Test Report for FCC

Report Number		ESTF150612-001		
Applicant	Company name	NURI Telecom Co., Ltd.		
	Address	B-10F Woolim Lion's Valley 371-28 Gasan-dong Geumcheon-gu,Seoul, 153-786, Korea		
	Telephone	82-2-781-0611		
Product	Product name	NURI AimiR Pulse Counter		
	Model No.	NAPC-CM2	Manufacturer	NURI Telecom Co., Ltd.
	Serial No.	B120000033B9C	Country of origin	KOREA
Test date	2006-10-12 ~2006-12-01		Date of issue	1-Dec-06
Testing location	ESTECH. Co., Ltd. 97-1 Hoiuk-Ri Majang-Myon, Icheon-city, KyungKi-Do, Korea			
Standard	FCC PART 15 2006 , ANSI C 63.4 2003			
Measurement facility registration number	94696			
Tested by	Engineer H.H.Lee (Signature)			
Reviewed by	Engineering Manager J.M.Yang (Signature)			
Abbreviation	OK, Pass = Passed, 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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Appendix 1. Antenna Requirement

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
(Safety & Telecom. Test Lab)

EMC Test Lab : 58-1 Osan-Ri, GaNam-Myon, YeoJoo-Gun, KyungKi-Do, Korea
97-1 Hoiuk-Ri Majang-Myon, Icheon-city, KyungKi-Do, Korea

1.3 Official Qualification(s)

MIC : Granted Accreditation from Ministry of Information & Communication for EMC, Safety and Telecommunication
KOLAS : Accredited Lab By Korea Laboratory Accreditation Schema base on CENELEC requirements
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 Name	: NURI AimiR Pulse Counter
Model Number	: NAPC-CM2
Modulation Type	: ZigBee(OQPSK)
Transfer Rate	: up to 250kbps
Number of Channel	: 15
Channel Spacing	: 5MHz
Output Power	: 4.3dBm
Serial Number	: NONE
Manufacturer	: NURI Telecom Co., Ltd.
Country of origin	: KOREA
Rating	: INPUT:DC3.6V Li-SOCL2 battery,8500mAh
Receipt Date	: 2006-09-12

2.2 General descriptions of EUT

This device fully compatible with the DSSS standard to provide a wireless data rate of 250kbps.
For the detailed features, please refer to the manufacturer's specifications or User's Manual.

3. Test Standards

Test Standard : FCC PART 15 (2006)

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 decides 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 method apply to the measurement of individual units or systems comprised of multiple units

Summary of Test Results

Applied Satandard : 47 CFR Part 15, Subpart C				
Standard	Test Type	Result	Remark	Limit
15.207	AC Power Conducted Emission	Pass	Meet the requirement	
15.209	Radiated Emission	Pass	Meet the requirement	
15.247(a)(2)	Spectrum Bandwidth of a DSSS System	Pass	Meet the requirement	Min. 500kHz
15.247(b)	Maximum Peak ouput power	Pass	Meet the requirement	Max. 30dBm
15.247(c)	Transmitter Radiated Emission	Pass	Meet the requirement	Table 15.209
15.247(d)	Power Spectral Density	Pass	Meet the requirement	Max. 8dBm
15.247(c)	Band Edge Measurement	Pass	Meet the requirement	20dB less

4. Measurement Condition

4.1 EUT Operation(ZigBee)

a. Channel

Ch.	Frequency	Ch.	Frequency
0	2405MHz	8	2445MHz
1	2410MHz	9	2450MHz
2	2415MHz	10	2455MHz
3	2420MHz	11	2460MHz
4	2425MHz	12	2465MHz
5	2430MHz	13	2470MHz
6	2435MHz	14	2475MHz
7	2440MHz	15	2480MHz

b. Measurement Channel : ZigBee: Low(2405MHz), Middle(2440Mhz),High(2480MHz)

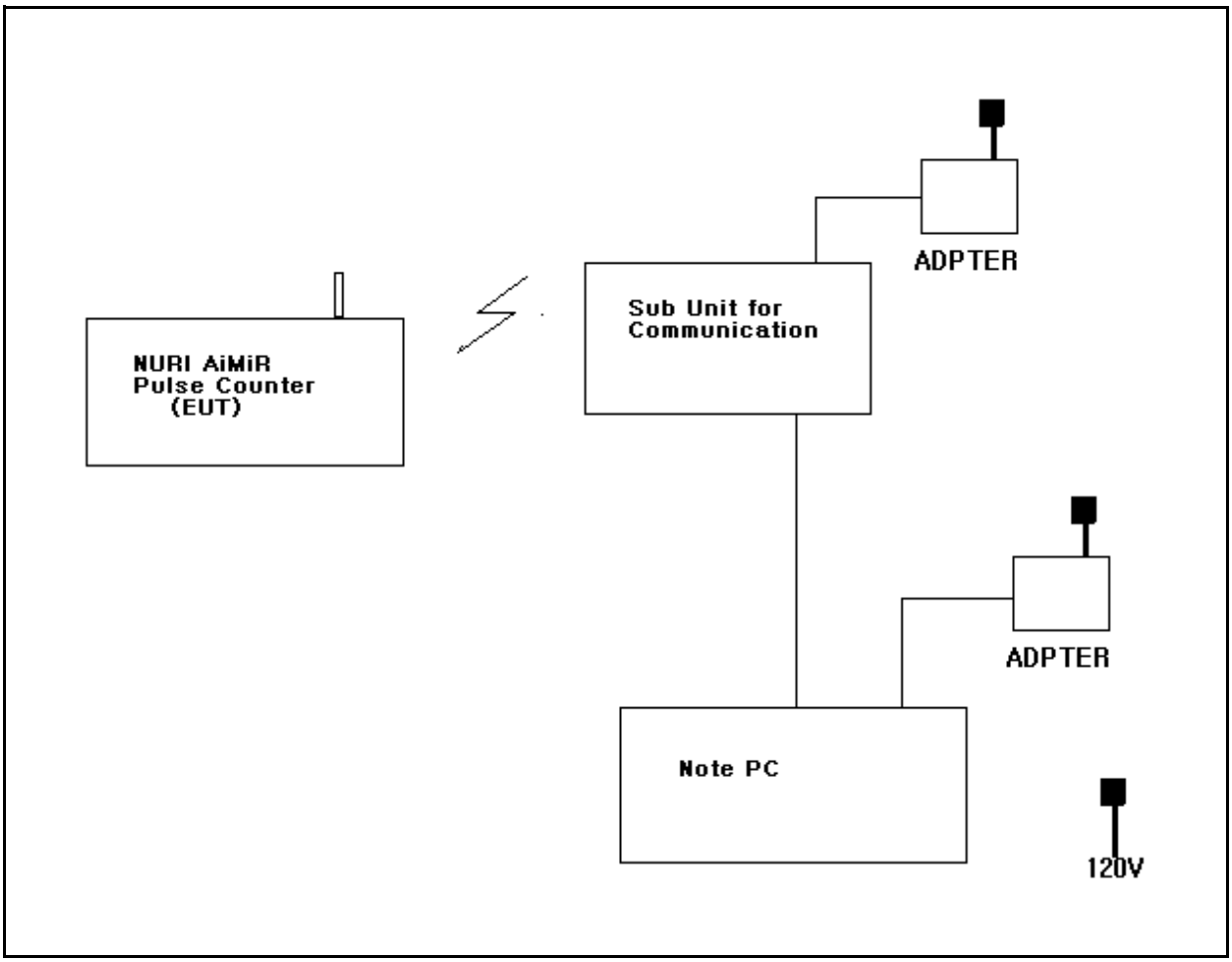
c. Test Mode : Continuous Output, OQPSK

d. Test rate : the worst case of rate 250kbps

4.2 EUT Operation.

* The EUT was in the following operation mode during all testing
* The operational conditions of the EUT was determined by the manufacturer according to the typical use of the EUT with respect to the expected hightest level of emission
* The computer system ran a test program to enable EUT under transmission/receiving condition continuously at specific channel frequency.

4.3 Configuration and Peripherals



4.4 EUT and Support equipment

Equipment Name	Model Name	S/N	Manufacturer	Remark (FCC ID)
NURI AimiR Pulse Counter	NAPC-CM2	B120000033B9C	NURI Telecom Co., Ltd.	EUT
Sub Unit	EK-Z101	-	NURI Telecom Co., Ltd.	
Note PC	Latitude D400	326-40CT	Dell	
Adapter	PA-1650-05D	2CU-016B	Lite-on Technology Corporation	
Adapter	SHA10501	-	Sung Ho Elec.	

4.5 Cable Connecting

Start Equipment		End Equipment		Cable Standard		Remark
Name	I/O port	Name	I/O port	Length	Shielded	
NURI AiMiR Pulse Counter	Wireless	Sub Unit	Wireless	-	-	
Note PC	Serial	Sub Unit	Serial	2	Shielded	
Note PC	Power	Adapter	-	2	Unshielded	
Sub Unit	Power	Adapter	-	2	Unshielded	

5. 6dB Bandwidth Measurement

5.1 Test procedure

The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measured by spectrum analyzer. The 6dB bandwidth is defined as the bandwidth at 6dB below from peak power point. The minimum of 6dB bandwidth measurement is 0.5MHz.

5.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

. RBW= 100KHz

. VBW= 100KHz

. Span= 20MHz

. Sweep= suitable duration based on the EUT specification.

6dB Bandwidth Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4407B	US42041281	2007-03-03
RF Cable	Length: 20cm	-	
-Spectrum Analyzer <=> EUT	Loss: 1.2dB	-	

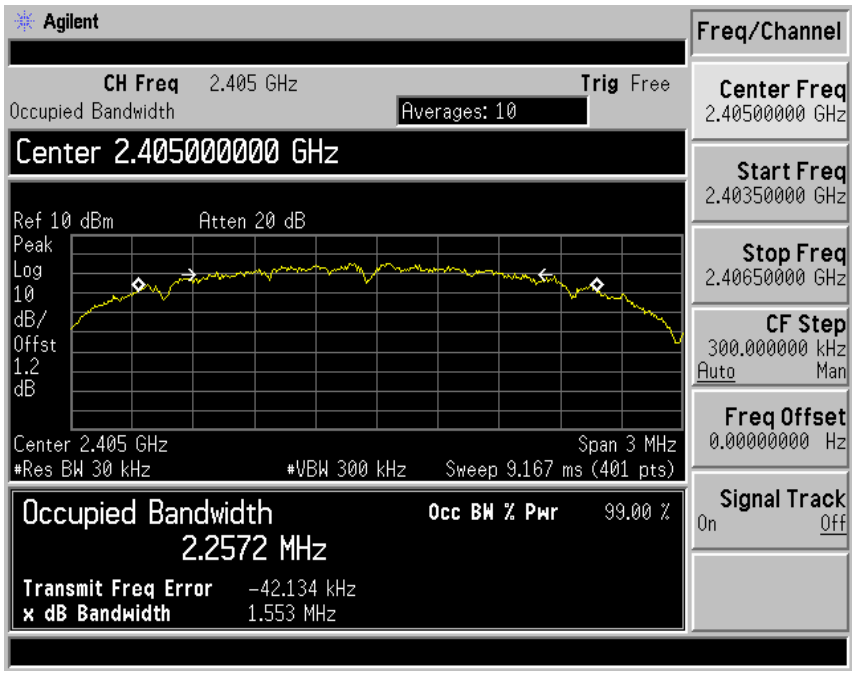
5.3 Measurement results

EUT	NURI AimiR Pulse Counter	MODEL	NAPC-CM2
MODE	OQPSK	ENVIRONMENTAL CONDITION	24℃, 44%RH
INPUT POWER	120Vac, 60Hz		

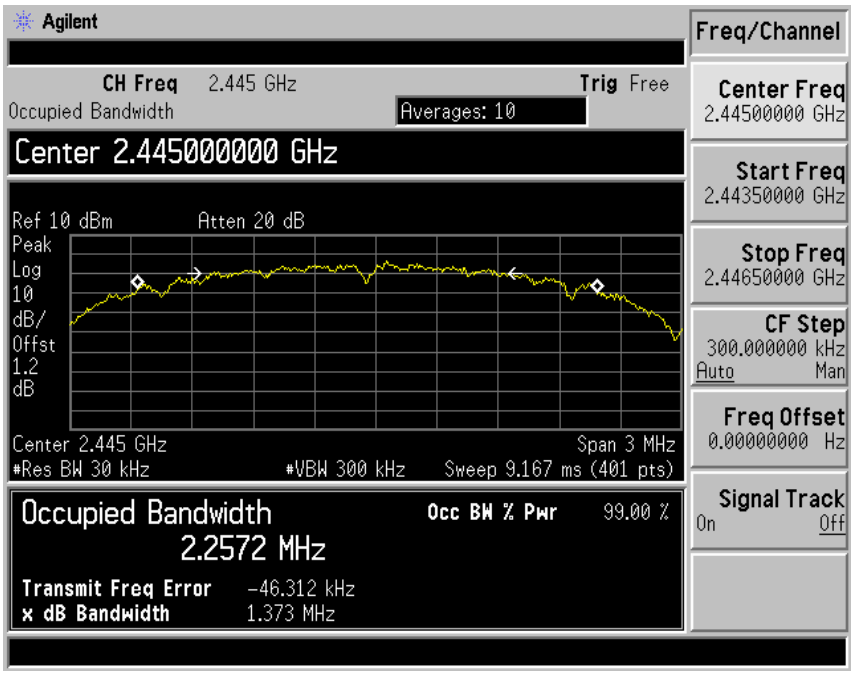
CHANNEL	Channel Frequency (MHz)	Bandwidth at 6dB below(MHz)	Minimum Limit (MHz)	PASS/FAIL
0	2405	1.55	0.5	PASS
8	2445	1.37	0.5	PASS
15	2480	1.48	0.5	PASS

5.4 Trace data

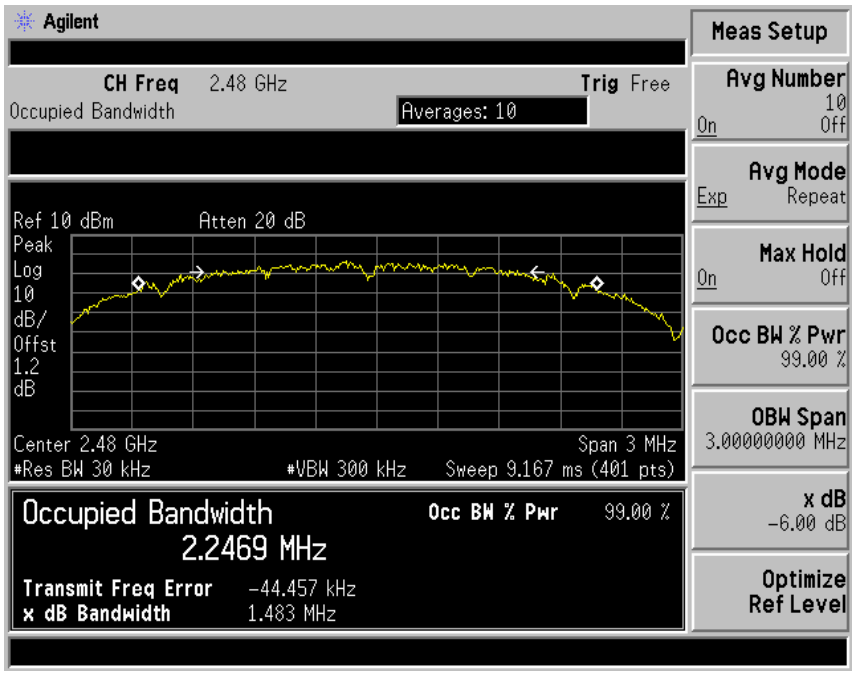
0ch



8ch



15ch


Agilent
Meas Setup
CH Freq 2.48 GHz
Trig Free
Occupied Bandwidth
Averages: 10
Avg Number
10
On Off
Avg Mode
Exp Repeat
Max Hold
On Off
Ref 10 dBm
Atten 20 dB
Peak
Log
10
dB/
Offst
1.2
dB
Occ BW % Pwr
99.00 %
OBW Span
3.00000000 MHz
Center 2.48 GHz
Span 3 MHz
#Res BW 30 kHz
#VBW 300 kHz
Sweep 9.167 ms (401 pts)
x dB
-6.00 dB
Occupied Bandwidth
2.2469 MHz
Occ BW % Pwr 99.00 %
Transmit Freq Error -44.457 kHz
x dB Bandwidth 1.483 MHz
Optimize Ref Level

6. MAXIMUM PEAK OUTPUT POWER

6.1 Test procedure

The transmitter antenna terminal is connected to the input of a RF power sensor. Measurement is made while EUT is operating in transmission mode at the appropriate center frequency. The maximum peak output power measurement is 30dBm.

Maximum Peak Output Power Test Instruments

Description	Model	Serial Number	Cal. Due Date
Power Meter	HP E4418A	GB38272717	2007-03-03
Power Sensor	HP 8481A	3318A96478	2007-03-08
RF Cable:	Length: 20cm	-	
-Spectrum Analyzer <=> EUT	Loss: 1.2dB	-	

6.2 Measurement results

EUT	NURI AimiR Pulse Counter	MODEL	NAPC-CM2
MODE	OQPSK	ENVIRONMENTAL CONDITION	24℃, 43%RH
INPUT POWER	120Vac, 60Hz		

CHANNEL	Channel Frequency (MHz)	Peak Power Output(dBm)		Limit[1W] (dBm)	PASS/FAIL
		(dBm)	(W)		
0	2405	3.2	0.002	30.0	PASS
8	2445	3.8	0.002	30.0	PASS
15	2480	4.3	0.003	30.0	PASS

7. Transmitter power spectral density

7.1 Test procedure

The peak power density was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency. The maximum of power spectral dencity measurement is 8dBm.

7.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

. RBW= 3KHz

. VBW= 30KHz

. Span= 1.5MHz

. Sweep= 500 seconds (It is allowed to be longer than span/3kHz.)

The peak power density Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4407B	US42041281	2007-03-03
RF Cable	Length: 20cm	-	
-Spectrum Analyzer <=> EUT	Loss: 1.2dB	-	

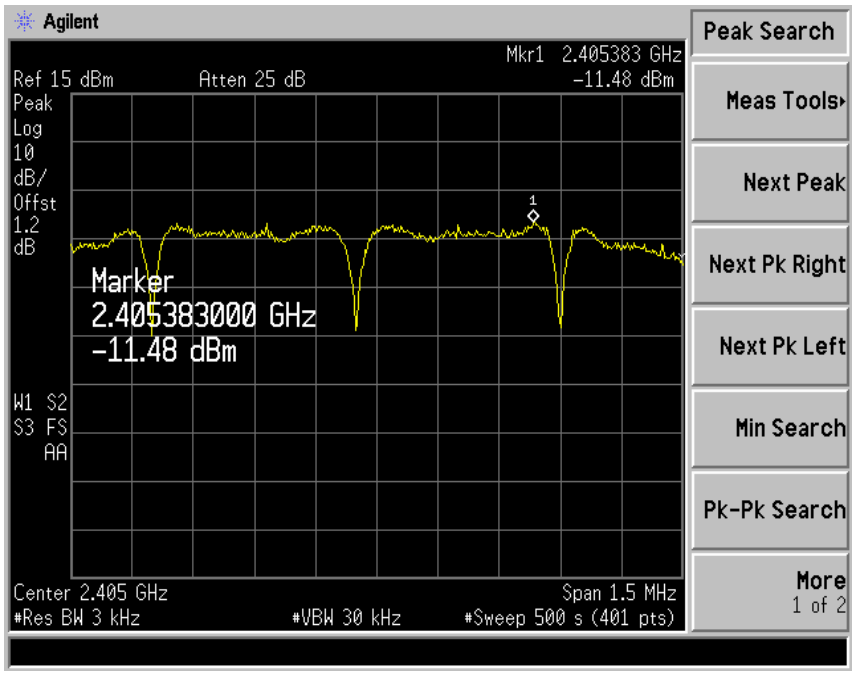
7.3 Measurement results

EUT	NURI AimiR Pulse Counter	MODEL	NAPC-CM2
MODE	OQPSK	ENVIRONMENTAL CONDITION	23℃, 43%RH
INPUT POWER	120Vac, 60Hz		

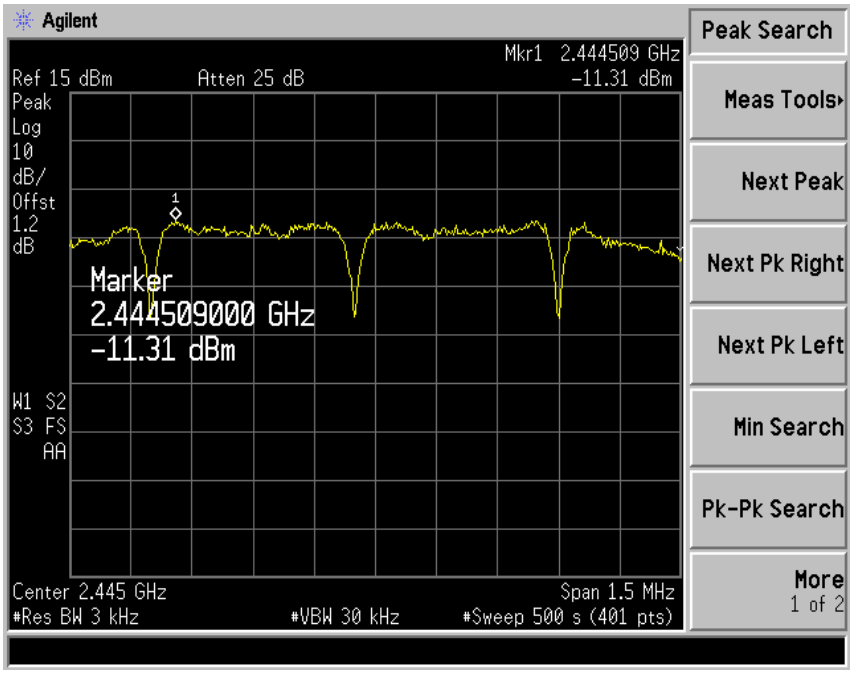
CHANNEL	Channel Frequency (MHz)	RF Power Spectral Density (dBm)	Maximum Limit (dBm)	PASS/FAIL
1	2405	-11.48	8.0	PASS
8	2445	-11.31	8.0	PASS
15	2480	-10.69	8.0	PASS

7.4 Trace data

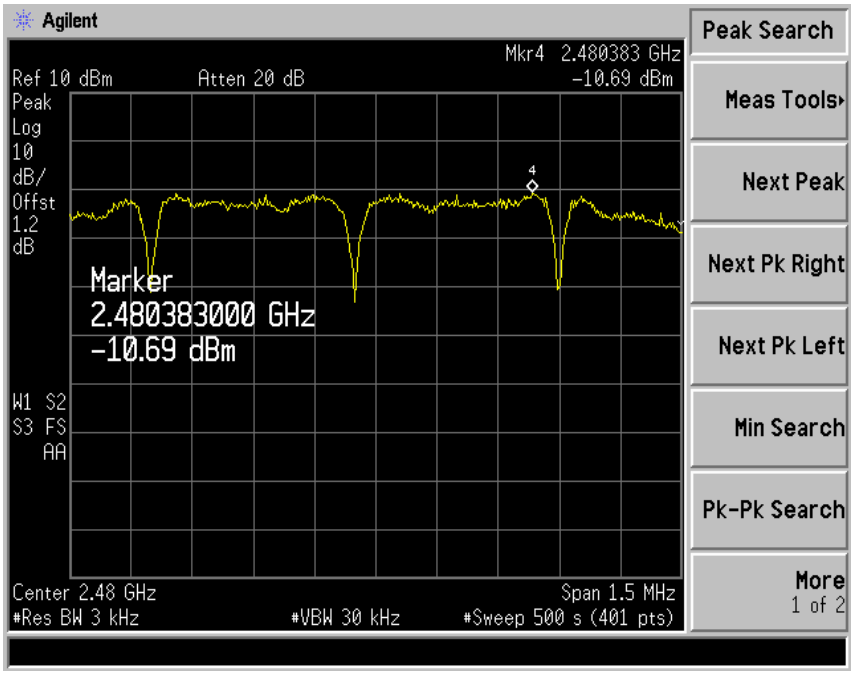
0ch



8ch



15ch


Agilent
Mkr4 2.480383 GHz
Ref 10 dBm
Atten 20 dB
-10.69 dBm
Peak
Log
10
dB/
Offst
1.2
dB
Marker
2.480383000 GHz
-10.69 dBm
W1 S2
S3 FS
AA
Center 2.48 GHz
#Res BW 3 kHz
#VBW 30 kHz
Span 1.5 MHz
#Sweep 500 s (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

8. band-edge and out of band emissions.

8.1 Test procedure

The radio frequecy power at 20dB down from the highest inband power level is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency. The band edge&out of band emission shall be at least 20dB below of the highest inband power level.

8.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

. RBW= 100KHz

. VBW= 100KHz

. Span= suitable frequency span

. Sweep= suitable duration based on the EUT specification.

Band Edge&Out of Emission Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4407B	US42041281	2007-03-03
RF Cable	Length: 20cm		-
-Spectrum Analyzer <=> EUT	Loss: 1.2dB		-

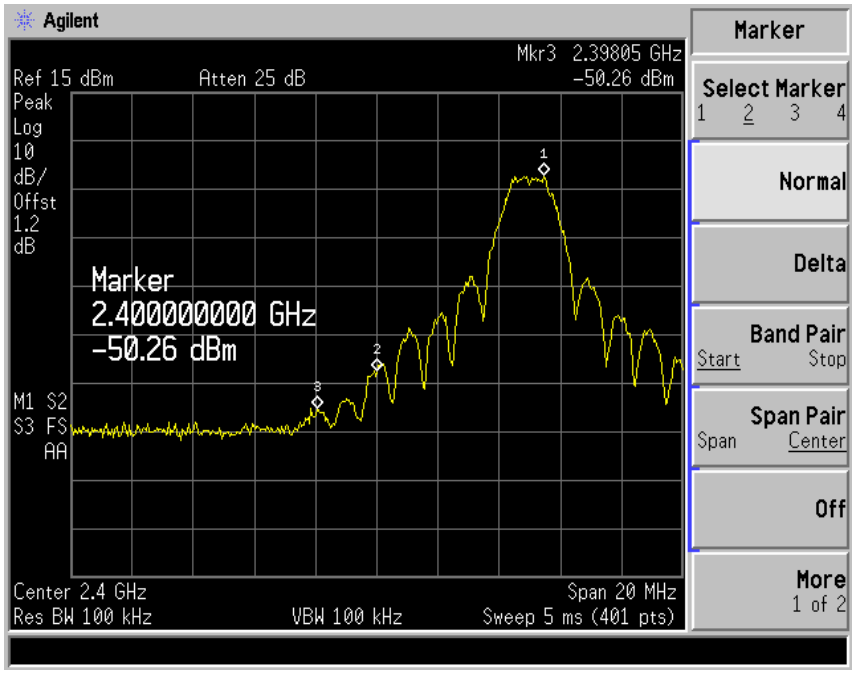
8.3 Measurement results of band-edge & out of emission

EUT	NURI AimiR Pulse Counter	MODEL	NAPC-CM2
MODE	OQPSK	ENVIRONMENTAL CONDITION	23℃, 43%RH
INPUT POWER	120Vac, 60Hz		

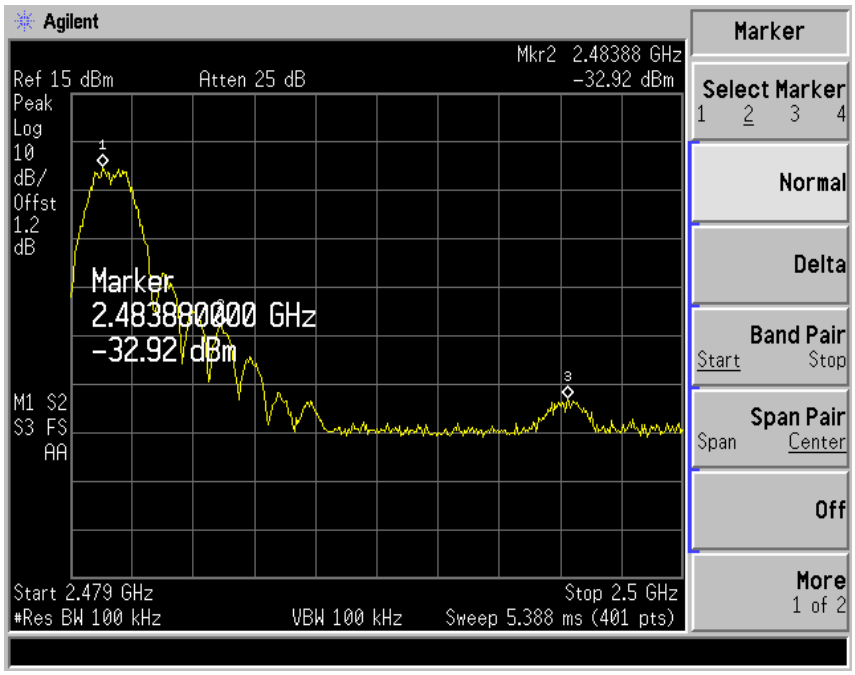
CHANNEL	Channel Frequency (MHz)	Measurement Frequency (MHz)	Peak Level at 20dB below(dBm)	Limit (MHz)
0	2405	2400.0	-50.26	Below 20dB from peak power level to band edge
15	2480	2483.9	-32.92	Below 20dB from peak power level to band edge

8.4 Trace data of band-edge & Out of Emission

0ch



15ch



9. Measurement of radiated disturbance

Above 30 MHz Electric Field strength was measured in accordance with FCC Part 15 (2006) & ANSI C 63.4 (2003). The test setup was made according to FCC Part 15 (2006) & ANSI C 63.4 (2003) on an open test site, which allows a 3m distance measurement. The EUT was placed in the center of wooden turntable. The height of this table was 0.8m. The measurement was conducted with both horizontal and vertical antenna polarization. The turntable has fully rotated. For further description of the configuration refer to the picture of the test setup.

9.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESVS10	Rohde & Schwarz	838562/002	2007. 1. 23
TEST Receiver	ESPI7	Rohde & Schwarz	100185	2007. 8. 24
Amplifier	310N	Sonoma Instrument	185723	2007. 9. 26
Spectrum Analyzer	R3261C	ADVANTEST	61720116	2007. 4. 19
LogBicon Antenna	VULB 9160	S/B	3142	2007. 5. 03
Horn Antenna	BBHA 9120 D	SCHWARZBECK	352	2007. 6. 05
Spectrum Analyzer	8563E	HP	3623A05297	2007. 3. 6
PREAMPLIFIER	8449B	HP	3008A00581	2007. 3. 9
Turn Table	2087	EMCO	2129	-
Antenna Mast	2070-01	EMCO	9702-203	-
ANT Mast Controller	2090	EMCO	1535	-
Turn Table Controller	2090	EMCO	1535	-

9.2 Environmental Condition

Test Place : Open site(3m)
Temperature (°C) : 26 ℃
Humidity (%) : 62 %

9.3 Test Data

Test Date : 12-Oct-06 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
57.96	10.60	V	1.0	12.56	1.2	40.0	24.39	-15.61
111.70	14.30	V	1.0	11.23	1.7	43.5	27.18	-16.32
125.00	19.20	V	1.0	12.33	1.7	43.5	33.27	-10.23
135.33	16.20	V	1.0	13.02	1.8	43.5	31.04	-12.46
200.00	12.00	V	1.0	10.38	2.2	43.5	24.53	-18.97
216.03	12.10	V	1.0	10.68	2.3	46.0	25.08	-20.92
224.01	20.00	V	1.0	10.95	2.4	46.0	33.31	-12.69
272.00	12.10	V	1.0	12.54	2.8	46.0	27.41	-18.59
303.99	11.40	H	2.0	13.28	2.9	46.0	27.58	-18.42
320.02	13.30	V	1.0	13.65	3.0	46.0	29.94	-16.06
368.00	15.50	V	1.0	14.59	3.2	46.0	33.27	-12.73
400.01	14.00	V	1.0	15.32	3.4	46.0	32.69	-13.31
408.00	12.20	V	1.0	15.47	3.4	46.0	31.11	-14.89
464.02	10.00	V	1.0	16.59	3.7	46.0	30.26	-15.74
528.01	10.80	V	1.0	17.47	4.0	46.0	32.28	-13.72
Remark	*Checked in all 3 axis and the maximum measured data were reported. *CL = Cable Loss-Amplifier Gain(In case of above1000Mhz) *CL = Cable Loss(In case of below1000Mhz) *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120KHz for Quasi-peak detection at frequency below 1GHz.							

9.3-1 Test Data

Test Date : 12-Oct-06 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW:1MHz VBW:1MHz)								
2396.6	44.67	H	1.5	27.63	-33.0	74.0	39.27	-34.73
2405	67.33	H	1.5	27.62	-33.0	-	97.22	-
4810	48.17	H	1.1	31.28	-32.3	74.0	47.14	-26.87
2396.6	45.00	V	1.3	27.63	-33.0	74.0	39.60	-34.40
2405	73.50	V	1.1	27.62	-33.0	-	103.39	-
4810	50.00	V	1.3	31.28	-32.3	74.0	48.97	-25.04
AV(RBW:1MHz VBW:10Hz)								
2396.6	35.00	H	1.5	27.63	-33.0	54.0	29.60	-24.40
2405	65.50	H	1.5	27.62	-33.0	-	95.39	-
4810	38.83	H	1.1	31.28	-32.3	54.0	37.80	-16.21
2396.6	34.83	V	1.3	27.63	-33.0	54.0	29.43	-24.57
2405	72.14	V	1.1	27.62	-33.0	-	66.73	-
4810	38.67	V	1.3	31.28	-32.3	54.0	37.64	-16.37
Remark	H : Horizontal, V : Vertical TEST MODE : ZigBee-CH0(2405MHz) *The TX signal isn't detected from 2th harmonics. *OB = Operating band *CL = Cable Loss-Amplifier Gain(In case of above1000Mhz) *CL = Cable Loss(In case of below1000Mhz)							

9.3-2 Test Data

Test Date : 12-Oct-06 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW:1MHz VBW:1MHz)								
2445	70.00	H	1.5	27.60	-33.0	-	99.87	-
4890	52.33	H	1.4	31.40	-32.3	74.0	51.42	-22.59
2445	76.00	V	1.3	27.60	-33.0	-	105.87	-
4890	54.13	V	1.1	31.40	-32.3	74.0	53.22	-20.79
AV(RBW:1MHz VBW:10Hz)								
2445	67.83	H	1.5	27.60	-33.0	-	97.70	-
4890	40.67	H	1.4	31.40	-32.3	54.0	39.76	-14.25
2445	73.83	V	1.3	27.60	-33.0	-	68.40	-
4890	43.83	V	1.1	31.40	-32.3	54.0	42.92	-11.09
Remark	H : Horizontal, V : Vertical TEST MODE : ZigBee-CH8(2445MHz) *The TX signal isn't detected from 2th harmonics. *OB = Operating band *CL = Cable Loss-Amplifier Gain(In case of above1000Mhz) *CL = Cable Loss(In case of below1000Mhz)							

9.3-3 Test Data

Test Date : 12-Oct-06 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW:1MHz VBW:1MHz)								
2480	69.33	H	1.5	27.59	-33.0	-	63.89	-
2499	43.33	H	1.4	27.58	-33.0	74.0	37.88	-36.12
4960	54.83	H	1.3	31.49	-32.3	74.0	54.01	-19.99
2480	78.17	V	1.2	27.59	-33.0	-	72.73	-
2499	44.83	V	1.2	27.58	-33.0	74.0	39.38	-34.62
4960	54.83	V	1.3	31.49	-32.3	74.0	54.01	-19.99
AV(RBW:1MHz VBW:10Hz)								
2480	68.00	H	1.5	27.59	-33.0	-	62.56	-
2499	34.67	H	1.4	27.58	-33.0	54.0	29.22	-24.78
4960	48.33	H	1.3	31.49	-32.3	54.0	47.51	-6.49
2480	78.00	V	1.2	27.59	-33.0	-	72.56	-
2499	34.67	V	1.2	27.58	-33.0	54.0	29.22	-24.78
4960	50.50	V	1.3	31.49	-32.3	54.0	49.68	-4.32
Remark	H : Horizontal, V : Vertical TEST MODE : ZigBee-CH15(2480MHz) *The TX signal isn't detected from 2th harmonics. *OB = Operating band *CL = Cable Loss-Amplifier Gain(In case of above1000Mhz) *CL = Cable Loss(In case of below1000Mhz)							

10. Measurement of conducted disturbance

The continuous disturbance voltage of AC Mains in the frequency from 0.15 to 30 MHz was measured in accordance to FCC Part 15 (2006) & ANSI C 63.4 (2003) The test setup was made according to FCC Part 15 (2006) & ANSI C 63.4 (2003) in a shielded. The EUT was placed on a non-conductive table at least 80 above the ground plan. A grounded vertical reference plane was positioned in a distance of 40cm from the EUT. The distance from the EUT to other metal surfaces was at least 0.8m. 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 1.0m.. The test receiver with Quasi Peak detector complies with CISPR 16.

10.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
LISN	ESH3-Z5	Rohde & Schwarz	838979/010	2007. 2. 27
LISN	NNLA8120A	Schwarzbeck	NONE	2007. 2. 27
TEST Receive	ESPI7	Rohde & Schwarz	100185	2007. 8. 24
Pulse Limiter	ESH3Z2	Rohde & Schwarz	NONE	2007. 6. 15

10.2 Environmental Condition

Test Place : Shield Room

Temperature (°C) : ℃

Humidity (%) : %

10.3 Test Data for ZigBee (N/A)

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)		Limit (dBμV)	Reading (dBμV)	Result (dBμV)	Limit (dBμV)	Reading (dBμV)	Result (dB)
Remark	H : Hot Line, N : Neutral Line It does not need to test this requirement, because the power of the EUT is supplied from battery only.								

Appendix 1. Antenna Requirement

1. Antenna Requirement

1.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 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.

And according to FCC 47 CFR Section 15.24

1.2 Antenna Connected Construction

The antenna types used in this product are Intergrated PCB Pattern Antenna. The maximum Gain of this antenna is 2dBi.