Test Report for FCC

FCC ID:X59-HRM-1000

Report Number		ESTF151201-005		
Applicant	Company name	H3 SYSTEM Co., Ltd.		
	Address	3F, 397-27, Doryong-dong, Yuseong-gu, Daejeon, R.O.Korea		
	Telephone	82-42-862-9314		
Product	Product name	Heart Rate Monitor		
	Model No.	HRM-1000	Manufacturer	H3 SYSTEM Co., Ltd.
	Serial No.	NONE	Country of origin	KOREA
Test date	2011-12-29 ~2011-12-30		Date of issue	13-Jan-12
Testing location	ESTECH Co., Ltd. 58-1 OSan-Ri Kanam-Myon, Yeoju-Gun, KyungKi-Do, Korea			
Standard	FCC PART 15 2010 , ANSI C 63.4 2003			
Measurement facility registration number	94696			
Tested by	Engineer J.H. KIM (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

Contents

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	: Heart Rate Monitor
Model Number	: HRM-1000
Modulation Type	: ZigBee(OQPSK)
Transfer Rate	: up to 250kbps
Number of Channel	: 16
Channel Spacing	: 5MHz
Output Power	: 5.7 dBm
Serial Number	: NONE
Manufacturer	: H3 SYSTEM Co., Ltd.
Country of origin	: KOREA
Rating	: Adapter Power Input : (100 - 240) V , (50 - 60) Hz, 0.5 A Output : + 4.2 V , 1.5 A
Receipt Date	: 2011-10-12

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 (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 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
11	2405MHz	19	2445MHz
12	2410MHz	20	2450MHz
13	2415MHz	21	2455MHz
14	2420MHz	22	2460MHz
15	2425MHz	23	2465MHz
16	2430MHz	24	2470MHz
17	2435MHz	25	2475MHz
18	2440MHz	26	2480MHz

b. Measurement Channel : ZigBee: Low(2405MHz), Middle(2445Mhz),High(2480MHz)

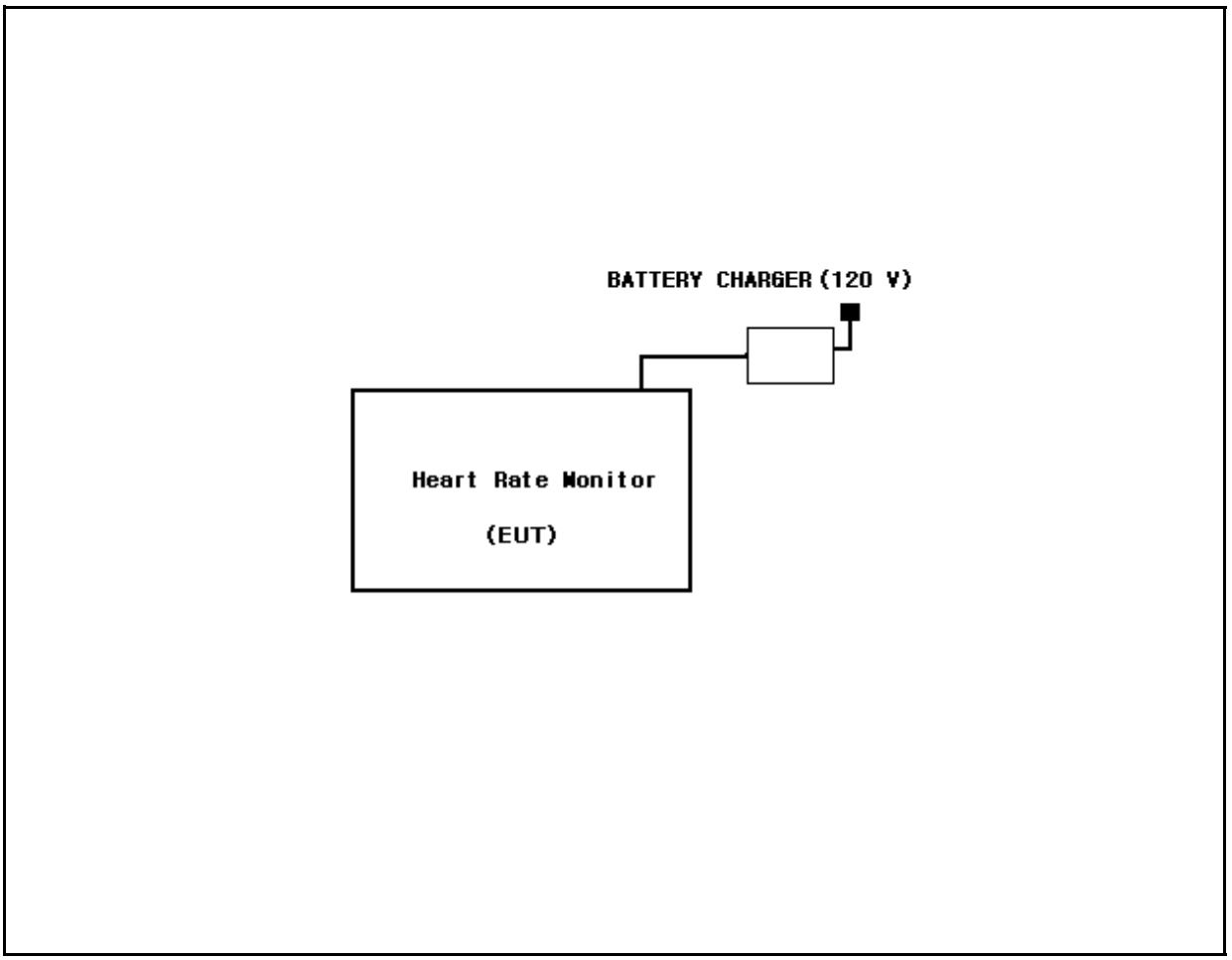
c. Test Mode : Continuous Output, OQPSK

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 EUT was measured under transmitting / 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)
Heart Rate Monitor	HRM-1000	NONE	H3 SYSTEM Co., Ltd.	EUT
BATTERY CHARGER	BPL910S04N01	NONE	Bridge Power Corp.	

4.5 Cable Connecting

Start Equipment		End Equipment		Cable Standard		Remark
Name	I/O port	Name	I/O port	Length	Shielded	
Heart Rate Monitor	Power	BATTERY CHARGER	-	1.2	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	2012-09-08
RF Cable	Length: 20cm	-	
-Spectrum Analyzer <=> EUT	Loss: 1.0dB	-	

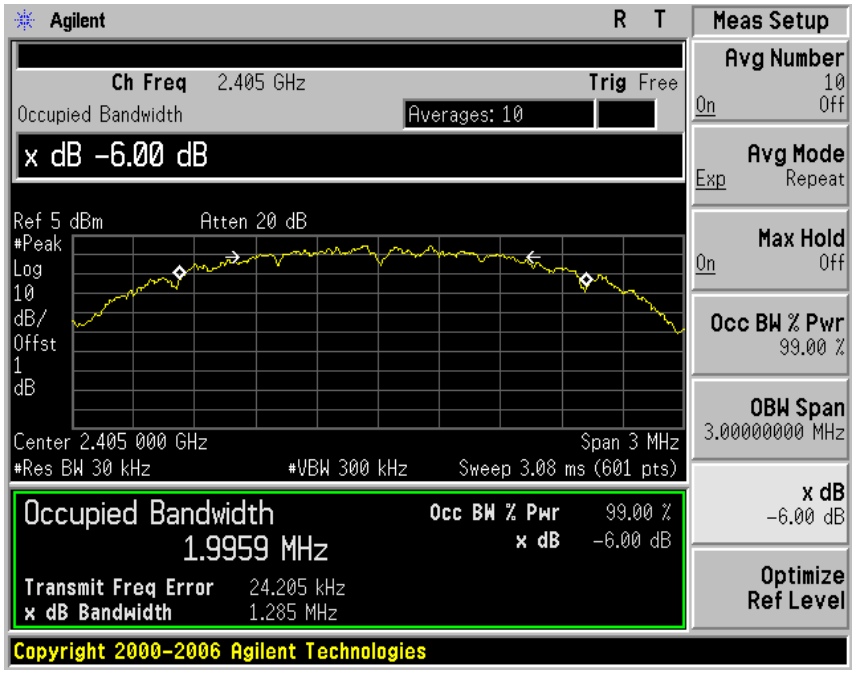
5.3 Measurement results

EUT	Heart Rate Monitor	MODEL	HRM-1000
MODE	OQPSK	ENVIRONMENTAL CONDITION	24℃, 44%RH
INPUT POWER	120Vac, 60Hz		

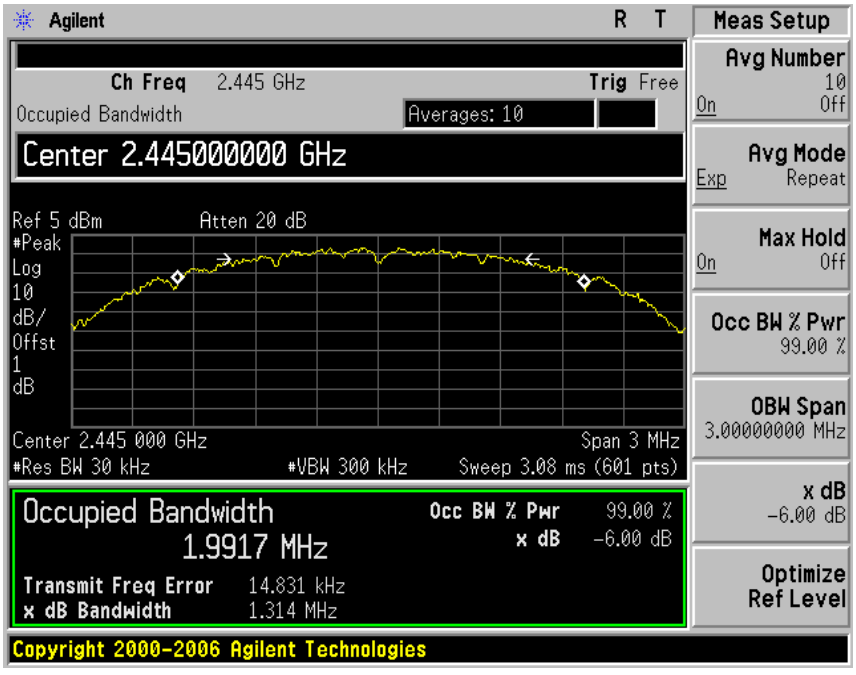
CHANNEL	Channel Frequency (MHz)	Bandwidth at 6dB below(MHz)	Minimum Limit (MHz)	PASS/FAIL
11	2405	1.29	0.5	PASS
19	2445	1.31	0.5	PASS
26	2480	1.19	0.5	PASS

5.4 Trace data

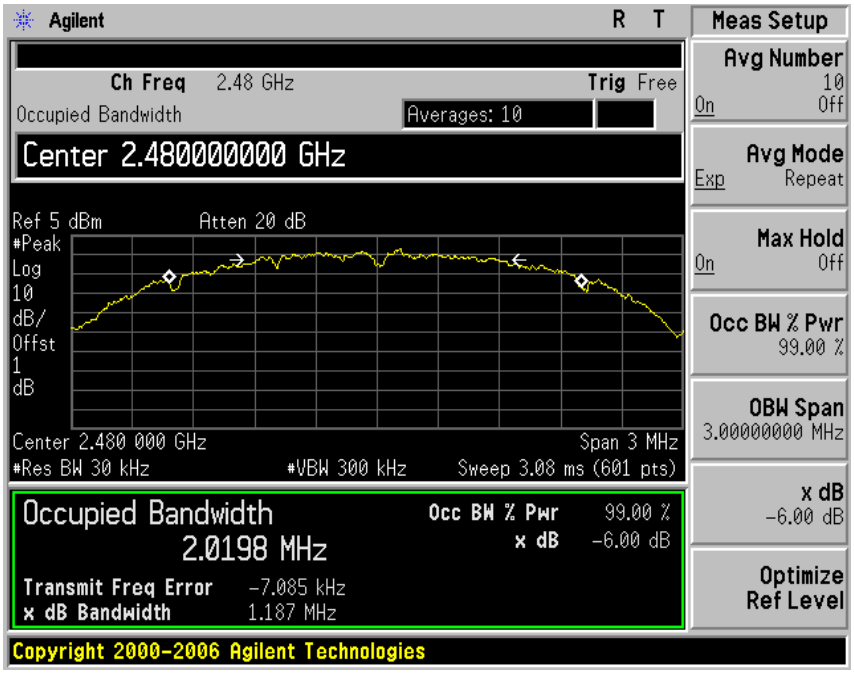
11ch



19ch



26ch


Agilent
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Span 3 MHz
#Res BW 30 kHz
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Sweep 3.08 ms (601 pts)
OBW Span
3.00000000 MHz
Occupied Bandwidth
2.0198 MHz
Occ BW % Pwr 99.00 %
x dB -6.00 dB
x dB
-6.00 dB
Transmit Freq Error -7.085 kHz
x dB Bandwidth 1.187 MHz
Optimize Ref Level
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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	GB38272722	2012-02-25
Power Sensor	HP 8481A	3318A96478	2012-02-25
RF Cable:	Length: 20cm	-	
-Spectrum Analyzer <=> EUT	Loss: 1.0dB	-	

6.2 Measurement results

EUT	Heart Rate Monitor	MODEL	HRM-1000
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)		
11	2405	5.7	0.004	30.0	PASS
19	2445	4.3	0.003	30.0	PASS
26	2480	3.4	0.002	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	2012-09-08
RF Cable	Length: 20cm	-	
-Spectrum Analyzer <=> EUT	Loss: 1.0dB	-	

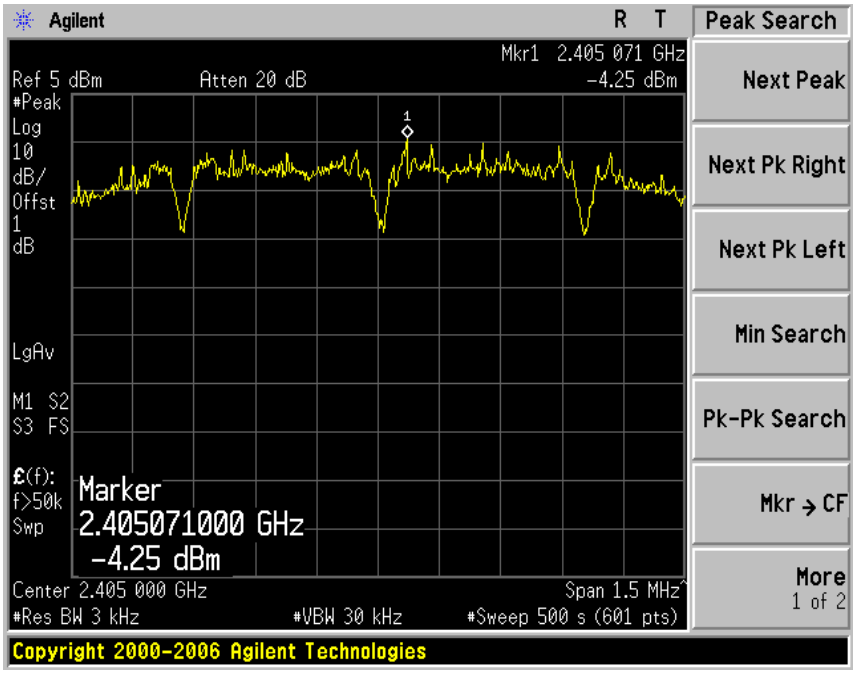
7.3 Measurement results

EUT	Heart Rate Monitor	MODEL	HRM-1000
MODE	OQPSK	ENVIRONMENTAL CONDITION	23℃, 43%RH
INPUT POWER	120Vac, 60Hz		

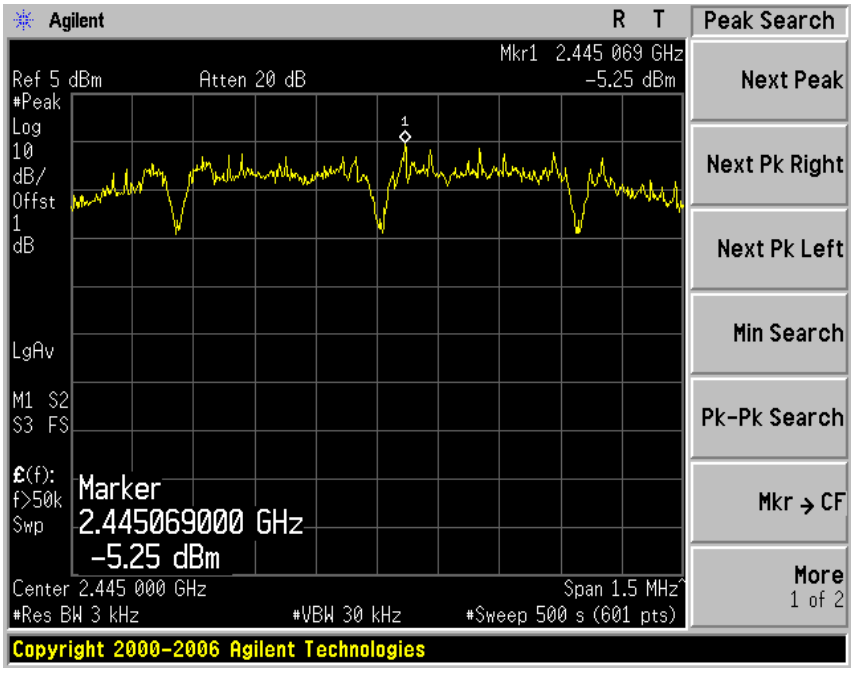
CHANNEL	Channel Frequency (MHz)	RF Power Spectral Density (dBm)	Maximum Limit (dBm)	PASS/FAIL
11	2405	-4.25	8.0	PASS
19	2445	-5.25	8.0	PASS
26	2480	-6.44	8.0	PASS

7.4 Trace data

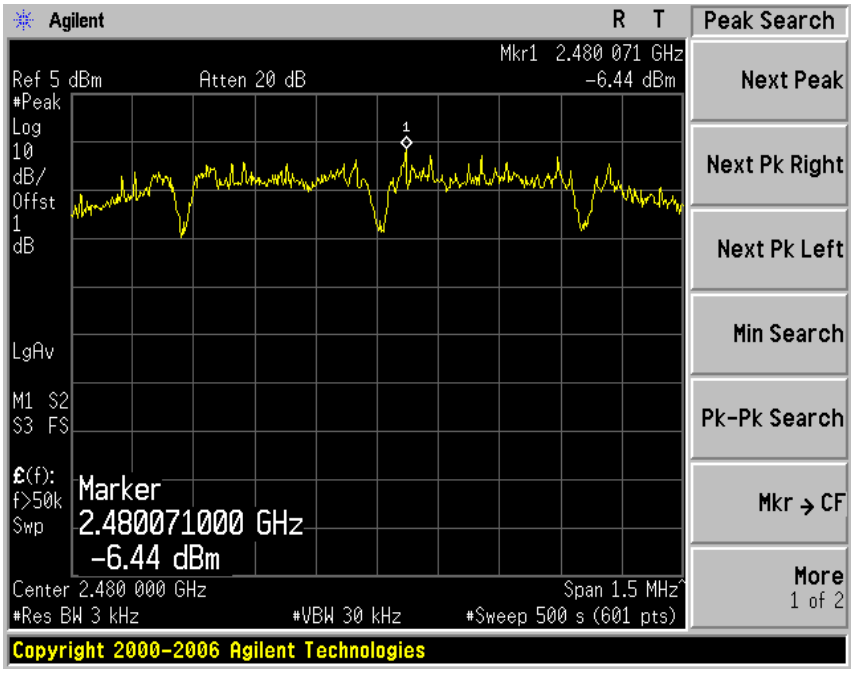
11ch



19ch



26ch


Agilent
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Peak Search
Mkr1 2.480 071 GHz
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#Sweep 500 s (601 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
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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	2012-09-08
RF Cable	Length: 20cm		-
-Spectrum Analyzer <=> EUT	Loss: 1.0dB		-

8.3 Measurement results of band-edge & out of emission

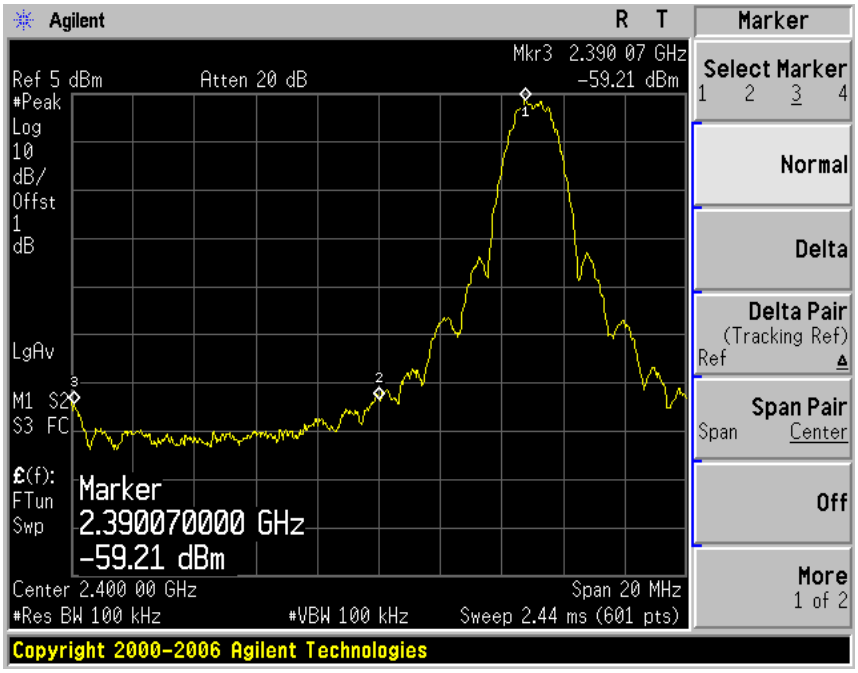
EUT	Heart Rate Monitor	MODEL	HRM-1000
MODE	OQPSK	ENVIRONMENTAL CONDITION	23℃, 43%RH
INPUT POWER	120Vac, 60Hz		

CHANNEL	Channel Frequency (MHz)	Measurement Frequency (MHz)	Peak Level at 20dB below(dBm)	Limit (MHz)
11	2405	2400.0	-59.21	Below 20dB from peak power level to band edge
26	2480	2483.9	-58.55	Below 20dB from peak power level to band edge

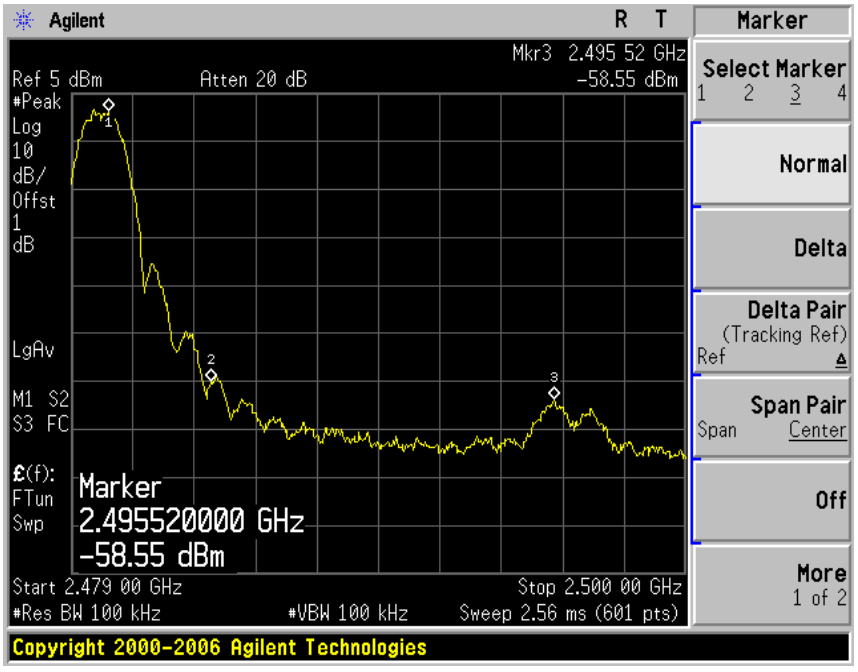
8.4 Trace data of band-edge & Out of Emission

band-edge

11ch



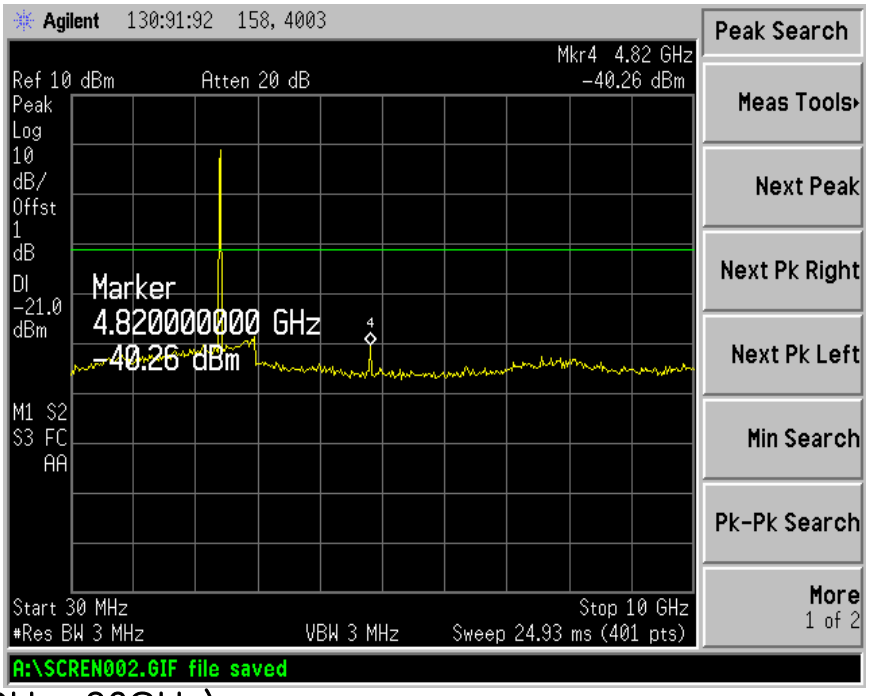
26ch



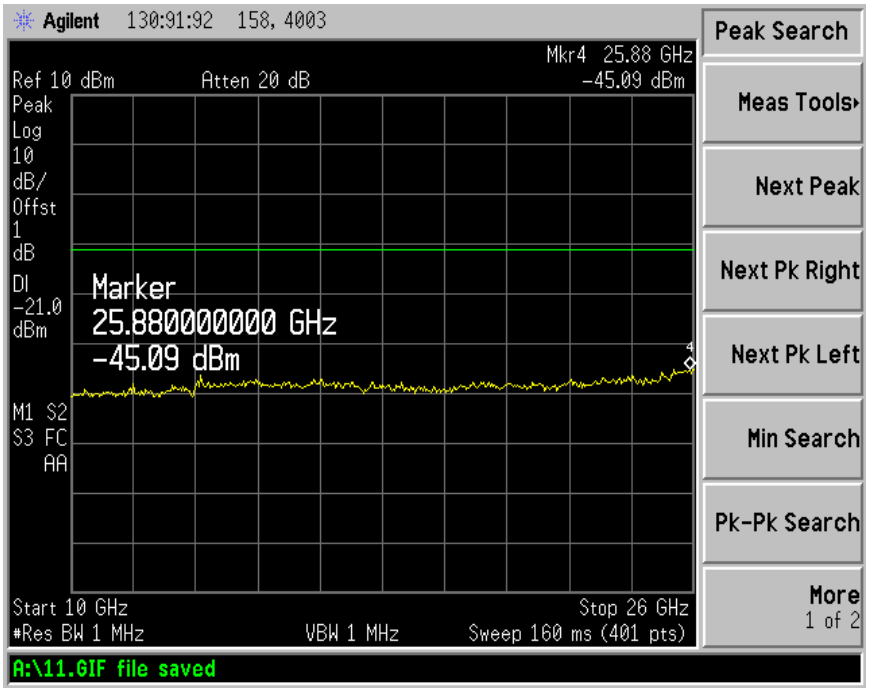
8.4 Trace data of band-edge & Out of Emission

Out of Emission

11ch (30MHz~10GHz)



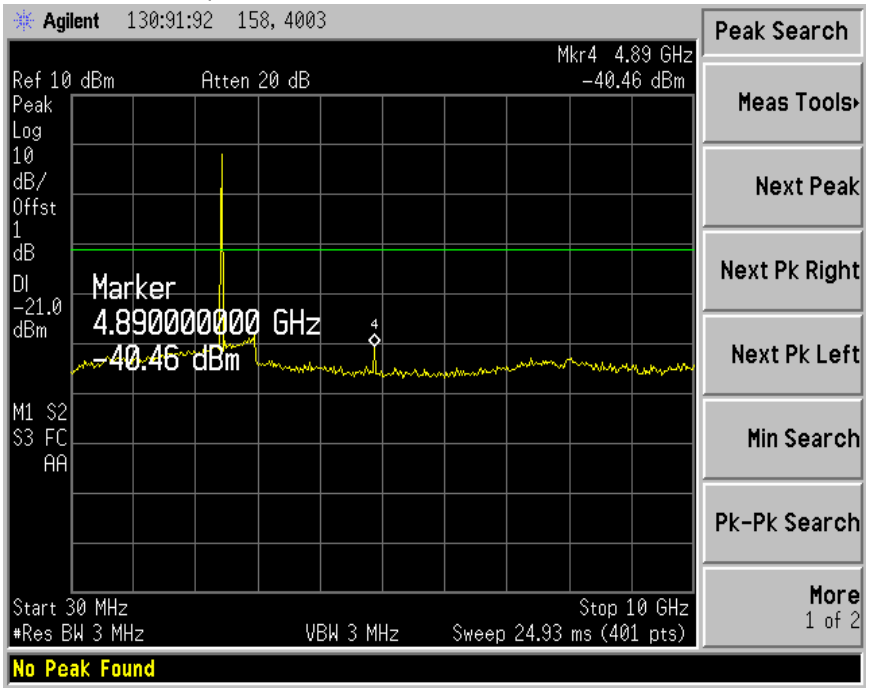
11ch (10GHz~26GHz)



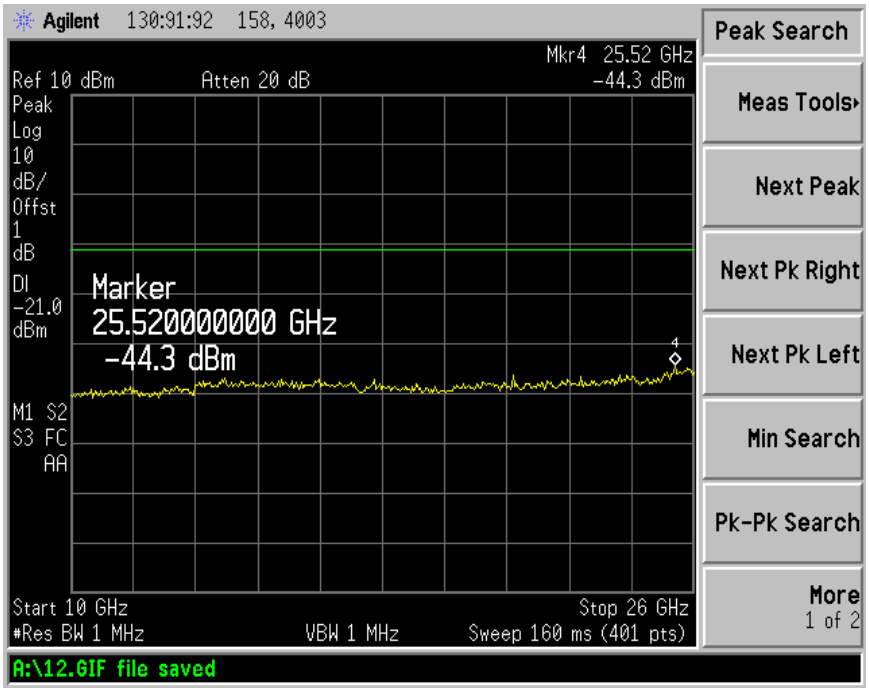
8.4 Trace data of band-edge & Out of Emission

Out of Emission

19ch (30MHz~10GHz)



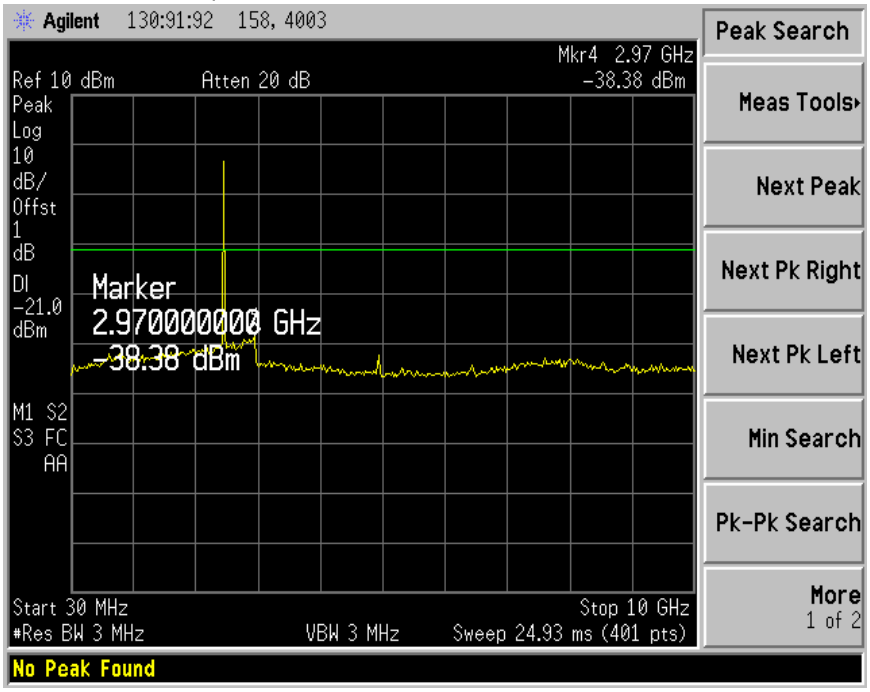
19ch (10GHz~26GHz)



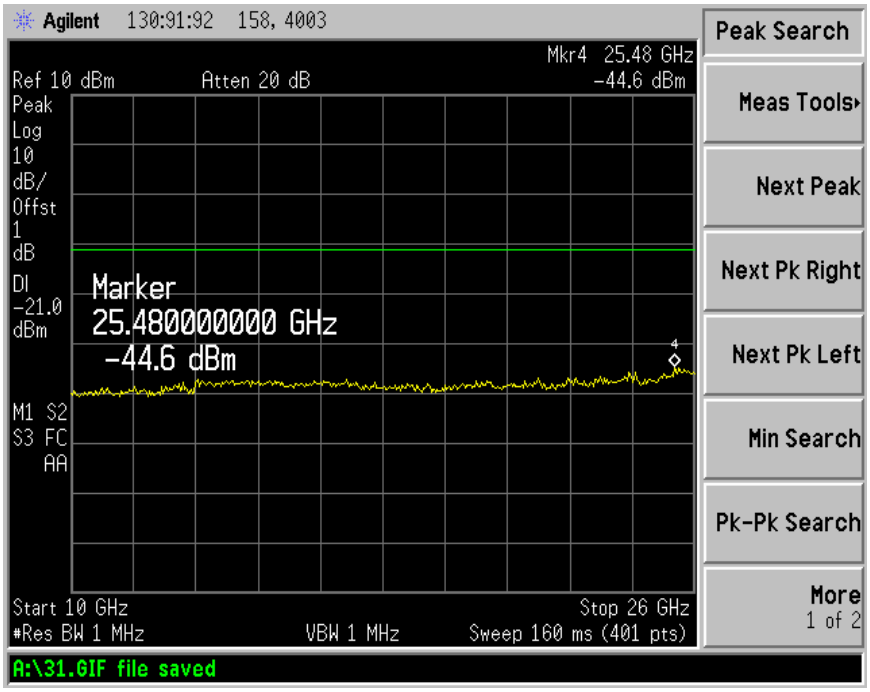
8.4 Trace data of band-edge & Out of Emission

Out of Emission

19ch (30MHz~10GHz)



19ch (10GHz~26GHz)



9. Measurement of radiated disturbance

Above 30 MHz Electric Field strength was measured in accordance with 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) on an open test site, which allows a 3 m distance measurement. The EUT was placed in the center of wooden turntable. The height of this table was 0.8 m. 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
Turn Table	2081-1.2M	EMCO	NONE	-
Antenna Mast	2070-1	EMCO	0005-2205	-
Pre Amplifier	8447F	HP	2944A03711	11-Jan-12
ANT Mast Controller	2090	EMCO	9612-1202	-
Spectrum Analyzer	R3273	ADVANTEST	110600592	27-Jan-12
Logbicon Antenna	VULB 9160	SCHWARZBECK	3106	21-Mar-12
Test Receiver	ESVS10	Rohde & Schwarz	838562/002	27-Jan-12
Horn Antenna	BBHA 9120 D	Schwarzbeck	352	22-Mar-12
PREAMPLIFIER	8449B	Agilent	3008A00595	27-Jan-12
Pyramidal Horn Antenna	3160-09	ETS-LINDGREN	00102642	7-Sep-12

9.2 Environmental Condition

Test Place : Open site(3 m)

Temperature (°C) : 2 ℃

Humidity (%) : 56 %

9.3 Test Data

Test Date : 29-Dec-11 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)
46.50	39.20	V	1.0	12.70	-24.7	40.0	27.19	-12.81
141.21	37.90	V	1.0	13.43	-23.1	43.5	28.22	-15.28
167.51	39.20	V	1.0	13.47	-22.6	43.5	30.06	-13.44
216.09	34.60	V	1.0	10.69	-22.1	46.0	23.16	-22.84
223.75	35.80	V	1.0	10.94	-22.0	46.0	24.70	-21.30

Remark	*Checked in all 3 axis and the maximum measured data were reported. *CL = Cable Loss-Amplifier Gain *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 : 29-Dec-11 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)								
2405	47.73	H	1.5	27.06	4.61	-	79.40	-
2405	50.63	H	1.5	27.06	4.61	-	82.30	-
4810	52.76	H	1.1	31.48	-28.80	74.00	55.44	18.56
4810	52.11	V	1.3	31.48	-28.80	74.00	54.79	19.21
AV(RBW:1MHz VBW:10Hz)								
2405	45.00	H	1.3	27.06	4.61	-	76.67	-
2405	46.42	V	1.1	27.06	4.61	-	78.09	-
4810	44.96	H	1.1	31.48	-28.80	54.00	47.64	6.36
4810	43.24	V	1.1	31.48	-28.80	54.00	45.92	8.08
Remark	H : Horizontal, V : Vertical TEST MODE : ZigBee-CH11(2405MHz) *The TX signal isn't detected from 3 th harmonics. *OB = Operating band *CL = Cable Loss-Amplifier Gain(In case of above1000MHz)							

9.3-2 Test Data

Test Date : 29-Dec-11 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	50.11	H	1.1	27.15	4.62	-	81.88	-
2445	52.87	V	1.1	27.15	4.62	-	84.64	-
4890	50.96	H	1.2	31.62	-28.80	74.00	53.78	20.22
4890	52.01	V	1.2	31.62	-28.80	74.00	54.83	19.17
AV(RBW:1MHz VBW:10Hz)								
2445	48.76	H	1.1	27.15	4.62	-	80.53	-
2445	50.71	V	1.1	27.15	4.62	-	82.48	-
4890	43.74	H	1.2	31.62	-28.80	54.00	46.56	7.44
4890	43.01	V	1.2	31.62	-28.80	54.00	45.83	8.17
Remark	H : Horizontal, V : Vertical TEST MODE : ZigBee-CH18(2445MHz) *The TX signal isn't detected from 3 th harmonics. *OB = Operating band *CL = Cable Loss-Amplifier Gain(In case of above1000MHz)							

9.3-3 Test Data

Test Date : 29-Dec-11 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	51.84	H	1.1	27.25	4.70	-	83.79	-
2480	55.02	V	1.1	27.25	4.70	-	86.97	-
4960	51.11	H	1.3	31.78	-28.72	74.00	54.17	19.83
4960	52.11	V	1.2	31.78	-28.72	74.00	55.17	18.83
AV(RBW:1MHz VBW:10Hz)								
2480	49.85	H	1.1	27.25	4.70	-	81.80	-
2480	52.04	V	1.1	27.25	4.70	-	83.99	-
4960	45.03	H	1.3	31.78	-28.72	54.00	48.09	5.91
4960	44.12	V	1.2	31.78	-28.72	54.00	47.18	6.82
Remark	H : Horizontal, V : Vertical TEST MODE : ZigBee-CH26(2480MHz) *The TX signal isn't detected from 3 th harmonics. *OB = Operating band *CL = Cable Loss-Amplifier Gain(In case of above1000MHz)							

10. 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. 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 40cm 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.

10.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESHS 30	Rohde & Schwarz	828765/002	16-Dec-12
LISN	ESH2-Z5	POLARAD	872461/048	11-Jan-12
LISN	ESH3-Z5	Rohde & Schwarz	836679/025	27-Sep-12
Pulse Limiter	ESH3Z2	Rohde & Schwarz	NONE	21-Mar-12

10.2 Environmental Condition

Test Place : Shielded Room

Temperature (°C) : 21 ℃

Humidity (%) : 43 % R.H.

10.3 Test Data

Test Date : 29-Dec-11

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)
0.15	0.17	0.35	N	66.00	37.37	37.89	56.00		
0.18	0.17	0.36	H	64.49	34.31	34.84	54.49		
0.21	0.17	0.36	N	63.21	29.98	30.51	53.21		
0.24	0.17	0.36	N	62.10	26.40	26.93	52.10		
0.42	0.18	0.37	N	57.45	26.89	27.44	47.45		
0.48	0.19	0.37	N	56.34	33.48	34.04	46.34		
0.79	0.20	0.40	N	56.00	24.79	25.39	46.00		
0.82	0.20	0.41	H	56.00	23.17	23.78	46.00		
1.09	0.21	0.47	N	56.00	25.41	26.09	46.00		
1.37	0.22	0.46	N	56.00	23.91	24.59	46.00		
1.77	0.23	0.45	H	56.00	22.05	22.73	46.00		
2.04	0.24	0.44	N	56.00	24.44	25.12	46.00		
6.81	0.35	0.31	H	60.00	17.25	17.91	50.00		
9.01	0.38	0.45	H	60.00	18.99	19.81	50.00		
11.26	0.43	0.53	N	60.00	17.74	18.70	50.00		
13.10	0.50	0.54	N	60.00	18.65	19.68	50.00		
14.07	0.53	0.54	N	60.00	17.27	18.34	50.00		
28.84	0.72	0.82	N	60.00	19.31	20.85	50.00		
Remark	H : Hot Line, N : Neutral Line								

Appendix 1. Special diagram

*HOT

ES TECH
HOT LINE

30 Dec 2011 18:35

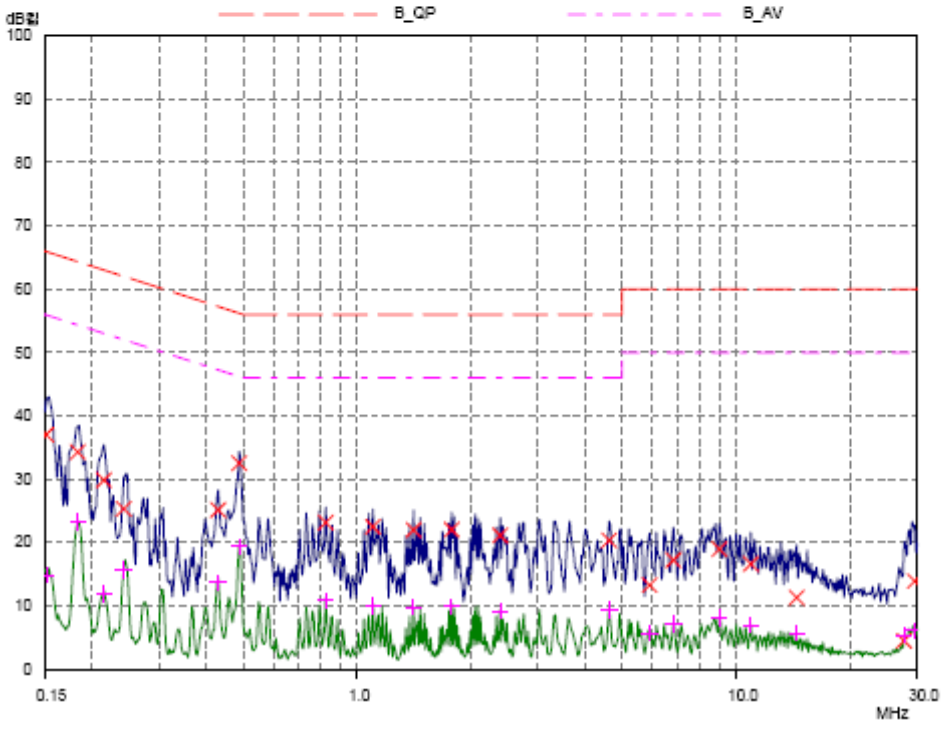
EUT: HRM-1000
Manuf: H3 SYSTEM Co.,Ltd
Op Cond: 120 V
Operator: J.H.KIM
Test Spec: CLASS B
Comment:

Result File: 120105_h.dat : ESTF151201-005

Scan Settings (1 Range)

Frequencies			Receiver Settings					
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
ES TECH
NEUTRAL LINE

30 Dec 2011 16:27

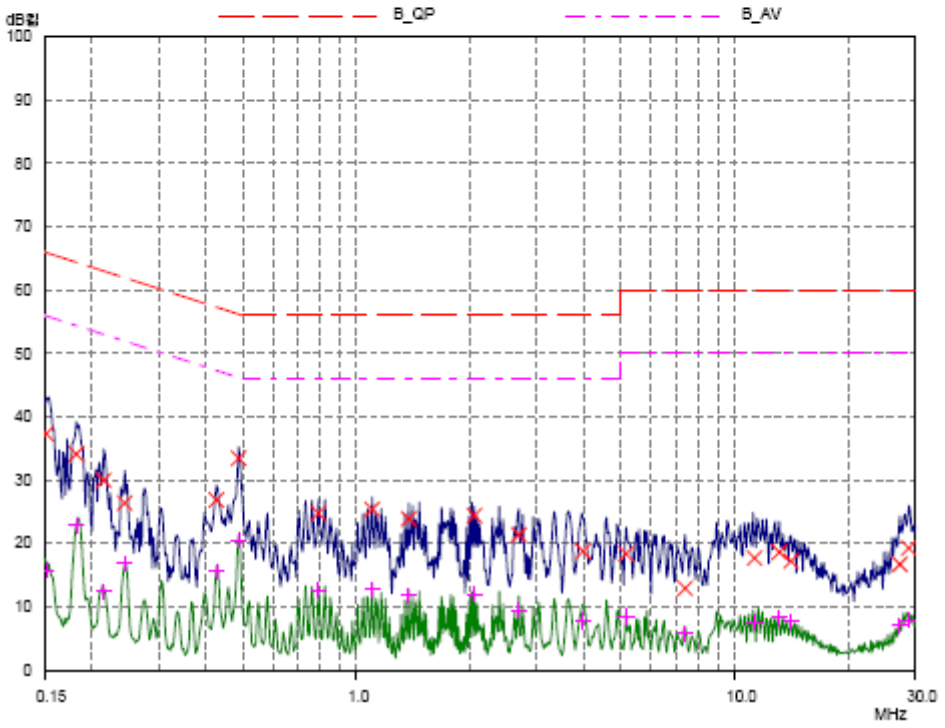
EUT: HRM-1000
Manuf: H3 SYSTEM Co.,Ltd
Op Cond: 120 V
Operator: J.H.KIM
Test Spec: CLASS B
Comment:

Result File: 120105_n.dat : ESTF151201-005

Scan Settings (1 Range)

Frequencies			Receiver Settings					
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

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 3.5 dBi.