TEST REPORT

of

FCC Part 15 Subpart E §15.407
FCC ID: U7XM3ORANGE

Equipment Under Test	:	Industrial PDA phone
Model Name	:	M3 ORANGE
The addition of model name	:	CR4100
Serial No.	:	N/A
Applicant	:	M3 Mobile
Manufacturer	:	M3 Mobile
Date of Test(s)	:	2010. 08. 25 ~ 2010. 11. 15
Date of Issue	:	2010. 11. 15

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

Tested By: Grant Lee **Date** 2010. 11. 15

Approved By: Feel Jeong **Date** 2010. 11. 15

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1. General information

1.1. Testing laboratory

SGS Testing Korea Co., Ltd.
- Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040
- 705, Dongcheon-dong Suji-gu, Yongin-si, Gyeonggi-do, Korea.
www.electrolab.kr.sgs.com
Phone No. : +82 +31 428 5700
Fax No. : +82 +31 427 2371

1.2 Details of applicant

Applicant : M3 Mobile
Address : Dongwon-Bldg, 725-30 Yeoksam-Dong, Gangnam-Gu, Seoul, Korea
Contact Person : Jooheon Kwon
Phone No. : +82 +2 2022-1328

1.3 Description of EUT

Kind of Product	Industrial PDA phone
Model Name	M3 ORANGE (the addition of model name : CR4100)
Serial Number	N/A
Power Supply	DC 3.7 V (Li-Ion Battery)
Frequency Range	2 412 ㎒ ~ 2 462 ㎒ (11b/g) 5 745 ㎒ ~ 5 825 ㎒ (11a) 5 180 ㎒ ~ 5 240 ㎒ (11a – Non DFS) 5 260 ㎒ ~ 5 320 ㎒ (DFS) 5 500 ㎒ ~ 5 700 ㎒ (DFS)
Modulation Technique	DSSS, OFDM
Number of Channels	11 channel(11b/g), 5 channel(11a), 4 channel(11a – Non DFS), 4 channel (DFS_5 260 ㎒ ~ 5 320 ㎒), 11 channel (DFS_5 500 ㎒ ~ 5 700 ㎒)
Operating Conditions	-10 ~ 50℃
Antenna Type	Fixed type
Antenna Gain	0.73 ㏈i(11b/g), 2.04 ㏈i(11a), -3.44 ㏈i(11a – Non DFS), 2.04 ㏈i(11a -DFS),

- All models are exactly same for the hardware and software.

1.4. Description of test mode

- EUT is SLAVE without DFS and TPC
802.11a & (Non-DFS) mode:
We found out the test mode with the highest power level after we analyze all the data rates. So we choose 6 Mbps data rate (worst case) as a representative.

1.5. Test equipment list

Equipment	Manufacturer	Model	Cal Due.
Signal Generator	R&S	SMR40	Jul. 15, 2011
Spectrum Analyzer	R&S	FSV30	Aug. 09, 2011
Spectrum Analyzer	R&S	FSP40	Jul. 15, 2011
High Pass Filter	Wainwright Instrument GmbH	WHK6.0/18G-11SS	Sep. 29, 2011
Attenuator	Agilent	8494B	Apr. 02, 2011
DC Power Supply	Agilent	U8002A	Jan. 06, 2011
Two-Lie V-network	R & S	ENV216	Jan. 06, 2011
Test Receiver	R & S	ESHS10	Jul. 13, 2011
Test Receiver	R & S	ESU26	Apr. 08, 2011
Preamplifier	H.P	8447F	Jul. 05, 2011
Preamplifier	H.P	8449B	Apr. 01, 2011
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	Jul. 22, 2011
Horn Antenna	SCHWARZBECK MESSELEKTRONIK	BBHA 9170	Mar. 17, 2012
Horn Antenna	R&S	HF906	Oct. 08, 2011
Anechoic Chamber	SY Corporation	L x W x H (6.5 m x 3.5 m x 3.5 m)	N.C.R.
Anechoic Chamber	SY Corporation	L x W x H (9.6 m x 6.4 m x 6.6 m)	Jan. 27, 2011

▶ Support equipment

Description	Manufacturer	Model	Serial Number
Access Point(master)	Cisco	AIR-AP1242AG-K-K9	FHK1034407S
Notebook	IBM	T43	2669CC8

1.7. Summary of test result

The EUT has been tested according to the following specifications:

Applied standard : FCC Part15 subpart E		
Standard section	**Test Item**	**Result**
15.205(a) 15.209(a) 15.407(b)(1)	Transmitter radiated spurious emissions and Conducted spurious emission	Complied
15.407(a)(1)	Output power	Complied
15.407(a)(1)	Peak power spectral density	Complied
15.407(a)(1)	Peak excursion	Complied
15.207	Transmitter AC power line conducted emission	Complied
15.407(h)	DFS -Channel closing transmission time -Channel move time -Non occupied period	Complied

1.8. Test report revision

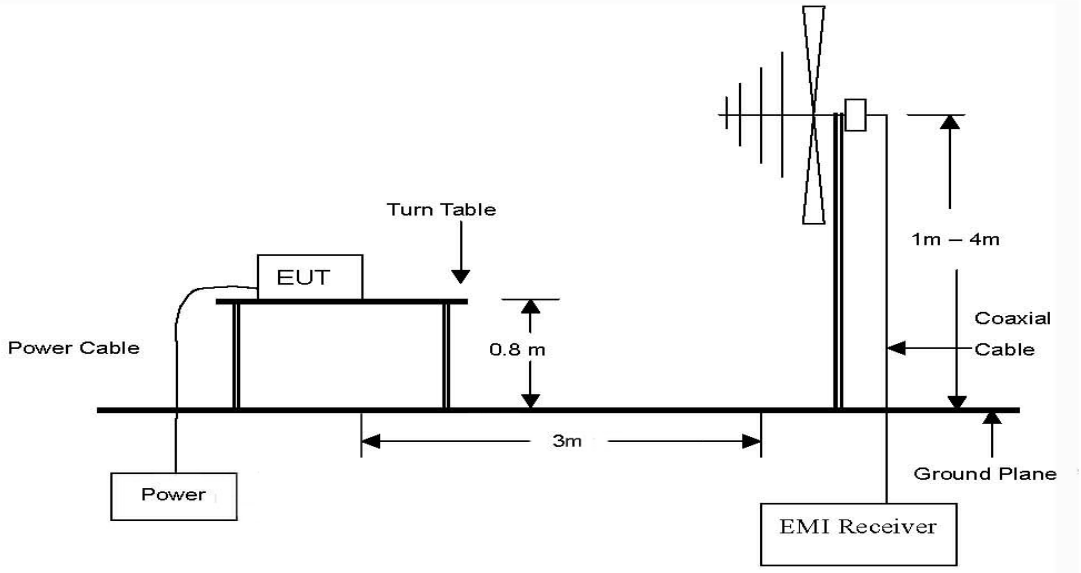
Revision	Report number	Description
0	F690501/RF-RTL004283	Initial

2. Transmitter radiated spurious emissions and conducted spurious emission

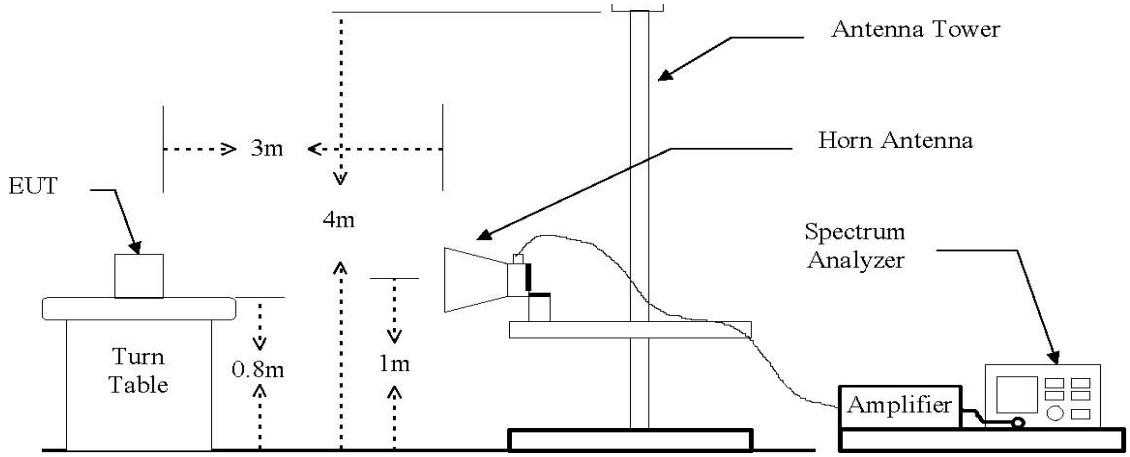
2.1. Test setup

2.1.1. Transmitter radiated spurious emissions

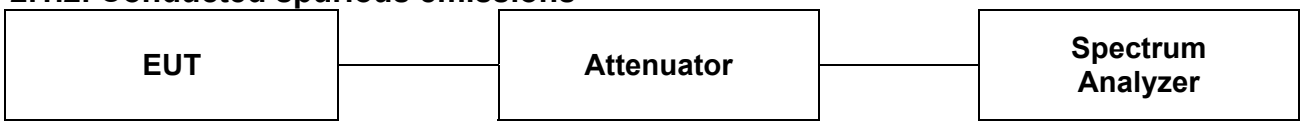
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to 40 ㎓ Emissions.



2.1.2. Conducted spurious emissions



2.2. Limit

For transmitters operating in the 5.15 ~ 5.25 ㎓ band : all emissions outside of the 5.15 ~ 5.35 ㎓ band shall not exceed an EIRP of -27 ㏈m

For transmitters operating in the 5.25–5.35 ㎓ band: all emissions outside of the 5.15–5.35 ㎓ band shall not exceed an EIRP of –27 ㏈m/㎒. Devices operating in the 5.25–5.35 ㎓ band that generate emissions in the 5.15–5.25 ㎓ band must meet all applicable technical requirements for operation in the 5.15–5.25 ㎓ band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of –27 ㏈m/㎒ in the 5.15–5.25 ㎓ band.

For transmitters operating in the 5.47–5.725 ㎓ band: all emissions outside of the 5.47–5.725 ㎓ band shall not exceed an EIRP of −27 ㏈m/㎒.

2.3. Test procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

2.3.1. Test procedures for radiated spurious emissions

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 broadband 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*

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 ㎑ for Peak detection (PK) or Quasi-peak detection (QP) at frequency below 1 ㎓.

2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection and frequency above 1 ㎓.

3. The resolution bandwidth of test receiver/spectrum analyzer is 1 ㎒ and the video bandwidth is 10 ㎐ for Average detection (AV) at frequency above 1 ㎓.

2.3.2. Test procedures for conducted spurious emissions

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=1 ㎒, VBW=1 ㎒.

2.4. Test result

Ambient temperature : (24 ± 2) ℃
Relative humidity : 49 % R.H.

2.4.1. Spurious radiated emission

The frequency spectrum from 30 ㎒ to 1000 ㎒ was investigated. All emissions are not reported much lower than the prescribed limits.

Radiated emissions			Ant	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB uV)	Detect mode	Pol.	AF (dB/m)	Amp gain+CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
331.508	45.63	Peak	H	11.83	-25.26	32.20	46.00	13.80
340.470	54.47	Peak	H	12.09	-25.26	41.30	46.00	4.70
409.513	51.00	Peak	H	13.70	-25.60	39.10	46.00	6.90
721.489	46.14	Peak	H	18.80	-25.34	39.60	46.00	6.40
760.491	42.10	Peak	H	19.43	-25.23	36.30	46.00	9.70
Above 800.000	Not Detected							

▣ *Remark:*

1. All spurious emission at channels are almost the same below 1 ㎓, so that the channel was chosen at representative in final test.
2. Actual = Reading + AF + AMP + CL
3. To get a maximum emission level from the EUT, the EUT was moved throughout the X, Y and Z planes. The worst case is Y.

2.4.2. Spurious radiated emission for above 1 ㎓

802.11a (Non-DFS)

A. Low Channel (5 180 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Dis. (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 150.00*	28.70	Peak	V	33.50	7.55	-9.5	69.75	74.00	4.25
5 150.00*	15.40	Average	V	33.50	7.55	-9.5	46.95	54.00	7.05
Frequency (㎒)	**Reading (dB uV)**	**Detect Mode**	**Pol.**	**AF (dB/m)**	**Amp Gain +CL (dB)**	**Dis. (dB)**	**Actual (dB uV/m)**	**Limit (dB uV/m)**	**Margin (dB)**
10 360.00	50.32	Peak	V	37.10	-24.12	-9.5	54.30	74.00	19.70
10 360.00	34.34	Average	V	37.60	-24.12	-9.5	38.32	54.00	15.68
Above 10 400.00	Not Detected								

B. Middle Channel (5 220 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Dis. (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
10 440.00	48.94	Peak	V	37.59	-23.62	-9.5	53.40	74.00	20.60
10 440.00	34.32	Average	V	37.59	-23.62	-9.5	38.78	54.00	15.22
Above 10 500.00	Not Detected								

C. High Channel (5 240 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Dis. (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 350.00*	28.99	Peak	V	33.94	7.39	-9.5	60.82	74.00	13.19
5 350.00*	16.27	Average	V	33.94	7.39	-9.5	48.10	54.00	5.91
Frequency (㎒)	**Reading (dB uV)**	**Detect Mode**	**Pol.**	**AF (dB/m)**	**Amp Gain +CL (dB)**	**Dis. (dB)**	**Actual (dB uV/m)**	**Limit (dB uV/m)**	**Margin (dB)**
10 480.00	48.97	Peak	V	37.58	-24.00	-9.5	53.05	74.00	20.95
10 480.00	33.78	Average	V	37.58	-24.00	-9.5	37.86	54.00	16.14
Above 10 500.00	Not Detected								

802.11a (DFS)

A. Low Channel (5 260 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Dis. (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
10 520.00	48.58	Peak	V	37.59	-24.24	-9.5	52.43	74.00	21.57
10 520.00	33.96	Average	V	37.59	-24.24	-9.5	37.81	54.00	16.19
Above 10 600.00	Not Detected								

B. Middle Channel (5 300 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Dis. (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
10 600.00	49.11	Peak	V	37.62	-24.12	-9.5	53.11	74.00	20.89
10 600.00	33.69	Average	V	37.62	-24.12	-9.5	37.69	54.00	16.31
Above 10 700.00	Not Detected								

C. High Channel (5 320 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Dis. (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 350.00*	30.16	Peak	V	33.94	7.39	-9.5	61.99	74.00	12.02
5 350.00*	15.86	Average	V	33.94	7.39	-9.5	47.69	54.00	6.32
Frequency (㎒)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Dis. (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
10 640.00	49.06	Peak	V	37.68	-24.02	-9.5	53.22	74.00	20.78
10 640.00	34.00	Average	V	37.68	-24.02	-9.5	38.16	54.00	15.84
Above 10 700.00	Not Detected								

802.11a (DFS)

A. Low Channel (5 500 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Dis. (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 460.00*	29.20	Peak	V	34.01	7.99	-9.5	61.72	74.00	12.28
5 460.00*	14.80	Average	V	34.01	7.99	-9.5	47.30	54.00	6.70
Frequency (㎒)	**Reading (dB uV)**	**Detect Mode**	**Pol.**	**AF (dB/m)**	**Amp Gain +CL (dB)**	**Dis. (dB)**	**Actual (dB uV/m)**	**Limit (dB uV/m)**	**Margin (dB)**
11 000.00	46.26	Peak	V	38.26	-23.27	-9.5	51.75	74.00	22.25
11 000.00	31.29	Average	V	38.26	-23.27	-9.5	36.78	54.00	17.22
Above 11 100.00	Not Detected								

B. Middle Channel (5 600 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Dis. (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
11 200.00	45.11	Peak	V	38.22	-23.29	-9.5	50.54	74.00	23.46
11 200.00	30.89	Average	V	38.22	-23.29	-9.5	36.32	54.00	17.68
Above 11 300.00	Not Detected								

C. High Channel (5 700 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Dis. (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
11 400.00	44.81	Peak	V	38.22	-23.91	-9.5	49.62	74.00	24.38
11 400.00	30.89	Average	V	38.22	-23.91	-9.5	35.70	54.00	18.30
Above 11 500.00	Not Detected								

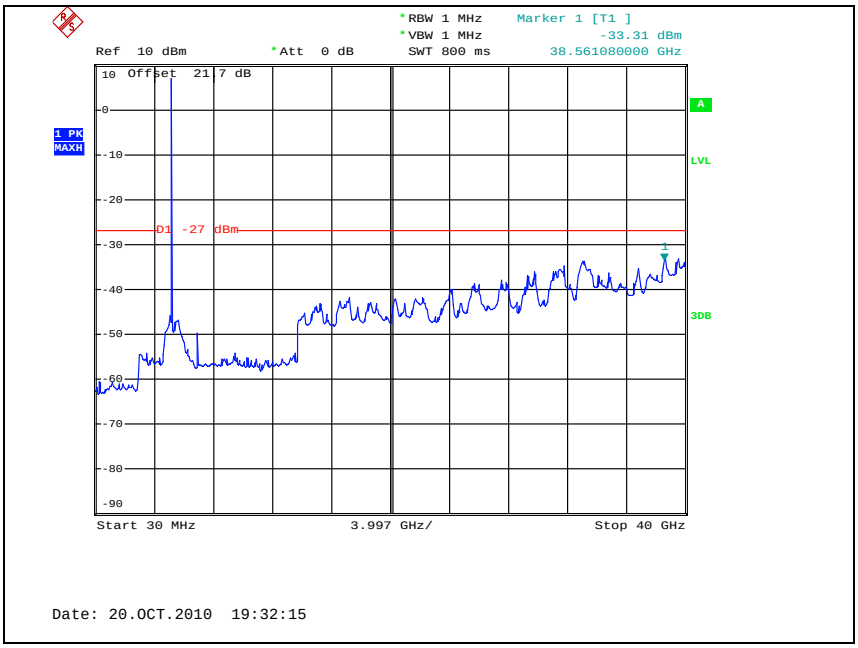
▣ *Remarks*

1. *"*" means the restricted band.*
2. *Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental Frequency.*
3. *Radiated emissions measured in frequency above 1000 ㎒ were made with an instrument using peak/average detector mode.*
4. *Average test would be performed if the peak result were greater than the average limit.*
5. *To get a maximum emission level from the EUT, the EUT was moved throughout the X, Y and Z planes. The worst case is Y.*
7. Spurious emission above 5 ㎓ measured 1 m away from EUT.
   Distance remuneration is – 9.5 ㏈. Ref.) 20 log (1/3) = -9.5

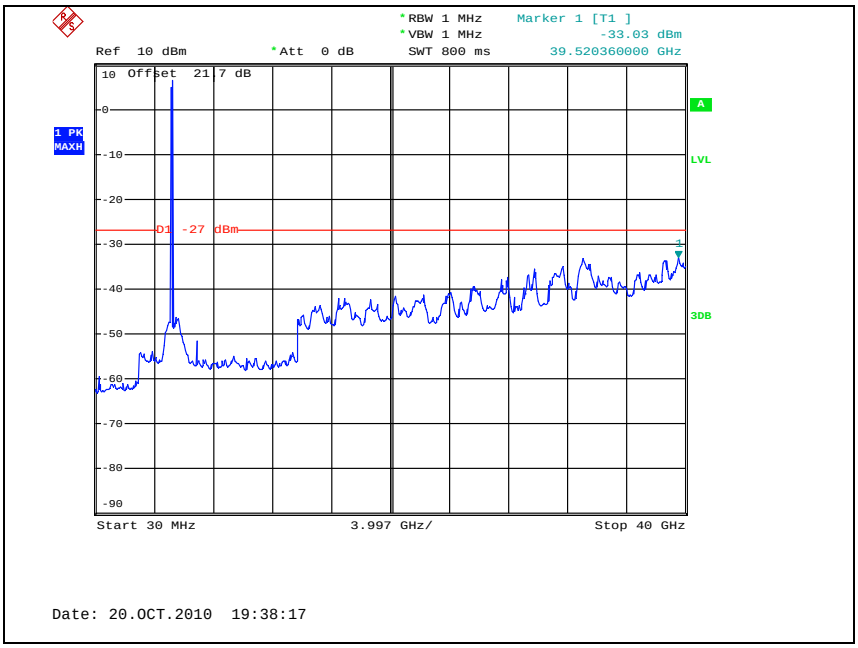
2.4.3. Spurious RF Conducted Emissions: Plot of Spurious RF Conducted Emission

802.11a (Non-DFS)

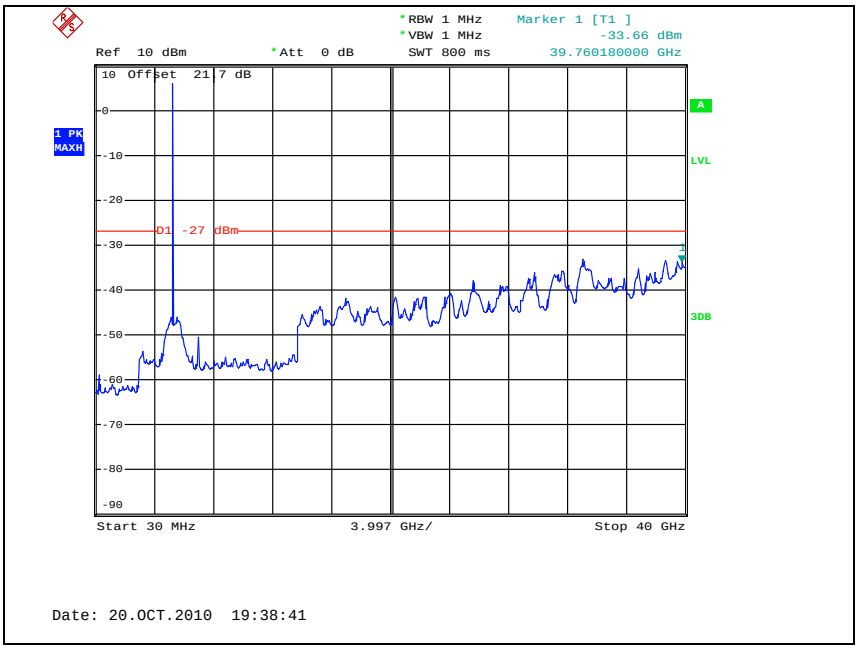
Low Channel (5 180 ㎒)



Middle Channel (5 220 ㎒)

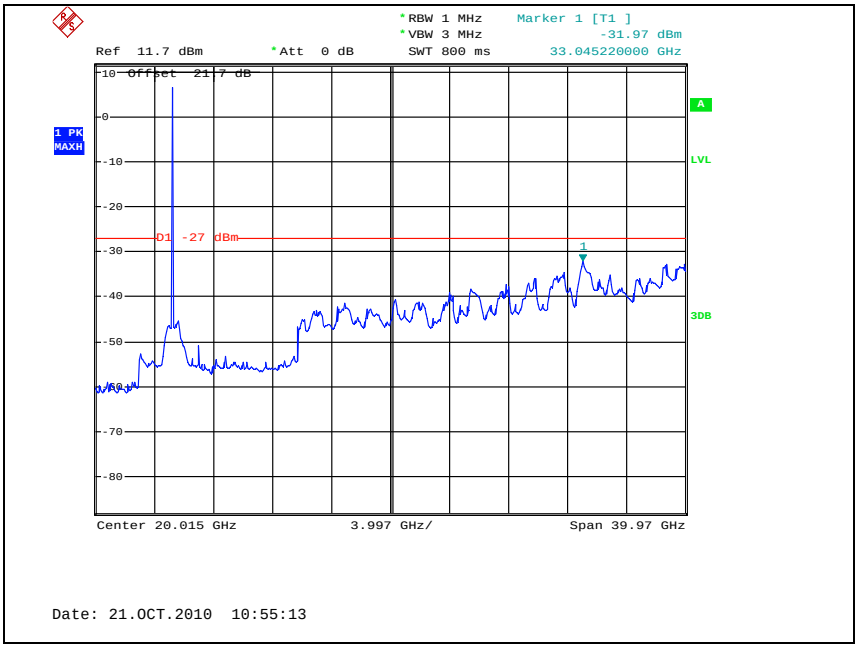


High Channel (5 240 ㎒)

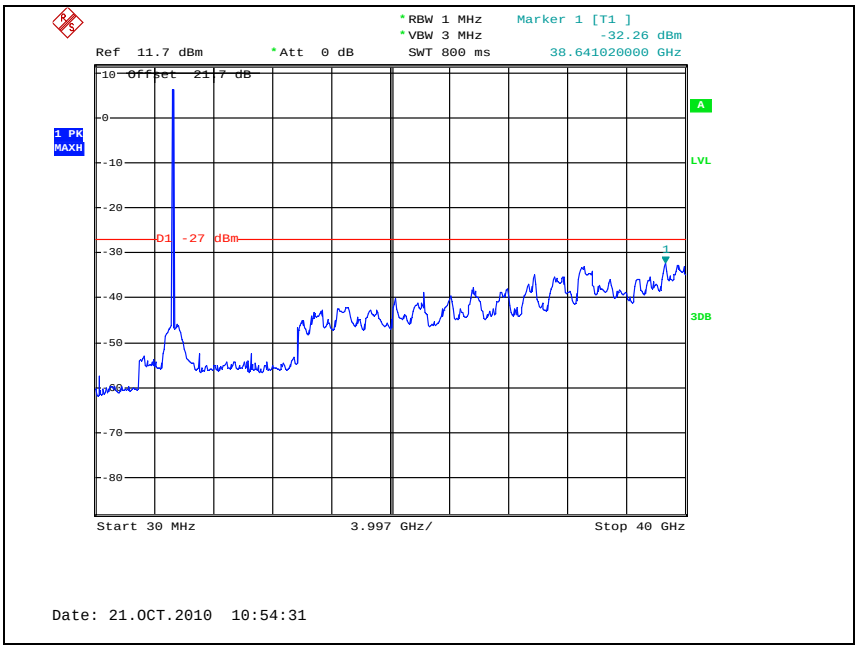


802.11a (DFS)

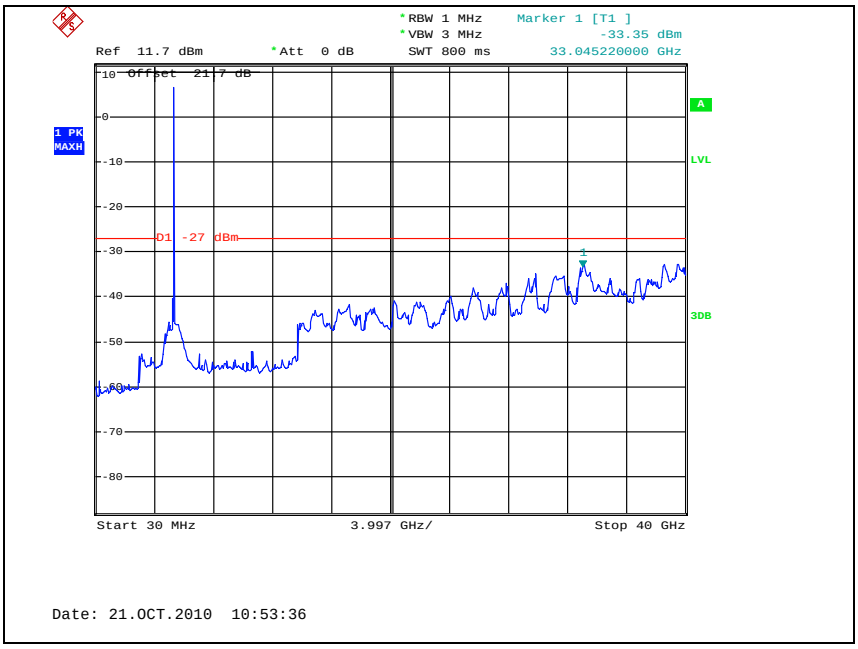
Low Channel (5 260 ㎒)



Middle Channel (5 300 ㎒)

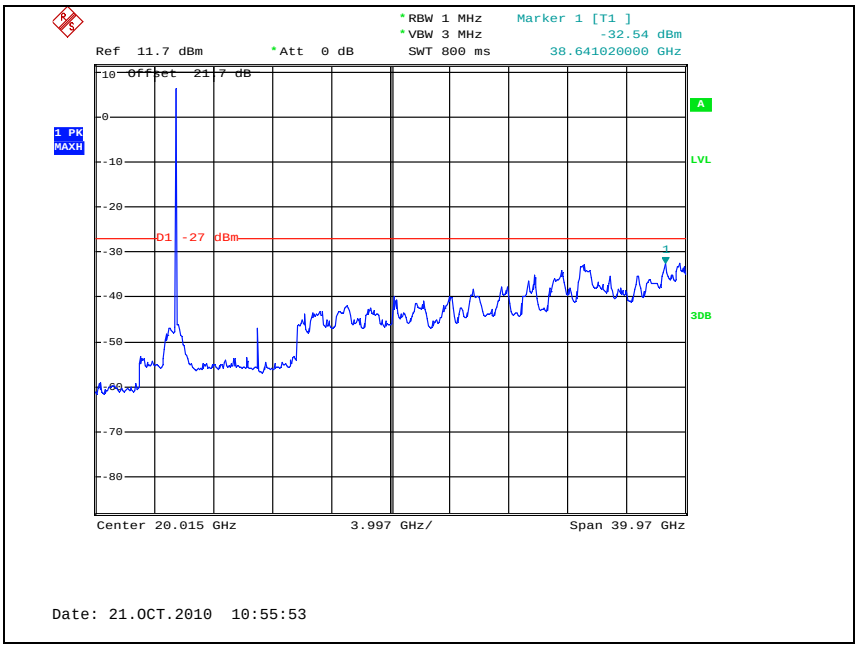


High Channel (5 320 ㎒)

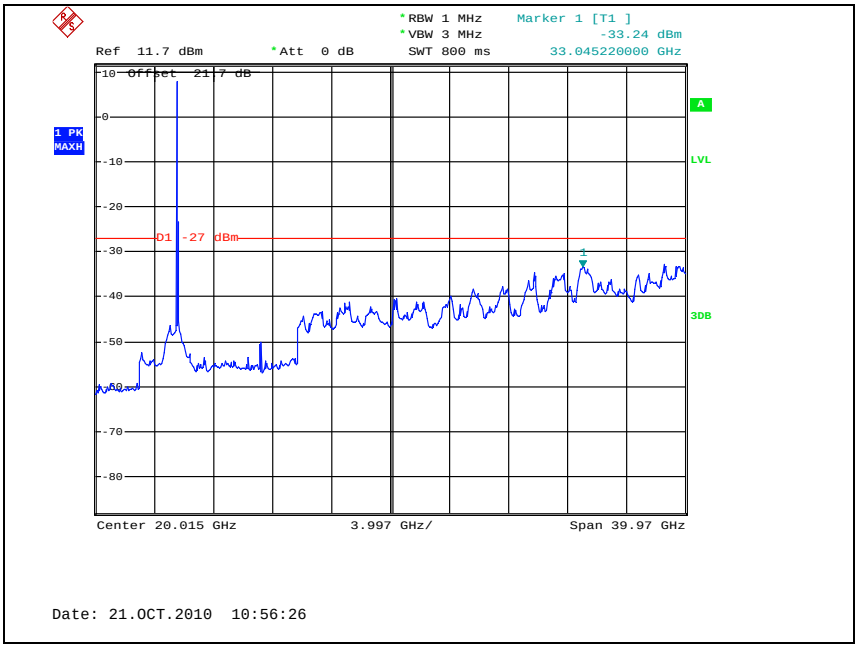


802.11a (DFS)

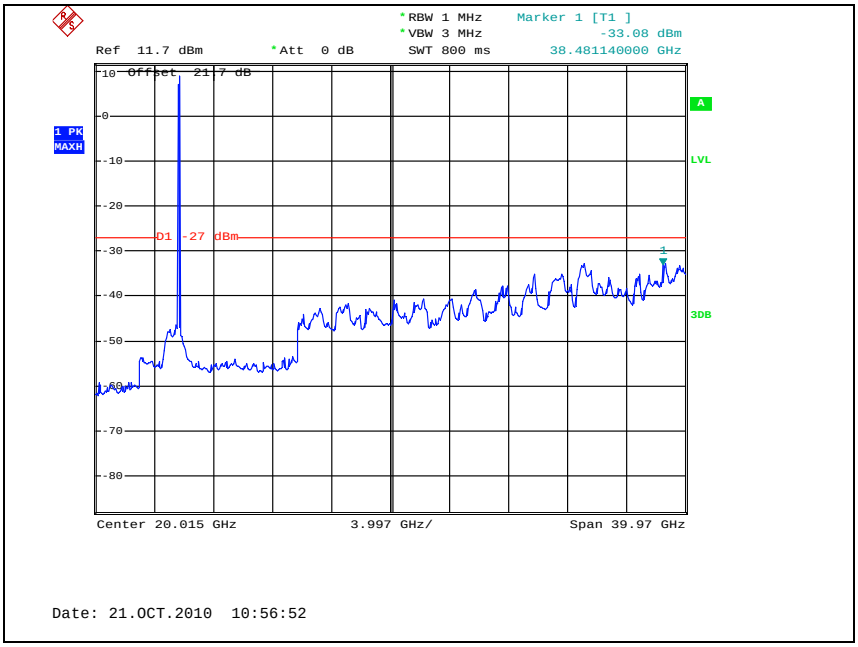
Low Channel (5 500 ㎒)



Middle Channel (5 600 ㎒)



High Channel (5 700 ㎒)



3. 26 dB bandwidth

3.1. Test setup

3.2. Limit

None; for reporting purpose only

3.3. Test procedure

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 spectrum analyzer.
3. Set the spectrum analyzer as RBW = 100 ㎑, VBW = RBW, Span = 100 ㎒, Sweep = auto.
4. Repeat until all the rest channels are investigated.

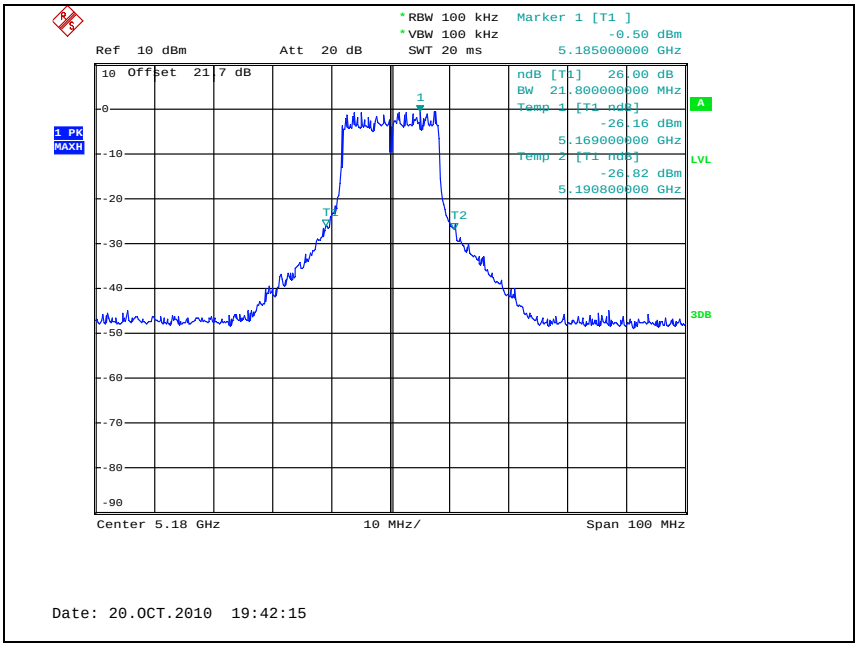
3.4. Test result

Ambient temperature : (24 ± 2) ℃
Relative humidity : 49 % R.H.

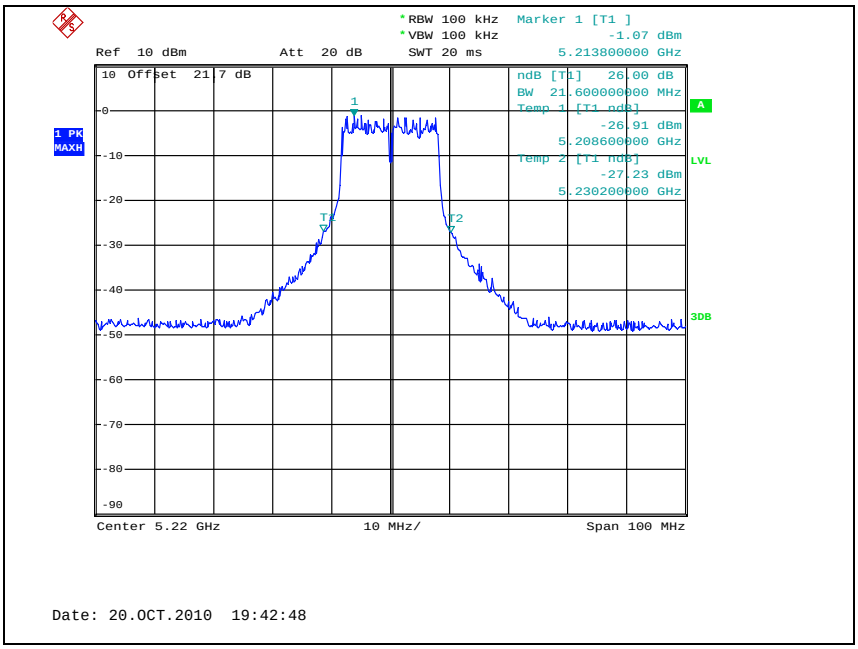
Operating mode	Frequency (㎒)	26 ㏈ bandwidth (㎒)
Non - DFS	5 180	21.80
	5 220	21.60
	5 240	21.20
DFS	5 260	20.60
	5 300	21.60
	5 320	21.80
DFS	5 500	21.20
	5 600	21.80
	5 700	21.60

802.11a (Non-DFS)

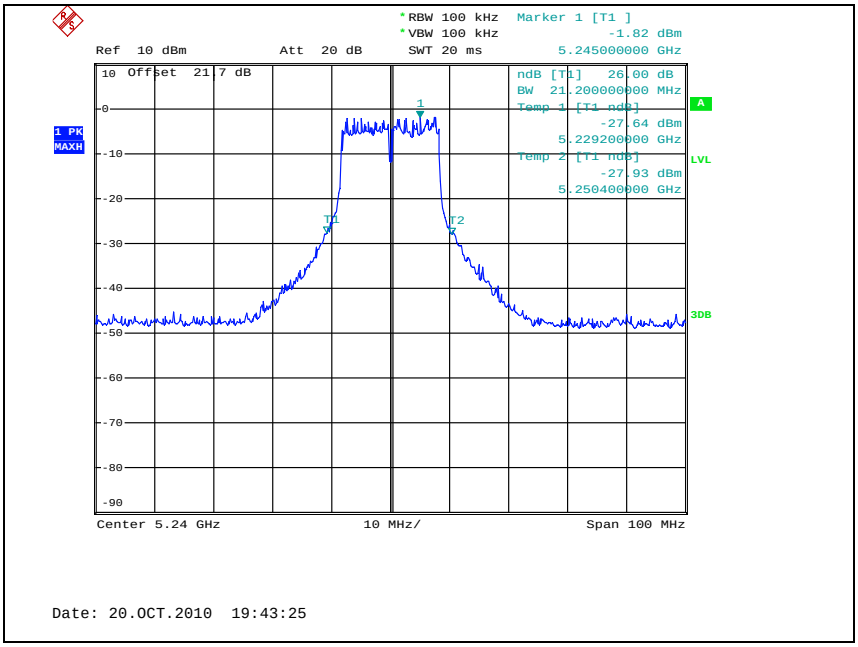
Low Channel (5 180 ㎒)



Middle Channel (5 220 ㎒)

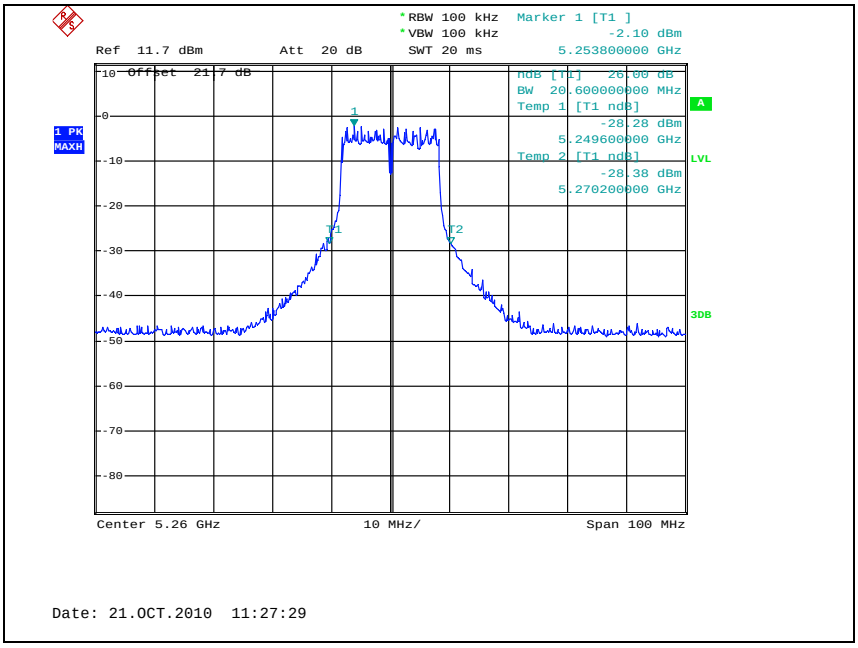


High Channel (5 240 ㎒)

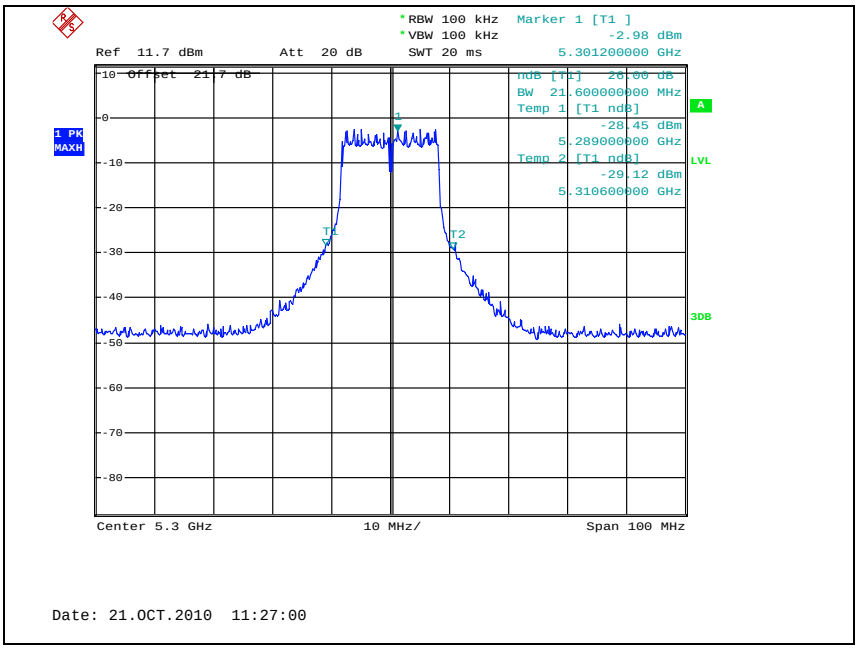


802.11a (DFS)

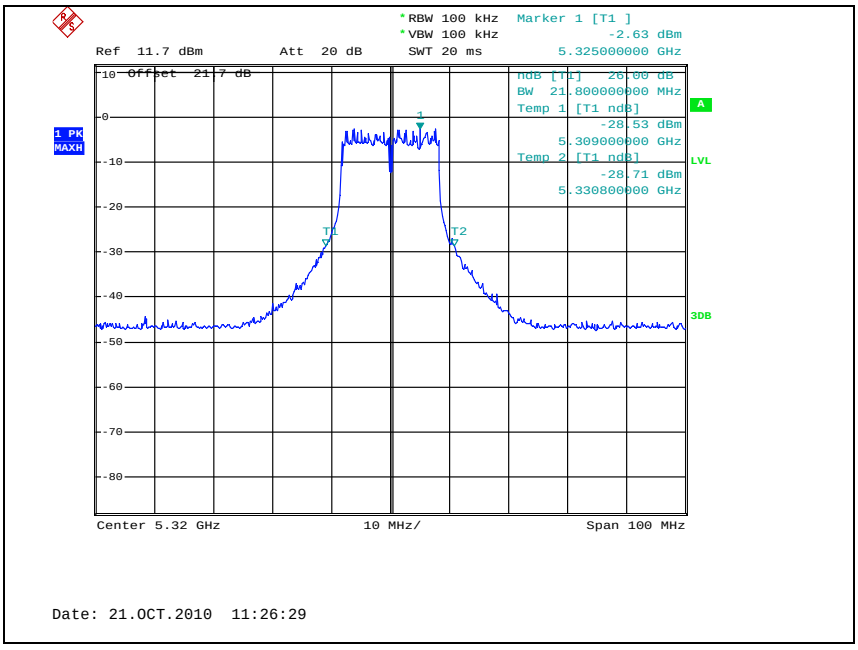
Low Channel (5 260 ㎒)



Middle Channel (5 300 ㎒)

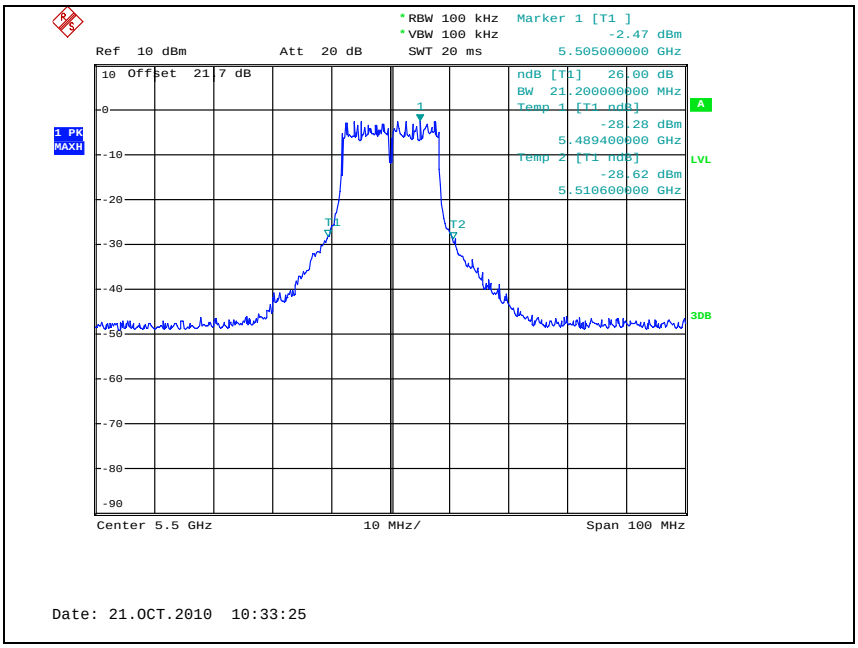


High Channel (5 320 ㎒)

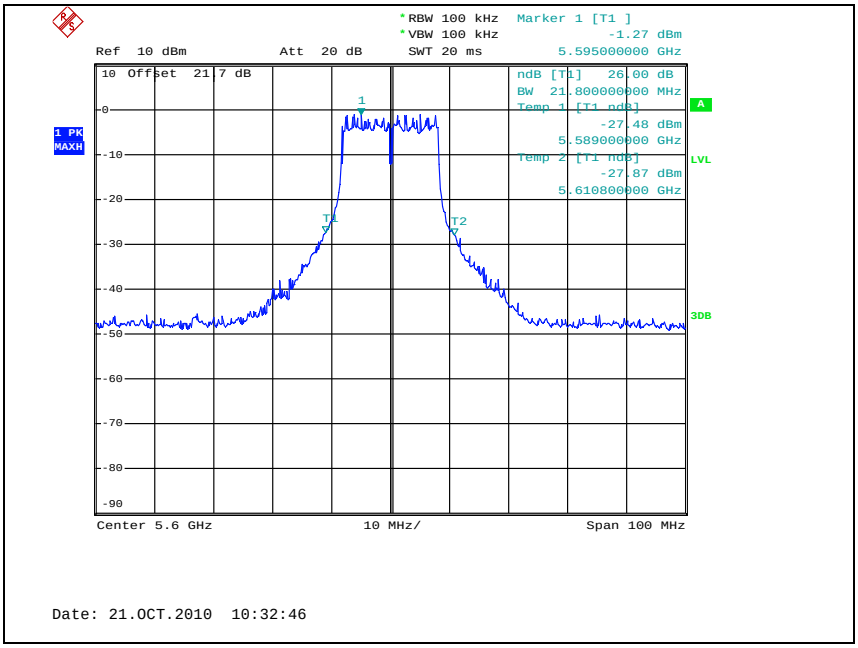


802.11a (DFS)

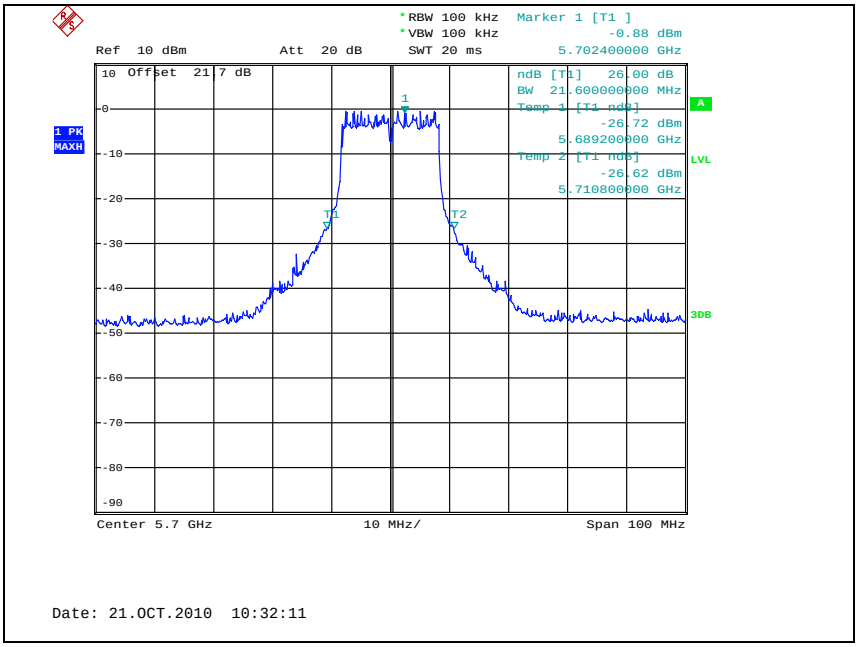
Low Channel (5 500 ㎒)



Middle Channel (5 600 ㎒)



High Channel (5 700 ㎒)



4. Output power

4.1. Test setup

4.2. Limit

For the 5.15-5.25 ㎓ band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 ㎽ or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in ㎒. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the 5.25–5.35 ㎓ and 5.47–5.725 ㎓ bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 ㎽ or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.3. Test procedure

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 spectrum analyzer.
3. Set the Spectrum analyzer as RBW = 1 ㎒, VBW = 3 ㎒, Span = Auto, Channel BW = 26 dB bandwidth

4.4. Test result

Ambient temperature : (24 ± 2) ℃
Relative humidity : 49 % R.H.

Limit

Frequency (㎒)	Fixed Limit (dB m)	B (㎒)	4+10LogB (dB m)	Antenna gain (dB i)	Limit (dB)
5 180	17	21.80	17.38	2.04	17
5 220	17	21.60	17.34	2.04	17
5 240	17	21.20	17.26	2.04	17

Frequency (㎒)	Fixed Limit (dB m)	B (㎒)	11+10LogB (dB m)	Antenna gain (dB i)	Limit (dB)
5 260	24	20.60	24.14	2.04	24
5 300	24	21.60	24.34	2.04	24
5 320	24	21.80	24.38	2.04	24
5 500	24	21.20	24.26	2.04	24
5 600	24	21.80	24.38	2.04	24
5 700	24	21.60	24.34	2.04	24

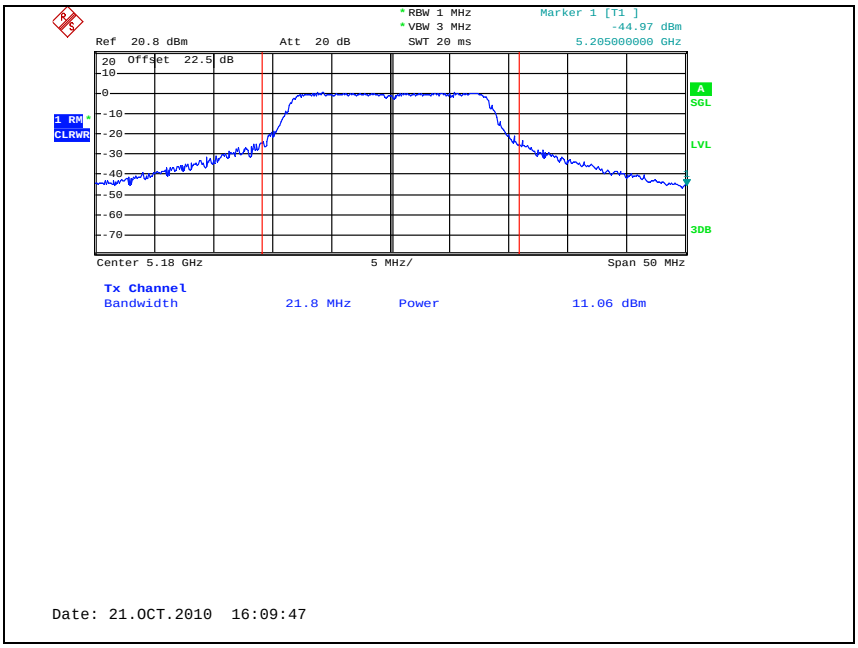
Results

Frequency (㎒)	Output power (dB m)	Limit (dB m)	Margin (dB)
5 180	11.60	17	5.40
5 220	10.42		6.58
5 240	10.20		6.80

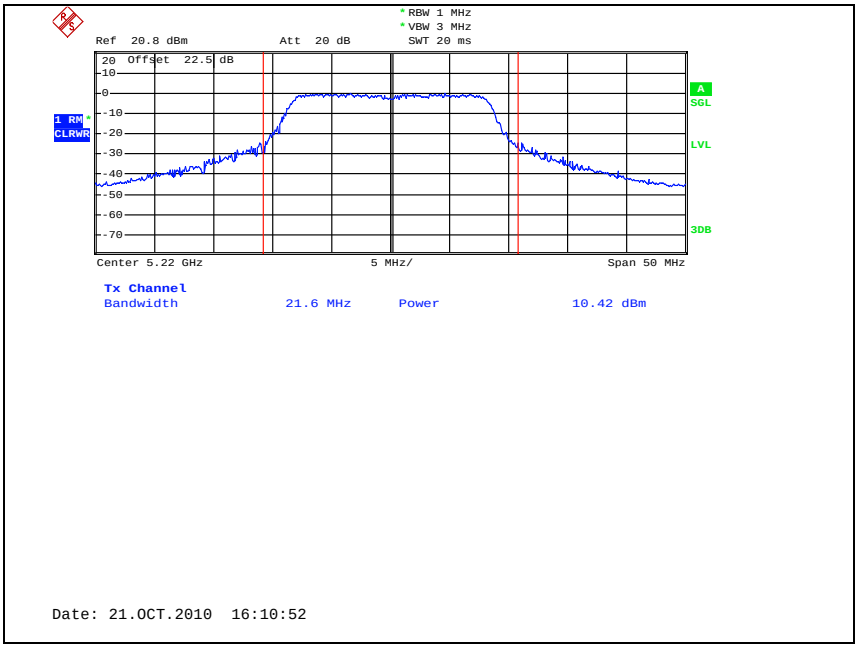
Frequency (㎒)	Output power (dB m)	Limit (dB m)	Margin (dB)
5 260	10.24	24	13.76
5 300	10.14		13.86
5 320	10.56		13.44
5 500	9.83		14.17
5 600	11.81		12.19
5 700	11.50		12.50

802.11a (Non-DFS)

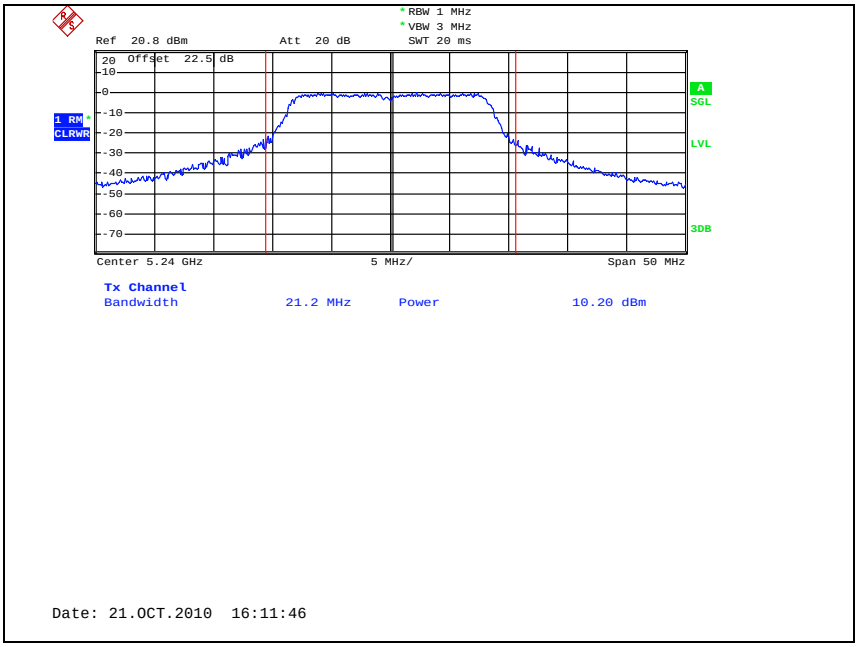
Low Channel (5 180 ㎒)



Middle Channel (5 220 ㎒)

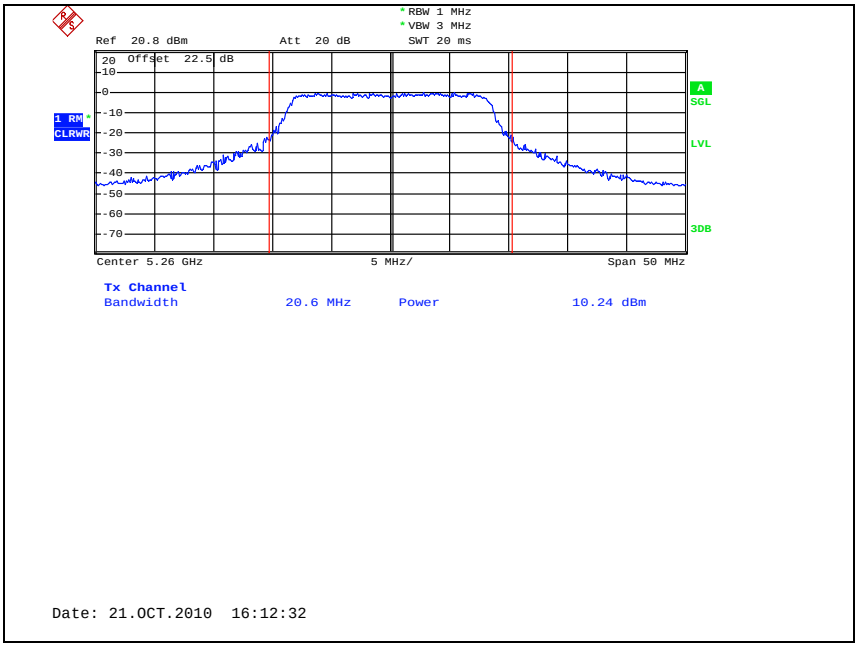


High Channel (5 240 ㎒)

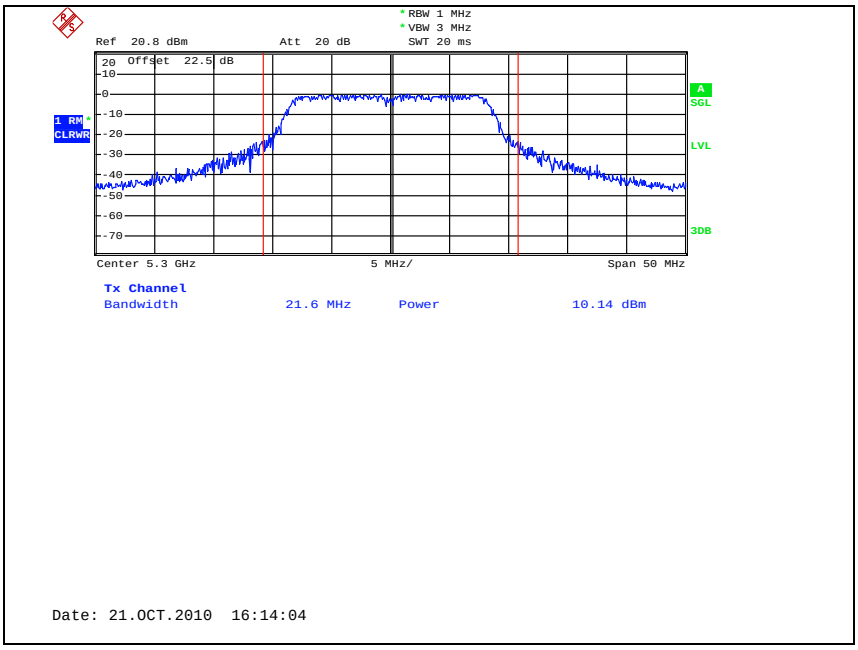


802.11a (DFS)

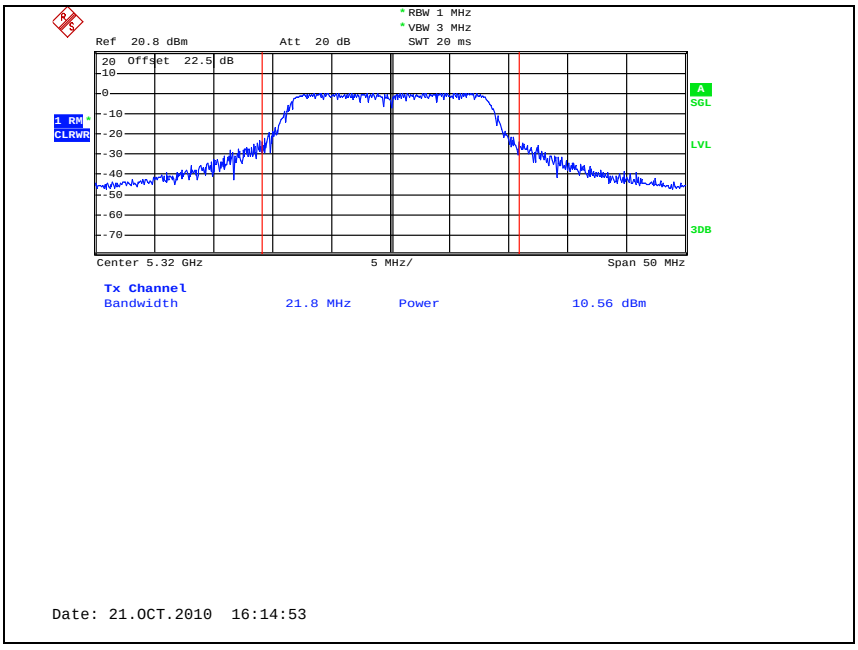
Low Channel (5 260 ㎒)



Middle Channel (5 300 ㎒)

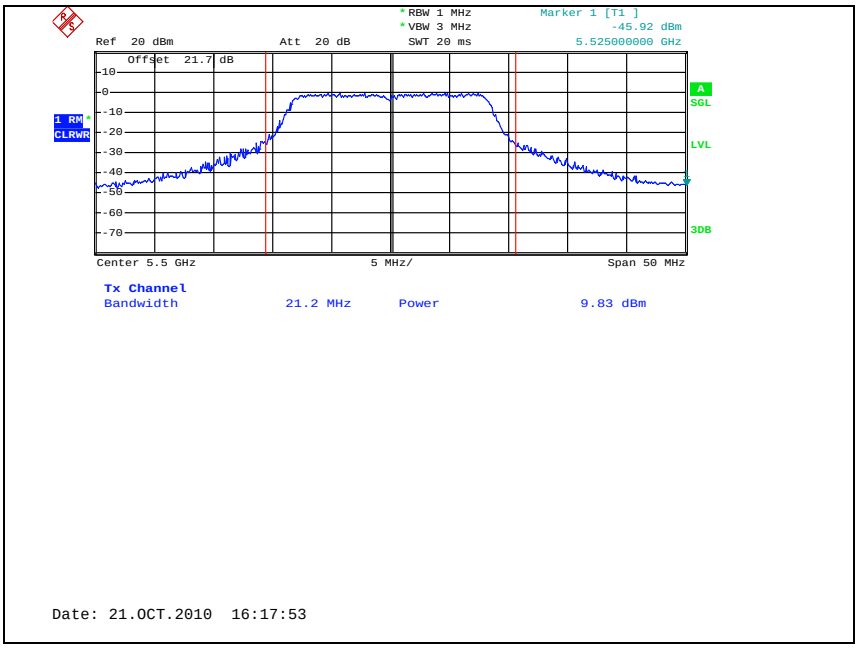


High Channel (5 320 ㎒)

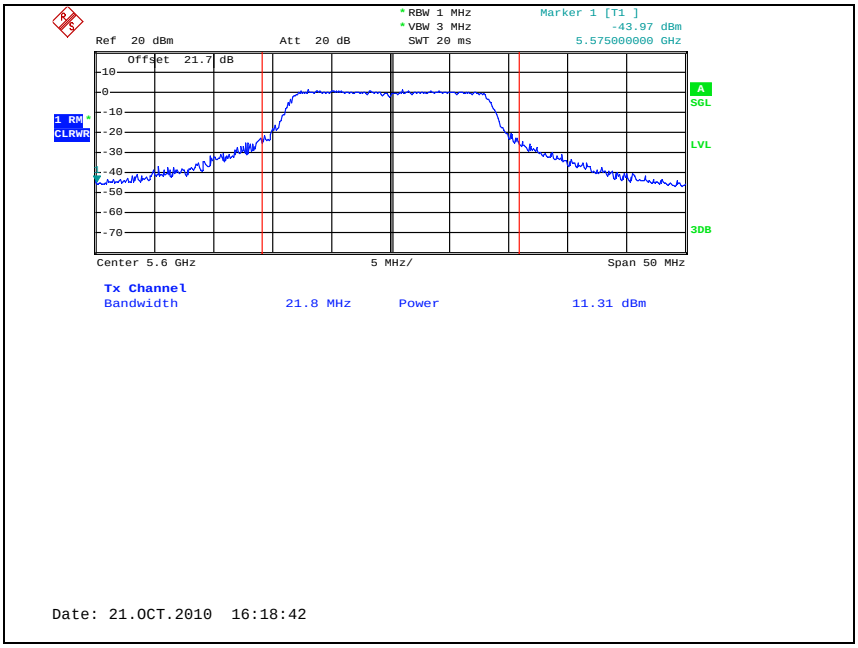


802.11a (DFS)

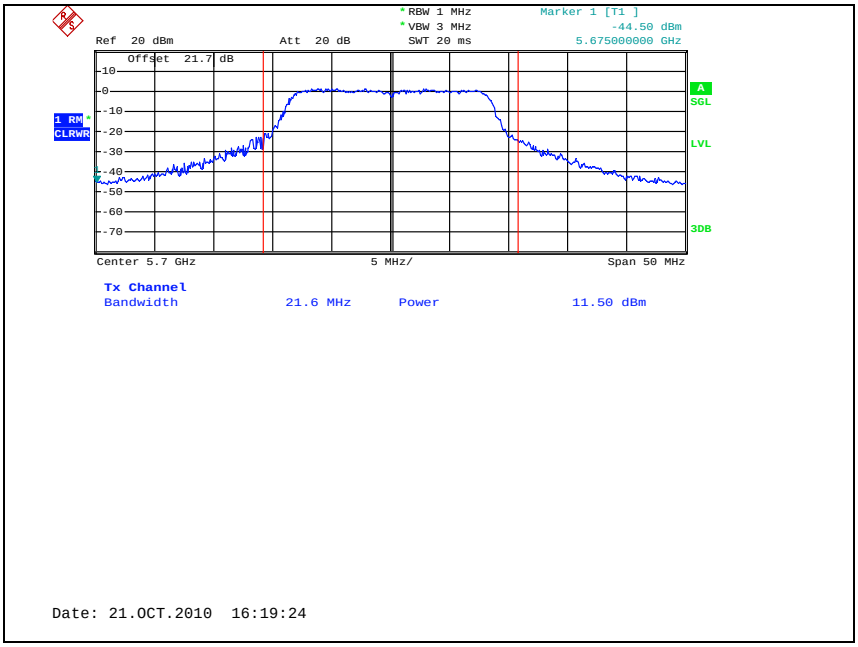
Low Channel (5 500 ㎒)



Middle Channel (5 600 ㎒)



High Channel (5 700 ㎒)



5. Peak power spectral density

5.1. Test setup

5.2. Limit

For the 5.15-5.25 ㎓ band, the peak power spectral density shall not exceed 4 ㏈m in any 1 ㎒ band.
If transmitting antennas of directional gain greater than 6 ㏈i are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i.
The maximum antenna gain is less than or equal to 6 ㏈i, therefore the limit is 4 ㏈m.

For the 5.25–5.35 ㎓ and 5.47–5.725 ㎓ bands, the peak power spectral density shall not exceed 11 ㏈m in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i.

5.3. Test procedure

1. Place the EUT on the table and set it in transmitting mode
   Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 1 ㎒, VBW = 3 ㎒, Span = 20 ㎒.
3. Record the max reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

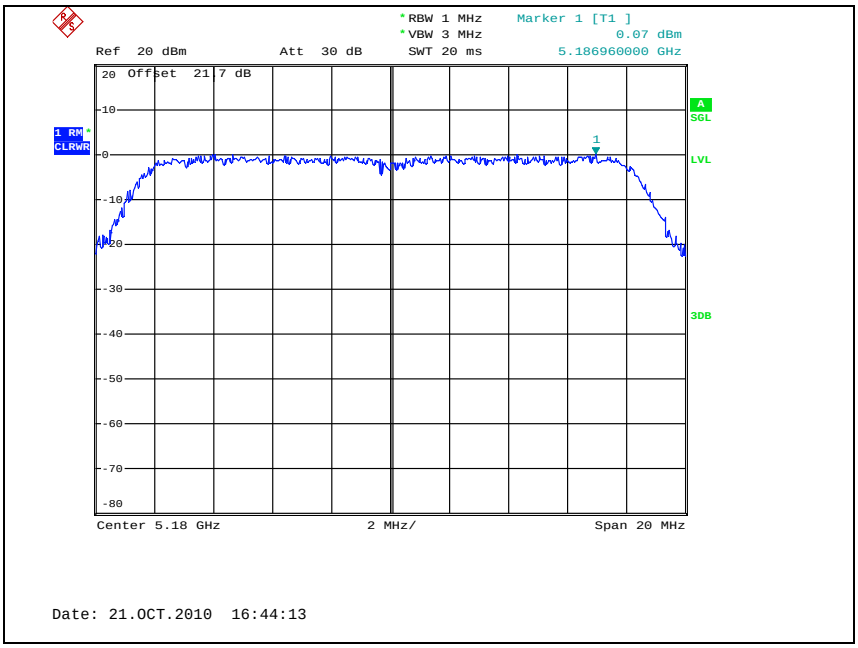
5.4. Test result

Ambient temperature : (24 ± 2) ℃
Relative humidity : 49 % R.H.

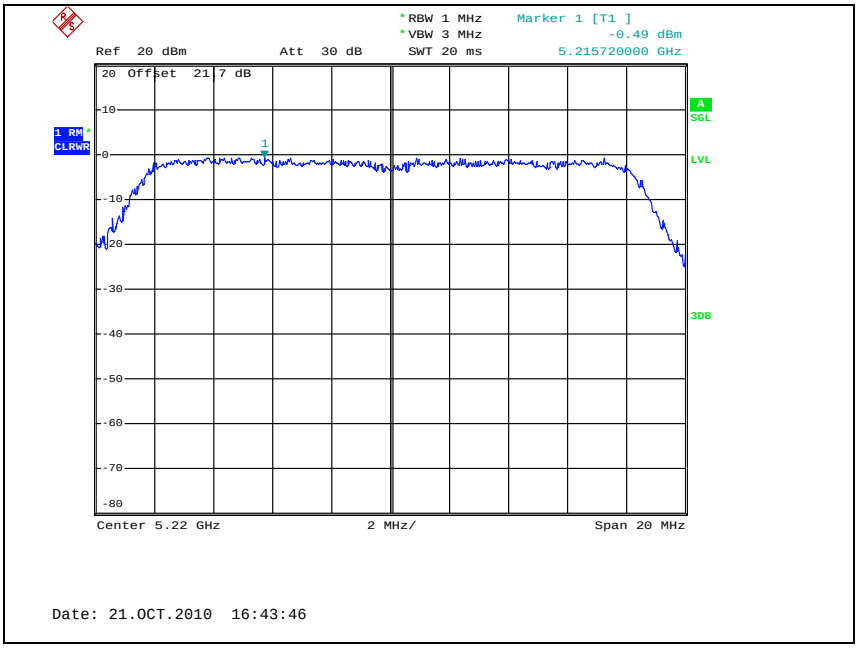
Operating mode	Frequency (㎒)	PPSD (dB m)	Limit (dB m)	Margin (dB)
Non - DFS	5 180	0.07	4	3.93
	5 220	-0.49		4.49
	5 240	-0.85		4.85
DFS	5 260	-0.60	11	11.60
	5 300	-1.03		12.03
	5 320	-0.26		11.26
DFS	5 500	-0.30		11.30
	5 600	0.97		10.03
	5 700	1.06		9.94

802.11a (Non-DFS)

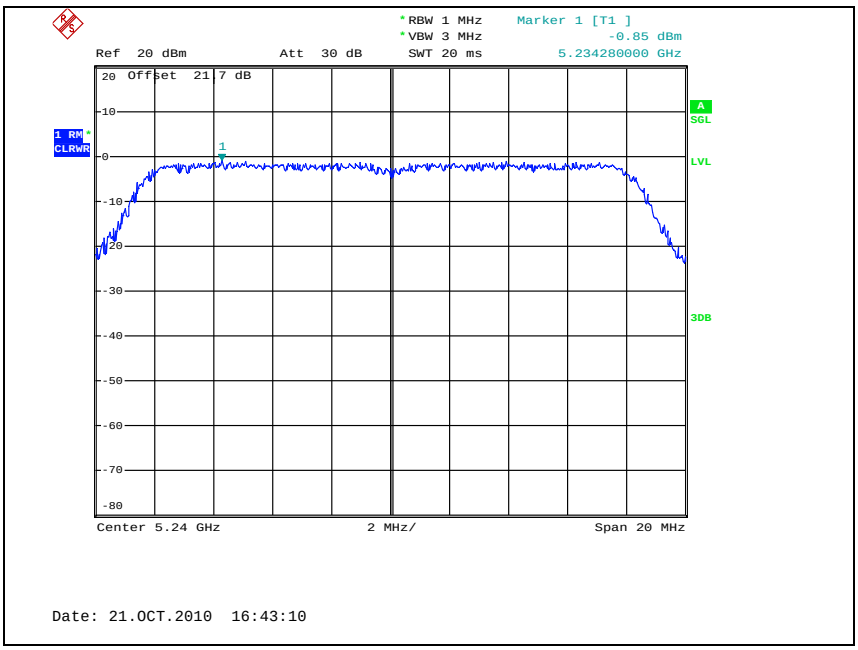
Low Channel (5 180 ㎒)



Middle Channel (5 220 ㎒)

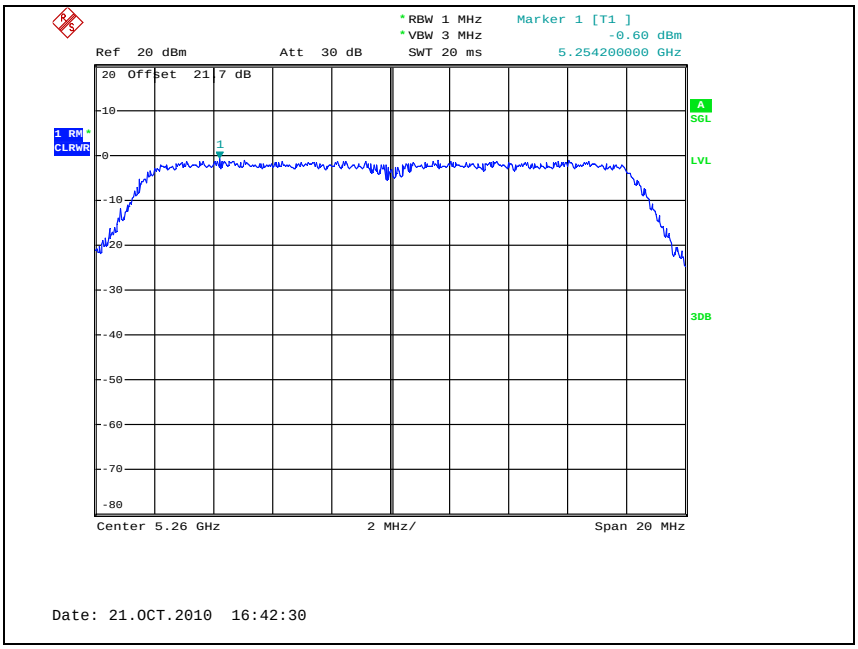


High Channel (5 240 ㎒)

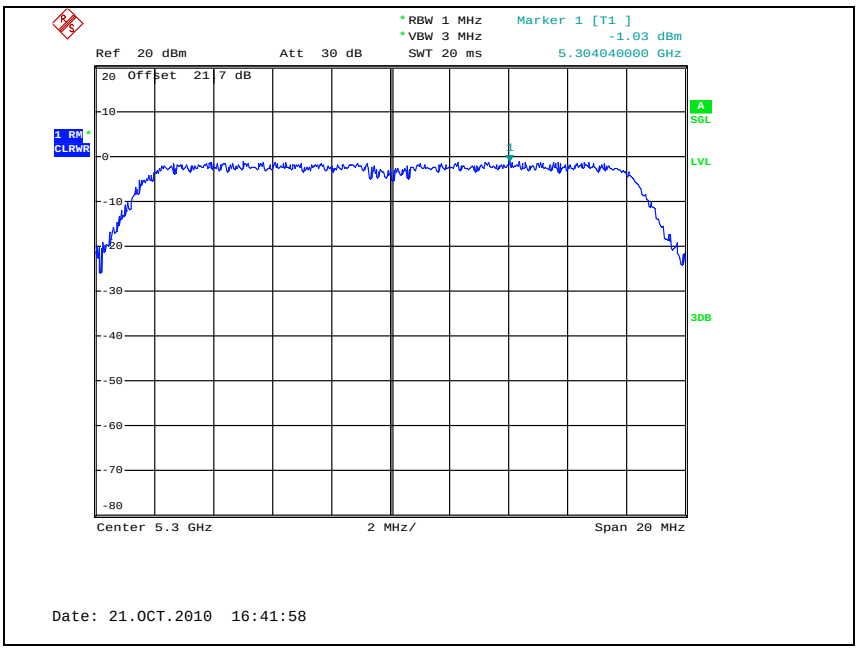


802.11a (DFS)

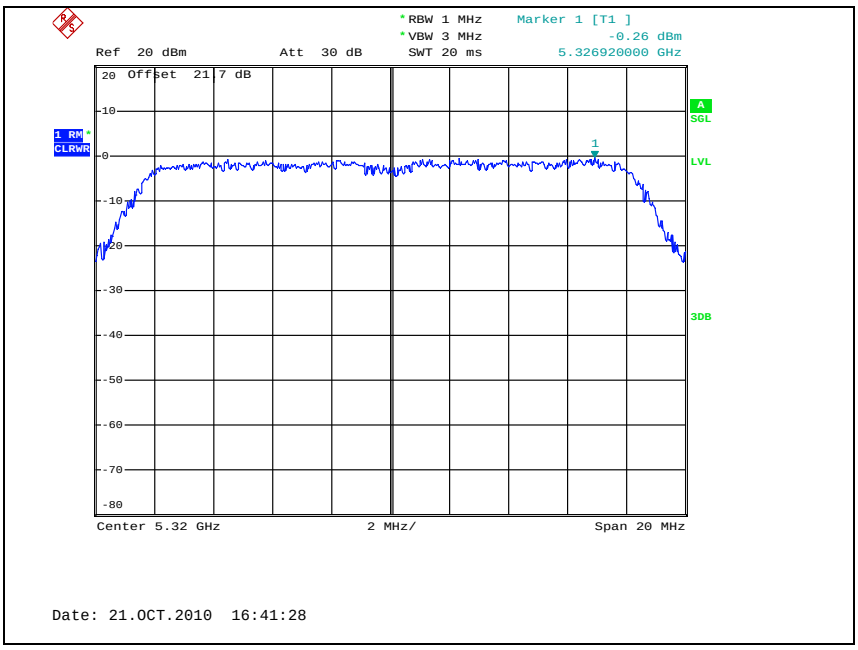
Low Channel (5 260 ㎒)



Middle Channel (5 300 ㎒)

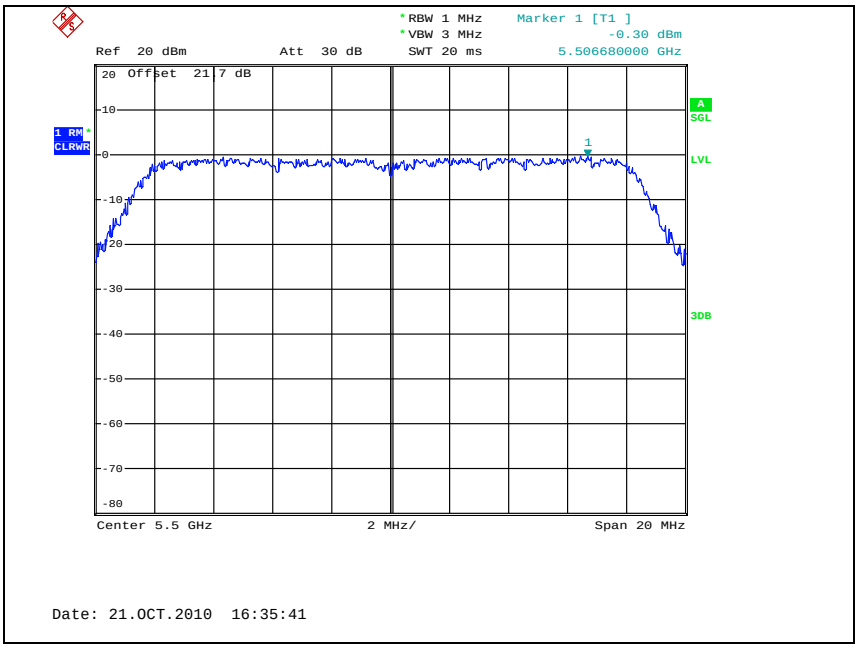


High Channel (5 320 ㎒)

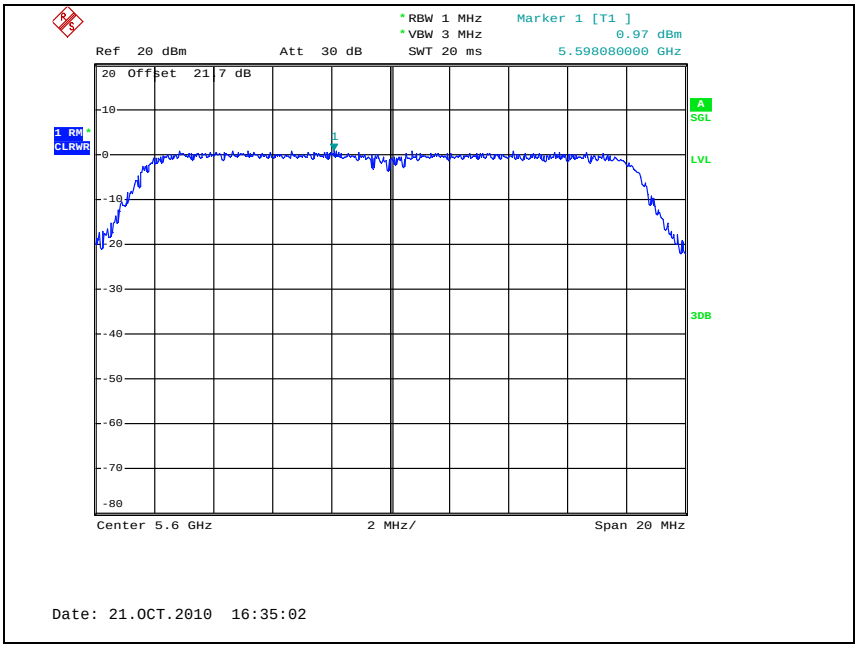


802.11a (DFS)

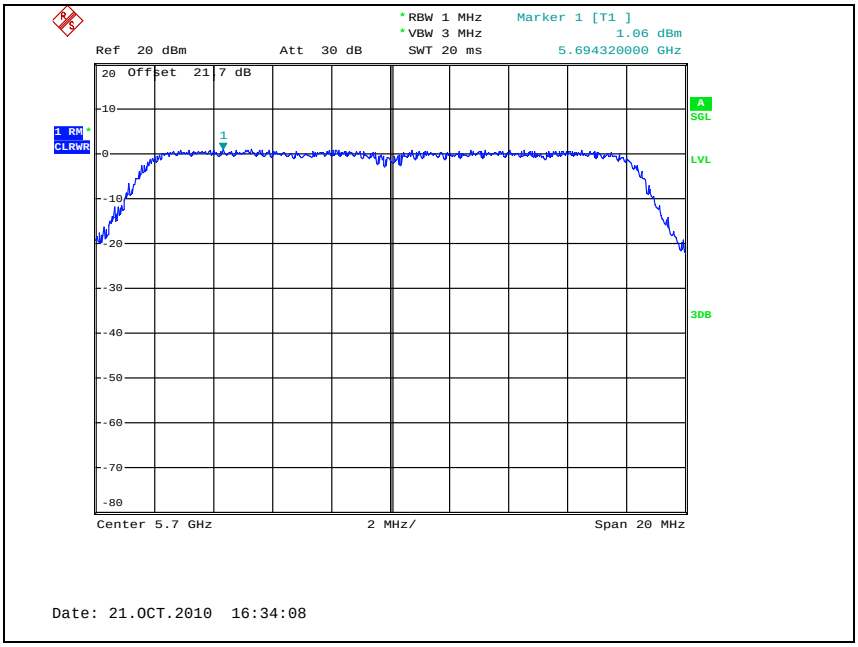
Low Channel (5 500 ㎒)



Middle Channel (5 600 ㎒)



High Channel (5 700 ㎒)



6. Peak excursion

6.1. Test setup

6.2. Limit

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 ㏈ across any 1 ㎒ bandwidth or the emission bandwidth whichever is less. The maximum antenna

6.3. Test procedure

1. Place the EUT on the table and set it in transmitting mode
   Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as ;
   RBW = 1 ㎒, VBW = 3 ㎒, Span = 30 ㎒, Detector mode: average, Trace 1: Max hold & View
3. Set the spectrum analyzer as ;
   RBW = 1 ㎒, VBW = 3 ㎒, Span = 30 ㎒, Detector mode: peak, Trace 2: Max hold
4. Record the max reading.
5. Repeat the above procedure until the measurements for all frequencies are completed.

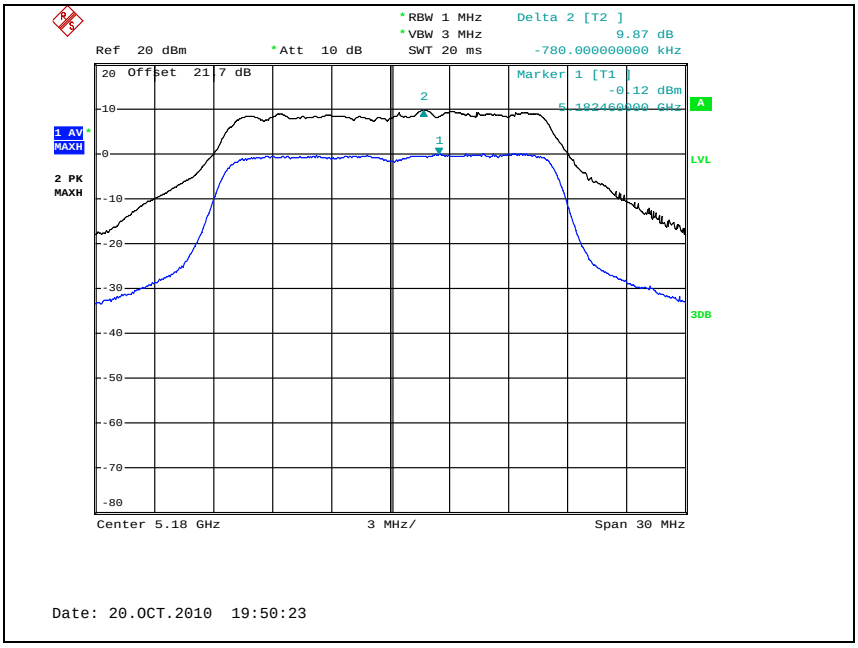
6.4. Test result

Ambient temperature : (24 ± 2) ℃
Relative humidity : 49 % R.H.

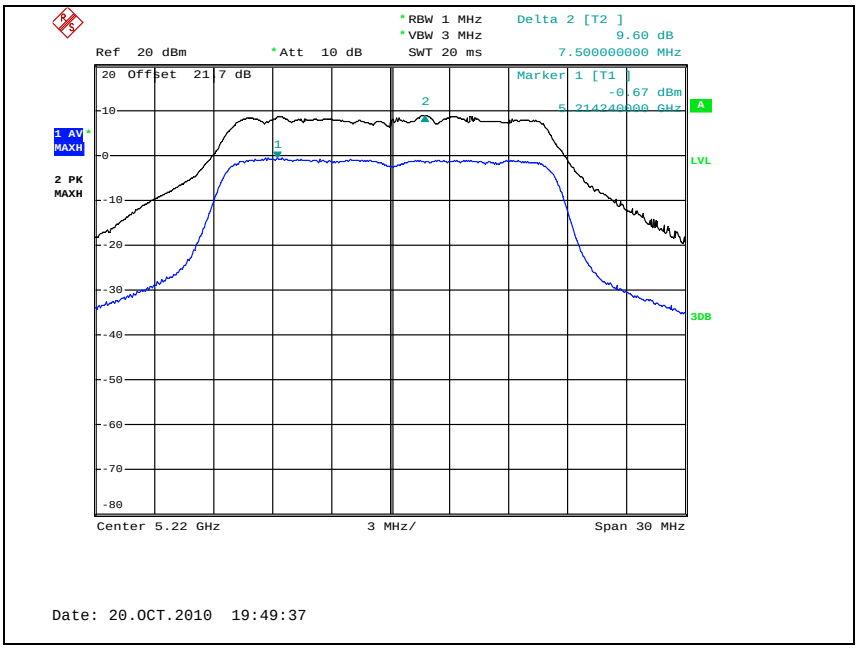
Operating mode	Frequency (㎒)	Peak excursion (dB)	Limit (dB)	Margin (dB)
Non - DFS	5 180	9.87	13	3.13
	5 220	9.60		3.40
	5 240	10.04		2.96
DFS	5 260	7.69		5.31
	5 300	9.98		3.02
	5 320	9.95		3.05
DFS	5 500	9.89		3.11
	5 600	10.08		2.92
	5 700	10.14		2.86

802.11a (Non-DFS)

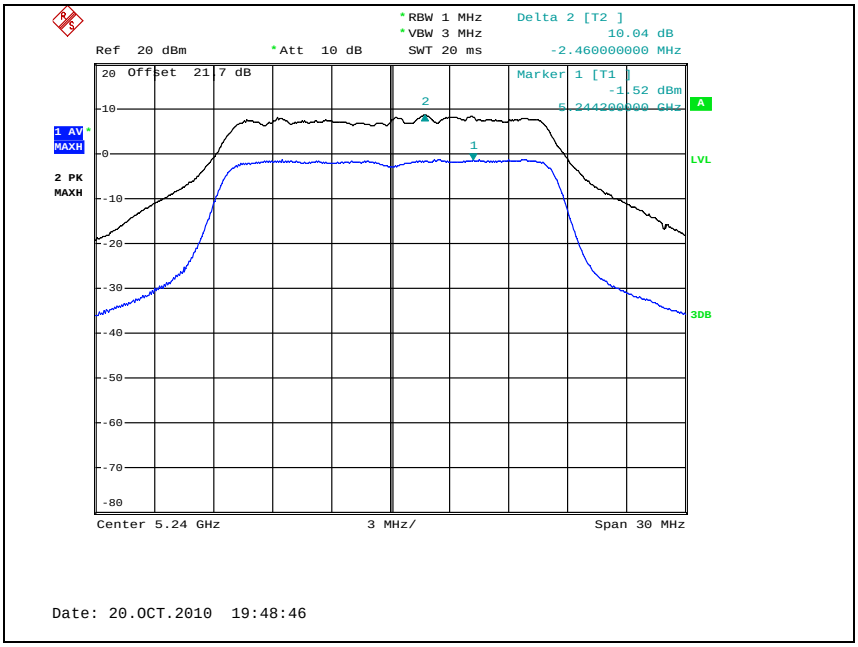
Low Channel (5 180 ㎒)



Middle Channel (5 220 ㎒)

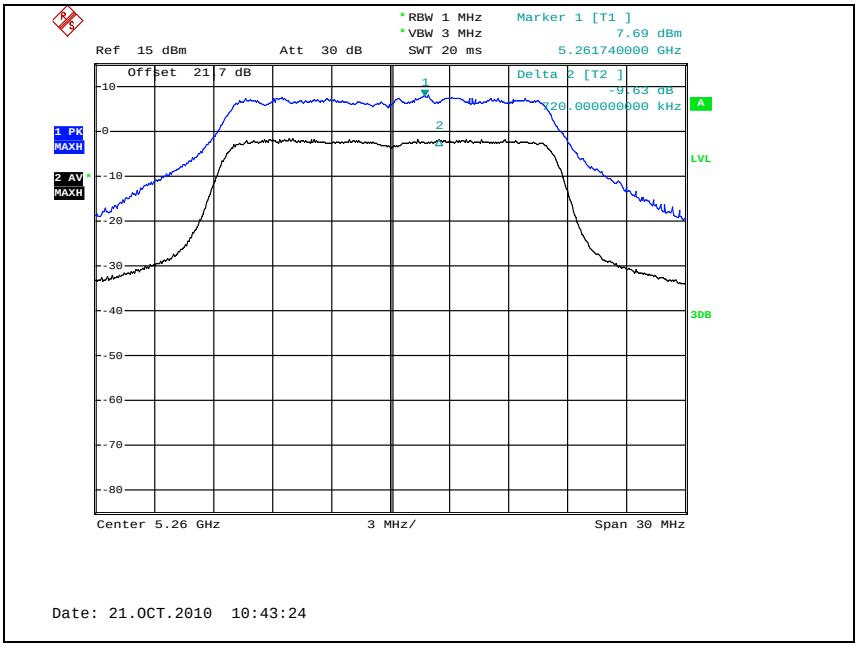


High Channel (5 240 ㎒)

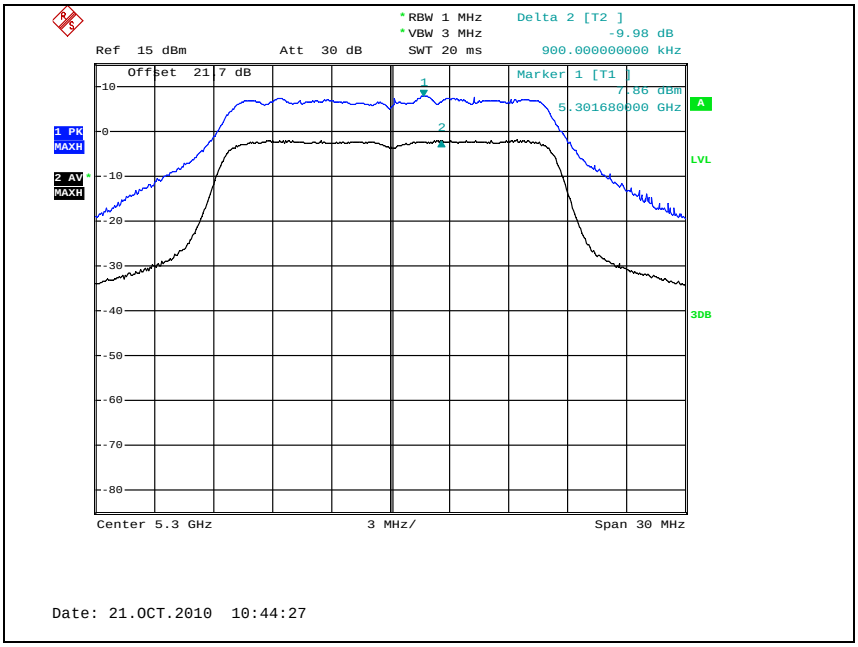


802.11a (DFS)

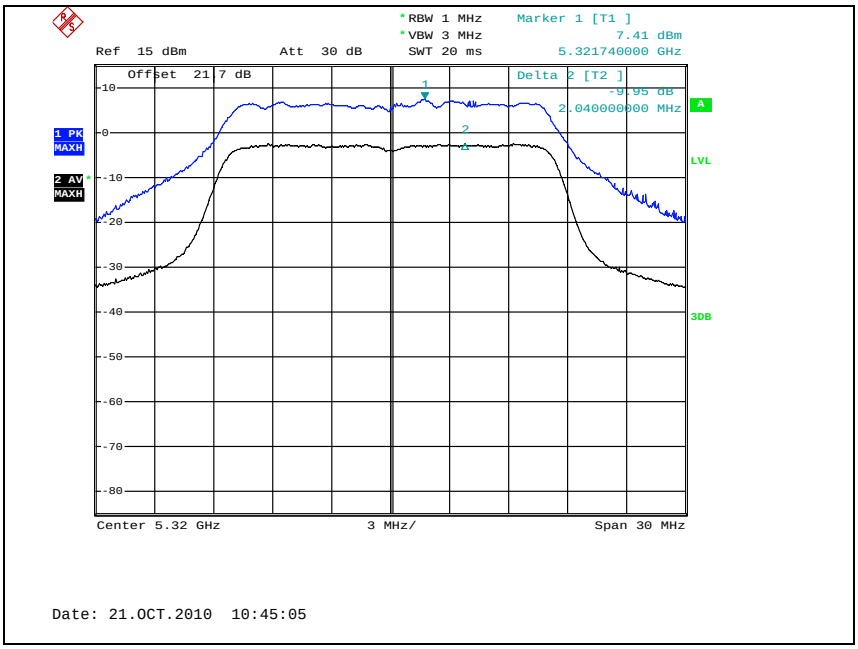
Low Channel (5 260 ㎒)



Middle Channel (5 300 ㎒)

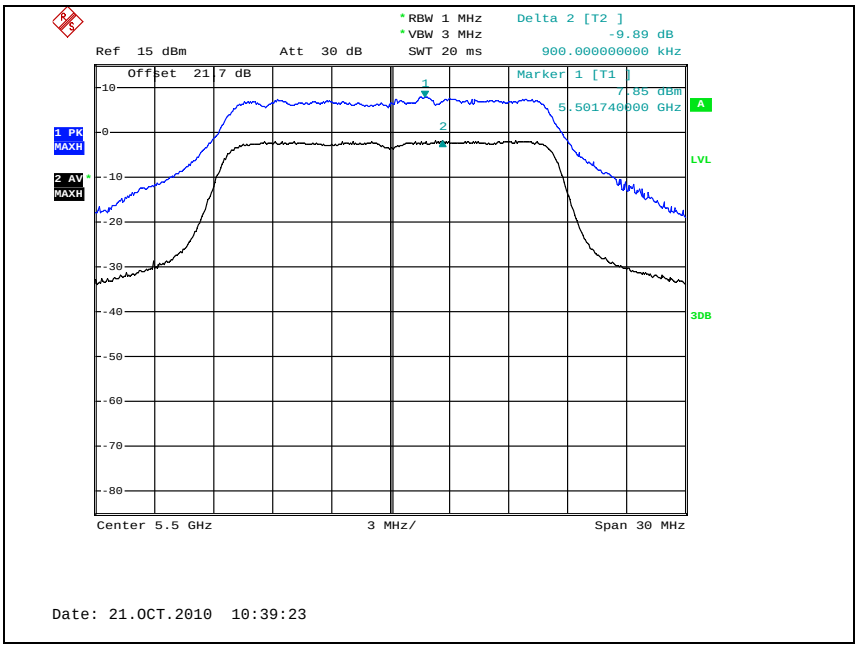


High Channel (5 320 ㎒)

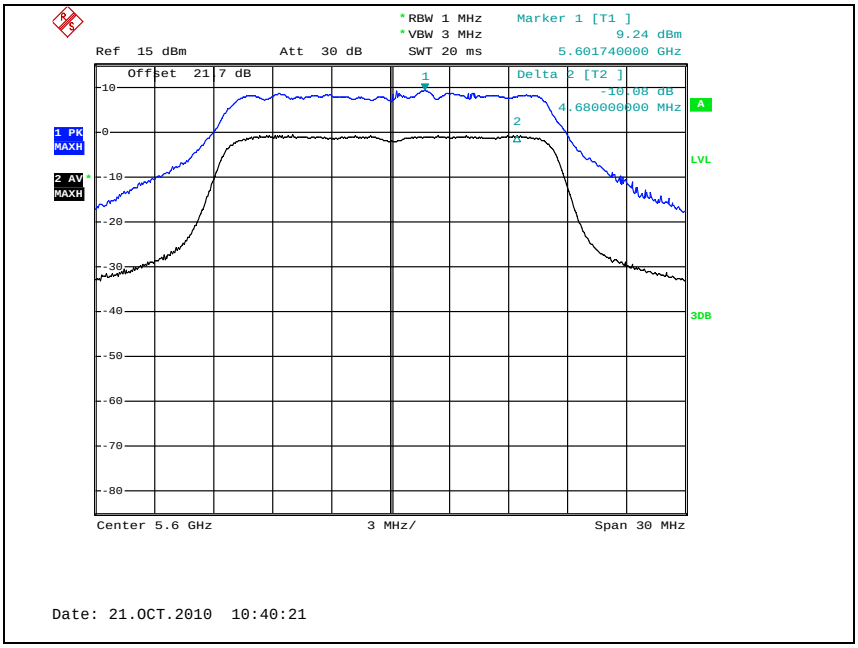


802.11a (DFS)

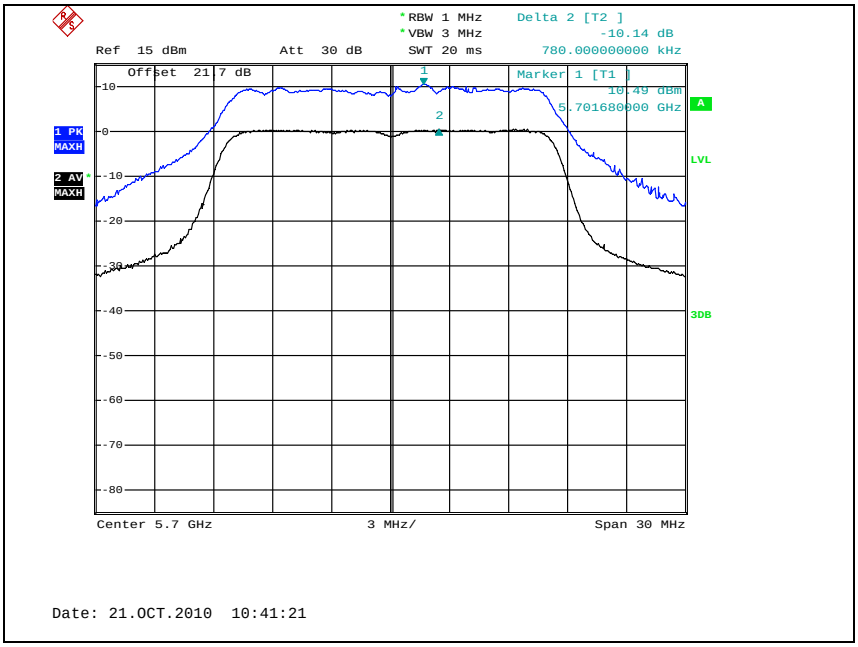
Low Channel (5 500 ㎒)



Middle Channel (5 600 ㎒)

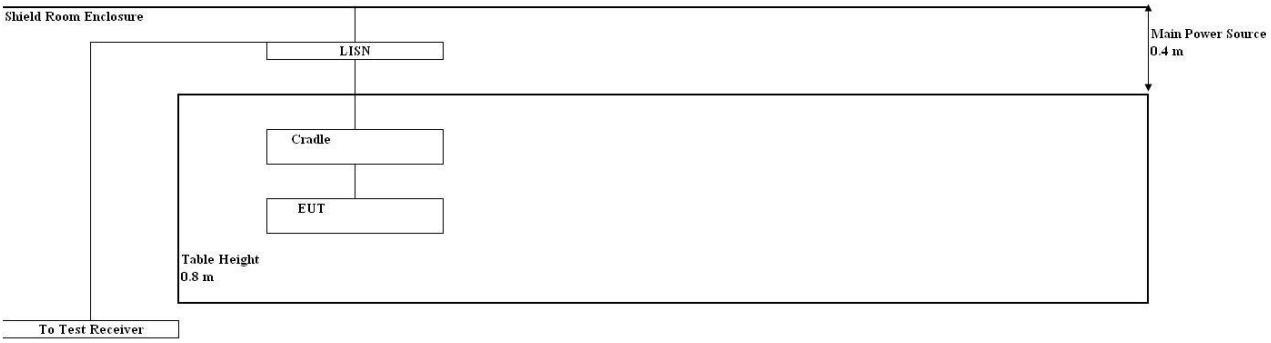


High Channel (5 700 ㎒)



7. Transmitter AC power line conducted emission

7.1. Test setup



7.2. Limit

According to §15.207(a) for an intentional radiator that 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 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network(LISN).
Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency of Emission (㎒)	Conducted limit (㏈ μV)	
	Quasi-peak	Average
0.15 – 0.50	66-56*	56-46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

▣ *Decreases with the logarithm of the frequency.*

7.3. Test procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

1. The test procedure is performed in a 6.5 m × 3.6 m× 3.6 m (L×W×H) shielded room. The EUT along with its peripherals were placed on a 1.0 m(W)× 1.5 m(L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

7.4. Test result (Worst case configuration_802.11a (5 600 ㎒) & Cradle included)

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

Ambient temperature : (24 ± 2) ℃
Relative humidity : 49 % R.H.

Frequency range : 0.15 ㎒ – 30 ㎒
Measured Bandwidth : 9 ㎑

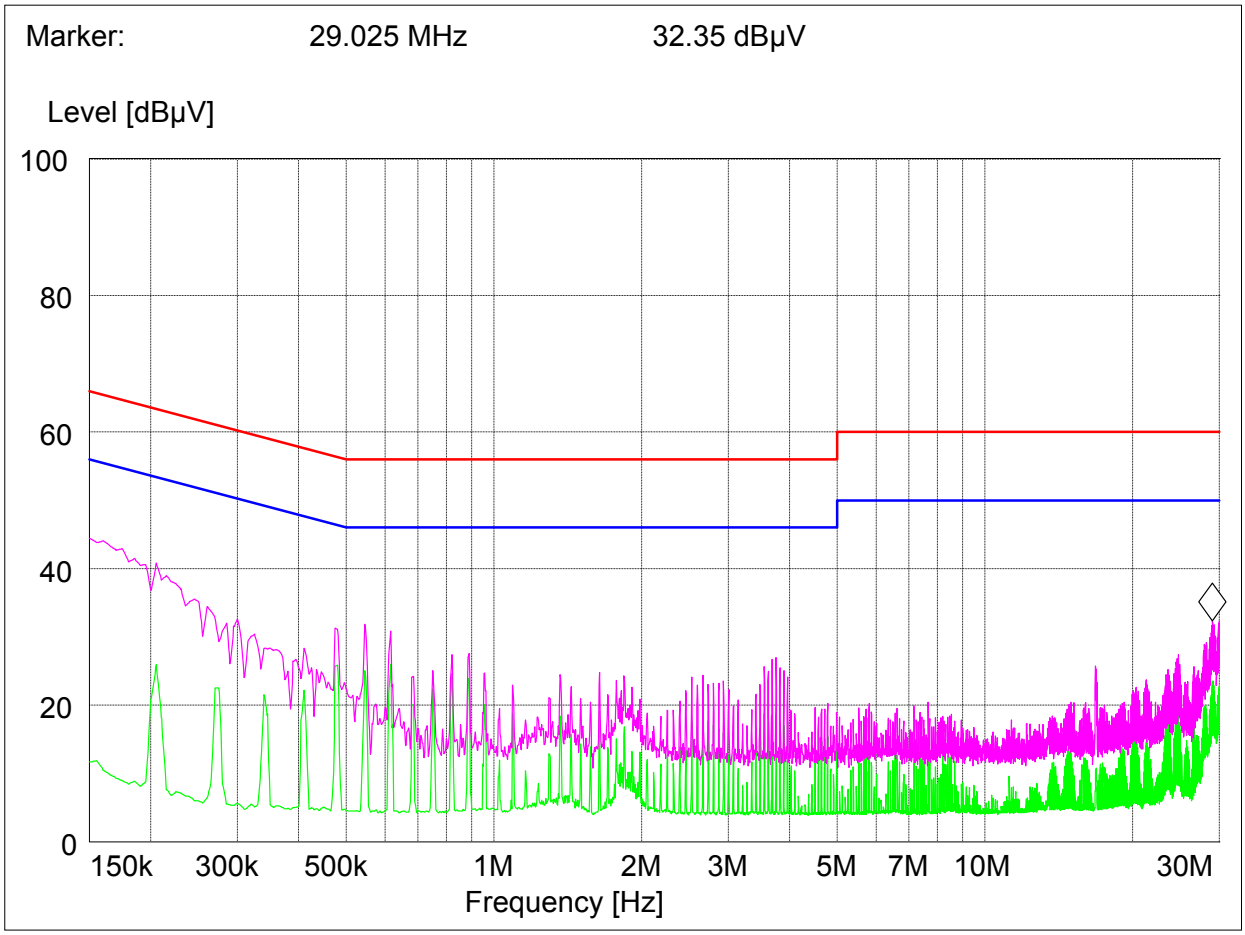
Freq.	Level (dB uV)		Line	Limit (dB uV)		Margin (dB)	
(㎒)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.195	17.30	5.00	H	63.82	53.82	46.52	48.82
0.480	29.60	26.20	H	56.34	46.34	26.74	20.14
3.685	24.60	18.60	H	56.00	46.00	31.40	27.40
3.755	24.60	18.60	H	56.00	46.00	31.40	27.40
16.810	18.10	10.20	H	60.00	50.00	41.90	39.80
29.025	28.10	23.00	H	60.00	50.00	31.90	27.00
0.205	32.20	24.00	N	63.41	53.41	31.21	29.41
0.275	26.80	22.20	N	60.97	50.97	34.17	28.77
0.340	26.00	23.10	N	59.20	49.20	33.20	26.10
0.545	26.90	23.10	N	56.00	46.00	29.10	22.90
2.660	22.30	20.30	N	56.00	46.00	33.70	25.70
29.905	27.50	21.60	N	60.00	50.00	32.50	28.40

▣ Note

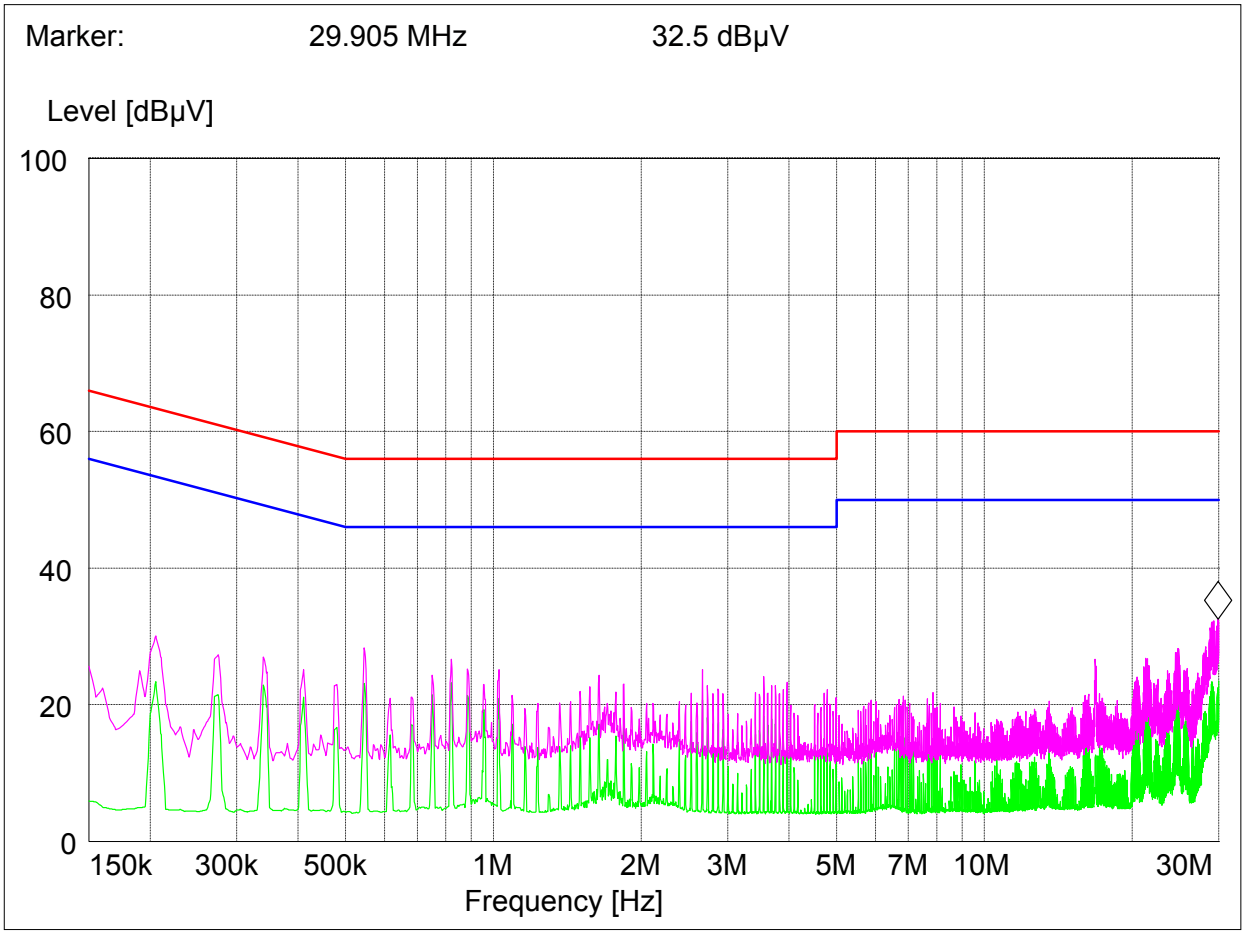
Line (H) : Hot
Line (N) : Neutral

Plot of conducted power line

Test mode: (Hot)



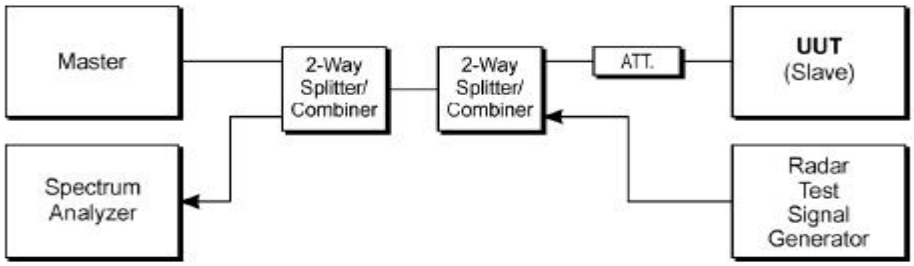
Test mode: (Neutral)



8. DFS (Dynamic Frequency Selection)

8.1. System overview

8.1.1. Set up of EUT



▶ **Support equipment**

Description	Manufacturer	Model	Cal Due.
Spectrum analyzer	R&S	FSV30	Aug. 09, 2011
Vector signal generator	R&S	SMBV100A	Jul. 26, 2011
Access Point(master)	Cisco	AIR-AP1242AG-K-K9	N / A
Notebook	IBM	T43	N / A
Splitter / Combiner	Mini-Circuits	ZFSC-2-10G	Oct. 30, 2011
Attenuator	Agilent	8494B	Apr. 02, 2011

The radar signal generation equipment consists of a vector signal generator

The signal monitoring equipment consists of a spectrum analyzer set to display 8001 bins on the horizontal axis. The time domain resolution is 2 msec/bin with a 16 second sweep time, meeting the 10 second short pulse reporting criteria. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold.

The Slave is tested separately for compliance with the Channel Shutdown requirements, for the situation when the Slave device vacates the channel in response to detection of a radar by the Master.

All tests were performed at a channel center frequency of 5 500 ㎒. Measurements were performed using conducted test methods.

8.2 Limit

§15.407 (h) and FCC 06-96 APPENDIX “COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVCIES OPERATING IN THE 5250-5350 ㎒ AND 5470-5725 ㎒ BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION

8.1.1. Set up of EUT

Table 1: Applicability of DFS requirements prior to use of a channel

Requirement	Operational Mode		
	Master	Client (without radar detection)	Client (with radar detection)
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
Uniform Spreading	Yes	Not required	Not required

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode		
	Master	Client (without DFS)	Client (with DFS)
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes

Table 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value (see note)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.	

Table 4: DFS Response requirement values

Parameter	Value
Non-occupancy period	30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds
Channel Closing Transmission Time	200 milliseconds + approx. 60 milliseconds over remaining 10 second period
The instant that the Channel Move Time and the Channel Closing Transmission Time begins is as follows: For the Short pulse radar Test Signals this instant is the end of the Burst. For the Frequency Hopping radar Test Signal, this instant is the end of the last radar burst generated. For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission. The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate channel changes (an aggregate of approximately 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.	

Table 5 – Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (Microseconds)	PRI (Microseconds)	Pulses	Minimum Percentage of Successful Detection	Minimum Trials
1	1	1428	18	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

Table 6 – Long Pulse Radar Test Signal

Radar Waveform	Bursts	Pulses per Burst	Pulse Width (µsec)	Chirp Width (㎒)	PRI (µsec)	Minimum Percentage of Successful Detection	Minimum Trials
5	8-20	1-3	50-100	5-20	1000-2000	80%	30

Table 7 – Frequency Hopping Radar Test Signal

Radar Waveform	Pulse Width (µsec)	PRI (µsec)	Burst Length (ms)	Pulses per Hop	Hopping Rate (kHz)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	300	9	.333	70%	30

8.2. Description of EUT

The EUT operates over the 5 250 ㎒ ~ 5 350 ㎒ (11a – DFS), 5 470 ㎒ ~ 5725 ㎒ (11a – DFS) range.

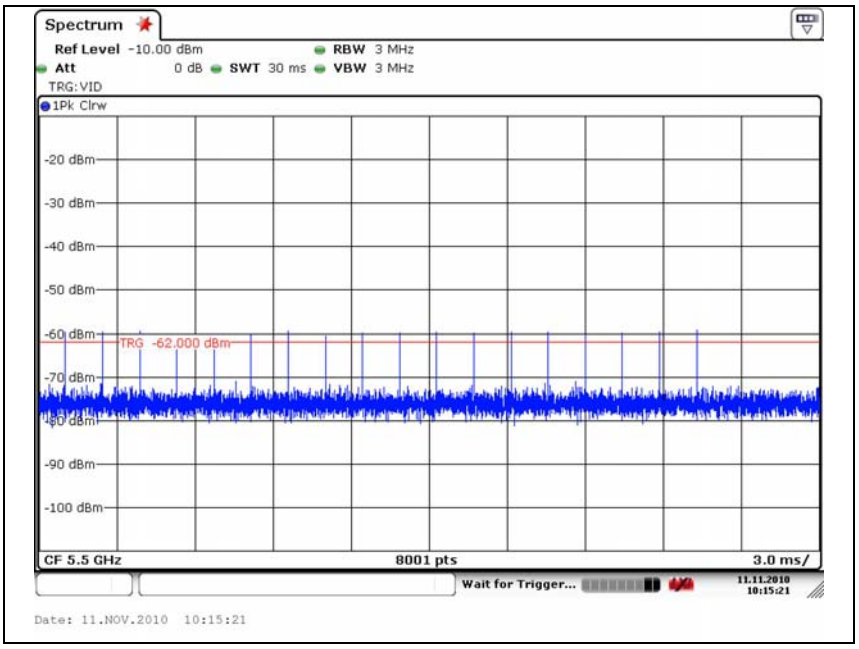
The gain antenna assembly utilized with the master has a gain of 2.50 ㏈ i.

The rated output power of the master unit is <200 milliwatt. Therefore the required interference threshold level is -62 ㏈ m. After correction for antenna gain and procedure adjustments the required conducted threshold at the antenna port is -62 +2.5 = -59.50 ㏈ m

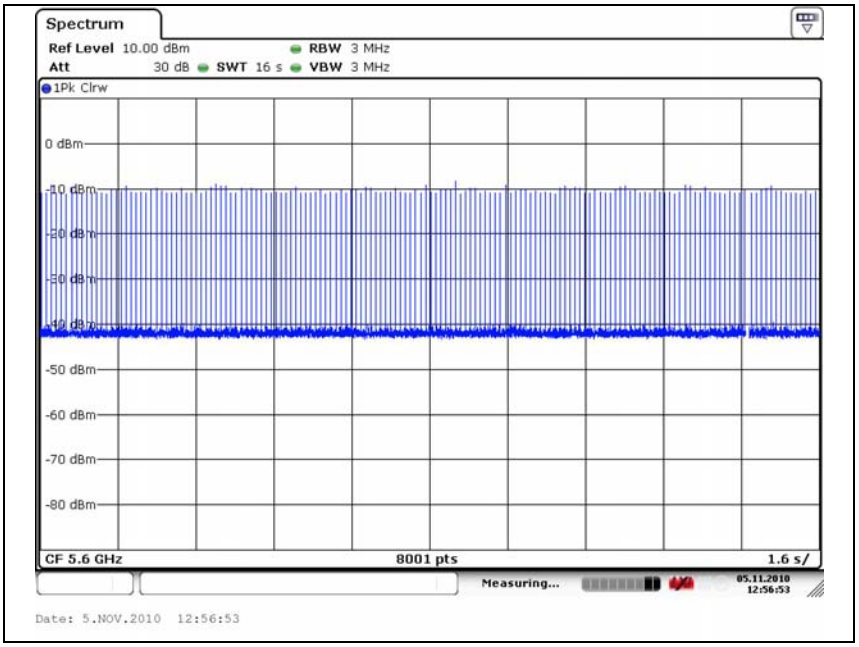
The calibrated conducted DFS Detection Threshold level is set to - 59 ㏈ m

PLOTS OF RADAR WAVEFORMS AND WLAN TRAFFIC

Plot of radar waveform type 1



Plot of LAN traffic



The reference maker is set at the end of Last radar pulse.

The delta maker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time= (Number of analyzer bins showing transmission)*(dwell time per bin)

The observation period over which the aggregated time is calculated begins at (Reference Maker) and ends no earlier than (Reference Maker +10 sec)

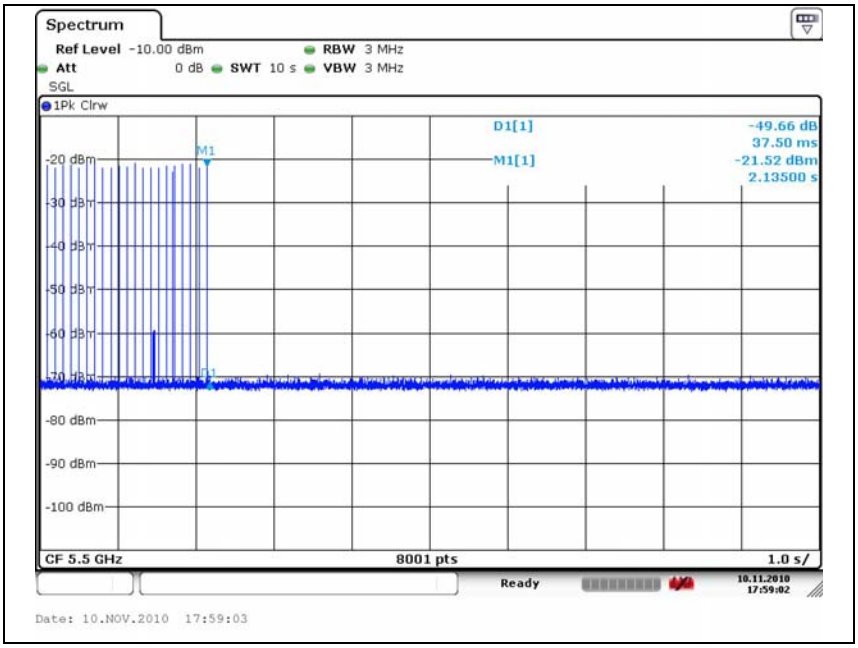
8.3. Test result

Channel Move Time (msec)	Limit (sec)
37.50	10

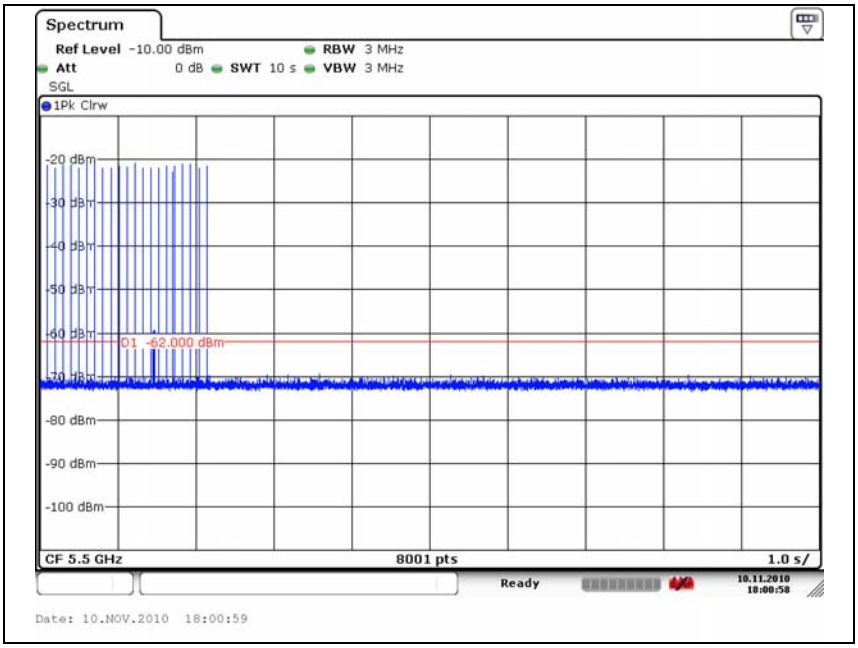
Aggregate channel closing transmission time (msec)	Limit (msec)
10	1000

2 * 5 = 10 msec

Plot of channel move time



Plot of aggregate channel closing transmission time



Plot of Non-occupancy period