Power Spectral Density

Test mode	Band	Frequency (MHz)	Measured PSD (dBm/MHz)	DCF (dB)	Maximum PSD (dB m/MHz)	Limit (dBm/MHz)
802.11a	UNII 2C	5 720	3.70	0.31	4.01	11.00
802.11n HT20			3.23	0.34	3.57	

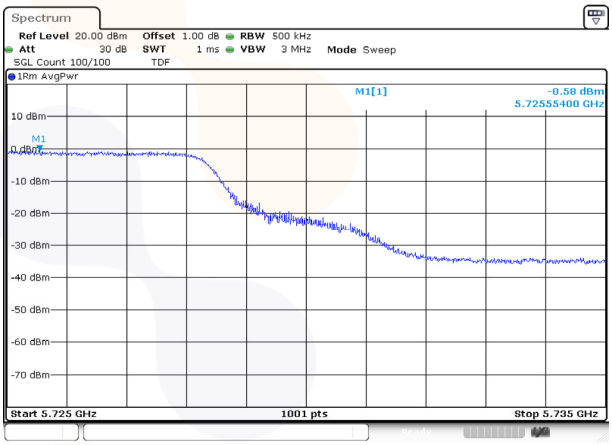
Test mode	Band	Frequency (MHz)	Measured PSD (dBm/MHz)	DCF (dB)	Maximum PSD (dB m /500 kHz)	Limit (dBm /500 kHz)
802.11a	UNII 3	5 720	-0.58	0.31	-0.27	30.00
802.11n HT20			-0.75	0.34	-0.41	

Notes:

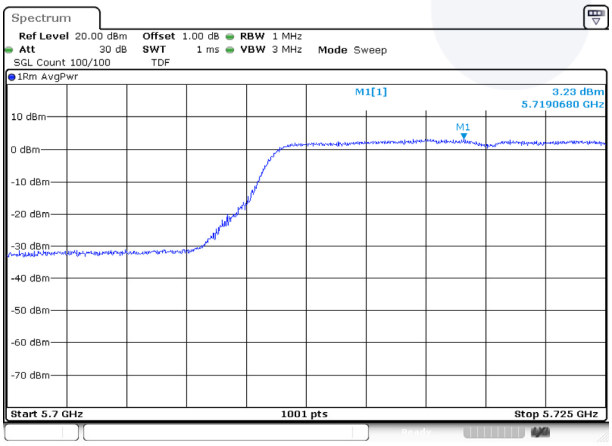
1. Maximum PSD(dB m/MHz) = Reading (dB m/MHz) + D.C.F(dB)

UNII 2C / 802.11a

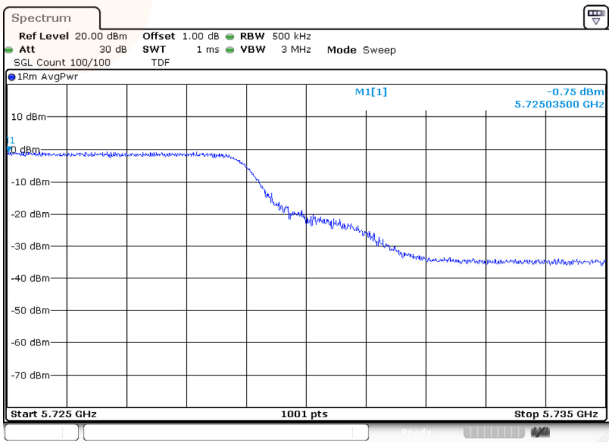
UNII 3 / 802.11a



UNII 2C / 802.11n HT20



UNII 3 / 802.11n HT20



7.6. DFS (Dynamic Frequency Selection)

Test description

- 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
U-NII Detection Bandwidth	Yes	Not required	Yes

- Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
Bandwidth	Yes	Not required

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

- Requirements of client devices

a) A Client Device will not transmit before having received appropriate control signals from a Master Device.
b) A Client Device will stop all its transmissions whenever instructed by a Master Device to which it is associated and will meet the Channel Move Time and Channel Closing Transmission Time requirements. The Client Device will not resume any transmissions until it has again received control signals from a Master Device.
c) If a Client Device is performing In-Service Monitoring and detects a Radar Waveform above the DFS Detection Threshold, it will inform the Master Device. This is equivalent to the Master Device detecting the Radar Waveform and d) through f) of section 5.1.1 apply.
d) Irrespective of Client Device or Master Device detection the Channel Move Time and Channel Closing Transmission Time requirements remain the same.
e) The client test frequency must be monitored to ensure no transmission of any type has occurred for 30 minutes. Note: If the client moves with the master, the device is considered compliant if nothing appears in the client non-occupancy

- DFS Response requirement values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. Note 2: 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 a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.	

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

Maximum Transmit Power	Value (see note)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 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.

Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.

- Radar test waveforms

Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{PRI_{\mu sec}}\right)\right\}$	60%	30
		Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A			
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

Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.

Note 2: This report was applied Short Pulse Radar Type 0.

*Short Pulse Radar Test Waveforms

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

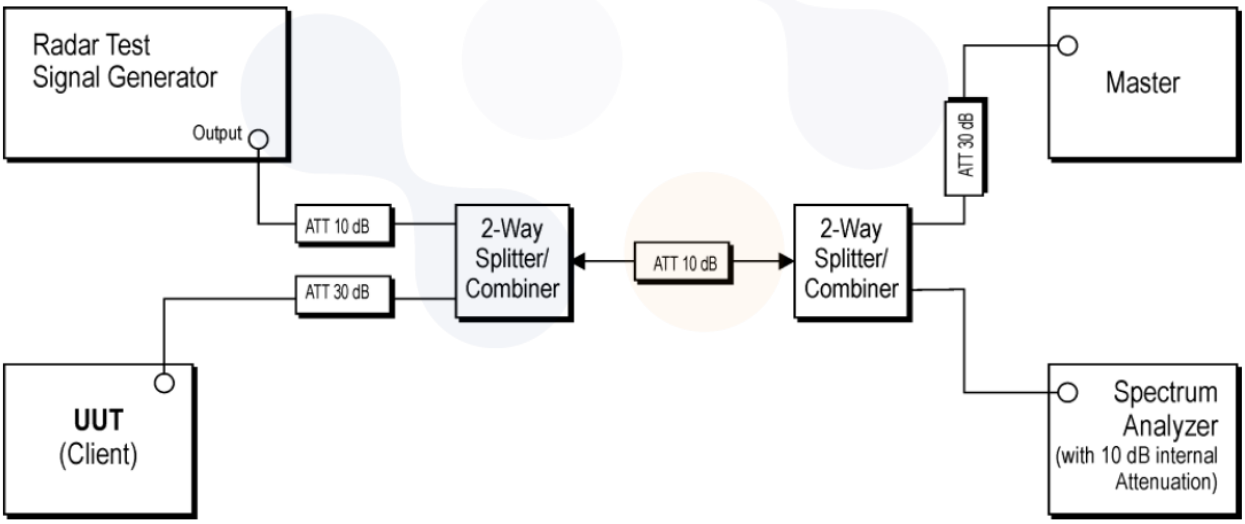
*Long Pulse Radar Test Waveform

Radar Waveform	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (㎑)	Hopping Sequence Length (µs)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	9	0.333	300	70%	30

*Frequency Hopping Radar Test Waveform

Test setup

- Setup for Client with injection at the Master



- Spectrum analyzer setting parameter

This setting parameter is shown below and it according to the 905462 D02 UNII DFS Compliance Procedures New Rules.

1) RBW/VBW ≥ 3 ㎒
2) Detector = peak
3) Span = zero span

- Conducted test procedure

1) One frequency will be chosen from the Operating Channels of the UUT within the 5 250-5 350 ㎒ or 5 470-5 725 ㎒ bands.
2) The Client Device (EUT) is set up the above diagram and communications between the Master device and the Client is established.
3) Stream the channel loading test file from the Master Device to the Client Device on the test Channel for the entire period of the test.
4) An additional 1 ㏈ is added to the radar test signal to ensure it is at or above the DFS Detection Threshold, accounting for equipment variations/errors.
5) Observe the transmissions of the UUT at the end of the Burst on the Operating Channel for duration greater than 12 seconds for Radar Type 0 to ensure detection occurs.
6) After the initial radar burst the channel is monitored for 30 minutes to ensure no transmissions or beacons occur. A second monitoring setup is used to verify that the Master and Client have both moved to different channels.

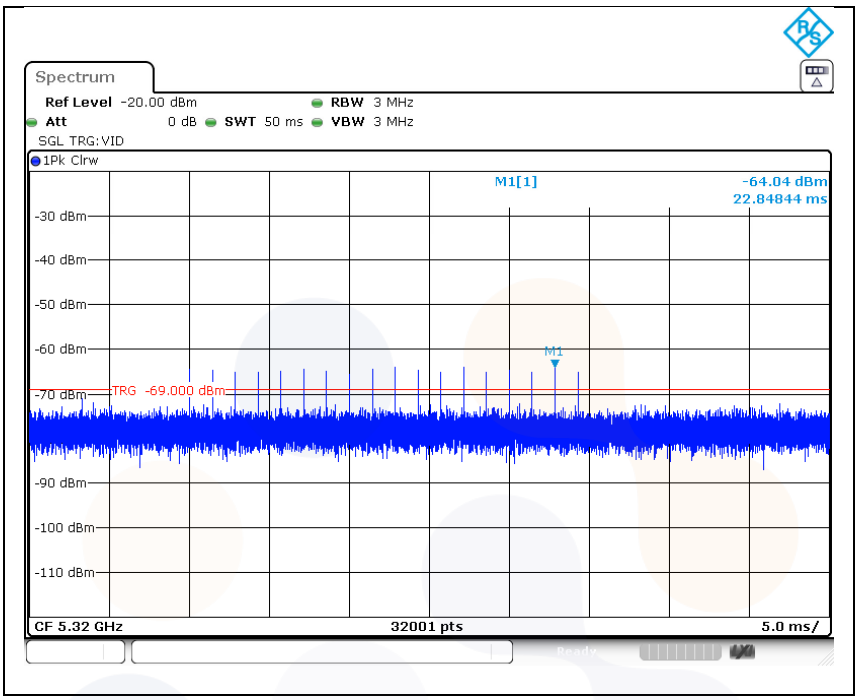
- Master device information

Equipment Name	Manufacturer	Model No.	Serial No.	FCC ID
Access Point	ASUSTeK Computer Inc	RT-AXE11000	M6IAJF203393	MSQ-RTAXJF00

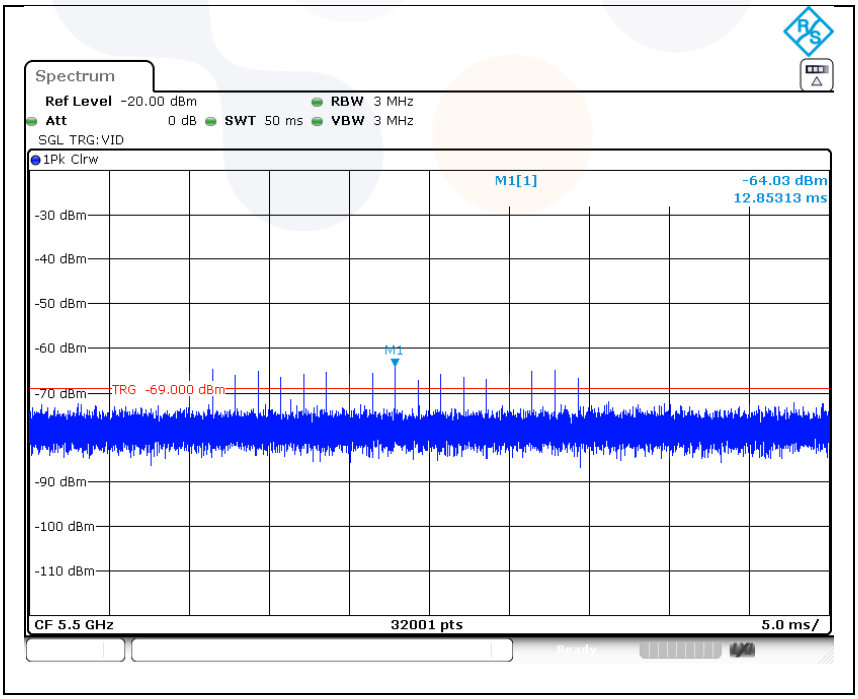
Test result

Plot of radar waveform

5 320 ㎒

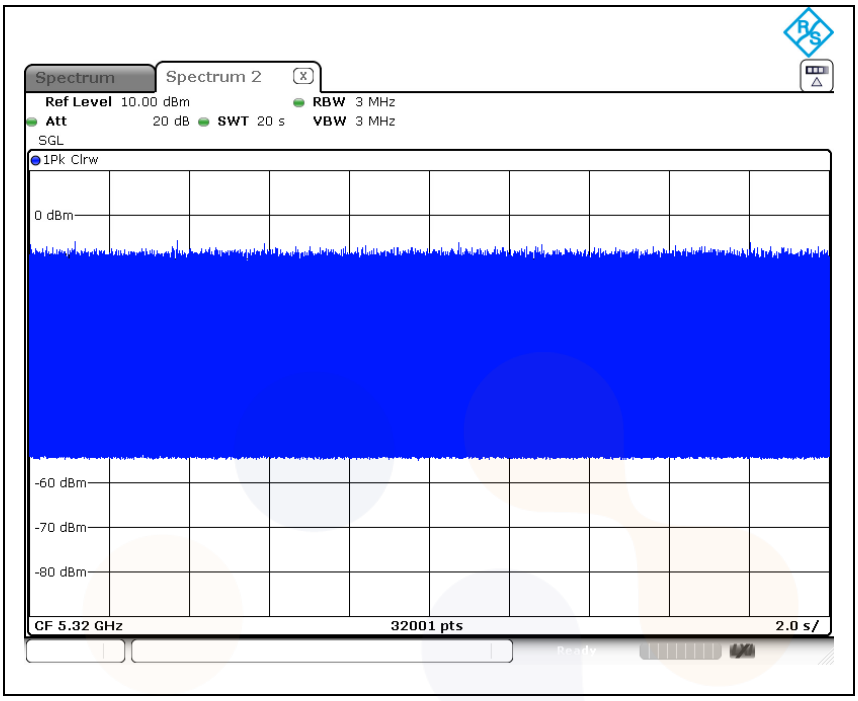


5 500 ㎒

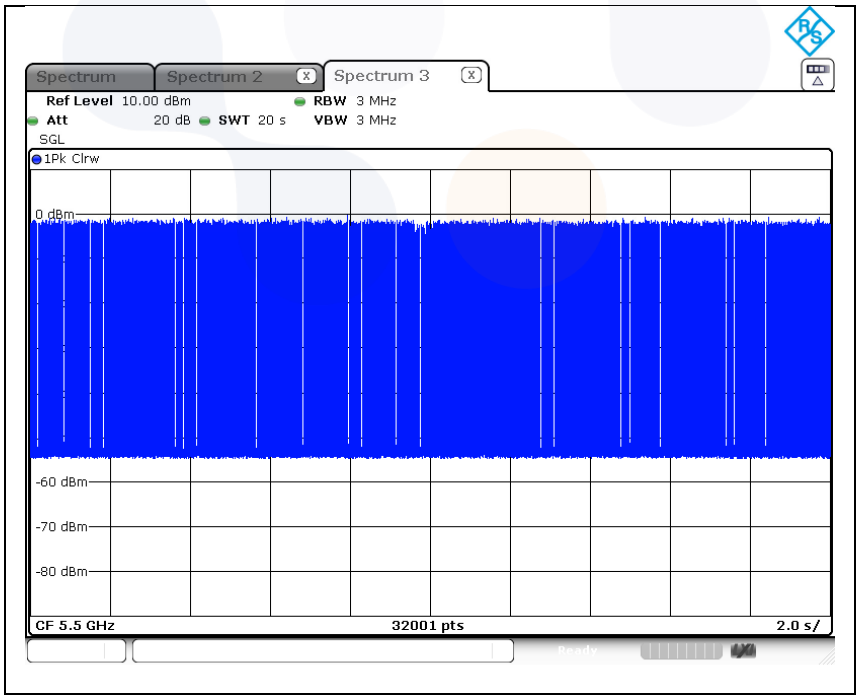


Plot of LAN traffic

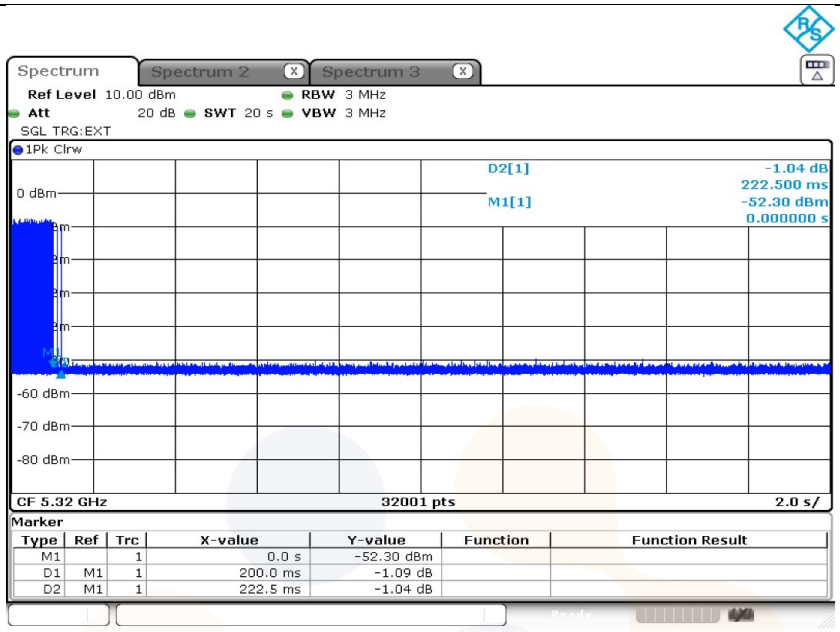
5 320 ㎒



5 500 ㎒

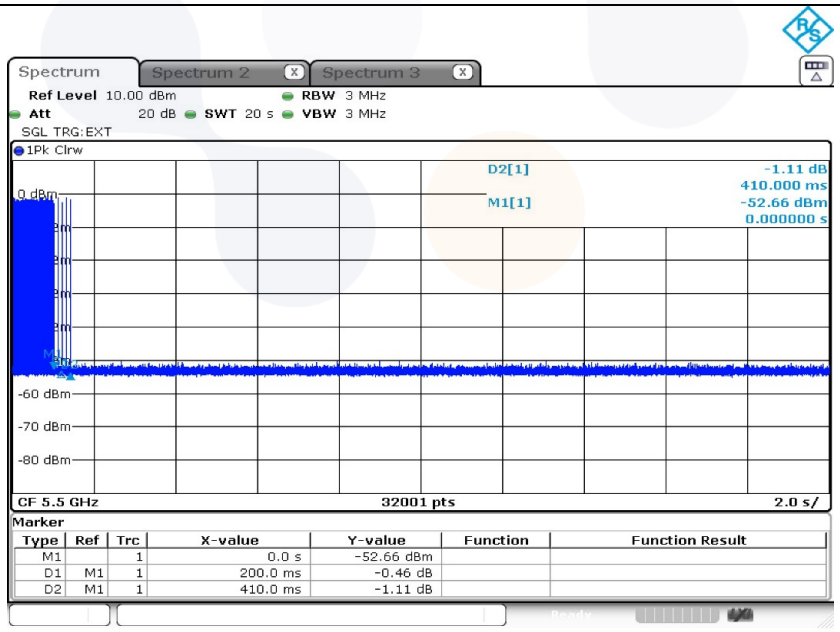


Plot of channel move time and aggregate time



Channel move time = 0.222 500 s
Closing time = 0.000 625 s x 5 = 0.003 125 s
(Closing time : Burst unit time(20 s / 32 001 points) * Number of burst(between 2 markers))

UNII 2A: 802.11 a, 5 320 ㎒

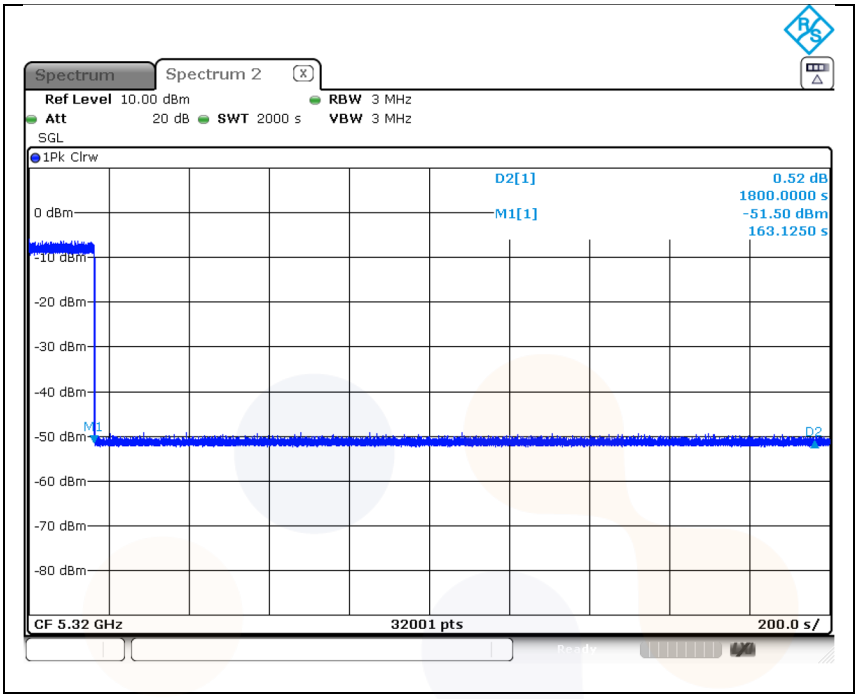


Channel move time = 0.410 000 s
Closing time = 0.000 625 s x 6 = 0.003 750 s
(Closing time : Burst unit time(20 s / 32 001 points) * Number of burst(between 2 markers))

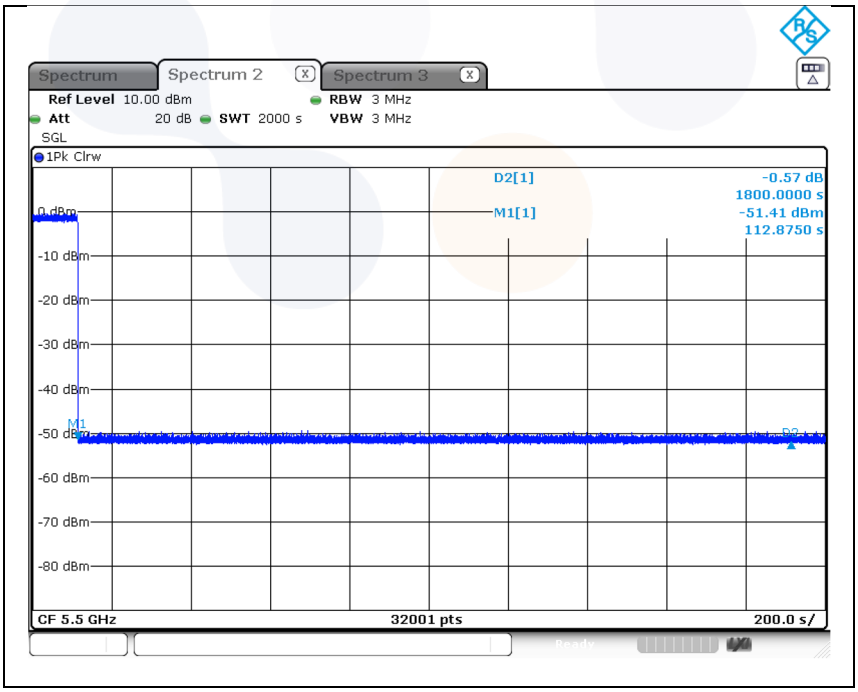
UNII 2C: 802.11 a, 5 500 ㎒

Plot of Non-occupancy period

5 320 ㎒



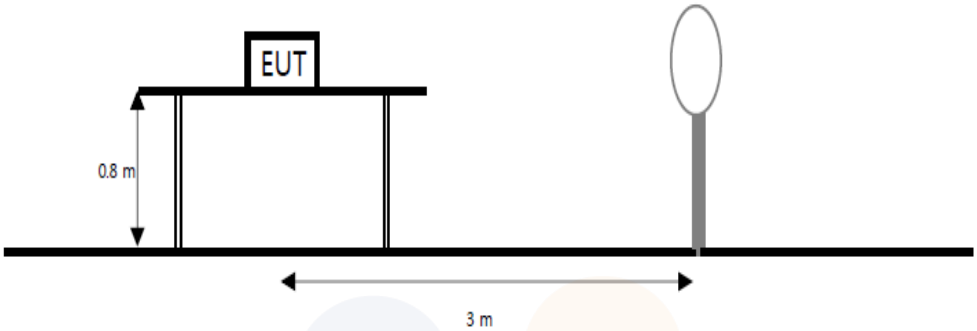
5 500 ㎒



7.7. Spurious Emission, Band Edge and Restricted bands

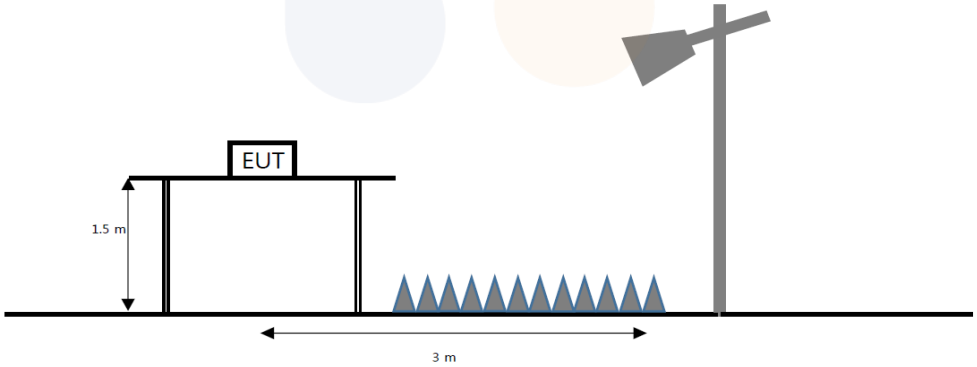
Test setup

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 from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.



Limit

According to section 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 (㎒)	Field strength (㎛/m)	Measurement distance (m)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	30
1.705 - 30	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 ㎒, 76–88 ㎒, 174–216 ㎒ or 470–806 ㎒. However, operation within these frequency bands is permitted under other sections of this part, e.g., Section15.231 and 15.241.

According to section 15.205(a) and (b),

Only spurious emissions are permitted in any of the frequency bands listed below:

㎒	㎒	㎒	㎓
0.009 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 – 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 – 1 427	8.025 - 8.5
4.177 25 - 4.177 75	37.5 - 38.25	1 435 – 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 – 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 – 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 – 1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 – 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 – 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525 25	2 483.5 – 2 500	17.7 - 21.4
8.376 25 - 8.386 75		2 690 – 2 900	22.01 - 23.12
8.414 25 - 8.414 75	156.7 - 156.9	3 260 – 3 267	23.6 - 24.0
12.29 - 12.293	162.012 5 - 167.17	3 332 – 3 339	31.2 - 31.8
12.519 75 - 12.520 25	167.72 - 173.2	3 345.8 – 3 358	36.43 - 36.5
12.576 75 - 12.577 25	240 - 285	3 600 – 4 400	Above 38.6
13.36 - 13.41	322 - 335.4		

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in section 15.209. At frequencies equal to or less than 1 000 ㎒, compliance with the limits in section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 ㎒, compliance with the emission limits in section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in section 15.35 apply to these measurements.

According to section 15.407(b),

Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

For transmitters operating in the 5.15-5.25 ㎓ band: All emissions outside of the 5.15-5.35 ㎓ band shall not exceed an e.i.r.p. 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 e.i.r.p. of −27 ㏈m/㎒.

For transmitters operating in the 5.725-5.85 ㎓ band: All emissions shall be limited to a level of -27 ㏈m/㎒ at 75 ㎒ or more above or below the band edge increasing linearly to 10 ㏈m/㎒ at 25 ㎒ above or below the band edge, and form 25 ㎒ above or below the band edge increasing linearly to a level of 15.6 ㏈m/㎒ at 5 ㎒ above or below the band edge, and from 5 ㎒ above or below the band edge increasing linearly to a level of 27 ㏈m/㎒ at the band edge.

Test procedure
ANSI C63.10-2013 Section 12.7.7.2, 12.7.5, 12.7.6
KDB 789033 D02 v02r01 – Section G

Test settings
Peak field strength measurements
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in table
3. VBW ≥ (3×RBW)
4. Detector = peak
5. Sweep time = auto
6. Trace mode = max hold
7. Allow sweeps to continue until the trace stabilizes

Table. RBW as a function of frequency

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

Average field strength measurements

Trace averaging with continuous EUT transmission at full power

If the EUT can be configured or modified to transmit continuously (D ≥ 98%), then the average emission levels shall be measured using the following method (with EUT transmitting continuously):
1. RBW = 1 ㎒ (unless otherwise specified).
2. VBW ≥ (3×RBW).
3. Detector = RMS (power averaging), 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.
4. 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 to use linear voltage averaging. Log or ㏈ averaging shall not be used.
5. Sweep time = auto.
6. Perform a trace average of at least 100 traces.

Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction

If continuous transmission of the EUT (D ≥ 98%) cannot be achieved and the duty cycle is constant (duty cycle variations are less than ±2%), then the following procedure shall be used:

1. The EUT shall be configured to operate at the maximum achievable duty cycle.
2. Measure the duty cycle D of the transmitter output signal as described in 11.6.
3. RBW = 1 ㎒ (unless otherwise specified).
4. VBW ≥ [3 × RBW].
5. Detector = RMS (power averaging), 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.
6. 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 to use linear voltage averaging. Log or ㏈ averaging shall not be used.
7. Sweep time = auto.
8. Perform a trace average of at least 100 traces.
9. A correction factor shall be added to the measurement results prior to comparing with the emission limit to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
   1) If power averaging (rms) mode was used in step f), then the applicable correction factor is [10 log (1 / D)], where D is the duty cycle.
   2) If linear voltage averaging mode was used in step f), then the applicable correction factor is [20 log (1 / D)], where D is the duty cycle.
   3) If a specific emission is demonstrated to be continuous (D ≥ 98%) rather than turning ON and OFF with with the transmit cycle, then no duty cycle correction is required for that emission.

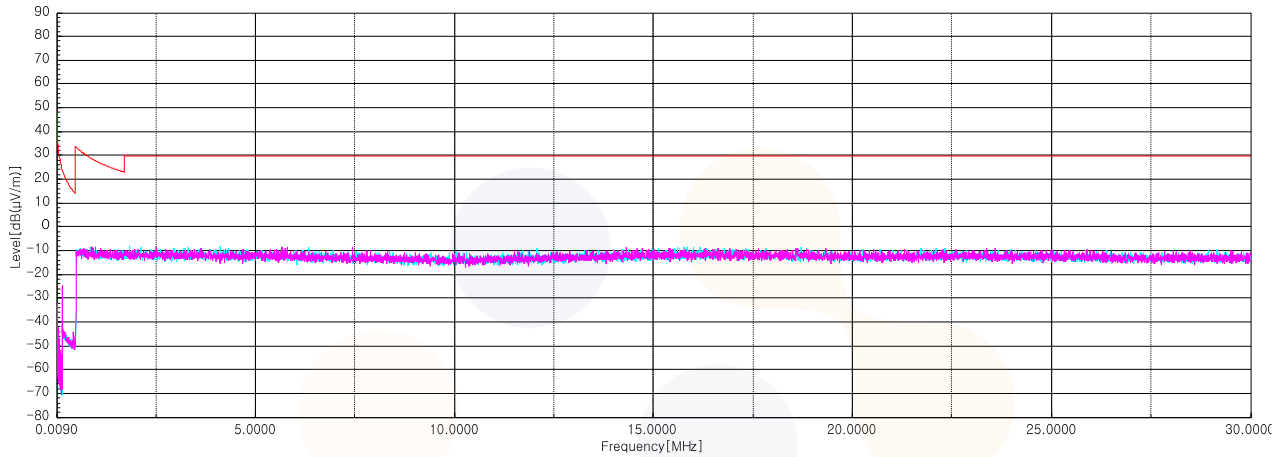
Notes:

1. *f* <30 ㎒, extrapolation factor of 40 ㏈/decade of distance. $F_d = 40\log(D_m/D_s)$
   f ≥30 ㎒, extrapolation factor of 20 ㏈/decade of distance. $F_d = 20\log(D_m/D_s)$
   Where:
   F_d= Distance factor in ㏈
   D_m= Measurement distance in meters
   D_s= Specification distance in meters
2. Factors(㏈) = Antenna factor(㏈/m) + Cable loss(㏈) + or Amp. gain(㏈) + or F_d(㏈)
3. The worst-case emissions are reported however emissions whose levels were not within 20 ㏈ of respective limits were not reported.
4. Average test would be performed if the peak result were greater than the average limit.
5. 1) means restricted band.
6. Below 30 ㎒ frequency range, In order to search for the worst result, all orientations about parallel, perpendicular, and ground-parallel were investigated then reported. when the emission level was higher than 20 ㏈ of the limit, then the following statement shall be made: “No spurious emissions were detected within 20 ㏈ of the limit.”
7. Above 1 ㎓ the worst results between two antenna polarizations (H and V) were documented in the test report.
8. For above 1 ㎓ pre-scan to detect harmonic and spurious emissions, the resolution bandwidth is set to 1 ㎒; the video bandwidth is set to 30 ㎑ for peak measurements.

Test results (Below 30 ㎒) – Worst case: 802.11a / UNII 2A_5 320 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data								
No spurious emissions were detected within 20 ㏈ of the limit.								

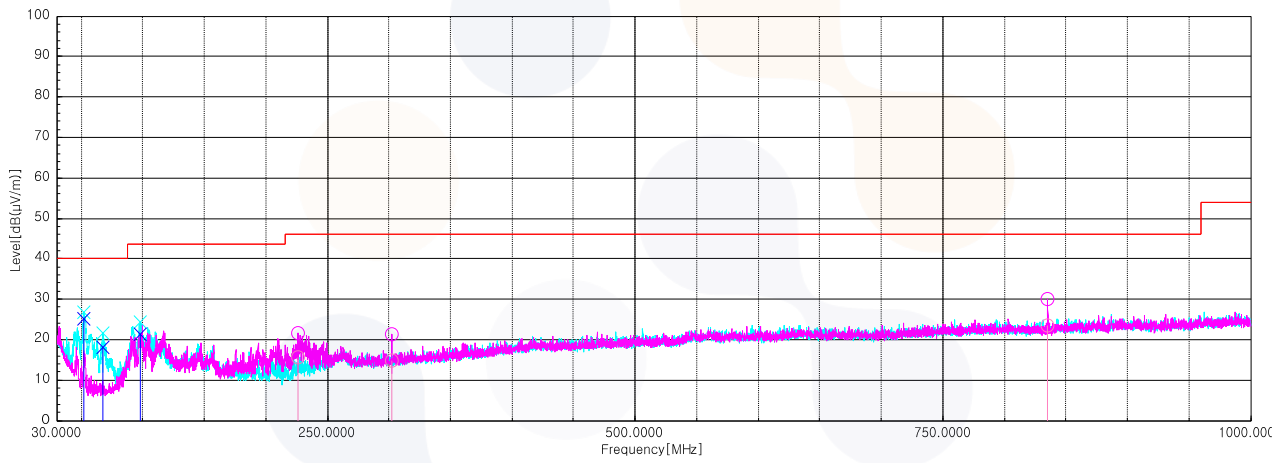
Horizontal/Vertical



Test results (Below 1 000 ㎒) – Worst case: 802.11a / UNII 2A_5 320 ㎒

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data								
52.19	V	43.60	13.16	-31.68	-	25.08	40.00	14.92
67.71	V	37.50	12.10	-31.64	-	17.96	40.00	22.04
98.02	V	36.90	15.90	-31.65	-	21.15	43.50	22.35
225.94	H	31.20	15.59	-31.08	-	15.71	46.00	30.29
302.09	H	26.70	19.10	-30.90	-	14.90	46.00	31.10
834.98	H	27.10	25.85	-29.51	-	23.44	46.00	22.56

Horizontal/Vertical



Test results (Above 1 000 ㎒)

UNII 1

802.11a_Lowest Channel (5 180 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 149.89[1)]	V	53.50	33.30	-27.26	-	59.54	74.00	14.46
10 358.63	V	55.10	38.88	-44.56	-	49.42	68.20	18.78
15 543.22[1)]	V	54.80	38.21	-42.44	-	50.57	74.00	23.43
Average Data								
5 149.89[1)]	V	38.47	33.30	-27.26	0.31	44.82	54.00	9.18

802.11a_Middle Channel (5 200 ㎒)

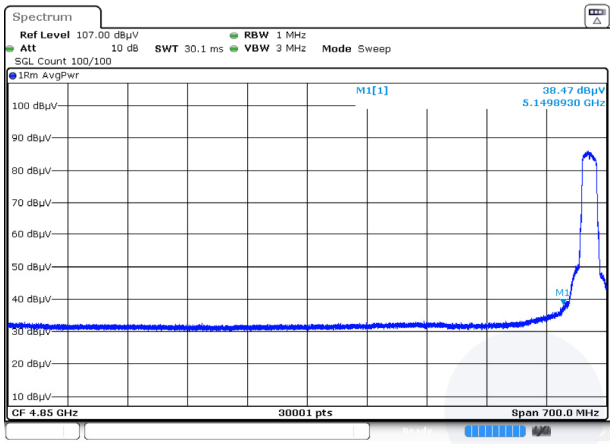
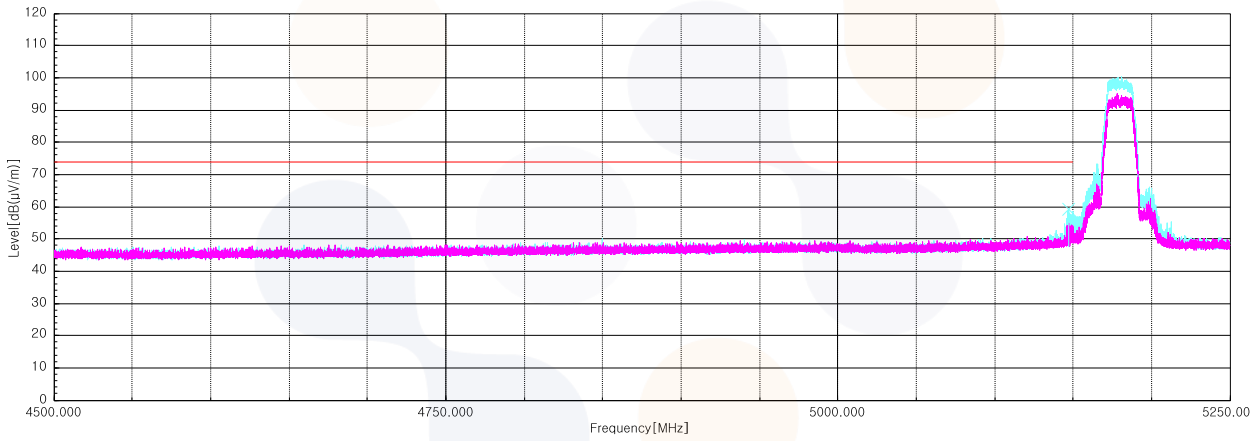
Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
10 386.23	H	55.30	38.83	-44.55	-	49.58	68.20	18.62
15 597.13[1)]	V	55.40	38.11	-42.43	-	51.08	74.00	22.92
Average Data								
15 597.13[1)]	V	48.31	38.11	-42.43	0.31	44.30	54.00	9.70

802.11a_Highest Channel (5 240 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
10 472.87	H	54.60	39.00	-44.51	-	49.09	68.20	19.11
15 723.30[1)]	V	55.90	38.10	-42.42	-	51.58	74.00	22.42
Average Data								
15 723.30[1)]	V	48.39	38.10	-42.42	0.31	44.38	54.00	9.62

In order to simplify the report, attached plots were only the lowest margin condition

802.11a_Lowest Channel (5 180 ㎒)

Average data	
	Blank
Horizontal/Vertical for Band-edge	
	

802.11n_HT20_Lowest Channel (5 180 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 149.33[1)]	V	54.20	33.30	-27.26	-	60.24	74.00	13.76
10 357.48	V	54.70	38.89	-44.56	-	49.03	68.20	19.17
15 559.32[1)]	H	53.80	38.18	-42.44	-	49.54	74.00	24.46
Average Data								
5 149.33[1)]	V	38.69	33.30	-27.26	0.34	45.07	54.00	8.93

802.11n_HT20_Middle Channel (5 200 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
10 423.03	V	54.60	39.05	-44.53	-	49.12	68.20	19.08
15 597.65[1)]	V	55.00	38.10	-42.43	-	50.67	74.00	23.33
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit								

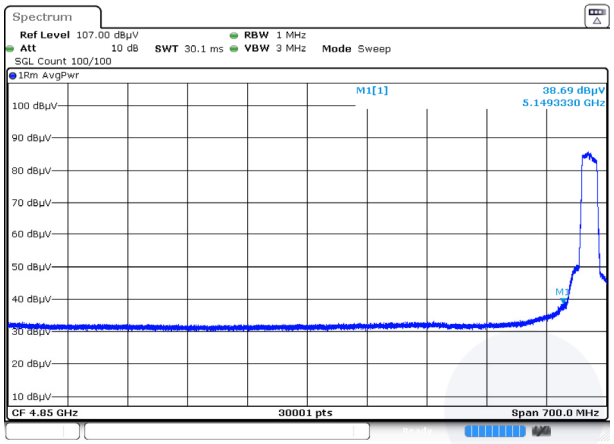
802.11n_HT20_Highest Channel (5 240 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
10 512.35	H	54.60	39.00	-44.52	-	49.08	68.20	19.12
15 724.15[1)]	V	55.00	38.10	-42.42	-	50.68	74.00	23.32
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit								

In order to simplify the report, attached plots were only the lowest margin condition

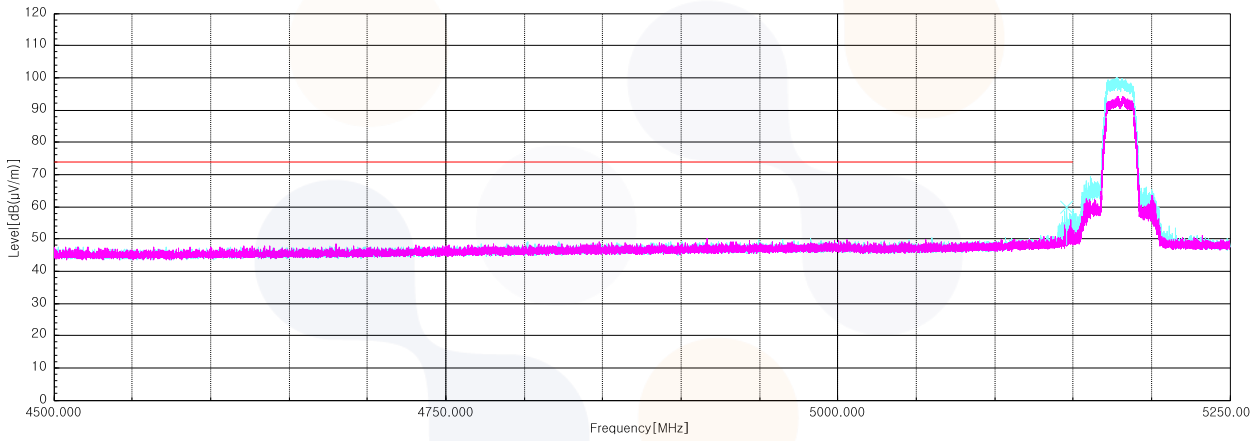
802.11n_HT20_Lowest Channel (5 180 ㎒)

Average data



Blank

Horizontal/Vertical for Band-edge

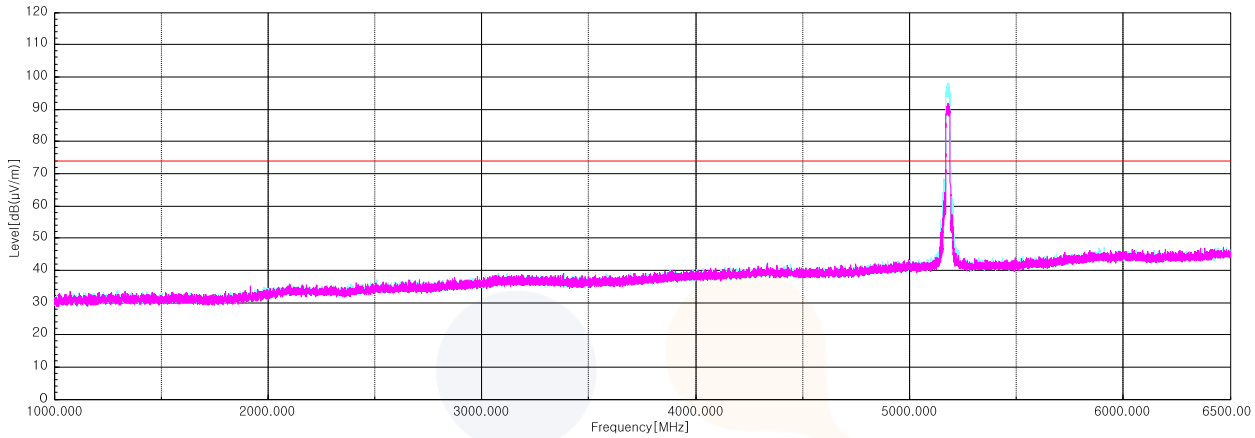


Plot of Harmonics and Spurious Emissions

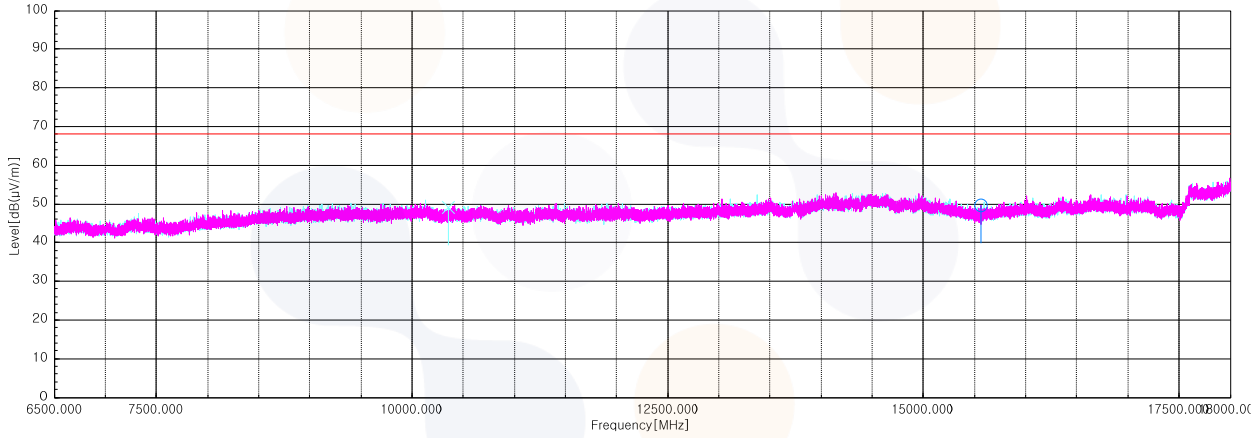
In order to simplify the report, attached plots were only the lowest margin condition

802.11n HT20_UNII 1_Lowest Channel (5 180 ㎒)

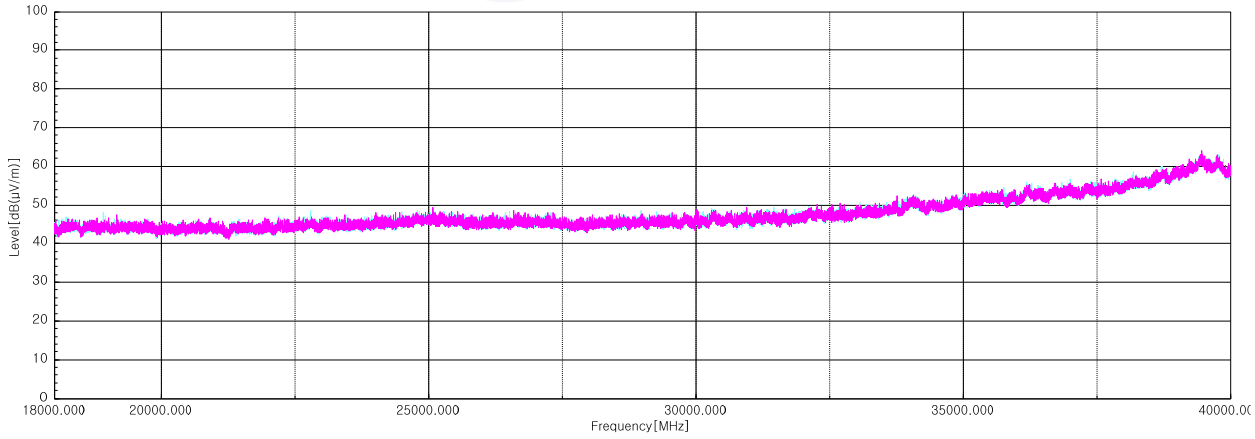
Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



Horizontal/Vertical for 18 ㎓ ~ 40 ㎓



UNII 2A

802.11a_Lowest Channel (5 260 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
10 538.80	H	54.30	39.00	-44.55	-	48.75	68.20	19.45
15 777.49[1)]	V	56.20	38.10	-42.34	-	51.96	74.00	22.04
Average Data								
15 777.49[1)]	V	48.33	38.10	-42.34	0.31	44.40	54.00	9.60

802.11a_Middle Channel (5 280 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
10 564.10	V	54.60	39.13	-44.58	-	49.15	68.20	19.05
15 838.23[1)]	V	55.50	38.28	-42.17	-	51.61	74.00	22.39
Average Data								
15 838.23[1)]	V	49.23	38.28	-42.17	0.31	45.65	54.00	8.35

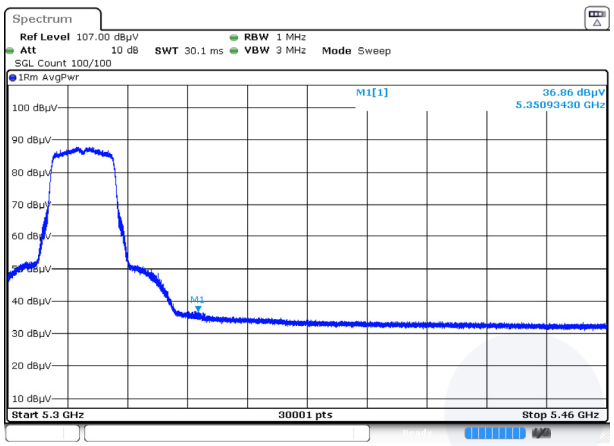
802.11a_Highest Channel (5 320 ㎒)

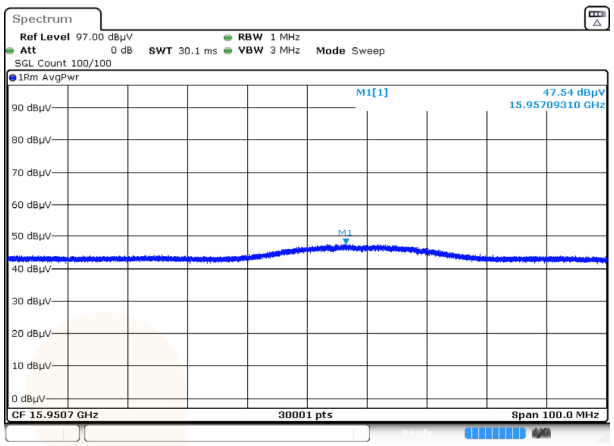
Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 350.93[1)]	V	54.70	33.00	-26.92	-	60.78	74.00	13.22
10 658.40[1)]	H	55.90	39.32	-44.71	-	50.51	74.00	23.49
15 957.09[1)]	V	55.20	38.20	-41.83	-	51.57	74.00	22.43
Average Data								
5 350.93[1)]	V	36.86	33.00	-26.92	0.31	43.25	54.00	10.75
15 957.09[1)]	V	47.54	38.20	-41.83	0.31	44.22	54.00	9.78

In order to simplify the report, attached plots were only the lowest margin condition

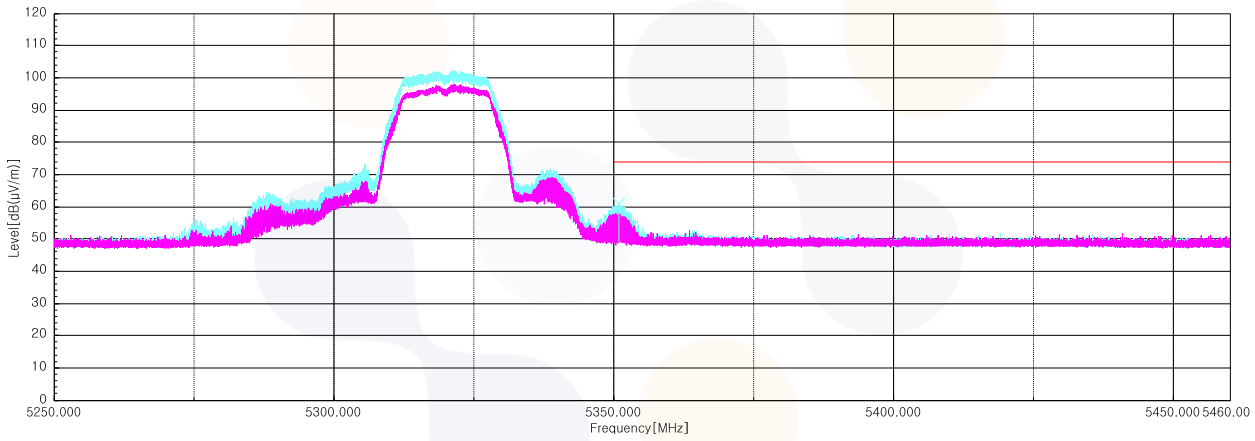
802.11a_Highest Channel (5 320 ㎒)

Average data





Horizontal/Vertical for Band-edge



802.11n_HT20_Lowest Channel (5 260 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
10 539.57	V	55.00	39.00	-44.55	-	49.45	68.20	18.75
15 775.97[1)]	V	55.60	38.10	-42.35	-	51.35	74.00	22.65
Average Data								
15 775.97[1)]	V	45.88	38.10	-42.35	0.34	41.97	54.00	12.03

802.11n_HT20_Middle Channel (5 280 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
10 545.32	V	55.00	39.00	-44.56	-	49.44	68.20	18.76
15 837.64[1)]	V	54.90	38.28	-42.17	-	51.01	74.00	22.99
Average Data								
15 837.64[1)]	V	47.20	38.28	-42.17	0.34	43.65	54.00	10.35

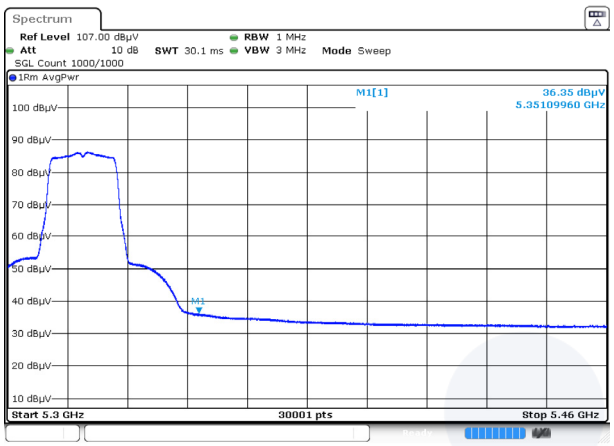
802.11n_HT20_Highest Channel (5 320 ㎒)

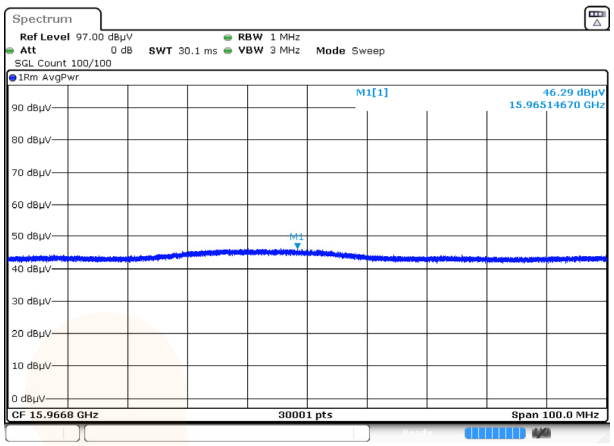
Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 351.10[1)]	V	51.60	33.00	-26.92	-	57.68	74.00	16.32
10 617.00[1)]	V	54.90	39.23	-44.65	-	49.48	74.00	24.52
15 965.15[1)]	V	54.90	38.20	-41.81	-	51.29	74.00	22.71
Average Data								
5 351.10[1)]	V	36.35	33.00	-26.92	0.34	42.77	54.00	11.23
15 965.15[1)]	V	46.29	38.20	-41.81	0.34	43.02	54.00	10.98

In order to simplify the report, attached plots were only the lowest margin condition

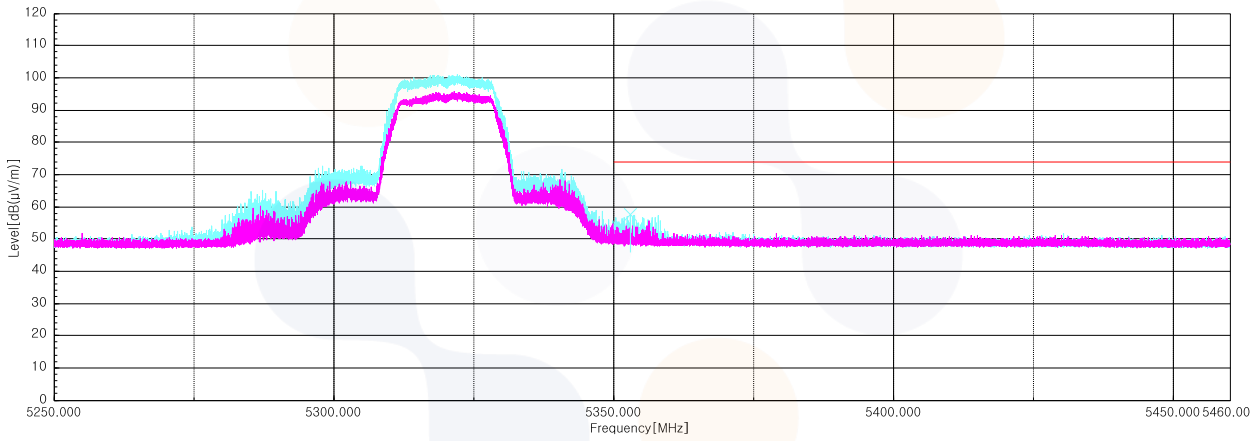
802.11n_HT20_Highest Channel (5 320 ㎒)

Average data





Horizontal/Vertical for Band-edge

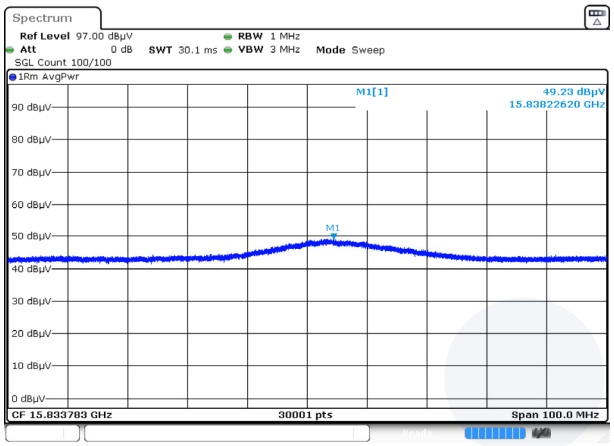


Plot of Harmonics and Spurious Emissions

In order to simplify the report, attached plots were only the lowest margin condition

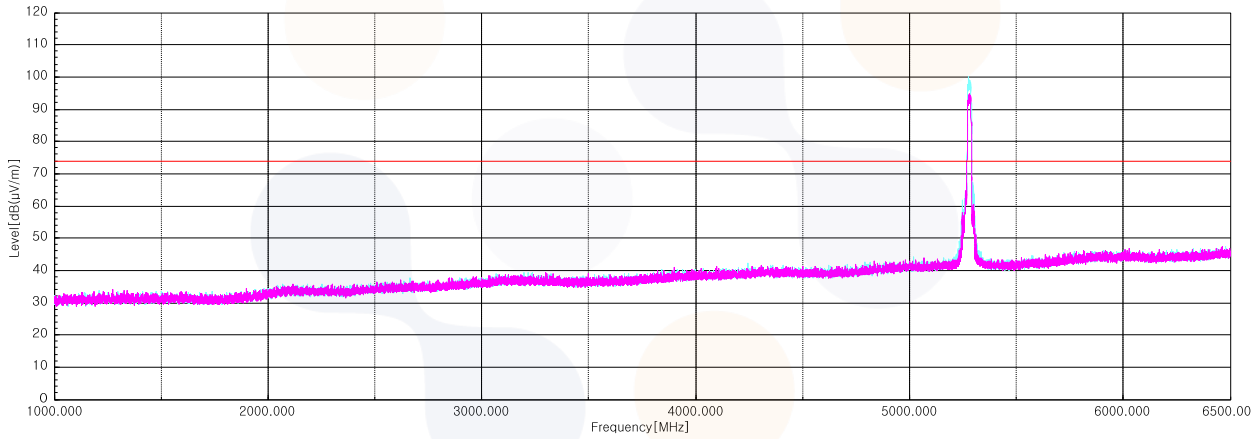
802.11a_UNII 2A_Middle Channel (5 280 ㎒)

Average data

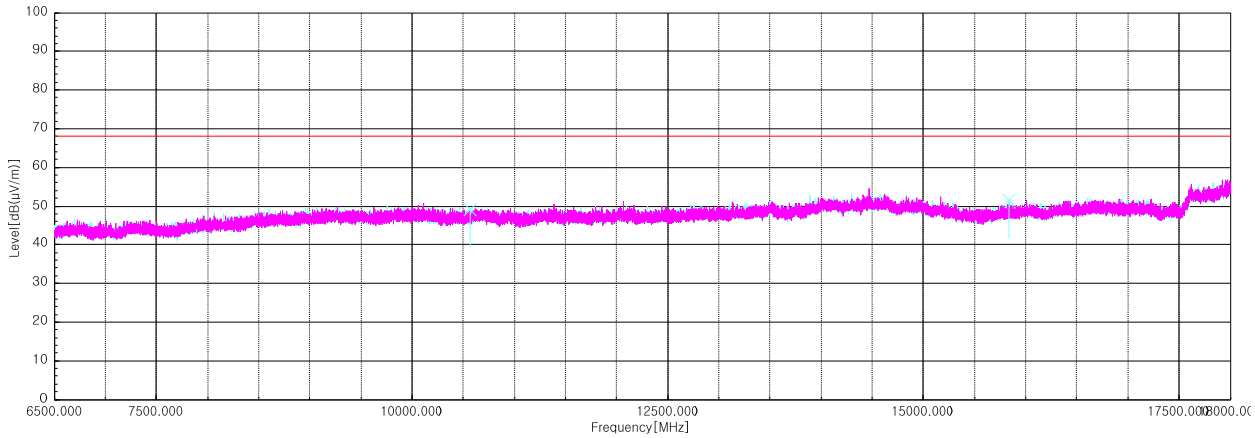


Blank

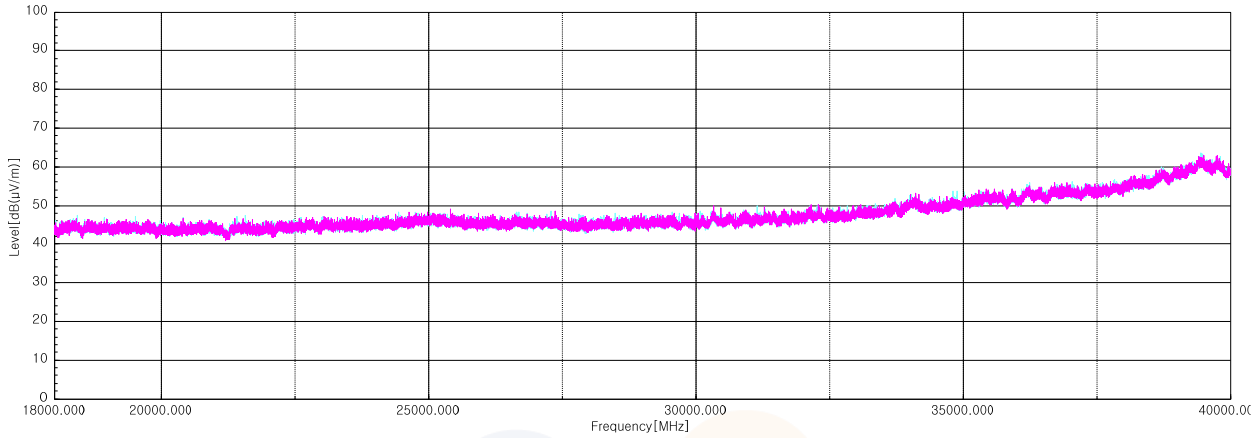
Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



Horizontal/Vertical for 18 ㎓ ~ 40 ㎓



UNII 2C

802.11a_Lowest Channel (5 500 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 459.90[1)]	V	47.30	33.00	-26.82	-	53.48	74.00	20.52
11 000.33[1)]	V	53.80	39.10	-44.08	-	48.82	74.00	25.18
16 501.55	V	54.40	38.10	-41.43	-	51.07	68.20	17.13
Average Data								
5 459.90[1)]	V	35.75	33.00	-26.82	0.31	42.24	54.00	11.76

802.11a_Middle Channel (5 600 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
11 256.40[1)]	V	55.10	39.10	-43.92	-	50.28	74.00	23.72
16 788.67	H	56.40	38.02	-41.40	-	53.02	68.20	15.18
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

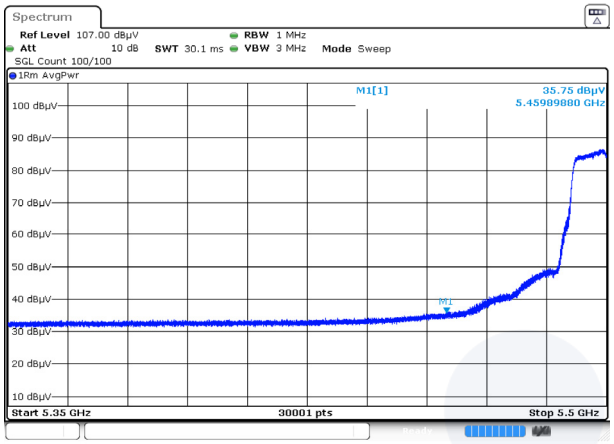
802.11a_Highest Channel (5 700 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 725.84	V	50.70	33.76	-26.14	-	58.32	68.20	9.88
11 397.08[1)]	H	54.90	39.20	-43.45	-	50.65	74.00	23.35
17 102.62	V	55.70	38.10	-41.97	-	51.83	68.20	16.37
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

In order to simplify the report, attached plots were only the lowest margin condition

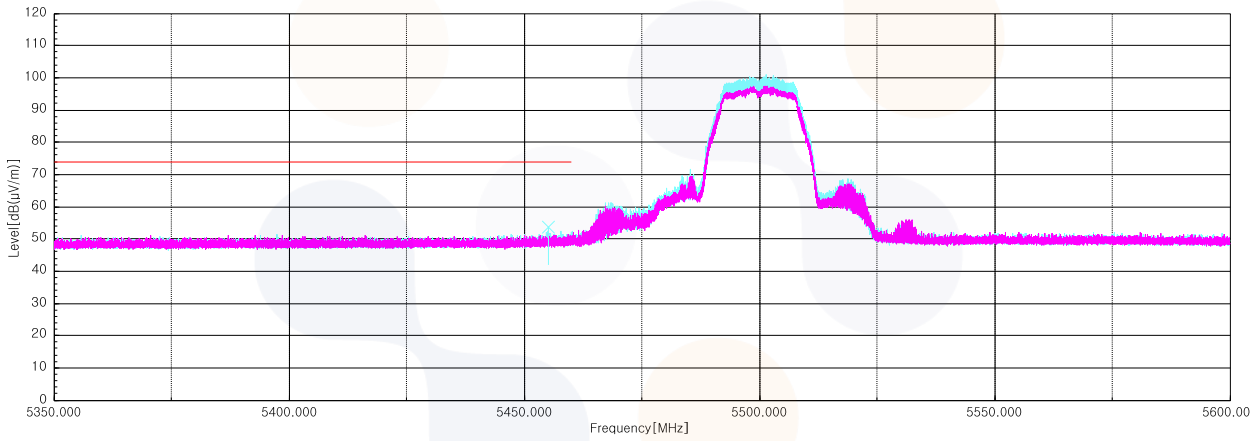
802.11a_Lowest Channel (5 500 ㎒)

Average data



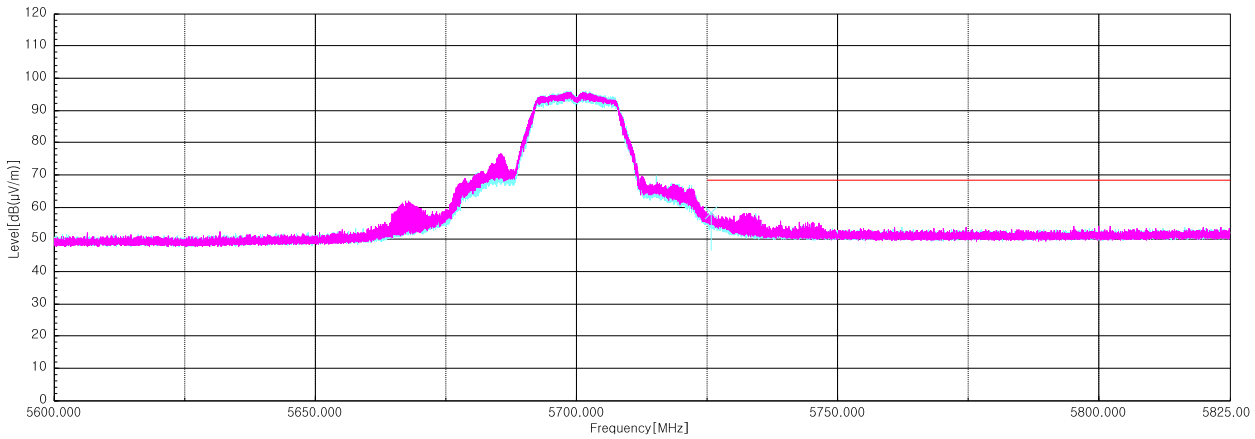
Blank

Horizontal/Vertical for Band-edge



Highest Channel (5 700 ㎒)

Horizontal/Vertical for Band-edge



802.11n_HT20_Lowest Channel (5 500 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 459.35[1)]	V	48.10	33.00	-26.82	-	54.28	74.00	19.72
11 000.72[1)]	V	53.40	39.10	-44.08	-	48.42	74.00	25.58
16 514.58	H	54.20	38.10	-41.42	-	50.88	68.20	17.32
Average Data								
5 459.35[1)]	V	36.17	33.00	-26.82	0.34	42.69	54.00	11.31

802.11n_HT20_Middle Channel (5 600 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
11 223.82[1)]	V	54.40	39.15	-43.95	-	49.60	74.00	24.40
16 808.22	V	55.90	38.10	-41.46	-	52.54	68.20	15.66
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

802.11n_HT20_Highest Channel (5 700 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 726.05	H	49.50	33.76	-26.14	-	57.12	68.20	11.08
11 403.60[1)]	H	53.30	39.20	-43.42	-	49.08	74.00	24.92
17 092.27	H	56.10	38.18	-41.98	-	52.30	68.20	15.90
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

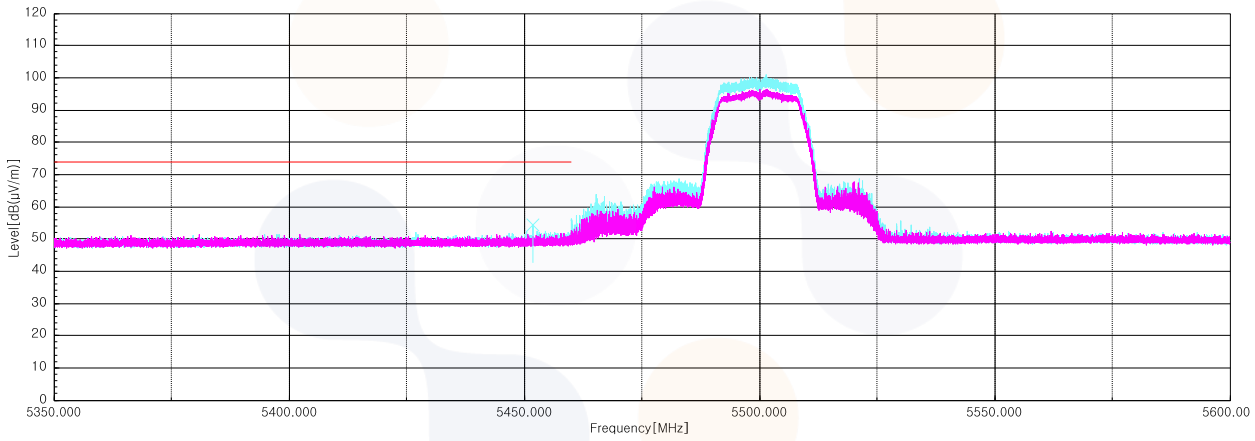
In order to simplify the report, attached plots were only the lowest margin condition

802.11n_HT20_Lowest Channel (5 500 ㎒)

Average data

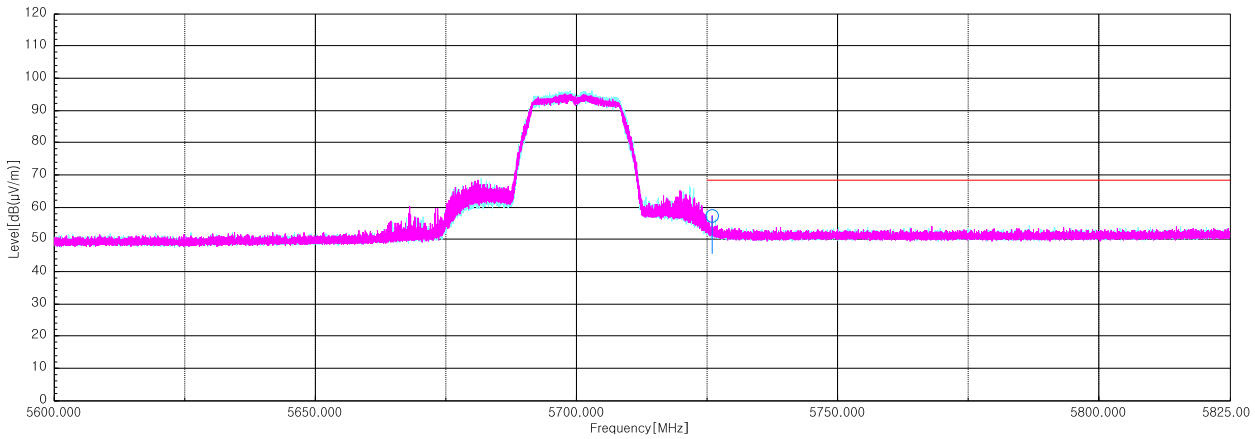
Blank

Horizontal/Vertical for Band-edge



Highest Channel (5 700 ㎒)

Horizontal/Vertical for Band-edge

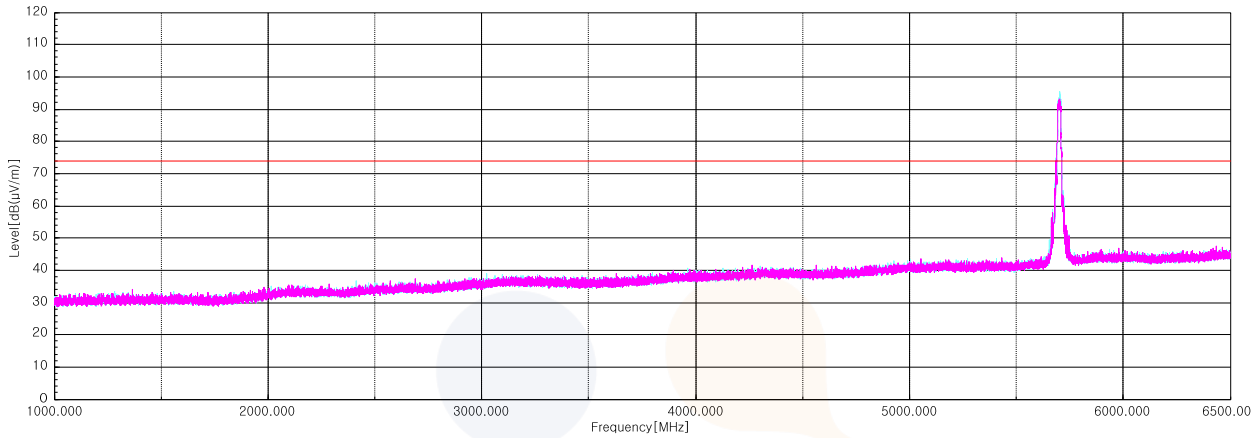


Plot of Harmonics and Spurious Emissions

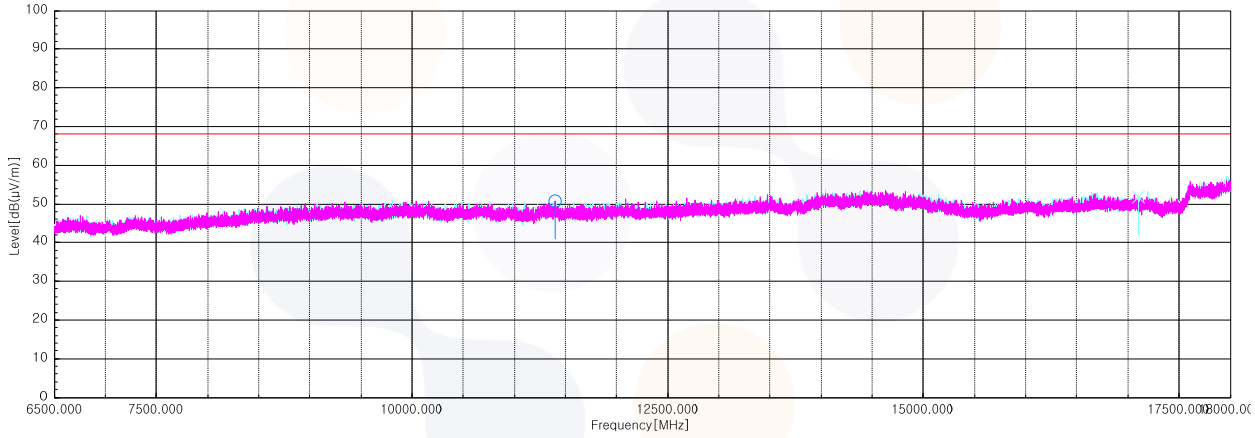
In order to simplify the report, attached plots were only the lowest margin condition

802.11a_UNII 2C_Highest Channel (5 700 ㎒)

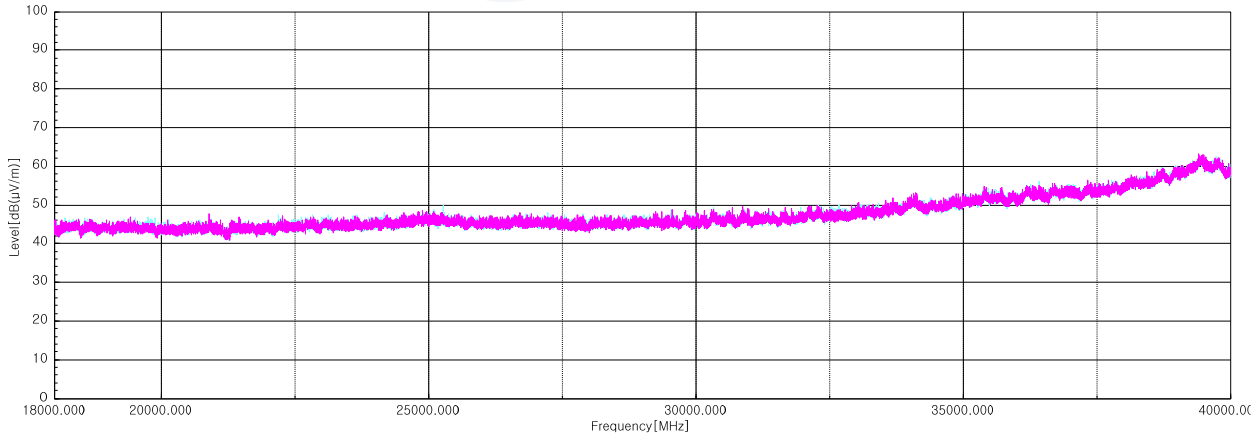
Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



Horizontal/Vertical for 18 ㎓ ~ 40 ㎓



Straddle Channel

802.11a (5 720 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
11 441.93[1)]	V	53.60	39.20	-43.30	-	49.50	74.00	24.50
17 155.90	V	54.90	38.10	-41.93	-	51.07	68.20	17.13
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

802.11n HT20 (5 720 ㎒)

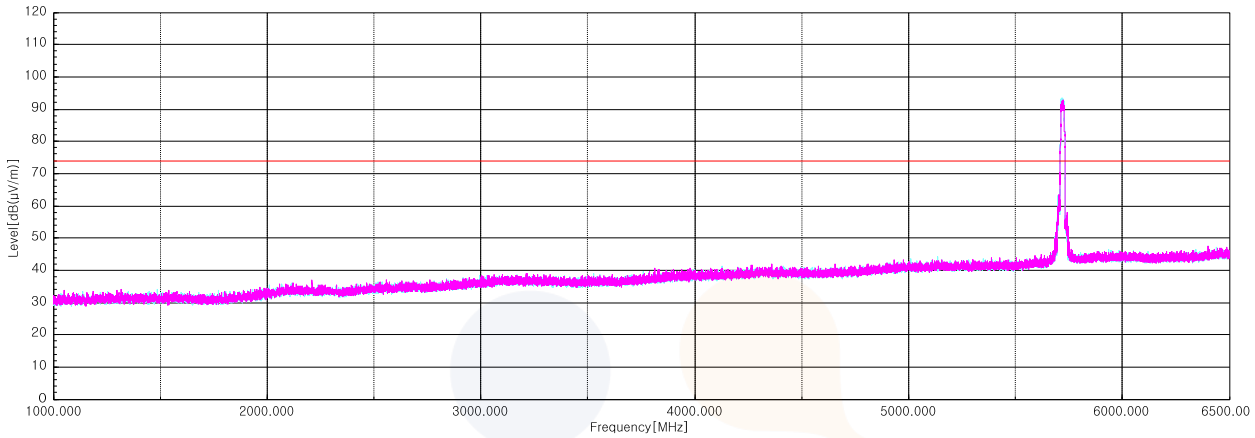
Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
11 410.88[1)]	V	54.00	39.20	-43.40	-	49.80	74.00	24.20
17 160.88	H	55.80	38.10	-41.93	-	51.97	68.20	16.23
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

Plot of Harmonics and Spurious Emissions

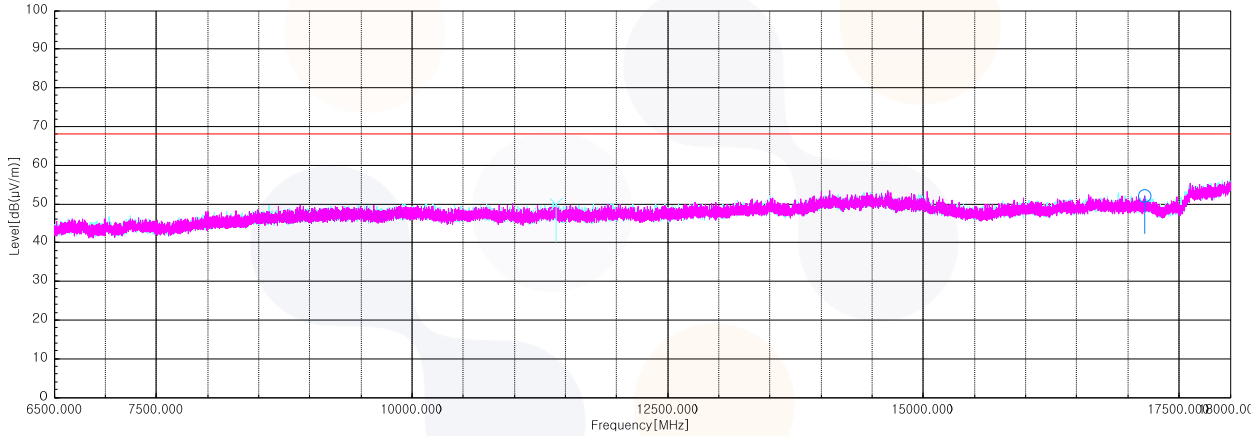
In order to simplify the report, attached plots were only the lowest margin condition

802.11n HT20_Straddle Channel (5 720 ㎒)

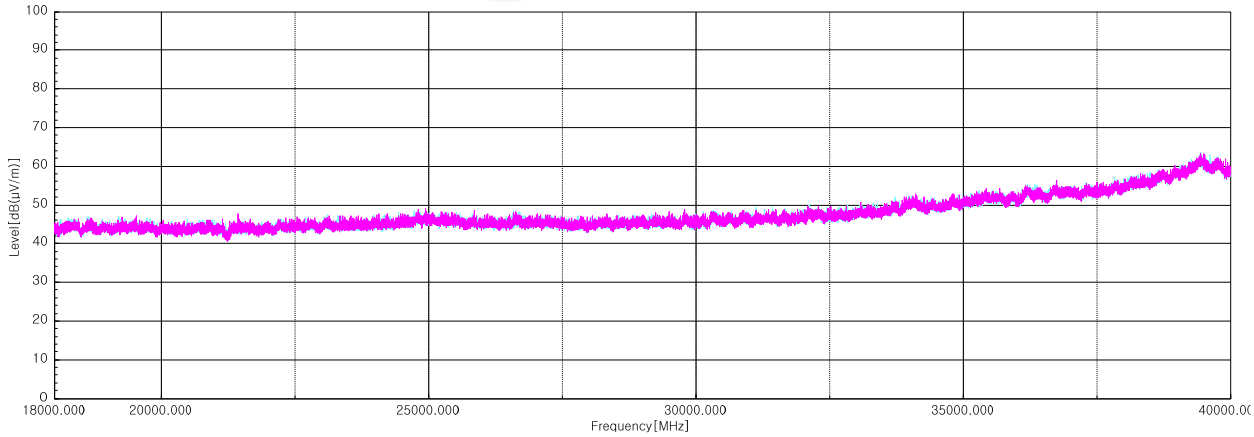
Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



Horizontal/Vertical for 18 ㎓ ~ 40 ㎓



UNII 3

802.11a_Lowest Channel (5 745 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 712.75	H	47.10	33.68	-26.18	-	54.60	108.80	54.20
11 494.83[1)]	V	53.30	39.01	-43.12	-	49.19	74.00	24.81
17 231.80	H	54.60	38.43	-41.87	-	51.16	68.20	17.04
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

802.11a_Middle Channel (5 785 ㎒)

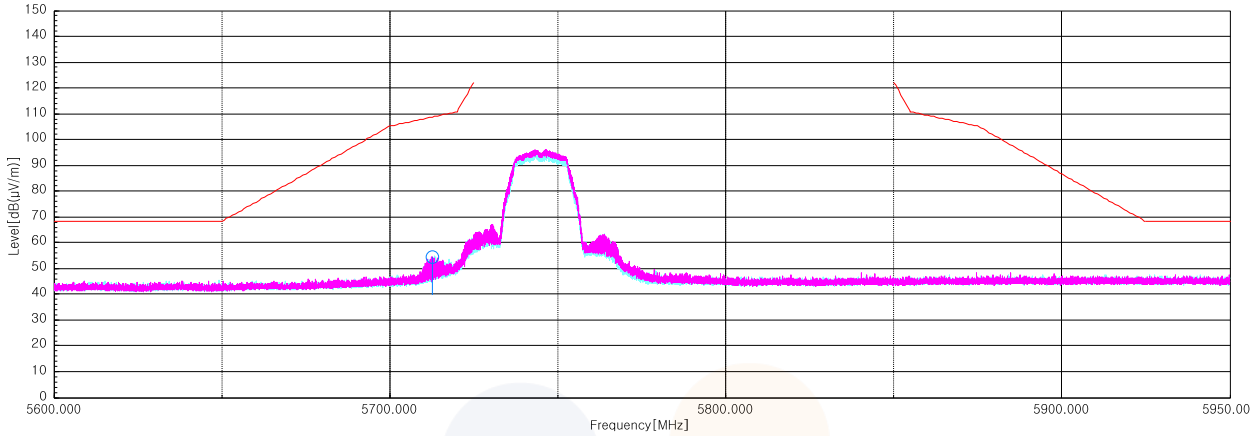
Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
11 584.15[1)]	V	53.60	38.83	-42.82	-	49.61	74.00	24.39
17 336.83	H	53.80	38.57	-42.04	-	50.33	68.20	17.87
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

802.11a_Highest Channel (5 825 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 859.84	V	41.60	34.24	-25.92	-	49.92	109.40	59.48
11 623.25[1)]	H	53.60	38.75	-42.70	-	49.65	74.00	24.35
17 465.25	V	55.30	39.26	-42.30	-	52.26	68.20	15.94
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

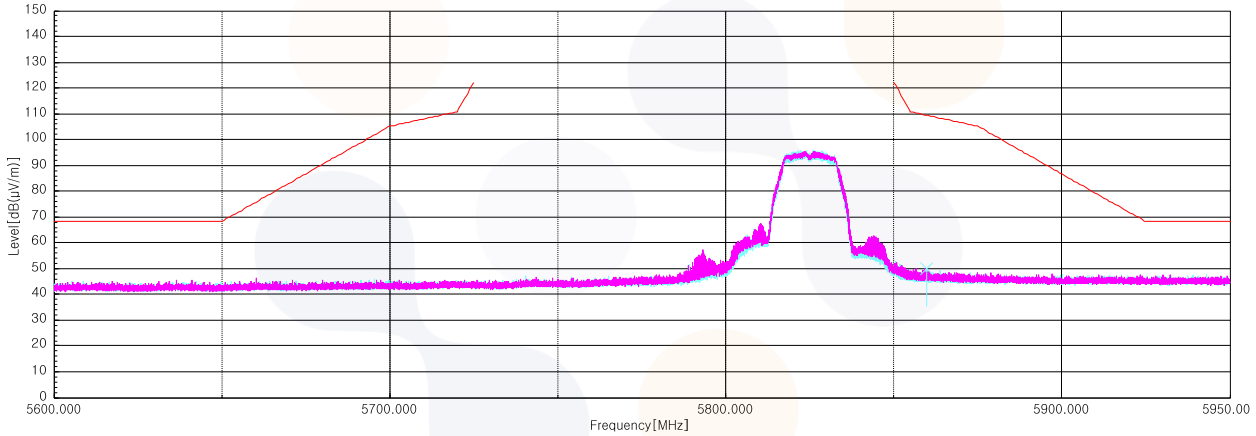
802.11a_Lowest Channel (5 745 ㎒)

Horizontal/Vertical for Band-edge



802.11a_Highest Channel (5 825 ㎒)

Horizontal/Vertical for Band-edge



802.11n_HT20_Lowest Channel (5 745 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 723.17	V	57.00	33.74	-26.15	-	64.59	118.00	53.41
11 513.23[1)]	H	53.40	38.97	-43.06	-	49.31	74.00	24.69
17 189.63	V	56.10	38.10	-41.91	-	52.29	68.20	15.91
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

802.11n_HT20_Middle Channel (5 785 ㎒)

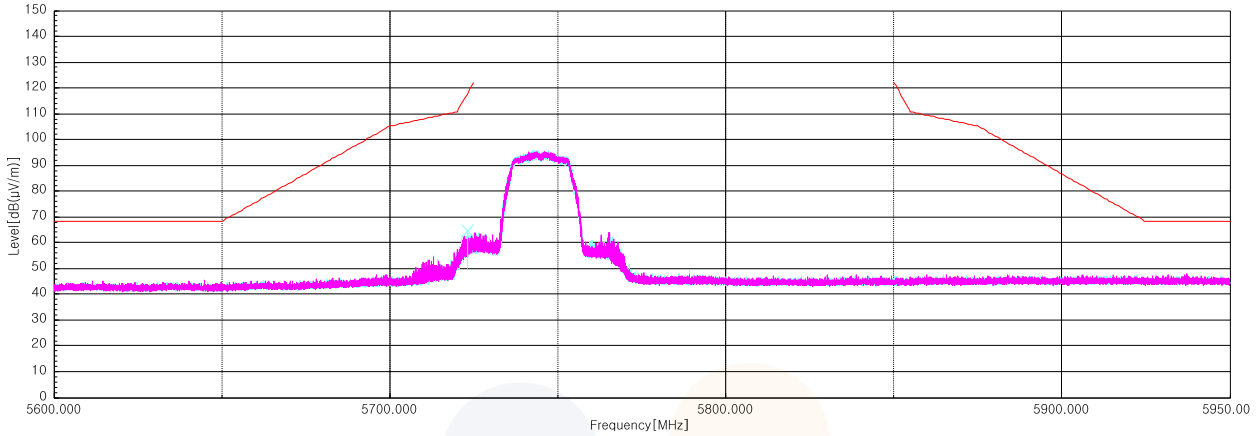
Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
11 561.53[1)]	V	53.50	38.88	-42.90	-	49.48	74.00	24.52
17 384.75	V	54.10	38.84	-42.13	-	50.81	68.20	17.39
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

802.11n_HT20_Highest Channel (5 825 ㎒)

Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
5 860.32	V	40.90	34.24	-25.92	-	49.22	109.30	60.08
11 647.40[1)]	V	53.30	38.71	-42.62	-	49.39	74.00	24.61
17 472.53	V	55.40	39.29	-42.31	-	52.38	68.20	15.82
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

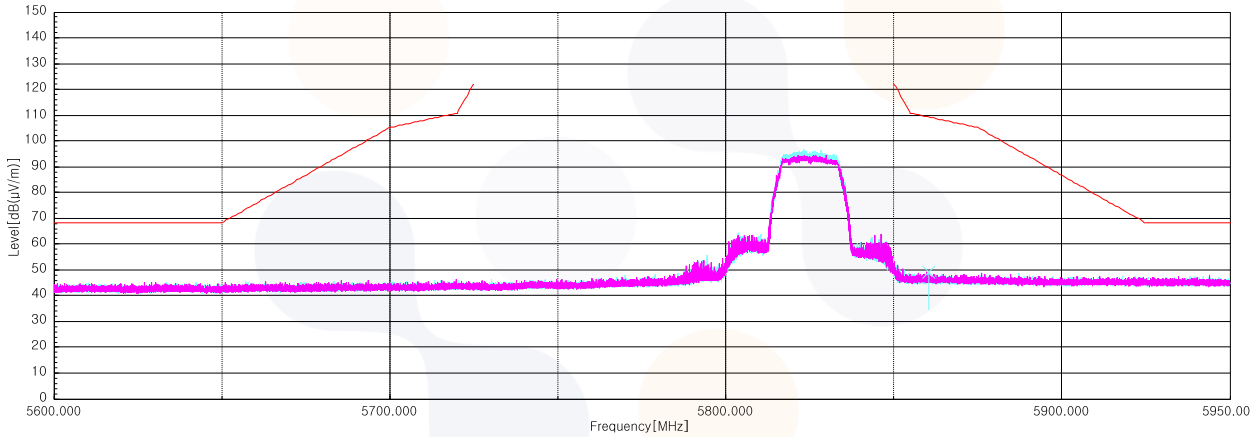
802.11n_HT20_Lowest Channel (5 745 ㎒)

Horizontal/Vertical for Band-edge



802.11n_HT20_Highest Channel (5 825 ㎒)

Horizontal/Vertical for Band-edge

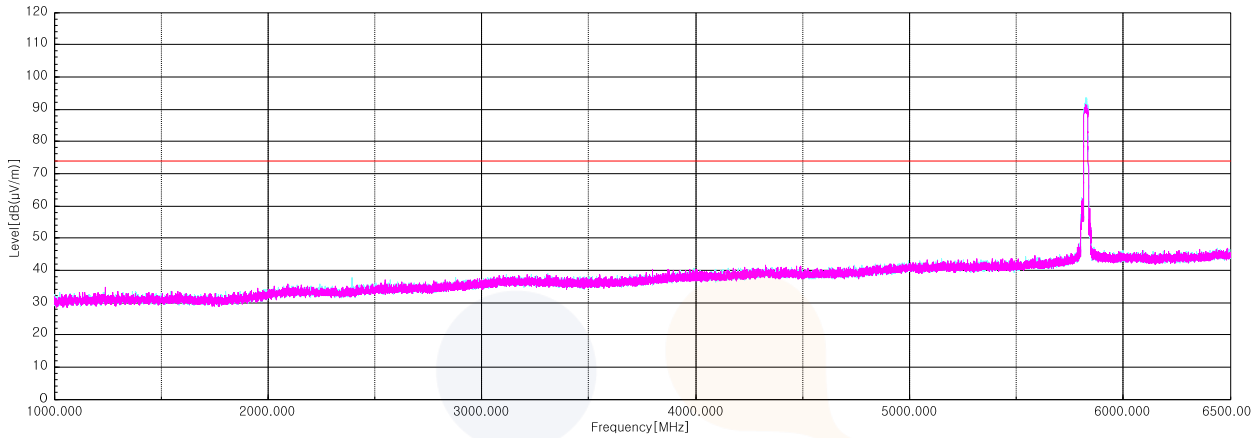


Plot of Harmonics and Spurious Emissions

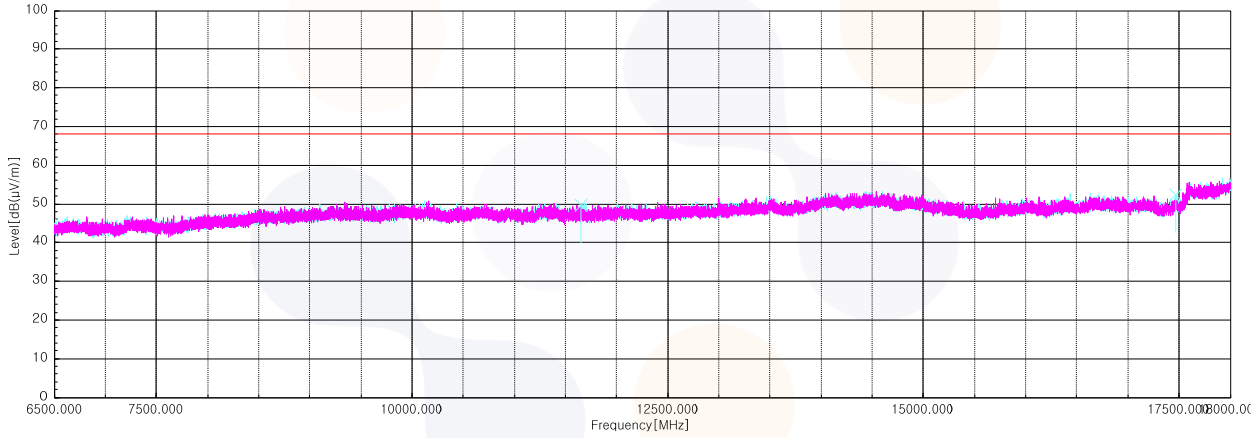
In order to simplify the report, attached plots were only the lowest margin condition

802.11n_HT20_UNII 3_Highest Channel (5 825 ㎒)

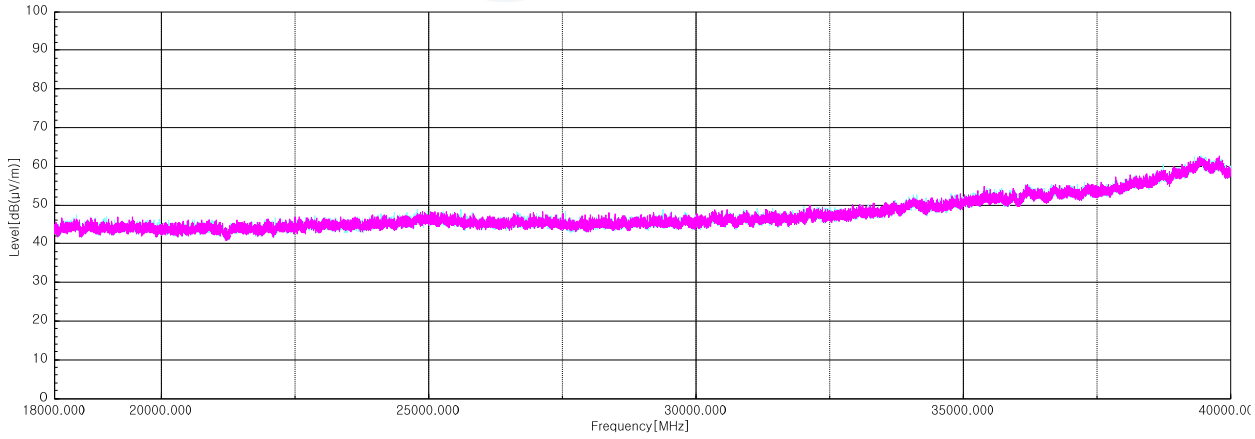
Horizontal/Vertical for 1 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓



Horizontal/Vertical for 18 ㎓ ~ 40 ㎓



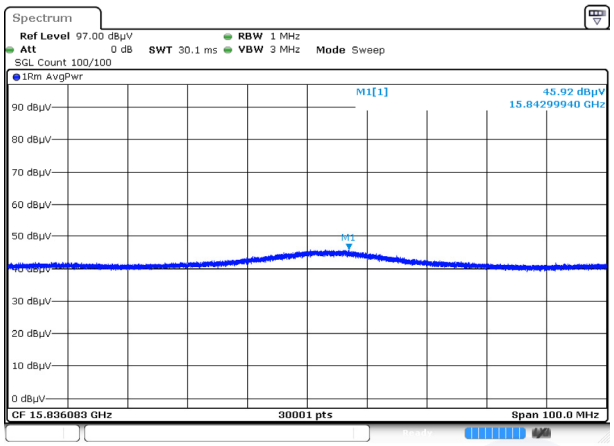
Spurious Emission for Simultaneous Tx Condition

Case	WLAN 5 GHz	Bluetooth
Mode	802.11a	BLE
Channel	56	0
Frequency	5 280 MHz	2 402 MHz
Data Rate	MCS0	2M Bits/s, 37 Packet

Notes.
The lowest margin condition among the channels and modes were selected for test.

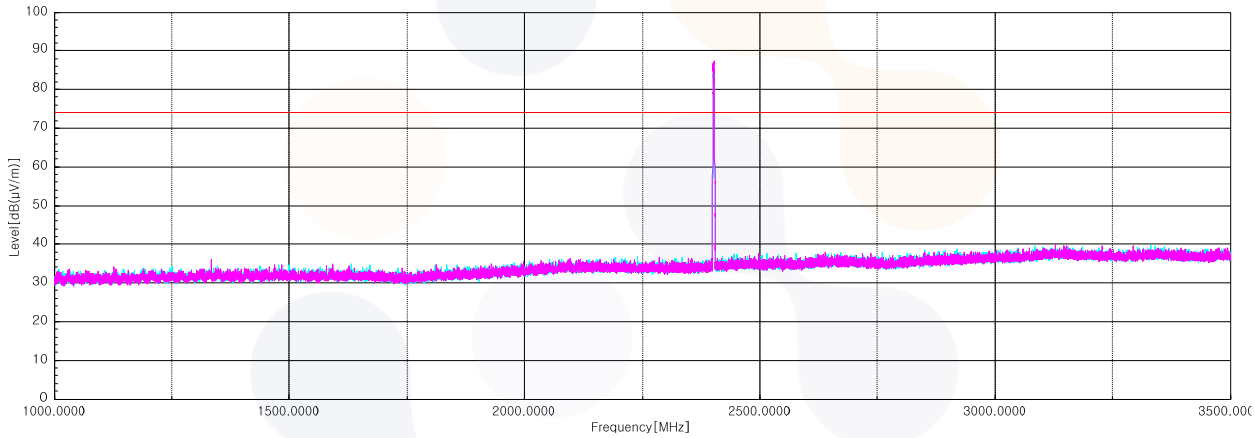
Frequency	Pol.	Reading	Ant. Factor	Amp.+Cable	DCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
4 810.65[1)]	H	54.70	32.26	-43.80	-	43.16	74.00	30.84
7 194.98	H	50.80	36.68	-40.89	-	46.59	74.00	27.41
10 558.35	H	53.50	38.62	-42.22	-	49.90	68.20	18.30
15 843.00[1)]	V	54.10	38.29	-39.32	-	53.07	74.00	20.93
Average Data								
15 843.00[1)]	V	45.92	38.29	-39.32	0.31	45.20	54.00	8.80

Average data

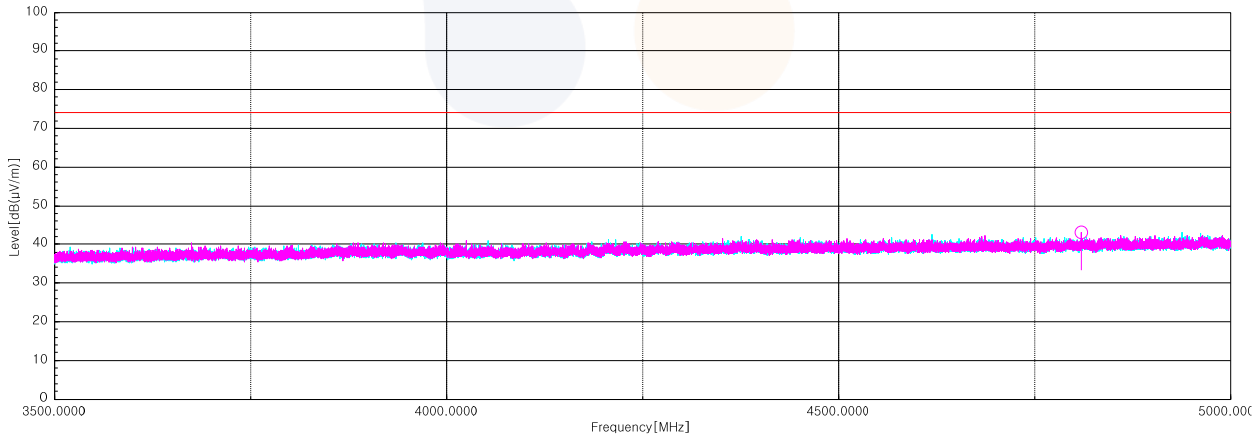


Blank

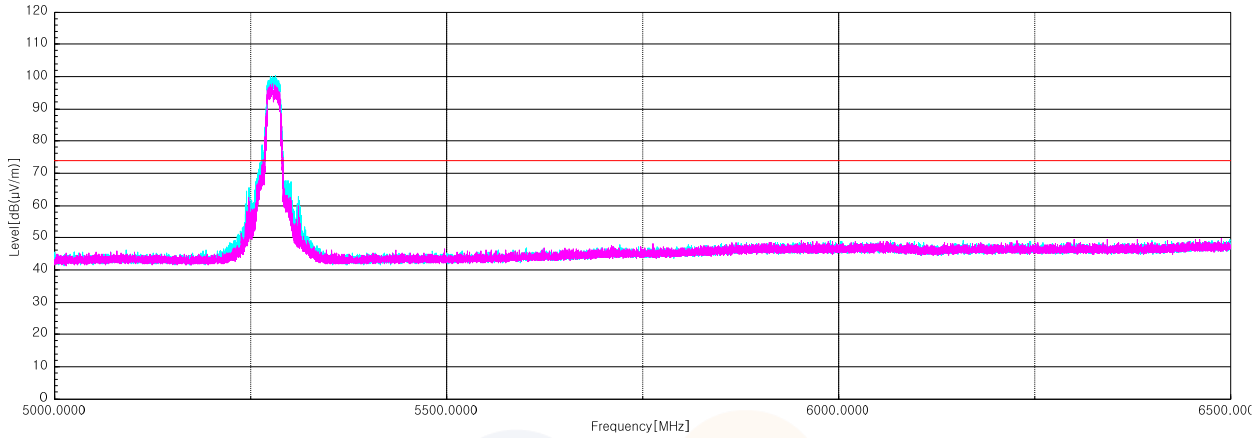
Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



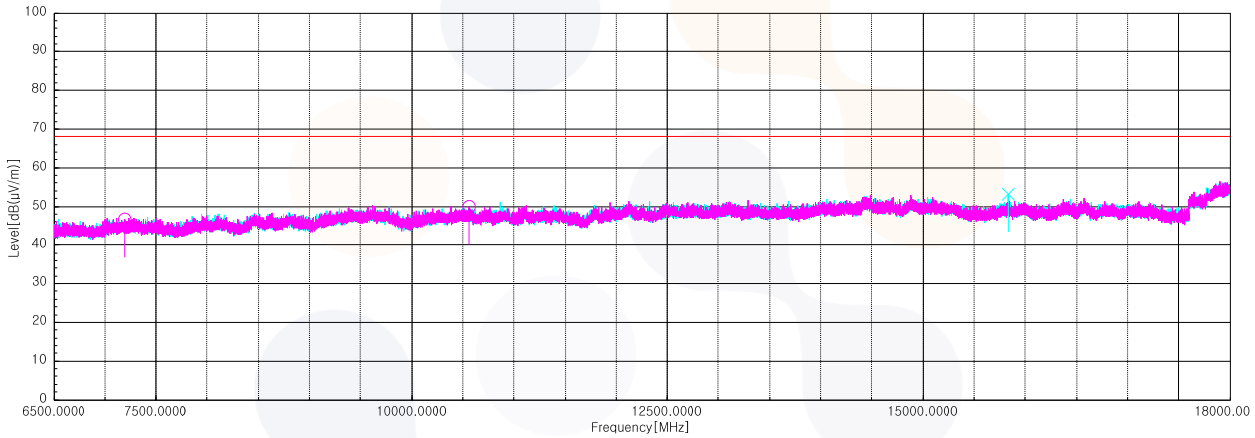
Horizontal/Vertical for 3.5 ㎓ ~ 5 ㎓



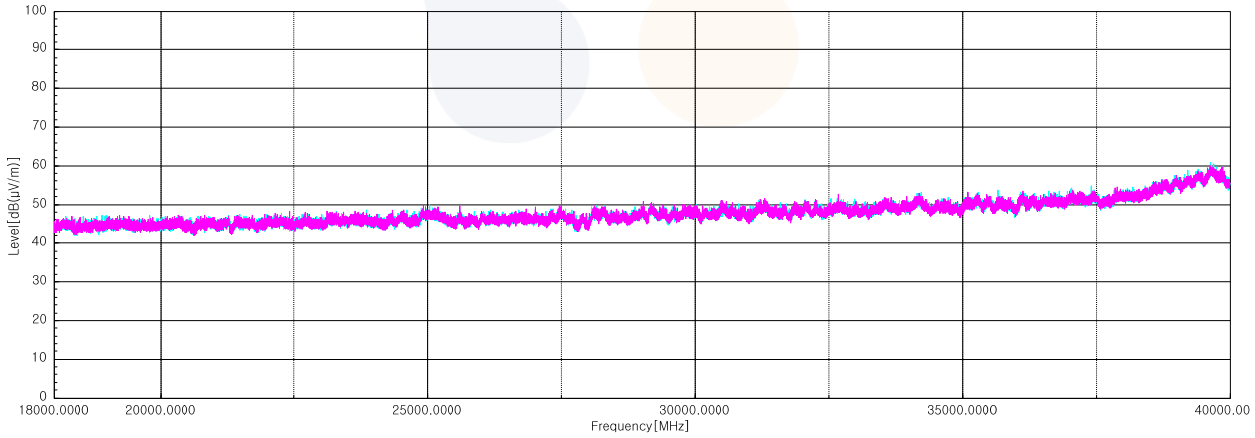
Horizontal/Vertical for 5 ㎓ ~ 6.5 ㎓



Horizontal/Vertical for 6.5 ㎓ ~ 18 ㎓

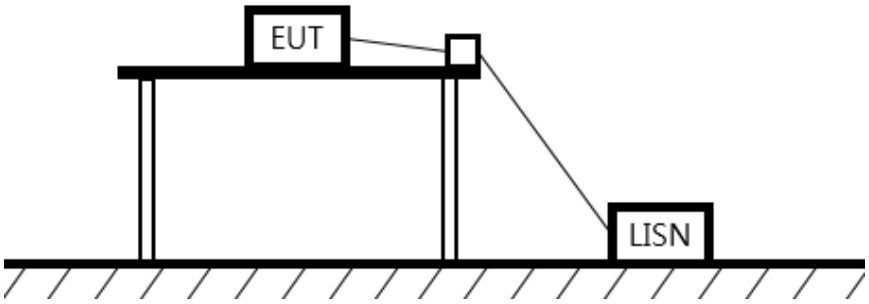


Horizontal/Vertical for 18 ㎓ ~ 40 ㎓



7.8. AC Conducted emission

Test setup



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 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

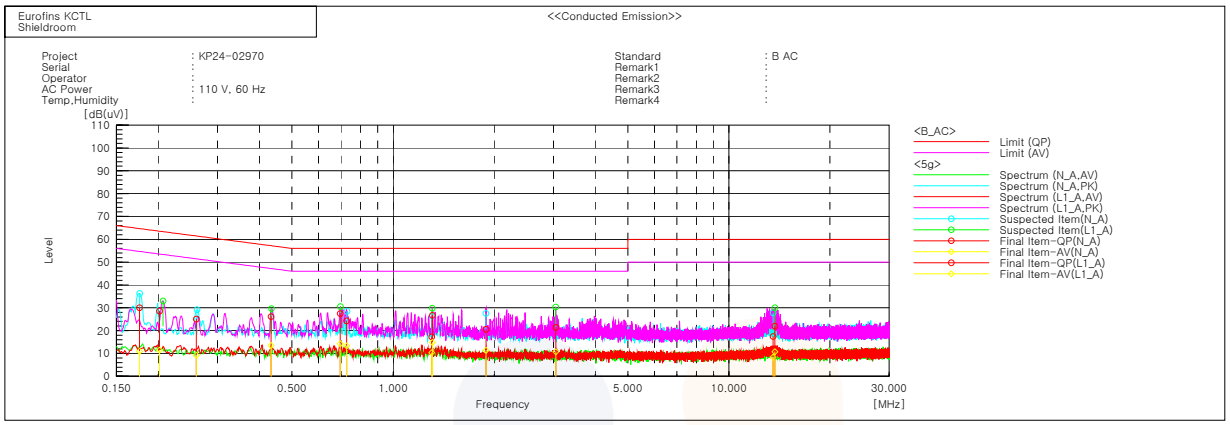
Frequency of Emission (㎒)	Conducted limit (dBμV/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

Measurement procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 ㎝ in which is located 40 ㎝ away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a spectrum analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 ㎒ to 30 ㎒.
5. The measurements were made with the detector set to peak amplitude within a bandwidth of 10 ㎑ or to quasi-peak and average within a bandwidth of 9 ㎑. The EUT was in transmitting mode during the measurements.

Test results

Worst case: 802.11a / UNII 2A_5 320 ㎒



Final Result

--- N_A Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.1758	19.6	0.6	10.4	30.0	11.0	64.7	54.7	34.7	43.7
2	0.25941	15.1	-0.8	10.0	25.1	9.2	61.5	51.5	36.4	42.3
3	0.72744	14.3	3.3	10.0	24.3	13.3	56.0	46.0	31.7	32.7
4	1.30362	7.3	0.4	10.0	17.3	10.4	56.0	46.0	38.7	35.6
5	1.89206	10.7	1.5	9.9	20.6	11.4	56.0	46.0	35.4	34.6
6	13.54974	6.7	-2.5	10.8	17.5	8.3	60.0	50.0	42.5	41.7

--- L1_A Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.20164	18.4	1.2	10.2	28.6	11.4	63.5	53.5	34.9	42.1
2	0.43333	15.9	3.3	10.2	26.1	13.5	57.2	47.2	31.1	33.7
3	0.69578	17.5	4.2	10.0	27.5	14.2	56.0	46.0	28.5	31.8
4	1.30903	16.7	4.8	10.0	26.7	14.8	56.0	46.0	29.3	31.2
5	3.05367	11.5	0.8	9.9	21.4	10.7	56.0	46.0	34.6	35.3
6	13.70925	11.0	-0.1	10.9	21.9	10.8	60.0	50.0	38.1	39.2

8. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSV30	100807	24.07.03
Spectrum Analyzer	R&S	FSVA40	101575	25.04.24
Spectrum Analyzer	R&S	FSV40	100988	24.07.03
PSA Spectrum Analyzer	Agilent	E4440A	MY44303500	24.07.04
Spectrum Analyzer	R&S	FSV30	100914	24.07.03
EMI TEST RECEIVER	R&S	ESCI3	101428	24.08.18
Vector Signal Generator	R&S	SMBV100A	257566	24.07.04
Signal Generator	R&S	SMB100A	176206	25.01.18
DC Power Supply	AGILENT	E3632A	MY40016393	24.07.04
DC Power Supply	POWERCOM	DCP-50100A	20220610-01	25.01.19
DC Power Supply	AGILENT	E3632A	MY40018781	24.05.24
Attenuator	API Inmet	40AH2W-10	10	24.07.04
Step Attenuator	KEYSIGHT	8495D	MY42144296	25.01.19
Power Splitter	Mini-Circuits	ZFSC-2-10G+	4	24.07.03
Power Splitter	Mini-Circuits	ZFSC-2-10G+	1	24.07.03
Broadband Pre-Amplifier	SCHWARZBECK	BBV9718D	57	25.01.19
Low Noise Amplifier	TESTEK	TK-PA18H	220124-L	24.10.12
Low Noise Amplifier	TESTEK	TK-PA1840H	220133-L	24.10.17
Low Noise Amplifier	TESTEK	TK-PA18H	220123-L	24.10.12
Low Noise Amplifier	TESTEK	TK-PA1840H	220234-L	24.10.17
Amplifier	SONOMA INSTRUMENT	310N	421910	24.10.12
Bi-log Antenna	Teseq GmbH	CBL 6112D	61521	24.11.17
Loop Antenna	R&S	HFH2-Z2	100355	24.08.10
Horn Antenna	SCHWARZBECK	BBHA9120D	2763	24.10.18
Horn Antenna	SCHWARZBECK	BBHA9170	1267	24.10.16
Horn Antenna	SCHWARZBECK	BBHA9120D	2764	24.10.18
Horn Antenna	SCHWARZBECK	BBHA9170	1266	24.10.16
High Pass Filter	Wainwright Instruments GmbH	WHKX8-5655-6500-18000-40SS	SN8	24.10.16
High Pass Filter	Wainwright Instruments GmbH	WHKX12-2805-3000-18000-40SS	SN59	24.10.16
High Pass Filter	Qotana	DBHF058004000A	23041800061	24.07.10
High Pass Filter	QOTANA TECHNOLOGIES	DBHF0508004000A	23041800061	24.07.10
Band Reject Filter	Wainwright Instruments GmbH	WTRCJV8-5100-5850-20-100-50SSK	62	24.10.13
TWO-LINE V - NETWORK	R&S	ENV216	101358	24.09.27

End of test report