FCC TEST REPORT

Test report No.:	EMC- FCC- R0107-2
FCC ID:	O6ZC41W-500
Type of equipment:	Wireless Client
Model Name:	C41W-500
Applicant:	HUMAX Co., Ltd.
Max.RF Output Power:	25.90 dBm
FCC Rule Part(s):	FCC Part 15 Subpart C 15.247
Frequency Range:	5 755 MHz ~ 5 795 MHz
Test result:	Complied

The above equipment was tested by EMC compliance Testing Laboratory for compliance with the requirements of FCC Rules and Regulations.
The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Date of test: February 06, 2013 ~ March 07, 2013

Issued date: April 4, 2013

Tested by: YU, SANG HOON

Approved by: KIM, CHANG MIN

[Contents]

1. Client information

Applicant:	HUMAX Co., Ltd
Address:	HUMAX Village, 11-4, Sunae-dong, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-825, KOREA
Telephone number:	+82-31-776-6400
Facsimile number :	+82-31-776-6149
Contact person:	Inseok Seo / Senior Engineer

Manufacturer :	Flextronics Electronics Technology (ShenZhen) Co., Ltd.
Address:	89, YongFu Rd, TongFuYu Ind Park, FuYong, BaoAn, SHZ, 518103 C

2. Laboratory information

Address
EMC Compliance Ltd.
480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
Telephone Number: 82 31 336 9919 Facsimile Number: 82 31 336 4767

Certificate
CBTL Testing Laboratory, KOLAS NO.: 231
FCC Filing No.: 508785
VCCI Registration No.: C-1713, R-1606, T-258
IC Recognition No.:8035A-2

SITE MAP

3. Description of E.U.T.

3.1 Basic description

Applicant :	HUMAX Co., Ltd
Address of Applicant:	HUMAX Village, 11-4, Sunae-dong, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-825, KOREA
Manufacturer:	Flextronics Electronics Technology (ShenZhen) Co., Ltd.
Address of Manufacturer:	89, YongFu Rd, TongFuYu Ind Park, FuYong, BaoAn, SHZ, 518103 C
Type of equipment:	Wireless Client
Basic Model:	C41W-500
Serial number:	Proto Type

3.2 General description

Communication	802.15.4(RF4CE) 802.11n HT40
Frequency Range	**2.4 GHz RF4CE** : 2 425 ~ 2 475 MHz **5.0 GHz Wi-Fi** : 5 190 ~ 5 230 MHz, 5 270 ~ 5 310 MHz, 5 510 ~ 5 670 MHz, 5 755 ~ 5 795 MHz
Type of Modulation (Technologies)	**2.4 GHz RF4CE** : O-QPSK(DSSS), **5.0 GHz Wi-Fi** : 64QAM, 16QAM, QPSK, BPSK(OFDM)
Channel capacity	**2.4 GHz RF4CE** : 3 ch(RF4CE) **5.0 GHz** : 5 190 ~ 5 230 MHz: 2 ch(802.11n_HT40) 5 270 ~ 5 310 MHz: 2 ch(802.11n_HT40) 5 510 ~ 5 670 MHz: 5 ch(802.11n_HT40) 5 755 ~ 5 795 MHz: 2 ch(802.11n_HT40)
Antenna Gain	**2.4 GHz RF4CE** : Ant0 2.89 dBi, Ant1 2.26 dBi **5.0 GHz Wi-Fi :** 5 190 ~ 5 230 MHz: 1.9 dBi 5 270 ~ 5 310 MHz: 2.5 dBi 5 510 ~ 5 670 MHz: 2.9 dBi 5 755 ~ 5 795 MHz: 3.0 dBi
Type of Antenna	Integral Embedded Antenna(Wi-Fi), Integral PCB antenna(RF4CE)
Firmware version	Wi-Fi Driver Ver: v35.1.0.27 RF4CE Driver Ver: GP510 FW v1.1.0.0 CL 00026578
Power supply	AC 120 V
Operating temperature	0 ~ 50 °C
Dimension	176 mm x 116 mm x 28 mm (W x D x H)

3.3 Test frequency

For all teset items, the low, middle and high channels of the modes were tested with above worst case data rate.

2400 ~ 2483.5 (MHz) : 802.15.4(RF4CE)

	CH	Frequency
Low frequency	15	2 425 MHz
Middle frequency	20	2 450 MHz
High frequency	25	2 475 MHz

5150~5250 (MHz) : 802.11n HT40

	CH	Frequency
Band Width	40 MHz	
Low frequency	38	5 190 MHz
Middle frequency	-	-
High frequency	46	5 230 MHz

5250~5350 (MHz) : 802.11n HT40

	CH	Frequency
Band Width	40 MHz	
Low frequency	54	5 270 MHz
Middle frequency	-	-
High frequency	62	5 310 MHz

5470~5350 (MHz) : 802.11n HT40

	CH	Frequency
Band Width	40 MHz	
Low frequency	102	5 510 MHz
Middle frequency	110	5 550 MHz
High frequency	134	5 670 MHz

5250~5350 (MHz) : 802.11n HT40

	CH	Frequency
Band Width	40 MHz	
Low frequency	151	5 755 MHz
Middle frequency	-	-
High frequency	159	5 795 MHz

3.4 Test Voltage

mode	Voltage
Norminal voltage	AC 120V

4. Summary of test results

4.1 Standards & results

Rule Reference	Parameter	Report Section	Test Result
15.203, 15.247(b)(4)	Antenna Requirement	5.1	C
15.247(b)(3)	Maximum Peak Output Power	5.2	C
15.247(e)	Peak Power Spectral Density	5.3	C
15.247(a)(2)	6 dB Channel Bandwidth	5.4	C
15.247(d), 15.205(a), 15.209(a)	Spurious Emission, Band Edge, and Restricted bands	5.5	C
15.207(a)	Conducted Emissions	5.6	C
15.247(i), 1.1307(b)(1)	RF Exposure	5.7	C
RSS-Gen, Issue 3,6	Receiver Spurious Emission (Radiated)	5.8	NA

Note: C = complies
NC = Not complies
NT = Not tested
NA = Not Applicable

4.2 Uncertainty

Measurement Item	Combined Standard Uncertainty Uc	Expanded Uncertainty U = KUc (K = 2)
Conducted RF power	± 0.29 dB	± 0.58 dB
Radiated disturbance	30 MHz ~ 300 MHz : + 2.43 dB, - 2.44 dB 300 MHz~1 000 MHz : + 2.49dB, - 2.50 dB 1 GHz ~ 6 GHz : + 3.10 dB, - 3.10 dB 6 GHz ~ 18 GHz : + 3.21 dB, - 3.27 dB	30 MHz ~ 300 MHz : + 4.86 dB, - 4.88 dB 300 MHz ~ 1 000 MHz + 4.98dB, - 4.99 dB 1 GHz ~ 6 GHz : + 6.19 dB, - 6.20 dB 6 GHz ~ 18 GHz : + 6.41 dB, - 6.53 dB

5. Test results

5.1 Antenna Requirement

5.1.1 Regulation

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

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

5.1.2 Result

- Complied

The transmitter has an integral PCB antenna.
The total directional peak gain of the antenna does not exceed 6.0 dBi.

	5 150~5 250 MHz	5 250~5 350 MHz	5 470~5 725 MHz	5 725~5 850 MHz
ANT Gain	1.9	2.5	2.9	3.0

According to KDB 662911 D01 Multiple Transmitter Output v01r02
- Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

For power measurements on IEEE 802.11 devices

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};

Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices:

Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

5.2 Maximum Peak Output Power

5.2.1 Regulation

According to §15.247(b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

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

5.2.2 Measurement Procedure

These test measurement settings are specified in section 8.2 of 558074 D01 DTS Meas Guidance.

5.2.2.1 Measurement Procedure Option3:

This procedure provides an alternative for determining the RMS output power using a broadband RF average power meter with a thermocouple detector if the EUT can be configured to transmit continuously or if the power meter can be triggered/signal-gated such that the power is measured only when the EUT is transmitting at its maximum power control level.

5.2.2.2 Measurement Procedure Alternative 1:

When the EUT cannot be configured to transmit continuously (i.e., duty cycle < 98%), and video triggering/signal gating cannot be used to perform the measurement only during a time interval when the EUT is transmitting at its maximum power control level, then one of the procedures above can be used in free run mode to determine the average power inclusive of the on/off periods of the transmitter and then corrected by the duty cycle as follows:

1. Measure the duty cycle per the guidance provided in Section 5.0.
2. Add 10log (1/duty cycle) to the logarithmic representation of the maximum measured power level.
3. Note that when a power meter is used to perform this measurement then the integration period must exceed the repetition period of the transmitted signal by at least a factor of five.

5.2.3 Test Result

-Complied

802.11n 40MHz

Frequency (MHz)	Average Power (dBm)				C.L (dB)	Total result (dBm)	Duty cycle (dB)	Total +D.F (dBm)	Limit (dBm)	Margin (dB)
	Ant1	Ant2	Ant3	Ant4						
5 755	13.85	12.83	12.35	12.80	2.84	19.01	0.11	21.96	30.0	8.04
5 795	16.64	16.86	17.01	16.92	2.90	25.78	0.11	25.89	30.0	4.11

-NOTE:

1. Since the directional gain of the integral antenna declared by the manufacturer does not exceed 6.0 dBi, there was no need to reduce the output power.(This device is $N_{ANT} = 4$, Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$)
2. Total power calculation = 10 log(10^(Ant1 power/10) + 10^(Ant2 power/10) + 10^(Ant3 power/10) + 10^(Ant4 power/10)).
3. Duty cycle = 0.975, Duty cycle factor = 10log(1/duty cycle) = 10log(1/0.975) = 0.11 dB

480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
82 31 336 9919 (Main) 82 31 336 4767 (Fax)

5.3 Peak Power Spectral Density

5.3.1 Regulation

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

5.3.2 Measurement Procedure

These test measurement settings are specified in section 9.2 of 558074 D01 DTS Meas Guidance.

5.3.2.1 Measurement Procedure Option 2:

1. Set analyzer center frequency to DTS channel center frequency.
2. Set span to at least 1.5 times the DTS channel bandwidth.
3. Set RBW ≥ 3 kHz.
4. Set VBW ≥3 x RBW.
5. Detector = power averaging (RMS) or sample detector (when RMS not available).
6. Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW.
7. Sweep time = auto couple.
8. Employ trace averaging (RMS) mode over a minimum of 100 traces.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.3.2.2 Measurement Procedure Alternative 1:

When the EUT cannot be configured to transmit continuously (i.e., duty cycle < 98%), and video triggering/signal gating cannot be used to measure only when the EUT is transmitting at its maximum power control level, then one of the procedures described above can be used in free run mode to determine the average power inclusive of the on/off periods of the transmitter and the result corrected by the duty cycle as follows:

1. Measure the duty cycle per the guidance provided in Section 5.0.
2. Add 10log (1/duty cycle) to the logarithmic representation of the maximum measured power level.

5.3.3 Test Result

-Complied

802.11n 40 MHz

Freq (MHz)	PPSD (dBm)				C.L (dB)	Total result (dBm)	Duty cycle (dB)	Total +D.F (dBm)	Limit (dBm)	Margin (dB)
	Ant1	Ant2	Ant3	Ant4						
5 755	-14.28	-14.99	-14.98	-14.96	2.84	-8.77	0.11	-5.82	8.0	13.82
5 795	-10.91	-10.48	-10.89	-11.02	2.90	-4.80	0.11	-1.79	8.0	9.79

-NOTE:

1. Since the directional gain of the integral antenna declared by the manufacturer does not exceed 6.0 dBi, there was no need to reduce the Peak Power Spectral Density. (This device is N_{SS} = 4, Array Gain = 10 log(N_{ANT}/N_{SS}) dB = 0.)
2. Total PPSD calculation = 10log(10^(Ant1 PSD / 10) + 10^(Ant2 PSD / 10) + 10^(Ant3 PSD / 10) + 10^(Ant4 PSD / 10)).
3. Duty cycle = 0.975, Duty cycle factor = 10log(1/duty cycle) = 10log(1/0.975) = 0.11 dB.

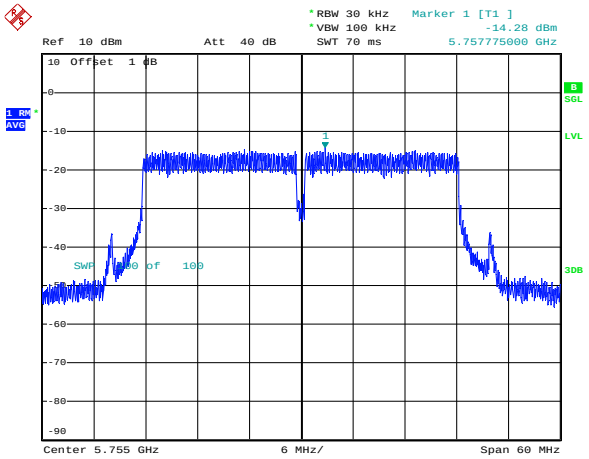
5.3.4 Test Plot

Figure 1. Plot of the Power Density (Conducted)

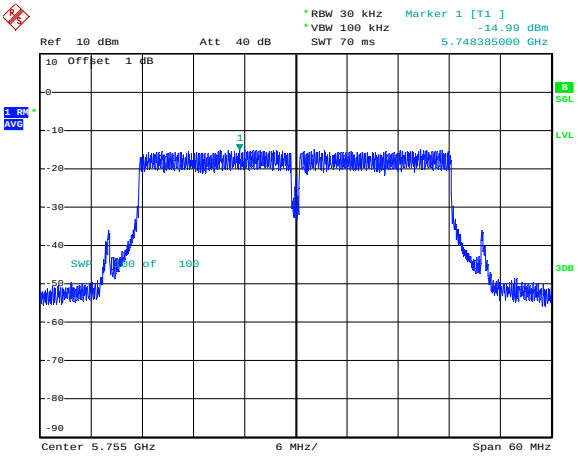
802.11n 40 MHz

- Lowest Channel (5 755 MHz)

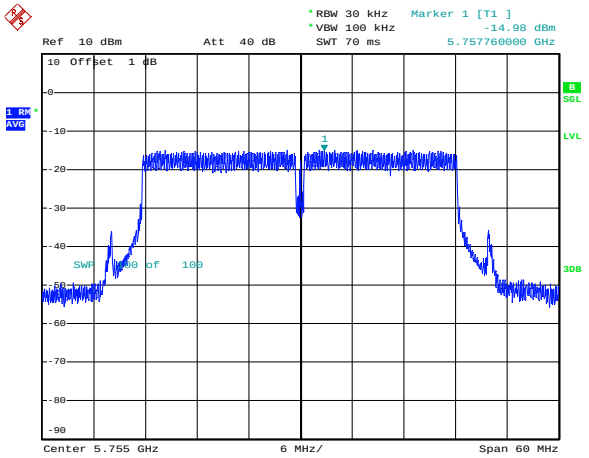
Ant1



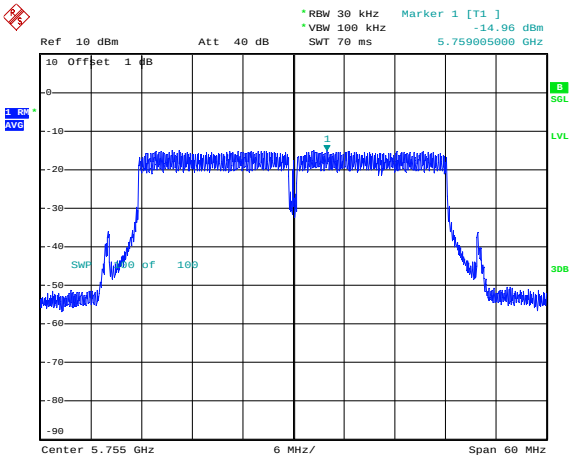
Ant2



Ant3



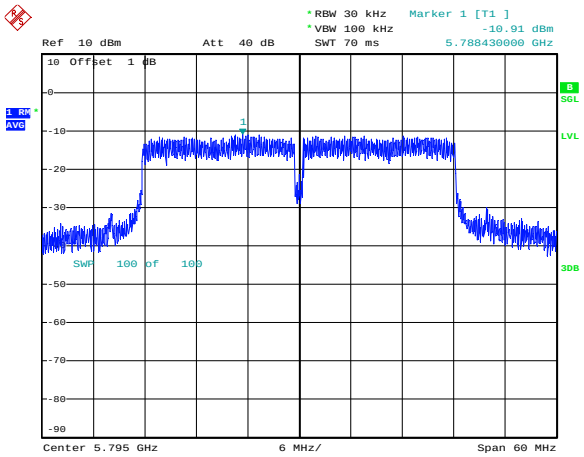
Ant4



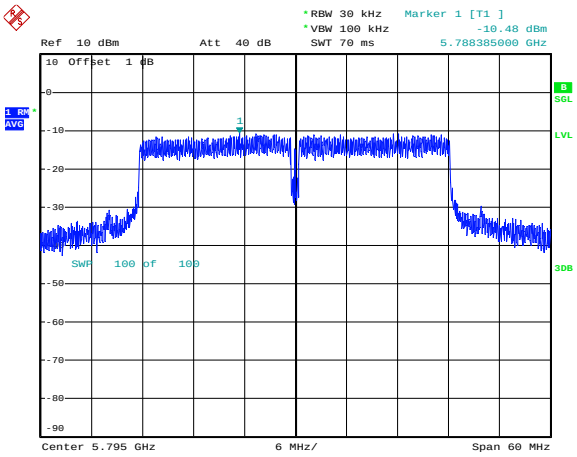
802.11n 40 MHz

- Highest Chnnel (5 795 MHz)

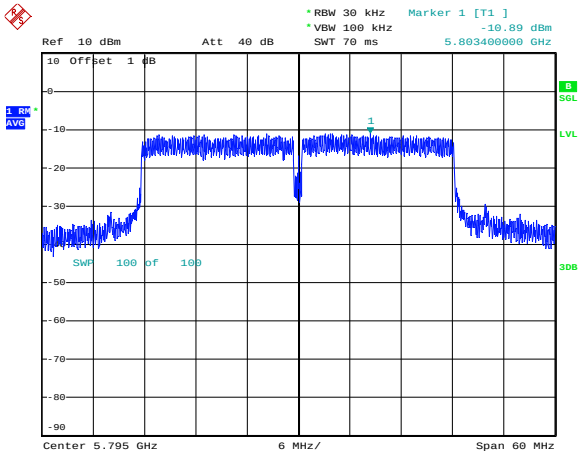
Ant1



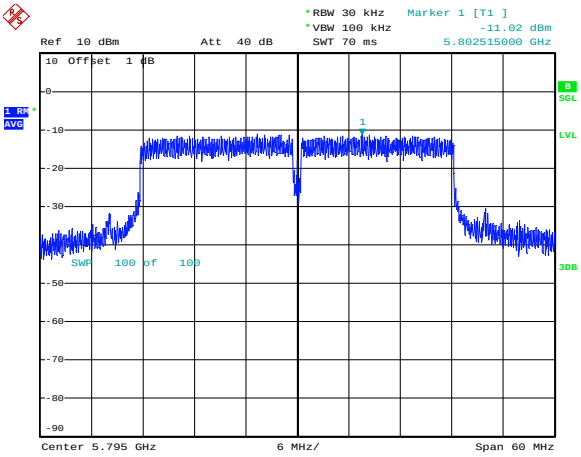
Ant2



Ant3



Ant4



5.4 6 dB Bandwidth

5.4.1 Regulation

According to §15.247(a)(2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.4.2 Measurement Procedure

These test measurement settings are specified in section 7.0 of 558074 D01 DTS Meas Guidance.

5.4.2.1 DTS Channel Bandwidth-Option 1

1. Set resolution bandwidth (RBW) = 1-5% or DTS BW, not to exceed 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.4.2.2 DTS Channel Bandwidth Measurement Procedure-Option 2

The automatic bandwidth measurement capability of a spectrum analyzer may be employed using the X dB bandwidth mode with X set to 6 dB, if it implements the functionality described above. When using this capability, care should be taken to ensure that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that may be ≥ 6 dB.

480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
82 31 336 9919 (Main) 82 31 336 4767 (Fax)

5.4.3 Test Result

-Complied

802.11n 40 MHz

Channel	Frequency (MHz)	6dB BW Ant1 (MHz)	6dB BW Ant2 (MHz)	6dB BW Ant3 (MHz)	6dB BW Ant4 (MHz)	Min. Limit (kHz)
Low	5 755	36.30	36.30	36.40	36.40	500
High	5 795	36.00	36.10	36.10	36.00	500

-NOTE:

1. We took the insertion loss of the cable loss into consideration within the measuring instrument.

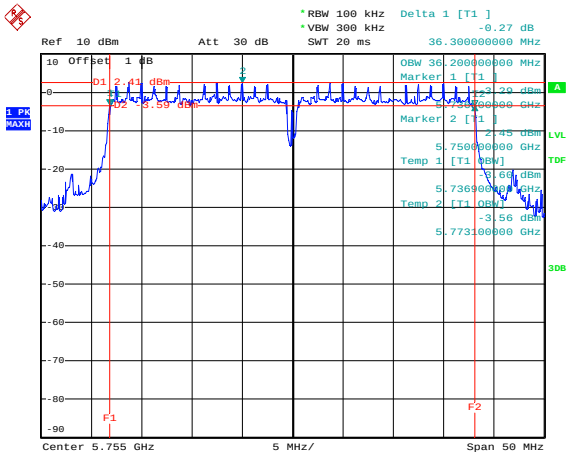
5.4.4 Test Plot

Figure 2. Plot of the 6dB Bandwidth (Conducted)

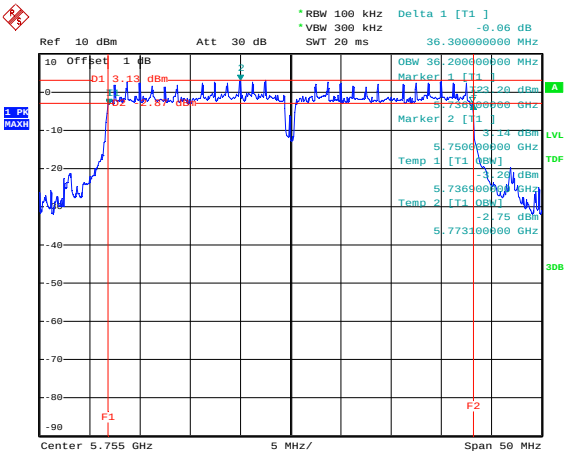
802.11n 40 MHz

- Lowest Channel (5 755 MHz)

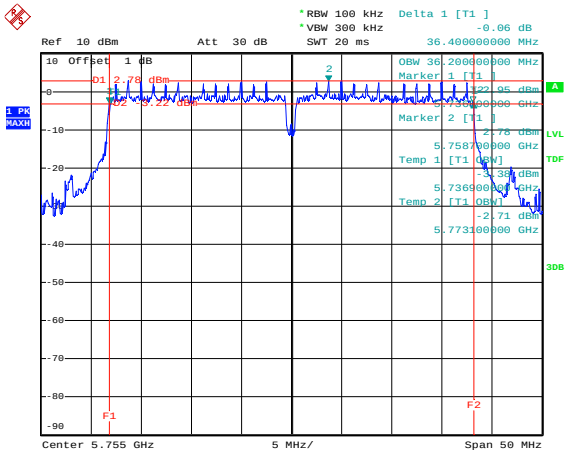
Ant1



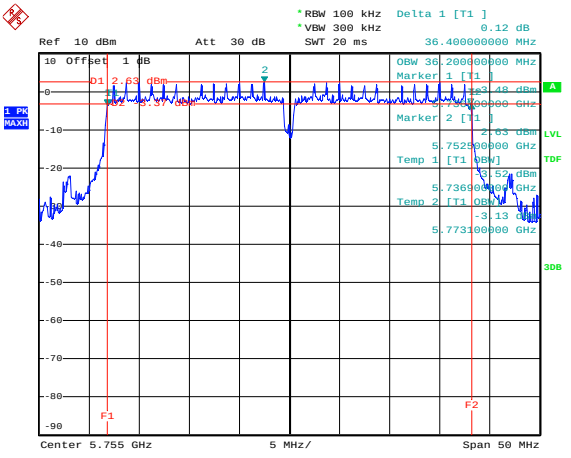
Ant2



Ant3



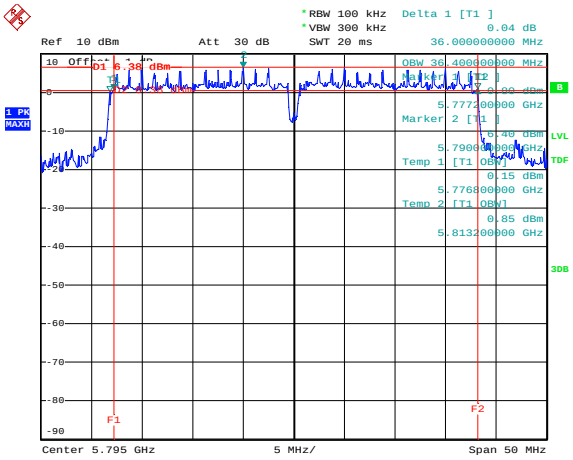
Ant4



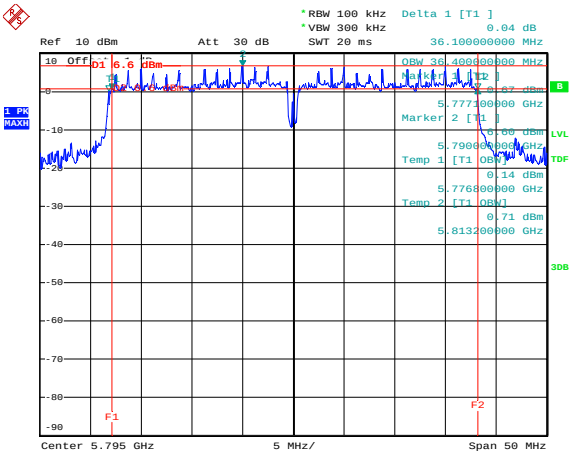
802.11n 40 MHz

- Highest Chnnel (5 795 MHz)

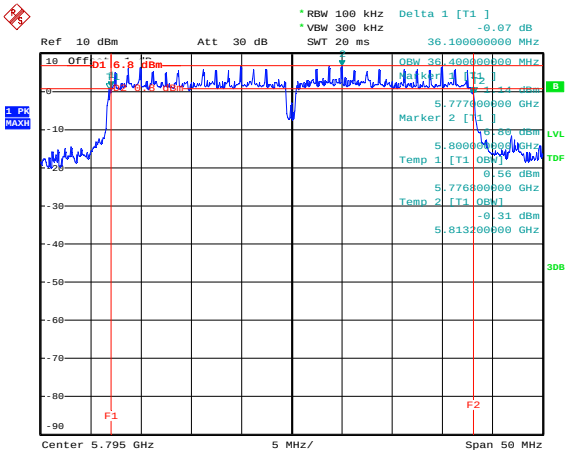
Ant1



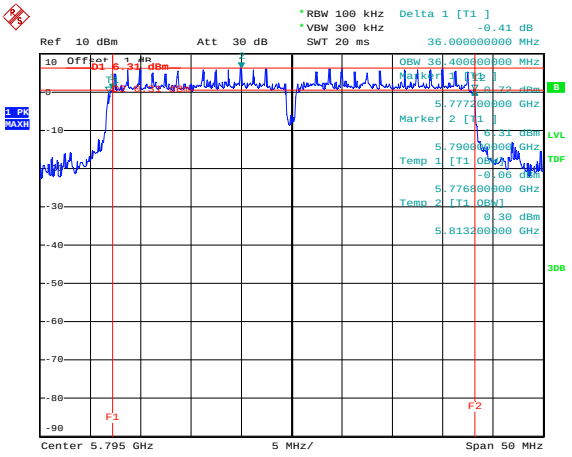
Ant2



Ant3



Ant4



480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
82 31 336 9919 (Main) 82 31 336 4767 (Fax)

5.5 SPURIOUS EMISSION, BAND EDGE, AND RESTRICTED BANDS

5.5.1 Regulation

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

According to §15.209(a), Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall notexceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 -1.705	24000/F(kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 MHz are based on the average value of measured emissions.

480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
82 31 336 9919 (Main) 82 31 336 4767 (Fax)

5.5.2 Measurement Procedure

5.5.2.1 Band-edge Compliance of RF Conducted(or Rediated) Emissions.

5.5.2.1.1 Reference Level Measurement

Establish the reference level by using the peak PSD procedure from Section 9.1 to measure the PSD level in any 100 kHz bandwidth (i.e., set RBW = 100 kHz and VBW ≥ 300 kHz) within the DTS channel bandwidth (the channel found to contain the maximum PSD level can be used to establish the reference level).

5.5.2.1.2 Unwanted Emissions Level Measurement

1. Set start frequency to DTS channel edge frequency.
2. Set stop frequency so as to encompass the spectrum to be examined.
3. Set RBW = 100 kHz.
4. Set VBW ≥ 300 kHz.
5. Detector = peak.
6. Trace Mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize (this may take some time, depending on the extent of the span).
9. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

5.5.2.2 Conducted Spurious Emissions

Set the spectrum analyzer as follows:

1. Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
2. RBW = 100 kHz
3. VBW ≥ RBW
4. Sweep = auto
5. Detector function = peak
6. Trace = max hold
7. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
8. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

5.5.2.3 Radiated Spurious Emissions

1. The preliminary and final rdiated measurements were performed to determine the frequency producing the maximum emissions in at a 10m anechoic chamber. The EUT was tested at a distance 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360˚.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, and from 30 to 1000 MHz using the TRILOG broadband antenna, and from 1 000 MHz to 40 000 MHz using the horn antenna.
4. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

- Sample calculation

The field strength is calculated adding the antenna Factor, cable loss and, Antenna pad adding, subtracting the amplifier gain from the measured reading.

**The sample calculation is as follow:

Result = M.R + C.F(A.F + C.L +3 dB Att – A.G)
M.R = Meter Reading
C.F = Correction Factor
A.F = Antenna Factor
C.L = Cable Loss
A.G = Amplifier Gain
3 dB Att = 3 dB Attenuator

If M.R is 30 dB, A.F 12 dB, C.L 5 dB, 3 dB, A.G 35 dB
The result is : 30 + 12 + 5 + 3 – 35 = 15 dB(μV/m)

480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
82 31 336 9919 (Main) 82 31 336 4767 (Fax)

5.7.3 Test Result

-complied

1. Band-edge & Conducted Spurious Emissions was shown in figure 3.
   Note: We took the insertion loss of the cable into consideration within the measuring instrument.
2. Band edge compliance of Radiated Emissions(Restricted Bands) was shown in figure 4.
3. Measured value of the Field strength of spurious Emissions (Radiated)

- The Measuring below 30 MHz was detected too small. (More than 20 dB below the limit)

802.11n 40 MHz
Low channel (5 755 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
315.91	120	H	46.1	-8.1	38.0	46.0	8.0
440.07	120	H	40.7	-4.4	36.3	46.0	9.7
-	-	-	-	-	-	-	-
Peak DATA. Emissions above 1GHz							
1 848.25	1 000	V	54.6	-3.0	51.6	74.0	22.4
2 163.25	1 000	V	54.7	-1.4	53.3	74.0	20.7
2 435.50	1 000	H	59.5	-1.1	58.4	74.0	15.6
Above 3 000.00	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
1 848.25	1 000	V	38.8	-3.0	35.8	54.0	18.2
2 163.25	1 000	V	38.4	-1.4	37.0	54.0	17.0
2 435.50	1 000	H	36.9	-1.1	35.8	54.0	18.2
Above 3 000.00	**Not Detected**	-	-	-	-	-	-

High channel (5 795 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
316.64	120	H	45.9	-8.1	37.8	46.0	8.2
440.07	120	H	40.8	-4.4	36.4	46.0	9.6
-	-	-	-	-	-	-	-
Peak DATA. Emissions above 1GHz							
1 847.50	1 000	V	55.5	-3.0	52.5	74.0	21.5
2 167.00	1 000	V	50.7	-1.4	49.3	74.0	24.7
2 435.50	1 000	V	57.6	-1.1	56.5	74.0	17.5
Above 3 000.00	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
1 847.50	1 000	V	36.8	-3.0	33.8	54.0	20.2
2 167.00	1 000	V	36.8	-1.4	35.4	54.0	18.6
2 435.50	1 000	V	39.7	-1.1	38.6	54.0	15.4
Above 3 000.00	**Not Detected**	-	-	-	-	-	-

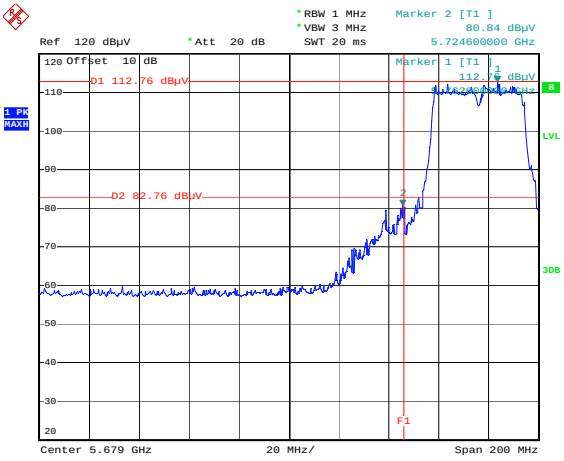
Note:
1. This measurement was performed the worst case data were reported.

5.6.4 Test Plot

Figure 3. Plot of the Band Edge (Radiated)

802.11n 40MHz

- Lowest Channel (5 755 MHz)



- Highest Channel (5 795 MHz)

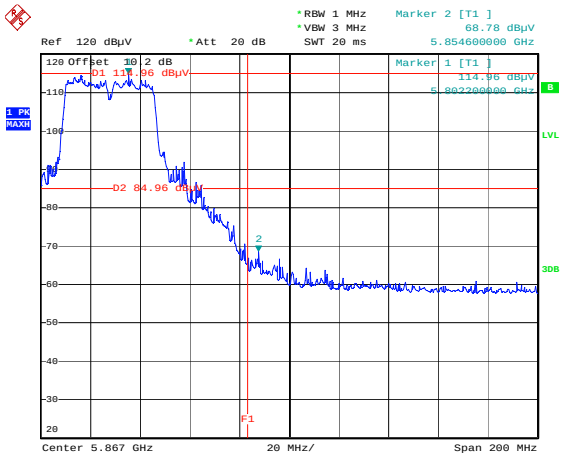
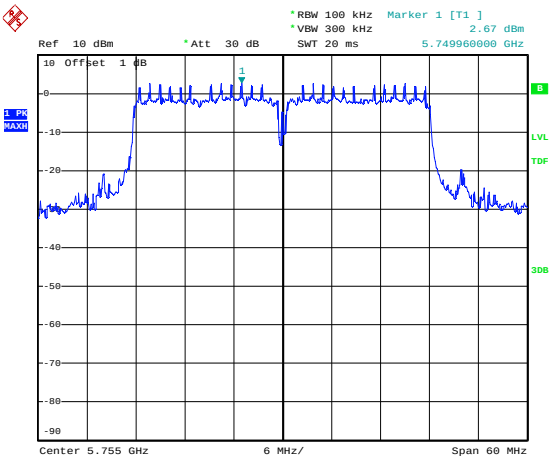
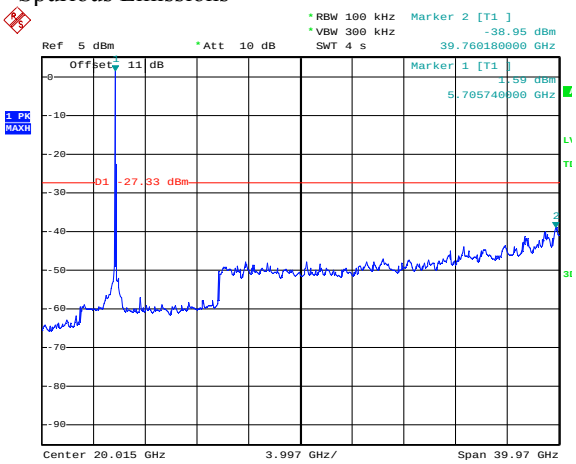


Figure 4. Plot of the Spurious RF conducted emissions

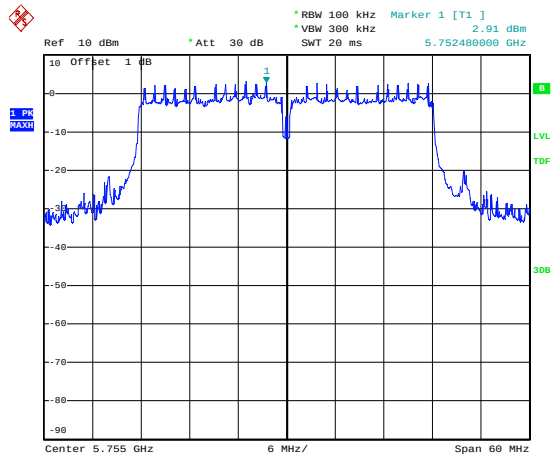
802.11n 40 MHz
Lowest Channel(5 755 MHz)
Ant1
Reference



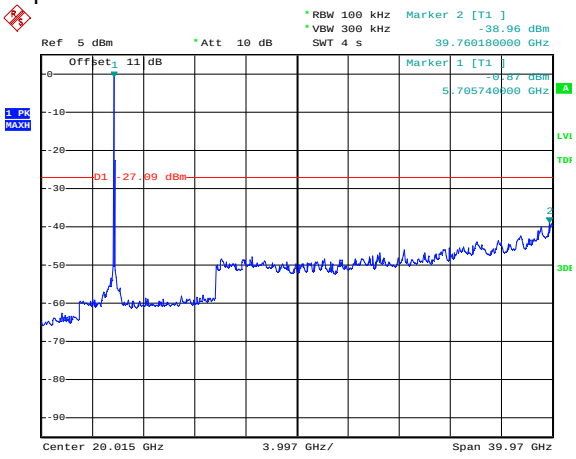
Spurious Emissions



Ant2
Reference

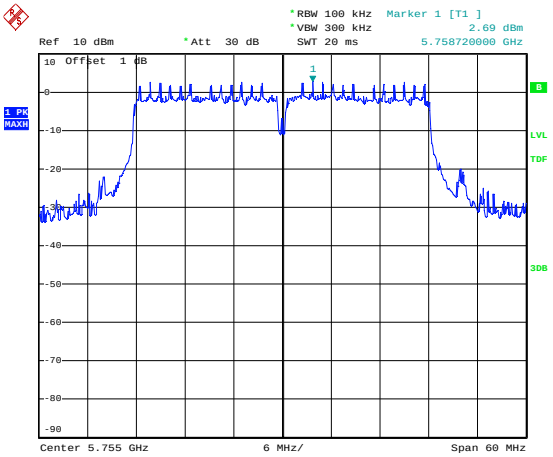


Spurious Emissions

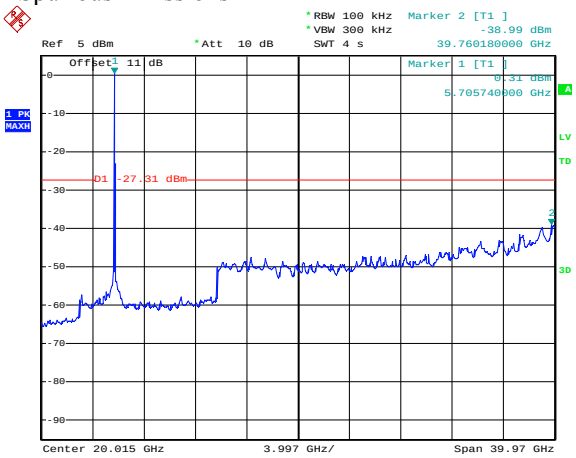


Ant3

Reference

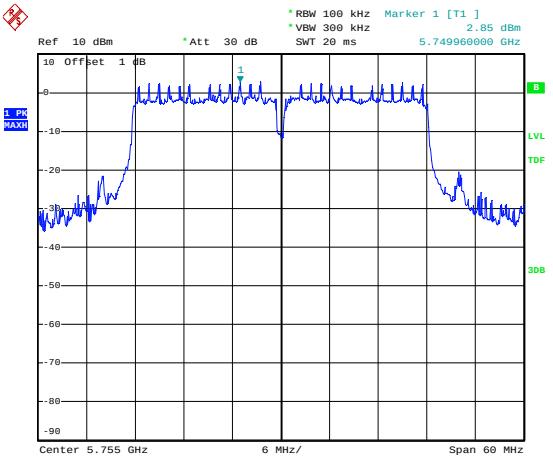


Spurious Emissions

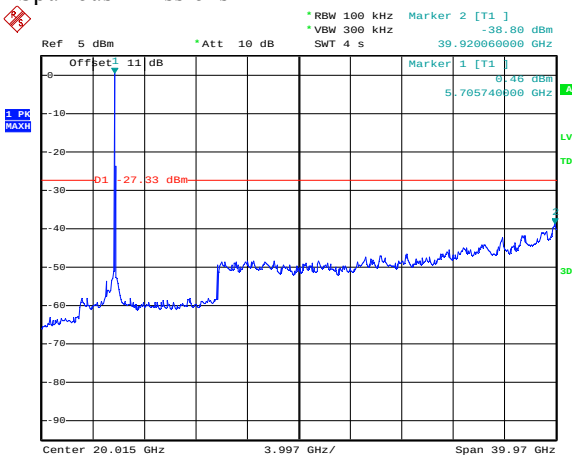


Ant4

Reference



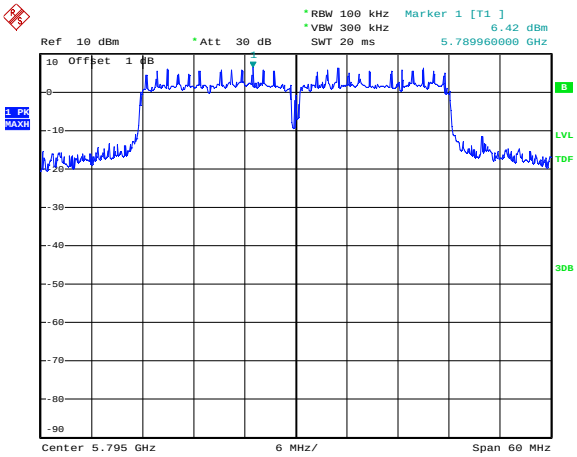
Spurious Emissions



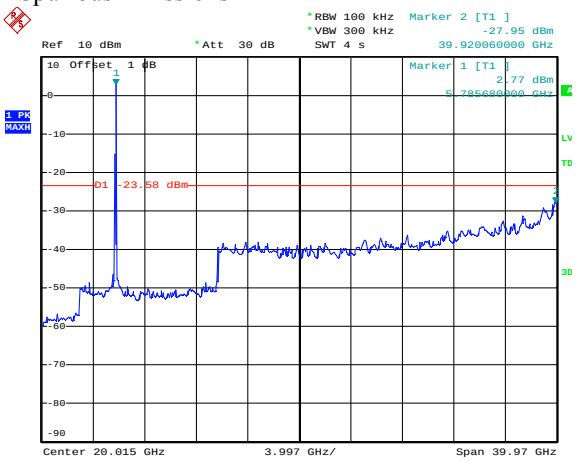
Highest Channel(5 795 MHz)

Ant1

Reference

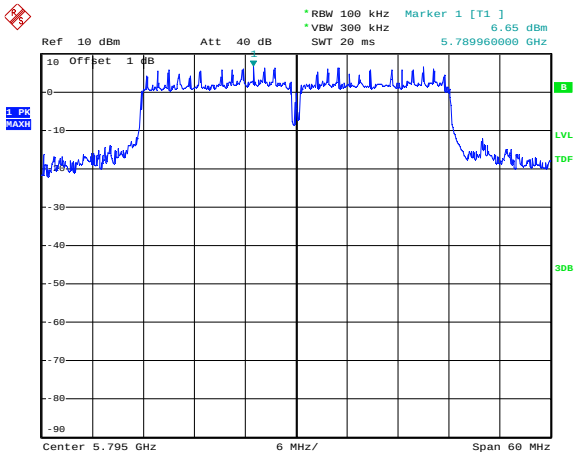


Spurious Emissions

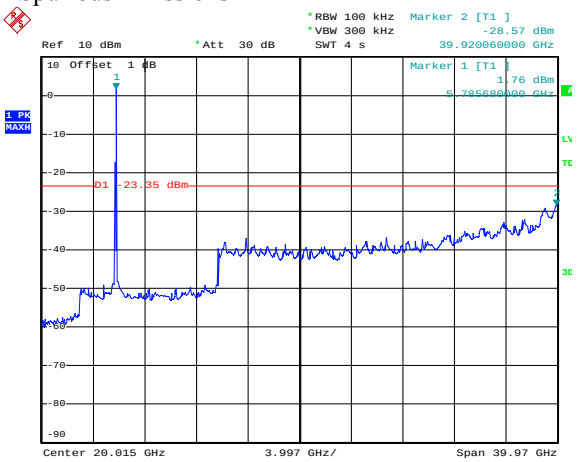


Ant2

Reference

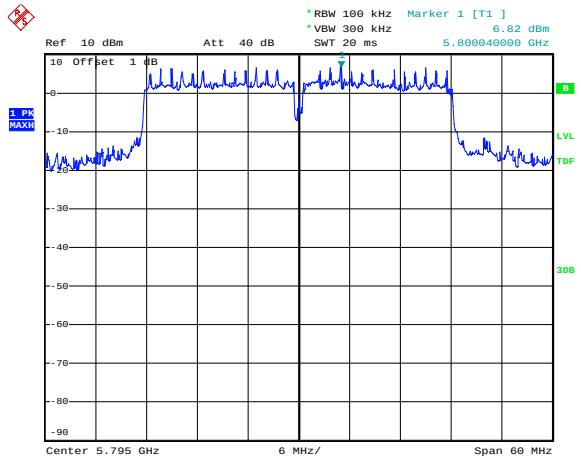


Spurious Emissions

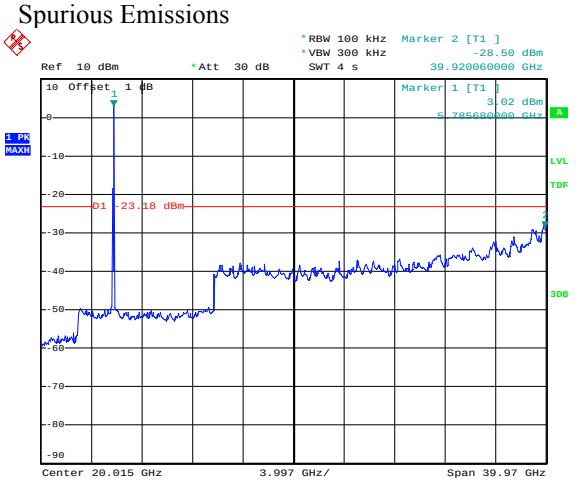


Ant3

Reference

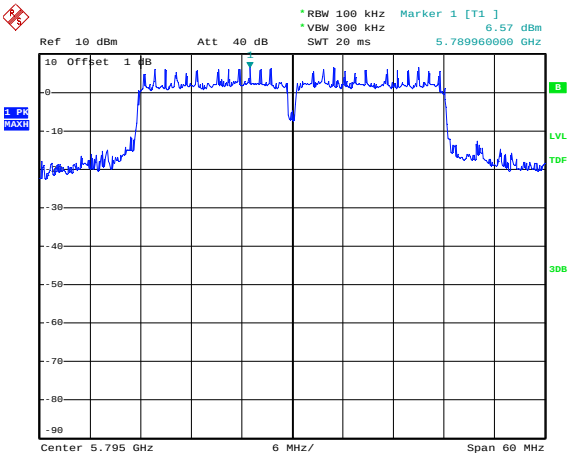


Spurious Emissions

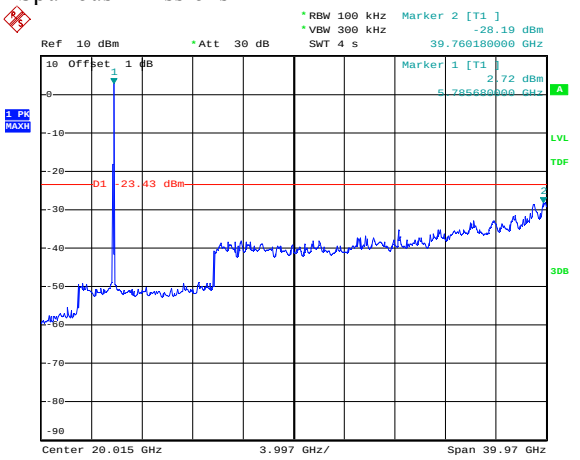


Ant4

Reference



Spurious Emissions



5.6 Conducted Emission

5.6.1 Regulation

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 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50μH/50Ω 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 (MHz)	Conducted limit (dBμV)	
	Qausi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

5.6.2 Measurement Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm 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 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

5.6.3 Test Result

-complied

802.11n 40MHz

5 755 MHz

Frequency [MHz]	Correction Factor		Line	Quasi-peak				Average			
	LISN	Cable		Limit [dBuV]	Reading [dBuV]	Result [dBuV]	Margin [dB]	Limit [dBuV]	Reading [dBuV]	Result [dBuV]	Margin [dB]
0.153	9.82	0.01	H	65.84	38.10	47.93	17.91	55.84	25.10	34.93	20.91
0.153	9.83	0.01	N	65.84	37.86	47.70	18.14	55.84	24.52	34.36	21.48
0.165	9.83	0.01	N	65.21	33.53	43.37	21.84	55.21	18.71	28.55	26.66
0.207	9.90	0.03	H	63.32	26.29	36.22	27.10	53.32	13.82	23.75	29.57
0.207	9.90	0.03	N	63.32	26.14	36.07	27.25	53.32	12.69	22.62	30.70
0.255	9.90	0.03	N	61.59	20.56	30.49	31.10	51.59	10.77	20.70	30.89
0.258	9.90	0.03	H	61.50	20.16	30.09	31.41	51.50	10.64	20.57	30.93
0.363	9.92	0.03	N	56.66	19.74	29.69	26.97	46.66	13.50	23.45	23.21
0.453	9.95	0.03	H	56.82	18.14	28.12	28.70	46.82	13.06	23.04	23.78
0.456	9.95	0.03	N	56.77	20.19	30.17	26.60	46.77	14.42	24.40	22.37
0.498	9.97	0.03	H	56.03	12.76	22.76	33.27	46.03	9.50	19.50	26.53
0.660	9.92	0.03	H	56.00	8.74	18.69	37.31	46.00	8.05	18.00	28.00
0.888	9.81	0.03	N	56.00	16.84	26.68	29.32	46.00	10.60	20.44	25.56
1.191	9.77	0.03	H	56.00	6.39	16.19	39.81	46.00	6.94	16.74	29.26
1.407	9.77	0.03	N	56.00	14.82	24.62	31.38	46.00	9.43	19.23	26.77
1.704	9.65	0.04	H	56.00	6.43	16.12	39.88	46.00	7.22	16.91	29.09
14.550	9.71	0.10	N	60.00	18.81	28.62	31.38	50.00	12.05	21.86	28.14
14.660	9.67	0.10	H	60.00	16.20	25.97	34.03	50.00	11.78	21.55	28.45

Note:

1. This measurement was performed the worst case data were reported.(Test Mode, Frequency)

480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
82 31 336 9919 (Main) 82 31 336 4767 (Fax)

5 795 MHz

Frequency [MHz]	Correction Factor		Line	Quasi-peak				Average			
	LISN	Cable		Limit [dBuV]	Reading [dBuV]	Result [dBuV]	Margin [dB]	Limit [dBuV]	Reading [dBuV]	Result [dBuV]	Margin [dB]
0.150	9.83	0.01	N	66.00	37.37	47.21	18.79	56.00	23.57	33.41	22.59
0.153	9.82	0.01	H	65.84	38.01	47.84	18.00	55.84	24.89	34.72	21.12
0.204	9.90	0.03	H	63.45	26.70	36.63	26.82	53.45	13.63	23.56	29.89
0.204	9.90	0.03	N	63.45	26.76	36.69	26.76	53.45	13.04	22.97	30.48
0.213	9.90	0.03	H	63.09	25.58	35.51	27.58	53.09	12.49	22.42	30.67
0.258	9.90	0.03	H	61.50	19.65	29.58	31.92	51.50	9.24	19.17	32.33
0.366	9.92	0.03	H	58.59	17.32	27.27	31.32	48.59	11.13	21.08	27.51
0.399	9.95	0.03	N	57.87	17.06	27.04	30.83	47.87	10.42	20.40	27.47
0.450	9.95	0.03	H	56.88	19.36	29.34	27.54	46.88	13.21	23.19	23.69
0.504	9.97	0.03	H	56.00	15.84	25.84	30.16	46.00	9.14	19.14	26.86
0.648	9.93	0.03	N	56.00	15.84	25.79	30.21	46.00	9.97	19.92	26.08
0.876	9.81	0.03	N	56.00	16.82	26.66	29.34	46.00	10.77	20.61	25.39
1.182	9.77	0.03	N	56.00	14.83	24.63	31.37	46.00	9.48	19.28	26.72
1.407	9.77	0.03	N	56.00	14.80	24.60	31.40	46.00	9.52	19.32	26.68
2.009	9.65	0.04	H	56.00	14.82	24.51	31.49	46.00	5.45	15.14	30.86
14.250	9.67	0.10	H	60.00	17.37	27.14	32.86	50.00	11.63	21.40	28.60
14.540	9.71	0.10	N	60.00	18.59	28.40	31.60	50.00	11.91	21.72	28.28
16.210	9.73	0.10	N	60.00	14.92	24.75	35.25	50.00	7.96	17.79	32.21

Note:

1. This measurement was performed the worst case data were reported.(Test Mode, Frequency)

480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
82 31 336 9919 (Main) 82 31 336 4767 (Fax)

5.6.4 Test plot

Figure 5. Plot of the Conducted Emission

802.11n 40 MHz

5 755 MHz_H

EMC Compliance LTD

EUT: C41W-500
Manuf: 5755
Op Cond: H
Operator:
Test Spec: FCC Class B Conducted Emission
Comment:

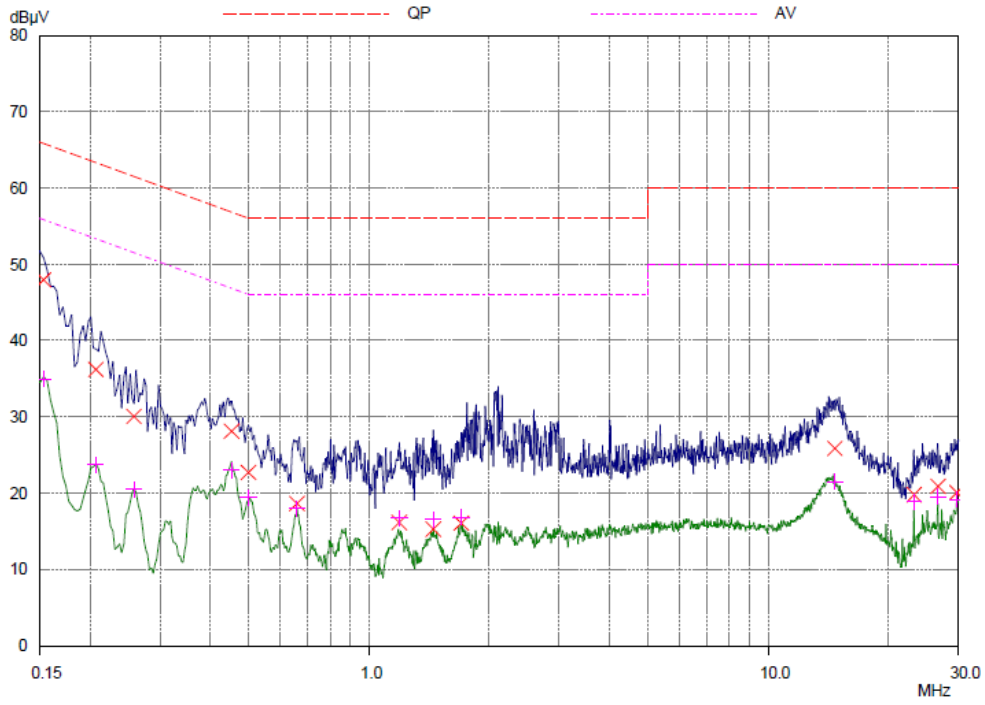
Result File: 5755_h.dat :

Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	3MHz	3kHz	10kHz	PK+AV	10msec	Auto	OFF	60dB
3MHz	30MHz	10kHz	10kHz	PK+AV	5msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	22	9kHz	30MHz	HI_ON_H

Final Measurement: Detectors: X QP / + AV
Meas Time: 1sec
Peaks: 8
Acc Margin: 25 dB



5 755 MHz_N

EMC Compliance LTD

EUT: C41W-500
Manuf: 5755
Op Cond: N
Operator:
Test Spec: FCC Class B Conducted Emission
Comment:

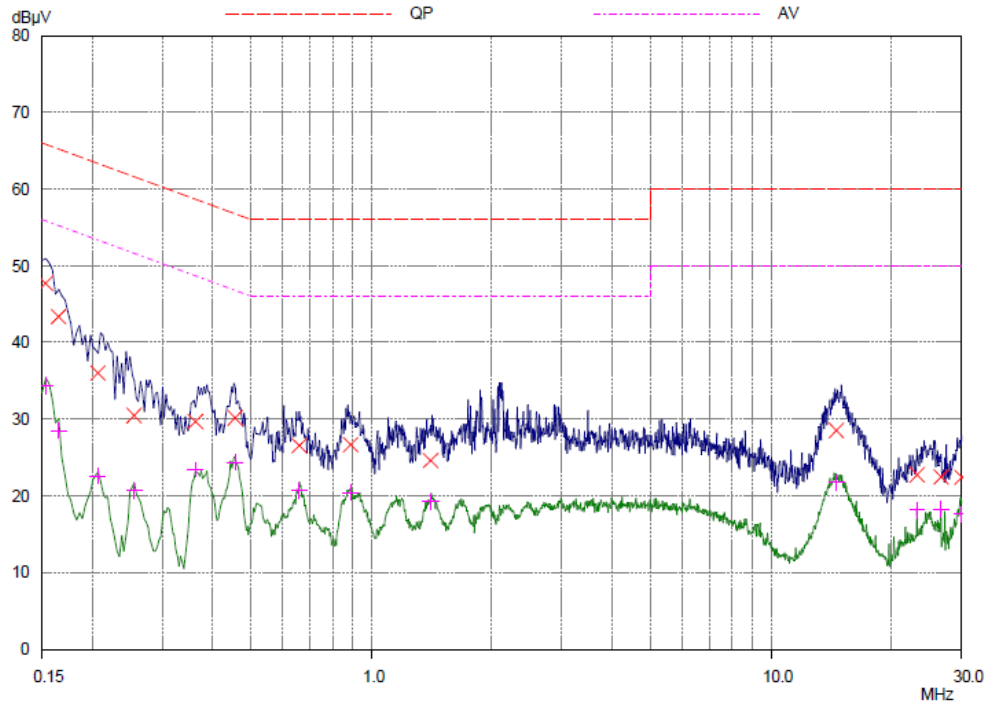
Result File: 5755_n.dat :

Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	3MHz	3kHz	10kHz	PK+AV	10msec	Auto	OFF	60dB
3MHz	30MHz	10kHz	10kHz	PK+AV	5msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	22	9kHz	30MHz	HI_ON_N

Final Measurement: Detectors: X QP / + AV
Meas Time: 1sec
Peaks: 8
Acc Margin: 25 dB



5 795 MHz_H

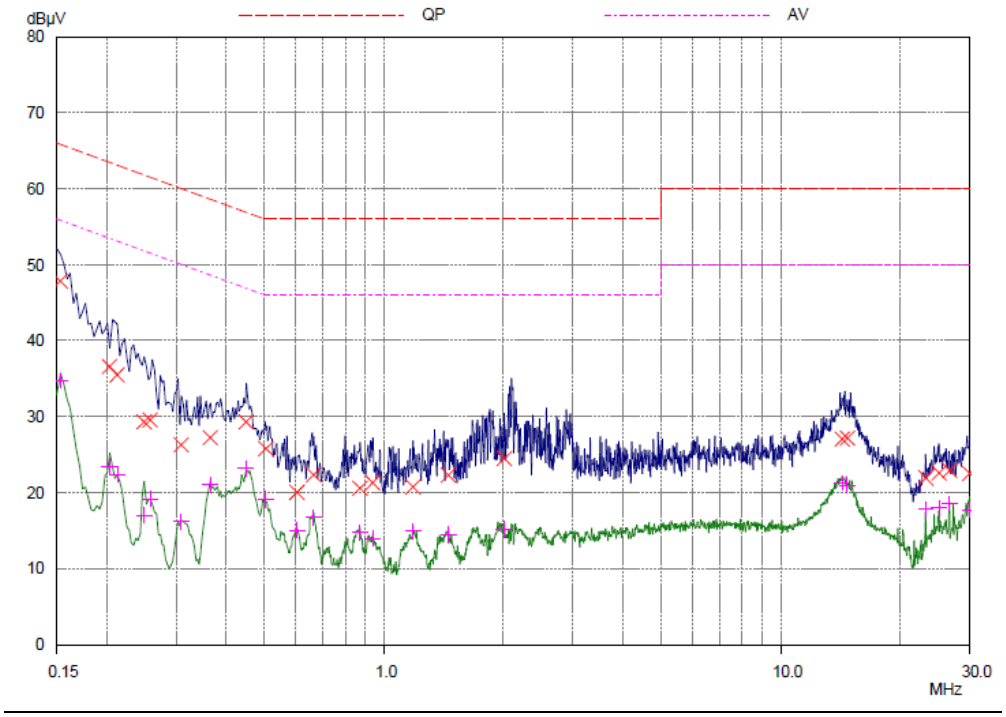
EMC Compliance LTD

EUT:	C41W-500
Manuf:	5795
Op Cond:	H
Operator:	
Test Spec:	FCC Class B Conducted Emission
Comment:	
Result File:	5795_h.dat :
Scan Settings	(2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	3MHz	3kHz	10kHz	PK+AV	10msec	Auto	OFF	60dB
3MHz	30MHz	10kHz	10kHz	PK+AV	5msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	22	9kHz	30MHz	HI_ON_H

Final Measurement:	Detectors:	X QP / + AV
	Meas Time:	1sec
	Peaks:	8
	Acc Margin:	25 dB



5 795 MHz_N

EMC Compliance LTD

EUT: C41W-500
Manuf: 5795
Op Cond: N
Operator:
Test Spec: FCC Class B Conducted Emission
Comment:

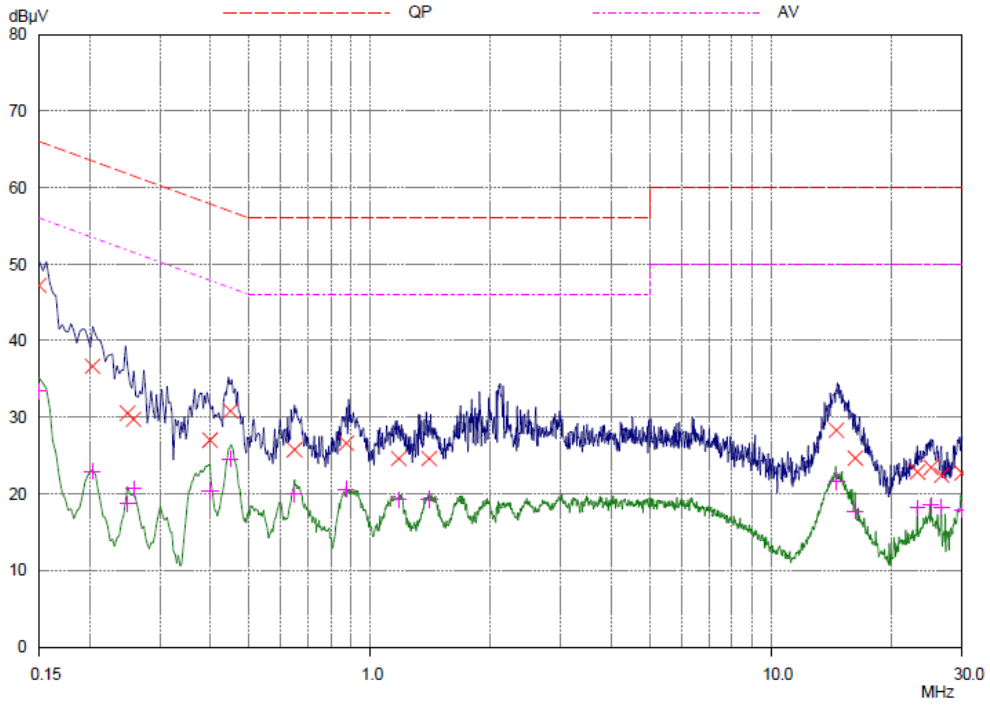
Result File: 5795_n.dat :

Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	3MHz	3kHz	10kHz	PK+AV	10msec	Auto	OFF	60dB
3MHz	30MHz	10kHz	10kHz	PK+AV	5msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	22	9kHz	30MHz	HI_ON_N

Final Measurement: Detectors: X QP / + AV
Meas Time: 1sec
Peaks: 8
Acc Margin: 25 dB



5.7 RF Exposure

5.7.1 Regulation

According to §15.247(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this Chapter.

Limits for Maximum Permissive Exposure: RF exposure is calculated.

Frequency Range	Electric Field Strength [V/m]	Magnetic Field Strength [A/m]	Power Density [mW/cm^2]	Averaging Time [minute]
Limits for General Population / Uncontrolled Exposure				
0.3 ~ 1.34	614	1.63	*(100)	30
1.34 ~ 30	824 /f	2.19/f	*(180/f^2)	30
30 ~ 300	27.5	0.073	0.2	30
300 ~ 1500	/	/	f/1500	30
1500 ~ 15000	/	/	1.0	30

*f=frequency in MHz, *= plane-wave equivalent power density*

MPE (Maximum Permissive Exposure) Prediction
Predication of MPE limit at a given distance: Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2 \quad \left(\Rightarrow R = \sqrt{PG/4\pi S}\right)$$

S=power density [mW/cm^2]
P=Power input to antenna [mW]
G=Power gain of the antenna in the direction of interest relative to an isotropic radiator
R= distance to the center of radiation of the antenna [cm]

5.7.2 RF Exposure Compliance Issue

The information should be included in the user's manual:
This appliance and its antenna must not be co-located or operation in conjunction with any other antenna or transmitter. A minimum separation distance of 20 cm must be maintained between the antenna and the person for this appliance to satisfy the RF exposure requirements.

Band [MHz]	Mode	Antenna Selection	Channel Frequency [MHz]	Ant Gain [dBi]	Conducted power [dBm]	E.I.R.P power [dBm]	Power Density at 20 cm [mW/Cm2]
2 400 ~ 2 483.5	RF4CE	ANT0+1	2 425	5.59	2.28	7.87	0.001 22
5 725 ~ 5 850	11n 40	ANT1+2+3+4	5 755	3.00	25.90	28.90	0.154 43
							0.155 65

5.7.3 Calculation Result of RF Exposure

- 2 400 ~ 2 483.5 MHz (RF4CE)

Channel	Antenna Selection	Channel Frequency [MHz]	Ant Gain [dBi]	Conducted power [dBm]	E.I.R.P power [dBm]	Power Density at 20 cm [mW/Cm2]
Lowest	ANT0+1	2 425	5.59	2.28	7.87	**0.001 22**
Middle		2 450	5.59	2.10	7.69	0.001 17
Highest		2 475	5.59	2.23	7.82	0.001 20

- 5 150 ~ 5 250 MHz (Wi-Fi)

mode	Antenna Selection	Channel	Channel Frequency [MHz]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/Cm2]
11n 40MHz	ANT1+2+3+4	Lowest	5 190	1.55	15.44	34.99	0.010 78
		Highest	5 230	1.55	15.62	36.48	0.011 24

- 5 250 ~ 5 350 MHz (Wi-Fi)

mode	Antenna Selection	Channel	Channel Frequency [MHz]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/Cm2]
11n 40MHz	ANT1+2+3+4	Lowest	5 270	1.78	22.77	189.23	0.066 95
		Highest	5 310	1.78	22.70	186.21	0.065 88

- 5 470 ~ 5 725 MHz (Wi-Fi)

mode	Antenna Selection	Channel	Channel Frequency [MHz]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/Cm2]
11n 40MHz	ANT1+2+3+4	Lowest	5 510	1.95	22.88	194.09	0.075 29
		Middle	5 550	1.95	23.07	202.77	0.078 66
		Highest	5 670	1.95	22.92	195.88	0.075 99

- 5 725 ~ 5 850 MHz (Wi-Fi)

mode	Antenna Selection	Channel	Channel Frequency [MHz]	Ant Gain [mW]	power [dBm]	power [mW]	Power Density at 20 cm [mW/Cm2]
11n 40MHz	ANT1+2+3+4	Lowest	5 755	2.00	25.90	389.05	**0.154 43**
		Highest	5 795	2.00	25.89	388.15	0.154 07

480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
82 31 336 9919 (Main) 82 31 336 4767 (Fax)

6. Test equipment used for test

	Description	Manufacture	Model No.	Serial No.	Next Cal Date.
□	Temp & humidity chamber	Taekwang	TK-04	TK001	13.12.07
□	Temp & humidity chamber	Taekwang	TK-500	TK002	13.09.03
□	Frequency Counter	HP	53150A	US39250565	13.09.04
□	Spectrum Analyzer	Agilent	E4440A	MY46186407	13.06.27
■	Spectrum Analyzer	R & S	FSP40	100209	13.10.23
■	Spectrum Analyzer	R & S	FSG13	100051	14.02.15
■	Signal Generator	R & S	SMR40	100007	13.06.27
□	Vector Signal Generator	R & S	SMBV100A	257566	14.01.07
■	Wideband Power Sensor	R & S	NRP-Z81	100677	13.05.04
□	Modulation Analyzer	HP	8901B	3538A05527	13.10.25
□	Audio Analyzer	HP	8903B	3729A19213	13.10.23
■	AC Power Supply	Kikusui	PCR2000W	GB001619	13.10.23
□	DC Power Supply	Tektronix	PS2520G	TW50517	14.03.02
□	DC Power Supply	Tektronix	PS2521G	TW53135	13.10.23
□	Attenuator	HP	8494A	2631A09825	13.10.24
□	Attenuator	HP	8496A	3308A16640	13.10.24
□	Attenuator	BIRD	50-A-MFN-20	0403002	13.10.24
□	Power Divider	Weinschel	1580-1	NX375	13.10.23
□	Power Divider	Weinschel	1580-1	NX380	13.09.09
□	Power Divider	Weinschel	1594	671	13.09.10
□	Power Divider	Krytar	7005265	143244	13.09.03
■	EMI Test Receiver	R&S	ESCI	100710	13.11.06
■	LOOP Antenna	EMCO	EMCO6502	9205-2745	13.05.23
■	BILOG Antenna	Schwarzbeck	VULB 9168	9168-440	13.10.04
■	HORN Antenna	ETS	3115	00086706	13.11.21
■	HORN Antenna	ETS	3116	00086632	13.11.15
■	Amplifier	Sonoma	310N	293004	13.11.06
■	Amplifier	Agilent	8449B	3008A01802	13.05.04
■	Attenuator	HP	8491A	27444	13.11.06
■	Antenna Mast	Innco Systems	MA4000-EP	303	-
■	Turn Table	Innco Systems	DT2000S-1t	079	-
■	Test Receiver	R & S	844827/011	ESHS30	13.08.06
■	LISN	R & S	101352	ENV216	14.01.07
■	LISN	PMM	0120J20305	L3-32	-

480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
82 31 336 9919 (Main) 82 31 336 4767 (Fax)