.105

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.

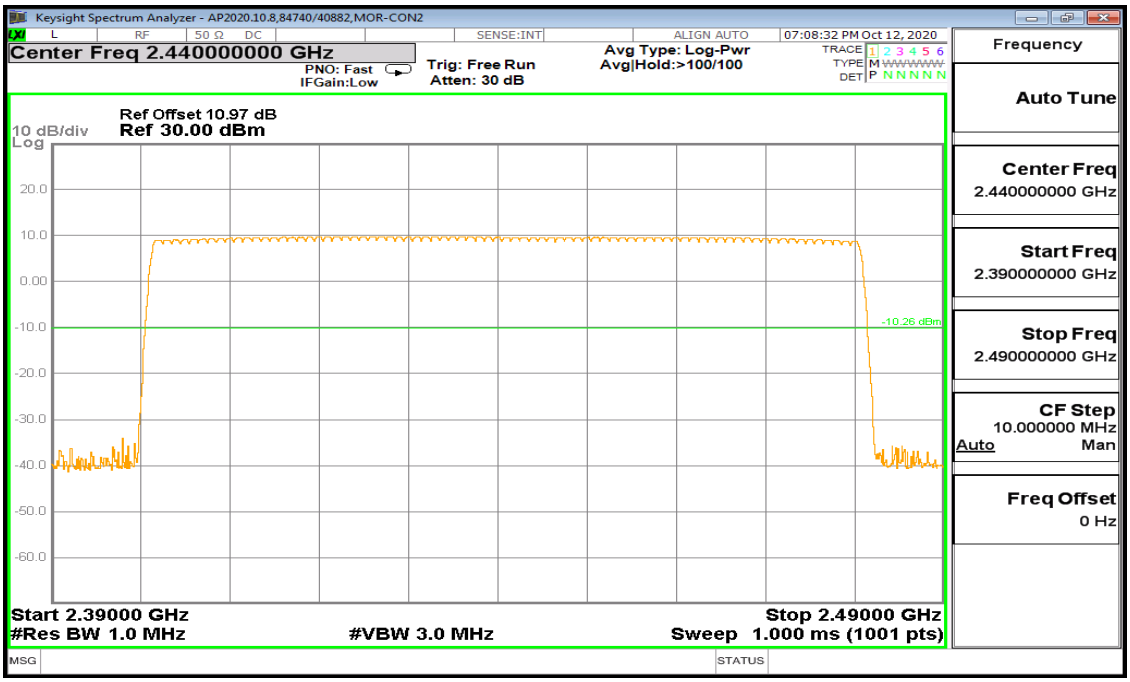
TEST PROCEDURE

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.

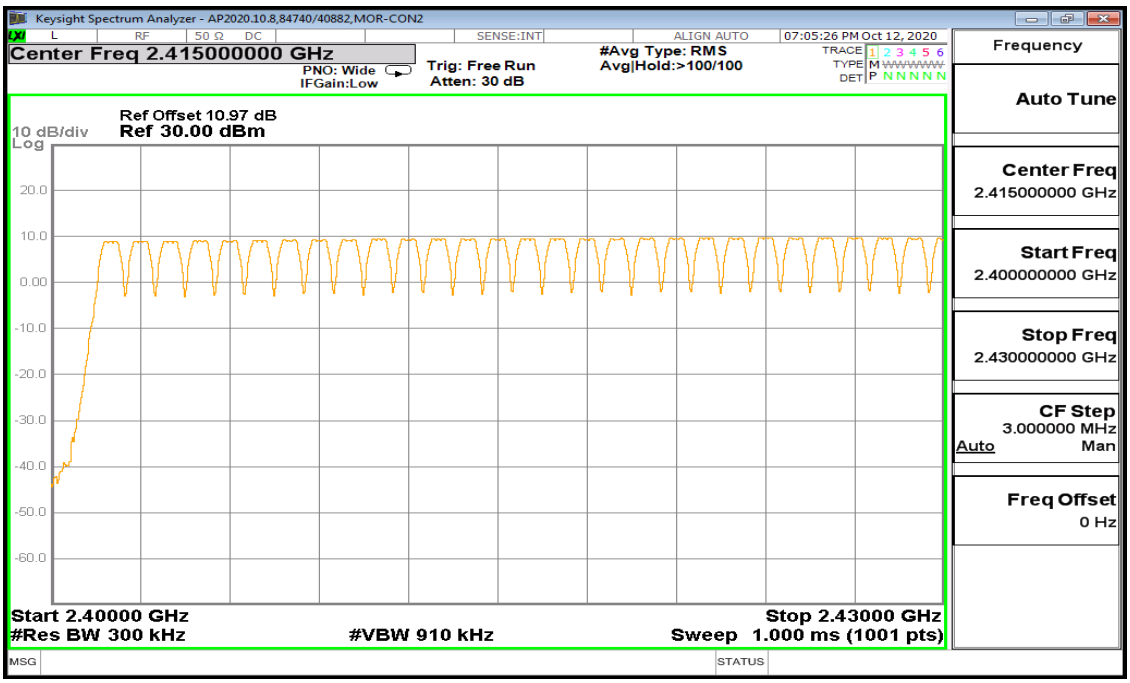
RESULTS

Normal Mode: All Channels Observed

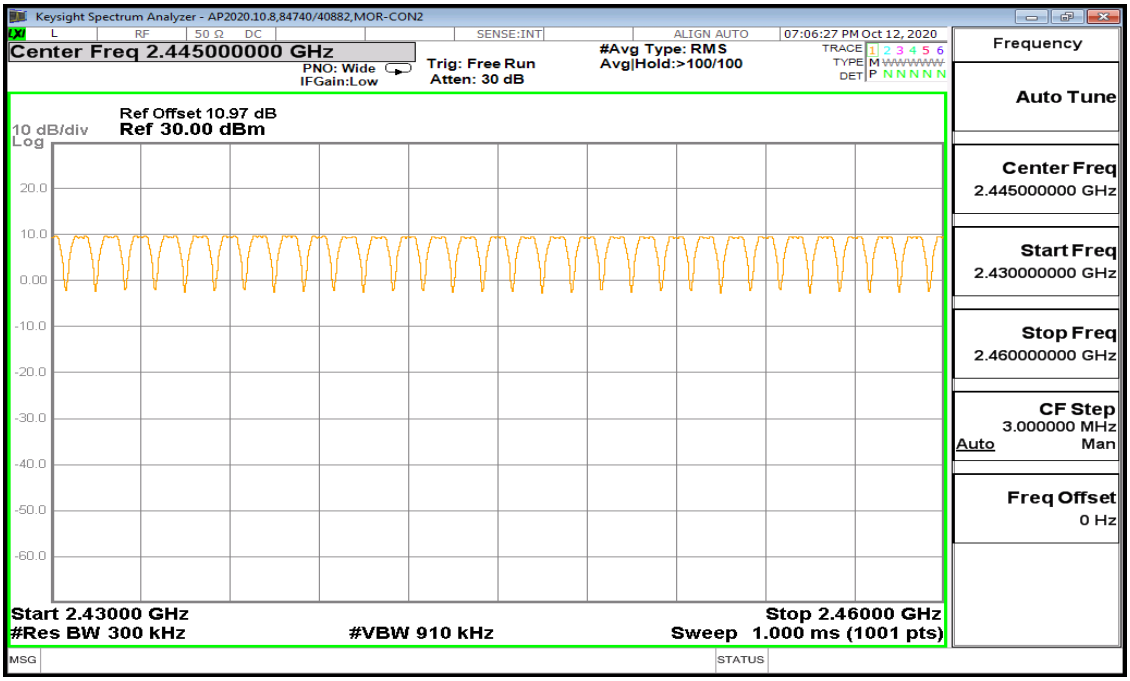
9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



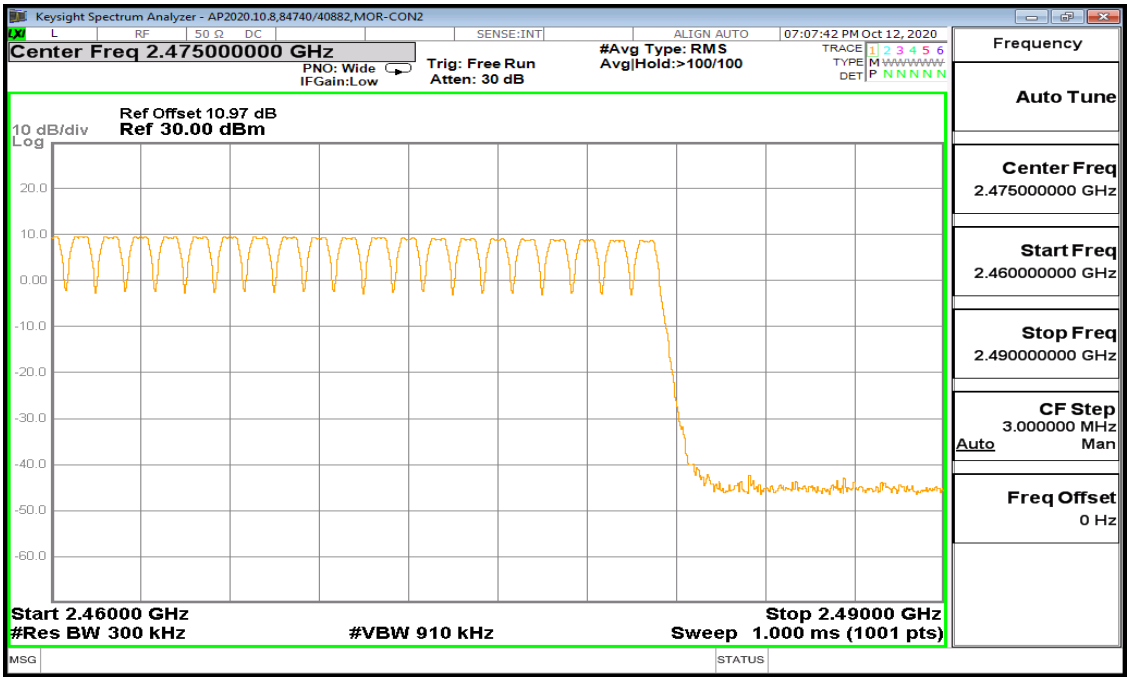
100MHz SPAN



30MHz SPAN, SEGMENT 1 OF 3

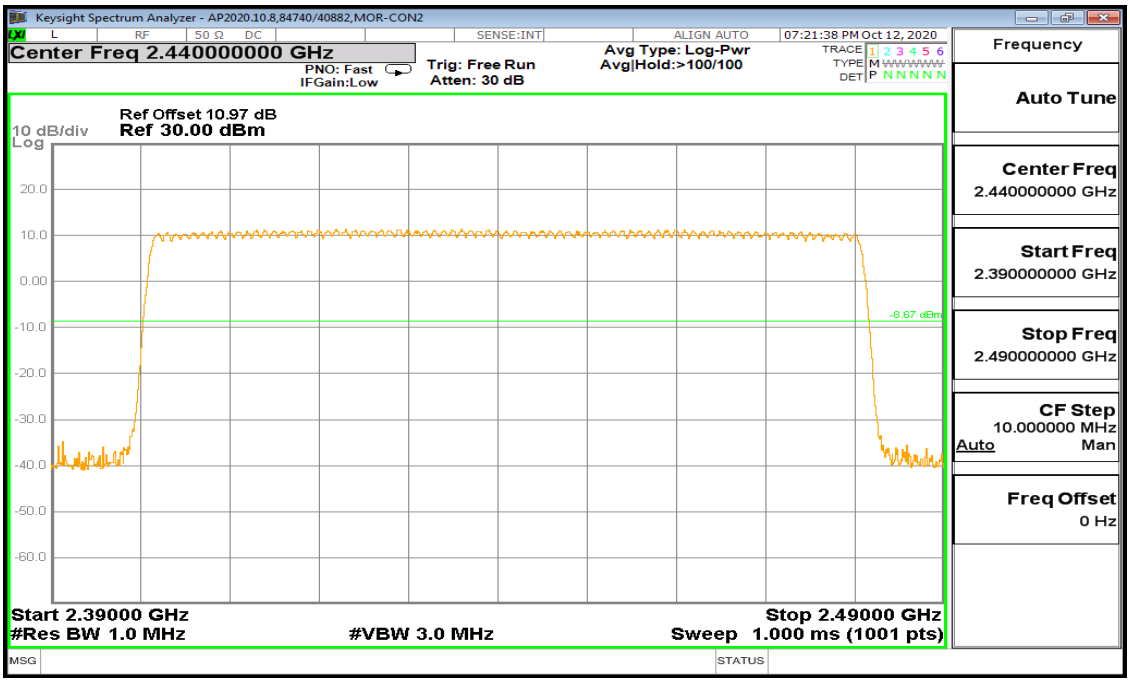


30MHz SPAN, SEGMENT 2 OF 3

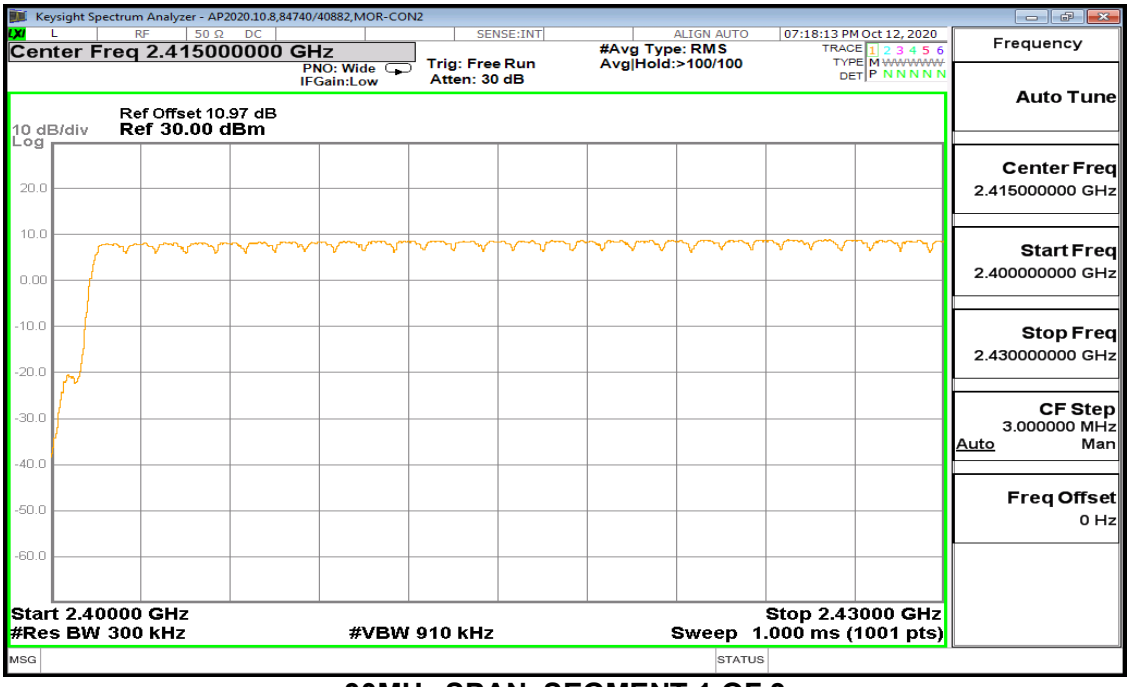


30MHz SPAN, SEGMENT 3 OF 3

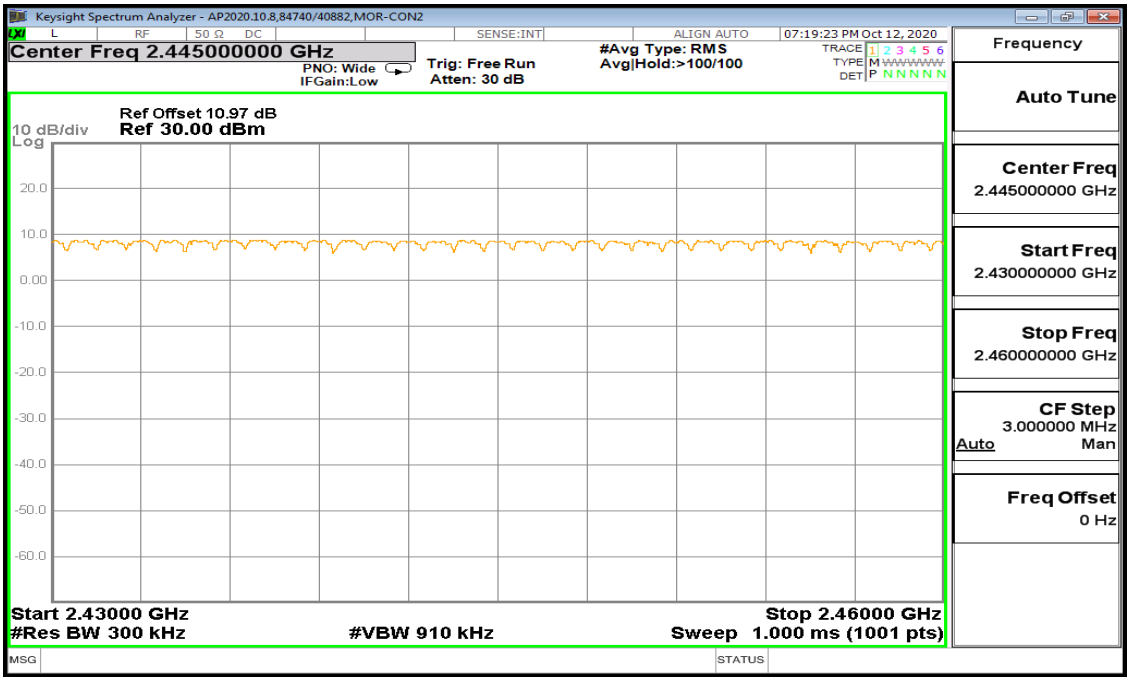
9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



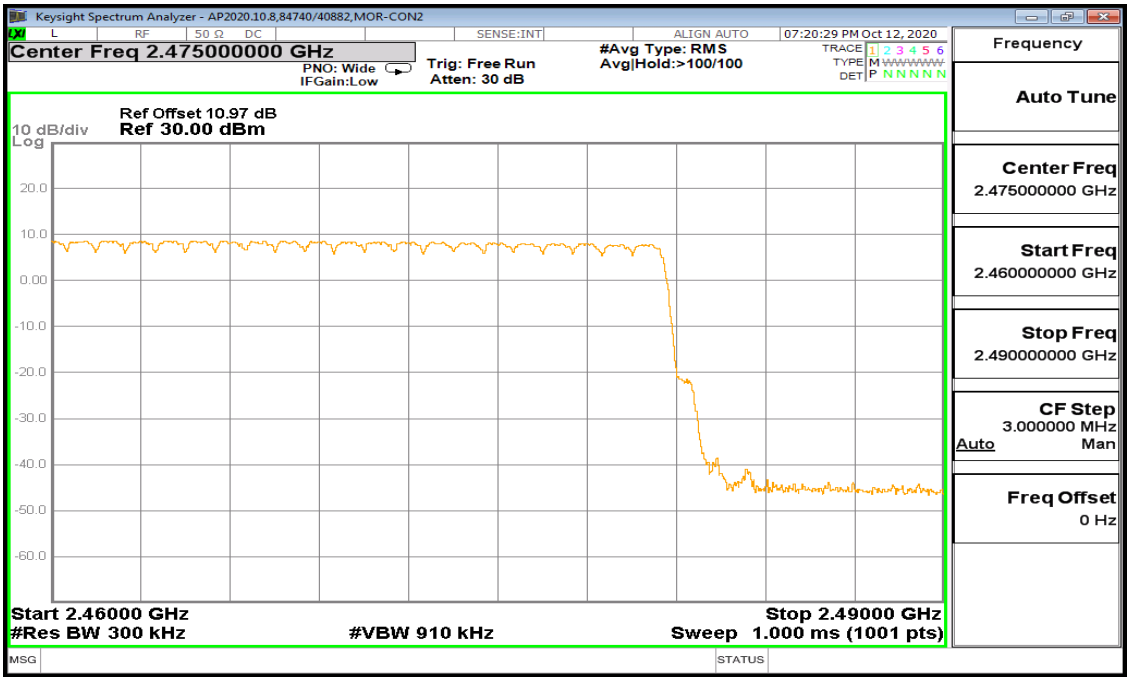
100MHz SPAN



30MHz SPAN, SEGMENT 1 OF 3



30MHz SPAN, SEGMENT 2 OF 3



30MHz SPAN, SEGMENT 3 OF 3

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 * (# of pulses in 3.16 s) * 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 * (# of pulses in 0.8 s) * 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)
GFSK Normal Mode					
DH1	0.375	31	0.1163	0.4	-0.2838
DH3	1.628	16	0.2605	0.4	-0.1395
DH5	2.872	11	0.3159	0.4	-0.0841
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.375	7.75	0.02906	0.4	-0.3709
DH3	1.628	4	0.06512	0.4	-0.3349
DH5	2.872	2.75	0.07898	0.4	-0.3210

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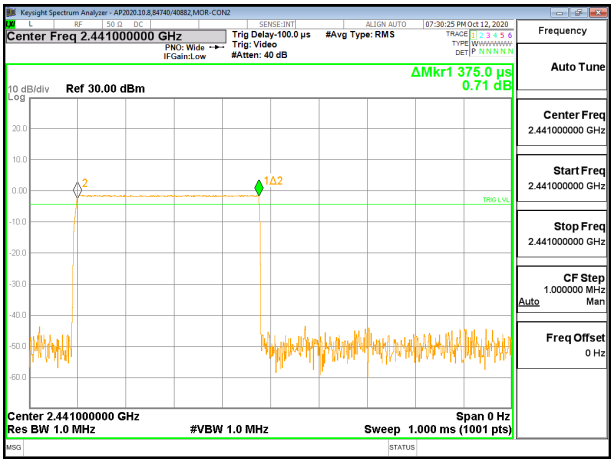
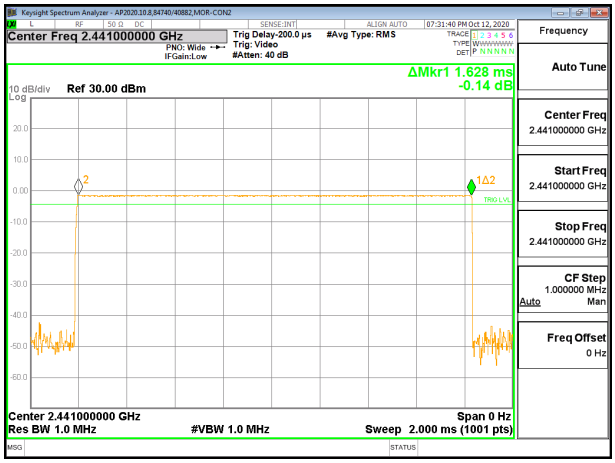
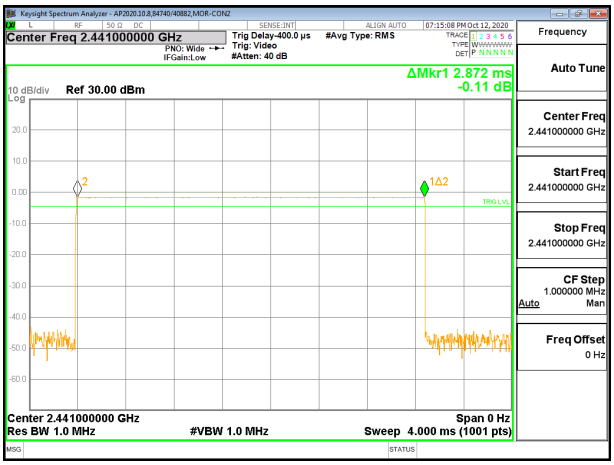


PULSE WIDTH – DH1



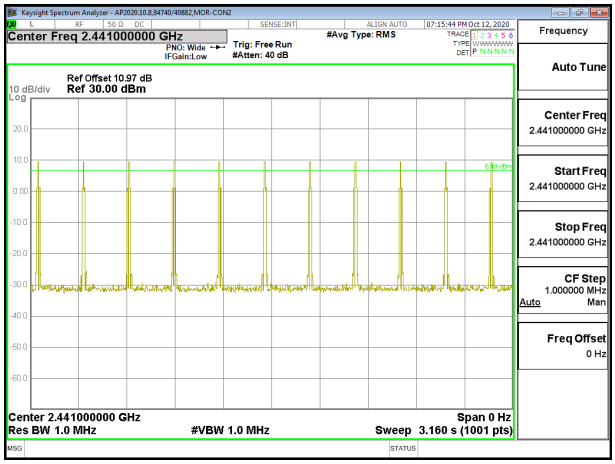
PULSE WIDTH – DH3



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	0.383	32	0.12256	0.4	-0.2774
3DH3	1.628	16	0.26048	0.4	-0.1395
3DH5	2.872	11	0.31592	0.4	-0.0841

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.

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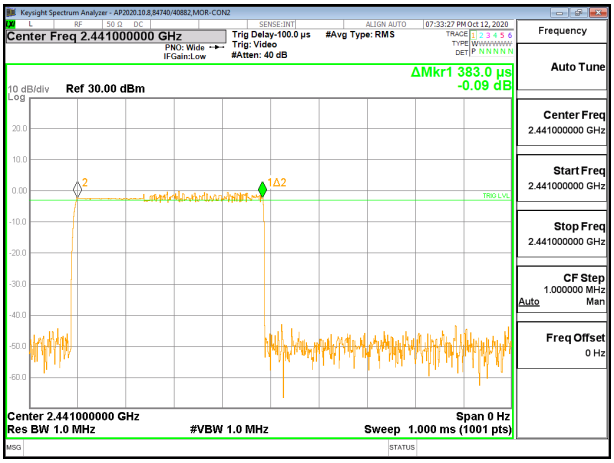
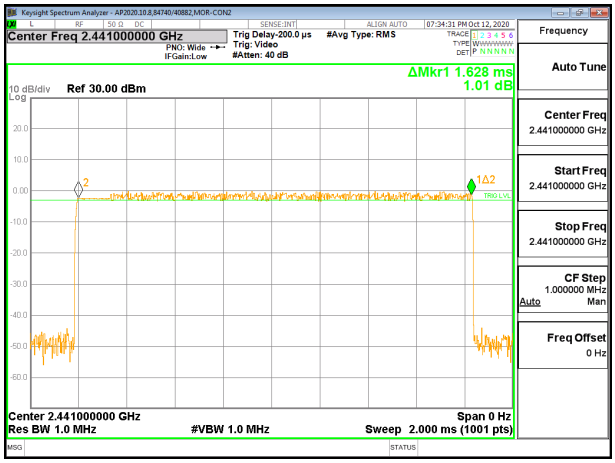
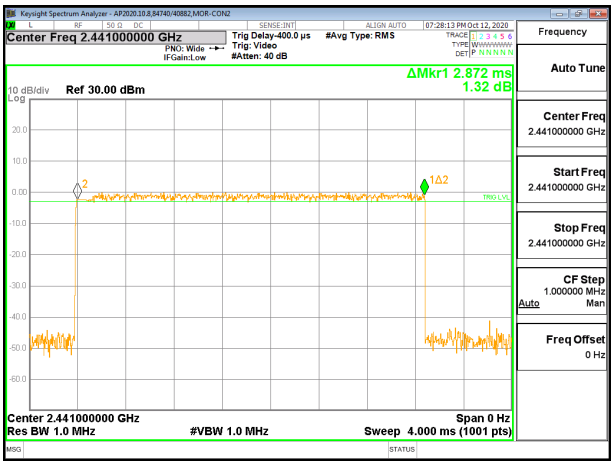


PULSE WIDTH – 3DH1

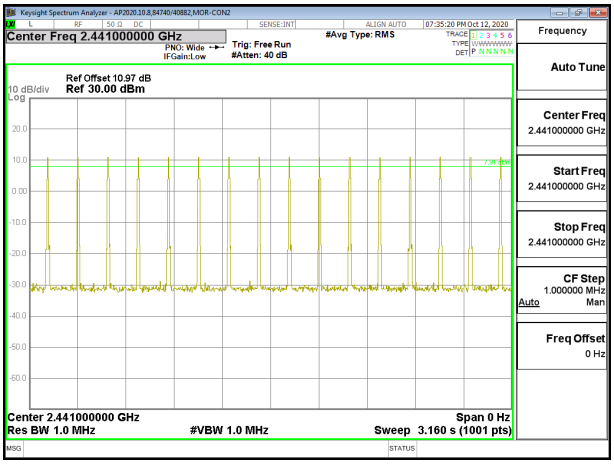


PULSE WIDTH – 3DH3

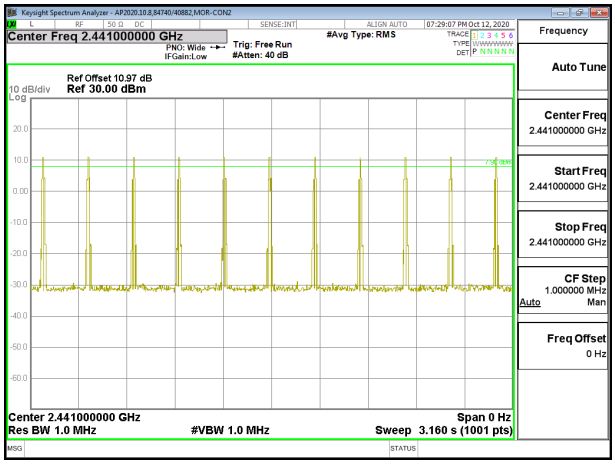


PULSE WIDTH – 3DH5

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 10.77 dB (including 10.13 dB pad and 0.64 dB cable) was entered as an offset in the power meter to allow for a peak reading of power.

RESULTS

9.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	84740/40882
Date:	2020-10-07

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	8.31	30	-21.69
Middle	2441	8.73	30	-21.27
High	2480	7.92	30	-22.08

9.6.2. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	84740/40882
Date:	2020-10-07

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.99	30	-20.01
Middle	2441	10.40	30	-19.6
High	2480	9.68	30	-20.32

9.6.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	84740/40882
Date:	2020-10-07

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.42	21	-10.58
Middle	2441	10.80	21	-10.2
High	2480	10.12	21	-10.88

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 10.77 dB (including 10.13 dB pad and 0.64 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

9.7.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	84740/40882
Date	2020-10-07

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	8.21
Middle	2441	8.64
High	2480	7.81

9.7.2. BLUETOOTH ENHANCED DATA RATE QPSK MODULATION

Tested By:	84740/40882
Date	2020-10-07

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.26
Middle	2441	7.67
High	2480	6.86

9.7.1. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	84740/40882
Date	2020-10-07

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.28
Middle	2441	7.70
High	2480	6.86

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

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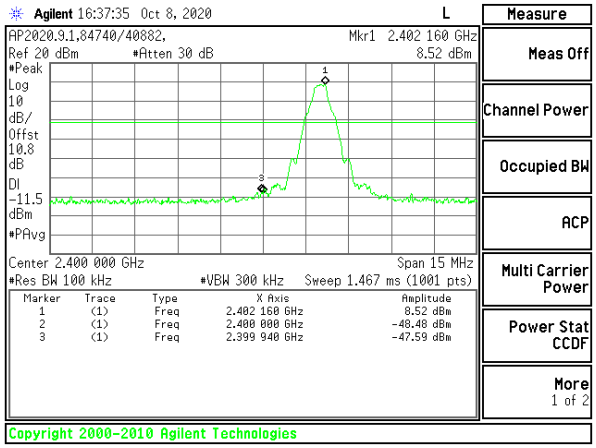
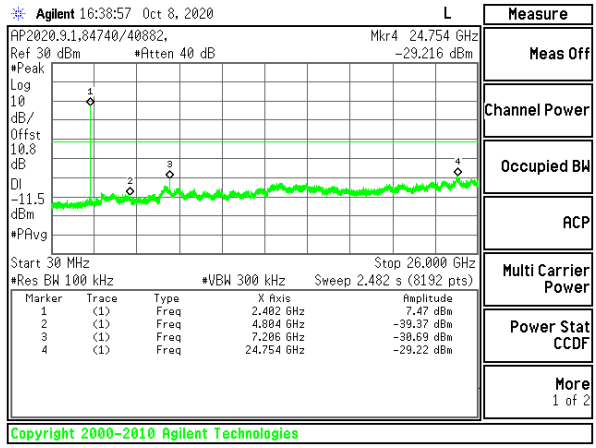
9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

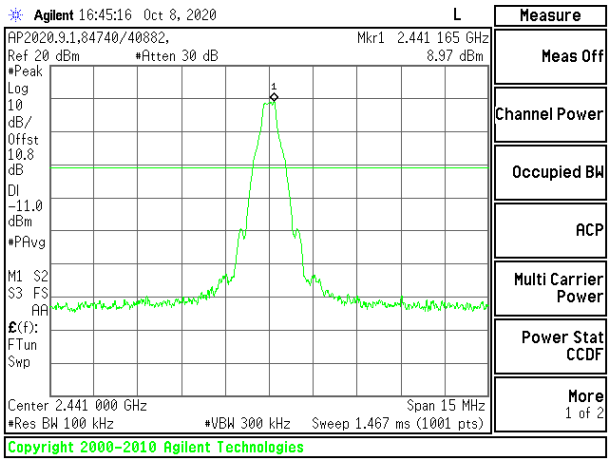
Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING



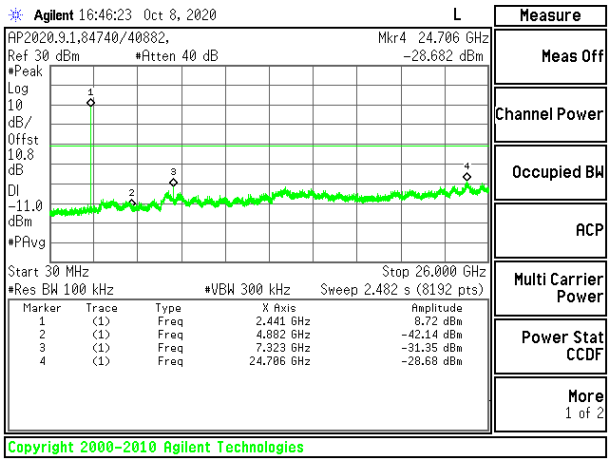
LOW CHANNEL BANDEDGE



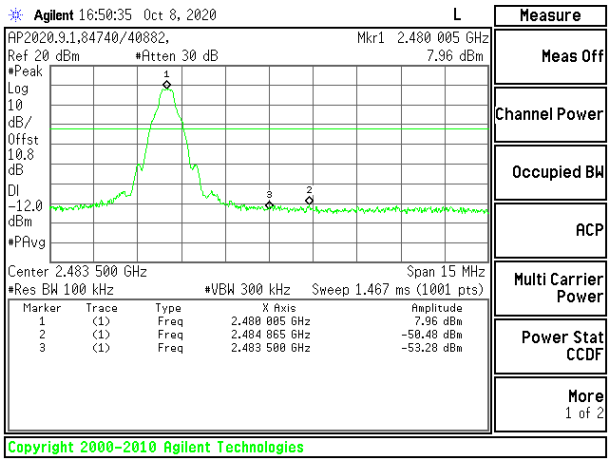
OUT-OF-BAND LOW CHANNEL



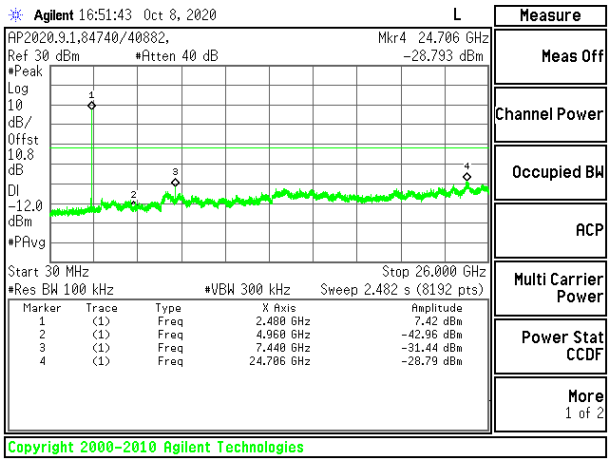
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL

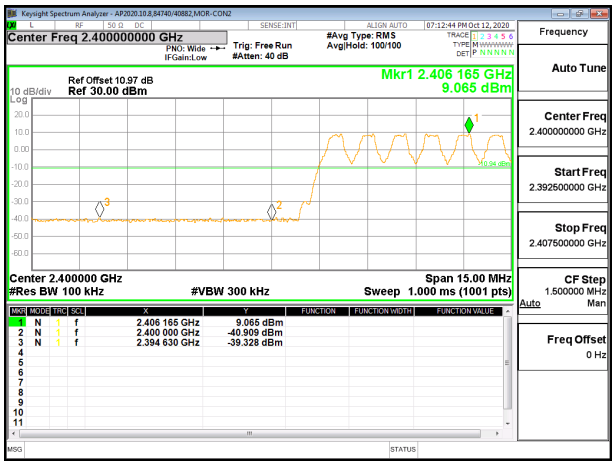


HIGH CHANNEL BANDEDGE

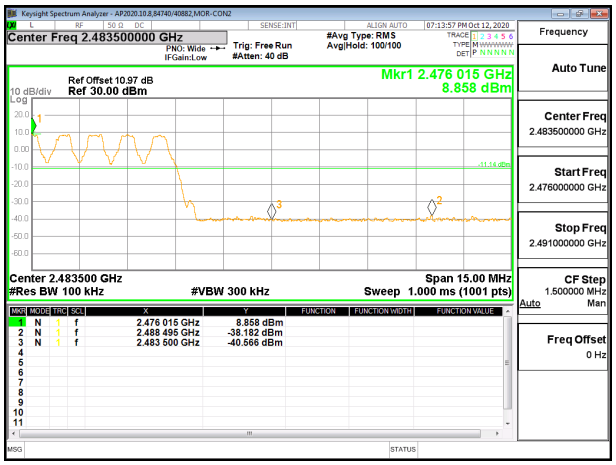


OUT-OF-BAND HIGH CHANNEL

Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



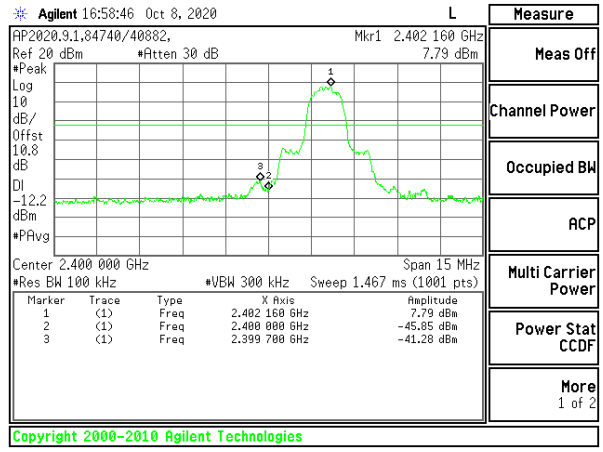
LOW BANDEDGE



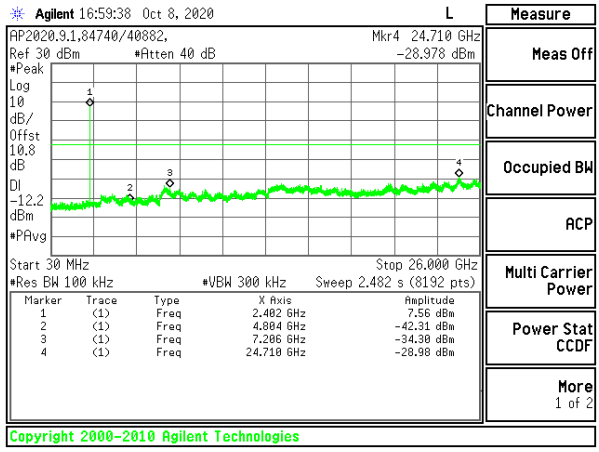
HIGH BANDEDGE

9.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

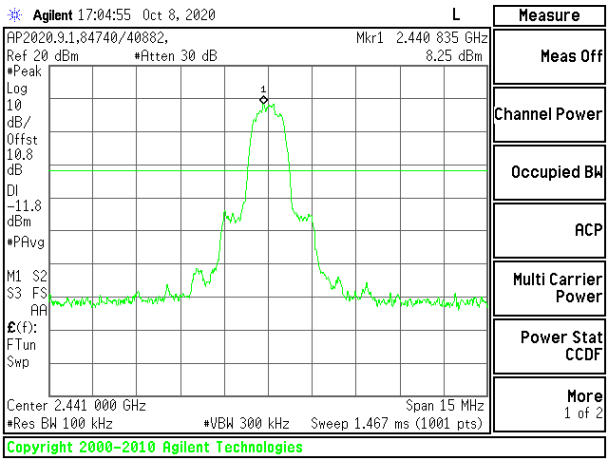
Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING



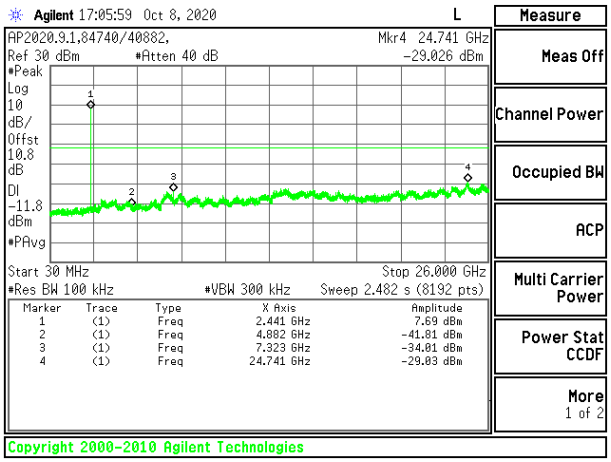
LOW CHANNEL BANDEDGE



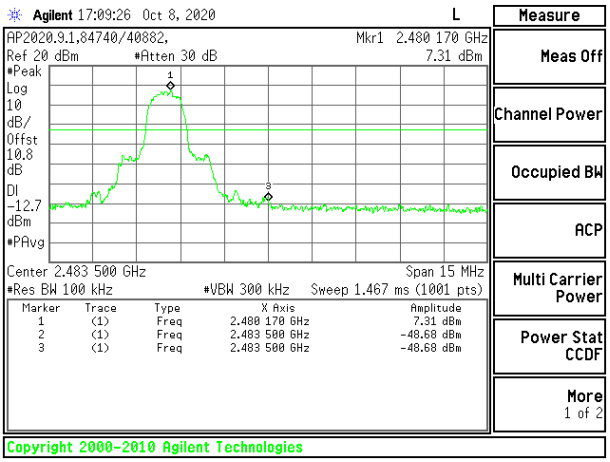
OUT-OF-BAND LOW CHANNEL



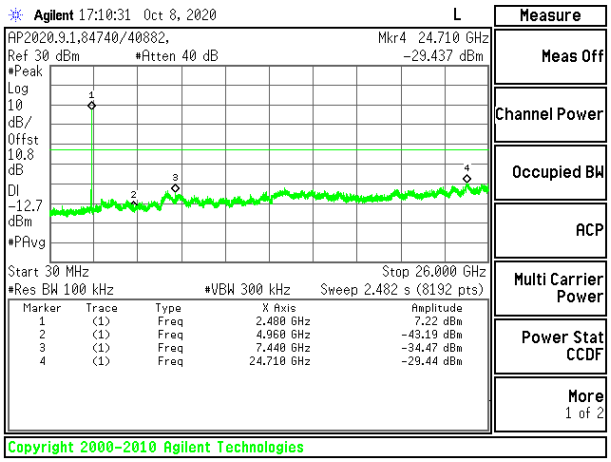
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL

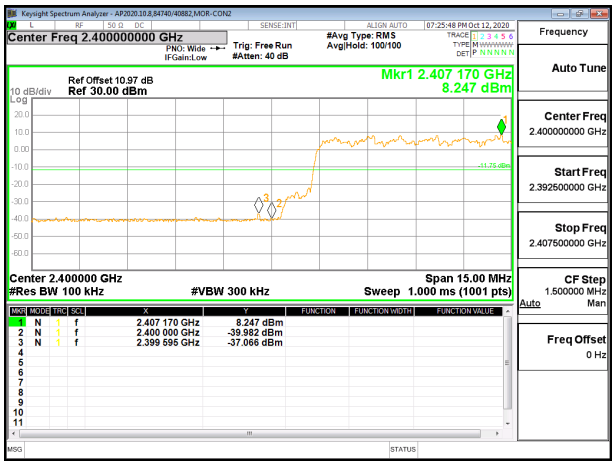


HIGH CHANNEL BANDEDGE

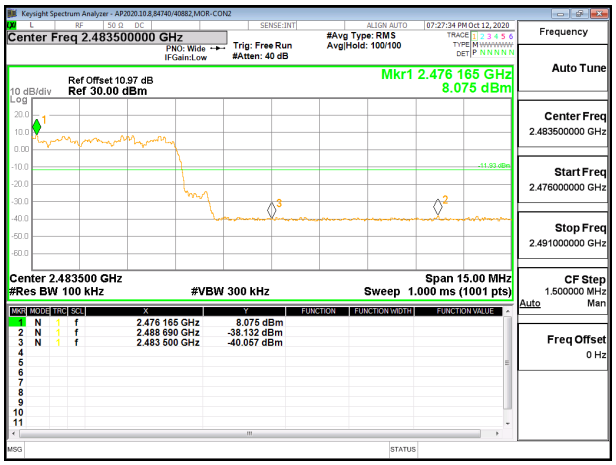


OUT-OF-BAND HIGH CHANNEL

Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



LOW BANDEDGE



HIGH BANDEDGE

10. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209

RSS-GEN, Section 8.9 and 8.10.

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

TEST PROCEDURE

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

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

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

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

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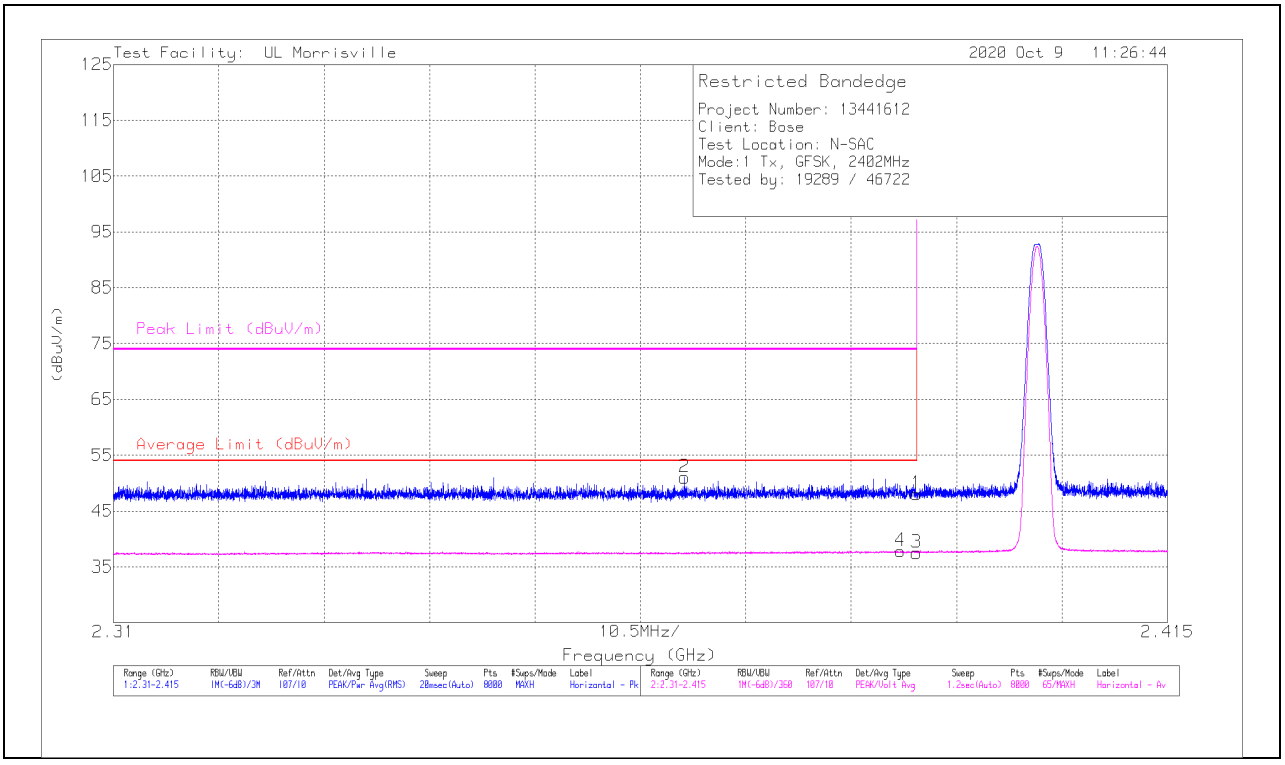
10.1. TRANSMITTER ABOVE 1 GHz

10.1.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

BANDEDGE (LOW CHANNEL)

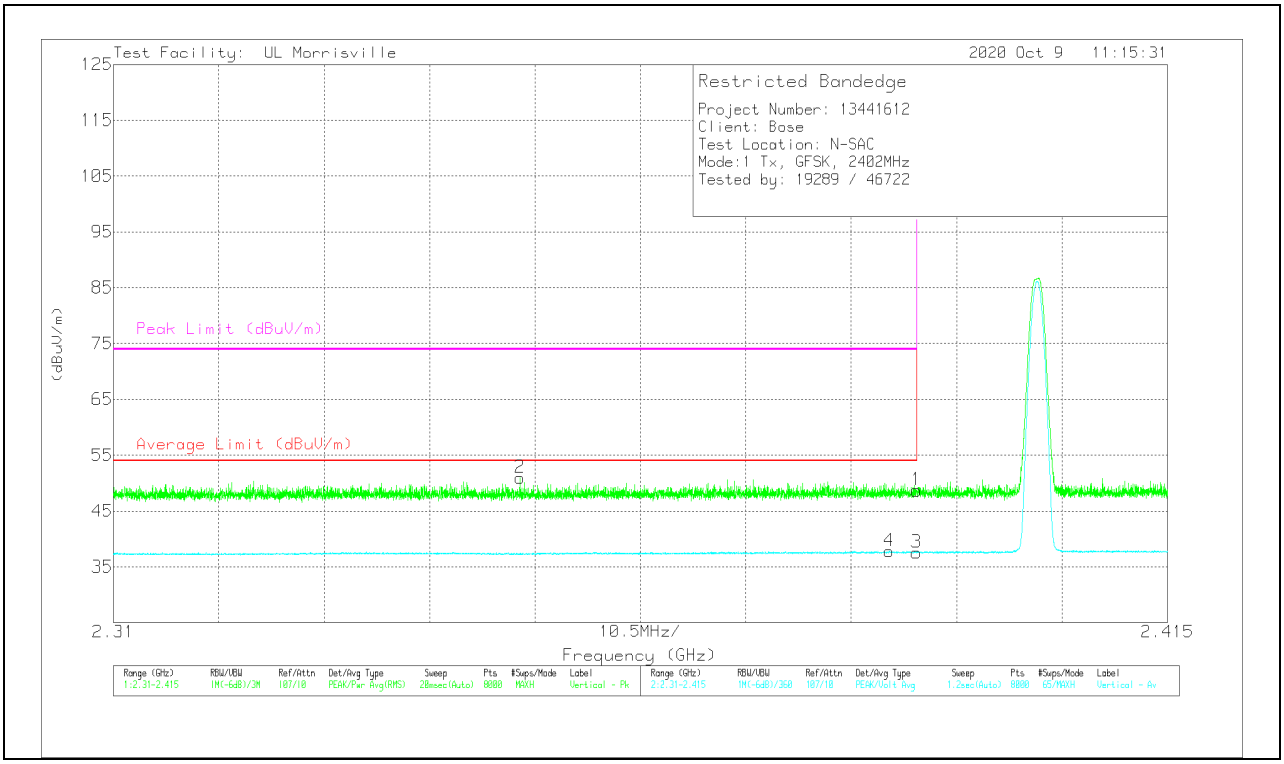
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/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	* ** 2.39	40.67	Pk	31.8	-24.4	48.07	-	-	74	-25.93	203	246	H
2	* ** 2.36689	43.83	Pk	31.7	-24.5	51.03	-	-	74	-22.97	203	246	H
3	* ** 2.39	30.11	V1TV	31.8	-24.4	37.51	54	-16.49	-	-	203	246	H
4	* ** 2.38842	30.44	V1TV	31.8	-24.4	37.84	54	-16.16	-	-	203	246	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 where: Ton is packet duration

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/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	* ** 2.39	41.3	Pk	31.8	-24.4	48.7	-	-	74	-25.3	174	384	V
2	* ** 2.35051	43.94	Pk	31.6	-24.6	50.94	-	-	74	-23.06	174	384	V
3	* ** 2.39	30.18	V1TV	31.8	-24.4	37.58	54	-16.42	-	-	174	384	V
4	* ** 2.3873	30.38	V1TV	31.8	-24.4	37.78	54	-16.22	-	-	174	384	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 where: Ton is packet duration

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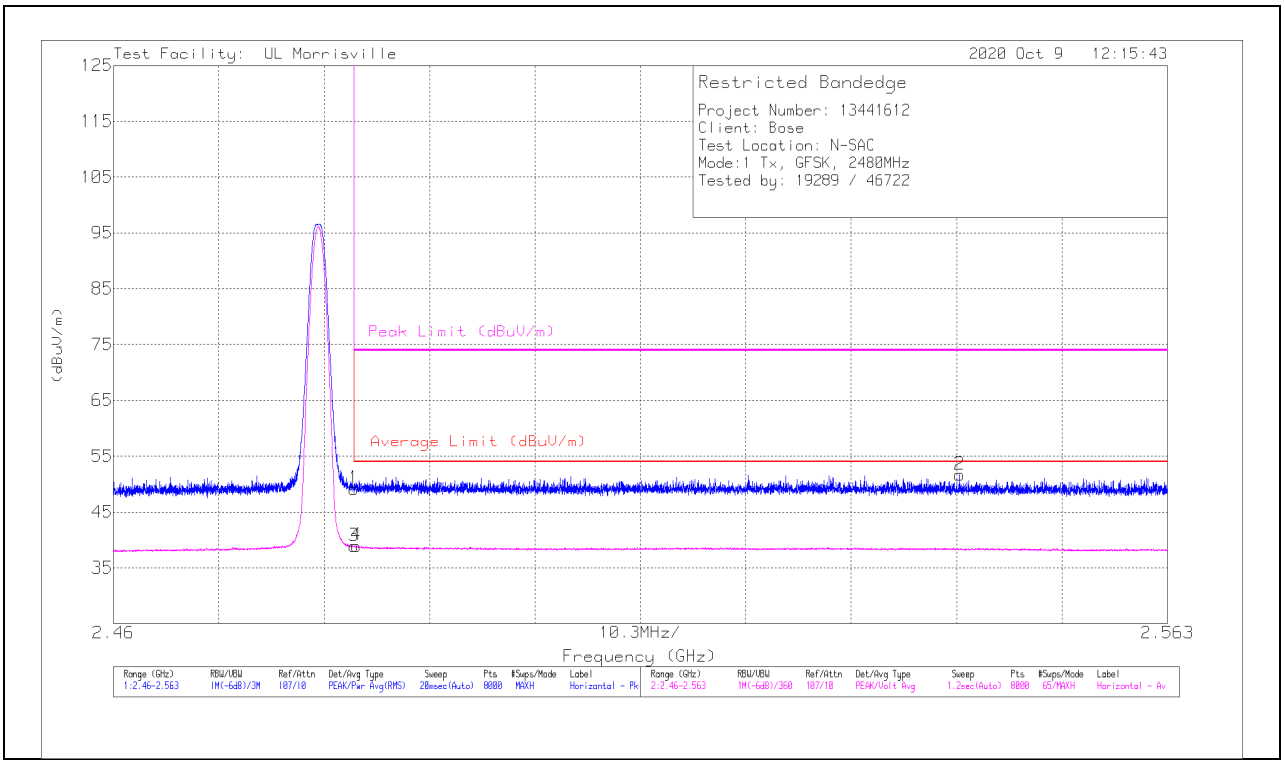
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/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	* ** 2.4835	40.98	Pk	32.4	-24.2	49.18	-	-	74	-24.82	338	258	H
2	** 2.5427	43.58	Pk	32.4	-24.3	51.68	-	-	74	-22.32	338	258	H
3	* ** 2.4835	30.68	V1TV	32.4	-24.2	38.88	54	-15.12	-	-	338	258	H
4	* ** 2.48376	30.77	V1TV	32.4	-24.2	38.97	54	-15.03	-	-	338	258	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 where: Ton is packet duration

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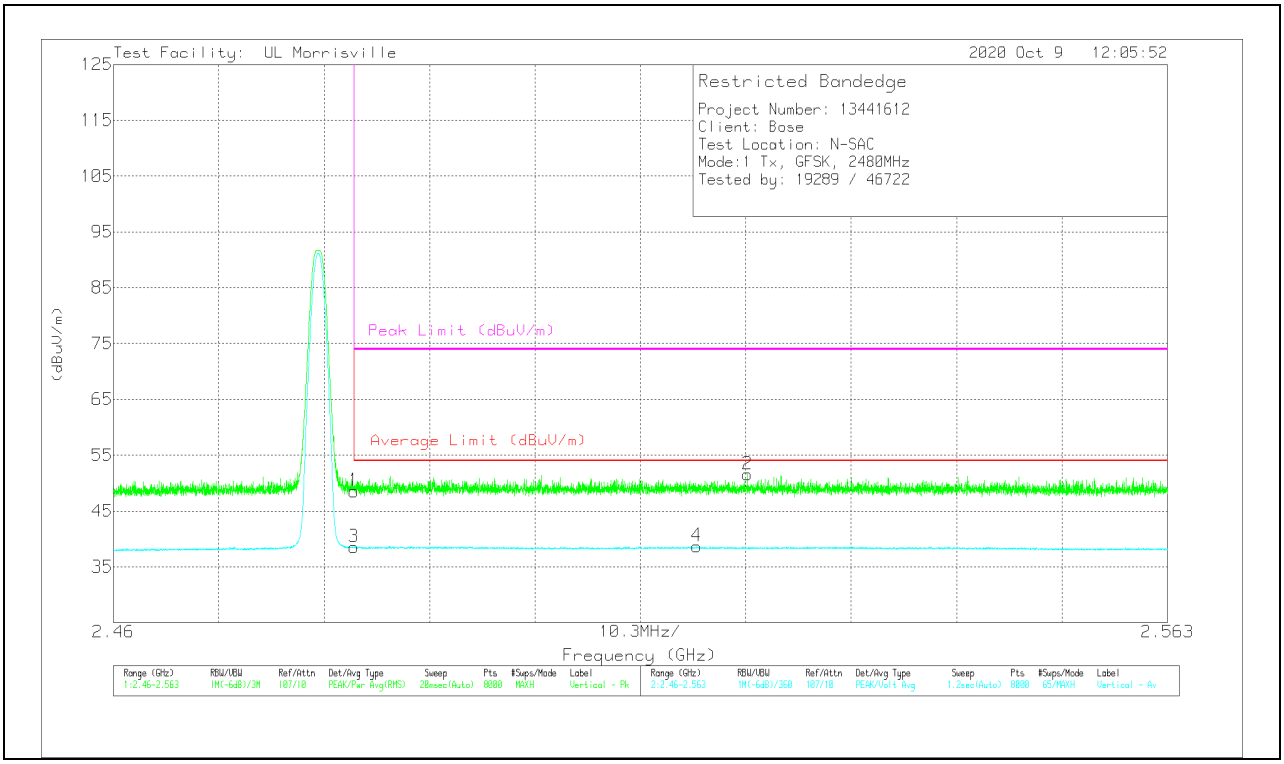
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/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	* ** 2.4835	40.37	Pk	32.4	-24.2	48.57	-	-	74	-25.43	29	152	V
2	** 2.52198	43.27	Pk	32.5	-24.2	51.57	-	-	74	-22.43	29	152	V
3	* ** 2.4835	30.32	V1TV	32.4	-24.2	38.52	54	-15.48	-	-	29	152	V
4	** 2.51701	30.3	V1TV	32.6	-24.2	38.7	54	-15.3	-	-	29	152	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 where: Ton is packet duration

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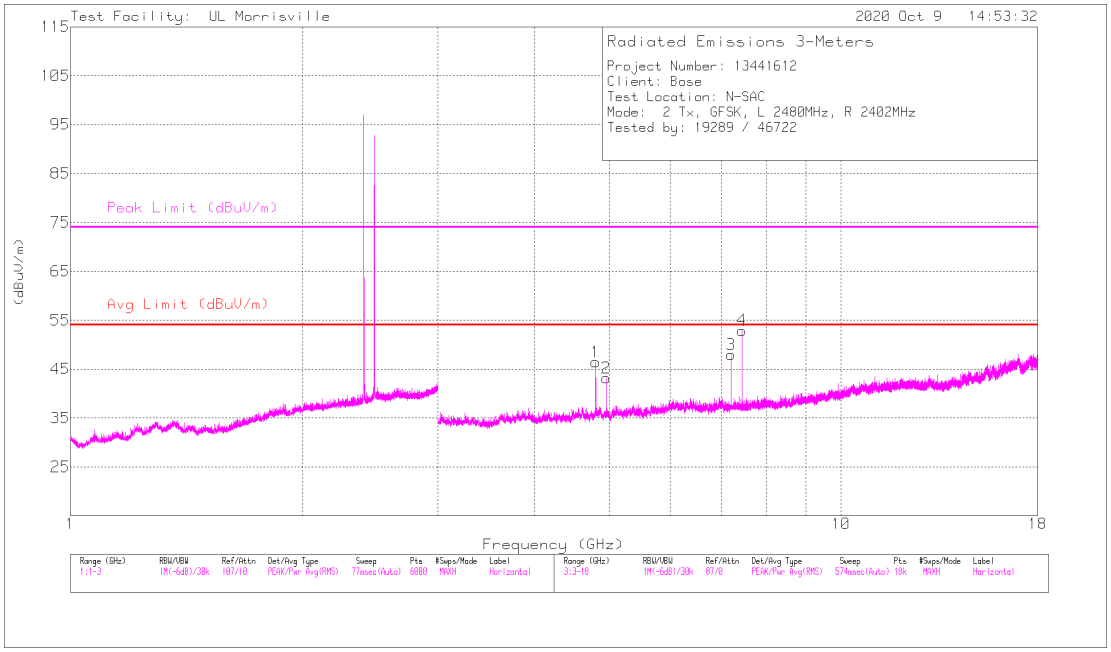
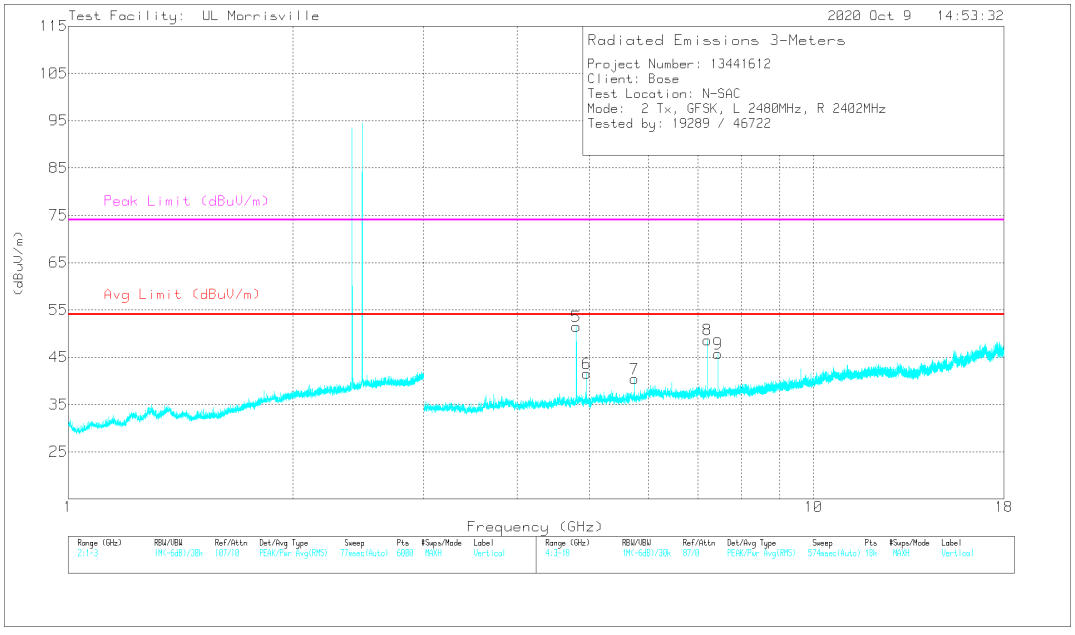
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS

**Note - both earbuds were tested at same time on different channels. This particular testing covers the right earbud only.



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/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	* ** 4.80429	48.19	PK2	34.3	-31.5	50.99	-	-	74	-23.01	180	108	H
	* ** 4.80395	42.8	V1TV	34.3	-31.5	45.6	54	-8.4	-	-	180	108	H
2	* ** 4.95953	46.9	PK2	34.1	-32.3	48.7	-	-	74	-25.3	289	101	H
	* ** 4.96003	39.97	V1TV	34.1	-32.4	41.67	54	-12.33	-	-	289	101	H
4	* ** 7.4405	49.16	PK2	35.7	-29.3	55.56	-	-	74	-18.44	336	104	H
	* ** 7.44006	43.48	V1TV	35.7	-29.3	49.88	54	-4.12	-	-	336	104	H
5	* ** 4.80359	50.93	PK2	34.3	-31.5	53.73	-	-	74	-20.27	7	102	V
	* ** 4.80398	46.95	V1TV	34.3	-31.5	49.75	54	-4.25	-	-	7	102	V
6	* ** 4.95998	45.83	PK2	34.1	-32.4	47.53	-	-	74	-26.47	236	101	V
	* ** 4.96003	38.16	V1TV	34.1	-32.4	39.86	54	-14.14	-	-	236	101	V
9	* ** 7.43952	44.01	PK2	35.7	-29.3	50.41	-	-	74	-23.59	18	102	V
	* ** 7.44007	35.92	V1TV	35.7	-29.3	42.32	54	-11.68	-	-	18	102	V
7	5.74765	37.19	Pk	34.7	-31.5	40.39	-	-	-	-	0-360	101	V
3	7.20607	42.3	Pk	35.6	-29.9	48	-	-	-	-	0-360	101	H
8	7.20607	42.96	Pk	35.6	-29.9	48.66	-	-	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK2 - Maximum Peak
V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration
Pk - Peak detector

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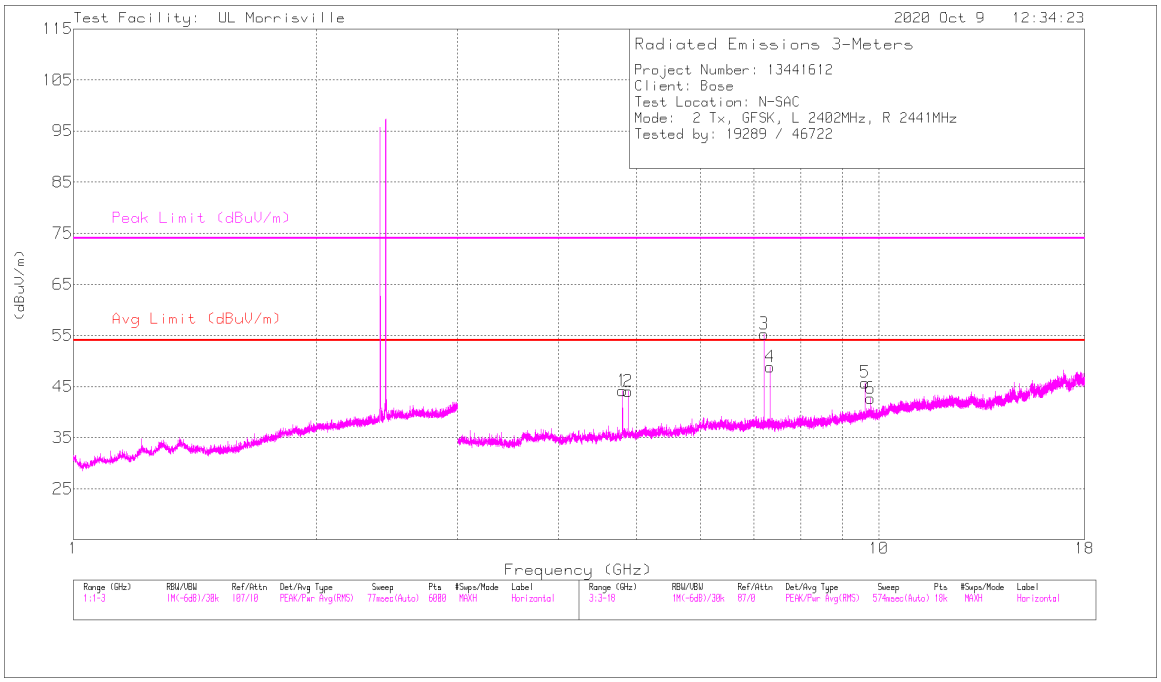
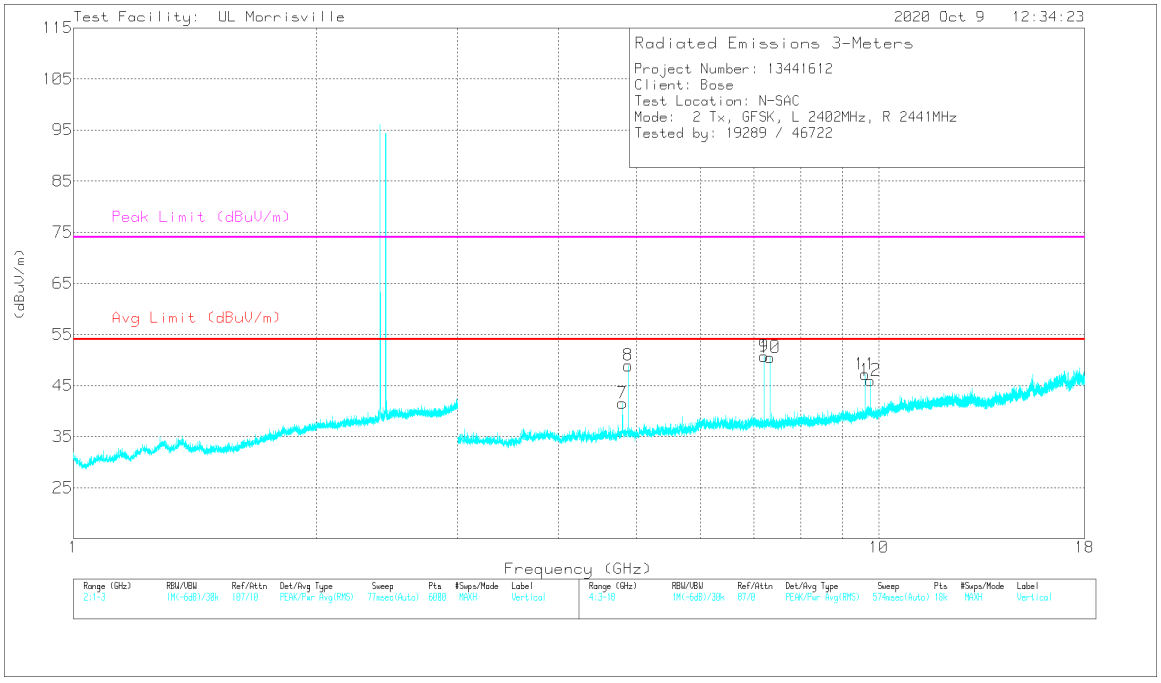
MID CHANNEL RESULTS

**Note - both earbuds were tested at same time on different channels. This particular testing covers the right earbud only.



HORIZONTAL



VERTICAL

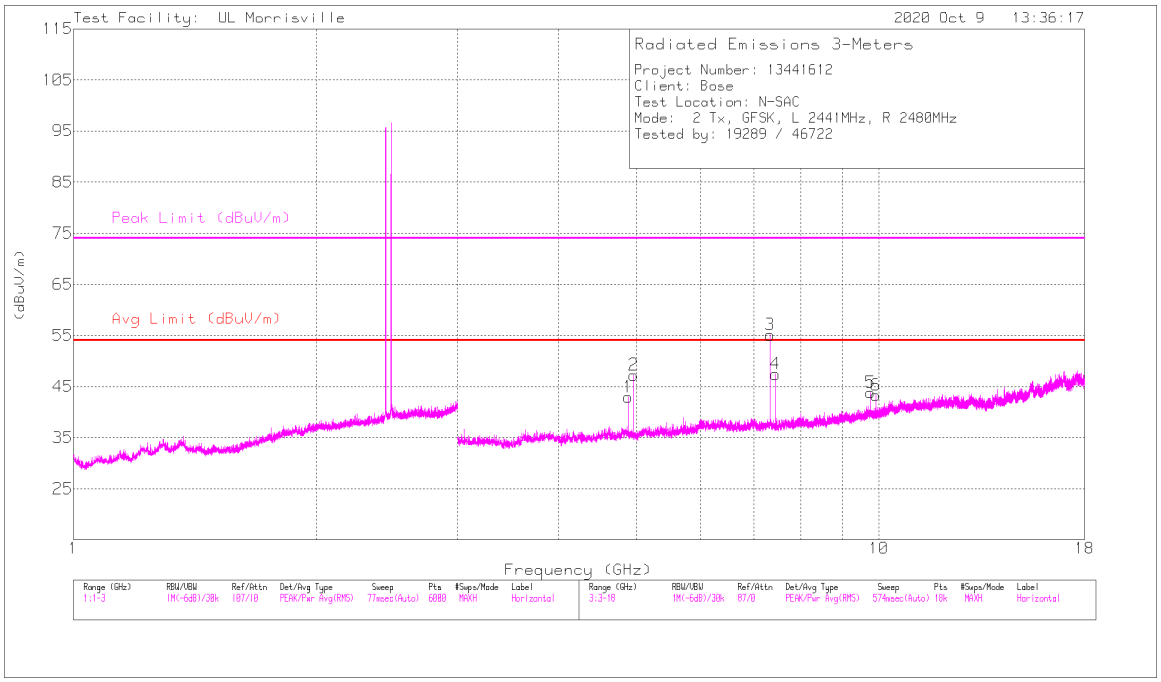
RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/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	* ** 4.80437	46.72	PK2	34.3	-31.5	49.52	-	-	74	-24.48	156	126	H
	* ** 4.80405	40.69	V1TV	34.3	-31.5	43.49	54	-10.51	-	-	156	126	H
2	* ** 4.88188	46.46	PK2	34.1	-31.4	49.16	-	-	74	-24.84	179	394	H
	* ** 4.88201	39.38	V1TV	34.1	-31.4	42.08	54	-11.92	-	-	179	394	H
4	* ** 7.32255	46.44	PK2	35.6	-29.2	52.84	-	-	74	-21.16	339	240	H
	* ** 7.32302	39.02	V1TV	35.7	-29.2	45.52	54	-8.48	-	-	339	240	H
7	* ** 4.80412	45.43	PK2	34.3	-31.5	48.23	-	-	74	-25.77	190	244	V
	* ** 4.80405	37.63	V1TV	34.3	-31.5	40.43	54	-13.57	-	-	190	244	V
8	* ** 4.88162	49.13	PK2	34.1	-31.4	51.83	-	-	74	-22.17	59	122	V
	* ** 4.88199	44.47	V1TV	34.1	-31.4	47.17	54	-6.83	-	-	59	122	V
10	* ** 7.32345	47.38	PK2	35.7	-29.2	53.88	-	-	74	-20.12	122	244	V
	* ** 7.32302	41.02	V1TV	35.7	-29.2	47.52	54	-6.48	-	-	122	244	V
3	7.20524	49.6	Pk	35.6	-29.9	55.3	-	-	-	-	0-360	101	H
9	7.20607	45.02	Pk	35.6	-29.9	50.72	-	-	-	-	0-360	200	V
11	9.60787	38.6	Pk	36.9	-28.3	47.2	-	-	-	-	0-360	101	V
5	9.6087	37.17	Pk	36.9	-28.3	45.77	-	-	-	-	0-360	101	H
6	9.76288	33.07	Pk	37	-27.4	42.67	-	-	-	-	0-360	101	H
12	9.76288	36.4	Pk	37	-27.4	46	-	-	-	-	0-360	101	V

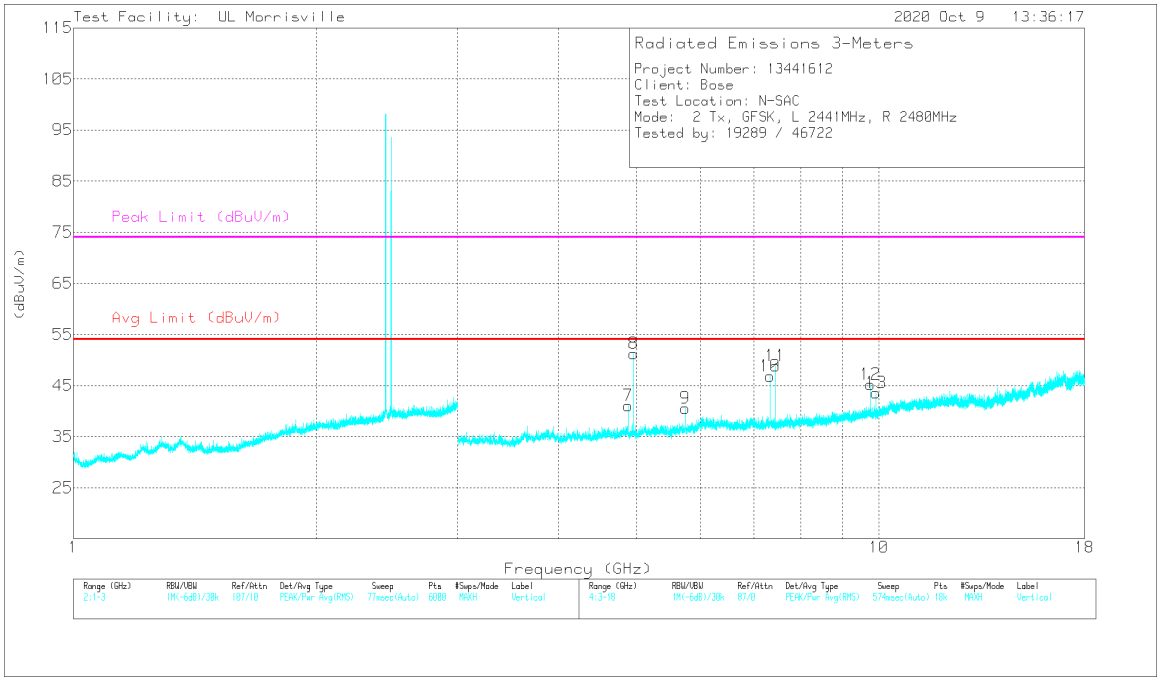
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK2 - Maximum Peak
V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration
Pk - Peak detector

HIGH CHANNEL RESULTS

**Note - both earbuds were tested at same time on different channels. This particular testing covers the right earbud only.



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/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	* ** 4.88187	46.17	PK2	34.1	-31.4	48.87	-	-	74	-25.13	330	147	H
	* ** 4.88202	39.38	V1TV	34.1	-31.4	42.08	54	-11.92	-	-	330	147	H
2	* ** 4.95964	49.83	PK2	34.1	-32.3	51.63	-	-	74	-22.37	344	292	H
	* ** 4.96001	44.67	V1TV	34.1	-32.4	46.37	54	-7.63	-	-	344	292	H
3	* ** 7.32251	50.35	PK2	35.6	-29.2	56.75	-	-	74	-17.25	197	105	H
	* ** 7.32304	45.12	V1TV	35.7	-29.2	51.62	54	-2.38	-	-	197	105	H
4	* ** 7.43959	44.86	PK2	35.7	-29.3	51.26	-	-	74	-22.74	88	101	H
	* ** 7.44	37.69	V1TV	35.7	-29.3	44.09	54	-9.91	-	-	88	101	H
7	* ** 4.88232	44.97	PK2	34	-31.4	47.57	-	-	74	-26.43	19	105	V
	* ** 4.882	36.91	V1TV	34.1	-31.4	39.61	54	-14.39	-	-	19	105	V
8	* ** 7.32254	45.29	PK2	35.6	-29.2	51.69	-	-	74	-22.31	198	108	V
	* ** 7.32307	38.08	V1TV	35.7	-29.2	44.58	54	-9.42	-	-	198	108	V
10	* ** 7.44045	46.07	PK2	35.7	-29.3	52.47	-	-	74	-21.53	307	105	V
	* ** 7.44002	39.27	V1TV	35.7	-29.3	45.67	54	-8.33	-	-	307	105	V
9	5.74849	37.34	Pk	34.7	-31.5	40.54	-	-	-	-	0-360	101	V
5	9.76371	34.22	Pk	37	-27.4	43.82	-	-	-	-	0-360	101	H
12	9.76455	35.6	Pk	37	-27.4	45.2	-	-	-	-	0-360	101	V
6	9.92039	34.09	Pk	37	-27.8	43.29	-	-	-	-	0-360	101	H
13	9.92039	34.4	Pk	37	-27.8	43.6	-	-	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK2 - Maximum Peak
V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration
Pk - Peak detector

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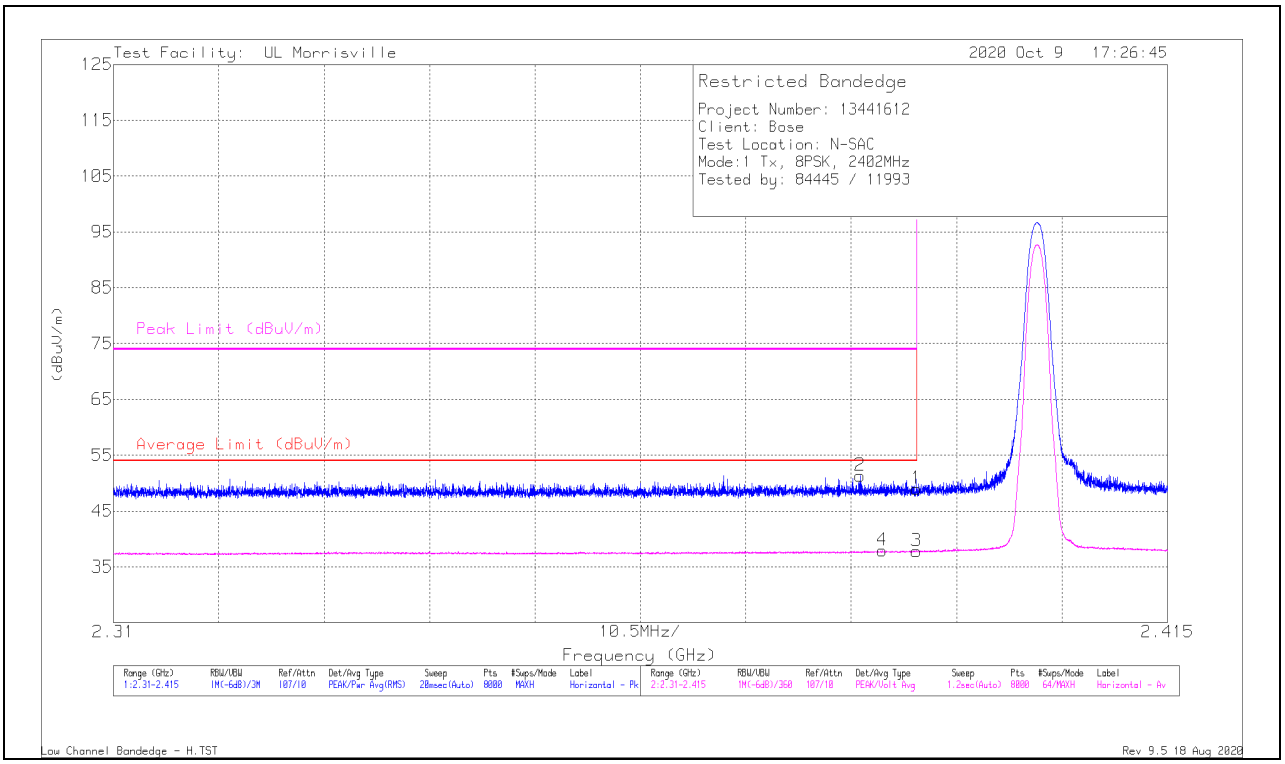
10.1.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

BANDEDGE (LOW CHANNEL)

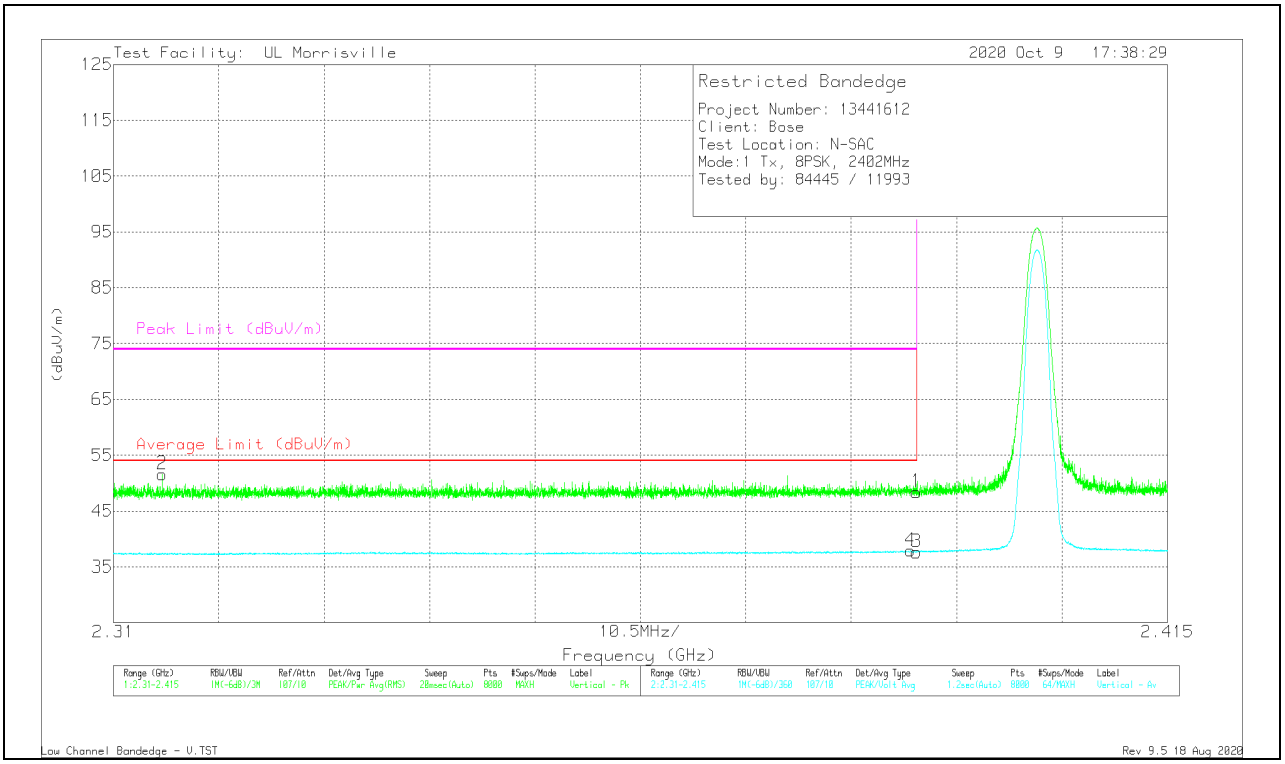
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/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	* ** 2.39	41.6	Pk	31.8	-24.4	49	-	-	74	-25	338	268	H
2	* ** 2.38438	43.92	Pk	31.8	-24.4	51.32	-	-	74	-22.68	338	268	H
3	* ** 2.39	30.38	V1TV	31.8	-24.4	37.78	54	-16.22	-	-	338	268	H
4	* ** 2.3866	30.49	V1TV	31.8	-24.4	37.89	54	-16.11	-	-	338	268	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 where: Ton is packet duration

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/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	* ** 2.39	41.02	Pk	31.8	-24.4	48.42	-	-	74	-25.58	269	351	V
2	* ** 2.31484	44.51	Pk	31.7	-24.6	51.61	-	-	74	-22.39	269	351	V
3	* ** 2.39	30.24	V1TV	31.8	-24.4	37.64	54	-16.36	-	-	269	351	V
4	* ** 2.38939	30.49	V1TV	31.8	-24.4	37.89	54	-16.11	-	-	269	351	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 where: Ton is packet duration

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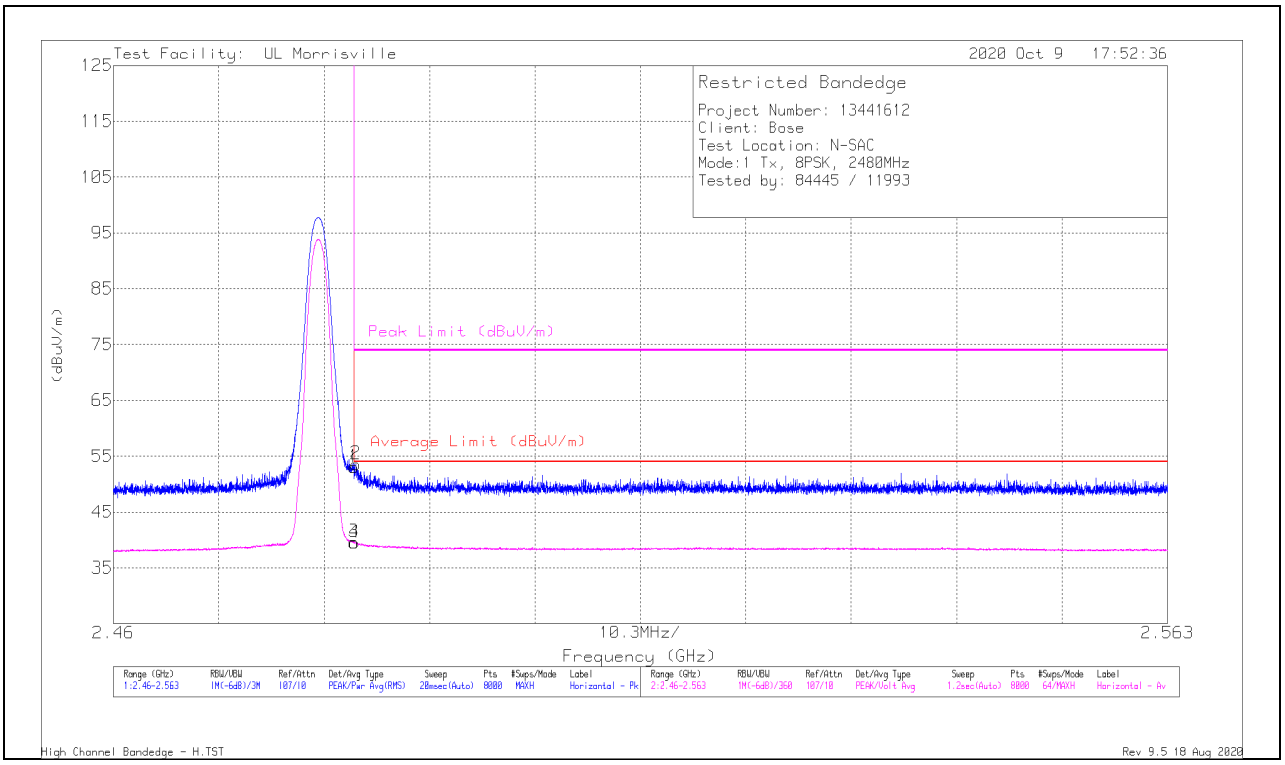
BANDEDGE (HIGH CHANNEL)

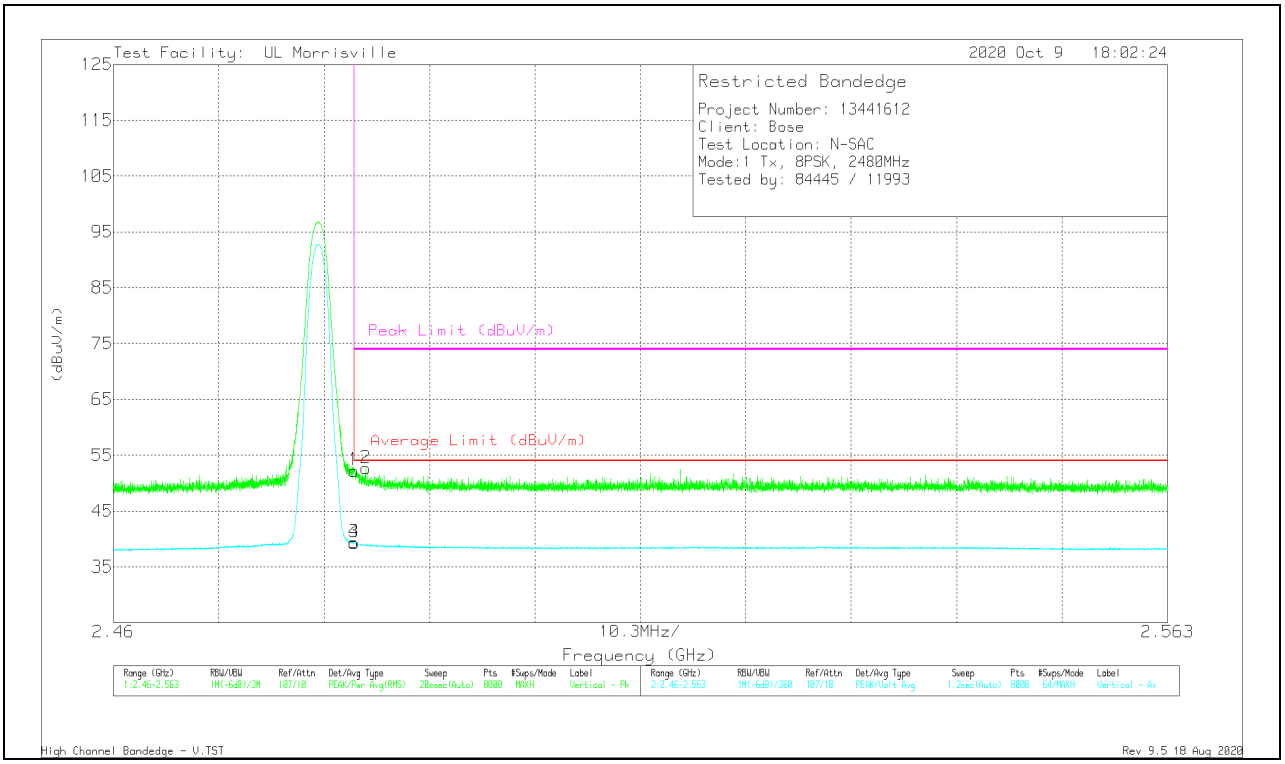
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/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	* ** 2.4835	44.87	Pk	32.4	-24.2	53.07	-	-	74	-20.93	183	257	H
2	* ** 2.48369	45.39	Pk	32.4	-24.2	53.59	-	-	74	-20.41	183	257	H
3	* ** 2.4835	31.4	V1TV	32.4	-24.2	39.6	54	-14.4	-	-	183	257	H
4	* ** 2.48355	31.35	V1TV	32.4	-24.2	39.55	54	-14.45	-	-	183	257	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 where: Ton is packet duration

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/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	* ** 2.4835	44.05	Pk	32.4	-24.2	52.25	-	-	74	-21.75	82	251	V
2	* ** 2.48466	44.44	Pk	32.4	-24.2	52.64	-	-	74	-21.36	82	251	V
3	* ** 2.4835	31.17	V1TV	32.4	-24.2	39.37	54	-14.63	-	-	82	251	V
4	* ** 2.48354	31.14	V1TV	32.4	-24.2	39.34	54	-14.66	-	-	82	251	V

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** - indicates frequency in Taiwan NCC LP0002 Restricted Band
Pk - Peak detector
V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration

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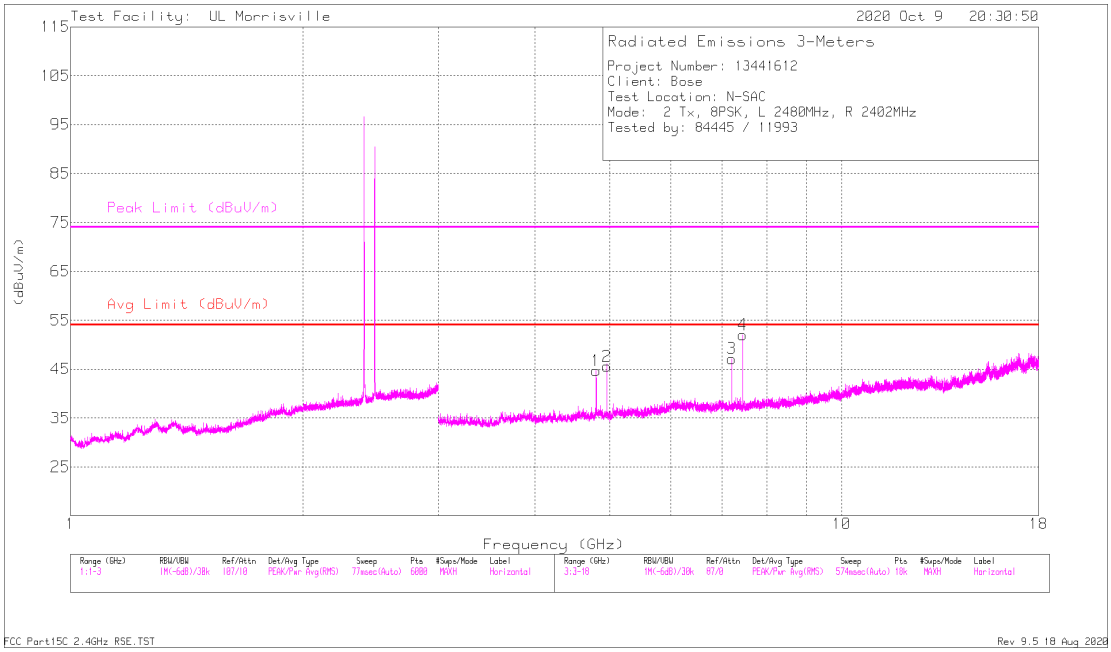
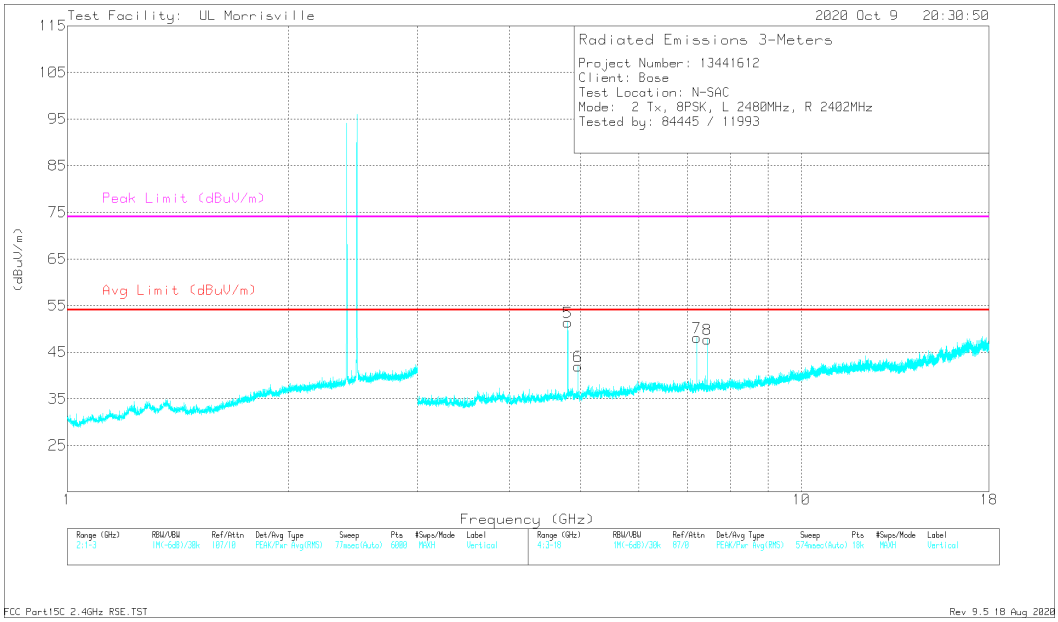
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS

**Note - both earbuds were tested at same time on different channels. This particular testing covers the right earbud only.



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Markers	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/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	* ** 4.80375	48.03	PK2	34.3	-31.5	50.83	-	-	74	-23.17	176	102	H
	* ** 4.80397	40.53	V1TV	34.3	-31.5	43.33	54	-10.67	-	-	176	102	H
2	* ** 4.96004	49.62	PK2	34.1	-32.4	51.32	-	-	74	-22.68	311	104	H
	* ** 4.96006	42.39	V1TV	34.1	-32.4	44.09	54	-9.91	-	-	311	104	H
4	* ** 7.43986	49.4	PK2	35.7	-29.3	55.8	-	-	74	-18.2	292	101	H
	* ** 7.44003	41.15	V1TV	35.7	-29.3	47.55	54	-6.45	-	-	292	101	H
5	* ** 4.80363	51.95	PK2	34.3	-31.5	54.75	-	-	74	-19.25	45	103	V
	* ** 4.80402	45.39	V1TV	34.3	-31.5	48.19	54	-5.81	-	-	45	103	V
6	* ** 4.96003	46.17	PK2	34.1	-32.4	47.87	-	-	74	-26.13	232	106	V
	* ** 4.96001	37.13	V1TV	34.1	-32.4	38.83	54	-15.17	-	-	232	106	V
8	* ** 7.44001	45.54	PK2	35.7	-29.3	51.94	-	-	74	-22.06	5	109	V
	* ** 7.44009	36.85	V1TV	35.7	-29.3	43.25	54	-10.75	-	-	5	109	V
3	7.20607	41.46	Pk	35.6	-29.9	47.16	-	-	-	-	0-360	101	H
7	7.20607	42.38	Pk	35.6	-29.9	48.08	-	-	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK2 - Maximum Peak
V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration
Pk - Peak detector

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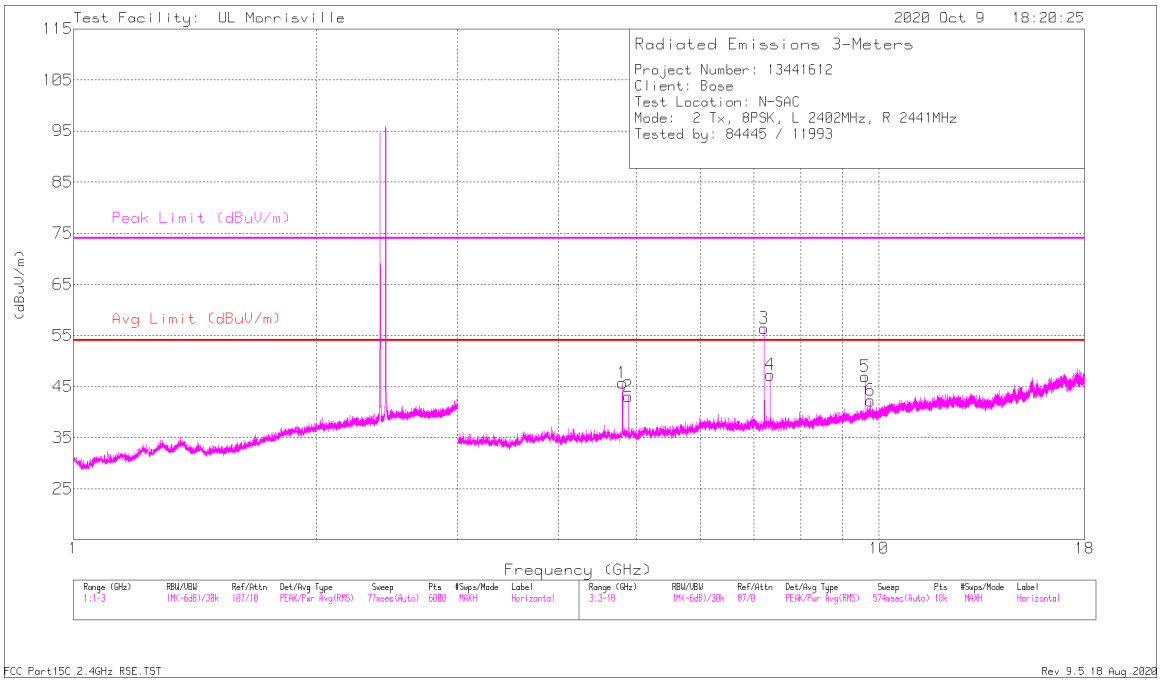
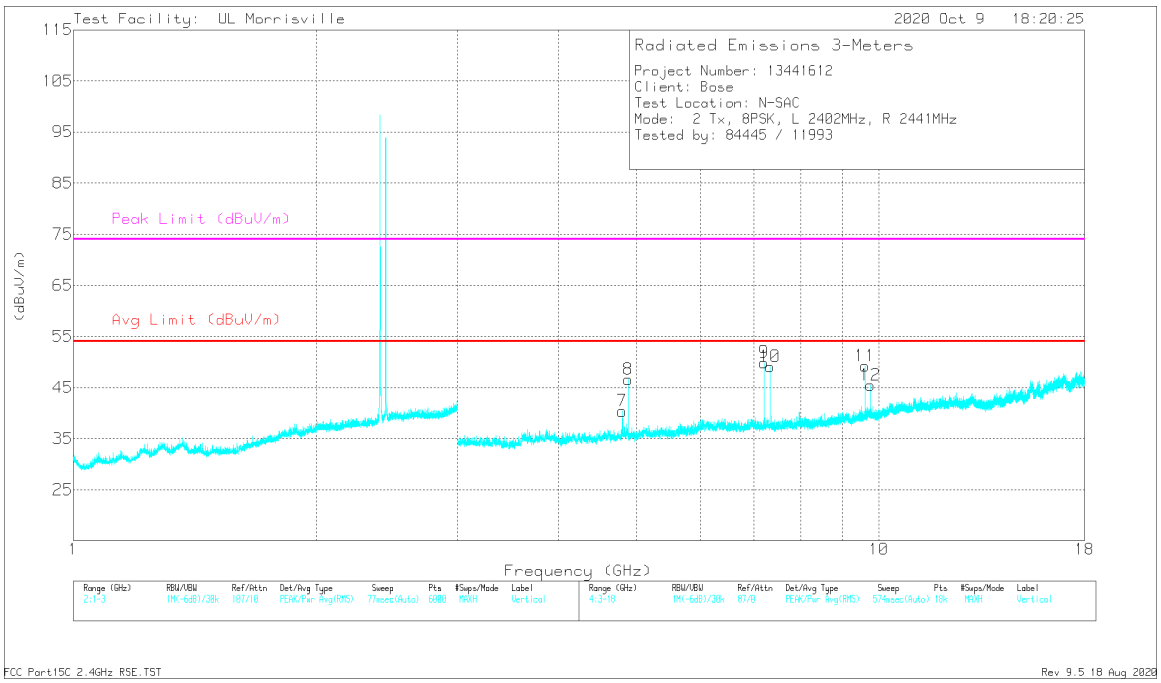
MID CHANNEL RESULTS

**Note - both earbuds were tested at same time on different channels. This particular testing covers the right earbud only.



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Markers	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/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	* ** 4.80423	47.54	PK2	34.3	-31.5	50.34	-	-	74	-23.66	331	109	H
	* ** 4.80406	39.77	V1TV	34.3	-31.5	42.57	54	-11.43	-	-	331	109	H
2	* ** 4.88164	46.71	PK2	34.1	-31.4	49.41	-	-	74	-24.59	330	322	H
	* ** 4.88203	38.65	V1TV	34.1	-31.4	41.35	54	-12.65	-	-	330	322	H
4	* ** 7.32347	45.78	PK2	35.7	-29.2	52.28	-	-	74	-21.72	292	101	H
	* ** 7.32301	36.91	V1TV	35.7	-29.2	43.41	54	-10.59	-	-	292	101	H
7	* ** 4.80378	44.45	PK2	34.3	-31.5	47.25	-	-	74	-26.75	12	101	V
	* ** 4.80404	34.78	V1TV	34.3	-31.5	37.58	54	-16.42	-	-	12	101	V
8	* ** 4.88196	49.11	PK2	34.1	-31.4	51.81	-	-	74	-22.19	163	103	V
	* ** 4.88202	42.05	V1TV	34.1	-31.4	44.75	54	-9.25	-	-	163	103	V
10	* ** 7.3231	48.01	PK2	35.7	-29.2	54.51	-	-	74	-19.49	267	104	V
	* ** 7.32305	39.87	V1TV	35.7	-29.2	46.37	54	-7.63	-	-	267	104	V
3	7.20607	50.68	Pk	35.6	-29.9	56.38	-	-	-	-	0-360	101	H
9	7.20607	44.19	Pk	35.6	-29.9	49.89	-	-	-	-	0-360	101	V
5	9.60704	38.33	Pk	36.9	-28.3	46.93	-	-	-	-	0-360	101	H
11	9.60704	40.59	Pk	36.9	-28.3	49.19	-	-	-	-	0-360	101	V
6	9.76371	32.66	Pk	37	-27.4	42.26	-	-	-	-	0-360	101	H
12	9.76371	35.86	Pk	37	-27.4	45.46	-	-	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK2 - Maximum Peak
V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration
Pk - Peak detector

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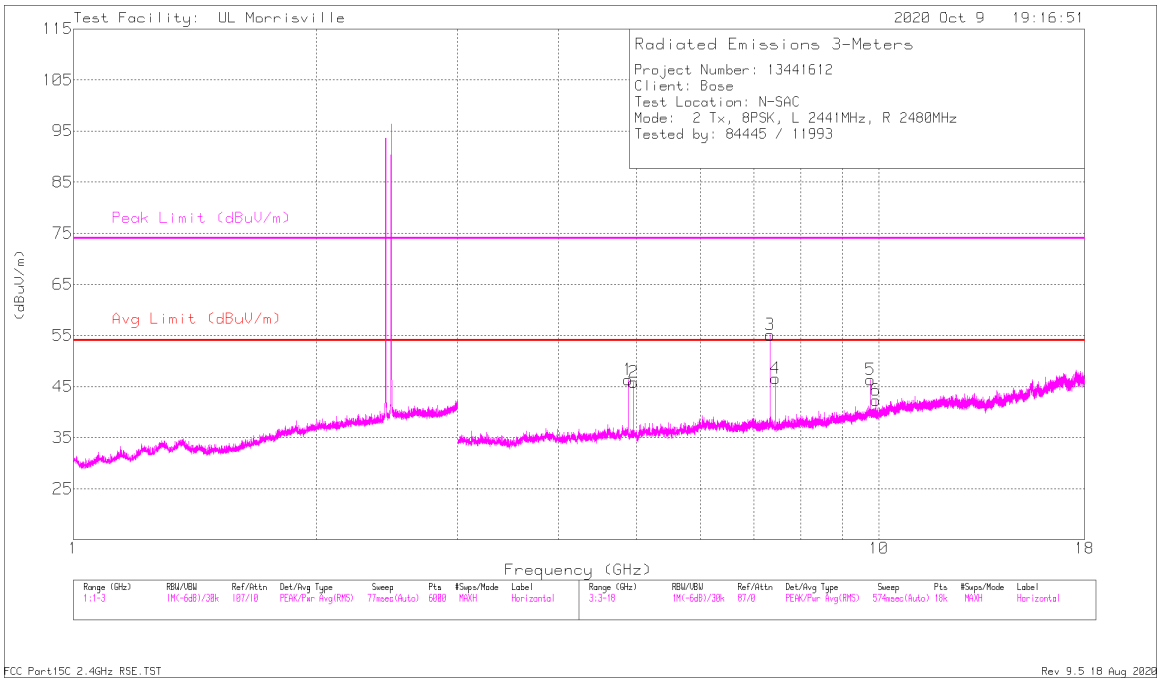
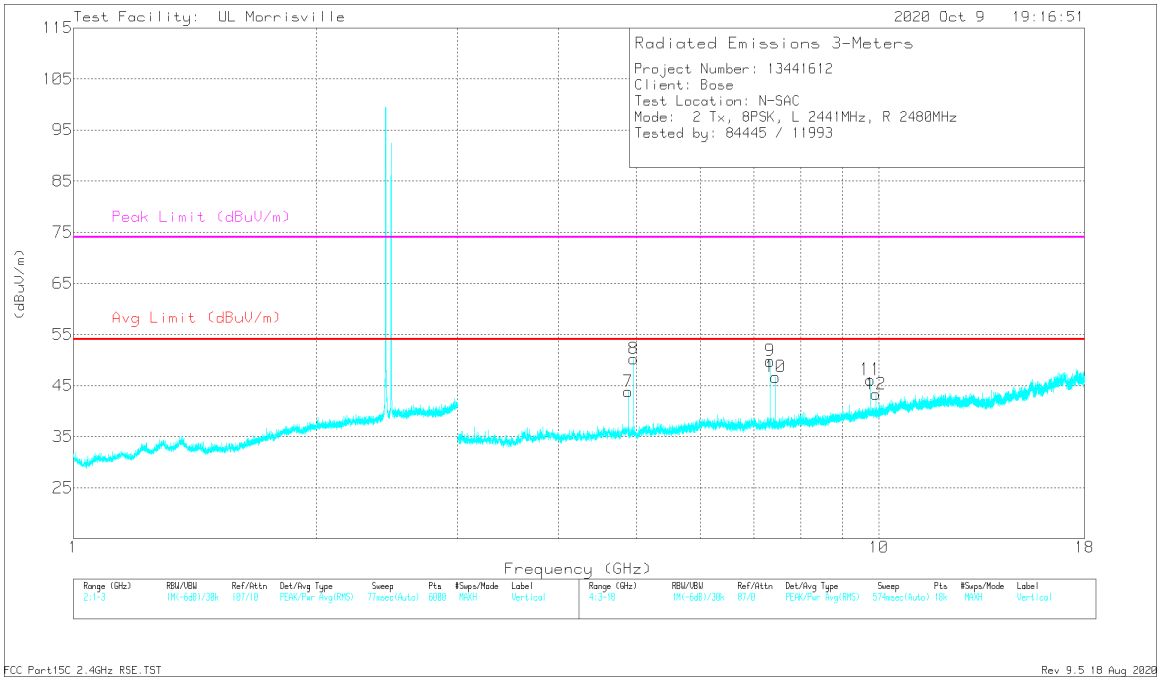
HIGH CHANNEL RESULTS

**Note - both earbuds were tested at same time on different channels. This particular testing covers the right earbud only.



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Markers	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/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	* ** 4.88168	48.45	PK2	34.1	-31.4	51.15	-	-	74	-22.85	286	103	H
	* ** 4.88208	40.49	V1TV	34.1	-31.4	43.19	54	-10.81	-	-	286	103	H
2	* ** 4.96029	48.87	PK2	34.1	-32.4	50.57	-	-	74	-23.43	179	101	H
	* ** 4.96	41.37	V1TV	34.1	-32.4	43.07	54	-10.93	-	-	179	101	H
3	* ** 7.32303	53.34	PK2	35.7	-29.2	59.84	-	-	74	-14.16	21	111	H
	* ** 7.32302	46.03	V1TV	35.7	-29.2	52.53	54	-1.47	-	-	21	111	H
4	* ** 7.44006	45.53	PK2	35.7	-29.3	51.93	-	-	74	-22.07	327	314	H
	* ** 7.44005	36.81	V1TV	35.7	-29.3	43.21	54	-10.79	-	-	327	314	H
7	* ** 4.88239	47.07	PK2	34	-31.4	49.67	-	-	74	-24.33	238	110	V
	* ** 4.88205	39.09	V1TV	34.1	-31.4	41.79	54	-12.21	-	-	238	110	V
8	* ** 4.96002	52.83	PK2	34.1	-32.4	54.53	-	-	74	-19.47	42	121	V
	* ** 4.96007	46.37	V1TV	34.1	-32.4	48.07	54	-5.93	-	-	42	121	V
9	* ** 7.32322	48.3	PK2	35.7	-29.2	54.8	-	-	74	-19.2	342	101	V
	* ** 7.32307	40.03	V1TV	35.7	-29.2	46.53	54	-7.47	-	-	342	101	V
10	* ** 7.44064	46.42	PK2	35.7	-29.3	52.82	-	-	74	-21.18	135	104	V
	* ** 7.44008	38.04	V1TV	35.7	-29.3	44.44	54	-9.56	-	-	135	104	V
11	9.76371	36.54	Pk	37	-27.4	46.14	-	-	-	-	0-360	101	V
5	9.76455	36.75	Pk	37	-27.4	46.35	-	-	-	-	0-360	101	H
12	9.91955	34.13	Pk	37	-27.8	43.33	-	-	-	-	0-360	101	V
6	9.92039	33.09	Pk	37	-27.8	42.29	-	-	-	-	0-360	101	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK2 - Maximum Peak
V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration
Pk - Peak detector

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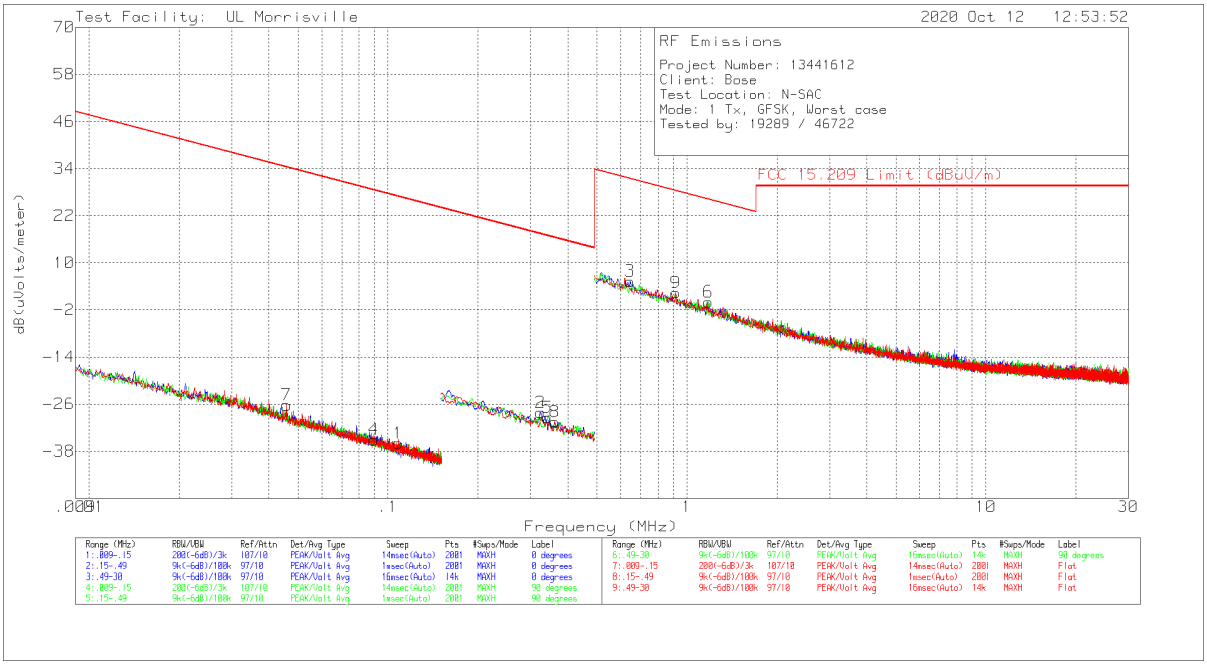
10.2. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)

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

The below 30 MHz limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency 45.78 kHz resulted in a level of -26.28 dBuV/m, which is equivalent to -26.28-51.5 = -77.78 dBuA/m, which has the same margin, -60.67 dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit



ANTENNA- THREE ORIENTATIONS

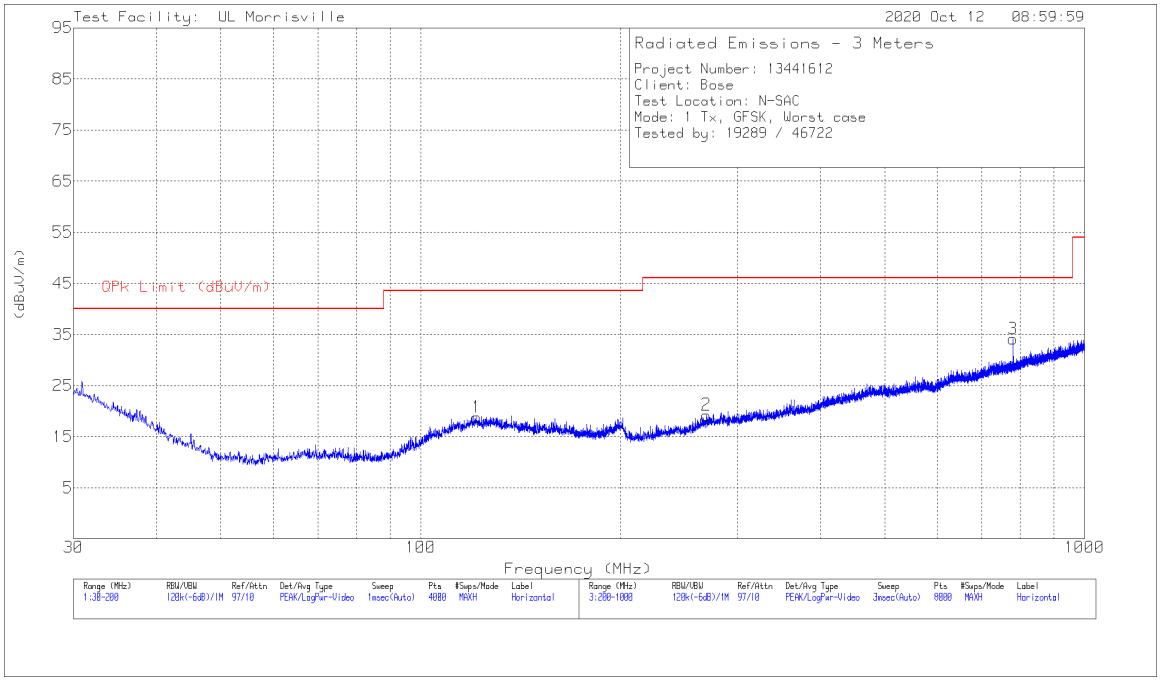
Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 QP/AV Limit (dBuV/m)	FCC 15.209 PK Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
7	.04578	41.82	Pk	11.8	.1	-80	-26.28	34.39	54.39	-60.67	0-360
4	.08966	33.62	Pk	11.2	.1	-80	-35.08	28.55	48.55	-63.63	0-360
1	.10833	33.06	Pk	10.9	.1	-80	-35.94	26.91	-	-62.85	0-360
2	.32366	41.06	Pk	10.7	.1	-80	-28.14	17.4	37.4	-45.54	0-360
5	.34142	39.78	Pk	10.7	.1	-80	-29.42	16.94	36.94	-46.36	0-360
8	.36106	38.76	Pk	10.6	.1	-80	-30.54	16.45	36.45	-46.99	0-360
3	.64599	34.31	Pk	10.8	.2	-40	5.31	31.4	-	-26.09	0-360
9	.91582	31.23	Pk	10.9	.2	-40	2.33	28.37	-	-26.04	0-360
6	1.17721	28.82	Pk	11	.2	-40	.02	26.19	-	-26.17	0-360

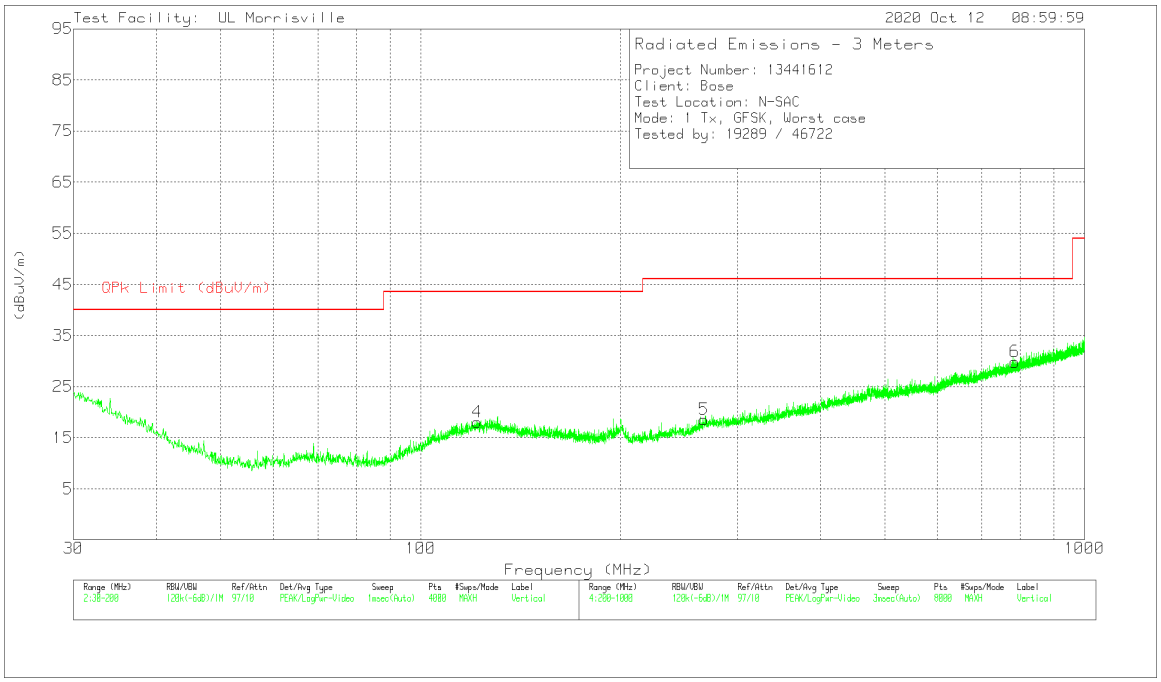
Pk - Peak detector

10.3. WORST CASE BELOW 1 GHZ

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



HORIZONTAL



VERTICAL

Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 121.5262	29.02	Pk	20	-30.2	18.82	43.52	-24.7	0-360	300	H
4	* ** 121.8238	28.25	Pk	20	-30.2	18.05	43.52	-25.47	0-360	100	V
2	* ** 269.609	28.82	Pk	19.3	-28.9	19.22	46.02	-26.8	0-360	300	H
3	** 780.2754	32.71	Pk	27.2	-25.8	34.11	46.02	-11.91	0-360	199	H
5	* ** 267.4088	28.33	Pk	19.1	-28.9	18.53	46.02	-27.49	0-360	200	V
6	** 784.976	28.51	Pk	27.2	-25.9	29.81	46.02	-16.21	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

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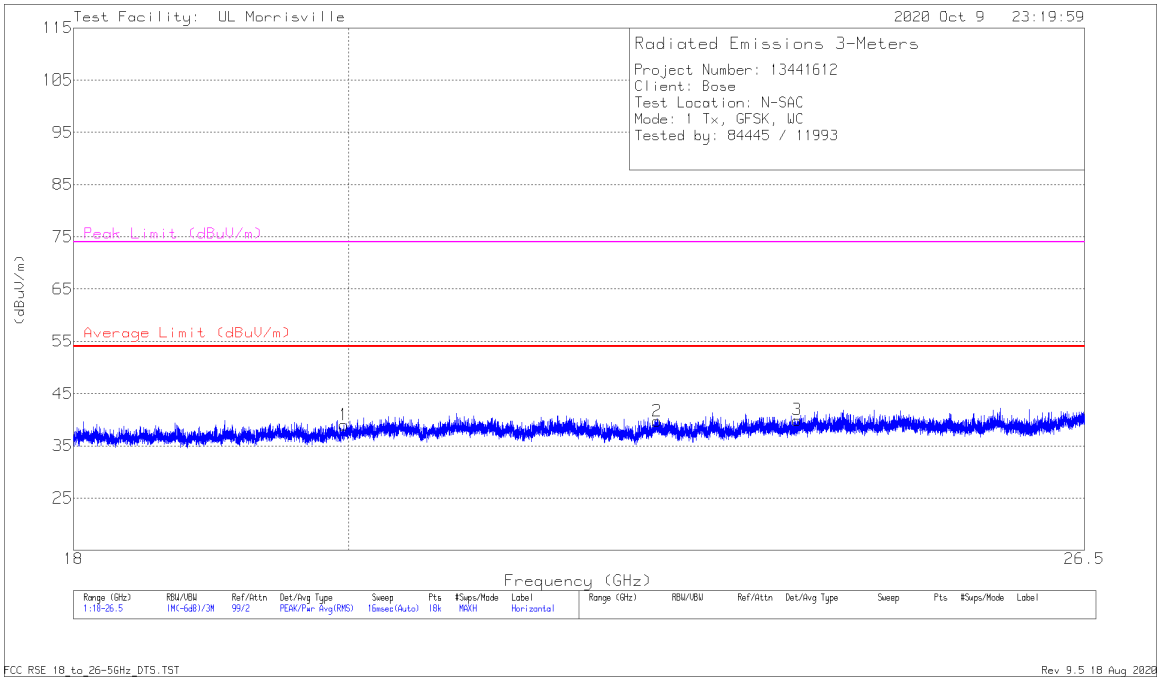
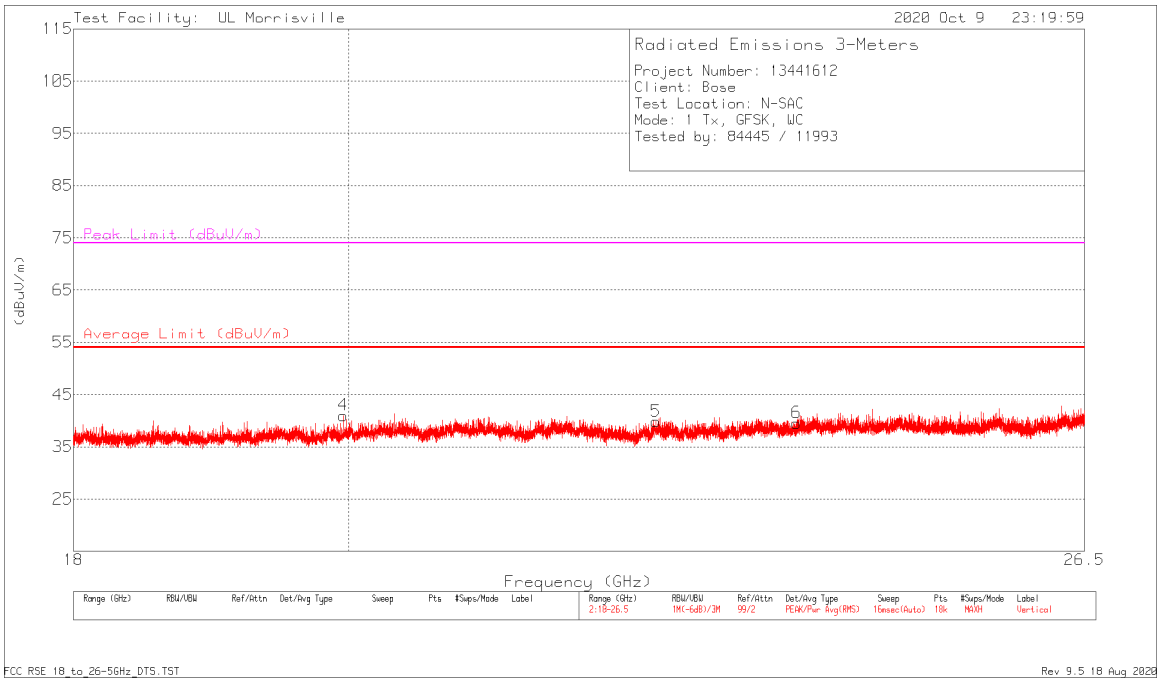
10.4. WORST CASE 18-26 GHZ

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



HORIZONTAL



VERTICAL

18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0076 AF (dB/m)	Amp/CBL (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 19.96219	46.7	Pk	32.9	-40.6	39	54	-15	74	-35	0-360	300	H
2	* ** 22.50383	47.09	Pk	33.6	-41	39.69	54	-14.31	74	-34.31	0-360	300	H
3	* ** 23.7397	46.51	Pk	34	-40.6	39.91	54	-14.09	74	-34.09	0-360	250	H
4	* ** 19.95747	48.72	Pk	32.8	-40.5	41.02	54	-12.98	74	-32.98	0-360	200	V
5	* ** 22.49108	47.31	Pk	33.6	-41.1	39.81	54	-14.19	74	-34.19	0-360	250	V
6	* ** 23.73356	46.24	Pk	34	-40.7	39.54	54	-14.46	74	-34.46	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

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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.

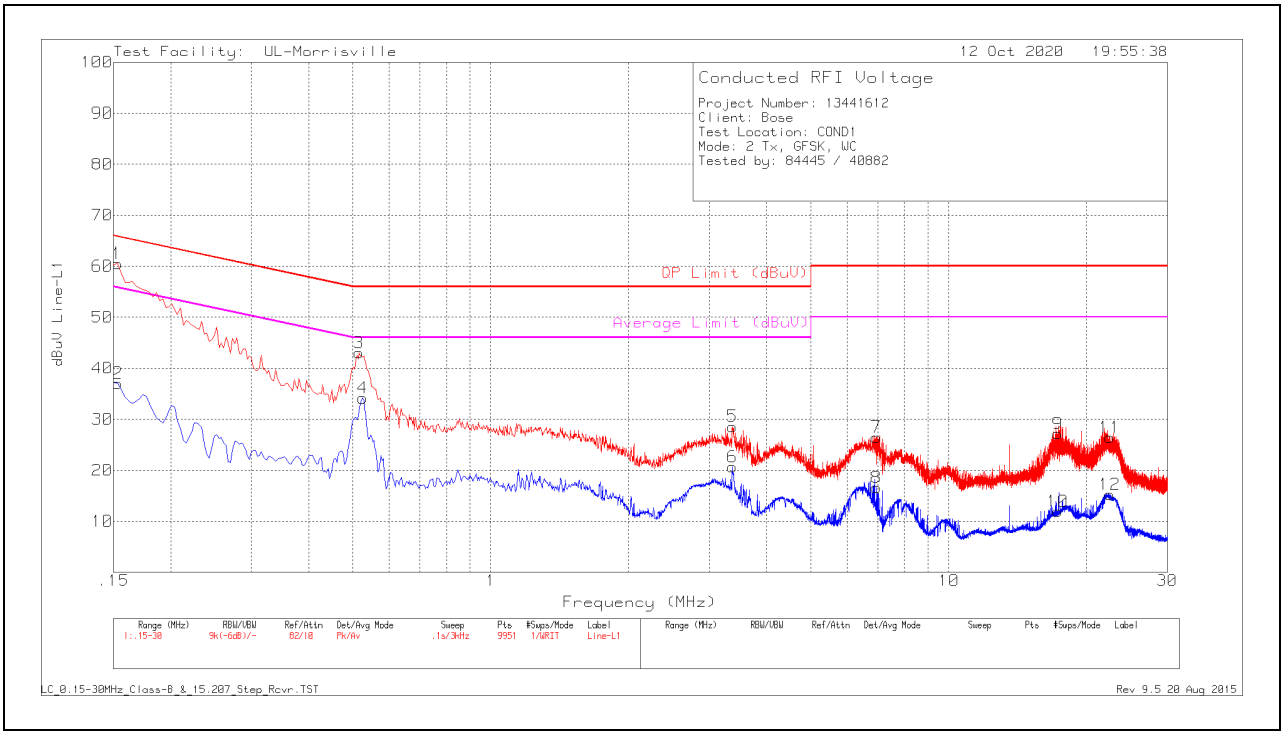
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

11.1.1. AC Power Line Norm

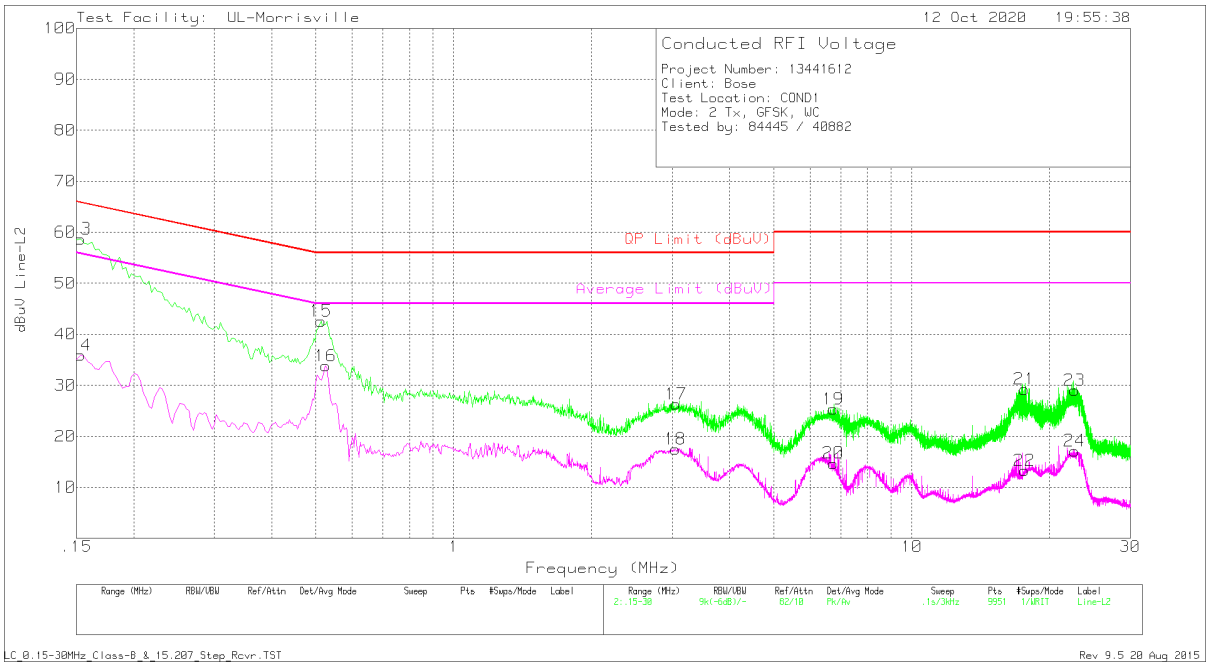
LINE 1 RESULTS



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	.15197	45.58	Qp	.2	9.7	55.48	65.89	-10.41	-	-
2	.153	27.16	Av	.2	9.7	37.06	-	-	55.84	-18.78
3	.516	33.22	Pk	0	9.8	43.02	56	-12.98	-	-
4	.525	24.35	Av	0	9.8	34.15	-	-	46	-11.85
5	3.3675	18.79	Pk	0	9.8	28.59	56	-27.41	-	-
6	3.369	10.86	Av	0	9.8	20.66	-	-	46	-25.34
7	6.945	16.49	Pk	.1	9.9	26.49	60	-33.51	-	-
8	6.945	6.64	Av	.1	9.9	16.64	-	-	50	-33.36
9	17.28	17.01	Pk	.1	10.1	27.21	60	-32.79	-	-
10	17.28	1.76	Av	.1	10.1	11.96	-	-	50	-38.04
11	22.461	16.16	Pk	.2	10.1	26.46	60	-33.54	-	-
12	22.449	4.94	Av	.2	10.1	15.24	-	-	50	-34.76

Pk - Peak detector
Av - Average detection
Qp - Quasi-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)**
13	.153	48.8	Pk	.2	9.7	58.7	65.84	-7.14	-	-
14	.153	26.01	Av	.2	9.7	35.91	-	-	55.84	-19.93
15	.513	32.69	Pk	.1	9.8	42.59	56	-13.41	-	-
16	.525	23.89	Av	.1	9.8	33.79	-	-	46	-12.21
17	3.06	16.53	Pk	0	9.8	26.33	56	-29.67	-	-
18	3.045	7.71	Av	0	9.8	17.51	-	-	46	-28.49
19	6.735	15.36	Pk	.1	9.9	25.36	60	-34.64	-	-
20	6.744	4.71	Av	.1	9.9	14.71	-	-	50	-35.29
21	17.616	19.02	Pk	.1	10.1	29.22	60	-30.78	-	-
22	17.6175	3.11	Av	.1	10.1	13.31	-	-	50	-36.69
23	22.662	18.7	Pk	.2	10.1	29	60	-31	-	-
24	22.671	6.85	Av	.2	10.1	17.15	-	-	50	-32.85

Pk - Peak detector
Av - Average detection

12. SETUP PHOTOS

Please refer to R13441612R-EP1 for setup photos

END OF TEST REPORT

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