IC RF TEST REPORT
No. 170500327SHA-001

Applicant	:	The Ketchum Group,Inc.dba Outdoor Technology 25201 Paseo De Alicia, Ste.105, Laguna Hills, CA 92653, USA
Manufacturer	:	XIA MEN JOYATECH CO., LTD. 304# 28TH BUILDING, GUANRI ROAD, XIAMEN SOFTWARE PARK, XIAMEN, FUJIAN PROVINCE
Product Name	:	Bluetooth headset
Type/Model	:	Tags 2.0
TEST RESULT	**:**	**PASS**

SUMMARY

The equipment complies with the requirements according to the following standard(s) or specification:

47CFR Part 15 (2016): Radio Frequency Devices

ANSI C63.10 (2013): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

RSS-247 Issue 2 (Feb 2017): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

RSS-Gen Issue 4 (December 2014): General Requirements for Compliance of Radio Apparatus

Date of issue: May 30, 2017

Prepared by: Reviewed by:

Jesse Xu (*Project Engineer*) Daniel Zhao (*Reviewer*)

FCC ID: PGW-OT1005
IC: 21672-OT1005

Description of Test Facility

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1 GENERAL INFORMATION

1.1 Description of Client

Applicant	:	The Ketchum Group,Inc.dba Outdoor Technology 25201 Paseo De Alicia, Ste.105, Laguna Hills, CA 92653, USA
Name of contact	:	Charles Gugliuzza
Tel	:	(+1)310-499-2329
Fax	:	(+1)310-388-0384
Email	:	Anthony@outdoortech.com
Manufacturer	:	XIA MEN JOYATECH CO., LTD. 25231 Paseo De Alicia, Ste. 200 Laguna Hills California United States 92653

1.2 Identification of the EUT

Product Name	:	Bluetooth headset
Type/model	:	Tags 2.0
FCC ID	:	PGW-OT1005
IC	:	21672-OT1005

1.3 Technical Specification

Operation Frequency Band	:	2400 – 2483.5 MHz
Protocol	:	Bluetooth Base Rate + EDR
Type of Modulation	:	GFSK, π/4-DQPSK, 8DPSK
Channel Number	:	79 channels
Description of EUT	:	EUT is a bluethooth device.This report is assessed for BT function. We tested it and listed the worst data in this report.
Antenna	:	MULTILAYER CERAMIC ANTENNA, 2.0dBi
Rating	:	3.7Vdc
Category of EUT	:	Class B
EUT type	:	☒ Table top ☐ Floor standing
Sample received date	:	Mar 15, 2017
Date of test	:	Mar 16, 2017 –May 20, 2017

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2016)
RSS-247 Issue 2 (Feb 2017)
RSS-Gen Issue 4 (December 2014)
ANSI C63.10 (2013)

2.2 Mode of operation during the test

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

The lowest, middle and highest channel were tested as representatives.

Freq. Band (MHz)	Modulation	Lowest (MHz)	Middle (MHz)	Highest (MHz)
2400-2483.5	GFSK	2402	2442	2480
	π/4-DQPSK	2402	2442	2480
	8DPSK	2402	2442	2480

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

Item No.	Name	Band and Model	Description
1	Laptop computer	HP, EliteBook 2530P	-
2	AC adapter	HUAWEI	
3			

2.5 Instrument list

Selected	Instrument	EC no.	Model	Valid until date
☒	Shielded room	EC 2838	GB88	2018-1-8
☒	EMI test receiver	EC 2107	ESCS 30	2017-10-19
☒	A.M.N.	EC 3119	ESH2-Z5	2017-12-16
☐	A.M.N.	EC 3394	ENV 216	2017-8-1
☒	Semi anechoic chamber	EC 3048	-	2018-5-11
☒	EMI test receiver	EC 3045	ESIB26	2017-10-19
☒	Broadband antenna	EC 4206	CBL 6112D	2018-4-27
☒	Horn antenna	EC 3049	HF906	2018-4-27
☐	Horn antenna	EC 4792-1	3117	2018-4-21
☒	Horn antenna	EC 4792-3	HAP18-26W	2017-6-11
☐	Pre-amplifier	EC 5262	pre-amp 18	2017-5-25
☒	Pre-amplifier	EC 4792-2	TPA0118-40	2018-4-10
☐	High Pass Filter	EC 4797-1	WHKX 1.0/15G-10SS	2018-1-8
☒	High Pass Filter	EC 4797-2	WHKX 2.8/18G-12SS	2018-1-8
☐	High Pass Filter	EC 4797-3	WHKX 7.0/1.8G-8SS	2018-1-8
☒	Band Reject Filter	EC 4797-4	WRCGV2400/2483/10SS	2018-1-8
☐	Test Receiver	EC 4501	ESCI 7	2018-1-13
☒	PXA Signal Analyzer	EC5338	N9030A	2017-5-14
☒	Power sensor/Power meter	EC4318	N1911A/N1921A	2018-4-8
☐	Power sensor	EC5338-1	U2021XA	2018-3-5
☐	MXG Analog Signal Generator	EC5338-2	N5181A	2018-3-5
☐	MXG Vector Signal Generator	EC5175	N51812B	2018-1-8

2.6 Test Summary

This report applies to tested sample only. The test results have been compared directly with the limits, and the measurement uncertainty is recorded. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

TEST ITEM	FCC REFERANCE	IC REFERANCE	RESULT
20 dB bandwidth	15.247(a)(1)	RSS-247 Issue 2 Clause 5.1	Tested
Carrier frequency separation	15.247(a)(1)	RSS-247 Issue 2 Clause 5.1	Pass
Maximum peak output power	15.247(b)(1)	RSS-247 Issue 2 Clause 5.4	Pass
Radiated emissions	15.205 & 15.209	RSS-Gen Issue 4 Clause 8.9	Pass
Emission outside the frequency band	15.247(d)	RSS-247 Issue 2 Clause 5.5	Pass
Number of hopping frequencies	15.247(a)(1)(iii)	RSS-247 Issue 2 Clause 5.1	Pass
Dwell time	15.247(a)(1)(iii)	RSS-247 Issue 2 Clause 5.1	Pass
Power line conducted emission	15.207	RSS-Gen Issue 4 Clause 8.8	Pass
Occupied bandwidth	-	RSS-Gen Issue 4 Clause 6.6	Tested

Notes: 1: NA =Not Applicable

2: This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

2.7 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

TEST ITEM	MEASUREMENT UNCERTAINTY
Maximum peak output power	± 0.74dB
Radiated Emissions in restricted frequency bands below 1GHz	± 4.90dB
Radiated Emissions in restricted frequency bands above 1GHz	± 5.02dB
Emission outside the frequency band	± 2.89dB
Power line conducted emission	± 3.19dB

2.8 Antenna requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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 manufacturer may design the unit so that a broken antenna can be replaced by the user, butthe use of a standard antenna jack or electrical connector is prohibited.

The manufacturer used a MULTILAYER CERAMIC ANTENNA, so fulfill these requirements.

3 20 dB Bandwidth

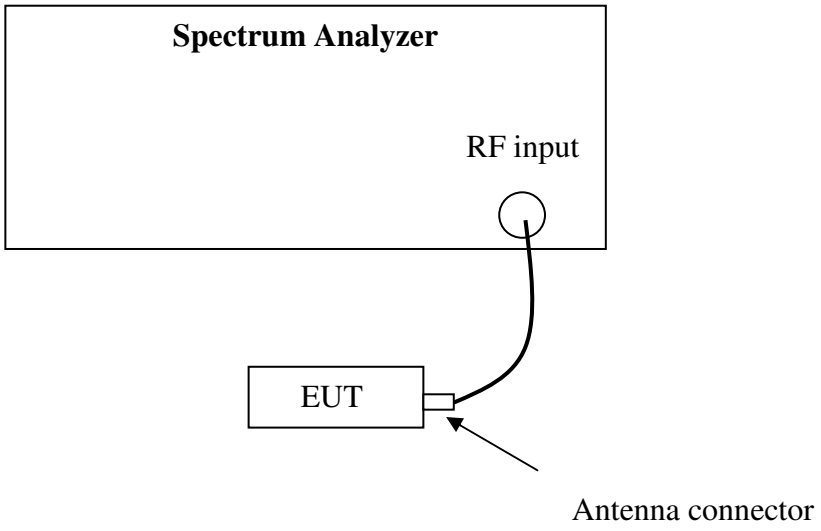
Test result: Pass

3.1 Limit

☐ 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.

☒ 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 125mW.

3.2 Test Configuration



3.3 Test Procedure and test setup

The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems)

The 20 bandwidth per FCC § 15.247(a)(1) is measured using the Spectrum Analyzer with Span = 2 to 3 times the 20 dB bandwidth, RBW≥1% of the 20 dB bandwidth, VBW≥RBW, Sweep = auto, Detector = peak, Trace = max hold.
The test was performed at 3 channels (lowest, middle and highest channel).

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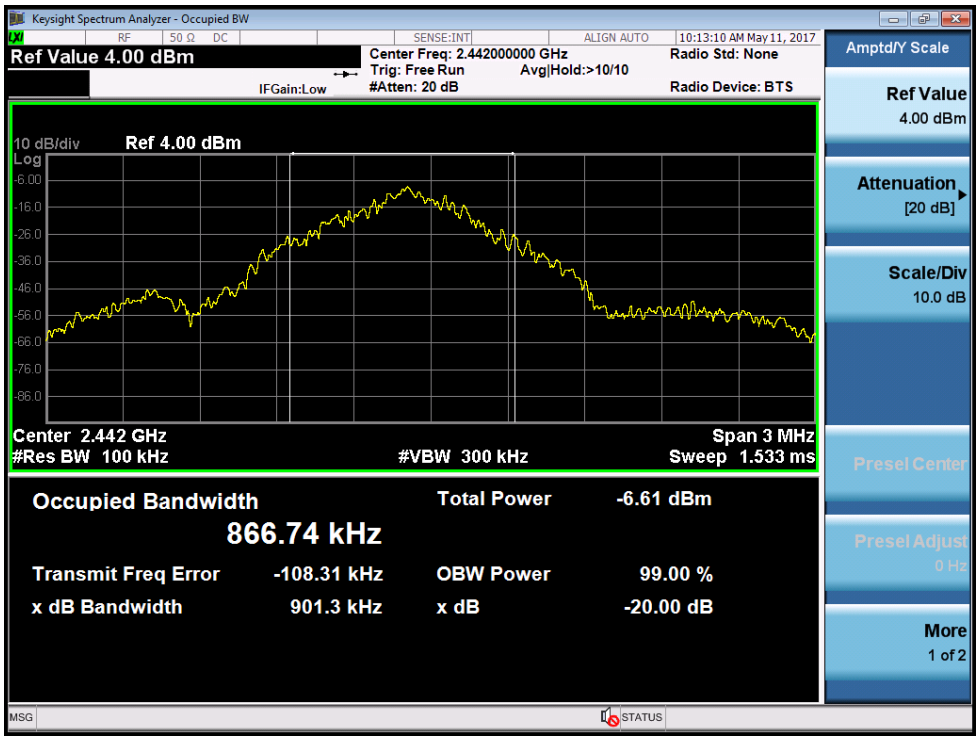
3.4 Test Protocol

Temperature: 22°C
Relative Humidity: 54%

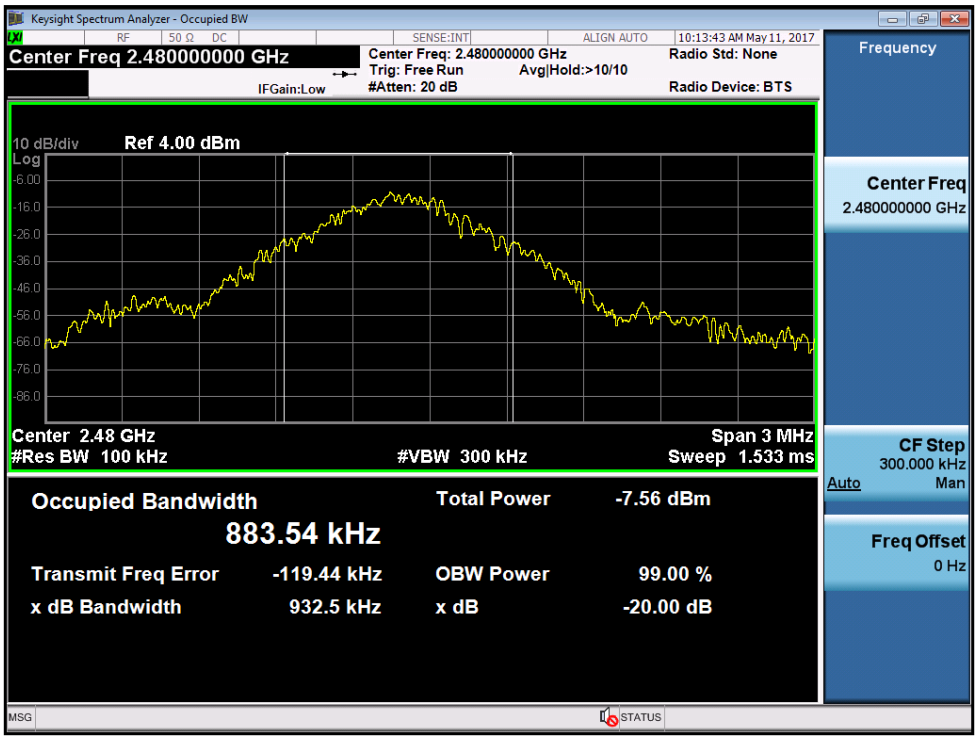
Modulation	Channel	20dB Bandwidth (kHz)	Two-thirds of Bandwidth (kHz)
GFSK	L	950.4	633.60
	M	901.3	600.00
	H	932.5	621.66

Channel L

Channel M

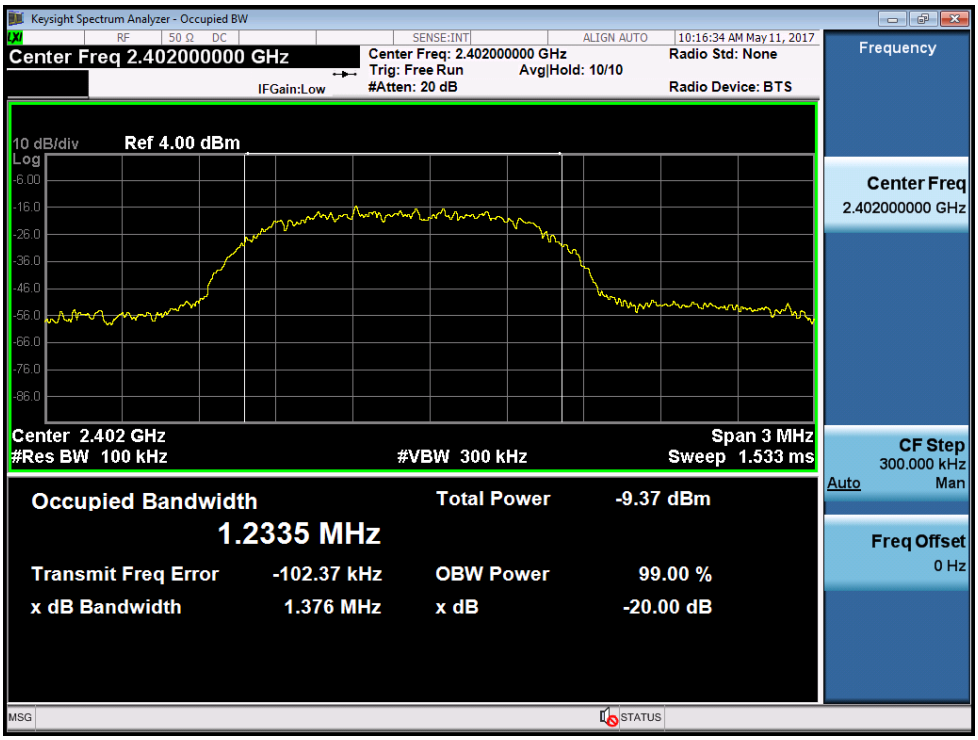


Channel H

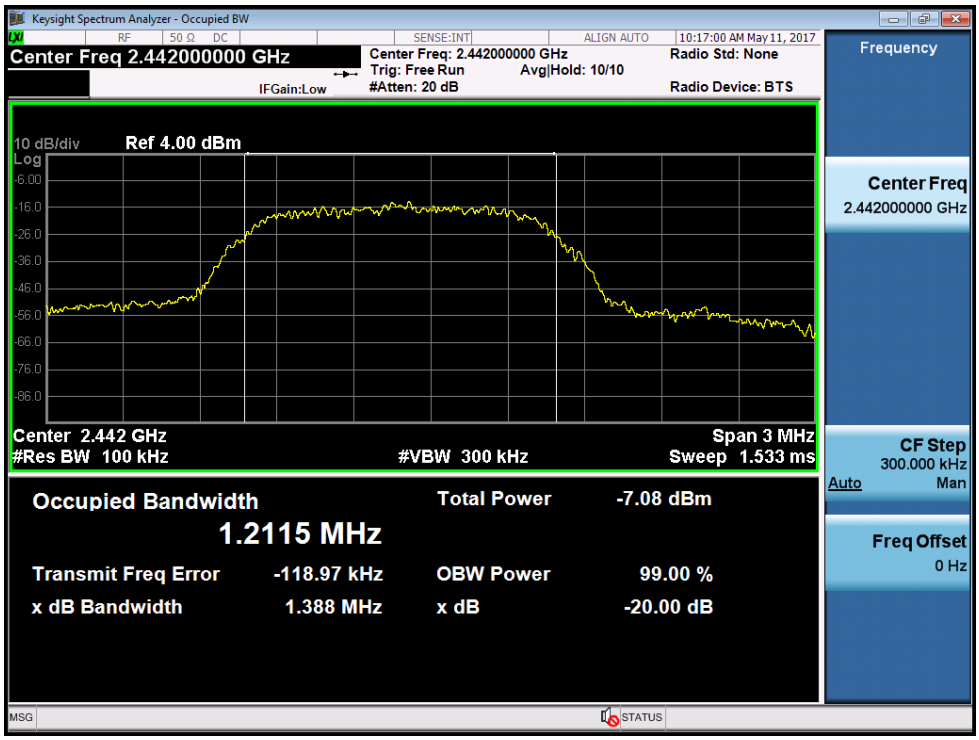


Modulation	Channel	20dB Bandwidth (kHz)	Two-thirds of Bandwidth (kHz)
π/4-DQPSK	L	1376	917.33
	M	1388	925.37
	H	1397	931.33

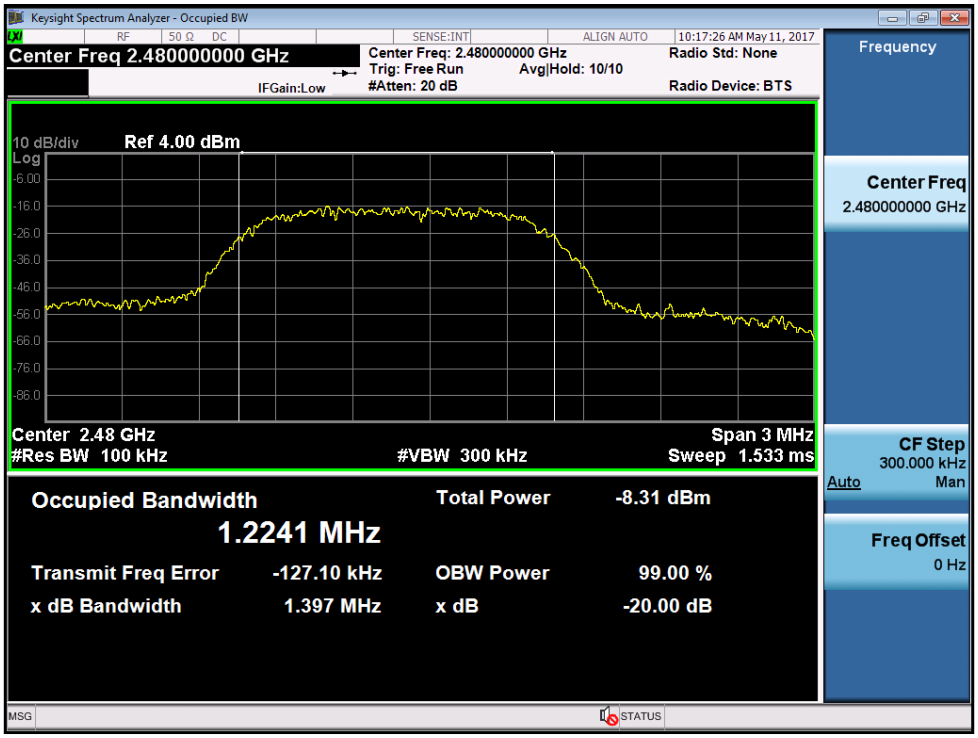
Channel L



Channel M



Channel H



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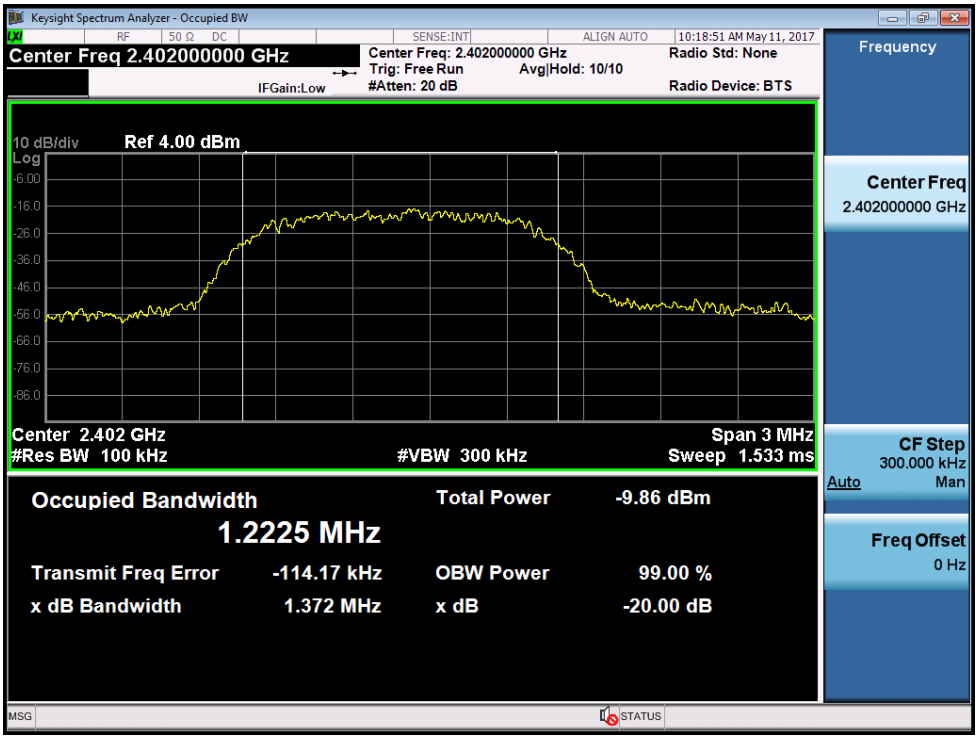
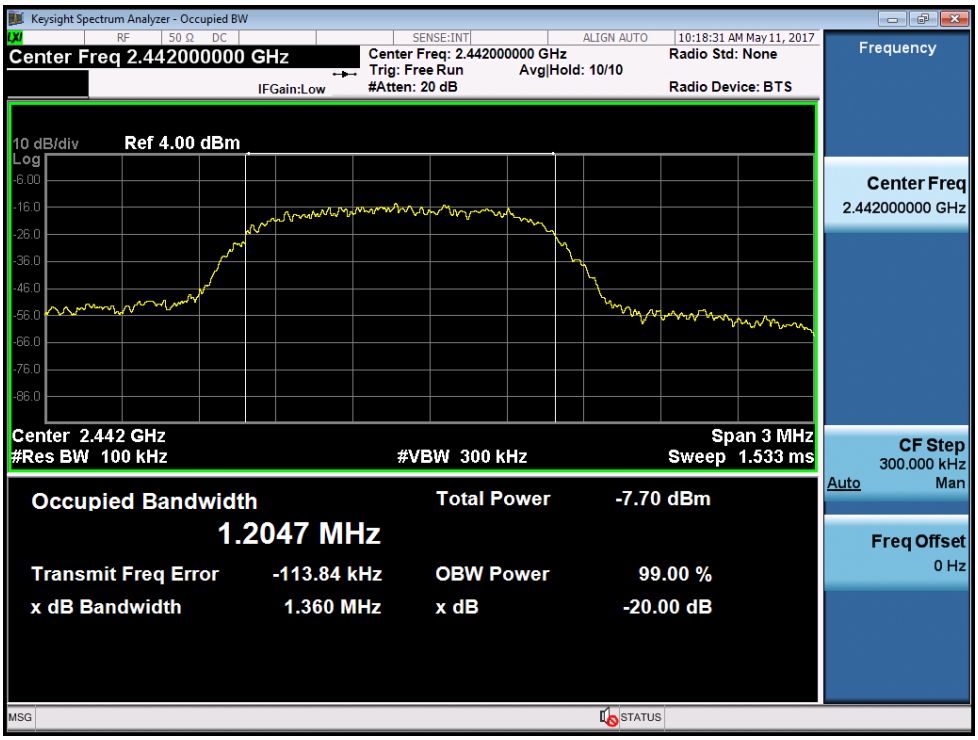
Modulation	Channel	20dB Bandwidth (kHz)	Two-thirds of Bandwidth (kHz)
8DPSK	L	1372	914.67
	M	1360	906.67
	H	1380	920.00

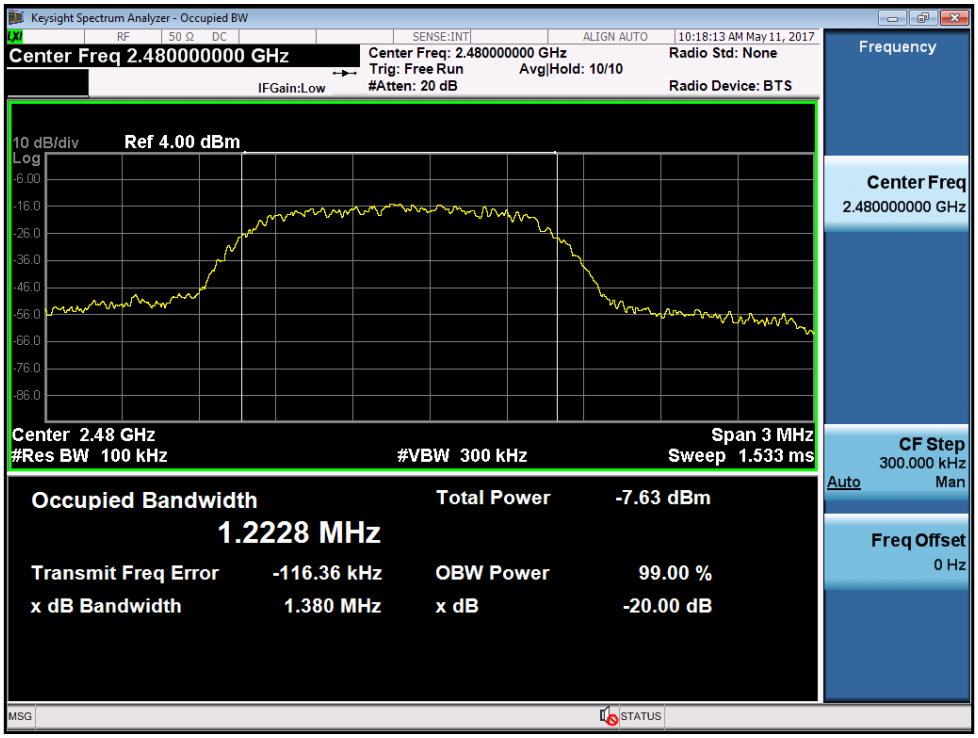
Channel L



Channel M



Channel H



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4 Carrier frequency separation

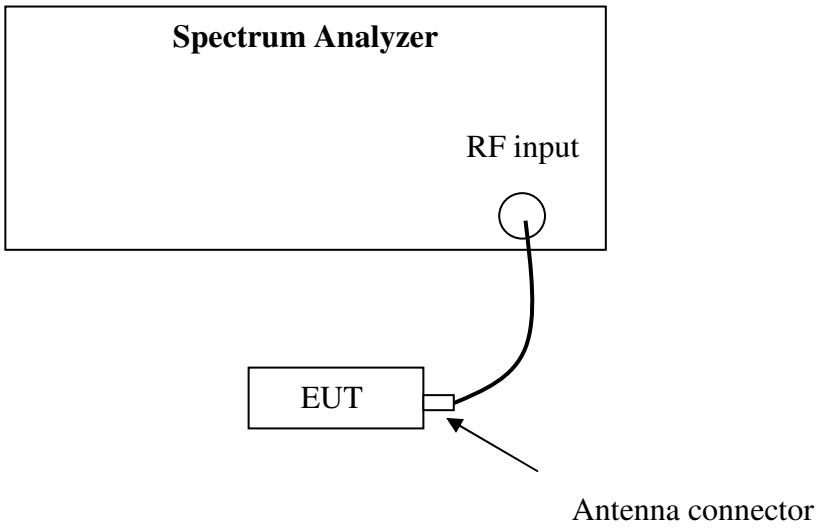
Test result: Pass

4.1 Test limit

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

☒ 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 125mW.

4.2 Test Configuration



4.3 Test procedure and test setup

The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems)

The Carrier frequency separation per FCC § 15.247(a)(1) is measured using the Spectrum Analyzer with Span can capture two adjacent channels, RBW≥1% of the span, VBW≥RBW, Sweep = auto, Detector = peak, Trace = max hold.
The test was performed at 3 channels (lowest, middle and highest channel).

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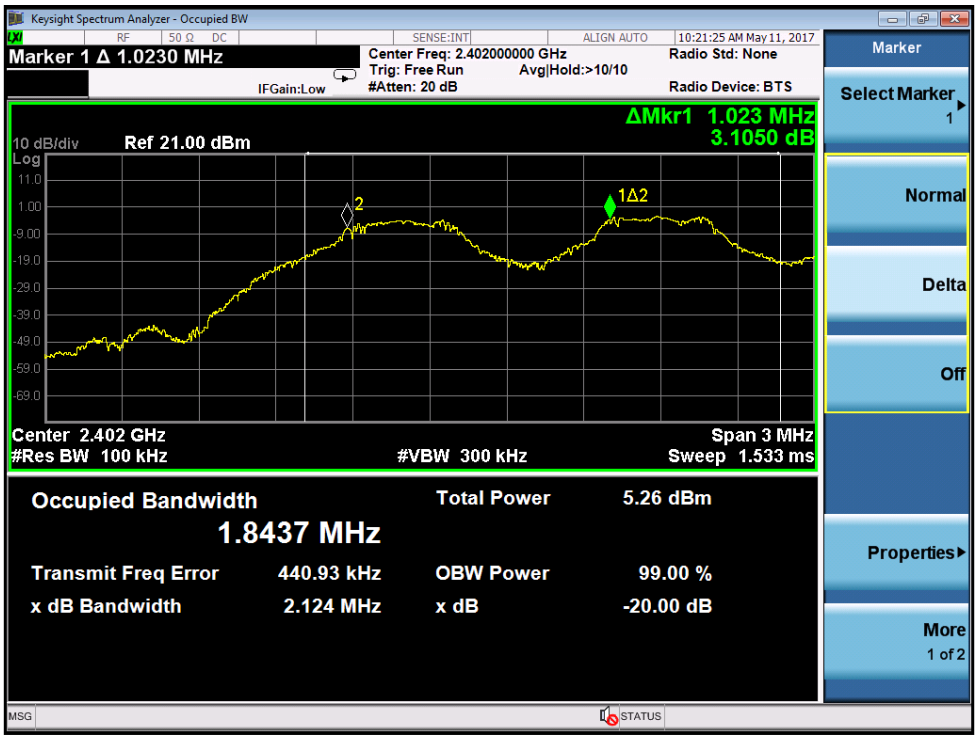
4.4 Test protocol

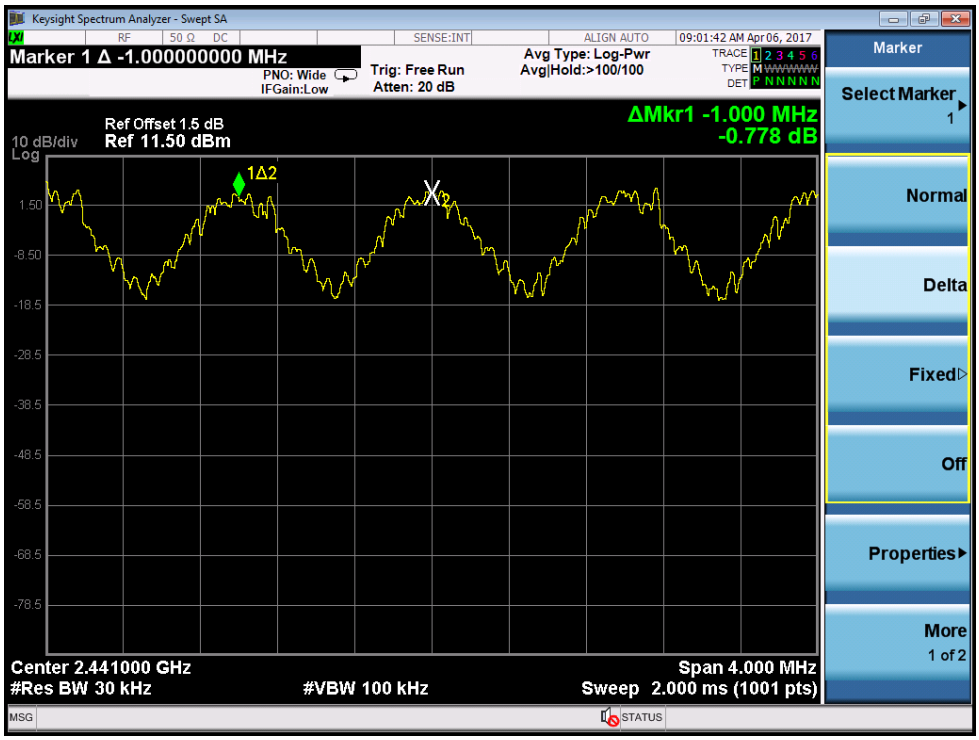
Temperature: 22 °C
Relative Humidity: 54 %

Modulation	Channel	Frequency Separation (kHz)	Limit (kHz)
GFSK	L	1004	≥633.60
	M	1000	≥600.00
	H	1000	≥621.66

Channel L



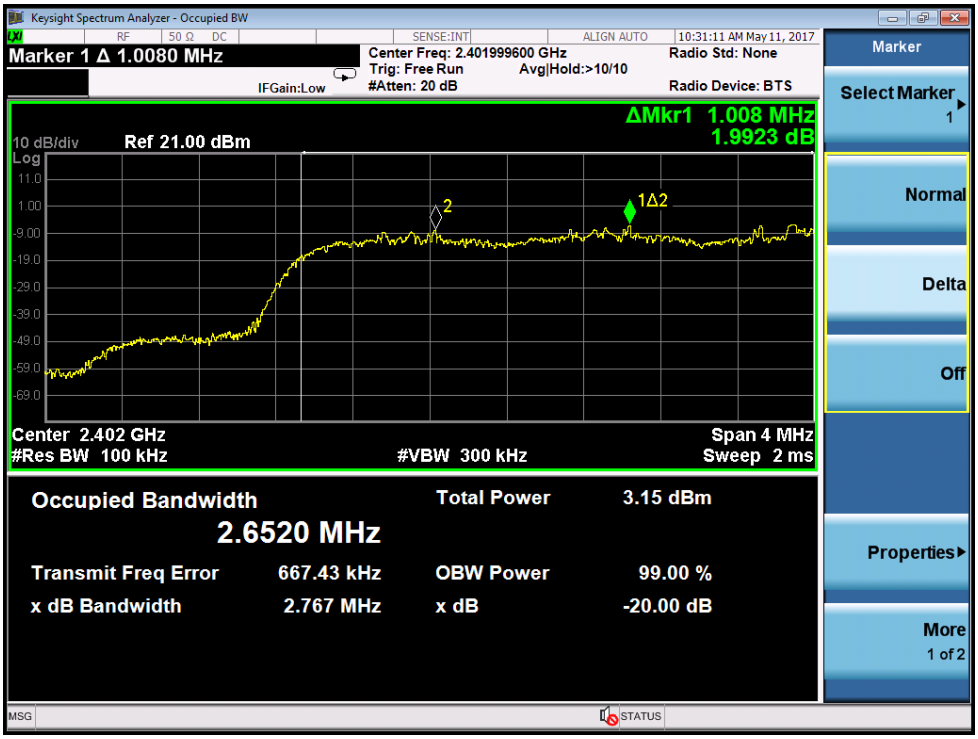
Channel M



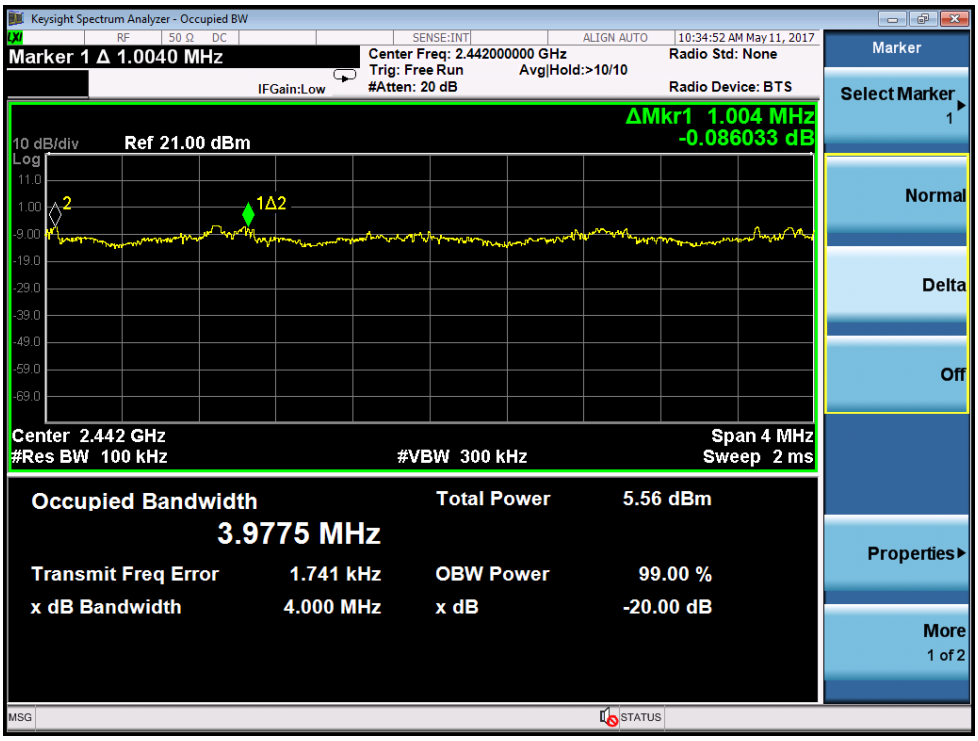
Channel H

Modulation	Channel	Frequency Separation (kHz)	Limit (kHz)
π/4-DQPSK	L	1008	≥ 917.33
	M	1004	≥ 906.67
	H	1044	≥ 931.33

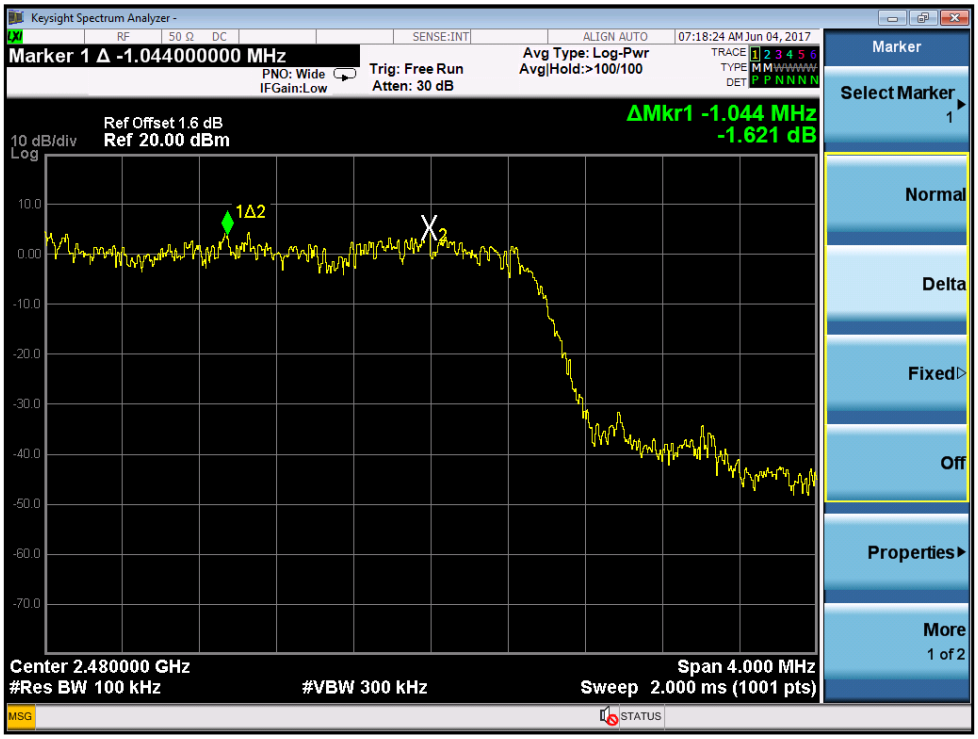
Channel L



Channel M

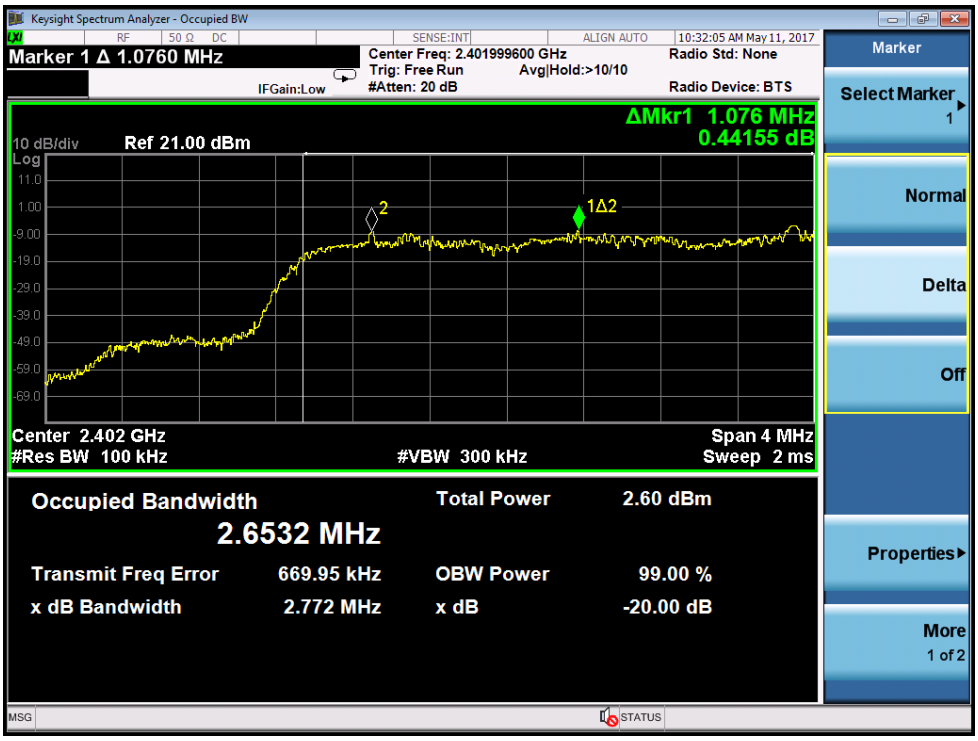


Channel H



Modulation	Channel	Frequency Separation (kHz)	Limit (kHz)
8DPSK	L	1076	≥ 914.67
	M	1056	≥ 906.67
	H	1044	≥ 920.00

Channel L



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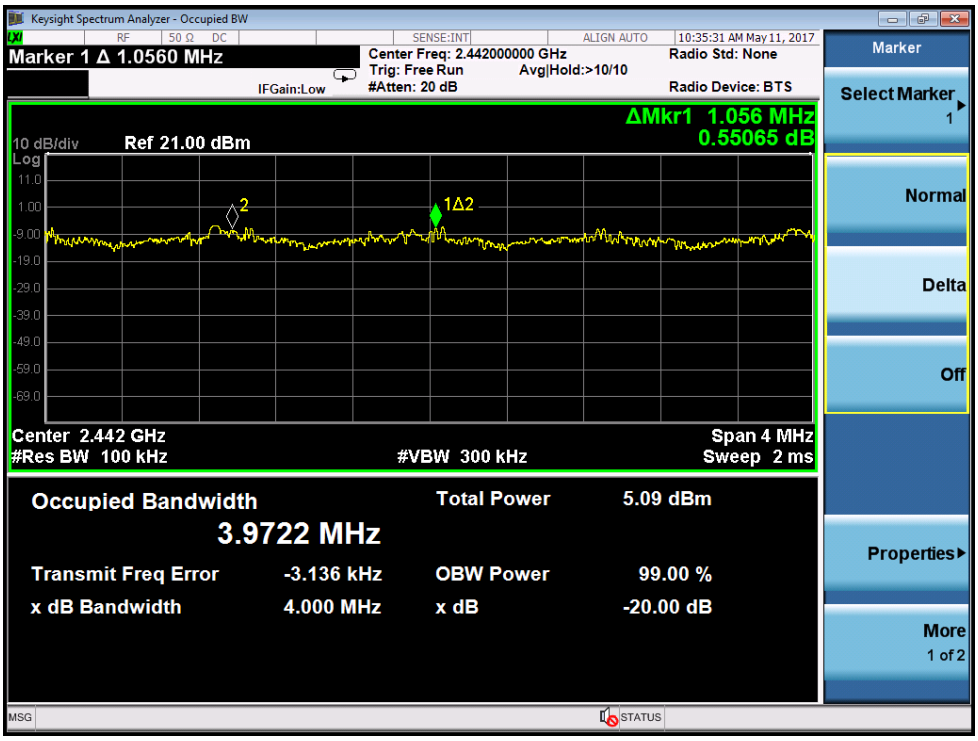
Channel M



Channel H

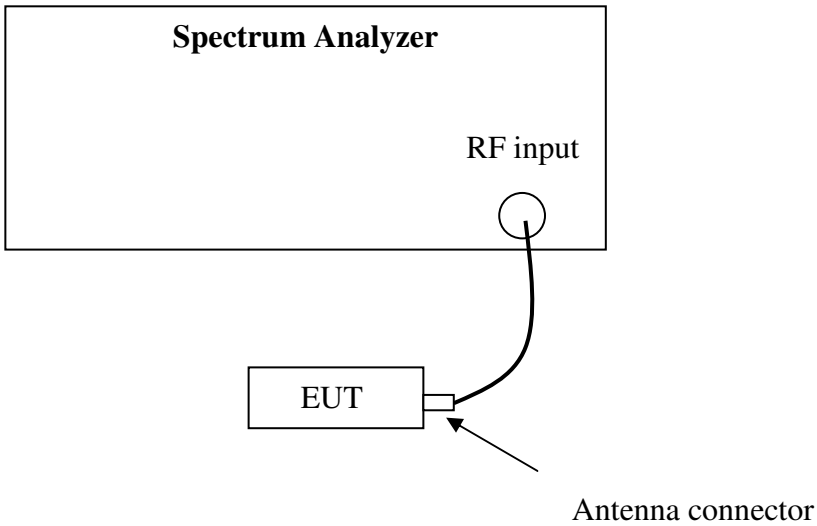
5 Maximum peak output power

Test result: Pass

5.1 Test limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt
For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts
If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

5.2 Test Configuration



5.3 Test procedure and test setup

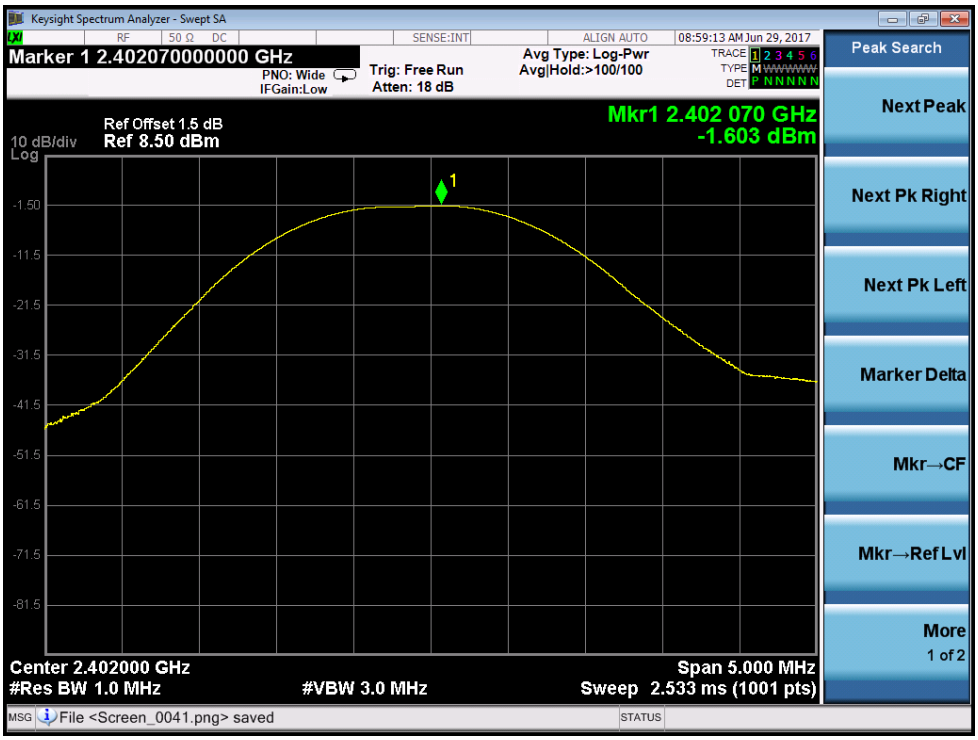
The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems)

The Maximum peak output power per FCC § 15.247(b) is measured using the Spectrum Analyzer with Span = 5 times the 20 dB bandwidth, RBW≥ the 20 dB bandwidth, VBW≥RBW, Sweep = auto, Detector = peak, Trace = max hold.
The test was performed at 3 channels (lowest, middle and highest channel).

5.4 Test Protocol

Temperature: 22°C
Relative Humidity: 54%
Modulation: GFSK

L



M

H

Modulation	Channel	Conducted Power (dBm)	Limit (dBm)
GFSK	L	-1.03	≤ 21.00
	M	-0.389	≤ 21.00
	H	-0.658	≤ 21.00

Conclusion: The maximum EIRP = -0.389dBm+2.0dBi = 1.449mW which is lower than the limit of 4W listed in RSS-247.

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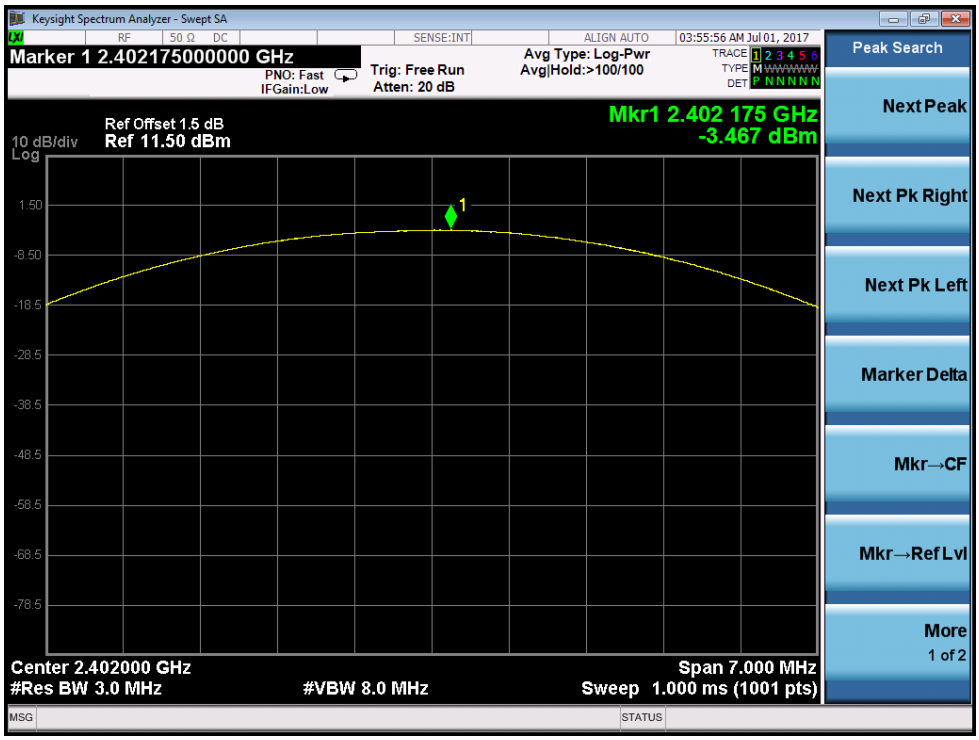
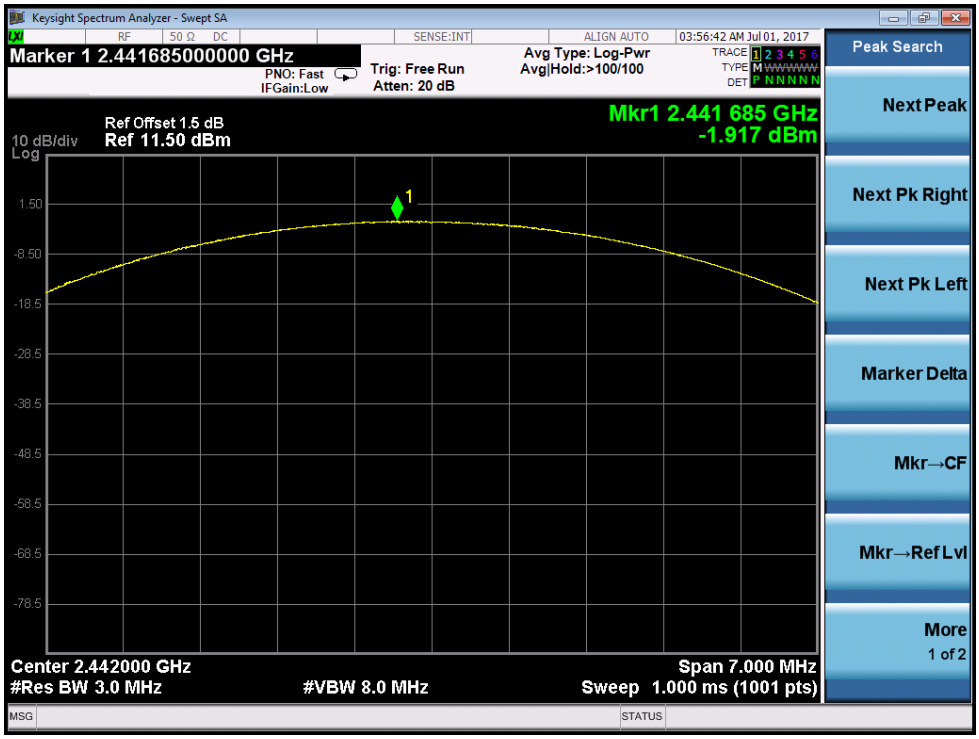
Modulation: π/4-DQPSK

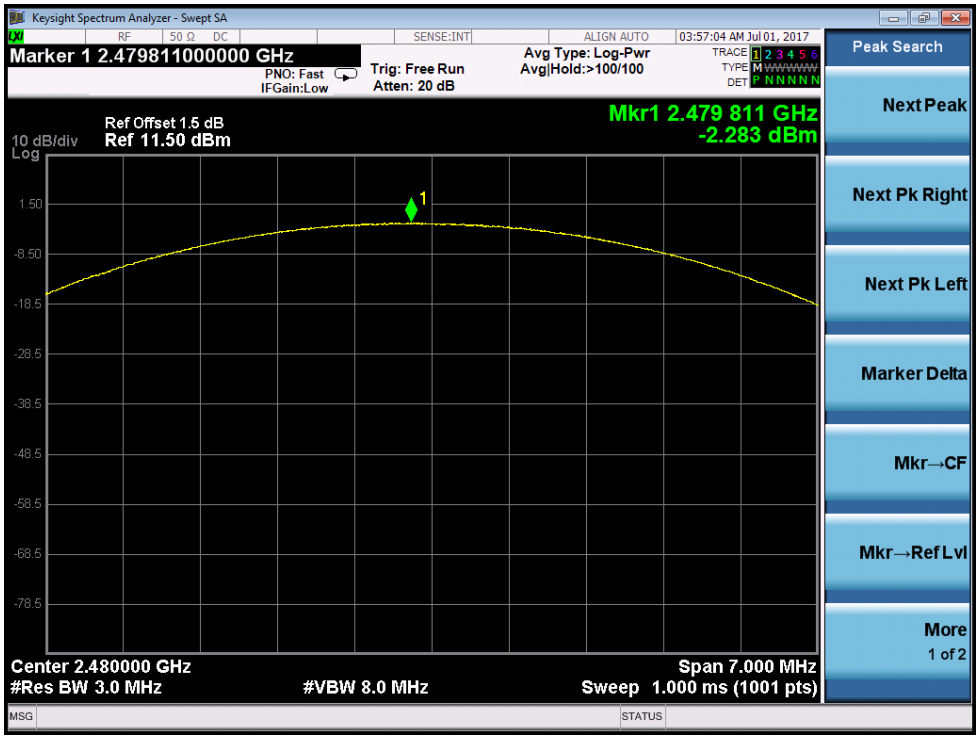
L



M



H

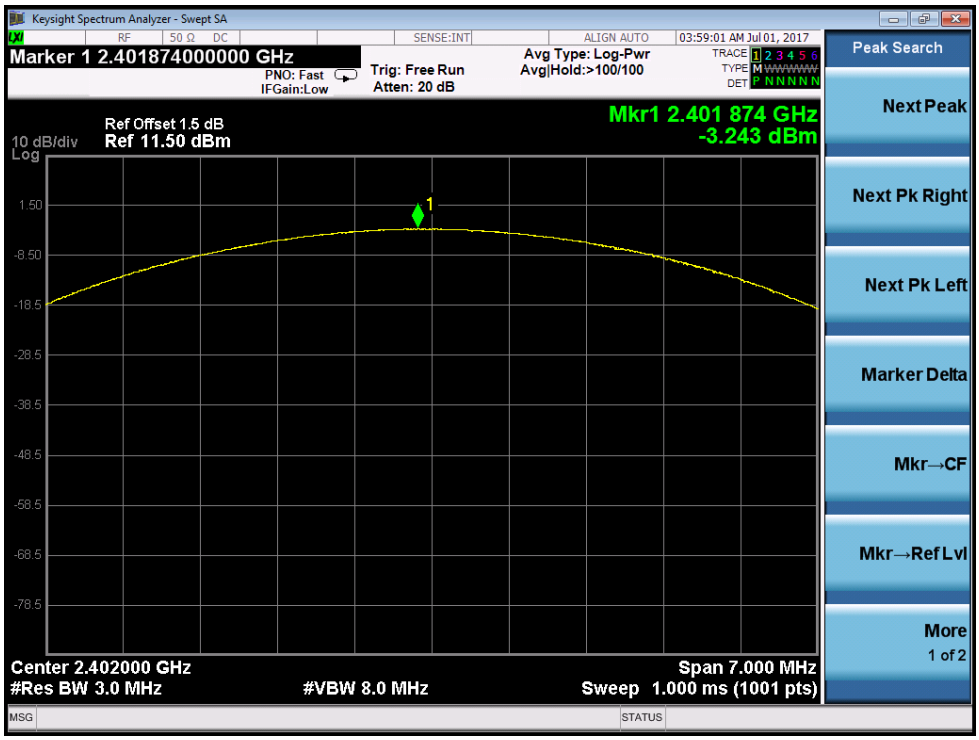


Modulation	Channel	Conducted Power (dBm)	Limit (dBm)
π/4-DQPSK	L	-3.467	≤ 21.00
	M	-1.917	≤ 21.00
	H	-2.283	≤ 21.00

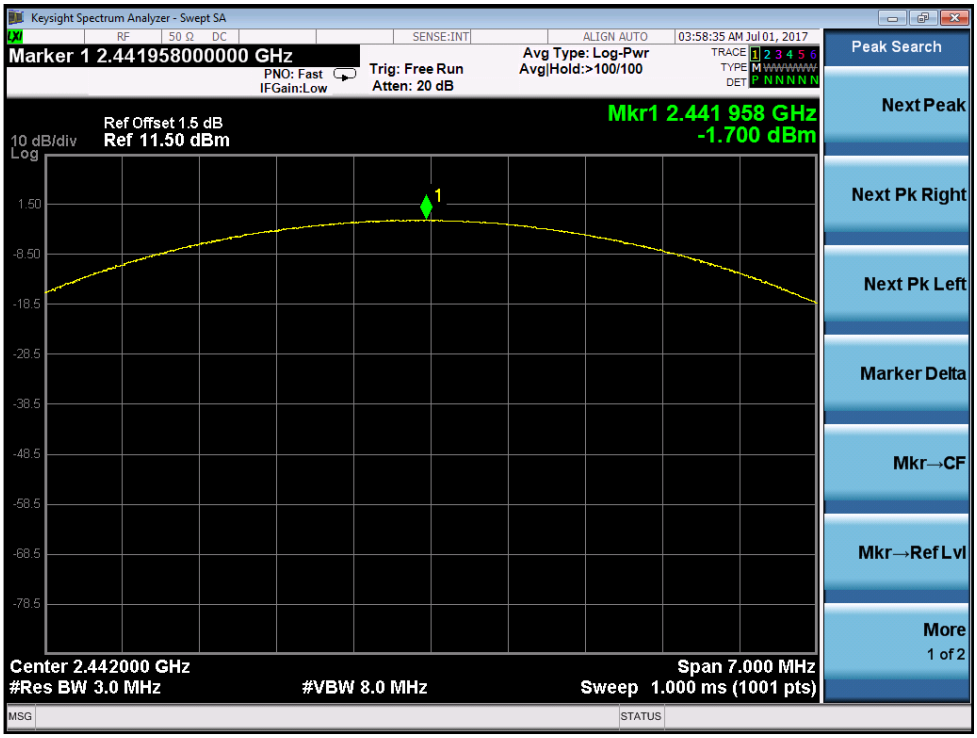
Conclusion: The maximum EIRP = -1.917dBm+2.0dBi = 1.019mW which is lower than the limit of 4W listed in RSS-247.

Modulation: 8DPSK

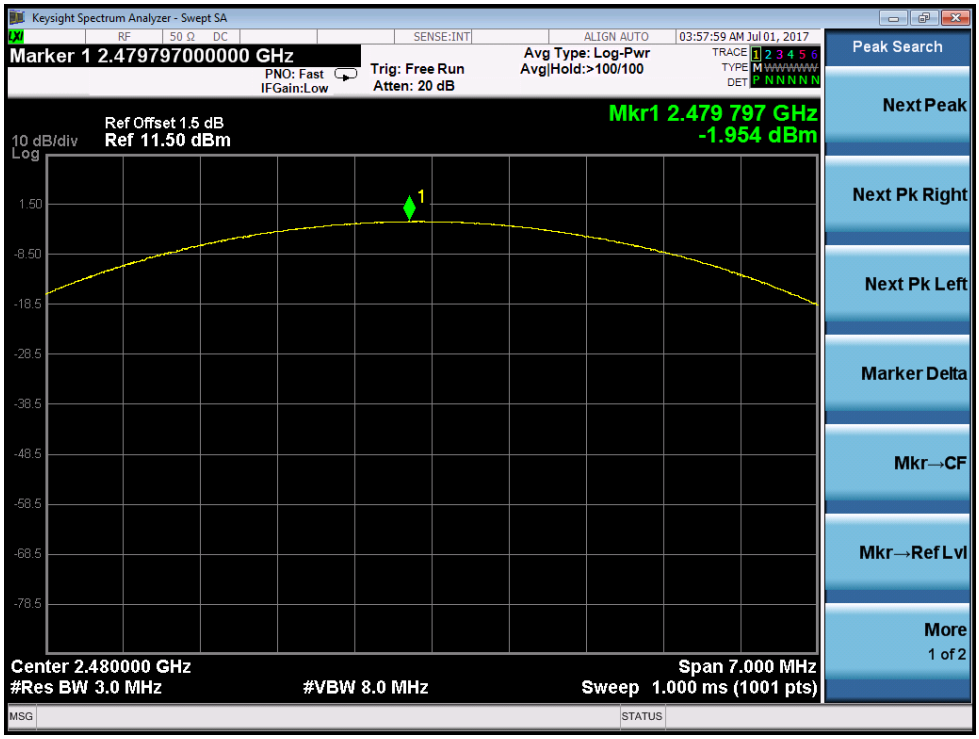
L



M



H



Modulation	Channel	Conducted Power (dBm)	Limit (dBm)
8DPSK	L	-3.243	≤ 21.00
	M	-1.700	≤ 21.00
	H	-1.954	≤ 21.00

Conclusion: The maximum EIRP = -1.700dBm+2.0dBi = 1.071mW which is lower than the limit of 4W listed in RSS-247.

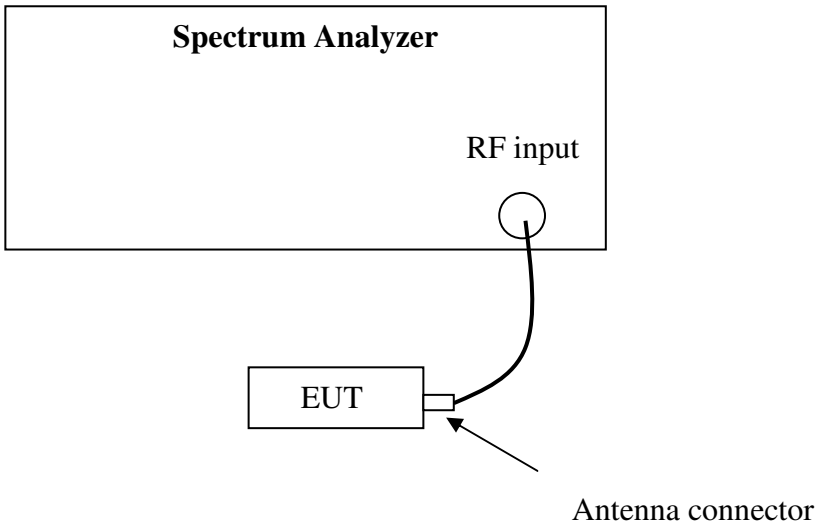
6 Emission outside the frequency band

Test result: Pass

6.1 Test limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

6.2 Test Configuration



6.3 Test procedure and test setup

The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems)

The Emission outside the frequency band per FCC § 15.247(d) is measured using the Spectrum Analyzer with Span wide enough capturing all spurious from the lowest emission frequency of the EUT up to 10th harmonics, RBW = 100kHz, VBW≥RBW, Sweep = auto, Detector = peak, Trace = max hold.
The test was performed at 3 channels (lowest, middle and highest channel).

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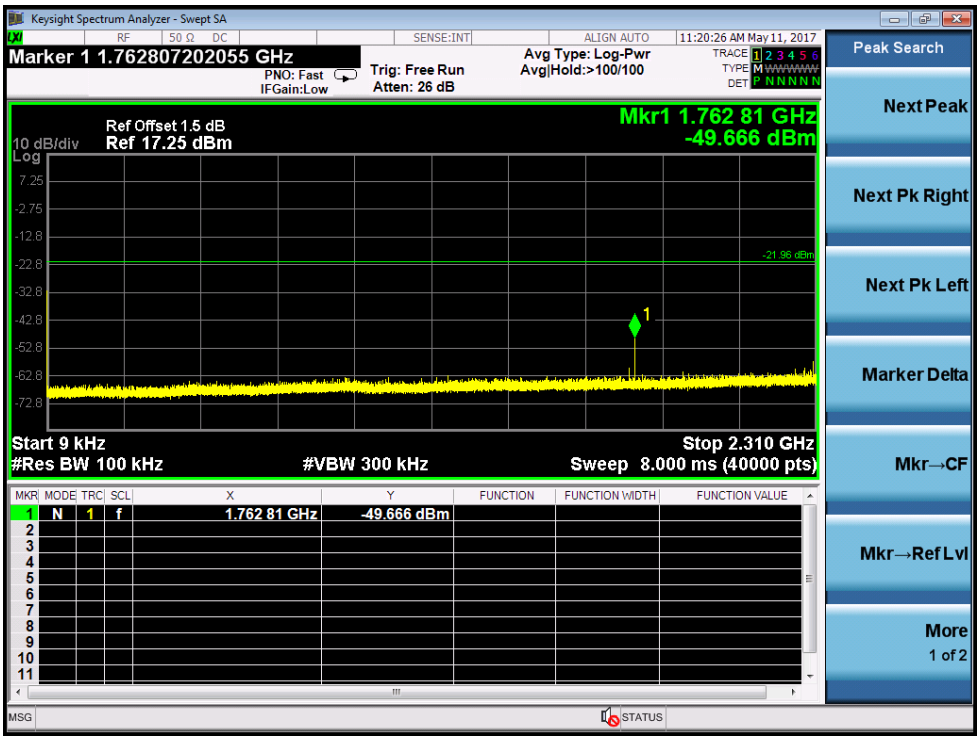
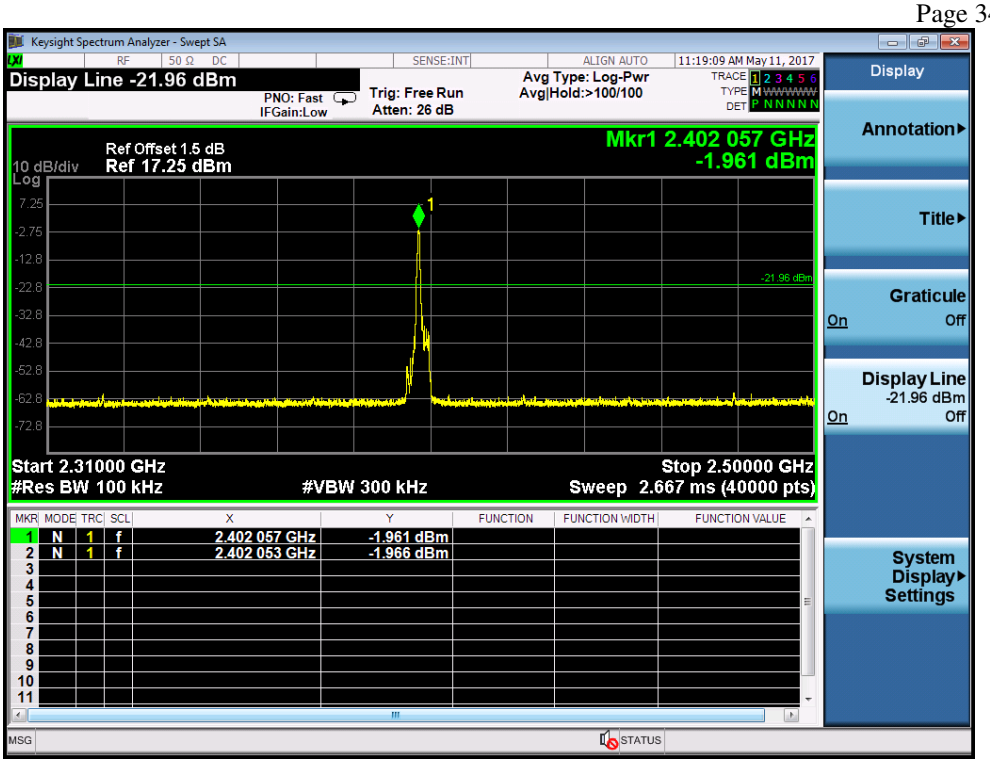
6.4 Test Protocol

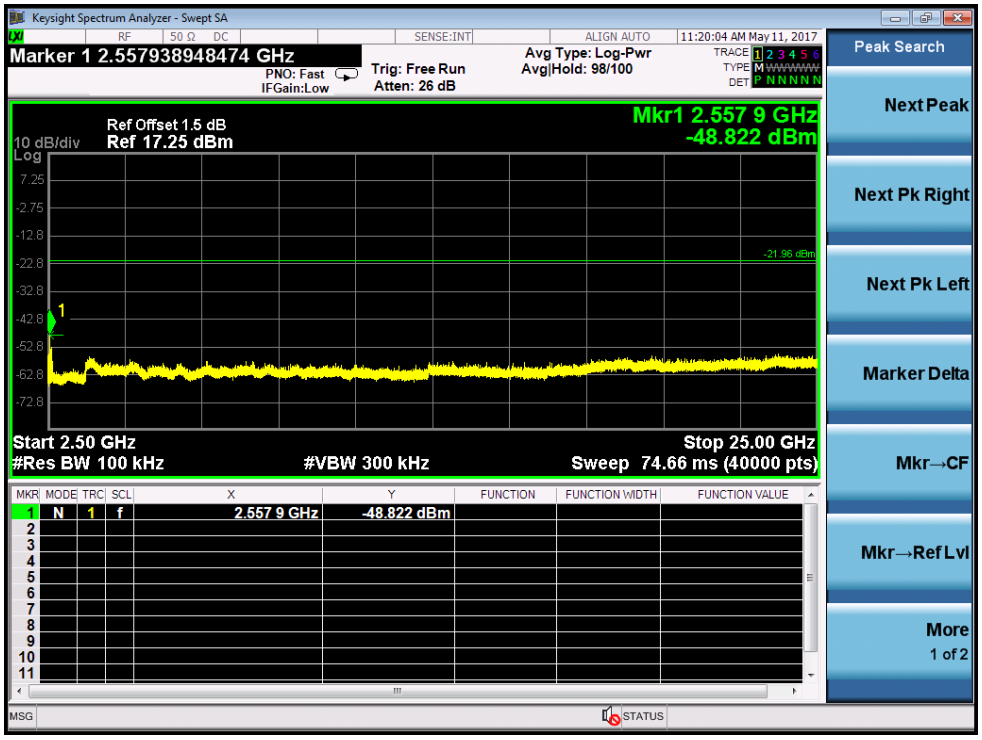
Temperature: 22°C
Relative Humidity: 54%

Modulation	Channel	The most restrict Attenuation outside band (dB)	Result
GFSK	L	≥20	Pass
	M	≥20	Pass
	H	≥20	Pass
	Hopping	≥20	Pass

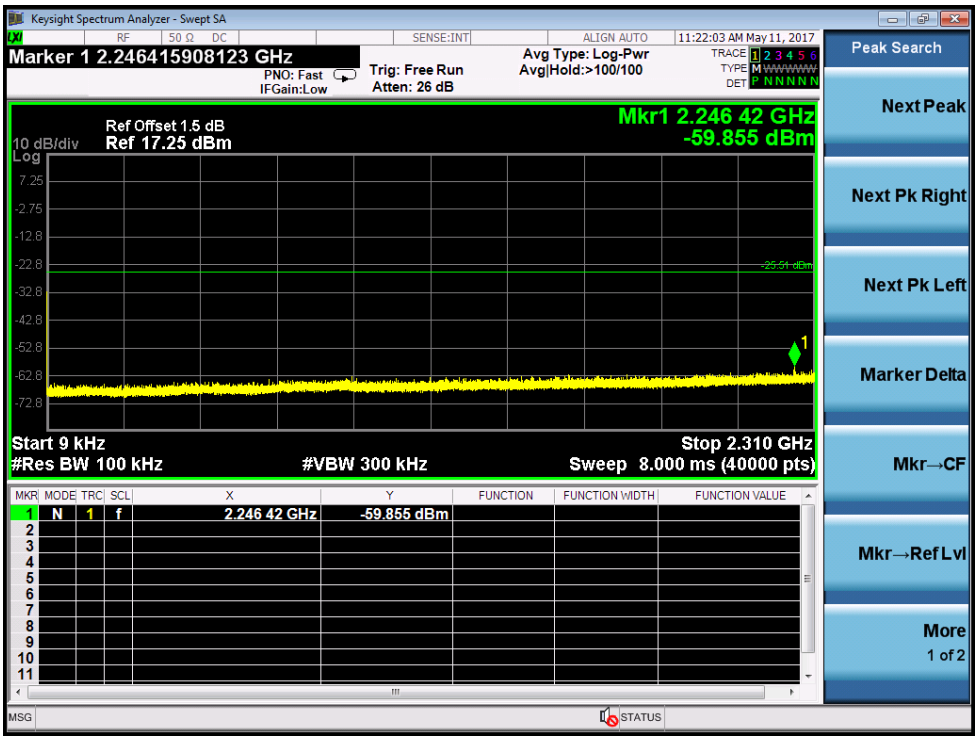
Channel L

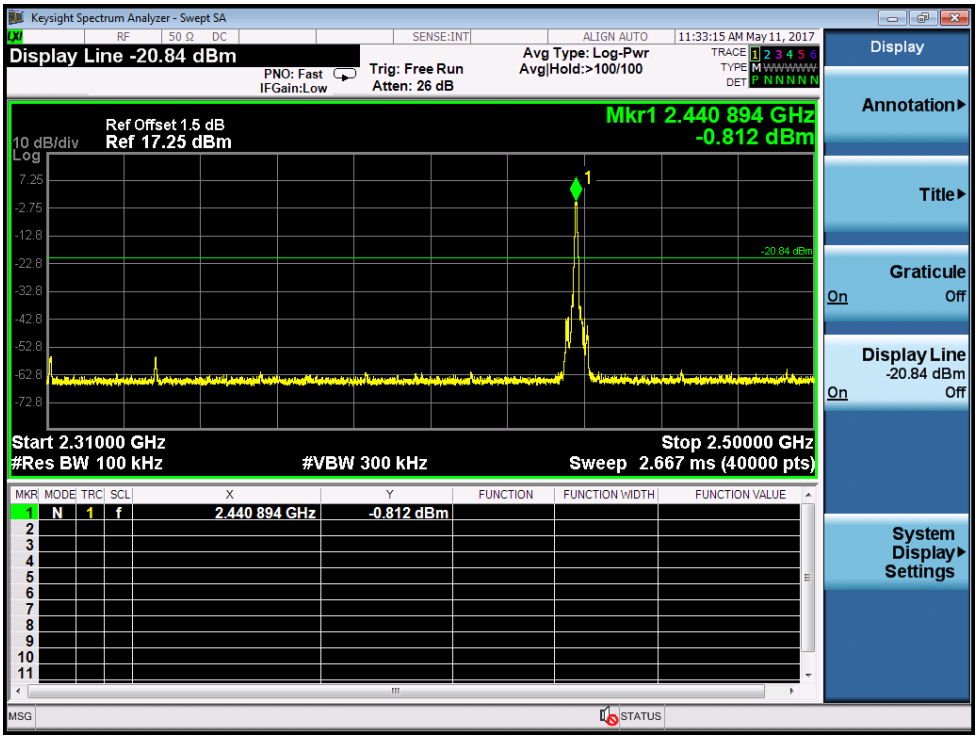


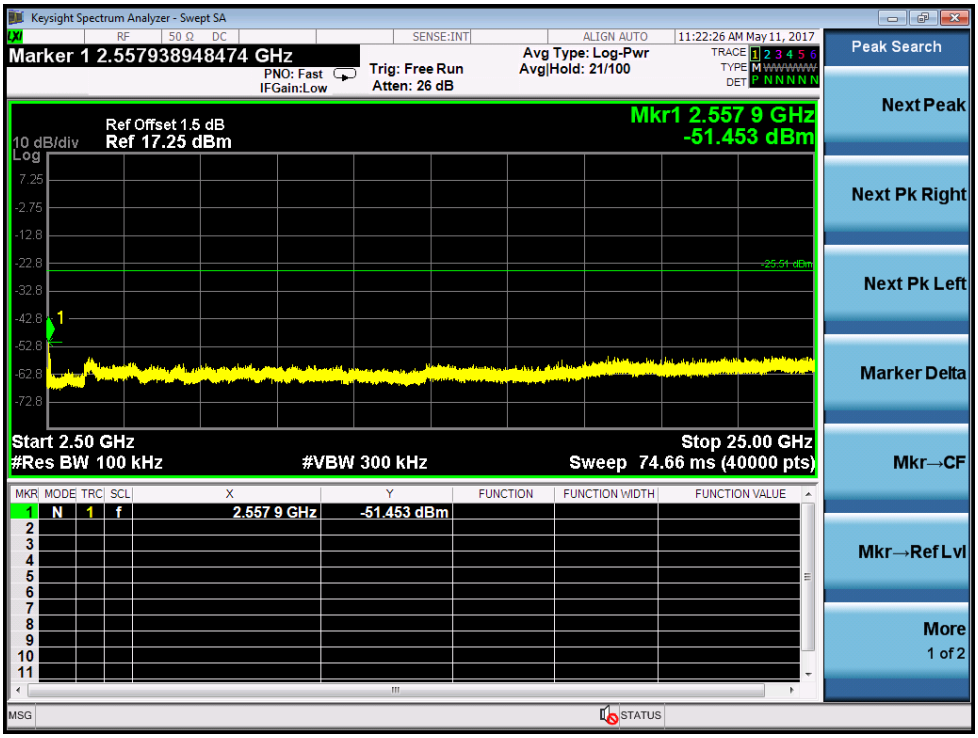

Keysight Spectrum Analyzer - Swept SA
Display Line -21.96 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:19:09 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.402 057 GHz
-1.961 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40000 pts)
1 N 1 f 2.402 057 GHz -1.961 dBm
2 N 1 f 2.402 053 GHz -1.966 dBm
Display
Annotation
Title
Graticule
Display Line
System Display Settings


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.557938948474 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 98/100
11:20:04 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.557 9 GHz
-48.822 dBm
Start 2.50 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 74.66 ms (40000 pts)
1 N 1 f 2.557 9 GHz -48.822 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

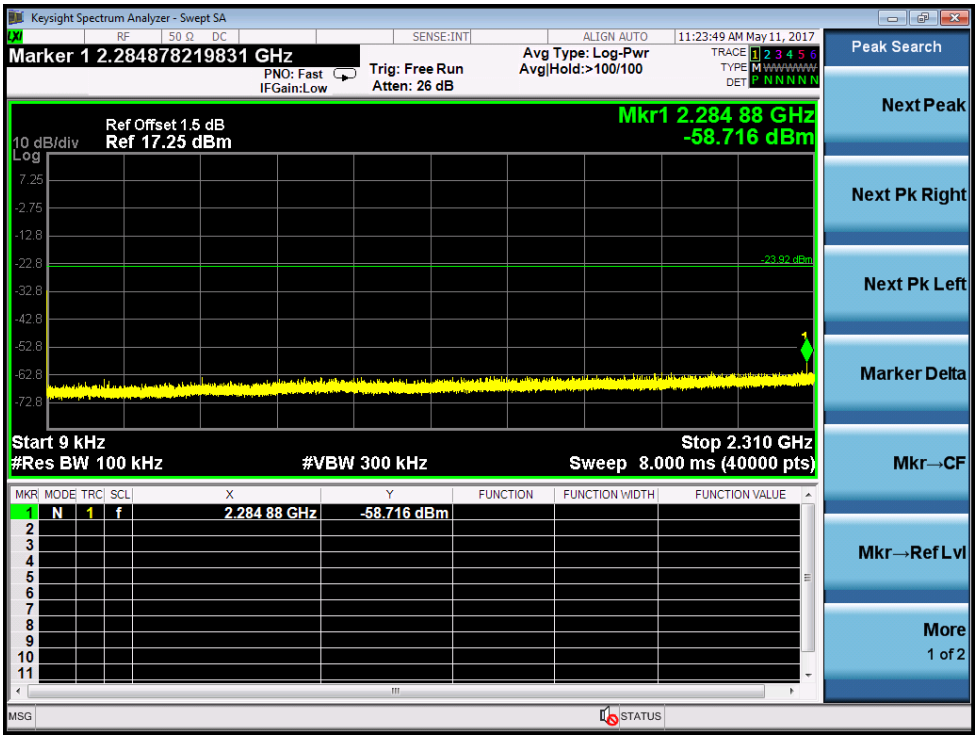
Channel M


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.246415908123 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:22:03 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.246 42 GHz
-59.855 dBm
Start 9 kHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.310 GHz
Sweep 8.000 ms (40000 pts)
1 N 1 f 2.246 42 GHz -59.855 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Keysight Spectrum Analyzer - Swept SA
Display Line -20.84 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:33:15 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.440 894 GHz
-0.812 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40000 pts)
1 N 1 f 2.440 894 GHz -0.812 dBm
Display
Annotation
Title
Graticule
On Off
Display Line
-20.84 dBm
On Off
System Display Settings



Channel H



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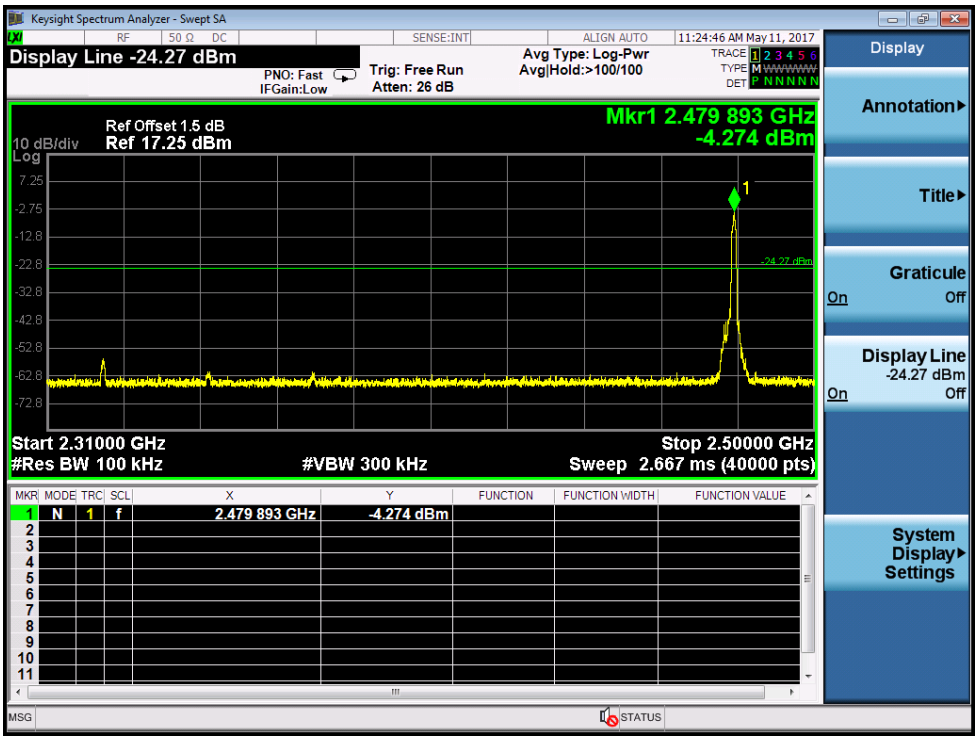
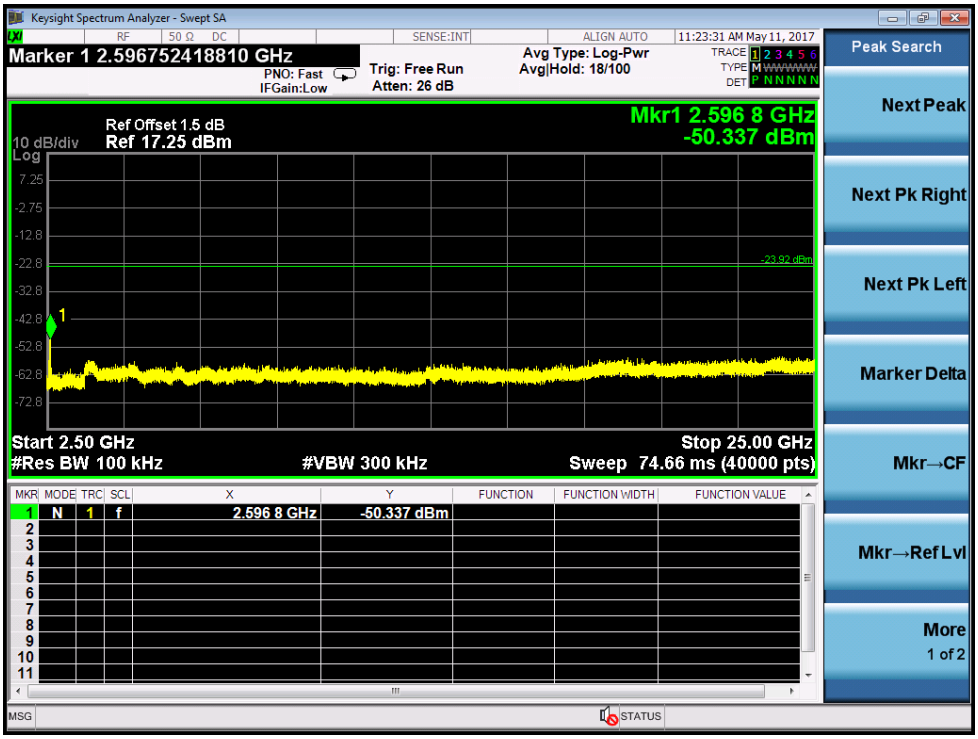
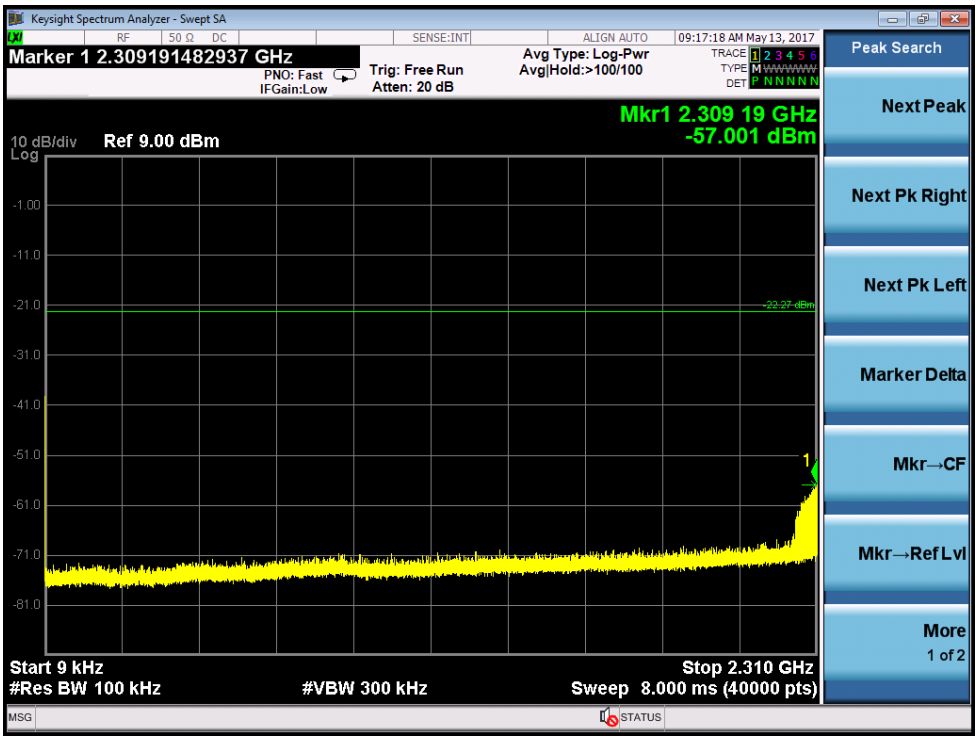
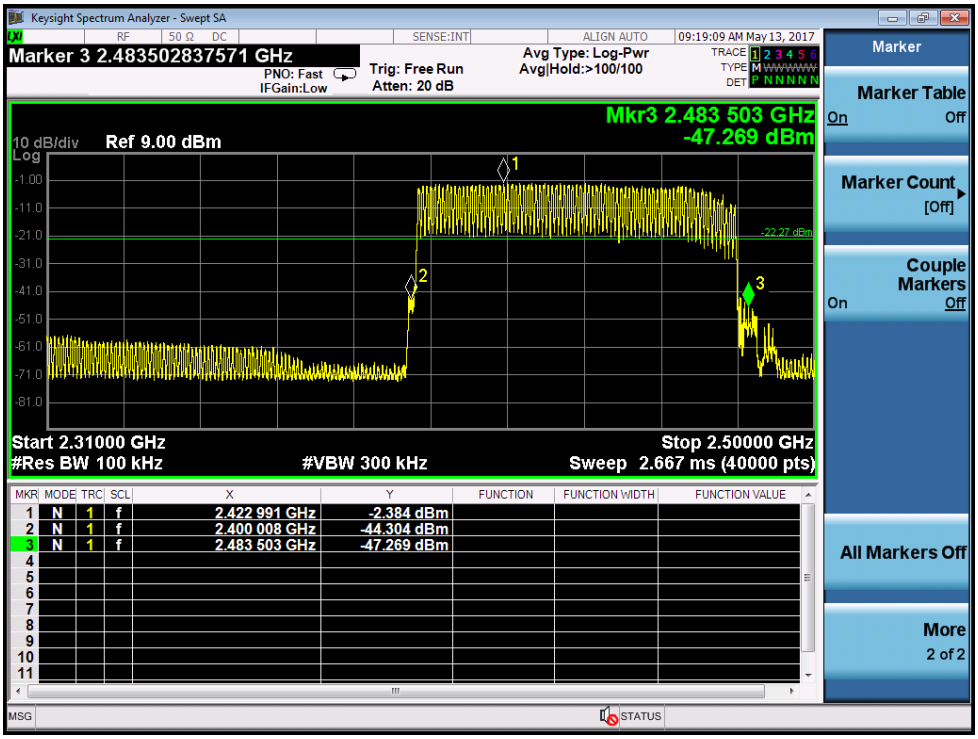
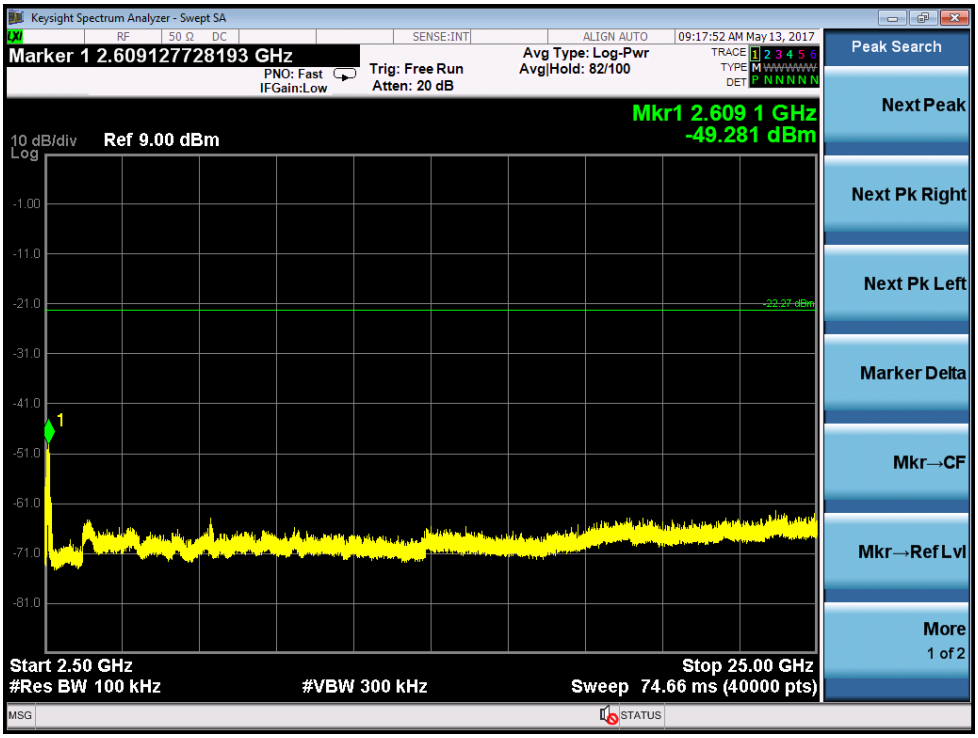

Keysight Spectrum Analyzer - Swept SA
Display Line -24.27 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:24:46 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.479 893 GHz
-4.274 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40000 pts)
1 N 1 f 2.479 893 GHz -4.274 dBm
Display
Annotation
Title
Graticule
On Off
Display Line
-24.27 dBm
On Off
System Display Settings


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.596752418810 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 18/100
11:23:31 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.596 8 GHz
-50.337 dBm
Start 2.50 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 74.66 ms (40000 pts)
1 N 1 f 2.596 8 GHz -50.337 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

Hopping

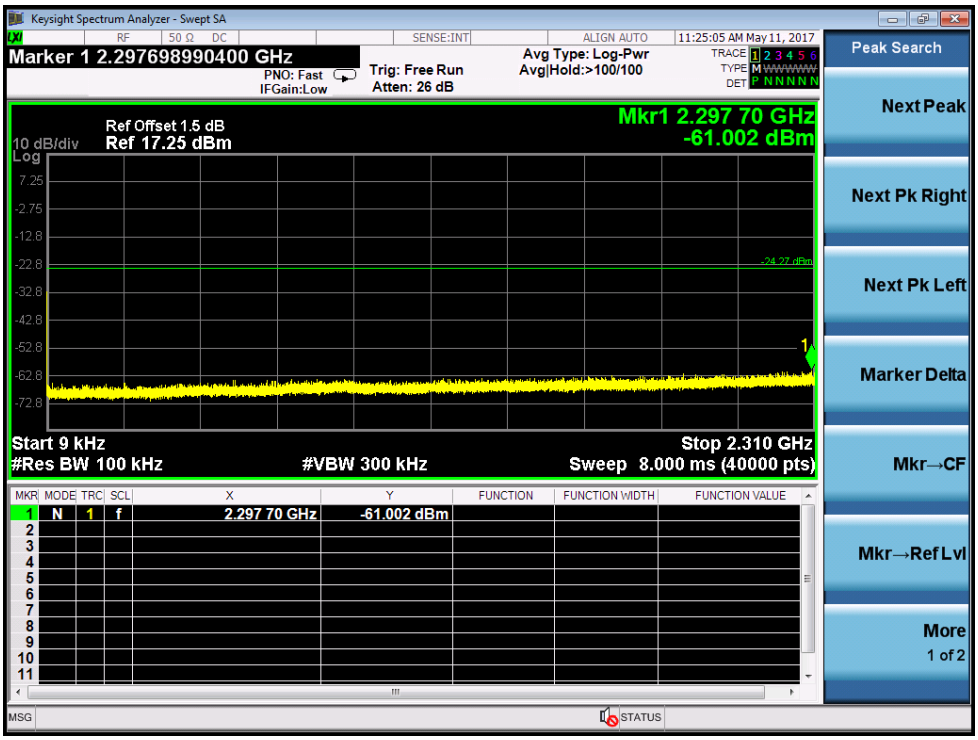

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.309191482937 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:17:18 AM May 13, 2017
Mkr1 2.309 19 GHz
-57.001 dBm
10 dB/div
Ref 9.00 dBm
Start 9 kHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.310 GHz
Sweep 8.000 ms (40000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

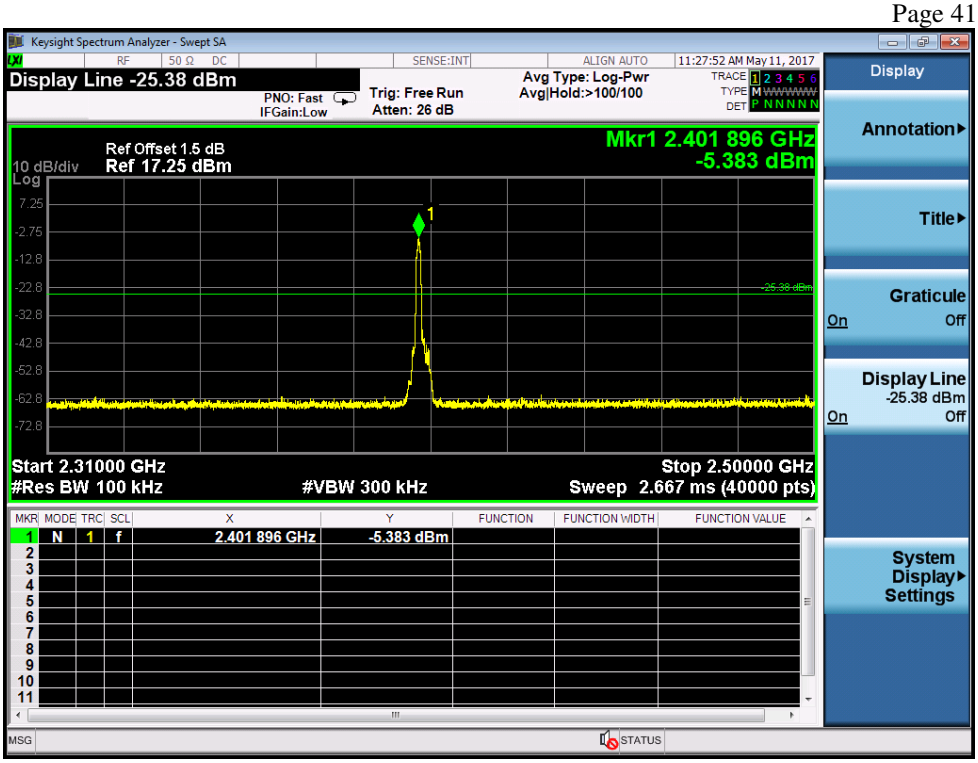

Keysight Spectrum Analyzer - Swept SA
Marker 3 2.483502837571 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:19:09 AM May 13, 2017
Mkr3 2.483 503 GHz
-47.269 dBm
10 dB/div
Ref 9.00 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40000 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.422 991 GHz -2.384 dBm
2 N 1 f 2.400 008 GHz -44.304 dBm
3 N 1 f 2.483 503 GHz -47.269 dBm
Marker
Marker Table
On Off
Marker Count
[Off]
Couple Markers
On Off
All Markers Off
More
2 of 2

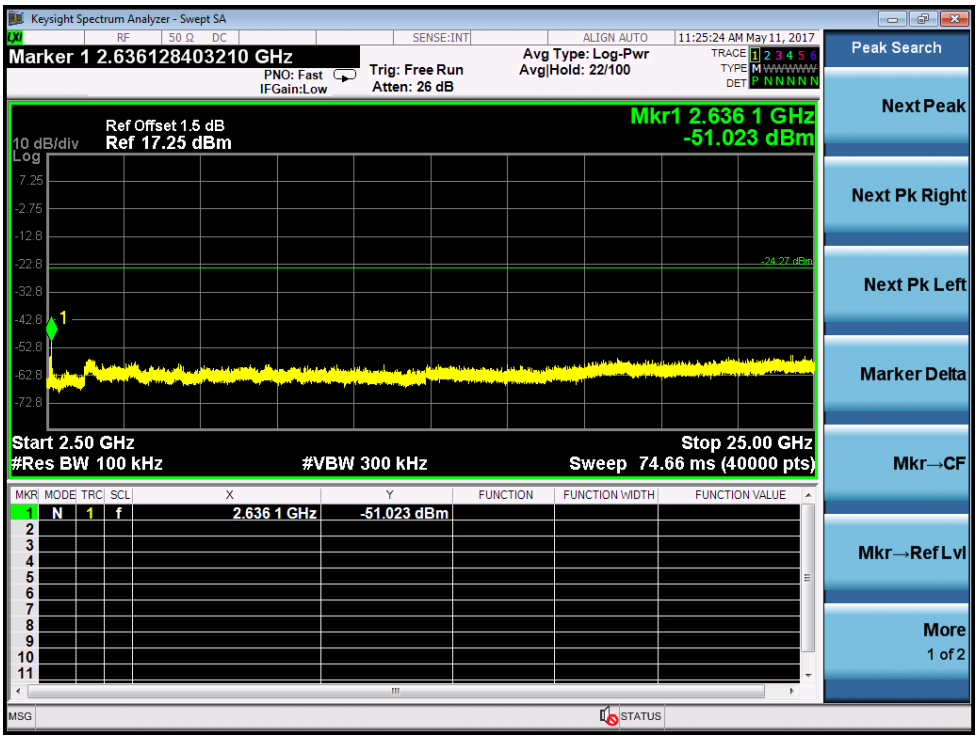

Keysight Spectrum Analyzer - Swept SA
RF
50 Ω DC
SENSE:INT
ALIGN AUTO
09:17:52 AM May 13, 2017
Marker 1 2.609127728193 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 82/100
TRACE 1 2 3 4 5 6
TYPE M WWWWWW
DET P N N N N N
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
Mkr1 2.609 1 GHz
-49.281 dBm
10 dB/div
Log
Ref 9.00 dBm
-1.00
-11.0
-21.0
-31.0
-41.0
-51.0
-61.0
-71.0
-81.0
-22.27 dBm
1
Start 2.50 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 74.66 ms (40000 pts)
MSG
STATUS

Modulation	Channel	The most restrict Attenuation outside band (dB)	Result
π/4-DQPSK	L	≥20	Pass
	M	≥20	Pass
	H	≥20	Pass
	Hopping	≥20	Pass

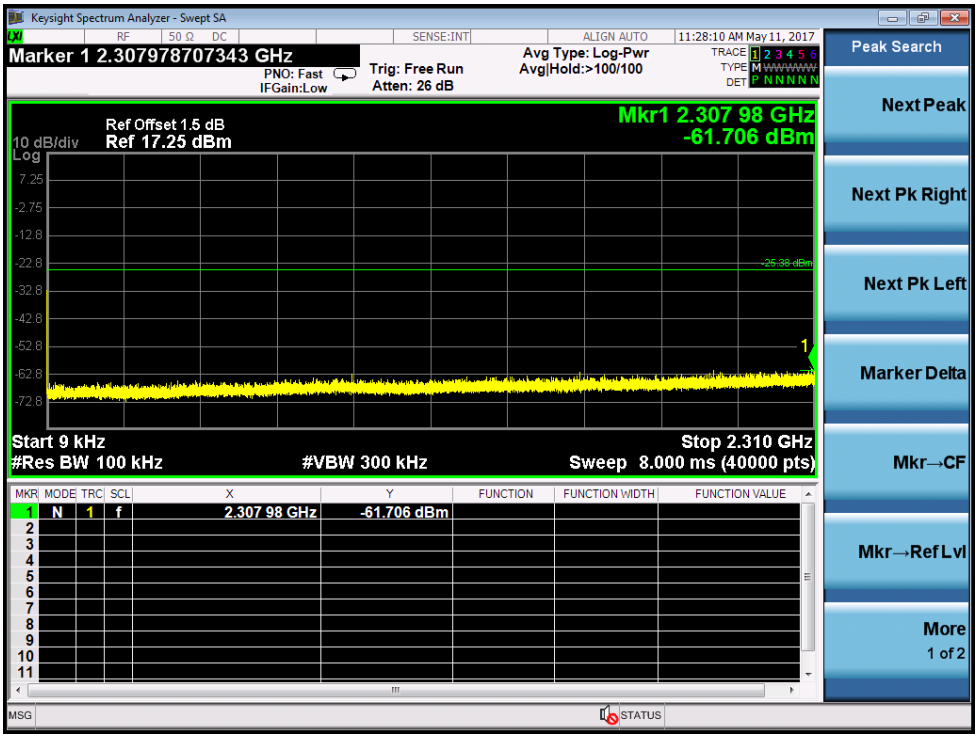
Channel L

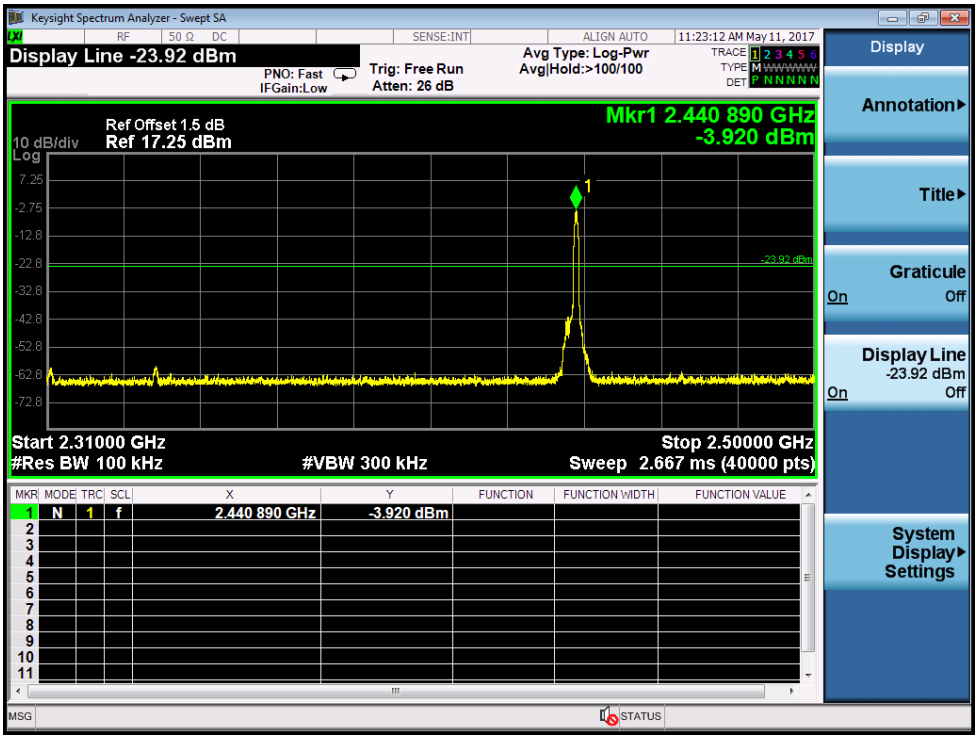


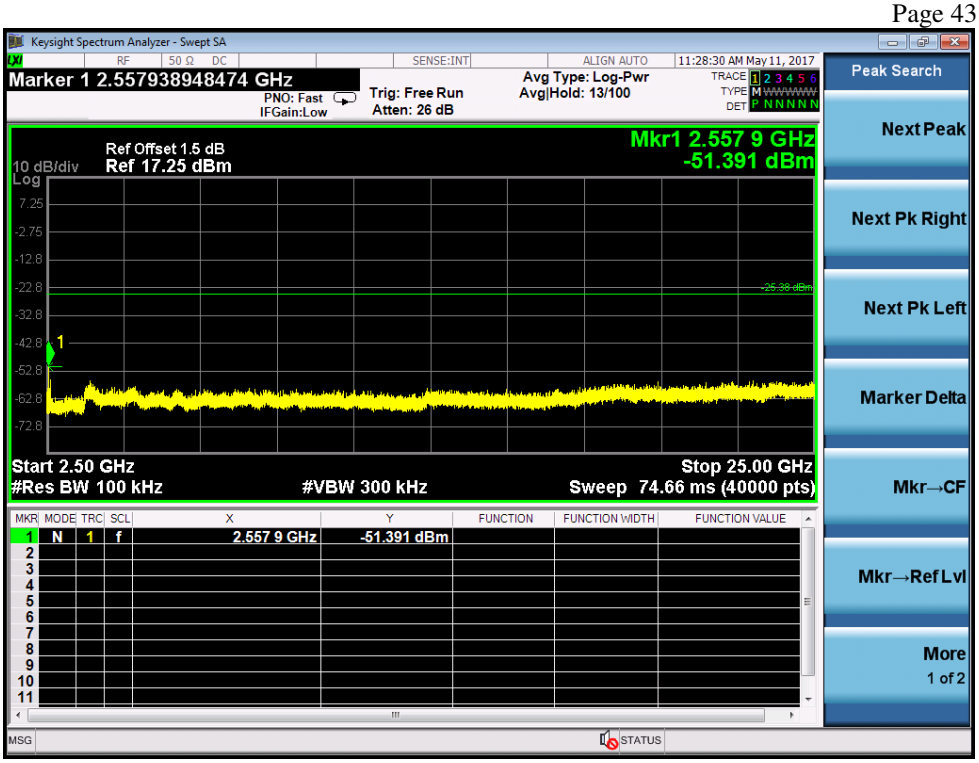

Keysight Spectrum Analyzer - Swept SA
Display Line -25.38 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:27:52 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.401 896 GHz
-5.383 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40000 pts)
1 N 1 f 2.401 896 GHz -5.383 dBm
Display
Annotation
Title
Graticule
On Off
Display Line
-25.38 dBm
On Off
System Display Settings


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.636128403210 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 22/100
11:25:24 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.636 1 GHz
-51.023 dBm
Start 2.50 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 74.66 ms (40000 pts)
1 N 1 f 2.636 1 GHz -51.023 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

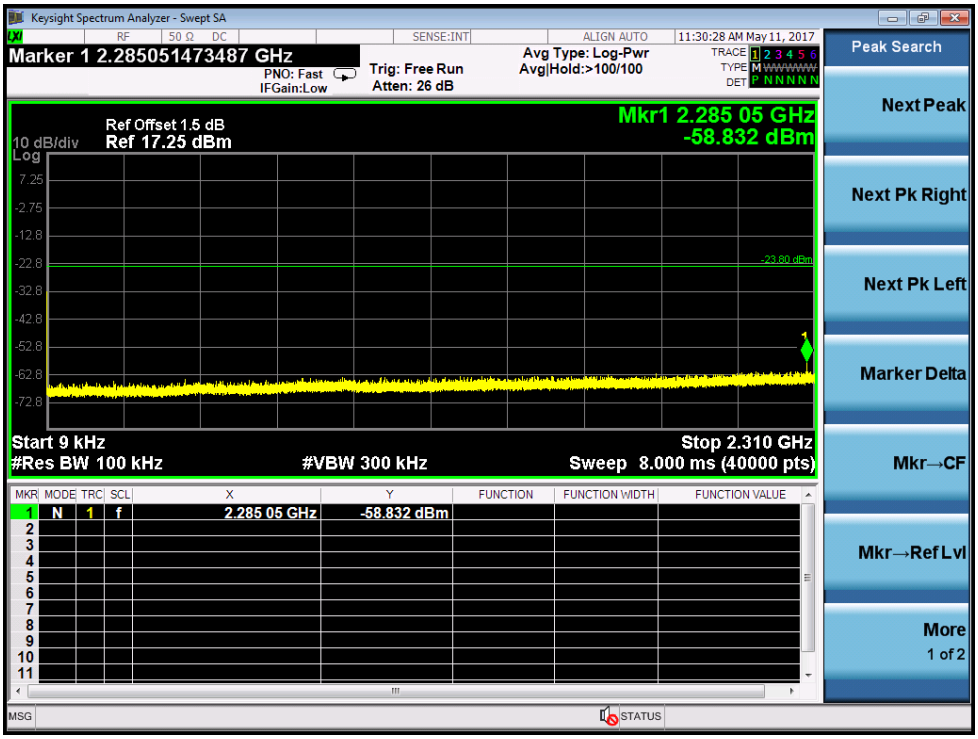
Channel M

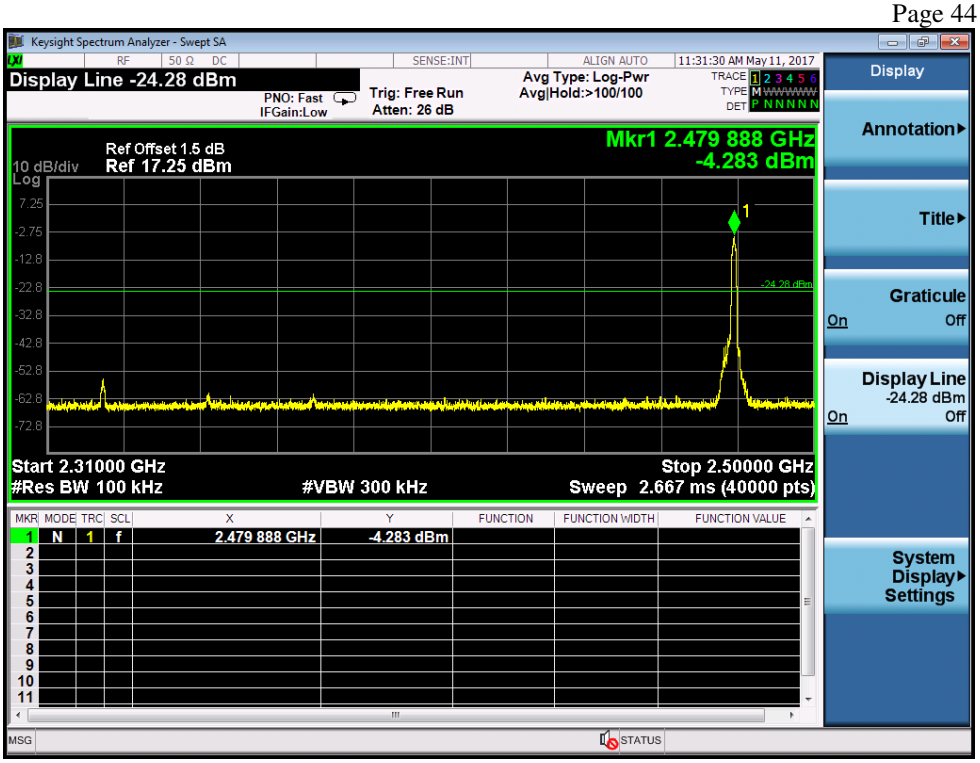

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.307978707343 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:28:10 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.307 98 GHz
-61.706 dBm
Start 9 kHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.310 GHz
Sweep 8.000 ms (40000 pts)
1 N 1 f 2.307 98 GHz -61.706 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

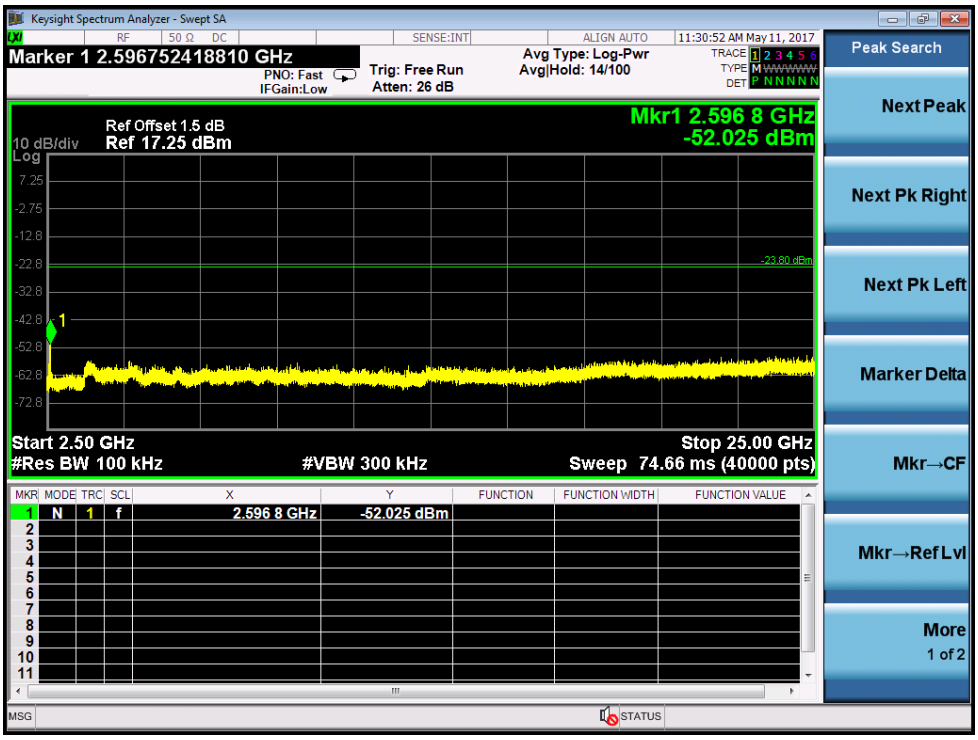

Keysight Spectrum Analyzer - Swept SA
Display Line -23.92 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:23:12 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.440 890 GHz
-3.920 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40000 pts)
1 N 1 f 2.440 890 GHz -3.920 dBm
Display
Annotation
Title
Graticule
On Off
Display Line
-23.92 dBm
On Off
System Display Settings


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.557938948474 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 13/100
11:28:30 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.557 9 GHz
-51.391 dBm
Start 2.50 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 74.66 ms (40000 pts)
1 N 1 f 2.557 9 GHz -51.391 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

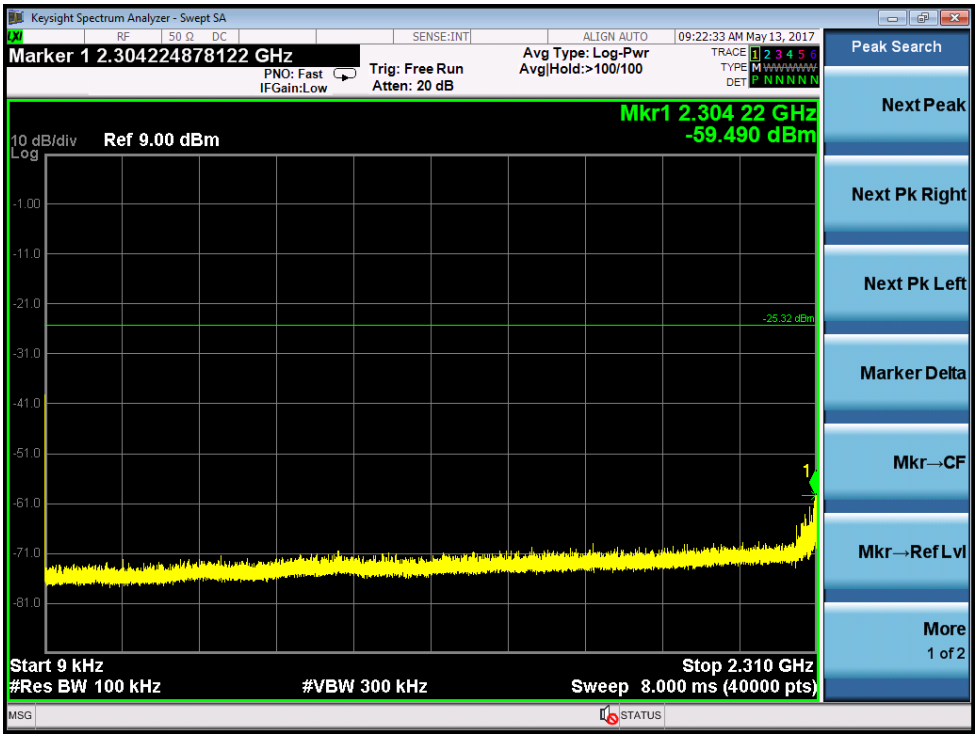
Channel H

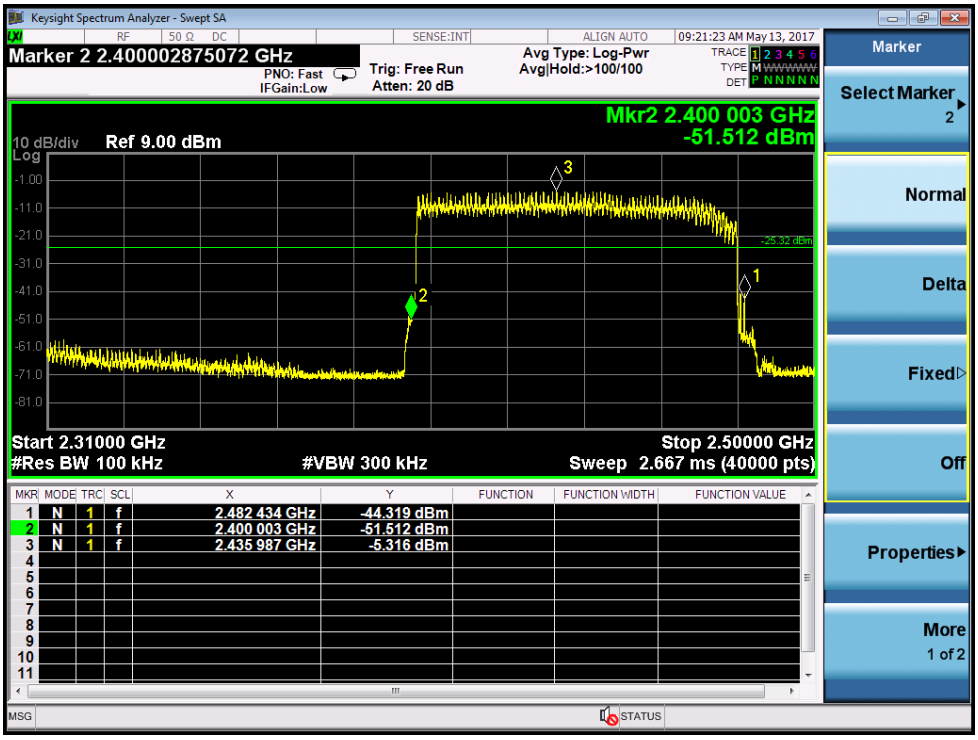

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.285051473487 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:30:28 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.285 05 GHz
-58.832 dBm
Start 9 kHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.310 GHz
Sweep 8.000 ms (40000 pts)
1 N 1 f 2.285 05 GHz -58.832 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

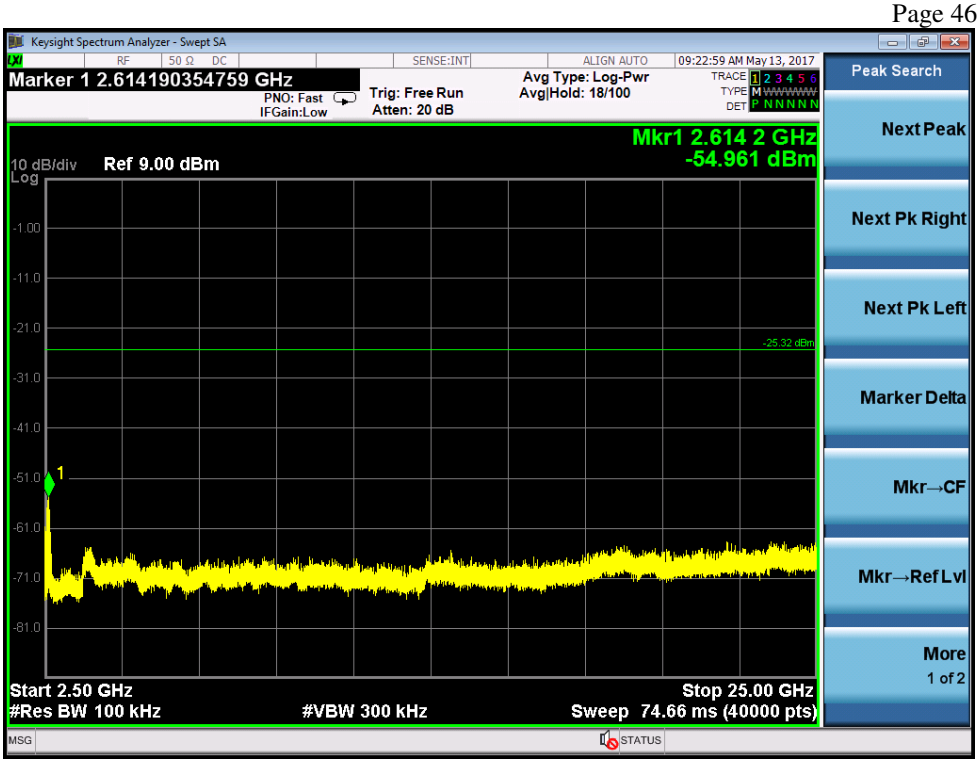

Keysight Spectrum Analyzer - Swept SA
Display Line -24.28 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:31:30 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.479 888 GHz
-4.283 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40000 pts)
1 N 1 f 2.479 888 GHz -4.283 dBm
Display
Annotation
Title
Graticule
On Off
Display Line
-24.28 dBm
On Off
System Display Settings


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.596752418810 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 14/100
11:30:52 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.596 8 GHz
-52.025 dBm
Start 2.50 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 74.66 ms (40000 pts)
1 N 1 f 2.596 8 GHz -52.025 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

Hopping

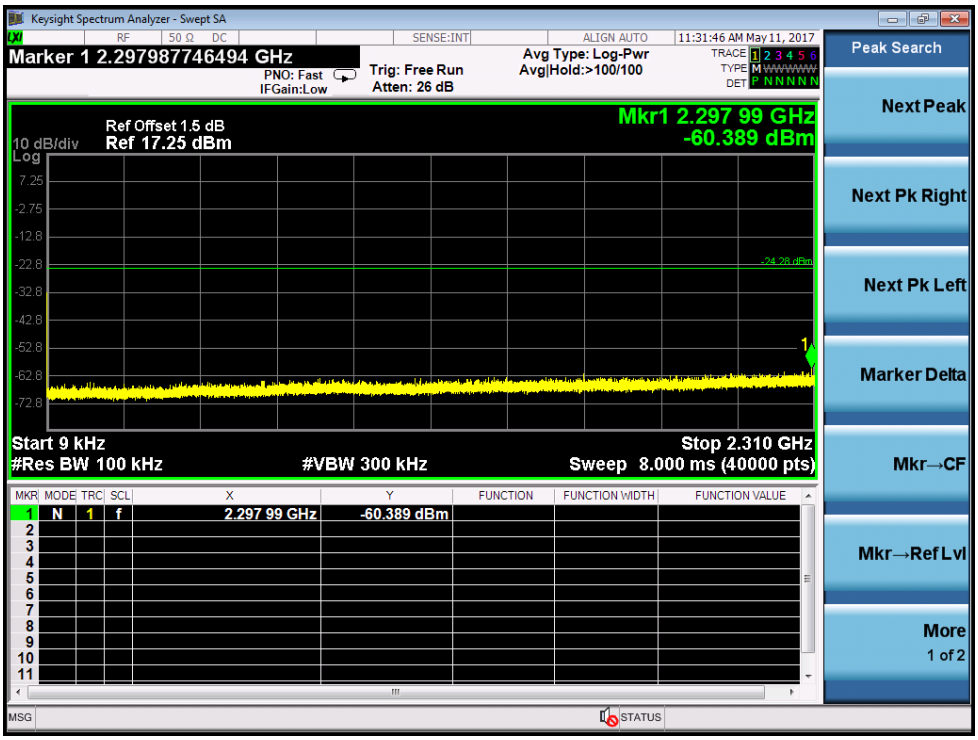

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.304224878122 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:22:33 AM May 13, 2017
Mkr1 2.304 22 GHz
-59.490 dBm
10 dB/div
Ref 9.00 dBm
Start 9 kHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.310 GHz
Sweep 8.000 ms (40000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

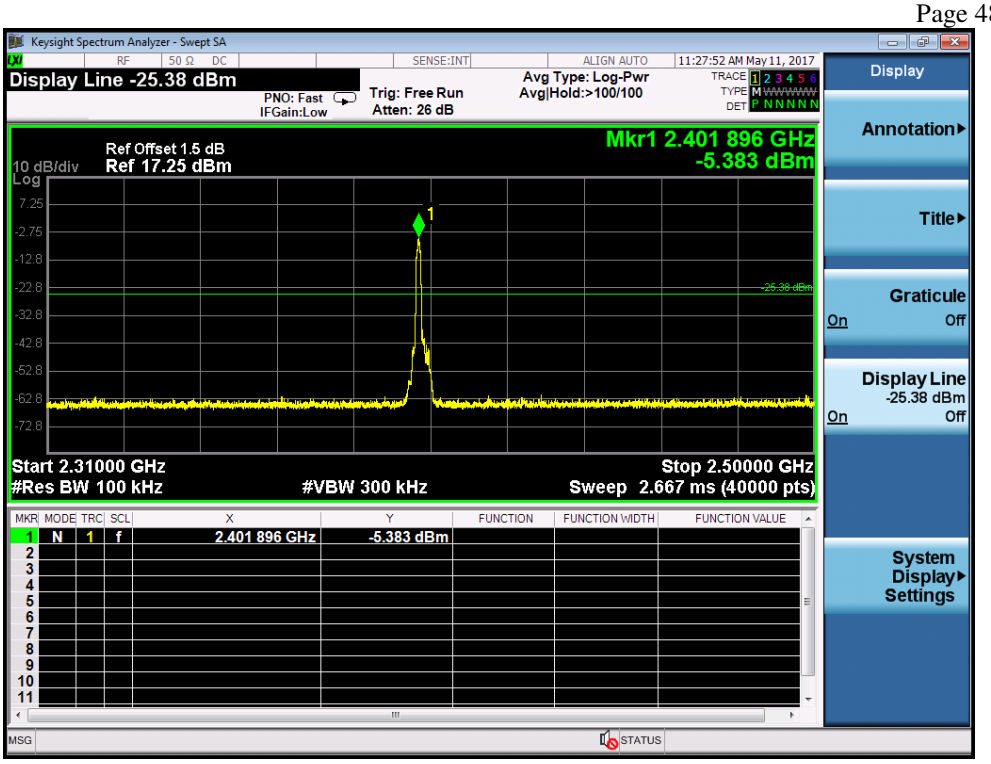

Keysight Spectrum Analyzer - Swept SA
Marker 2 2.400002875072 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:21:23 AM May 13, 2017
Mkr2 2.400 003 GHz
-51.512 dBm
10 dB/div
Ref 9.00 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40000 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.482 434 GHz -44.319 dBm
2 N 1 f 2.400 003 GHz -51.512 dBm
3 N 1 f 2.435 987 GHz -5.316 dBm
Marker
Select Marker 2
Normal
Delta
Fixed
Off
Properties
More
1 of 2

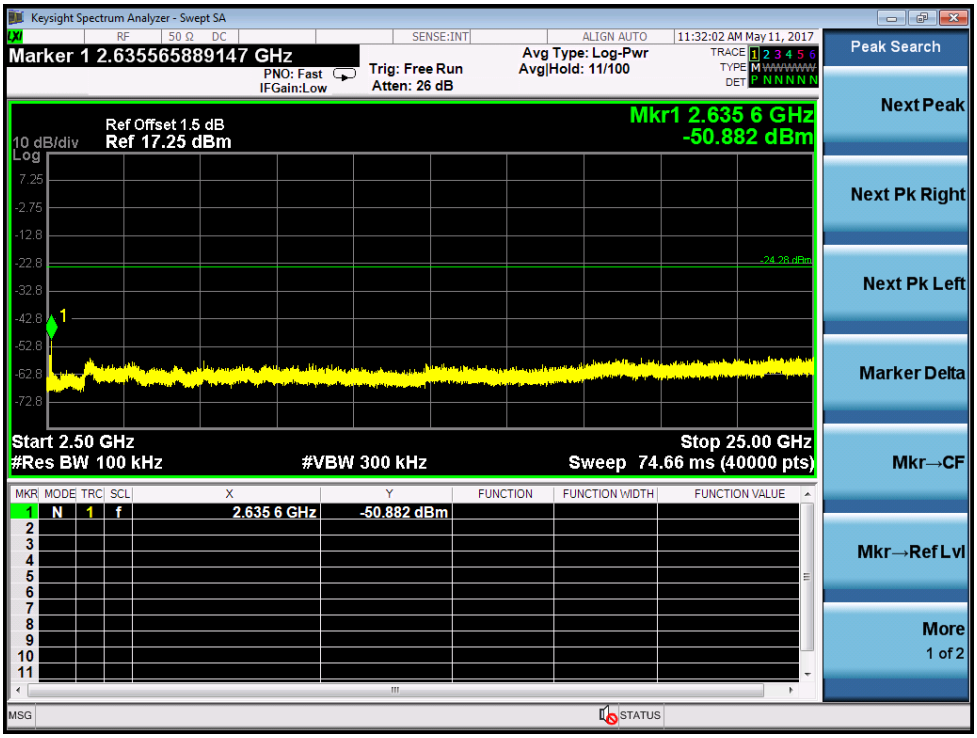

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.614190354759 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 18/100
09:22:59 AM May 13, 2017
Mkr1 2.614 2 GHz
-54.961 dBm
10 dB/div
Log
Ref 9.00 dBm
-25.32 dBm
Start 2.50 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 74.66 ms (40000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

Modulation	Channel	The most restrict Attenuation outside band (dB)	Result
8DPSK	L	≥20	Pass
	M	≥20	Pass
	H	≥20	Pass
	Hopping	≥20	Pass

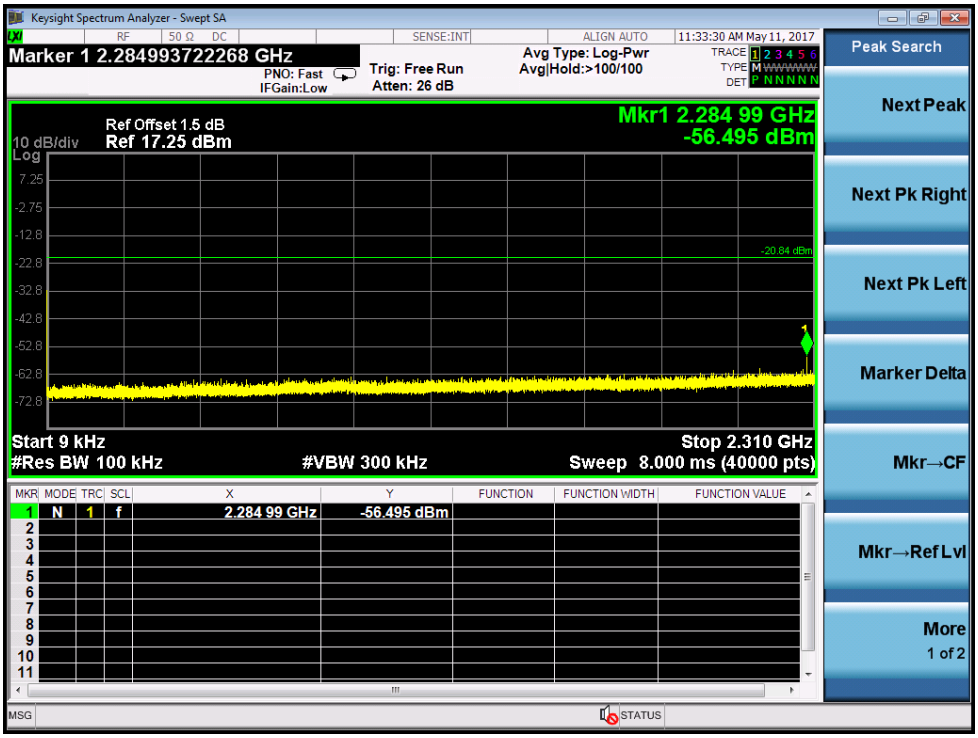
Channel L

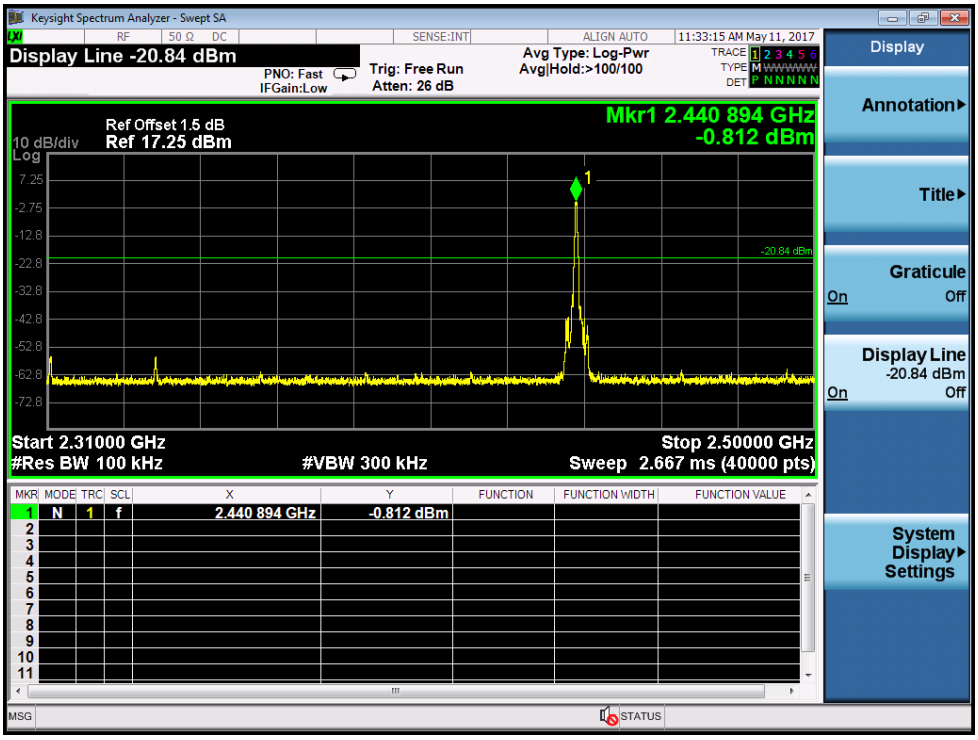


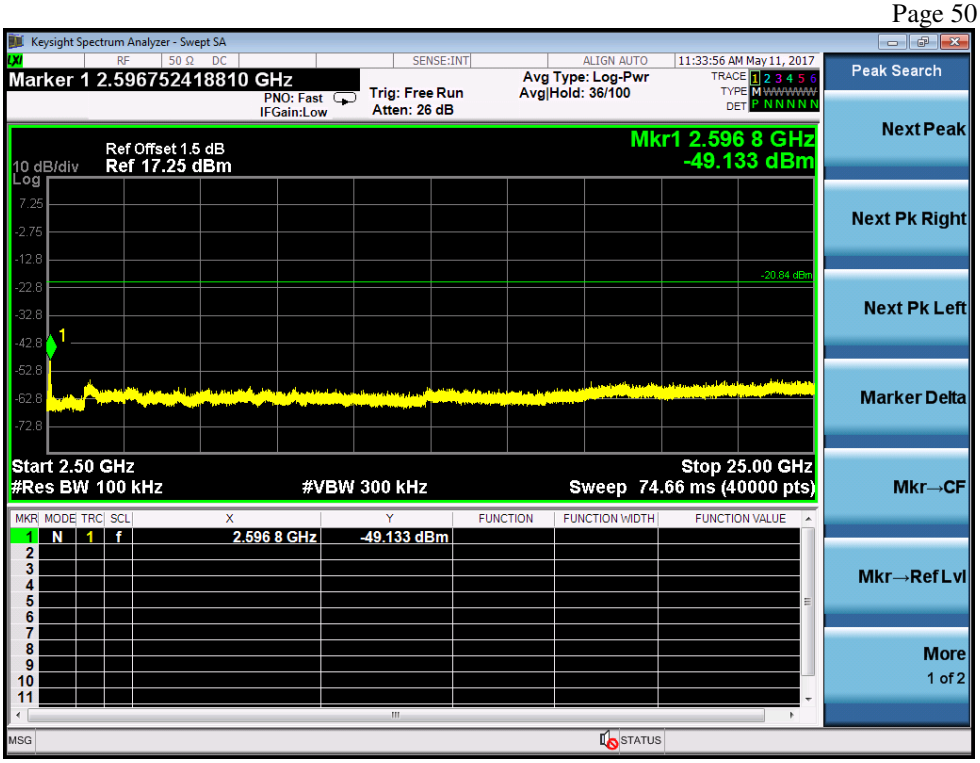

Keysight Spectrum Analyzer - Swept SA
Display Line -25.38 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:27:52 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.401 896 GHz
-5.383 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40000 pts)
1 N 1 f 2.401 896 GHz -5.383 dBm
Display
Annotation
Title
Graticule
On Off
Display Line
-25.38 dBm
On Off
System Display Settings


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.635565889147 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 11/100
11:32:02 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.635 6 GHz
-50.882 dBm
Start 2.50 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 74.66 ms (40000 pts)
1 N 1 f 2.635 6 GHz -50.882 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

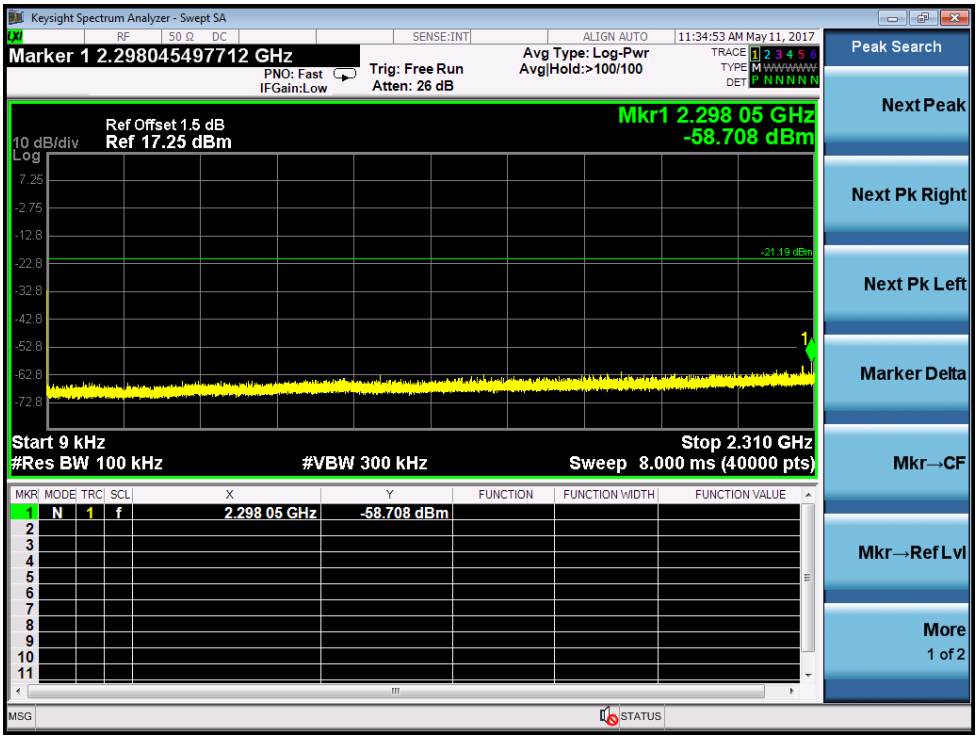
Channel M

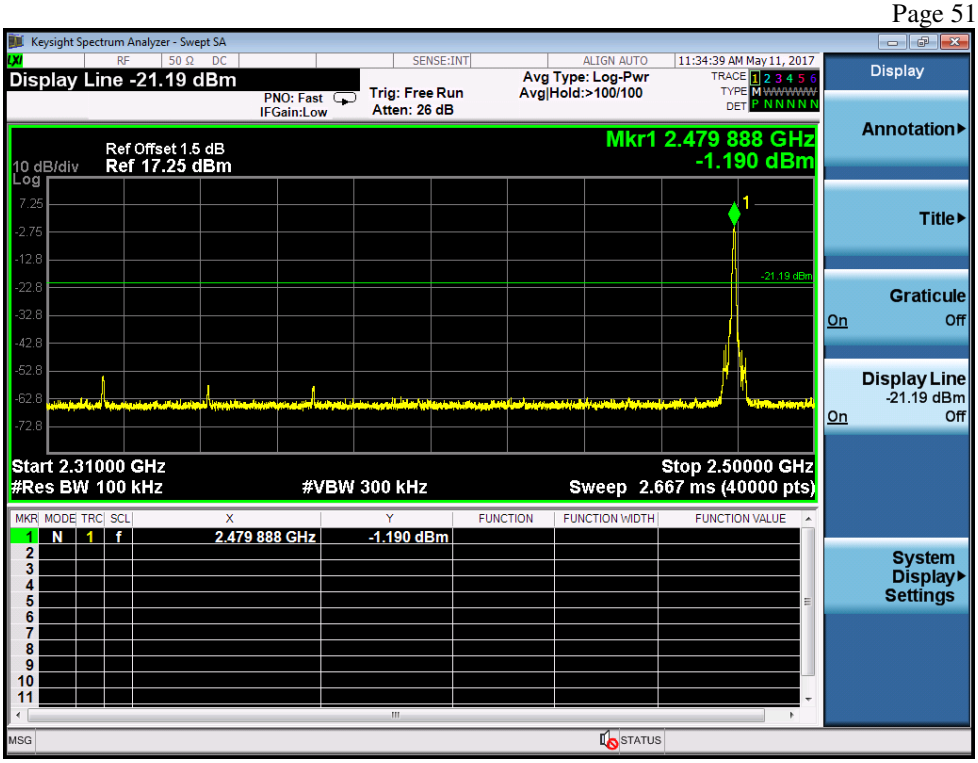

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.284993722268 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:33:30 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.284 99 GHz
-56.495 dBm
-20.84 dBm
Start 9 kHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.310 GHz
Sweep 8.000 ms (40000 pts)
1 N 1 f 2.284 99 GHz -56.495 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

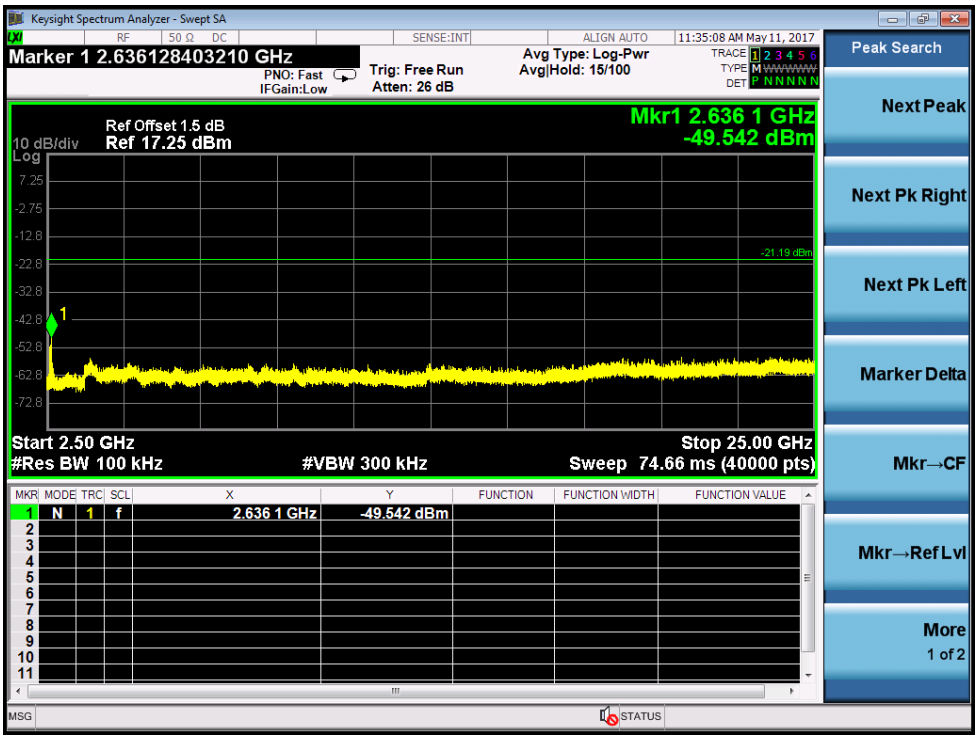

Keysight Spectrum Analyzer - Swept SA
Display Line -20.84 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:33:15 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.440 894 GHz
-0.812 dBm
-20.84 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40000 pts)
1 N 1 f 2.440 894 GHz -0.812 dBm
Display
Annotation
Title
Graticule
On Off
Display Line
-20.84 dBm
On Off
System Display Settings


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.596752418810 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 36/100
11:33:56 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Log
Mkr1 2.596 8 GHz
-49.133 dBm
-20.84 dBm
Start 2.50 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 74.66 ms (40000 pts)
1 N 1 f 2.596 8 GHz -49.133 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

Channel H

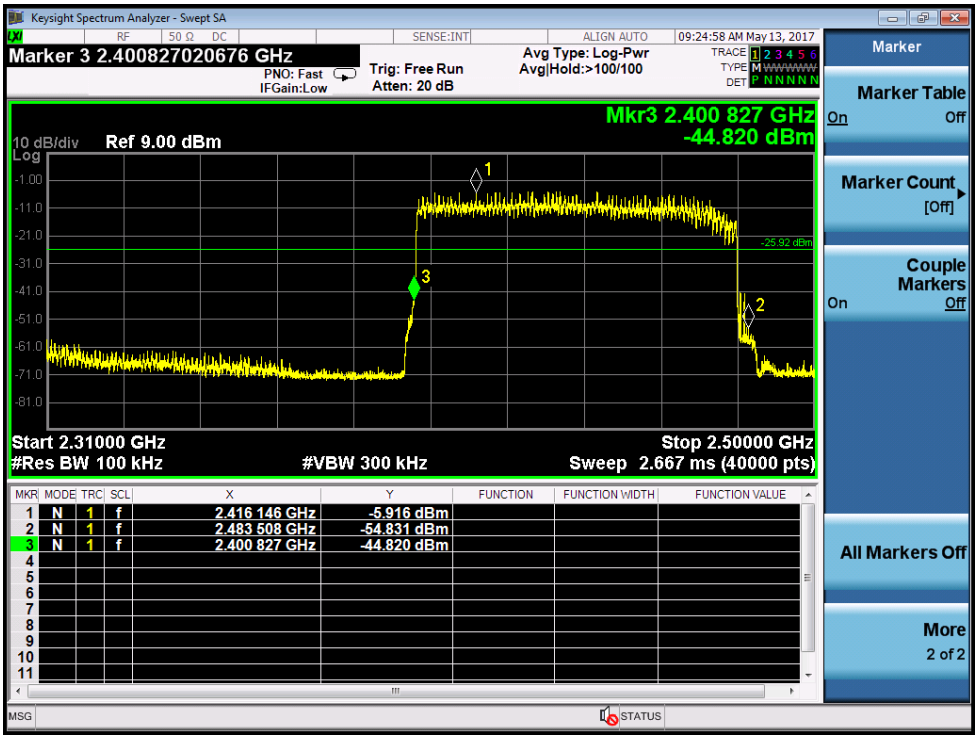

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.298045497712 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:34:53 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Log
Mkr1 2.298 05 GHz
-58.708 dBm
-21.19 dBm
Start 9 kHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.310 GHz
Sweep 8.000 ms (40000 pts)
1 N 1 f 2.298 05 GHz -58.708 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

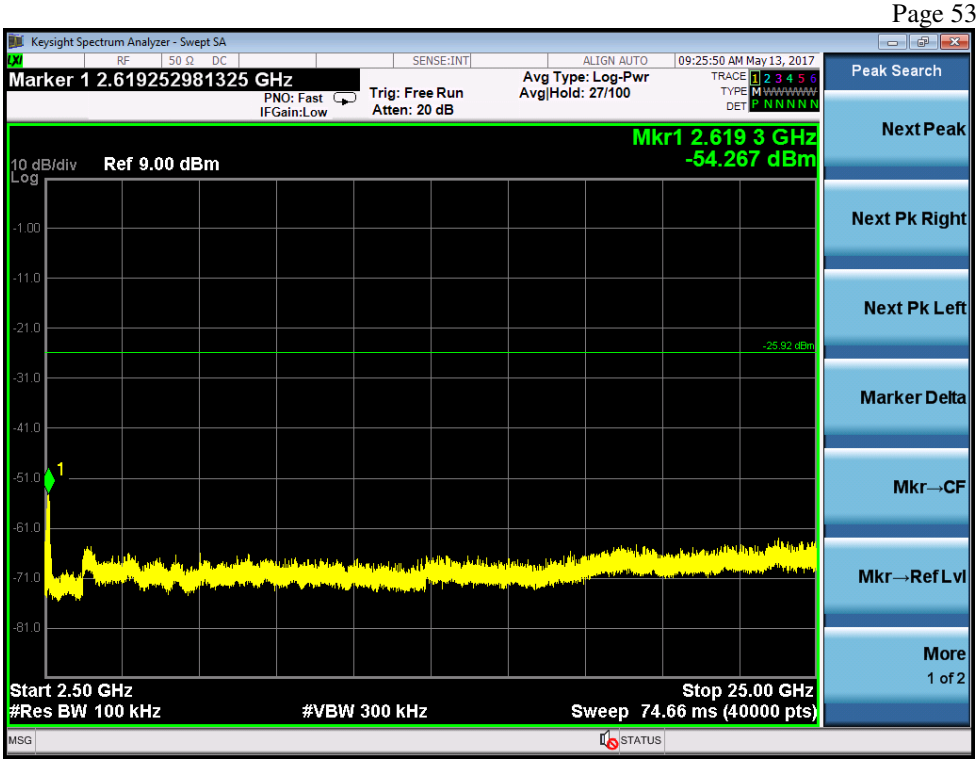

Keysight Spectrum Analyzer - Swept SA
Display Line -21.19 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:34:39 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.479 888 GHz
-1.190 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40000 pts)
1 N 1 f 2.479 888 GHz -1.190 dBm
Display
Annotation
Title
Graticule
Display Line
-21.19 dBm
System Display Settings


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.636128403210 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 15/100
11:35:08 AM May 11, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 17.25 dBm
Mkr1 2.636 1 GHz
-49.542 dBm
Start 2.50 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 74.66 ms (40000 pts)
1 N 1 f 2.636 1 GHz -49.542 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

Hopping

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.303243107403 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:25:31 AM May 13, 2017
Mkr1 2.303 24 GHz
-59.645 dBm
10 dB/div
Ref 9.00 dBm
Log
-25.92 dBm
Start 9 kHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.310 GHz
Sweep 8.000 ms (40000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Keysight Spectrum Analyzer - Swept SA
Marker 3 2.400827020676 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:24:58 AM May 13, 2017
Mkr3 2.400 827 GHz
-44.820 dBm
10 dB/div
Ref 9.00 dBm
Log
-25.92 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40000 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.416 146 GHz -5.916 dBm
2 N 1 f 2.483 508 GHz -54.831 dBm
3 N 1 f 2.400 827 GHz -44.820 dBm
Marker
Marker Table
On Off
Marker Count
[Off]
Couple Markers
On Off
All Markers Off
More
2 of 2


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.619252981325 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 27/100
09:25:50 AM May 13, 2017
Mkr1 2.619 3 GHz
-54.267 dBm
10 dB/div
Log
Ref 9.00 dBm
-25.92 dBm
Start 2.50 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 74.66 ms (40000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

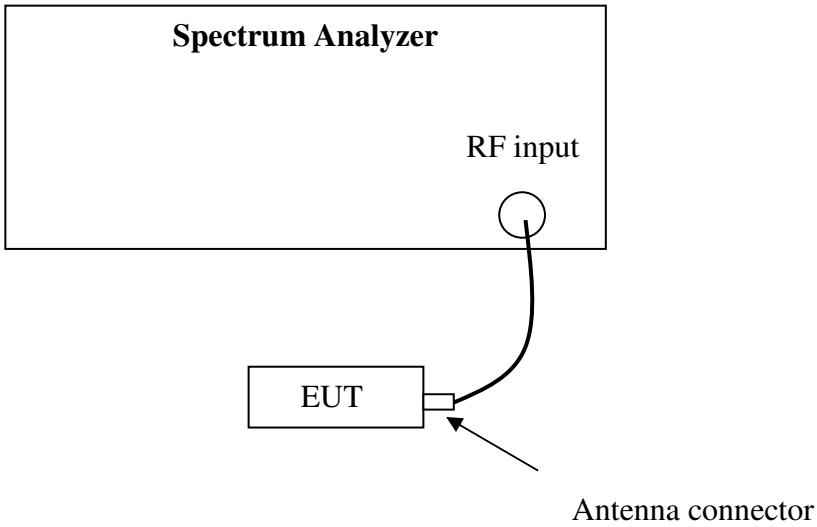
7 Number of hopping frequencies

Test result: Pass

7.1 Test limit

Number of Hopping Frequencies in the 2400-2483.5 MHz band shall use at least 15 channels.

7.2 Test Configuration



7.3 Test procedure and test setup

The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems).

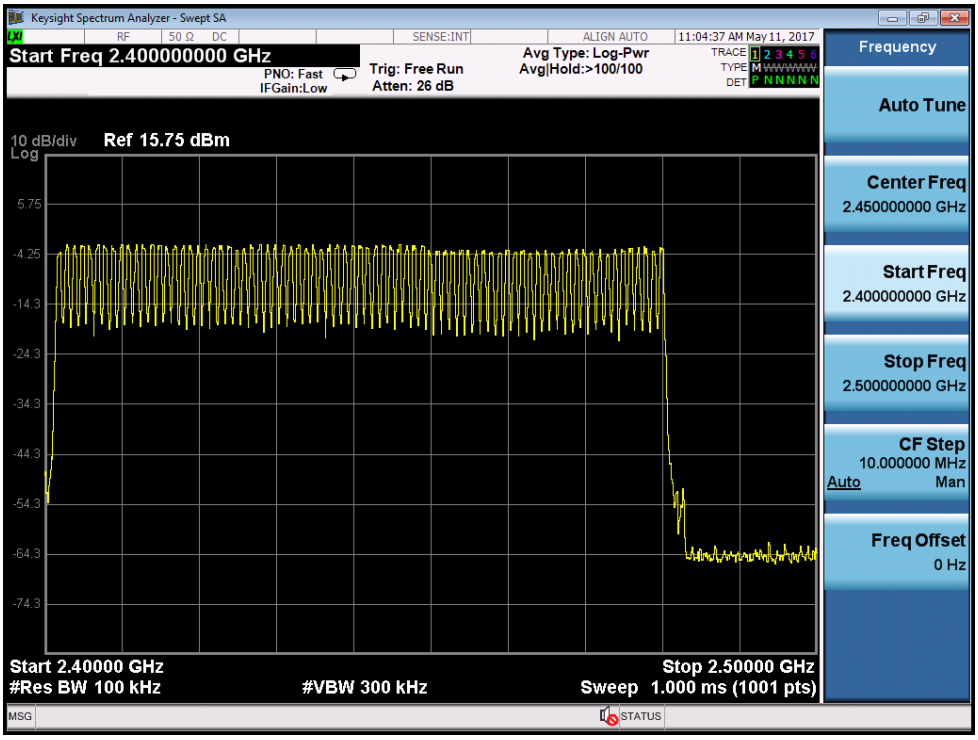
The Number of hopping frequencies per FCC § 15.247(a)(1)(iii) is measured using the Spectrum Analyzer with RBW=100kHz, VBW≥RBW, Sweep = auto, Detector = peak, Trace = max hold.

TTRF15.247_V1© 2015 Intertek

7.4 Test Protocol

Temperature: 22°C
Relative Humidity: 54%

Number of Hopping Frequencies	Limit
79	≥15



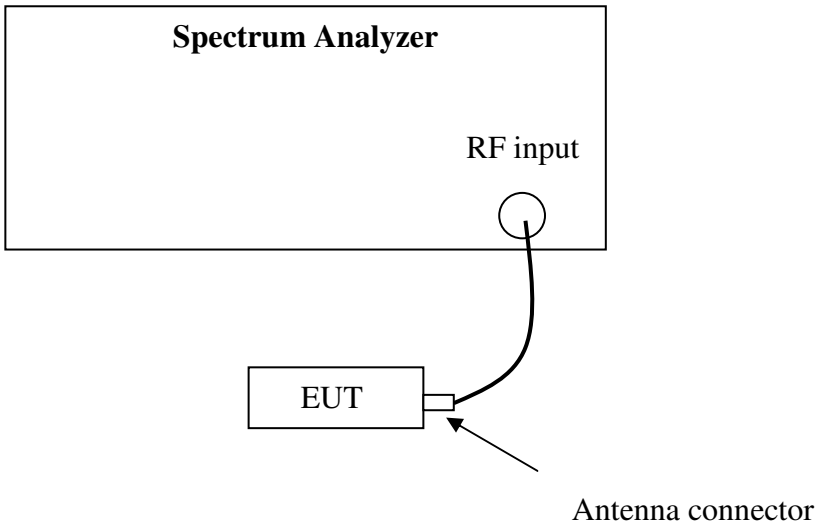
8 Dwell time

Test result: Pass

8.1 Test limit

The dwell time 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

8.2 Test Configuration



8.3 Test procedure and test setup

The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems).

Dwell time per FCC § 15.247(a)(1)(iii) is measured using the Spectrum Analyzer with Span = 0, RBW=1MHz, VBW≥RBW, Sweep can capture the entire dwell time, Detector = peak, Trace = max hold.

TTRF15.247_V1© 2015 Intertek

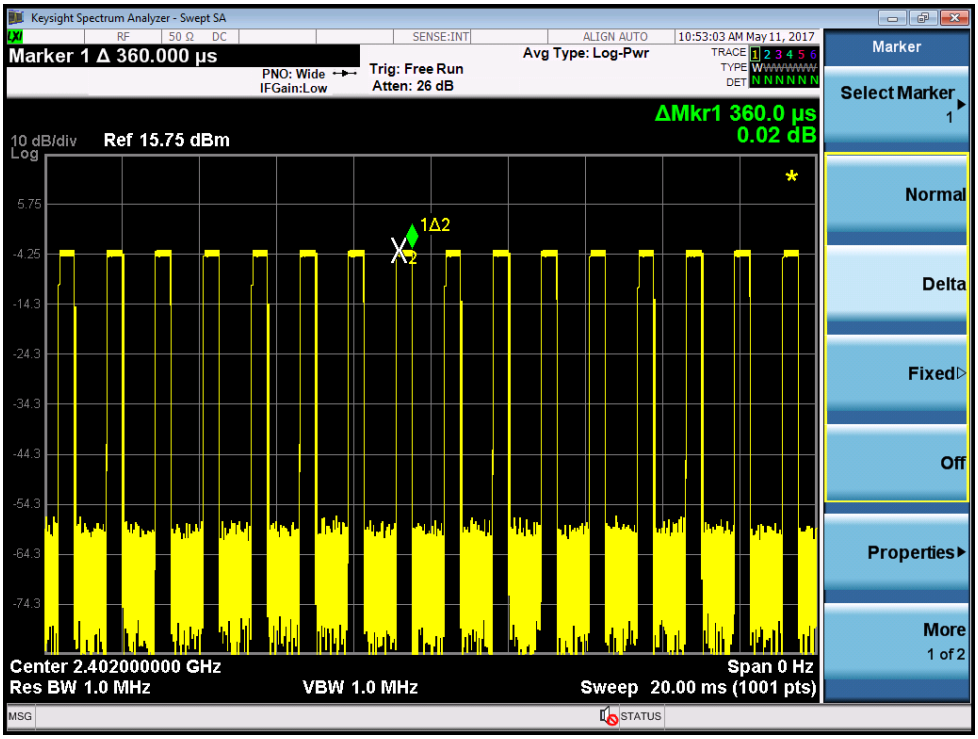
8.4 Test Protocol

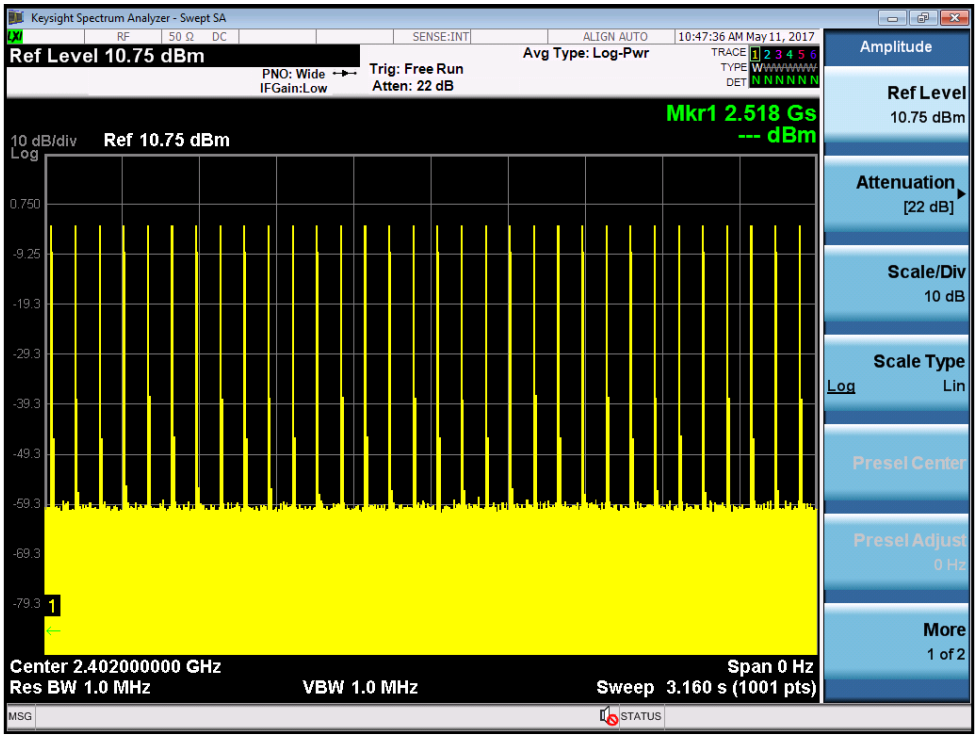
Temperature: 22°C
Relative Humidity: 54%

Packet	Occupancy time for single hop (ms) O	Channel	Real observed period (s) P	Hops among Observed period I	Dwell time (ms) T	Limit (s)
DH1	0.36	L	3.16	32	115.2	≤0.4
		M	3.16	32	115.2	
		H	3.16	32	115.2	
DH3	1.60	L	3.16	16	256.00	
		M	3.16	16	256.00	
		H	3.16	16	256.00	
DH5	2.78	L	3.16	10	305.8	
		M	3.16	10	305.8	
		H	3.16	10	305.8	

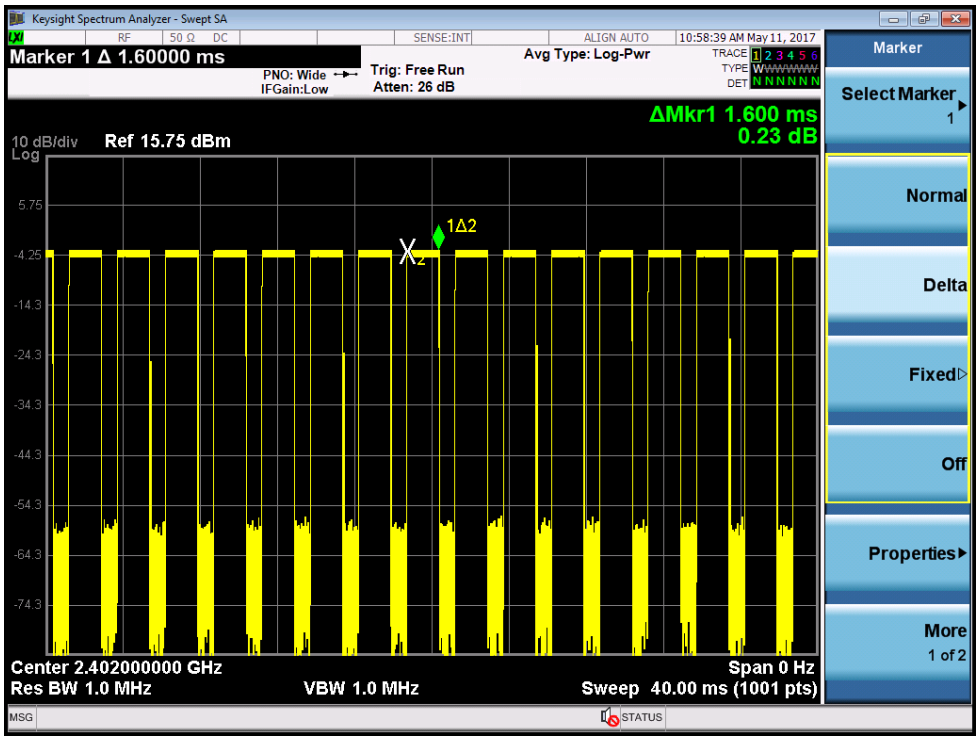
Remark: 1. There are 79 channels in all. So the complete observed period P = 0.4 * 79 = 31.6 s.
2. Average time of occupancy **T = O *I * 31.6 / P**

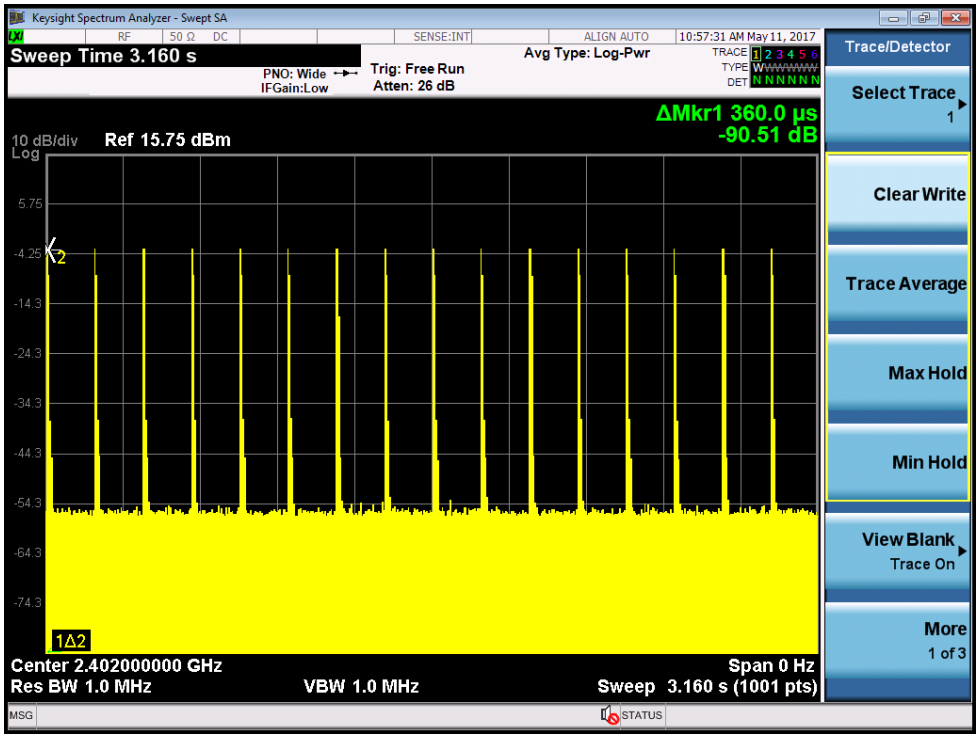
DH1


Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 360.000 µs
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
10:53:03 AM May 11, 2017
ΔMkr1 360.0 µs
0.02 dB
10 dB/div
Log
Ref 15.75 dBm
1Δ2
Center 2.402000000 GHz
Res BW 1.0 MHz
VBW 1.0 MHz
Span 0 Hz
Sweep 20.00 ms (1001 pts)
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2

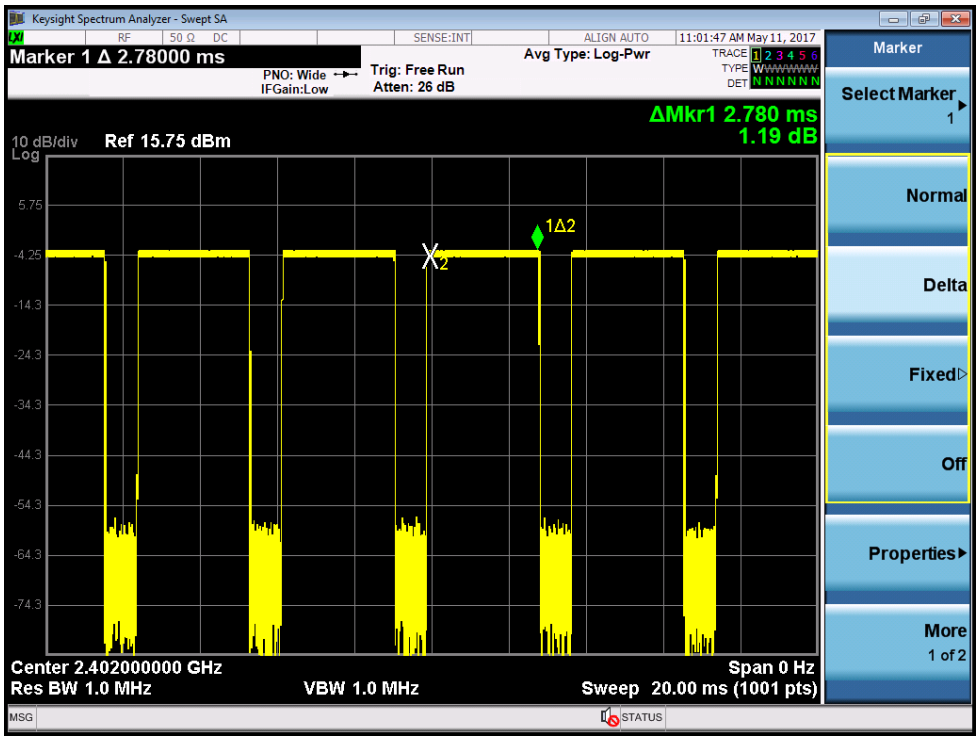

Keysight Spectrum Analyzer - Swept SA
Ref Level 10.75 dBm
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 22 dB
Avg Type: Log-Pwr
10:47:36 AM May 11, 2017
Mkr1 2.518 Gs
--- dBm
10 dB/div
Log
Ref 10.75 dBm
Center 2.402000000 GHz
Res BW 1.0 MHz
VBW 1.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)
Amplitude
Ref Level
10.75 dBm
Attenuation
[22 dB]
Scale/Div
10 dB
Scale Type
Log
Lin
More
1 of 2

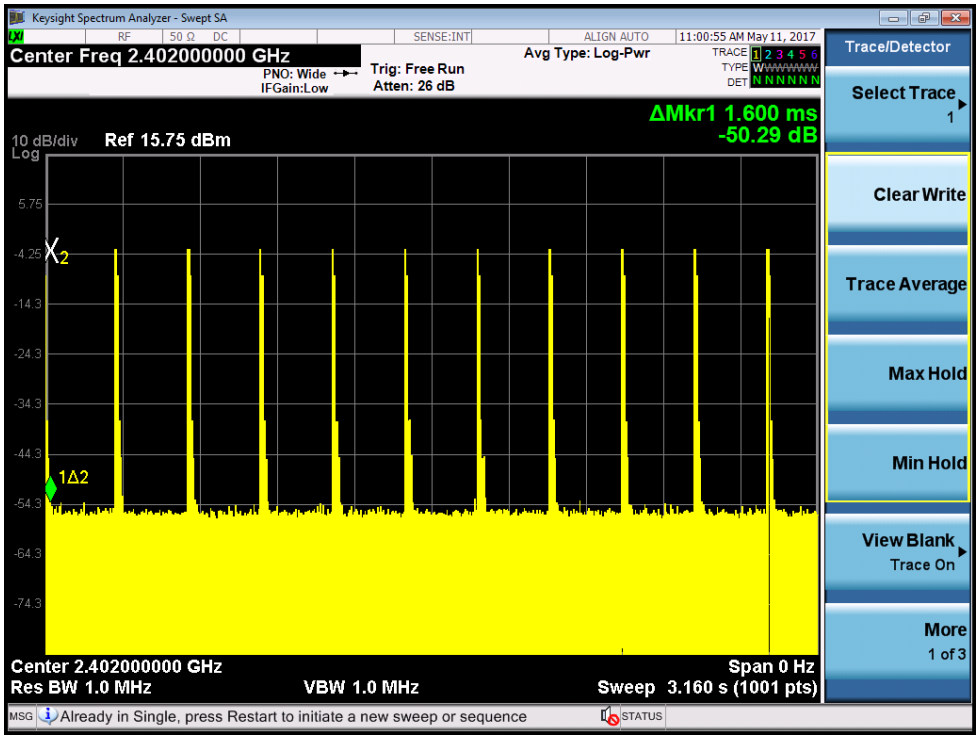
DH3


Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 1.60000 ms
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
10:58:39 AM May 11, 2017
ΔMkr1 1.600 ms
0.23 dB
10 dB/div
Log
Ref 15.75 dBm
1Δ2
Center 2.402000000 GHz
Res BW 1.0 MHz
VBW 1.0 MHz
Span 0 Hz
Sweep 40.00 ms (1001 pts)
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2


Keysight Spectrum Analyzer - Swept SA
Sweep Time 3.160 s
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
10:57:31 AM May 11, 2017
ΔMkr1 360.0 µs
-90.51 dB
10 dB/div
Log
Ref 15.75 dBm
1Δ2
Center 2.402000000 GHz
Res BW 1.0 MHz
VBW 1.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)
Trace/Detector
Select Trace
Clear Write
Trace Average
Max Hold
Min Hold
View Blank
Trace On
More
1 of 3

DH5


Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 2.78000 ms
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
11:01:47 AM May 11, 2017
ΔMkr1 2.780 ms
1.19 dB
10 dB/div
Ref 15.75 dBm
Log
Center 2.402000000 GHz
Res BW 1.0 MHz
VBW 1.0 MHz
Span 0 Hz
Sweep 20.00 ms (1001 pts)
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.402000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
11:00:55 AM May 11, 2017
ΔMkr1 1.600 ms
-50.29 dB
10 dB/div
Ref 15.75 dBm
Log
Center 2.402000000 GHz
Res BW 1.0 MHz
VBW 1.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)
Trace/Detector
Select Trace
Clear Write
Trace Average
Max Hold
Min Hold
View Blank
Trace On
More
1 of 3
Already in Single, press Restart to initiate a new sweep or sequence

9 Radiated Emissions

Test result: Pass

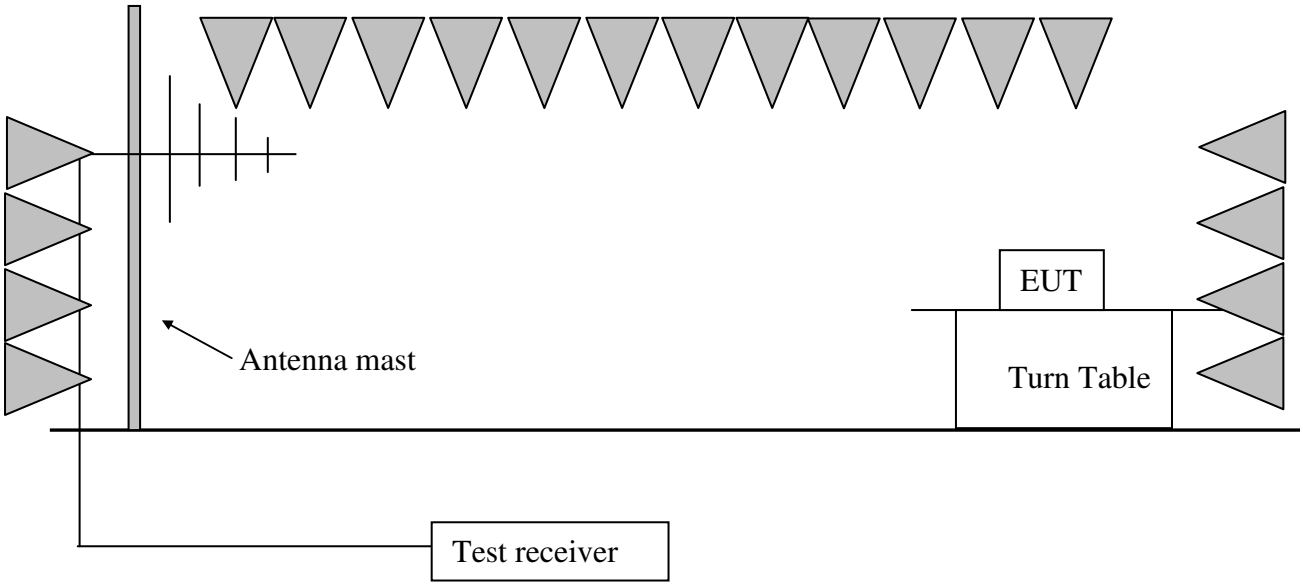
9.1 Test limit

The radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) showed as below:

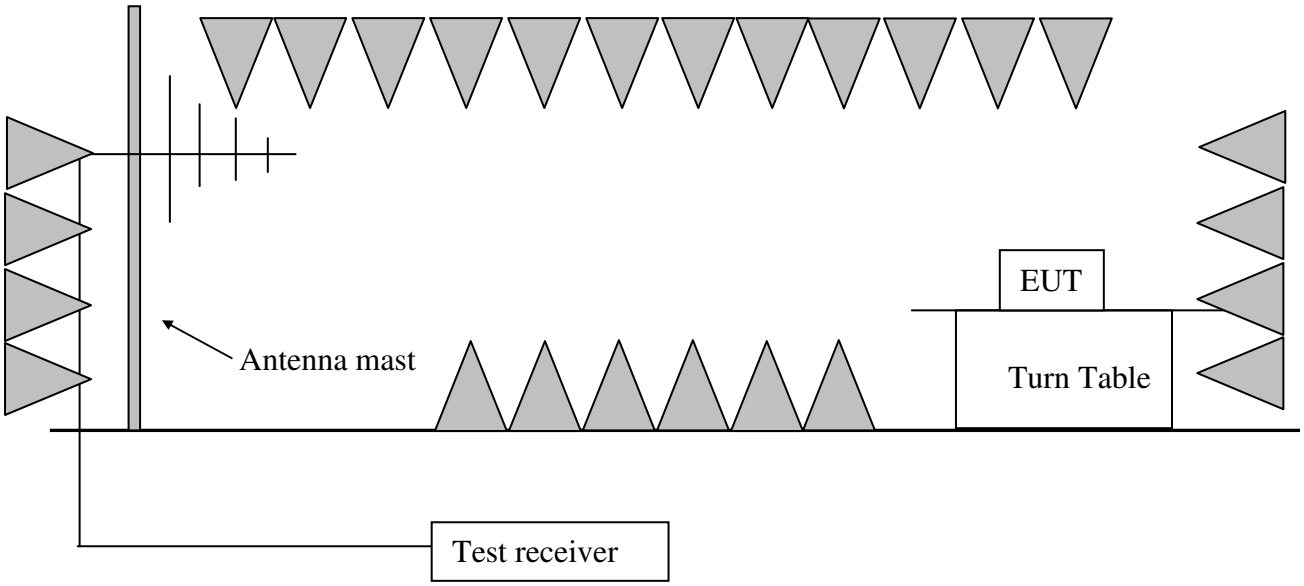
Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

9.2 Test Configuration

Frequency range below 1GHz:



Frequency range above 1GHz:



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9.3 Test procedure and test setup

The radiated emissions were tested according to the procedure of ANSI C63.10 for compliance to FCC 47CFR 15.247 requirements.

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna.

Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 1 m by 1.5 m. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m.

The turntable rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.

The radiated emission was measured using the Spectrum Analyzer with the resolutions bandwidth set as:

RBW = 300 Hz, VBW = 1 kHz (9 kHz~150 kHz);
RBW = 10 kHz, VBW = 30 kHz (150 kHz~30MHz);
RBW = 100 kHz, VBW = 300 kHz (30MHz~1GHz for PK)
RBW = 1MHz, VBW = 3MHz (>1GHz for PK);

Remark:
1. Factor= Antenna Factor + Cable Loss (-Amplifier, is employed)
2. Measured level= Original Receiver Reading + Factor
3. Margin = Limit – Measured level
4. If the PK measured level is lower than AV limit, the AV test can be elided.

Example:

Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10dBuV.
Then Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;
Measured level = 10dBuV + 0.20dB/m = 10.20dBuV/m
Assuming limit = 54dBuV/m,
Measured level = 10.20dBuV/m, then Margin = 54 - 10.20 = 43.80dBuV/m.

9.4 Test Protocol

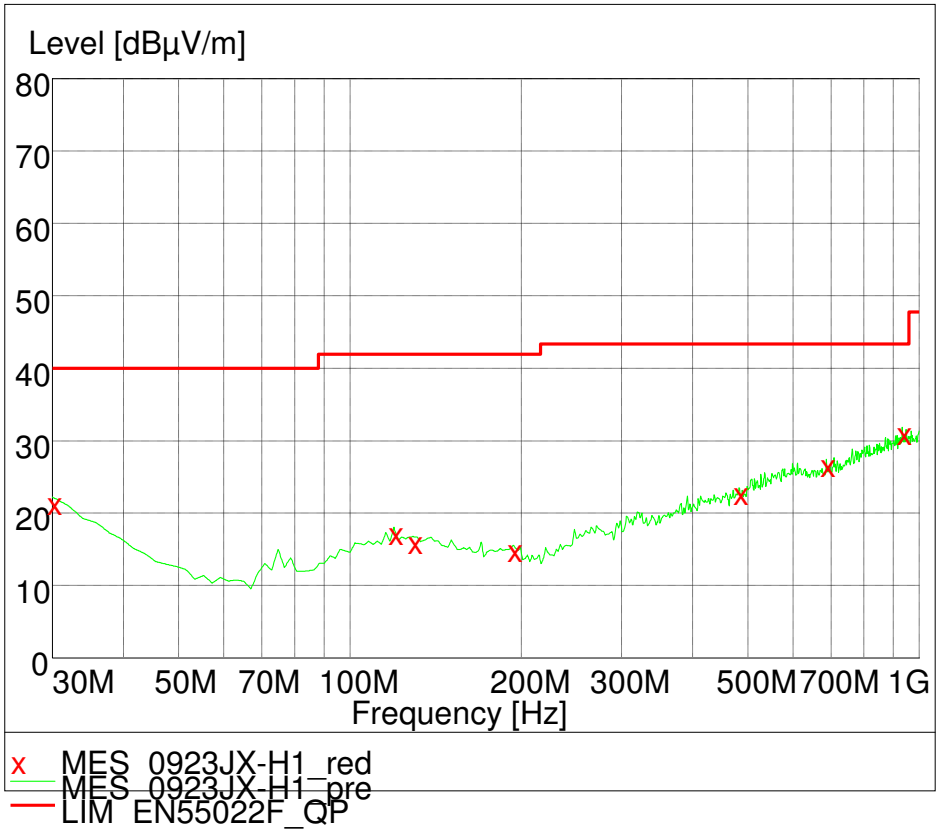
Temperature: 22°C
Relative Humidity: 54%

All the two models of product were tested and the worst data was listed in the report.

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

The worst waveform from 30MHz to 1000MHz (GFSK, 2402MHz) is listed as below:

Horizontal



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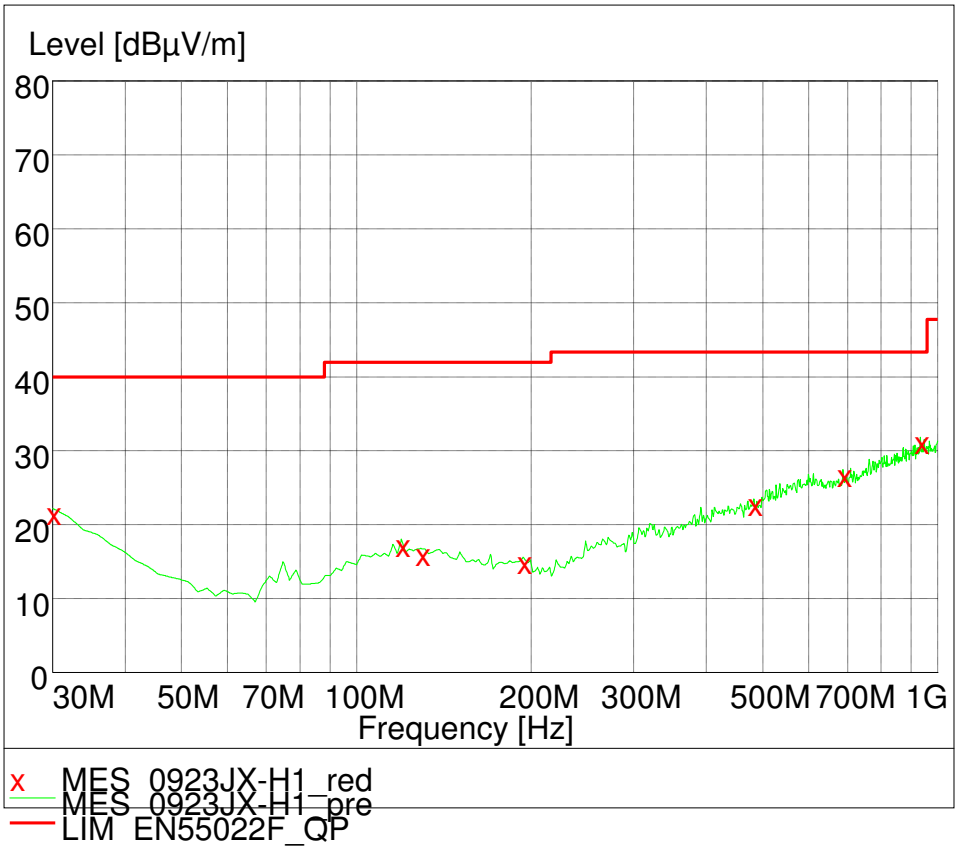
Vertical



Test result below 1GHz:

Channel	Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
H	H	197.00	*	13.18	43.00	*	QP
	H	307.48	*	24.79	46.00	*	QP
	H	960.00	*	19.86	46.00	*	QP
	V	30.00	*	21.40	40.00	*	QP
	V	55.15	*	12.70	40.00	*	QP
	V	68.95	*	10.22	40.00	*	QP
	V	197.76	*	9.30	43.50	*	QP
	V	480.00	*	20.10	46.00	*	QP
	V	960.00	*	20.70	46.00	*	QP
Remark: If the margin higher than 20dB, it would be marked as *.							

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Test result above 1GHz:

The emission within the frequency range of 1GHz to 25GHz was tested.

GFSK

Channel	Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	H	2402.20	90.60	34.34	Fundamental	/	PK
	H	2389.60	60.20	34.29	74.00	13.80	PK
	H	2389.60	35.28	34.29	54.00	18.72	AV
	V	2402.20	85.30	30.30	Fundamental	/	PK
	V	2389.60	52.31	30.40	74.00	21.69	PK
M	H	2441.20	90.80	34.60	Fundamental	/	PK
	H	4883.77	50.14	-3.35	74.00	23.86	PK
H	H	2480.20	89.98	34.62	Fundamental	/	PK
	H	2483.60	59.65	34.63	74.00	14.35	PK
	H	2483.60	40.77	34.63	54.00	13.23	AV
	V	2480.20	84.10	34.62	Fundamental	/	PK
	V	2483.60	52.50	34.63	74.00	21.50	PK

π/4-DQPSK:

Channel	Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	H	2402.20	89.60	34.34	Fundamental	/	PK
	H	2389.60	62.44	34.29	74.00	11.56	PK
	H	2389.60	36.70	34.29	54.00	17.30	AV
	V	2402.20	85.28	30.30	Fundamental	/	PK
	V	2389.60	52.69	30.40	74.00	21.31	PK
M	H	2441.20	90.10	34.60	Fundamental	/	PK
	H	4883.77	52.33	-3.35	74.00	22.67	PK
H	H	2480.20	89.75	34.62	Fundamental	/	PK
	H	2483.60	64.10	34.63	74.00	16.56	PK

	H	2483.60	38.77	34.63	74.00	15.23	AV
	V	2480.20	86.30	34.62	Fundamental	/	PK
	V	2483.60	57.44	34.63	74.00	16.56	PK
	V	2483.60	38.50	34.63	54.00	15.50	AV

8DPSK:

Channel	Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	H	2402.20	90.35	34.34	Fundamental	/	PK
	H	2389.60	62.38	34.29	74.00	11.62	PK
	H	2389.60	36.50	34.29	54.00	17.50	AV
	V	2402.20	85.30	30.30	Fundamental	/	PK
	V	2389.60	52.31	30.40	74.00	21.69	PK
M	H	2441.20	90.44	34.60	Fundamental	/	PK
	H	4883.77	53.68	-3.35	74.00	20.32	PK
H	H	2480.20	89.98	34.62	Fundamental	/	PK
	H	2483.60	65.65	34.63	74.00	8.35	PK
	H	2483.60	35.59	34.63	54.00	18.41	AV
	V	2480.20	84.10	34.62	Fundamental	/	PK
	V	2483.60	58.20	34.63	74.00	15.80	PK
	V	2483.60	36.38	34.63	54.00	17.62	AV

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (-Amplifier, is employed)
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = limit – Corrected Reading

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10dBuV.
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m; Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m
Assuming limit = 54dBuV/m, Corrected Reading = 10.20dBuV/m, then Margin = 54 -10.20 = 43.80dBuV/m

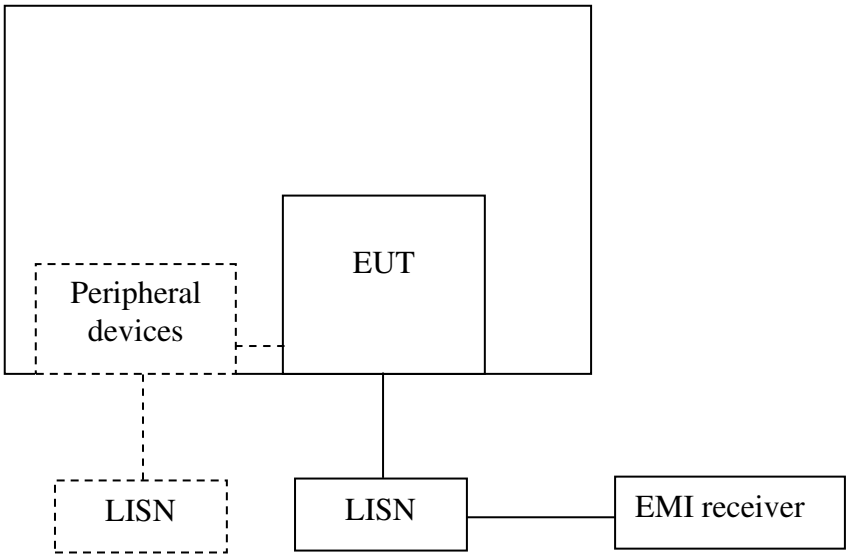
10 Power line conducted emission

Test result: **Pass**

10.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
0.15-0.5	66 to 56*	56 to 46 *
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

10.2 Test configuration



☒ For table top equipment, wooden support is 0.8m height table

☐ For floor standing equipment, wooden support is 0.1m height rack.

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10.3 Test procedure and test set up

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

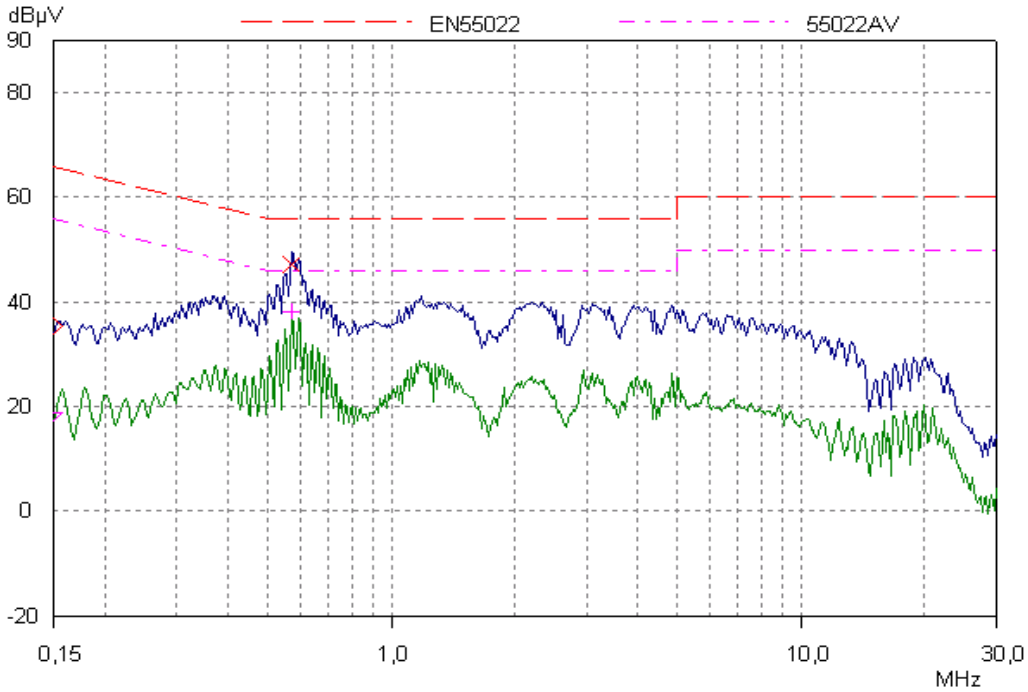
The bandwidth of the test receiver is set at 9 kHz.

10.4 Test protocol

Temperature: 22°C
Relative Humidity: 54%

All the three models of product were tested and the worst data (GFSK, 2402MHz) was listed in the report.

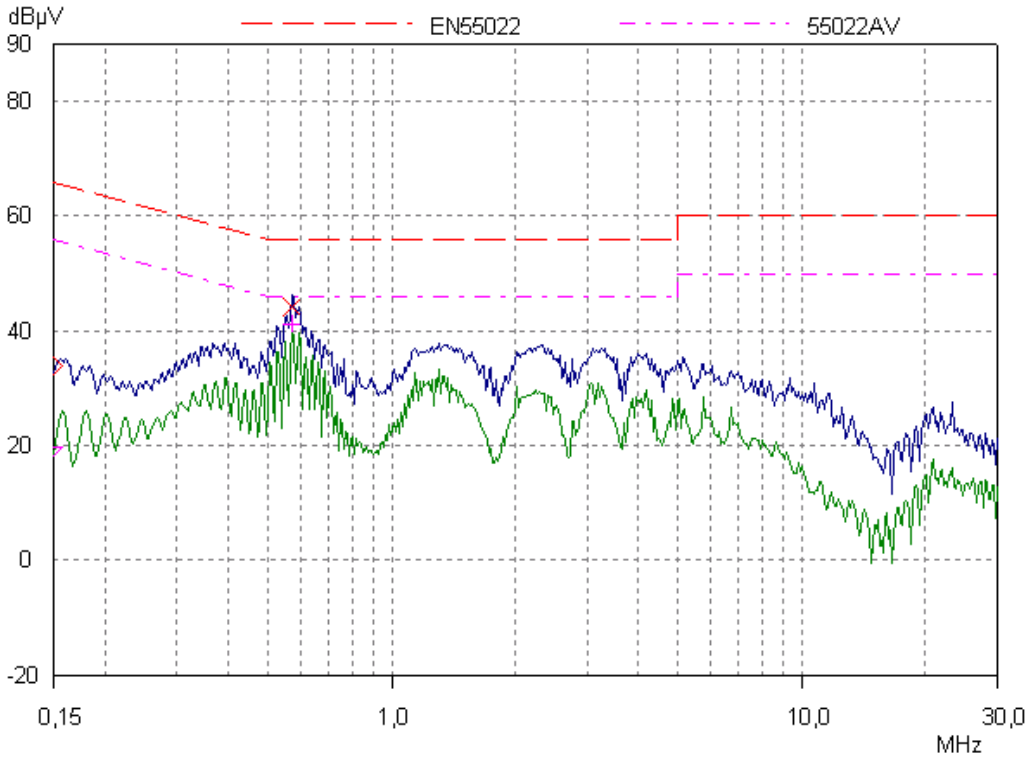
L line:



Test Data:

Frequency (MHz)	Quasi-peak			Average		
	level dB(µV)	Limit dB(µV)	Margin (dB)	level dB(µV)	limit dB(µV)	Margin (dB)
0.15	*	*	*	*	*	*
0.663	37.36	56.00	18.64	29.48	46.00	16.52
1.167	*	*	*	*	*	*
1.719	*	*	*	*	*	*
2.229	*	*	*	*	*	*
25.863	*	*	*	*	*	*
Remark: If the margin higher than 20dB, it would be marked as *.						

N line:



Frequency (MHz)	Quasi-peak			Average		
	level dB(µV)	Limit dB(µV)	Margin (dB)	level dB(µV)	limit dB(µV)	Margin (dB)
0.38	*	*	*	*	*	*
0.57	44.06	56.00	11.94	41.17	46.00	4.83
1.50	*	*	*	*	*	*
2.65	*	*	*	*	*	*
3.41	*	*	*	*	*	*
15.26	*	*	*	*	*	*
Remark: If the margin higher than 20dB, it would be marked as *.						

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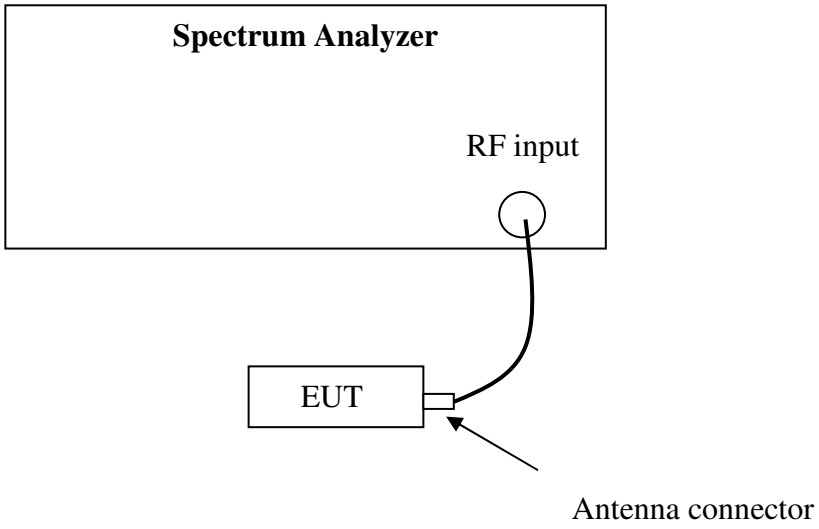
11 Occupied Bandwidth

Test Status: Tested

11.1 Test limit

None

11.2 Test Configuration



11.3 Test procedure and test setup

The occupied bandwidth per RSS-Gen Issue 4 Clause 6.6 was measured using the Spectrum Analyzer.

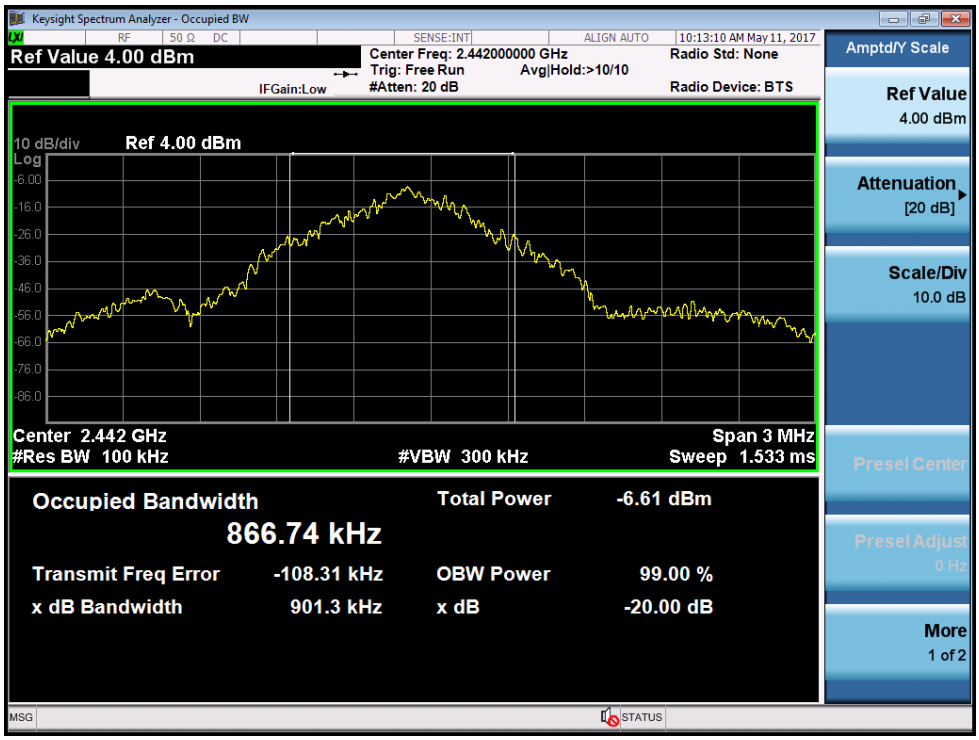
11.4 Test protocol

Temperature : 25 °C
Relative Humidity : 55 %

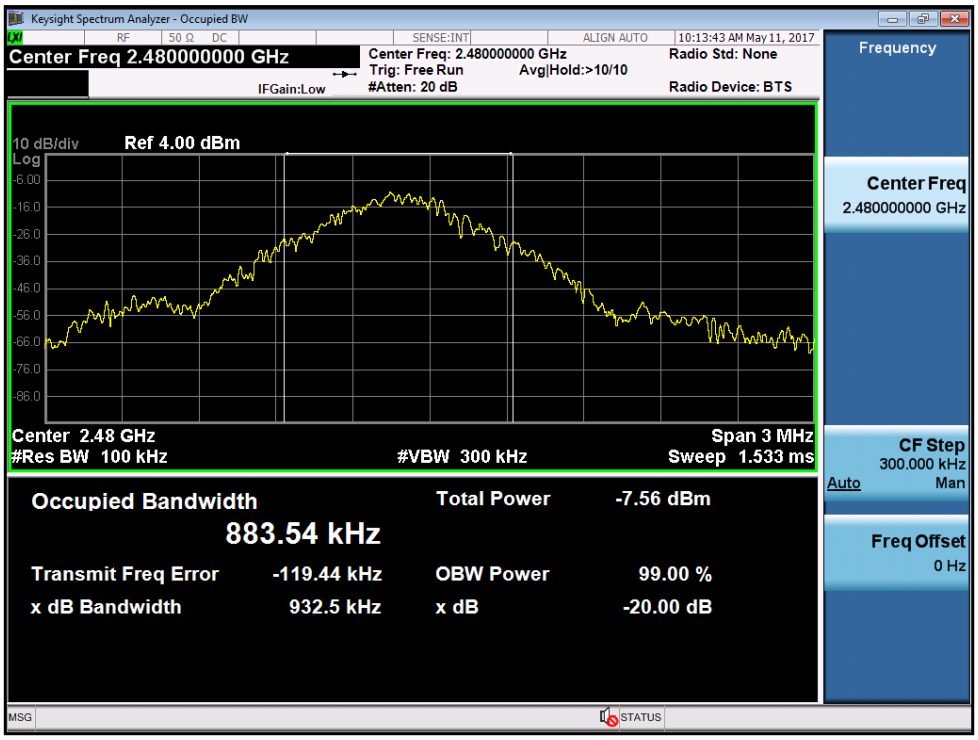
Modulation	Mode	99% Bandwidth (MHz)
GFSK	L	0.85459
	M	0.86674
	H	0.88354

Channel L

Channel M

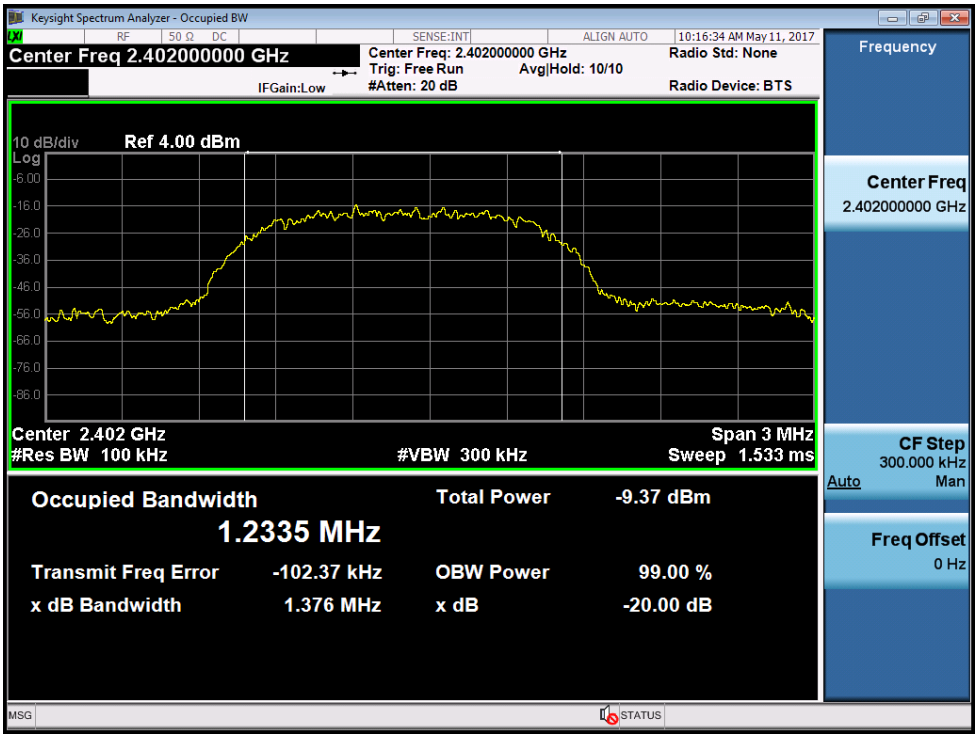


Channel H

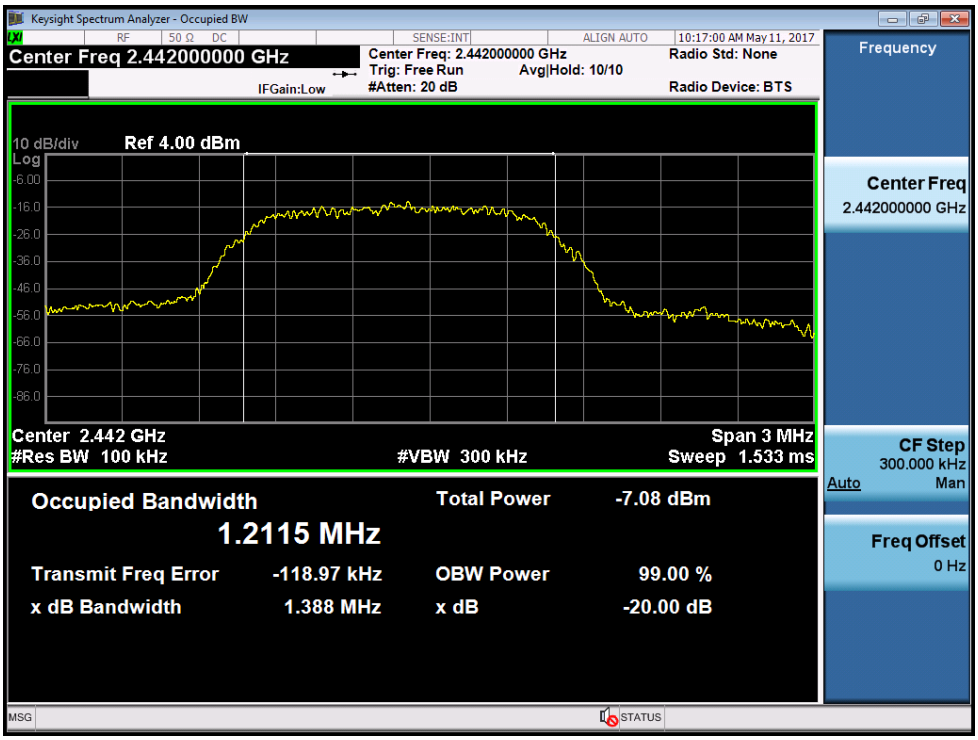


Modulation	Mode	99% Bandwidth (MHz)
π/4-DQPSK	L	1.2335
	M	1.2115
	H	1.2241

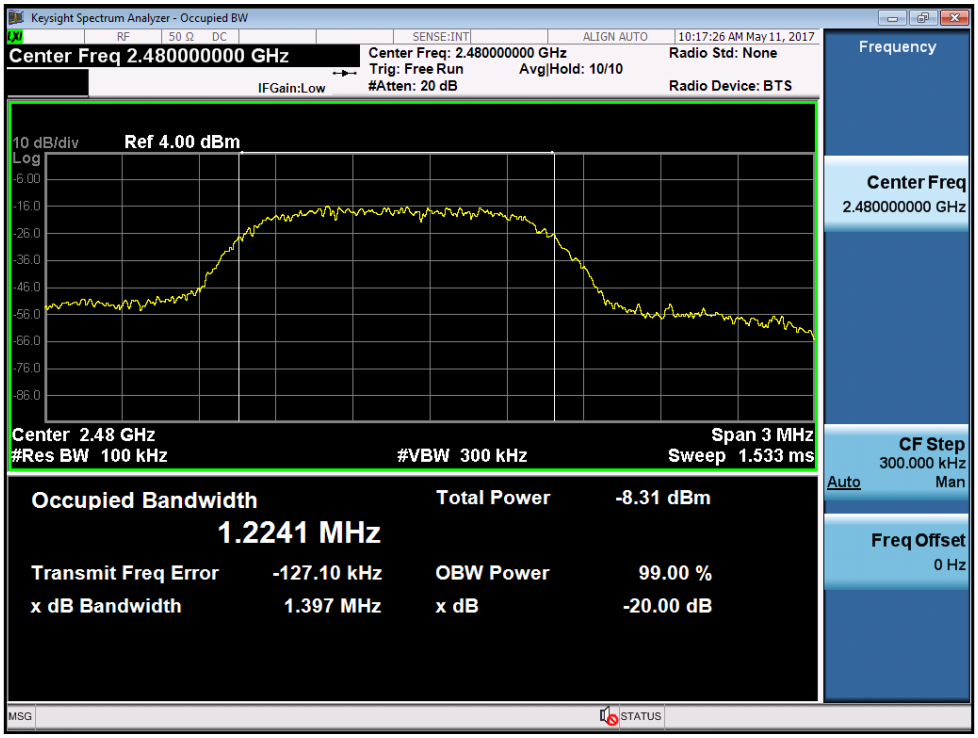
Channel L



Channel M



Channel H



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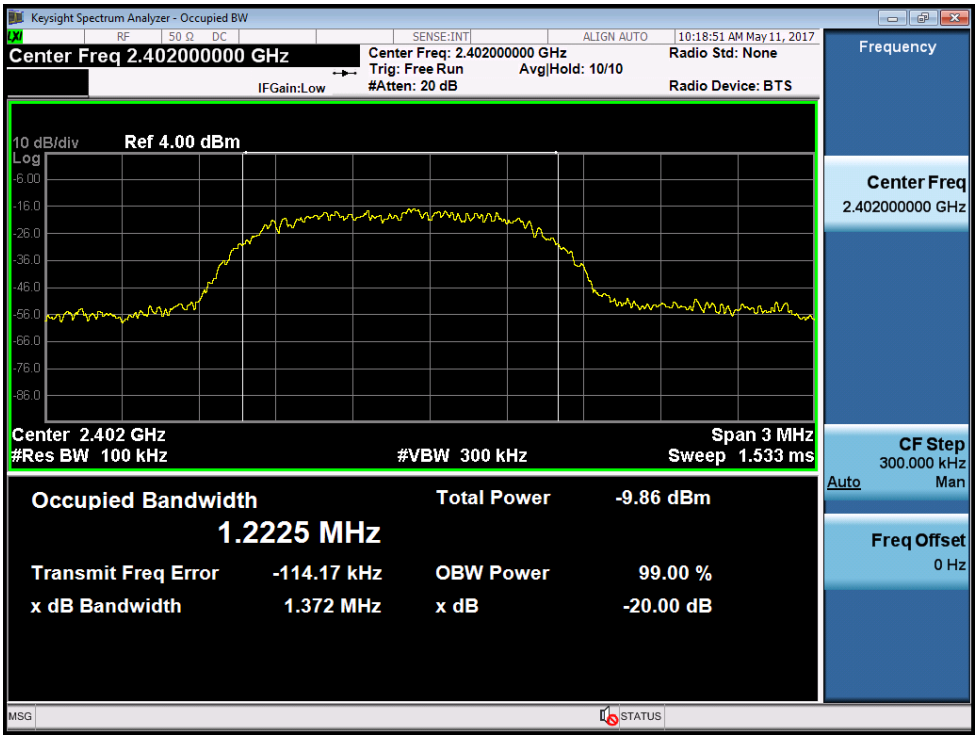
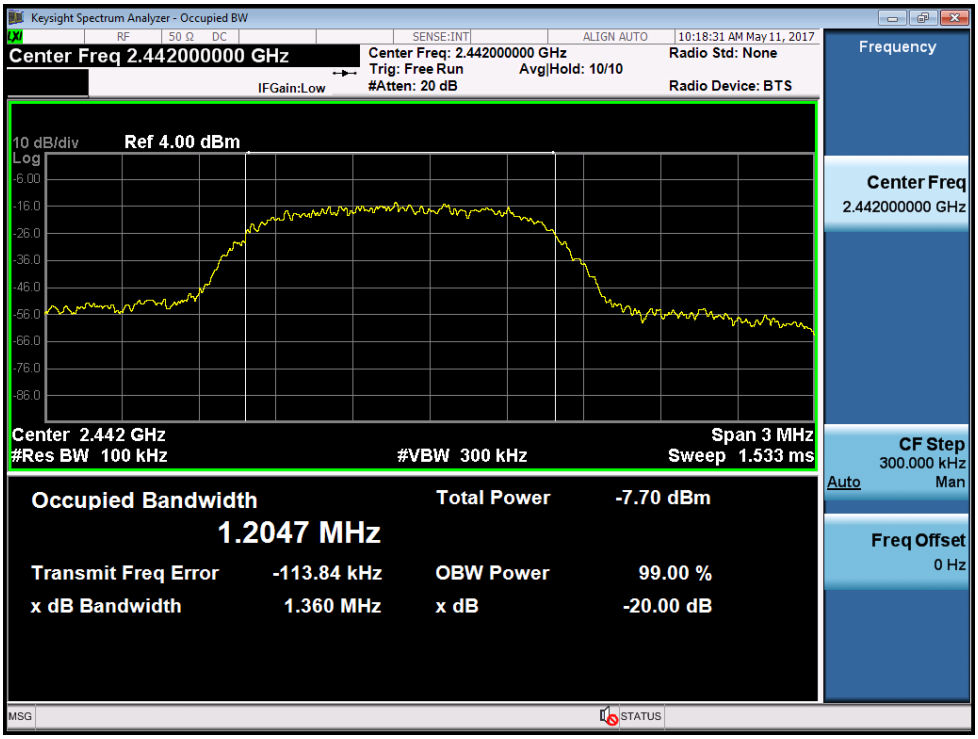
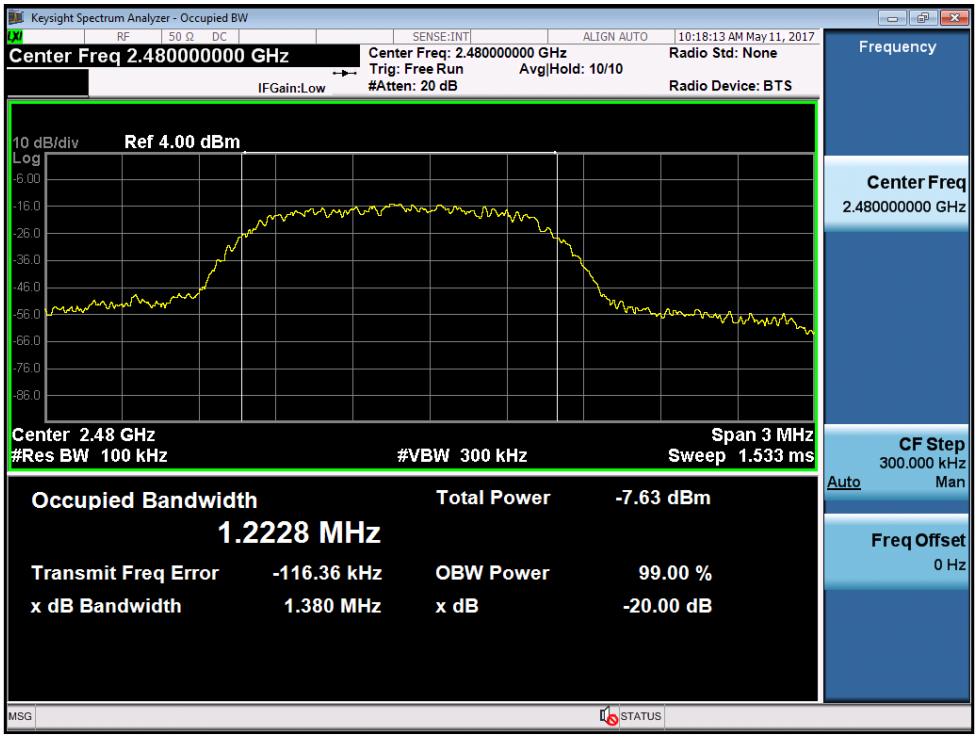
Modulation	Mode	99% Bandwidth (MHz)
8DPSK	L	1.2225
	M	1.2047
	H	1.2228

Channel L



Channel M



Channel H