TEST REPORT

Report Number: R14176139-E2V1

Applicant	:	Sony Corporation 1-7-1 Konan Minato-ku Tokyo, 108-0076, Japan
FCC ID	:	PY7-83262V
EUT Description	:	GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac/ax, GPS, WPT & NFC
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
2022-03-25

Prepared by:
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ACCREDITED
CERT #0751.06

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2022-03-18	Initial Issue	Brian Kiewra
V1	2022-03-25	Corrected headers for 8PSK and DQPSK to “Enhanced Data Rate” from “Basic Data Rate” Updated to correct version of KDB558074 in Section 3. Harmonized antenna port descriptors so all read as chain 0 and chain 1.	Brian Kiewra

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Sony Corporation
1-7-1 Konan Minato-ku
Tokyo, 108-0076, Japan

EUT DESCRIPTION: GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac/ax, GPS, WPT & NFC

SERIAL NUMBER: QV77002ZAQ, QV770028AQ, QV770019B8, QV77007QB8, QV77003RB8, QV770058B8

SAMPLE RECEIPT DATE: 2022-01-13

DATE TESTED: 2022-02-01 to 2022-03-18

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Refer to Section 2

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

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

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by a2La, NIST, or any agency of the U.S. government.

Approved & Released
For UL LLC By:

Michael Antola
Staff Engineer
Consumer Technology Division
UL LLC

Prepared By:

Brian Kiewra
Project Engineer
Consumer Technology Division
UL LLC

2. TEST RESULTS SUMMARY

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

FCC Clause	Requirement	Result	Comment
See Comment	Duty Cycle	Reporting purposes only	Per ANSI C63.10, Section 11.6.
See Comment	20dB BW	Reporting purposes only	ANSI C63.10 Sections 6.9.2.
15.247 (a)(1)	Hopping Frequency Separation	Compliant	None
15.247 (a)(1)(iii)	Number of Hopping Channels		
15.247 (a)(1)(iii)	Average Time of Occupancy		
15.247 (b)(1)	Output Power		
See Comment	Average Power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (d)	Conducted Spurious Emissions	Compliant	None
15.209, 15.205	Radiated Emissions		
15.207	AC Mains Conducted Emissions		

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, and KDB 414788 D01 Radiated Test Site v01r01.

4. FACILITIES AND ACCREDITATION

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

	Address	ISED CABID	ISED Company Number	FCC Registration
☐	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	825374
☒	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A		27265	

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

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

5.2. DECISION RULES

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

5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U_{Lab}
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%

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 GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac/ax, GPS, WPT & NFC. This test report covers BT testing

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)
Chain 0			
2402 - 2480	Basic GFSK	12.50	17.78
2402 - 2480	Enhanced DQPSK	12.57	18.07
2402 - 2480	Enhanced 8PSK	14.30	26.92
Chain 1			
2402 - 2480	Basic GFSK	12.52	17.86
2402 - 2480	Enhanced DQPSK	12.51	17.82
2402 - 2480	Enhanced 8PSK	14.10	25.70

Note: GFSK, DQPSK, 8PSK power were all investigated, The GFSK and 8PSK are worst case based on AV power. Testing is based on these modes to showing compliance. For average power data please refer to section 9.7.

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer' are as follows:
The radio utilizes two loop antennas for diversity, with the following maximum gains:

Chain	Frequency Range (MHz)	Maximum Gain (dBi)
0	2402-2480	-2.3
1	2402-2480	-8.6

	Theory of Operation	Antenna	Manufacturer Tolerance	Block Diagram
Chain 0	WLAN Main/Bluetooth #1	WLAN Main/Bluetooth #1	Chain 0	WLAN Main/Bluetooth #1
Chain 1	WLAN Sub/Bluetooth #2	WLAN Sub/Bluetooth #2	Chain 1	WLAN Sub/Bluetooth #2

6.4. SOFTWARE AND FIRMWARE

The EUT software installed during testing was conducted: 0.364 and radiated: 0.428.

6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emissions were performed with the EUT set to transmit on both antennas 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 on each antenna. It was determined that X orientation was worst-case orientation for Chain 0 and Y orientation was worst-case for Chain 1. Therefore, all final radiated testing was performed with the EUT in X orientation for Chain 0 testing and Y orientation for Chain 1 testing.

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

GFSK mode: DH5
8PSK mode: 3-DH5

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	HP	14-dk1003dx	5CG016B4XM	TX2-RTL8821CE
Headphones	Sony	MDR-EX15AP	NA	NA
Adapter	Sony	XQZ-UC11-010-236-21	1821W34209742	NA
Adapter	Sony	XQZ-UC11-010-236-21	1821W34209856	NA
USB Cable	Sony	XQZ-UC1	NA	NA

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB	1	USB-C	Non-Shielded	<3m	Connected to power supply
2	3.5mm	1	3.5mm Audio	Non-shielded	<1m	Connected to headphones

TEST SETUP

The EUT is setup as a standalone device. Test software exercised the radio card.

SETUP DIAGRAMS

Please refer to R14176139-EP2 for setup diagrams

7. 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

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

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

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8. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Wireless Antenna Port Conducted Measurement Equipment

Equipment ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
HI0090	Environmental Meter	Fisher Scientific	15-077-963	2021-07-12	2022-07-12
PWM003	RF Power Meter	Keysight Technologies	N1911A	2021-08-30	2022-08-30
PWS001	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2021-06-25	2022-06-25
SA0025	Spectrum Analyzer	Keysight Technologies	N9030A	2021-04-01	2022-04-01
SOFTEMI	Antenna Port Software	UL	Version 2021.11.03	NA	NA
-	DC Power Supply	Keysight Technologies	E3633A	NA	NA
MM0167 (PRE0126458)	True RMS Multimeter	Agilent	U1232A	2021-08-17	2022-08-17

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 1)

Equipment ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
1-18 GHz					
AT0067	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2021-05-13	2022-05-13
Gain-Loss Chains					
C1-SAC03	Gain-loss string: 1-18GHz	Various	Various	2021-07-20	2022-07-20
Receiver & Software					
197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-30	2022-03-30
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
Additional Equipment used					
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2021-09-27	2022-09-27

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Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 4)

Equipment ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
0.009-30MHz					
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2021-08-19	2022-08-19
30-1000 MHz					
206210	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2021-03-11	2022-03-11
1-18 GHz					
206211	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2021-03-11	2022-03-11
AT0069	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2021-06-29	2022-06-29
Gain-Loss Chains					
C4-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2021-05-07	2022-05-07
C4-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2021-05-07	2022-05-07
C4-SAC03	Gain-loss string: 1-18GHz	Various	Various	2021-05-07	2022-05-07
Receiver & Software					
SA0026	Spectrum Analyzer	Agilent	N9030A	2021-07-16	2022-07-16
206496	Spectrum Analyzer	Rohde & Schwarz	ESW44	2022-02-15	2023-02-15
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
Additional Equipment used					
210642	Environmental Meter	Fisher Scientific	210701942	2021-8-16	2023-08-16

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 2)

Equipment ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
18-40 GHz					
AT0063	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2021-11-04	2022-11-04
Gain-Loss Chains					
C2-SAC04	Gain-loss string: 18-40GHz	Various	Various	2021-07-09	2022-07-09
Receiver & Software					
SA0020	Spectrum Analyzer	Agilent	E4446A	2021-05-25	2022-05-25
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		

Equipment ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
Additional Equipment used					
210642	Environmental Meter	Fisher Scientific	210701942	2021-8-16	2023-08-16

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
s/n 210701941	Environmental Meter	Fisher Scientific	15-077-963	2021-08-16	2023-08-16
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
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		

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9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

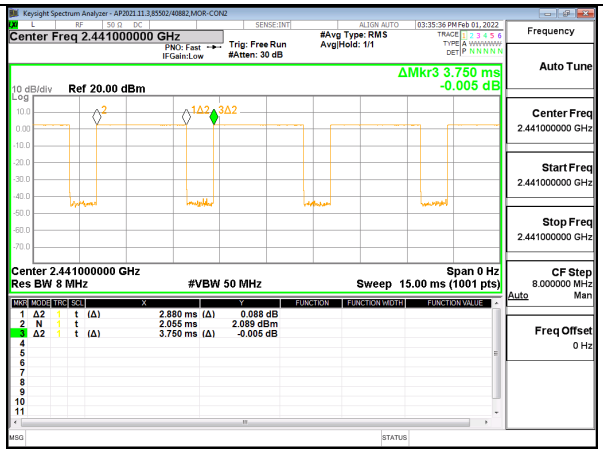
None; for reporting purposes only.

PROCEDURE

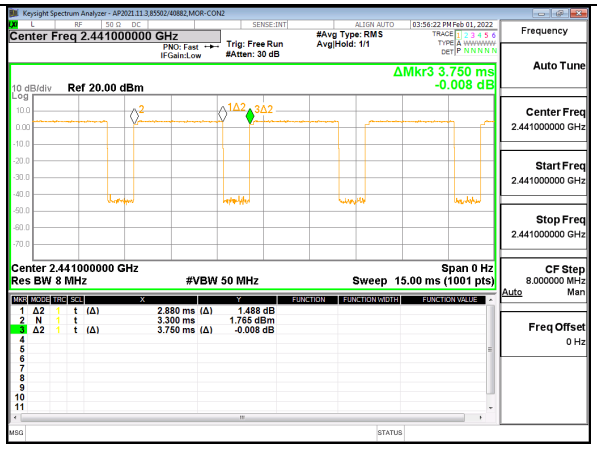
ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

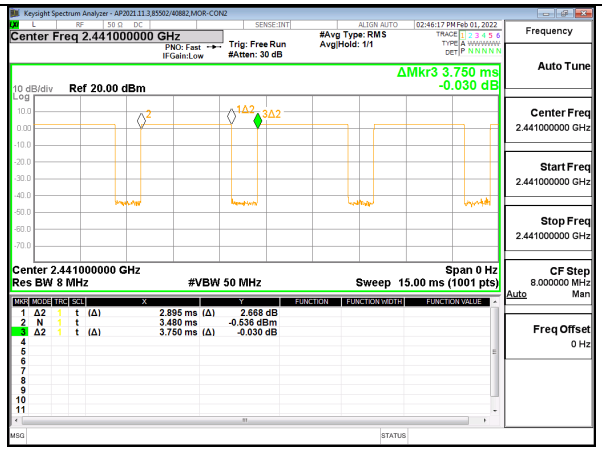
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
Bluetooth GFSK Ant 1	2.880	3.750	0.768	76.80	2.29	0.347
Bluetooth 8PSK Ant 1	2.880	3.750	0.768	76.80	2.29	0.347
Bluetooth GFSK Ant 2	2.895	3.750	0.772	77.20	2.25	0.345
Bluetooth 8PSK Ant 2	2.880	3.750	0.768	76.80	2.29	0.347



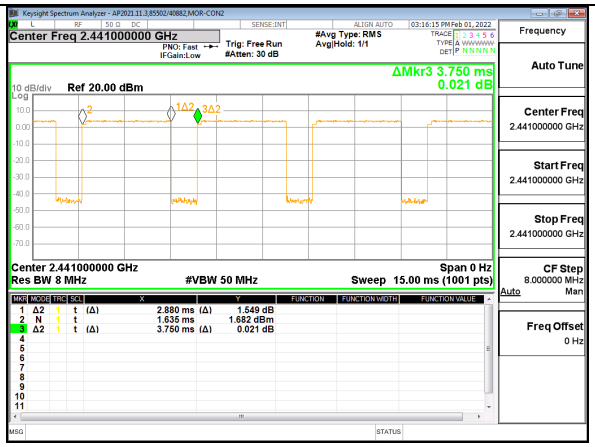
Bluetooth GFSK



Bluetooth 8PSK



Bluetooth GFSK



Bluetooth 8PSK

9.2. 20 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

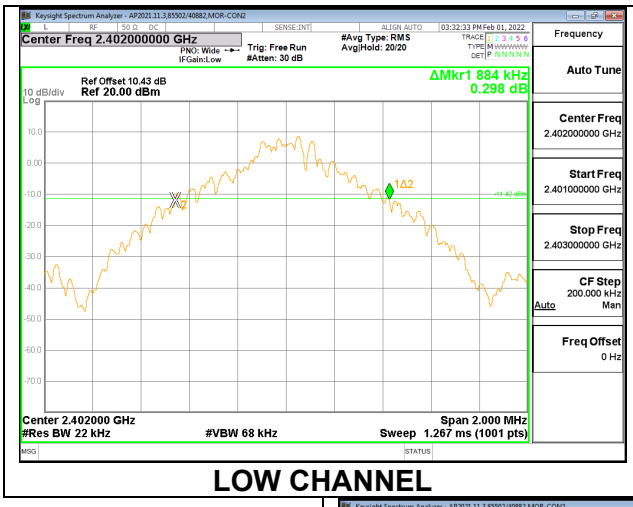
TEST PROCEDURE

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

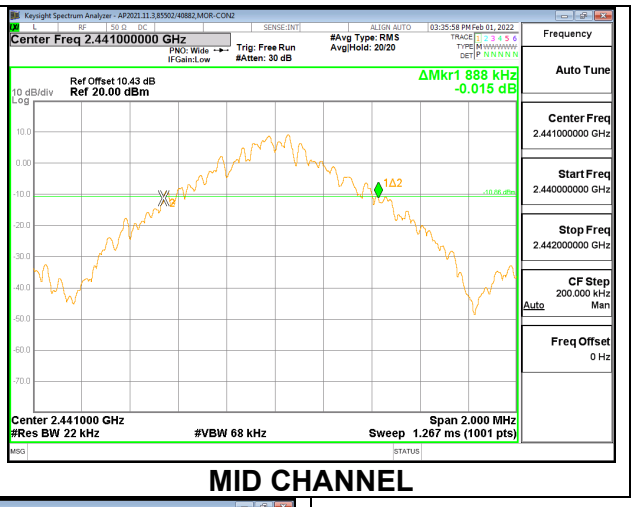
9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Chain 0

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	0.884
Mid	2441	0.888
High	2480	0.860



LOW CHANNEL

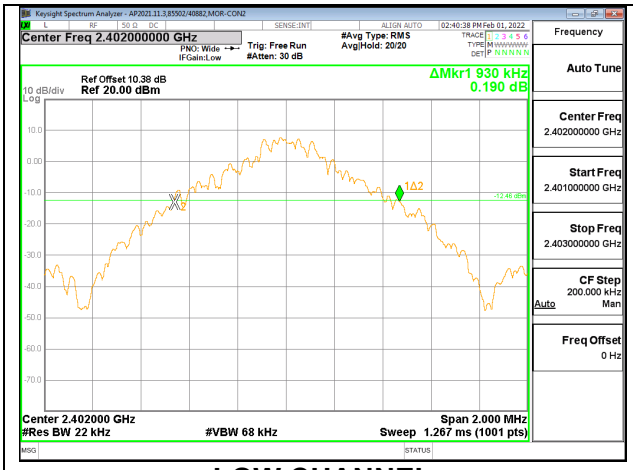


MID CHANNEL

HIGH CHANNEL

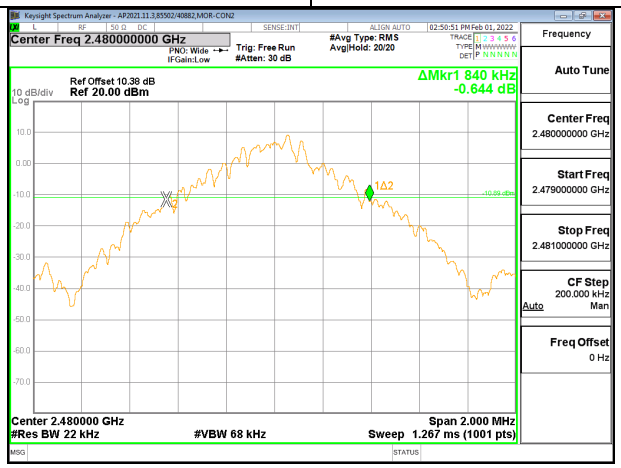
Chain 1

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	0.930
Mid	2441	0.834
High	2480	0.840



LOW CHANNEL

MID CHANNEL

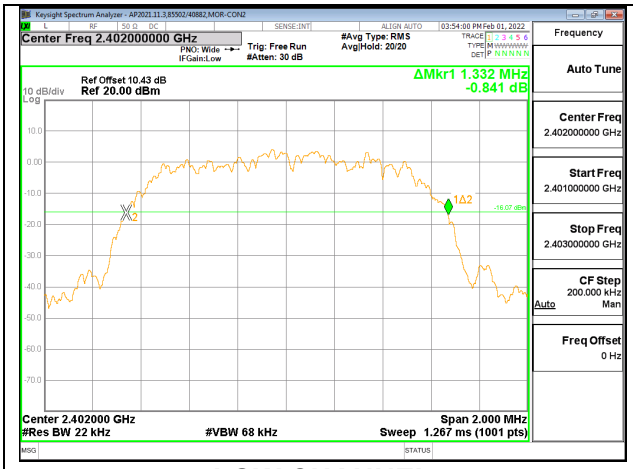


HIGH CHANNEL

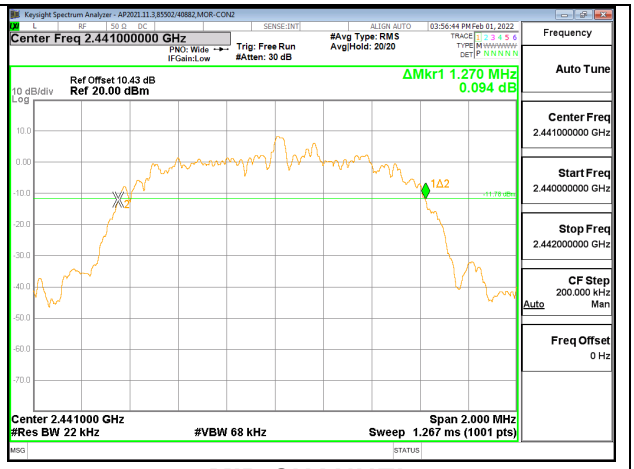
9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Chain 0

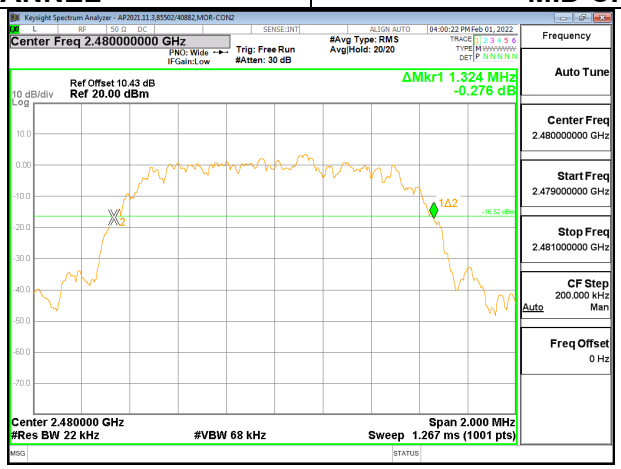
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.3320
Mid	2441	1.2700
High	2480	1.3240



LOW CHANNEL



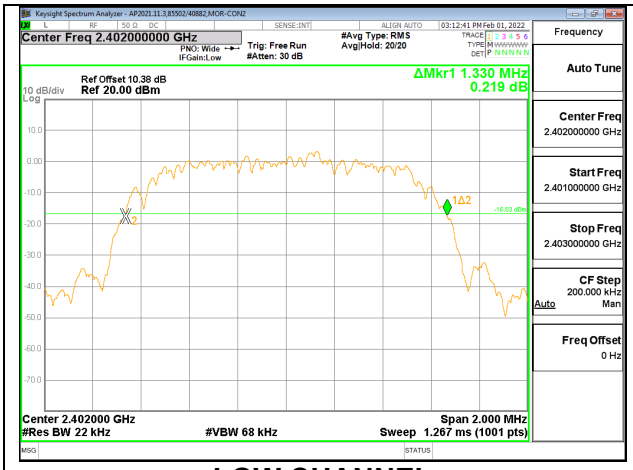
MID CHANNEL



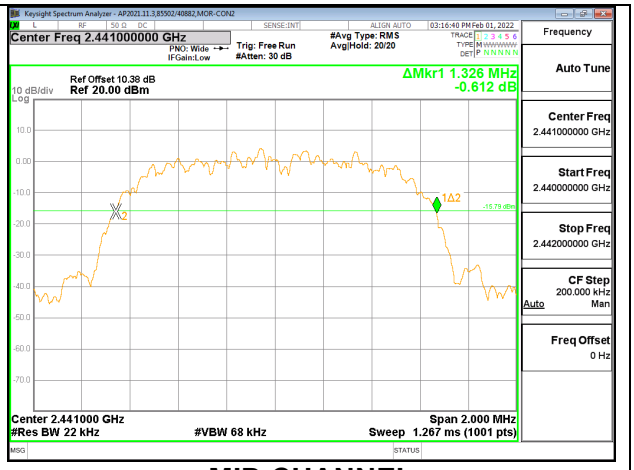
HIGH CHANNEL

Chain 1

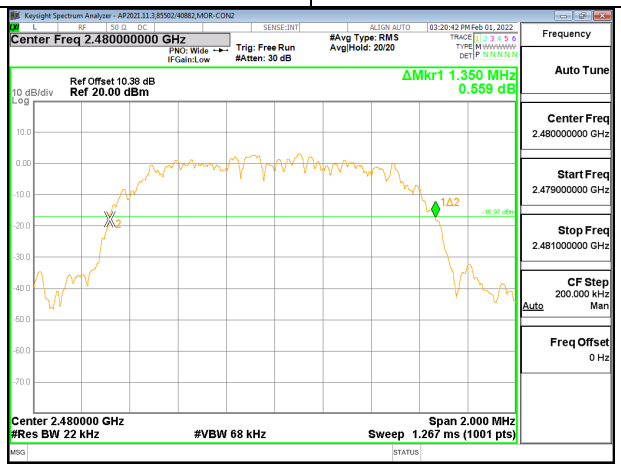
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.330
Mid	2441	1.326
High	2480	1.350



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

9.3. HOPPING FREQUENCY SEPARATION

LIMITS

FCC §15.247 (a) (1)

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 >= RBW. The sweep time is coupled.

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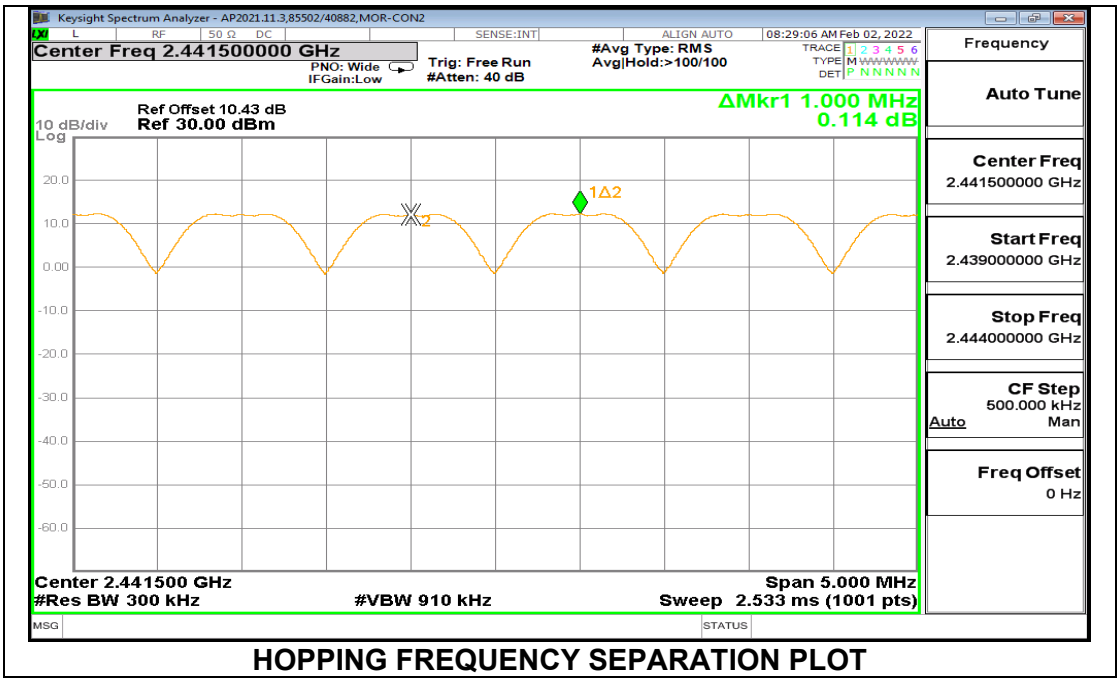
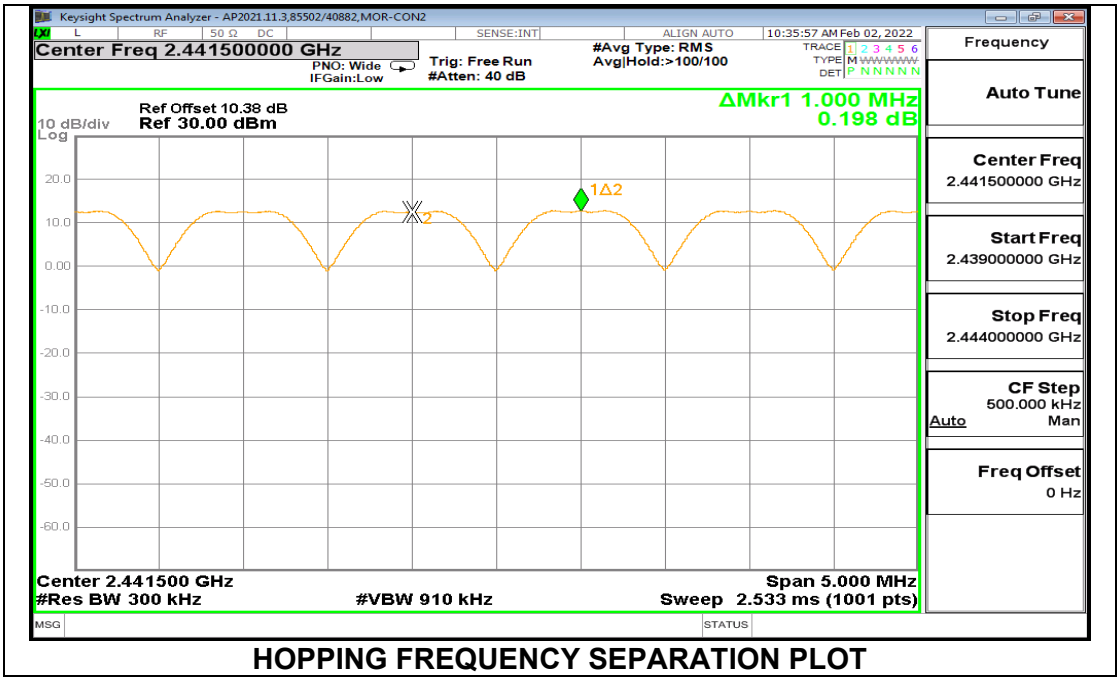
9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Chain 0



HOPPING FREQUENCY SEPARATION PLOT

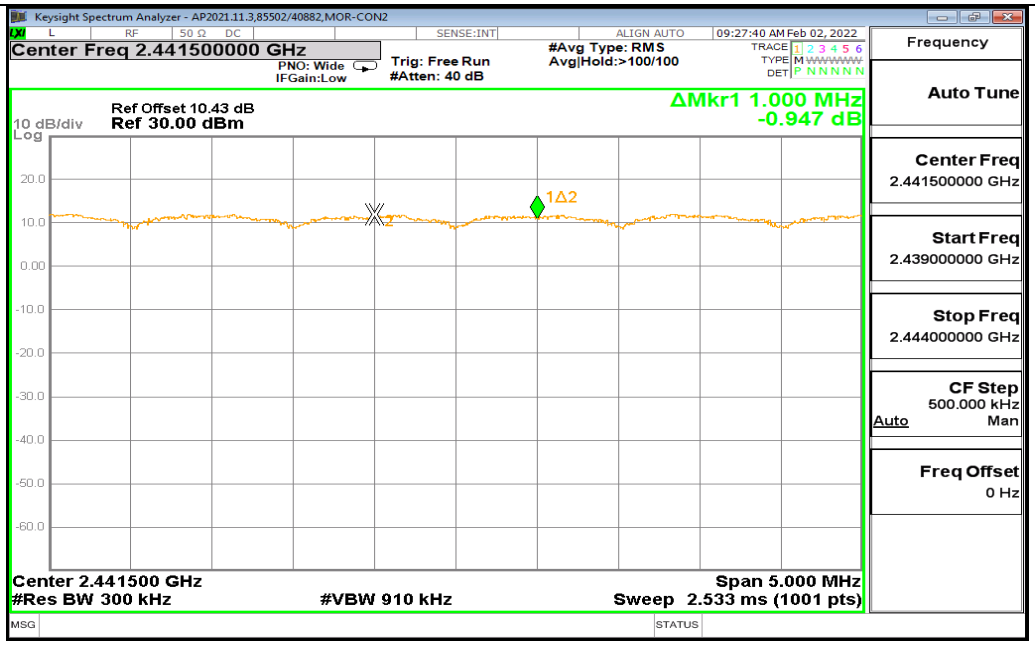
Chain 1



HOPPING FREQUENCY SEPARATION PLOT

9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Chain 0

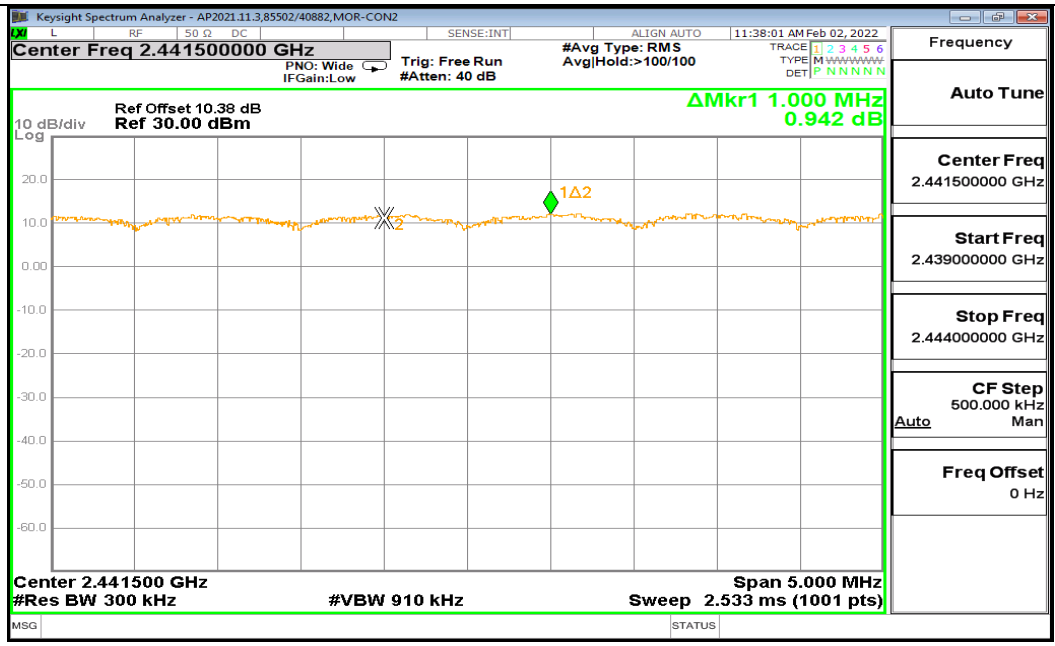


HOPPING FREQUENCY SEPARATION PLOT

Since output power is <125mW (21dBm), Separation can be > 2/3 20dB BW

Output Power (dBm)	Separation (MHz)	20dB BW (MHz)	2/3 dB BW (MHz)	Margin (MHz)
14.30	1.000	1.27	0.847	-0.153

Chain 1



HOPPING FREQUENCY SEPARATION PLOT

Since output power is <125mW (21dBm), Separation can be > 2/3 20dB BW

Output Power (dBm)	Separation (MHz)	20dB BW (MHz)	2/3 dB BW (MHz)	Margin (MHz)
14.10	1.000	1.326	0.884	-0.116

9.4. NUMBER OF HOPPING CHANNELS

LIMITS

FCC §15.247 (a) (1) (iii)

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. The RBW is set to <30% of the channel spacing. The analyzer is set to Max Hold.

RESULTS

Normal Mode: 79 Channels Observed

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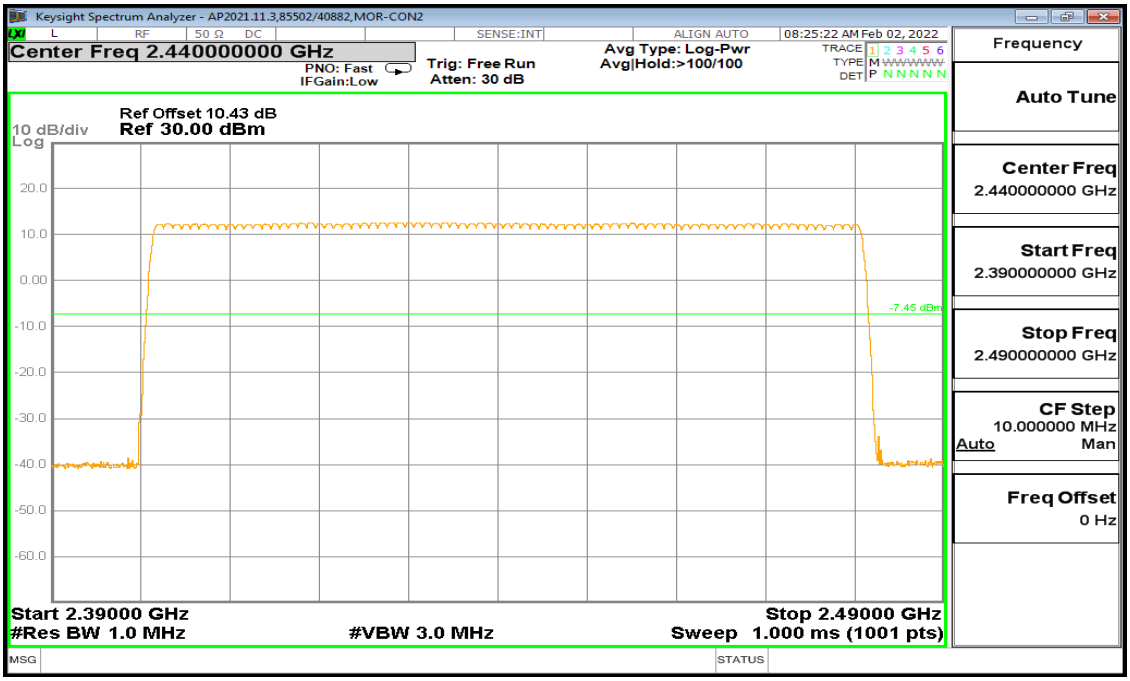
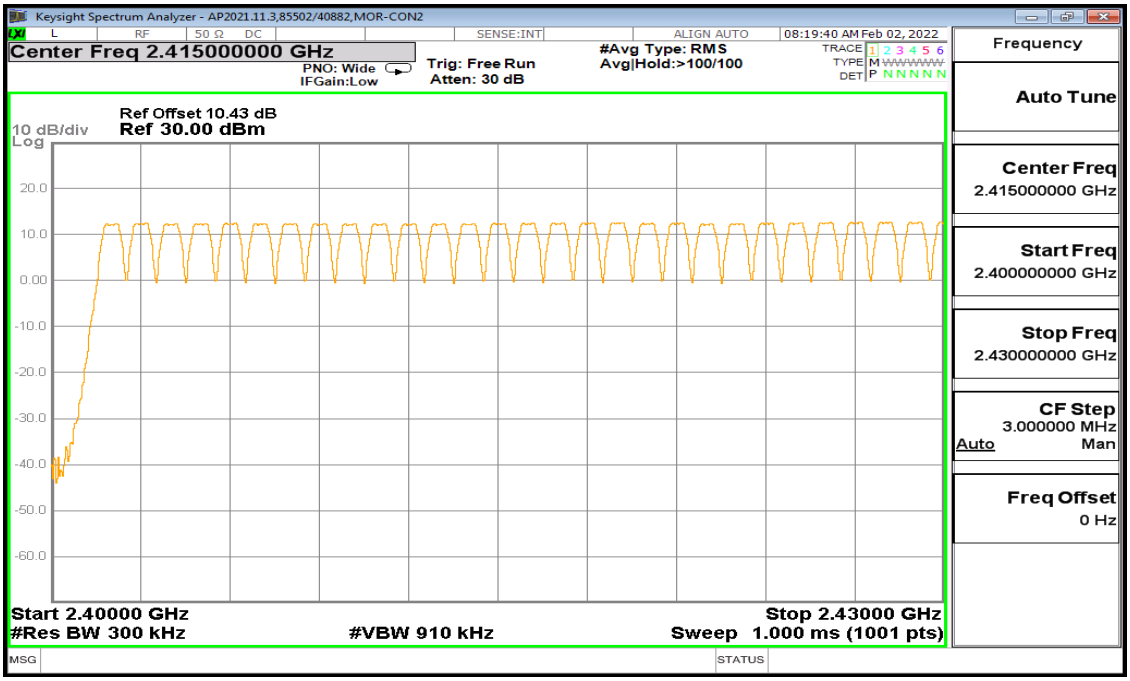
9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

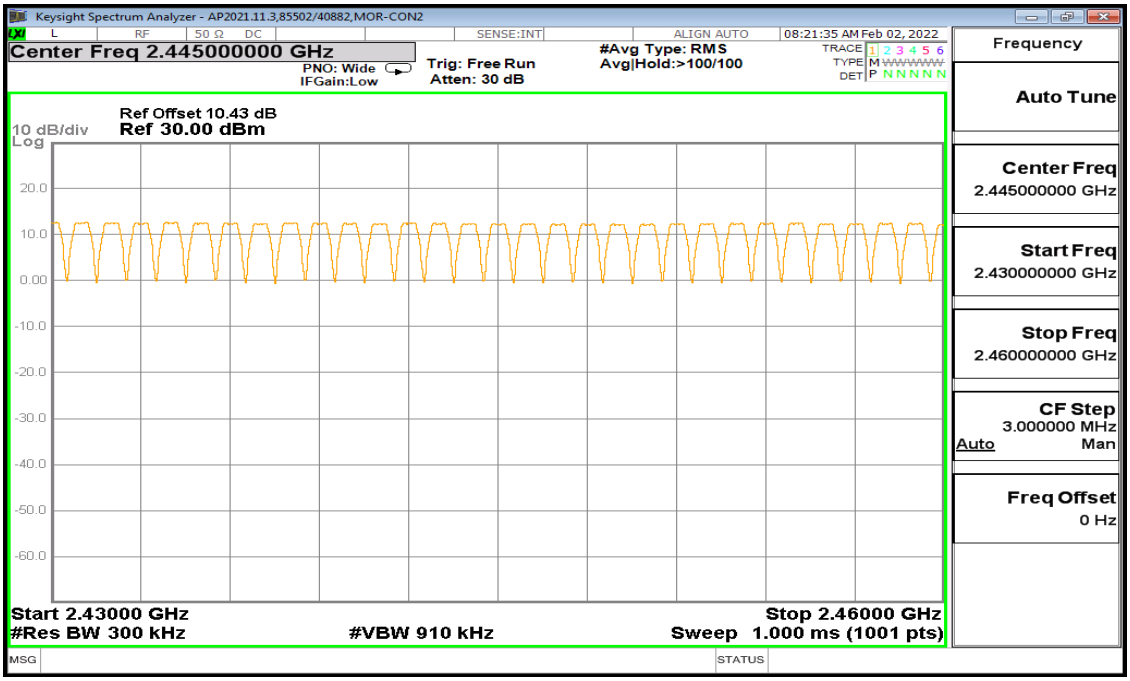
Chain 0



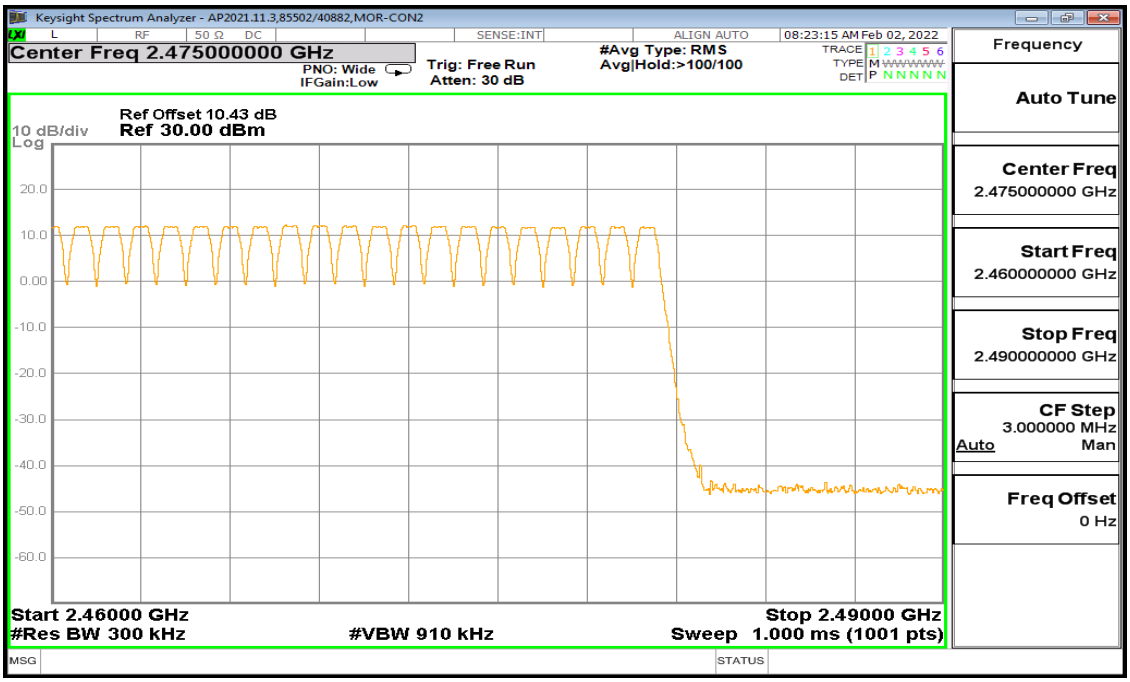
100MHz SPAN



30MHz SPAN, SEGMENT 1 OF 3

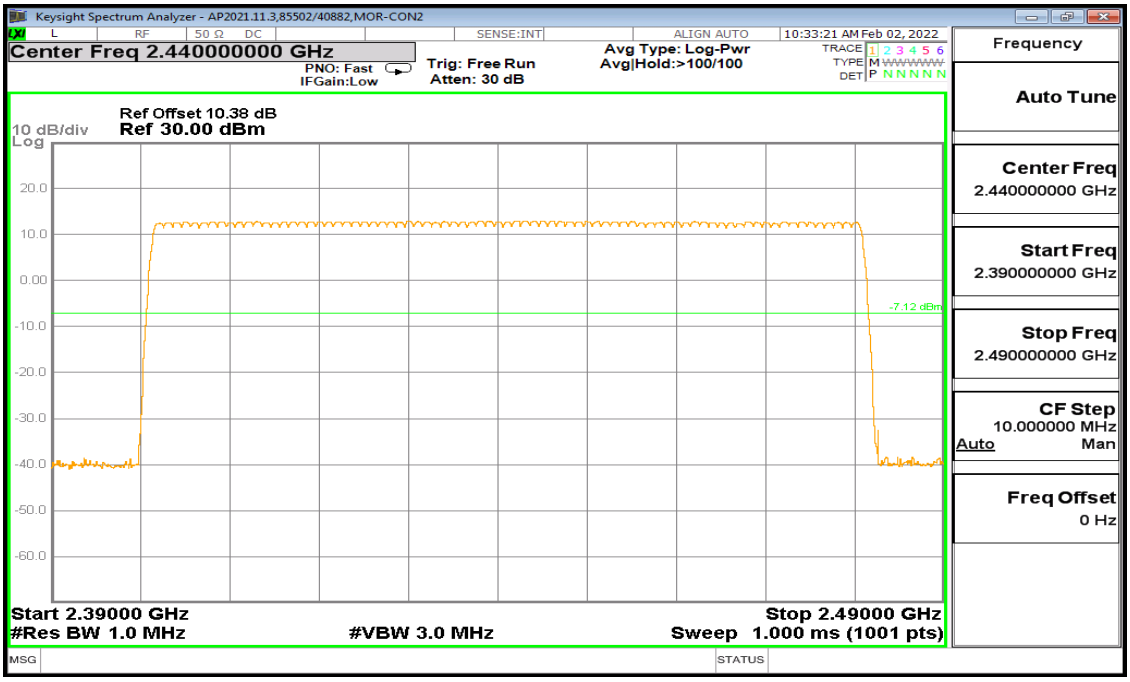


30MHz SPAN, SEGMENT 2 OF 3

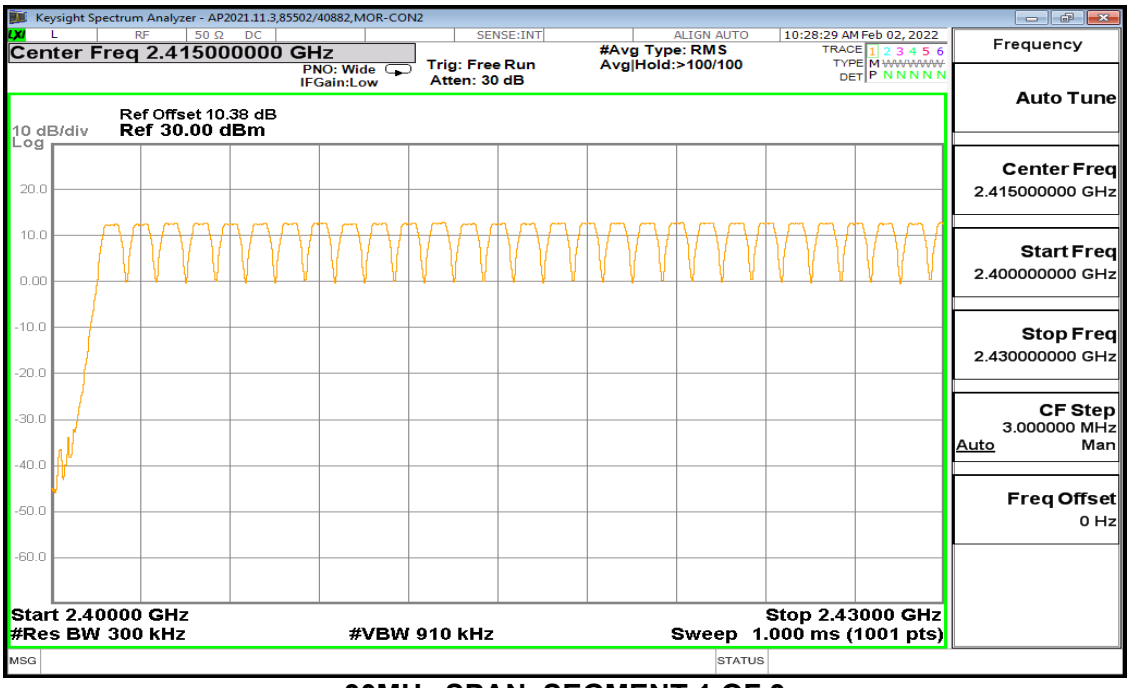


30MHz SPAN, SEGMENT 3 OF 3

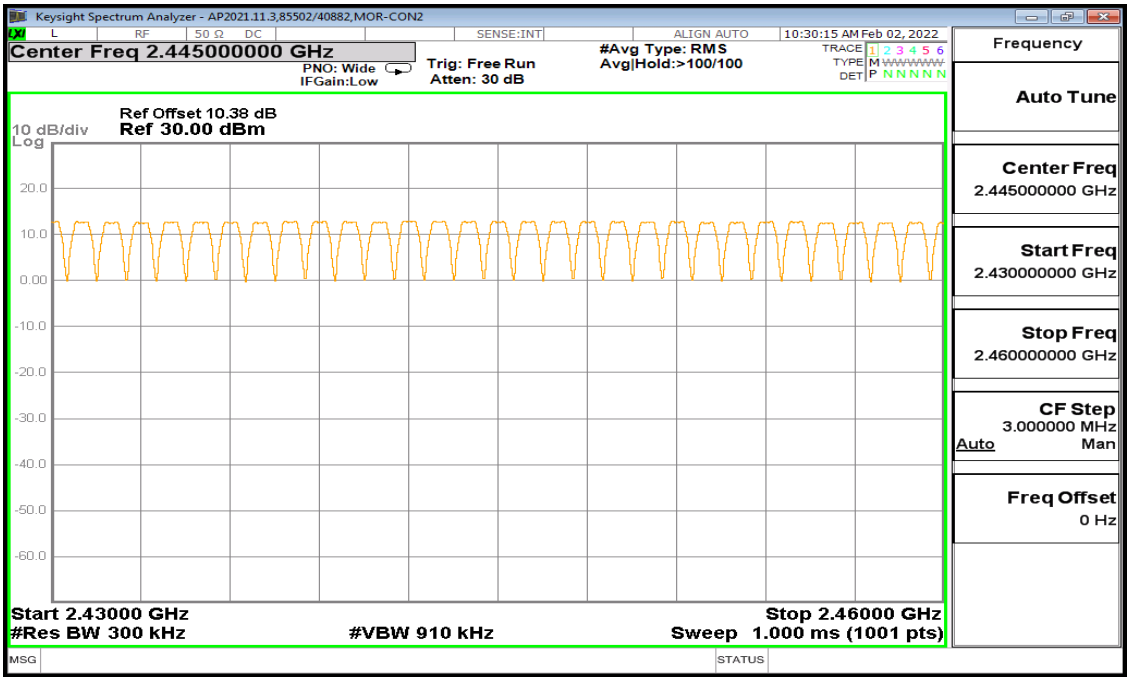
Chain 1



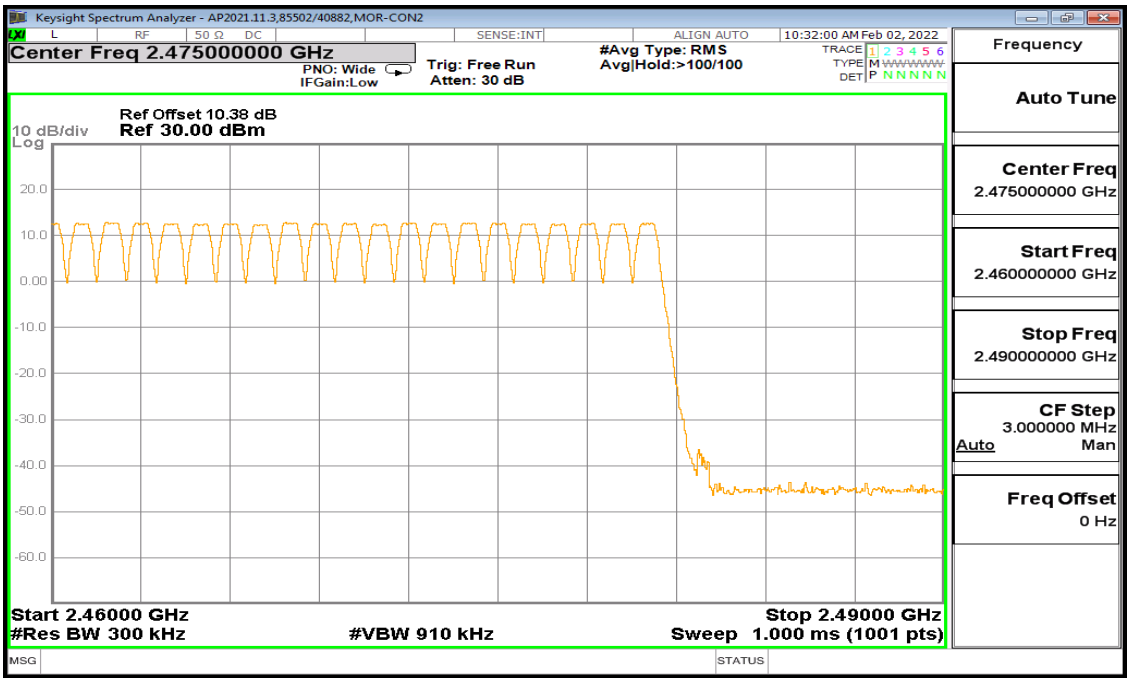
100MHz SPAN



30MHz SPAN, SEGMENT 1 OF 3



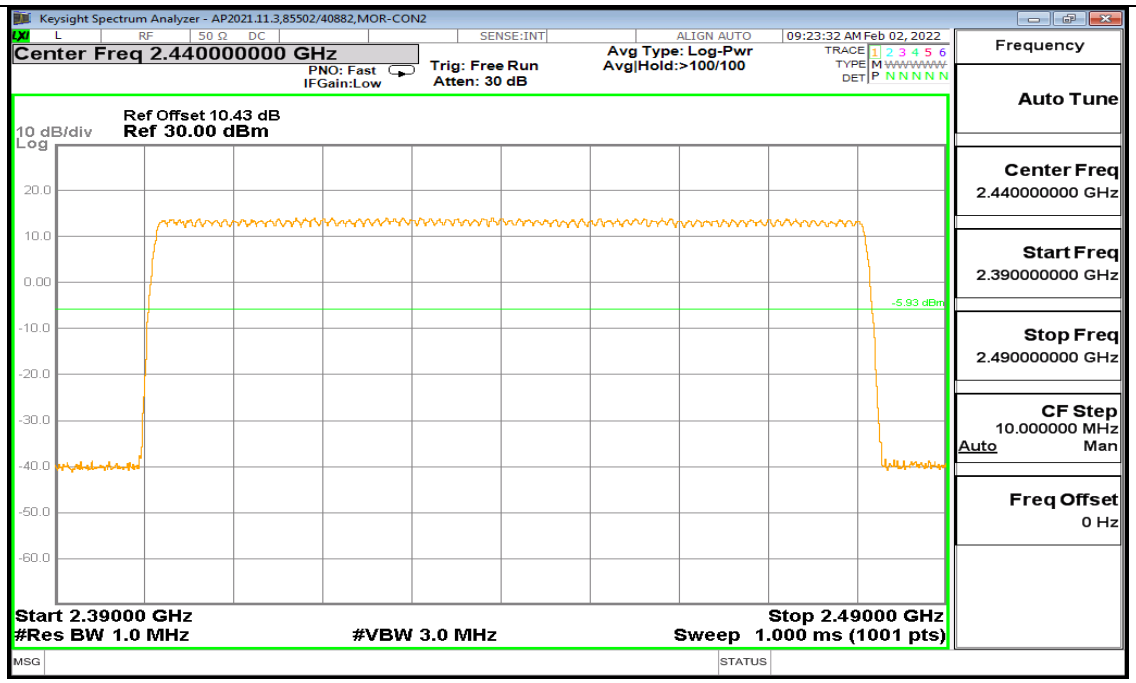
30MHz SPAN, SEGMENT 2 OF 3



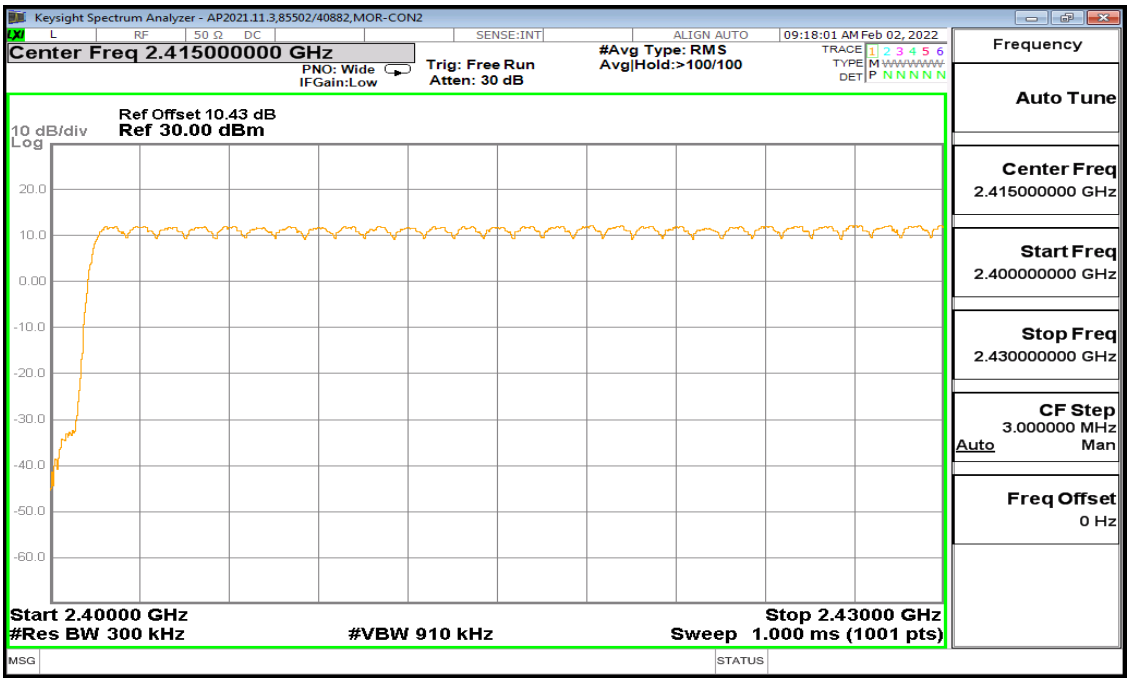
30MHz SPAN, SEGMENT 3 OF 3

9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

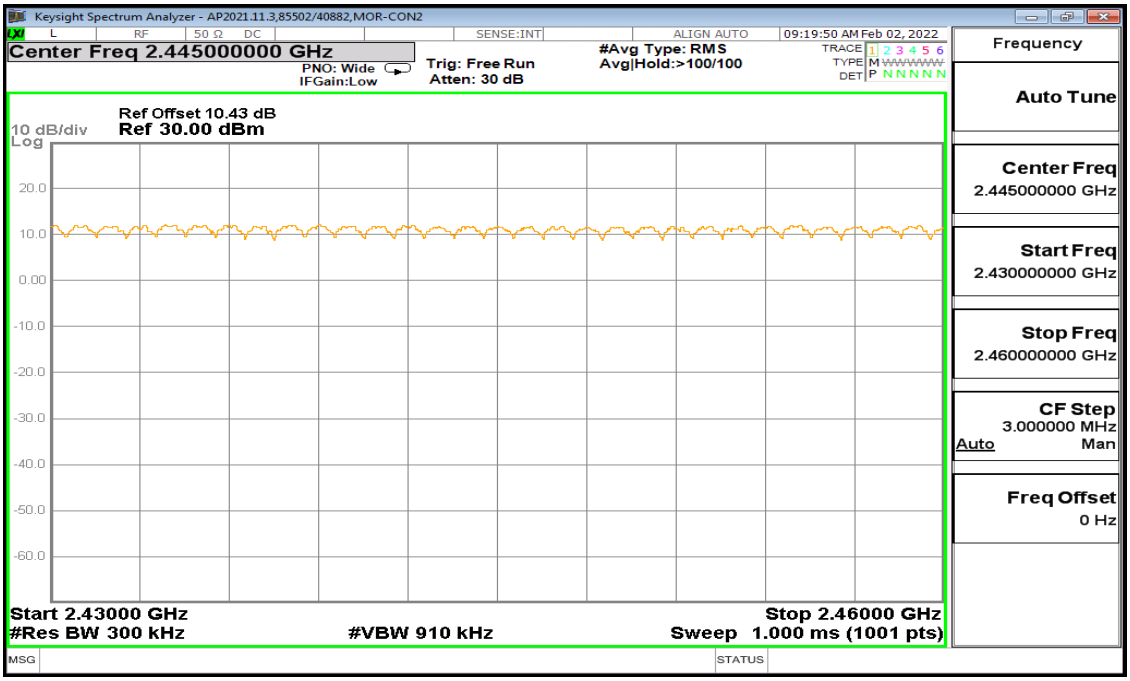
Chain 0



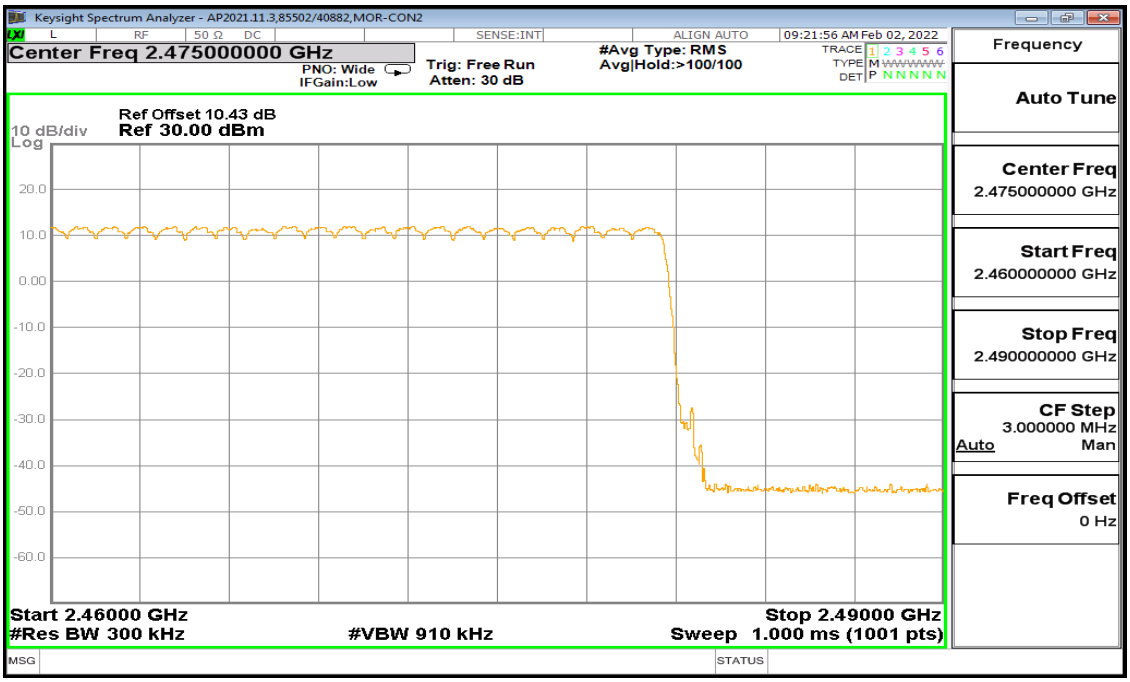
100MHz SPAN



30MHz SPAN, SEGMENT 1 OF 3

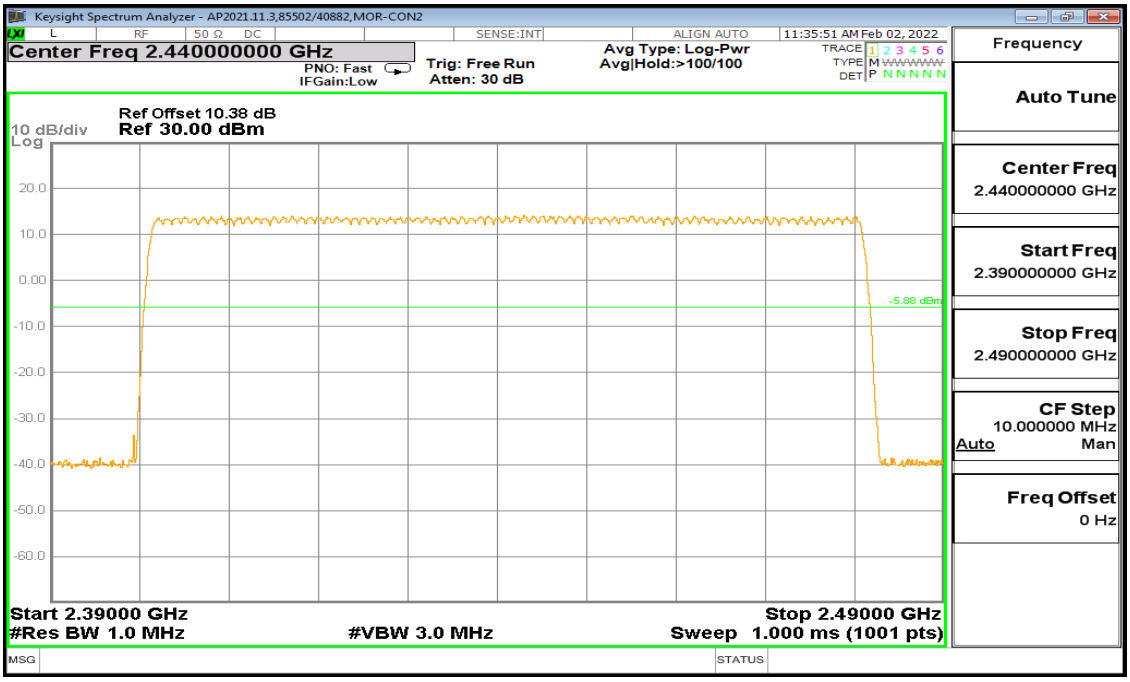


30MHz SPAN, SEGMENT 2 OF 3

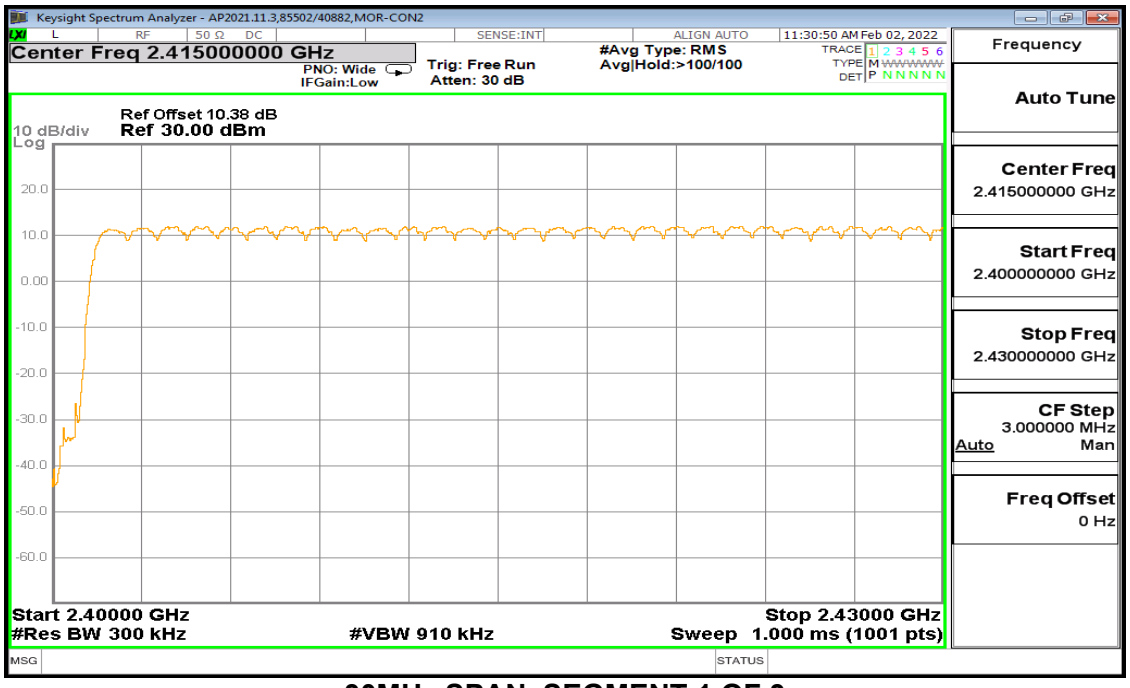


30MHz SPAN, SEGMENT 3 OF 3

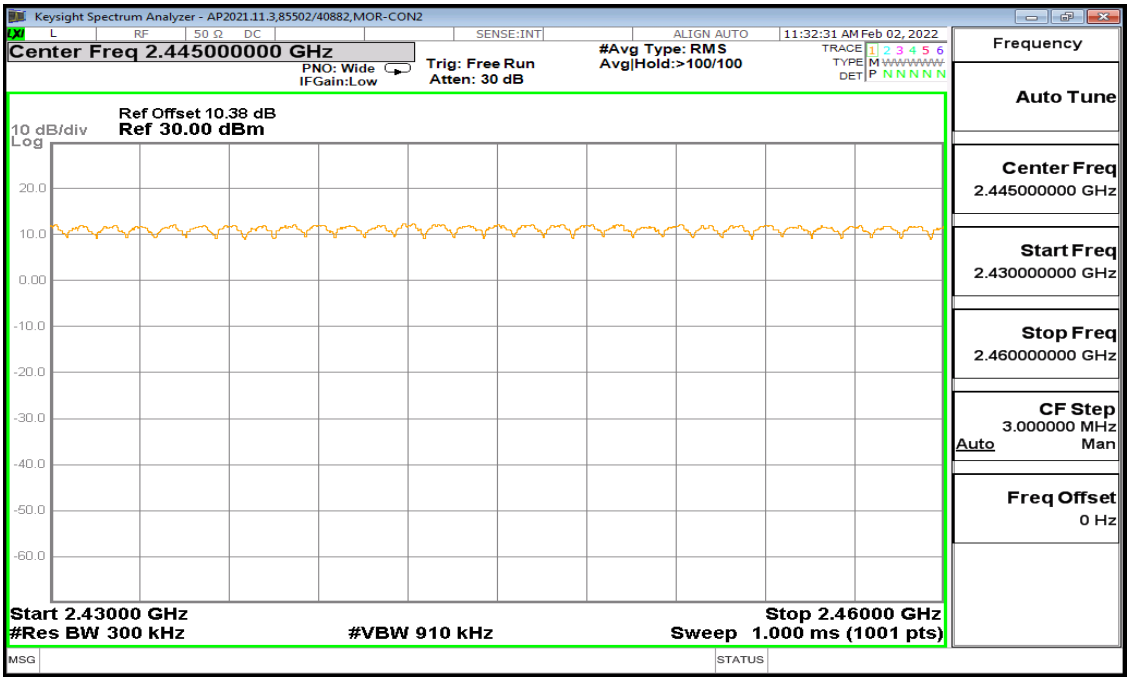
Chain 1



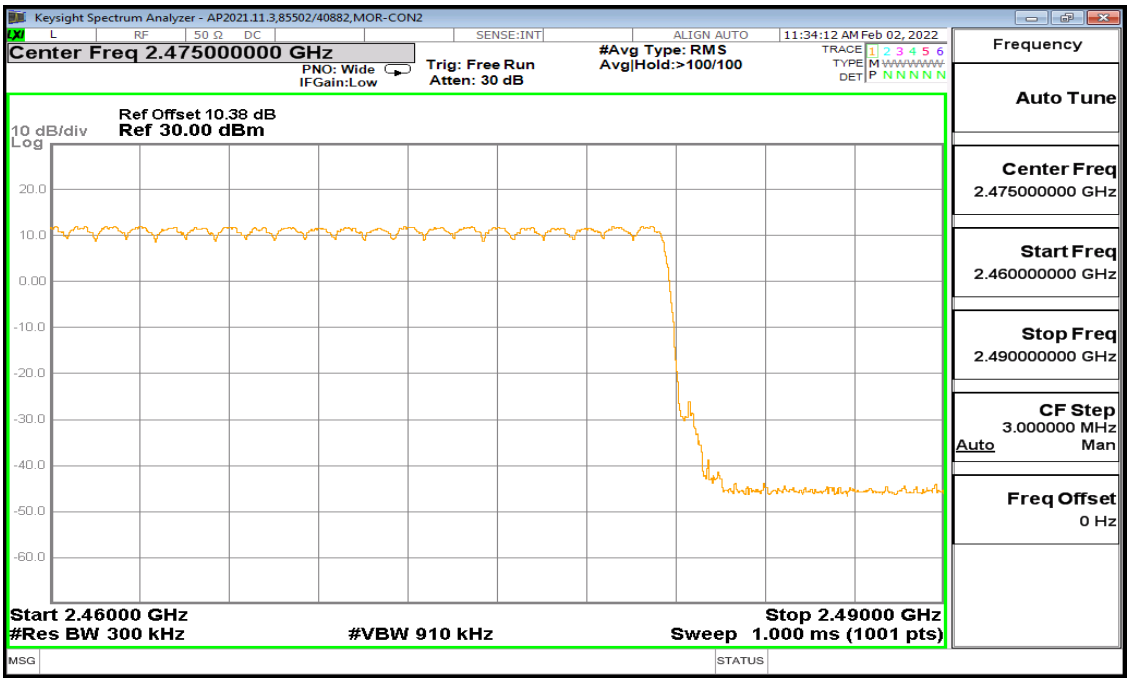
100MHz SPAN



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)

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

UL LLC
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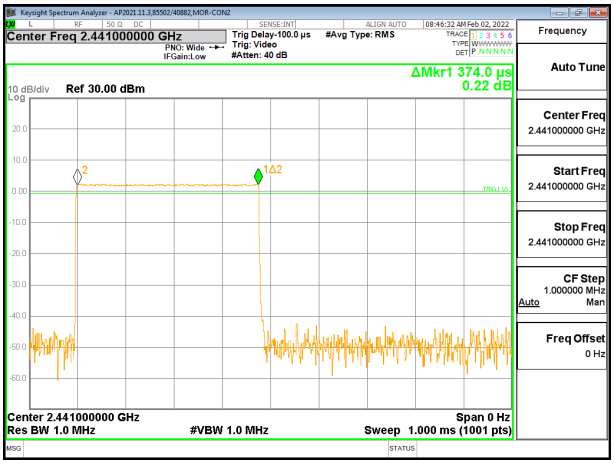
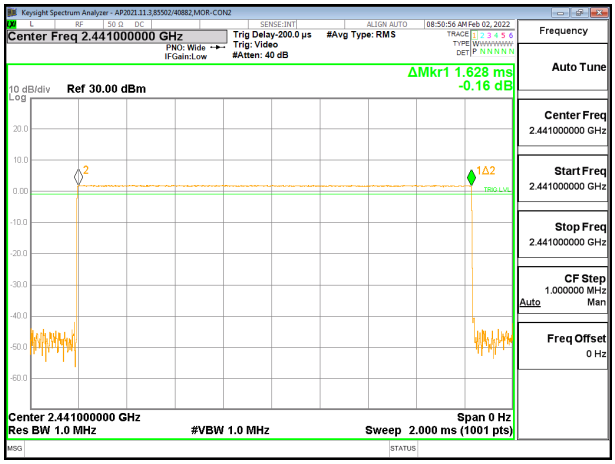
9.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Chain 0

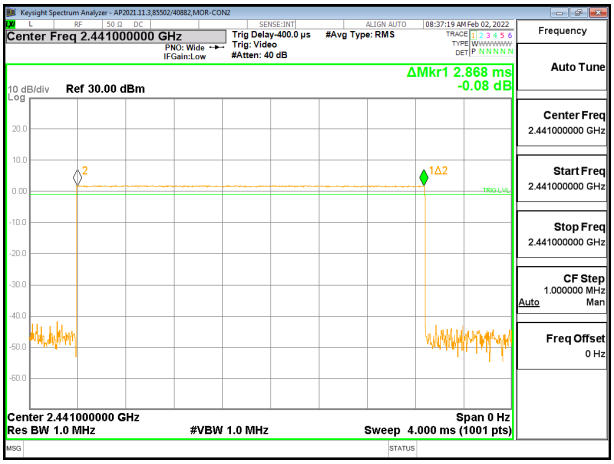
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.374	31	0.1159	0.4	-0.2841
DH3	1.628	15	0.2442	0.4	-0.1558
DH5	2.868	7	0.2008	0.4	-0.1992
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.374	7.75	0.02899	0.4	-0.3710
DH3	1.628	3.75	0.06105	0.4	-0.3390
DH5	2.868	1.75	0.05019	0.4	-0.3498



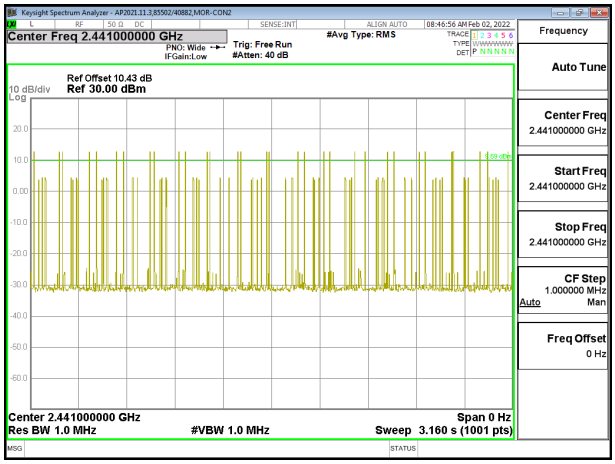
PULSE WIDTH – DH1



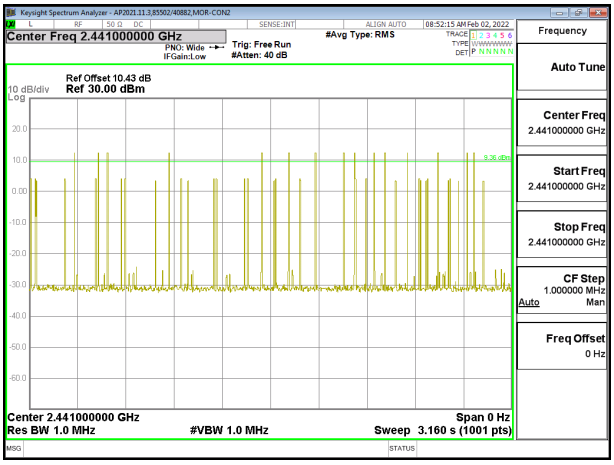
PULSE WIDTH – DH3



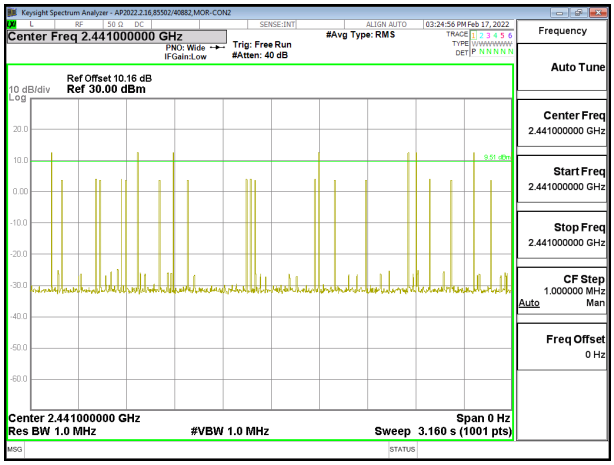
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



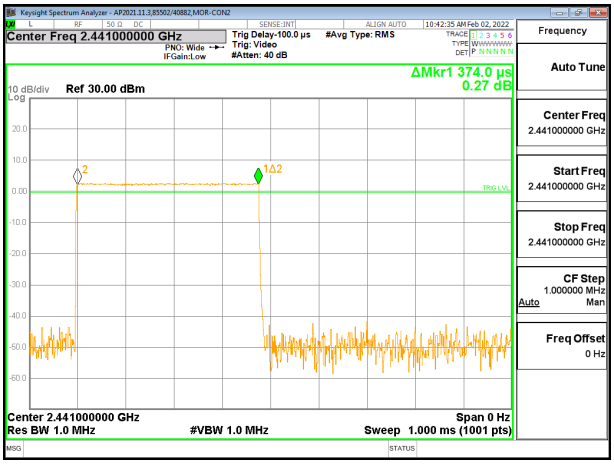
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



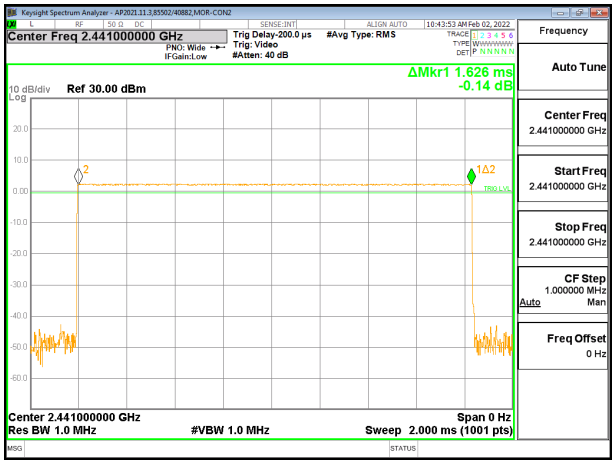
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

Chain 1

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	0.374	31	0.1159	0.4	-0.2841
DH3	1.626	17	0.2764	0.4	-0.1236
DH5	2.868	8	0.2294	0.4	-0.1706
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	0.374	7.75	0.02899	0.4	-0.3710
DH3	1.626	4.25	0.06911	0.4	-0.3309
DH5	2.868	2	0.05736	0.4	-0.3426

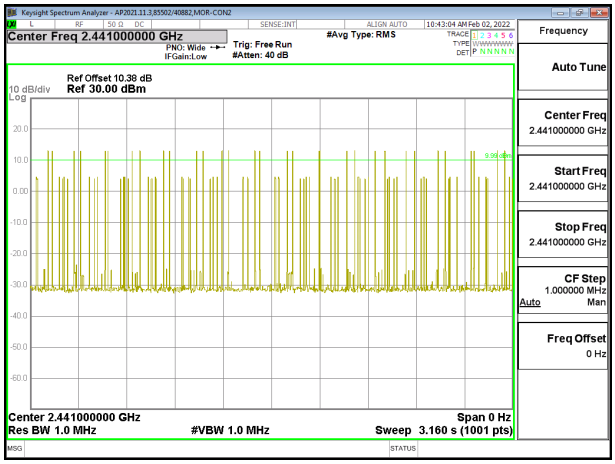


PULSE WIDTH – DH1

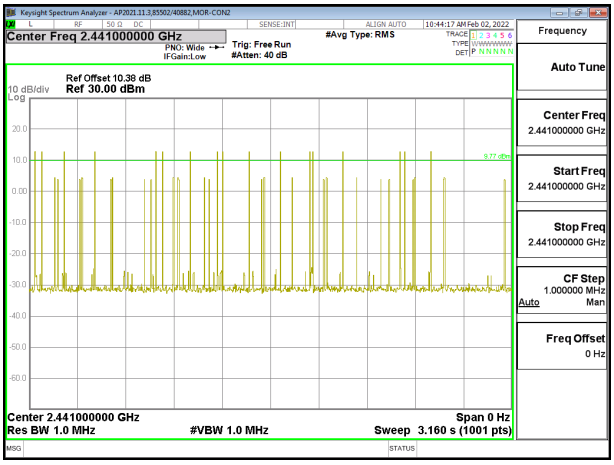


PULSE WIDTH – DH3

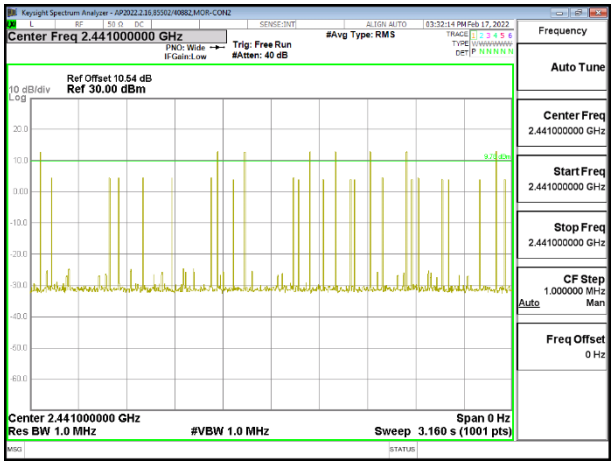
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3

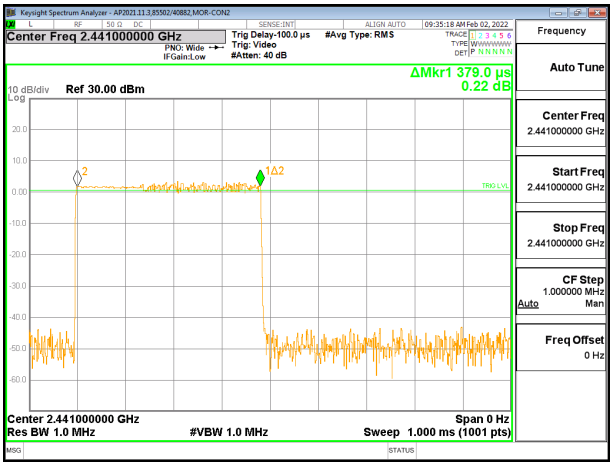


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

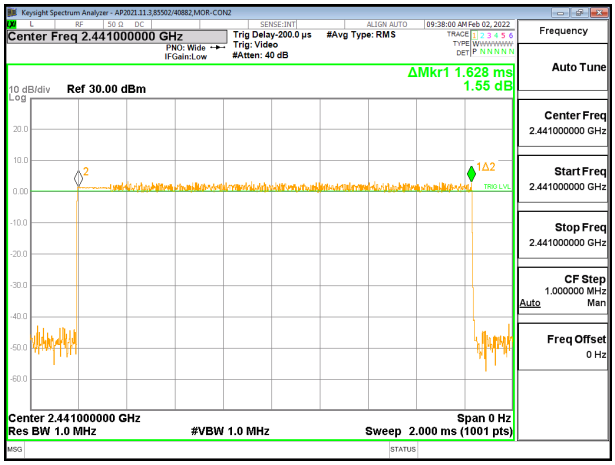
9.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Chain 0

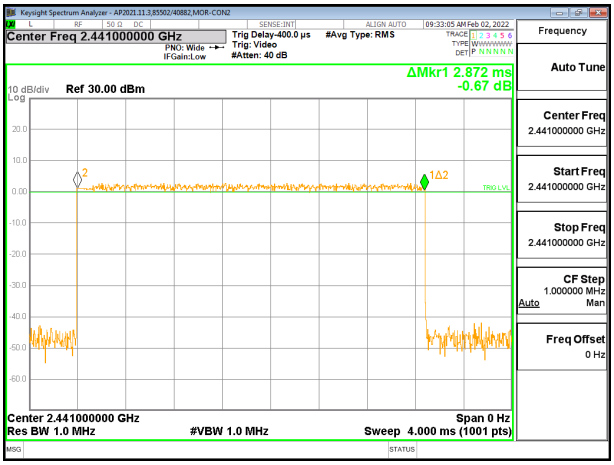
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.379	30	0.1137	0.4	-0.2863
DH3	1.628	15	0.2442	0.4	-0.1558
DH5	2.872	10	0.2872	0.4	-0.1128
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.379	7.5	0.02843	0.4	-0.3716
DH3	1.628	3.75	0.06105	0.4	-0.3390
DH5	2.872	2.5	0.07180	0.4	-0.3282



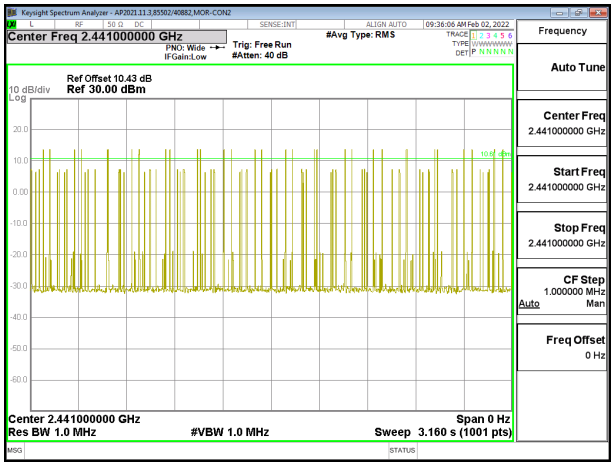
PULSE WIDTH – DH1



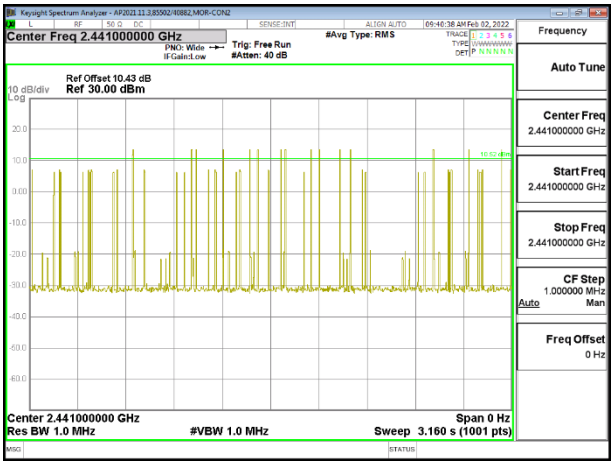
PULSE WIDTH – DH3



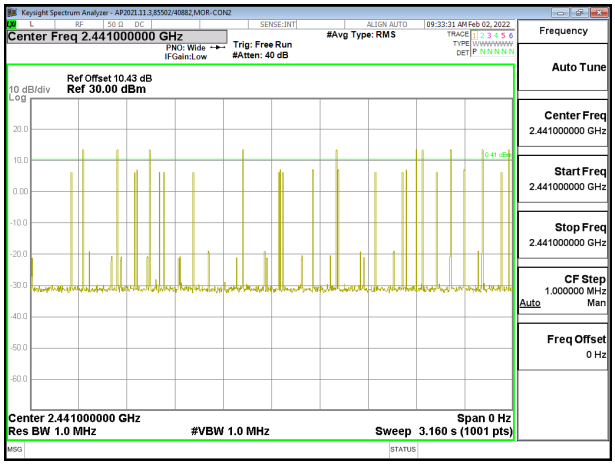
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



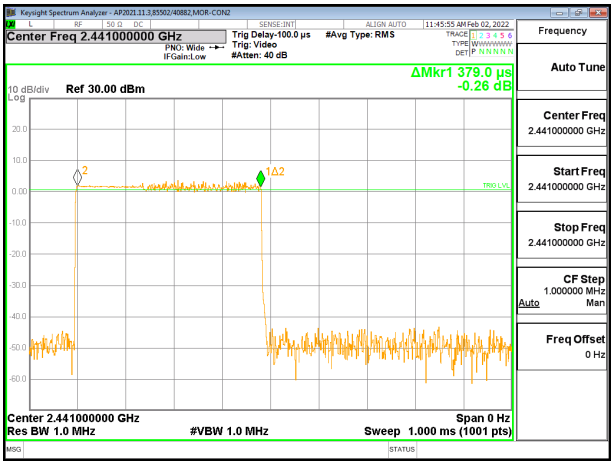
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



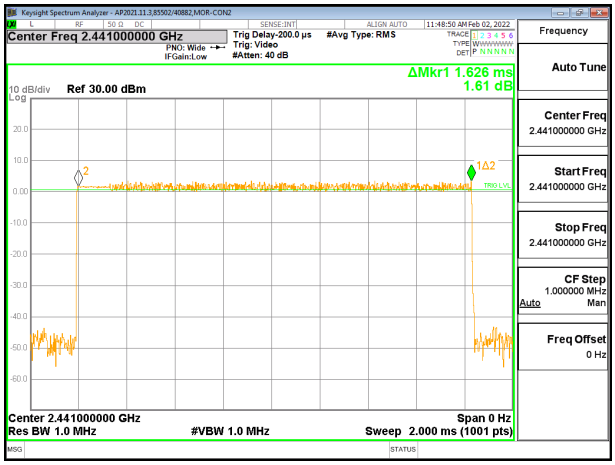
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

Chain 1

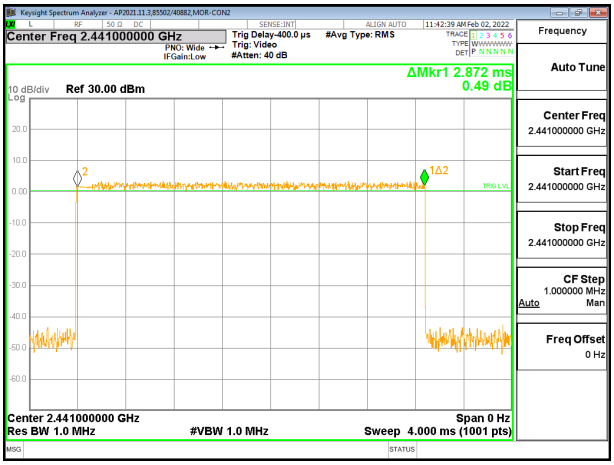
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.379	32	0.1213	0.4	-0.2787
DH3	1.626	14	0.2276	0.4	-0.1724
DH5	2.872	9	0.2585	0.4	-0.1415
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.379	8	0.03032	0.4	-0.3697
DH3	1.626	3.5	0.05691	0.4	-0.3431
DH5	2.872	2.25	0.06462	0.4	-0.3354



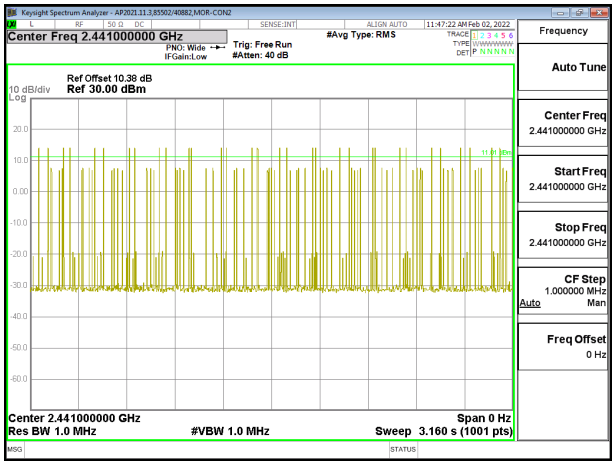
PULSE WIDTH – DH1



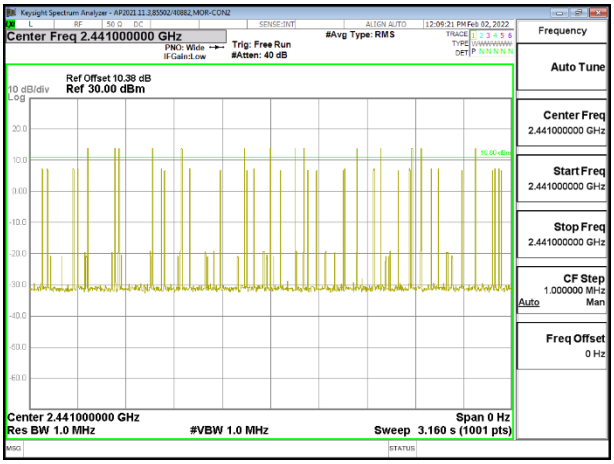
PULSE WIDTH – DH3



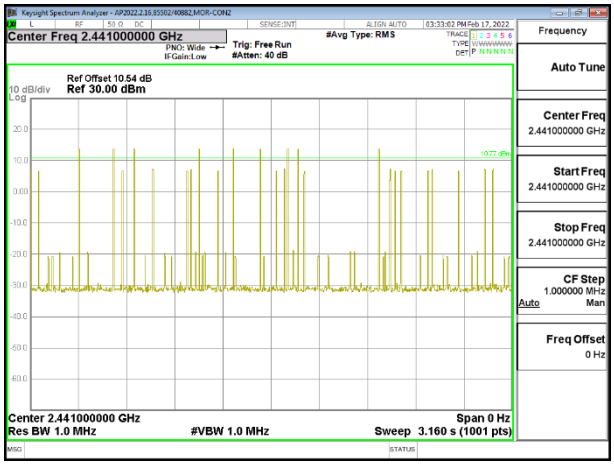
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

9.6. OUTPUT POWER

LIMITS

§15.247 (b) (1)

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 RF power meter.

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

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

RESULTS

UL LLC
12 Laboratory Dr., RTP, NC 27709; USA TEL: (919)549-1400

9.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Chain 0

Tested By:	84740/40882
Date:	2022-02-15

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.50	30	-17.50
Middle	2441	12.29	30	-17.71
High	2480	12.21	30	-17.79

Chain 1

Tested By:	84740/40882
Date:	2022-02-15

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.21	30	-17.79
Middle	2441	12.52	30	-17.48
High	2480	12.08	30	-17.92

9.6.2. BLUETOOTH BASIC DATA RATE DQPSK MODULATION

Chain 0

Tested By:	84740/40882
Date:	2022-02-15

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.57	21	-8.43
Middle	2441	12.33	21	-8.67
High	2480	12.32	21	-8.68

Chain 1

Tested By:	84740/40882
Date:	2022-02-15

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.23	21	-8.77
Middle	2441	12.51	21	-8.49
High	2480	12.14	21	-8.86

9.6.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Chain 0

Tested By:	84740/40882
Date:	2022-02-15

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	14.30	21	-6.7
Middle	2441	13.93	21	-7.07
High	2480	13.92	21	-7.08

Chain 1

Tested By:	84740/40882
Date:	2022-02-15

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	13.84	21	-7.16
Middle	2441	14.10	21	-6.9
High	2480	13.65	21	-7.35

9.7. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

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

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

RESULTS

9.7.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	84740/40882
Date	2022-02-15

Channel	Frequency (MHz)	Average Power Chain 0 (dBm)	Average Power Chain 1 (dBm)
Low	2402	12.10	11.82
Middle	2441	11.88	12.06
High	2480	11.83	11.67

9.7.2. BLUETOOTH ENHANCED DATA RATE QPSK MODULATION

Tested By:	84740/40882
Date	2022-02-15

Channel	Frequency (MHz)	Average Power Chain 0 (dBm)	Average Power Chain 1 (dBm)
Low	2402	12.18	11.78
Middle	2441	11.92	12.03
High	2480	11.88	11.70

9.7.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	84740/40882
Date	2022-02-15

Channel	Frequency (MHz)	Average Power Chain 0 (dBm)	Average Power Chain 1 (dBm)
Low	2402	11.12	10.60
Middle	2441	10.83	10.90
High	2480	10.75	10.53

9.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

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.

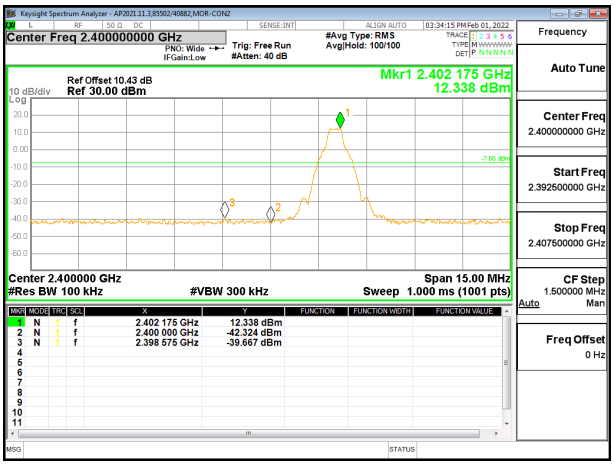
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the lowest, middle, and highest channels and normal hopping mode.

RESULTS

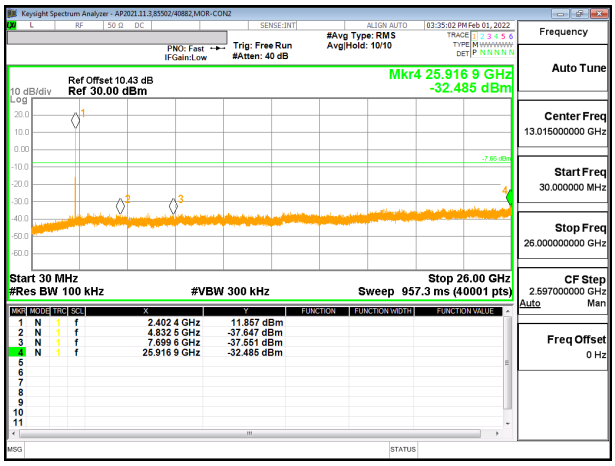
UL LLC
12 Laboratory Dr., RTP, NC 27709; USA TEL: (919)549-1400

9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

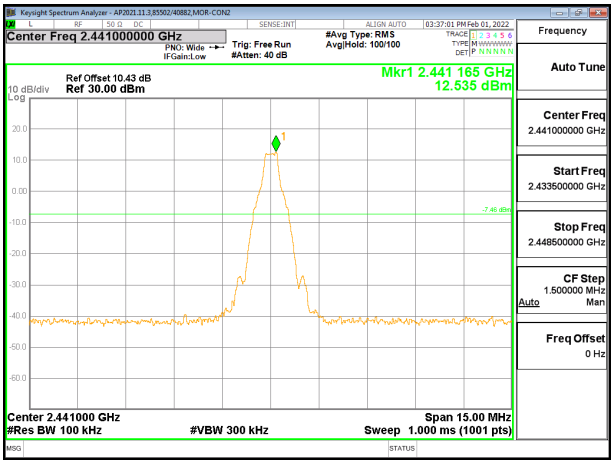
Chain 0 SPURIOUS EMISSIONS, NON-HOPPING



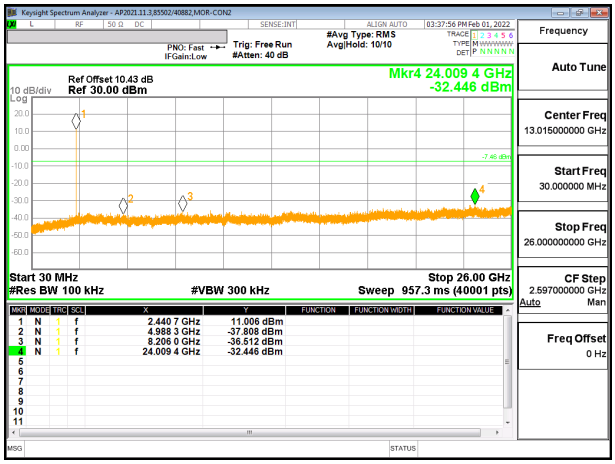
LOW CHANNEL BANDEDGE



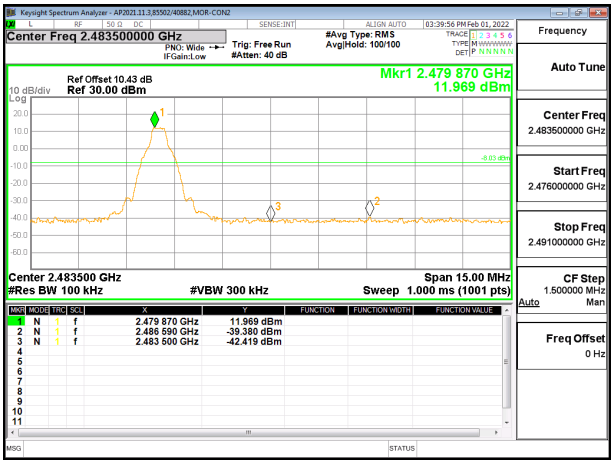
OUT-OF-BAND LOW CHANNEL



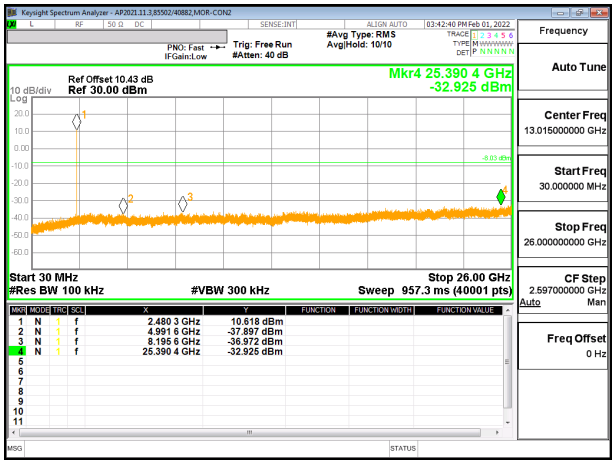
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL

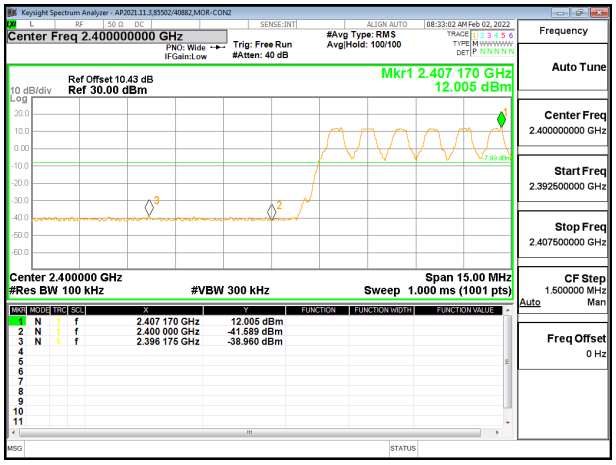


HIGH CHANNEL BANDEDGE

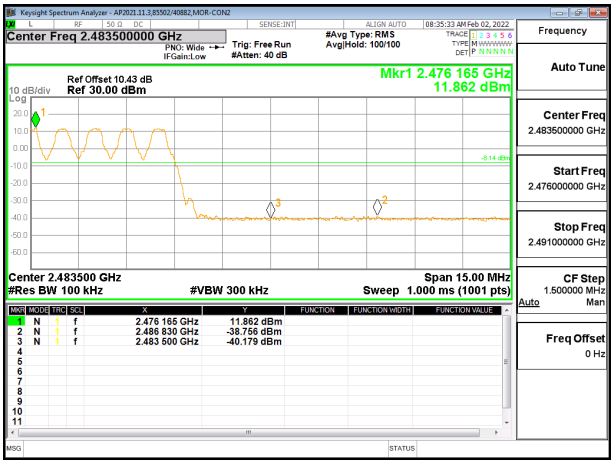


OUT-OF-BAND HIGH CHANNEL

Chain 0 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



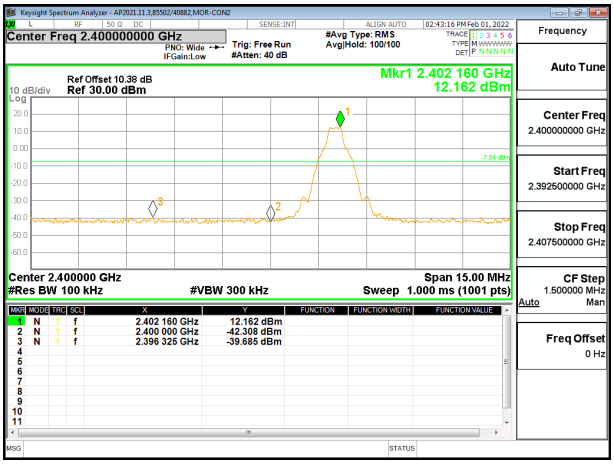
LOW BANDEDGE



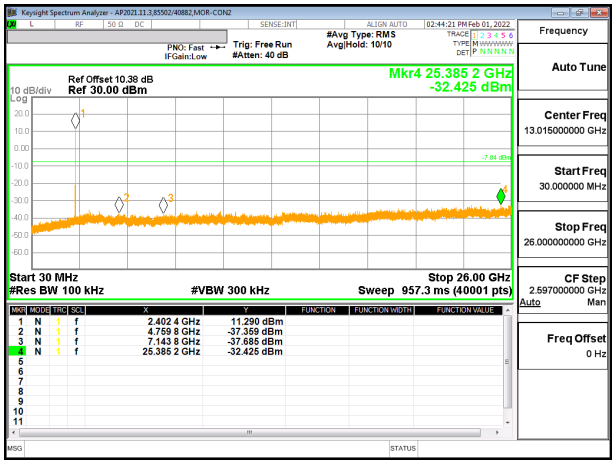
HIGH BANDEDGE

UL LLC
12 Laboratory Dr., RTP, NC 27709; USA TEL: (919)549-1400

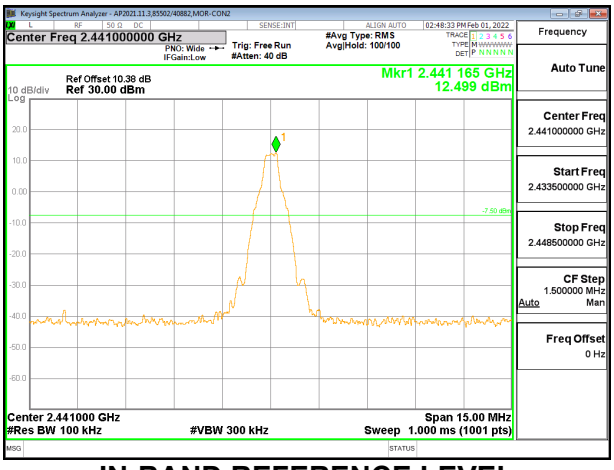
Chain 1 SPURIOUS EMISSIONS, NON-HOPPING



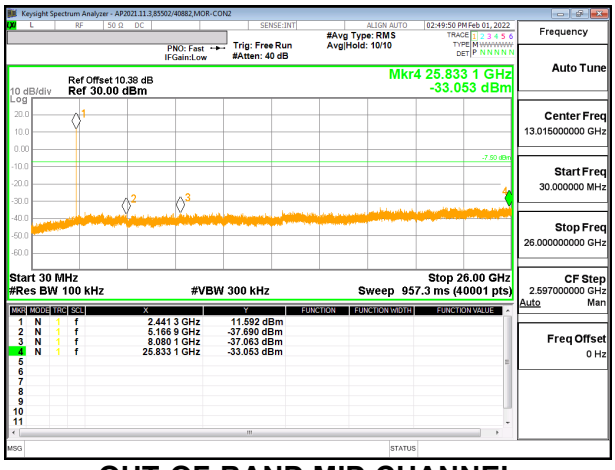
LOW CHANNEL BANDEDGE



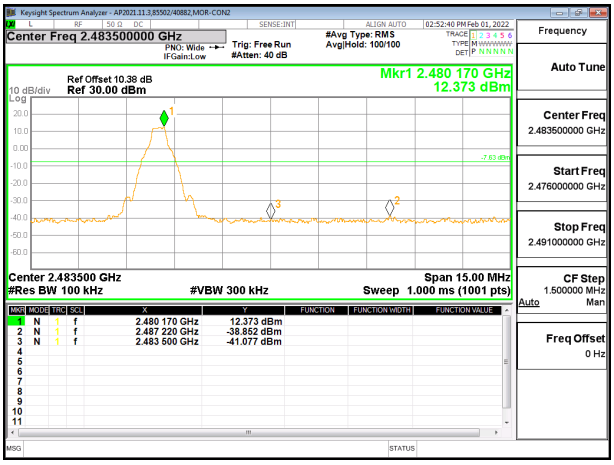
OUT-OF-BAND LOW CHANNEL



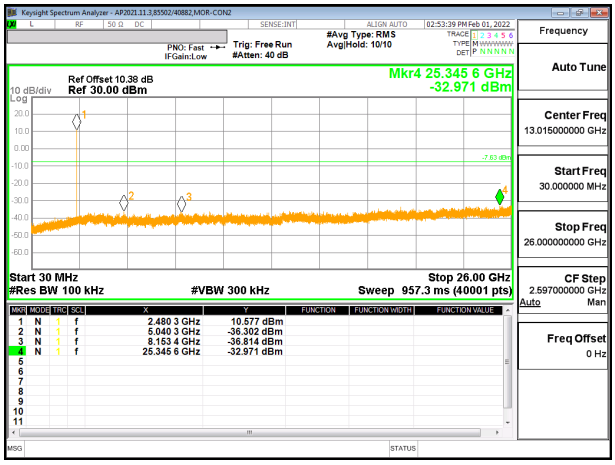
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL

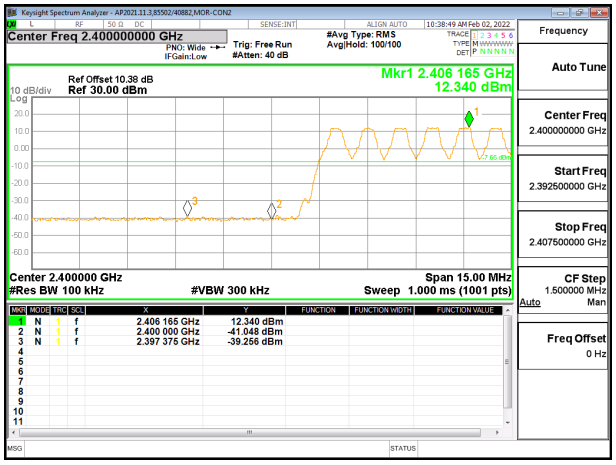


HIGH CHANNEL BANDEDGE

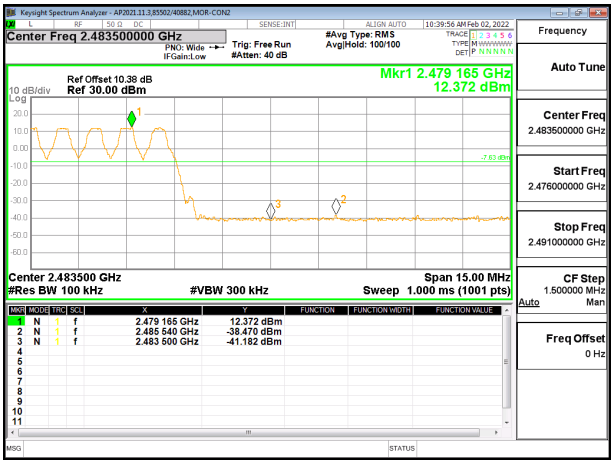


OUT-OF-BAND HIGH CHANNEL

Chain 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



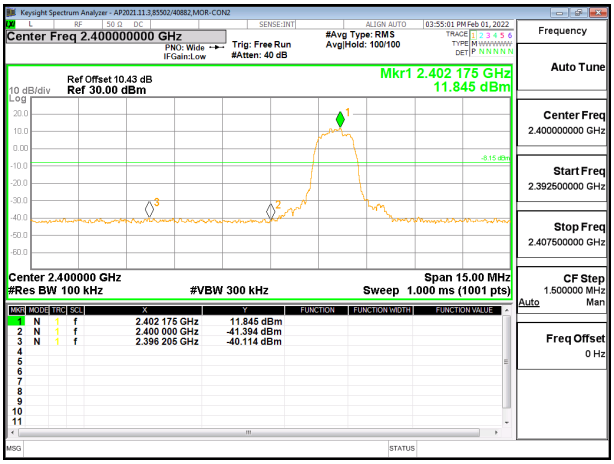
LOW BANDEDGE



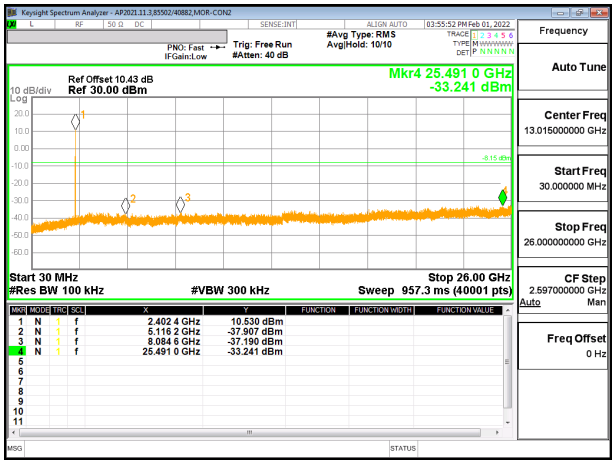
HIGH BANDEDGE

9.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

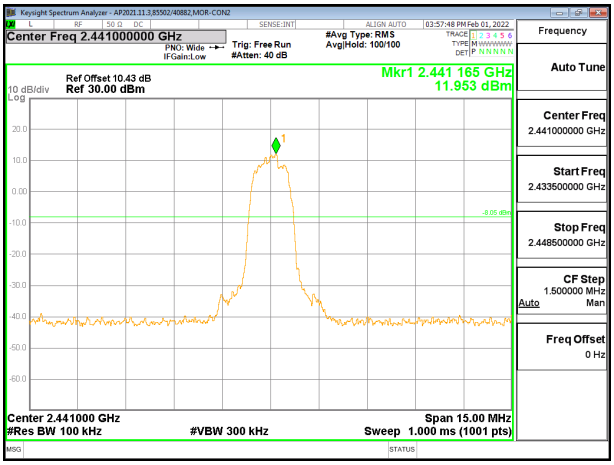
Chain 0 SPURIOUS EMISSIONS, NON-HOPPING



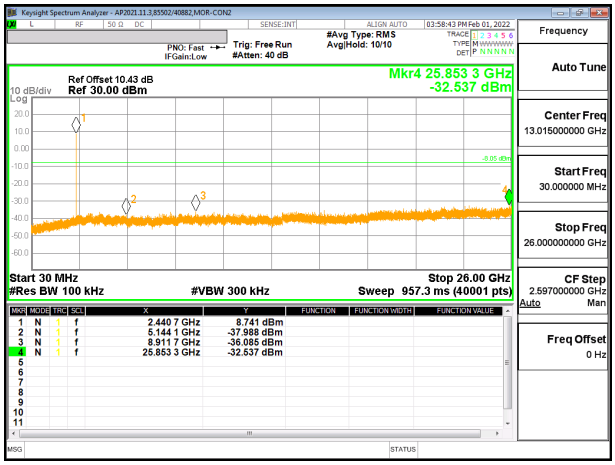
LOW CHANNEL BANDEDGE



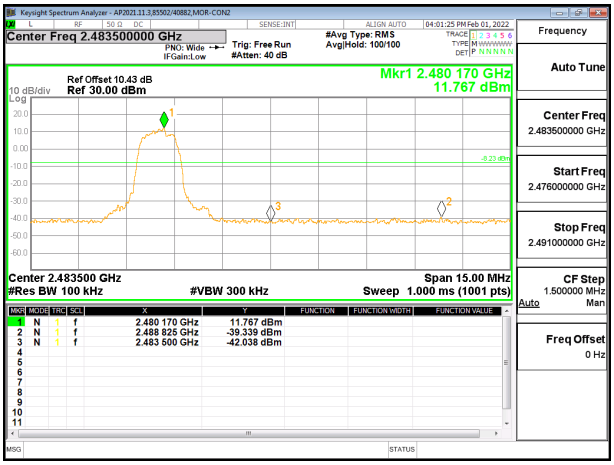
OUT-OF-BAND LOW CHANNEL



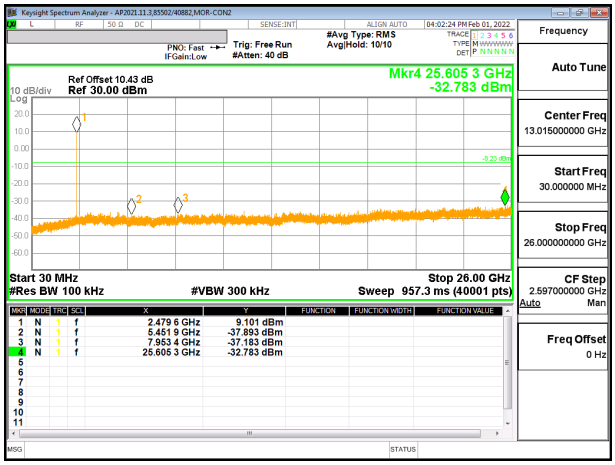
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL

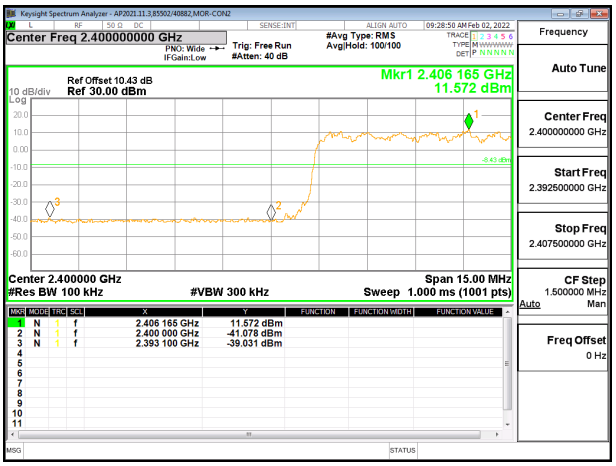


HIGH CHANNEL BANDEDGE

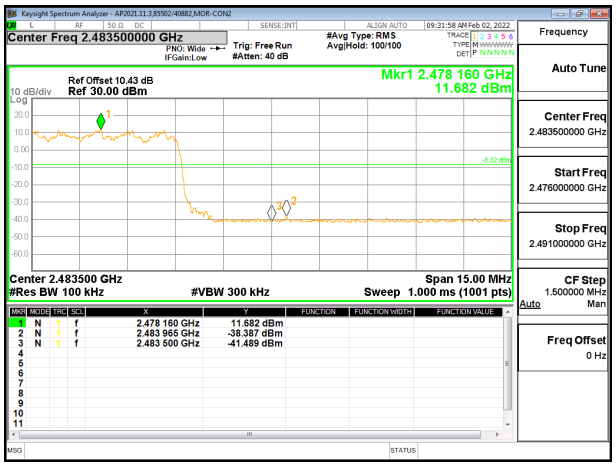


OUT-OF-BAND HIGH CHANNEL

Chain 0 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



LOW BANDEDGE



HIGH BANDEDGE