CERTIFICATION TEST REPORT

Report Number. : 4789555428-E5V1

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-G781B/DS, SM-G781B
FCC ID	:	A3LSMG781B
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:
August 14, 2020

Prepared by:
UL Korea, Ltd.
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Suwon Test Site: UL Korea, LTD. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu
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IAS ACCREDITED
TL-637

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	08/14/20	Initial issue	Jihyeon Park

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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 NUMBER: SM-G781B/DS, SM-G781B

SERIAL NUMBER: 437d2d4d431e7ece (CONDUCTED); R3CN7038YAF (RADIATED);

DATE TESTED: JUL 21, 2020 – AUG 11, 2020;

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:

Jihyeon Park
Suwon Lab Technician
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. DECISION RULES

Decision rule for statement(s) of conformity is based on Procedure 1, Clause 4.4.2 in IEC Guide 115:2007.

4.4. 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	2.35 dB
Radiated Disturbance, 30 MHz to 1 GHz	3.49 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.82 dB
Radiated Disturbance, 18 GHz to 40 GHz	5.49 dB

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

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-G781B/DS and SM-G781B.
These models are identical in hardware except SM-G781B has single SIM tray.
With some pre-scan, model SM-G781B/DS 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	17.872	61.26
		Peak	18.350	68.39
	Enhanced Pi/4-DPSK	Average	15.666	36.86
		Peak	18.176	65.71
	Enhanced 8PSK	Average	15.639	36.64
		Peak	18.655	73.37

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	R37MCQS5HH1DK3	N/A
Data Cable	SAMSUNG	EP-DR140ABE	N/A	N/A

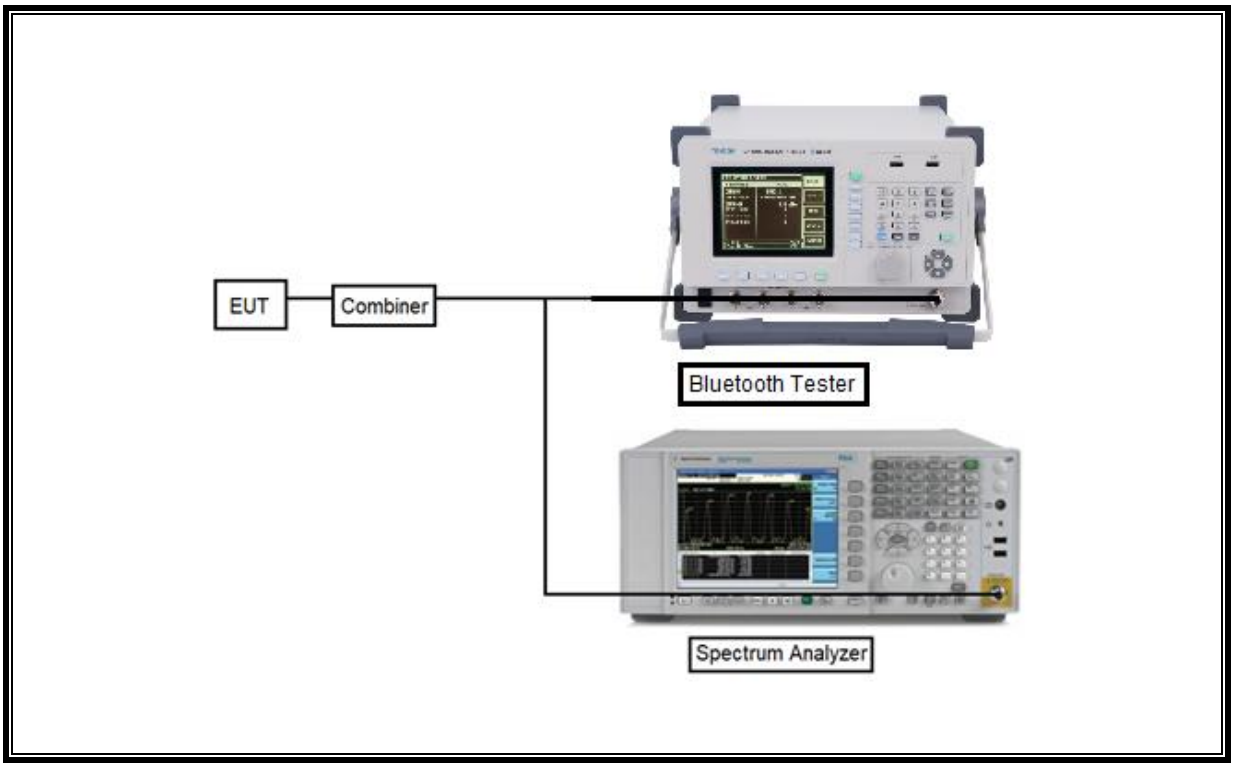
I/O CABLE

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	1.1m	N/A

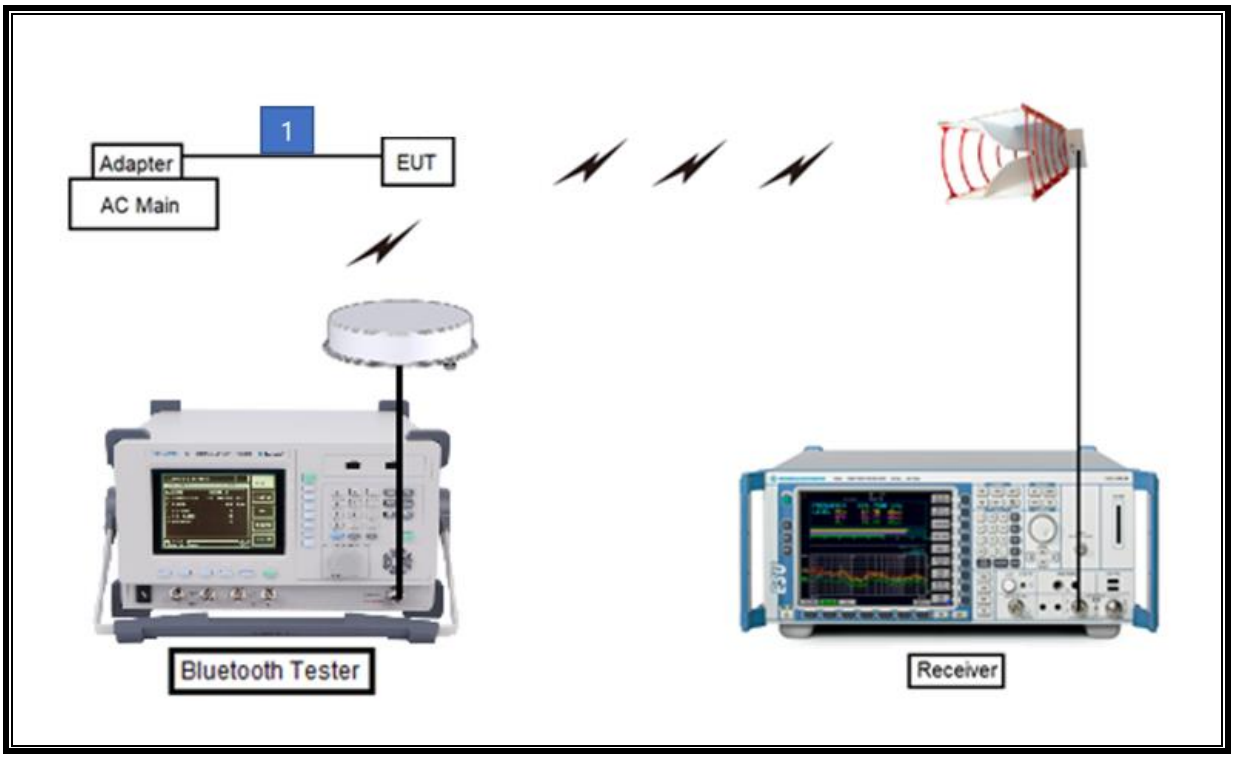
TEST SETUP

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**	**Next Cal. Date**	
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845(Note)	08-04-20	08-13-22
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749(Note)	08-04-20	08-13-22
Antenna, Horn, 18 GHz	ETS	3115	00167211	08-04-20	07-27-22
Antenna, Horn, 18 GHz	ETS	3117	00168724	08-04-20	07-27-22
Antenna, Horn, 40 GHz	ETS	3116C	00166155	08-13-20	08-04-22
Antenna, Horn, 40 GHz	ETS	3116C	00168645	10-02-21	
Preamplifier	ETS	3116C-PA	00168841	08-08-20	08-06-21
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	08-05-20	08-03-21
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-05-20	08-03-21
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-06-20	08-03-21
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-06-20	08-03-21
Spectrum Analyzer, 44 GHz	Keysight	N9030B	MY57143717	01-20-21	
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-06-20	08-05-21
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-06-20	08-05-21
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-09-20	08-05-21
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	08-07-20	08-03-21
Power Splitter	MINI-CIRCUITS	WA1534	UL001	02-05-21	
Attenuator	PASTERNACK	PE7087-10	A001	08-08-20	08-03-21
Attenuator	PASTERNACK	PE7087-10	A008	08-08-20	08-03-21
Attenuator	PASTERNACK	PE7087-10	A007	08-08-20	08-03-21
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-06-20	08-03-21
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-06-20	08-03-21
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-05-20	08-03-21
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-06-20	08-03-21
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-06-20	08-03-21
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-06-20	08-03-21
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-06-20	08-03-21
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-06-20	08-03-21
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-06-20	08-03-21
LISN	R&S	ENV-216	101837	08-09-20	08-06-21
Termination	WEINSCHEL	M1406A	T01	08-08-20	08-05-21
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	10-02-21	
UL Software					
Description	**Manufacturer**	**Model**	**Version**		
Radiated software	UL	UL EMC	Ver 9.5		
AC Line Conducted software	UL	UL EMC	Ver 9.5		

Note. The above antenna was not used for testing from August 4th to August 13th.

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	-20dBc	Conducted	Pass
15.247 (b)(1)	TX conducted output power	<21dBm		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	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.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(04)
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9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

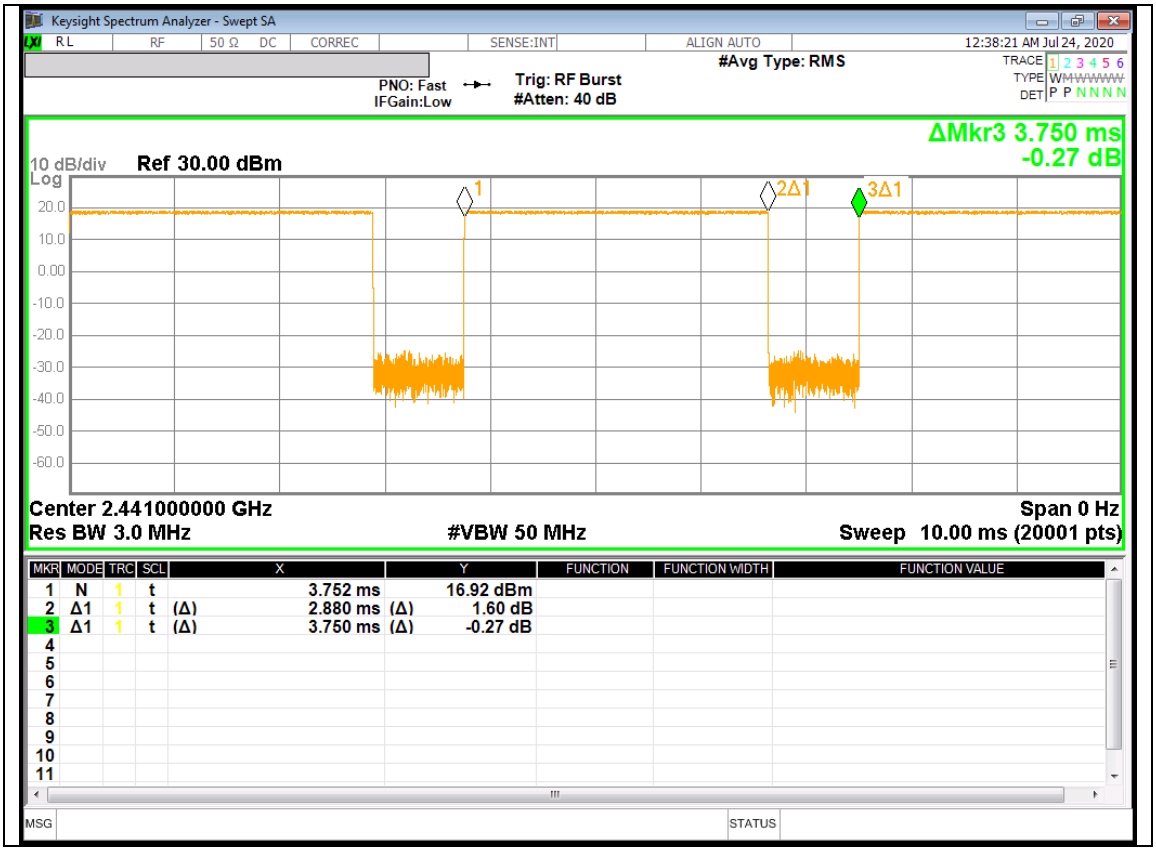
None; for reporting purposes only.

PROCEDURE

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

ON TIME AND DUTY CYCLE RESULTS

Mode	On time [msec]	Period [msec]	Duty Cycle [%]	Duty Cycle Correction Factor[dB]	1/T Minimum VBW [kHz]
2 400 ~ 2 483.5 MHz Band					
Bluetooth	2.880	3.750	76.80	1.15	0.347



9.2. 20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% 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

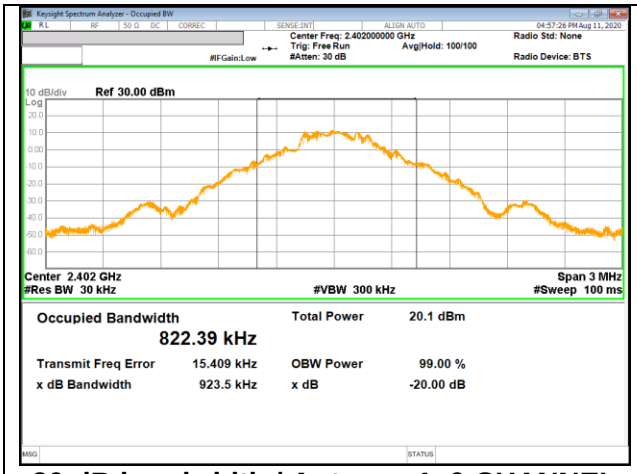
Chain	Channel	Frequency [MHz]	20 dB Bandwidth [kHz]	99% Bandwidth [kHz]
Antenna 1	0	2 402	923.5	825.2
	39	2 441	924.1	822.2
	78	2 480	920.3	823.0
Antenna 2	0	2 402	923.4	821.9
	39	2 441	924.3	824.4
	78	2 480	921.1	822.8
Worst			**924.3**	**825.2**

9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

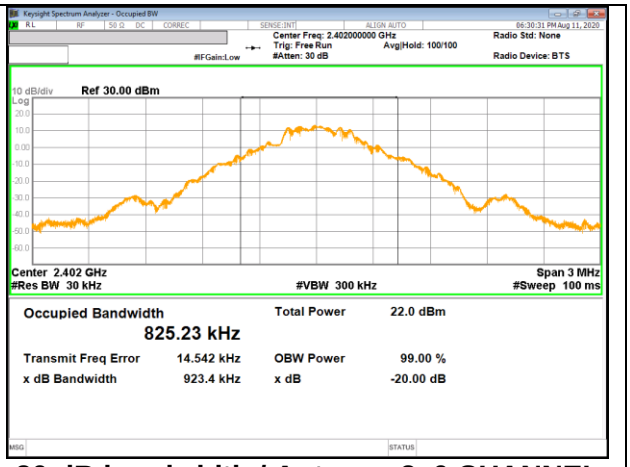
Chain	Channel	Frequency [MHz]	20 dB Bandwidth [kHz]	99% Bandwidth [kHz]
Antenna 1	0	2 402	1232.0	1160.8
	39	2 441	1268.0	1160.2
	78	2 480	1269.0	1131.1
Antenna 2	0	2 402	1269.0	1162.5
	39	2 441	1268.0	1161.5
	78	2 480	1234.0	1162.4
Worst			**1269.0**	**1162.5**

9.2.3. Bandwidth Plot

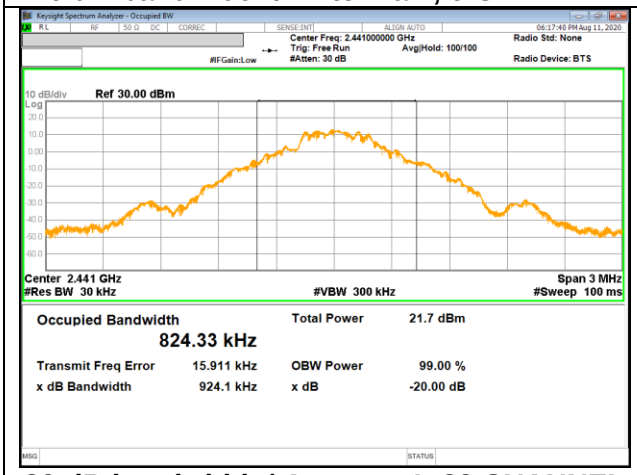
GFSK



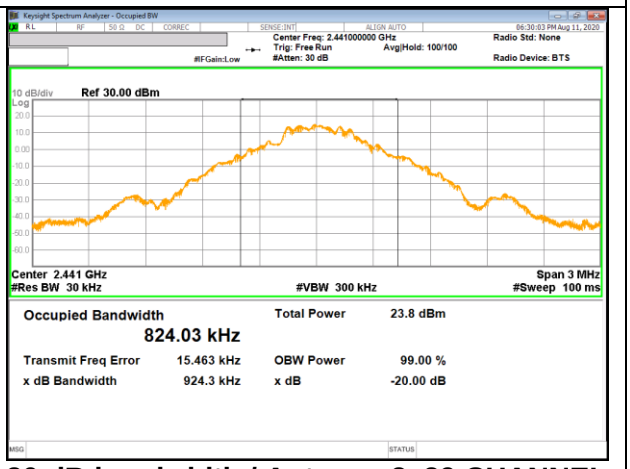
20 dB bandwidth / Antenna 1, 0 CHANNEL



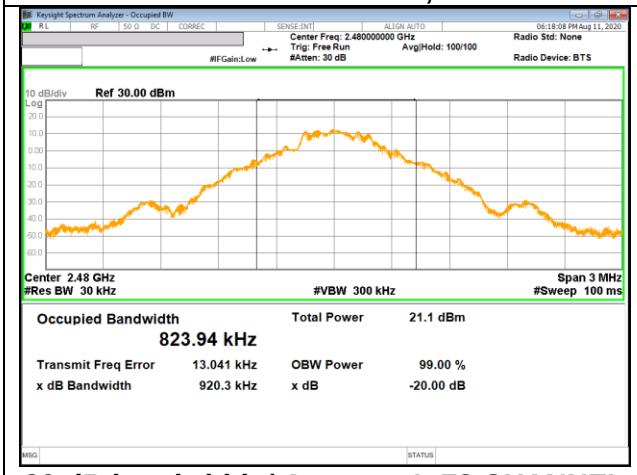
20 dB bandwidth / Antenna 2, 0 CHANNEL



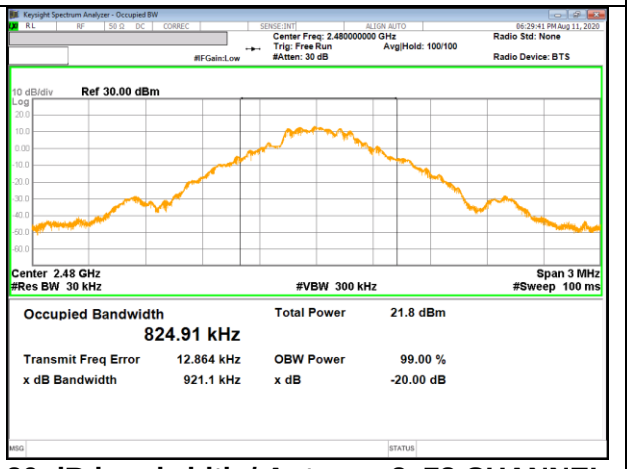
20 dB bandwidth / Antenna 1, 39 CHANNEL



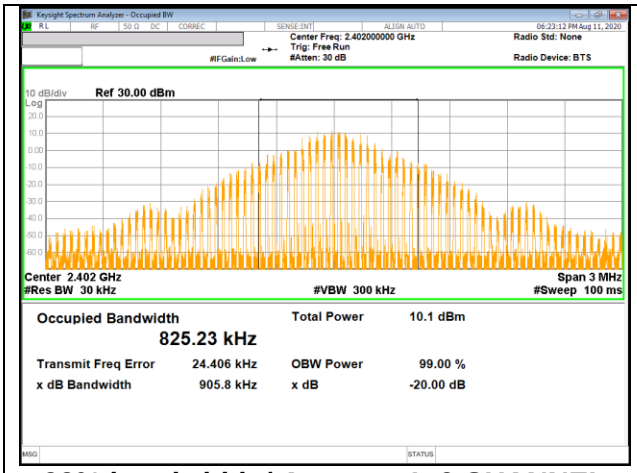
20 dB bandwidth / Antenna 2, 39 CHANNEL



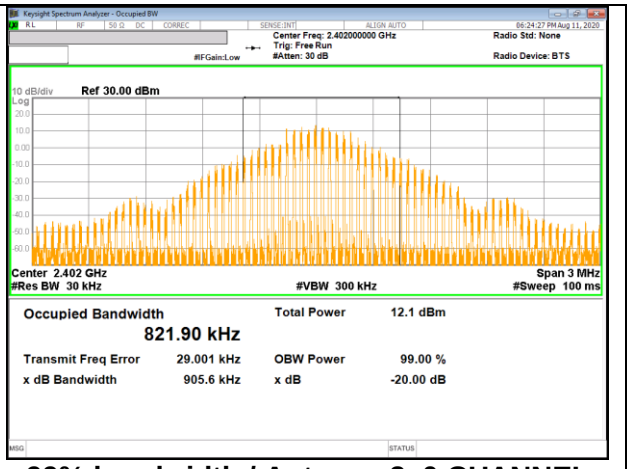
20 dB bandwidth / Antenna 1, 78 CHANNEL



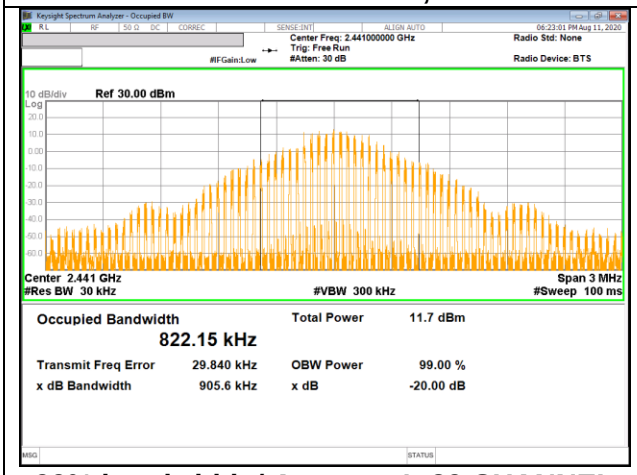
20 dB bandwidth / Antenna 2, 78 CHANNEL



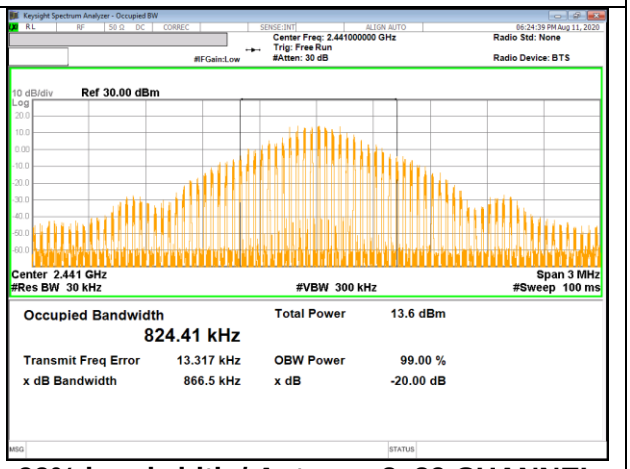
99% bandwidth / Antenna 1, 0 CHANNEL



99% bandwidth / Antenna 2, 0 CHANNEL



99% bandwidth / Antenna 1, 39 CHANNEL



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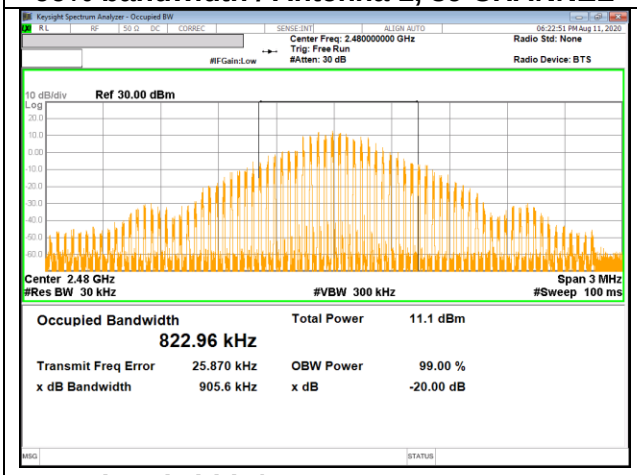
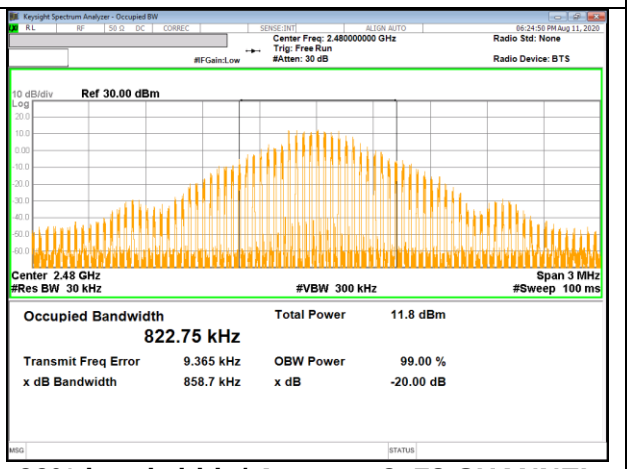
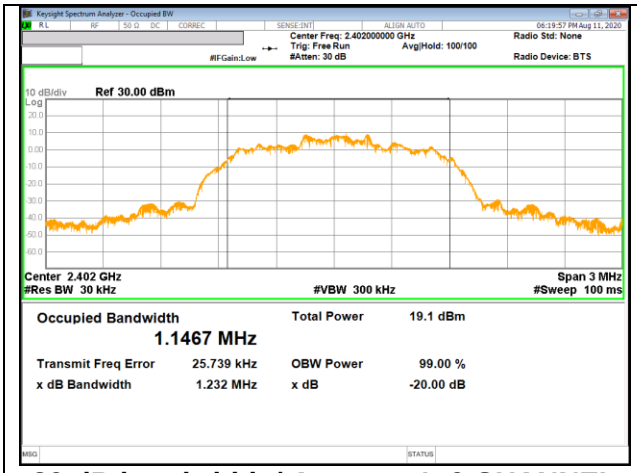


99% bandwidth / Antenna 1, 78 CHANNEL

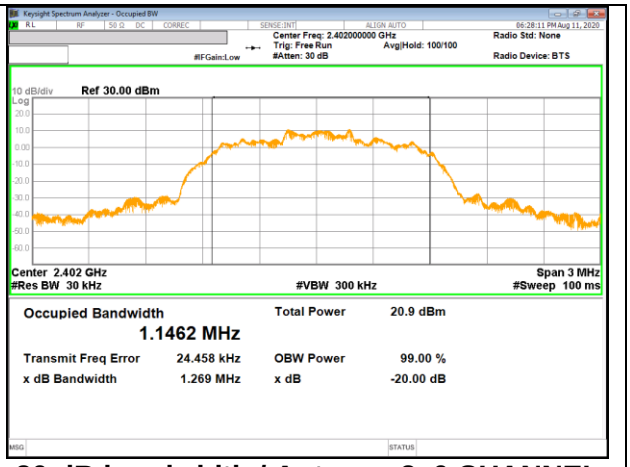


99% bandwidth / Antenna 2, 78 CHANNEL

8PSK



20 dB bandwidth / Antenna 1, 0 CHANNEL



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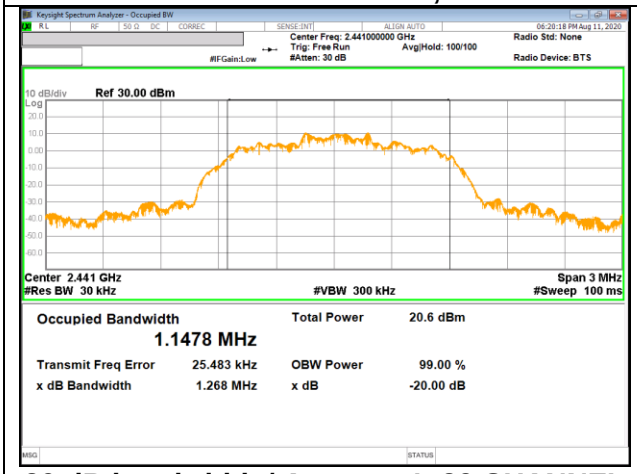
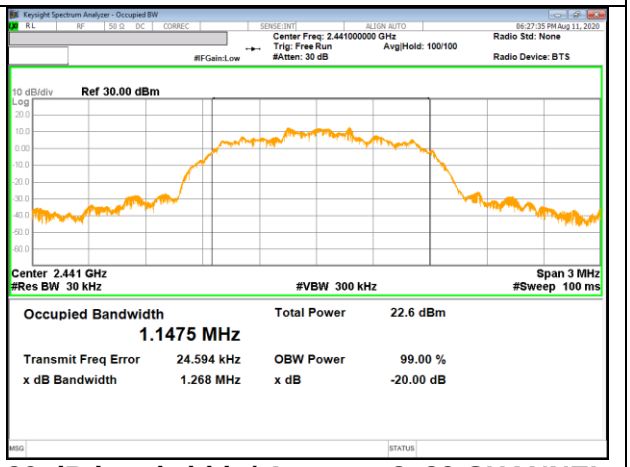
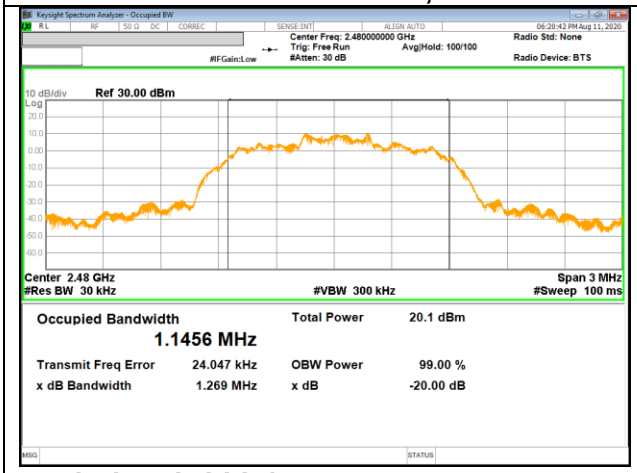


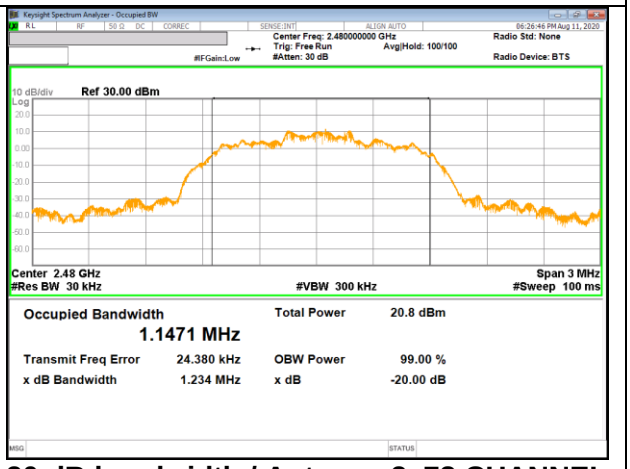
20 dB bandwidth / Antenna 1, 39 CHANNEL



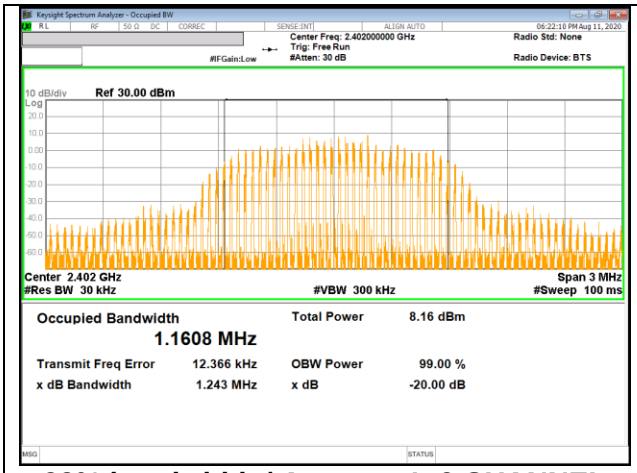
20 dB bandwidth / Antenna 2, 39 CHANNEL



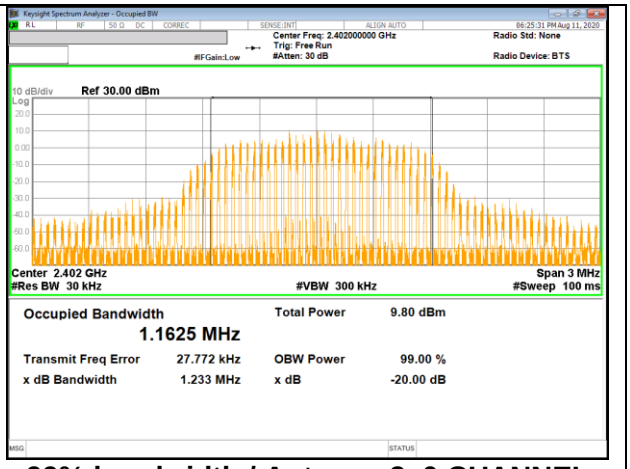
20 dB bandwidth / Antenna 1, 78 CHANNEL



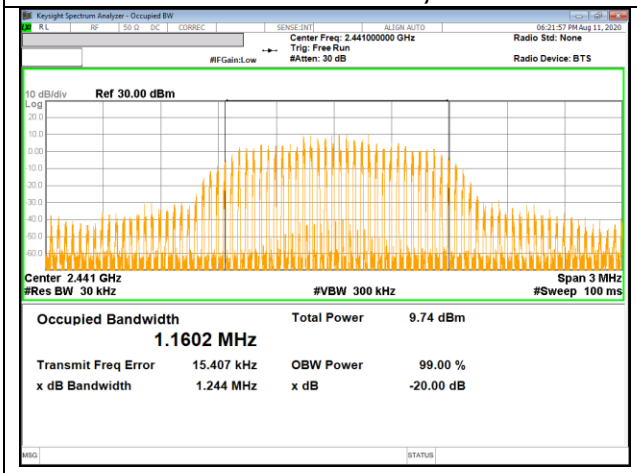
20 dB bandwidth / Antenna 2, 78 CHANNEL



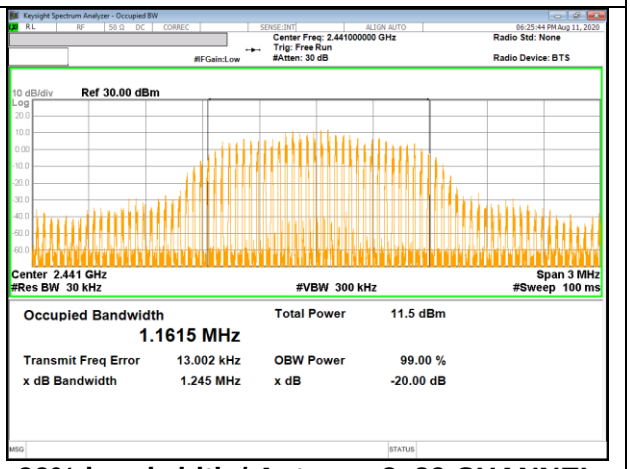
99% bandwidth / Antenna 1, 0 CHANNEL



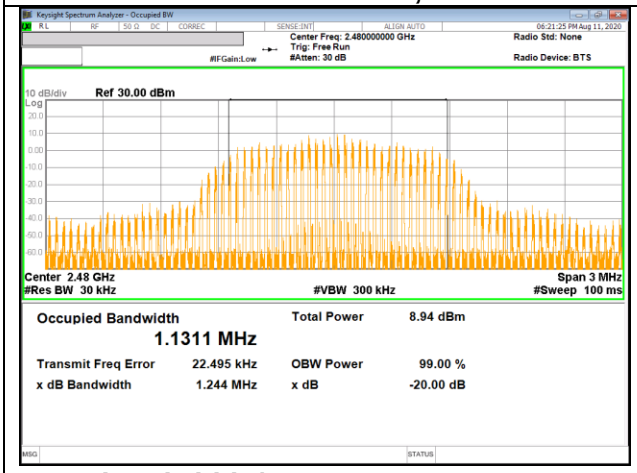
99% bandwidth / Antenna 2, 0 CHANNEL



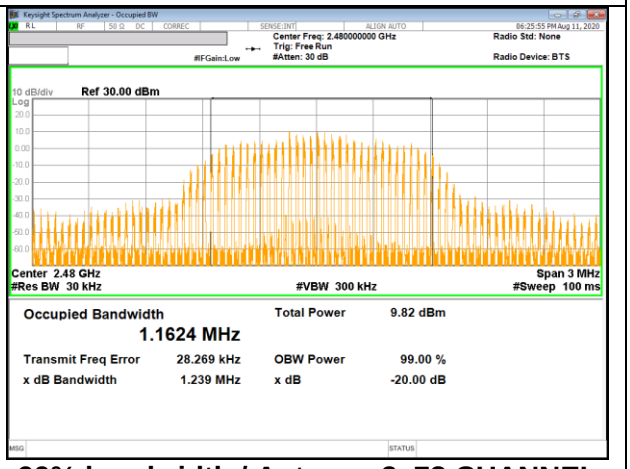
99% bandwidth / Antenna 1, 39 CHANNEL



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.

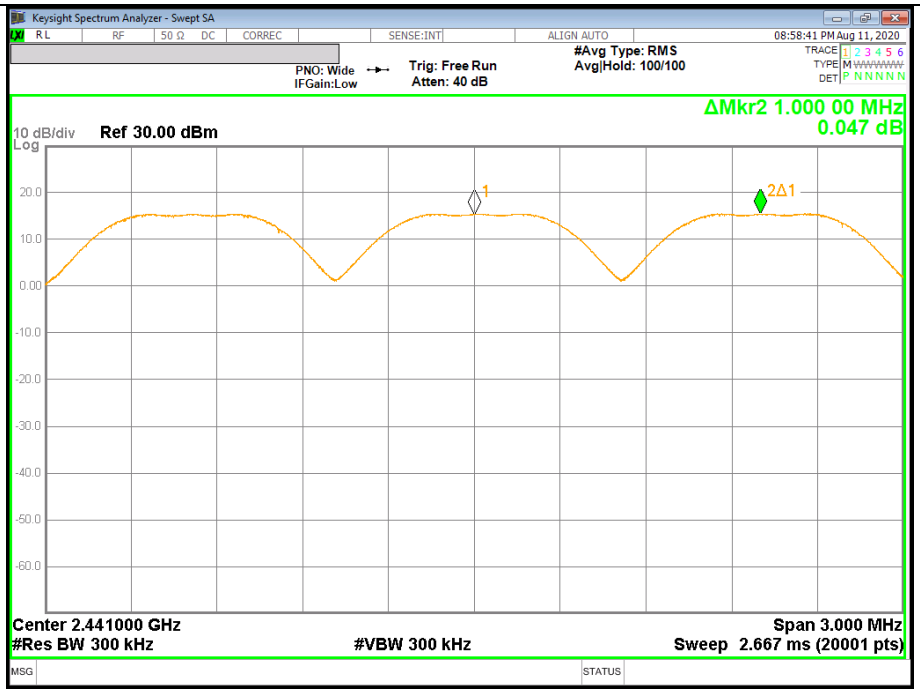
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

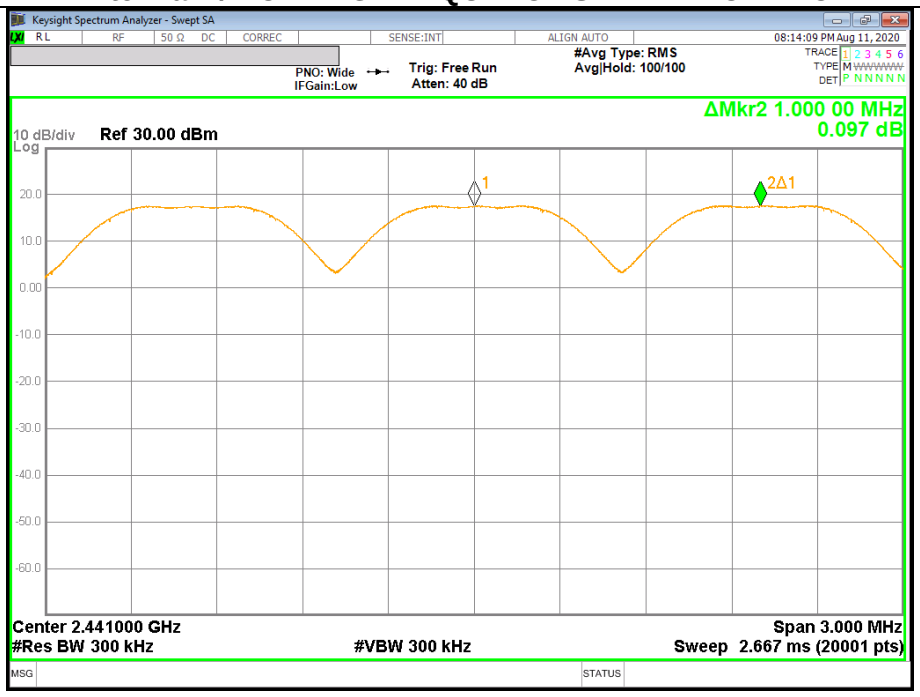
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to VBW >= RBW. The sweep time is coupled.

RESULTS

9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

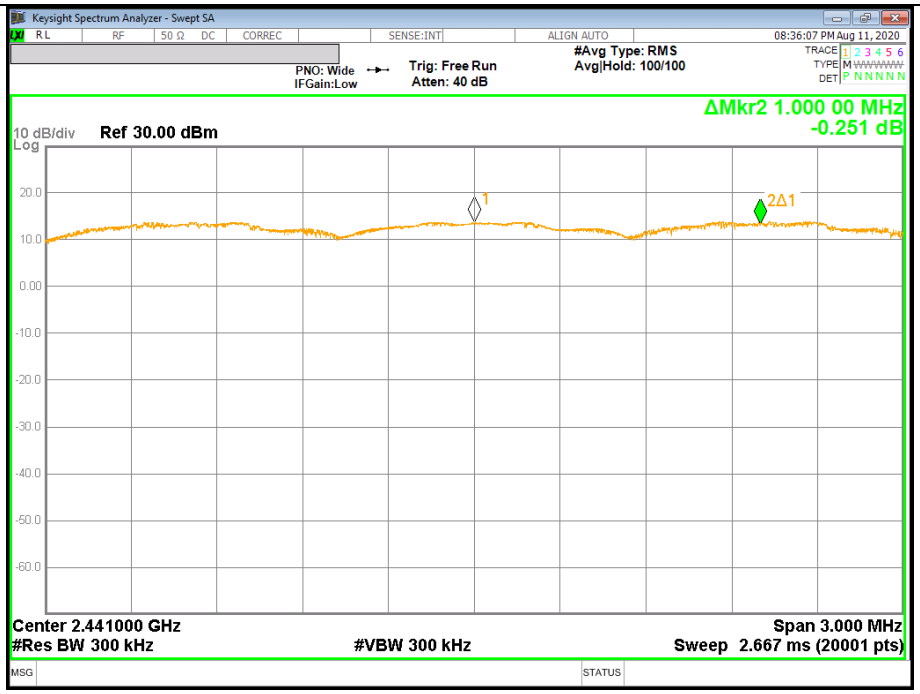


Antenna 1 / HOPPING FREQUENCY SEPARATION PLOT

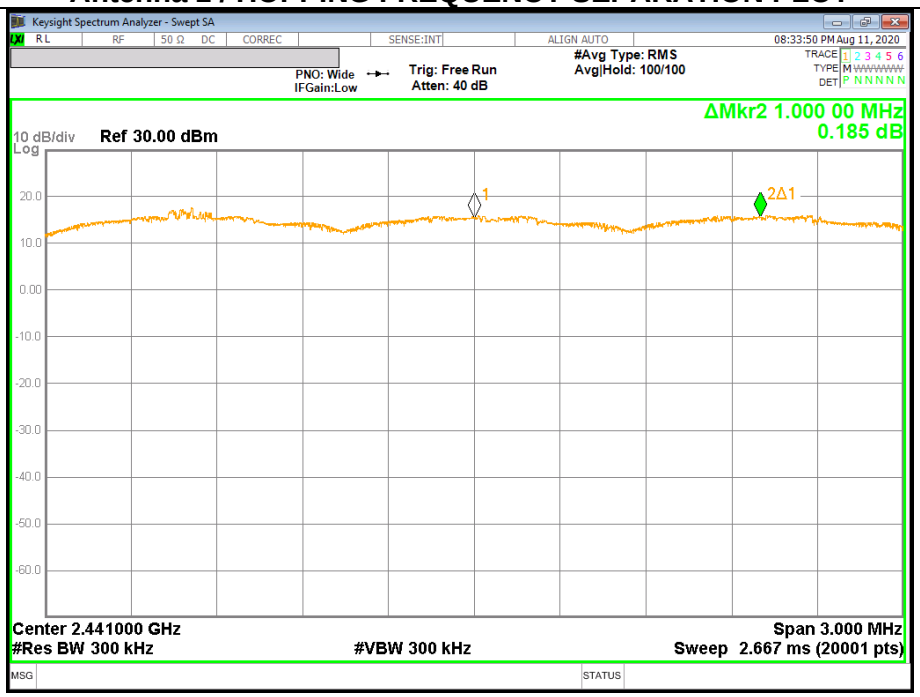


Antenna 2 / HOPPING FREQUENCY SEPARATION PLOT

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.

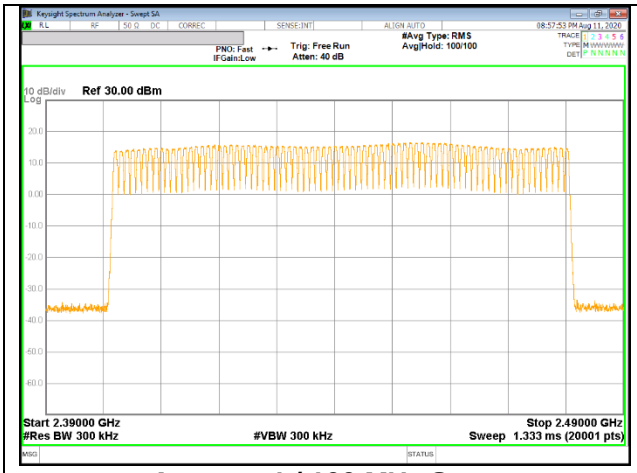
TEST PROCEDURE

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.

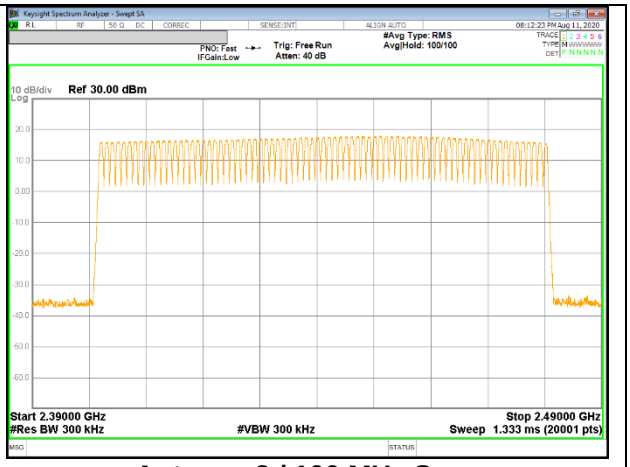
RESULTS

Normal Mode: All Channels Observed

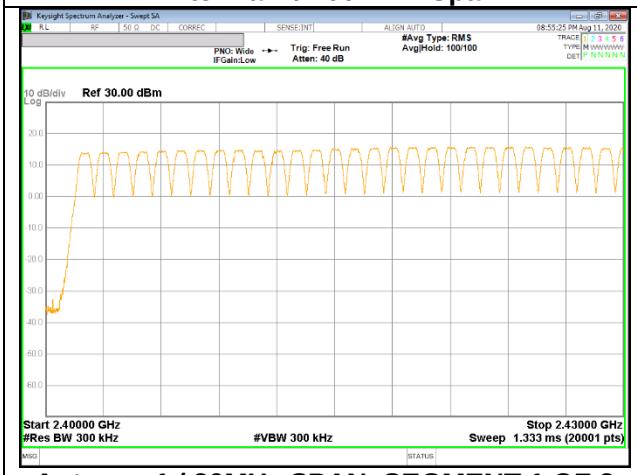
9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



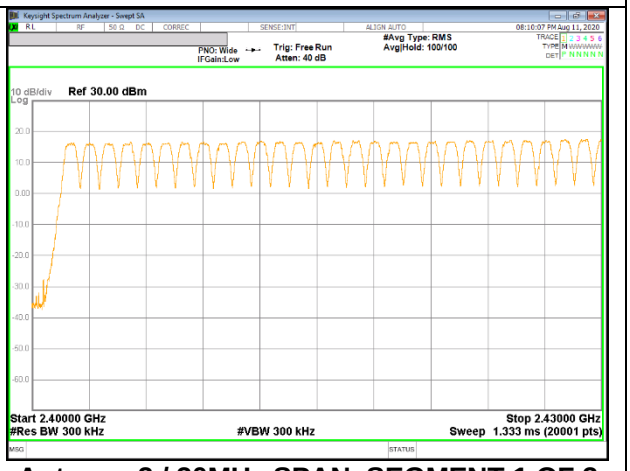
Antenna 1 / 100 MHz Span



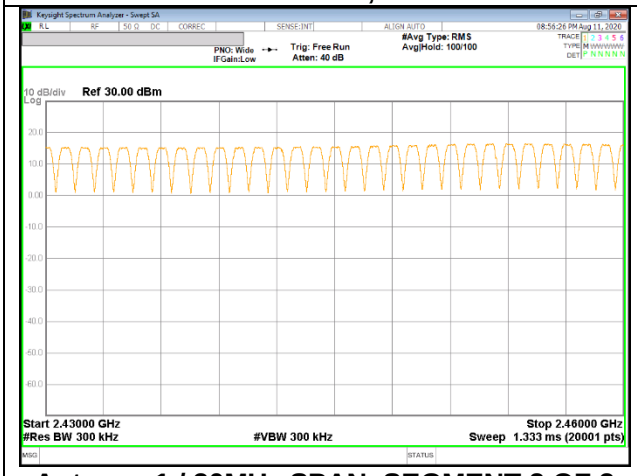
Antenna 2 / 100 MHz Span



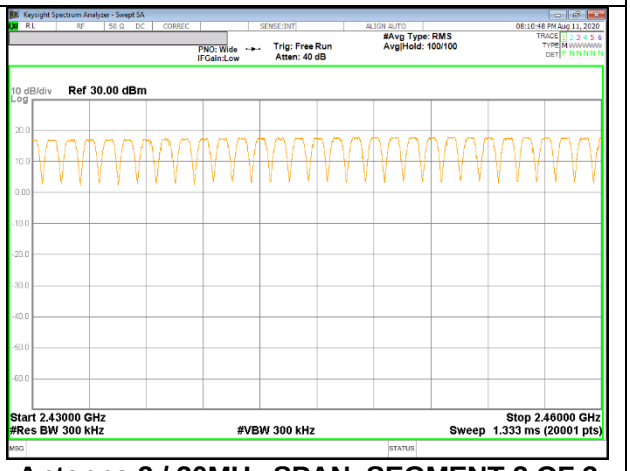
Antenna 1 / 30MHz SPAN, SEGMENT 1 OF 3



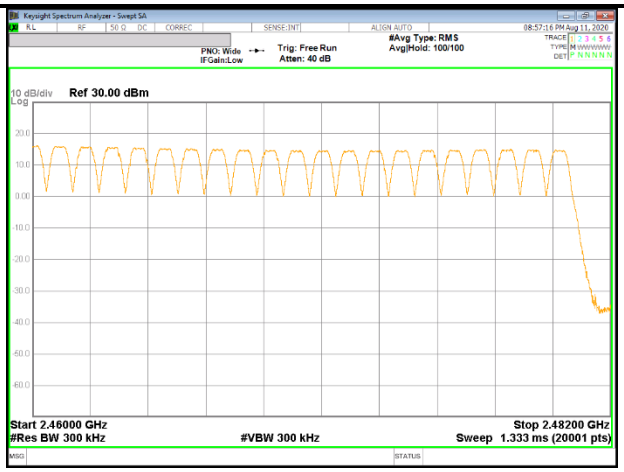
Antenna 2 / 30MHz SPAN, SEGMENT 1 OF 3



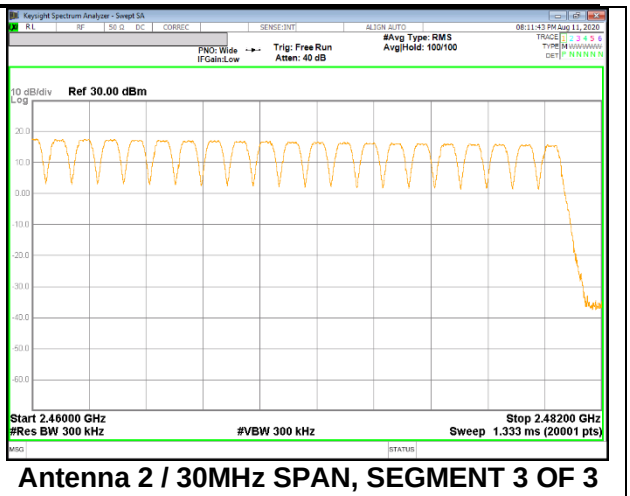
Antenna 1 / 30MHz SPAN, SEGMENT 2 OF 3



Antenna 2 / 30MHz SPAN, SEGMENT 2 OF 3

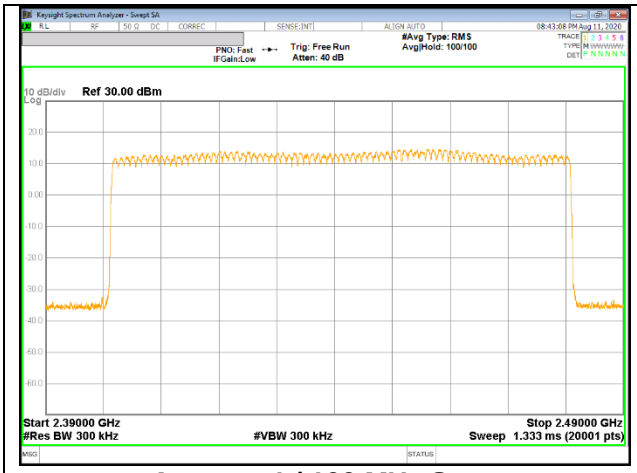


Antenna 1 / 30MHz SPAN, SEGMENT 3 OF 3

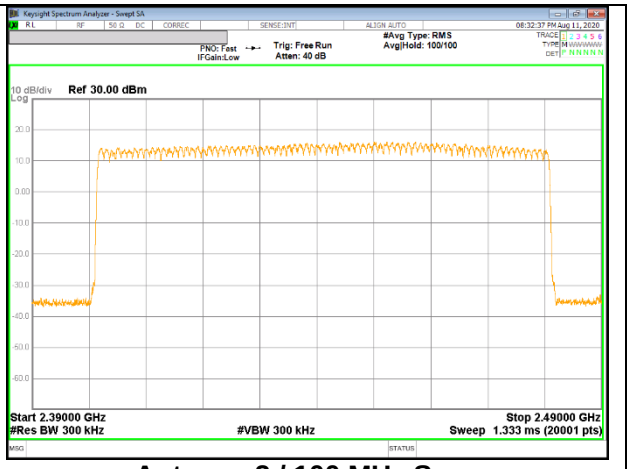


Antenna 2 / 30MHz SPAN, SEGMENT 3 OF 3

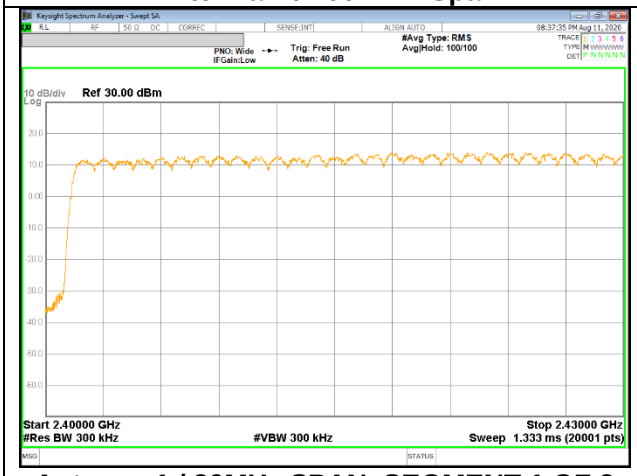
9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



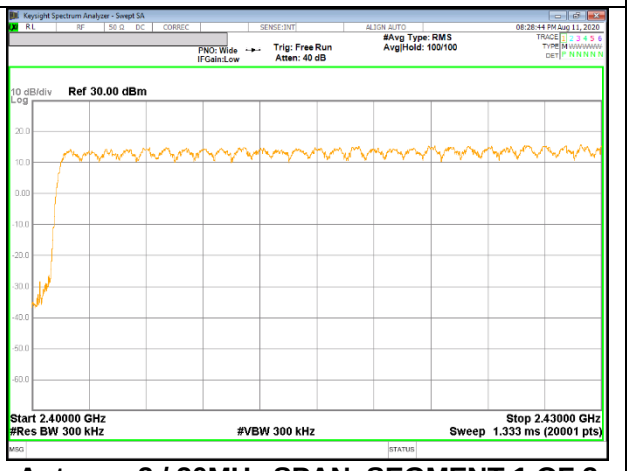
Antenna 1 / 100 MHz Span



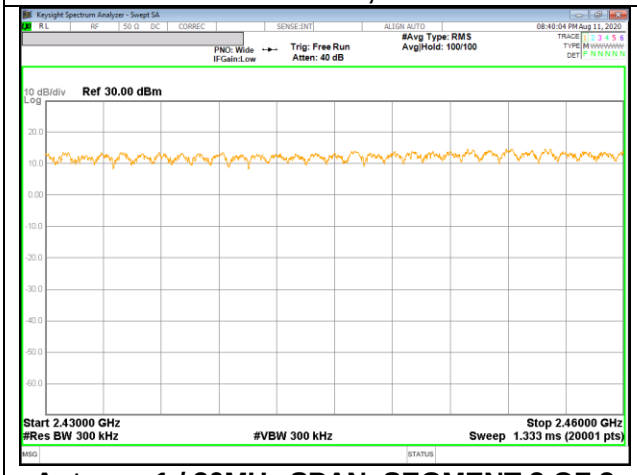
Antenna 2 / 100 MHz Span



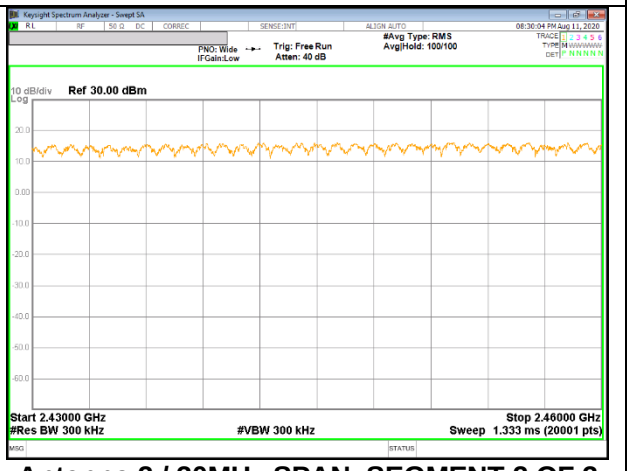
Antenna 1 / 30MHz SPAN, SEGMENT 1 OF 3



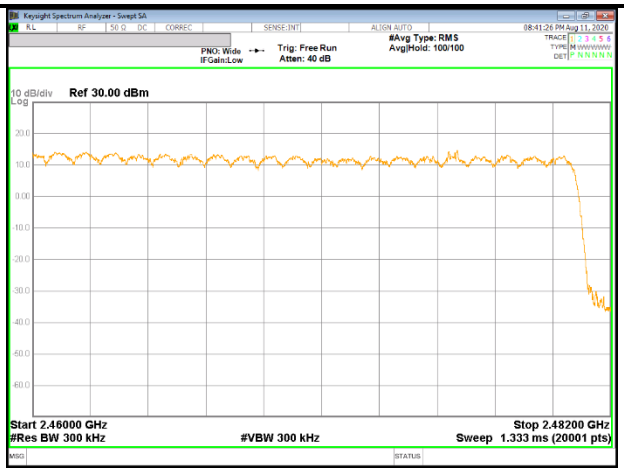
Antenna 2 / 30MHz SPAN, SEGMENT 1 OF 3



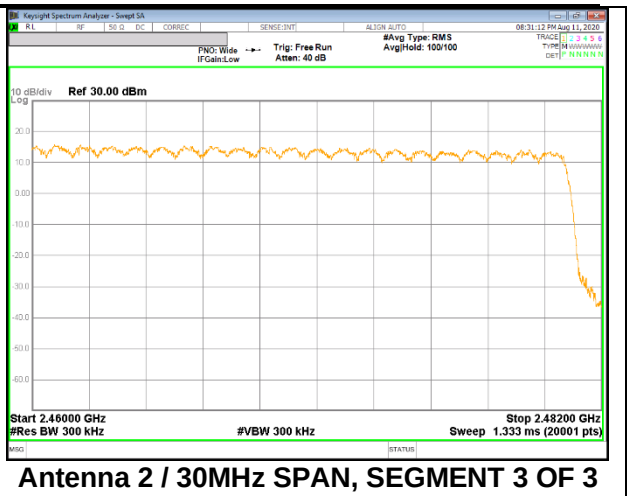
Antenna 1 / 30MHz SPAN, SEGMENT 2 OF 3



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.

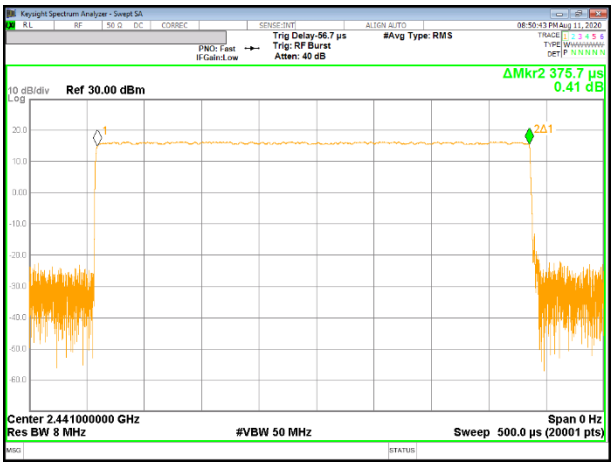
For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to 10 * (# of pulses in 0.8 s) * pulse width.

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	0.120224	0.4	-0.2798
DH3	1.631	16	0.260960	0.4	-0.1390
DH5	2.876	12	0.345120	0.4	-0.0549
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	0.030056	0.4	-0.3699
DH3	1.631	4	0.065240	0.4	-0.3348
DH5	2.876	3	0.086280	0.4	-0.3137

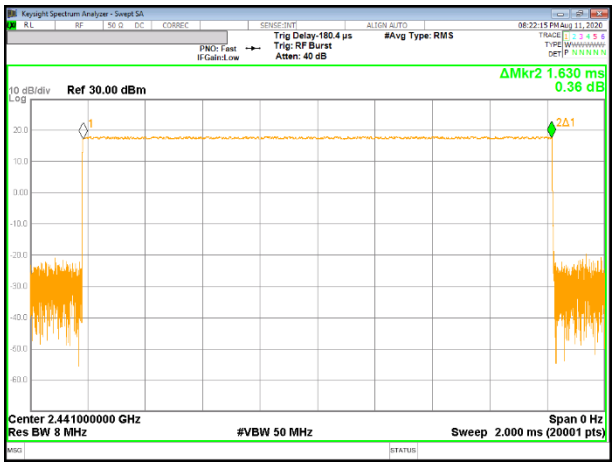
DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK Antenna 2 Normal					
DH1	0.375	32	0.120000	0.4	-0.2800
DH3	1.630	17	0.277100	0.4	-0.1229
DH5	2.876	12	0.345120	0.4	-0.0549
DH Packet	**Pulse Width [msec]**	**Number of Pulses in 0.8 seconds**	**Average Time of Occupancy [sec]**	**Limit [sec]**	**Margin [sec]**
GFSK Antenna 2 AFH					
DH1	0.375	8	0.030000	0.4	-0.37
DH3	1.630	4.25	0.069275	0.4	-0.330725
DH5	2.876	3	0.086280	0.4	-0.31372



Antenna 1 / PULSE WIDTH – DH1

Antenna 2 / PULSE WIDTH – DH1

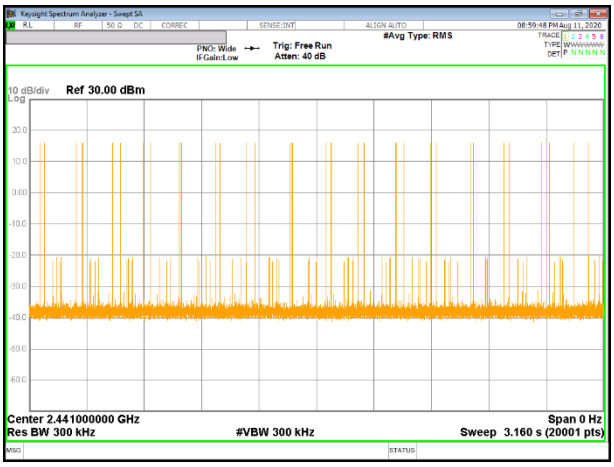
Antenna 1 / PULSE WIDTH – DH3



Antenna 2 / PULSE WIDTH – DH3

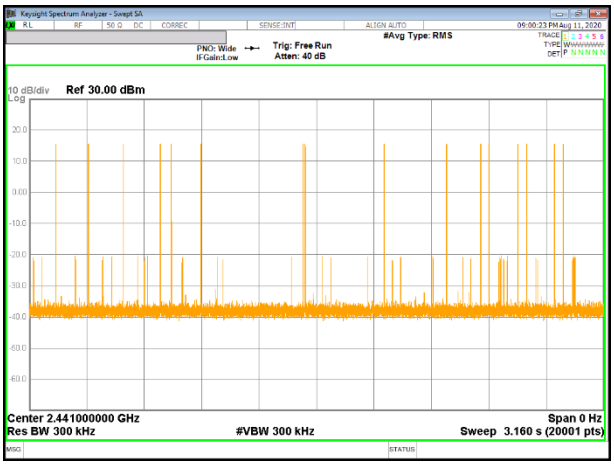
Antenna 1 / PULSE WIDTH – DH5

Antenna 2 / PULSE WIDTH – DH5

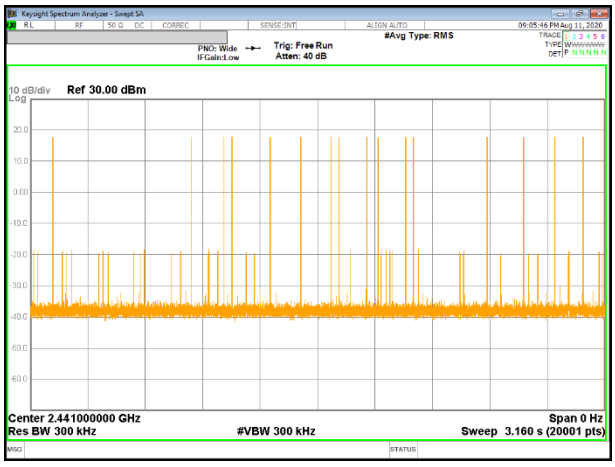


Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1

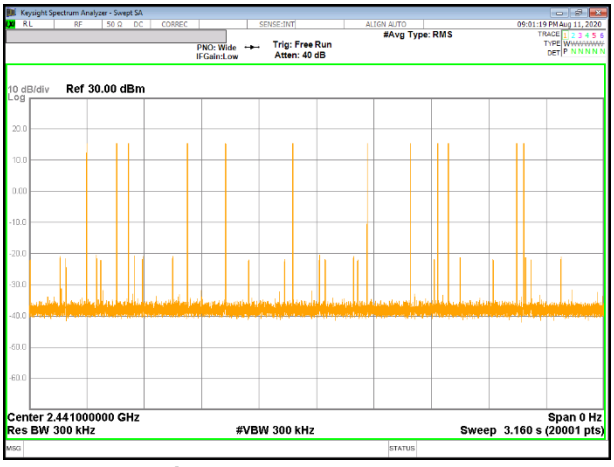
Antenna 2 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



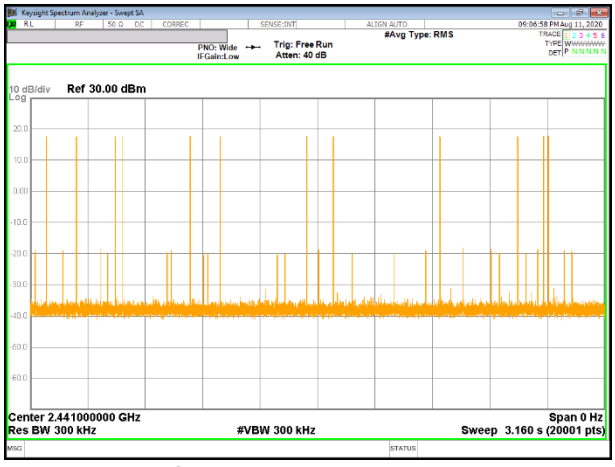
Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



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	0.122208	0.4	-0.2778
DH3	1.632	16	0.261120	0.4	-0.1389
DH5	2.883	12	0.345960	0.4	-0.0540
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	0.030552	0.4	-0.3694
DH3	1.632	4	0.065280	0.4	-0.3347
DH5	2.883	3	0.086490	0.4	-0.3135

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	0.381	32	0.121952	0.4	-0.2780
DH3	1.630	17	0.277100	0.4	-0.1229
DH5	2.882	12	0.345840	0.4	-0.0542
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	0.381	8	0.030488	0.4	-0.369512
DH3	1.630	4.25	0.069275	0.4	-0.330725
DH5	2.882	3	0.086460	0.4	-0.31354

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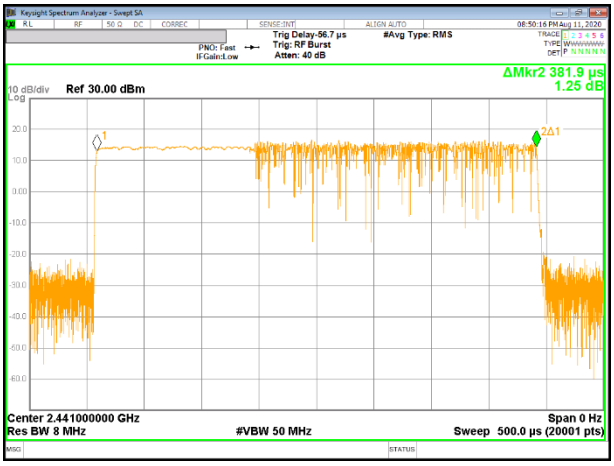
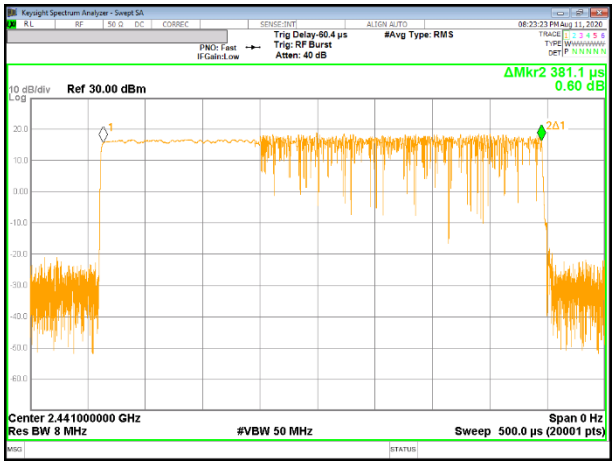
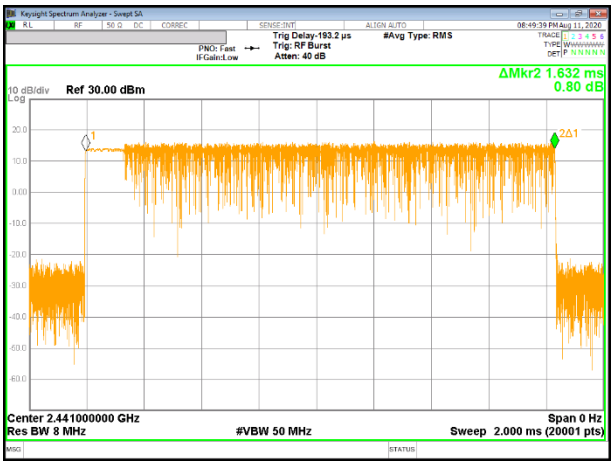


Antenna 1 / PULSE WIDTH – 3-DH1



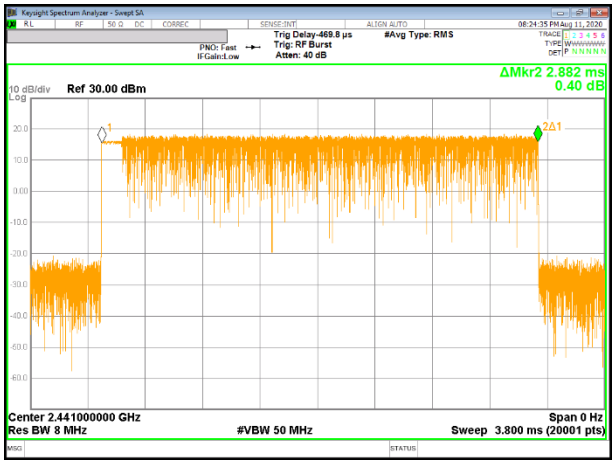
Antenna 2 / PULSE WIDTH – 3-DH1



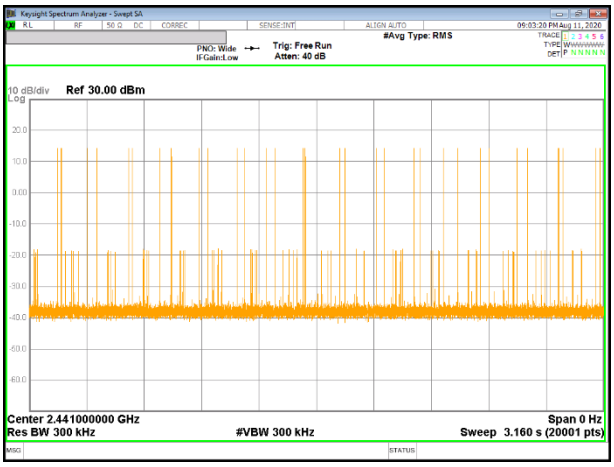
Antenna 1 / PULSE WIDTH – 3-DH3

Antenna 2 / PULSE WIDTH – 3-DH3

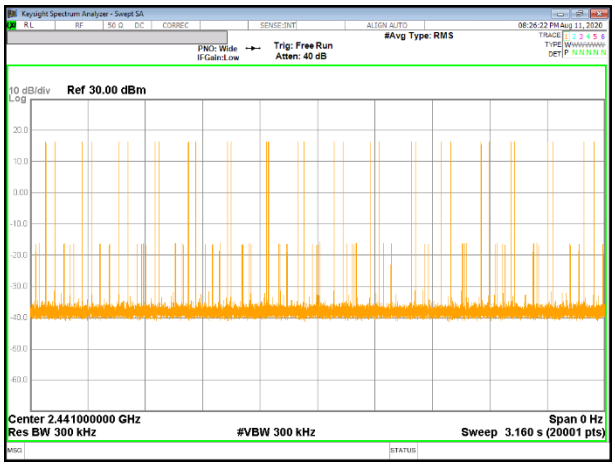
Antenna 1 / PULSE WIDTH – 3-DH5



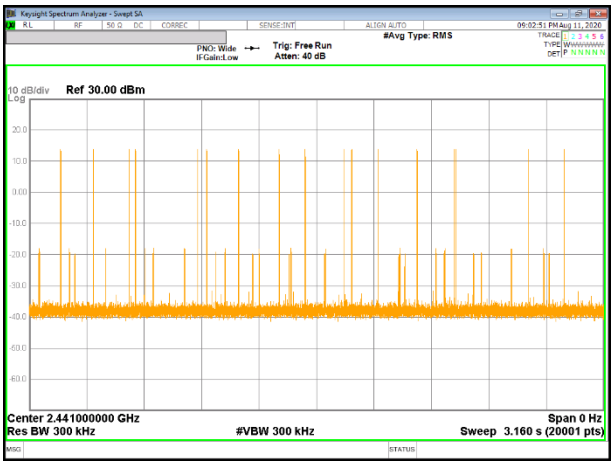
Antenna 2 / PULSE WIDTH – 3-DH5



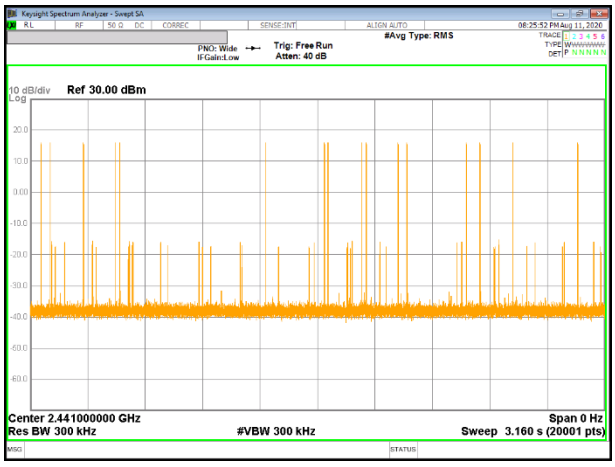
Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH1



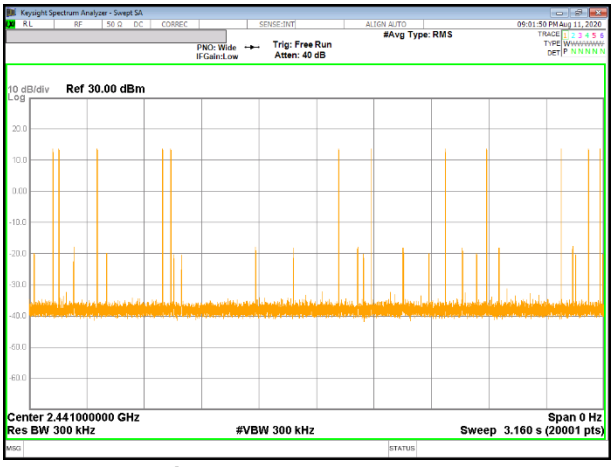
Antenna 2 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH1



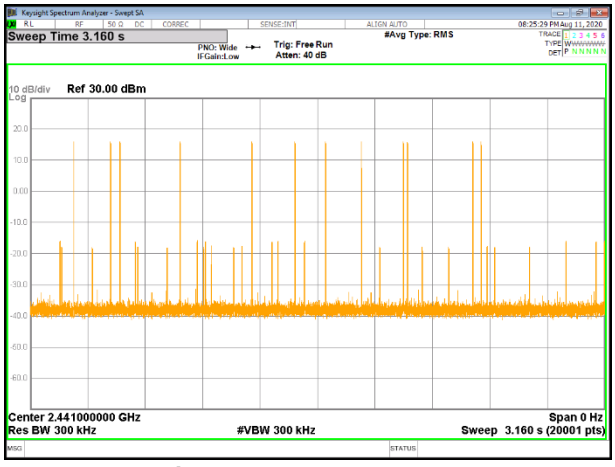
Antenna 1 / NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH3



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	14.916	21.000	-6.084
	39	2 441	16.376	21.000	-4.624
	78	2 480	15.805	21.000	-5.195
Antenna 2	0	2 402	16.711	21.000	-4.289
	39	**2 441**	**18.350**	**21.000**	**-2.650**
	78	2 480	16.486	21.000	-4.514
Worst			18.350	21.000	-2.650

9.6.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

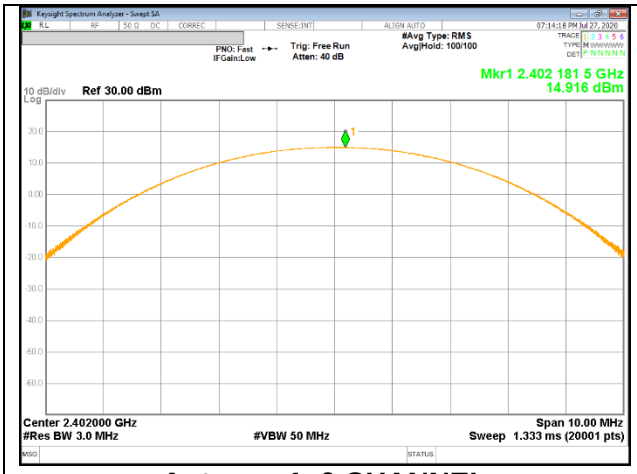
Chain	Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dBm]
Antenna 1	0	2 402	14.730	21.000	-6.270
	39	2 441	16.203	21.000	-4.797
	78	2 480	15.619	21.000	-5.381
Antenna 2	0	2 402	16.518	21.000	-4.482
	39	**2 441**	**18.176**	**21.000**	**-2.824**
	78	2 480	16.304	21.000	-4.696
Worst			18.176	21.000	-2.824

9.6.3. ENHANCED DATA RATE 8PSK MODULATION

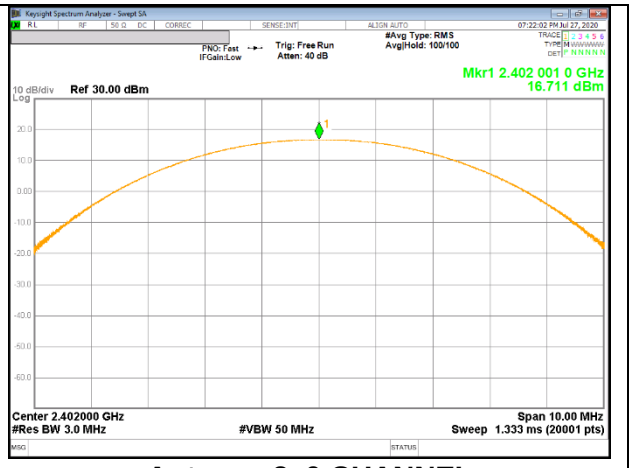
Chain	Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dBm]
Antenna 1	0	2 402	15.277	21.000	-5.723
	39	2 441	16.698	21.000	-4.302
	78	2 480	16.133	21.000	-4.867
Antenna 2	0	2 402	17.012	21.000	-3.988
	39	**2 441**	**18.655**	**21.000**	**-2.345**
	78	2 480	16.745	21.000	-4.255
Worst			18.655	21.000	-2.345

9.6.4. OUTPUT POWER PLOTS

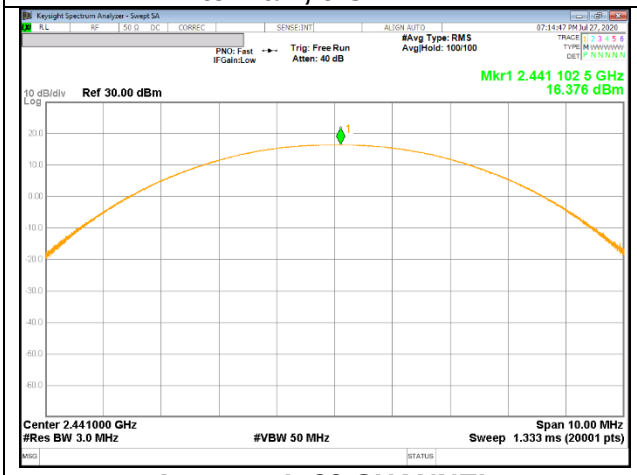
GFSK OUTPUT POWER



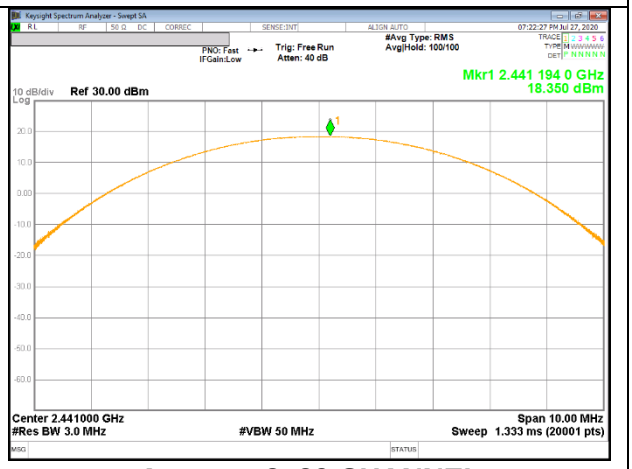
Antenna 1, 0 CHANNEL



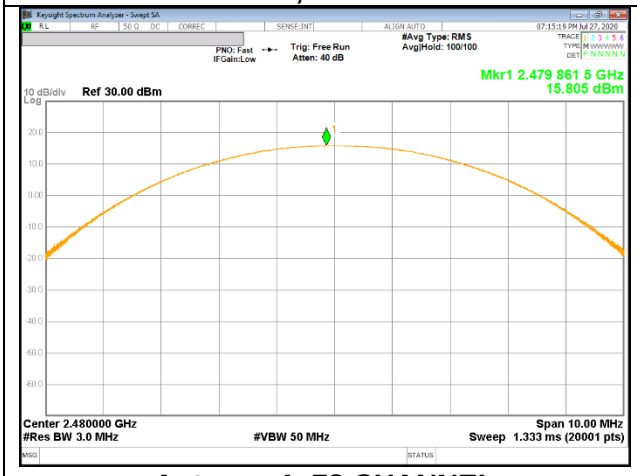
Antenna 2, 0 CHANNEL



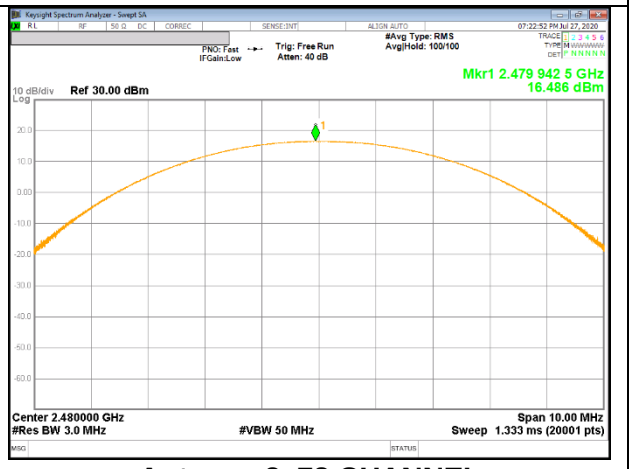
Antenna 1, 39 CHANNEL



Antenna 2, 39 CHANNEL

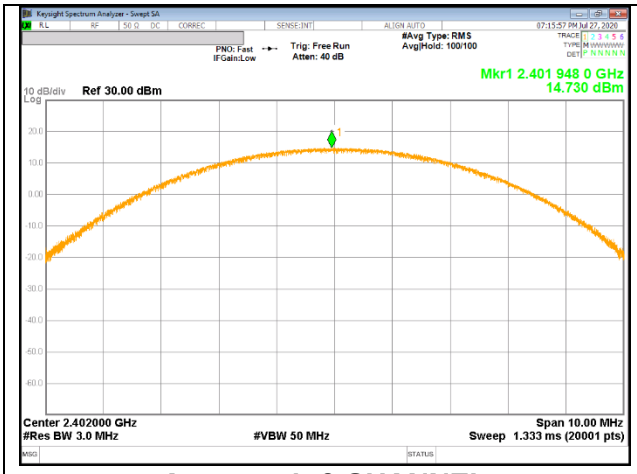


Antenna 1, 78 CHANNEL

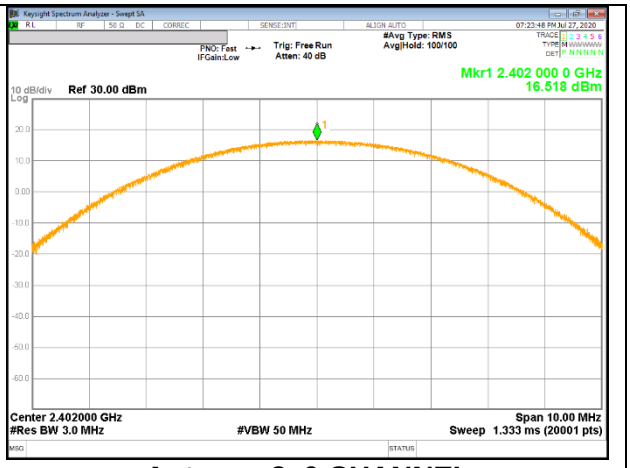


Antenna 2, 78 CHANNEL

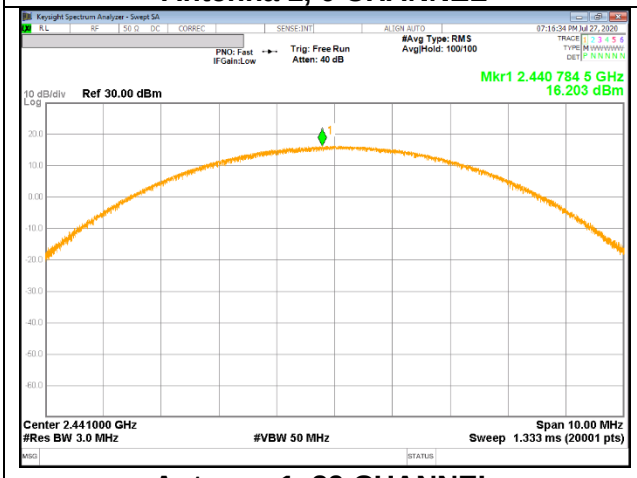
Pi/4-DPSK OUTPUT POWER



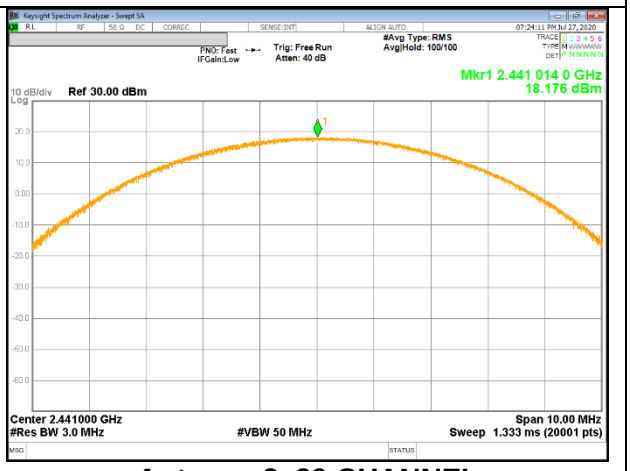
Antenna 1, 0 CHANNEL



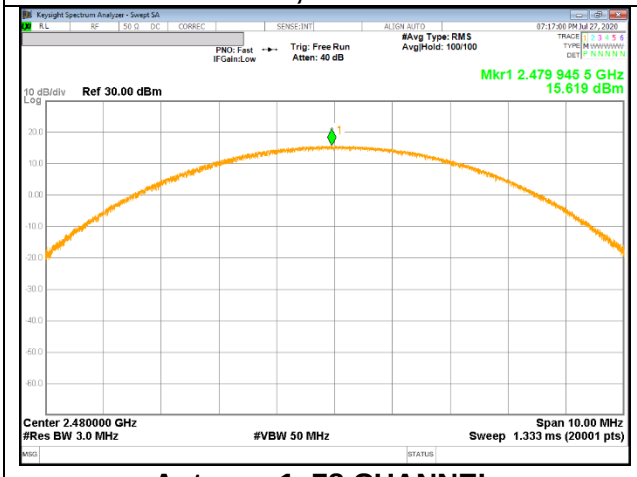
Antenna 2, 0 CHANNEL



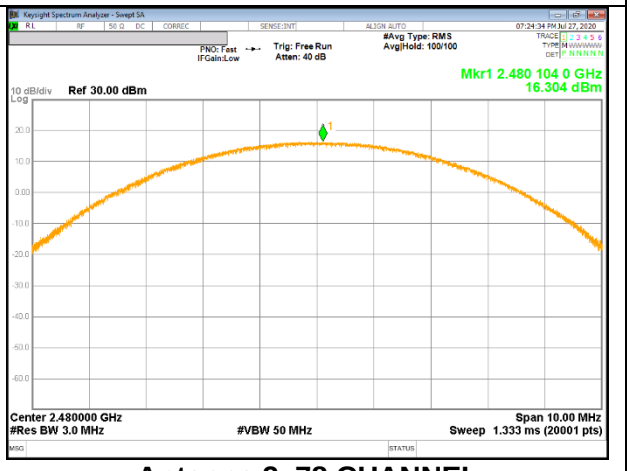
Antenna 1, 39 CHANNEL



Antenna 2, 39 CHANNEL

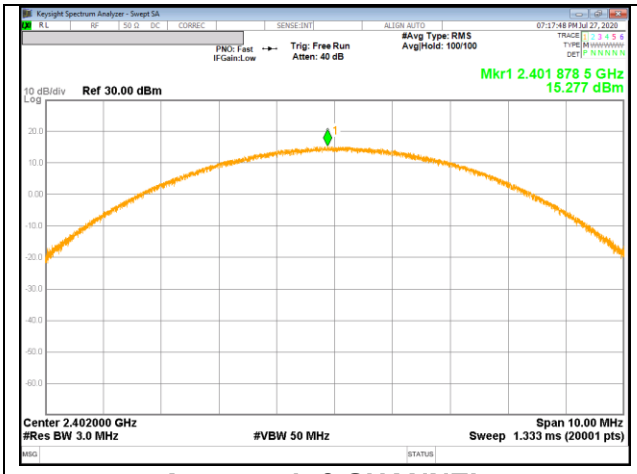


Antenna 1, 78 CHANNEL

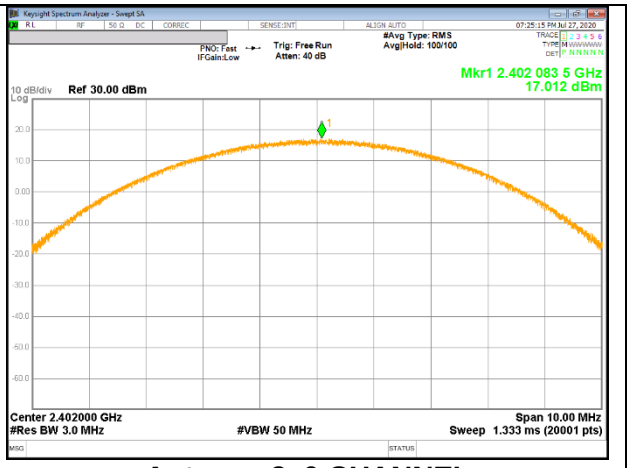


Antenna 2, 78 CHANNEL

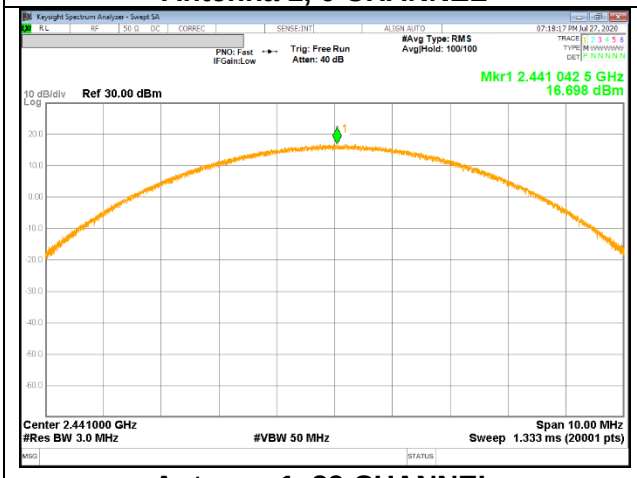
8PSK OUTPUT POWER



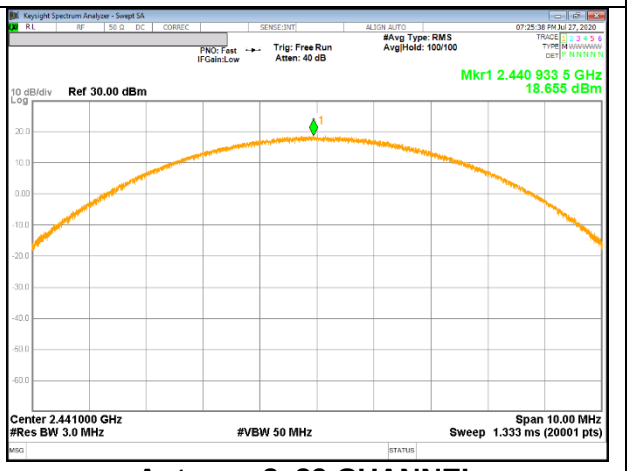
Antenna 1, 0 CHANNEL



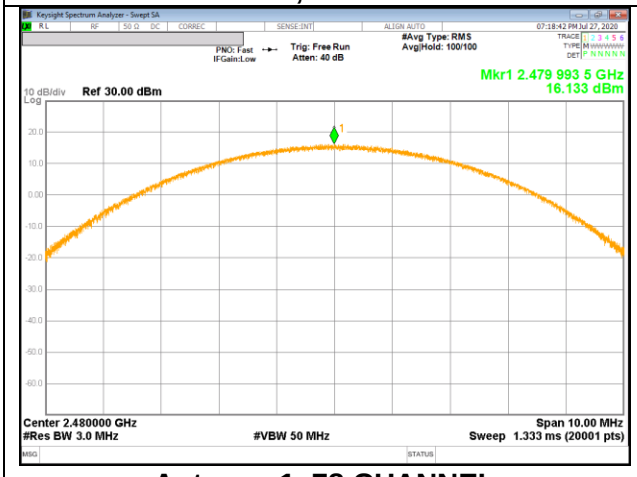
Antenna 2, 0 CHANNEL



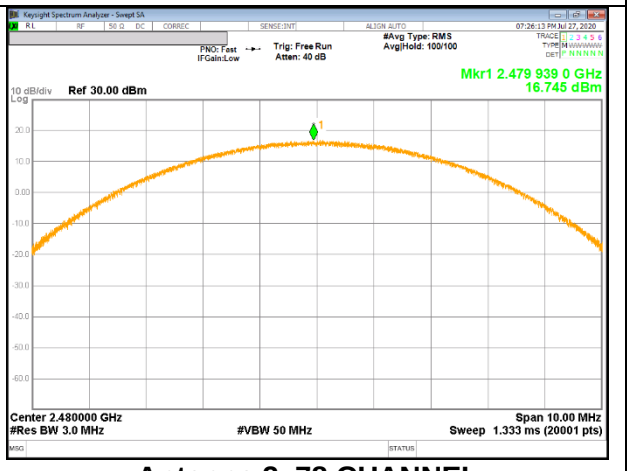
Antenna 1, 39 CHANNEL



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	14.440	27.797
	39	2 441	15.899	38.896
	78	2 480	15.314	33.994
Antenna 2	0	2 402	16.261	42.277
	39	**2 441**	**17.872**	**61.263**
	78	2 480	16.036	40.142

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	12.297	16.971
	39	2 441	13.700	23.442
	78	2 480	13.134	20.578
Antenna 2	0	2 402	14.060	25.468
	39	**2 441**	**15.666**	**36.864**
	78	2 480	13.862	24.333

9.7.3. ENHANCED DATA RATE 8PSK MODULATION

Chain	Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Antenna 1	0	2 402	12.162	16.451
	39	2 441	13.686	23.367
	78	2 480	13.278	21.272
Antenna 2	0	2 402	13.974	24.969
	39	**2 441**	**15.639**	**36.635**
	78	2 480	13.847	24.249

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.

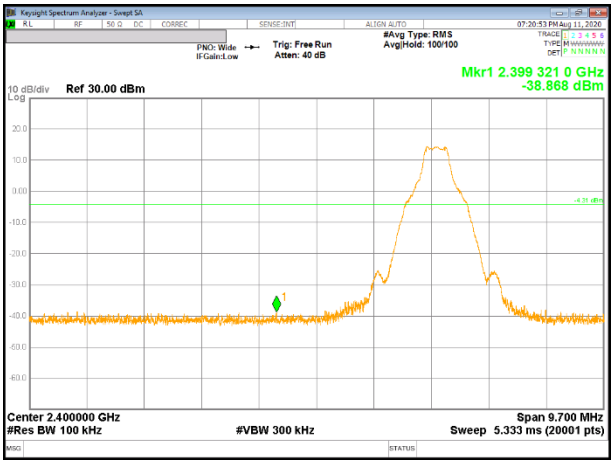
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

RESULTS

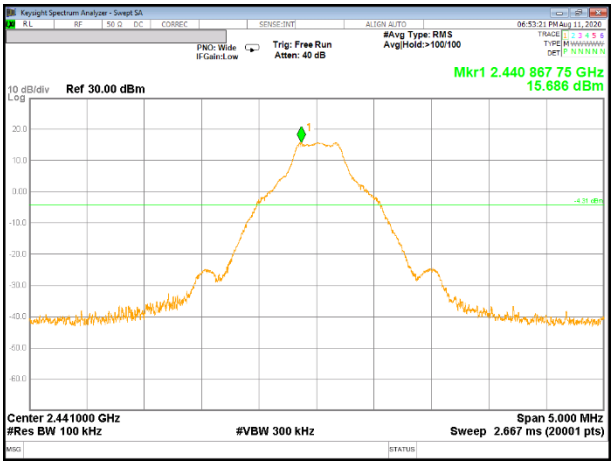
9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

SPURIOUS EMISSIONS, NON-HOPPING(Antenna 1)



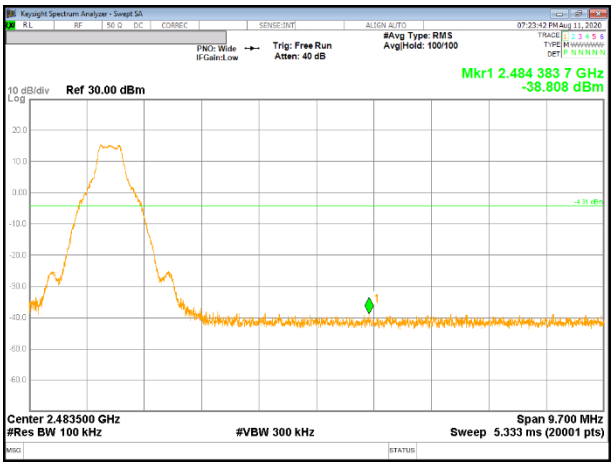
0 CHANNEL BANDEDGE

OUT-OF-BAND 0 CHANNEL



IN-BAND REFERENCE LEVEL

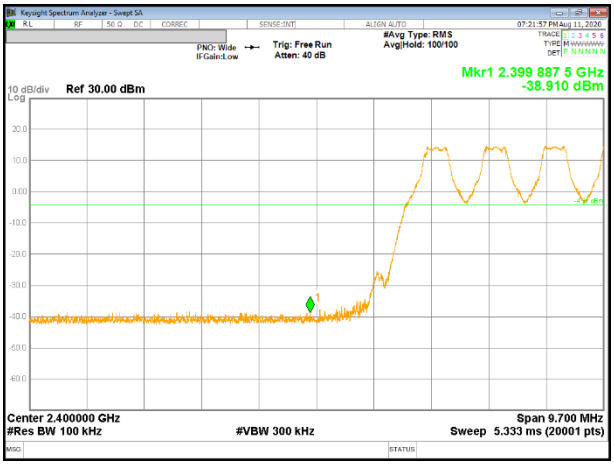
OUT-OF-BAND 39 CHANNEL



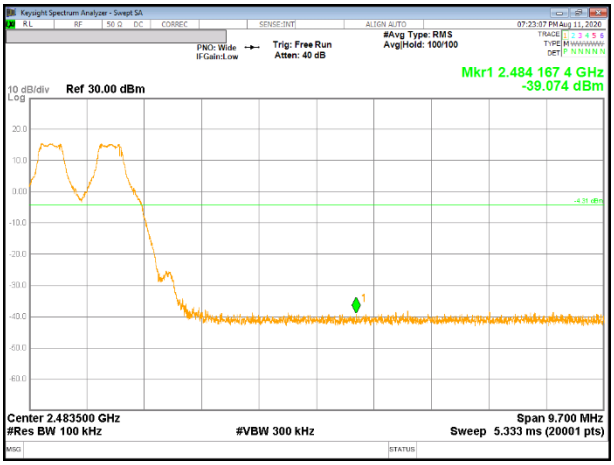
78 CHANNEL BANDEDGE

OUT-OF-BAND 78 CHANNEL

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

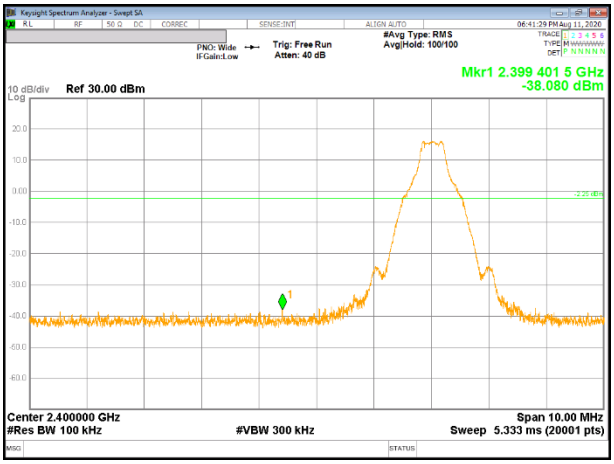


LOW BANDEDGE



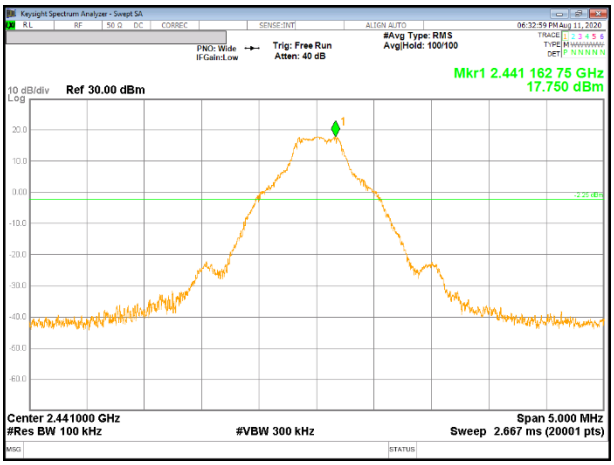
HIGH BANDEDGE

SPURIOUS EMISSIONS, NON-HOPPING(Antenna 2)



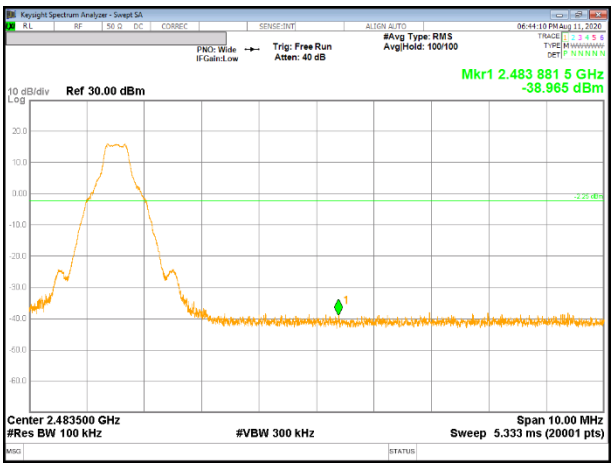
0 CHANNEL BANDEDGE

OUT-OF-BAND 0 CHANNEL



IN-BAND REFERENCE LEVEL

OUT-OF-BAND 39 CHANNEL



78 CHANNEL BANDEDGE

OUT-OF-BAND 78 CHANNEL