RF TEST REPORT

Test item	:	Set top Box
Model No.	:	Spectrum200-H
Order No.	:	DTNC1411-04758
Date of receipt	:	2014-11-03
Test duration	:	2014-11-11 ~ 2014-11-19
Date of issue	:	2014-12-05
Use of report	:	FCC Original Grant

Applicant : Humax Co., Ltd.
HUMAX Village, 11-4, Sunae-dong, Bundang-gu Seongnam city, Gyeonggi-do South Korea 463-825

Test laboratory : DT&C Co., Ltd.
42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935

Test specification	:	FCC Part 15 Subpart C 247
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

Tested by:

Engineer
SeokHwan Hong

Reviewed by:

Technical Manager
HongHee Lee

Test Report Version

Test Report No.	Date	Description
DRTFCC1411-1513	Nov. 27, 2014	Initial issue
DRTFCC1411-1513(1)	Dec. 05, 2014	Conducted emission re-test

Table of Contents

1. EUT DESCRIPTION

Product	Set top Box
Model Name	Spectrum200-H
Power Supply	DC 12 V
Frequency Range	2425 ~ 2475 MHz(3 channels)
Modulation Type	ZIGBEE
Antenna Specification	**Antenna Type:** Internal Antenna **Antenna gain** ▪ Antenna 0 Gain: 4.3 dBi(PK) ▪ Antenna 1 Gain: 4.4 dBi(PK) **Antenna configuration** ▪ ZIGBEE : Single Transmitting (ANT 1 or ANT 2)
Adapter Information	**Model :** EADP-40MB A **Input :** 100-240 V ~ 1.2 A , 50-60 Hz **Output :** 12 V , 3 A **S/N :** HFHD49U006L

2. SUMMARY OF TESTS

FCC Part Section(s)	RSS Section(s)	Parameter	Limit	Test Condition	Status Note 1
I. Transmitter Mode (TX)					
15.247(a)	RSS-210 [A8.2]	6 dB Bandwidth	> 500 kHz	Conducted	**C**
15.247(b)	RSS-210 [A8.4]	Transmitter Output Power	< 1Watt		**C**
15.247(d)	RSS-210 [A8.5]	Out of Band Emissions / Band Edge	20dBc in any 100kHz BW		**C**
15.247(e)	RSS-210 [A8.2]	Transmitter Power Spectral Density	< 8dBm / 3kHz		**C**
-	RSS Gen [6.6]	Occupied Bandwidth (99%)	RSS-Gen		**NA**
15.205 15.209	RSS-210 [A8.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	< FCC 15.209 limits	Radiated	**C**Note2
15.207	RSS-Gen [8.8]	AC Conducted Emissions	< FCC 15.207 limits	AC Line Conducted	**C**
15.203	-	Antenna Requirements	FCC 15.203	-	**C**

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

Note 2: This test item was performed in each axis and the worst case data was reported.

3. TEST METHODOLOGY

Generally the tests were performed according to the KDB558074 v03r02. And ANSI C63.10-2009 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing.

3.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 General Test Procedures

Conducted Emissions

According to the requirements in Section 6.2 of ANSI C63.10, the EUT is placed on the turntable, which is 0.8 m above ground plane and the conducted emissions from the EUT are measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and Average detector.

Radiated Emissions

The EUT is placed on a turntable, which is 0.8 m above ground plane. The turntable shall rotate360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the highest emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axis according to the requirements in Section6.3 of ANSI C63.10

3.4 Description of Test Modes

The EUT has been tested with the operating condition for maximizing the emission characteristics. A test program is used to control the EUT for staying in transmitting.

Test Mode	Channel	Frequency [MHz]
ZIGBEE	Lowest	2425
	Middle	2450
	Highest	2475

4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.

5. FACILITIES AND ACCREDITATIONS

5.1 Facilities

The open area test site(OATS) or semi anechoic chamber and conducted measurement facility used to collect the radiated and conducted test data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935. The site is constructed in conformance with the requirements.

- Semi anechoic chamber registration Number: 165783

5.2 Equipment

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, loop, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and peak, quasi-peak detectors are used to perform radiated measurements.
Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.
Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are al soused for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

6. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

This device uses a pattern antenna.

Therefore this E.U.T Complies with the requirement of §15.203

7. TEST RESULT

7.1 6dB Bandwidth

▣ Test Requirements and limit, §15.247(a) & RSS-210[A8.2]

The minimum 6 dB band-width shall be at least 500 kHz.

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure

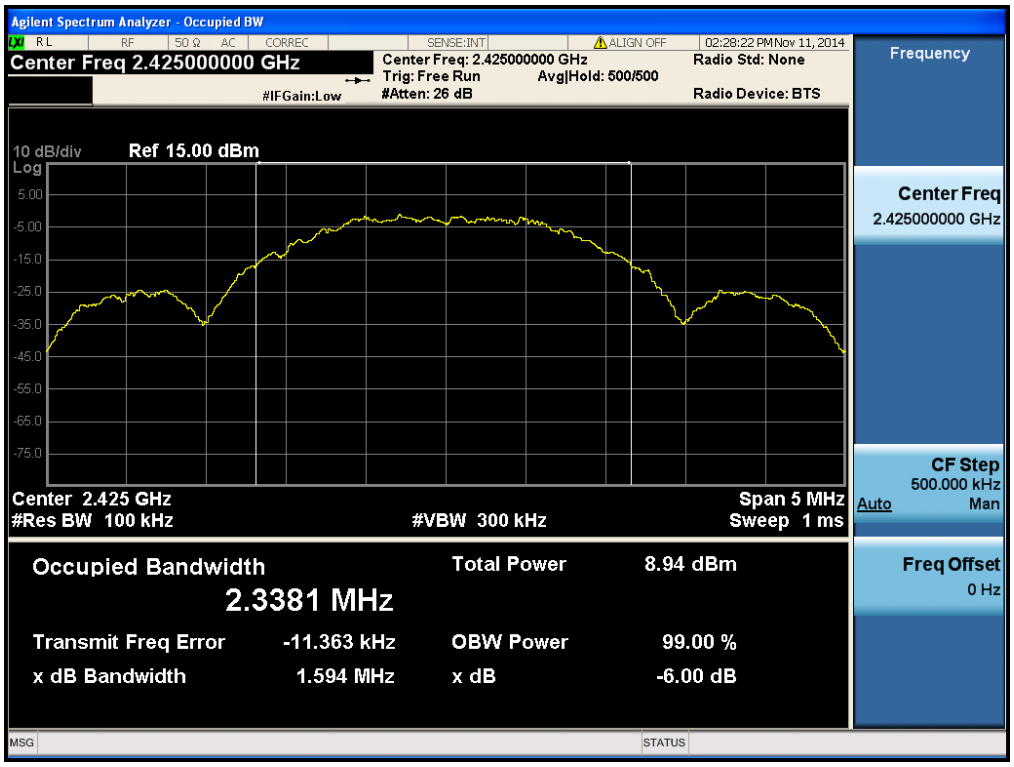
The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 × RBW, peak detector with maximum hold) is implemented by the instrumentation function.
When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

▣ Test Results: *Comply*

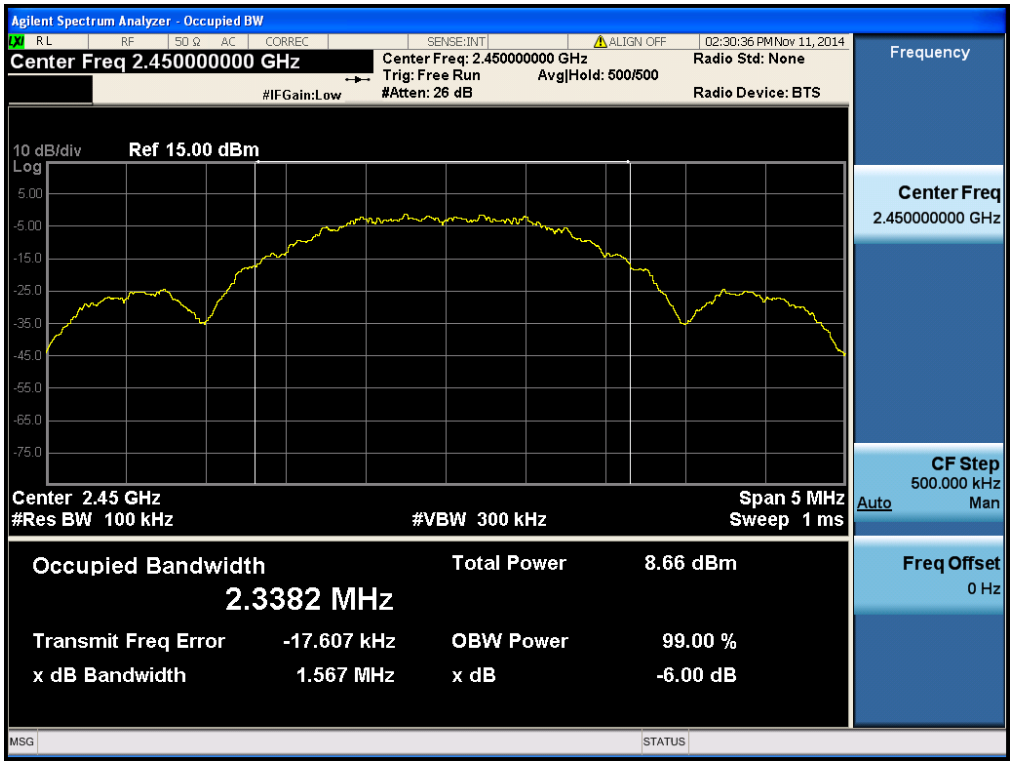
Test Mode	Channel	Results [MHz]	
		ANT 0	ANT 1
ZIGBEE	Lowest	1.594	1.593
	Middle	1.567	**1.615**
	Highest	**1.599**	1.602

▣ Result Plots

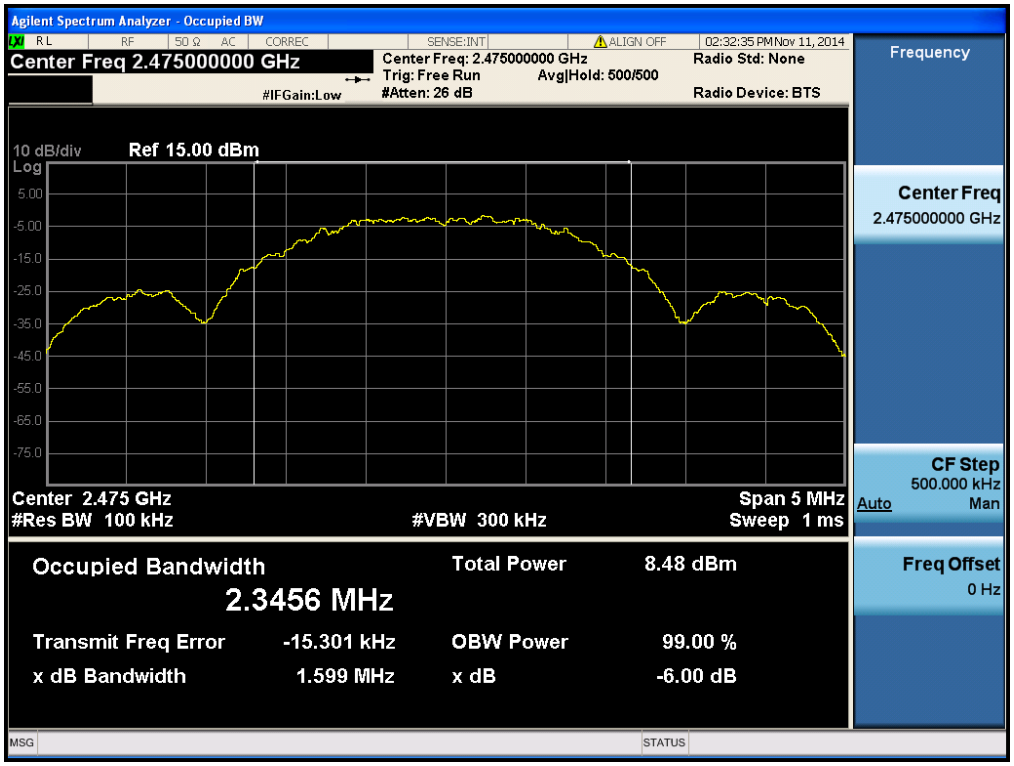
6 dB Bandwidth — Lowest channel & ANT 0



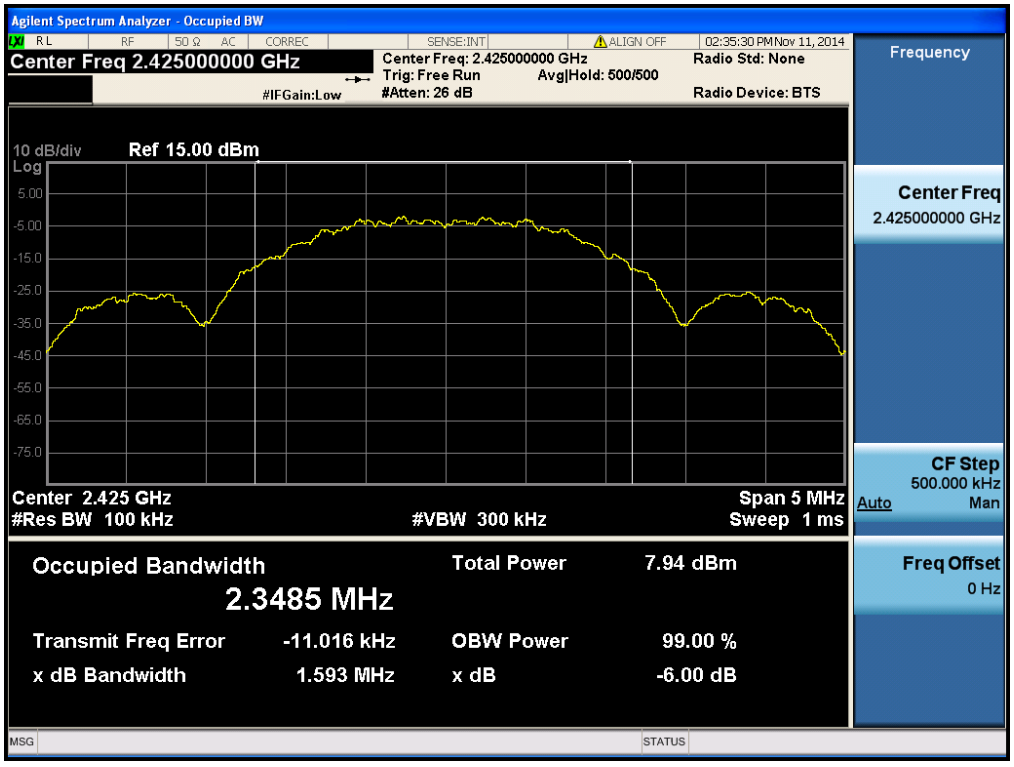
6 dB Bandwidth — Middle channel & ANT 0



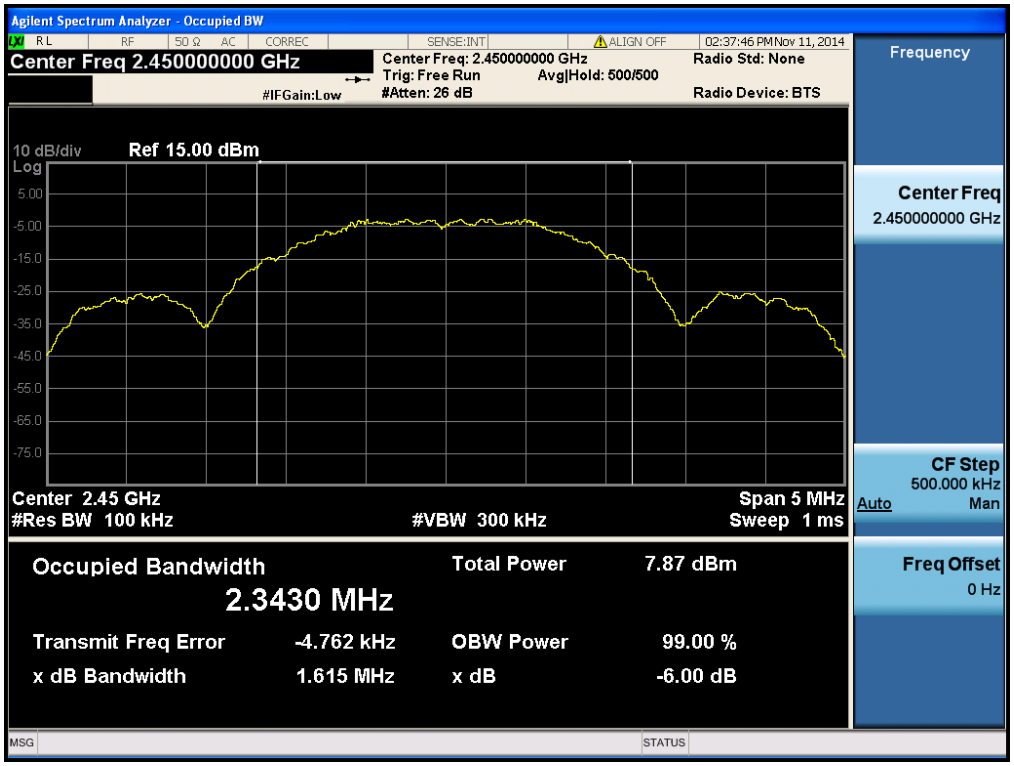
6 dB Bandwidth Highest channel & ANT 0



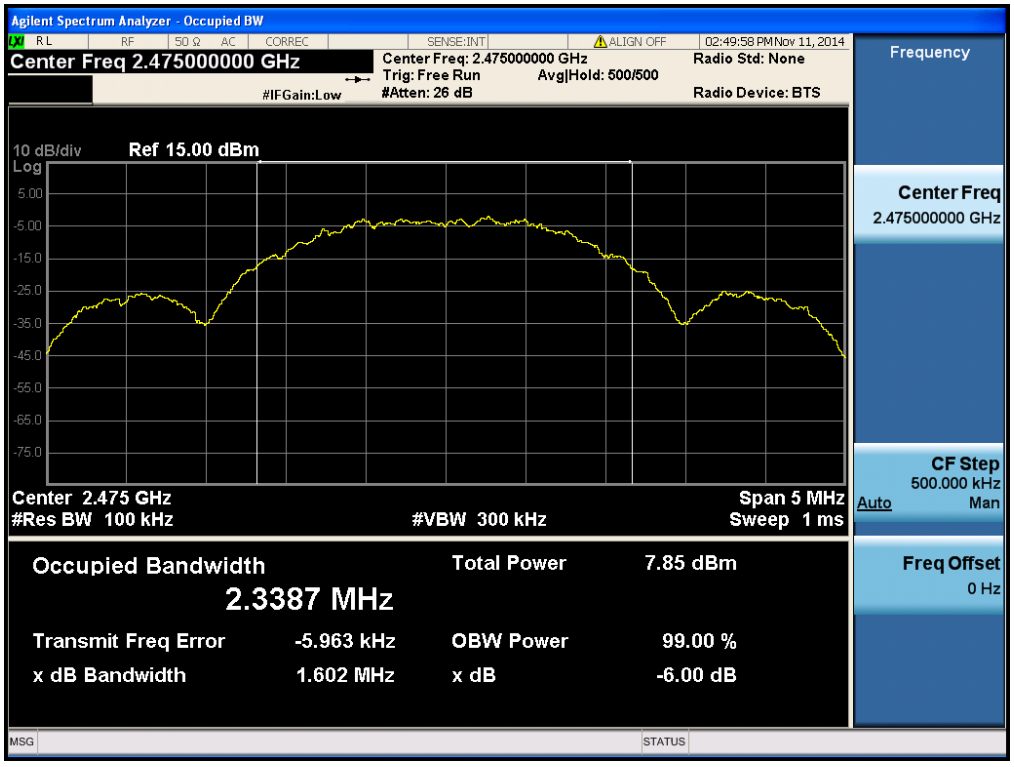
6 dB Bandwidth Lowest channel & ANT 1



6 dB Bandwidth Middle channel & ANT 1



6 dB Bandwidth Highest channel & ANT 1



7.2 Maximum Peak Conducted Output Power

▣ Test Requirements and limit, §15.247(b) & RSS-210[A8.4]

The maximum peak conducted power shall not exceed 1 Watt.

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure

Maximum Peak Conducted Output Power is measured using the following procedure(RBW ≥ DTS bandwidth).

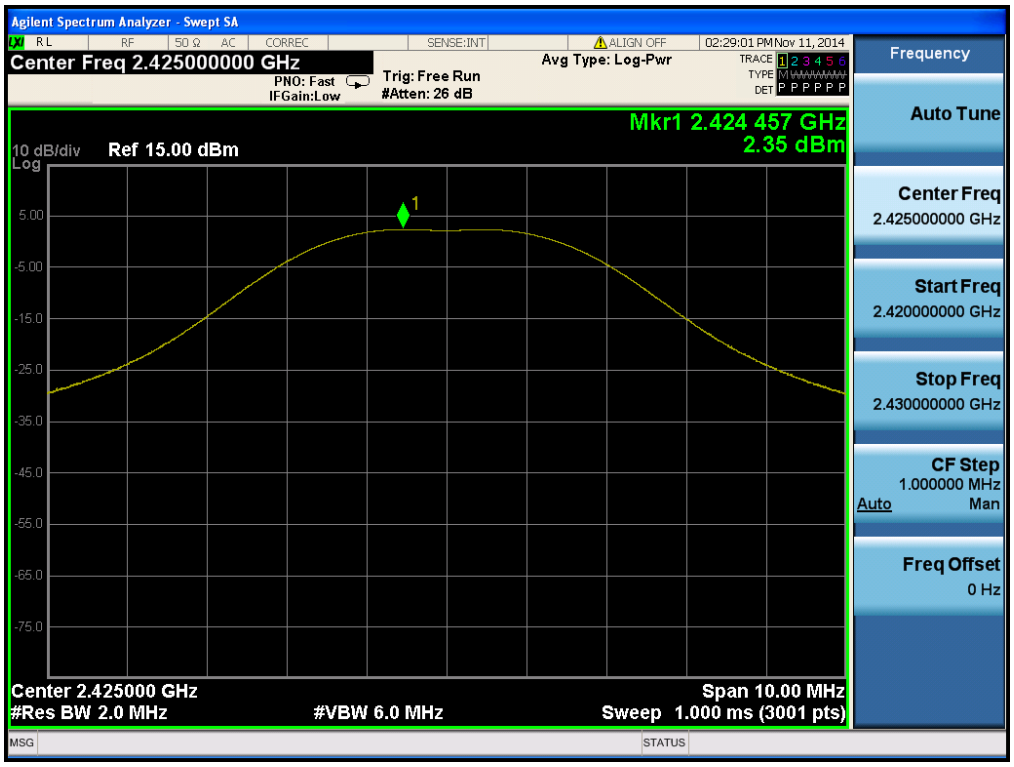
1. Set the RBW ≥ DTS bandwidth.
2. Set VBW ≥ 3 x RBW.
3. Set span ≥ 3 x RBW.
4. Sweep time = auto couple
5. Detector = peak
6. Trace mode = max hold
7. Allow trace to fully stabilize
8. Use peak marker function to determine the peak amplitude level.

▣ Test Results: *Comply*

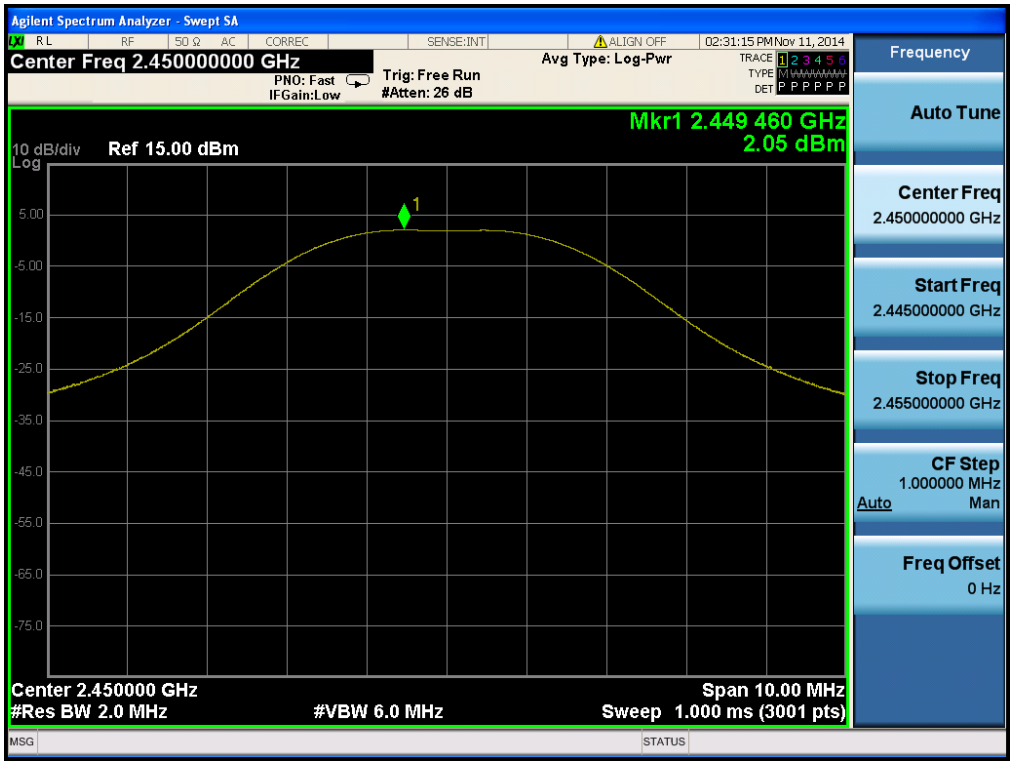
Test Mode	Channel	Results [dBm]	
		ANT 0	ANT 1
ZIGBEE	Lowest	**2.35**	1.25
	Middle	2.05	**1.27**
	Highest	1.86	1.26

▣ Result Plots

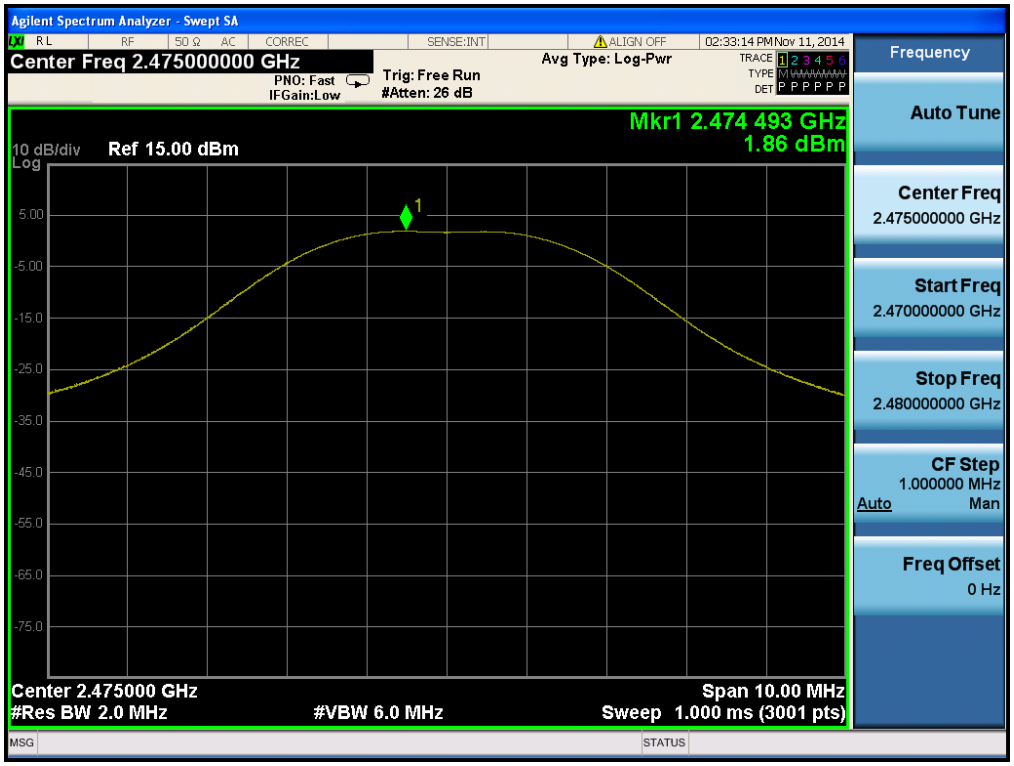
Maximum Peak Conducted Output Power Lowest channel & ANT0



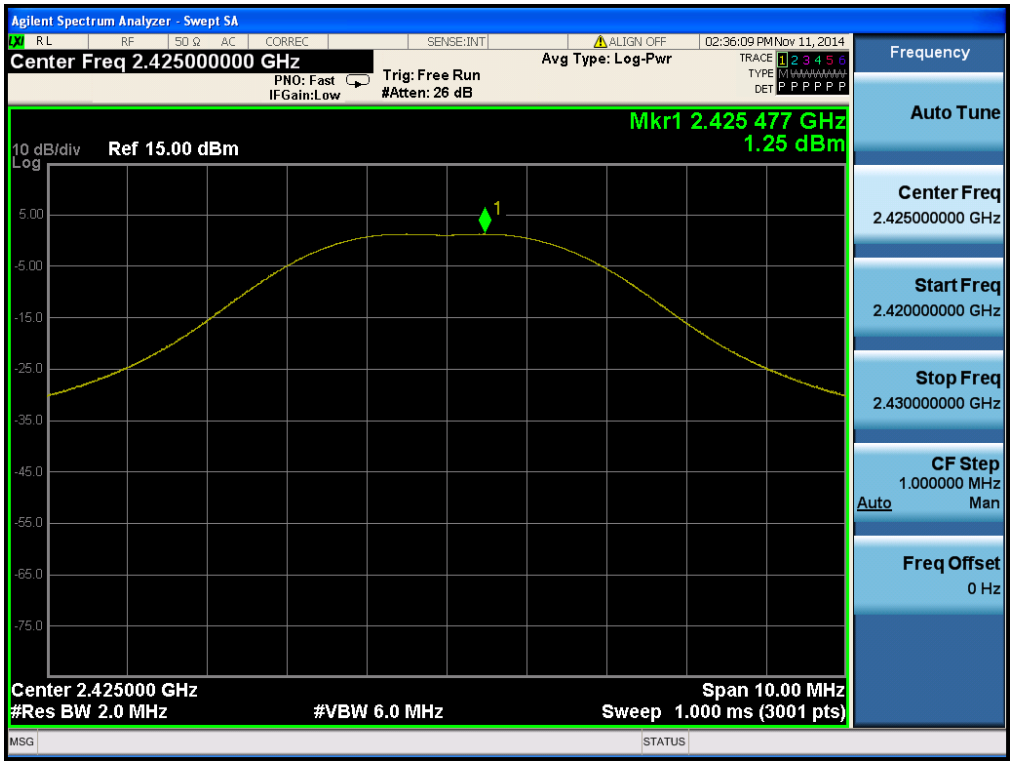
Maximum Peak Conducted Output Power Middle channel & ANT0



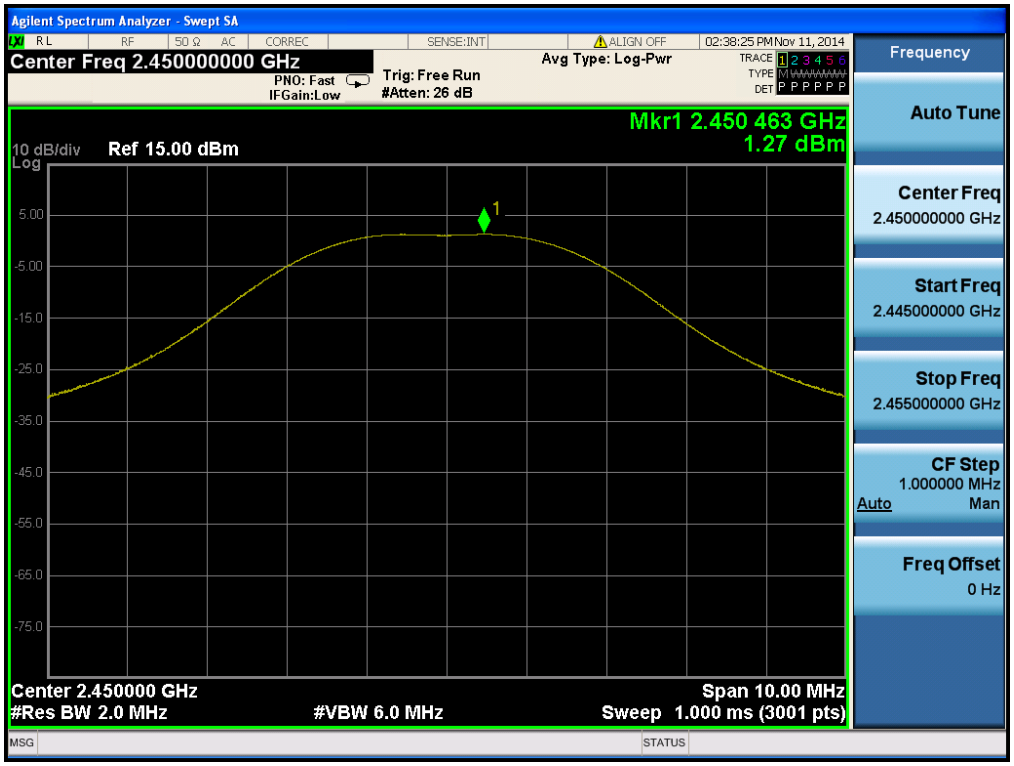
Maximum Peak Conducted Output Power Highest channel & ANT0



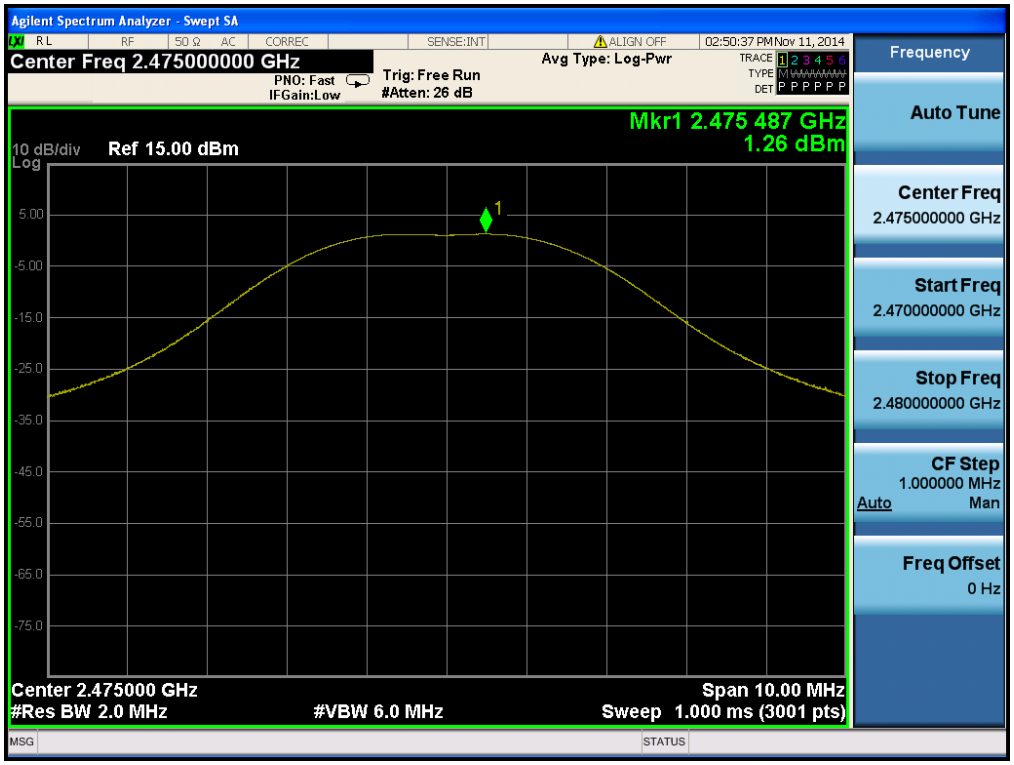
Maximum Peak Conducted Output Power Lowest channel & ANT1



Maximum Peak Conducted Output Power Middle channel & ANT1



Maximum Peak Conducted Output Power Highest channel & ANT1



7.3 Maximum Power Spectral Density.

▣ Test requirements and limit, §15.247(e) & RSS-210[A8.2]

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

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure

The power spectral density is measured using the following procedure(PKPSD method).

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

▣ Test Results: *Comply*

Test Mode	Channel	Results [dBm]	
		ANT 0	ANT 1
ZIGBEE	Lowest	-12.98	**-12.77**
	Middle	**-12.16**	-13.86
	Highest	-12.93	-13.75

▣ Result Plots

Maximum Power Spectral Density Lowest channel & ANT0

Maximum Power Spectral Density Middle channel & ANT0

Maximum Power Spectral Density Highest channel & ANT0

Maximum Power Spectral Density Lowest channel & ANT1

Maximum Power Spectral Density Middle channel & ANT1

Maximum Power Spectral Density Highest channel & ANT1

7.4 Out of Band Emissions in non-restricted frequency band

▣ Test requirements and limit, §15.247(d) & RSS-210[A8.5]

If the maximum peak conducted output power procedure was used to demonstrate compliance as described in 9.1, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc).

If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).

In either case, attenuation to levels below the 15.209 general radiated emissions limits is not required.

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure

The transmitter output is connected to a spectrum analyzer.

- **Measurement Procedure 1 – Reference level measurement**
  1. Set instrument center frequency to DTS channel center frequency.
  2. Set the span to ≥ 1.5 times the DTS bandwidth.
  3. Set the RBW = 100 kHz.
  4. Set the VBW ≥ 3 x RBW.
  5. Detector = peak.
  6. Sweep time = auto couple.
  7. Trace mode = max hold.
  8. Allow trace to fully stabilize.
  9. Use the peak marker function to determine the maximum PSD level

- **Measurement Procedure 2 – Emissions level measurement**
  1. Set the center frequency and span to encompass frequency range to be measured.
  2. Set the RBW = 100 kHz (See below note for actual setting)
  3. Set the VBW ≥ 3 x RBW (See below note for actual setting)
  4. Detector = peak.
  5. Sweep time = auto couple.
  6. Trace mode = max hold.
  7. Allow the trace to stabilize.
  8. Use the peak marker function to determine the maximum amplitude level.

  Note: This test item was tested with below settings.
  - RBW= 100kHz, VBW= 300kHz for frequency range: 9 kHz ~ 30 MHz
  - RBW= 1MHz, VBW= 3MHz for frequency range: 30 MHz ~ 10 GHz and 10 GHz~25 GHz

  If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 kHz, VBW = 300 kHz, SPAN = 100 MHz and BINS = 2001 to get accurate emission level within 100 kHz BW.

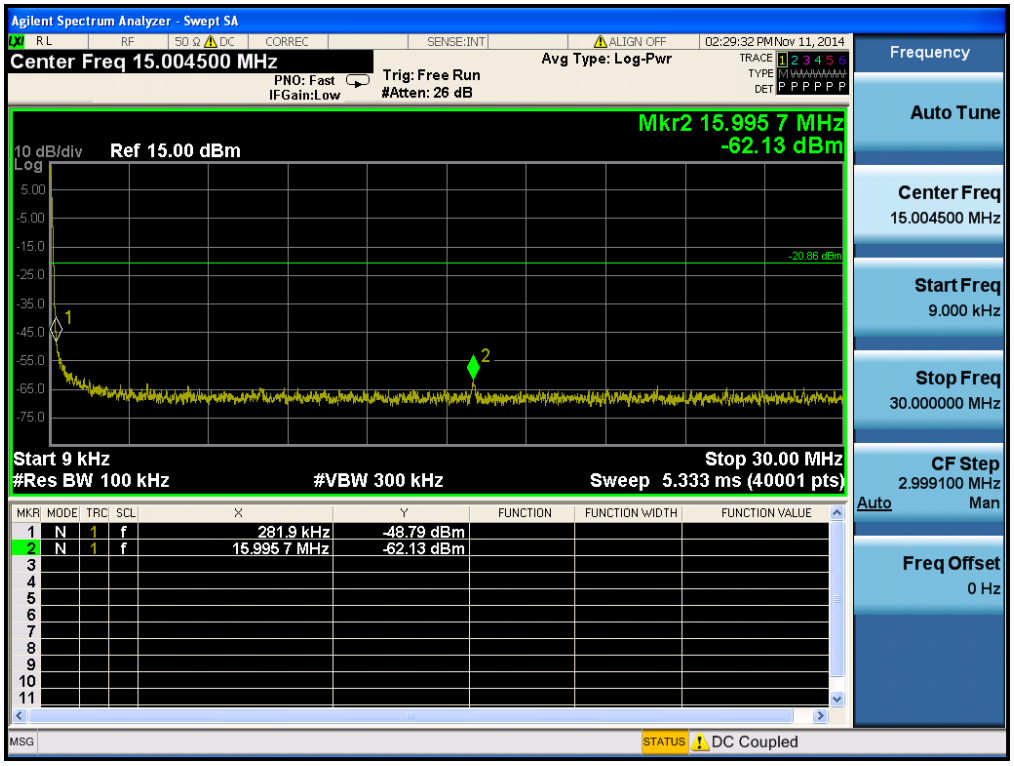
▣ Test Results: ***Comply***

▣ Test Plots ANT 0

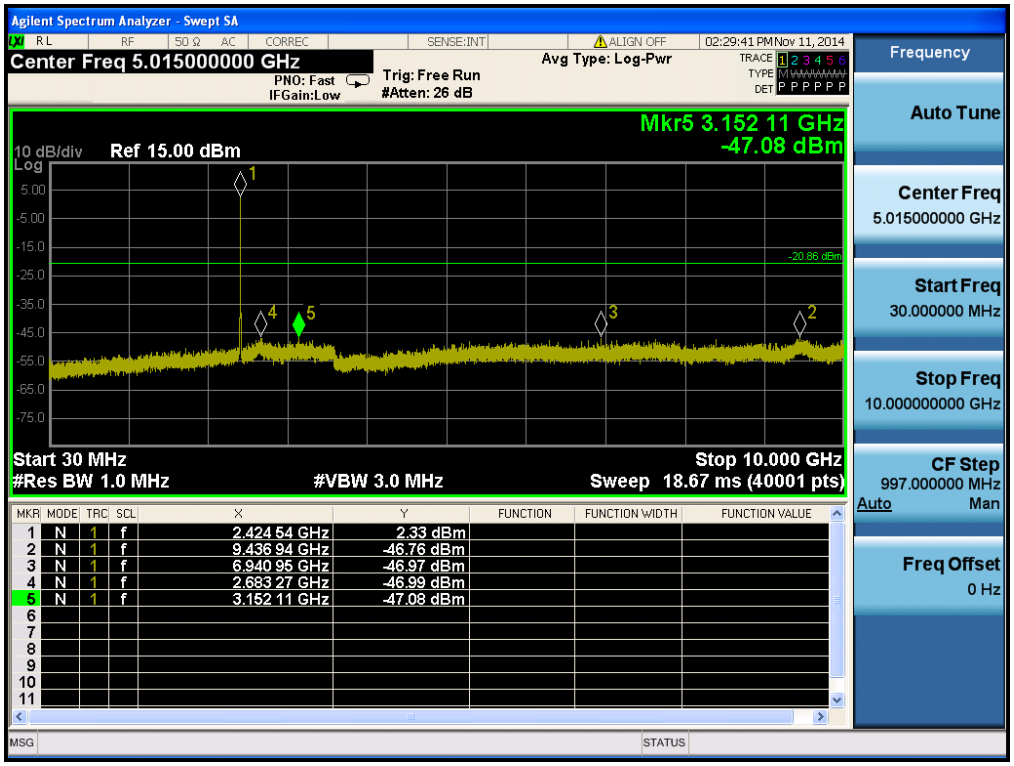
Lowest channel

Reference level measurement

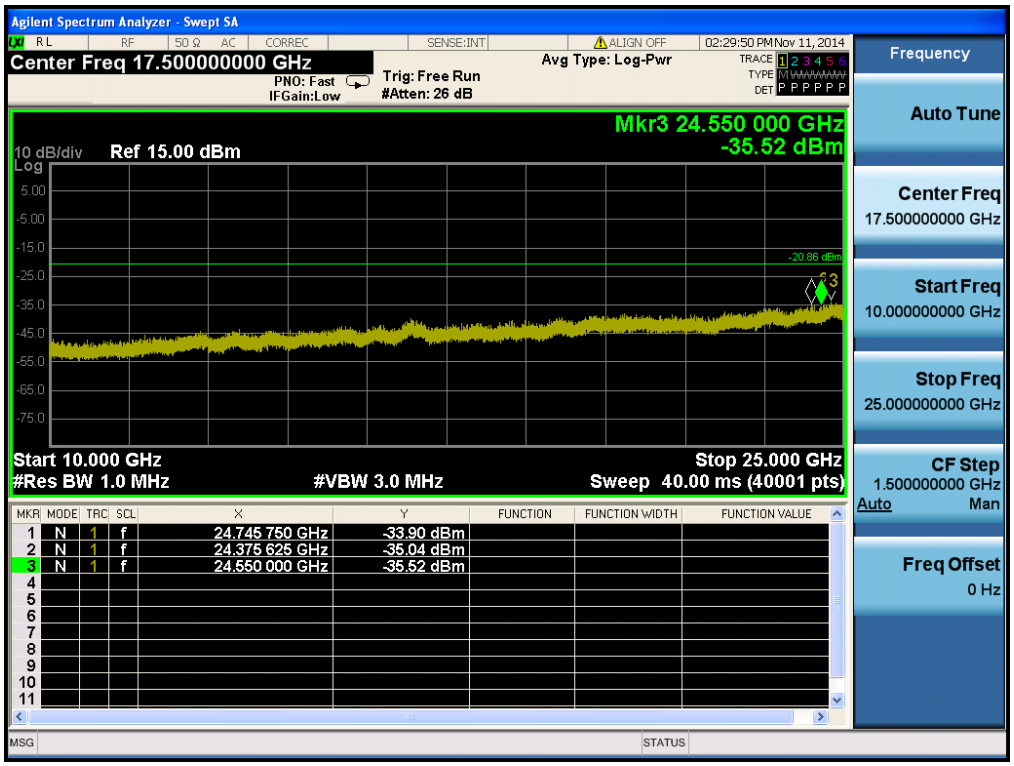
Emissions level measurement 1



Emissions level measurement 2

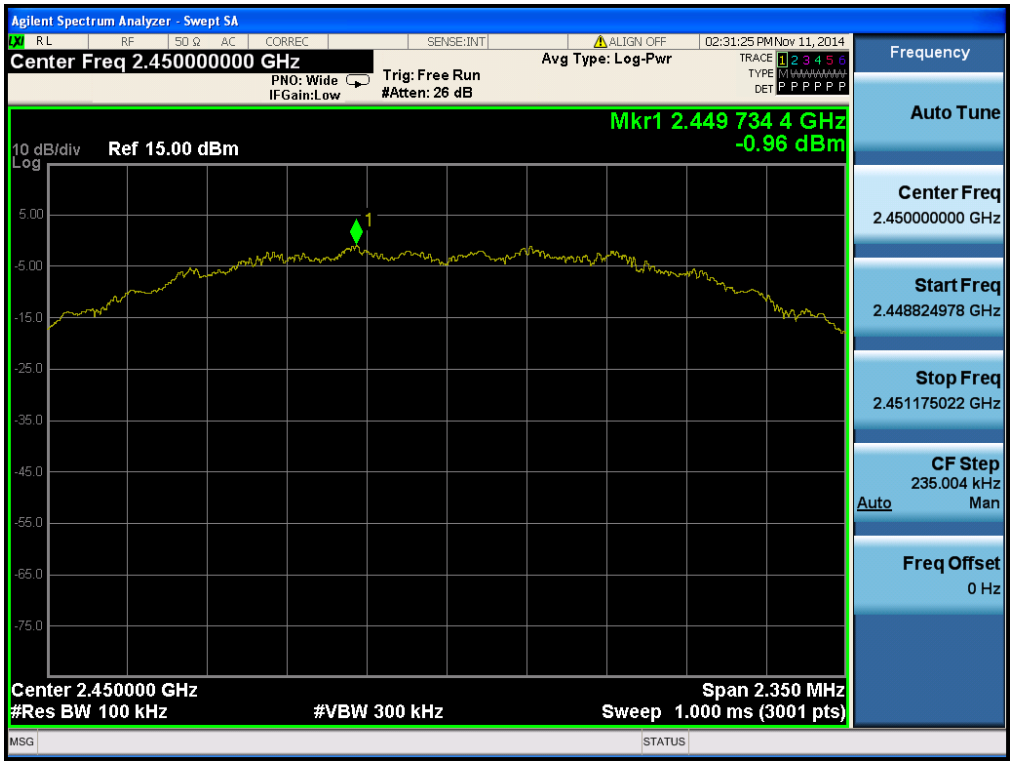


Emissions level measurement 3

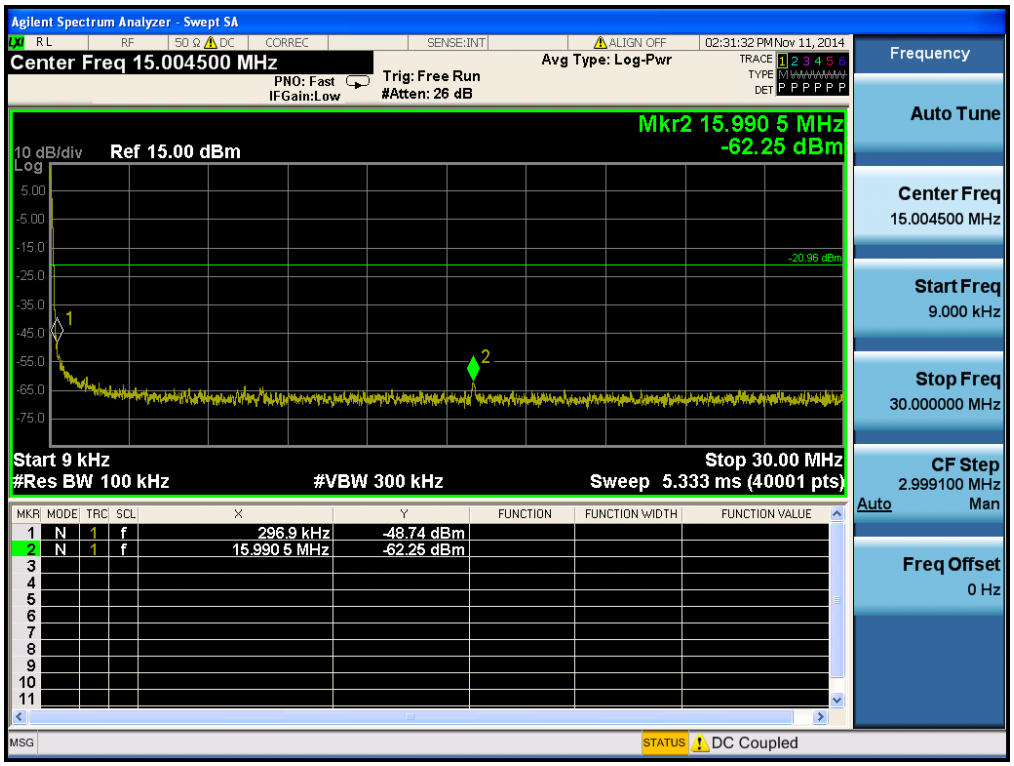


Middle channel

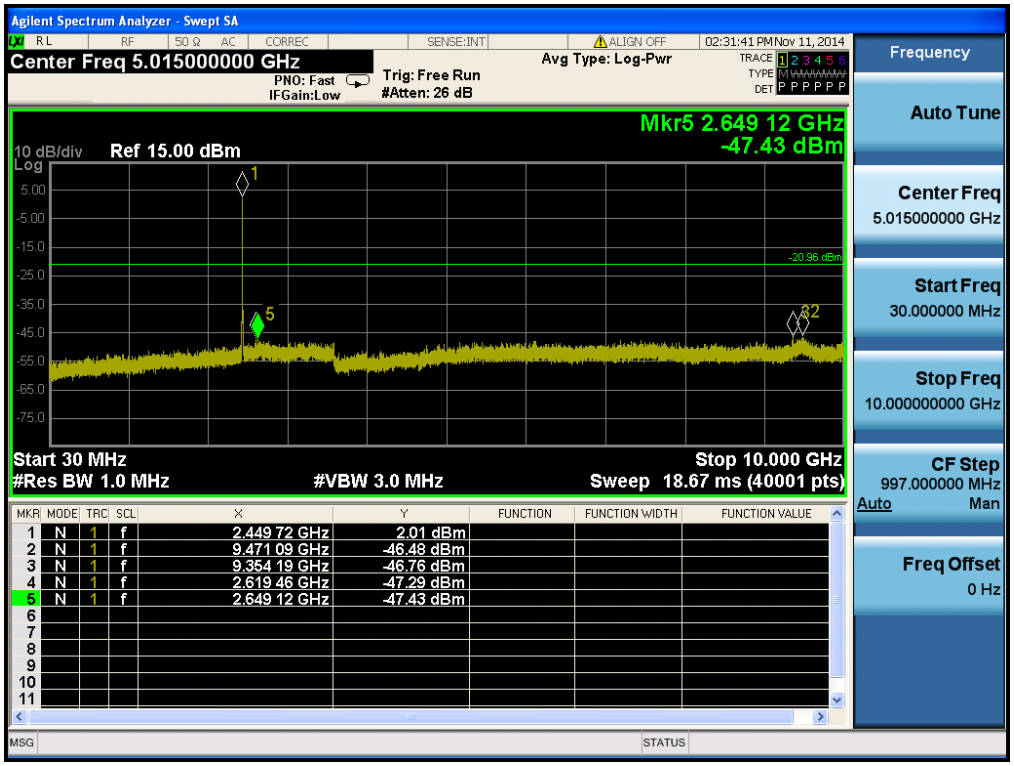
Reference level measurement



Emissions level measurement 1



Emissions level measurement 2



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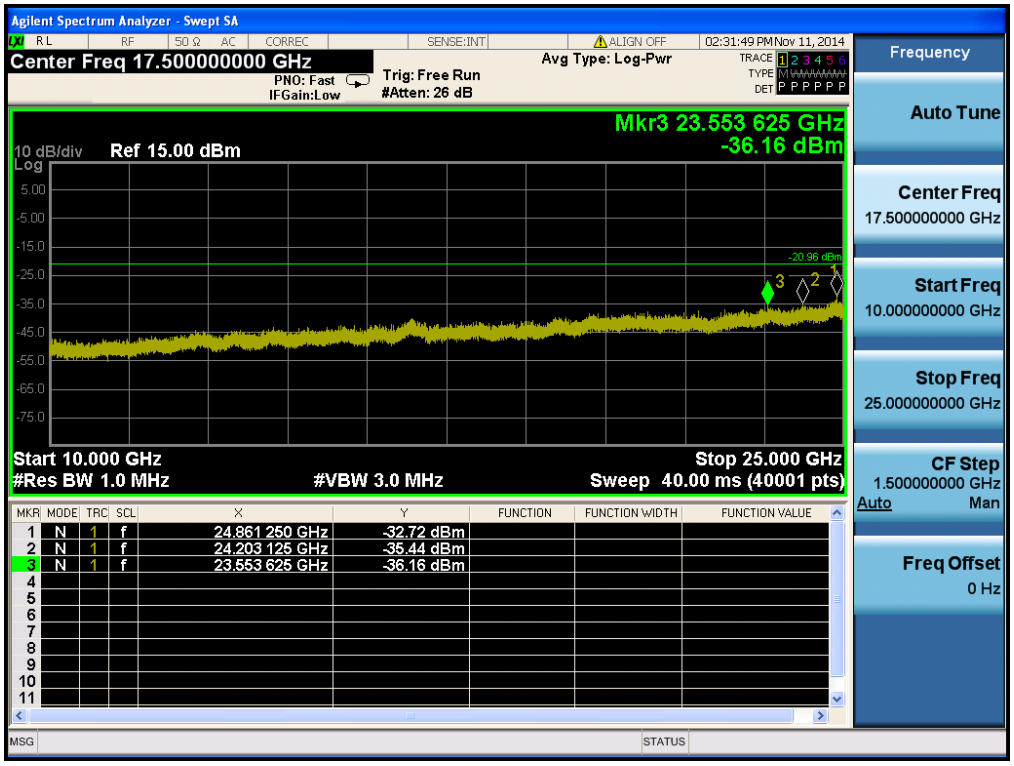
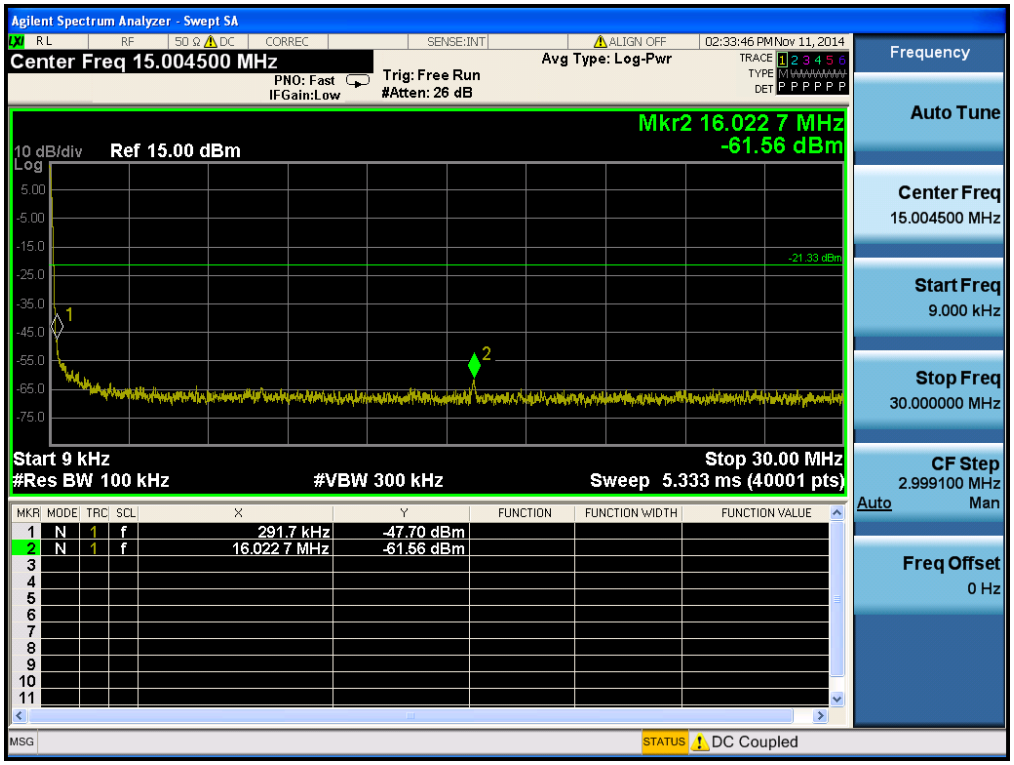


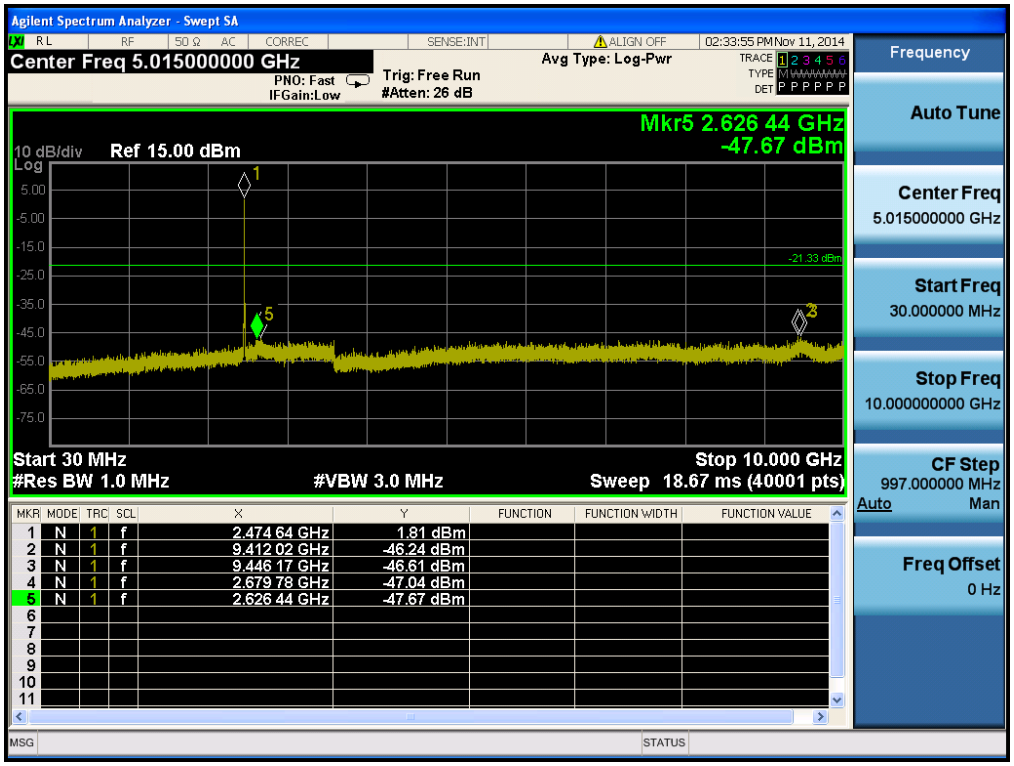
Highest channel

Reference level measurement

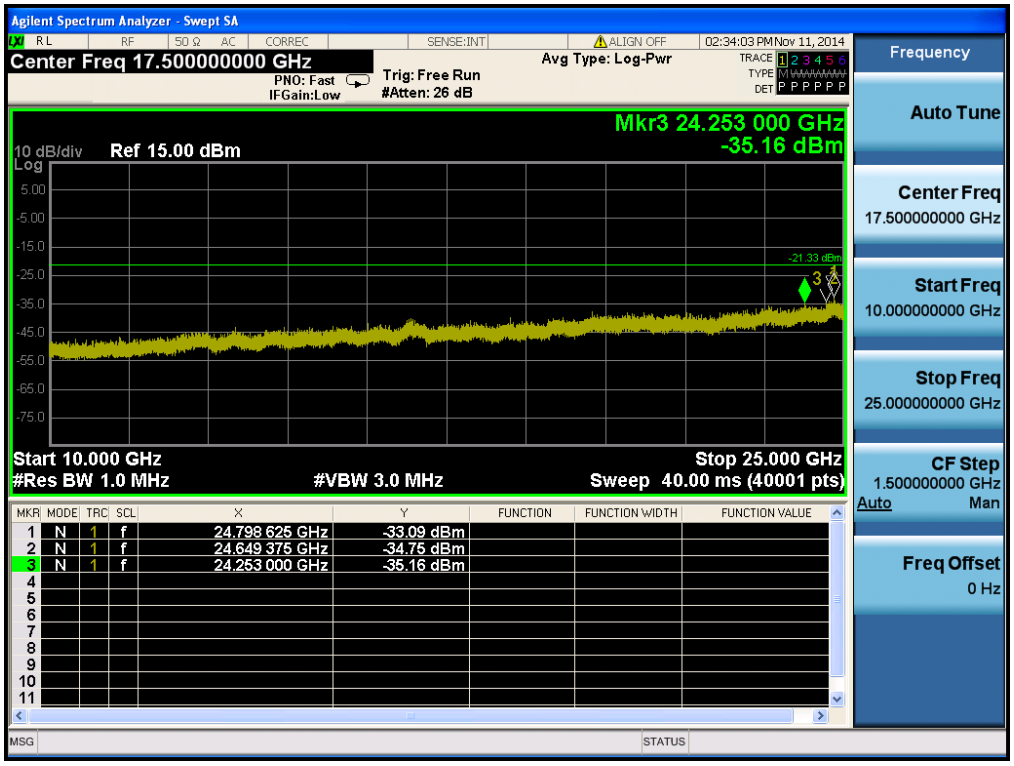
Emissions level measurement 1



Emissions level measurement 2



Emissions level measurement 3

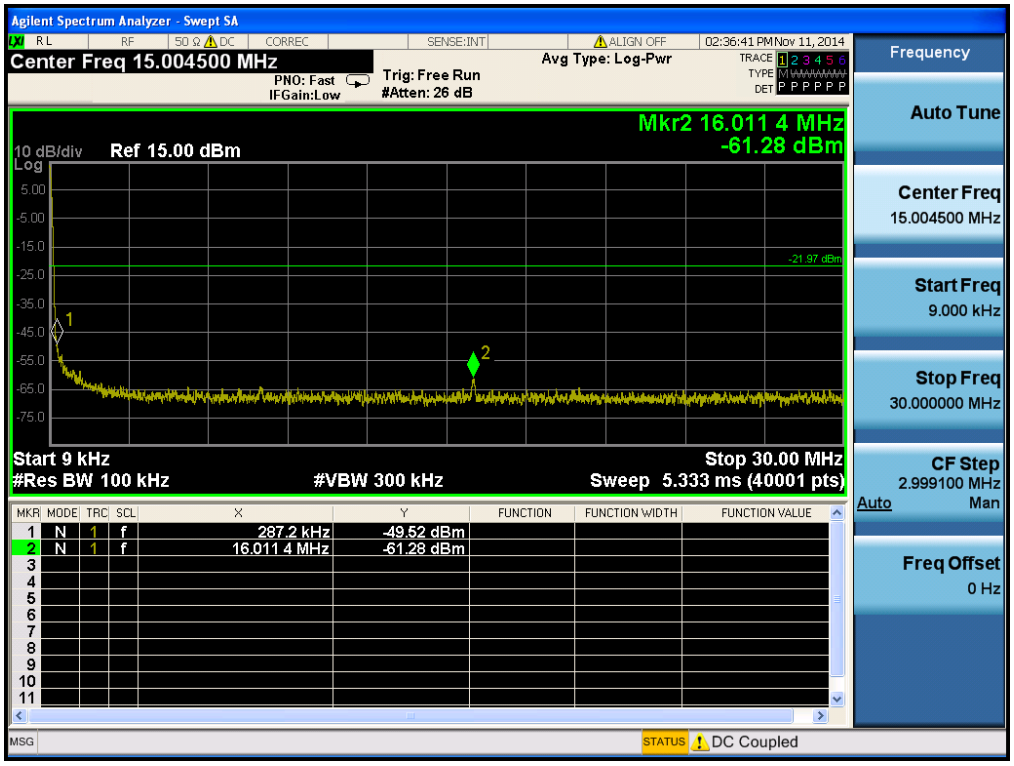


▣ Test Plots ANT 1

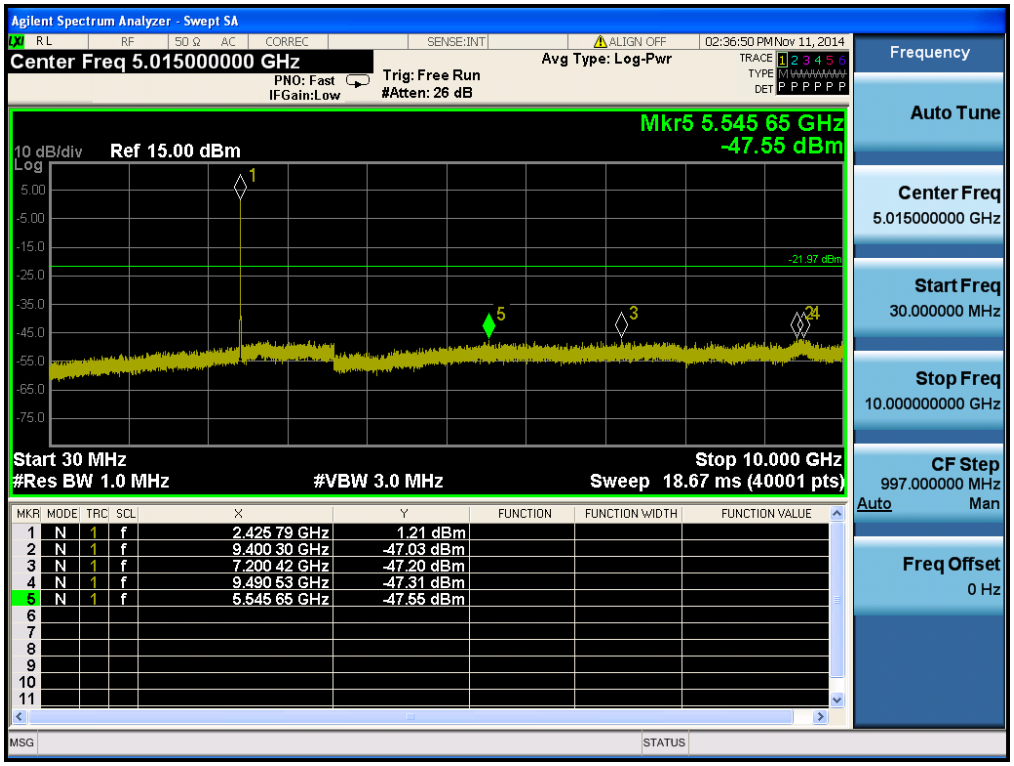
Lowest channel

Reference level measurement

Emissions level measurement 1



Emissions level measurement 2



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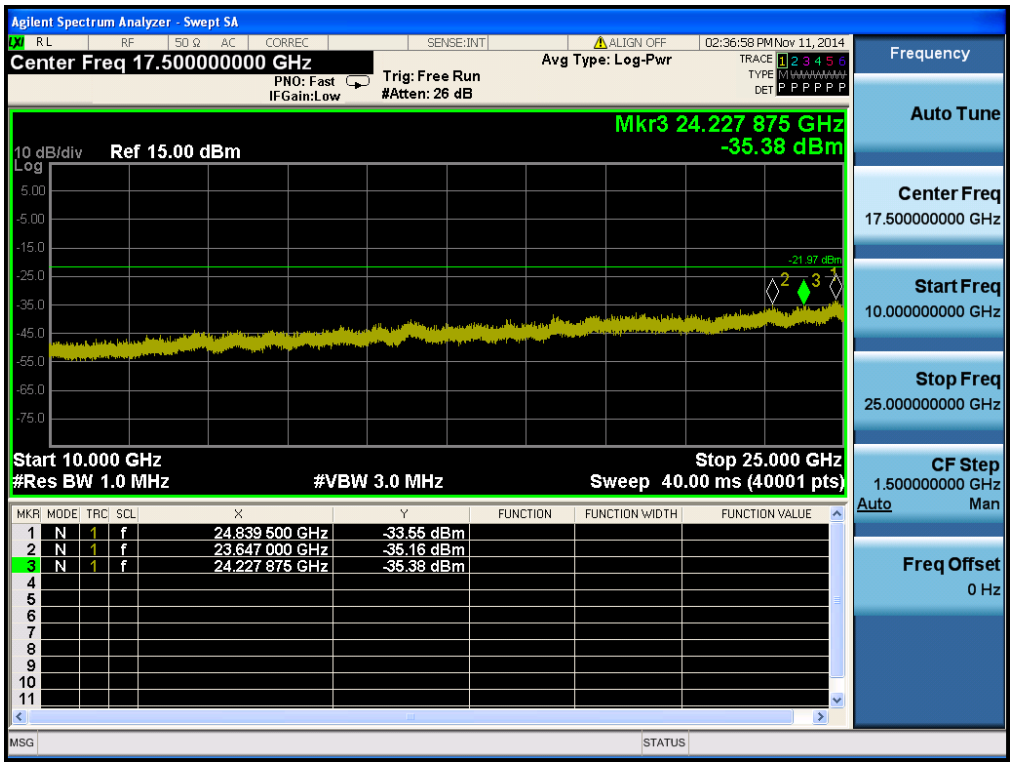
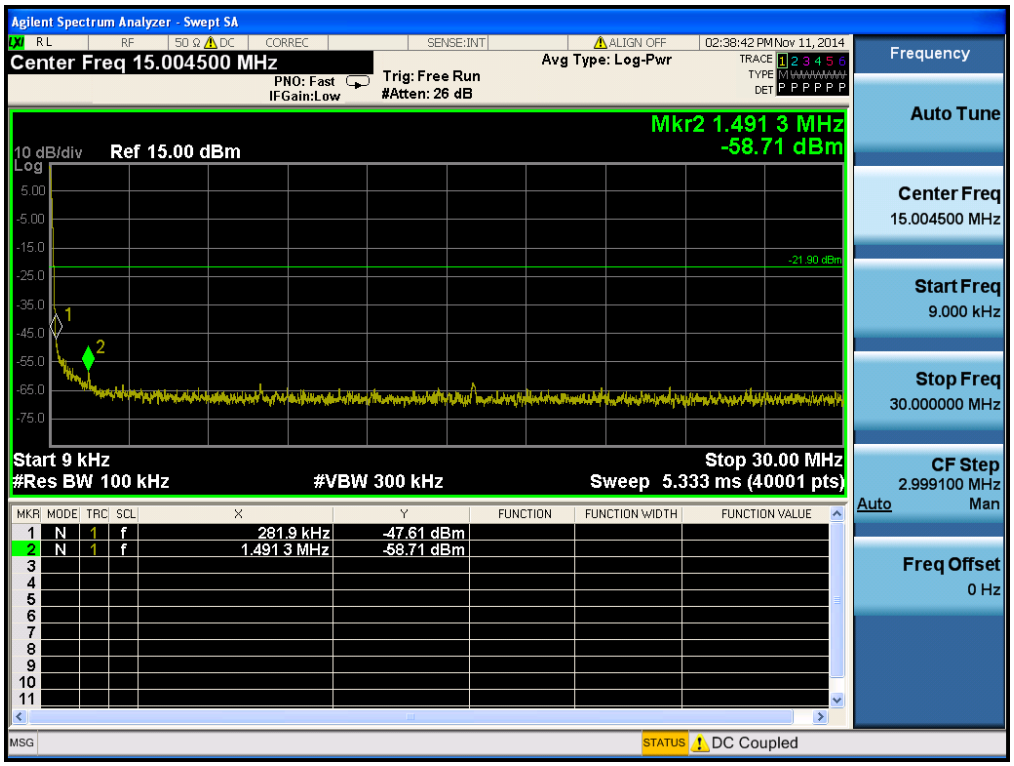


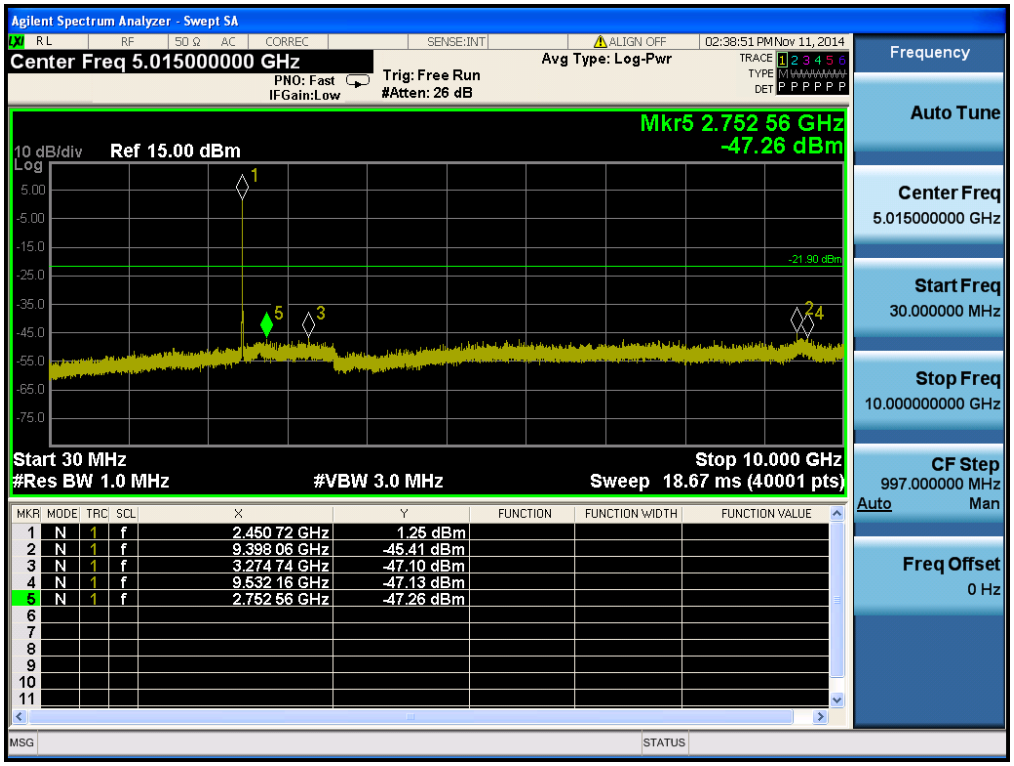
Middle channel

Reference level measurement

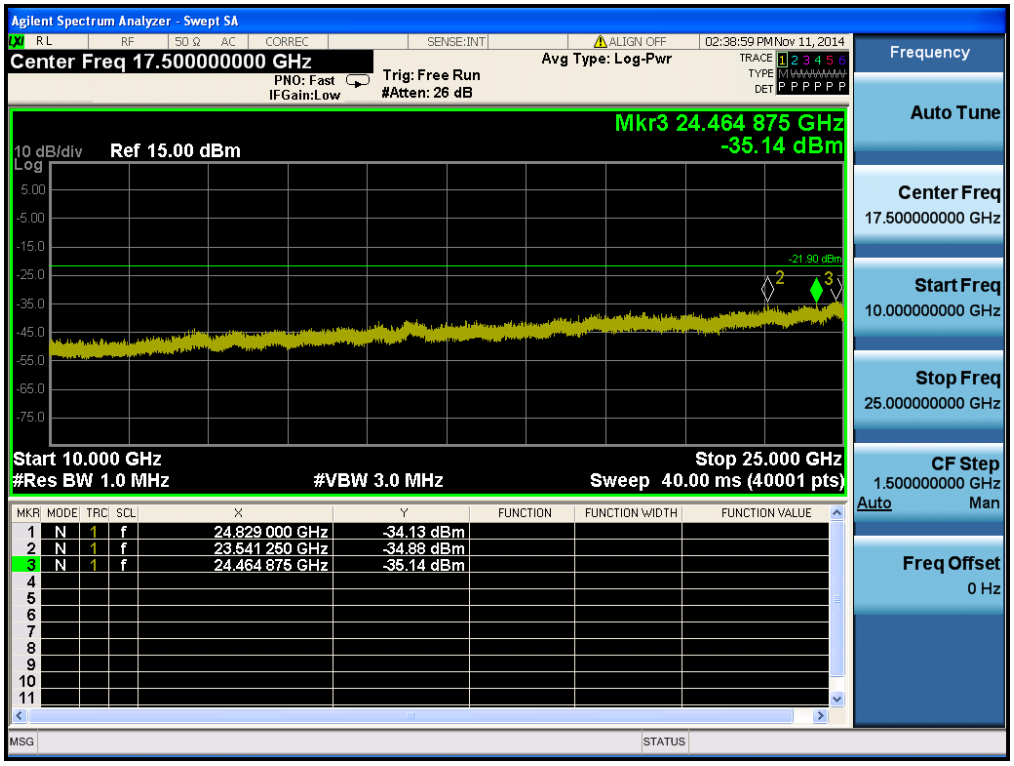
Emissions level measurement 1



Emissions level measurement 2

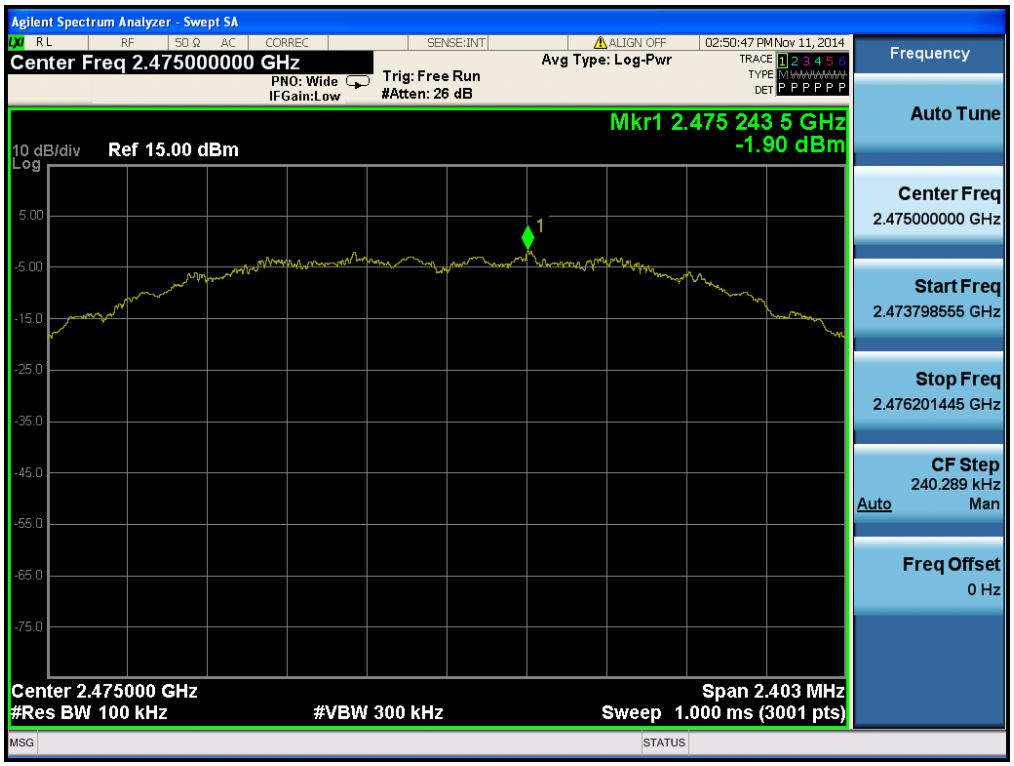


Emissions level measurement 3

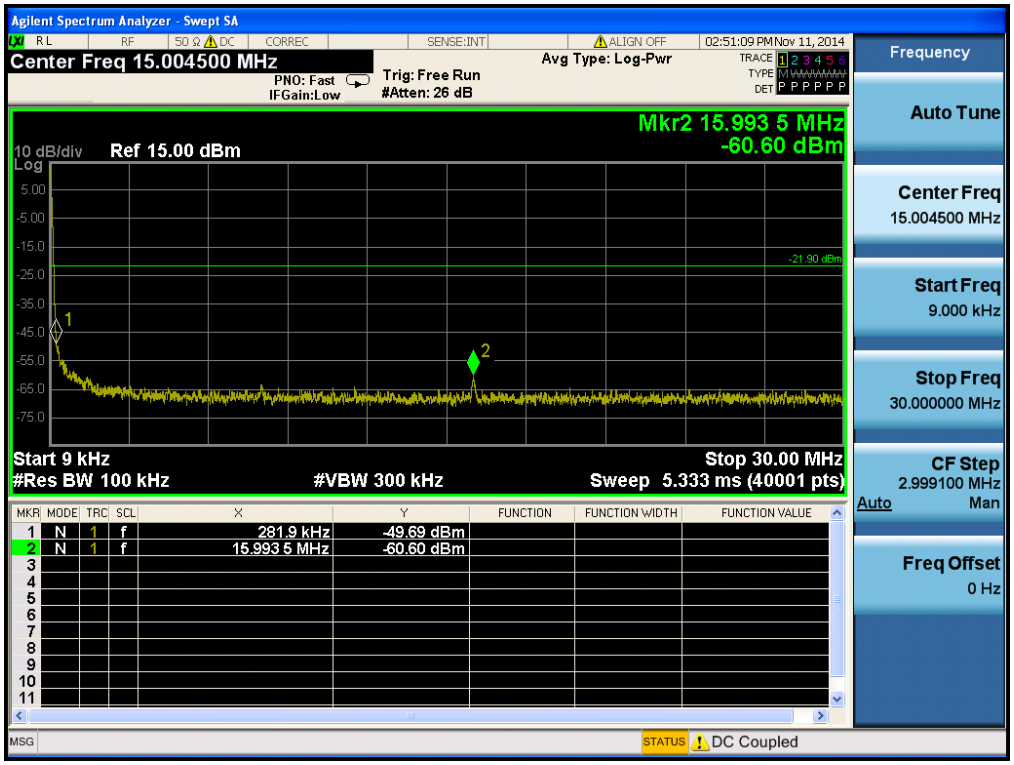


Highest channel

Reference level measurement



Emissions level measurement 1



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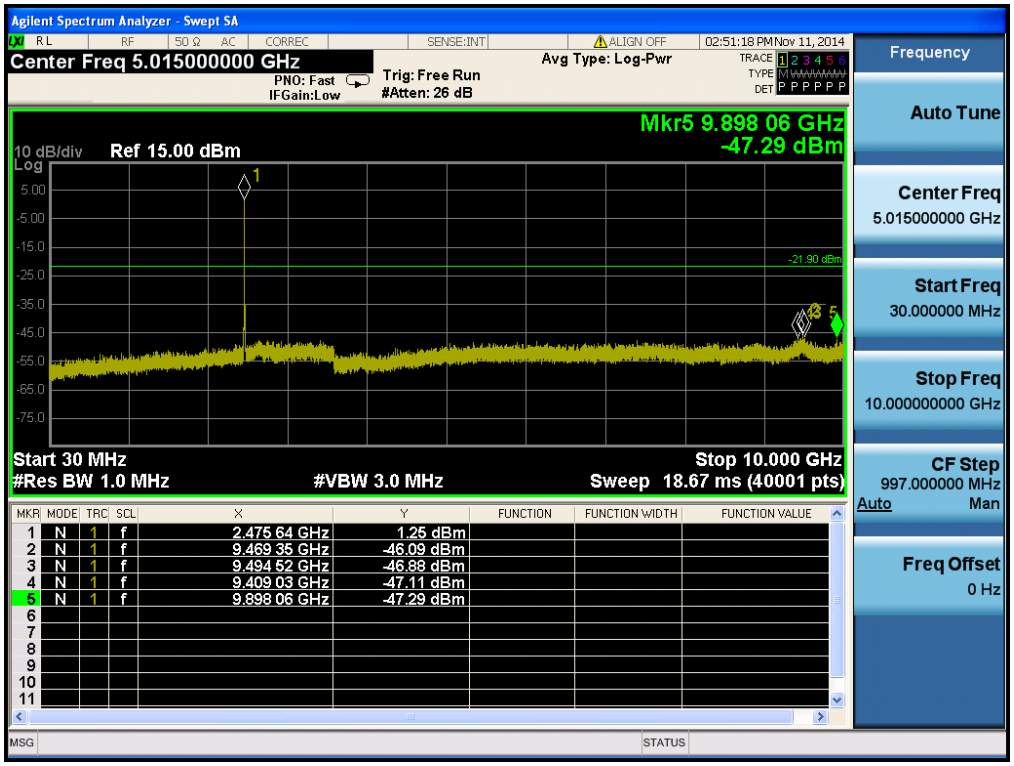
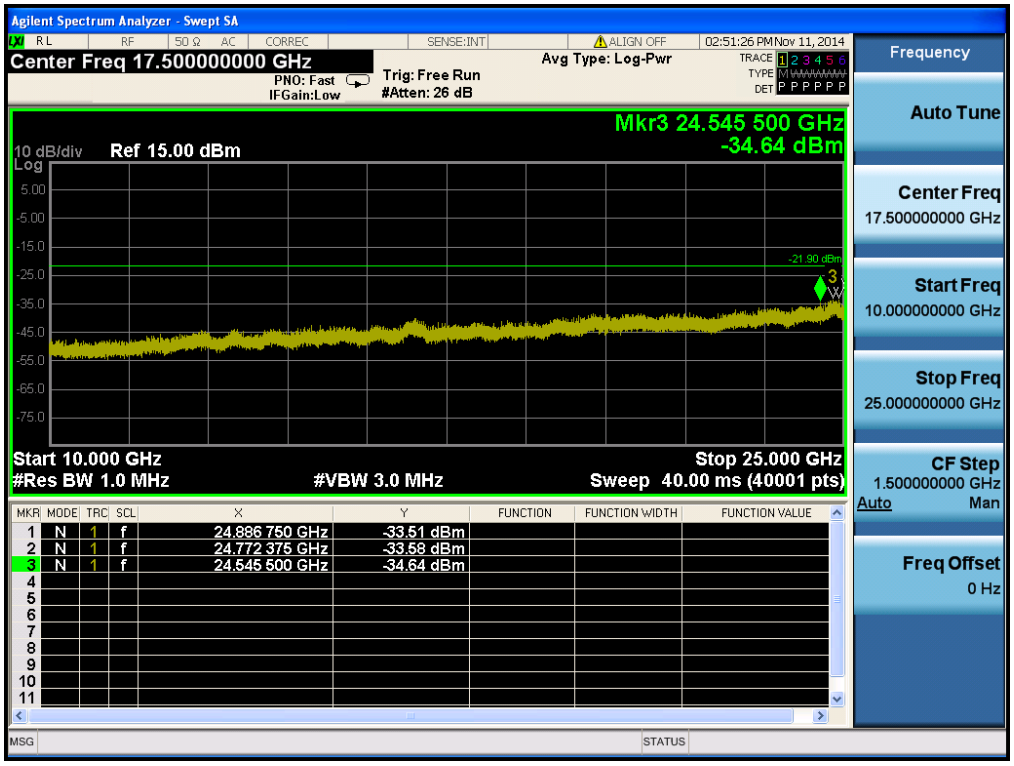


Emissions level measurement 3



7.5 Out of Band Emissions in restricted frequency band

▣ Test Requirements and limit, §15.247(d) & RSS-210[A8.5]

In any 100kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) and (b), then the 15.209(a) limit in the table below has to be followed

▪ **FCC Part 15.209(a) and (b)**

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
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

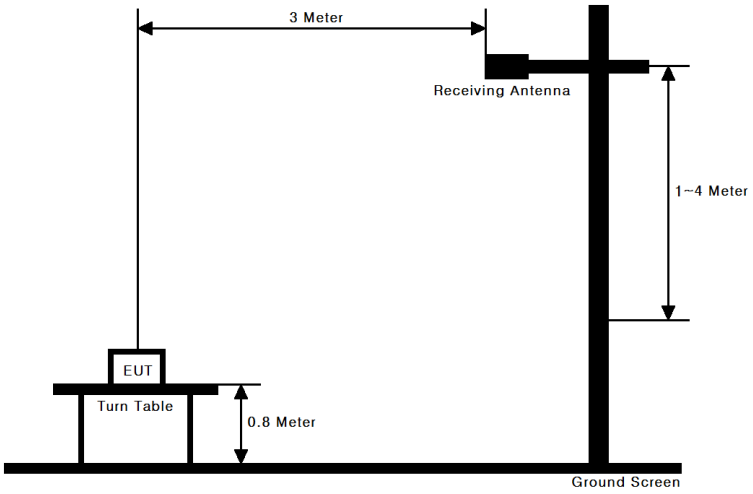
** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

▪ **FCC Part 15.205 (a):** Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	156.7 ~ 156.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	162.0125 ~ 167.17	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	167.72 ~ 173.2	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	240 ~ 285	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	608 ~ 614	3345.8 ~ 3358		
		960 ~ 1240	3600 ~ 4400		

▪ **FCC Part 15.205(b):** The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

▣ Test Configuration



▣ Test Procedure

1. The EUT is placed on a turntable, which is 0.8 m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

Note: Measurement Instrument Setting for Radiated Emission Measurements.

Peak Measurement

RBW = As specified in below table , VBW ≥ 3 x RBW, Sweep = Auto, Detector = Peak, Trace mode = Max Hold until the trace stabilizes.

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

Average Measurement

RBW = 1MHz, VBW = 10Hz, Detector = Peak, Average-VBW = Voltage, Sweep = Auto, Trace mode = Max Hold until the trace stabilize

▣ **Test Results:** ***Comply***

9 kHz ~ 25GHz Data

▪ Lowest Channel & ANT0

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2377.86	H	Y	PK	52.05	2.51	0.00	54.56	74.00	19.44
2377.68	H	Y	AV	39.37	2.51	0.00	41.88	54.00	12.12
4849.13	H	Y	PK	46.76	8.71	0.00	55.47	74.00	18.53
4849.04	H	Y	AV	37.81	8.71	0.00	46.52	54.00	7.48

▪ Middle Channel & ANT0

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4900.73	H	Y	PK	48.00	8.72	0.00	56.72	74.00	17.28
4900.99	H	Y	AV	39.46	8.72	0.00	48.18	54.00	5.82
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

▪ Highest Channel & ANT0

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.50	H	Y	PK	56.50	3.46	0.00	59.96	74.00	14.04
2483.60	H	Y	AV	48.72	3.46	0.00	52.18	54.00	1.82
4949.04	H	Y	PK	47.65	8.73	0.00	56.38	74.00	17.62
4949.10	H	Y	AV	38.32	8.73	0.00	47.05	54.00	6.95

Note.

1. No other spurious and harmonic emissions were reported greater than listed emissions above table.
2. Sample Calculation for PK result

Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG
Where, T.F = Total Factor / AF = Antenna Factor / CL = Cable Loss
AG = Amplifier Gain

DCF = duty cycle factor

9 kHz ~ 25GHz Data

▪ Lowest Channel & ANT1

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2376.82	H	Y	PK	51.83	2.51	0.00	54.34	74.00	19.66
2376.48	H	Y	AV	39.26	2.51	0.00	41.77	54.00	12.23
4849.05	H	Y	PK	46.33	8.71	0.00	55.04	74.00	18.96
4849.12	H	Y	AV	37.52	8.71	0.00	46.23	54.00	7.77

▪ Middle Channel & ANT1

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4899.18	H	Y	PK	48.11	8.72	0.00	56.83	74.00	17.17
4899.09	H	Y	AV	39.34	8.72	0.00	48.06	54.00	5.94
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

▪ Highest Channel & ANT1

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.55	H	Y	PK	56.45	3.46	0.00	59.91	74.00	14.09
2483.70	H	Y	AV	48.52	3.46	0.00	51.98	54.00	2.02
4948.83	H	Y	PK	47.22	8.73	0.00	55.95	74.00	18.05
4948.92	H	Y	AV	37.60	8.73	0.00	46.33	54.00	7.67

Note.

1. No other spurious and harmonic emissions were reported greater than listed emissions above table.
2. Sample Calculation for PK result

   Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG

   Where, T.F = Total Factor / AF = Antenna Factor / CL = Cable Loss

   AG = Amplifier Gain

   DCF = duty cycle factor

7.6 AC Power-line Conducted Emissions

▣ Test Requirements and limit, §15.207 & RSS-Gen[8.8]

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
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

▣ Test Configuration

See test photographs for the actual connections between EUT and support equipment.

▣ Test Procedure

1. The EUT is placed on a wooden table 80 cm above the reference groundplane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained using quasi-peak and average detector mode.

▣ Test Results: Comply

Note: See next pages for actual measured spectrum plots.

AC Line Conducted Emissions (Graph) & Modulation: ***ZIGBEE & ANT0***

Results of Conducted Emission

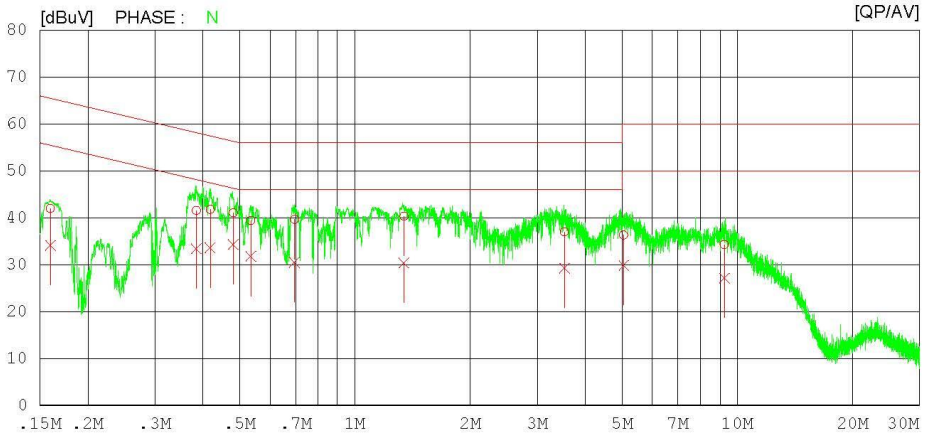
DT&C

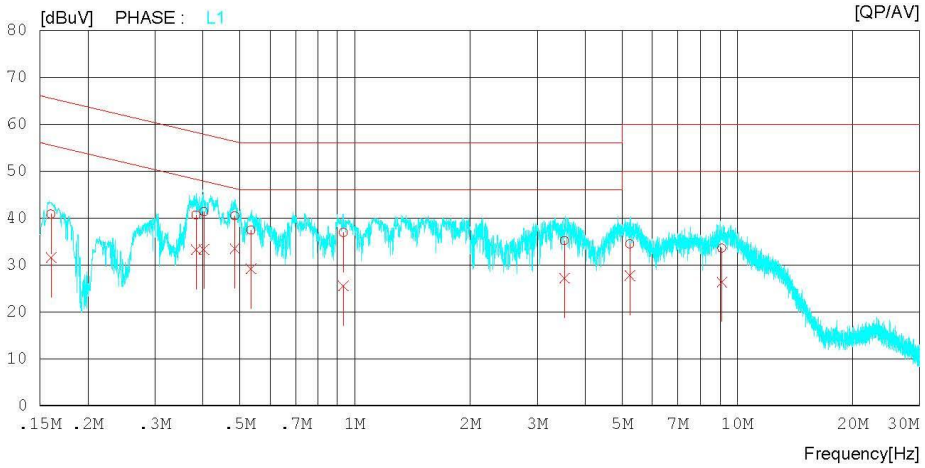
Date : 2014-11-19

Model No.	:	Sectrum200-H	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	25 'C 41 % R.H.
Test Condition	:	zigbee	Operator	:	S.H.HONG

Memo : 2425MHz, ANT0

LIMIT : FCC P15.207 QP
FCC P15.207 AV





AC Line Conducted Emissions (List) & Modulation: ***ZIGBEE & ANT0***

Results of Conducted Emission

DT&C

Date : 2014-11-19

Model No.	:	Sectrum200-H	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	25 'C 41 % R.H.
Test Condition	:	zigbee	Operator	:	S.H.HONG

Memo : 2425MHz, ANT0

LIMIT : FCC P15.207 QP
FCC P15.207 AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.15981	41.7	33.9	0.2	41.9	34.1	65.5	55.5	23.6	21.4	N
2	0.38453	41.3	33.2	0.2	41.5	33.4	58.2	48.2	16.7	14.8	N
3	0.41772	41.5	33.4	0.2	41.7	33.6	57.5	47.5	15.8	13.9	N
4	0.48050	40.8	34.1	0.2	41.0	34.3	56.3	46.3	15.3	12.0	N
5	0.53435	39.2	31.6	0.2	39.4	31.8	56.0	46.0	16.6	14.2	N
6	0.69513	39.4	30.2	0.2	39.6	30.4	56.0	46.0	16.4	15.6	N
7	1.34400	40.1	30.1	0.2	40.3	30.3	56.0	46.0	15.7	15.7	N
8	3.53560	36.8	29.1	0.2	37.0	29.3	56.0	46.0	19.0	16.7	N
9	5.04780	36.0	29.5	0.3	36.3	29.8	60.0	50.0	23.7	20.2	N
10	9.25800	33.8	26.6	0.5	34.3	27.1	60.0	50.0	25.7	22.9	N
11	0.16027	40.6	31.3	0.2	40.8	31.5	65.4	55.4	24.6	23.9	L1
12	0.38419	40.4	33.0	0.2	40.6	33.2	58.2	48.2	17.6	15.0	L1
13	0.40269	41.2	33.2	0.1	41.3	33.3	57.8	47.8	16.5	14.5	L1
14	0.48536	40.3	33.4	0.1	40.4	33.5	56.2	46.2	15.8	12.7	L1
15	0.53468	37.3	29.0	0.1	37.4	29.1	56.0	46.0	18.6	16.9	L1
16	0.93223	36.7	25.3	0.1	36.8	25.4	56.0	46.0	19.2	20.6	L1
17	3.53320	34.7	26.7	0.4	35.1	27.1	56.0	46.0	20.9	18.9	L1
18	5.23880	33.9	27.2	0.5	34.4	27.7	60.0	50.0	25.6	22.3	L1
19	9.11620	32.8	25.6	0.7	33.5	26.3	60.0	50.0	26.5	23.7	L1

AC Line Conducted Emissions (Graph) & Modulation: ***ZIGBEE & ANT1***

Results of Conducted Emission

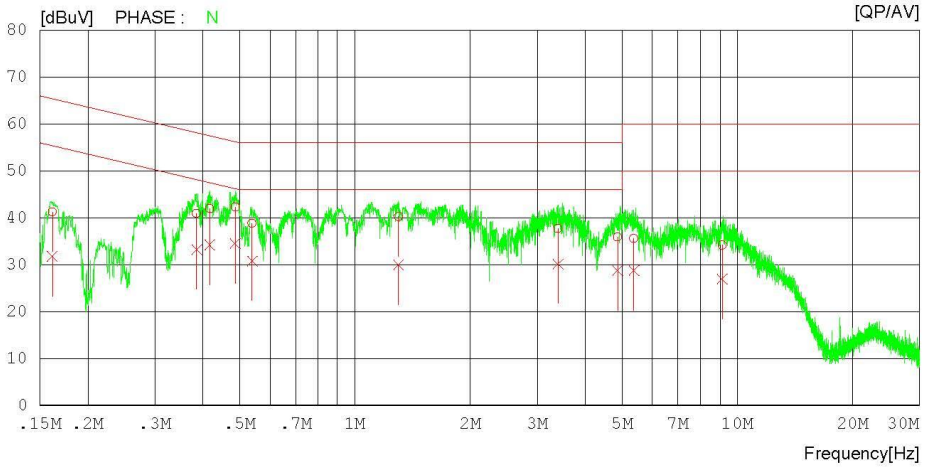
DT&C

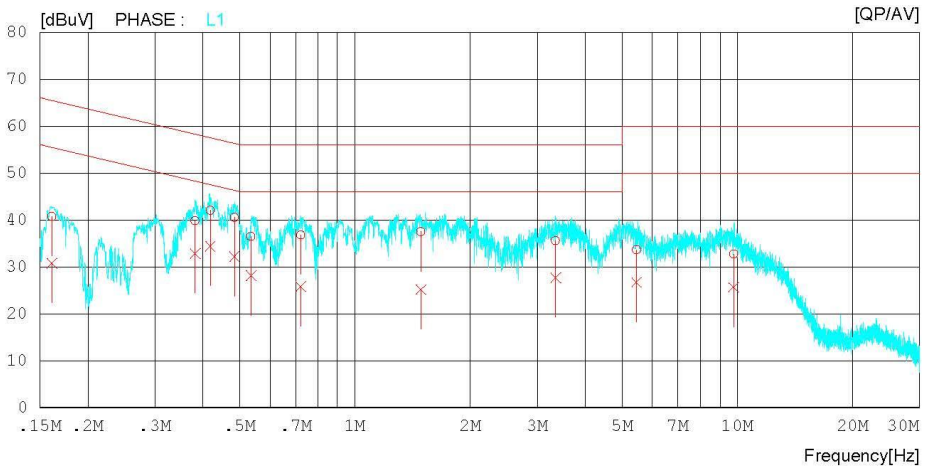
Date : 2014-11-19

Model No.	:	Sectrum200-H	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	25 'C 41 % R.H.
Test Condition	:	zigbee	Operator	:	S.H.HONG

Memo : 2425MHz, ANT1

LIMIT : FCC P15.207 QP
FCC P15.207 AV





AC Line Conducted Emissions (List) & Modulation: ***ZIGBEE & ANT1***

Results of Conducted Emission

DT&C

Date : 2014-11-19

Model No.	:	Sectrum200-H	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	25 'C 41 % R.H.
Test Condition	:	zigbee	Operator	:	S.H.HONG

Memo : 2425MHz, ANT1

LIMIT : FCC P15.207 QP
FCC P15.207 AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.16145	41.1	31.7	0.1	41.2	31.8	65.4	55.4	24.2	23.6	N
2	0.38550	40.7	33.0	0.2	40.9	33.2	58.2	48.2	17.3	15.0	N
3	0.41693	41.7	34.0	0.2	41.9	34.2	57.5	47.5	15.6	13.3	N
4	0.48624	42.1	34.3	0.2	42.3	34.5	56.2	46.2	13.9	11.7	N
5	0.53798	38.6	30.6	0.2	38.8	30.8	56.0	46.0	17.2	15.2	N
6	1.29960	40.0	29.8	0.2	40.2	30.0	56.0	46.0	15.8	16.0	N
7	3.39600	37.5	29.9	0.2	37.7	30.1	56.0	46.0	18.3	15.9	N
8	4.86460	35.5	28.4	0.3	35.8	28.7	56.0	46.0	20.2	17.3	N
9	5.36340	35.3	28.5	0.3	35.6	28.8	60.0	50.0	24.4	21.2	N
10	9.13660	33.6	26.4	0.5	34.1	26.9	60.0	50.0	25.9	23.1	N
11	0.16121	40.5	30.6	0.2	40.7	30.8	65.4	55.4	24.7	24.6	L1
12	0.38182	39.6	32.7	0.2	39.8	32.9	58.2	48.2	18.4	15.3	L1
13	0.41815	41.9	34.3	0.1	42.0	34.4	57.5	47.5	15.5	13.1	L1
14	0.48377	40.3	32.1	0.1	40.4	32.2	56.3	46.3	15.9	14.1	L1
15	0.53519	36.4	28.0	0.1	36.5	28.1	56.0	46.0	19.5	17.9	L1
16	0.72089	36.6	25.7	0.1	36.7	25.8	56.0	46.0	19.3	20.2	L1
17	1.48800	37.2	24.9	0.2	37.4	25.1	56.0	46.0	18.6	20.9	L1
18	3.34840	35.2	27.3	0.4	35.6	27.7	56.0	46.0	20.4	18.3	L1
19	5.45220	33.1	26.1	0.5	33.6	26.6	60.0	50.0	26.4	23.4	L1
20	9.77640	31.8	24.7	0.9	32.7	25.6	60.0	50.0	27.3	24.4	L1

7.7 Occupied Bandwidth

▣ Test Requirements, RSS-Gen [6.6]

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure

The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%.
The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted.
Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.

▣ Test Results: N/A

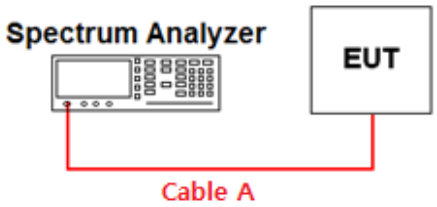
8. LIST OF TEST EQUIPMENT

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
MXA Signal Analyzer	Agilent	N9020A	14/10/21	15/10/21	MY48011075
Digital Multimeter	H.P	34401A	14/02/27	15/02/27	3146A13475
Vector Signal Generator	Rohde Schwarz	SMBV100A	14/01/07	15/01/07	255571
Signal Generator	Rohde Schwarz	SMF100A	14/07/01	15/07/01	102341
Thermohygrometer	BODYCOM	BJ5478	14/05/13	16/05/13	120612-2
Dynamic Measurement DC Source	Agilent	66332A	14/09/11	15/09/11	MY43000440
High-pass filter	Wainwright	WHKX3.0	14/09/12	15/09/12	9
LOOP Antenna	Schwarzbeck	FMZB1513	14/04/29	16/04/29	1513-128
BILOG ANTENNA	Schwarzbeck	VULB 9160	13/12/16	15/12/16	3358
Horn Antenna	ETS-LINDGREN	3117	14/05/12	16/05/12	00140394
HORN ANT	A.H.Systems	SAS-574	13/03/20	15/03/20	154
Amplifier (22dB)	H.P	8447E	14/01/07	15/01/07	2945A02865
Amplifier (30dB)	Agilent	8449B	14/02/27	15/02/27	3008A00370
EMI TEST RECEIVER	Rohde Schwarz	ESU	14/01/08	15/01/08	100014
EMI TEST RECEIVER	R&S	ESCI	14/02/27	15/02/27	100910
CVCF	NF	4420	14/09/11	15/09/11	3049354420023
LISN	R&S	ESH2-Z5	14/09/11	15/09/11	828739/006
PULSE LIMITER	R&S	ESH3-Z2	14/01/08	15/01/08	101334

APPENDIX I

Conducted Test set up Diagram & Path loss Information

- **Conducted Measurement**



Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	0.32	15	6.63
1	1.48	20	8.44
2.425 ~ 2475	2.41	25	9.12
5	3.56		
10	5.11		

Note. 1: The path loss from EUT to Spectrum analyzer was measured and used for test.

APPENDIX II
Duty cycle plots

▣ **TEST PROCEDURE**

Duty Cycle measured using **section 6.0 b) of KDB558074 v03r02:**

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal.

Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average.

The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

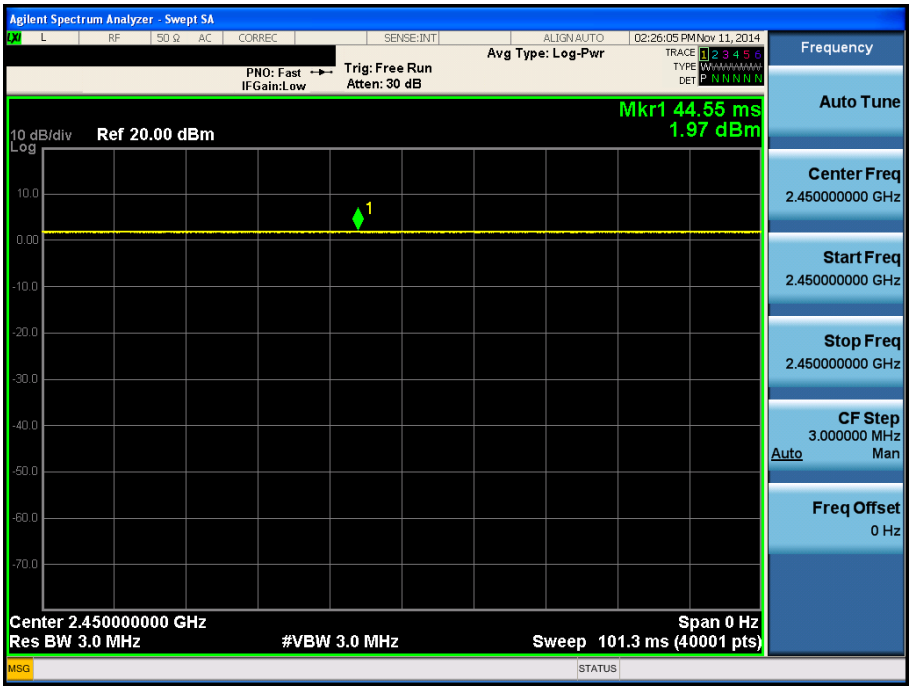
Measurement set-up of RBW

Mode	T	50/T	RBW (≤VBW)
-	-	-	-
-	-	-	-

Test Plots :

Duty Cycle

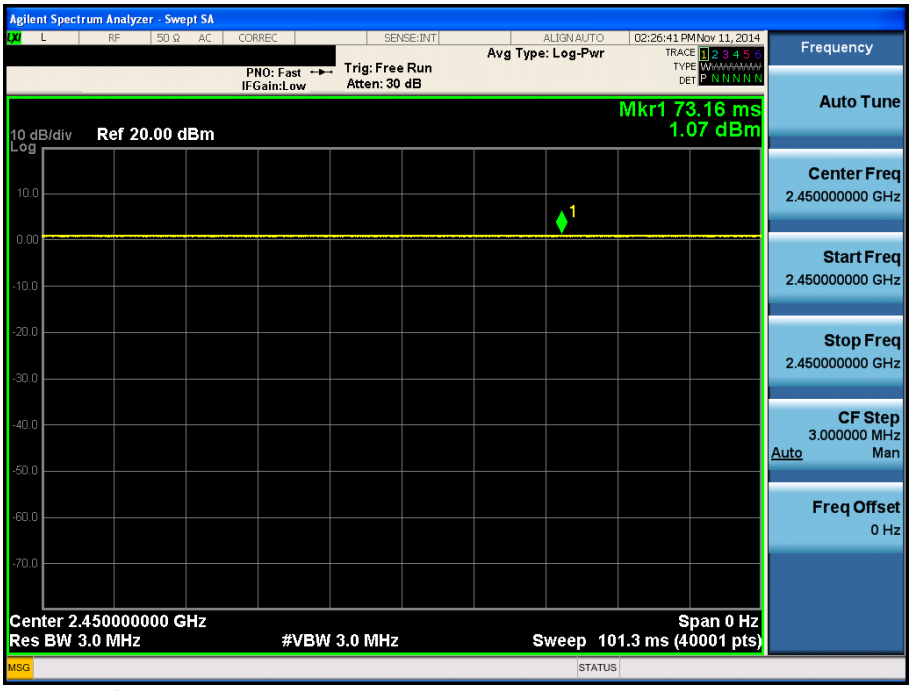
Test Mode: ZIGBEE & 2450MHz & ANT0



Duty Cycle = 100%

Duty Cycle

Test Mode: ZIGBEE & 2450MHz & ANT1



Duty Cycle = 100%