CERTIFICATION TEST REPORT

Report Number. : 4790047196-E5V1

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-G780G/DSM, SM-G780G/DS, SM-G780G
FCC ID	:	A3LSMG780G1
EUT Description	:	GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, WPT and NFC
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
2021-08-18

Prepared by:
UL Korea, Ltd.
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IAS ACCREDITED
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2021-08-18	Initial issue	Dexter(Hyunsik) Yun

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, WPT and NFC
MODEL:	SM-G780G/DSM, SM-G780G/DS, SM-G780G
SERIAL NUMBER:	R38R301JNJM (CONDUCTED); R38R301JNSD, R38R301JN8P, R38R301JR3B, R38R301JQQM (RADIATED);
DATE TESTED:	2021-07-29 ~ 2021-08-13

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Complies

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. 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 IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Dexter(Hyunsik) Yun
Suwon Lab Engineer
UL Korea, Ltd.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. KDB 558074 D01 15.247 Meas Guidance v05r02.
4. ANSI C63.10-2013.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. 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.

218 Maeyeong-ro
☒ Chamber 1
☒ Chamber 2
☒ Chamber 3

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf.

4. DECISION RULES AND MEASUREMENT UNCERTAINTY

4.1. METROLOGICAL TRACEABILITY

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.01 dB
Radiated Disturbance, 30 MHz to 1 GHz	4.26 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.90 dB
Radiated Disturbance, 18 GHz to 40 GHz	5.49 dB

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

4.4. DECISION RULES

Decision rule for statement(s) of conformity is based on Procedure 2, Clause 4.4.3 in IEC Guide 115:2007.

5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is a GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, WPT and NFC.
This test report addresses the BT(DSS) operational mode.

This report covers the Samsung models SM-G780G/DSM, SM-G780G/DS and SM-G780G.
These models are identical in hardware except SM-G780G/DSM is supported MST and SMG780G/DS has dual SIM tray and SM-G780G has single SIM tray.
All series model was same hardware thus, SM-G780G/DS(Dual SIM tray) was set for final test.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range [MHz]	Mode	Power Mode	Output Power [dBm]	Output Power [mW]
2 402 ~ 2 480	Basic GFSK	Average	17.260	53.21
		Peak	17.653	58.25
	Enhanced Pi/4-DPSK	Average	14.845	30.51
		Peak	17.103	51.32
	Enhanced 8PSK	Average	14.863	30.64
		Peak	17.532	56.65

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The internal antenna was Permanently attached.
Therefore this E.U.T Complies with the requirement of §15.203.

The radio utilizes an internal antennas, with Antenna 1's maximum gain of -4.12 dBi and Antenna 2's maximum gain of -8.02 dBi

"BT0" and "BT1" as indicated in antenna specification are written as Antenna 1 and Antenna 2 in this report.

5.4. WORST-CASE CONFIGURATION AND MODE

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

Radiated emission above 1GHz was performed with the EUT set to transmit low/mid/high channels.

For Antenna 1, the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

For Antenna 2, the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

Note: GFSK, Pi/4-DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on this mode to showing compliance.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA200	R37M194G2J1SE3	N/A
Data Cable	SAMSUNG	EP-DR140AWE	N/A	N/A

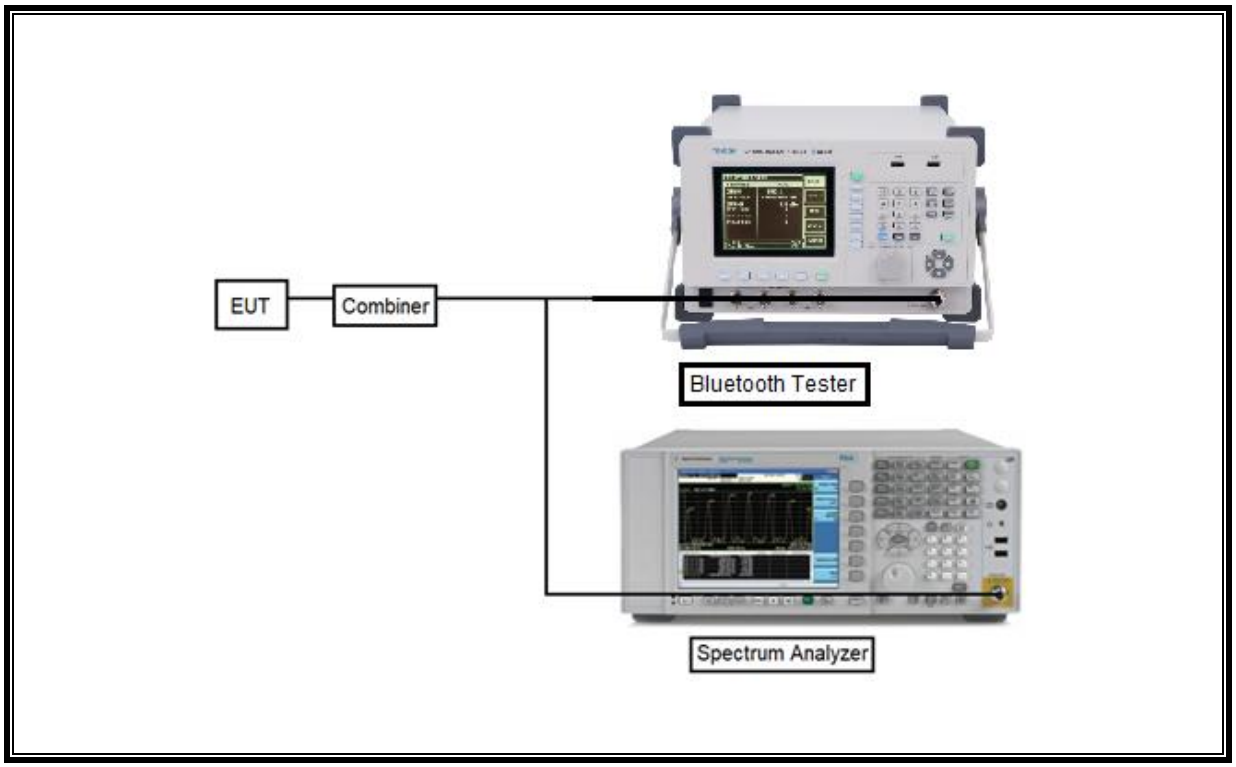
I/O CABLE

I/O Cable List						
Cable No.	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	C Type	Shielded	0.7 m	N/A

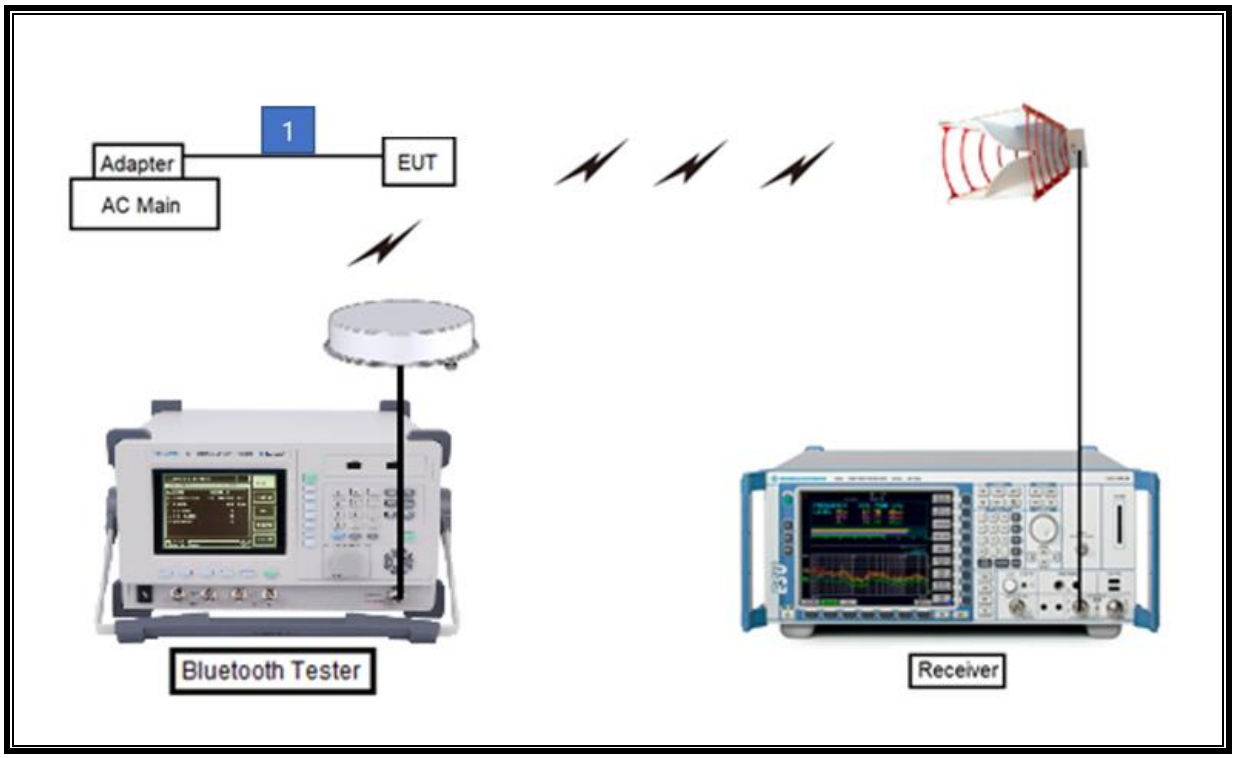
TEST SETUP

The EUT is continuously communicating to the Bluetooth tester during the tests.
Test software enable BT communications.

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	2022-08-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	2022-08-13
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	2022-08-13
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	2021-10-02
Antenna, Horn, 18 GHz	ETS	3115	00167211	2022-07-27
Antenna, Horn, 18 GHz	ETS	3115	00161451	2022-08-15
Antenna, Horn, 18 GHz	ETS	3117	00168724	2022-07-27
Antenna, Horn, 18 GHz	ETS	3117	00168717	2022-08-15
Antenna, Horn, 40 GHz	ETS	3116C	00166155	2022-08-04
Antenna, Horn, 40 GHz	ETS	3116C	00168645	2021-10-02
Preamplifier	ETS	3116C-PA	00168841	2022-08-04
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	80108-0004	N/A
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	110367-0003	N/A
Preamplifier, 1000 MHz	Sonoma	310N	341282	2022-08-02
Preamplifier, 1000 MHz	Sonoma	310N	351741	2022-08-02
Preamplifier, 1000 MHz	Sonoma	310N	370599	2022-08-02
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	2022-08-02
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	2022-08-02
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029168	2022-08-02
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	2022-08-04
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	2022-08-04
Average Power Sensor	Agilent / HP	U2000	MY54270007	2022-08-04
Average Power Sensor	Agilent / HP	U2000	MY54260010	2022-08-04
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	2022-08-04
Power Splitter	MINI-CIRCUITS	WA1534	UL001	2022-01-27
Attenuator	PASTERNACK	PE7087-10	A009	2022-08-03
Attenuator	PASTERNACK	PE7087-10	A001	2022-08-03
Attenuator	PASTERNACK	PE7087-10	A008	2022-08-03
Attenuator	PASTERNACK	PE7004-10	2	2022-08-02
EMI Test Receive, 40 GHz	R&S	ESU40	100439	2022-08-02
EMI Test Receive, 40 GHz	R&S	ESU40	100457	2022-08-02
EMI Test Receive, 3 GHz	R&S	ESR3	101832	2022-08-02
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	2022-08-02
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	2022-08-02
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	019	2022-08-02
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	2022-08-02
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	2022-08-02
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	2022-08-02
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	2022-08-02
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	2022-08-02
High Pass Filter 6GHz	Micro-Tronics	HPS17542	020	2022-08-02
LISN	R&S	ENV-216	101837	2022-08-05
Termination	WEINSCHEL	M1406A	T09	2022-08-03
UL Software				
Description	**Manufacturer**	**Model**	**Version**	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

7. TEST RESULTS SUMMARY

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1051, 15.247(d)	Band Edge / Conducted Spurious Emission	-20 dBc	Conducted	PASS
15.247 (b)(1)	TX conducted output power	< 21 dBm		PASS
15.247 (a)(1)	Hopping frequency separation	> two-thirds of the 20 dB bandwidth		PASS
15.247 (a)(1)(iii)	Number of Hopping channels	More than 15 non-overlapping channels		PASS
15.247 (a)(1)(iii)	Avg Time of Occupancy	< 0.4sec		PASS
15.207(a)	AC Power Line conducted emissions	Section 10	Power Line conducted	PASS
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m(Av)	Radiated	PASS

8. MEASUREMENT METHODS

20dB BW : ANSI C63.10, Section 6.9.2

99% BW : ANSI C63.10, Section 6.9.3

HOPPING FREQUENCY SEPARATION : ANSI C63.10, Section 7.8.2

NUMBER OF HOPPING CHANNELS : ANSI C63.10, Section 7.8.3

AVERAGE TIME OF OCCUPANCY : ANSI C63.10, Section 7.8.4

OUTPUT POWER : ANSI C63.10, Section 7.8.5.

Out-of-band EMISSIONS (Conducted) : ANSI C63.10, Section 7.8.6, 7.8.8

Out-of-band EMISSIONS IN NON-RESTRICTED BANDS: ANSI C63.10, Section 6.

Out-of-band EMISSIONS IN RESTRICTED BANDS : ANSI C63.10, Section 6.

AC Power Line Conducted Emission : ANSI C63.10-2013, Section 6.2.

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

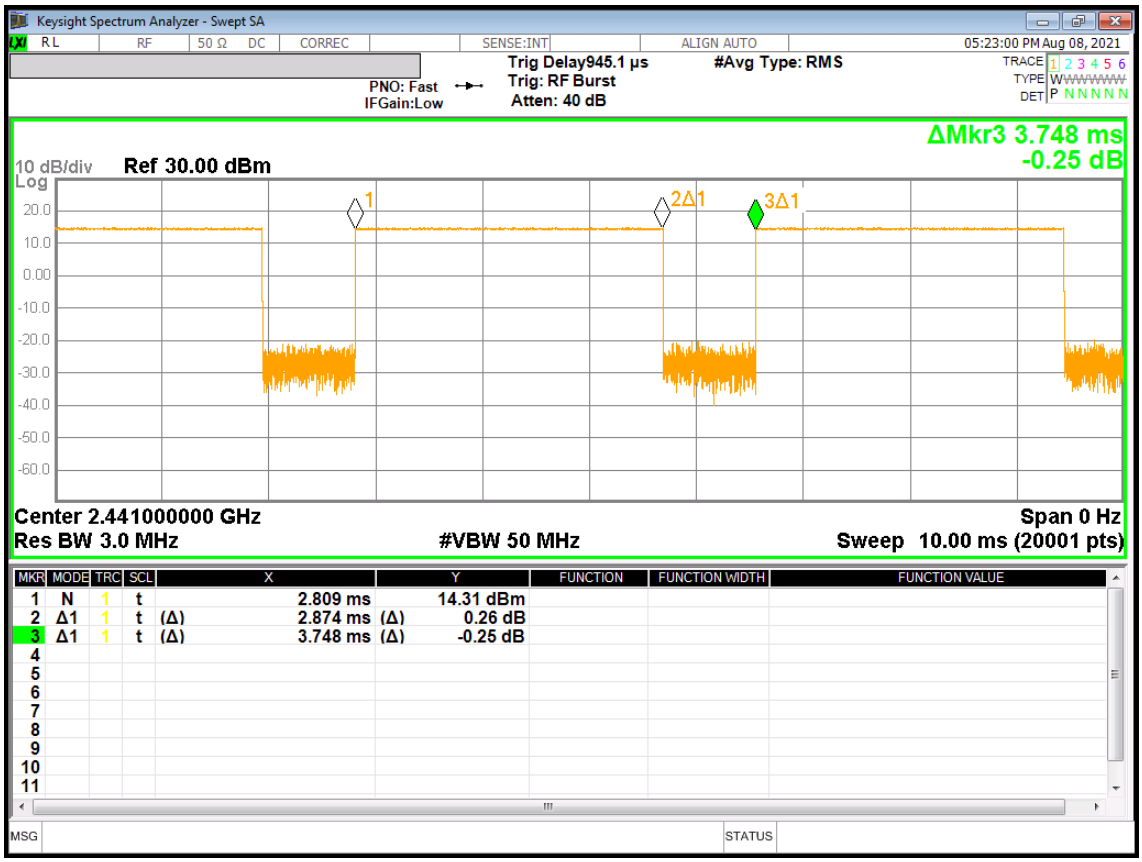
None; for reporting purposes only.

PROCEDURE

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

ON TIME AND DUTY CYCLE RESULTS

Mode	On time [msec]	Period [msec]	Duty Cycle [%]	Duty Cycle Correction Factor[dB]	1/T Minimum VBW [kHz]
2 400 ~ 2 483.5 MHz Band					
Bluetooth	2.874	3.748	76.68	1.15	0.348



9.2. 20 dB & 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% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

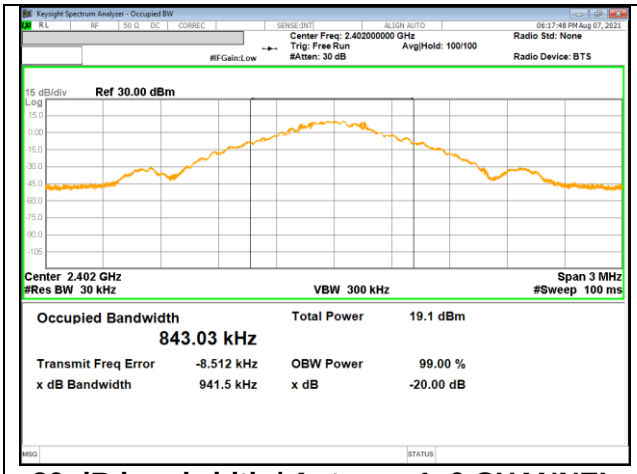
Chain	Channel	Frequency [MHz]	20 dB Bandwidth [kHz]	99% Bandwidth [kHz]
Antenna 1	0	2 402	914.5	824.9
	39	2 441	942.3	824.9
	78	2 480	941.9	825.0
Antenna 2	0	2 402	941.8	821.5
	39	2 441	942.7	823.4
	78	2 480	943.5	824.8
Worst			**943.5**	**825.0**

9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

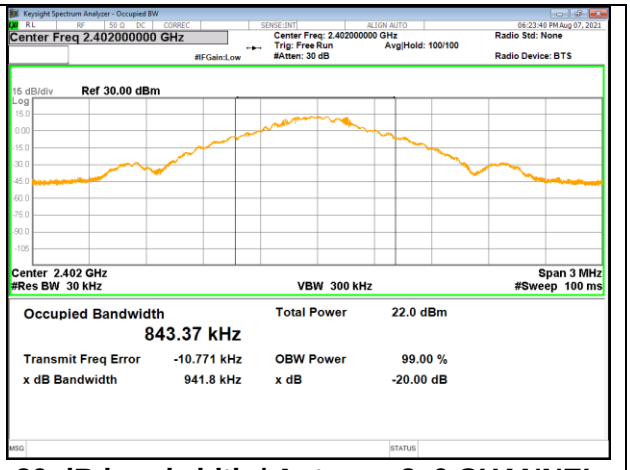
Chain	Channel	Frequency [MHz]	20 dB Bandwidth [kHz]	99% Bandwidth [kHz]
Antenna 1	0	2 402	1309.0	1161.6
	39	2 441	1307.0	1161.1
	78	2 480	1319.0	1161.6
Antenna 2	0	2 402	1307.0	1131.6
	39	2 441	1307.0	1132.4
	78	2 480	1316.0	1162.7
Worst			**1319.0**	**1162.7**

9.2.3. Bandwidth Plot

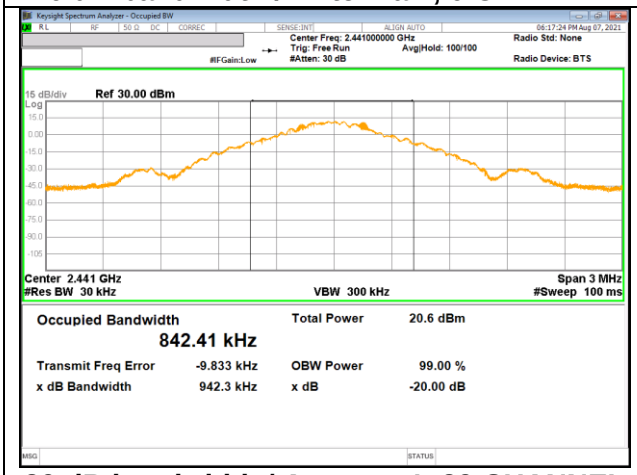
GFSK



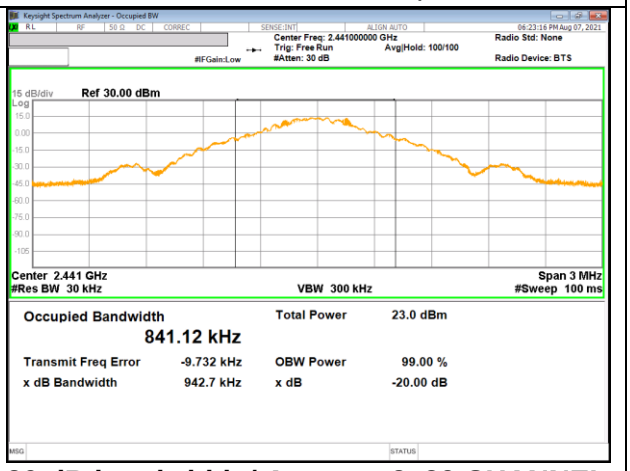
20 dB bandwidth / Antenna 1, 0 CHANNEL



20 dB bandwidth / Antenna 2, 0 CHANNEL



20 dB bandwidth / Antenna 1, 39 CHANNEL



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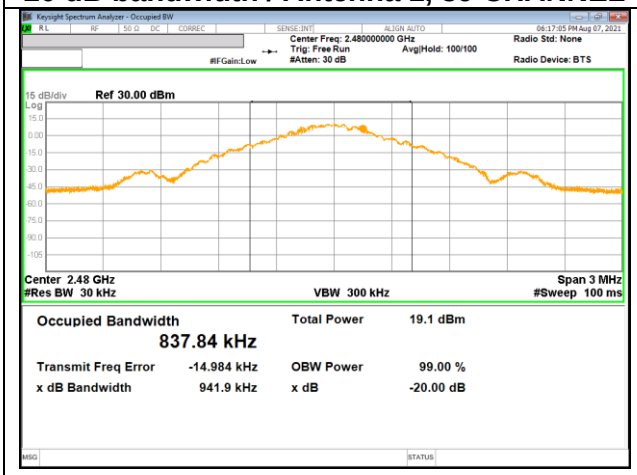
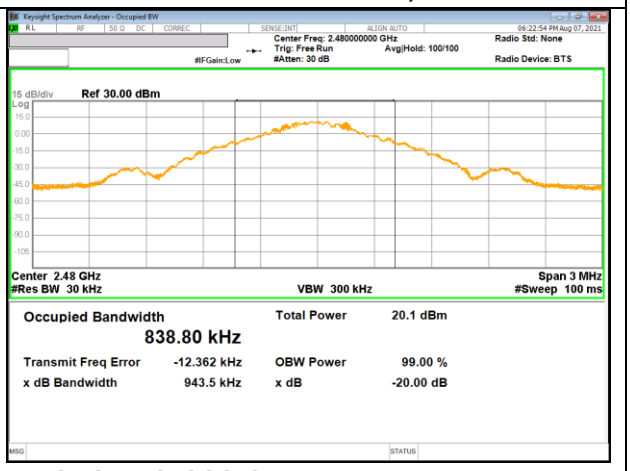
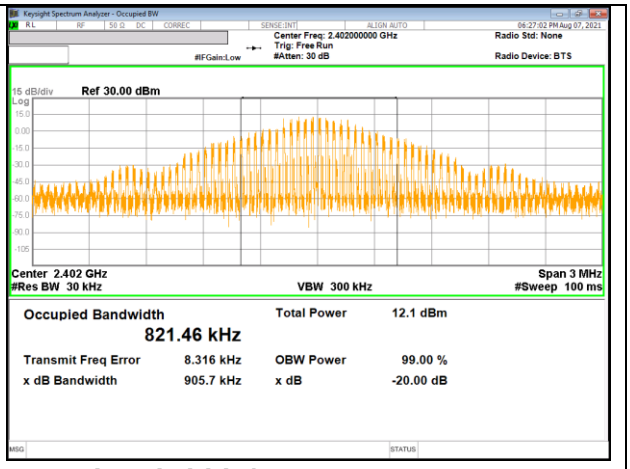


20 dB bandwidth / Antenna 1, 78 CHANNEL

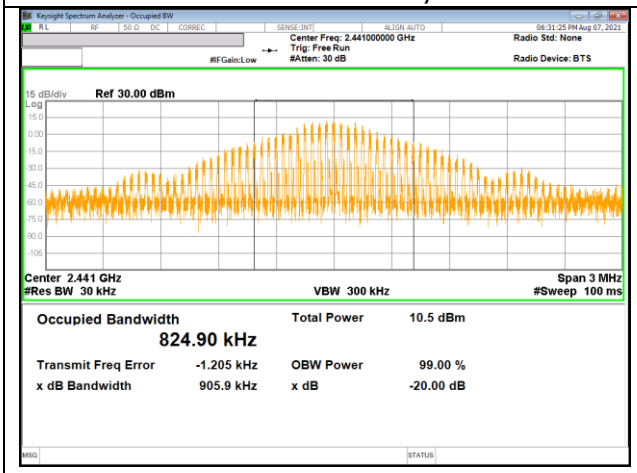


20 dB bandwidth / Antenna 2, 78 CHANNEL

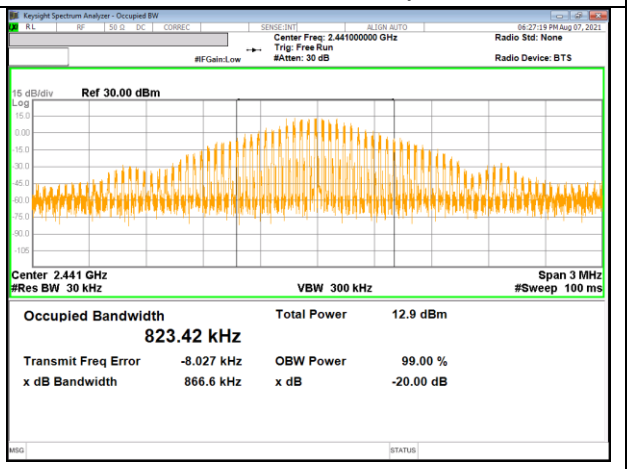
99% bandwidth / Antenna 1, 0 CHANNEL



99% bandwidth / Antenna 2, 0 CHANNEL



99% bandwidth / Antenna 1, 39 CHANNEL



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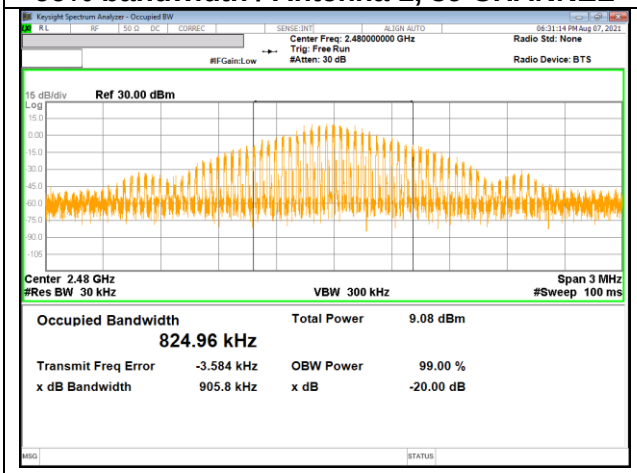
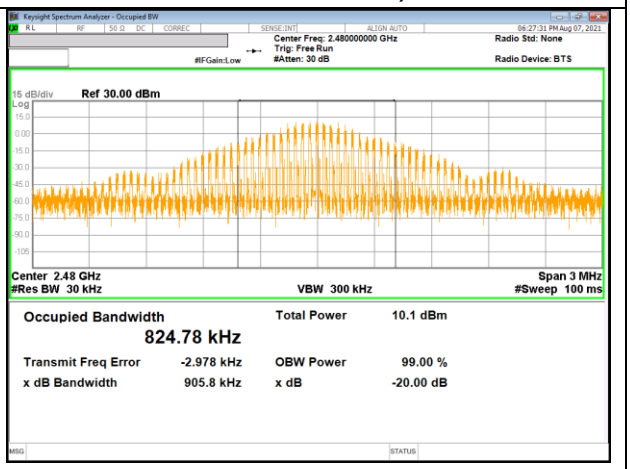
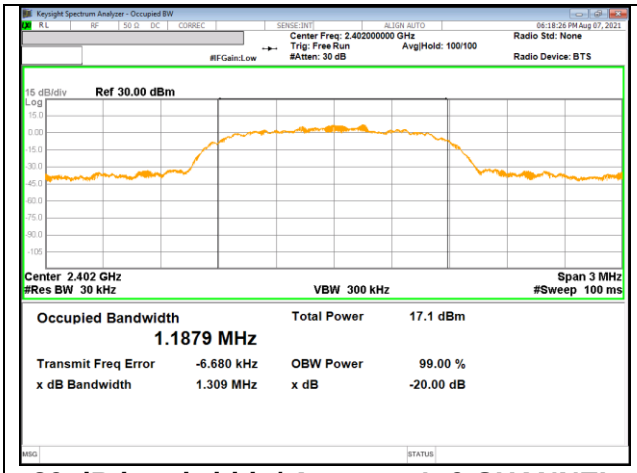


99% bandwidth / Antenna 1, 78 CHANNEL

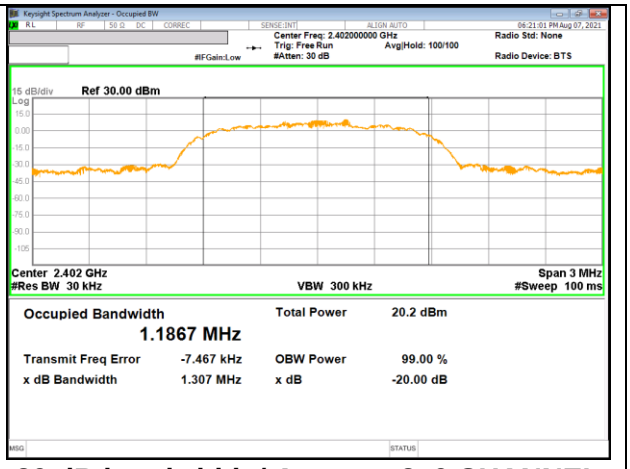


99% bandwidth / Antenna 2, 78 CHANNEL

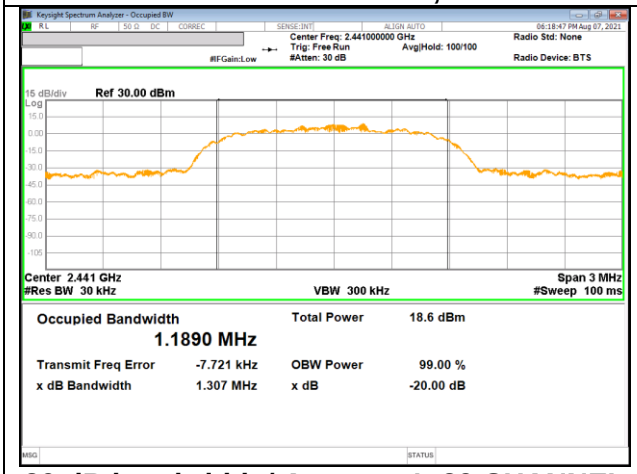
8PSK



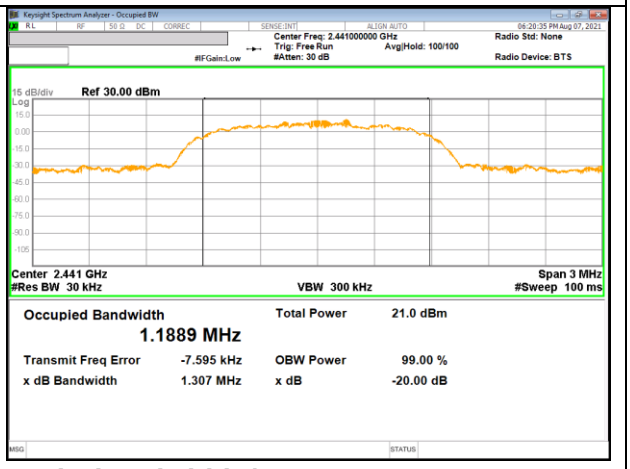
20 dB bandwidth / Antenna 1, 0 CHANNEL



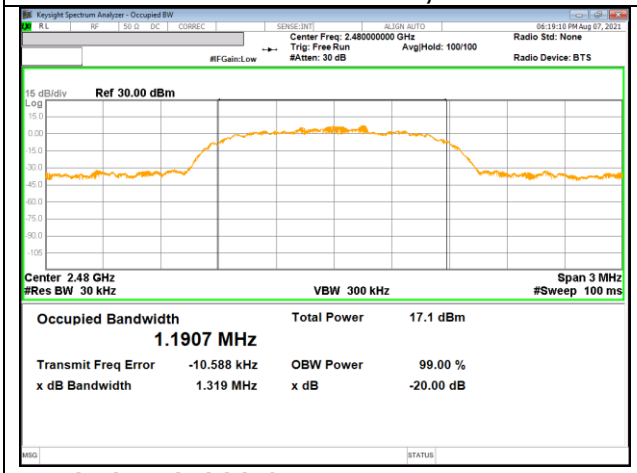
20 dB bandwidth / Antenna 2, 0 CHANNEL



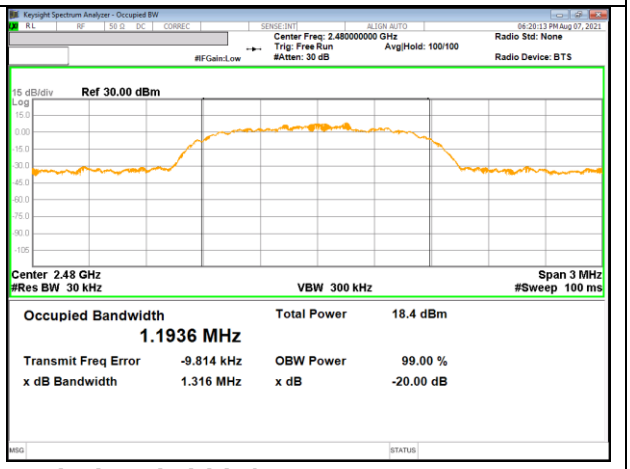
20 dB bandwidth / Antenna 1, 39 CHANNEL



20 dB bandwidth / Antenna 2, 39 CHANNEL

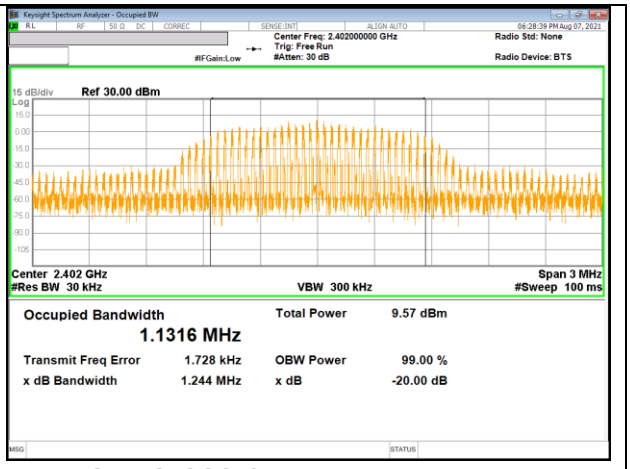


20 dB bandwidth / Antenna 1, 78 CHANNEL



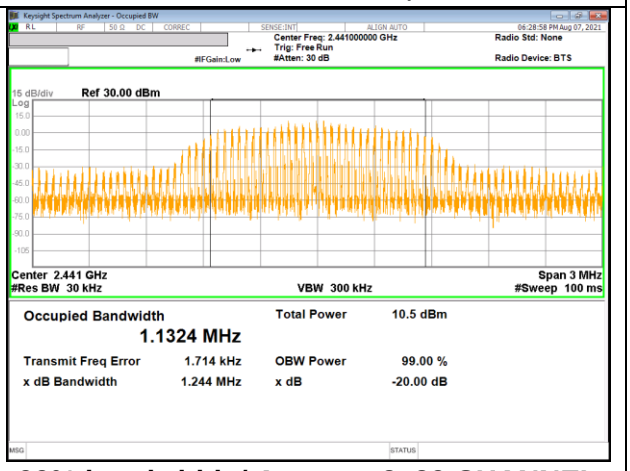
20 dB bandwidth / Antenna 2, 78 CHANNEL

99% bandwidth / Antenna 1, 0 CHANNEL



99% bandwidth / Antenna 2, 0 CHANNEL

99% bandwidth / Antenna 1, 39 CHANNEL



99% bandwidth / Antenna 2, 39 CHANNEL

99% bandwidth / Antenna 1, 78 CHANNEL

99% bandwidth / Antenna 2, 78 CHANNEL

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.

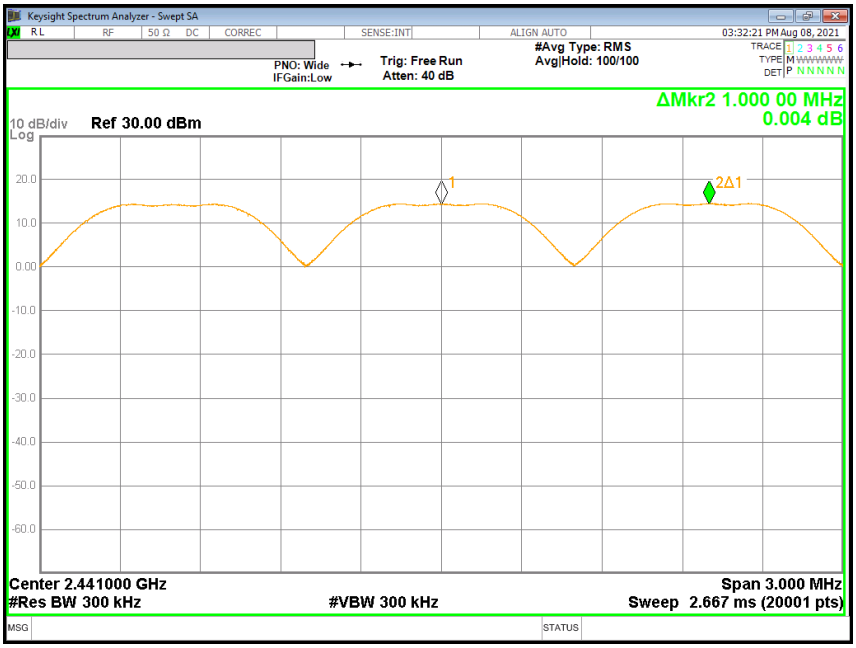
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

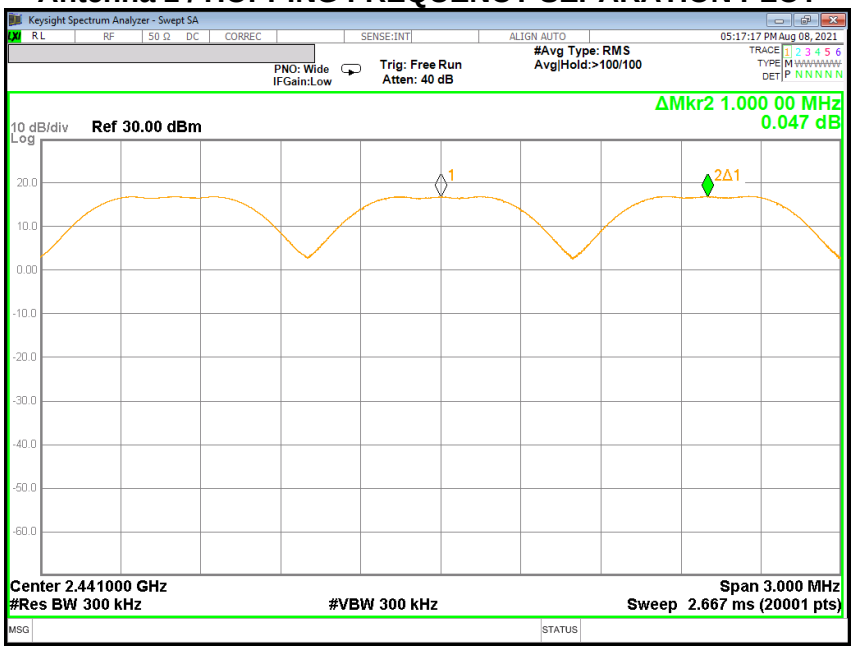
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to VBW >= RBW. The sweep time is coupled.

RESULTS

9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

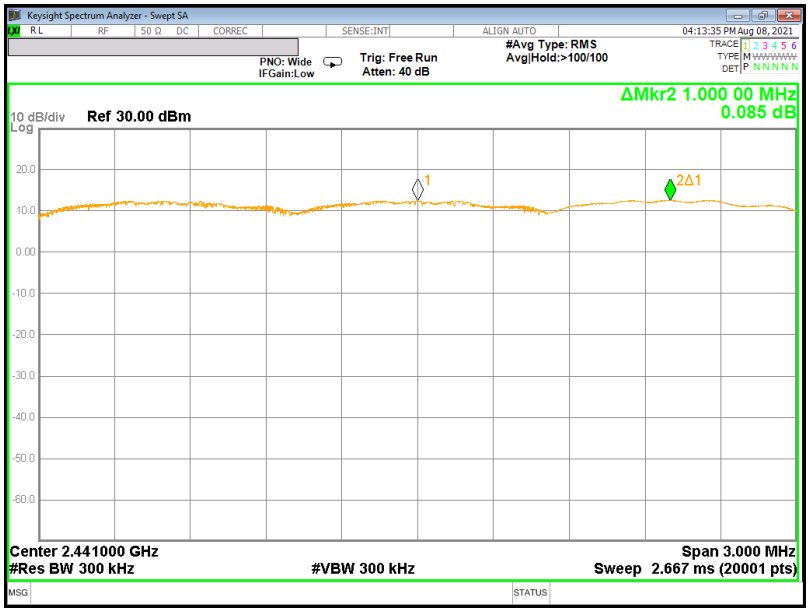


Antenna 1 / HOPPING FREQUENCY SEPARATION PLOT

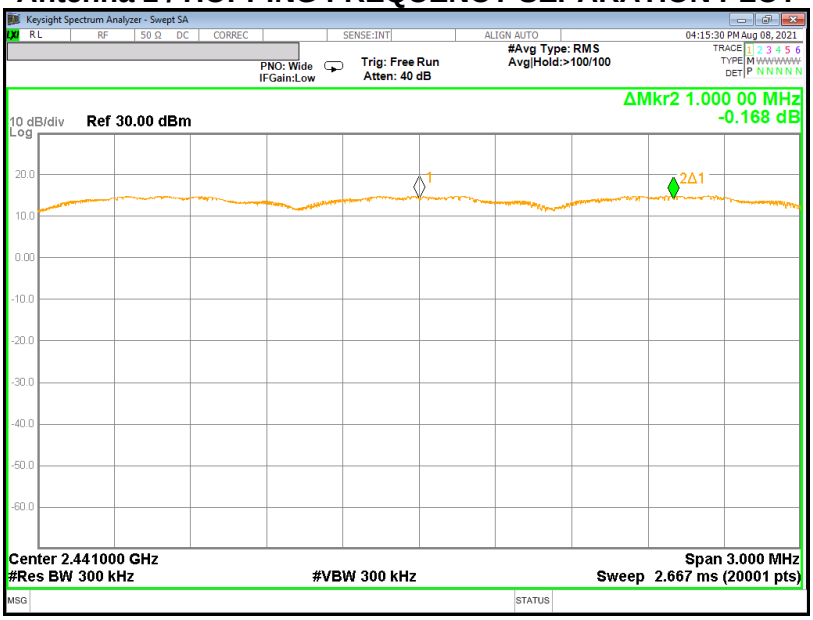


Antenna 2 / HOPPING FREQUENCY SEPARATION PLOT

9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



Antenna 1 / HOPPING FREQUENCY SEPARATION PLOT



Antenna 2 / HOPPING FREQUENCY SEPARATION PLOT

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.

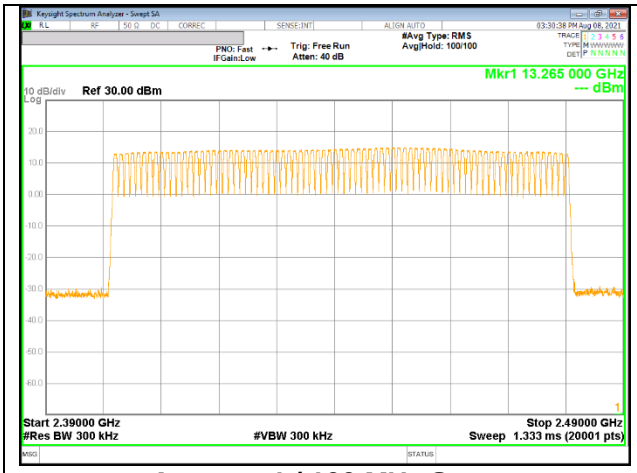
TEST PROCEDURE

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. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

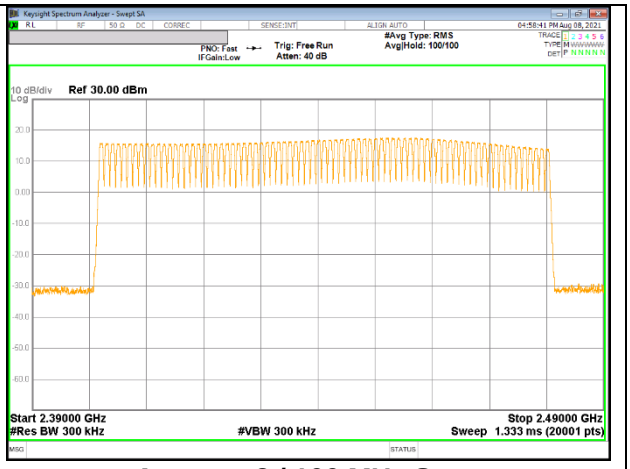
RESULTS

Normal Mode: All Channels Observed

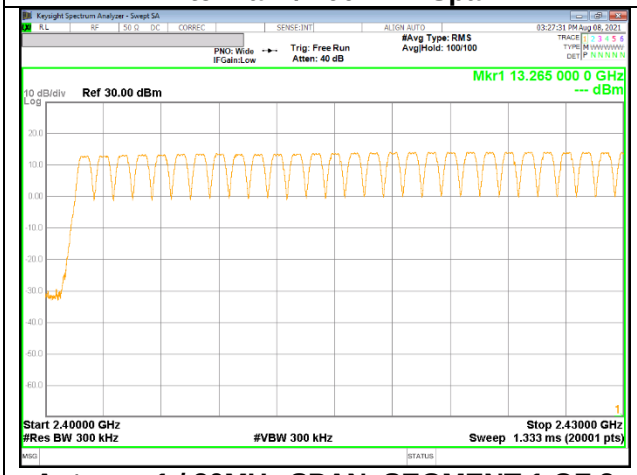
9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



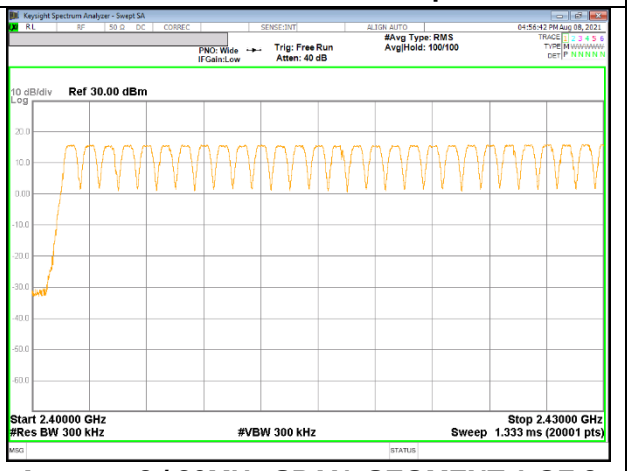
Antenna 1 / 100 MHz Span



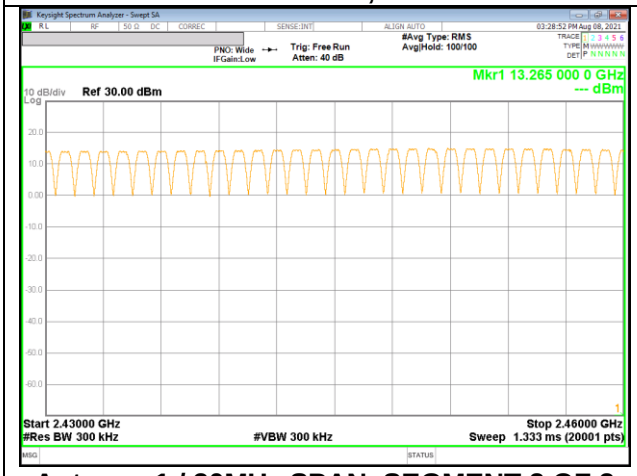
Antenna 2 / 100 MHz Span



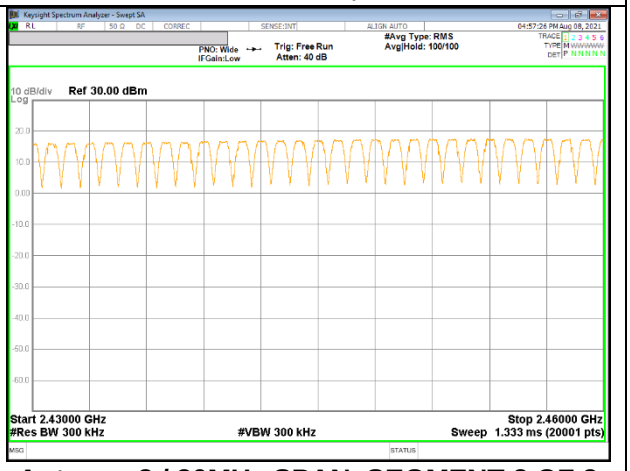
Antenna 1 / 30MHz SPAN, SEGMENT 1 OF 3



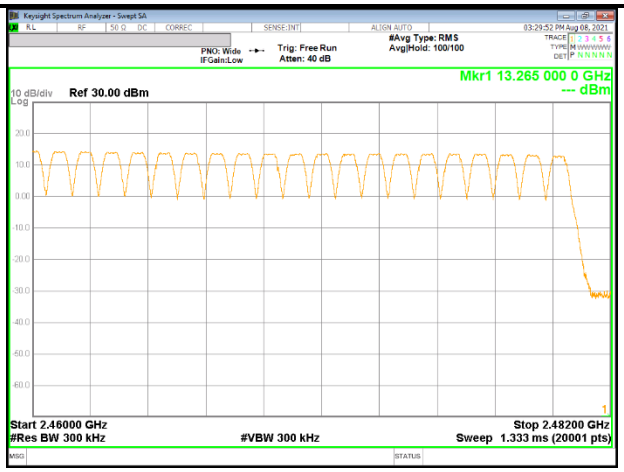
Antenna 2 / 30MHz SPAN, SEGMENT 1 OF 3



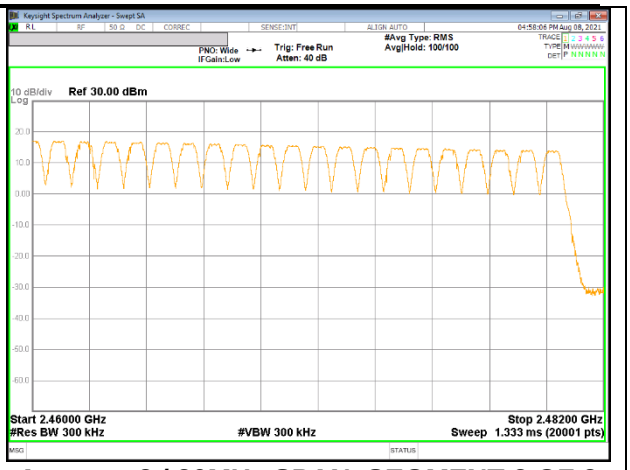
Antenna 1 / 30MHz SPAN, SEGMENT 2 OF 3



Antenna 2 / 30MHz SPAN, SEGMENT 2 OF 3

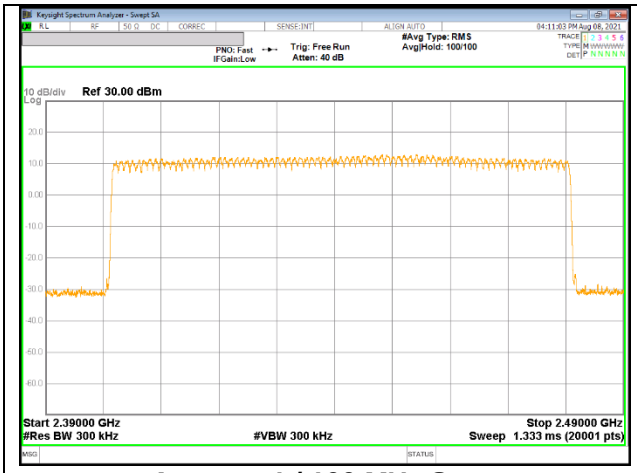


Antenna 1 / 30MHz SPAN, SEGMENT 3 OF 3

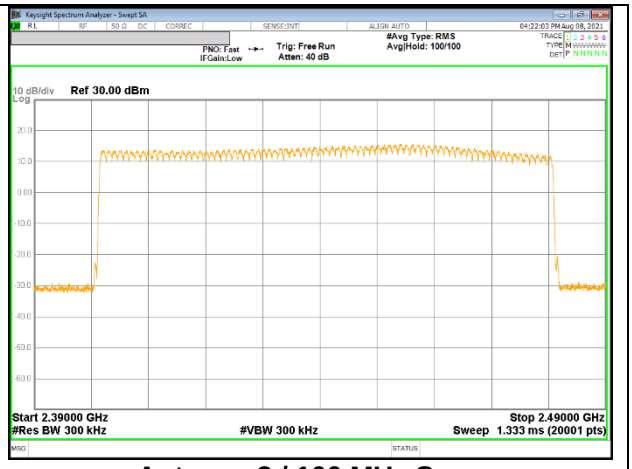


Antenna 2 / 30MHz SPAN, SEGMENT 3 OF 3

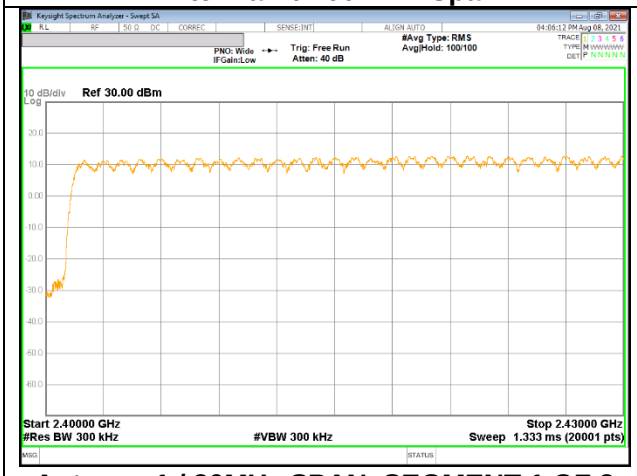
9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



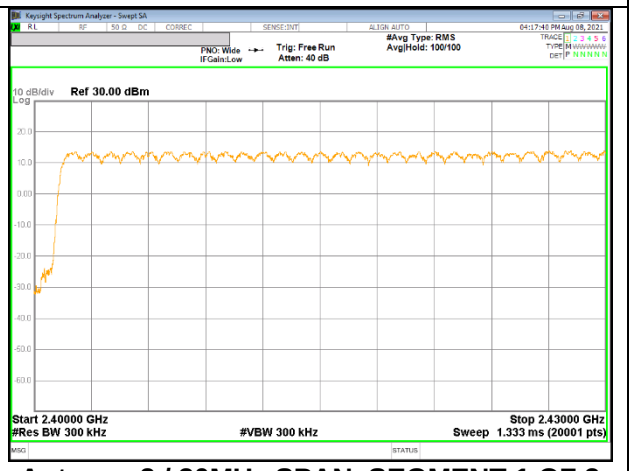
Antenna 1 / 100 MHz Span



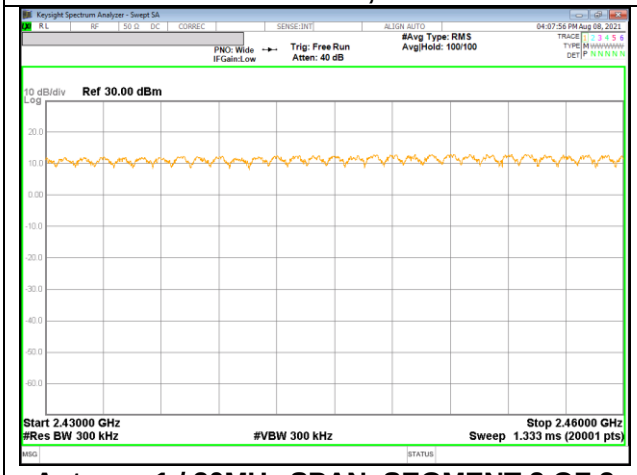
Antenna 2 / 100 MHz Span



Antenna 1 / 30MHz SPAN, SEGMENT 1 OF 3

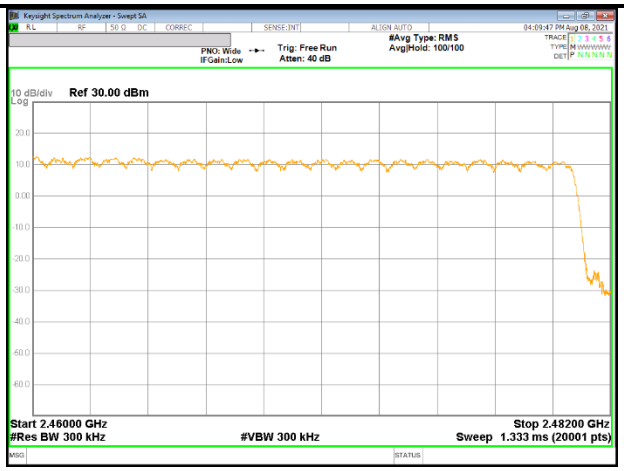


Antenna 2 / 30MHz SPAN, SEGMENT 1 OF 3

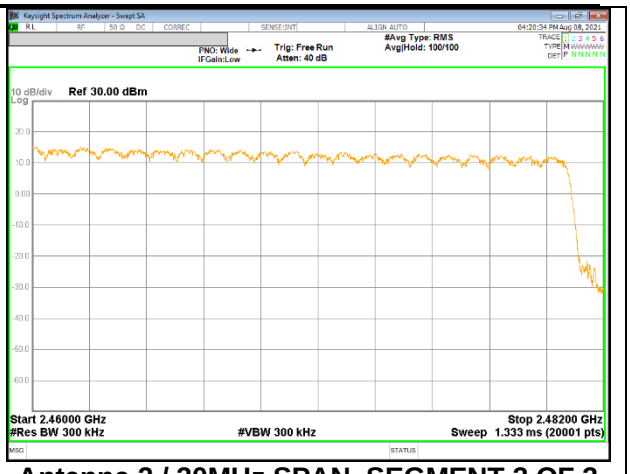


Antenna 1 / 30MHz SPAN, SEGMENT 2 OF 3

Antenna 2 / 30MHz SPAN, SEGMENT 2 OF 3



Antenna 1 / 30MHz SPAN, SEGMENT 3 OF 3



Antenna 2 / 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.

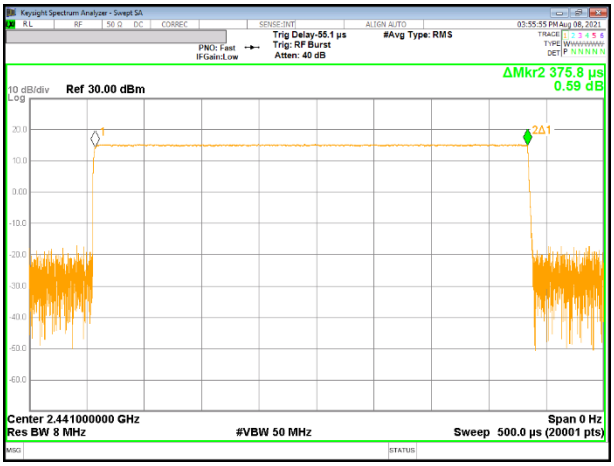
For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to 10 * (# of pulses in 0.8 s) * pulse width.

RESULTS

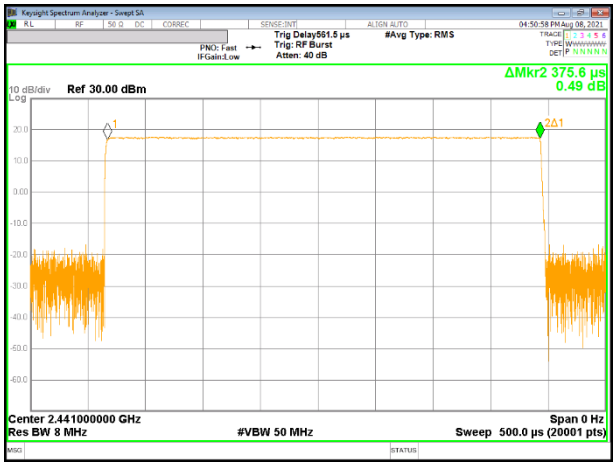
9.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK Antenna 1 Normal					
DH1	0.376	32	0.12032	0.4	-0.27968
DH3	1.632	16	0.26112	0.4	-0.13888
DH5	2.879	12	0.34548	0.4	-0.05452
DH Packet	**Pulse Width [msec]**	**Number of Pulses in 0.8 seconds**	**Average Time of Occupancy [sec]**	**Limit [sec]**	**Margin [sec]**
GFSK Antenna 1 AFH					
DH1	0.376	8	0.03008	0.4	-0.36992
DH3	1.632	4	0.06528	0.4	-0.33472
DH5	2.879	3	0.08637	0.4	-0.31363

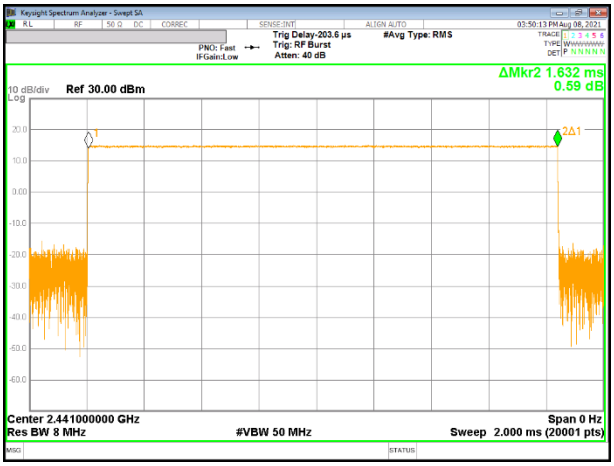
DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK Antenna 2 Normal					
DH1	0.376	32	0.12032	0.4	-0.27968
DH3	1.630	16	0.2608	0.4	-0.1392
DH5	2.878	12	0.34536	0.4	-0.05464
DH Packet	**Pulse Width [msec]**	**Number of Pulses in 0.8 seconds**	**Average Time of Occupancy [sec]**	**Limit [sec]**	**Margin [sec]**
GFSK Antenna 2 AFH					
DH1	0.376	8	0.03008	0.4	-0.36992
DH3	1.630	4	0.0652	0.4	-0.3348
DH5	2.878	3	0.08634	0.4	-0.31366



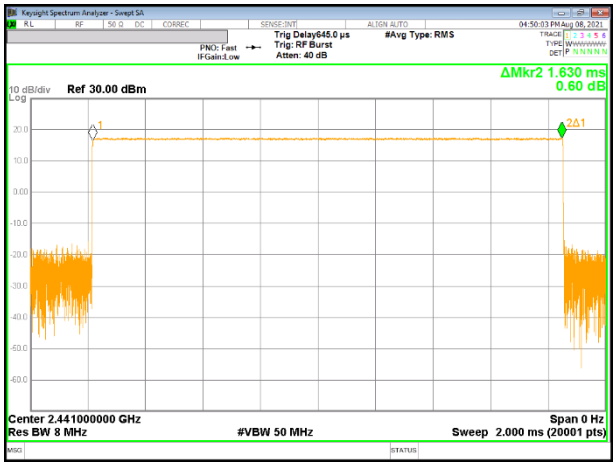
Antenna 1 / PULSE WIDTH – DH1



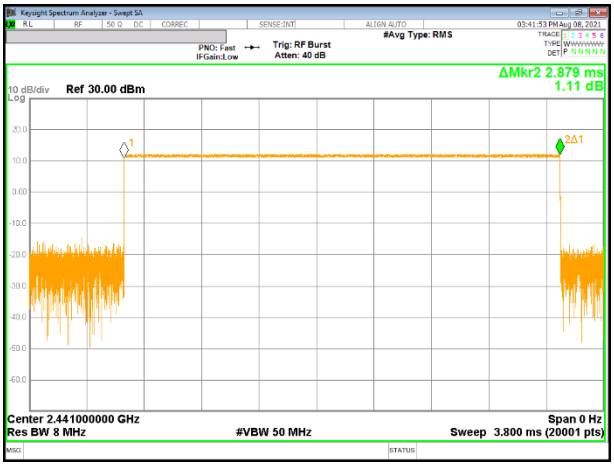
Antenna 2 / PULSE WIDTH – DH1



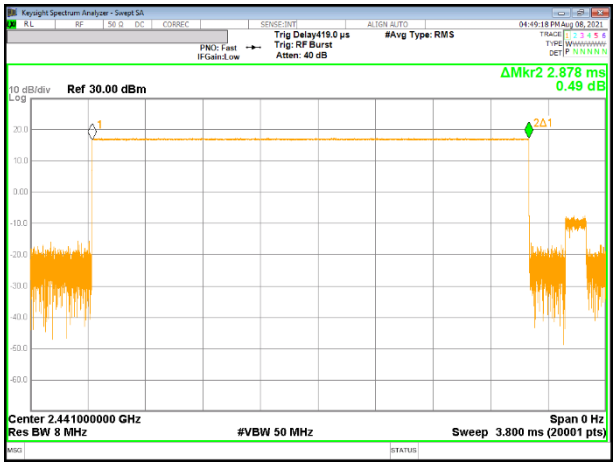
Antenna 1 / PULSE WIDTH – DH3



Antenna 2 / PULSE WIDTH – DH3



Antenna 1 / PULSE WIDTH – DH5

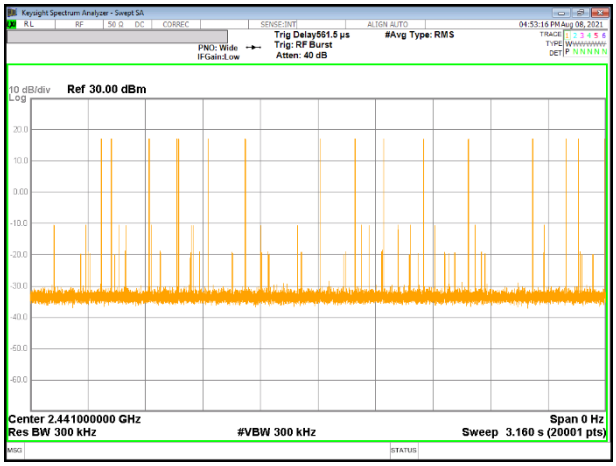


Antenna 2 / PULSE WIDTH – DH5

Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1

Antenna 2 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1

Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



Antenna 2 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3

Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

Antenna 2 / 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 Antenna 1 Normal					
DH1	0.382	32	0.12224	0.4	-0.27776
DH3	1.630	16	0.2608	0.4	-0.1392
DH5	2.880	12	0.3456	0.4	-0.0544
DH Packet	**Pulse Width [msec]**	**Number of Pulses in 0.8 seconds**	**Average Time of Occupancy [sec]**	**Limit [sec]**	**Margin [sec]**
8PSK Antenna 1 AFH					
DH1	0.382	8	0.03056	0.4	-0.36944
DH3	1.630	4	0.0652	0.4	-0.3348
DH5	2.880	3	0.0864	0.4	-0.3136

DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
8PSK Antenna 2 Normal					
DH1	0.382	32	0.12224	0.4	-0.27776
DH3	1.632	16	0.26112	0.4	-0.13888
DH5	2.880	12	0.3456	0.4	-0.0544
DH Packet	**Pulse Width [msec]**	**Number of Pulses in 0.8 seconds**	**Average Time of Occupancy [sec]**	**Limit [sec]**	**Margin [sec]**
8PSK Antenna 2 AFH					
DH1	0.382	8	0.03056	0.4	-0.36944
DH3	1.632	4	0.06528	0.4	-0.33472
DH5	2.880	3	0.0864	0.4	-0.3136

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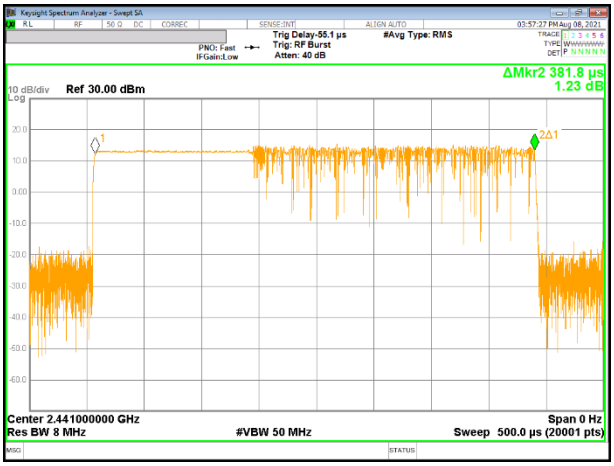
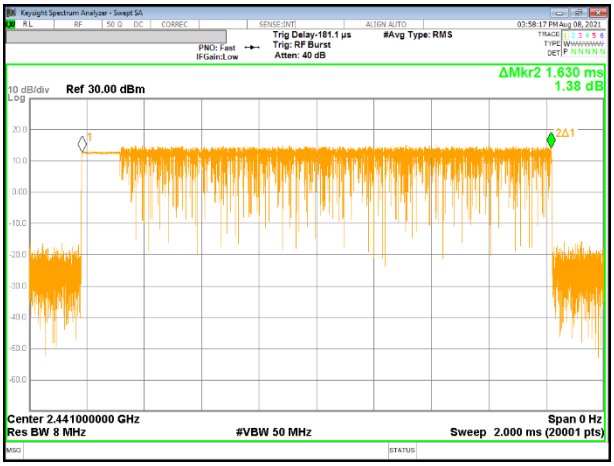
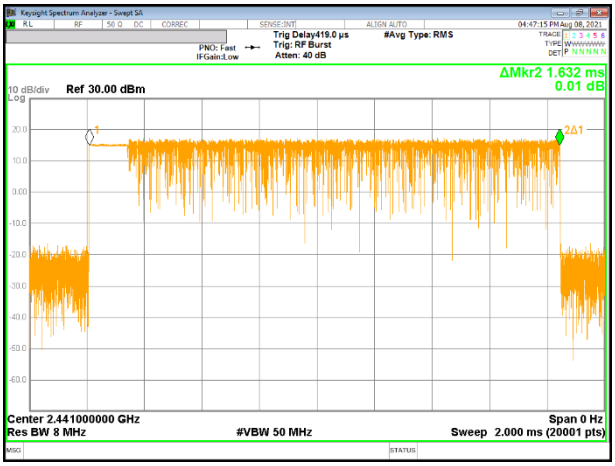


Antenna 1 / PULSE WIDTH – 3-DH1

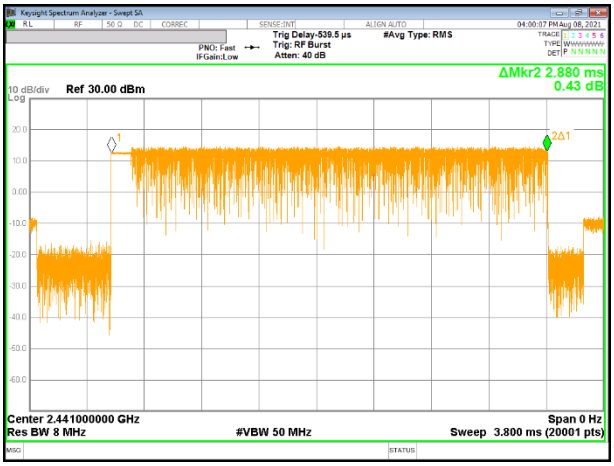
Antenna 2 / PULSE WIDTH – 3-DH1



Antenna 1 / PULSE WIDTH – 3-DH3



Antenna 2 / PULSE WIDTH – 3-DH3

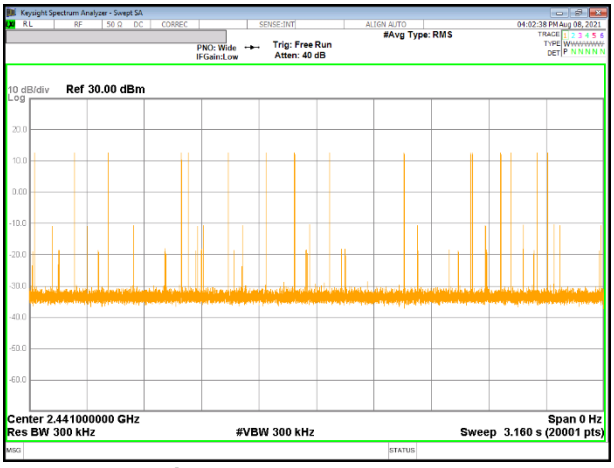


Antenna 1 / PULSE WIDTH – 3-DH5

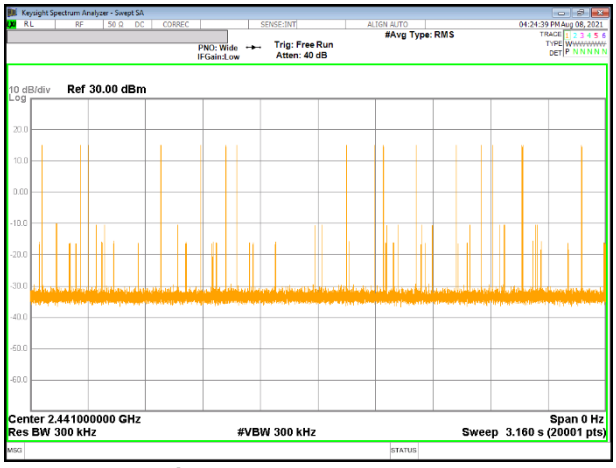
Antenna 2 / PULSE WIDTH – 3-DH5

Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH1

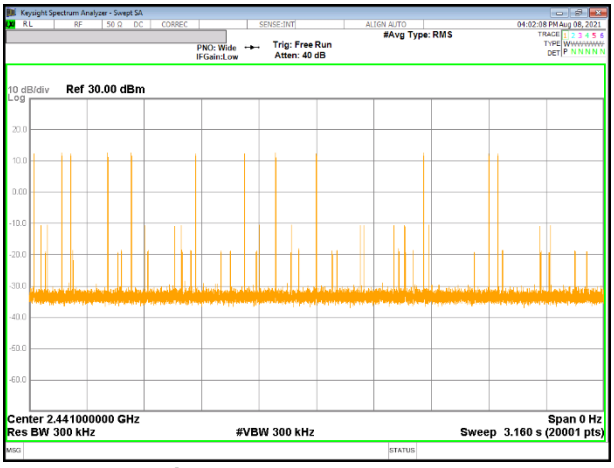
Antenna 2 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH1



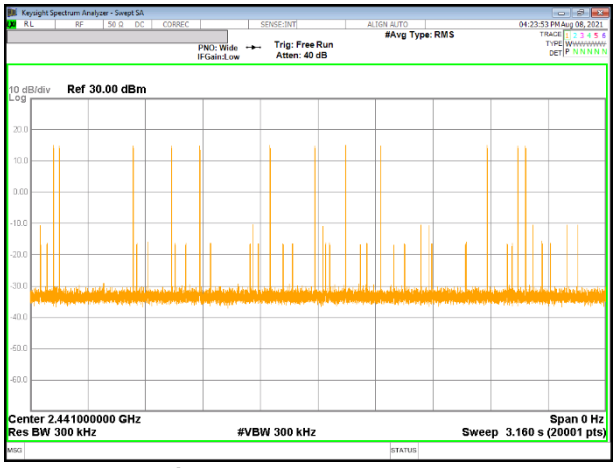
Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH3



Antenna 2 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH3



Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH5



Antenna 2 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH5

9.6. OUTPUT POWER

LIMITS

§15.247 (b) (1)
The maximum antenna gain is less than 6 dBi, therefore the limit is 21 dBm.

TEST PROCEDURE
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

9.6.1. BASIC DATA RATE GFSK MODULATION

Chain	Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dBm]
Antenna 1	0	2 402	13.983	21.000	-7.017
	39	2 441	15.405	21.000	-5.595
	78	2 480	14.620	21.000	-6.38
Antenna 2	0	2 402	16.898	21.000	-4.102
	39	**2 441**	**17.653**	**21.000**	**-3.347**
	78	2 480	15.387	21.000	-5.613
Worst			17.653	21.000	-3.347

9.6.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

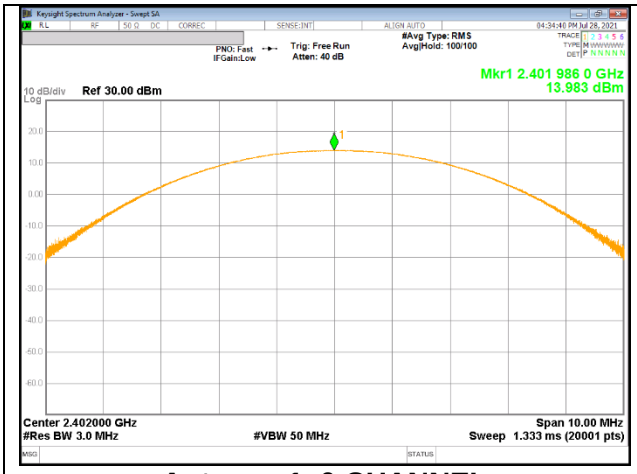
Chain	Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dBm]
Antenna 1	0	2 402	13.374	21.000	-7.626
	39	2 441	14.871	21.000	-6.129
	78	2 480	14.212	21.000	-6.788
Antenna 2	0	2 402	16.266	21.000	-4.734
	39	**2 441**	**17.103**	**21.000**	**-3.897**
	78	2 480	14.943	21.000	-6.057
Worst			17.103	21.000	-3.897

9.6.3. ENHANCED DATA RATE 8PSK MODULATION

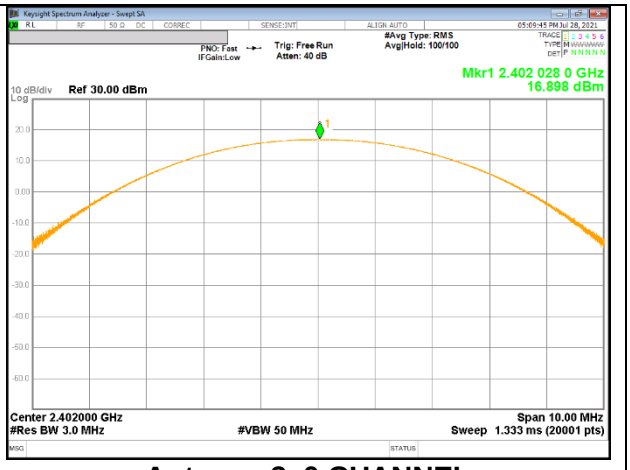
Chain	Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dBm]
Antenna 1	0	2 402	13.936	21.000	-7.064
	39	2 441	15.430	21.000	-5.57
	78	2 480	14.629	21.000	-6.371
Antenna 2	0	2 402	16.667	21.000	-4.333
	39	**2 441**	**17.532**	**21.000**	**-3.468**
	78	2 480	15.338	21.000	-5.662
Worst			17.532	21.000	-3.468

9.6.4. OUTPUT POWER PLOTS

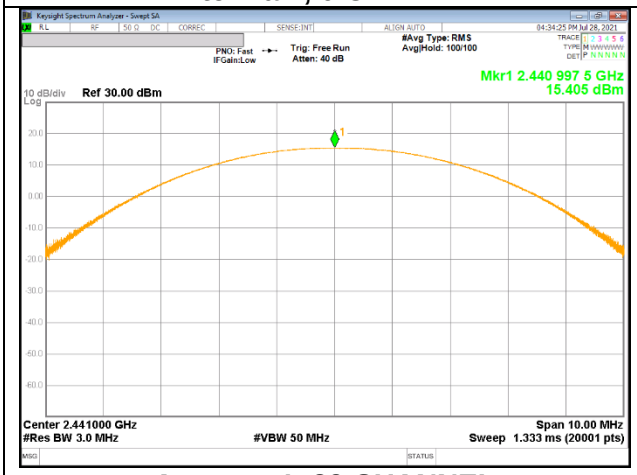
GFSK OUTPUT POWER



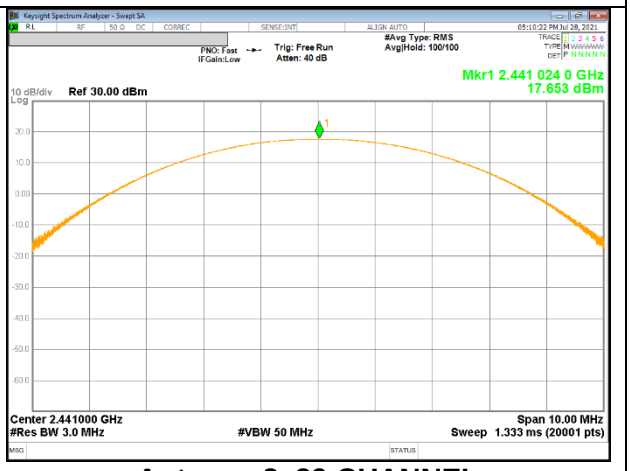
Antenna 1, 0 CHANNEL



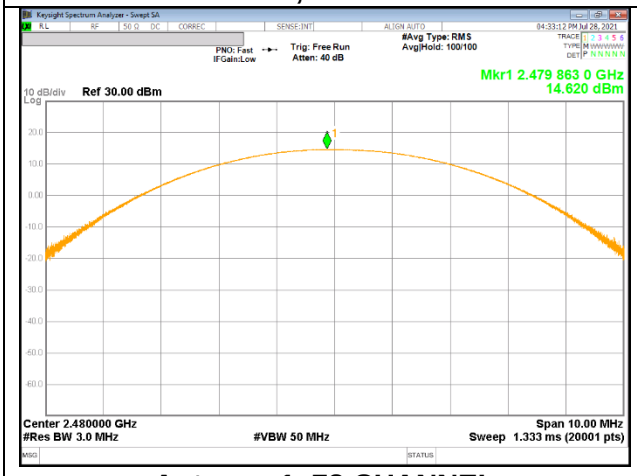
Antenna 2, 0 CHANNEL



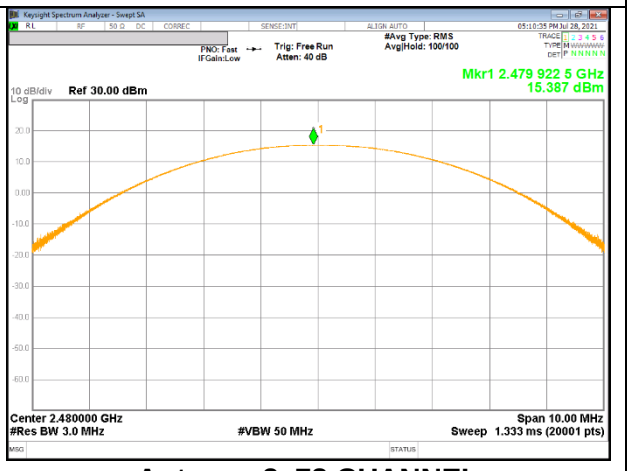
Antenna 1, 39 CHANNEL



Antenna 2, 39 CHANNEL

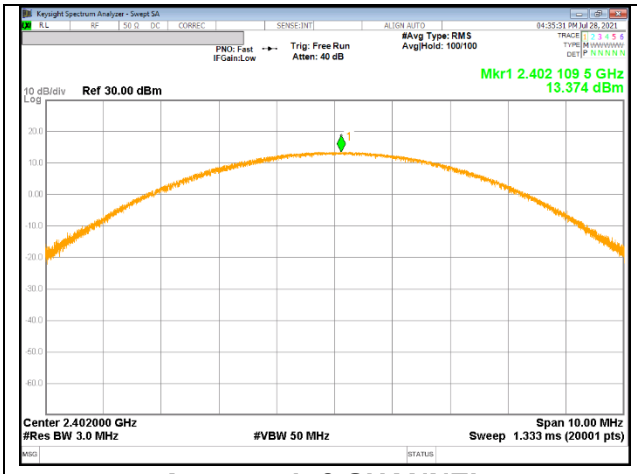


Antenna 1, 78 CHANNEL

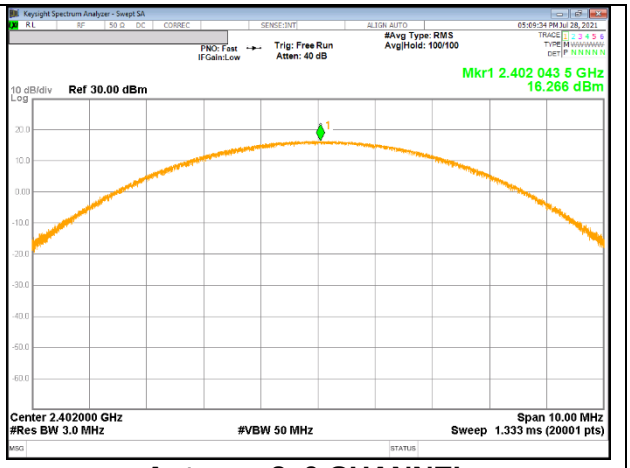


Antenna 2, 78 CHANNEL

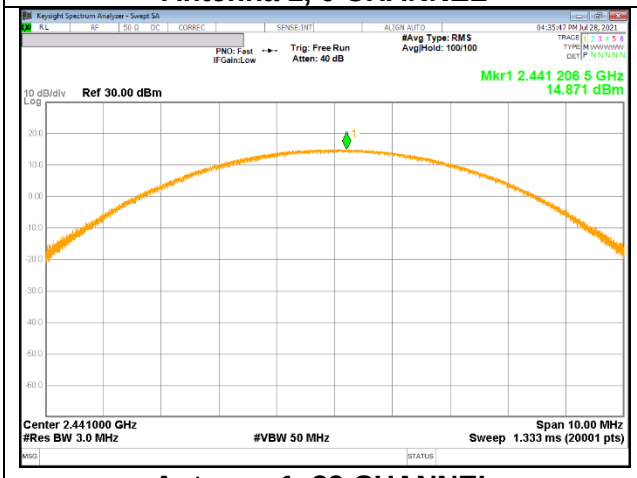
Pi/4-DPSK OUTPUT POWER



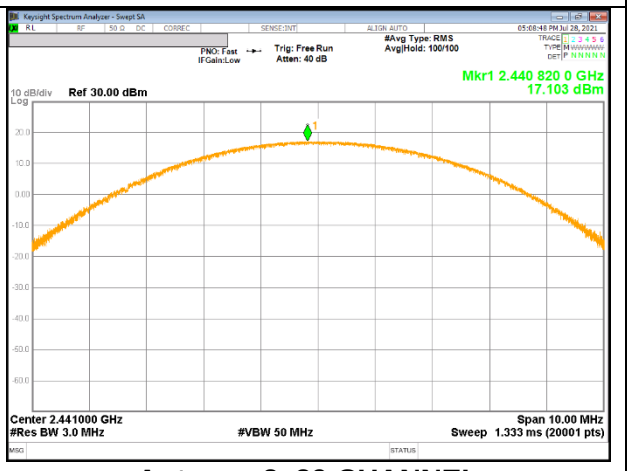
Antenna 1, 0 CHANNEL



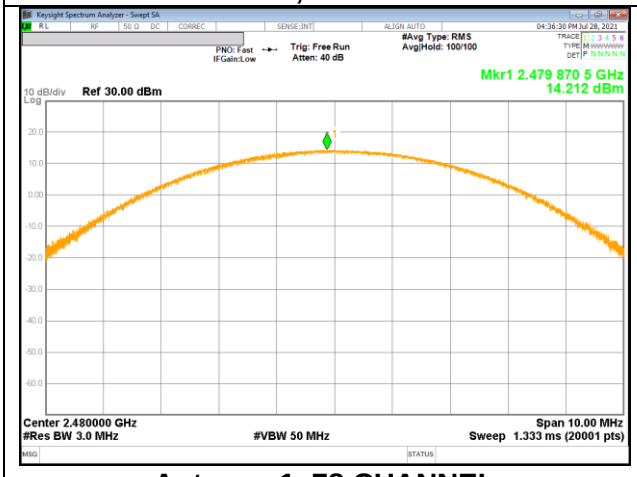
Antenna 2, 0 CHANNEL



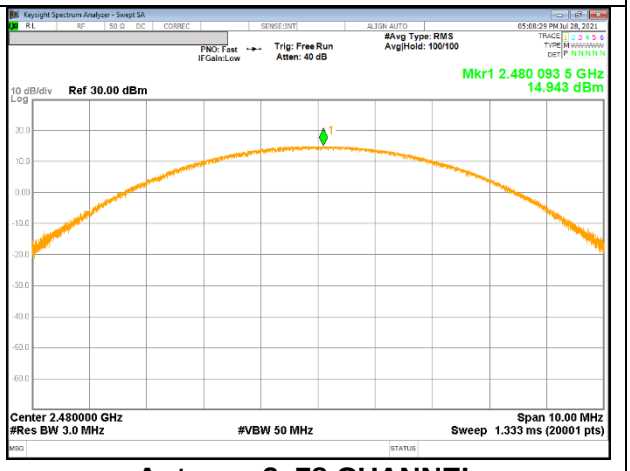
Antenna 1, 39 CHANNEL



Antenna 2, 39 CHANNEL

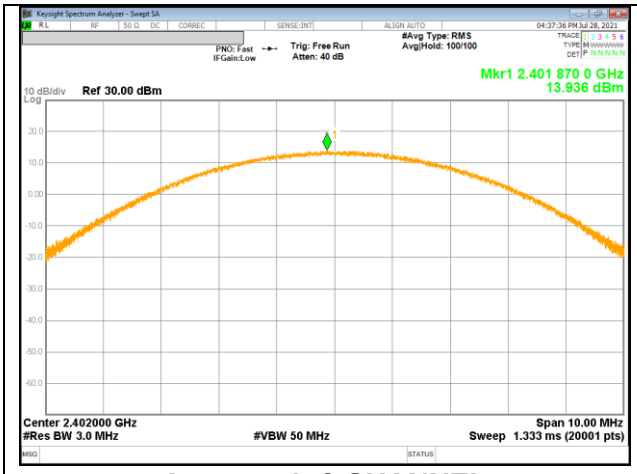


Antenna 1, 78 CHANNEL

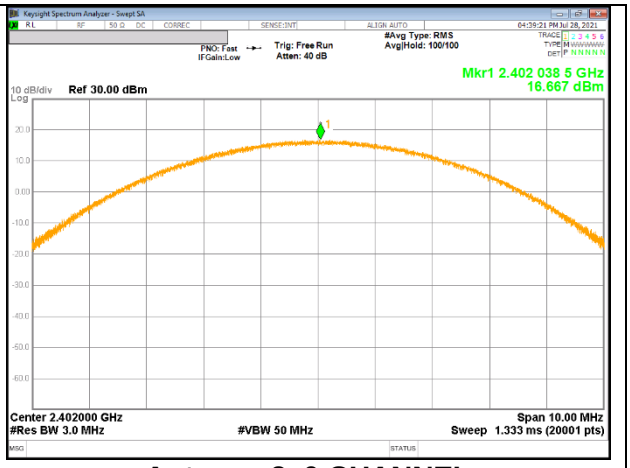


Antenna 2, 78 CHANNEL

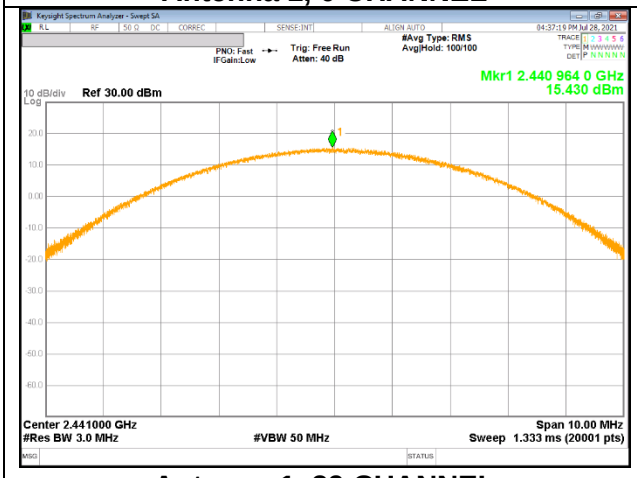
8PSK OUTPUT POWER



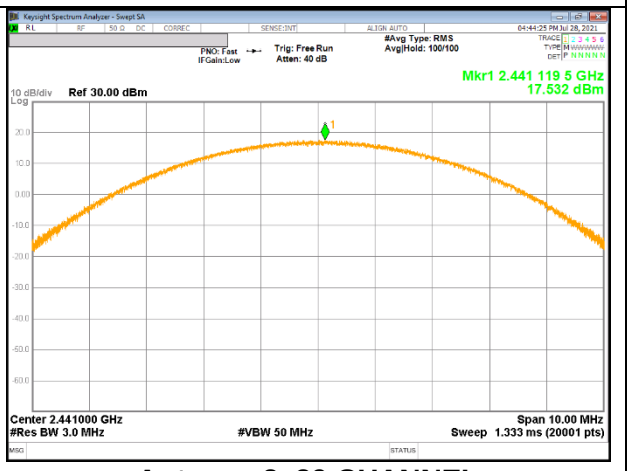
Antenna 1, 0 CHANNEL



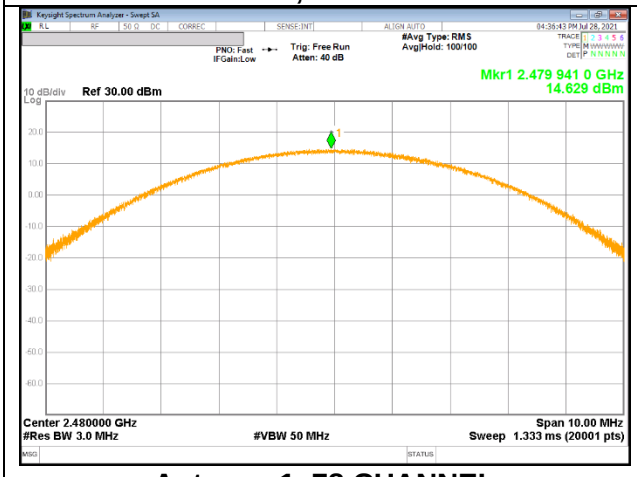
Antenna 2, 0 CHANNEL



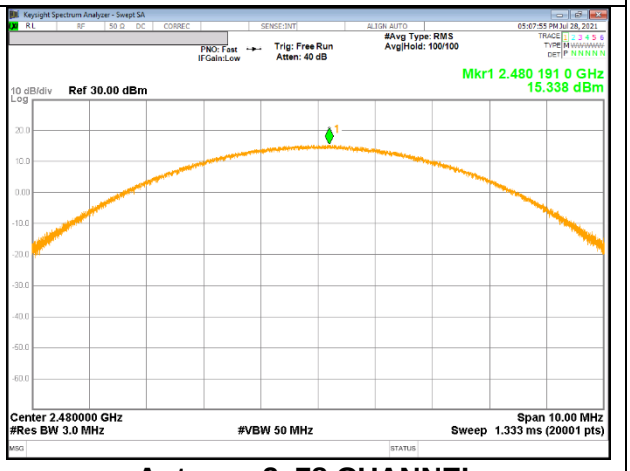
Antenna 1, 39 CHANNEL



Antenna 2, 39 CHANNEL



Antenna 1, 78 CHANNEL



Antenna 2, 78 CHANNEL

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 was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

9.7.1. BASIC DATA RATE GFSK MODULATION

Chain	Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Antenna 1	0	2 402	13.565	22.725
	39	2 441	15.270	33.651
	78	2 480	14.239	26.540
Antenna 2	0	2 402	16.503	44.699
	39	**2 441**	**17.260**	**53.211**
	78	2 480	15.020	31.769

9.7.2. ENHANCED DATA RATE PI/4-DQPSK MODULATION

Chain	Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Antenna 1	0	2 402	11.073	12.803
	39	2 441	12.645	18.387
	78	2 480	11.977	15.765
Antenna 2	0	2 402	13.988	25.050
	39	**2 441**	**14.845**	**30.514**
	78	2 480	12.705	18.642

9.7.3. ENHANCED DATA RATE 8PSK MODULATION

Chain	Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Antenna 1	0	2 402	11.114	12.924
	39	2 441	12.643	18.378
	78	2 480	11.977	15.765
Antenna 2	0	2 402	13.928	24.706
	39	**2 441**	**14.863**	**30.641**
	78	2 480	12.723	18.720

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.

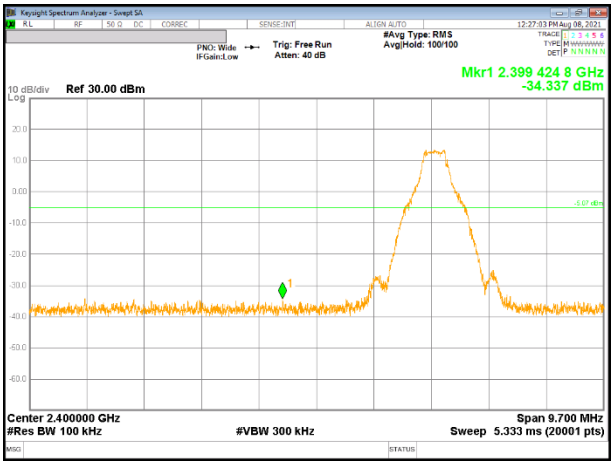
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

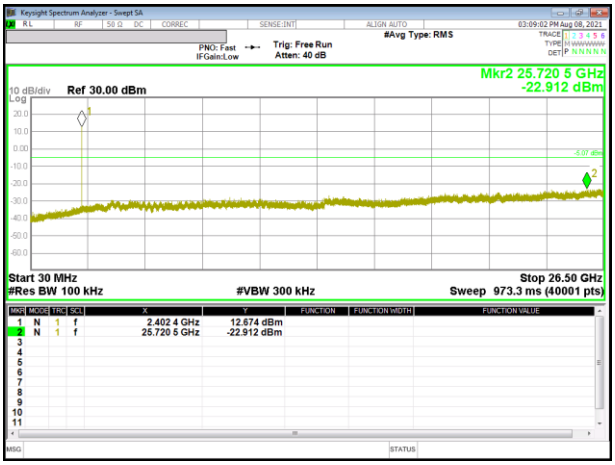
RESULTS

9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

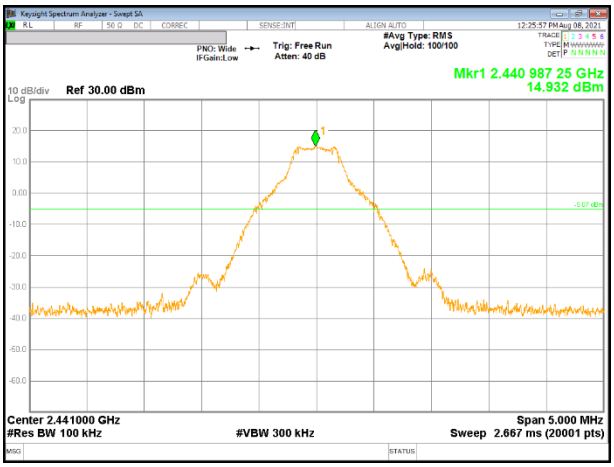
SPURIOUS EMISSIONS, NON-HOPPING(Antenna 1)



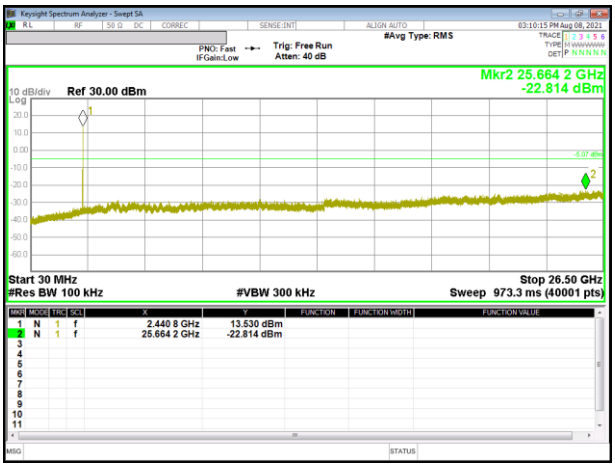
0 CHANNEL BANDEDGE



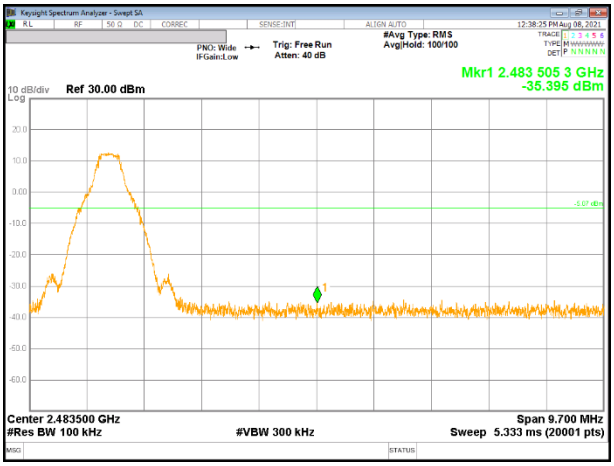
OUT-OF-BAND 0 CHANNEL



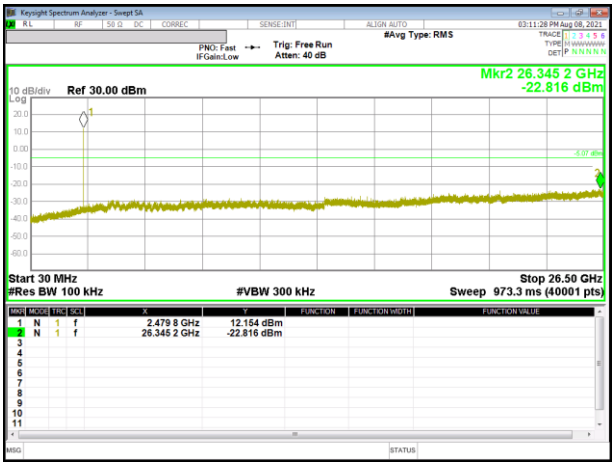
IN-BAND REFERENCE LEVEL



OUT-OF-BAND 39 CHANNEL

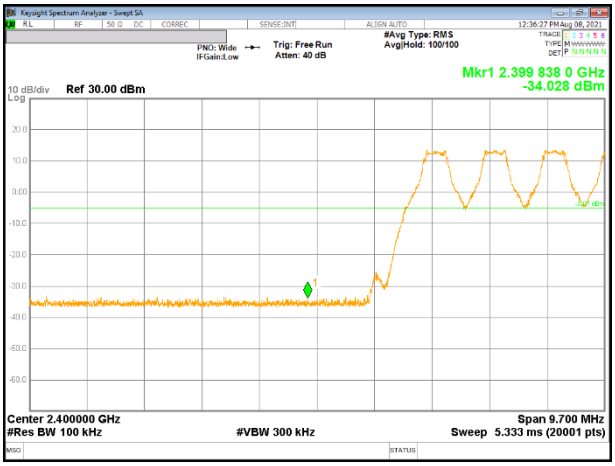


78 CHANNEL BANDEDGE

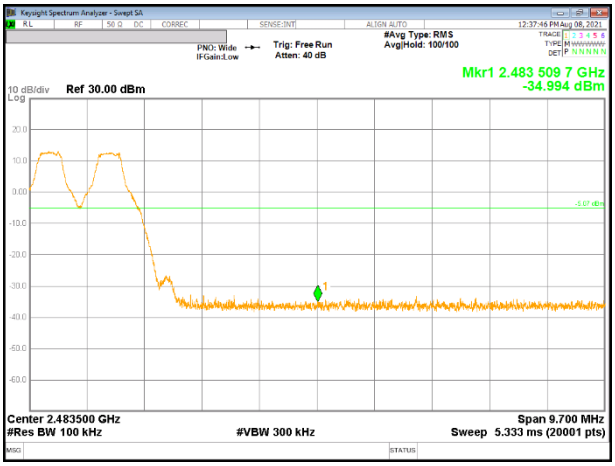


OUT-OF-BAND 78 CHANNEL

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

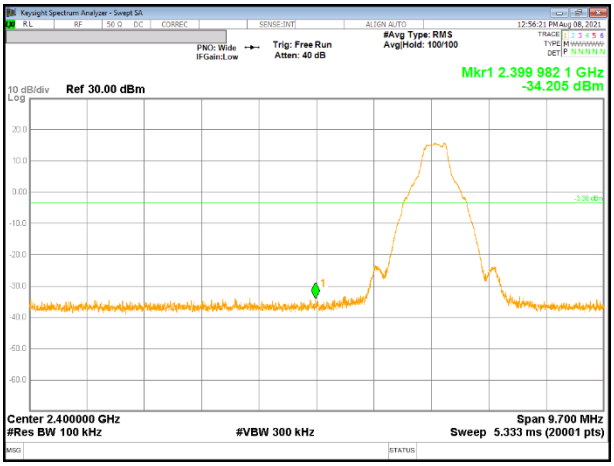


LOW BANDEDGE

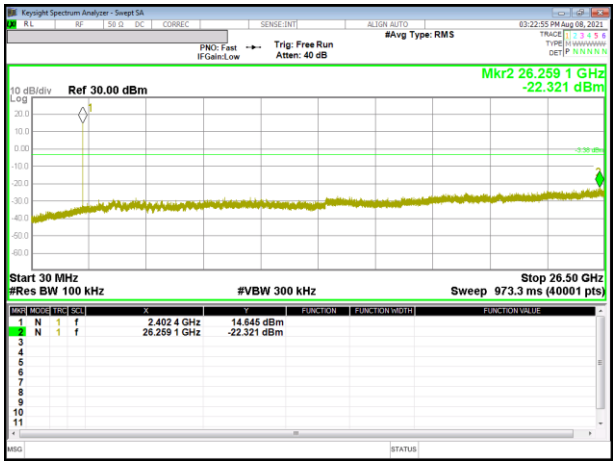


HIGH BANDEDGE

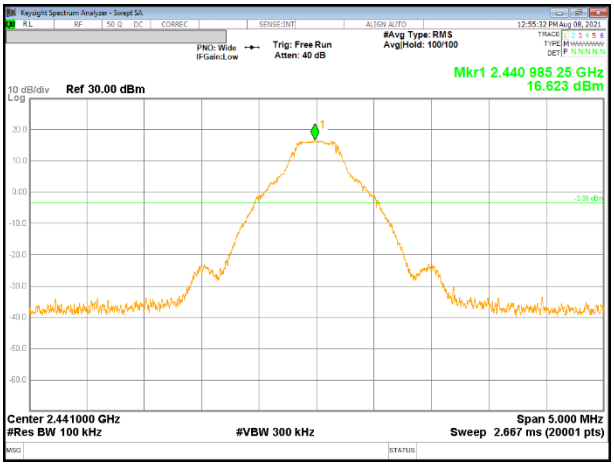
SPURIOUS EMISSIONS, NON-HOPPING(Antenna 2)



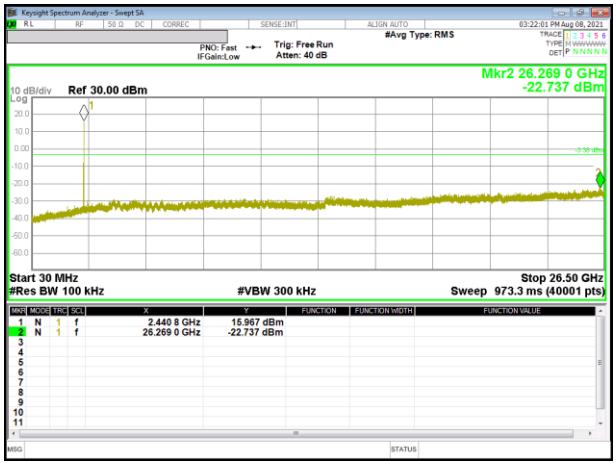
0 CHANNEL BANDEDGE



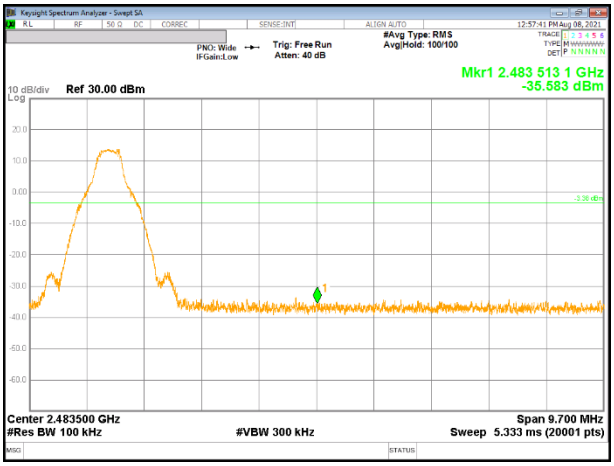
OUT-OF-BAND 0 CHANNEL



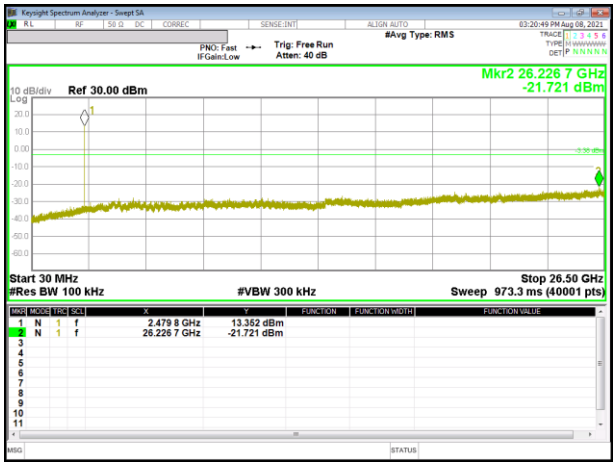
IN-BAND REFERENCE LEVEL



OUT-OF-BAND 39 CHANNEL

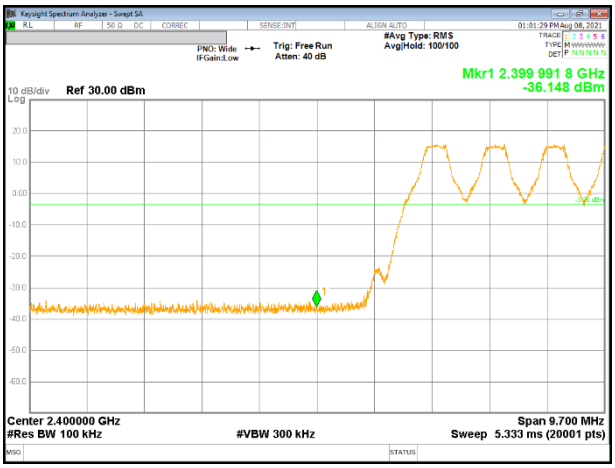


78 CHANNEL BANDEDGE

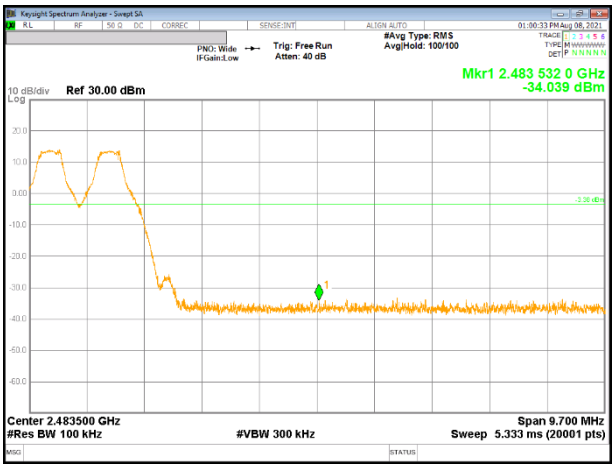


OUT-OF-BAND 78 CHANNEL

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



LOW BANDEDGE



HIGH BANDEDGE