

 ESTECH Co., Ltd. Rm 1015, World Venture Center II, 426-5 Gasan-dong, Guncheon-gu, Seoul, 158-803, Korea	   	Electromagnetic Interference Test Report
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Test Report for FCC

FCC ID : SS4MT3XX

Report Number		ESTF151303-007		
Applicant	Company name	Bluebird Soft Inc.		
	Address	SEI Tower 13,14, 467-14, Dogok-dong Gangnam-gu, Seoul, South Korea.		
	Telephone	82-70-7730-8239		
Product	Product name	PDA		
	Model No.	MT3XX	Manufacturer	Bluebird Soft Inc.
	Serial No.	NONE	Country of origin	KOREA
Test date	2013-03-18 ~ 2013-03-24		Date of issue	25-Mar-13
Testing location	ESTECH Co., Ltd. 97-1 Hoiuk-Ri Majang-Myon, Icheon-Si, KyungKi-Do, Korea			
Standard	FCC PART 15 (2010) , ANSI C 63.4 2003			
Result		Complied		
Measurement facility registration number		915135		
Tested by	Engineer H.K.Lee		(Signature)	
Reviewed by	Engineering Manager J.M.Yang		(Signature)	
Abbreviation	OK, Pass = Complied, Fail = Failed, N/A = not applicable			
* Note - This test report is not permitted to copy partly without our permission - This test result is dependent on only equipment to be used - This test result based on a single evaluation of one sample of the above mentioned				

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1. Laboratory Information

1.1 General

This EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards and is tested in accordance with the measurement procedures as indicated in this report. ESTECH Lab attests to accuracy of test data. All measurement reported herein were performed by ESTECH Co., Ltd.

ESTECH Lab assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

1.2 Test Lab.

Corporation Name : ESTECH Co., Ltd.

Head Office : Rm 1015, World Venture Center II, 426-5, Gasan-dong, Geumcheon-gu, Seoul, Korea

EMC Test Lab : 97-1 Hoiuk-Ri Majang-Myon, Icheon-city, KyungKi-Do, Korea

1.3 Official Qualification(s)

KCC : Granted Accreditation from Ministry of Information & Communication for EMC, Safety and Telecommunication

KOLAS : Accredited Lab By Korea Laboratory Accreditation Schema base on CENELEC

FCC : Filed Laboratory at Federal Communications Commission

VCCI : Granted Accreditation from Voluntary Control Council for Interference from ITE

2. Description of EUT

2.1 Summary of Equipment Under Test

Product : PDA
 Model Number : MT3XX
 Serial Number : NONE
 Manufacturer : Bluebird Soft Inc.
 Country of origin : KOREA
 Operating Frequency : 13.56 MHz
 Antenna Type : PCB Pattern Antenna
 Modulation Type : ASK
 Channel Spacing : 1
 Power Rating : DC 7.4 V Battery,
 AC-DC Adaptor : Input : AC100 V~240 V 50 Hz~60 Hz, Output : 9 V, 3.0 A
 Receipt Date : 14-Mar-13
 X-tal list(s) or Frequencies generated : The highest operating frequency is 48 MHz in the USB Clock.

2.2 General descriptions of EUT

The PN512 transceiver ICs support 4 different operating modes

- Reader/Writer mode supporting ISO/IEC 14443A/MIFARE and FeliCa scheme
- Reader/Writer mode supporting ISO/IEC 14443B
- Card Operation mode supporting ISO/IEC 14443A/MIFARE and FeliCa scheme
- NFCIP-1 mode

Enabled in Reader/Writer mode for ISO/IEC 14443A/MIFARE, the PN512's internal transmitter part is able to drive a reader/writer antenna designed to communicate with ISO/IEC 14443A/ MIFARE cards and transponders without additional active circuitry. The receiver part provides a robust and efficient implementation of a demodulation and decoding circuitry for signals from ISO/IEC 14443A/MIFARE compatible cards and transponders. The digital part handles the complete ISO/IEC 14443A framing and error detection (Parity & CRC).

The PN512 supports MIFARE 1K or MIFARE 4K emulation products. The PN512 supports contactless communication using MIFARE higher transfer speeds up to 424 kbit/s in both directions.

Enabled in Reader/Writer mode for FeliCa, the PN512 transceiver IC supports the FeliCa communication scheme. The receiver part provides a robust and efficient implementation of the demodulation and decoding circuitry for FeliCa coded signals. The digital part handles the FeliCa framing and error detection like CRC. The PN512 supports contactless communication using FeliCa Higher transfer speeds up to 424 kbit/s in both directions.

The PN512 supports all layers of the ISO/IEC 14443B reader/writer communication scheme, given correct implementation of additional components, like oscillator, power supply, coil etc. and provided that standardized protocols, e.g. like ISO/IEC 14443-4 and/or ISO/IEC 14443B anticollision are correctly implemented.

In Card Operation mode, the PN512 transceiver IC is able to answer to a reader/writer command either according to the FeliCa or ISO/IEC 14443A/MIFARE card interface scheme. The PN512 generates the digital load modulated signals and in addition with an external circuit the answer can be sent back to the reader/writer. A complete card functionality is only possible in combination with a secure IC using the S2C interface.

Additionally, the PN512 transceiver IC offers the possibility to communicate directly to an NFCIP-1 device in the NFCIP-1 mode. The NFCIP-1 mode offers different communication mode and transfer speeds up to 424 kbit/s according to the Ecma 340 and ISO/IEC 18092 NFCIP-1 Standard. The digital part handles the complete NFCIP-1 framing and error detection.

Various host controller interfaces are implemented:

- 8-bit parallel interface1
- SPI interface
- serial UART (similar to RS232 with voltage levels according pad voltage supply)
- I2C interface.

A purchaser of this NXP IC has to take care for appropriate third party patent licenses.

3. Test Standards

Test Standard : FCC PART 15 (2010)

This Standard sets out the regulations under which an intentional, unintentional, or incidental radiator may be operated without an individual license. It also contains the technical specifications, administrative requirements and other conditions relating to the marketing of Part 15 devices.

Test Method : ANSI C 63.4 (2003)

This standard sets forth uniform methods of measurement of radio-frequency (RF) signals and noise emitted from both unintentional and intentional emitters of RF energy in the frequency range 9 kHz to 40 GHz. Methods for the measurement of radiated and AC power-line conducted radio noise are covered and may be applied to any such equipment unless otherwise specified by individual equipment requirements. These methods cover measurement of certain devices that deliberately radiate energy, such as intentional emitters, but does not cover licensed transmitters. This standard is not intended for certification/approval of avionic equipment or for industrial, scientific, and medical (ISM) equipment. These methods apply to the measurement of individual units or systems comprised of multiple units.

Summary of Test Results

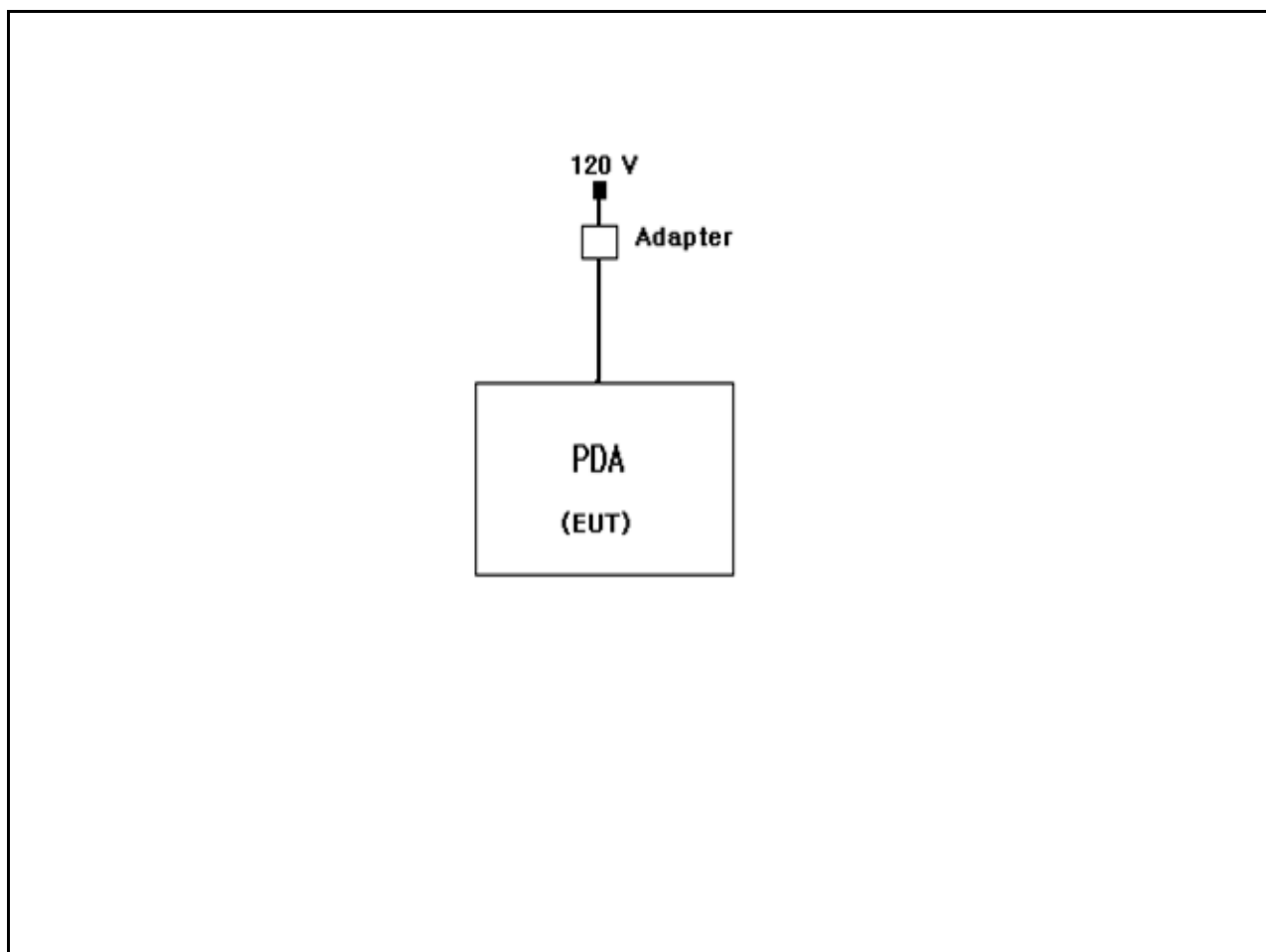
Applied Standard : 47 CFR Part 15, Subpart C				
Standard	Test Type	Result	Remark	Limit
15.207	AC Power Conducted Emission	Pass	Meet the requirement	
15.225(a)	Radiated Emission (13.553 ~13.567) MHz	Pass	Meet the requirement	15,848 uV/m at 30 m
15.225(b)	Radiated Emission (13.410 ~13.553 , 13.567 ~ 13.710) MHz	Pass	Meet the requirement	334 uV/m at 30 m
15.225(c)	Radiated Emission (13.110 ~13.410 , 13.710 ~ 14.010) MHz	Pass	Meet the requirement	106 uV/m at 30 m
15.225(d)	Apply section 15.209 (out side band of the 13.110 ~14.010) MHz	Pass	Meet the requirement	
15.225(e)	Frequency stability	Pass	Meet the requirement	
15.215(c)	20dB Bandwidth	Pass	Meet the requirement	

4. Measurement Condition

4.1 EUT Operation.

- The EUT was in the following operation mode during all testing
 1. Execute a RF test program to enable EUT under transmission condition continuously.

4.2 Configuration and Peripherals



4.3 EUT and Support equipment

Equipment Name	Model Name	S/N	Manufacturer	Remark (FCC ID)
PDA	MT3XX	NONE	Bluebird Soft Inc.	
Adapter	PSAC30U-090	NONE	Phihong Electronics Co., Ltd.	

4.4 Cable Connecting

Start Equipment		End Equipment		Cable Standard		Remark
Name	I/O port	Name	I/O port	Length	Shielded	
PDA	POWER	Adapter	—	1.5	Unshielded	

5. 20 dB Bandwidth

5.1 Procedure

The measurement was performed in the antenna height to gain the maximum of Electric field strength

5.2 20dB Bandwidth setup

The spectrum analyzer is set to as following

RBW: 30 Hz

VBW: 300 Hz

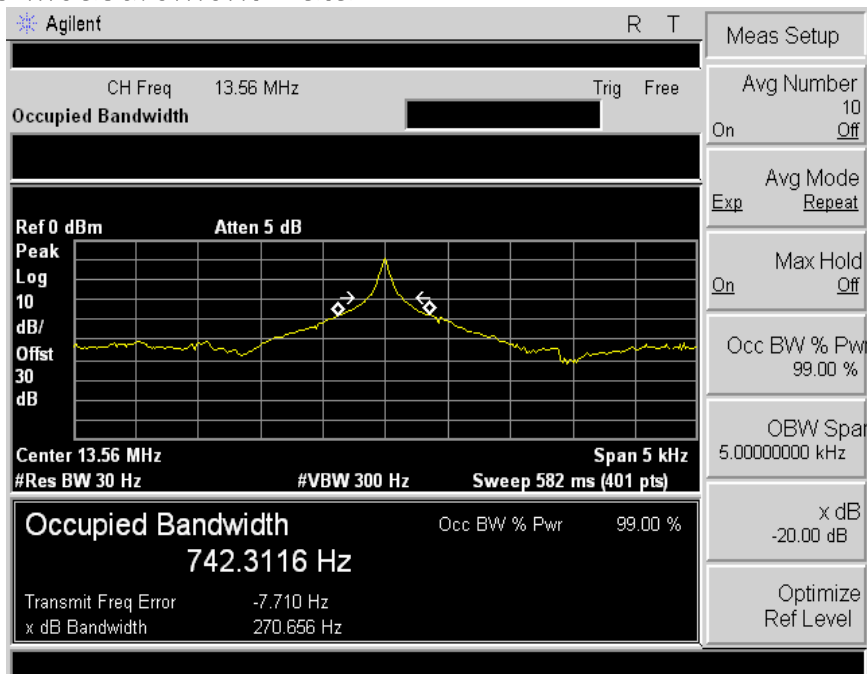
Span: 5 kHz

Sweep: suitable duration based on the EUT specification

20dB Bandwidth Test Instruments

Decription	Model	Serial Number	Cal. Due Data
Spectrum Analyzer	E4407B	US40241281	27-Jan-14

5.3 Measurement Data



6. Frequency Tolerance

6.1 Procedure

The frequency stability of the transmitter is measured by:

- a) Temperature: The temperature is varied from $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$ using an environmental chamber.
- b) Primary Supply Voltage: The primary supply voltage is varied from 85 % to 115 % of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

The frequency tolerance of the carrier shall be maintained within $\pm 0.01\text{ }%$ of the operating frequency.

6.2 Equipment lists

The following test equipments are used during test

Decription	Model	Serial Number	Cal. Due Data
Spectrum Analyzer	E4407B	US40241281	27-Jan-14
DC Power Supply	AK-5007	00230804	31-Jan-14
Temp./Humidity Chamber	TEMP-HUMI-S-1500	112192724	20-Jun-13

6.3 Measurement Data

Operating Frequency :	13,560,000 Hz
Reference Voltage :	7.40 Vd.c.
Deviation Limit :	± 0.01 %

Voltage (%)	Power (Vdc)	Temperature (℃)	Frequency (Hz)	Deviation (%)
100	7.40	+20 ℃ (Ref)	13,561,107	0.008163
100		-20	13,560,960	0.007080
100		-10	13,561,038	0.007655
100		0	13,561,080	0.007965
100		10	13,561,072	0.007906
100		20	13,561,109	0.008178
100		30	13,561,134	0.008363
100		40	13,561,068	0.007876
100		50	13,561,051	0.007751
85	6.29	20	13,561,114	0.008215
115	8.51	20	13,561,123	0.008282
BATT.ENDPOINT	6.20	20	13,561,098	0.008097

7. Measurement of radiated disturbance

The EUT was placed on the top of a rotating table 0.8 m above the ground at a 10 m semi-anechoic chamber. The table was rotated 360° to determine the position of the highest radiation. Then antenna is a loop antenna is fixed at 1 m above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0° to 360° to find the maximum reading. The test receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

7.1 Radiated emission limits, general requirements

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 (MHz)	Field strength @30 m (uV/m)	Field strength @30 m (dBuV/m)	Field strength @3m (dBuV/m)
Below 13.110	30	29.5	69.5
13.110 ~13.410	106	40.5	80.5
13.410~13.553	334	50.5	90.5
13.553~13.567	15,848	84	124
13.567~13.710	334	50.5	90.5
13.710~14.010	106	40.5	80.5
Above 14.010	30	29.5	69.5

* dBuV/m=20*log(uV/m) * Distance factor=40dB / decade(15.31(f))

7.2 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESCI7	ROHDE & SCHWARZ	1166.5950.07	25-Jan-14
Logbicon Antenna	VULB 9168	SCHWARZBECK	9168-193	22-May-13
Turn Table	DT3000-2t	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
Antenna Master & Turn table controller	CO2000-P	Innco System GmbH	CO2000/641 /28051111/L	-
Loop Antenna	HFH2-Z2	ROHDE & SCHWARZ	100188	27-Jul-13

7.3 Environmental Condition

Test Place : 10 m Semi-anechoic chamber

Below 1 GHz

Temperature (°C) : 23.1 °C

Humidity (% R.H.) : 52.5 % R.H.

Test Place : 3 m Semi-anechoic chamber(3 m)

Above 1 GHz

Temperature (°C)

Humidity (% R.H.)

* This test does not require because the highest operating frequency of the EUT is less than 108 MHz.

7.4 Test data(9 kHz ~ 30 MHz)

Test Date : 23-Mar-13

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Vertical Position [Angle]	EUT Position	Height (m)	Correction Factor		Result Value(Quasi-Peak)		
					Ant Factor (dB)	Cable (dB)	Limit (dB μ V/m)	Result (dB μ V/m)	Margin (dB)
Below 13.110 MHz									
Noise Floor	–	–	–	–	18.70	0.5	69.5	–	–
13.110 MHz to 13.410 MHz									
Noise Floor	–	–	–	–	18.70	0.5	80.5	–	–
13.410 MHz to 13.553 MHz									
Noise Floor	–	–	–	–	18.70	0.5	90.5	–	–
13.553 MHz to 13.567 MHz									
13.560	52.73	0 °	Z	1.0	18.70	0.5	124.0	71.93	52.07
13.567 MHz to 13.710 MHz									
Noise Floor	–	–	–	–	18.70	0.5	90.5	–	–
13.710 MHz to 14.010 MHz									
Noise Floor	–	–	–	–	18.70	0.5	80.5	–	–
14.010 MHz to 30 MHz									
27.12	19.50	85 °	Z	1.0	18.80	0.8	69.5	39.10	30.40
Remark	*The 30 m limit was converted to 3 m Limit using square factor(x) as it was found by measurements as follows: *3 m Limit(dBuV/m) = 20log(X)+40log(30/3)= 20log(15848)+40log(30/3) = 124 dBuV *3 m Limit(dBuV/m) = 20log(X)+40log(30/3)= 20log(30)+40log(30/3) = 69.5 dBuV * The EUT was measured for the worst case by rotating of antenna angle. * The EUT performed at X,Y,Z and recorded the worst data in the report.								

7.5 Test data(30 MHz ~ 1 000 MHz)

Test Date : 23-Mar-13

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Position (V/H)	Height (m)	Correction Factor		Result Value(Quasi-peak)		
				Ant Factor (dB)	Cable (dB)	Limit (dB μ V/m)	Result (dB μ V/m)	Margin (dB)
40.74	20.03	V	1.0	12.22	1.00	40.00	33.25	6.75
67.80	23.06	V	1.0	11.24	1.20	40.00	35.50	4.50
192.00	22.23	V	1.2	9.87	2.10	43.50	34.20	9.30
264.00	17.92	V	1.9	11.74	2.44	46.00	32.10	13.90
366.30	15.58	H	1.0	14.63	2.95	46.00	33.16	12.84
480.30	15.21	H	1.0	17.29	3.40	46.00	35.90	10.10
Remark	H : Horizontal, V : Vertical *Result Value = Reading + Antenna + Cable loss *Correction Factor = Ant Factor + Cable *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection							

7.6 Test data (Above 1 GHz)–N/A

Test Date :

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB μ V/m)	Result (dB μ V/m)	Margin (dB)
Peak(RBW:1 MHz VBW:1 MHz)								
Average(RBW:1 MHz VBW:10 Hz)								
Remark	H : Horizontal, V : Vertical *Reading = receiver reading + Amplifier Gain *CL = Cable Loss–Amplifier Gain *The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 10 Hz for average detection at frequency above 1 GHz. *This test does not require because the highest operating frequency of the EUT is less than 108 MHz. *Application method of the highest frequency is in the following *Highest frequency of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz. *Highest frequency of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz. *Highest frequency of the EUT is between 500 MHz and 1 GHz, the measurement shall only be made up to 5 GHz. *Highest frequency of the EUT is above 1 GHz, the measurement shall be made up to 10 times the highest frequency or 40 GHz,							

8. Measurement of conducted disturbance

The continuous disturbance voltage of AC Mains in the frequency from 0.15 MHz to 30 MHz was measured in accordance to FCC Part 15 (2010) & ANSI C 63.4 (2003). The test setup was made according to FCC Part 15 (2010) & ANSI C 63.4 (2003) in a shielded Room. The EUT was placed on a non-conductive table at least 0.8 m above the ground plan. A grounded vertical reference plane was positioned in a distance of 0.4 m from the EUT. The distance from the EUT to other metal surfaces was at least 0.8 m. The EUT was only earthen by its power cord through the line impedance stabilizing network. The power cord has been bundled to a length of 1.0 m. The test receiver with Quasi Peak detector complies with CISPR 16.

8.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESHS 30	Rohde & Schwarz	828765/002	26-Jan-14
LISN	ESH3-Z5	Rohde & Schwarz	838979/010	27-Jan-14
Pulse Limiter	ESH3Z2	Rohde & Schwarz	NONE	26-Jan-14

8.2 Environmental Condition

Test Place : Shielded Room
 Temperature (°C) : 24.7 °C
 Humidity (% R.H.) : 42.4 % R.H.

8.3 Test data

Test Date : 21-Mar-13

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)		Limit (dB μ V)	Reading (dB μ V)	Result (dB μ V)	Limit (dB μ V)	Reading (dB μ V)	Result (dB)
0.15	0.13	0.16	N	63.61	44.8	39.34	53.61		
0.16	0.13	0.17	H	61.12	44.2	36.72	51.12		
0.17	0.33	0.42	N	60.00	50.5	50.56	50.00		
0.18	0.40	0.42	H	60.00	42.5	35.78	50.00		
0.20	0.65	0.46	N	60.00	43.7	36.96	50.00		
0.24	0.87	0.46	N	60.00	41.3	36.62	50.00		
Remark	H : Hot Line, N : Neutral Line *Correction Factor = Lisn + Cable *Result = Correction Factor + Reading								

Appendix 1. Special diagram

*HOT LINE

ES TECH
HOT LINE

21 Mar 2013 11:28

EUT: MT3XX

Manuf:

Op Cond: 120 V

Operator: Enginner H.K.Lee

Test Spec: CLASS B

Comment: 13.56 MHz

Result File: 00371c_h.dat : Bluebird Soft Inc.

Scan Settings

(1 Range)

Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	0.8%	10kHz	PK+AV	10msec	Auto	OFF	60dB

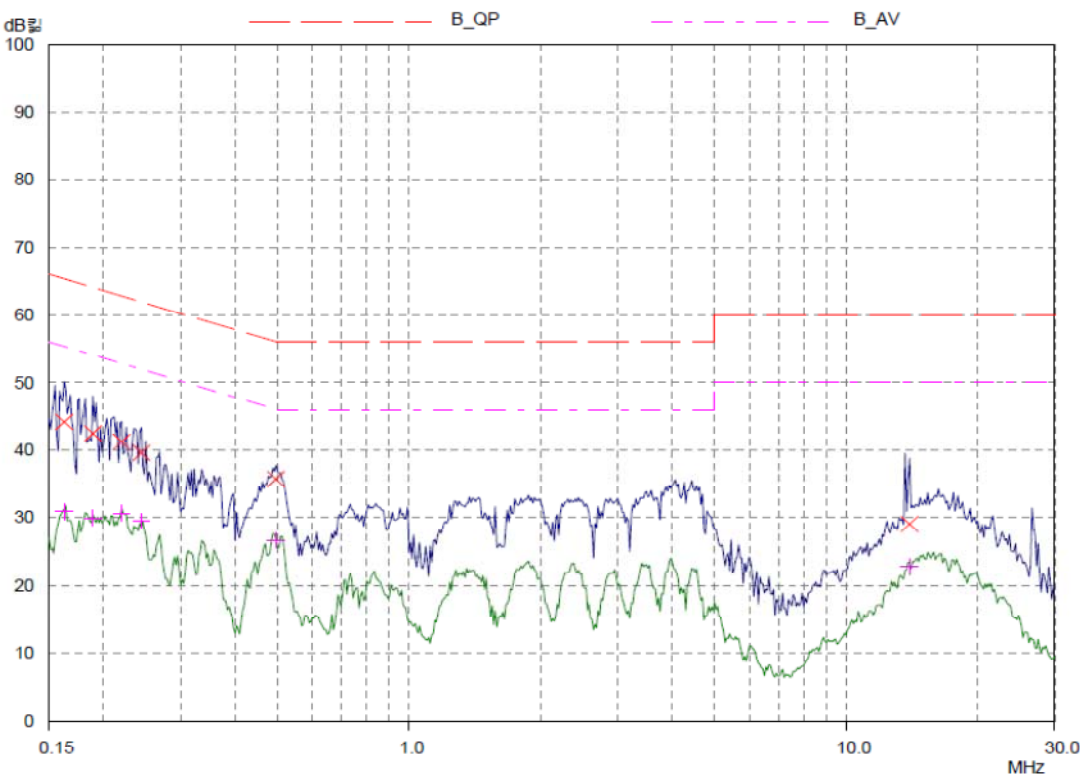
Final Measurement:

Detectors: X QP / + AV

Meas Time: 1sec

Subranges: 25

Acc Margin: 0 dB



*NEUTRAL LINE

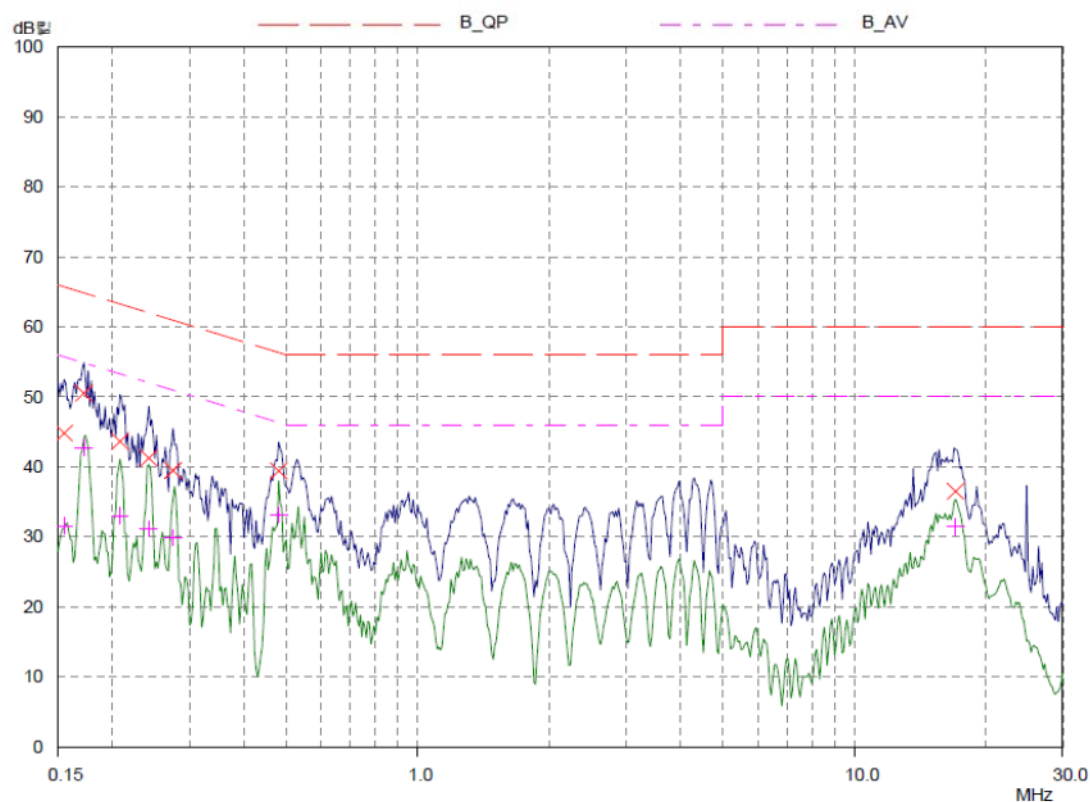
ES TECH
NEUTRAL LINE

21 Mar 2013 10:23

EUT: MT3XX
Manuf:
Op Cond: 120 V
Operator: Enginner H.K.Lee
Test Spec: CLASS B
Comment: 13.56 MHz

Result File: 00371c_n.dat : Bluebird Soft Inc.

Scan Settings			Receiver Settings					
(1 Range)								
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	0.8%	10kHz	PK+AV	10msec	Auto	OFF	60dB
Final Measurement:			Detectors: X QP / + AV					
			Meas Time: 1sec					
			Subranges: 25					
			Acc Margin: 0 dB					



Appendix 2. Antenna Requirement

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.

Result

–Complied

The transmitter has an integral PCB pattern antenna.