TEST REPORT

of

FCC Part 15 Subpart C §15.247

FCC ID: TQ8-AVCB0GSAN

Equipment Under Test	:	DIGITAL CAR AVNT SYSTEM
Model Name	:	AVCB0GSAN
Applicant	:	Hyundai MOBIS Co., Ltd.
Manufacturer	:	Hyundai MOBIS Co., Ltd.
Date of Test(s)	:	2014. 07. 07 ~ 2014. 07. 11
Date of Issue	:	2014. 07. 14

In the configuration tested, the EUT complied with the standards specified above.

Tested By: Alvin Kim **Date** 2014.07.14

Approved By: Hyunchae You **Date** 2014.07.14

INDEX

Table of contents

1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
-Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 435-837
All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx.
Telephone : +82 31 688 0901
FAX : +82 31 688 0921

1.2. Details of Applicant

Applicant : Hyundai MOBIS Co., Ltd.
Address : 203, Teheran-ro, Gangnam-gu, Seoul, 135-977, Korea
Contact Person : Choi, Seung-Hun
Phone No. : +82 31 260 0098

1.3. Description of EUT

Kind of Product	DIGITAL CAR AVNT SYSTEM
Model Name	AVCB0GSAN
Power Supply	DC 14.4 V (Vehicle Battery)
Frequency Range	2 412 ㎒ ~ 2 462 ㎒ (11b/g/n_HT20)
Modulation Technique	DSSS, OFDM
Number of Channels	11 channels
Antenna Type	Internal type
Antenna Gain	1.94 ㏈i

1.4. Declaration by the manufacturer

- N/A

1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal Date	Cal Interval	Cal Due.
Signal Generator	R&S	SMBV100A	255834	Jun. 25, 2014	Annual	Jun. 25, 2015
Signal Generator	R&S	SMR40	100272	Aug. 10, 2013	Annual	Aug. 10, 2014
Spectrum Analyzer	Agilent	N9030A	US51350132	Oct. 08, 2013	Annual	Oct. 08, 2014
Attenuator	AEROFLEX / INMET	18N-20dB	4	Mar. 24, 2014	Annual	Mar. 24, 2015
High Pass Filter	Wainwright	WHK3.0/18G-10SS	344	Jun. 10, 2014	Annual	Jun. 10, 2015
High Pass Filter	Wainwright	WHK7.5/26.5G-6SS	11	Jun. 10, 2014	Annual	Jun. 10, 2015
Low Pass Filter	Mini circuits	NLP-1200+	V8979400903-2	Mar. 21, 2014	Annual	Mar. 21, 2015
Power Meter	Anritsu	ML2495A	1223004	Jun. 10, 2014	Annual	Jun. 10, 2015
Power Sensor	Anritsu	MA2411B	1207272	Jun. 10, 2014	Annual	Jun. 10, 2015
Power Sensor	R&S	NRP-Z81	100669	Mar. 19. 2014	Annual	Mar. 19. 2015
DC Power Supply	Agilent	U8002A	MY50060028	Mar. 27, 2014	Annual	Mar. 27, 2015
Preamplifier	H.P.	8447D	2944A07087	Jan. 06, 2014	Annual	Jan. 06, 2015
Preamplifier	R&S	SCU 18	10117	Jan. 14, 2014	Annual	Jan. 14, 2015
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	Apr. 28, 2014	Annual	Apr. 28, 2015
Test Receiver	R&S	ESU26	100109	Mar. 04, 2014	Annual	Mar. 04, 2015
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	396	Jun. 07, 2013	Biennial	Jun. 07, 2015
Loop Antenna	R&S	HFH2-Z2	100118	Jul. 12, 2013	Biennial	Jul. 12, 2015
Horn Antenna	R&S	HF906	100326	Dec. 10, 2013	Biennial	Dec. 10, 2015
Horn Antenna	SCHWARZBECK MESSELEKTRONIK	BBHA9170	BBHA9170431	May 15, 2014	Biennial	May 15, 2016
Antenna Master	INNCO	MM4000	N/A	N.C.R.	N/A	N.C.R.
Turn Table	INNCO	DS 1200S	N/A	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.4 m)	N/A	N.C.R.	N/A	N.C.R.

▶ Support equipment

Description	Manufacturer	Model	Serial Number
N/A	-	-	-

1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part15 Subpart C § 15.247		
Standard section	**Test Item(s)**	**Result**
15.205 15.209 15.247(d)	Transmitter Radiated Spurious Emissions Conducted Spurious Emission	Complied
15.247(a)(2)	6 ㏈ Bandwidth	Complied
15.247(b)(3)	Maximum Peak Output Power	Complied
15.247(e)	Power Spectral Density	Complied

1.7. Test Procedure(s)

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 ㎑ to 40 ㎓ (ANSI C63.4-2003) and the guidance provided in KDB 558074_v03r02 were used in the measurement of the DUT.

1.8. Sample calculation

Where relevant, the following sample calculation is provided:

1.8.1. Conducted test

Offset value (㏈) = Attenuator (㏈) + Cable loss (㏈)

1.8.2. Radiation test

Field strength level (㏈㎶/m) = Measured level (㏈㎶) + Antenna factor (㏈) + Cable loss (㏈) - amplifier gain(㏈)

1.9. Test report revision

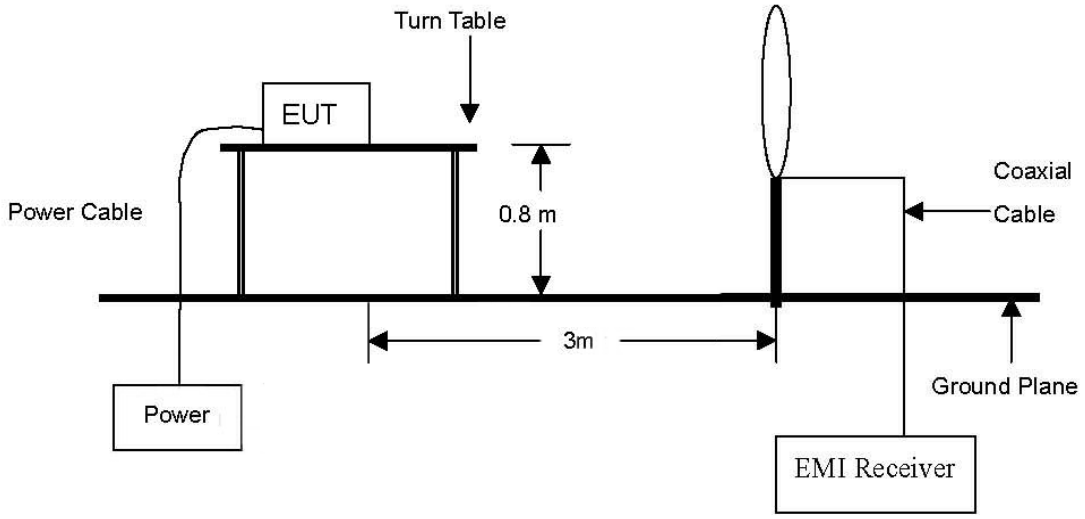
Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL007816	2014.07.14	Initial

2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

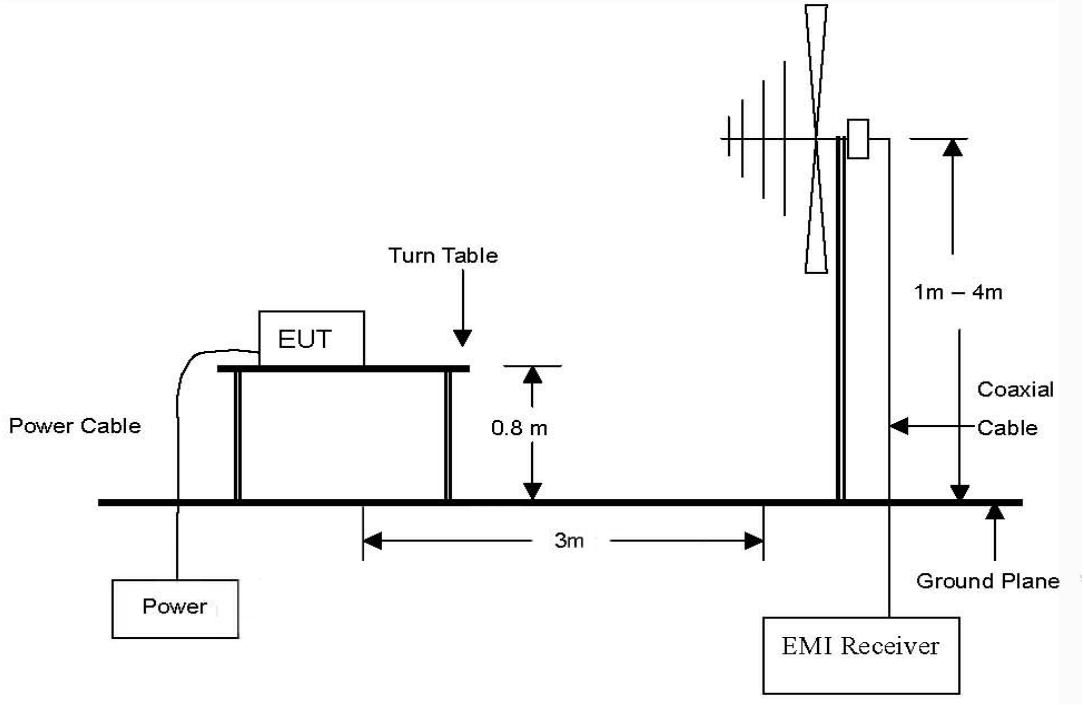
2.1. Test Setup

2.1.1. Transmitter Radiated Spurious Emissions

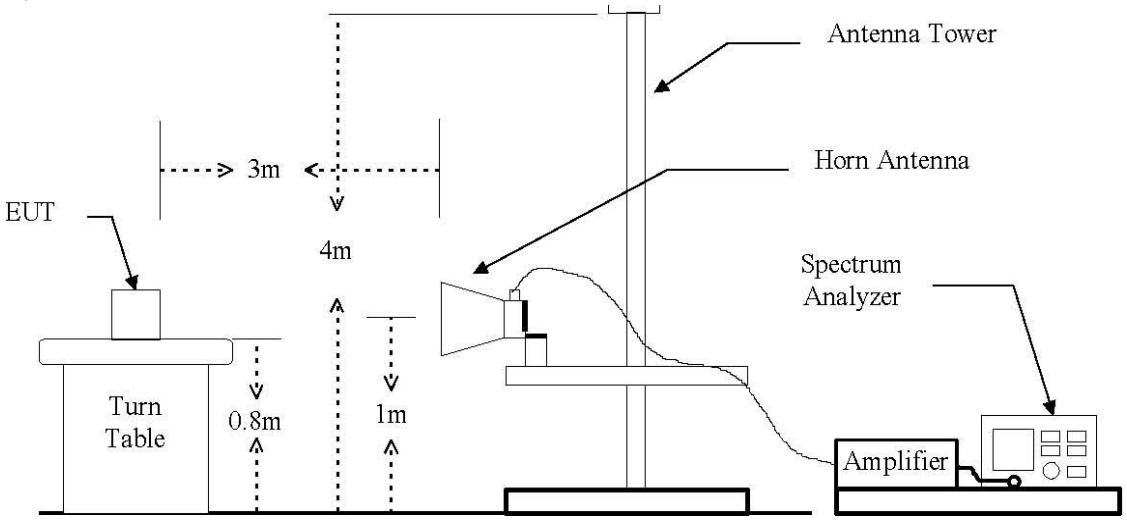
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



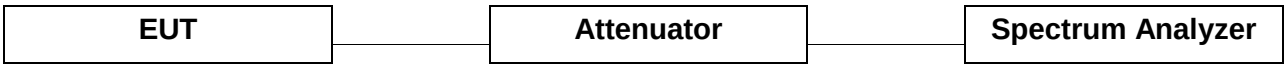
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission .The spurious emissions were investigated form 1 ㎓ to the 10th harmonic of the highest fundamental frequency or 40 ㎓, whichever is lower.



2.1.2. Conducted Spurious Emission



2.2. Limit

According to §15.247(d), in any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement , provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval , as permitted under paragraph(b)(3) of this section , the attenuation required under this paragraph shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

According to § 15.209(a), Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table：

Frequency (㎒)	Distance (Meters)	Field Strength (㏈㎶/m)	Field Strength (㎶/m)
0.009 – 0.490	300	20 log (2 400/F(㎑))	2 400/F(㎑)
0.490 – 1.705	30	20 log (24 000/F(㎑))	24 000/F(㎑)
1.705 – 30.0	30	29.54	30
30 - 88	3	40.0	100
88 – 216	3	43.5	150
216 – 960	3	46.0	200
Above 960	3	54.0	500

2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates in section 11.0 & 12.0 of KDB 558074_v03r02 and ANSI C63.4 2003.

2.3.1. Test Procedures for emission below 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum Hold Mode.

2.3.2. Test Procedures for emission from above 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a bi-log antenna, a horn antenna and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 ㏈ lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE;

All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

1. Unwanted Emissions into Non-Restricted Frequency Bands

- The Reference Level Measurement refer to section 11.2
Set analyzer center frequency to DTS channel center frequency, SPAN ≥ 1.5 times the DTS bandwidth, the RBW = 100 ㎑ and VBW ≥ 3 x RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold

- Unwanted Emissions Level Measurement refer to section 11.3
Set the center frequency and span to encompass frequency range to be measured, the RBW = 100 ㎑ and VBW ≥ 3 x RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold

2. Unwanted Emissions into Restricted Frequency Bands

- Peak Power measurement procedure refer to section 12.2.4
Set RBW = as specified in Table 1, VBW ≥ 3 x RBW, Detector = Peak, Sweep time = auto, Trace = Max hold

Table 1- RBW as a function of frequency

Frequency	RBW
9 – 150 ㎑	200 – 300 ㎐
0.15 – 30 ㎒	9 – 10 ㎑
30 – 1 000 ㎒	100 – 120 ㎑
>1 000 ㎒	1 ㎒

-Average Power measurements procedure refer to section 12.2.5.1
Set RBW = 1 ㎒, VBW ≥ 3 x RBW, Detector = RMS, if span/(# of points in sweep) ≤(RBW/2).
Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied then the detector mode shall be set to peak,
Averaging type = power(i.e., RMS).
1) As an alternative the detector and averaging type may be set for linear voltage averaging.
2) Some instruments require linear display mode in order to use linear voltage averaging.
Log or averaging shall not be used.
Sweep time = auto, Perform a trace average of at least 100 traces.

3. To get a maximum emission level from the EUT, the EUT is manipulated through three orthogonal planes.

Worst orthogonal plan of EUT is **X – axis** during radiation test.

2.3.2. Test Procedures for Conducted Spurious Emissions

All data rates and modes were investigated for conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.

Per the guidance of KDB 558074_v03r02, section 11.1 & 11.2, the reference level for out of band emissions is established from the plots of this section since the band edge emissions are measured with a RBW of 100 ㎑. This reference level is then used as the limit in subsequent plots for out of band spurious emissions shown in section 2.4.3. The limit for out of band spurious emission at the band edge is 20 ㏈ below the fundamental emission level measured in a 100 ㎑ bandwidth.

1. Conducted Emissions at Band Edge
 - The Measurement refer to section 11.2
   Set the center frequency and span to encompass frequency range to be measured, the RBW = 100 ㎑ and VBW ≥ 3 x RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold, Ensure that the number of measurement points ≥ span/RBW, The trace was allowed to stabilize.

2. Conducted Spurious Emissions
 - The Measurement refer to section 11.3
   Start frequency was set to 30 ㎒ and stop frequency was set to 26.5 ㎓ (separated into two plots per channel), RBW = 100 ㎑, VBW ≥ 3 x RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold, The trace was allowed to stabilize.

3. Correction factor
 - For plots showing conducted spurious emissions from 30 ㎒ to 26.5 ㎓, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as correction factor.
   The reading values shown in plots were final result.

2.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

2.4.1. Radiated Spurious Emission

The frequency spectrum from 9 ㎑ to 1 000 ㎒ was investigated. Emission levels are not reported much lower than the limits by over 30 ㏈. All reading values are peak values.

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	AMP + CL (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
33.84	37.24	Peak	V	14.95	-27.19	25.00	40.00	15.00
135.21	36.94	Peak	H	8.73	-26.07	19.60	43.50	23.90
196.11	37.39	Peak	H	11.15	-25.34	23.20	43.50	20.30
685.03	36.52	Peak	V	20.28	-24.40	32.40	46.00	13.60
686.33	37.45	Peak	H	21.33	-24.38	34.40	46.00	11.60
Above 700.00	Not detected	-	-	-	-	-	-	-

Remark:

1. Spurious emissions for all channels and modes were investigated and almost the same below 1 ㎓.
2. Reported spurious emissions are in **11b / 1 Mbps / High channel** as worst case among other modes.
3. Radiated spurious emission measurement as below
   (Actual = Reading + Antenna Factor + Amp + CL)

2.4.2. Spurious Radiated Emission

The frequency spectrum from above 1 000 ㎒ was investigated. All reading values are peak and average values.

DSSS : 802.11b(1 Mbps)

Low Channel (2 412 ㎒)

Fundamental Level			Ant.	Correction Factors		Total
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)
2 412.48	70.40	Peak	V	28.09	6.44	104.93

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 310.00	27.29	Peak	V	27.77	6.48	61.54	74.00	12.46
*2 310.00	16.23	Average	V	27.77	6.48	50.48	54.00	3.52
*2 375.44	29.09	Peak	V	28.16	6.55	63.80	74.00	10.20
*2 375.44	16.99	Average	V	28.16	6.55	51.70	54.00	2.30
*2 390.00	25.91	Peak	V	28.08	6.47	60.46	74.00	13.54
*2 390.00	15.58	Average	V	28.08	6.47	50.13	54.00	3.87

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
3 191.78	46.41	Peak	V	30.33	-35.42	41.32	84.93	43.61
*4 823.94	51.59	Peak	V	32.78	-33.69	50.68	74.00	23.32
*4 823.94	49.35	Average	V	32.78	-33.69	48.44	54.00	5.56
Above 4 900.00	Not detected	-	-	-	-	-	-	-

Middle Channel (2 437 ㎒)

Fundamental Level			Ant.	Correction Factors		Total
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)
2 437.48	70.05	Peak	V	28.00	6.70	104.75

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
3 191.72	47.04	Peak	V	30.33	-35.42	41.95	84.75	42.80
*4 873.99	49.90	Peak	V	33.01	-33.43	49.48	74.00	24.52
*4 873.99	47.30	Average	V	33.01	-33.43	46.88	54.00	7.12
Above 4 900.00	Not detected	-	-	-	-	-	-	-

High Channel (2 462 ㎒)

Fundamental Level			Ant.	Correction Factors		Total
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)
2 461.47	67.53	Peak	V	28.14	6.74	102.41

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 483.50	30.88	Peak	V	28.17	6.65	65.70	74.00	8.30
*2 483.50	16.34	Average	V	28.17	6.65	51.16	54.00	2.84
*2 483.67	32.33	Peak	V	28.17	6.65	67.15	74.00	6.85
*2 483.67	16.57	Average	V	28.17	6.65	51.39	54.00	2.61
*2 500.00	26.51	Peak	V	28.31	6.88	61.70	74.00	12.30
*2 500.00	16.04	Average	V	28.31	6.88	51.23	54.00	2.77

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
3 191.88	46.78	Peak	V	30.33	-35.42	41.69	82.41	40.72
*4 924.12	45.13	Peak	V	33.12	-33.37	44.88	74.00	29.12
*4 924.12	39.74	Average	V	33.12	-33.37	39.49	54.00	14.51
Above 5 000.00	Not detected	-	-	-	-	-	-	-

DSSS : 802.11g(6 Mbps)

Low Channel (2 412 ㎒)

Fundamental Level			Ant.	Correction Factors		Total
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)
2 413.25	64.96	Peak	V	28.09	6.45	99.50

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 310.00	26.37	Peak	V	27.77	6.48	60.62	74.00	13.38
*2 310.00	16.57	Average	V	27.77	6.48	50.82	54.00	3.18
*2 373.44	29.72	Peak	V	28.17	6.55	64.44	74.00	9.56
*2 373.44	17.37	Average	V	28.17	6.55	52.09	54.00	1.91
*2 390.00	27.79	Peak	V	28.08	6.47	62.34	74.00	11.66
*2 390.00	16.21	Average	V	28.08	6.47	50.76	54.00	3.24

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
3 192.28	46.33	Peak	V	30.33	-35.42	41.24	79.50	38.26
*4 826.06	45.32	Peak	V	32.79	-33.68	44.43	74.00	29.57
*4 826.06	36.23	Average	V	32.79	-33.68	35.34	54.00	18.66
Above 4 900.00	Not detected	-	-	-	-	-	-	-

Middle Channel (2 437 ㎒)

Fundamental Level			Ant.	Correction Factors		Total
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)
2 438.22	64.84	Peak	V	28.00	6.71	99.55

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
3 192.05	46.62	Peak	V	30.33	-35.42	41.53	79.55	38.02
*4 877.60	44.25	Peak	V	33.00	-33.44	43.81	74.00	30.19
*4 877.60	34.75	Average	V	33.00	-33.44	34.31	54.00	19.69
Above 4 900.00	Not detected	-	-	-	-	-	-	-

High Channel (2 462 ㎒)

Fundamental Level			Ant.	Correction Factors		Total
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)
2 455.74	62.62	Peak	V	28.13	6.83	97.58

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 483.50	26.99	Peak	V	28.17	6.65	61.81	74.00	12.19
*2 483.50	16.75	Average	V	28.17	6.65	51.57	54.00	2.43
*2 489.44	29.44	Peak	V	28.23	6.73	64.40	74.00	9.60
*2 489.44	16.90	Average	V	28.23	6.73	51.86	54.00	2.14
*2 500.00	26.94	Peak	V	28.31	6.88	62.13	74.00	11.87
*2 500.00	16.33	Average	V	28.31	6.88	51.52	54.00	2.48

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
3 192.36	46.12	Peak	V	30.33	-35.42	41.03	77.58	36.55
*4 919.90	40.98	Peak	V	33.10	-33.39	40.69	74.00	33.31
*4 919.90	34.09	Average	V	33.10	-33.39	33.80	54.00	20.20
Above 5 000.00	Not detected	-	-	-	-	-	-	-

DSSS : 802.11n_HT20(MCS0)

Low Channel (2 412 ㎒)

Fundamental Level			Ant.	Correction Factors		Total
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)
2 412.48	64.84	Peak	V	28.09	6.44	99.37

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 310.00	27.32	Peak	V	27.77	6.48	61.57	74.00	12.43
*2 310.00	16.25	Average	V	27.77	6.48	50.50	54.00	3.50
*2 389.68	31.06	Peak	V	28.08	6.47	65.61	74.00	8.39
*2 389.68	17.46	Average	V	28.08	6.47	52.01	54.00	1.99
*2 390.00	27.91	Peak	V	28.08	6.47	62.46	74.00	11.54
*2 390.00	16.47	Average	V	28.08	6.47	51.02	54.00	2.98

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
3 191.58	47.19	Peak	V	30.33	-35.42	42.10	79.37	37.27
*4 823.80	48.09	Peak	V	32.78	-33.69	47.18	74.00	26.82
*4 823.80	38.58	Average	V	32.78	-33.69	37.67	54.00	16.33
Above 4 900.00	Not detected	-	-	-	-	-	-	-

Middle Channel (2 437 ㎒)

Fundamental Level			Ant.	Correction Factors		Total
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)
2 439.48	65.18	Peak	V	28.00	6.73	99.91

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
3 191.60	46.74	Peak	V	30.33	-35.42	41.65	79.91	38.26
*4 869.45	44.13	Peak	V	33.02	-33.43	43.72	74.00	30.28
*4 869.45	36.14	Average	V	33.02	-33.43	35.73	54.00	18.27
Above 4 900.00	Not detected	-	-	-	-	-	-	-

High Channel (2 462 ㎒)

Fundamental Level			Ant.	Correction Factors		Total
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)
2 456.98	62.49	Peak	V	28.13	6.81	97.43

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 483.50	27.96	Peak	V	28.17	6.65	62.78	74.00	11.22
*2 483.50	16.89	Average	V	28.17	6.65	51.71	54.00	2.29
*2 498.32	29.68	Peak	V	28.30	6.86	64.84	74.00	9.16
*2 498.32	16.96	Average	V	28.30	6.86	52.12	54.00	1.88
*2 500.00	26.74	Peak	V	28.31	6.88	61.93	74.00	12.07
*2 500.00	16.27	Average	V	28.31	6.88	51.46	54.00	2.54

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
3 192.22	46.22	Peak	V	30.33	-35.42	41.13	77.43	36.30
*4 926.30	41.72	Peak	V	33.14	-33.35	41.51	74.00	32.49
*4 926.30	33.67	Average	V	33.14	-33.35	33.46	54.00	20.54
Above 5 000.00	Not detected	-	-	-	-	-	-	-

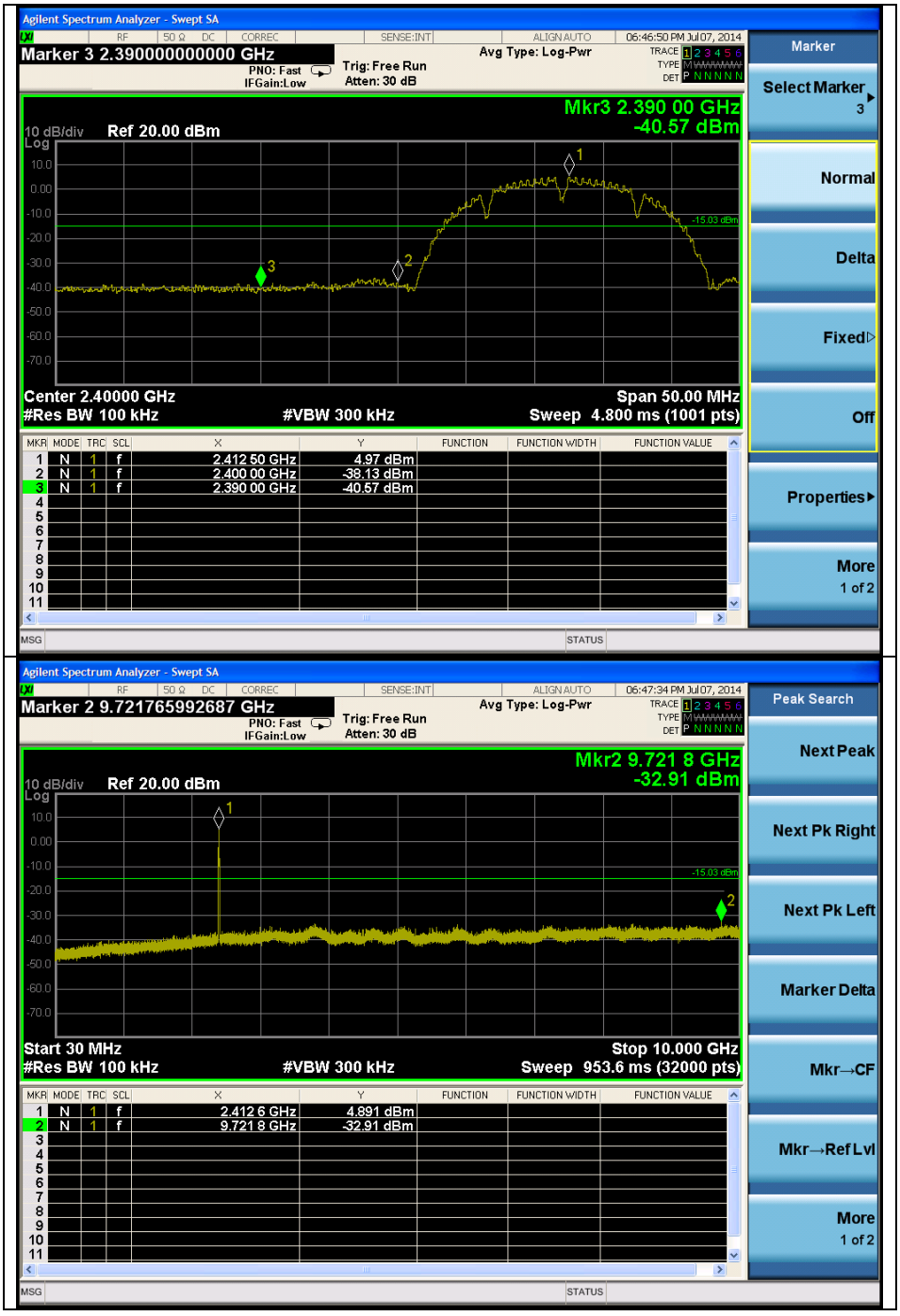
Remarks :

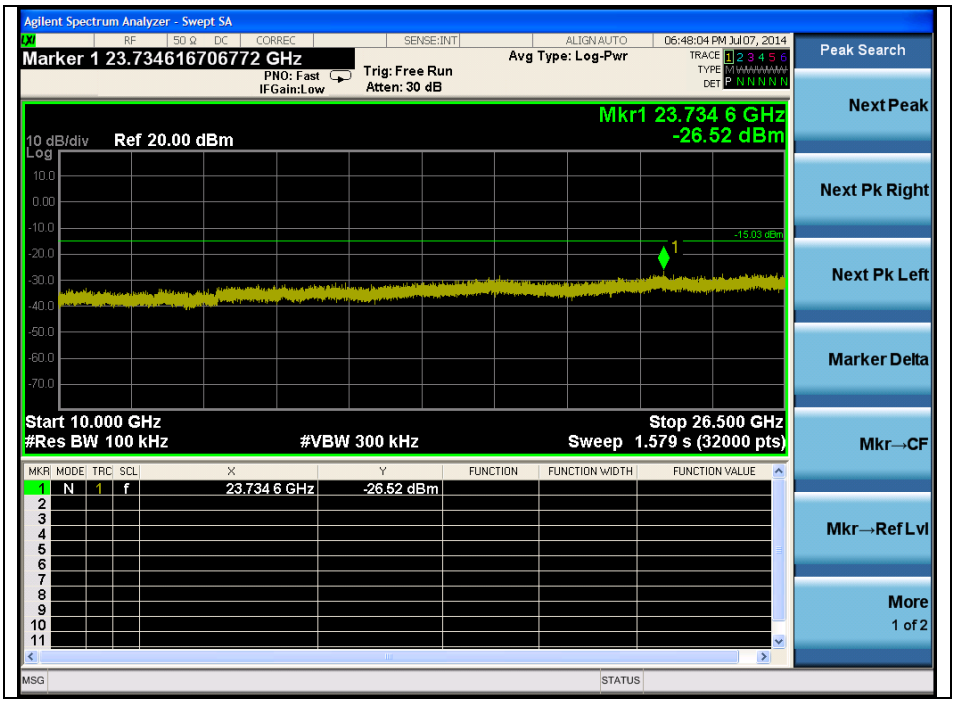
1. "*" means the restricted band.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using Peak / average detector mode if frequency was in restricted band. Otherwise the frequency was out of restricted band, only peak detector should be used.
3. Emissions out of restricted band are limited below 20 ㏈ of fundamental level in 100 ㎑ resolution bandwidth.
4. Band edge measurement
   (Actual = Reading + Antenna Factor + CL)
5. Radiated spurious emission measurement
   (Actual = Reading + Antenna Factor + Amp + CL)

2.4.3. Spurious RF Conducted Emissions: Plot of Spurious RF Conducted Emission

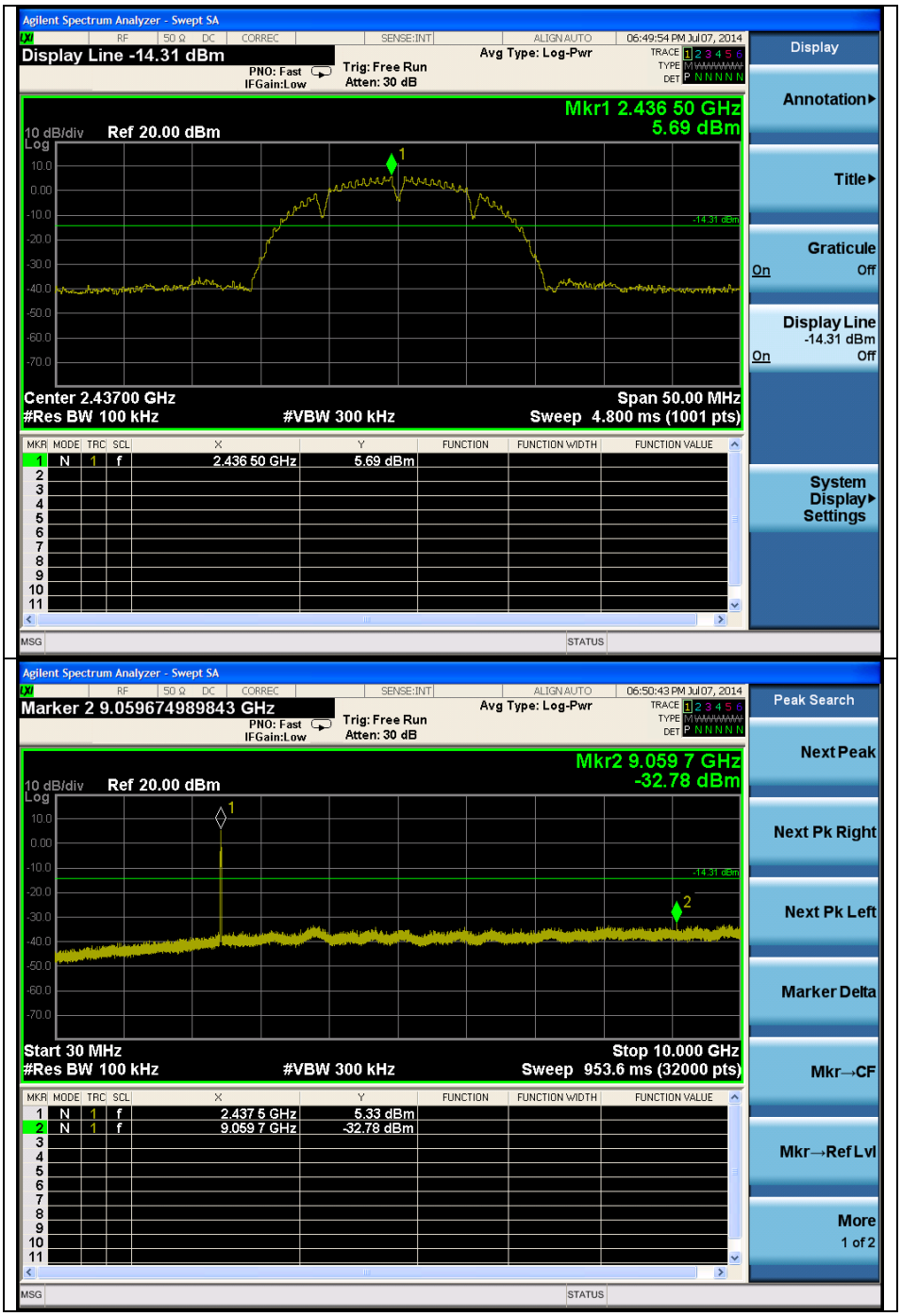
DSSS : 802.11b(1 Mbps)

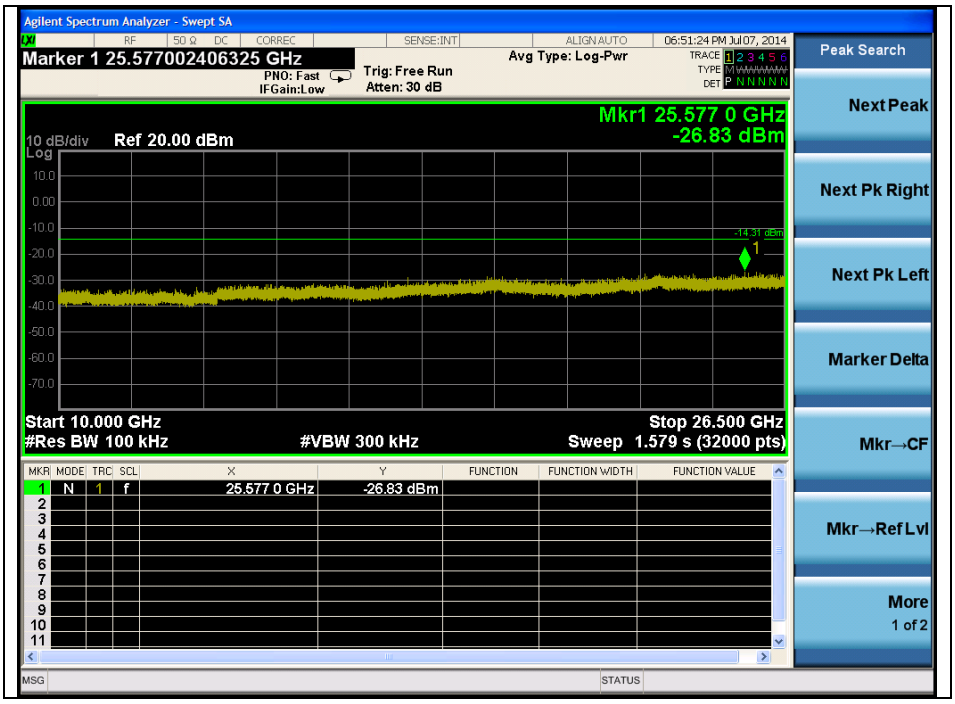
Low Channel



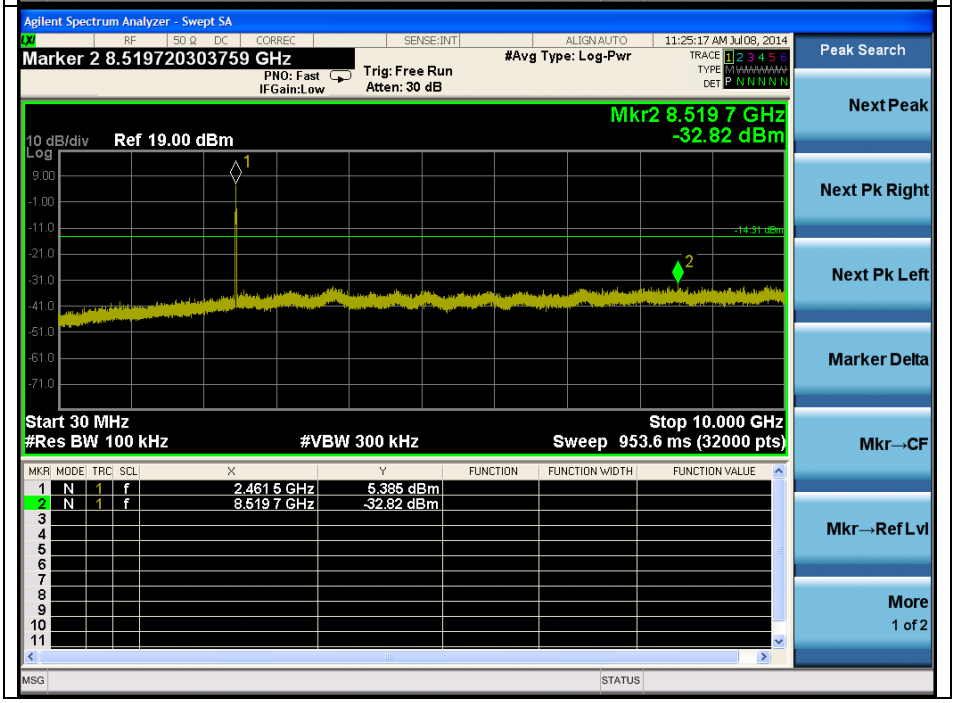


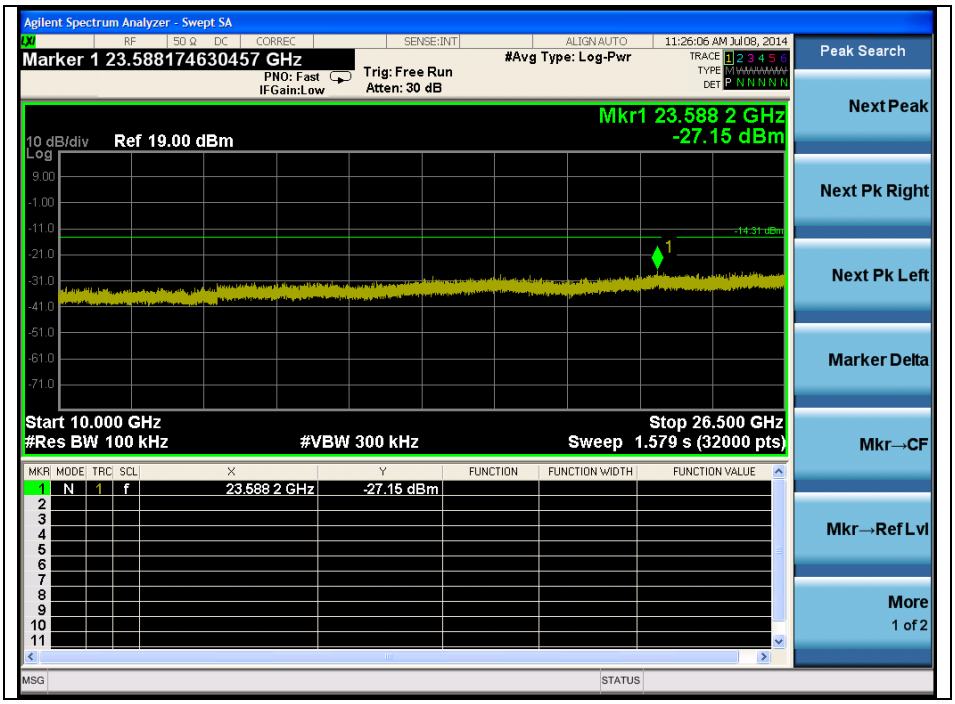
Middle Channel





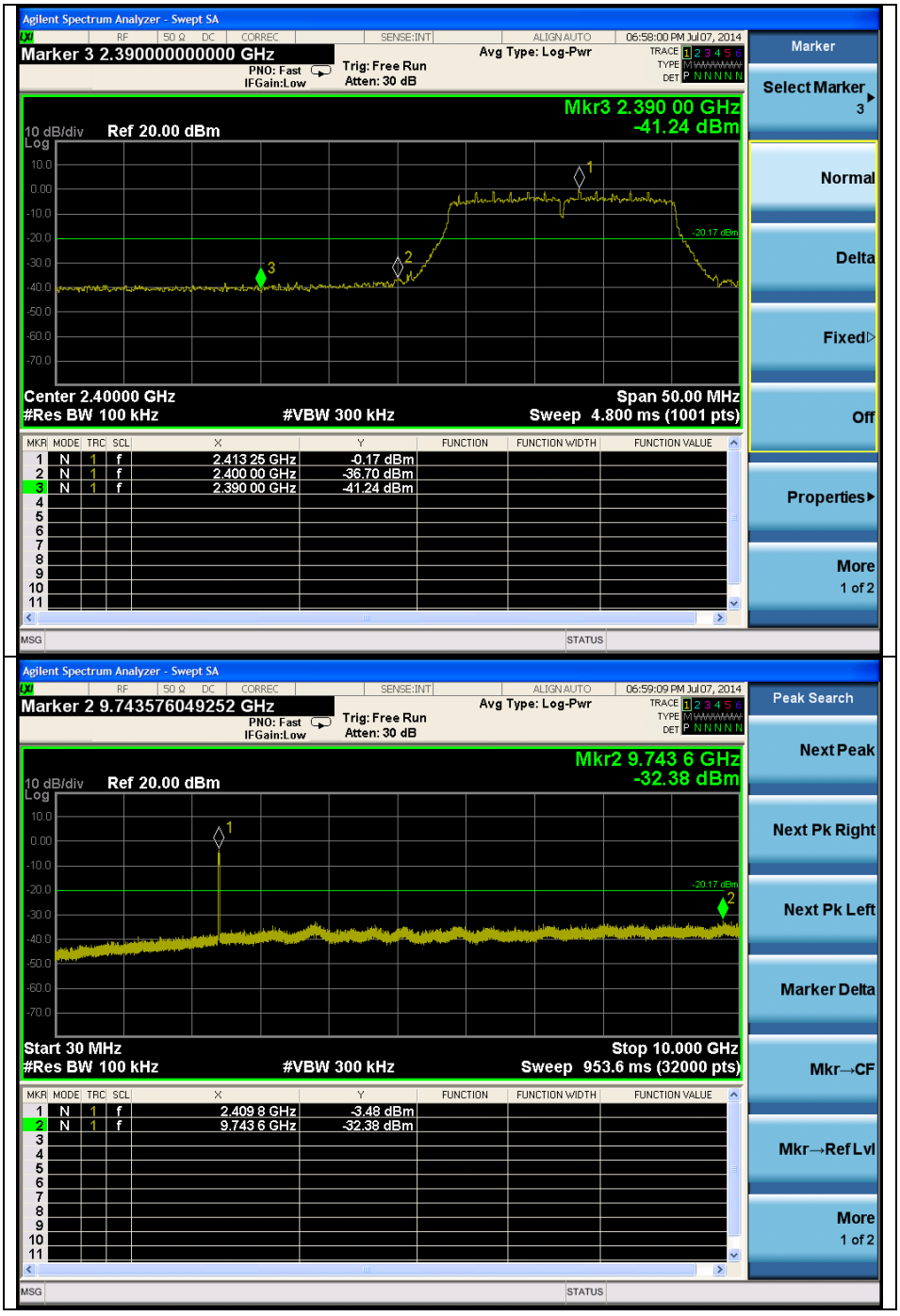
High Channel

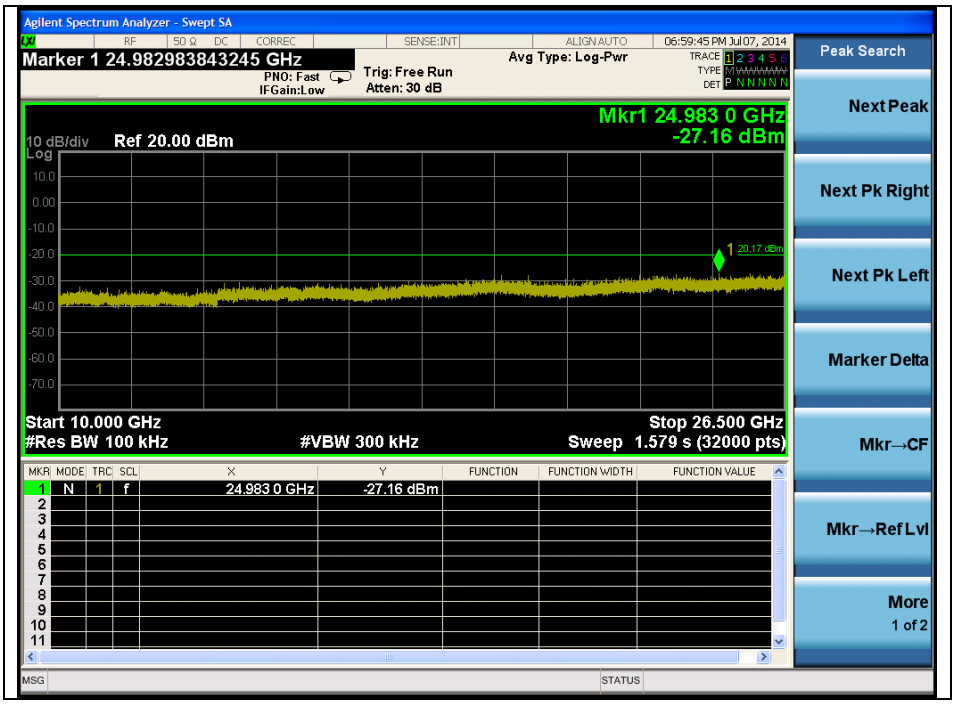




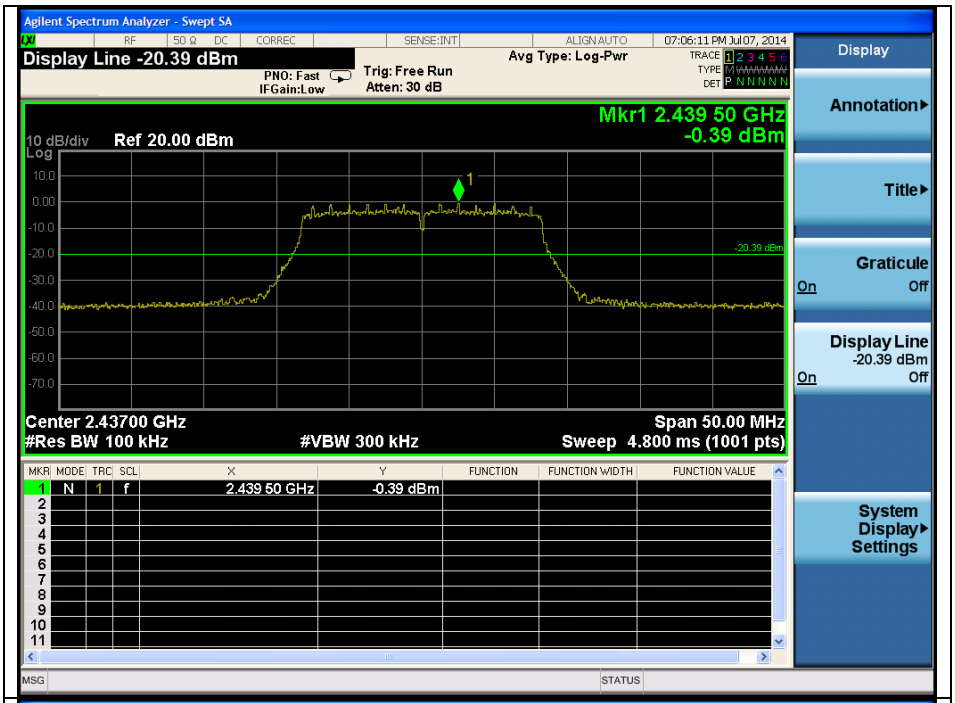
OFDM : 802.11g(6 Mbps)

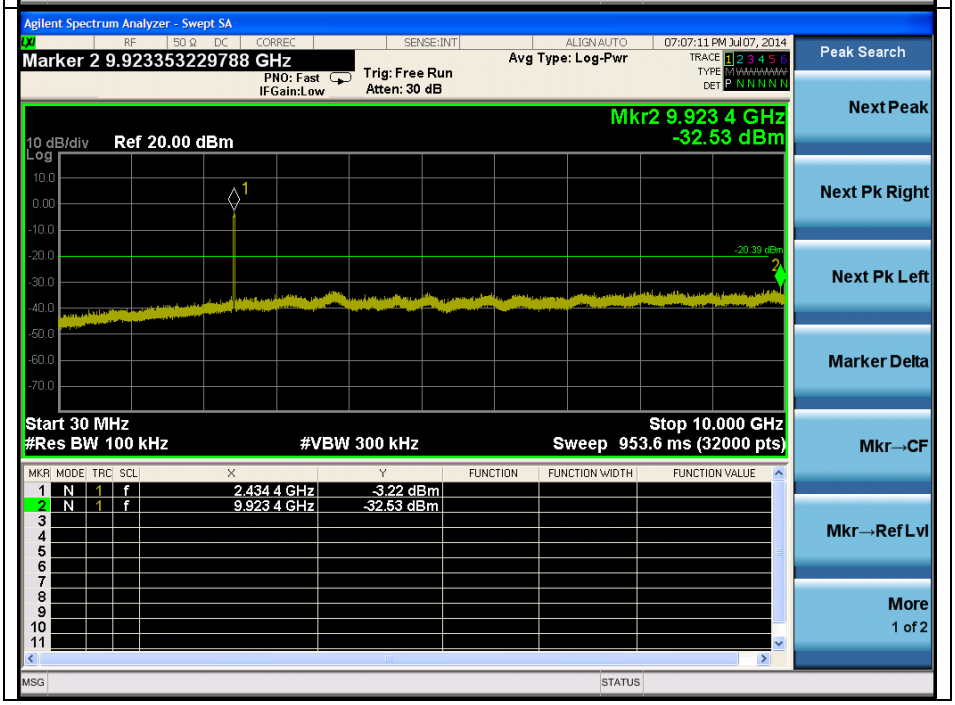
Low Channel

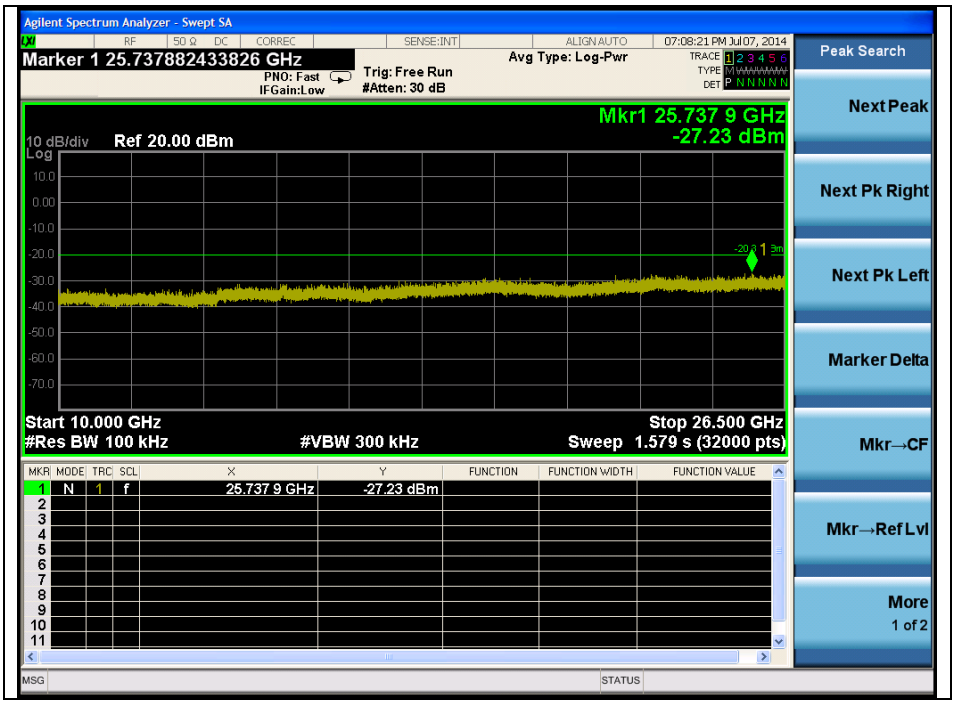




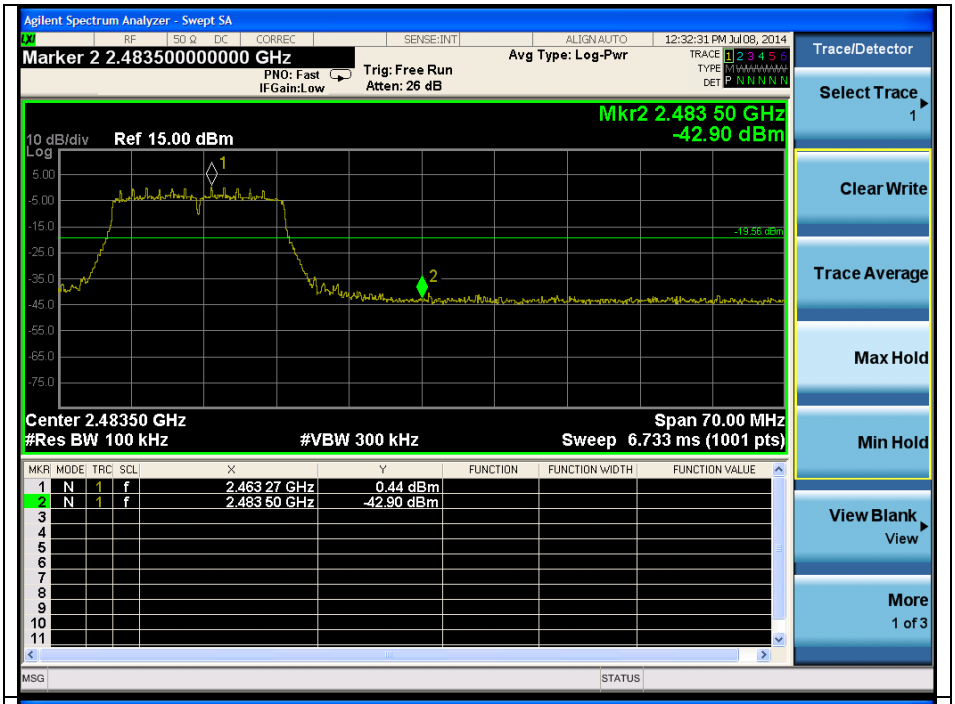
Middle Channel

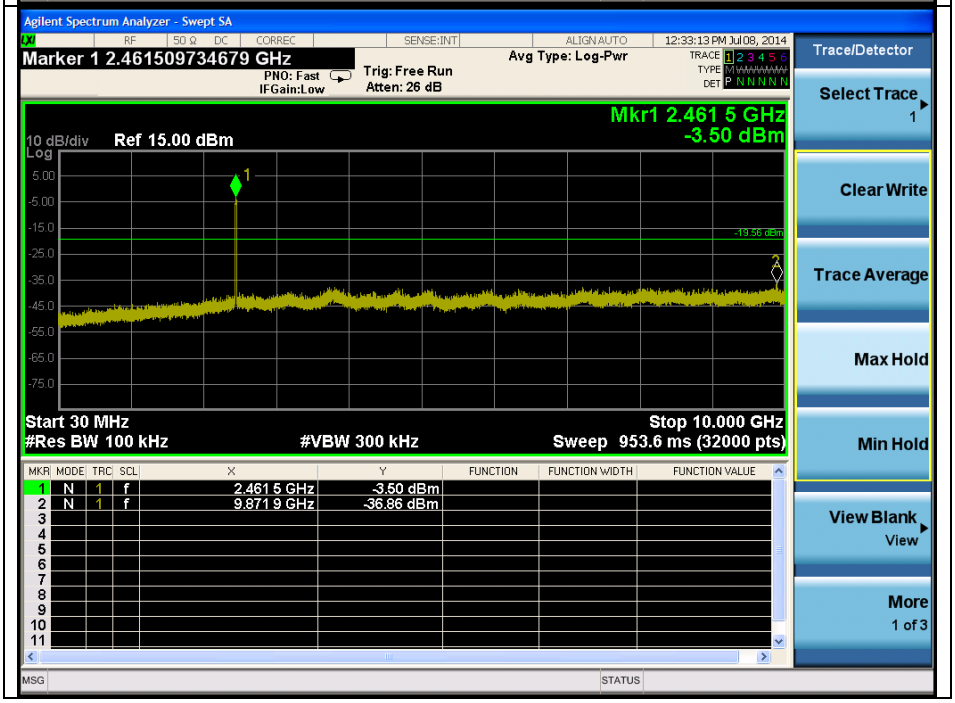


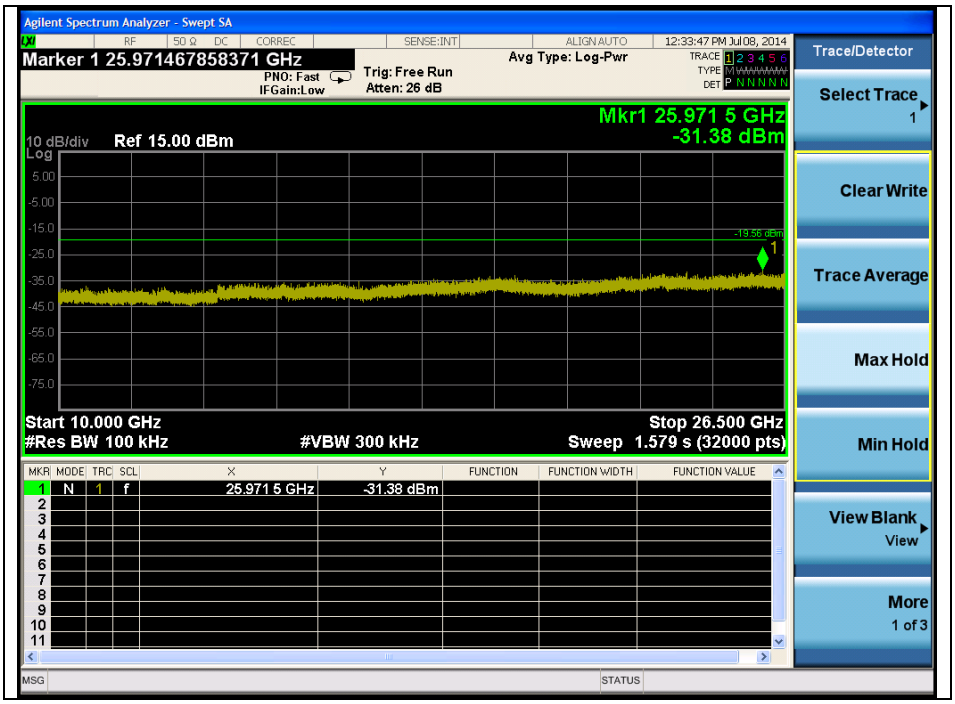




High Channel

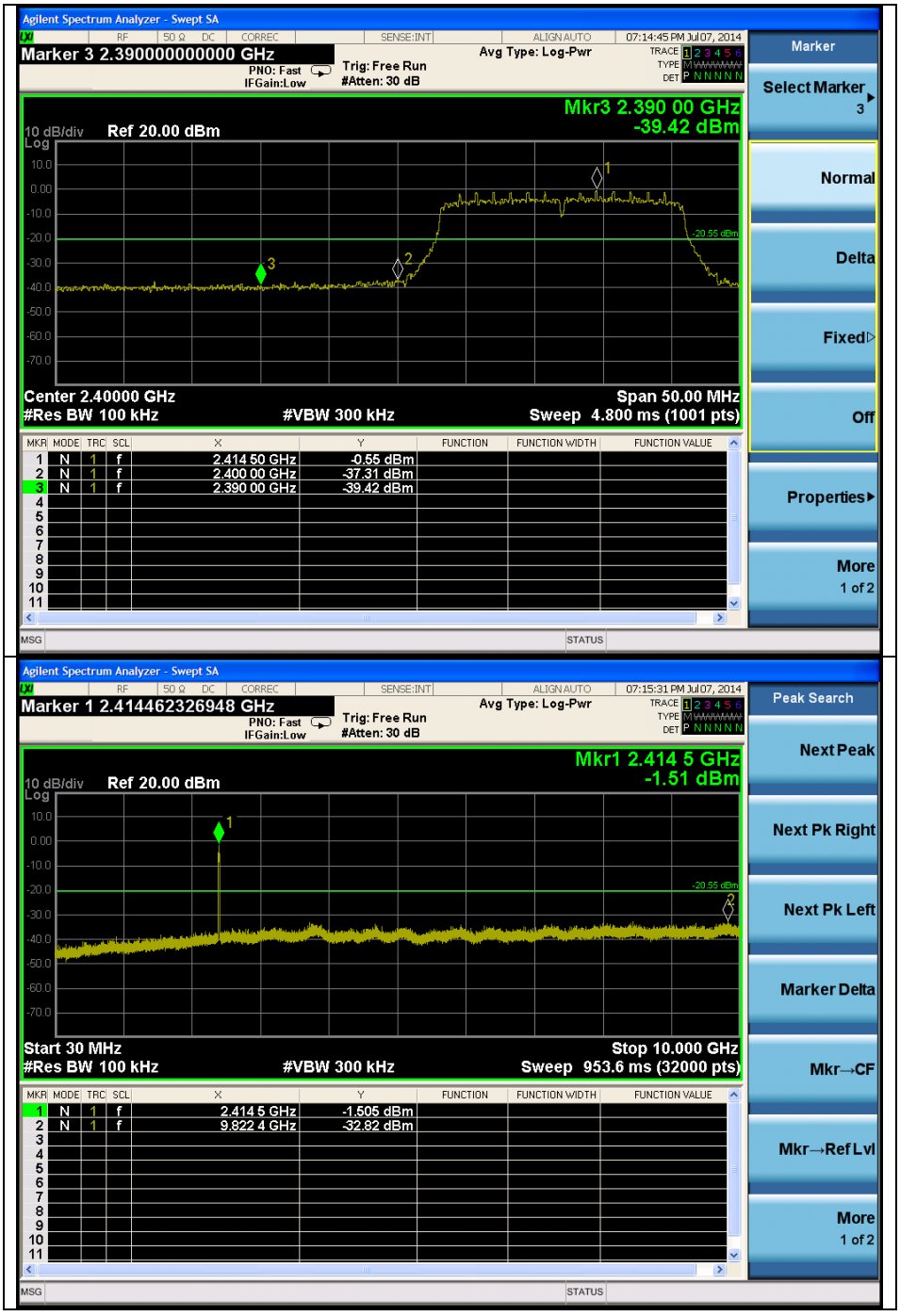


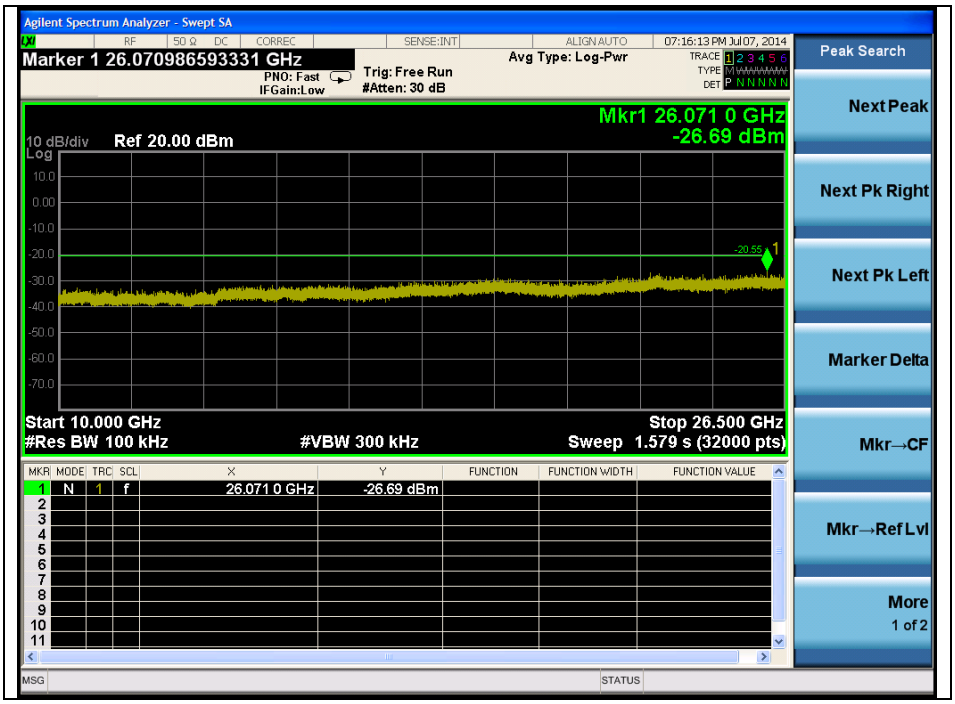




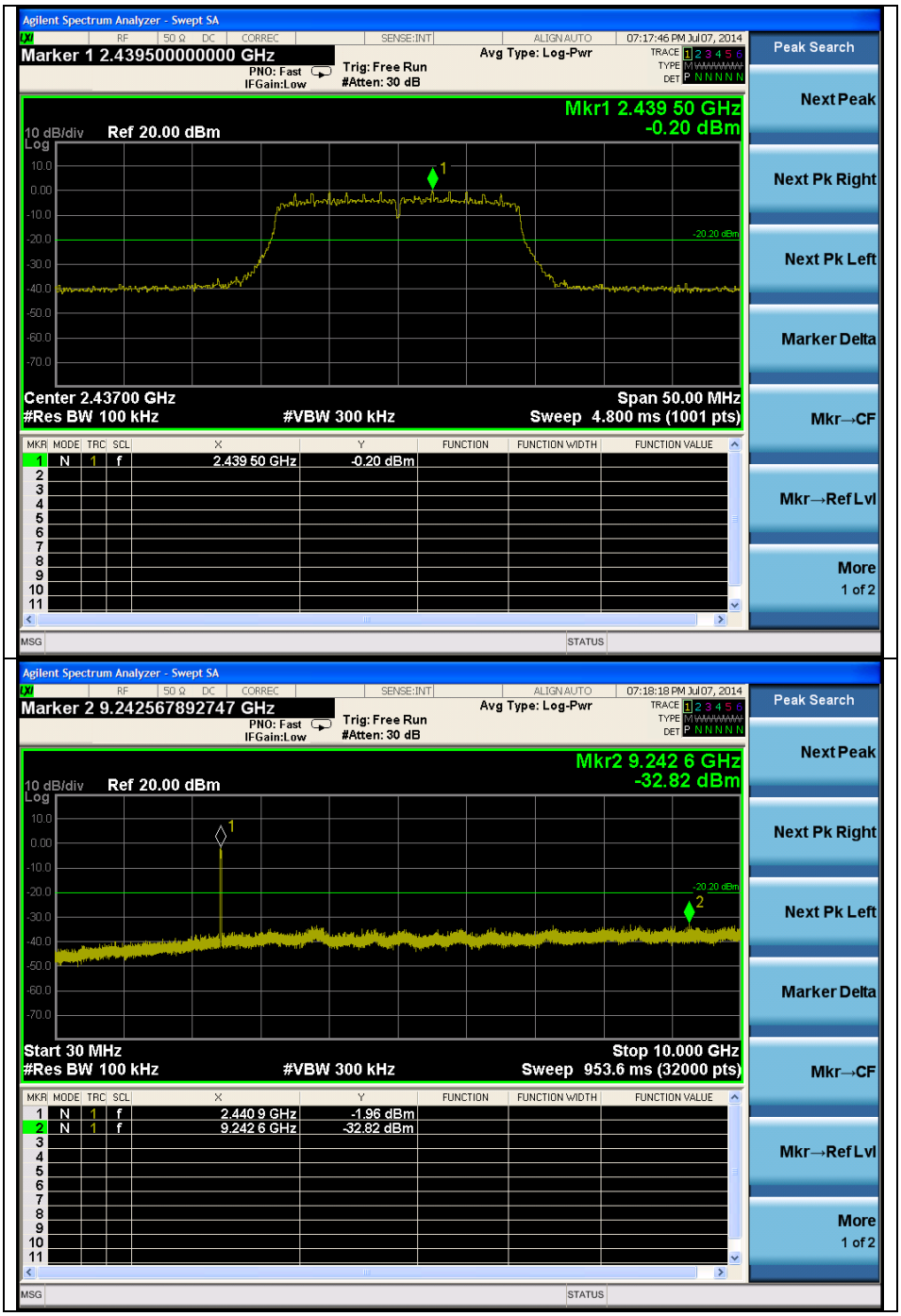
OFDM : 802.11n_HT20(MCS0)

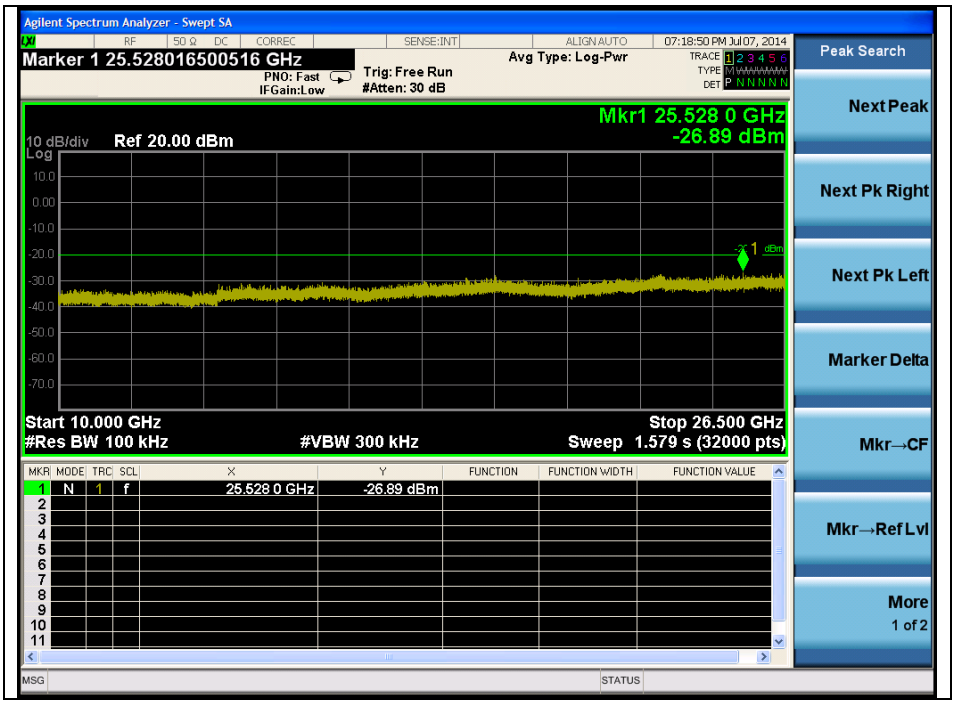
Low Channel



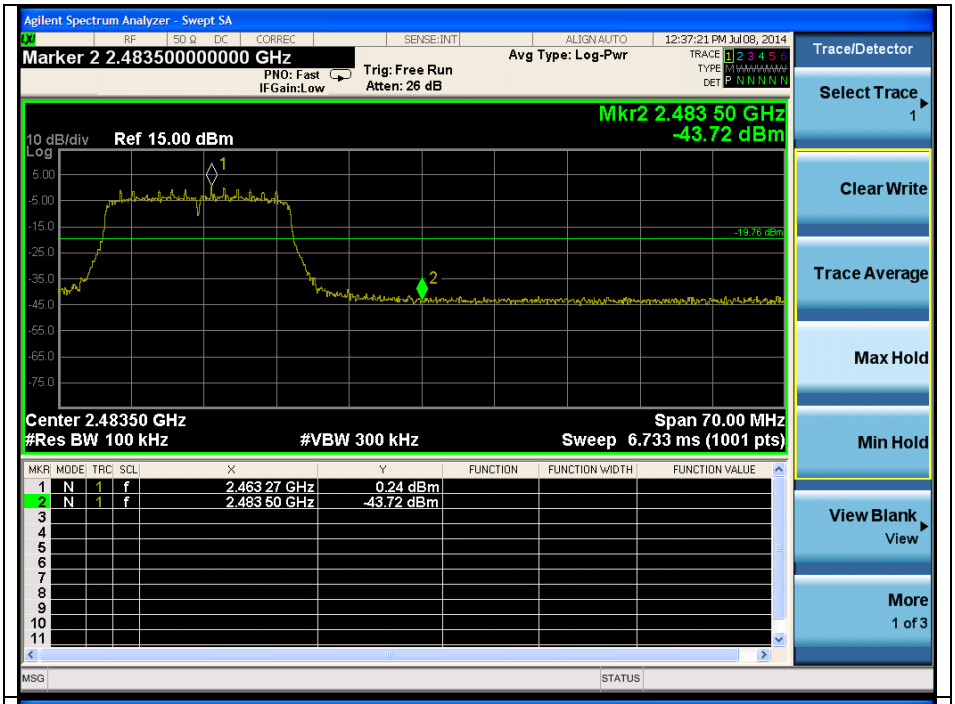


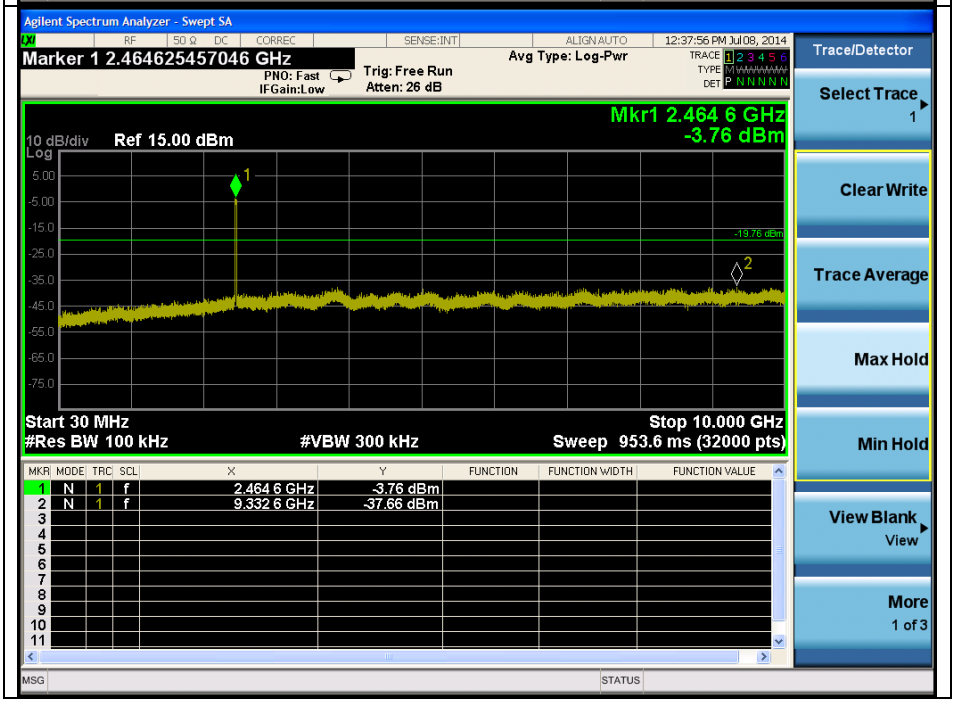
Middle Channel

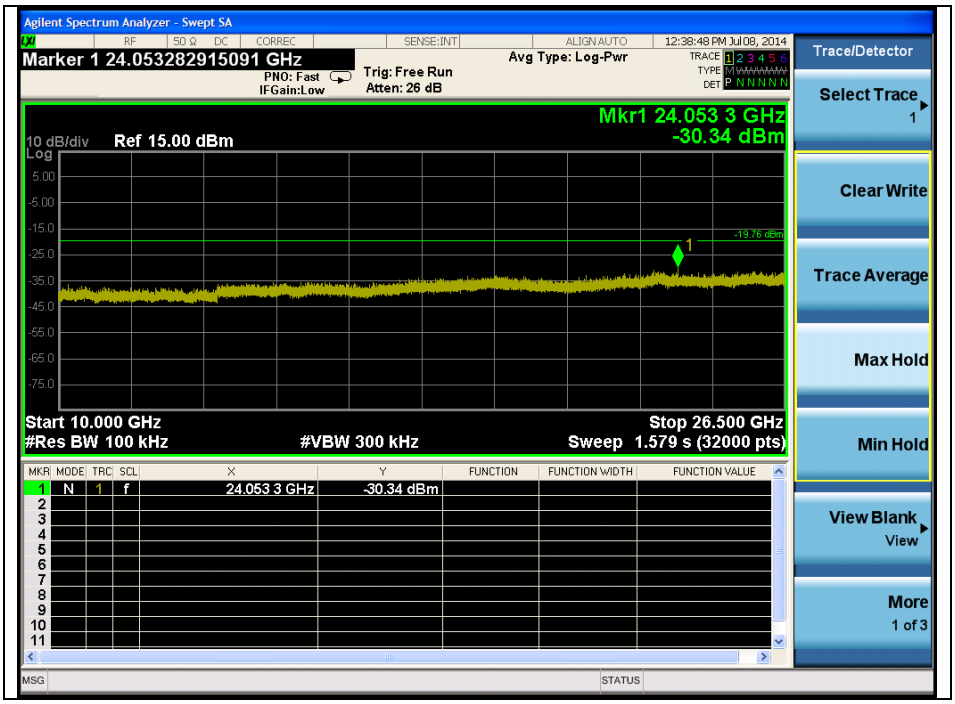




High Channel

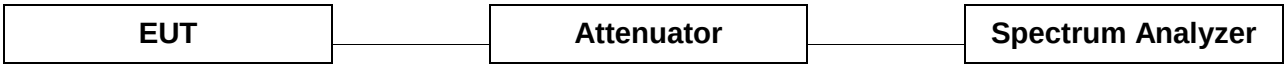






3. 6 dB Bandwidth Measurement

3.1. Test Setup



3.2. Limit

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 ~ 928 ㎒, 2 400 ~ 2 483.5 ㎒, and 5 725 ~ 5 825 ㎒ bands. The minimum of 6 dB Bandwidth shall be at least 500 ㎑

3.3. Test Procedure

3.3.1. 6 dB Bandwidth

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

The test follows section 8.0 of FCC KDB Publication 558074_v03r02
Tests performed using section 8.1 Option 1.

- Option 1:
1. Set RBW = 100 ㎑
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude point (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

3.4. Test Results

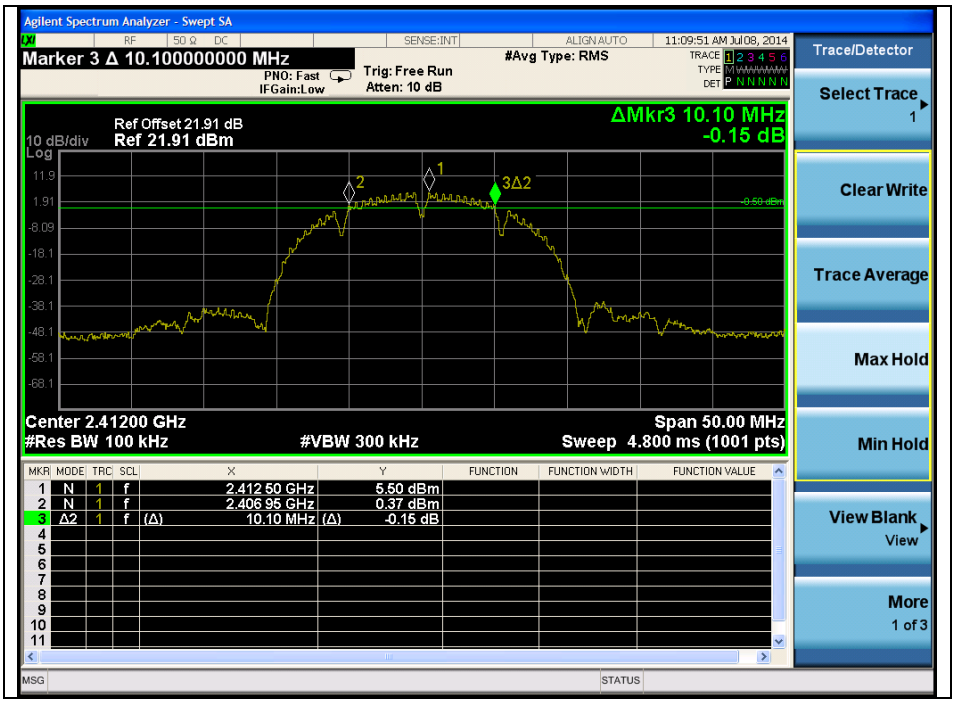
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Mode	Frequency (㎒)	Ch.	Data Rate	6 ㏈ Bandwidth (㎒)
11b	2 412	1	1	10.10
	2 437	6	1	10.10
	2 462	11	1	10.15
11g	2 412	1	6	16.40
	2 437	6	6	16.35
	2 462	11	6	16.35
11n_HT20	2 412	1	MCS0	17.50
	2 437	6	MCS0	17.50
	2 462	11	MCS0	17.30

6 dB Bandwidth

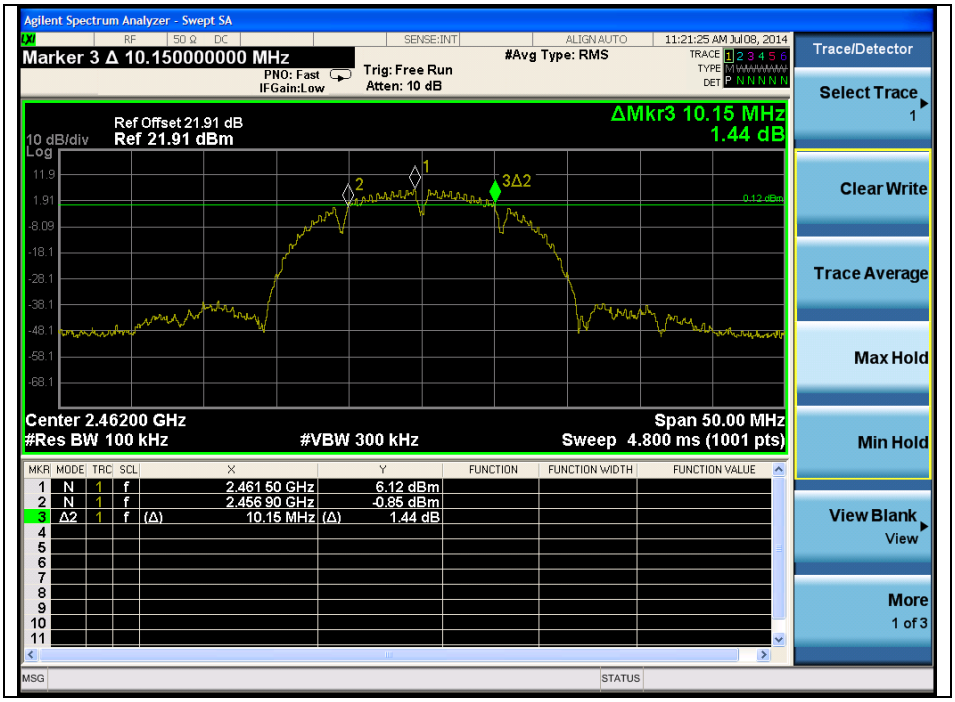
DSSS : 802.11b

Low Channel



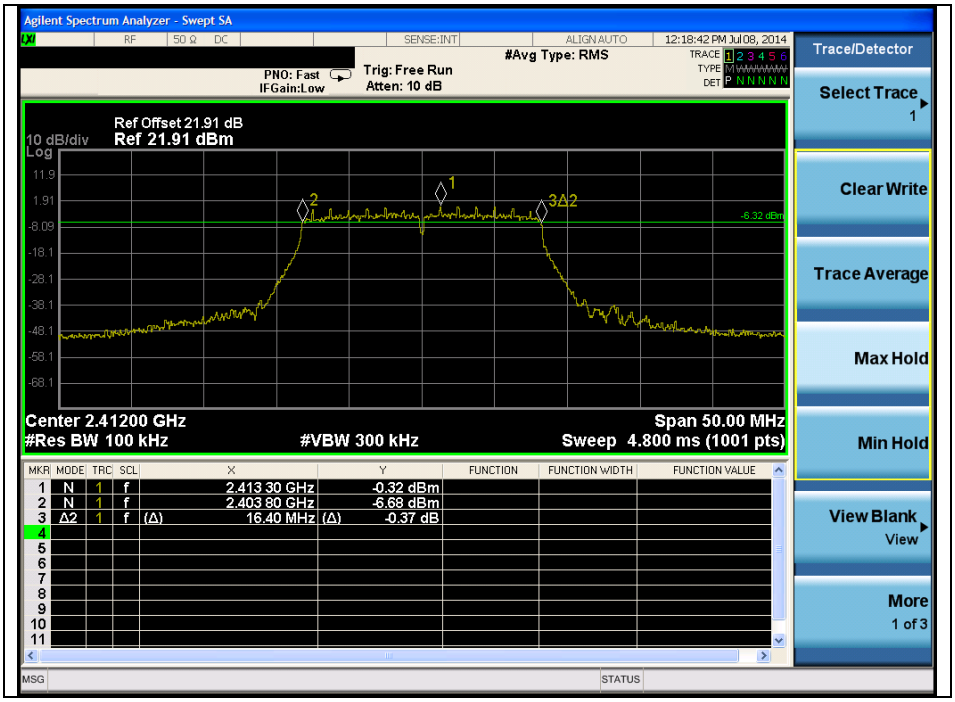
Middle Channel

High Channel

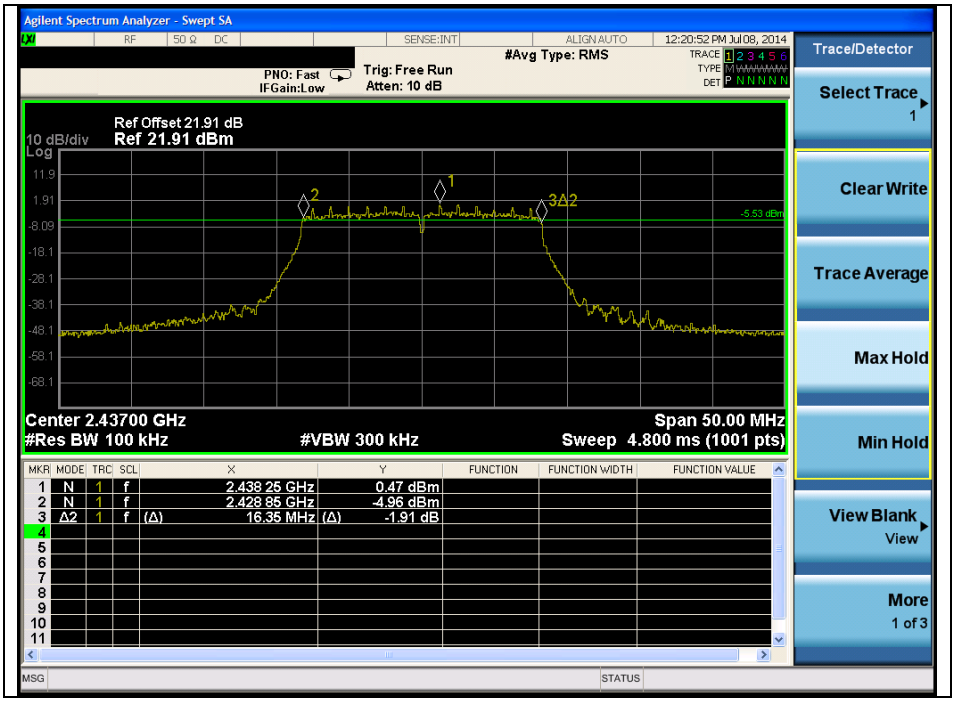


OFDM : 802.11g

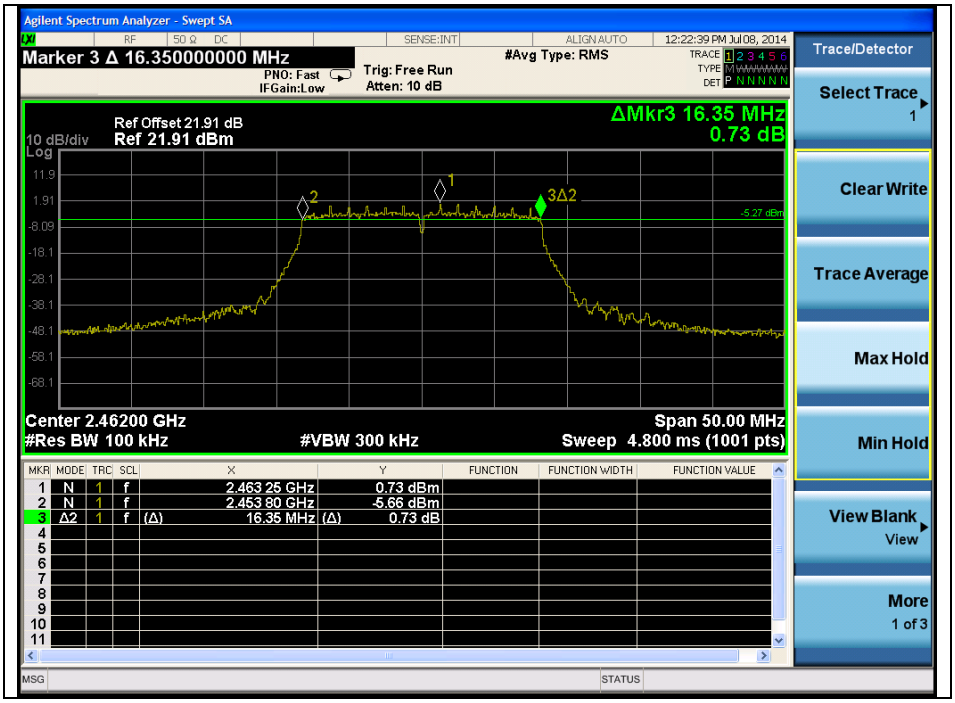
Low Channel



Middle Channel

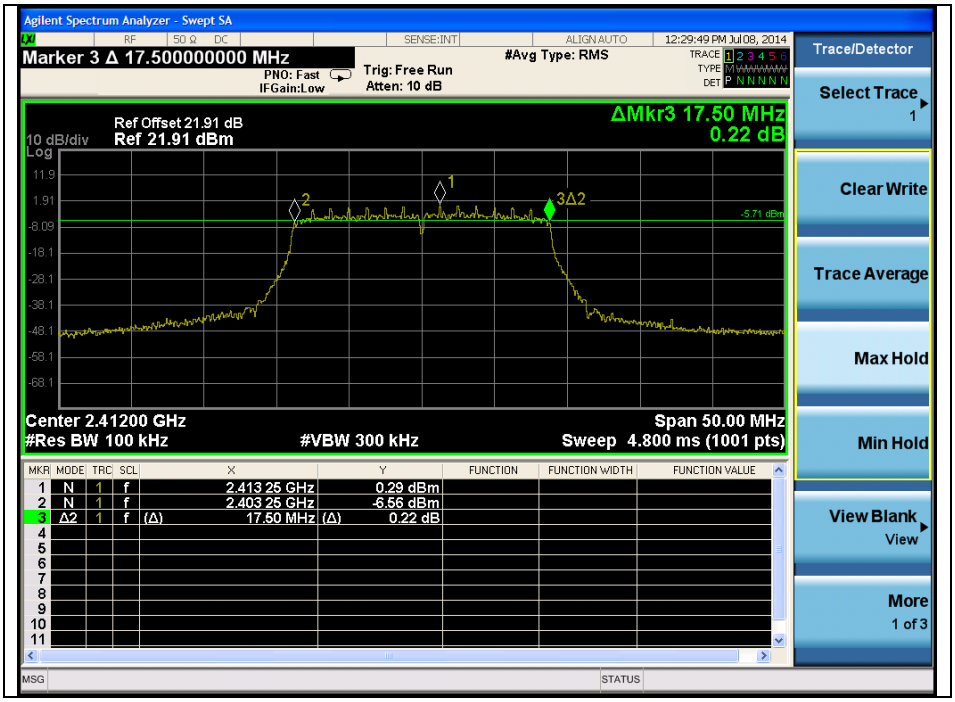


High Channel

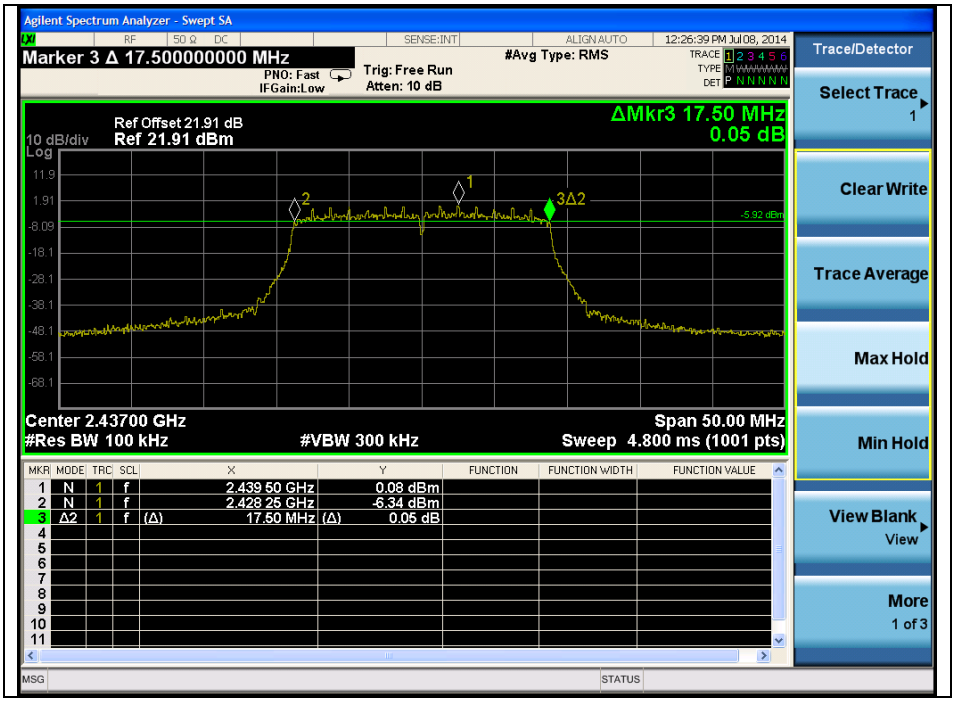


OFDM : 802.11n_HT20

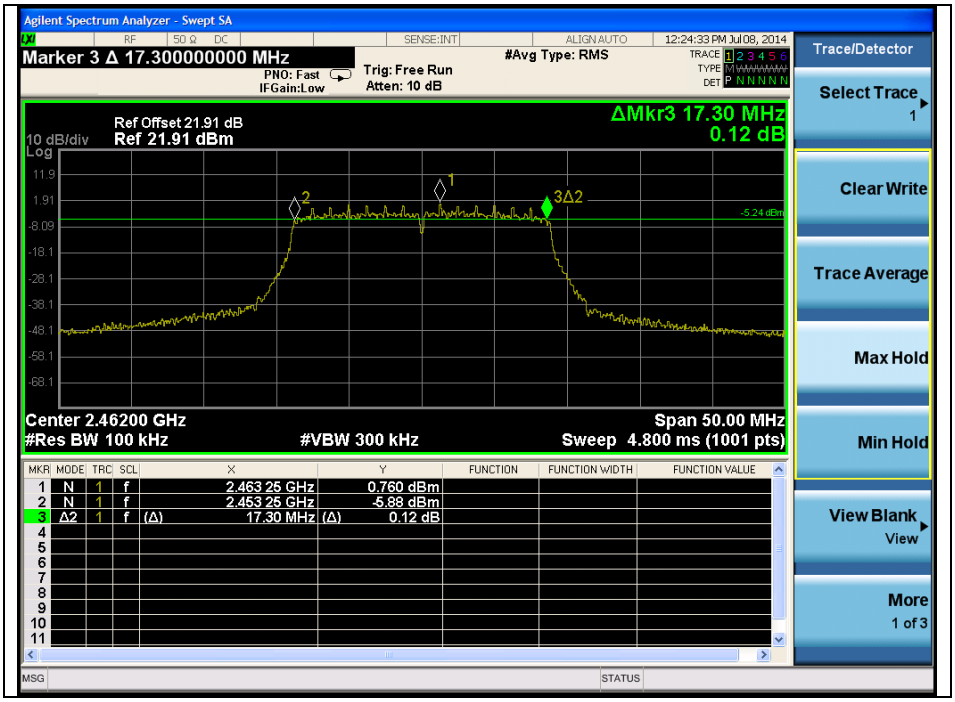
Low Channel



Middle Channel

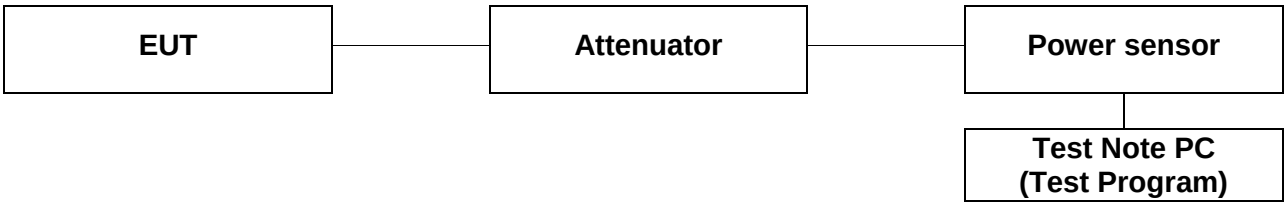


High Channel



4. Maximum Peak Output Power Measurement

4.1. Test Setup



4.2. Limit

According to §15.247(b)(3), for systems using digital modulation in the 902 ~ 928 ㎒, 2 400 ~2 483.5 ㎒, and 5 725 ~ 5 850 ㎒ band: 1 Watt. As an alternative to a peak power measurement, compliance with the one watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antenna elements. The average must not include any intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to §15.247(b)(4), the conducted output power limit specified in paragraph(b) of this section is based on the use of antenna with directional gains that do not exceed 6 ㏈i. Except as shown in paragraph(c) of this section, if transmitting antenna of directional gain greater than 6 ㏈i are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in ㏈ that the directional gain of the antenna exceeds 6㏈i.

4.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

The test follows section 9.1.2 & 9.2.3.1 of FCC KDB Publication 558074_v03r02

- Peak power meter method

-The maximum peak conducted output power can be measured using a broad band 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

- Average power meter method

- Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

1) The EUT is configured to transmit continuously, or to transmit with a constant duty factor.
2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

- If the transmitter does not transmit continuously, measure the duty cycle (x) of the transmitter output signal as described in Section 6.0 of KDB 558074_v03r02.

- Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

-Adjust the measurement in dBm by adding 10 log (1/x), where x is the duty cycle to the measurement result.

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the broadband power meter and power sensor.
   The power sensor employs a VBW = 65 ㎒ which is greater than the DTS bandwidth
3. Measure peak & average power each channel.

4.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

- 11b

Power	Frequency (㎒)	Conducted Power (㏈m)			
		Data Rate [Mbps]			
		1	2	5.5	11
Peak	2 412	18.49	18.45	18.39	18.43
Mea. Average		16.19	16.09	15.97	16.04
Result		16.19	16.13	16.01	16.17
Peak	2 437	18.56	18.44	18.37	18.51
Mea. Average		16.20	16.12	15.99	16.15
Result		16.20	16.16	16.03	16.28
Peak	2 462	18.61	18.56	18.55	18.59
Mea. Average		16.30	16.25	16.19	16.16
Result		16.30	16.29	16.23	16.29

Mode	Duty cycle			
	Data Rate [Mbps]			
11b	1	2	5.5	11
Duty Cycle (%)	100	99	99	97
Correction factor (dB)	0	0.04	0.04	0.13

Remark:
1. Result (㏈m) = Average (㏈m) + Correction factor (㏈)
2. Duty cycle (%) = (Tx on time / Tx on + off time) x 100
3. Correction factor (㏈) = 10 log (1/duty cycle (㎳))

- 11g

Power	Frequency (㎒)	Conducted Power (㏈m)							
		Data Rate [Mbps]							
		6	9	12	18	24	36	48	54
Peak	2 412	21.96	21.83	21.79	21.93	21.90	21.95	21.63	21.91
Mea. Average		11.95	11.80	11.82	11.80	11.74	11.61	11.55	11.47
Result		12.04	11.89	11.95	12.02	12.01	12.02	12.06	12.03
Peak	2 437	22.21	21.54	21.67	21.56	22.01	22.12	21.63	22.19
Mea. Average		11.98	11.77	11.76	11.81	11.76	11.63	11.57	11.46
Result		12.07	11.86	11.89	12.03	12.03	12.04	12.08	12.02
Peak	2 462	22.31	22.13	21.94	21.60	22.23	21.76	21.90	22.12
Mea. Average		12.12	12.05	11.98	11.96	11.85	11.78	11.68	11.63
Result		12.21	12.14	12.11	12.18	12.12	12.19	12.19	12.19

Mode	Duty cycle							
	Data Rate [Mbps]							
11g	6	9	12	18	24	36	48	54
Duty Cycle (%)	98	98	97	95	94	91	89	88
Correction factor (dB)	0.09	0.09	0.13	0.22	0.27	0.41	0.51	0.56

Remark:
1. Result (㏈m) = Average (㏈m) + Correction factor (㏈)
2. Duty cycle (%) = (Tx on time / Tx on + off time) x 100
3. Correction factor (㏈) = 10 log (1/duty cycle (㎳))

- 11n_HT20

Power	Frequency (㎒)	Conducted Power (㏈m)							
		Data Rate [MCS]							
		0	1	2	3	4	5	6	7
Peak	2 412	23.13	21.73	22.02	21.75	21.50	22.04	23.02	22.31
Mea. Average		11.80	11.57	11.54	11.47	11.40	11.37	11.32	11.26
Result		11.89	11.70	11.76	11.79	11.81	11.88	11.88	11.86
Peak	2 437	23.11	21.79	22.01	21.78	21.89	22.05	23.09	22.39
Mea. Average		11.86	11.60	11.56	11.62	11.50	11.42	11.38	11.33
Result		11.95	11.73	11.78	11.94	11.91	11.93	11.94	11.93
Peak	2 462	22.43	21.91	22.21	21.70	21.55	21.63	21.49	21.52
Mea. Average		11.92	11.79	11.74	11.63	11.55	11.50	11.43	11.40
Result		12.01	11.92	11.96	11.95	11.96	12.01	11.99	12.00

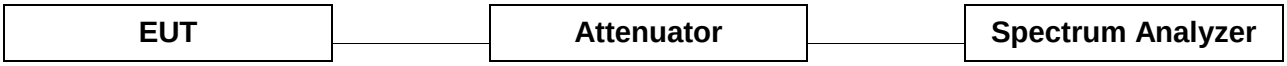
Mode	Duty cycle							
	Data Rate [MCS]							
11n_HT20	0	1	2	3	4	5	6	7
Duty Cycle (%)	98	97	95	93	91	89	88	87
Correction factor (㏈)	0.09	0.13	0.22	0.32	0.41	0.51	0.56	0.60

Remark:

1. Result (㏈m) = Average (㏈m) + Correction factor (㏈)
2. Duty cycle (%) = (Tx on time / Tx on + off time) x 100
3. Correction factor (㏈) = 10 log (1/duty cycle (㎳))

5. Power Spectral Density Measurement

5.1. Test Setup



5.2. Limit

§15.247(e) For digitally modulated system, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 ㏈ m in any 3 ㎑ band any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

The measurements are recorded using the PKPSD measurement procedure in section 10.2 of KDB 558074_v03r02.

- This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to at least 1.5 times the DTS bandwidth.
3. Set the RBW to : 3 ㎑ ≤ RBW ≤ 100 ㎑
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 ㎑) and repeat.

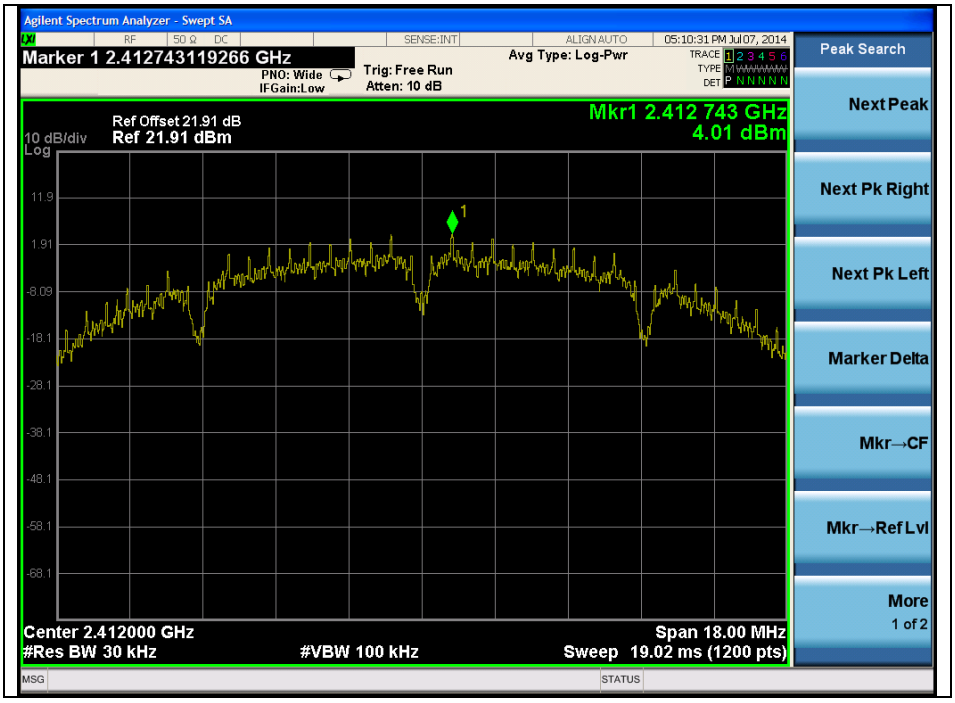
5.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

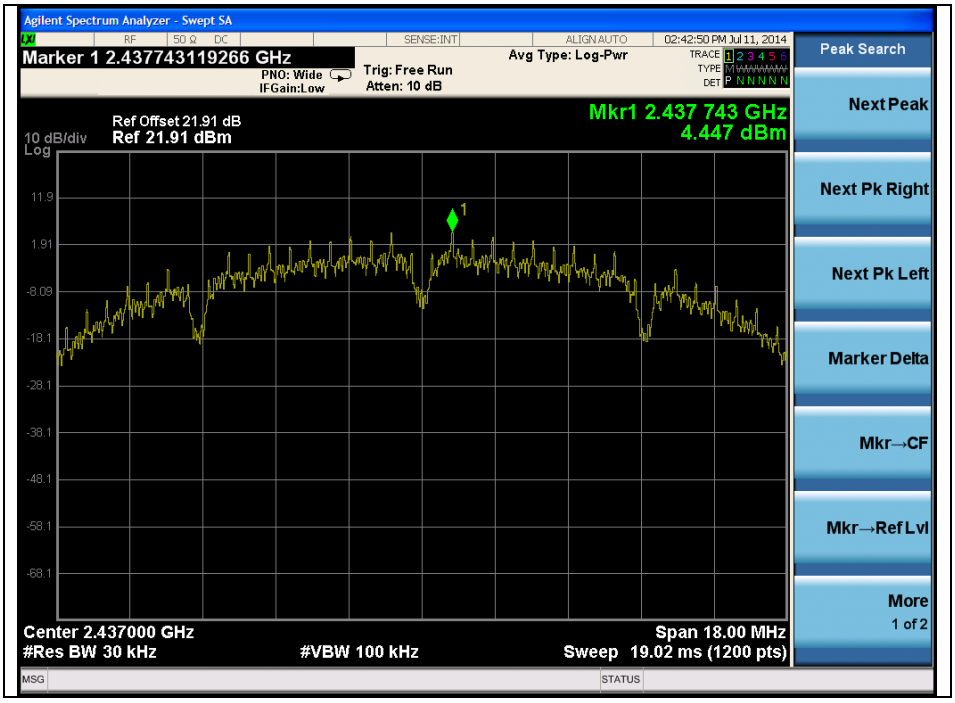
Mode	Frequency (㎒)	Ch.	Data Rate	Measured PSD (㏈m)	PSD Limit (㏈m / 3 ㎑)
11b	2 412	1	1	4.01	8
	2 437	6	1	4.45	8
	2 462	11	1	5.10	8
11g	2 412	1	6	-4.74	8
	2 437	6	6	-5.06	8
	2 462	11	6	-4.77	8
11n_HT20	2 412	1	MCS0	-5.34	8
	2 437	6	MCS0	-5.21	8
	2 462	11	MCS0	-4.74	8

DSSS : 802.11b

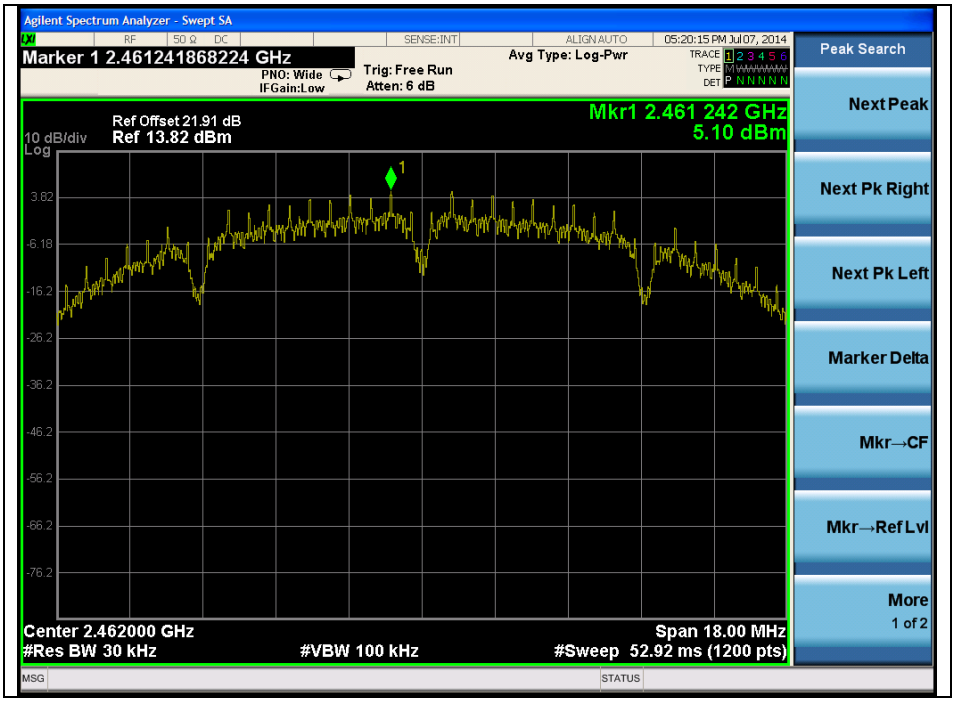
Low Channel



Middle Channel

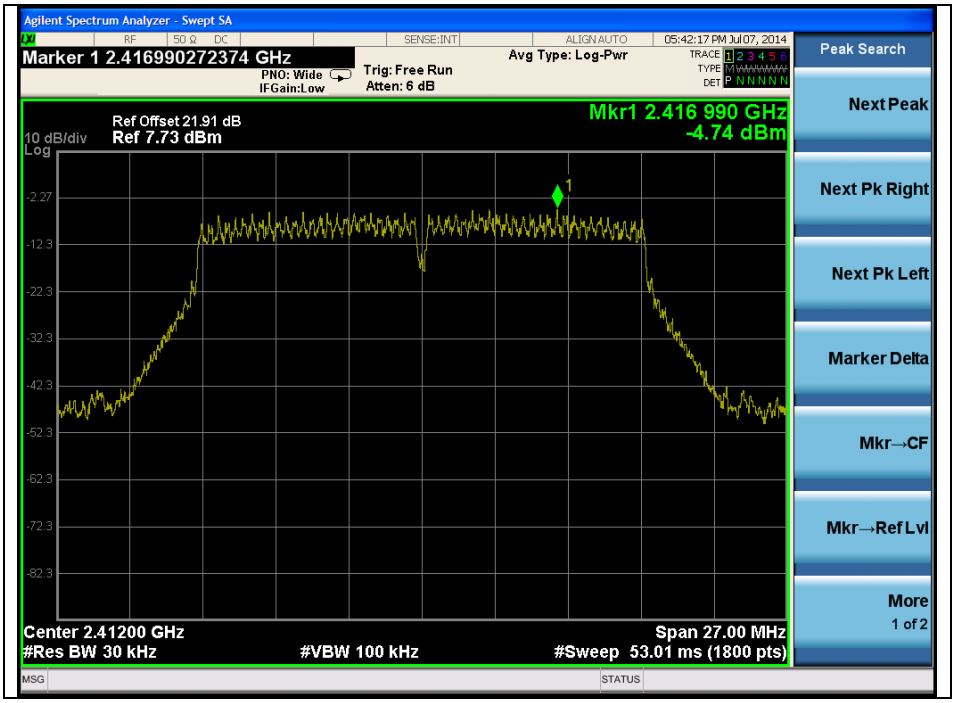


High Channel

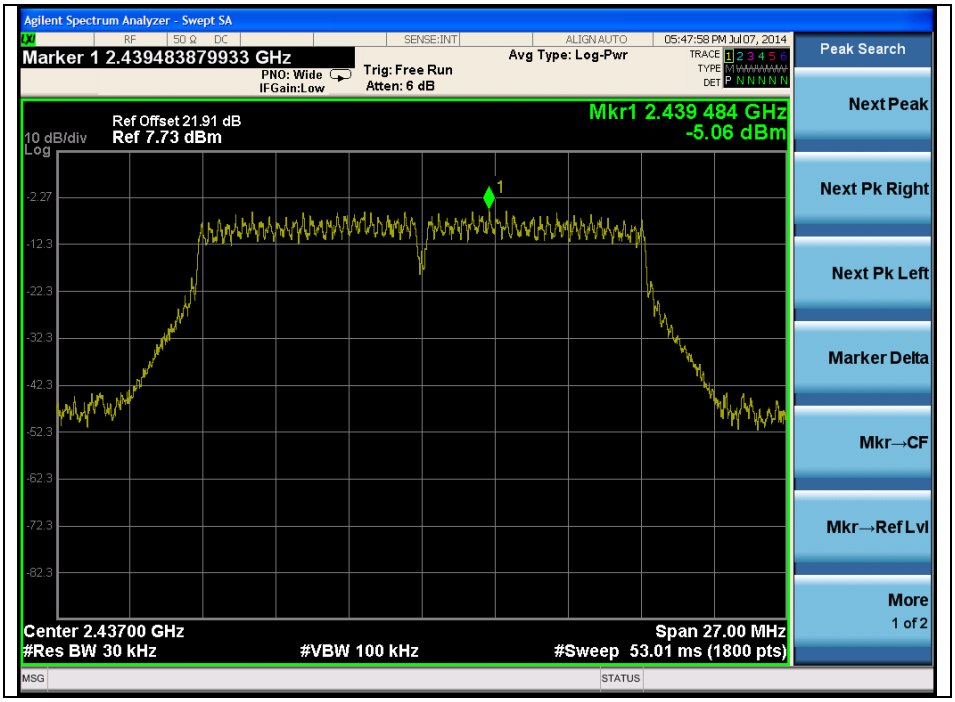


OFDM : 802.11g

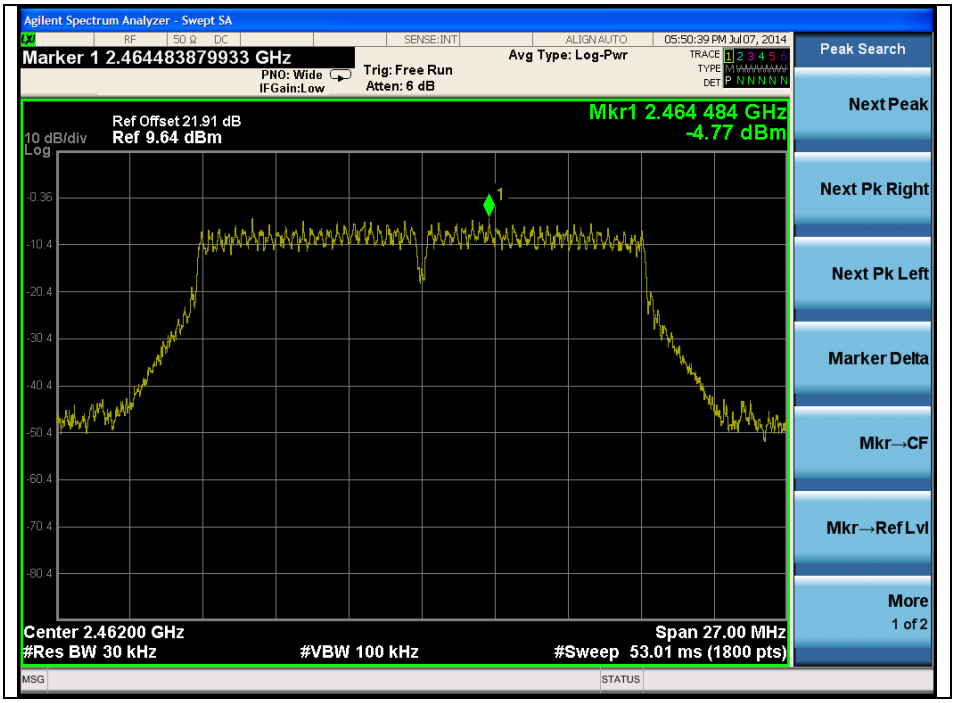
Low Channel



Middle Channel

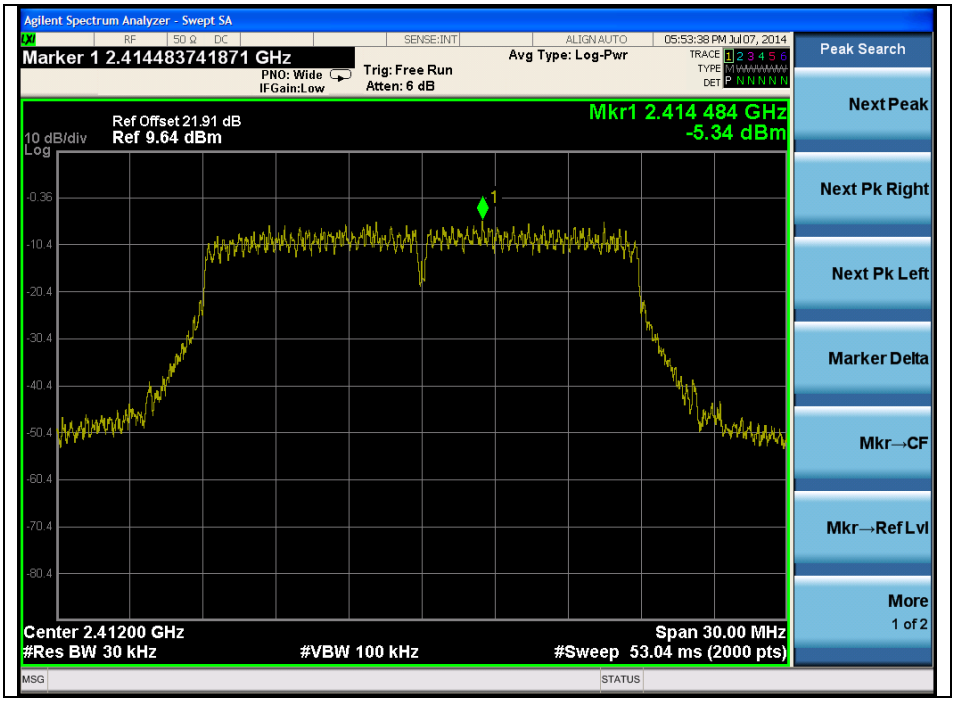


High Channel

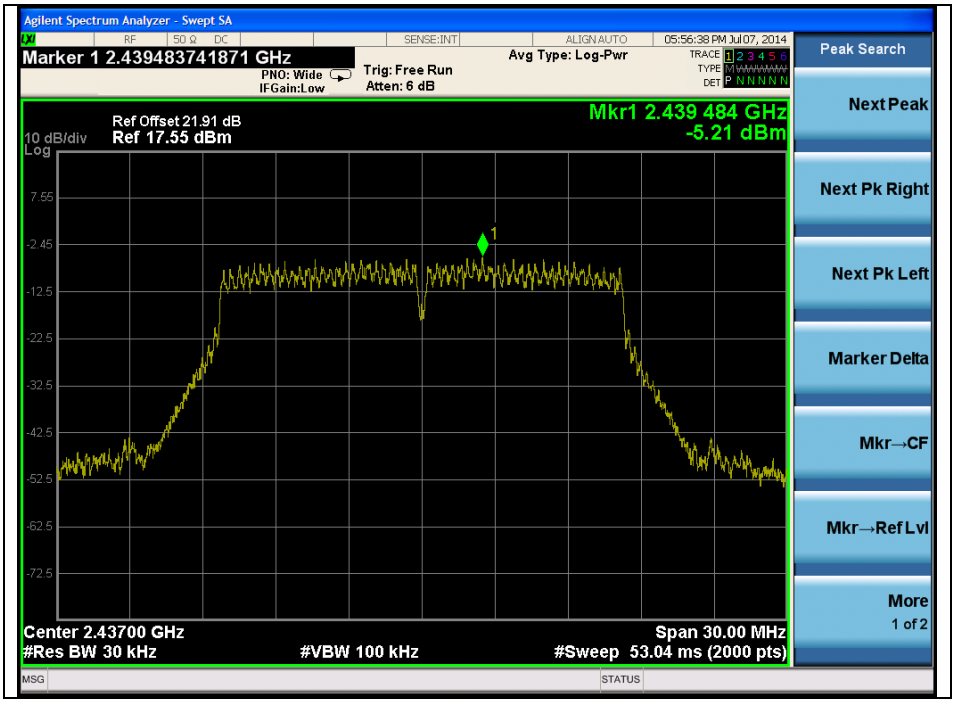


OFDM : 802.11n_HT20

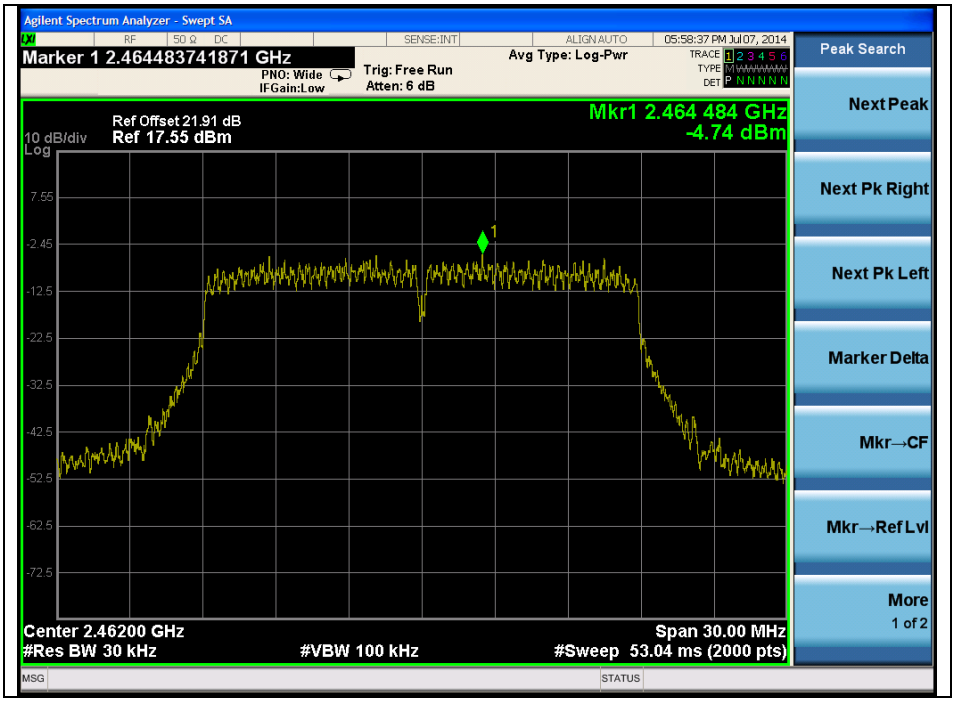
Low Channel



Middle Channel



High Channel



6. Antenna Requirement

6.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §15.203, 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. And according to FCC 47 CFR Section §15.247 (b) if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi.

6.2. Antenna Connected Construction

Antenna used in this product is patch type with gain of 1.94 dBi.