Head office & Test Lab: 28(175-20,Annyeong-dong)
406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea
Tel: +82-31-222-4251 / Fax: +82-31-222-4252

▪ **DTS WLAN**

TEST REPORT

Report No: KST-FCR-140011

Applicant	Name	Bluebird Inc.
	Address	(Dogok-dong, SEI Tower 13~14),39, Eonju-ro30-gil, Gangnam-gu, Seoul, Korea
Manufacturer	Name	Bluebird Inc.
	Address	(Dogok-dong, SEI Tower 13~14),39, Eonju-ro30-gil, Gangnam-gu, Seoul, Korea
Equipment	Name	Countertop Payment Terminal
	Model No	P3500
	Brand	-
	FCC ID	SS4P3500
Test Standard	FCC CFR 47, Part 15. Subpart C-15.247 558074 D01 DTS Meas. Guidance v03r02	
Test Date(s)	2014. 12. 17 - 2014. 12. 18	
Issue Date	2014. 12. 19	
Test Result	Compliance	
Note	None	

Supplementary Information

The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with measurement procedures specified in ANSI C 63.10-2009.

We attest to the accuracy of data and all measurements reported herein were performed by KOSTEC Co., Ltd. and were made under Chief Engineer's supervision. We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested by	Mi Young, Lee	Approved by	Gyeong Hyeon, Park
Signature		Signature	

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1. GENERAL INFORMATION

1.1 Test Facility

Test laboratory and address

KOSTEC Co., Ltd.

128(175-20,Annyeong-dong)406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea

The open area field test site and conducted measurement facility are used for these testing. This site at was fully described in a reports submitted to the Federal Communications Commission (FCC).

The details of these reports have been found to be in complies with the requirements of Section 2.948 of the FCC Rules on November 14, 2002. The facility also complies with the radiated and conducted test site criteria set forth in ANSI C 63.10-2009.

The Federal Communications Commission (FCC) has the reports on file and KOSTEC Co., Ltd. is listed under FCC Registration No.525762. The test site has been approved by the FCC for public use and is List in the FCC Public Access Link CORES (Commission Registration System)

Registration information

KCC (Korea Communications Commission) Number : KR0041

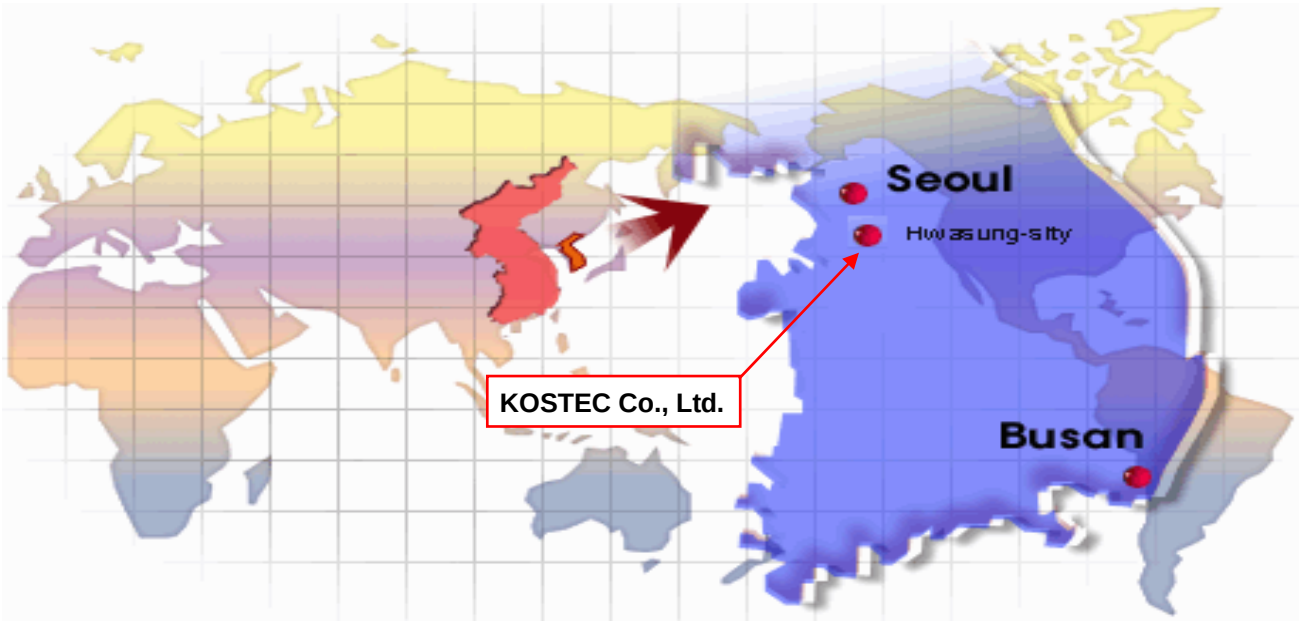
KOLAS(Korea Laboratory Accreditation Scheme) Number : 232

FCC Registration Number(FRN) : 525762

VCCI Registration Number : R-1657 / C –1763

IC Registration Site Number : 8305A

1.2 Location



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Revision History of test report

Rev.	Revisions	Effect page	Reviewed	Date
-	Initial issue	All	Gyeong Hyeon, Park	2014. 12. 19

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2. EQUIPMENT DESCRIPTION

The product specification described herein was declared by manufacturer. And refer to user's manual for the details.

Equipment Name	Countertop Payment Terminal
Model No	P3500
Usage	Countertop Payment Terminal
Serial Number	Proto type
Data connection Type	DSSS, OFDM
Modulation type	GPRS: GMSK 802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11g/n(HT20): OFDM (BPSK / QPSK / 16QAM / 64QAM) NFC: ASK
Max peak output	14.39 dBm**
Operated Frequency	GSM 850: 824.2 ㎒ - 848.8 ㎒ GSM1900: 1850.2 ㎒ – 1909.8 ㎒ 802.11b/g: 2 412 ㎒ – 2 462 ㎒ 802.11n(HT20): 2 412 ㎒ – 2 462 ㎒ NFC: 13.561 ㎒
Channel Number	2.4 ㎓: 11 for 802.11b, 802.11g, 802.11n (HT20)
Operation temperature	- 20℃~ + 55 ℃
Power Source	Standard only supplied : Li-on battery, Rating 7.4 Vdc
Antenna Description	Internal Metal Press Antenna, Max. gain: -3.2 dBi
Remark	1. The data rates used when evaluating the WLAN transmitter were the lowest data rates for each mode. The device was operating at its maximum output power at the lowest data rate for all measurements. 2. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test. 3. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report. 4. The above DUT's information was declared by manufacturer. Please refer to the specifications or user manual for more detailed description.
FCC ID	SS4P3500

** it is maximum peak conducted power.

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3. SYSTEM CONFIGURATION FOR TEST

3.1 Characteristics of equipment

The equipment under test is a Payment Terminal with IEEE 802.11b,g,n WLAN operating in the 2.4 ㎓ bands and GPRS850/1900 MHz and NFC.

3.2 Used peripherals list

Description	Model No.	Serial No.	Manufacture	Remark
PC	LS40	1402KIAW215672	LG-IBM	

3.3 Product Modification

N/A

3.4 Operating Mode

* Constantly transmitting with a modulated carrier at maximum power/widest bandwidth on the bottom, middle and top channels as required using the supported data rates/modulation types.

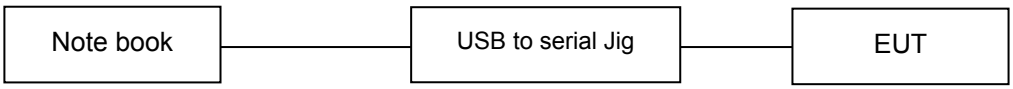
* The EUT has one transmit/receive RF port. When conducted measurements were performed, RF cables and attenuators connecting the test equipment to the EUT ports were calibrated before use and the calibration data incorporated into the conducted measurement results.

* Radiated emissions tests were performed with all unused ports terminated.

3.5 Test Setup of EUT

The measurements were taken in continuous transmit / receive mode using the TEST MODE.

For controlling the EUT as TEST MODE, the test program and the test Jig were provided by the applicant.



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3.6 Parameters of Test Software Setting

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

▣ TX Power setting value during test

Band	Mode	TX Power setting value
2.4 GHz band	802.11b	default
	802.11g, 802.11n(HT20)	default

3.7 Table for Carrier Frequencies

2.4 GHz band, 20MHz			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2 412	7	2 442
2	2 417	8	2 447
3	2 422	9	2 452
4	2 427	10	2 457
5	2 432	11	2 462
6	2 437		

3.8 Duty Cycle Of Test signal

Duty cycle is < 98%, duty factor shall be considered. Duty cycle = Tx on/(Tx on+ Tx off),Duty factor = 10*log(1/duty cycle)

Band	Mode	Duty cycle	Note
2.4 GHz band	802.11b	> 98 %	
	802.11g	> 98 %	
	802.11n(HT20)	> 98 %	

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3.8 Used Test Equipment List

No.	Instrument	Model	S/N	Manufacturer	Due to cal date	Cal interval	used
1	T & H Chamber	EY-101	90E14260	TABAI ESPEC	2015.09.19	1 year	☒
2	Constant switch Tester	DS-COT	None	Dong sung Ele.	N/A	N/A	☐
3	Vibration Tester	70UA	L90016	IDEX Co.,Ltd	N/A	N/A	☐
4	Vibration Meter	VM-6360	N225098	LANDTEK	2015.04.04	18 month	☐
5	Falling Tester	SWD-8000	None	Sinwoo	N/A	N/A	☐
6	Spectrum Analyzer	8563E	3846A10662	Agilent Technology	2015.02.07	1 year	☐
7	Spectrum Analyzer	8593E	3710A02859	Agilent Technology	2015.02.07	1 year	☐
8	Spectrum Analyzer	FSV30	20-353063	Rohde & Schwarz	2015.02.07	1 year	☒
9	EMI Test Receiver	ESCI7	100823	Rohde & Schwarz	2015.02.05	1 year	☒
10	EMI Test Receiver	ESI	834000/002	Rohde & Schwarz	2015.02.05	1 year	☒
11	Vector Signal Analyzer	89441A	3416A02620	Agilent Technology	2015.02.07	1 year	☐
12	Network Analyzer	8753ES	US39172348	AGILENT	2015.09.18	1 year	☐
13	EPM Series Power meter	E4418B	GB39512547	Agilent Technology	2015.02.07	1 year	☐
14	RF Power Sensor	E9300A	MY41496631	Agilent Technology	2015.02.07	1 year	☐
15	Microwave Frequency Counter	5352B	2908A00480	Agilent Technology	2015.02.07	1 year	☐
16	Modulation Analyzer	8901A	3538A07071	Agilent Technology	2015.02.07	1 year	☐
17	Audio Analyzer	8903B	3514A16919	Agilent Technology	2015.02.07	1 year	☐
18	Audio Telephone Analyzer	DD-5601CID	520010281	CREDIX	2015.02.07	1 year	☐
19	Digital storage Oscilloscope	TDS3052	B015962	Tektronix	2015.09.17	1 year	☐
20	ESG-D Series Signal Generator	E4436B	US39260458	Agilent Technology	2015.02.07	1 year	☐
21	ESG Vector Signal Generator	E4438C	MY42083133	Agilent Technology	2015.09.17	1 year	☐
22	Vector Signal Generator	SMBV100A	257557	Rohde & Schwarz	2015.01.21	1 year	☒
23	Tracking Source	85645A	070521-A1	Agilent Technology	2015.02.07	1 year	☐
24	Signal Generator	SML03	100692	Rohde & Schwarz	2015.02.07	1 year	☐
25	SLIDAC	None	0207-4	Myoung sung Ele.	2015.02.07	1 year	☐
26	DC Power supply	DRP-5030	9028029	Digital Electronic Co.,Ltd	2015.02.07	1 year	☐
27	DC Power supply	6038A	3440A12674	Agilent Technology	2015.02.07	1 year	☐
28	DC Power supply	E3610A	KR24104505	Agilent Technology	2015.02.07	1 year	☒
29	DC Power supply	UP-3005T	68	Unicon Co.,Ltd	2015.02.07	1 year	☐
30	DC Power Supply	SM 3004-D	114701000117	DELTA ELEKTRONIKA	2015.02.07	1 year	☐
31	Dummy Load	8173	3780	Bird Electronic Co., Corp	2015.02.07	1 year	☐
32	Attenuator	50FH-030-500	140410 9433	JEW Idustries Inc.	2015.02.07	1 year	☐
33	Attenuator	765-20	9703	Narda	2015.09.17	1 year	☐
34	Attenuator	8498A	3318A09485	HP	2015.02.07	1 year	☒
35	Step Attenuator	8494B	3308A32809	HP	2015.02.07	1 year	☐
36	Step Attenuator	8495D	3308A01464	HP	2015.02.07	1 year	☐
37	Power divider	11636B	51212	HP	2015.09.17	1 year	☐
38	3Way Power divider	KPDSU3W	00070365	KMW	2015.02.07	1 year	☐
39	Band rejection filter	WTR-BRF2442-84NN	09020001	WAVE TECH Co.,LTD	2015.02.07	1 year	☐
40	White noise audio filter	ST31EQ	101902	SoundTech	2015.09.17	1 year	☐
41	Dual directional coupler	778D	17693	HEWLETT PACKARD	2015.02.07	1 year	☐
42	Dual directional coupler	772D	2839A00924	HEWLETT PACKARD	2015.02.07	1 year	☐
43	Band rejection filter	3TNF-0006	26	DOVER Tech	2015.02.07	1 year	☐
44	Band rejection filter	3TNF-0008	317	DOVER Tech	2015.02.07	1 year	☐
45	Band rejection filter	3TNF-0007	311	DOVER Tech	2015.02.07	1 year	☐
46	Highpass Filter	WHJS1100-10EF	1	WAINWRIGHT	2015.02.07	1 year	☐
47	Highpass Filter	WHJS3000-10EF	1	WAINWRIGHT	2015.02.07	1 year	☐
48	Radio Communication Alalyzer	MT8815A	6200429622	ANRITSU	2015.02.07	1 year	☐
49	CDMA Mobile Station Test Set	E8285A	US40081298	AGILENT	2015.02.07	1 year	☐
50	WideBand Radio Communication Tester	CMW500	102276	Rohde & Schwarz	2015.04.10	1 year	☐

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No.	Instrument	Model	S/N	Manufacturer	Due to cal date	Cal interval	used
51	RF Up/Down Converter	DCP-1780	980901003	CREDIX	2015.02.07	1 year	☐
52	DECT Test set	8923B	3829U00364	HP	2015.02.07	1 year	☐
53	DECT Test set	CMD60	840677/005	Rohde & Schwarz	2015.09.17	1 year	☐
54	Loop Antenna	6502	9203-0493	EMCO	2015.05.31	2 year	☒
55	Dipole Antenna	HZ-12	100005	Rohde & Schwarz	2016.07.01	2 year	☐
56	Dipole Antenna	HZ-13	100007	Rohde & Schwarz	2016.07.01	2 year	☐
57	BiconiLog Antenna	3142B	1745	EMCO	2016.06.16	2 year	☒
58	Horn Antenna	3115	9605-4834	EMCO	2016.06.16	2 year	☐
59	Horn Antenna	3115	2996	EMCO	2016.02.26	2 year	☒
60	Horn Antenna	BBHA9170	BBHA9170152	SCHWARZBECK	2015.05.27	2 year	☒
61	Signal Generator	SMT-06	100552	Rohde & Schwarz	2015.02.07	1 year	☐
62	HYGRO-Thermograph	NSII-Q	1611545	SATO	2015.09.22	1 year	☐
63	Barometer	7612	81134	SATO	2016.01.20	2 year	☐
64	Multi meter	DM-313	S60901832	LG Precision Co.,Ltd	2015.02.07	1 year	☐
65	Antenna Mast(OSA)	AT14	None	Daeil EMC	N/A	N/A	☐
66	Turn table(OSA)	None	None	Daeil EMC	N/A	N/A	☐
67	RF Amplifier(OSA)	8447D	2944A07881	AGILENT	2015.02.04	1 year	☐
68	Antenna Master(3)	AT13	None	AUDIX	N/A	N/A	☒
69	Turn Table(3)	None	None	AUDIX	N/A	N/A	☒
70	PREAMPLIFIER(3)	8449B	3008A02577	Agilent	2015.02.05	1 year	☒
71	Antenna Master(10)	MA4000-EP	None	inno systems GmbH	N/A	N/A	☒
72	Turn Table(10)	None	None	inno systems GmbH	N/A	N/A	☒
73	AMPLIFIER(10)	TK-PA6S	120009	TESTEK	2015.02.05	1 year	☒
74	Vernier Calipers	None	8280373	Mitutoyo	2015.09.18	1 year	☐

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4. SUMMARY TEST RESULTS

Description of Test	FCC Rule	Reference Clause	Used	Test Result
Max. Conducted peak output power	15.247(b)(3)	Clause 5.1	☒	Compliance
Conducted peak power spectral density	15.247(e)	Clause 5.2	☒	Compliance
6 dB spectrum Bandwidth	15.247(a)(2)	Clause 5.3	☒	Compliance
Band edge of RF conducted emissions	15.247(d)	Clause 5.4	☒	Compliance
Spurious RF radiated emissions	15.247(d), 15.209	Clause 5.5	☒	Compliance
Antenna requirement	15.203, 15.247	Clause 5.6	☒	Compliance
AC Conducted emission	15.207	Clause 5.7	☒	Compliance
Compliance/pass : The EUT complies with the essential requirements in the standard. Not Compliance : The EUT does not comply with the essential requirements in the standard. N/A : The test was not applicable in the standard.				

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5. MEASUREMENT RESULTS

5.1 Max. Conducted peak output power

5.1.1 Standard Applicable [FCC §15.247(b)(3)]

For systems using digital modulation in the 902 – 928 ㎒, 2 400 – 2 483.5 ㎒, and 5 725 – 5 850 ㎒ 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.

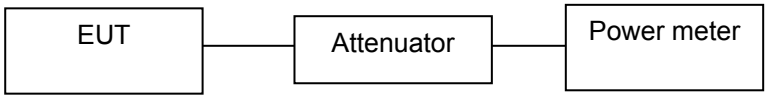
5.1.2 Test Environment conditions

- Ambient temperature : 20 ℃
- Relative Humidity : (38 - 41) % R.H.

5.1.3 Measurement Procedure

The transmitter output was connected to the power meter with an attenuator. The maximum conducted output power was measured and recorded with power meter. EUT was programmed to be in continuously transmitting mode. All conducted power tests were performed using a test receiver in accordance with FCC KDB 558074 v03r02 Section 9.2.3 Measurement using a power meter (PM)

5.1.4 Test setup



5.1.5 Measurement Result

For 2.4 ㎓

802.11b

Channel	Frequency [㎒]	Peak Power [dBm]	Peak Power [㎽]	Limit [dBm]	Test Results
1	2 412	14.35	27.22	30	Compliance
6	2 437	14.39	27.48	30	Compliance
11	2 462	14.09	25.64	30	Compliance

802.11g

Channel	Frequency [㎒]	Peak Power [dBm]	Peak Power [㎽]	Limit [dBm]	Test Results
1	2 412	10.28	10.67	30	Compliance
6	2 437	10.77	11.94	30	Compliance
11	2 462	10.13	10.30	30	Compliance

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802.11n(HT20)

Channel	Frequency [㎒]	Peak Power [dBm]	Peak Power [㎽]	Limit [dBm]	Test Results
1	2 412	10.10	10.23	30	Compliance
6	2 437	10.57	11.40	30	Compliance
11	2 462	10.11	10.26	30	Compliance

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5.2 Conducted peak power spectral density

5.2.1 Standard Applicable [FCC §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 ㏈m in any 3 ㎑ band during any time interval of continuous transmit

5.2.2 Test Environment conditions

- Ambient temperature : 20 ℃
- Relative Humidity : (38 - 41) % R.H.

5.2.3 Measurement Procedure

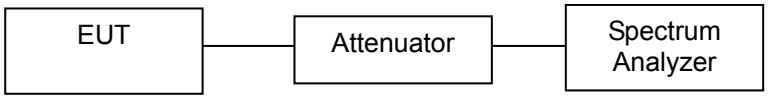
The power spectral density conducted from the intentional radiator was measured with a spectrum analyzer connected to the antenna terminal, while EUT had the highest, middle and the lowest available channels. After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak power spectral density.

All conducted power tests were performed using a test receiver in accordance with FCC KDB 558074 v03r02 Section 10.3 Method AVGPSD-1(trace averaging with EUT transmitting at full power throughout each sweep)

The spectrum analyzer is set to the as follows :

• Set analyzer center frequency to DTS channel center frequency.
• Set the span to 1.5 times the DTS bandwidth.
• Set the RBW to: 3 ㎑ ≤ RBW ≤ 100 ㎑.
• Set the VBW ≥ 3 x RBW.
• Detector = RMS
• Sweep time = auto couple.
• Trace averaging (RMS) mode over a minimum of 100 traces
• Use the peak marker function to determine the maximum amplitude level within the RBW.
• If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.2.4 Test setup



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5.2.5 Measurement Result

For 2.4 ㎓

802.11b

Channel	Frequency [㎒]	Result Value [dBm]	Limit [dBm]	Test Results
1	2 412	-14.96	8	Compliance
6	2 437	-13.51	8	Compliance
11	2 462	-14.32	8	Compliance

802.11g

Channel	Frequency [㎒]	Result Value [dBm]	Limit [dBm]	Test Results
1	2 412	-15.94	8	Compliance
6	2 437	-16.23	8	Compliance
11	2 462	-16.67	8	Compliance

802.11n(HT20)

Channel	Frequency [㎒]	Result Value [dBm]	Limit [dBm]	Test Results
1	2 412	-15.88	8	Compliance
6	2 437	-14.64	8	Compliance
11	2 462	-14.68	8	Compliance

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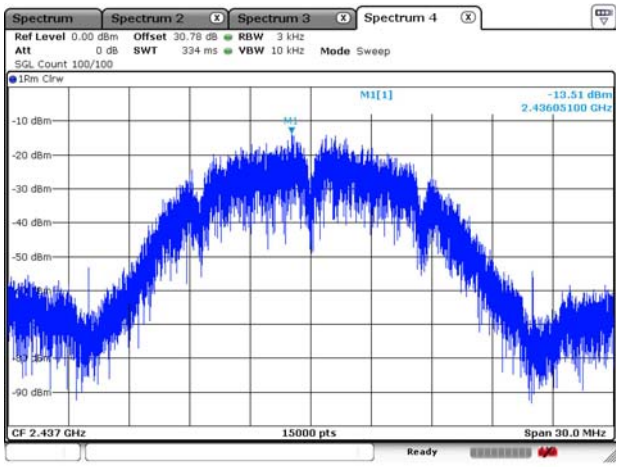
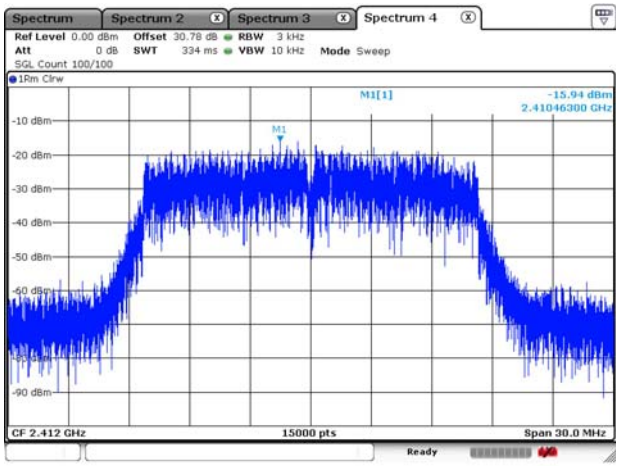
5.2.6 Test Plot

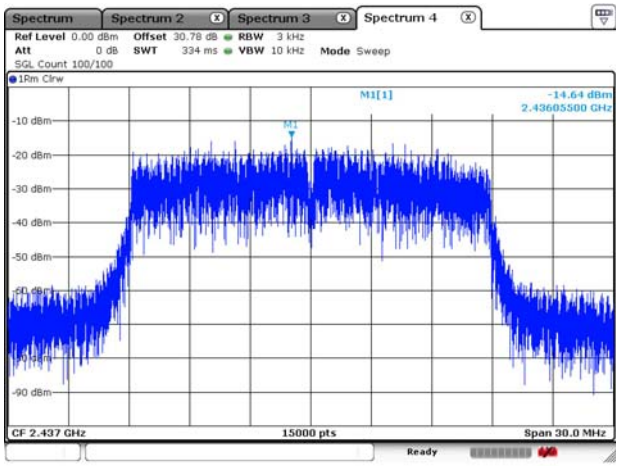
802.11b



802.11n(HT20)



802.11n(HT20)



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5.3 6 dB spectrum Bandwidth

5.3.1 Standard Applicable [FCC §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.

5.3.2 Test Environment conditions

- Ambient temperature : 20 ℃
- Relative Humidity : (38 - 41) % R.H.

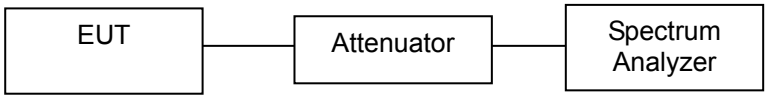
5.3.3 Measurement Procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. The resolution bandwidth of 100 kHz and the video bandwidth of 100 kHz were used.
3. Measured the spectrum width with power higher than 6 dB below carrier.

The spectrum analyzer is set to the as follows :

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

5.3.4 Test setup



5.3.5 Measurement Result

For 2.4 GHz

802.11b

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	99% Bandwidth [MHz]	Limit [MHz]	Test Results
1	2 412	9.03	12.85	>0.5	Compliance
6	2 437	8.51	12.81	>0.5	Compliance
11	2 462	8.55	12.81	>0.5	Compliance

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802.11g

Channel	Frequency [㎒]	6 dB Bandwidth [㎒]	99% Bandwidth [㎒]	Limit [㎒]	Test Results
1	2 412	15.90	16.35	>0.5	Compliance
6	2 437	15.14	16.35	>0.5	Compliance
11	2 462	15.15	16.35	>0.5	Compliance

802.11n(HT20)

Channel	Frequency [㎒]	6 dB Bandwidth [㎒]	99% Bandwidth [㎒]	Limit [㎒]	Test Results
1	2 412	15.09	16.28	>0.5	Compliance
6	2 437	15.11	16.28	>0.5	Compliance
11	2 462	15.11	16.28	>0.5	Compliance

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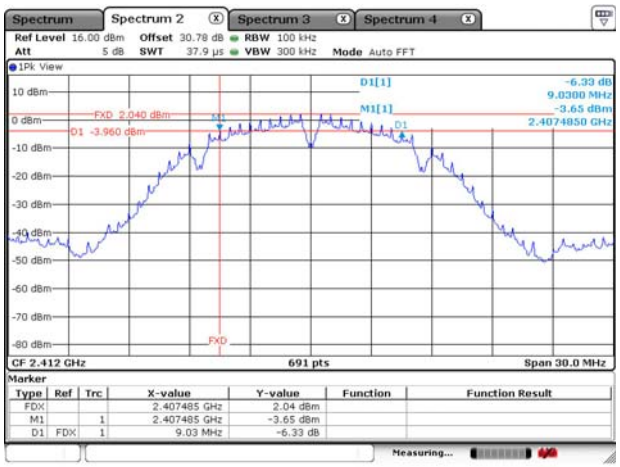
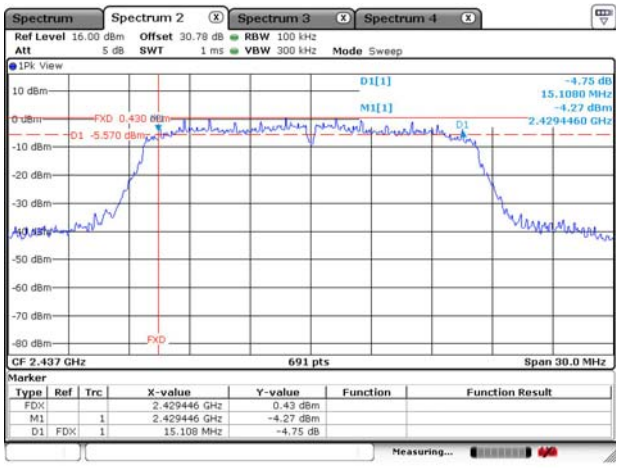
5.3.6 Test Plot (6 dB band width)

Only the worst case is shown in report.

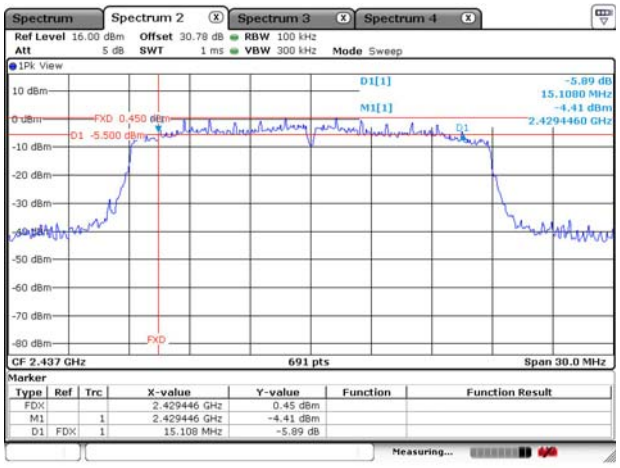
802.11b



802.11n(HT20)



802.11n(HT20)



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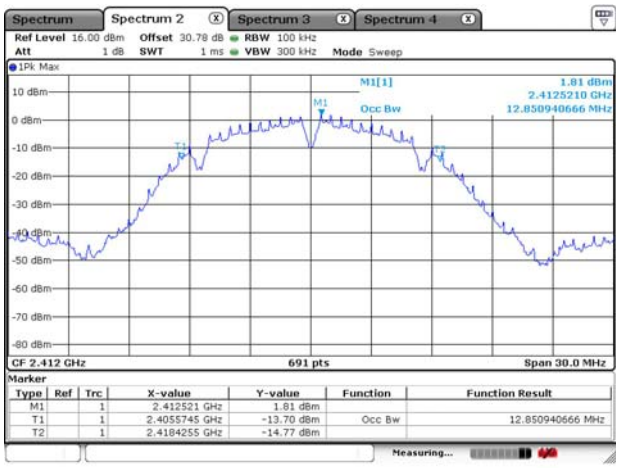
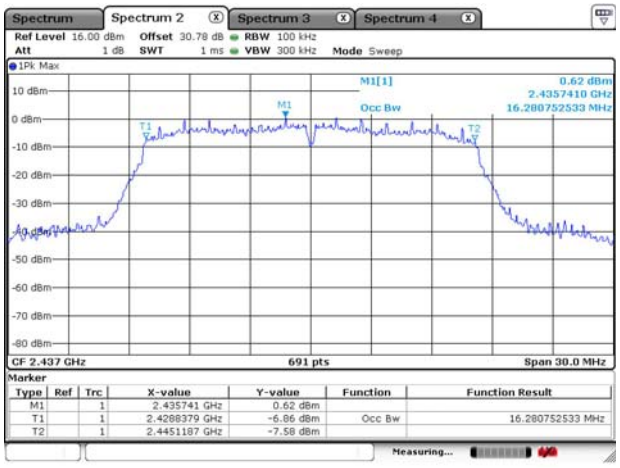
Test Plot (99 % band width)

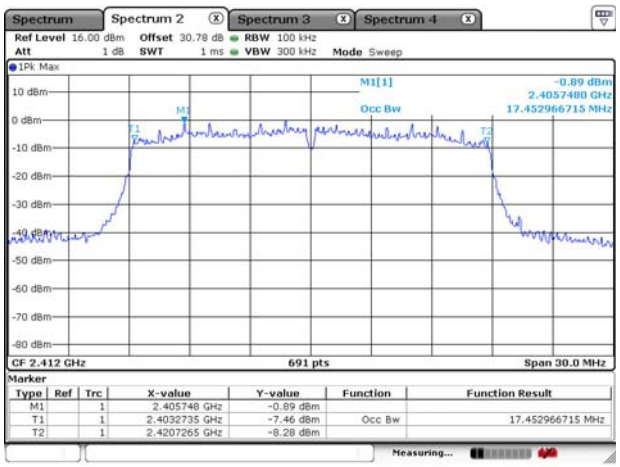
802.11b



802.11n(HT20)



802.11n(HT20)



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5.4 Band-edge Compliance of RF Conducted emissions

5.4.1 Standard Applicable [FCC §15.247(d)]

In any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on RF conducted.

5.4.2 Test Environment conditions

- Ambient temperature : 20 ℃
- Relative Humidity : (38 - 41) % R.H.

5.4.3 Measurement Procedure

① Pre-calibration for the spectrum analyzer has to be done first through a reference CW signal from CAL OUT(-10 ㏈m)
② Reference frequency generated from the signal generator is supply to spectrum analyzer input port via RF cable and attenuator, and then, it's apply to offset value on spectrum analyzer.
③ Remove the antenna from the EUT and then, connected to spectrum analyzer via a dc Block, suitable low loss RF cable and attenuator.
④ Place the EUT on the table and set on the emission at the band-edge,
⑤ After the trace being stable, Use the marker-to-peak function to move the marker to the peak of the in-band emission.
⑥ The marker-delta value now displayed must comply with the limit specified in above standard.
⑦ please refer to the detailed procedure method KDB 558074 v03r02.

The spectrum analyzer is set to the as follows :

- Span : Wide enough to capture the peak level of the emission operating on the channel closet to the Band-edge, as well as any modulation products which fall outside of the authorized band of operation
- RBW : 100 ㎑ (≥ 1 % of the span)
- VBW : ≥ RBW
- Sweep : auto
- Detector function : peak
- Trace : Max hold

5.4.4 Test setup

Please refer 5.3.4

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5.4.5 Measurement Result

802.11b

Setting Channel		Test Results		
		Measured value [dB]	Limit [dB]	Result
1	~ 2 400 MHz	41.87	≤ 20 than PSD level	Compliance
11	2 483.5 MHz ~	51.60		Compliance

802.11g

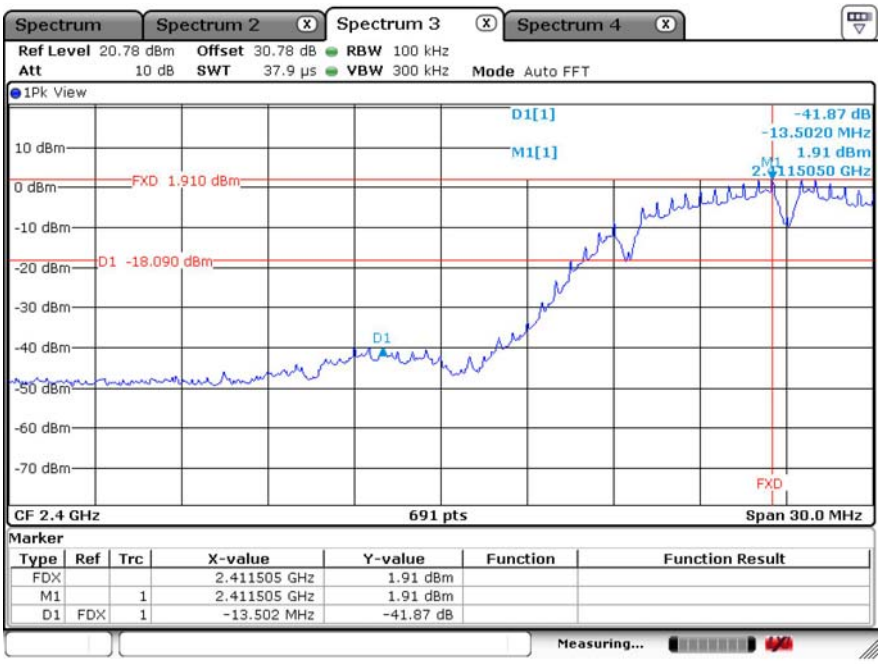
Setting Channel		Test Results		
		Measured value [dB]	Limit [dB]	Result
1	~ 2 400 MHz	39.15	≤20 than PSD level	Compliance
11	2 483.5 MHz ~	44.92		Compliance

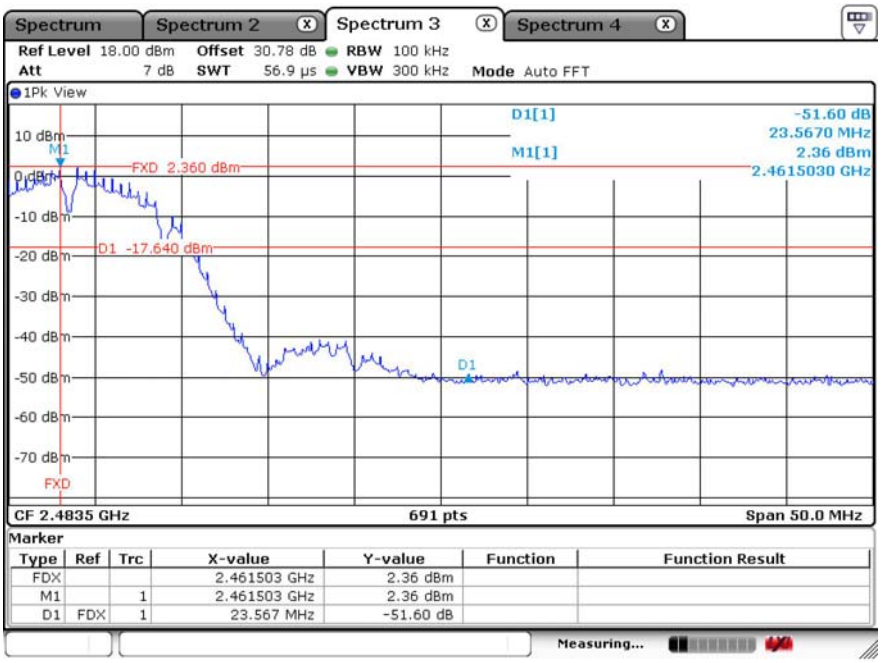
802.11n(HT20)

Setting Channel		Test Results		
		Measured value [dB]	Limit [dB]	Result
1	~ 2 400 MHz	38.56	≤ 20 than PSD level	Compliance
11	2 483.5 MHz ~	44.40		Compliance

5.4.6 Test Plot (Band-edge)

802.11b





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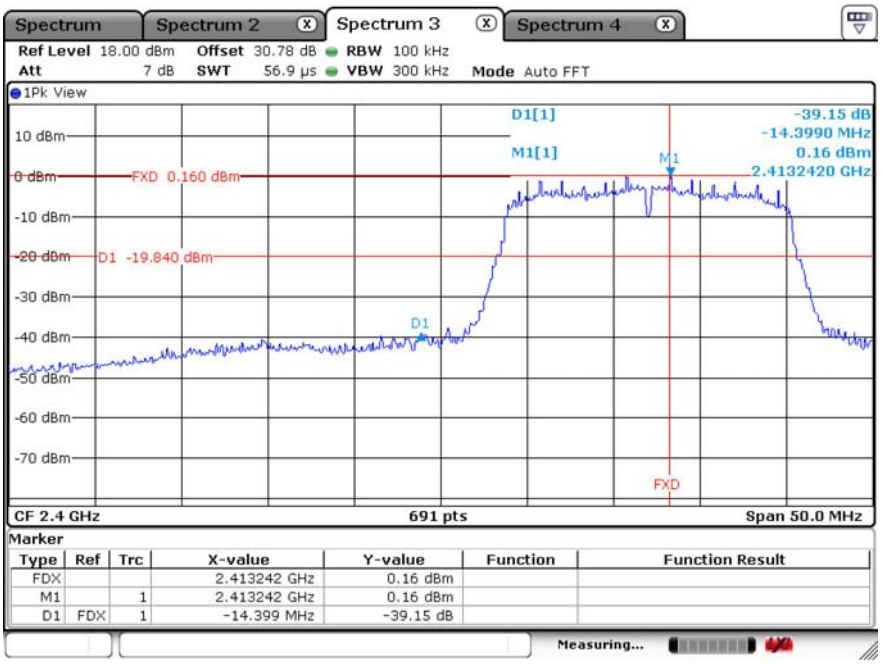
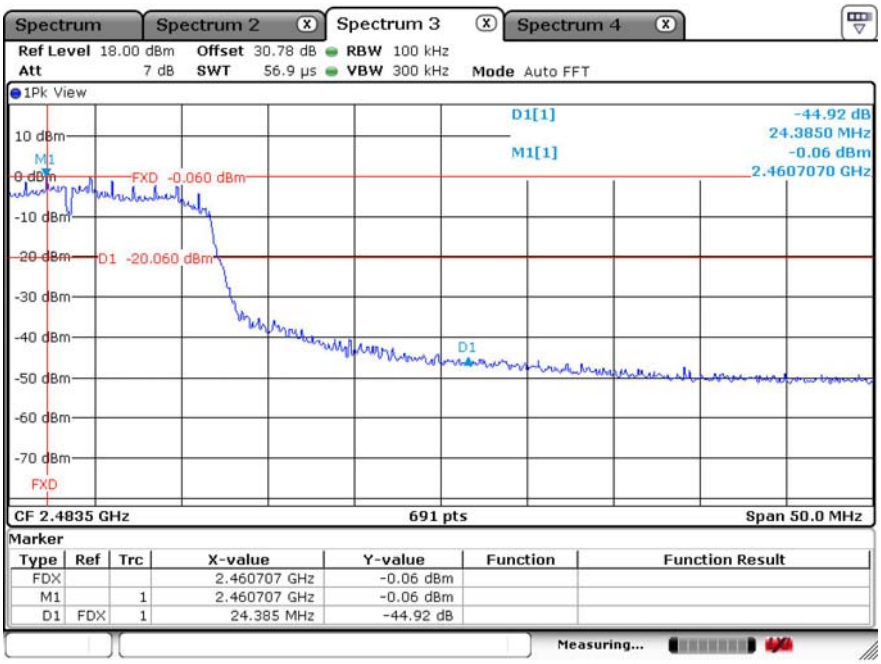
802.11g





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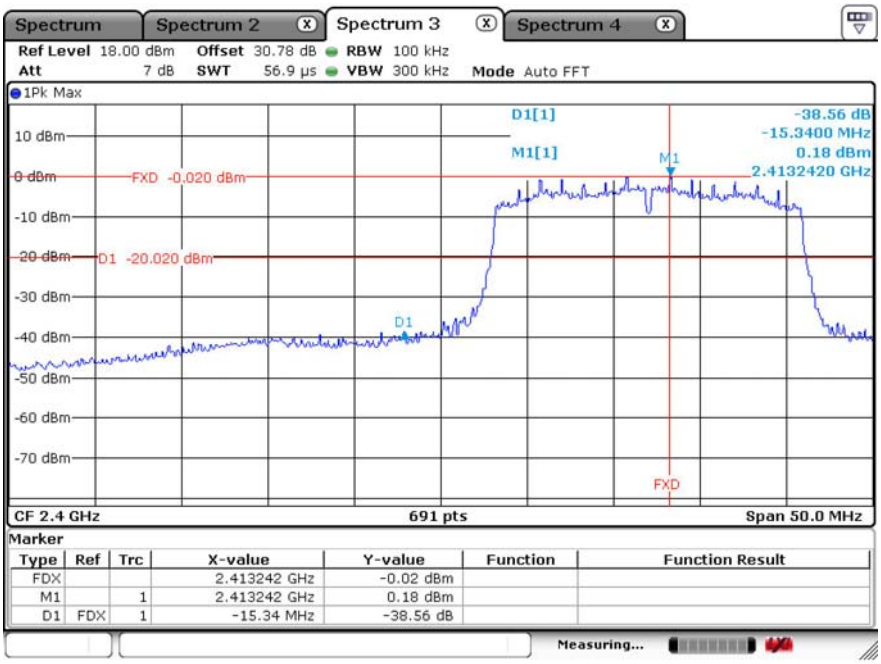

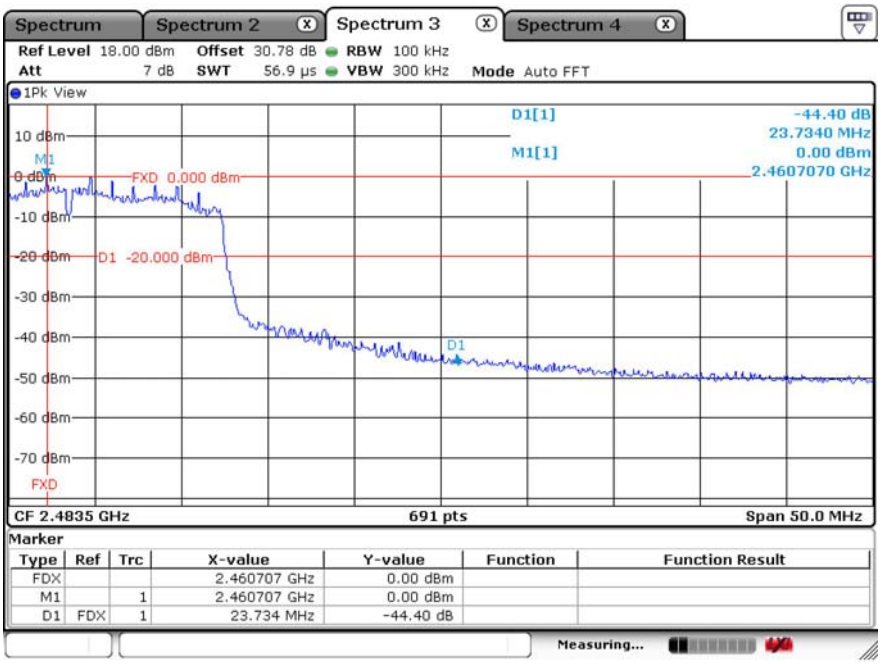

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5.5 Spurious RF Radiated emissions

5.5.1 Standard Applicable [FCC §15.247(d)]

All other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10 ㎓, the frequency Range of measurements : to the tenth harmonic of the highest fundamental frequency or to 40 ㎓, Whichever is lower. In addition, radiated emissions which fall in the restricted bands, as defined in Sec.15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a)

§15.209. [Table 1] limits for radiated emissions measurements (distance at 3 m)

Frequency Band [㎒]	DISTANCE[Meters]	Limit [㎶/m]	Limit [dB㎶/m]	Detector
0.009 ~ 0.490	300	2400/F(㎑)	67.6-20log(F)	Peak
0.490 ~ 1.705	30	24000/F(㎑)	87.6-20log(F)	Peak
1.705 ~ 30.0	30	30	29.54	Peak
30 - 88	3	100 **	40.00	Quasi peak
88 - 216	3	150 **	43.52	Quasi peak
216 - 960	3	200 **	46.02	Quasi peak
Above 960	3	500	54.00	Average
Above 1000	3	74.0 dB(μV)/m (Peak), 54.0 dB(μV)/m (Average)		
** fundamental emissions from intentional radiators operation 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 Section 15.231 and 15.241				

§15.205. [Table 2] Restrict Band of Operation

Only spurious emissions are permitted in any of the frequency bands listed below ;			
[㎒]	[㎒]	[㎒]	[㎓]
0.090 - 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.
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.
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 - 8.38 6 75	156.7 - 156.9	2 690 – 2 900	22.01 - 23.12
8.414 25 - 8.414 75	162.012 5 - 167.17	3 260 – 3 267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3 332 – 3 339	31.2 - 31.8
12.519 75 - 12.520 25	240 - 285	3 345.8 – 3 358	36.43 - 36.5
12.576 75 - 12.577 25	322 - 335.4	3 600 – 4 400	Above 38.6

** Until February 1, 1999, this restricted band shall be 0.490-0.510

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5.5.2 Test Environment conditions

- Ambient temperature : 20 ℃
- Relative Humidity : (38 - 41) % R.H.

5.5.3 Measurement Procedure

The measurements procedure of the transmitter radiated E-field is as following describe method.

The test is performed in a Shield chamber to determine the accurate frequencies, after maximum emissions level will be checked on a test chamber and measuring distance is 3 m from EUT to test antenna.
(The chamber is ensured that comply with at least 6 dB above the ambient noise level)

① The EUT was powered ON with continuously operating mode and placed on a 0.8 meter high non-conductive table on the reference ground plane.

② The test antenna was used on Horn antenna for above 1 GHz, and if the below 1 GHz, broad-band antenna and Loop antenna were used for below 30 MHz and it's antenna positioned in both the horizontal and vertical plane was location at EUT during the test for maximized the emission measurement.

③ The output of the test antenna will be connected to a measuring receiver, and it is set to tuned over the frequency range according to required standard

④ The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz for Peak measure; RBW is set at 1MHz, VBW is set at 10Hz for Average measure(according ANSI C63.10:2009 clause 4.2.3.2.3 procedure for average measure). Both PK and AV level test, PK detector is used.

⑤ The fundamental frequency at which a relevant radiated signal component is detected, the test antenna will be raised and lowered through the specified range of heights in horizontal and vertical polarized orientation, until an maximum signal level is detected on the measuring receiver.

⑥ The transmitter is position x, y, z axis on rotating through 360 degrees, until the maximum signal level is detected by the measuring receiver.

⑦ The receiver is scanned from requested measuring frequency band and then the maximum meter reading is recorded. The radiated emissions were measured with required standard.

- The measurement results are obtained as described below:
  Result(dBμV/m) = Reading(dBμV) + Antenna factor(dB/m)+ CL(dB) + other applicable factor (dB)
- According to §15.33 (a)(1), Frequency range of radiated measurement is performed the tenth harmonic.

5.5.4 Measurement Uncertainty

All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are test receiver, Cable loss, Antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, Antenna frequency interpolation, measurement distance variation, Site imperfection, mismatch, and system repeatability based on NIS 80,81, The measurement uncertainty level with a 95 % confidence level were apply to Uncertainty of a radiation emissions measurement at Chamber of KOSTEC is ± 6.0 dB

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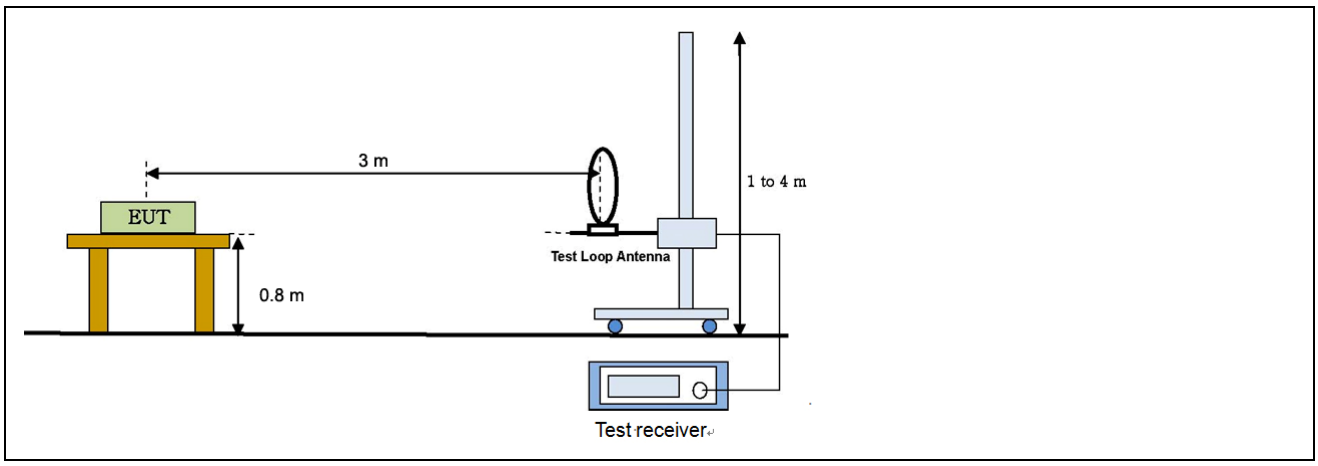
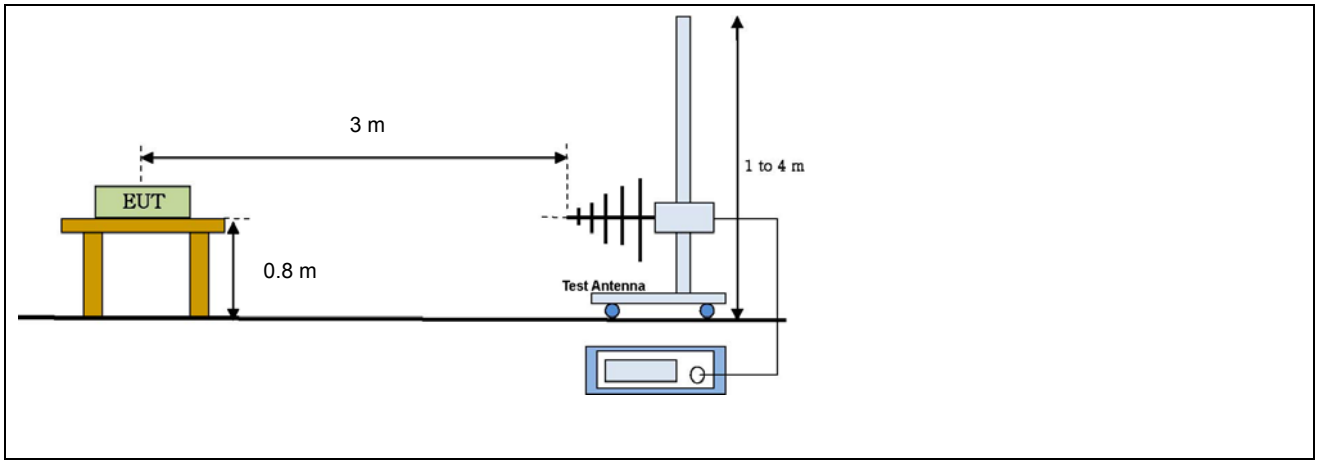
5.5.5 Test Configuration

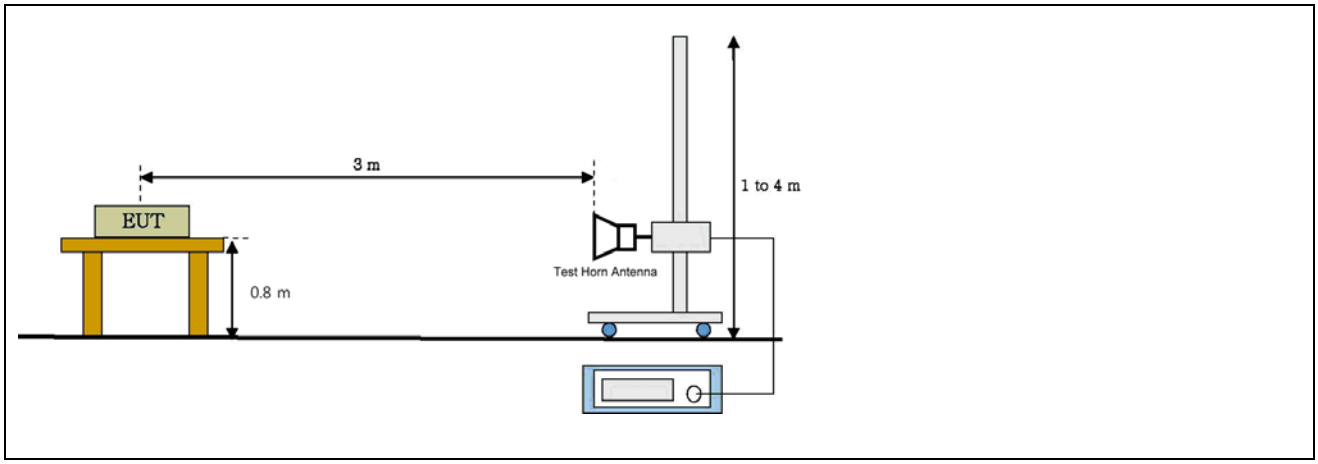
Radiated emission setup, Below 30 MHz



Radiated emission setup, Below 1 000 MHz



Radiated emission setup, Above 1 GHz



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5.5.6 Measurement Result

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

Following channel(s) was (were) selected for the final test as listed below.

Band	Mode	Tested channel	Modulation	Data rate	Tested frequency band
2.4 ㎓	802.11b	1,6,11	DSSS	1 Mbps	Above 1 ㎓
	802.11g	1,6,11	OFDM	6 Mbps	
	802.11n(HT20)	1,6,11	OFDM	MCS0	
2.4 ㎓	802.11b	1	DSSS	1 Mbps	Below 1 ㎓

Above 1 ㎓

802.11b CH 1(2 412 ㎒)

Freq. (㎓)	Reading (dB㎶/m)		Table (Deg)	Antenna			CL + AMP (dB)	Meas Result (dB㎶/m)		Limit (dB㎶/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)		PK	AV	PK	AV	PK	AV	
1.589	52.24	37.15	120	1.0	H	26.04	-33.07	45.21	30.12	74	54	28.79	23.88	Compliance
1.992	55.36	35.83	110	1.0	V	27.40	-32.37	50.38	30.85	74	54	23.62	23.15	Compliance

802.11b CH 6(2 437 ㎒)

Freq. (㎓)	Reading (dB㎶/m)		Table (Deg)	Antenna			CL + AMP (dB)	Meas Result (dB㎶/m)		Limit (dB㎶/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)		PK	AV	PK	AV	PK	AV	
1.992	56.23	36.85	120	1.0	V	27.40	-32.37	51.26	31.88	74	54	22.74	22.12	Compliance
2.384	49.23	33.85	120	1.0	V	28.61	-31.92	45.92	30.54	74	54	28.08	23.46	Compliance

802.11b CH 11(2 462 ㎒)

Freq. (㎓)	Reading (dB㎶/m)		Table (Deg)	Antenna			CL + AMP (dB)	Meas Result (dB㎶/m)		Limit (dB㎶/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)		PK	AV	PK	AV	PK	AV	
1.589	51.23	36.58	110	1.0	V	26.04	-33.07	44.20	29.55	74	54	29.8	24.45	Compliance
2.773	46.85	30.06	110	1.0	V	29.55	-31.90	44.50	27.71	74	54	29.5	26.29	Compliance
3.576	46.5	30.18	120	1.0	V	31.38	-31.40	46.48	30.16	74	54	27.52	23.84	Compliance

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802.11g CH 1(2 412 ㎒)

Freq. (㎓)	Reading (dB㎶/m)		Table (Deg)	Antenna			CL + AMP (dB)	Meas Result (dB㎶/m)		Limit (dB㎶/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)		PK	AV	PK	AV	PK	AV	
1.589	49.83	36.52	110	1.0	V	26.04	-33.07	42.80	29.49	74	54	31.2	24.51	Compliance
1.992	53.21	32.84	110	1.0	V	27.40	-32.37	48.24	27.87	74	54	25.76	26.13	Compliance

802.11g CH 6(2 437 ㎒)

Freq. (㎓)	Reading (dB㎶/m)		Table (Deg)	Antenna			CL + AMP (dB)	Meas Result (dB㎶/m)		Limit (dB㎶/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)		PK	AV	PK	AV	PK	AV	
1.993	52.32	34.21	120	1.0	V	27.40	-32.37	47.35	29.24	74	54	26.65	24.76	Compliance
2.385	46.25	30.52	110	1.0	V	28.61	-31.92	42.94	27.21	74	54	31.06	26.79	Compliance
2.772	44.21	28.97	130	1.0	V	29.55	-31.90	41.86	26.62	74	54	32.14	27.38	Compliance

802.11g CH 11(2 462 ㎒)

Freq. (㎓)	Reading (dB㎶/m)		Table (Deg)	Antenna			CL + AMP (dB)	Meas Result (dB㎶/m)		Limit (dB㎶/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)		PK	AV	PK	AV	PK	AV	
1.589	48.43	34.23	130	1.0	V	26.04	-33.07	41.40	27.20	74	54	32.6	26.8	Compliance
2.773	42.12	28.63	120	1.0	V	29.55	-31.90	39.77	26.28	74	54	34.23	27.72	Compliance
3.576	43.21	31.74	120	1.0	V	31.38	-31.40	43.19	31.72	74	54	30.81	22.28	Compliance

802.11n(HT20) CH 1(2 412 ㎒)

Freq. (㎓)	Reading (dB㎶/m)		Table (Deg)	Antenna			CL + AMP (dB)	Meas Result (dB㎶/m)		Limit (dB㎶/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)		PK	AV	PK	AV	PK	AV	
1.589	48.86	35.46	110	1.0	V	26.04	-33.07	41.83	28.43	74	54	32.17	25.57	Compliance
1.992	50.21	30.89	120	1.0	V	27.40	-32.37	45.24	25.92	74	54	28.76	28.08	Compliance

802.11n(HT20) CH 6(2 437 ㎒)

Freq. (㎓)	Reading (dB㎶/m)		Table (Deg)	Antenna			CL + AMP (dB)	Meas Result (dB㎶/m)		Limit (dB㎶/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)		PK	AV	PK	AV	PK	AV	
1.993	51.22	32.86	120	1.0	V	27.40	-32.37	46.25	27.89	74	54	27.75	26.11	Compliance
2.385	45.33	29.75	120	1.0	V	28.61	-31.92	42.02	26.44	74	54	31.98	27.56	Compliance
2.772	44.02	29.13	120	1.0	V	29.55	-31.90	41.67	26.78	74	54	32.33	27.22	Compliance

802.11n(HT20) CH 11(2 462 ㎒)

Freq. (㎓)	Reading (dB㎶/m)		Table (Deg)	Antenna			CL + AMP (dB)	Meas Result (dB㎶/m)		Limit (dB㎶/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)		PK	AV	PK	AV	PK	AV	
1.589	47.74	32.85	110	1.0	V	26.04	-33.07	40.71	25.82	74	54	33.29	28.18	Compliance
2.773	42.36	29.12	110	1.0	V	29.55	-31.90	40.01	26.77	74	54	33.99	27.23	Compliance

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Below 1 ㎓

For 2.4 ㎓

802.11b CH 1(2 412 ㎒)

Freq. (㎒)	Reading (dB㎶/m)	Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB㎶/m)	Limit (dB㎶/m)	Mgn (dB)	Result
			Height (m)	Pol. (H/V)	Fctr. (dB/m)						
104.74	69.06	140	1	V	9.98	2.09	-41.43	39.70	43.52	3.82	Compliance
158.50	68.83	130	1	V	8.47	2.62	-41.12	38.80	43.52	4.72	Compliance
199.99	72.15	120	1	V	7.94	2.98	-41.07	42.00	43.52	1.52	Compliance
219.02	67.51	110	3.8	H	8.81	3.13	-41.16	38.29	46.02	7.73	Compliance
250.00	68.69	130	3.4	H	10.24	3.37	-41.3	41.00	46.02	5.02	Compliance
274.97	62.85	120	1	V	10.98	3.55	-41.28	36.10	46.02	9.92	Compliance
312.20	62.00	130	1	V	12.07	3.81	-41.29	36.59	46.02	9.43	Compliance
574.02	56.59	120	1.8	H	17.35	5.37	-39.12	40.19	46.02	5.83	Compliance
641.72	54.18	120	3.2	V	18.29	5.72	-38.89	39.30	46.02	6.72	Compliance

※Note

- Above 1 ㎓ is measured average and peak detector mode on Spectrum analyzer in accordance with FCC Rule15.35
- Limit: 54 dB㎶/m(Average), 74 dB㎶/m(Peak), Attenuated more than 20 dB below the permissible value.
- It is not recorded on the report that the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to measured.
- For the below 30 ㎒, measured any other signal is not detected on test receiver
- The transmitter radiated spectrum was investigated from 9 ㎑ to 25 ㎓.

Freq.(㎒) : Measurement frequency, Reading(dB㎶/m) : Indicated value for test receiver,
Table (Deg) : Directional degree of Turn table,
Antenna (Height, Pol, Fctr) : Antenna Height, Polarization and Factor
Cbl(dB) : Cable loss, Pre AMP(dB) : Preamplifier gain(dB)
Meas Result (dB㎶/m) :Reading(dB㎶/m)+ Antenna factor.(dB/m)+ CL(dB) - Pre AMP(dB)
Limit(dB㎶/m): Limit value specified with FCC Rule, Mgn(dB) : FCC Limit (dB㎶/m) – Meas Result(dB㎶/m)

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5.6 Antenna requirement

5.6.1 Standard applicable [FCC §15.203, §15.247(4)(1)]

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by responsible party shall be used with the device.

The use of a permanently attached antenna or of an antenna that user 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 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(4)(1), 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.

5.6.2 Antenna gain

Frequency Band	Gain [dBi]	Limit [dBi]	Results
2.4 GHz	-3.2 dBi	≤ 6	Compliance

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5.7 AC Power Conducted emissions

5.7.1 Standard Applicable [FCC §15.207(a)]

For 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 frequencies hopping mode within the band 150 ㎑ to 30 ㎒ shall not exceed the limits in the following table, as measured using a 50 uH/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.

§15.207 limits for AC line conducted emissions;

Frequency of Emission(㎒)	Conducted Limit (㏈㎶)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

5.7.2 Test Environment conditions

- Ambient temperature : 20 ℃
- Relative Humidity : (38 - 41) % R.H.

5.7.3 Measurement Procedure

EUT was placed on a non- metallic table height of 0.8 m above the reference ground plane. Cables connected to EUT were fixed to cause maximum emission. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the Maximum signal strength.

5.7.4 Used equipment

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Cal interval	Used
Test receiver	ESCS30	100111	Rohde & Schwarz	2015.02.05	1 year	●
LISN	ESH2-Z5	100044	R&S	2015.02.05	1 year	●
	ESH3-Z5	100147	R&S	2015.02.05	1 year	●

*Test Program: " ESXS-K1 V2.2"
Measurement uncertainty
Conducted Emission measurement: 3.5 ㏈ (CL: Approx 95%, *k*=2)

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5.7.5 Measurement Result

Line. Live

Kostec Co., Ltd. 01 Dec 2014 18:04

Conducted Emission

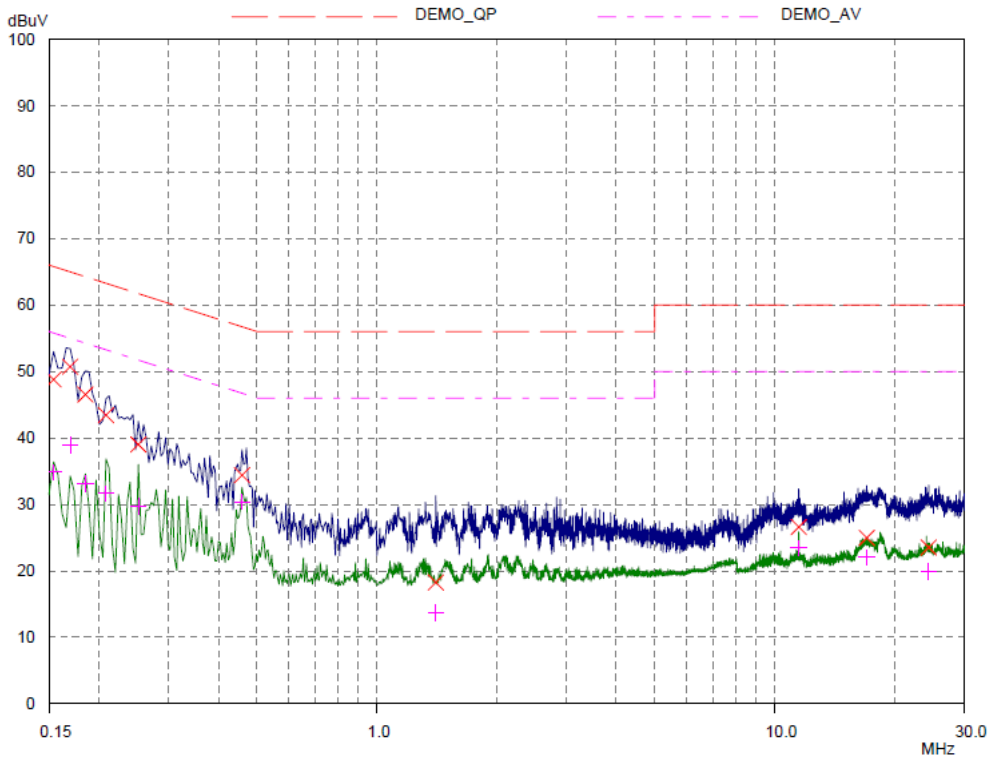
EUT:	P3500
Manuf:	Bluebird Inc.
Op Cond:	a.c. 120 V, 60 Hz
Operator:	M.Y.Lee
Test Spec:	FCC
Comment:	Live
Result File:	m0405_l.dat : New Measurement

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	10msec	15 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	12	9kHz	30MHz	CNEFactor

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Subranges:	25
	Acc Margin:	50 dB



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Line. Live

Kostec Co., Ltd. 01 Dec 2014 18:04

Conducted Emission

EUT: P3500
Manuf: Bluebird Inc.
Op Cond: a.c. 120 V, 60 Hz
Operator: M.Y.Lee
Test Spec: FCC
Comment: Live

Result File: m0405_l.dat : New Measurement

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	10msec	15 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	12	9kHz	30MHz	CNEFactor

Final Measurement: Detectors: X QP / + AV
Meas Time: 1sec
Subranges: 25
Acc Margin: 50 dB

Final Measurement Results

Frequency MHz	QP Level dBuV	QP Limit dBuV	QP Delta dB
0.1539	48.81	65.79	16.98
0.16953	50.73	64.98	14.25
0.18515	46.53	64.25	17.72
0.20859	43.44	63.26	19.82
0.25156	39.00	61.71	22.71
0.45859	34.40	56.72	22.32
1.40781	18.26	56.00	37.74
11.50937	26.59	60.00	33.41
17.05625	24.96	60.00	35.04
24.43125	23.52	60.00	36.48

Frequency MHz	AV Level dBuV	AV Limit dBuV	AV Delta dB
0.1539	34.84	55.79	20.95
0.16953	38.87	54.98	16.11
0.18515	33.10	54.25	21.15
0.20859	31.64	53.26	21.62
0.25156	29.71	51.71	22.00
0.45859	30.40	46.72	16.32
1.40781	13.72	46.00	32.28
11.50937	23.45	50.00	26.55
17.05625	22.04	50.00	27.96
24.43125	19.95	50.00	30.05

* limit exceeded

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Line. Live

Kostec Co., Ltd. 01 Dec 2014 18:20

Conducted Emission

EUT:	P3500
Manuf:	Bluebird Inc.
Op Cond:	a.c. 120 V, 60 Hz
Operator:	M.Y.Lee
Test Spec:	FCC
Comment:	Neutral

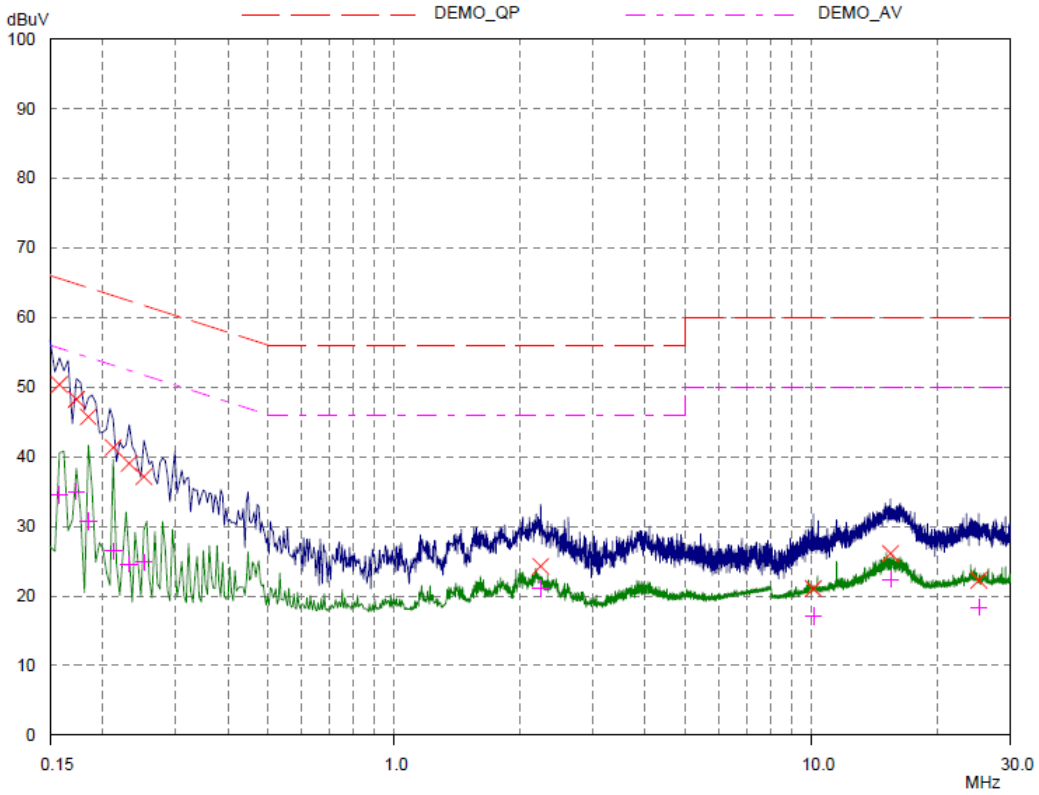
Result File: 0201_n.dat : New Measurement

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	10msec	15 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	12	9kHz	30MHz	CNEFactor

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Subranges:	25
	Acc Margin:	50 dB



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Line. Neutral

Kostec Co., Ltd. 01 Dec 2014 18:20

Conducted Emission

EUT: P3500
Manuf: Bluebird Inc.
Op Cond: a.c. 120 V, 60 Hz
Operator: M.Y.Lee
Test Spec: FCC
Comment: Neutral

Result File: 0201_n.dat : New Measurement

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	10msec	15 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	12	9kHz	30MHz	CNEFactor

Final Measurement: Detectors: X QP / + AV
Meas Time: 1sec
Subranges: 25
Acc Margin: 50 dB

Final Measurement Results

Frequency MHz	QP Level dBuV	QP Limit dBuV	QP Delta dB
0.15781	50.35	65.58	15.23
0.17343	48.24	64.79	16.55
0.18515	45.70	64.25	18.55
0.2125	41.28	63.11	21.83
0.23203	39.03	62.38	23.35
0.25156	37.12	61.71	24.59
2.24765	24.24	56.00	31.76
10.12265	21.05	60.00	38.95
15.49765	26.08	60.00	33.92
25.22421	22.25	60.00	37.75

Frequency MHz	AV Level dBuV	AV Limit dBuV	AV Delta dB
0.15781	34.48	55.58	21.10
0.17343	35.00	54.79	19.79
0.18515	30.70	54.25	23.55
0.2125	26.43	53.11	26.68
0.23203	24.58	52.38	27.80
0.25156	24.83	51.71	26.88
2.24765	21.06	46.00	24.94
10.12265	17.15	50.00	32.85
15.49765	22.37	50.00	27.63
25.22421	18.38	50.00	31.62

* limit exceeded

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