FCC TEST REPORT
No. 150900353SHA-003

Applicant	:	China Hualu Group Co., Ltd. No.1 Hua Road, Qixianling Hi-Tech Zone, Dalian, China
Manufacturer	:	Dalian Golden Hualu Digital Technology Co., Ltd. No.1 Hua Road, Qixianling Hi-Tech Zone, Dalian, China
Product Name	:	Blu-ray disc player and receiver
Type/Model	:	SOLO MOVIE, SOLO MOVIE 2.1, SOLO MUSIC
TEST RESULT	**:**	**PASS**

SUMMARY

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

47CFR Part 15 (2014): Radio Frequency Devices

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

RSS-247 Issue 1 (May 2015): 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: January 20, 2016

Prepared by: Reviewed by:

Nemo Li (*Project Engineer*) Daniel Zhao (*Reviewer*)

Description of Test Facility

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Address: Building No.86, 1198 Qinzhou Road(North), Shanghai 200233, P.R. China

FCC Registration Number: 236597
IC Assigned Code: 2402B-1

Name of contact: Jonny Jing
Tel: 86 21 61278271
Fax: 86 21 54262353

Content

1 GENERAL INFORMATION

1.1 Description of Client

Applicant	:	China Hualu Group Co., Ltd
		No.1 Hua Road Qixianling Hi-tech Zone, Dalian, China
Name of contact	:	Che Yongjin
Tel	:	86 0411 84790599
Fax	:	86 0411 84790944
Email	:	cheyj@hualu.com.cn
Manufacturer	:	Dalian Golden Hualu Digital Technology Co., Ltd.
		No.1 Hua Road, Qixianling Hi-Tech Zone, Dalian, China

1.2 Identification of the EUT

Product Name	:	Blu-ray disc player and receiver
Type/model	:	SOLO MOVIE, SOLO MOVIE 2.1, SOLO MUSIC
FCC ID	:	YLZ-BTM869
IC	:	9088A-BTM869

1.3 Technical Specification

Operation Frequency Band	:	2400 – 2483.5 MHz
Protocol	:	Bluetooth BLE
Type of Modulation	:	GFSK
Channel Number	:	40 channels
Description of EUT	:	EUT is a Blu-Ray disc player and receiver, and has three models. The models of SOLO MOVIE and SOLO MOVIE 2.1 are the same except that audio circuit. The models of SOLO MOVIE 2.1 and SOLO MUSIC are the same except that SOLO MUSIC was disabled to play BD/DVD disc. The SOLO MOVIE was chosen to perform the full tests and the model of SOLO MOVIE 2.1 and SOLO MUSIC were chosen to perform the test items of conducted emission and radiated emission, and the worst data was listed in the report.
Antenna		Pole antenna with reverse connector, 2.5dBi max
Rating		110-120V～ or 220-240V～, 50-60Hz, 1kW MAX., Class II
Category of EUT	:	Class B
EUT type	:	☒ Table top ☐ Floor standing
Sample received date	:	September 9, 2015
Date of test	:	September 9, 2015 – October 12, 2015

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2014)
RSS-247 Issue 1 (May 2015)
RSS-Gen Issue 4 (December 2014)
ANSI C63.10 (2013)
KDB 558074 D01 (v03r04)

2.2 Mode of operation during the test

While testing transmitting mode of EUT, the engineering mode and continuously transmission was applied. The software Bluetest3 is used to configure the engineer mode.

The radiated emission and conducted emission has been tested with Bluetooth and WiFi transmitting continuously at the same time.

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	2440	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	LCD TV	SONY KLV-32V200A	-
3	Resistor	-	-
4	SPI-USB	-	-

2.5 Instrument list

Selected	Instrument	EC no.	Model	Valid until date
☒	Shielded room	EC 2838	GB88	2016-1-8
☒	EMI test receiver	EC 2107	ESCS 30	2016-10-19
☒	A.M.N.	EC 3119	ESH2-Z5	2016-12-16
☐	A.M.N.	EC 3394	ENV 216	2016-8-1
☒	Semi anechoic chamber	EC 3048	-	2016-5-11
☒	EMI test receiver	EC 3045	ESIB26	2016-10-19
☒	Broadband antenna	EC 4206	CBL 6112D	2016-4-27
☒	Horn antenna	EC 3049	HF906	2016-4-27
☐	Horn antenna	EC 4792-1	3117	2016-4-21
☒	Horn antenna	EC 4792-3	HAP18-26W	2016-6-11
☐	Pre-amplifier	EC 5262	pre-amp 18	2016-5-25
☒	Pre-amplifier	EC 4792-2	TPA0118-40	2016-4-10
☐	High Pass Filter	EC 4797-1	WHKX 1.0/15G-10SS	2016-1-8
☒	High Pass Filter	EC 4797-2	WHKX 2.8/18G-12SS	2016-1-8
☐	High Pass Filter	EC 4797-3	WHKX 7.0/1.8G-8SS	2016-1-8
☒	Band Reject Filter	EC 4797-4	WRCGV2400/2483/10SS	2016-1-8
☐	Test Receiver	EC 4501	ESCI 7	2016-1-13
☒	PXA Signal Analyzer	EC5338	N9030A	2016-5-14
☒	Power sensor/Power meter	EC4318	N1911A/N1921A	2016-4-8
☐	Power sensor	EC5338-1	U2021XA	2016-3-5
☐	MXG Analog Signal Generator	EC5338-2	N5181A	2016-3-5
☐	MXG Vector Signal Generator	EC5175	N51812B	2016-1-8

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
Minimum 6dB bandwidth	15.247(a)(2)	RSS-247 Issue 1 Annex 5.2	Pass
Maximum conducted output power	15.247(b)	RSS-247 Issue 1 Annex 5.4	Pass
Power spectrum density	15.247(e)	RSS-247 Issue 1 Annex 5.2	Pass
Radiated emission	15.205 & 15.209	RSS-Gen Issue 4 Clause 8.9	Pass
Emission outside the frequency band	15.247(d)	RSS-247 Issue 1 Annex 5.5	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

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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

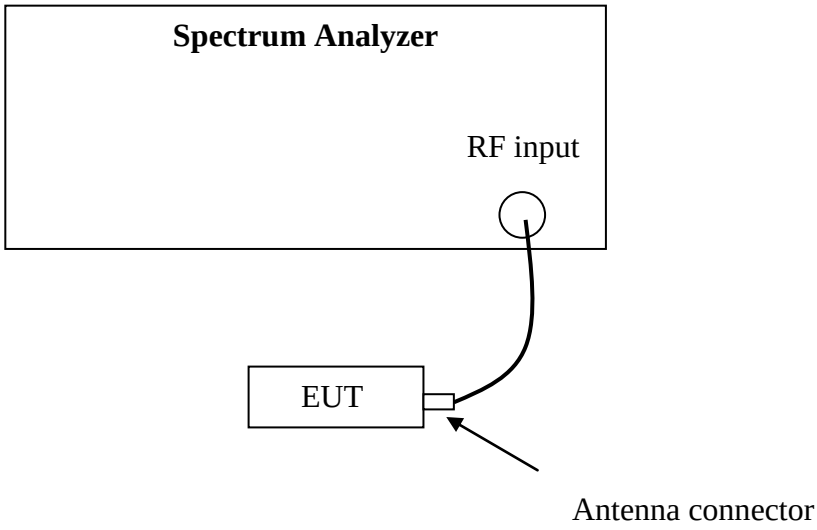
3 Minimum 6dB bandwidth

Test result: Pass

3.1 Limit

For systems using digital modulation techniques that may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz.

3.2 Test Configuration



3.3 Test Procedure and test setup

The minimum 6dB bandwidth per FCC §15.247(a)(2) is measured using the Spectrum Analyzer according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance v03r04" for compliance to FCC 47CFR 15.247 requirements(clause 8.2).

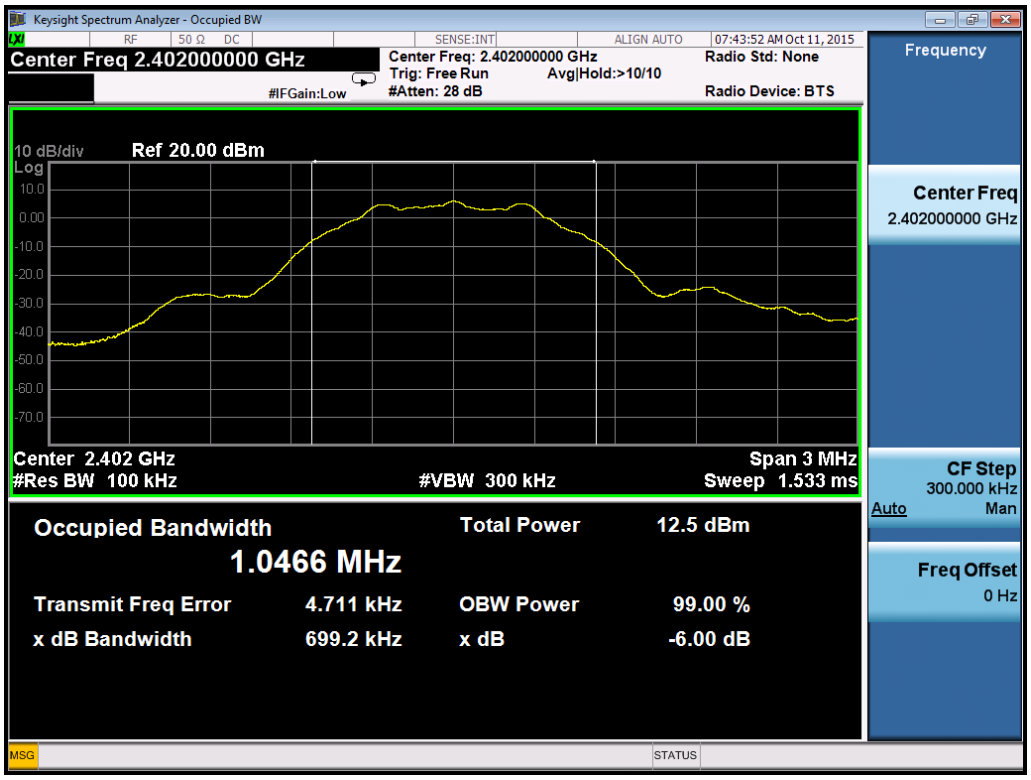
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

3.4 Test Protocol

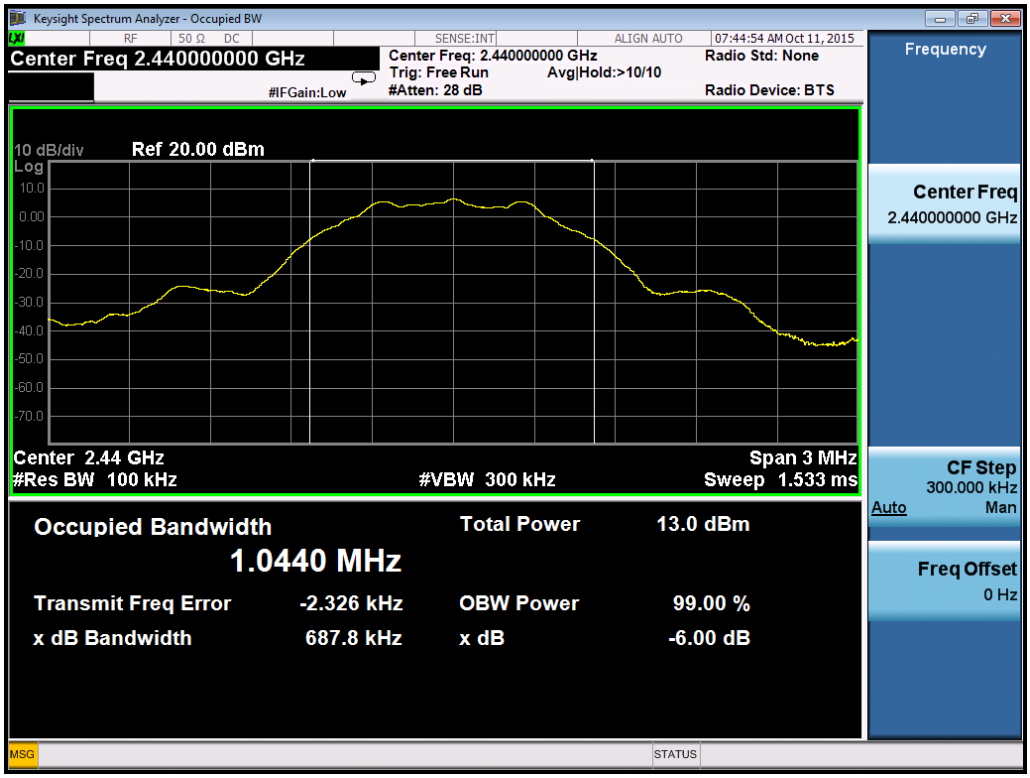
Temperature: 22°C
Relative Humidity: 54%

Mode	Channel	Minimum 6dB Bandwidth (kHz)	Limits (MHz)
BLE	L	699.2	≥ 0.5
	M	687.8	≥ 0.5
	H	690.1	≥ 0.5

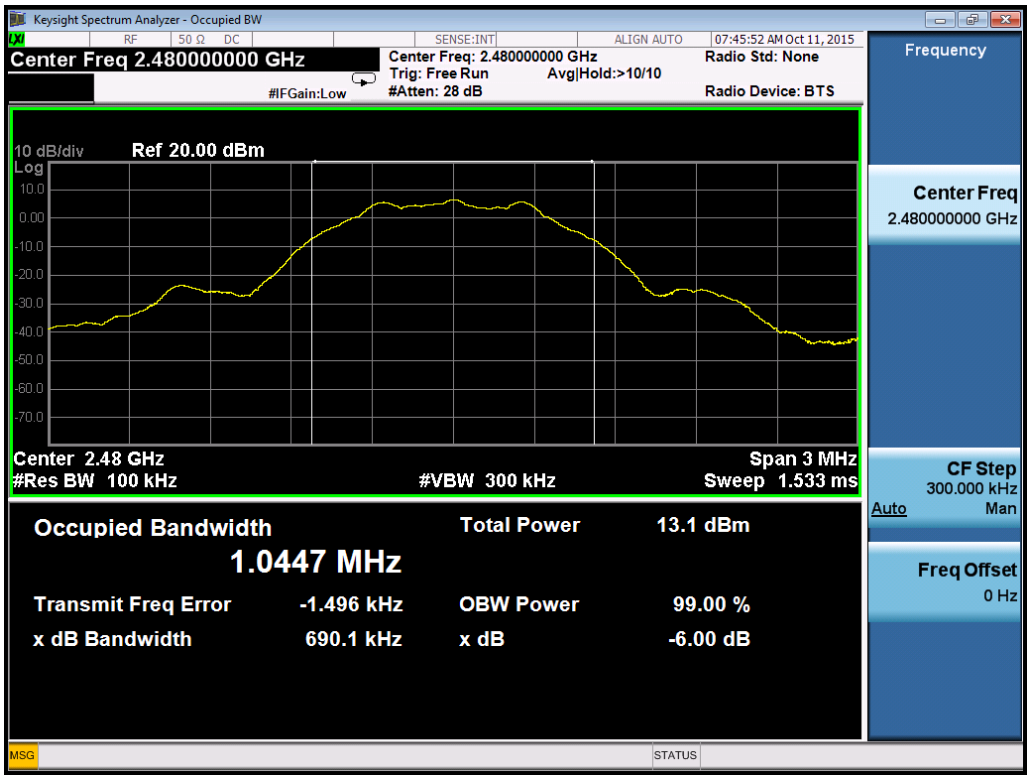
Channel L



Channel M



Channel H



4 Maximum conducted output power

Test result: Pass

4.1 Test limit

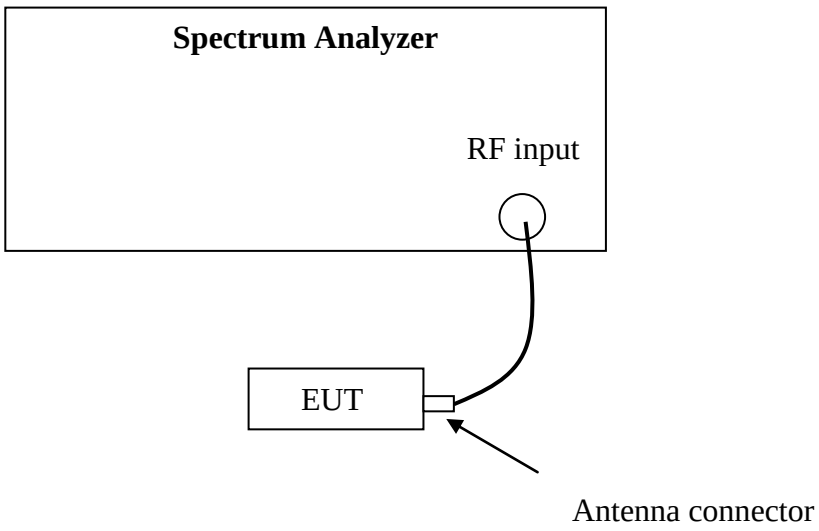
☐ For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt

☐ For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts

☒ For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt (EIRP: 4 watt).

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. If there have a beam forming type, the limit should be the minimum of 30dBm and (30 + 6 – antenna gain - beam forming gain) dBm.

4.2 Test Configuration



4.3 Test procedure and test setup

The conducted output power was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance v03r04" for compliance to FCC 47CFR 15.247 requirements (clause 9.2.2.4).

The maximum conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

4.4 Test protocol

Temperature: 22 °C
Relative Humidity: 54 %

Mode	Channel	Conducted Power (dBm)	Limit (dBm)
BLE	L	6.20	30
	M	6.60	30
	H	6.82	30

The maximum EIRP of the EUT = 6.82dBm + 2.50dBi = 9.32dBm = 8.55mW which is lower than the EIRP limit of RSS-247.

5 Power spectrum density

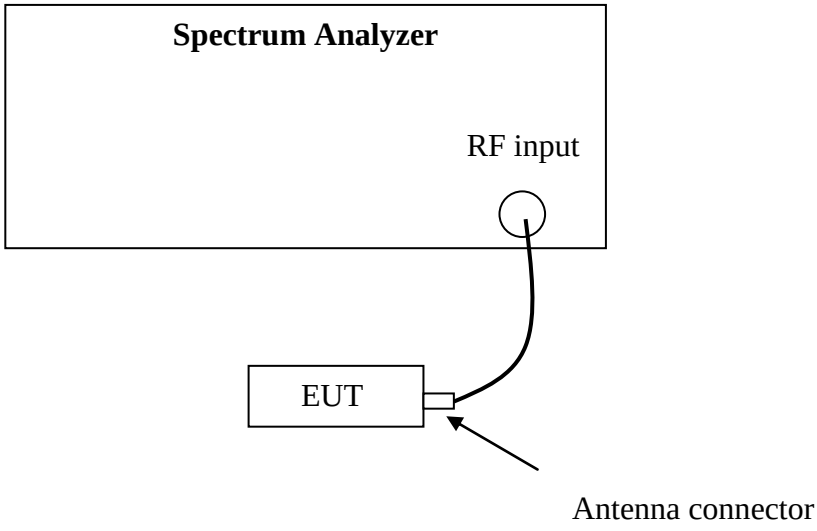
Test result: **Pass**

5.1 Test limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

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. If there have a beam forming type, the limit should be the minimum of 8dBm/3kHz and (8 + 6 – antenna gain - beam forming gain) dBm/3kHz.

5.2 Test Configuration



5.3 Test procedure and test setup

The power spectrum density per FCC §15.247(e) was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance v03r04" (clause 10.2) for compliance to FCC 47CFR 15.247 requirements.

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the *DTS bandwidth*.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 × RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.4 Test Protocol

Temperature: 22°C
Relative Humidity: 54%

Mode	Channel	PSD (dBm/100kHz)	Limit (dBm/3kHz)
BLE	L	5.897	8
	M	6.358	8
	H	6.479	8

Channel L

Channel M

Channel H

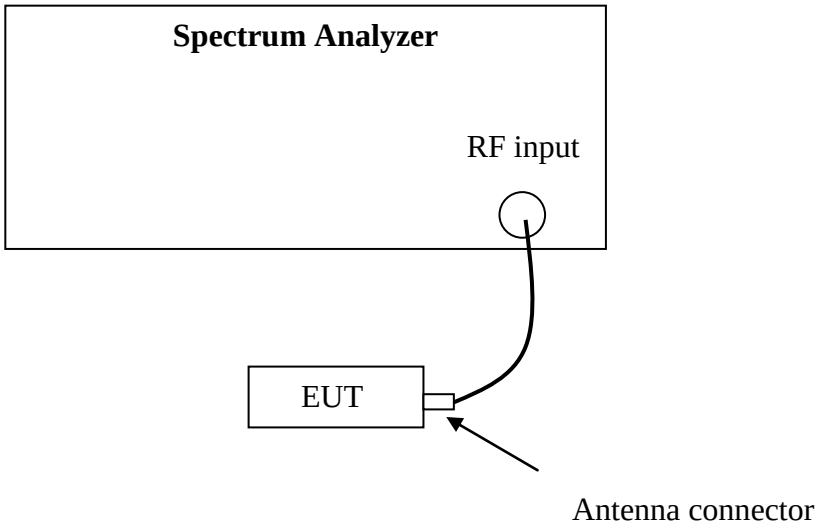
6 Emission outside the frequency band

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 emission outside the frequency band was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance v03r04" (clause 11.0) for compliance to FCC 47CFR 15.247 requirements.

Reference level measurement

Establish a reference level by using the following procedure:
a) Set instrument center frequency to DTS channel center frequency.
b) Set the span to ≥ 1.5 times the *DTS bandwidth*.
c) Set the RBW = 100 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.

h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

Emission level measurement
a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ 3 x RBW.
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum amplitude level.

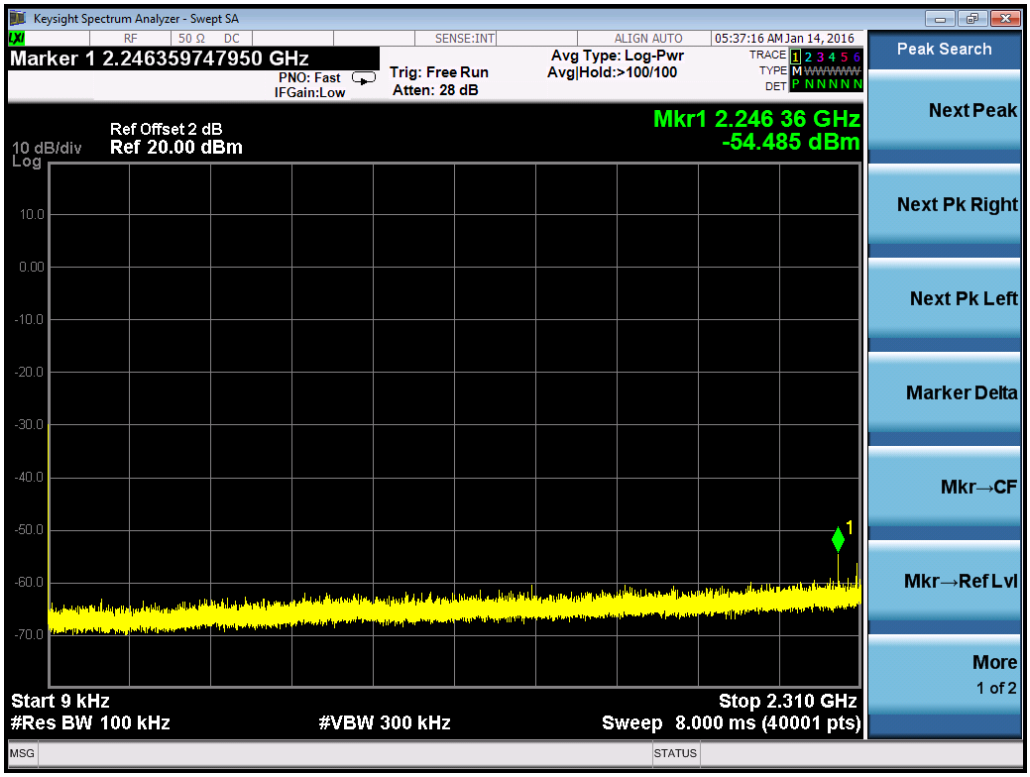
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

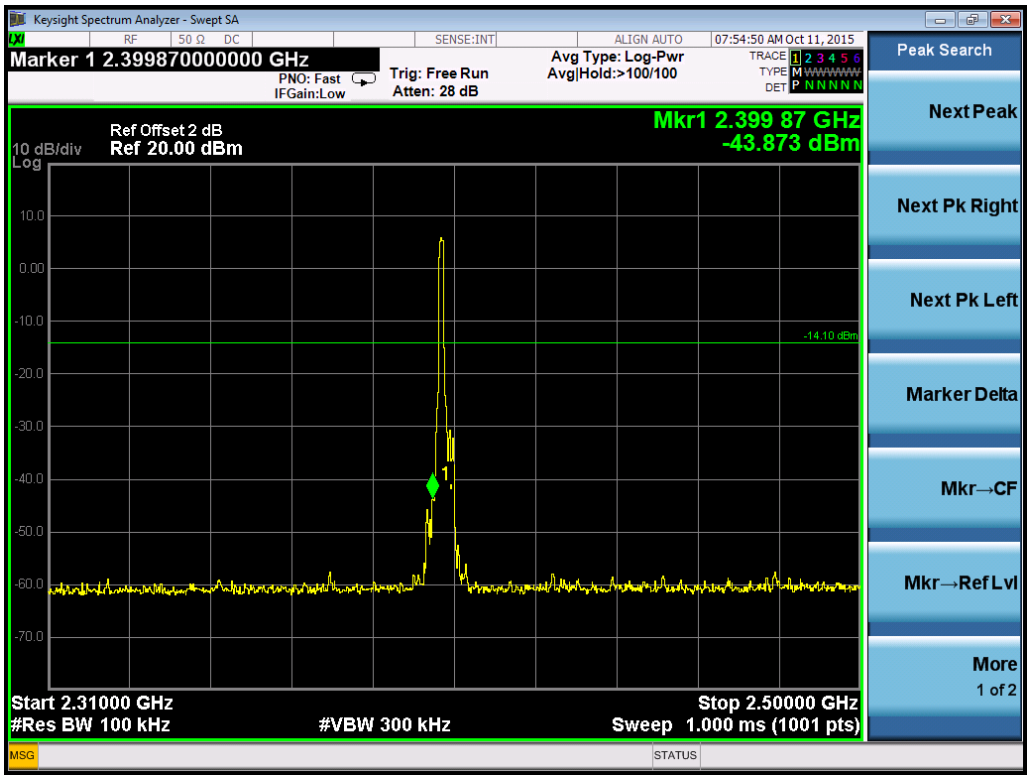
6.4 Test Protocol

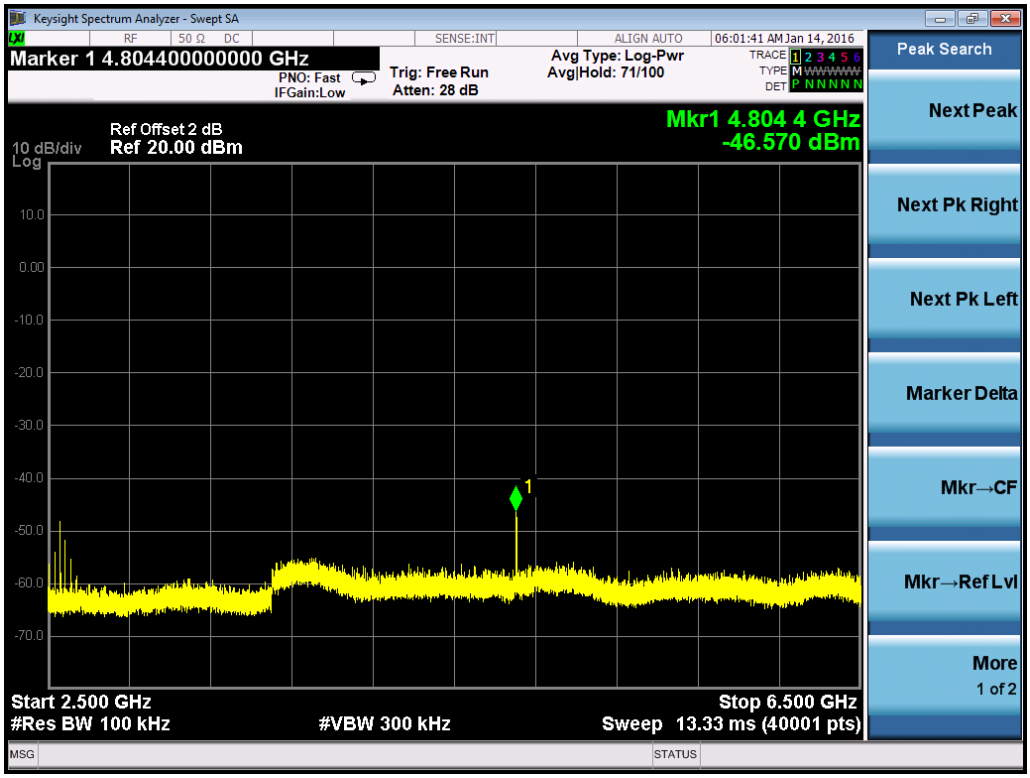
Temperature: 22°C
Relative Humidity: 54%

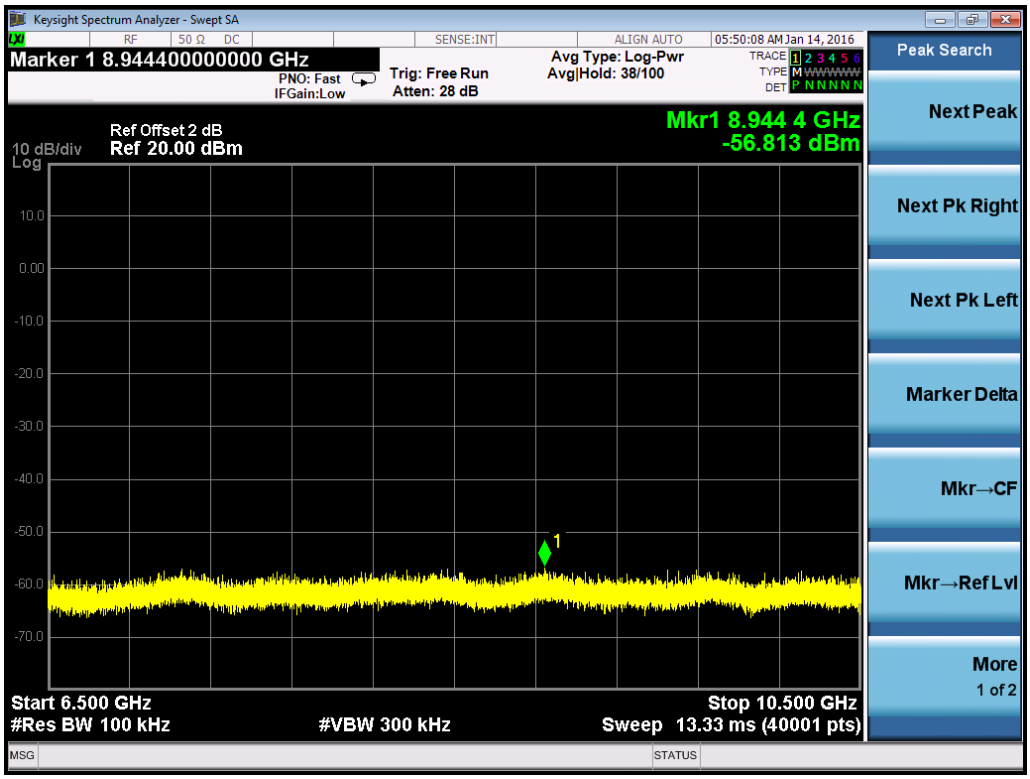
Mode	Channel	Reference Level (dBm)	Results	Limit (dBm)
BLE	L	5.897	Pass	≥20
	M	6.358	Pass	≥20
	H	6.479	Pass	≥20

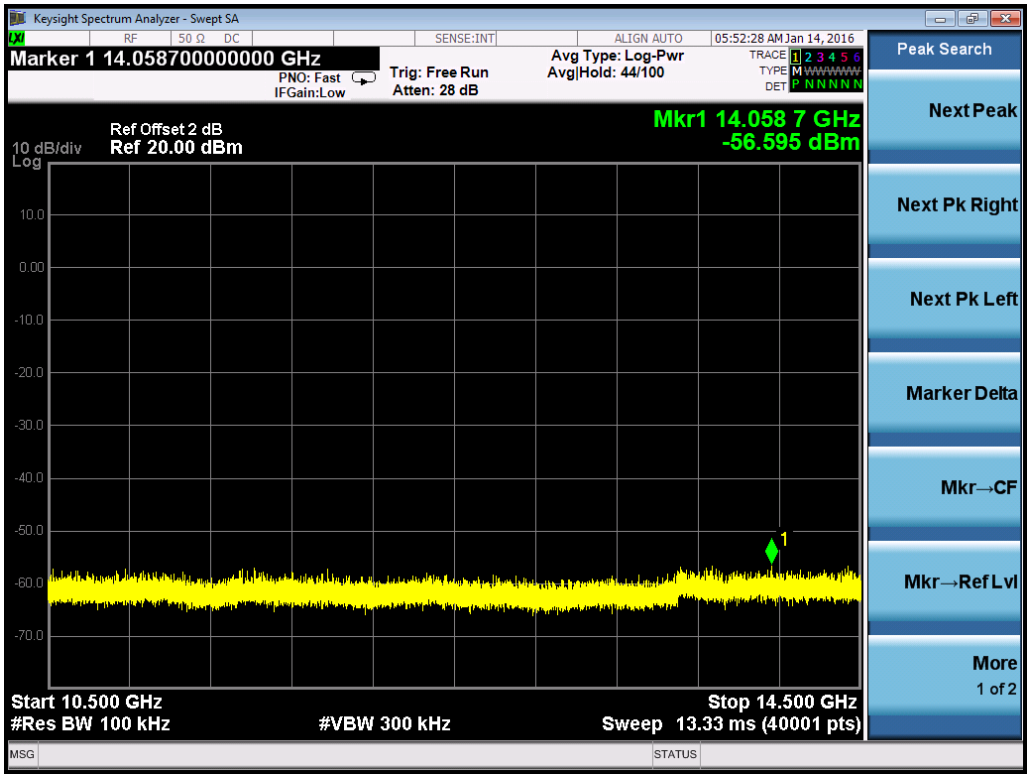
Channel L

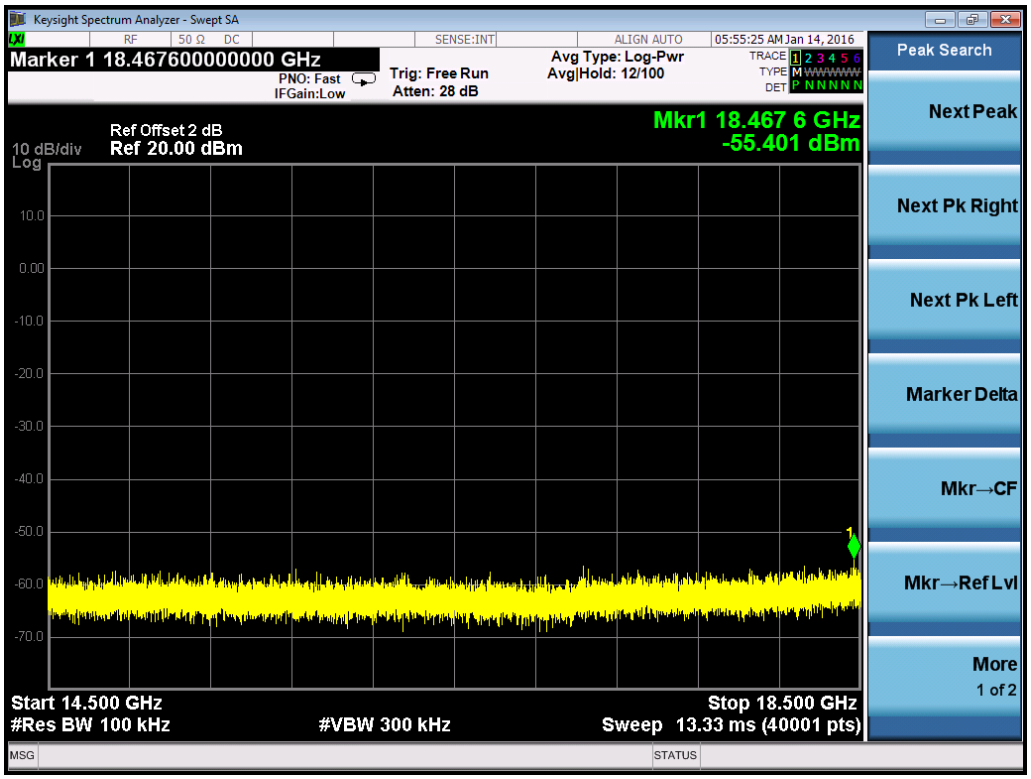


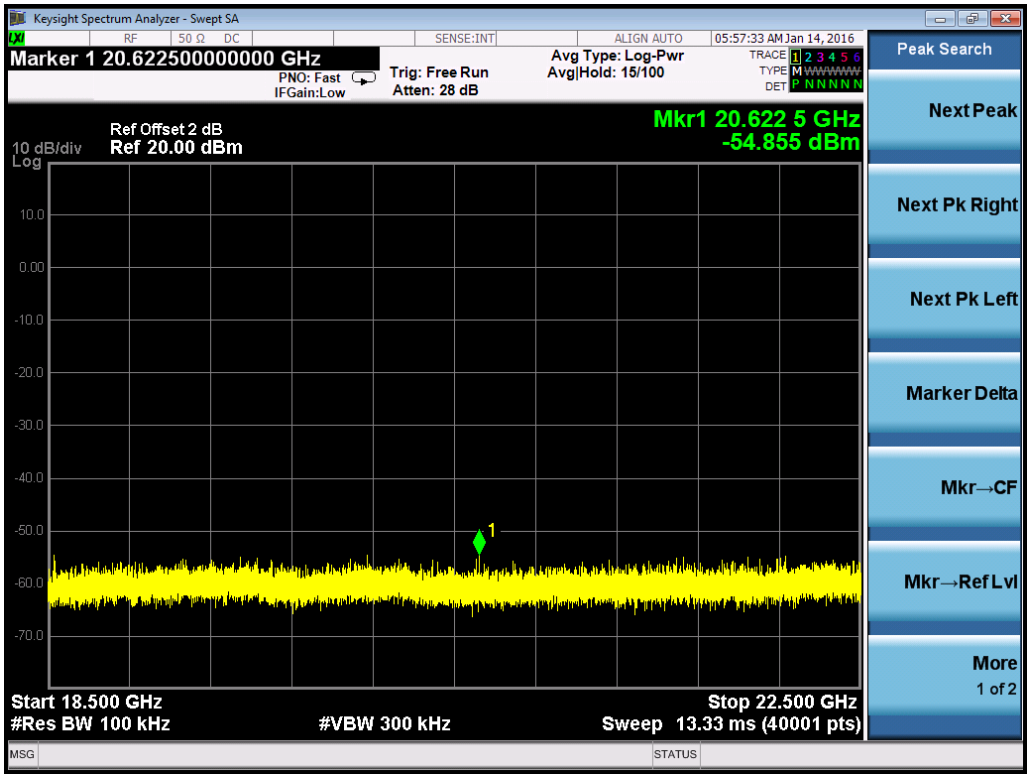

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
07:54:50 AM Oct 11, 2015
Marker 1 2.399870000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 2.399 87 GHz
-43.873 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-14.10 dBm
1
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 1.000 ms (1001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

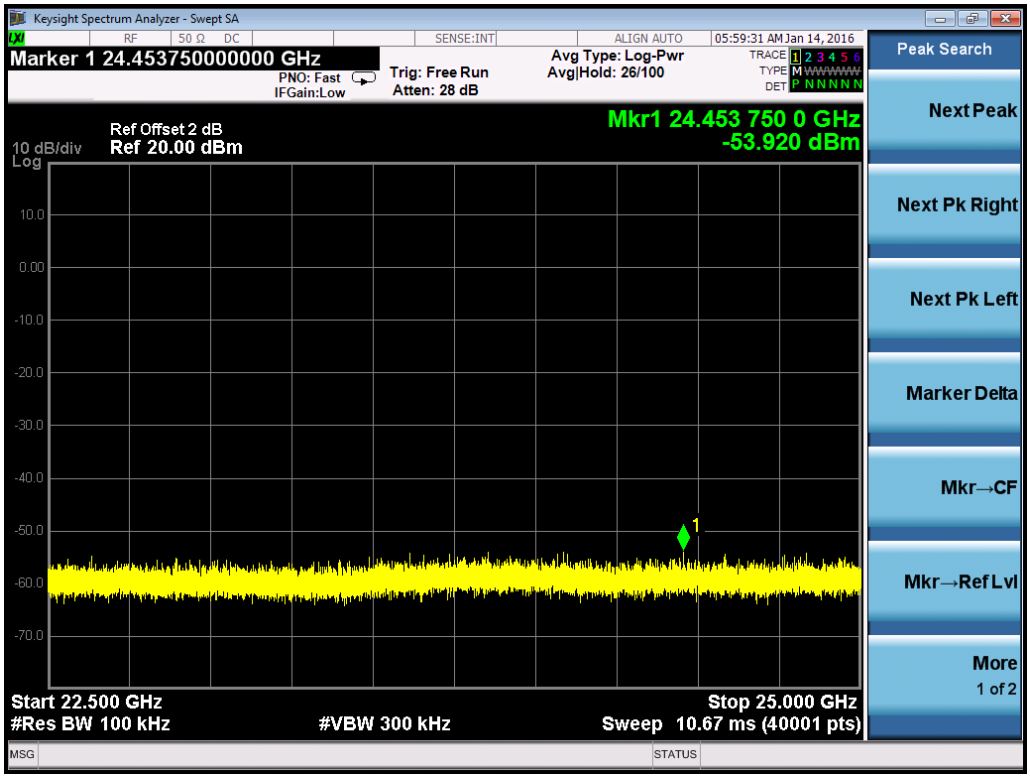

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
06:01:41 AM Jan 14, 2016
Marker 1 4.804400000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 71/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 4.804 4 GHz
-46.570 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
1
Start 2.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 6.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
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
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:50:08 AM Jan 14, 2016
Marker 1 8.944400000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 38/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 8.944 4 GHz
-56.813 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Start 6.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

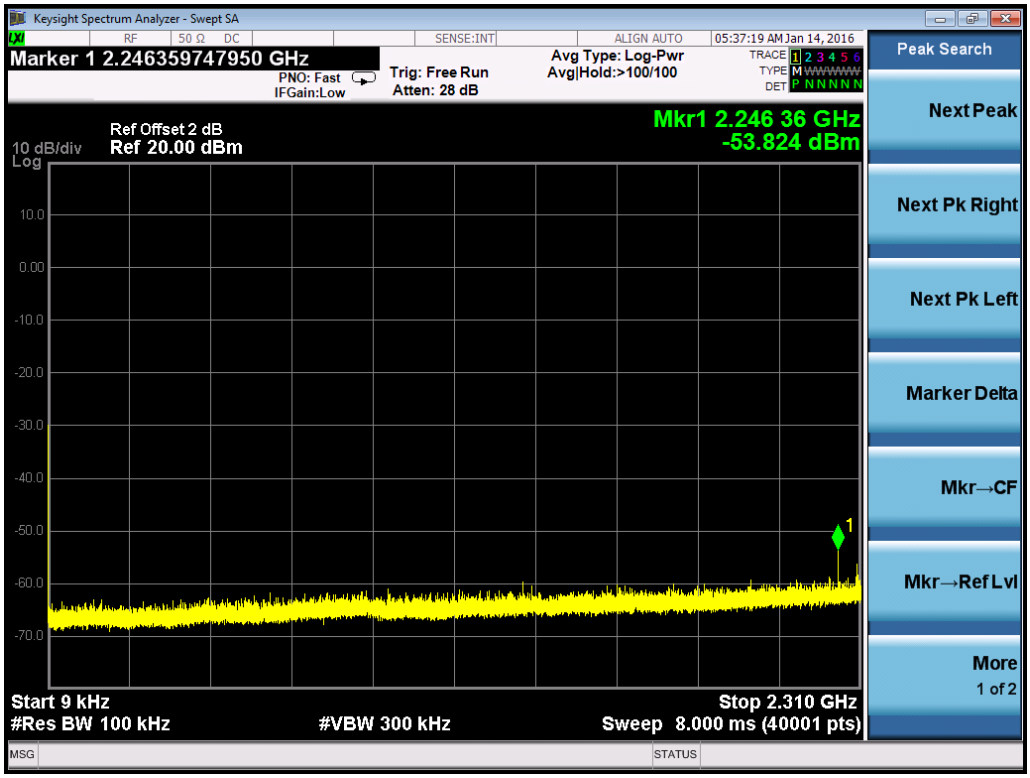

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:52:28 AM Jan 14, 2016
Marker 1 14.058700000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 44/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 14.058 7 GHz
-56.595 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Start 10.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 14.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

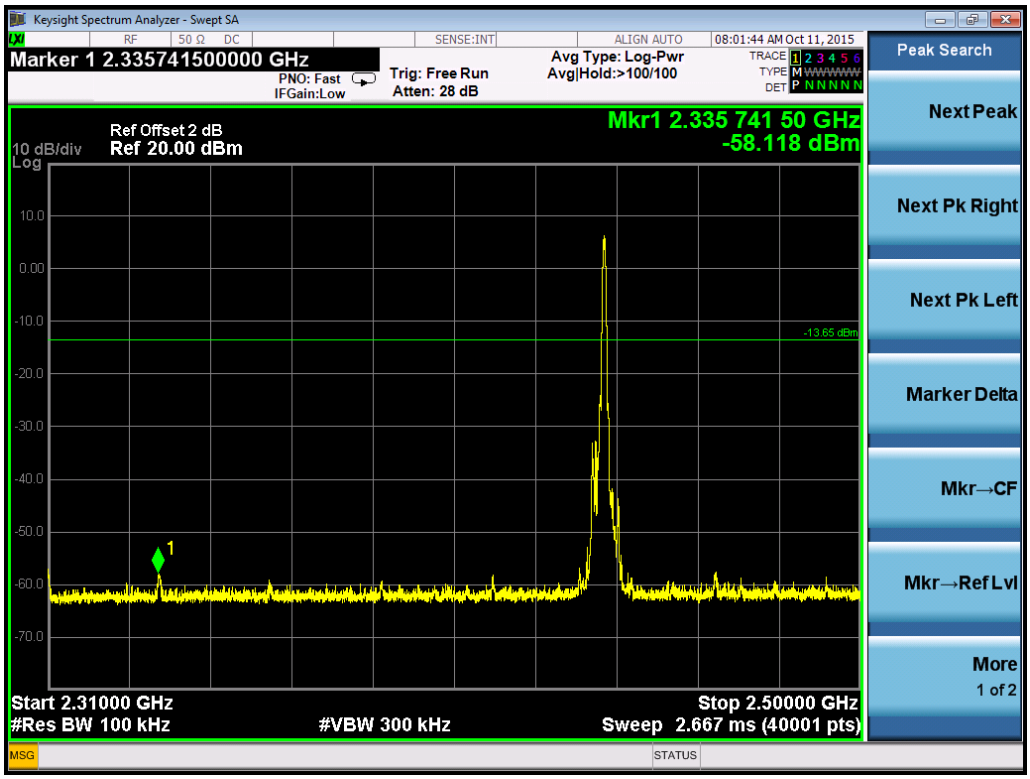

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:55:25 AM Jan 14, 2016
Marker 1 18.467600000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 12/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 18.467 6 GHz
-55.401 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Start 14.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 18.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

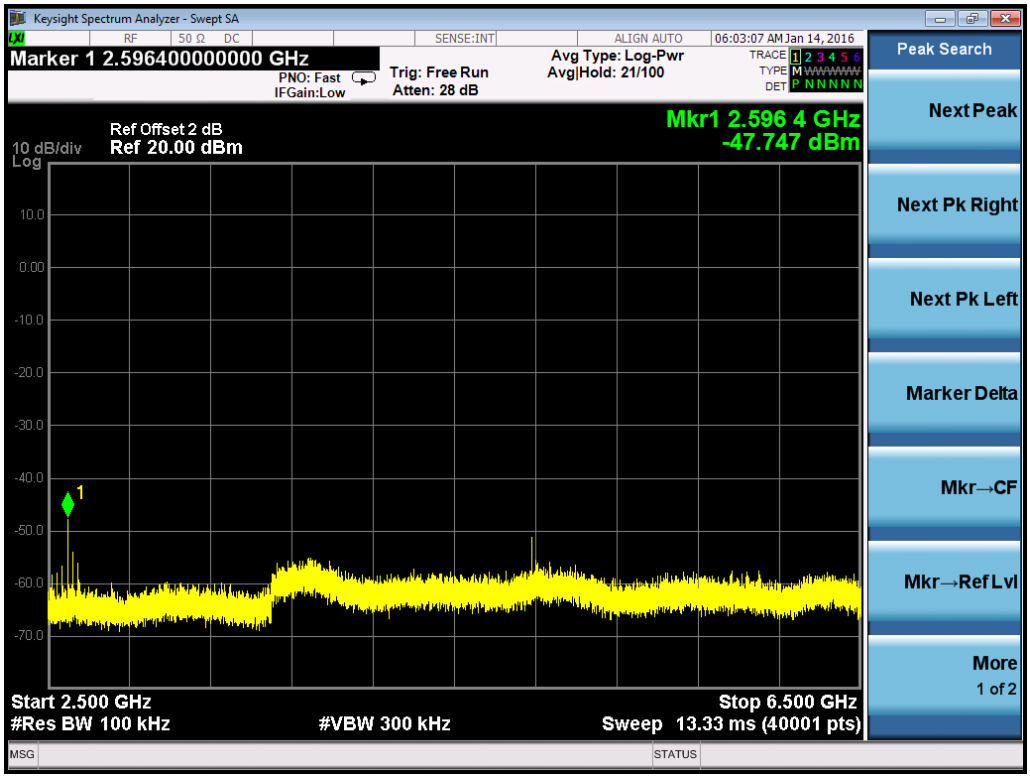

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:57:33 AM Jan 14, 2016
Marker 1 20.622500000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 15/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 20.622 5 GHz
-54.855 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Start 18.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 22.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

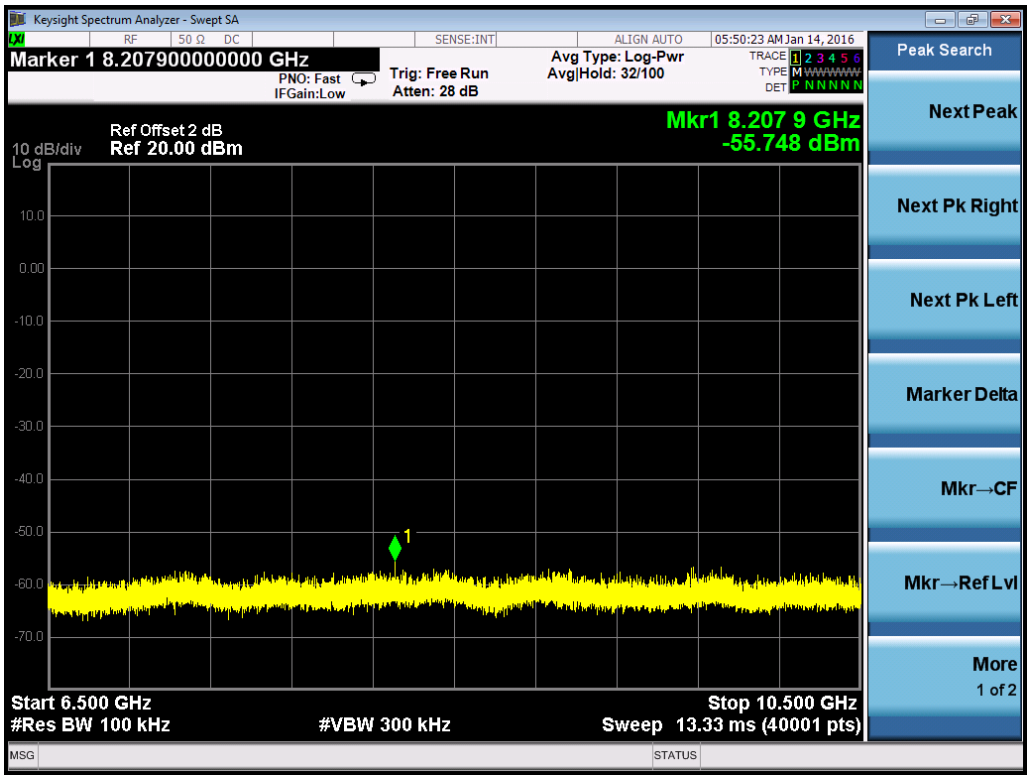

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:59:31 AM Jan 14, 2016
Marker 1 24.453750000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 26/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 24.453 750 0 GHz
-53.920 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Start 22.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.000 GHz
Sweep 10.67 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

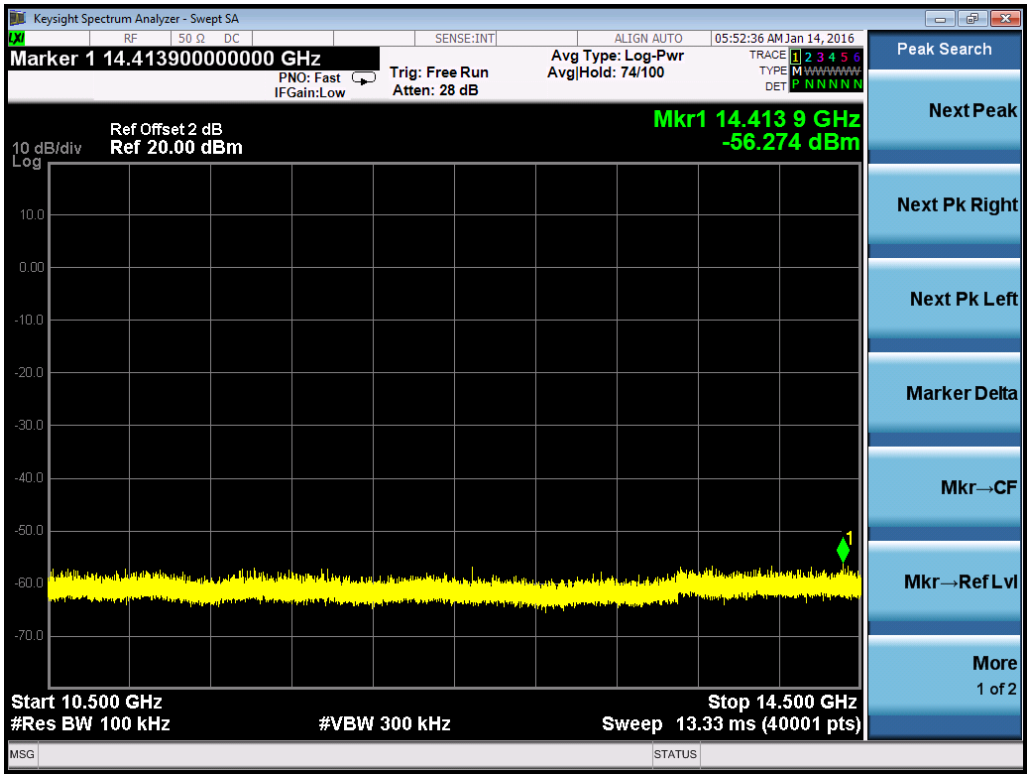
Channel M

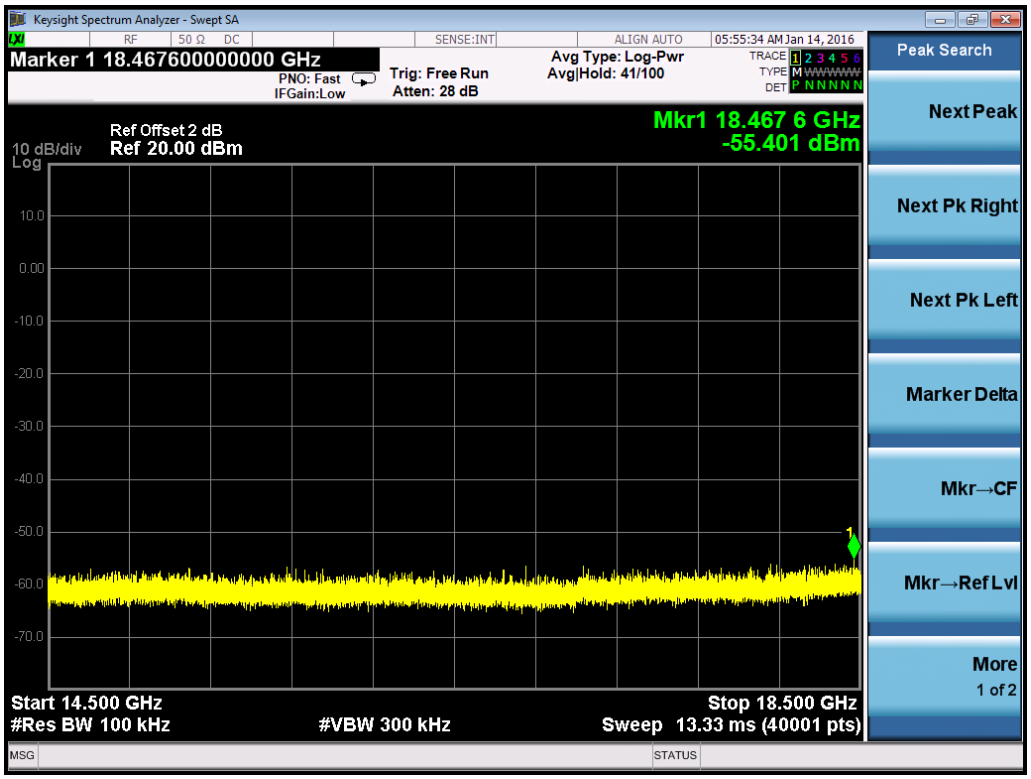

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:37:19 AM Jan 14, 2016
Marker 1 2.246359747950 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 2.246 36 GHz
-53.824 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Start 9 kHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.310 GHz
Sweep 8.000 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

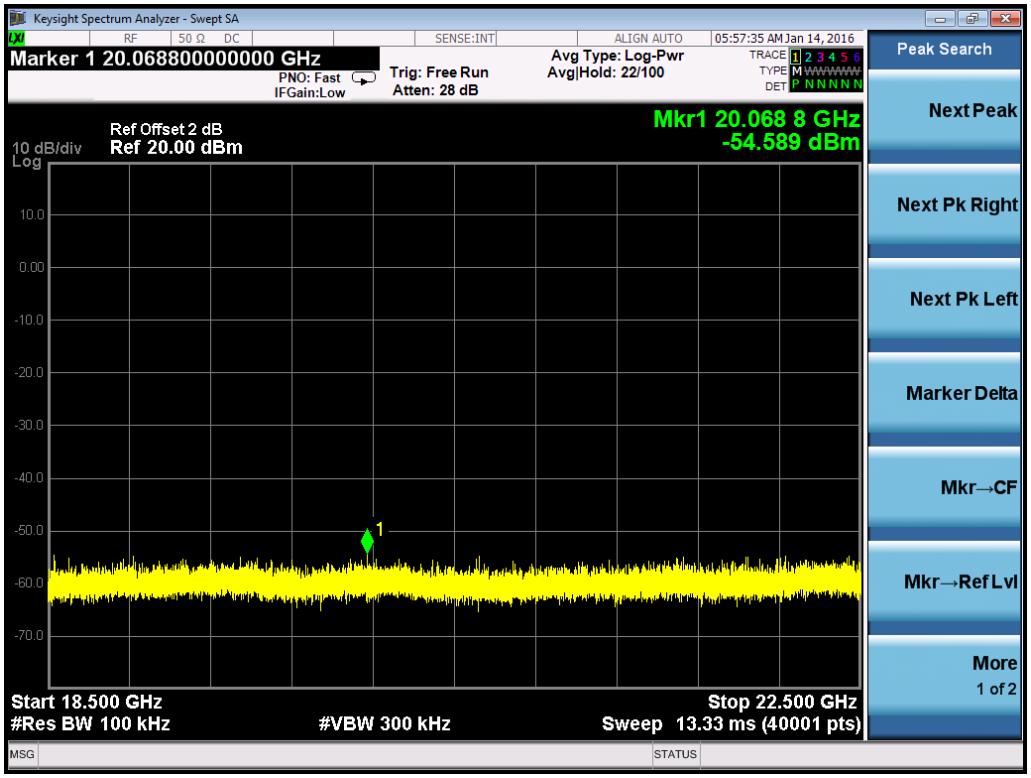

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
08:01:44 AM Oct 11, 2015
Marker 1 2.335741500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 2.335 741 50 GHz
-58.118 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-13.65 dBm
1
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

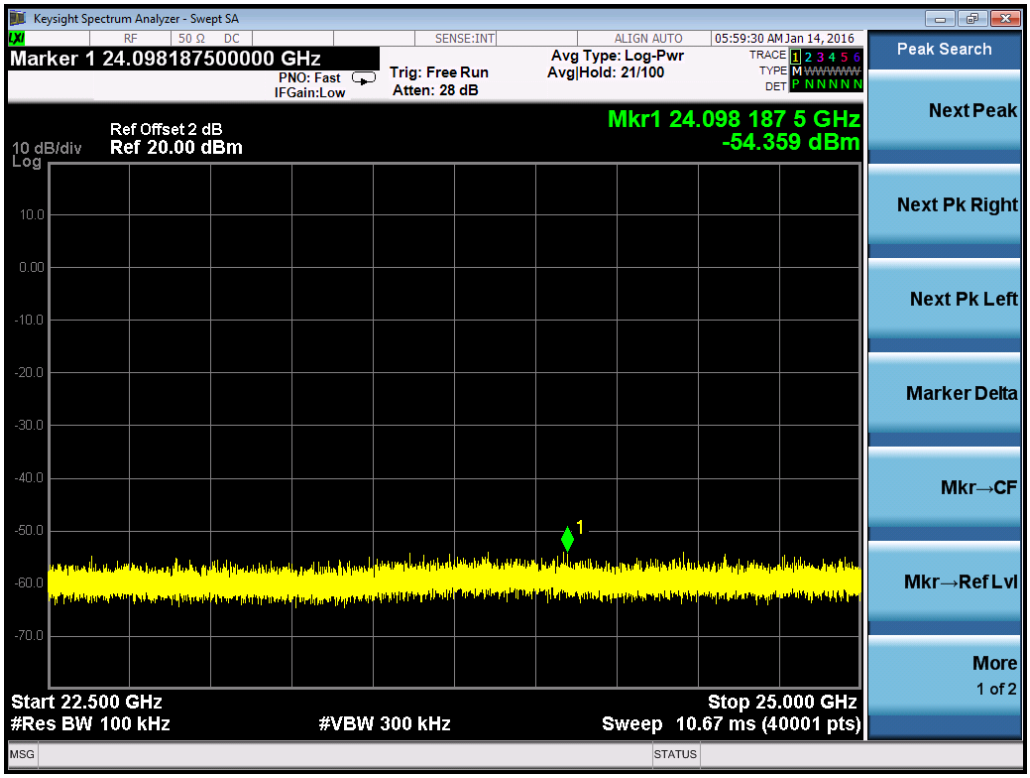

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
06:03:07 AM Jan 14, 2016
Marker 1 2.596400000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 21/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 2.596 4 GHz
-47.747 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
1
Start 2.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 6.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
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
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:50:23 AM Jan 14, 2016
Marker 1 8.207900000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 32/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 8.207 9 GHz
-55.748 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Start 6.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

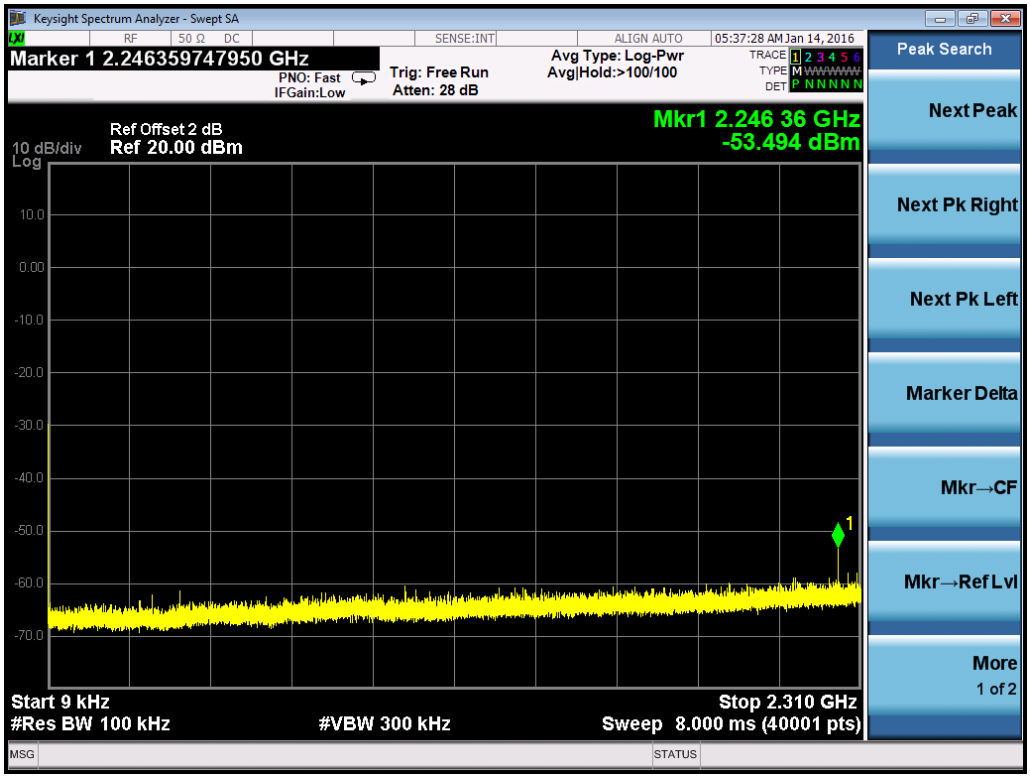

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:52:36 AM Jan 14, 2016
Marker 1 14.413900000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 74/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 14.413 9 GHz
-56.274 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Start 10.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 14.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

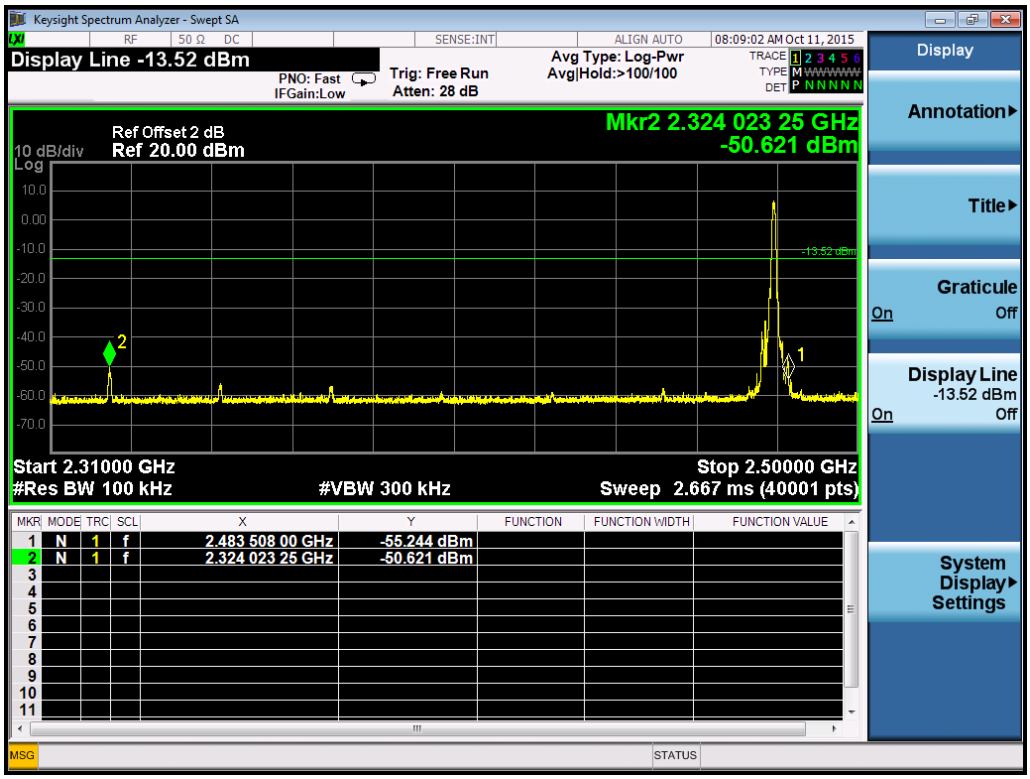

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:55:34 AM Jan 14, 2016
Marker 1 18.467600000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 41/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 18.467 6 GHz
-55.401 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Start 14.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 18.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

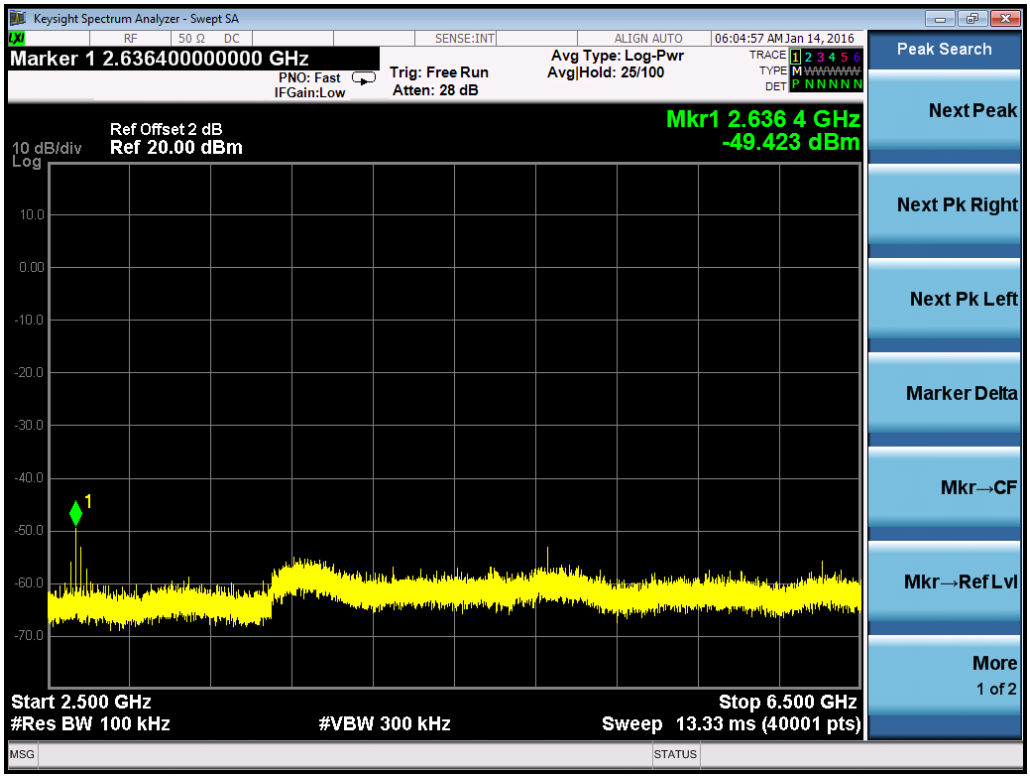

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:57:35 AM Jan 14, 2016
Marker 1 20.068800000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 22/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 20.068 8 GHz
-54.589 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Start 18.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 22.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

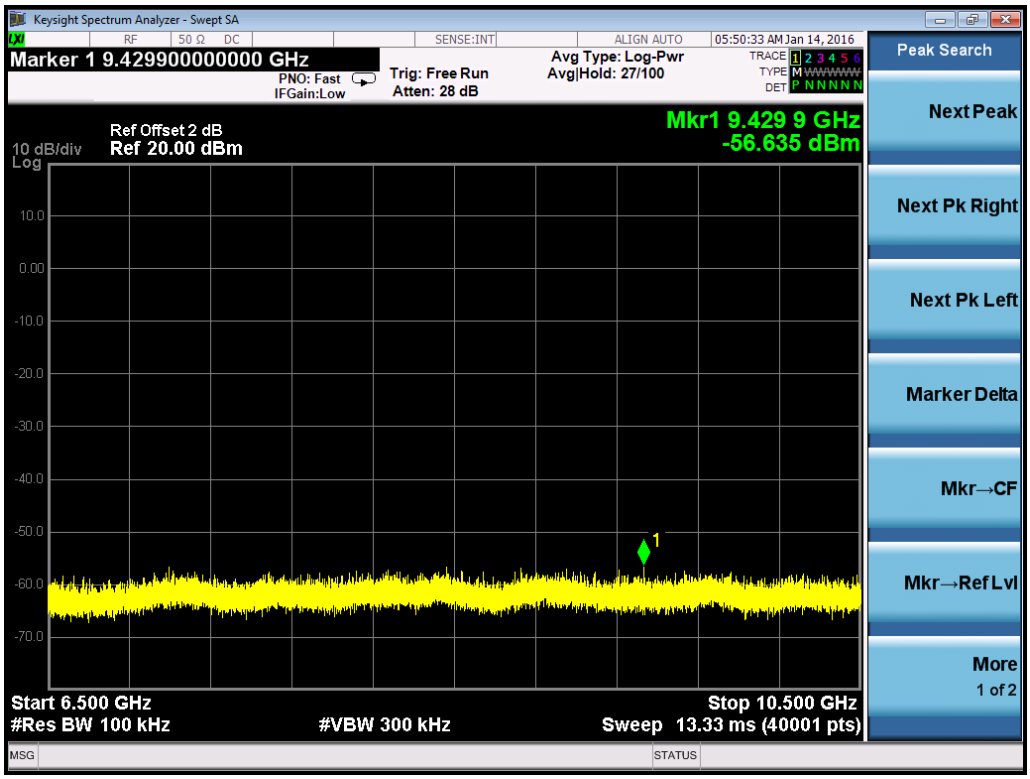

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:59:30 AM Jan 14, 2016
Marker 1 24.098187500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 21/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 24.098 187 5 GHz
-54.359 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Start 22.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.000 GHz
Sweep 10.67 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

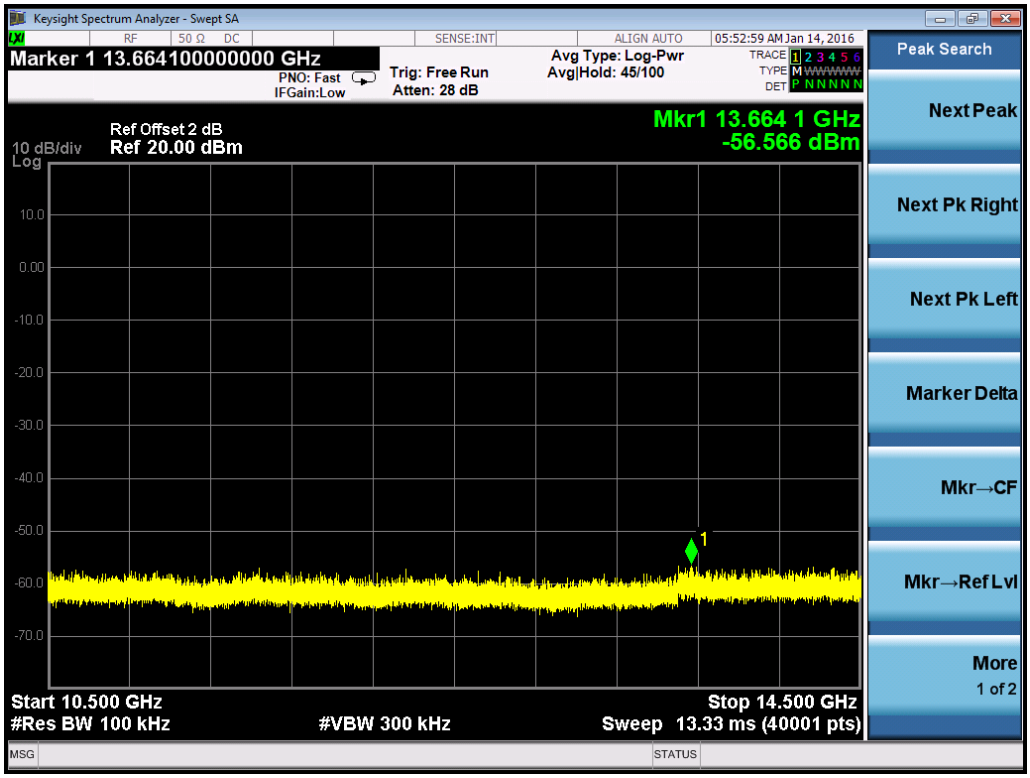
Channel H

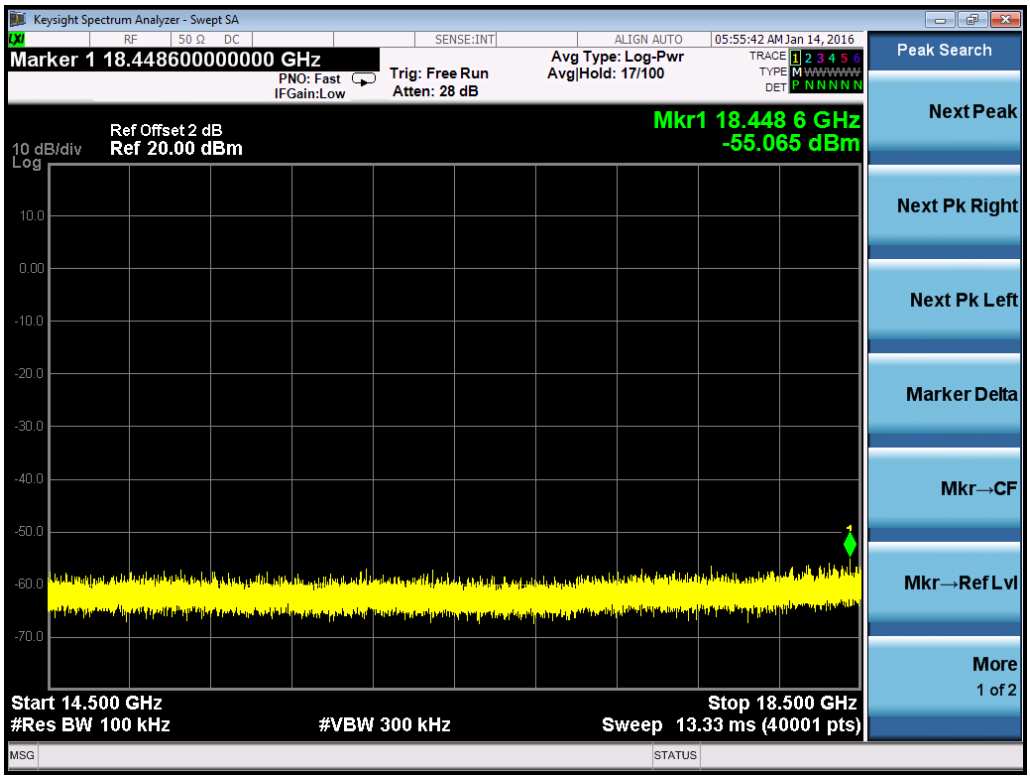

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:37:28 AM Jan 14, 2016
Marker 1 2.246359747950 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 2.246 36 GHz
-53.494 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Start 9 kHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.310 GHz
Sweep 8.000 ms (40001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

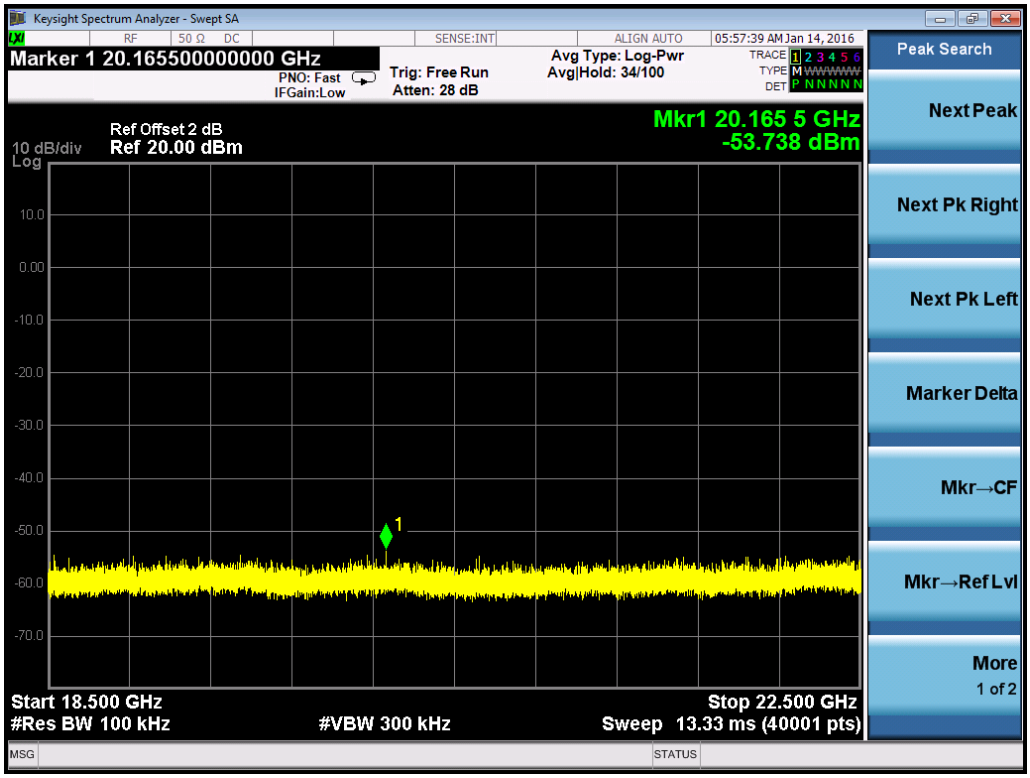

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
08:09:02 AM Oct 11, 2015
Display Line -13.52 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr2 2.324 023 25 GHz
-50.621 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-13.52 dBm
2
1
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.667 ms (40001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.483 508 00 GHz -55.244 dBm
2 N 1 f 2.324 023 25 GHz -50.621 dBm
3
4
5
6
7
8
9
10
11
MSG
STATUS
Display
Annotation
Title
Graticule
On Off
Display Line
-13.52 dBm
On Off
System
Display
Settings

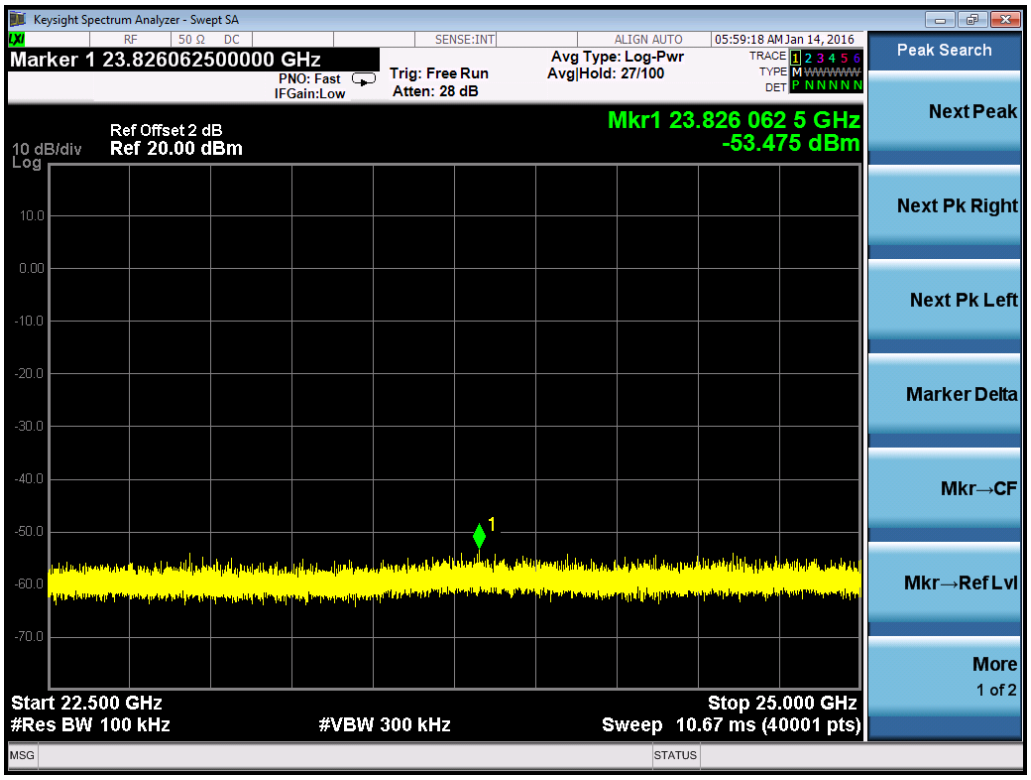

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
06:04:57 AM Jan 14, 2016
Marker 1 2.636400000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 25/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 2.636 4 GHz
-49.423 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
1
Start 2.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 6.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
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
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:50:33 AM Jan 14, 2016
Marker 1 9.429900000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 27/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 9.429 9 GHz
-56.635 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
1
Start 6.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
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
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:52:59 AM Jan 14, 2016
Marker 1 13.664100000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 45/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 13.664 1 GHz
-56.566 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
1
Start 10.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 14.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
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
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:55:42 AM Jan 14, 2016
Marker 1 18.448600000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 17/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 18.448 6 GHz
-55.065 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Start 14.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 18.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
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
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
05:57:39 AM Jan 14, 2016
Marker 1 20.165500000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 34/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 20.165 5 GHz
-53.738 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Start 18.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 22.500 GHz
Sweep 13.33 ms (40001 pts)
MSG
STATUS
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
RF
50 Ω DC
SENSE:INT
ALIGN AUTO
05:59:18 AM Jan 14, 2016
Marker 1 23.826062500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold: 27/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
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
Ref Offset 2 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 23.826 062 5 GHz
-53.475 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
1
Start 22.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.000 GHz
Sweep 10.67 ms (40001 pts)
MSG
STATUS

7 Radiated Emissions

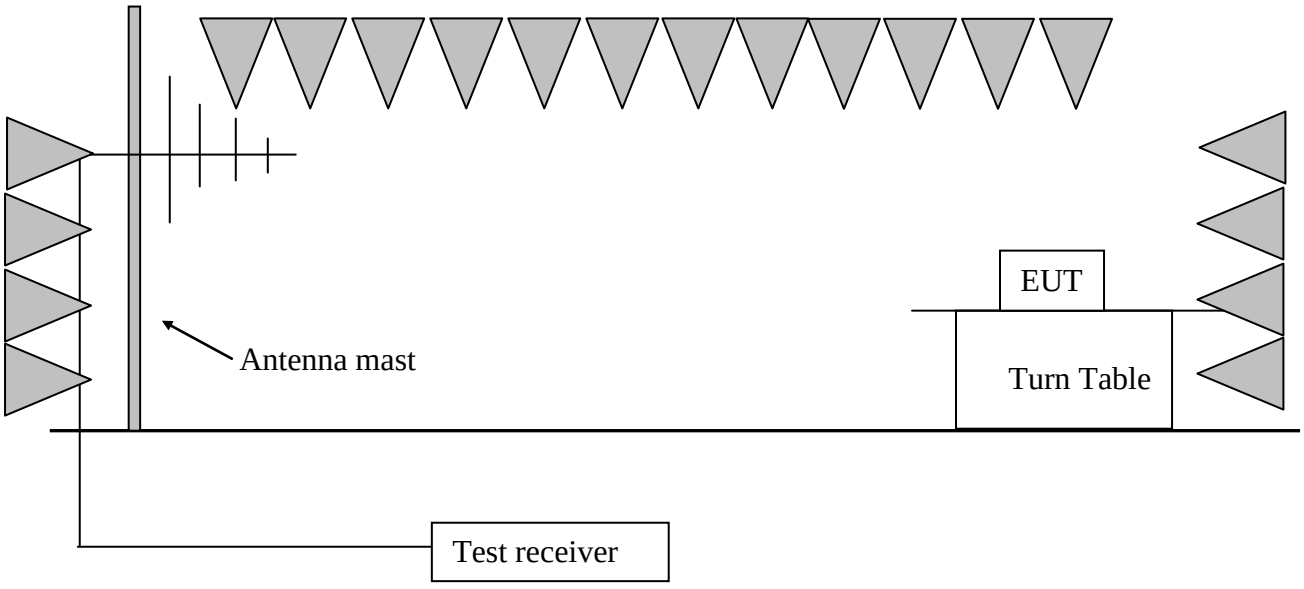
Test result: **Pass**

7.1 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

7.2 Test Configuration



7.3 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.

7.4 Test Protocol

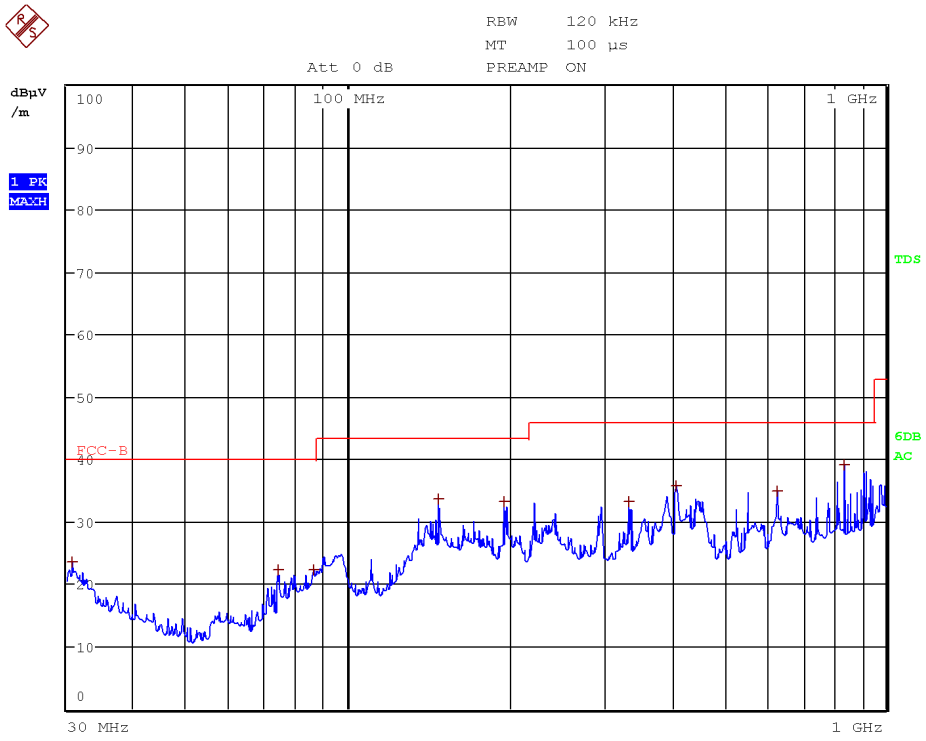
Temperature: 22°C
Relative Humidity: 54%

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

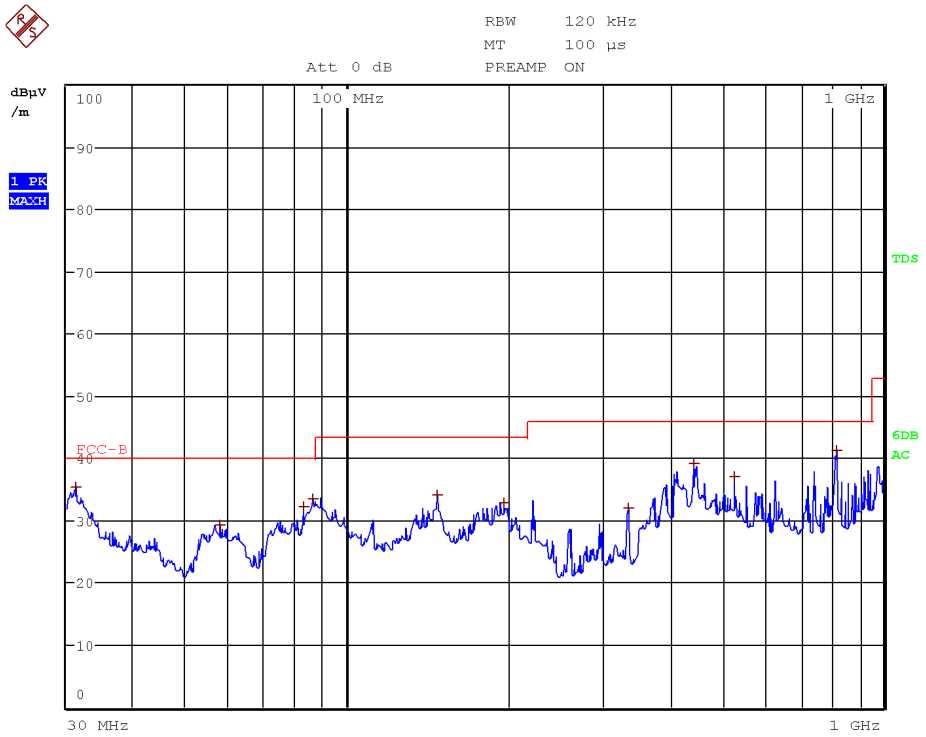
The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

The worst waveform from 30MHz to 1000MHz is listed as below:

Horizontal



Vertical



Test result below 1GHz:

Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
H	147.44	33.60	13.15	43.50	9.90	QP
H	835.56	39.00	24.80	46.00	7.00	QP
V	31.12	35.00	19.94	40.00	5.00	QP
V	86.24	33.20	10.06	40.00	6.80	QP
V	816.00	40.10	24.58	46.00	5.90	QP

Test result above 1GHz:

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

Channel	Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	V	2402.20	102.37	34.34	Fundamental	/	PK
	V	2389.58	51.63	34.29	74.00	22.37	PK
	V	4803.61	48.61	-3.55	74.00	25.39	PK
M	V	2442.20	101.68	34.48	Fundamental	/	PK
	V	4883.77	47.54	-3.35	74.00	26.46	PK
H	V	2480.20	101.44	34.62	Fundamental	/	PK
	V	2483.55	56.56	34.63	74.00	17.46	PK
	V	2483.55	41.51	34.63	54.00	12.49	AV
	V	4963.93	51.95	-3.16	74.00	22.05	PK

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

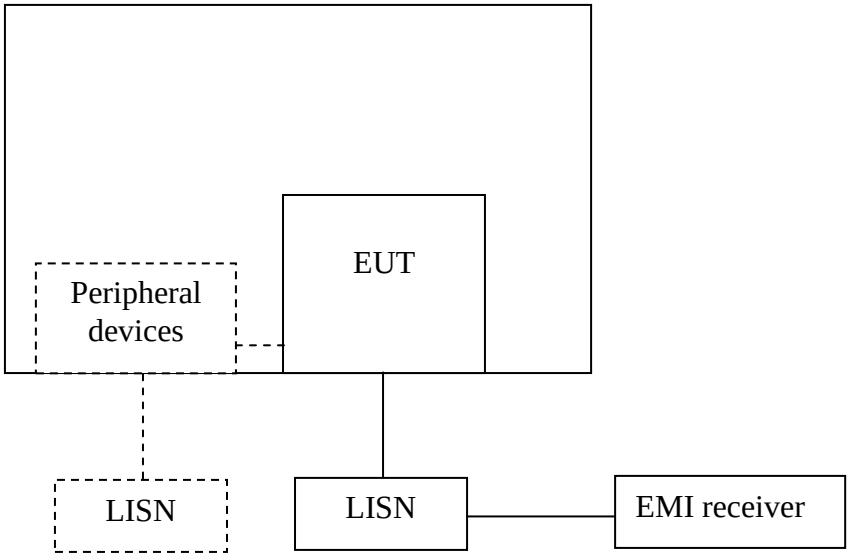
8 Power line conducted emission

Test result: **Pass**

8.1 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.		

8.2 Test configuration



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

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

8.3 Test procedure and test set up

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

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.

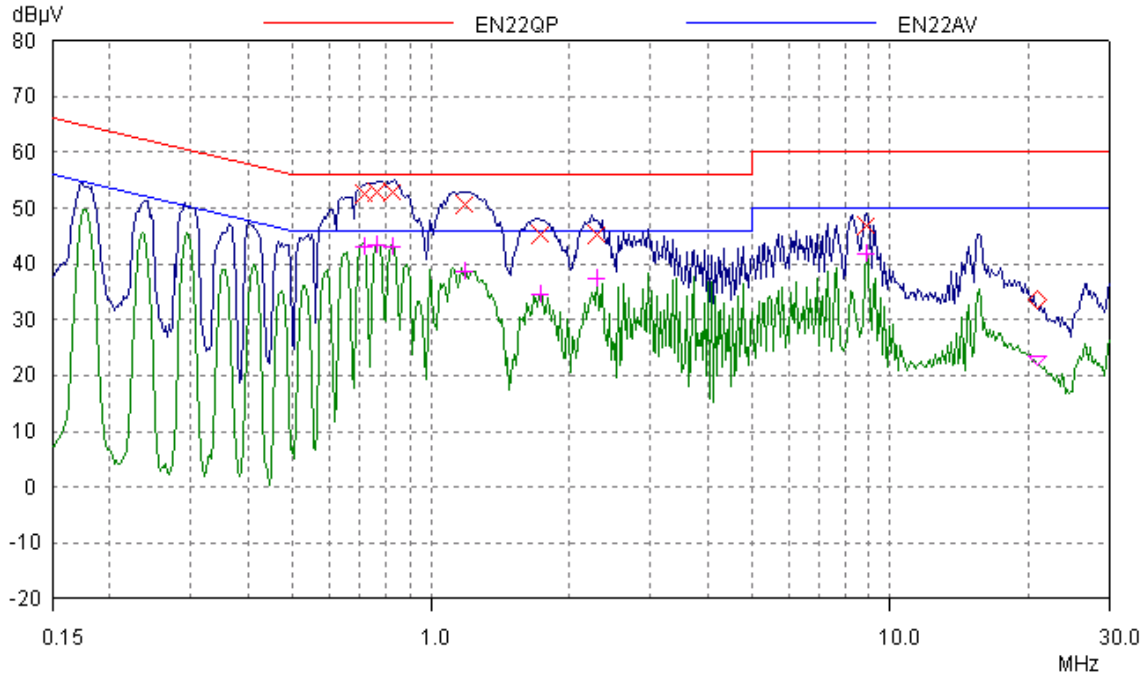
Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on 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.

8.4 Test protocol

Temperature: 22°C
Relative Humidity: 54%

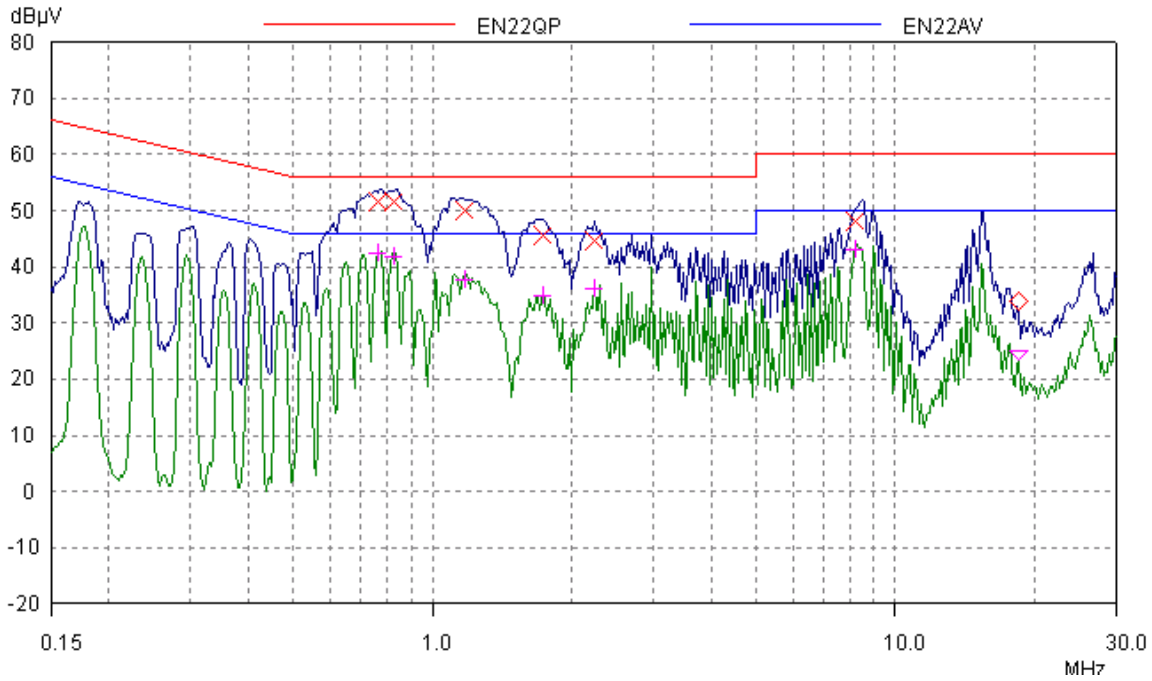
All the three models of product were tested and the worst data was listed in the report.



Test Data:

Frequency (MHz)	Quasi-peak			Average		
	level dB(µV)	Limit dB(µV)	Margin (dB)	level dB(µV)	limit dB(µV)	Margin (dB)
0.712	52.44	56.00	3.56	43.03	46.00	2.97
0.762	52.76	56.00	3.24	43.39	46.00	2.61
0.822	52.71	56.00	3.29	42.96	46.00	3.04
1.177	50.67	56.00	5.33	38.64	46.00	7.36
1.726	45.19	56.00	10.81	34.50	46.00	11.5
2.292	45.18	56.00	10.82	37.26	46.00	8.74
Remark: If the margin higher than 20dB, it would be marked as *.						

N line:



Test Data:

Frequency (MHz)	Quasi-peak			Average		
	level dB(µV)	Limit dB(µV)	Margin (dB)	level dB(µV)	limit dB(µV)	Margin (dB)
0.762	51.64	56.00	4.36	42.35	46.00	3.65
0.818	51.63	56.00	4.37	41.66	46.00	4.34
1.167	50.09	56.00	5.91	37.72	46.00	8.28
1.719	45.53	56.00	10.47	34.75	46.00	11.25
2.229	44.61	56.00	11.39	36.09	46.00	9.91
8.190	48.21	60.00	11.79	42.92	50.00	7.08
Remark: If the margin higher than 20dB, it would be marked as *.						

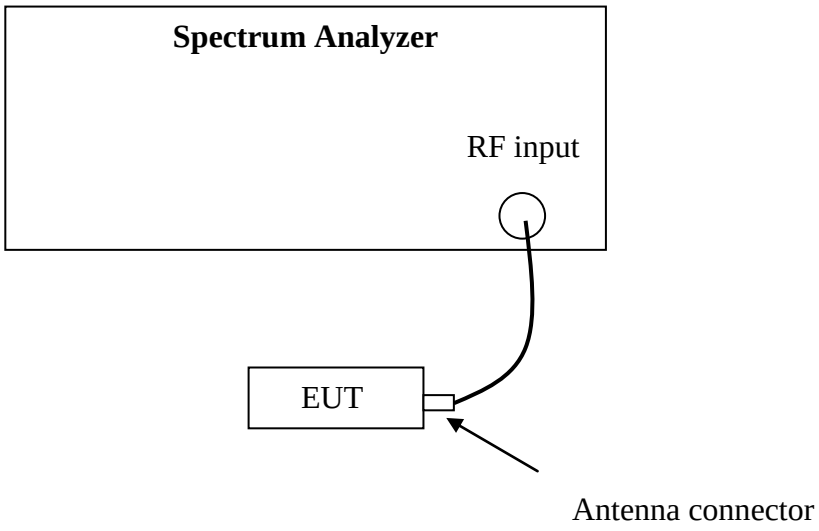
9 Occupied Bandwidth

Test Status: Tested

9.1 Test limit

None

9.2 Test Configuration



9.3 Test procedure and test setup

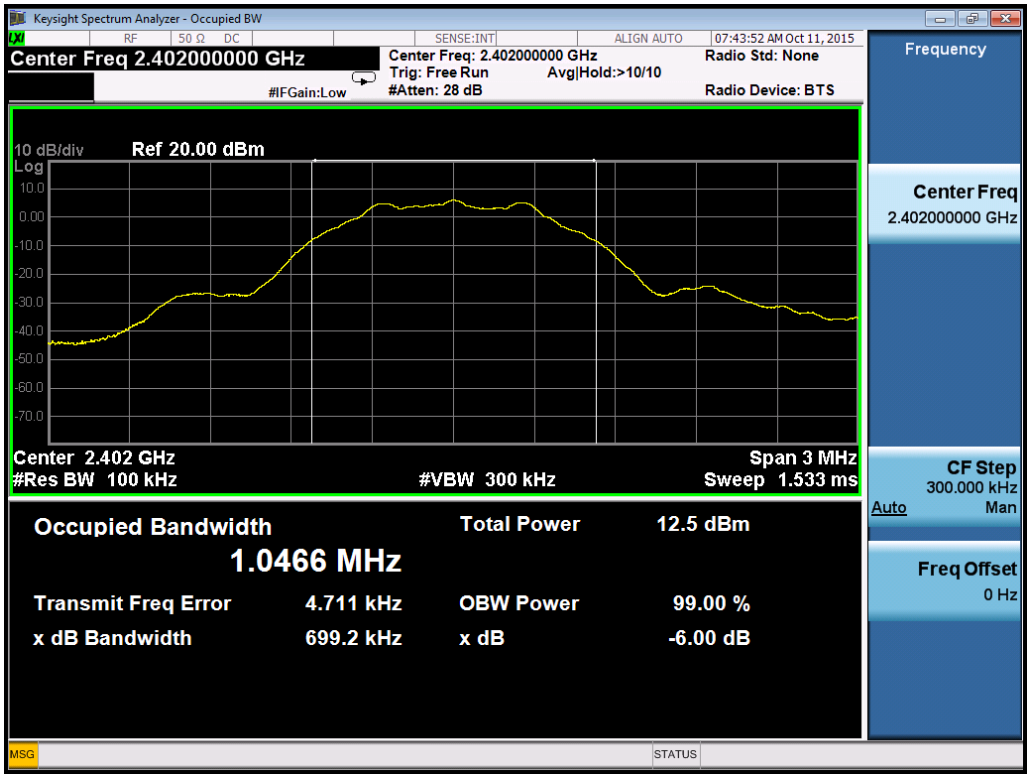
The occupied bandwidth per RSS-Gen Issue 4 Clause 6.6 was measured using the Spectrum Analyzer.

9.4 Test protocol

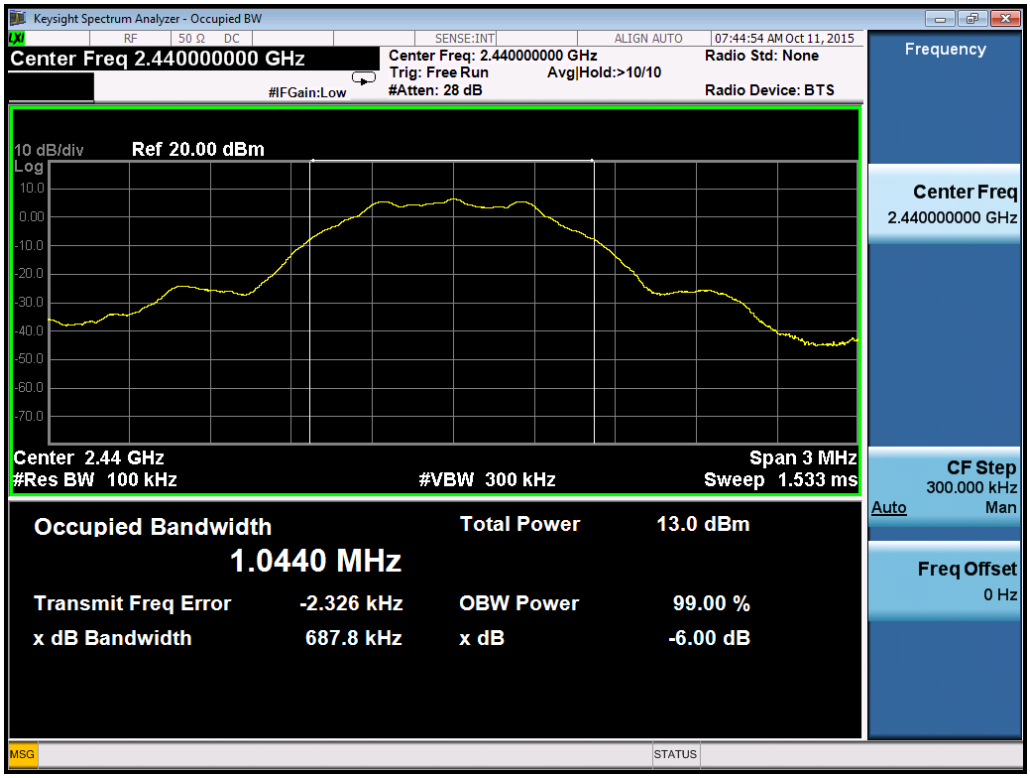
Temperature : 25 °C
Relative Humidity : 55 %

Mode	Mode	99% Bandwidth (MHz)
BLE	L	1.0466
	M	1.0440
	H	1.0447

Channel L



Channel M



Channel H