



FCC CFR47 PART 15 SUBPART C

Bluetooth

CERTIFICATION TEST REPORT

FOR

GSM Phone + BT/BLE, DTS b/g/n

MODEL NUMBER : SM-J105H, SM-J105H/DD, SM-J105H/DS

FCC ID: A3LSMJ105H

REPORT NUMBER: 15K22503-E3

ISSUE DATE: DEC 29, 2015

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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	12/29/15	Initial issue	SungGil Park

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION: GSM Phone + BT/BLE, DTS b/g/n
MODEL NUMBER: SM-J105H, SM-J105H/DD, SM-J105H/DS
SERIAL NUMBER: R31GB00ETTF (RADIATED); R31GB00ETXT (CONDUCTED)
DATE TESTED: DEC 12, 2015 - DEC 29, 2015

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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UL Korea, Ltd.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, 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 checked="" 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 GSM Phone + BT/BLE, DTS b/g/n.
This test report addresses the DSS (BT) operational mode.

SM-J105H and SM-J105H/DS are same hardware, but for different number of SIM card slot.
SM-J105H has one slot. SM-J105H/DS is dual SIM version.
SM-J105H/DS was used for the test.

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	8.91	7.78
		Peak	9.34	8.59
	Enhanced Pi/4-DPSK	Average	8.40	6.92
		Peak	10.68	11.69
	Enhanced 8PSK	Average	8.40	6.92
		Peak	10.90	12.30

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 0.4 dBi.

5.4. WORST-CASE CONFIGURATION AND MODE

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

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.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA60EBE	R37G6HL0KJ1SC3	N/A
Earphone	SAMSUNG	EHS61ASFWE	N/A	N/A

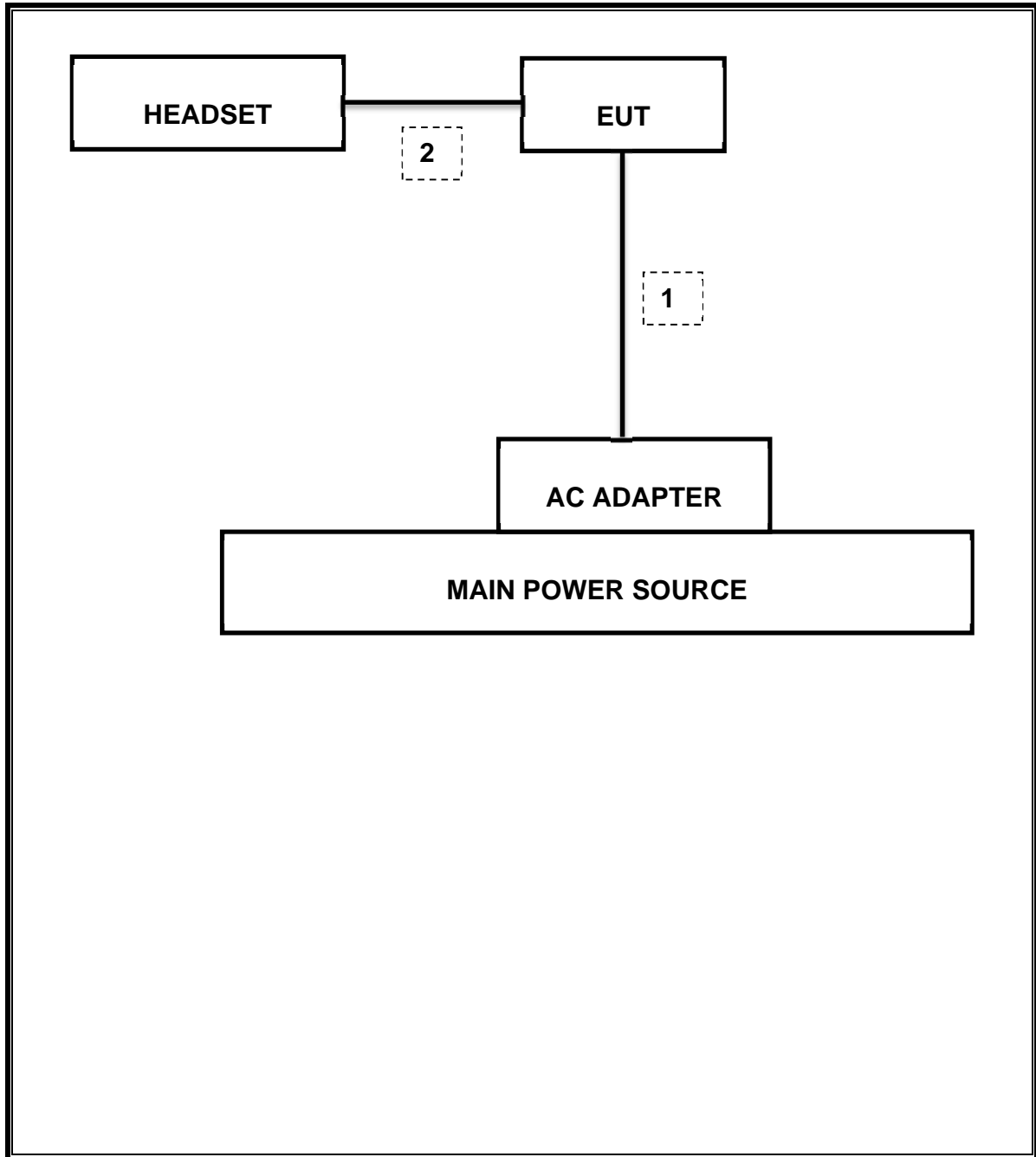
I/O CABLES

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
1	Audio	1	Mini-Jack	Unshielded	1.0m	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	09-26-16
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	09-23-16
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	08-24-17
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-18-16
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-18-16
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-18-16
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-18-16
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-19-16
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-19-16
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	08-18-16
Average Power Sensor	R&S	NRZ-Z91	102681	08-18-16
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-18-16
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-19-16
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-19-16
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-19-16
Attenuator / Switch driver	HP	11713A	3748A04272	N/A
Low Pass Filter 3GHz	Micro-Tronics	LPS17541	009	08-18-16
Low Pass Filter 3GHz	Micro-Tronics	LPS17541	015	08-18-16
High Pass Filter 5GHz	Micro-Tronics	HPS17542	009	08-18-16
High Pass Filter 6GHz	Micro-Tronics	HPM17543	010	08-18-16
High Pass Filter 5GHz	Micro-Tronics	HPS17542	016	08-18-16
High Pass Filter 6GHz	Micro-Tronics	HPM17543	015	08-18-16
LISN	R&S	ENV-216	101836	08-19-16
LISN	R&S	ENV-216	101837	08-19-16
Combiner	WEINSCHEL	1575	2151	08-20-16

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	1.165 MHz
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-41.494 dBm
15.247 (b)(1)	TX conducted output power	<21dBm		Pass	10.899 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	0.349 sec
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass	46.51 dBuV (QP)
15.205, 15.209	Radiated Spurious Emission	< 40dBuV/m	Radiated	Pass	25.1 dBuV/m (QP)

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 [MHz]
Low	2402	0.871	0.826
Mid	2441	0.868	0.830
High	2480	0.865	0.828
Worst		0.871	0.830

8.1.2. ENHANCED DATA RATE Pi/4-DQPSK MODULATION

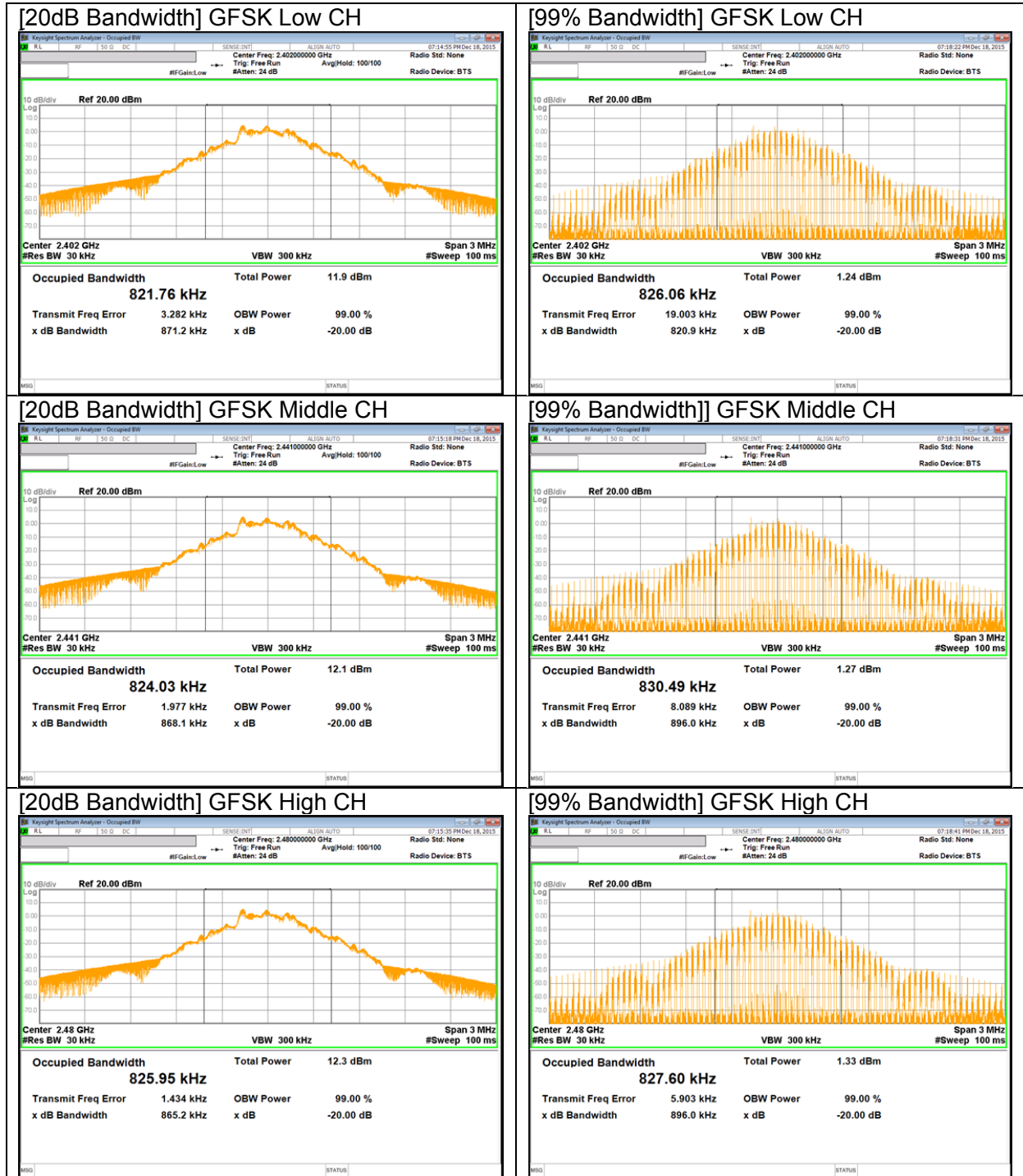
Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.256	1.165
Mid	2441	1.259	1.163
High	2480	1.260	1.163
Worst		1.260	1.165

8.1.3. ENHANCED DATA RATE 8PSK MODULATION

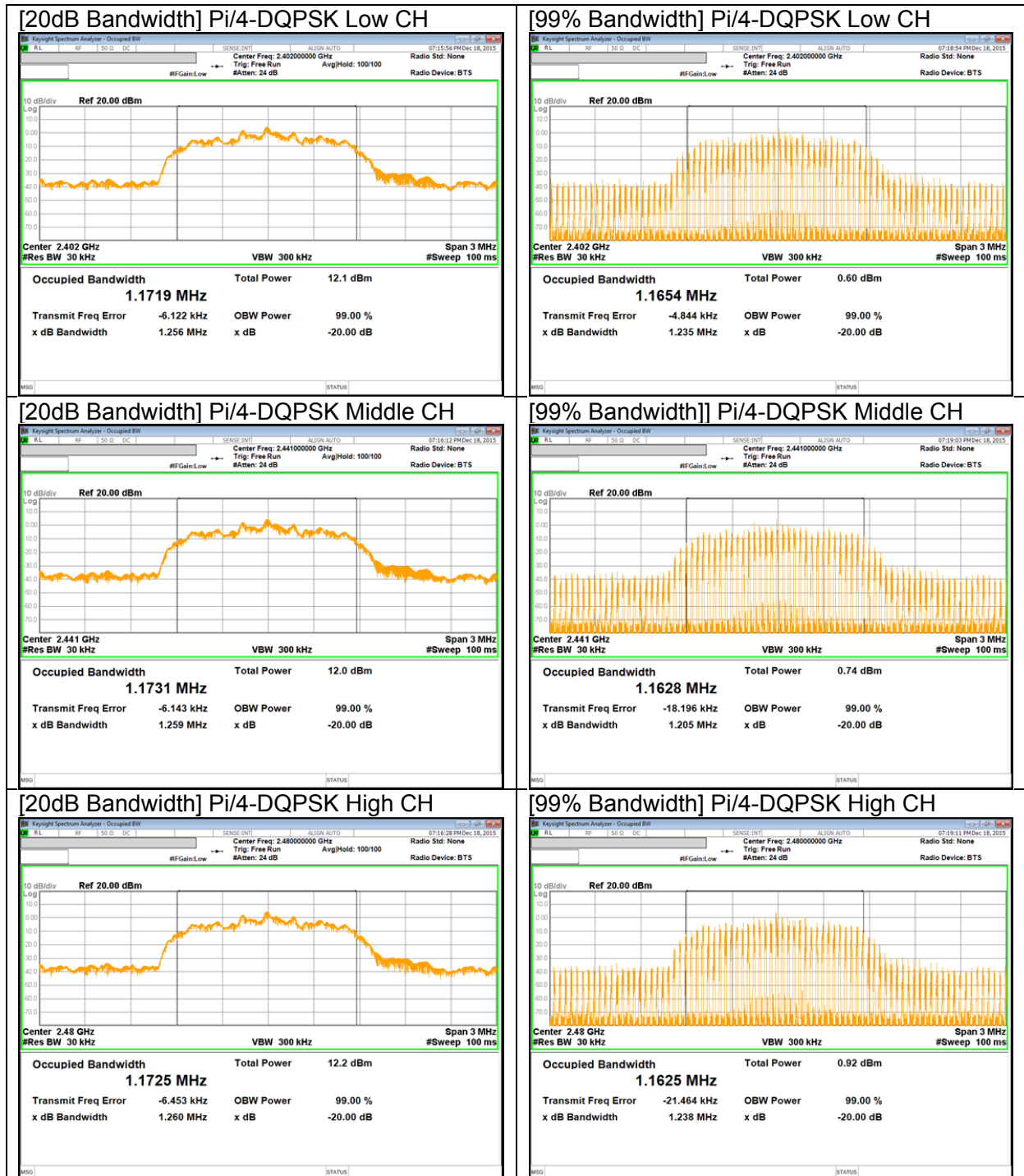
Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.223	1.164
Mid	2441	1.241	1.164
High	2480	1.223	1.164
Worst		1.241	1.164

8.1.4. 20 dB AND 99% BANDWIDTH PLOTS

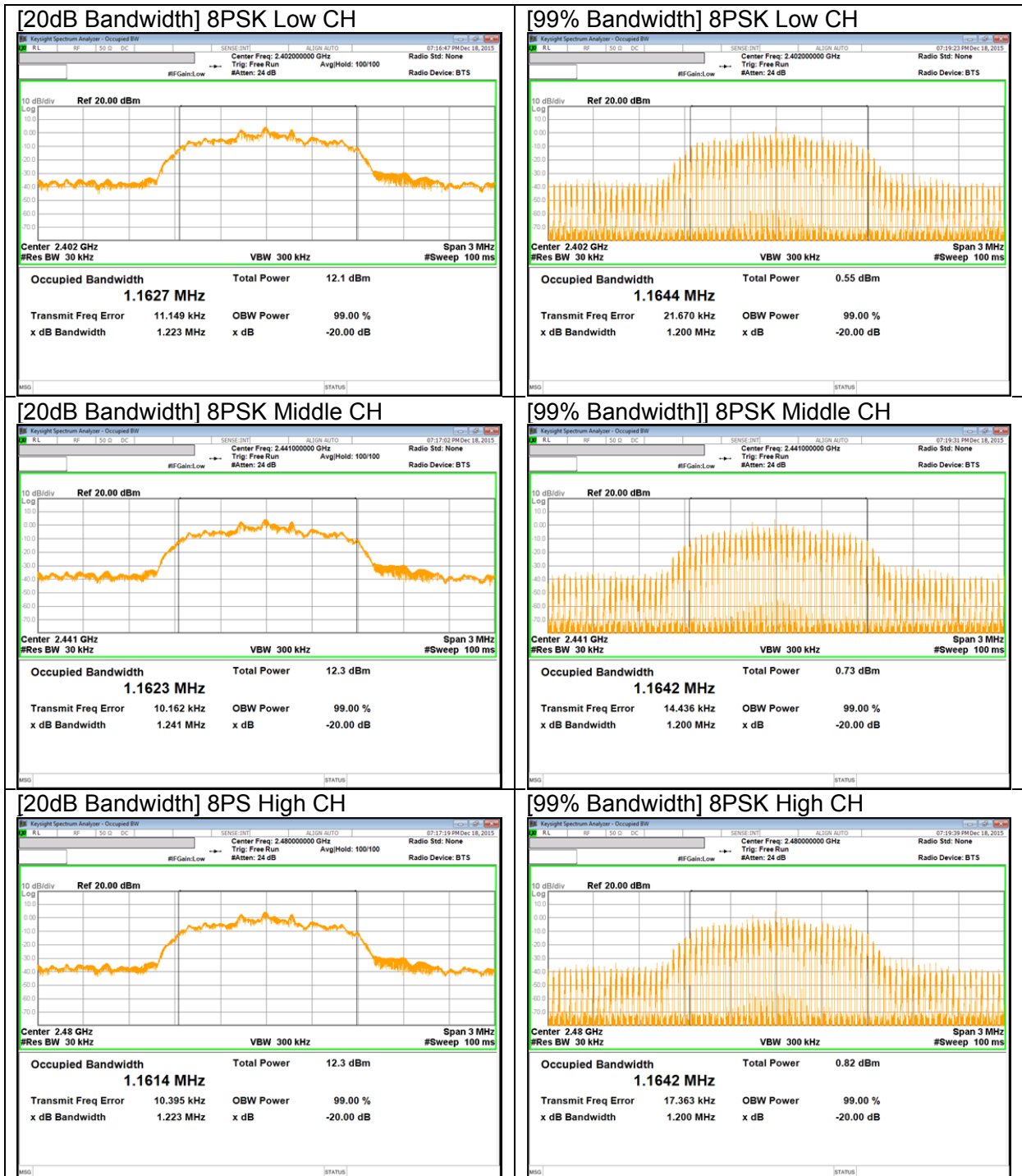
GFSK BANDWIDTH



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

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

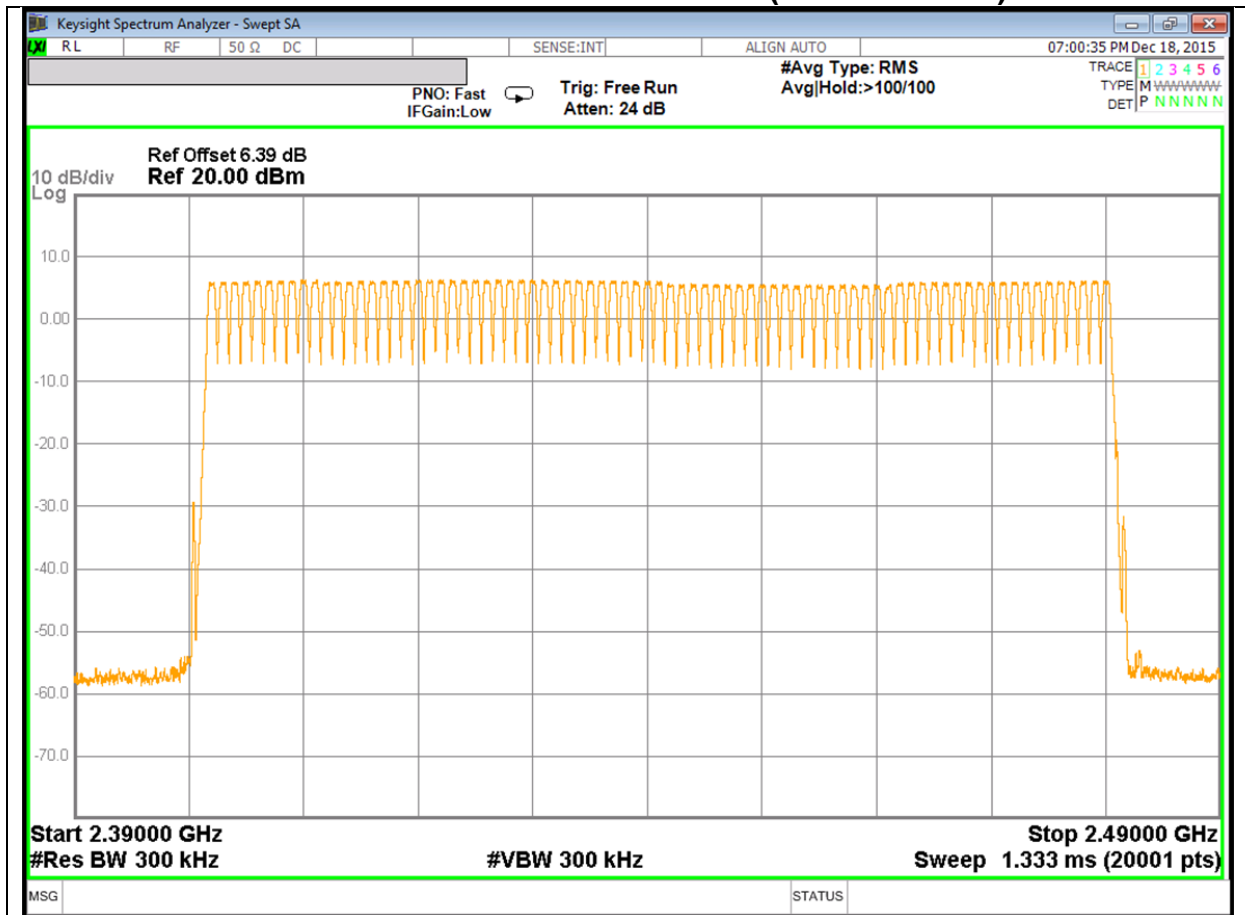
DA 00-705: The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

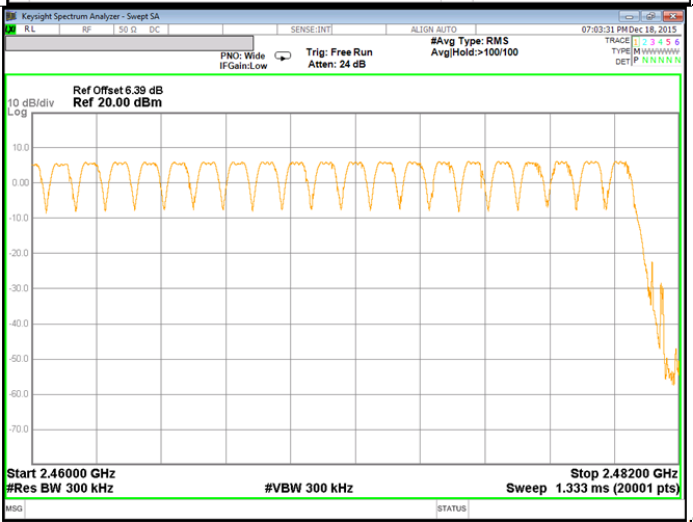
RESULTS

Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS PLOTS

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



<p>1st SEGMENT 2400 to 2430 MHz</p>	 <p>KeySight Spectrum Analyzer - Swept SA RL RF 1 50 D DC SENSE:INTI ALIGN: AUTO 07:01:28 PM Dec 18, 2015 #Avg Type: RMS AvgHold: >100/100 PNO: Wide IF Gain: Low Trig: Free Run Atten: 24 dB Ref Offset 6.39 dB Ref 20.00 dBm 10 dB/div Log Start 2.40000 GHz #Res BW 300 kHz #VBW 300 kHz Stop 2.43000 GHz Sweep 1.333 ms (20001 pts)</p>
<p>2nd SEGMENT 2430 to 2460 MHz</p>	 <p>KeySight Spectrum Analyzer - Swept SA RL RF 1 50 D DC SENSE:INTI ALIGN: AUTO 07:02:34 PM Dec 18, 2015 #Avg Type: RMS AvgHold: >100/100 PNO: Wide IF Gain: Low Trig: Free Run Atten: 24 dB Ref Offset 6.39 dB Ref 20.00 dBm 10 dB/div Log Start 2.43000 GHz #Res BW 300 kHz #VBW 300 kHz Stop 2.46000 GHz Sweep 1.333 ms (20001 pts)</p>
<p>3rd SEGMENT 2460 to 2482 MHz</p>	 <p>KeySight Spectrum Analyzer - Swept SA RL RF 1 50 D DC SENSE:INTI ALIGN: AUTO 07:03:31 PM Dec 18, 2015 #Avg Type: RMS AvgHold: >100/100 PNO: Wide IF Gain: Low Trig: Free Run Atten: 24 dB Ref Offset 6.39 dB Ref 20.00 dBm 10 dB/div Log Start 2.46000 GHz #Res BW 300 kHz #VBW 300 kHz Stop 2.48200 GHz Sweep 1.333 ms (20001 pts)</p>

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.

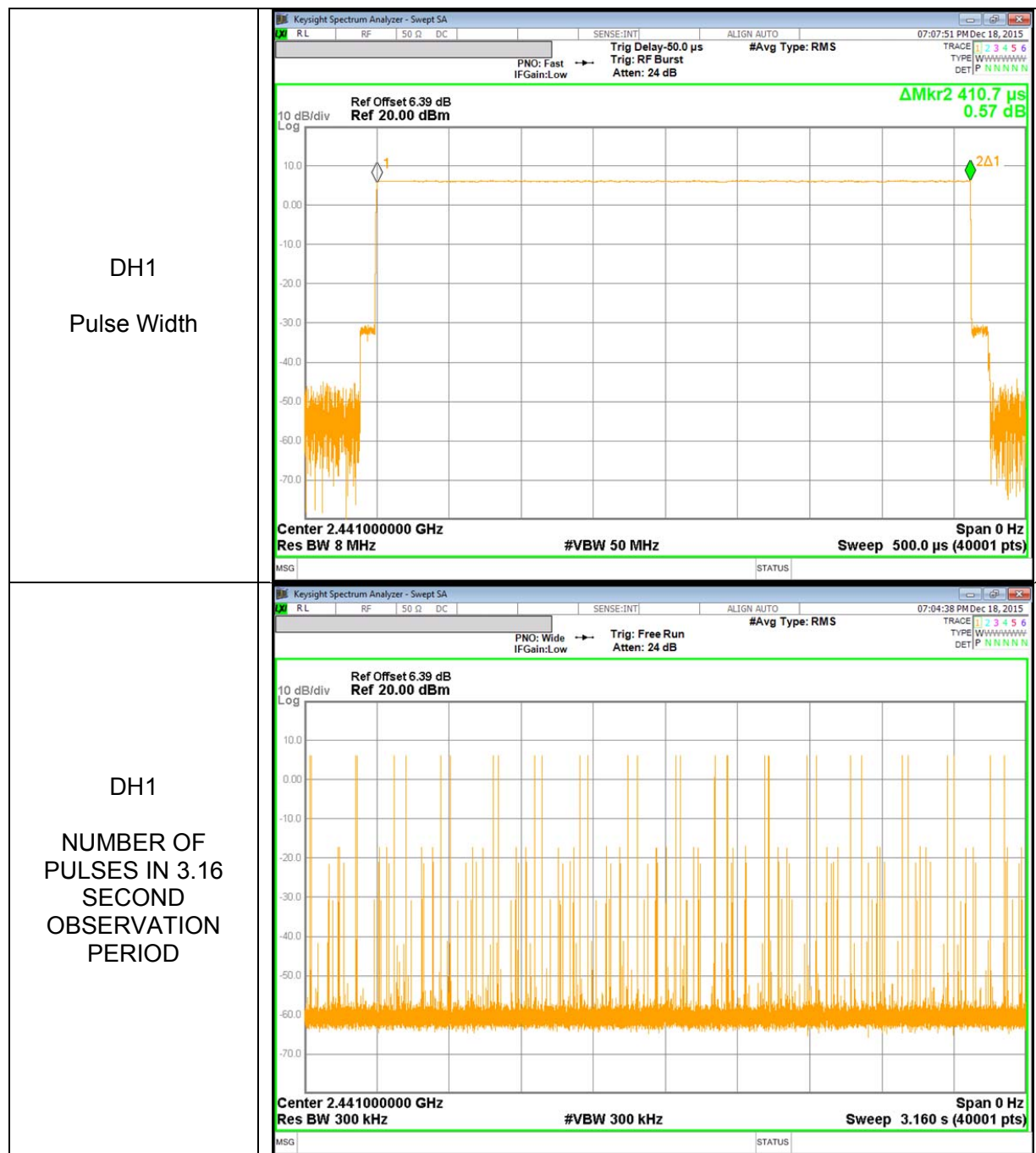
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$.

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

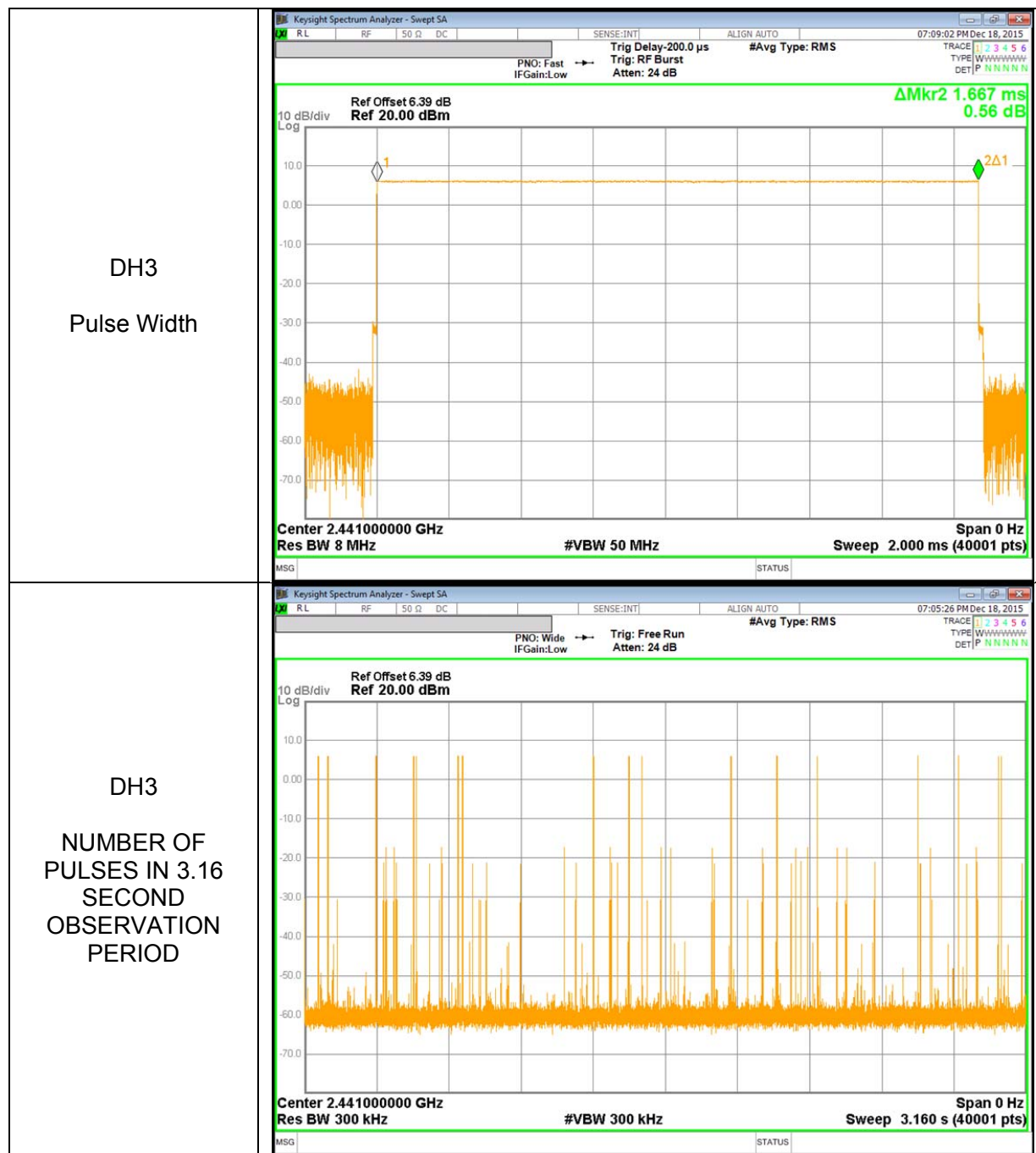
RESULTS

DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK Normal					
DH1	0.408	32	0.130528	0.4	-0.2695
DH3	1.663	17	0.282710	0.4	-0.1173
DH5	2.911	12	0.349320	0.4	-0.0507
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	0.408	8	0.032632	0.4	-0.36737
DH3	1.663	4.25	0.070678	0.4	-0.32932
DH5	2.911	3	0.087330	0.4	-0.31267

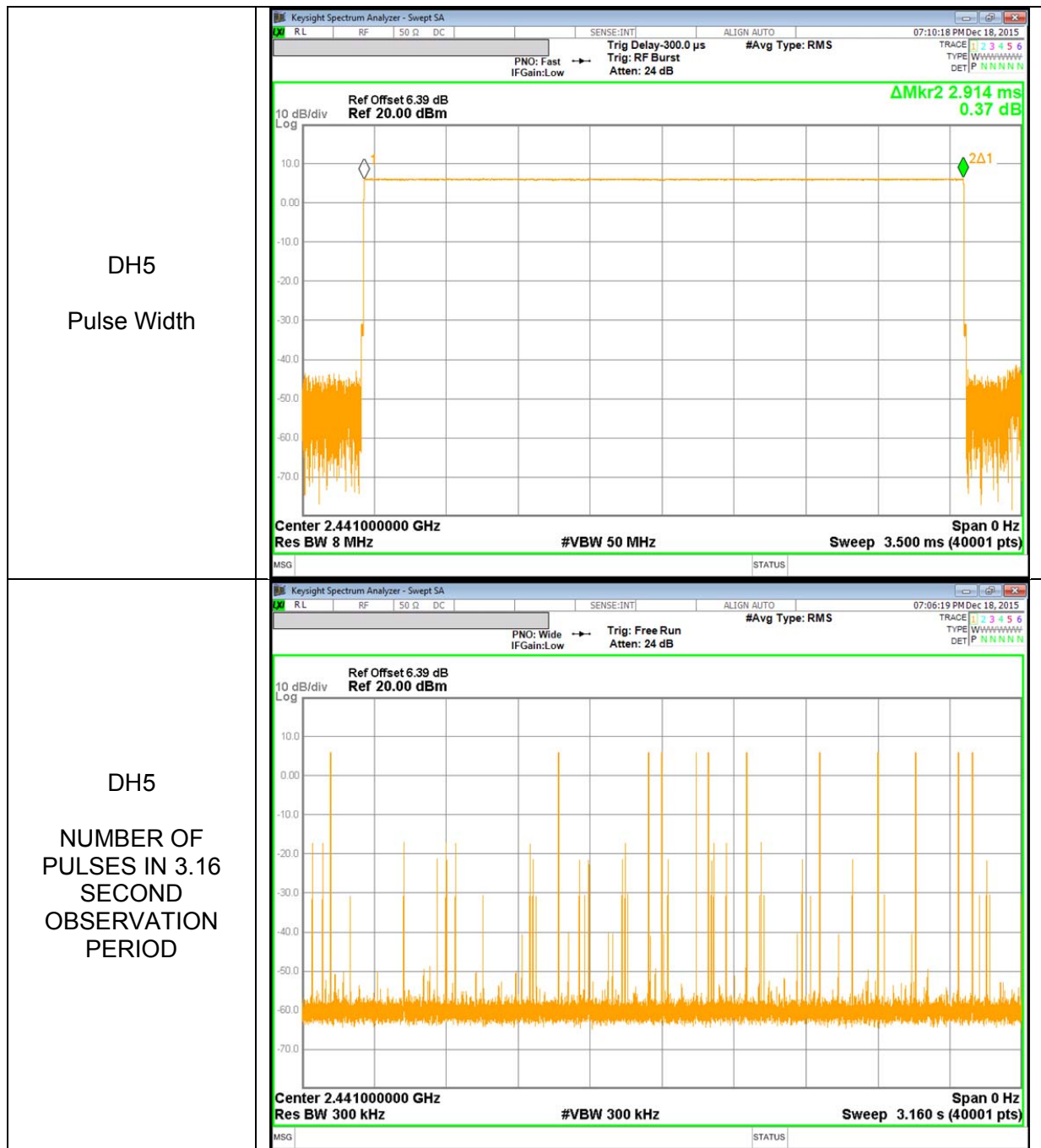
DH1



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	9.219	21	-11.781
Middle	2441	8.812	21	-12.188
High	2480	9.341	21	-11.659
Worst		9.341	21	-11.659

8.5.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	10.569	21	-10.431
Middle	2441	10.192	21	-10.808
High	2480	10.679	21	-10.321
Worst		10.679	21	-10.321

8.5.3. ENHANCED DATA RATE 8PSK MODULATION

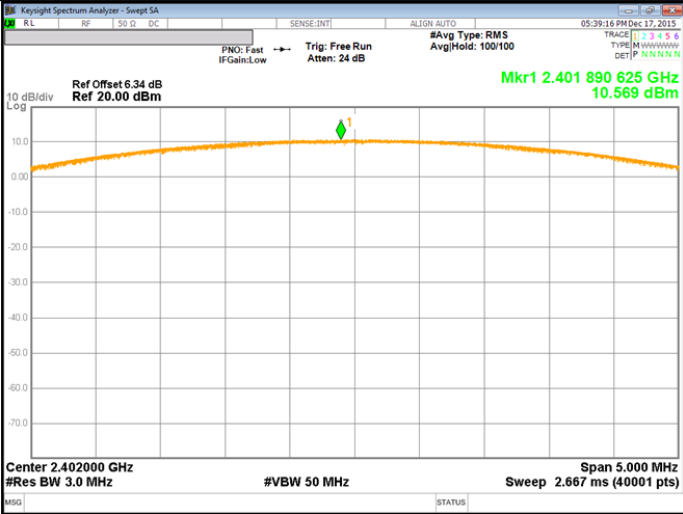
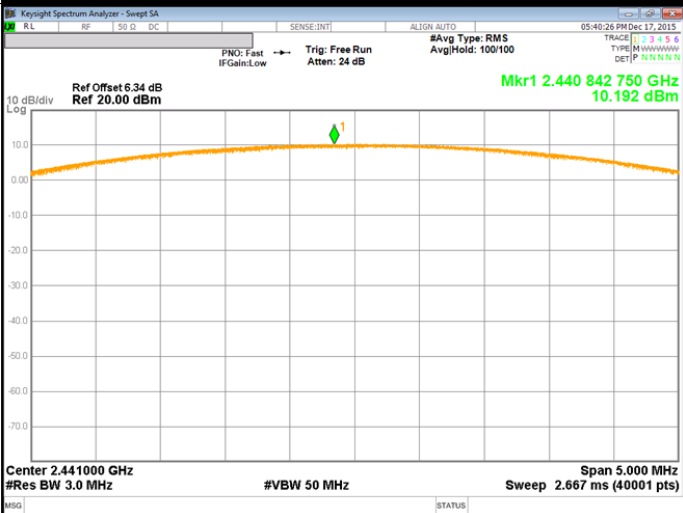
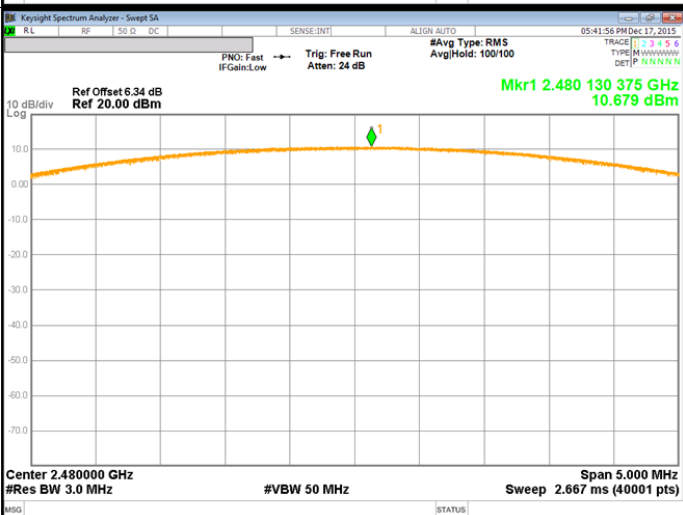
Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	10.828	21	-10.172
Middle	2441	10.446	21	-10.554
High	2480	10.899	21	-10.101
Worst		10.899	21	-10.101

8.5.4. OUTPUT POWER PLOTS

GFSK OUTPUT POWER

<p>GFSK Low CH</p>	<p>Keyight Spectrum Analyzer - Sweep SA 05:38:59 PM Dec 17, 2015 #Avg Type: RMS AvgHold: 100/100 Mkr1 2.401 879 000 GHz 9.219 dBm Ref Offset 6.34 dB Ref 20.00 dBm Center 2.402000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 2.667 ms (40001 pts)</p>
<p>GFSK Middle CH</p>	<p>Keyight Spectrum Analyzer - Sweep SA 05:41:33 PM Dec 17, 2015 #Avg Type: RMS AvgHold: 100/100 Mkr1 2.440 682 750 GHz 8.812 dBm Ref Offset 6.34 dB Ref 20.00 dBm Center 2.441000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 2.667 ms (40001 pts)</p>
<p>GFSK High CH</p>	<p>Keyight Spectrum Analyzer - Sweep SA 05:41:31 PM Dec 17, 2015 #Avg Type: RMS AvgHold: 100/100 Mkr1 2.479 841 375 GHz 9.341 dBm Ref Offset 6.34 dB Ref 20.00 dBm Center 2.480000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 2.667 ms (40001 pts)</p>

Pi/4-DPSK OUTPUT POWER

<p>Pi/4-DPSK Low CH</p>	 <p>Keysight Spectrum Analyzer - Swept SA Ref Offset 6.34 dB Ref 20.00 dBm Mkr1 2.401 890 625 GHz 10.589 dBm Center 2.402000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 2.667 ms (40001 pts)</p>
<p>Pi/4-DPSK Middle CH</p>	 <p>Keysight Spectrum Analyzer - Swept SA Ref Offset 6.34 dB Ref 20.00 dBm Mkr1 2.440 842 750 GHz 10.192 dBm Center 2.441000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 2.667 ms (40001 pts)</p>
<p>Pi/4-DPSK High CH</p>	 <p>Keysight Spectrum Analyzer - Swept SA Ref Offset 6.34 dB Ref 20.00 dBm Mkr1 2.480 130 375 GHz 10.679 dBm Center 2.480000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 2.667 ms (40001 pts)</p>

8PSK OUTPUT POWER

<p>8PSK Low CH</p>	<p>Keysight Spectrum Analyzer - Swept SA RL RF 50 Ω DC SENSE:INT1 ALIGN: AUTO 05:39:36 PM Dec 17, 2015 PNO: Fast IF Gain: Low Trig: Free Run #Avg Type: RMS AvgHold: 100/100 Ref Offset: 6.34 dB Ref: 20.00 dBm Mkr1 2.402108250 GHz 10.828 dBm 10 dB/div Log Center 2.402000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 2.667 ms (40001 pts)</p>
<p>8PSK Middle CH</p>	<p>Keysight Spectrum Analyzer - Swept SA RL RF 50 Ω DC SENSE:INT1 ALIGN: AUTO 05:40:08 PM Dec 17, 2015 PNO: Fast IF Gain: Low Trig: Free Run #Avg Type: RMS AvgHold: 100/100 Ref Offset: 6.34 dB Ref: 20.00 dBm Mkr1 2.440955750 GHz 10.446 dBm 10 dB/div Log Center 2.441000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 2.667 ms (40001 pts)</p>
<p>8PSK High CH</p>	<p>Keysight Spectrum Analyzer - Swept SA RL RF 50 Ω DC SENSE:INT1 ALIGN: AUTO 05:42:13 PM Dec 17, 2015 PNO: Fast IF Gain: Low Trig: Free Run #Avg Type: RMS AvgHold: 100/100 Ref Offset: 6.34 dB Ref: 20.00 dBm Mkr1 2.479937125 GHz 10.899 dBm 10 dB/div Log Center 2.480000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 2.667 ms (40001 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	8.790	7.57
Middle	2441	8.467	7.03
High	2480	8.908	7.78

8.6.2. DATA RATE PI/4-DQPSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	8.317	6.79
Middle	2441	7.991	6.30
High	2480	8.401	6.92

8.6.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	8.330	6.81
Middle	2441	7.998	6.31
High	2480	8.403	6.92

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.

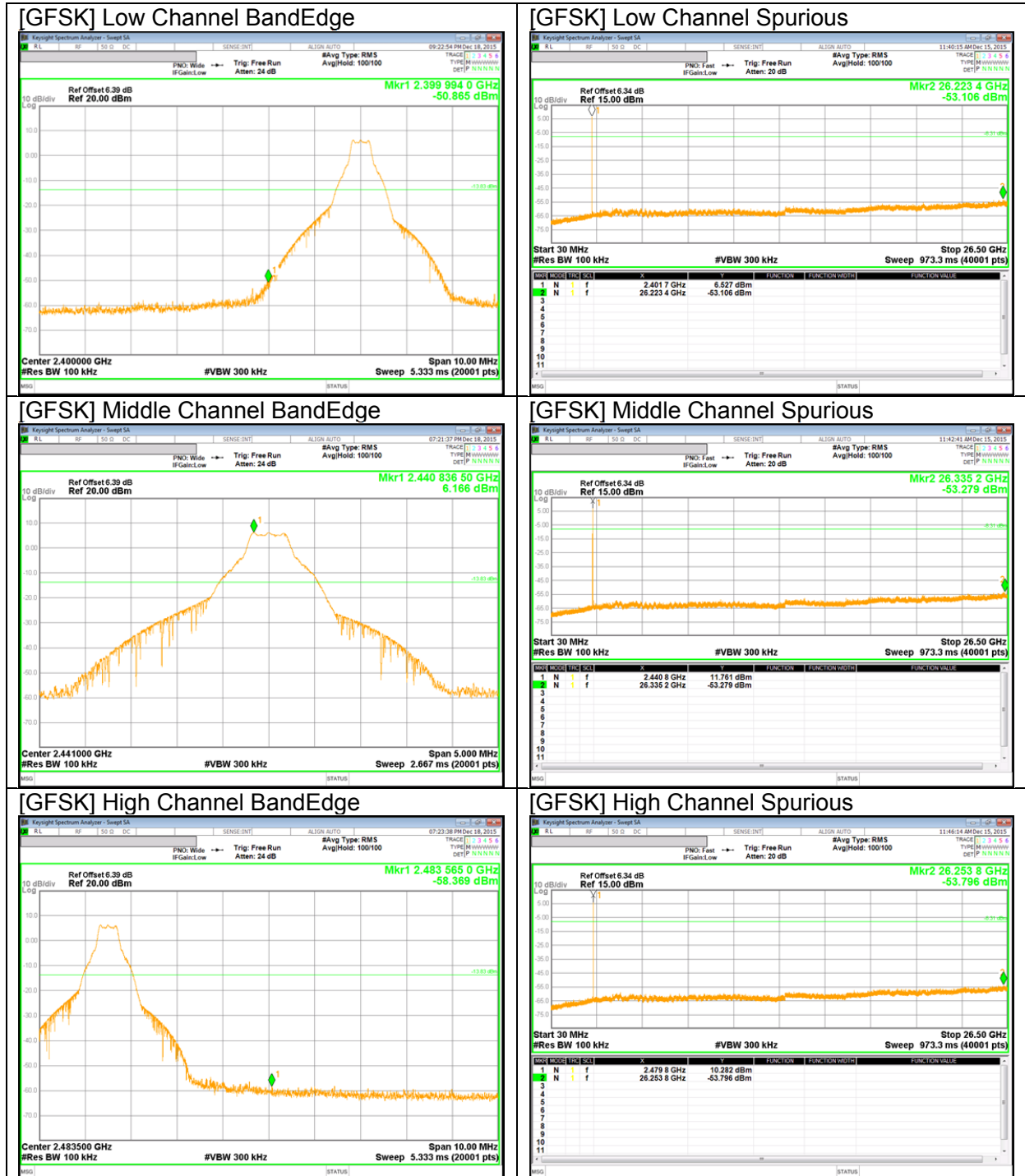
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

RESULTS

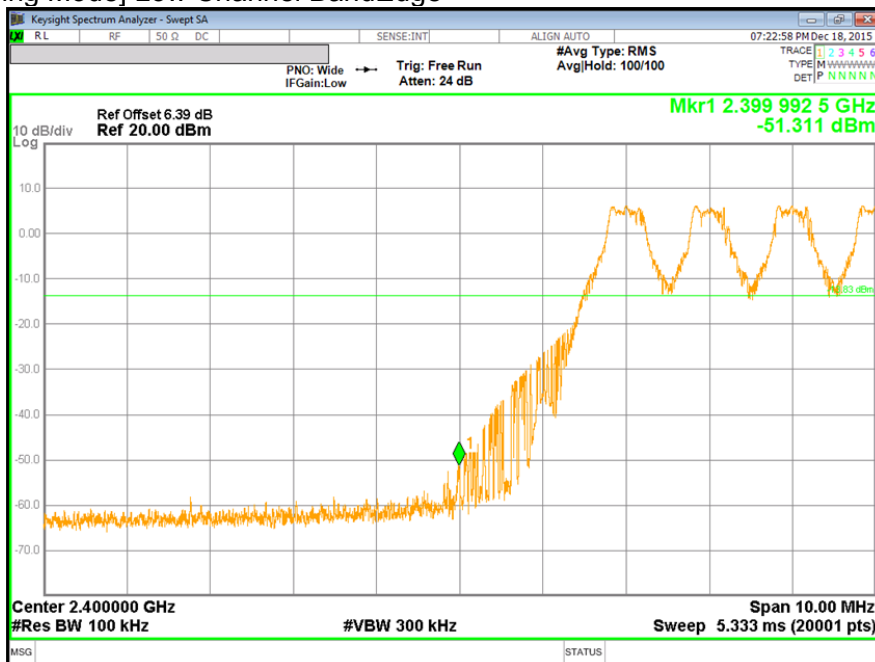
8.7.1. BASIC DATA RATE GFSK MODULATION

GFSK Mode

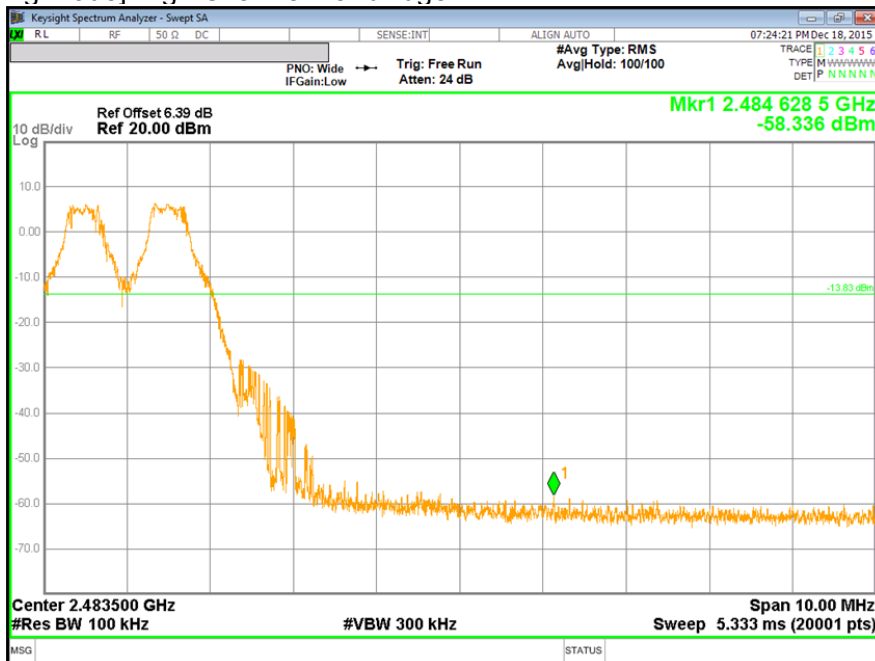


BandEdge Emission at GFSK Hopping Mode

[GFSK Hopping Mode] Low Channel BandEdge



[GFSK Hopping Mode] High Channel BandEdge



PI/4-DQPSK Mode

