



FCC CFR47 PART 15 SUBPART C

Bluetooth

CERTIFICATION TEST REPORT

FOR

LTE Watch + Bluetooth/BLE and DTS b/g/n

MODEL NUMBER : SM-R765, SM-R765S, SM-R765K, SM-R765L

FCC ID: A3LSMR765KOR

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Revision History

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V1	08/26/16	Initial issue	Junwhan Lee
V2	08/30/16	Revised section 5.1	Junwhan Lee
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION: LTE Watch + Bluetooth/BLE and DTS b/g/n
MODEL NUMBER: SM-R765, SM-R765S, SM-R765K, SM-R765L
SERIAL NUMBER: R3AH800BKEB, R3AH800BKDE (RADIATED);
R3AH800BKAL (CONDUCTED)
DATE TESTED: AUG 10, 2016 - AUG 25, 2016

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass

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
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CY Choi
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Tested By:



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Suwon Lab Engineer
UL Korea, Ltd.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

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	
<input checked="" type="checkbox"/>	Chamber 1
<input type="checkbox"/>	Chamber 2

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <http://www.iasonline.org/PDF/TL/TL-637.pdf>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamplifier Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

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	2.32 dB
Radiated Disturbance, Below 1GHz	4.14 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a LTE Watch + Bluetooth/BLE and DTS b/g/n.
This test report addresses the DSS (BT) operational mode.

SM-R765, SM-R765S, SM-R765K and SM-R765L are same H/W, only difference is UI (App, Booting logo) for network operator. SM-R765 was used for the tests

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range [MHz]	Mode	Power Mode	Output Power [dBm]	Output Power [mW]
2402 - 2480	Basic GFSK	Average	14.429	27.727
		Peak	14.641	29.114
	Enhanced Pi/4-DPSK	Average	11.695	14.774
		Peak	13.834	24.177
	Enhanced 8PSK	Average	11.703	14.801
		Peak	14.279	26.786

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. For average power data please refer to section 8.6.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antenna, with a maximum gain of -4.5 dBi.

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.

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

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Adapter	SAMSUNG	EP-TA60EBE	R37G9A2082RT3	N/A
Wireless Charger	SAMSUNG	EP-YO760	N/A	A3LEPYO760

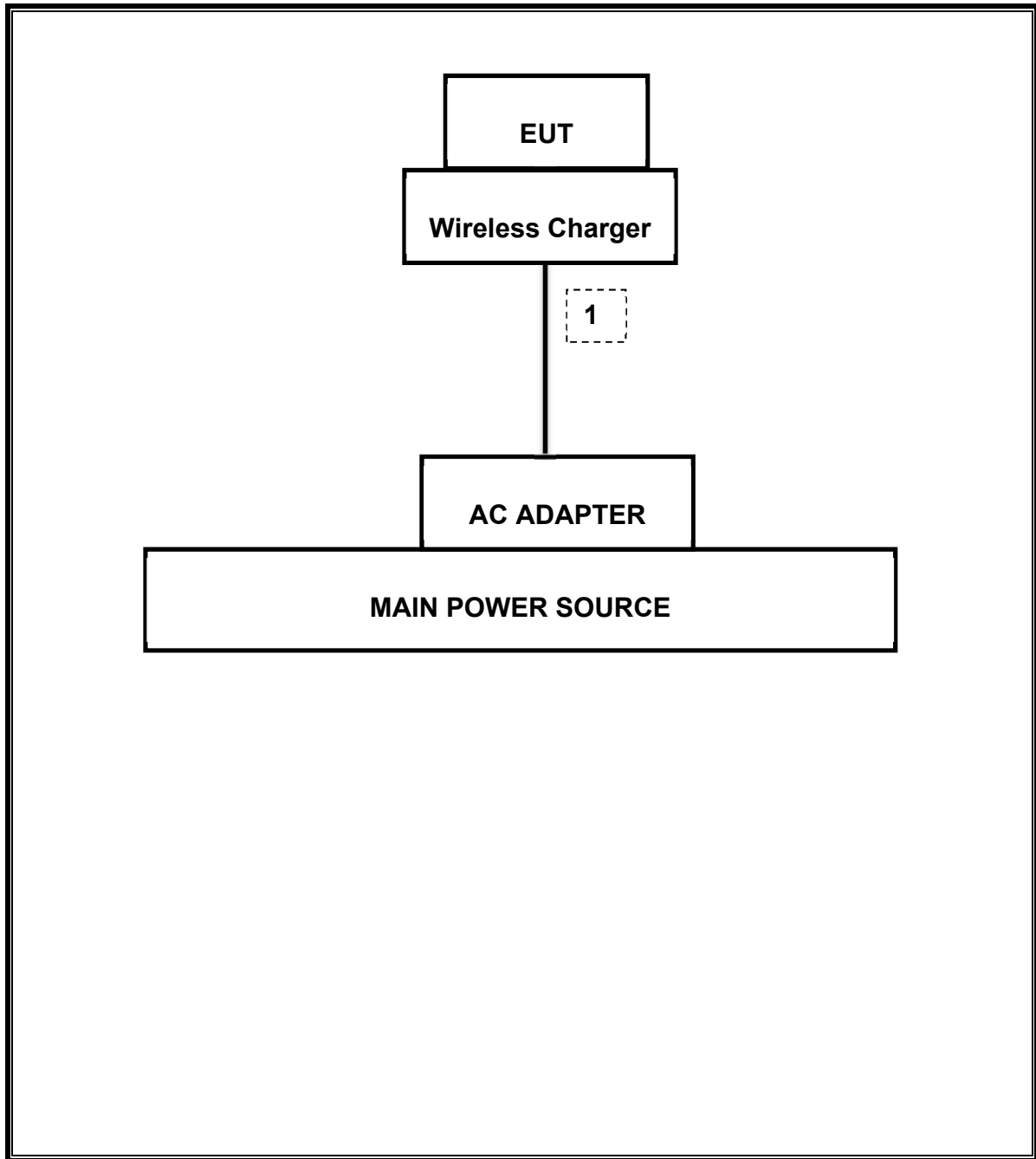
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	Mini-USB	Shielded	0.8m	N/A

TEST SETUP

The EUT is continuously communicating to the Bluetooth tester during the tests.
EUT was set in the Hidden menu mode to enable BT communications.

SETUP DIAGRAM FOR TESTS



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	11-17-16
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	04-25-17
Antenna, Horn, 18 GHz	ETS	3115	00167211	09-20-16
Antenna, Horn, 18 GHz	ETS	3115	00161451	05-17-17
Antenna, Horn, 18 GHz	ETS	3117	00168724	06-17-17
Antenna, Horn, 18 GHz	ETS	3117	00168717	06-17-17
Antenna, Horn, 40 GHz	ETS	3116C	00166155	11-30-17
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	12-15-17
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-17-17
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-16-17
Preamplifier	ETS	3115-PA	00167475	08-17-17
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-16-17
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-17-17
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-16-17
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	08-18-17
Average Power Sensor	R&S	NRZ-Z91	102681	08-16-17
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-17-17
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-17-17
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-16-17
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-16-17
Attenuator / Switch driver	HP	11713A	3748A04272	N/A
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-17-17
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-16-17
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-17-17
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-16-17
High Pass Filter 6GHz	Micro-Tronics	HPM17542	009	08-17-17
High Pass Filter 6GHz	Micro-Tronics	HPM17542	016	08-16-17
LISN	R&S	ENV-216	101836	08-16-17
LISN	R&S	ENV-216	101837	08-16-17
Attenuator	PASTERNAK	PE7087-10	A009	08-16-17

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result	Worst Case
2.1049	Occupied Band width (99%)	N/A	Conducted	Pass	1.199 MHz
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-39.925 dBm
15.247 (b)(1)	TX conducted output power	<21dBm		Pass	14.641 dBm (Peak)
15.247 (a)(1)	Hopping frequency separation	> 25KHz		Pass	1 MHz
15.247 (a)(1)(iii)	Number of Hopping channels	More than 15 non-overlapping channels		Pass	79
15.247 (a)(1)(iii)	Avg Time of Occupancy	< 0.4sec		Pass	0.37388 sec
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass	37.84 dBuV (Pk)
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass	43.33 dBuV/m (Av)

8. ANTENNA PORT TEST RESULTS

8.1. 20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

DA 00-705: The transmitter output is connected to a spectrum analyzer. The RBW is set to \geq 1% of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

RESULTS

8.1.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [KHz]
Low	2402	1.045	896.080
Mid	2441	1.029	896.790
High	2480	1.047	899.240
Worst		1.047	899.240

8.1.2. ENHANCED DATA RATE Pi/4-DQPSK MODULATION

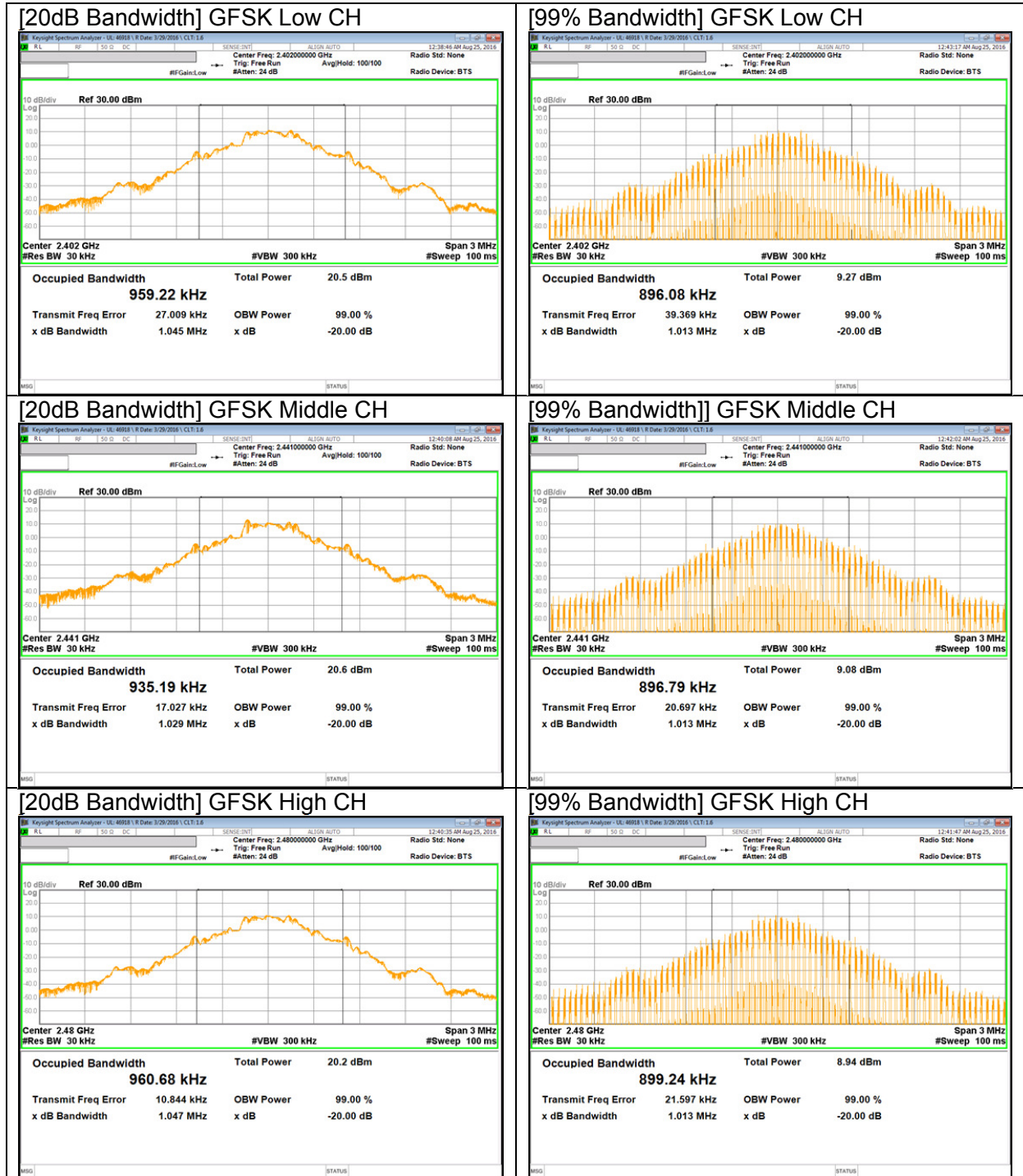
Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.289	1.165
Mid	2441	1.288	1.196
High	2480	1.286	1.199
Worst		1.289	1.199

8.1.3. ENHANCED DATA RATE 8PSK MODULATION

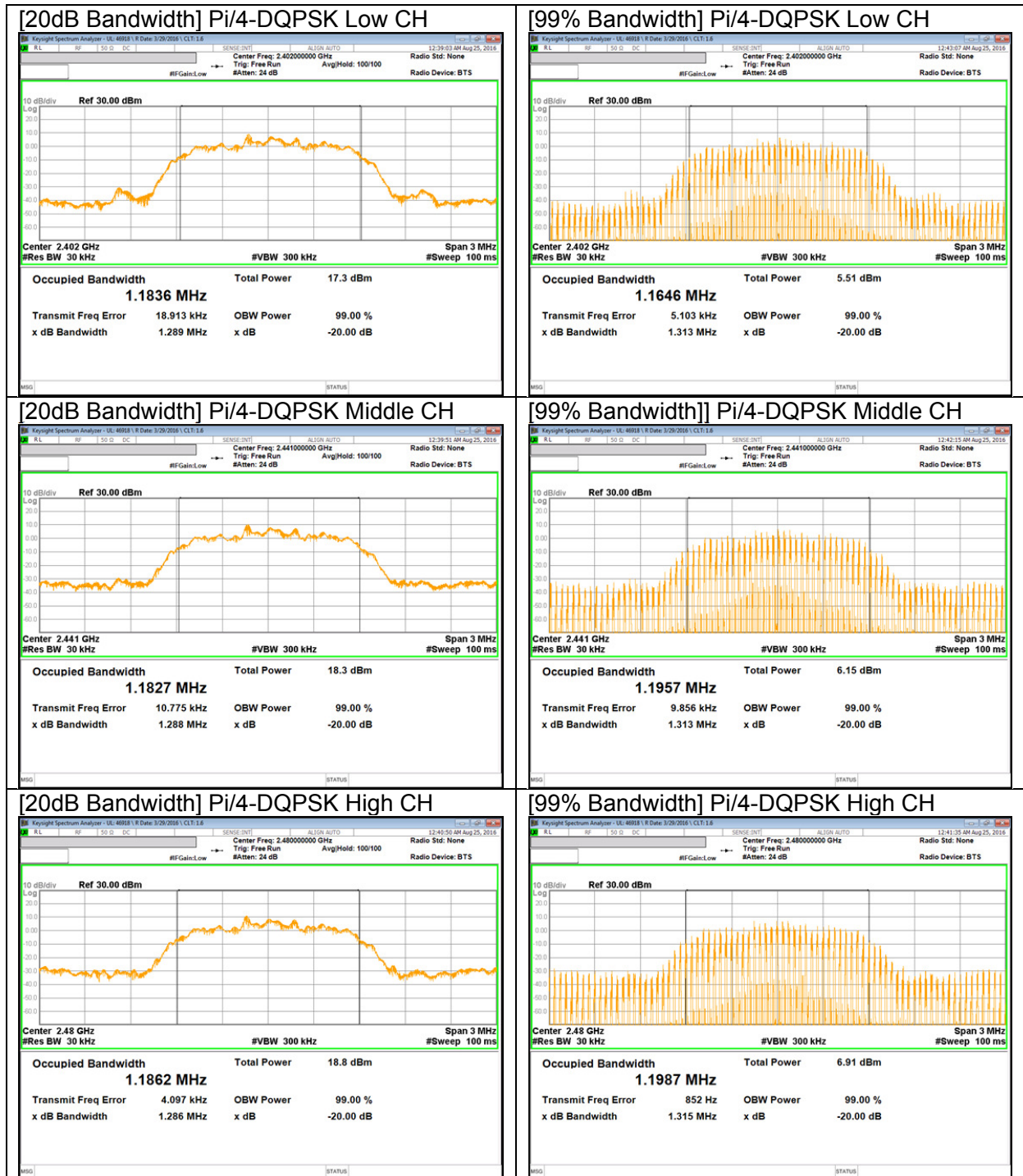
Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.298	1.195
Mid	2441	1.299	1.195
High	2480	1.299	1.167
Worst		1.299	1.195

8.1.4. 20 dB AND 99% BANDWIDTH PLOTS

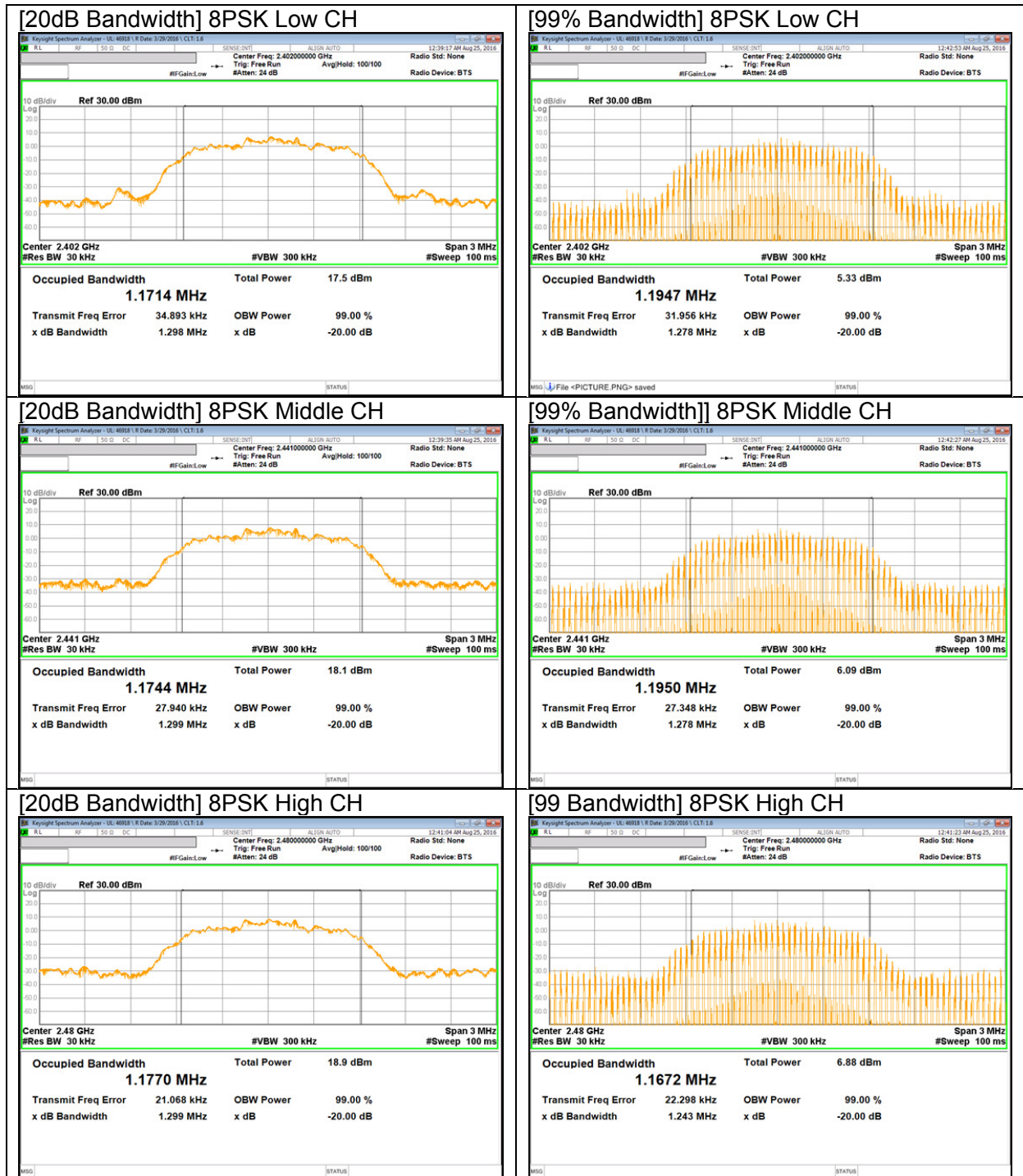
GFSK BANDWIDTH



Pi/4-DQPSK BANDWIDTH



8PSK BANDWIDTH



8.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

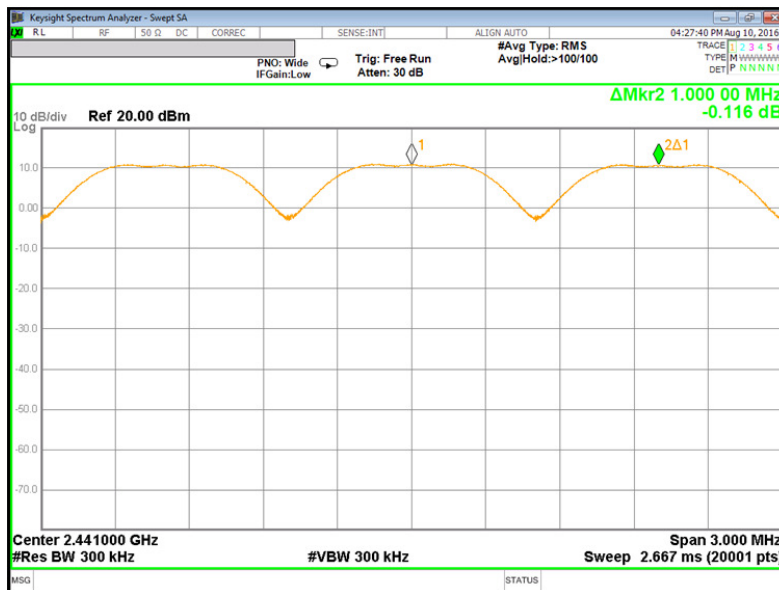
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

DA 00-705: The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION PLOT



8.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

TEST PROCEDURE

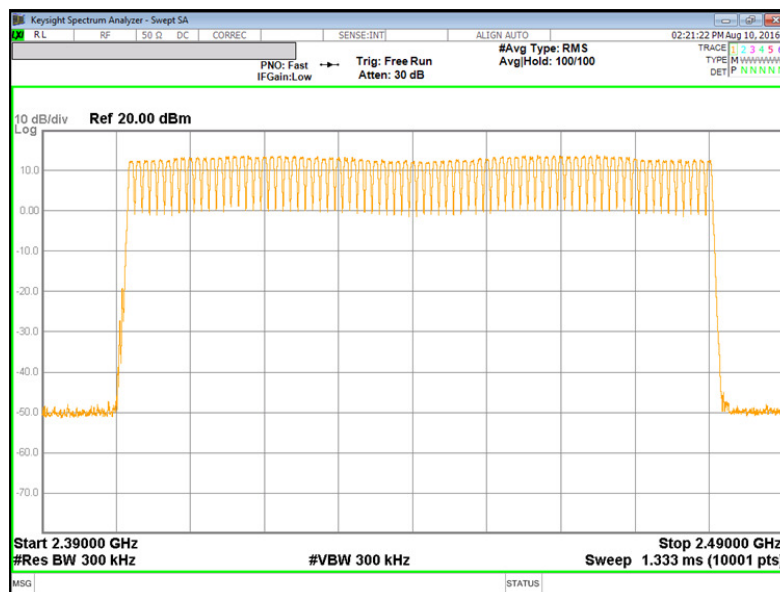
DA 00-705: The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

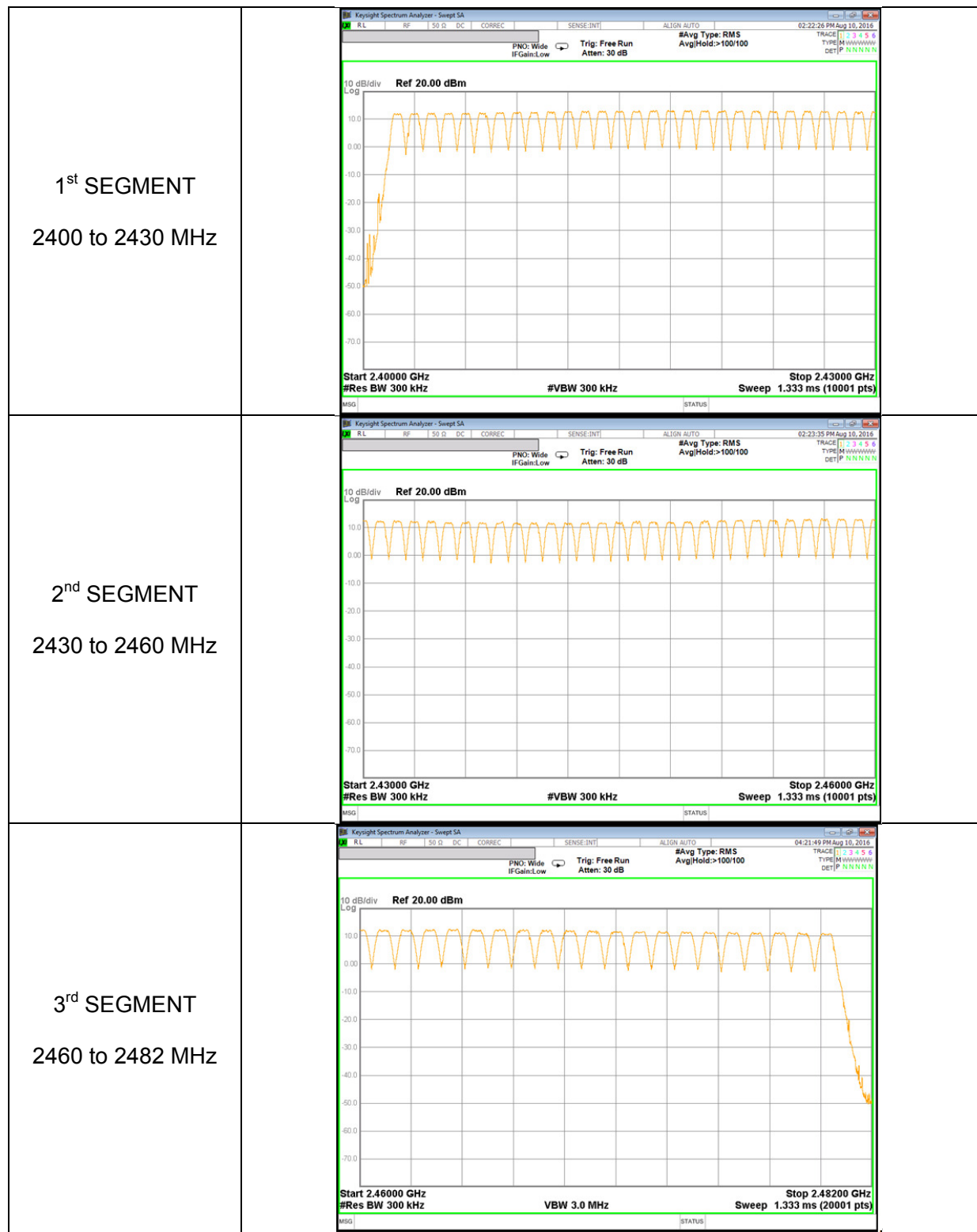
RESULTS

Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS PLOTS

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)





8.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

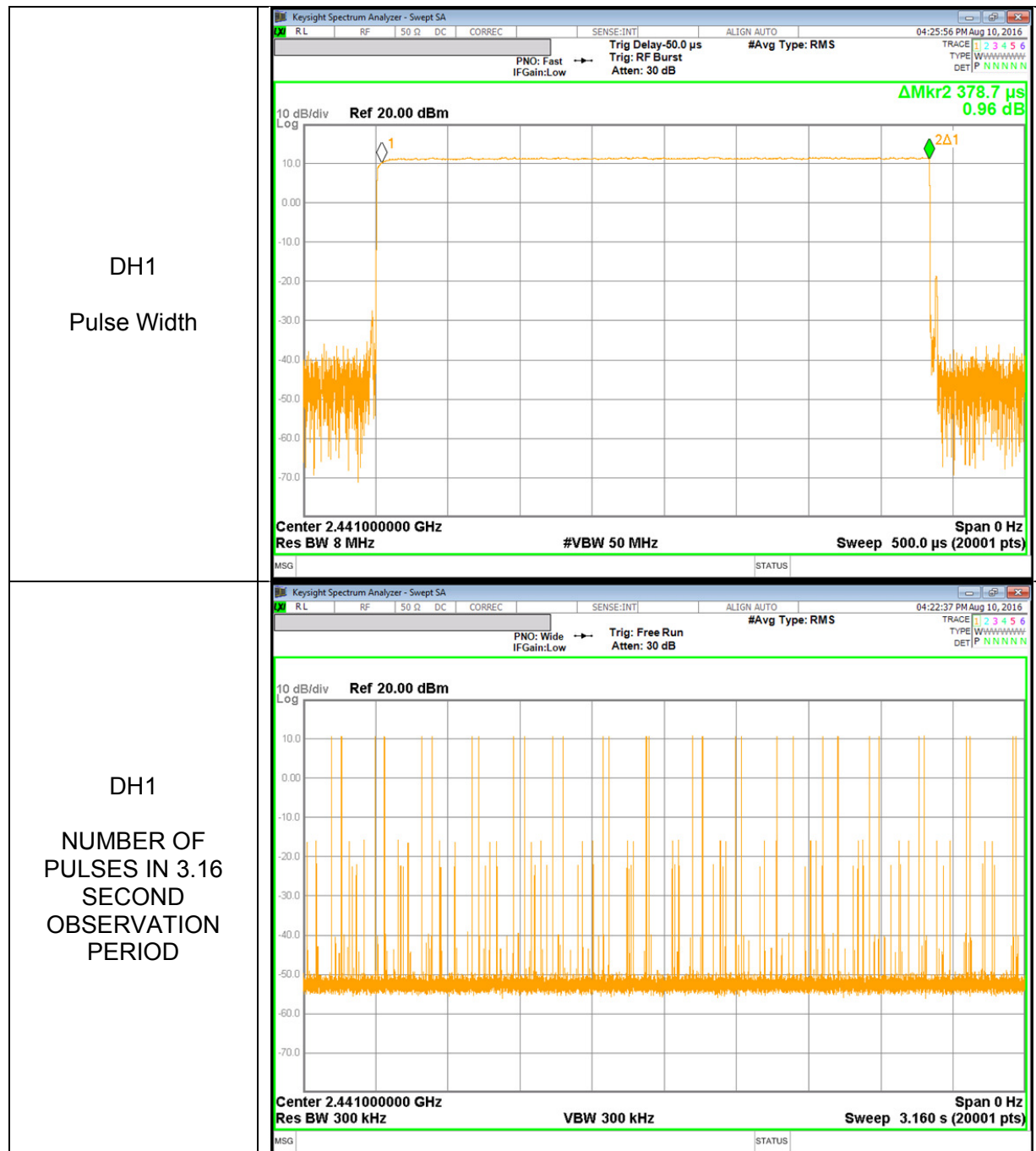
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$.

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

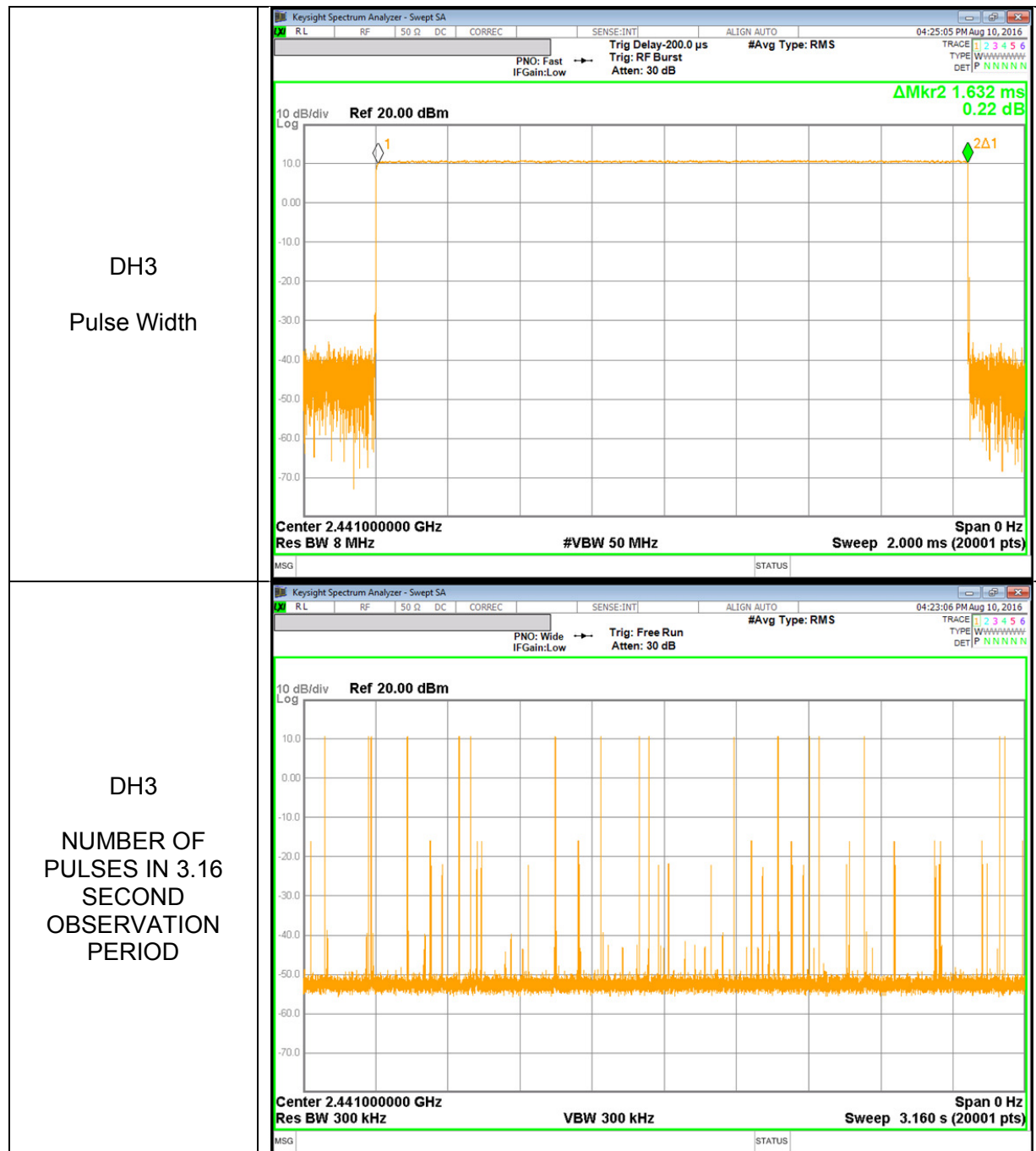
RESULTS

DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK Normal					
DH1	0.379	32	0.121184	0.4	-0.2788
DH3	1.632	17	0.277440	0.4	-0.1226
DH5	2.876	13	0.373880	0.4	-0.0261
GFSK AFH					
DH Packet	Pulse Width [msec]	Number of Pulses in 0.8 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK AFH					
DH1	0.379	8	0.030296	0.4	-0.3697
DH3	1.632	4.25	0.069360	0.4	-0.33064
DH5	2.876	3.25	0.093470	0.4	-0.30653

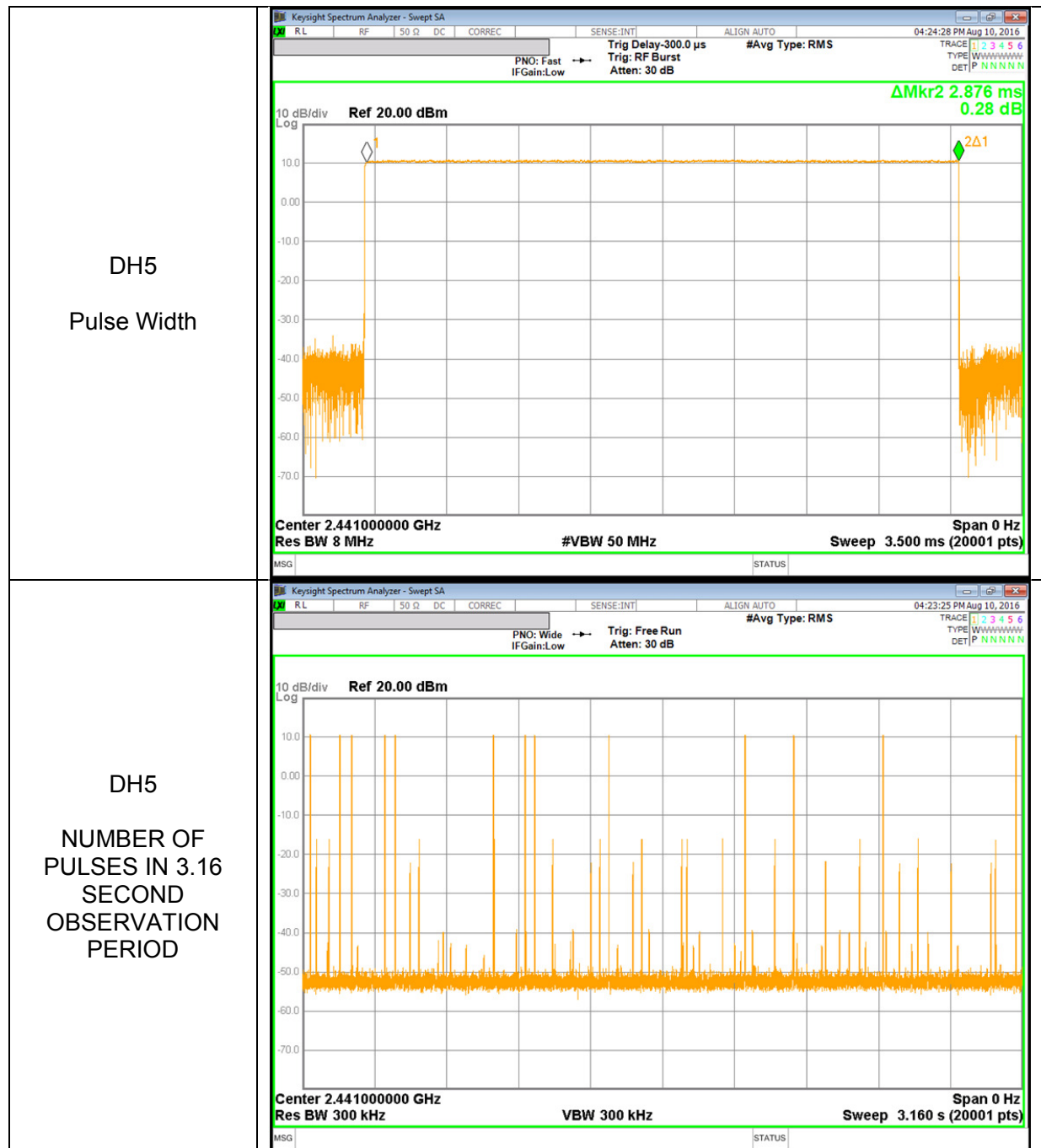
DH1



DH3



DH5



8.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

The maximum antenna gain is less than 6 dBi, therefore the limit is 21 dBm.

TEST PROCEDURE

DA 00-705: 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

8.5.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	14.641	21	-6.359
Middle	2441	14.510	21	-6.49
High	2480	14.298	21	-6.702
Worst		14.641	21	-6.359

8.5.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	12.968	21	-8.032
Middle	2441	13.605	21	-7.395
High	2480	13.834	21	-7.166
Worst		13.834	21	-7.166

8.5.3. ENHANCED DATA RATE 8PSK MODULATION

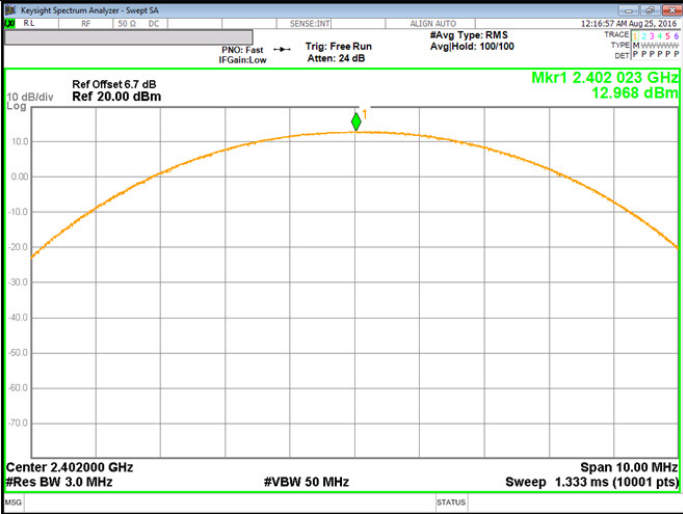
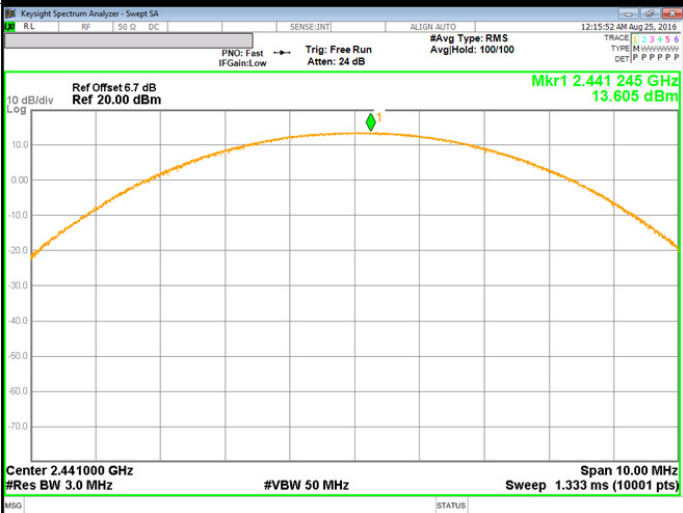
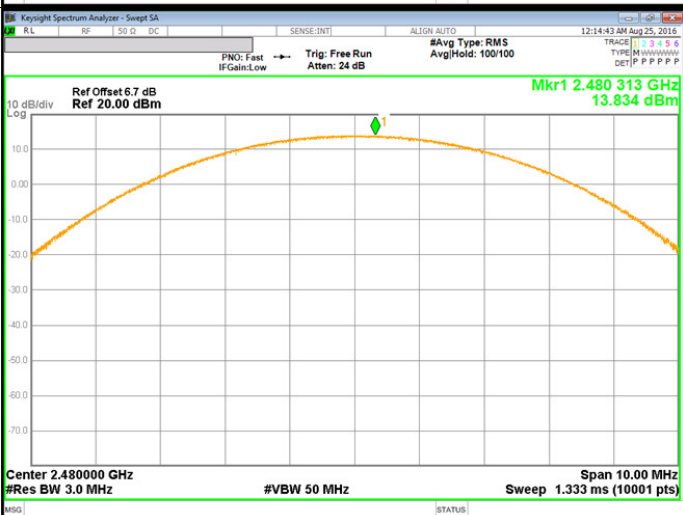
Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	13.512	21	-7.488
Middle	2441	13.988	21	-7.012
High	2480	14.279	21	-6.721
Worst		14.279	21	-6.721

8.5.4. OUTPUT POWER PLOTS

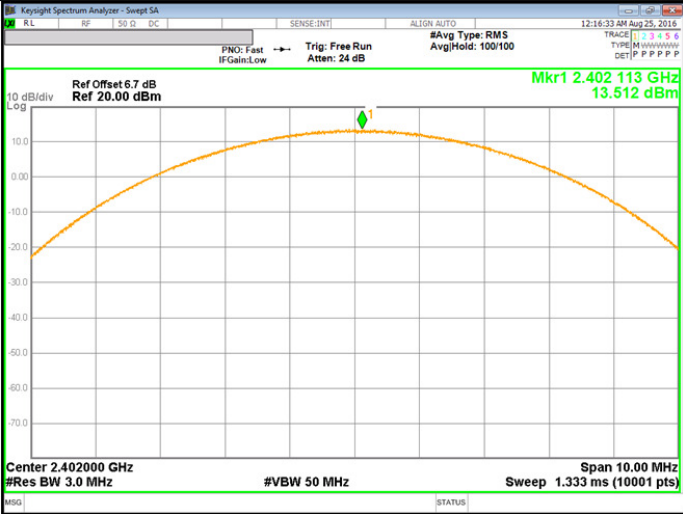
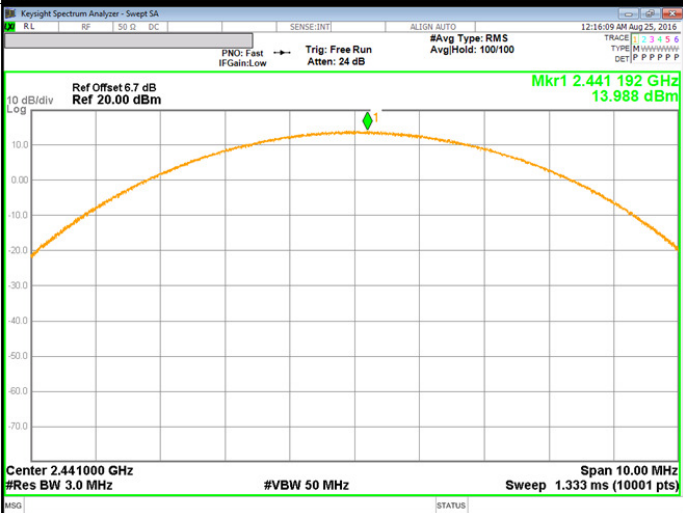
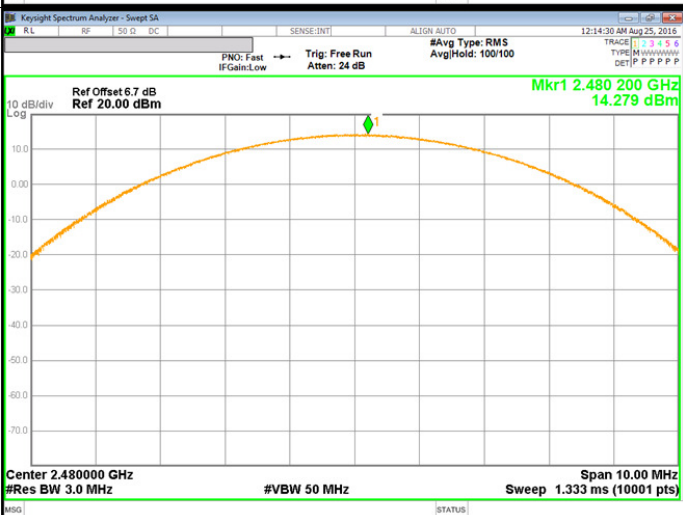
GFSK OUTPUT POWER

<p>GFSK Low CH</p>	
<p>GFSK Middle CH</p>	
<p>GFSK High CH</p>	

Pi/4-DPSK OUTPUT POWER

<p>Pi/4-DPSK Low CH</p>	 <p>Keysight Spectrum Analyzer - Swept SA 12:16:57 AM Aug 25, 2016 PNO: Fast IFGain:Low Trig: Free Run #Avg Type: RMS AvgHold: 100/100 Ref Offset 6.7 dB Ref 20.00 dBm Mkr1 2.402 023 GHz 12.968 dBm 10 dB/div Log Center 2.402000 GHz Span 10.00 MHz #Res BW 3.0 MHz #VBW 50 MHz Sweep 1.333 ms (10001 pts)</p>
<p>Pi/4-DPSK Middle CH</p>	 <p>Keysight Spectrum Analyzer - Swept SA 12:15:52 AM Aug 25, 2016 PNO: Fast IFGain:Low Trig: Free Run #Avg Type: RMS AvgHold: 100/100 Ref Offset 6.7 dB Ref 20.00 dBm Mkr1 2.441 245 GHz 13.805 dBm 10 dB/div Log Center 2.441000 GHz Span 10.00 MHz #Res BW 3.0 MHz #VBW 50 MHz Sweep 1.333 ms (10001 pts)</p>
<p>Pi/4-DPSK High CH</p>	 <p>Keysight Spectrum Analyzer - Swept SA 12:14:43 AM Aug 25, 2016 PNO: Fast IFGain:Low Trig: Free Run #Avg Type: RMS AvgHold: 100/100 Ref Offset 6.7 dB Ref 20.00 dBm Mkr1 2.480 313 GHz 13.834 dBm 10 dB/div Log Center 2.480000 GHz Span 10.00 MHz #Res BW 3.0 MHz #VBW 50 MHz Sweep 1.333 ms (10001 pts)</p>

8PSK OUTPUT POWER

<p>8PSK Low CH</p>	 <p>Keysight Spectrum Analyzer - Swept SA 12:16:33 AM Aug 25, 2016 PNO: Fast IFGain:Low Trig: Free Run #Avg Type: RMS AvgHold: 100/100 Ref Offset 6.7 dB Ref 20.00 dBm Mkr1 2.402 113 GHz 13.512 dBm 10 dB/div Log Center 2.402000 GHz Span 10.00 MHz #Res BW 3.0 MHz #VBW 50 MHz Sweep 1.333 ms (10001 pts)</p>
<p>8PSK Middle CH</p>	 <p>Keysight Spectrum Analyzer - Swept SA 12:16:09 AM Aug 25, 2016 PNO: Fast IFGain:Low Trig: Free Run #Avg Type: RMS AvgHold: 100/100 Ref Offset 6.7 dB Ref 20.00 dBm Mkr1 2.441 192 GHz 13.988 dBm 10 dB/div Log Center 2.441000 GHz Span 10.00 MHz #Res BW 3.0 MHz #VBW 50 MHz Sweep 1.333 ms (10001 pts)</p>
<p>8PSK High CH</p>	 <p>Keysight Spectrum Analyzer - Swept SA 12:14:30 AM Aug 25, 2016 PNO: Fast IFGain:Low Trig: Free Run #Avg Type: RMS AvgHold: 100/100 Ref Offset 6.7 dB Ref 20.00 dBm Mkr1 2.480 200 GHz 14.279 dBm 10 dB/div Log Center 2.480000 GHz Span 10.00 MHz #Res BW 3.0 MHz #VBW 50 MHz Sweep 1.333 ms (10001 pts)</p>

8.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

DA 00-705: The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.1 dB (including 10 dB pad and 0.1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

8.6.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	14.429	27.73
Middle	2441	14.175	26.15
High	2480	14.031	25.30

8.6.2. DATA RATE PI/4-DQPSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	10.535	11.31
Middle	2441	11.066	12.78
High	2480	11.695	14.77

8.6.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	10.576	11.42
Middle	2441	11.074	12.81
High	2480	11.703	14.80

8.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

Limit = -20 dBc

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

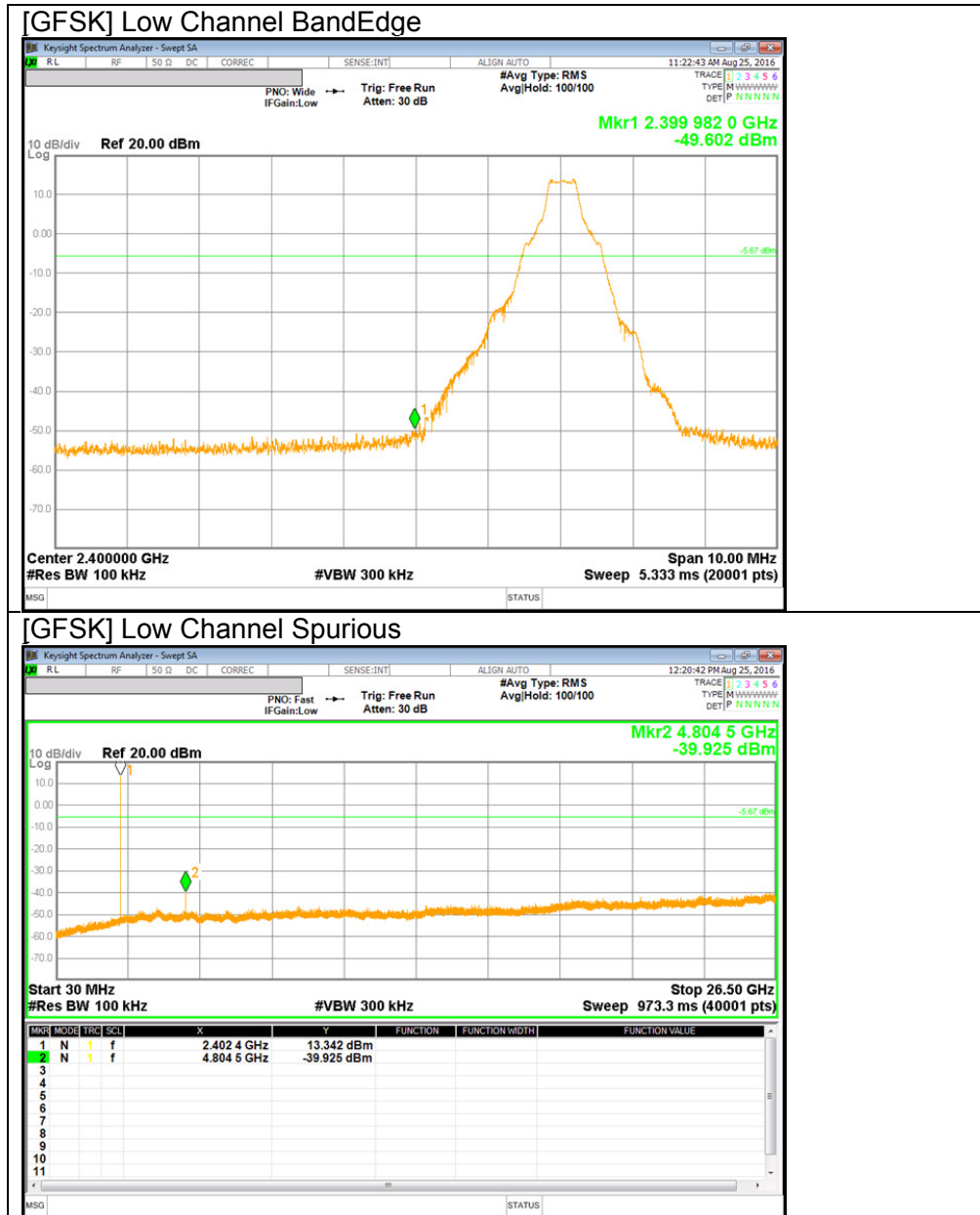
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

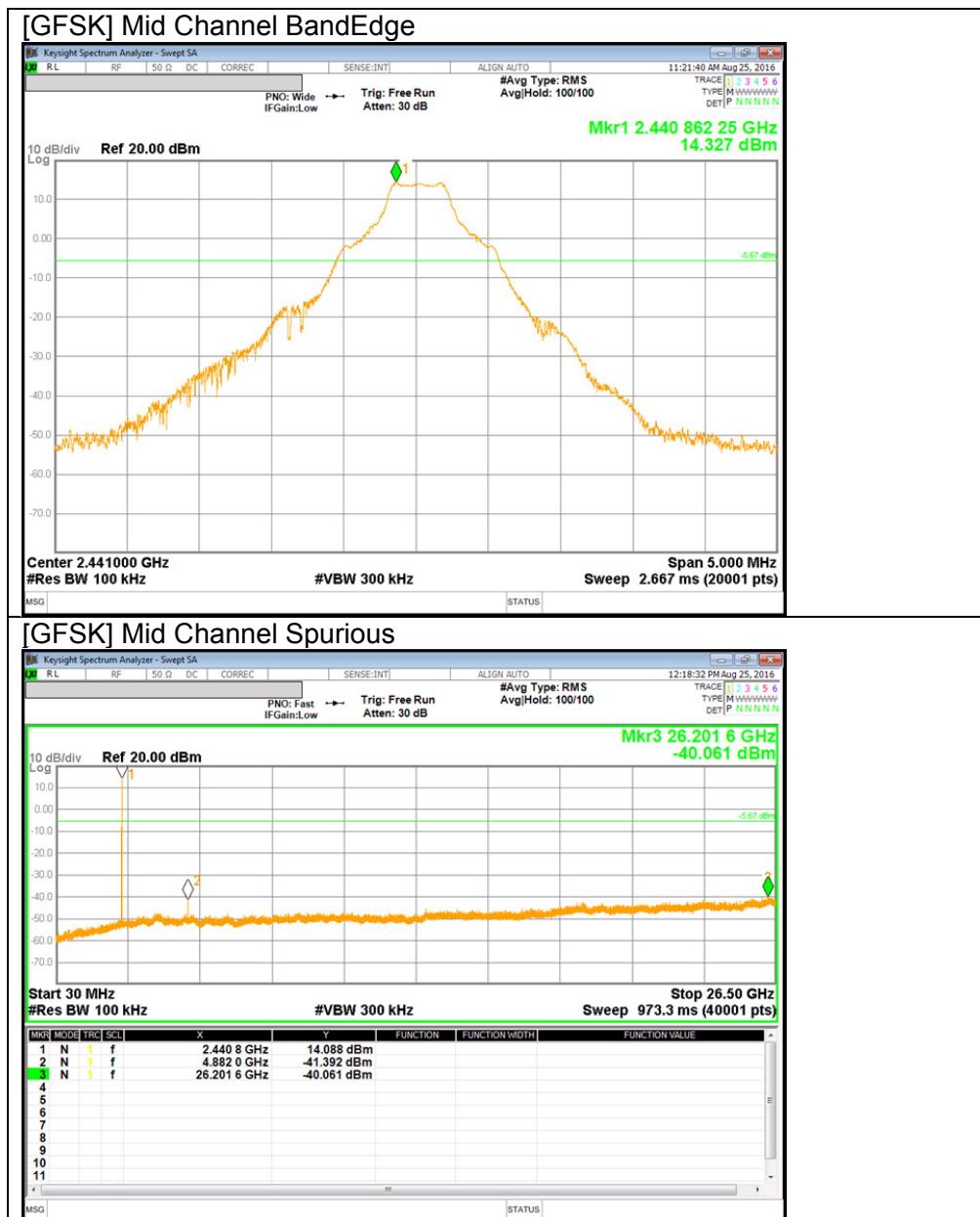
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

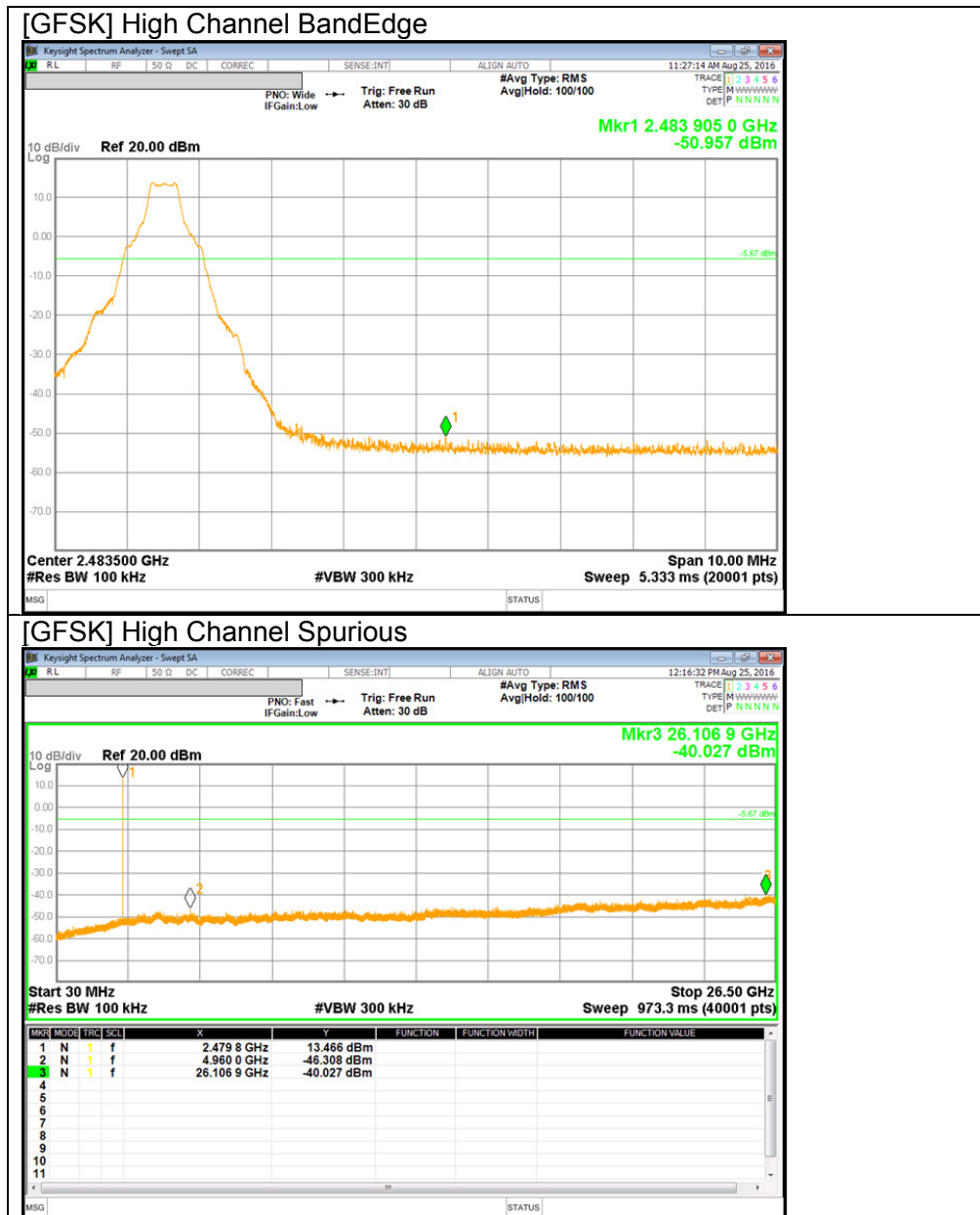
RESULTS

8.7.1. BASIC DATA RATE GFSK MODULATION

GFSK Mode

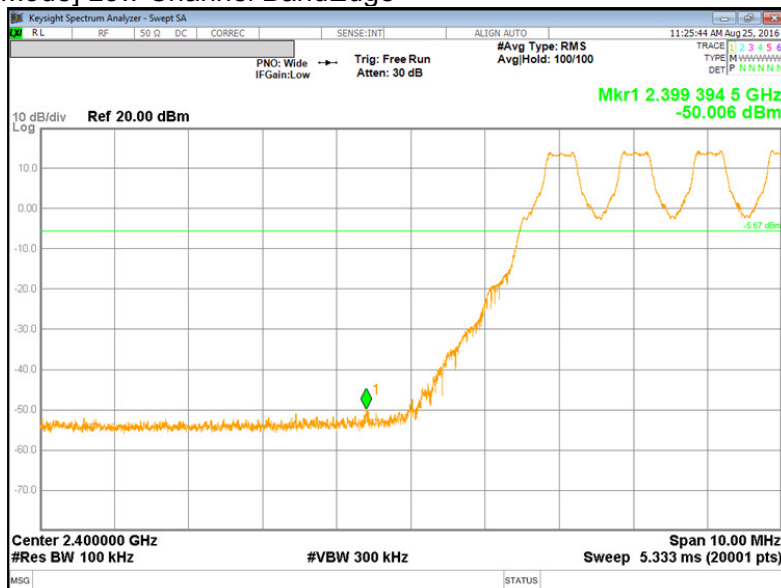




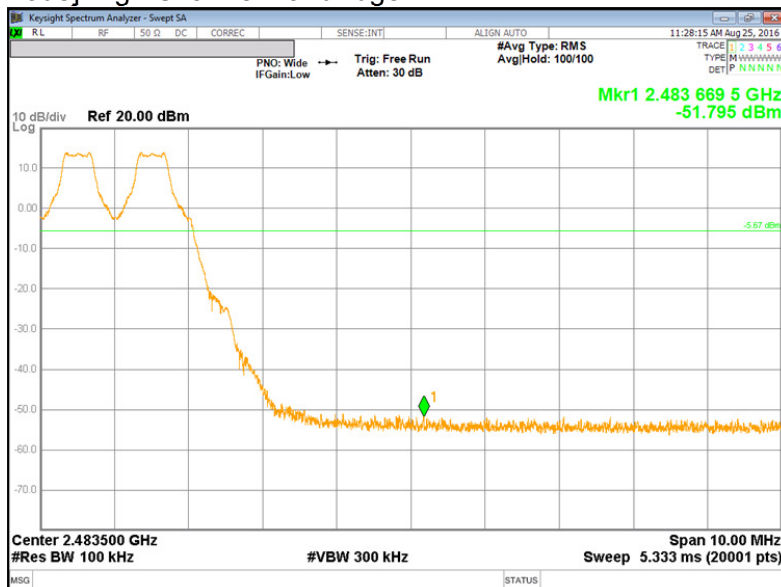


BandEdge Emission at GFSK Hopping Mode

[GFSK Hopping Mode] Low Channel BandEdge

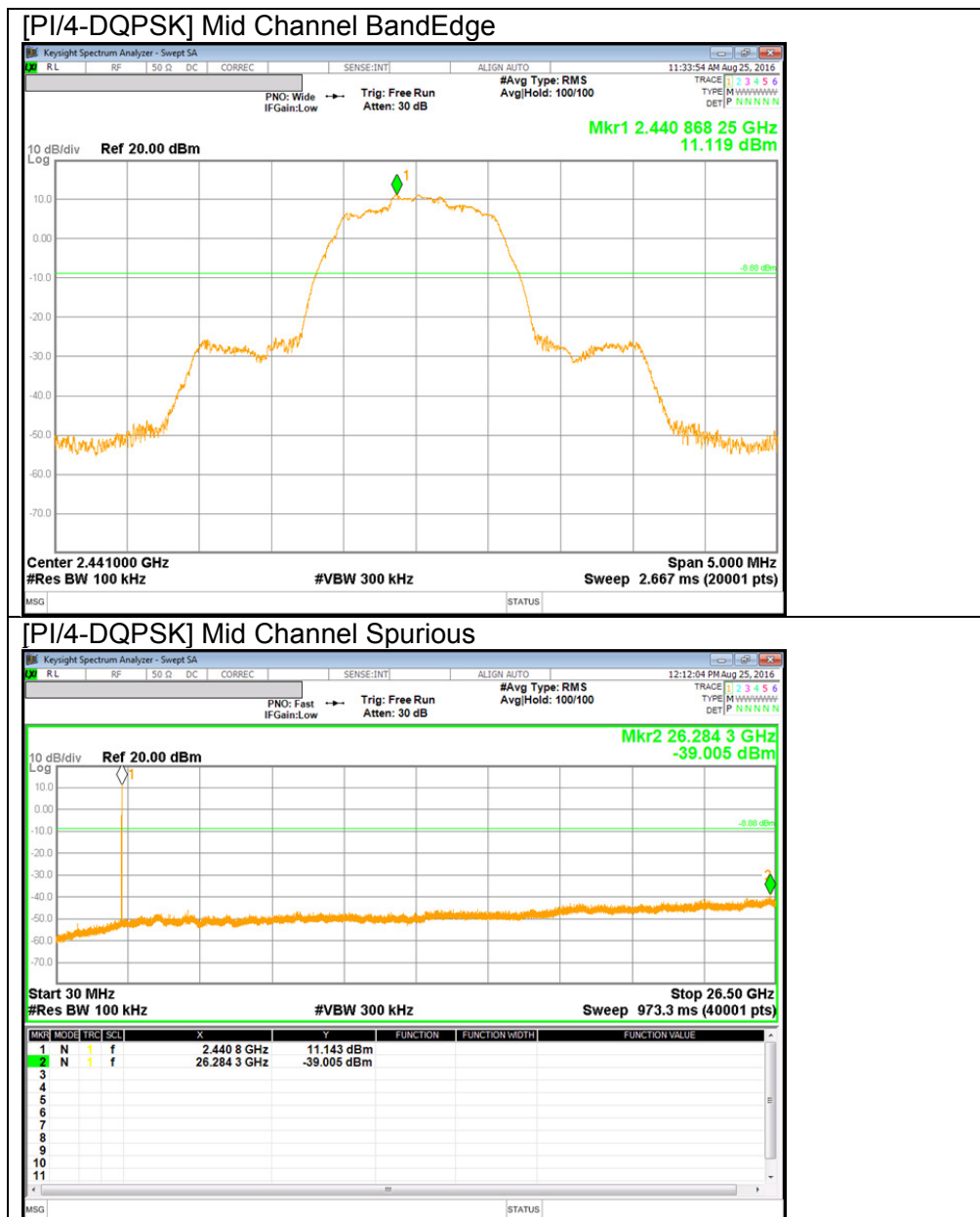


[GFSK Hopping Mode] High Channel BandEdge



PI/4-DQPSK Mode

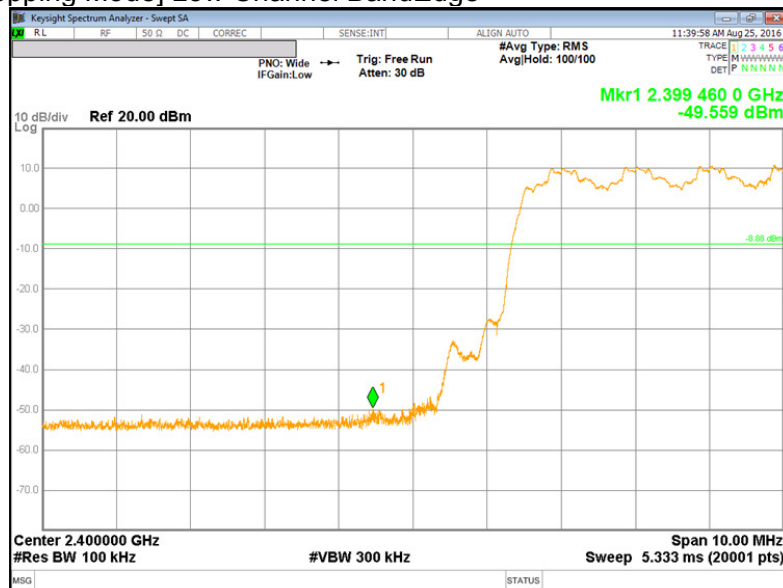




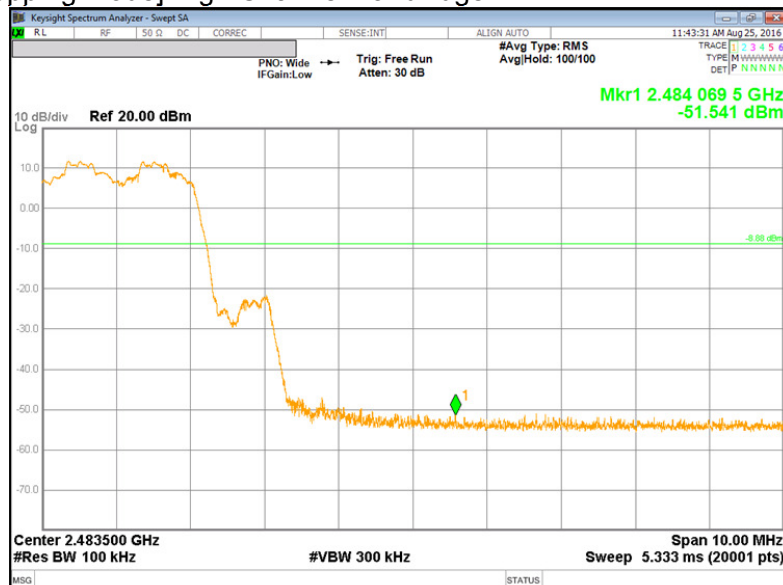


BandEdge Emission at PI/4-DQPSK Hopping Mode

[PI/4-DQPSK Hopping Mode] Low Channel BandEdge



[PI/4-DQPSK Hopping Mode] High Channel BandEdge



8PSK Mode

