FCC 47 CFR PART 15 SUBPART C: 2012 AND ANSI C63.4: 2009

TEST REPORT

For

QardioArm

Model Number: A100

Brand: QARDIO

Issued for

Qardio, Inc

340 S Lemon Ave #1104F, Walnut, California 91789, USA.

Issued by

Compliance Certification Services Inc.
Tainan Lab.
No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)
TEL: 886-6-580-2201
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Issued Date: November 29, 2013

Testing Laboratory
1109

REVISION HISTORY

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	November 29, 2013	Initial Issue	ALL	Eva Lin

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1. TEST REPORT CERTIFICATION

Applicant	：**Qardio, Inc**
Address	：340 S Lemon Ave #1104F, Walnut, California 91789, USA.
Manufacturer	：**YA HORNG ELECTORNIC CO., LTD.**
Address	：No.35, Shalun, Anding Dist., Tainan City , Taiwan
Equipment Under Test	：QardioArm
Model Number	：A100
Brand Name	：QARDIO
Date of Test	：November 18, 2013 – November 21, 2013

APPLICABLE STANDARD	
STANDARD	**TEST RESULT**
FCC Part 15 Subpart C: 2012 AND ANSI C63.4 : 2009	No non-compliance noted

Approved by:

Jeter Wu
Assistant Manager

Reviewed by:

Eric Huang
Assistant Section Manager

2. EUT DESCRIPTION

Product Name	QardioArm
Model Number	A100
Brand Name	QARDIO
Received Date	November 11, 2013
Operating Frequency Range	GFSK Mode : 2402MHz~2480MHz
Transmit Power	GFSK Mode : -6.98dBm (0.20045mW)
Channel Spacing	GFSK Mode : 2 MHz
Channel Number	GFSK Mode : 40 Channels
Transmit Data Rate	GFSK Mode：1 Mbps
Type of Modulation	GFSK：DSSS with DBPSK, DQPSK and CCK
Frequency Selection	By software / firmware
Antenna Type	Type: Multilayer Chip Antenna Model: AT8010-E2R9HAA_ Brand: ACX Gain: 2.5 dBi
Power Source	DC 6V
RF Exposure Evaluation	Since the EUT is classed portable device, and the maximum peak power -6.98dBm (0.20045mW) is less than the SAR exclusion test threshold. Therefore, SAR test is not required.
Temperature Range	10 ~ +40°C

REMARK: 1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: **2ABF2-888ARM** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.
3. For more details, please refer to the user manual.

3. DESCRIPTION OF TEST MODES

The EUT is a QardioArm.

The RF module is manufactured by EnzyTek Technology, Inc.

The antenna peak gain 2.5 dBi (highest gain) were chosen for full testing.

GFSK mode

The EUT had been tested under operating condition.

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2402
Middle	2440
High	2480

GFSK mode: 1Mbps long data rates (worst case) were chosen for full testing.

The worst-case data rates are determined according to the description above, based on the investigations by measuring the PSD, peak power and average power across all the data rates, bandwidths, modulations and spatial stream modes.

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CFR 47 15.207, 15.209 and 15.247 and KDB 558074.

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.7:1992, ANSI C63.4: 2009 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.3 LABORATORY ACCREDITATIONS LISTINGS

The test facilities used to perform radiated and conducted emissions tests are accredited by Taiwan Accreditation Foundation for the specific scope of accreditation under Lab Code: 1109 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by TAF or any agency of the Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: TW-1037 and 455173).

5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

Taiwan	TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	Industry Canada
Germany	TUV NORD
Taiwan	BSMI
USA	FCC

Copies of granted accreditation certificates are available for downloading from our web site, http://www.ccsrf.com

6. CALIBRATION AND UNCERTAINTY

6.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer’s recommendations, and is traceable to recognized national standards.

6.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

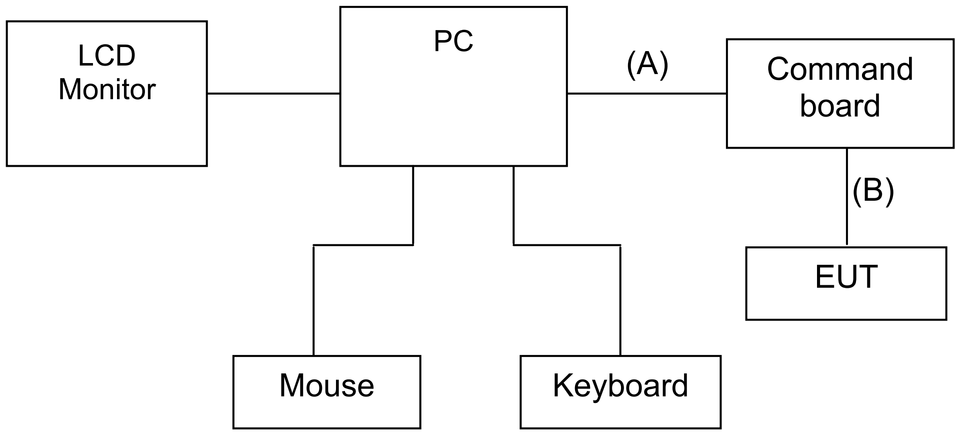
PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz Test Site : OATS-6	±3.3456dB
Radiated Emission, 200 to 1000 MHz Test Site : OATS-6	±2.6828dB
Radiated Emission, 1 to 8 GHz	± 2.6485dB
Radiated Emission, 8 to 18 GHz	± 2.6852dB
Radiated Emission, 18 to 26.5 GHz	± 2.6485dB
Radiated Emission, 26 to 40 GHz	± 3.0295dB
Power Line Conducted Emission	±1.91dB
Band Width	136.49kHz
Peak Output Power MU	±1.904dB
Band Edge MU	±0.302dBuV
Channel Separation MU	361.69Hz
Duty Cycle MU	0.064ms
Frequency Stability MU	0.223kHz

This measurement uncertainty is confidence of approximately 95%, k=2

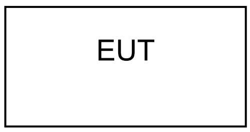
7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

RF Test Setup:



EMI Test Setup:



7.2 SUPPORT EQUIPMENT

RF test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1.	Keyboard (USB)	DETROIS	KB-2181	DOC	Keyboard cable, shd, 1.4m
2	Mouse (USB)	I-DRIVER	P002	DOC	Mouse cable, shd, 1.4m
3	LCD Monitor	SAMSUNG	710VS	GS17H9NXB 18699N	VGA cable, unsh, 1.8m, 2 cores
4	PC	N/A	N/A	DOC	Power cable, unshd, 1.6m

No.	Signal cable description	
A	USB	Shielded, 1.8m, 1pcs.
B	Command	Unshielded, 0.2m, 7pcs.

EMI test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1.	N/A	---	---	---	---

No.	Signal cable description	
A	N/A	---

REMARK:

1. All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

7.3 EUT OPERATING CONDITION

RF Setup

1. Set up all computers like the setup diagram.
2. The “uEnergyTest” software was used for testing.
3.Choose SPI Transport “USB SPI(253531)”.
4. Choose Source “Chip Non-Volatile Memory”
5. Choose Chip NVM Type “EEPROM”

TX Mode:

PACKET TRANSMIT
Channel (0~39) > 0、19、39
Pkt. Length (0~37) > 37
Payload Type (0~7) > 0
Num. Pkts. (0~65535) > 0

RX Mode:

RECEIVE
Channel (0~39) > 0、19、39

3. All of the function are under run.
4. Start test.

8. APPLICABLE LIMITS AND TEST RESULTS

8.1 6DB BANDWIDTH

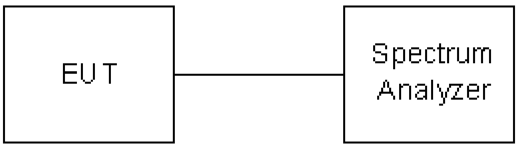
LIMIT

§ 15.207(a) (2) For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSV	101073	APR. 25, 2014

TEST SETUP



TEST PROCEDURE

The tests were performed in accordance with KDB 558074 8.1 & 8.2.

Option 1:

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) 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.

Option 2:

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

TEST RESULTS

No non-compliance noted.

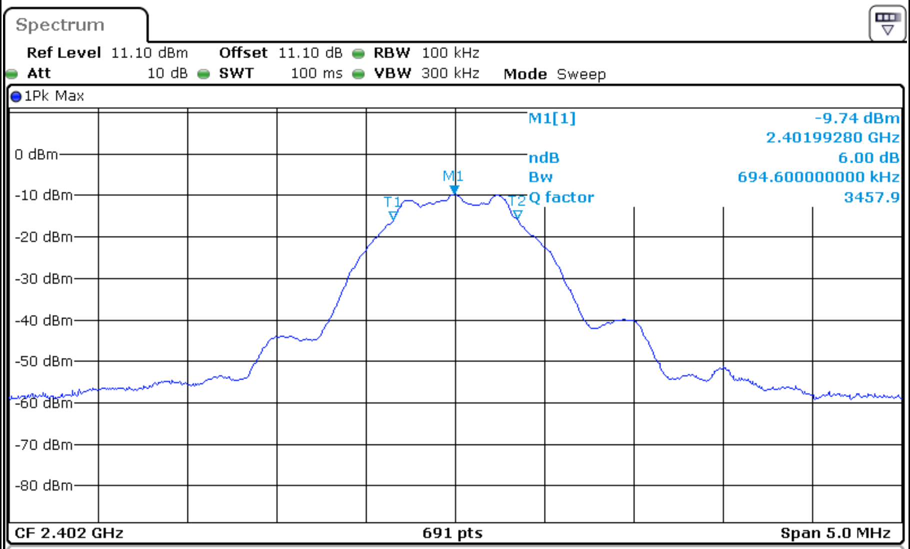
GFSK mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Minimum Limit (kHz)	Pass / Fail
Low	2402	694.60	500	PASS
Middle	2440	687.40	500	PASS
High	2480	694.60	500	PASS

NOTE : 1. At finial test to get the worst-case emission at1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

6dB BANDWIDTH (GFSK MODE)

CH Low (GFSK MODE)

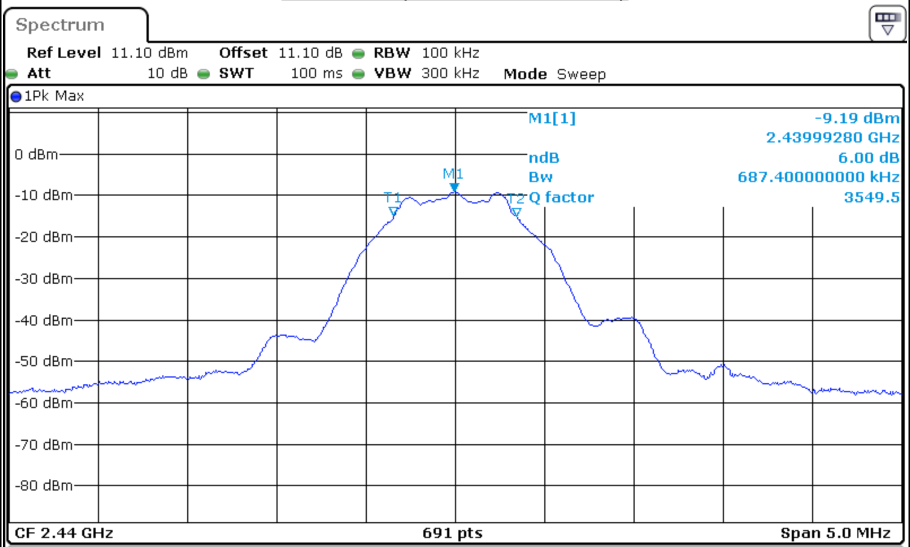


Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
M1		1	2.4019928 GHz	-9.74 dBm	ndB down	694.6 kHz
T1		1	2.4016527 GHz	-15.82 dBm	ndB	6.00 dB
T2		1	2.4023473 GHz	-15.70 dBm	Q factor	3457.9

Date: 21.NOV.2013 10:13:00

CH Mid (GFSK MODE)

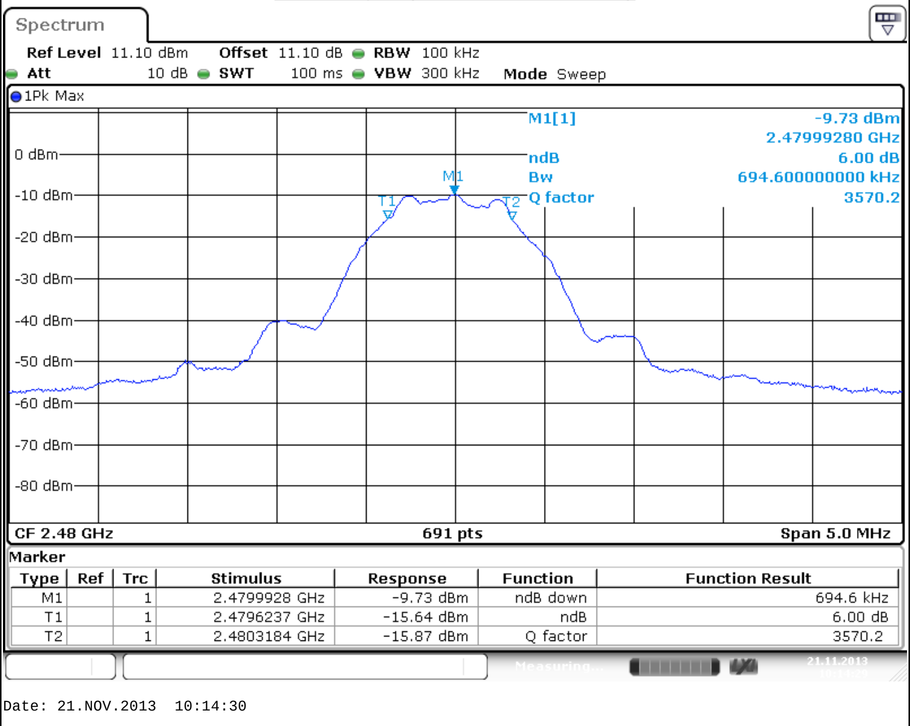


Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
M1		1	2.4399928 GHz	-9.19 dBm	ndB down	687.4 kHz
T1		1	2.4396527 GHz	-14.79 dBm	ndB	6.00 dB
T2		1	2.4403401 GHz	-15.17 dBm	Q factor	3549.5

Date: 21.NOV.2013 10:13:44

CH High (GFSK MODE)



8.2 MAXIMUM PEAK OUTPUT POWER

LIMIT

§ 15.247(b) The maximum peak output power of the intentional radiator shall not exceed the following :

§ 15.247(b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands : 1 watt.

§ 15.247(b) (4) Except as shown in paragraphs (c) of this section , if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2), and (b)(3) of this section , as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

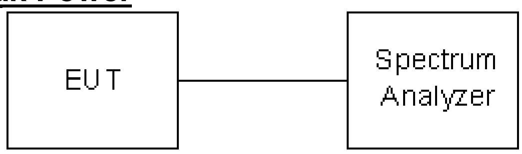
TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSV	101073	APR. 25, 2014
Power Meter	Anritsu	ML2487A	6K00003888	JUN. 24, 2014

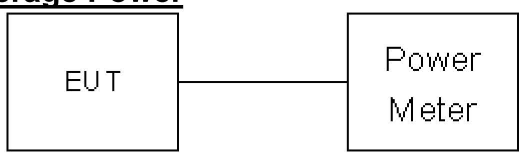
Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP

For Peak Power



For Average Power



TEST PROCEDURE

The tests were performed in accordance with KDB 558074 9.1.2 & 9.2.2.3 .

Integrated band power method

This procedure may be used when the maximum available RBW of the measurement instrument is less than the DTS bandwidth.
a) Set the RBW = 1 MHz.
b) Set the VBW ≥ 3 RBW
c) Set the span ≥ 1.5 x DTS bandwidth.
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

Average Power

Connect the EUT to power meter, set the center frequency of the power meter to the channel center frequency.

GFSK mode

Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2402	-7.43	30.00	PASS
Middle	2440	-6.98	30.00	PASS
High	2480	-7.50	30.00	PASS

NOTE : 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

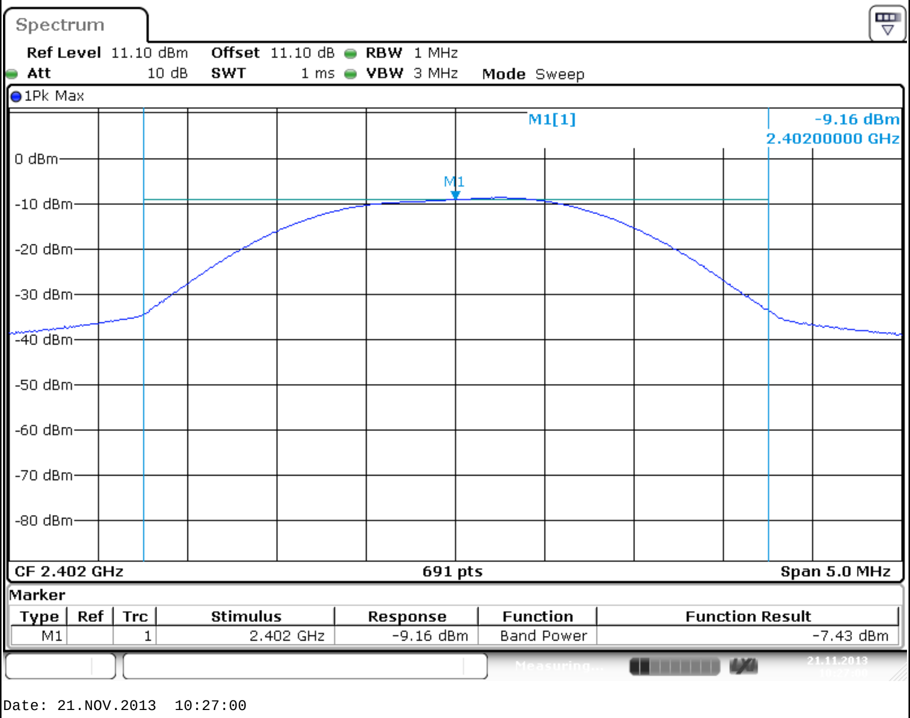
Average Power Data

GFSK mode

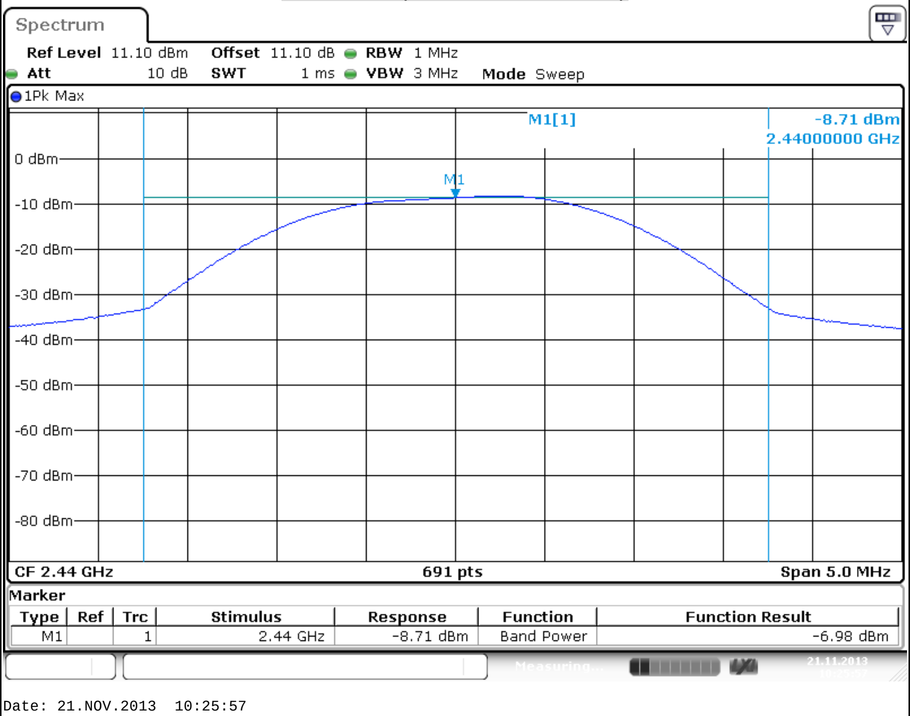
Channel	Channel Frequency (MHz)	Average Power (dBm)
Low	2402	-12.04
Middle	2440	-11.68
High	2480	-12.35

MAXIMUM PEAK OUTPUT POWER (GFSK MODE)

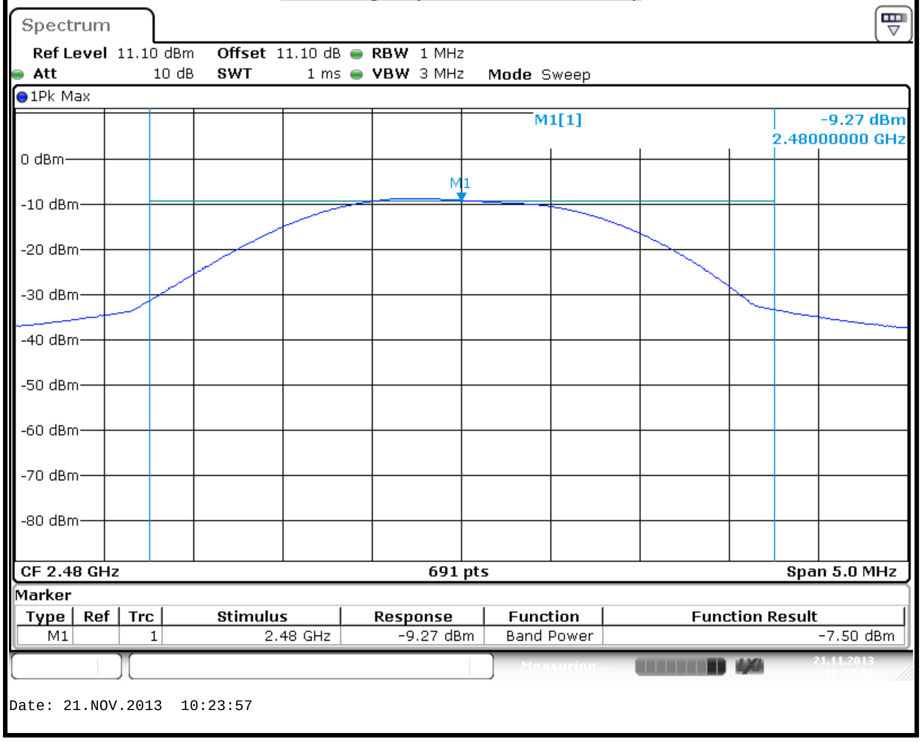
CH Low (GFSK MODE)



CH Mid (GFSK MODE)



CH High (GFSK MODE)



8.3 MAXIMUM PERMISSIBLE EXPOSURE

According to FCC 1.1310 : The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time
(A) Limits for Occupational / Control Exposures				
300-1,500	--	--	F/300	6
1,500-100,000	--	--	5	6
(B) Limits for General Population / Uncontrol Exposures				
300-1,500	--	--	F/1500	6
1,500-100,000	--	--	1	30

CALCULATIONS

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{3770}$

Where E = Field strength in Volts / meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770 d^2}$$

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and

d (cm) = d(m) / 100

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$

Where d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm^2

LIMIT

Power Density Limit, S=1.0mW/cm^2

TEST RESULTS

※Since the EUT is classed portable device, and the maximum peak power -6.98dBm (0.20045mW) is less than the SAR exclusion test threshold. Therefore, SAR test is not required.

8.4 POWER SPECTRAL DENSITY

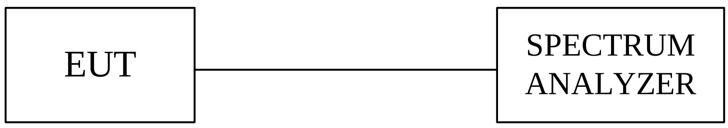
LIMIT

§ 15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSV	101073	APR. 25, 2014

TEST SETUP



TEST PROCEDURE

The tests were performed in accordance with KDB 558074 10.2.

Method PKPSD (peak PSD)

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.
a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST RESULTS

No non-compliance noted.

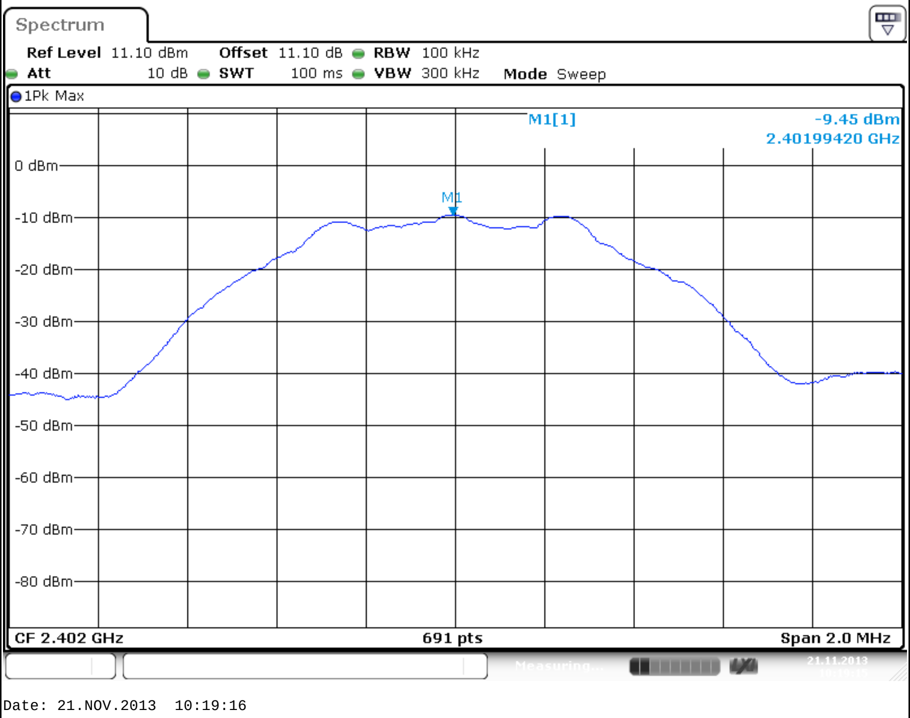
GFSK mode

Channel	Frequency (MHz)	Reading (dBm)	Limit (dBm)	Margin (dB)	Result
Low	2402	-9.45	8.00	-17.45	PASS
Middle	2440	-8.99	8.00	-16.99	PASS
High	2480	-9.58	8.00	-17.58	PASS

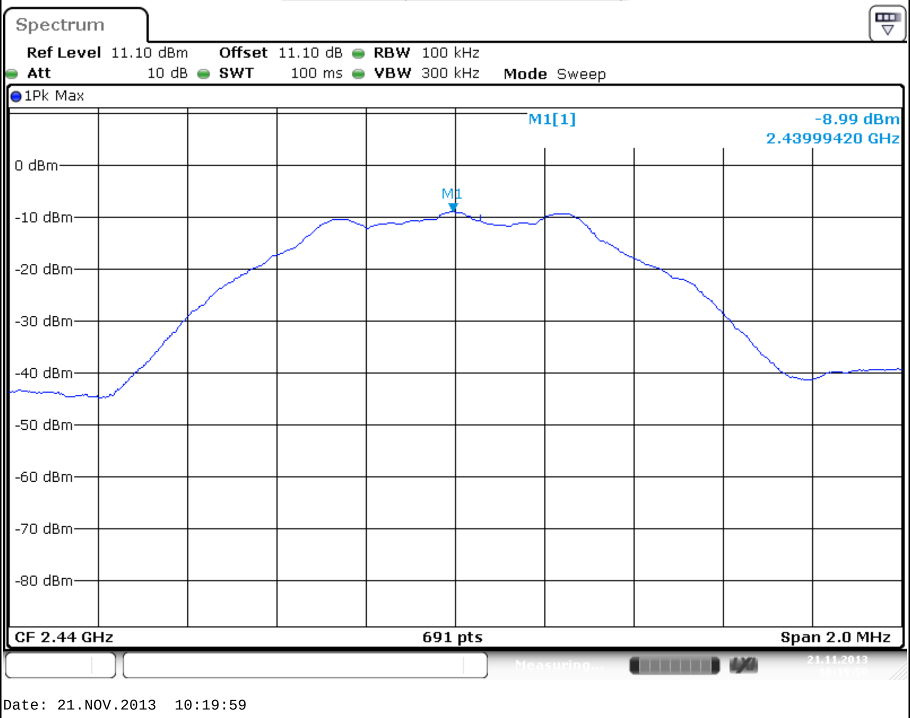
NOTE : 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

POWER SPECTRAL DENSITY (GFSK MODE)

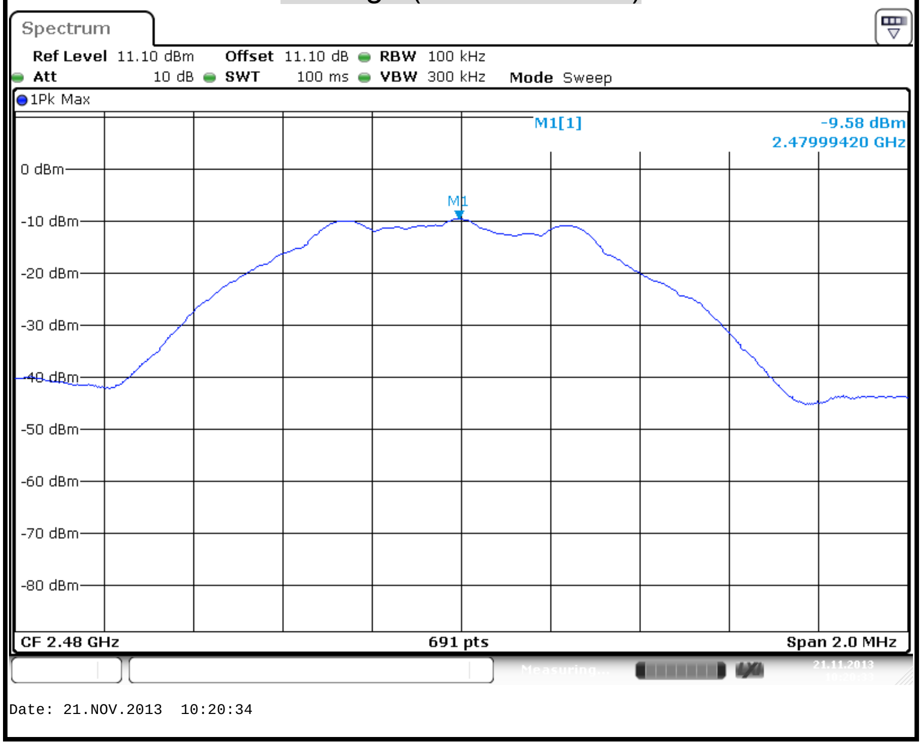
CH Low (GFSK MODE)



CH Mid (GFSK MODE)



CH High (GFSK MODE)



8.5 DUTY CYCLE

LIMIT

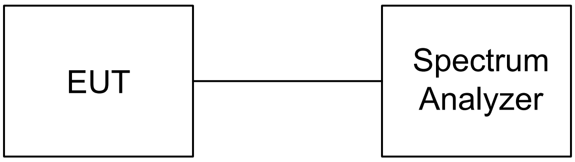
Nil (No dedicated limit specified in the Rules)

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSV	101073	APR. 25, 2014

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP



TEST PROCEDURE

a) Place the EUT on the table and set it in transmitting mode.

b) Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

c) The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

TEST RESULTS

No non-compliance noted.

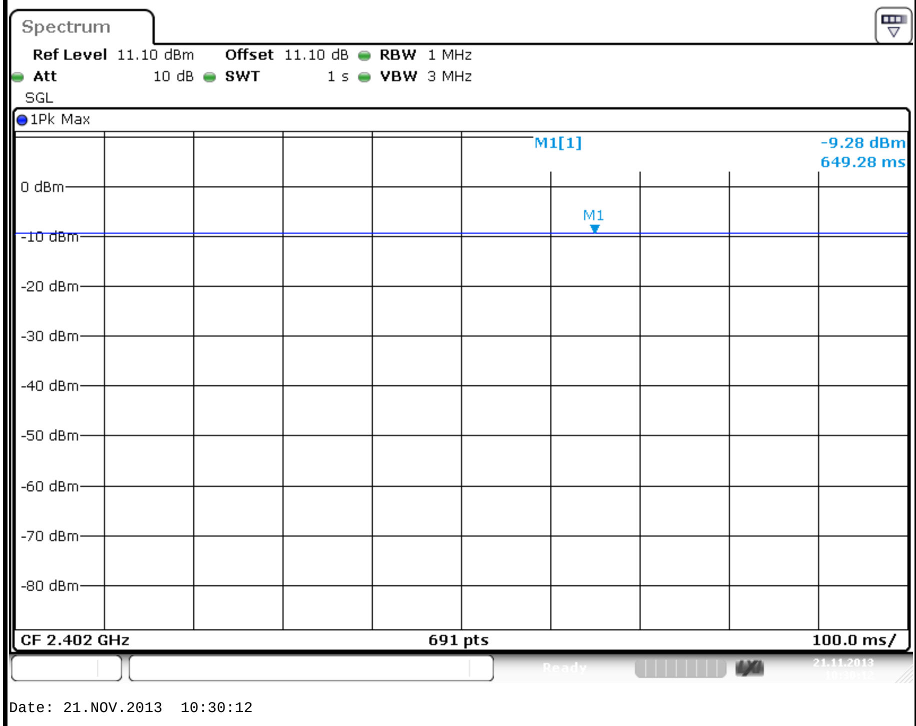
TEST DATA

	us	Times	Ton	Total Ton time(ms)
Ton1	100000.000	1	100000.000	100.000
Ton2		0	0.000	
Ton3		0	0.000	
Tp				100.000

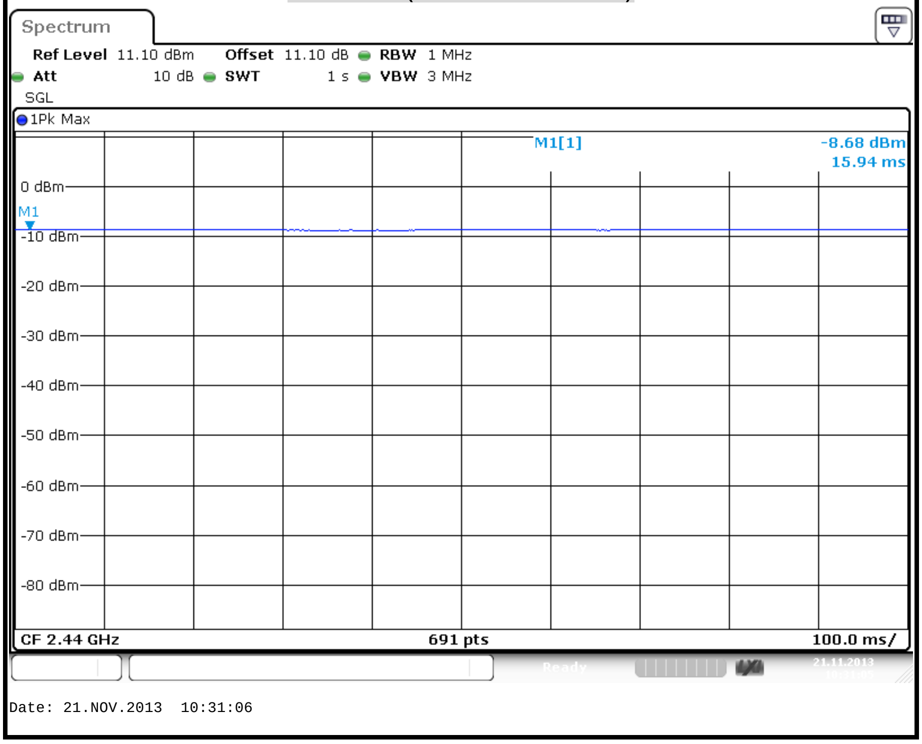
Ton	100.000		
Tp(Ton+Toff)	100.000		
Duty Cycle	1.000	100	%
Duty Factor	0.000		

TEST PLOT

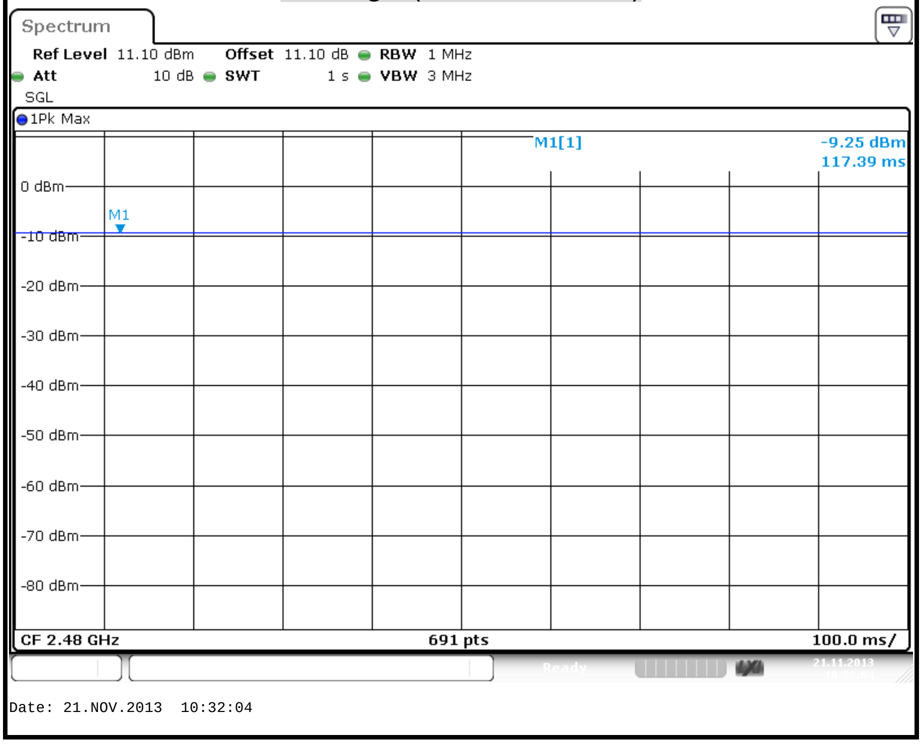
CH Low (GFSK MODE)



CH Mid (GFSK MODE)



CH High (GFSK MODE)



8.6 CONDUCTED SPURIOUS EMISSION

LIMITS

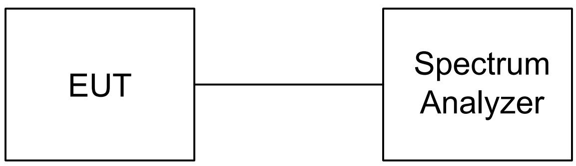
§ 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the and that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSV	101073	APR. 25, 2014

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP



TEST PROCEDURE

The tests were performed in accordance with KDB 558074 11.2 & 11.3 .

11.2 Reference level measurement

Establish a reference level by using the following procedure:

a) Set instrument center frequency to DTS channel center frequency.

b) Set the span to ≥ 1.5 times the *DTS bandwidth*.

c) Set the RBW = 100 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

11.3 Emission level measurement

a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ 3 x RBW.
d) Detector = peak.
e) Ensure that the number of measurement points ≥ span/RBW
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

<u>TEST RESULTS</u>

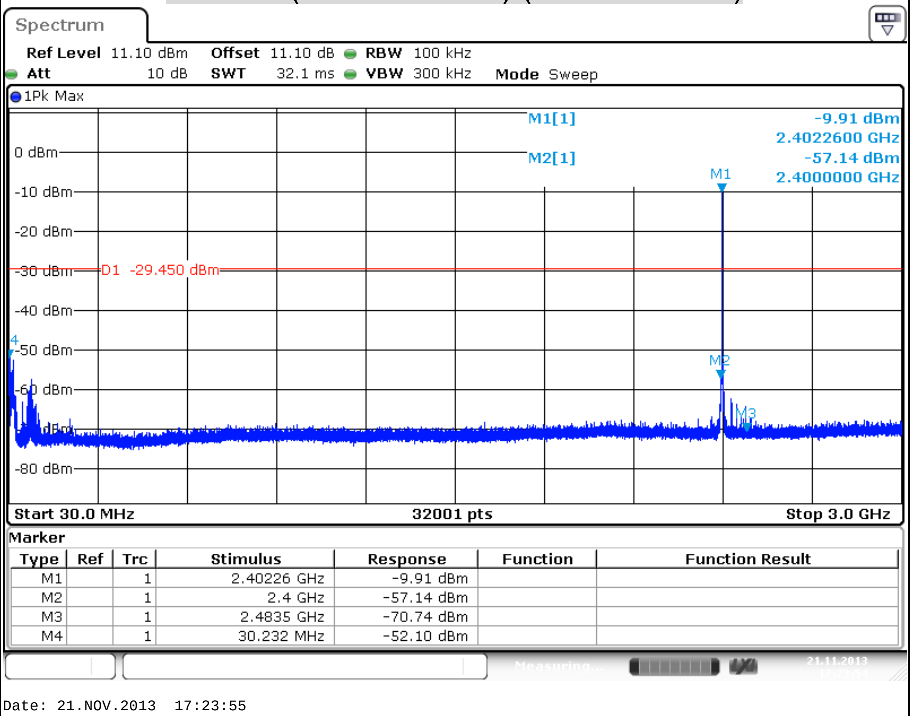
No non-compliance noted.

TEST DATA

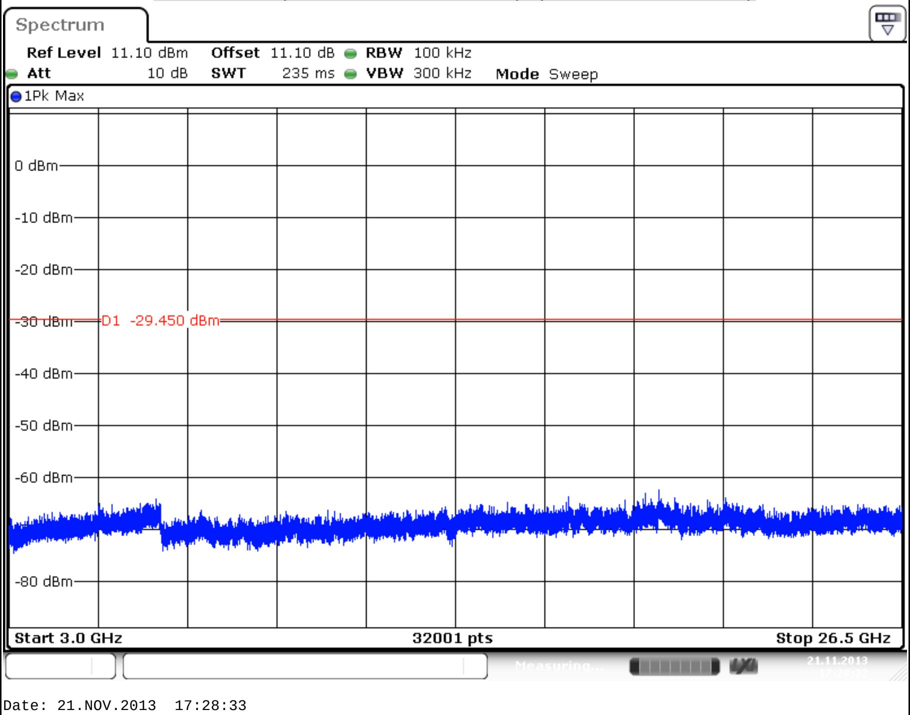
OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

(GFSK MODE)

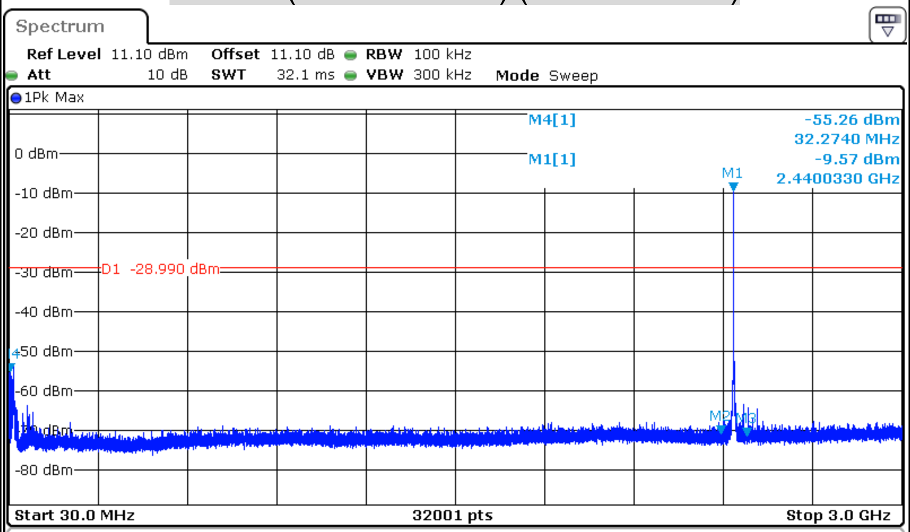
CH Low (30MHz~3GHz) (GFSK MODE)



CH Low (3GHz~26.5GHz) (GFSK MODE)



CH Mid (30MHz~3GHz) (GFSK MODE)

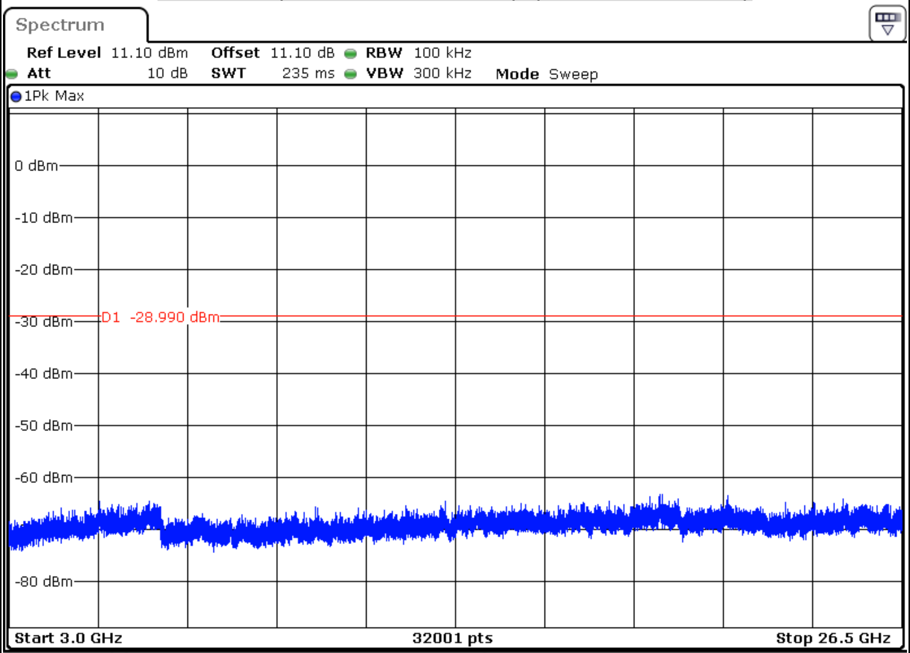


Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
M1		1	2.440033 GHz	-9.57 dBm		
M2		1	2.4 GHz	-70.77 dBm		
M3		1	2.4835 GHz	-71.39 dBm		
M4		1	32.274 MHz	-55.26 dBm		

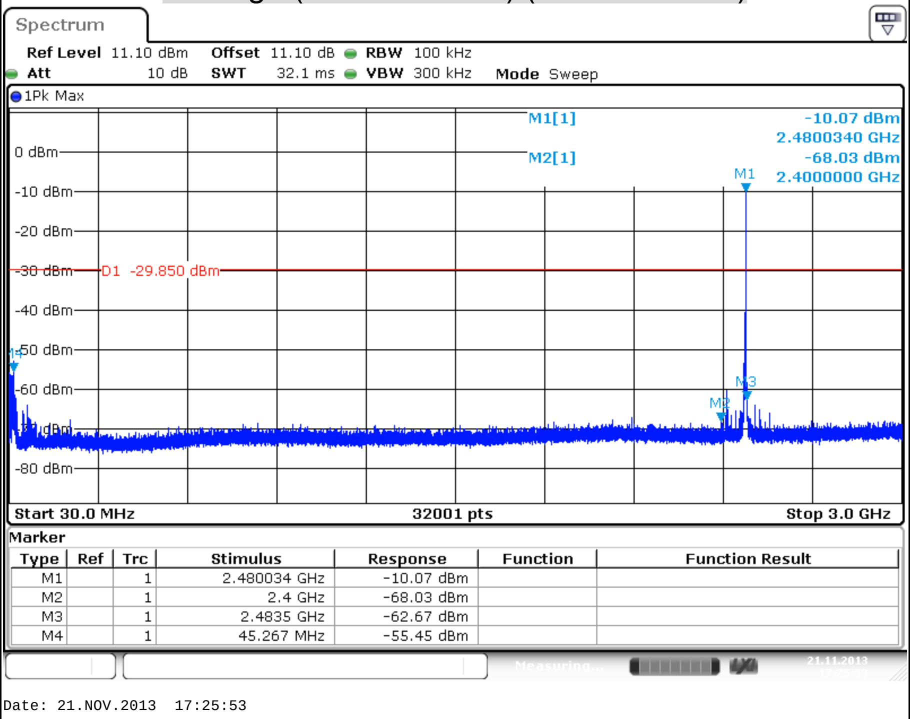
Date: 21.NOV.2013 17:25:06

CH Mid (3GHz~26.5GHz) (GFSK MODE)

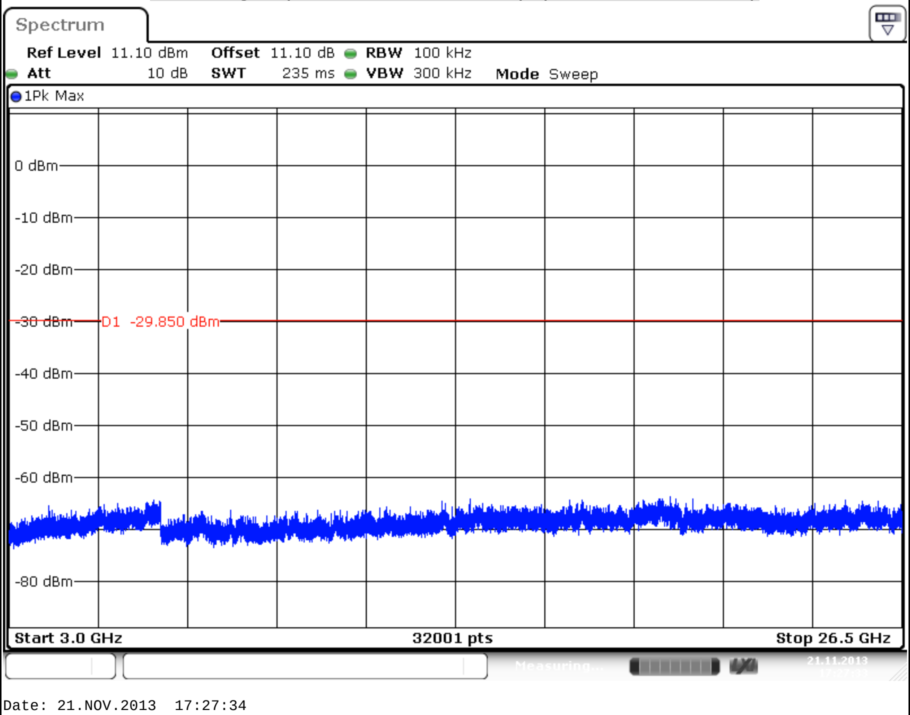


Date: 21.NOV.2013 17:28:03

CH High (30MHz~3GHz) (GFSK MODE)



CH High (3GHz~26.5GHz) (GFSK MODE)



8.7 RADIATED EMISSIONS

8.7.1 TRANSMITTER RADIATED SUPURIOUS EMSSIONS

LIMITS

§ 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 -1710	10.6 -12.7
6.26775 - 6.26825	108 -121.94	1718.8 - 1722.2	13.25 -13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 – 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 -16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3338	36.43 - 36.5
12.57675 - 12.57725	322 -335.4	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown is Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§ 15.209 (a) 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 (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz, However, operation within these frequency bands is permitted under other sections of this Part, e-g, Sections 15.231 and 15.241.

§ 15.209 (b) In the emission table above, the tighter limit applies at the band edges.

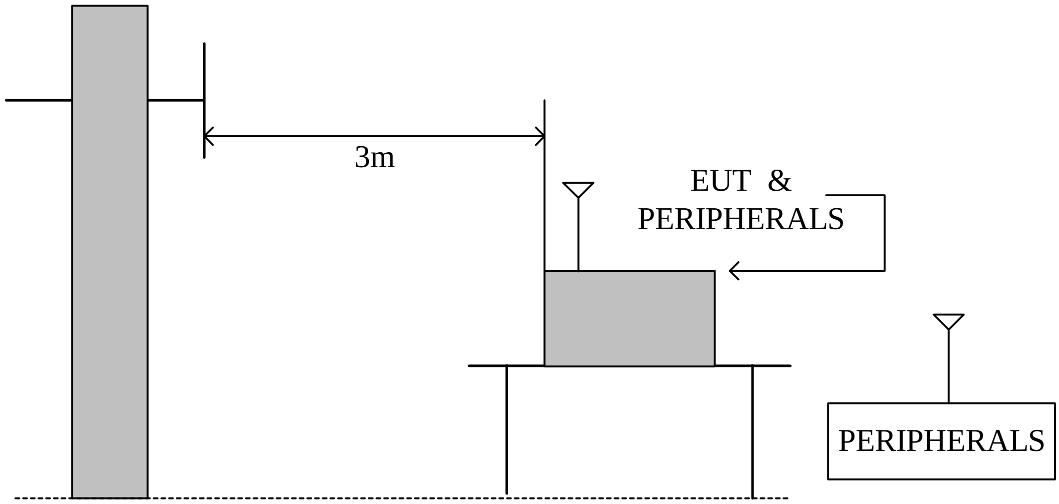
<u>TEST EQUIPMENTS</u>

The following test equipments are utilized in making the measurements contained in this report.

Open Area Test Site # 6				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
TYPE N COAXIAL CABLE	SUHNER	CHA9513	6	DEC. 18, 2013
BI-LOG Antenna	Sunol	JB1	A070506-2	SEP. 09, 2014
LOOP ANTENNA	EMCO	6502	8905-2356	JUN. 10, 2014
Pre-Amplifier	HP	8447F	2944A03817	DEC. 18, 2013
Pre-Amplifier	EMCI	EMC 012645	980097	DEC. 20, 2013
EMI Receiver	R&S	ESVS10	833206/012	JUN. 26, 2014
Horn Antenna	Com-Power	AH-118	071032	DEC. 05, 2013
3116 Double Ridge Antenna (40G)	ETS-LINDGREN	3116	00078900	DEC. 27, 2014
Turn Table	Yo Chen	001	----------	N.C.R.
Antenna Tower	AR	TP1000A	309874	N.C.R.
Controller	CT	SC101	----------	N.C.R.
RF Swicth	E-INSTRUMENT TELH LTD	ERS-180A	EC1204141	N.C.R
Power Meter	Anritsu	ML2487A	6K00003888	JUN. 24, 2014
Power Sensor	Anritsu	MA2491A	33265	JUN. 24, 2014
Temp./Humidity Chamber	K.SON	THS-M1	242	AUG. 08, 2014
DC Power Source	LOKO	DSP-5050	L1507009282	N.C.R
Spectrum Analyzer	R&S	FSV	101073	APR. 25, 2014
Spectrum Analyzer	R&S	FSEK 30	835253/002	SEP. 28, 2014

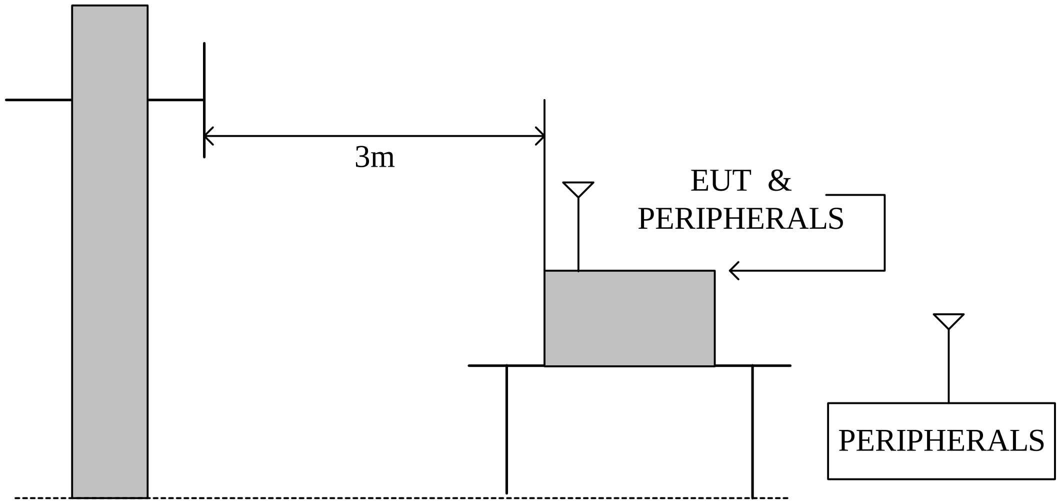
TEST SETUP

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 to 1GHz.



Antenna Elevation Variable

The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz.



Antenna Elevation Variable

TEST PROCEDURE

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.

b. White measuring the radiated emission below 1GHz, the EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. White measuring the radiated emission above 1GHz, the EUT was set 3 meters away from the interference-receiving antenna

c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarization of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. The tests were performed in accordance with KDB 558074 5.4.

NOTE：

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.

2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1GHz.

3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.

4. **No emission is found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)**

TEST RESULTS

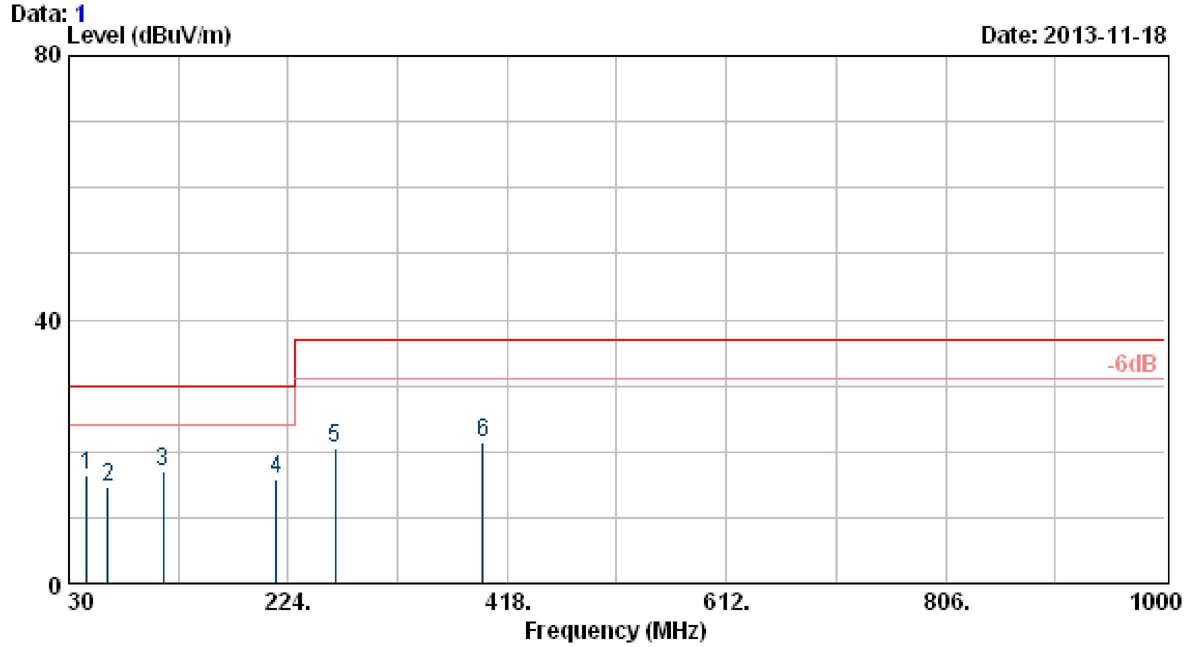
No non-compliance noted.

8.7.2 WORST-CASE RADIATED EMISSION BELOW 1 GHz

Product Name	QardioArm	Test Date	2013/11/18
Model	A100	Test By	Taiyu Cyu
Test Mode	Normal Operation / Worst case	TEMP& Humidity	25.9℃, 57%

Horizontal

(The chart below shows the highest readings taken from the final data.)



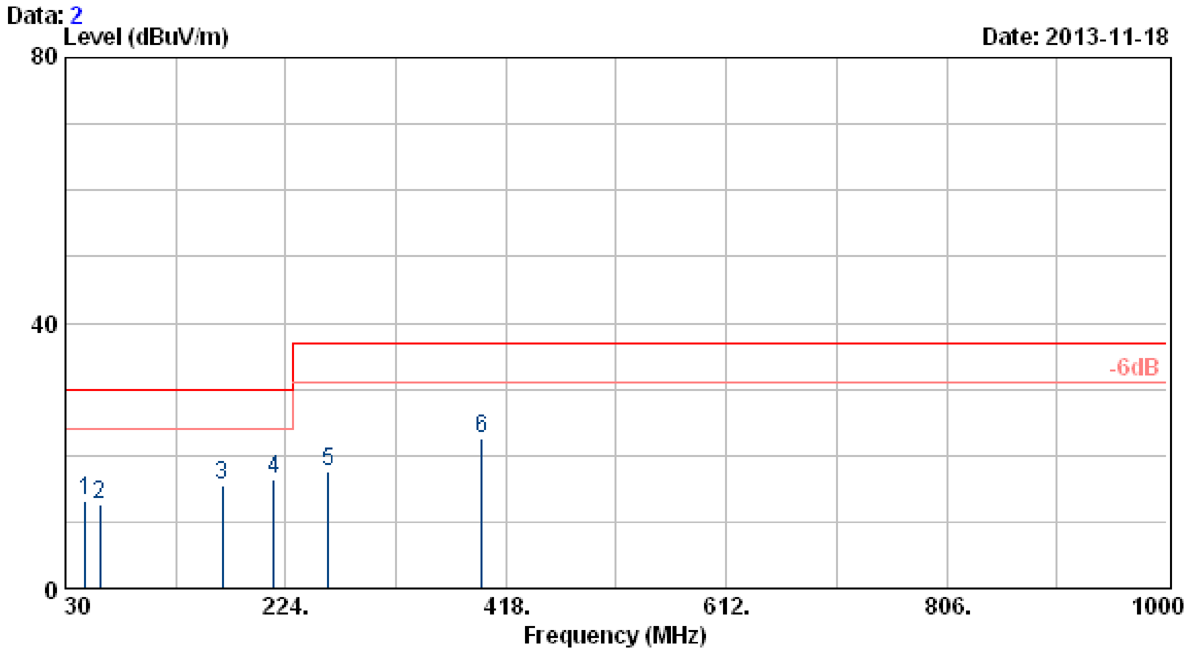
Freq. MHz	Reading Level dBuV	Antenna Factor dB/m	Cable Loss dB	Measure Level dBuV/m	Limit dBuV/m	Over Limit dBuV/m	Detector
45.66	5.59	9.44	1.50	16.52	30.00	-13.48	QP
64.80	5.04	7.78	1.82	14.63	30.00	-15.37	QP
113.29	2.06	12.76	2.31	17.13	30.00	-12.87	QP
213.70	1.29	11.43	3.18	15.90	30.00	-14.10	QP
265.36	4.04	12.54	3.81	20.39	37.00	-16.61	QP
396.18	1.20	15.47	4.82	21.49	37.00	-15.51	QP

Note: 1. QP= Quasi-peak Reading.
2. The other emission levels were very low against the limit

Product Name	QardioArm	Test Date	2013/11/18
Model	A100	Test By	Taiyu Cyu
Test Mode	Normal Operation / Worst case	TEMP& Humidity	25.9℃, 57%

Vertical

(The chart below shows the highest readings taken from the final data.)



Freq. MHz	Reading Level dBuV	Antenna Factor dB/m	Cable Loss dB	Measure Level dBuV/m	Limit dBuV/m	Over Limit dBuV/m	Detector
47.40	2.87	8.82	1.51	13.19	30.00	-16.81	QP
60.31	3.40	7.49	1.72	12.61	30.00	-17.39	QP
168.49	1.06	11.63	2.91	15.60	30.00	-14.40	QP
213.76	1.76	11.43	3.18	16.37	30.00	-13.63	QP
261.76	1.38	12.32	3.77	17.47	37.00	-19.53	QP
396.32	2.17	15.47	4.82	22.46	37.00	-14.54	QP

Note: 1. QP= Quasi-peak Reading.
2. The other emission levels were very low against the limit

8.7.3 TRANSMITTER RADIATED EMISSION ABOVE 1 GHz

Product Name	QardioArm	**Test Date**	2013/11/21
Model	A100	**Test By**	John Chen
Test Mode	GFSK TX (CH Low)	**TEMP& Humidity**	24.4℃, 58%

Horizontal

	TX / GFSK mode / CH Low				Measurement Distance at 3m Horizontal polarity					
	Freq.	**Reading**	**AF**	**Cable Loss**	**Pre-amp**	**Filter**	**Level**	**Limit**	**Margin**	**Mark**
	(MHz)	**(dBµV)**	**(dB/m)**	**(dB)**	**(dB)**	**(dB)**	**(dBµV/m)**	**(dBµV/m)**	**(dB)**	**(P/Q/A)**
*	1199.84	69.79	25.56	1.94	44.92	0.30	52.66	74.00	-21.34	P
*	1199.84	60.06	25.56	1.94	44.92	0.30	42.93	54.00	-11.07	A
*	1500.11	72.14	26.70	2.26	44.66	0.30	56.74	74.00	-17.26	P
*	1500.11	65.73	26.70	2.26	44.66	0.30	50.33	54.00	-3.67	A
*	1586.80	72.85	27.34	2.33	44.69	0.30	58.13	74.00	-15.87	P
*	1586.80	61.22	27.34	2.33	44.69	0.30	46.50	54.00	-7.50	A
*	4804.24	59.98	33.40	3.83	45.05	0.40	52.56	74.00	-21.44	P
*	4804.24	49.03	33.40	3.83	45.05	0.40	41.61	54.00	-12.39	A

Product Name	QardioArm	**Test Date**	2013/11/21
Model	A100	**Test By**	John Chen
Test Mode	GFSK TX (CH Low)	**TEMP& Humidity**	24.4℃, 58%

Vertical

	TX / GFSK mode / CH Low				Measurement Distance at 3m Vertical polarity					
	Freq.	**Reading**	**AF**	**Cable Loss**	**Pre-amp**	**Filter**	**Level**	**Limit**	**Margin**	**Mark**
	(MHz)	**(dBµV)**	**(dB/m)**	**(dB)**	**(dB)**	**(dB)**	**(dBµV/m)**	**(dBµV/m)**	**(dB)**	**(P/Q/A)**
*	1200.12	72.56	25.56	1.94	44.92	0.30	55.43	74.00	-18.57	P
*	1200.12	62.81	25.56	1.94	44.92	0.30	45.68	54.00	-8.32	A
*	1500.12	71.74	26.70	2.26	44.66	0.30	56.34	74.00	-17.66	P
*	1500.12	67.24	26.70	2.26	44.66	0.30	51.84	54.00	-2.16	A
*	1586.07	73.97	27.34	2.33	44.69	0.30	59.24	74.00	-14.76	P
*	1586.07	62.80	27.34	2.33	44.69	0.30	48.07	54.00	-5.93	A
*	4804.08	58.83	33.39	3.83	45.05	0.40	51.41	74.00	-22.59	P
*	4804.08	49.57	33.39	3.83	45.05	0.40	42.15	54.00	-11.85	A

REMARK:

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter – Dist, Margin = Level-Limit
4. The other emission levels were 20dB below the limit
5. The test limit distance is 3M limit.

Product Name	QardioArm	Test Date	2013/11/21
Model	A100	Test By	John Chen
Test Mode	GFSK TX (CH Middle)	TEMP& Humidity	24.4℃, 58%

Horizontal

	TX / GFSK mode / CH Middle				Measurement Distance at 3m Horizontal polarity					
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1200.00	69.52	25.56	1.94	44.92	0.30	52.39	74.00	-21.61	P
*	1200.00	59.47	25.56	1.94	44.92	0.30	42.34	54.00	-11.66	A
*	1500.11	72.49	26.70	2.26	44.66	0.30	57.09	74.00	-16.91	P
*	1500.11	65.84	26.70	2.26	44.66	0.30	50.44	54.00	-3.56	A
*	1584.59	72.49	27.33	2.33	44.69	0.30	57.75	74.00	-16.25	P
*	1584.59	61.13	27.33	2.33	44.69	0.30	46.39	54.00	-7.61	A
*	4879.78	59.20	33.67	3.85	45.13	0.40	51.99	74.00	-22.01	P
*	4879.78	49.41	33.67	3.85	45.13	0.40	42.20	54.00	-11.80	A

Product Name	QardioArm	Test Date	2013/11/21
Model	A100	Test By	John Chen
Test Mode	GFSK TX (CH Middle)	TEMP& Humidity	24.4℃, 58%

Vertical

	TX / GFSK mode / CH Middle				Measurement Distance at 3m Vertical polarity					
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1199.97	71.52	25.56	1.94	44.92	0.30	54.39	74.00	-19.61	P
*	1199.97	61.93	25.56	1.94	44.92	0.30	44.80	54.00	-9.20	A
*	1500.10	71.16	26.70	2.26	44.66	0.30	55.76	74.00	-18.24	P
*	1500.10	66.92	26.70	2.26	44.66	0.30	51.52	54.00	-2.48	A
*	1585.48	74.05	27.33	2.33	44.69	0.30	59.32	74.00	-14.68	P
*	1585.48	62.81	27.33	2.33	44.69	0.30	48.08	54.00	-5.92	A
*	4879.97	59.33	33.67	3.85	45.13	0.40	52.12	74.00	-21.88	P
*	4879.97	49.66	33.67	3.85	45.13	0.40	42.45	54.00	-11.55	A

REMARK:

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter – Dist, Margin = Level-Limit
4. The other emission levels were 20dB below the limit
5. The test limit distance is 3M limit.

Product Name	QardioArm	Test Date	2013/11/21
Model	A100	Test By	John Chen
Test Mode	GFSK TX (CH High)	TEMP& Humidity	24.4℃, 58%

Horizontal

	TX / GFSK mode / CH High				Measurement Distance at 3m			Horizontal polarity		
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
*	1199.91	70.33	25.56	1.94	44.92	0.30	53.20	74.00	-20.80	P
*	1199.91	60.08	25.56	1.94	44.92	0.30	42.95	54.00	-11.05	A
*	1500.09	72.49	26.70	2.26	44.66	0.30	57.09	74.00	-16.91	P
*	1500.09	65.91	26.70	2.26	44.66	0.30	50.51	54.00	-3.49	A
*	1586.79	72.69	27.34	2.33	44.69	0.30	57.97	74.00	-16.03	P
*	1586.79	60.84	27.34	2.33	44.69	0.30	46.12	54.00	-7.88	A
*	4960.17	58.52	33.96	3.87	45.22	0.40	51.53	74.00	-22.47	P
*	4960.17	48.40	33.96	3.87	45.22	0.40	41.41	54.00	-12.59	A

Product Name	QardioArm	Test Date	2013/11/21
Model	A100	Test By	John Chen
Test Mode	GFSK TX (CH High)	TEMP& Humidity	24.4℃, 58%

Vertical

	TX / GFSK mode / CH High				Measurement Distance at 3m			Vertical polarity		
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
*	1200.12	73.54	25.56	1.94	44.92	0.30	56.41	74.00	-17.59	P
*	1200.12	63.20	25.56	1.94	44.92	0.30	46.07	54.00	-7.93	A
*	1500.12	71.05	26.70	2.26	44.66	0.30	55.65	74.00	-18.35	P
*	1500.12	66.84	26.70	2.26	44.66	0.30	51.44	54.00	-2.56	A
*	1586.07	74.37	27.34	2.33	44.69	0.30	59.64	74.00	-14.36	P
*	1586.07	63.16	27.34	2.33	44.69	0.30	48.43	54.00	-5.57	A
*	4959.57	59.46	33.95	3.87	45.22	0.40	52.47	74.00	-21.53	P
*	4959.57	49.43	33.95	3.87	45.22	0.40	42.44	54.00	-11.56	A

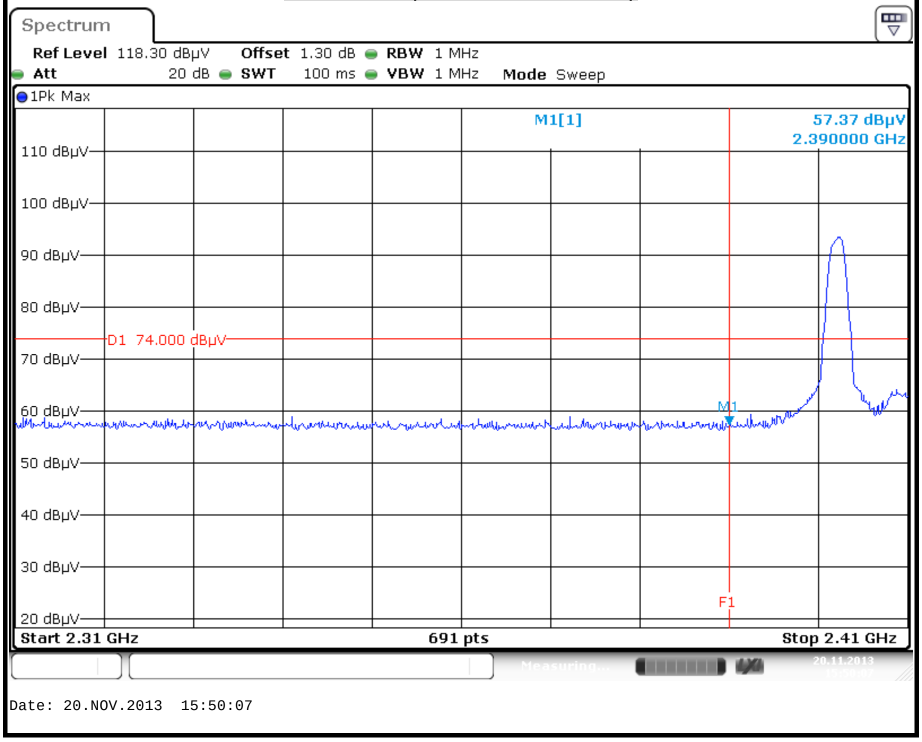
REMARK:

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
   Level = Reading + AF + Cable – Preamp + Filter – Dist, Margin = Level-Limit
4. The other emission levels were 20dB below the limit
5. The test limit distance is 3M limit.

8.7.4 RESTRICTED BAND EDGES

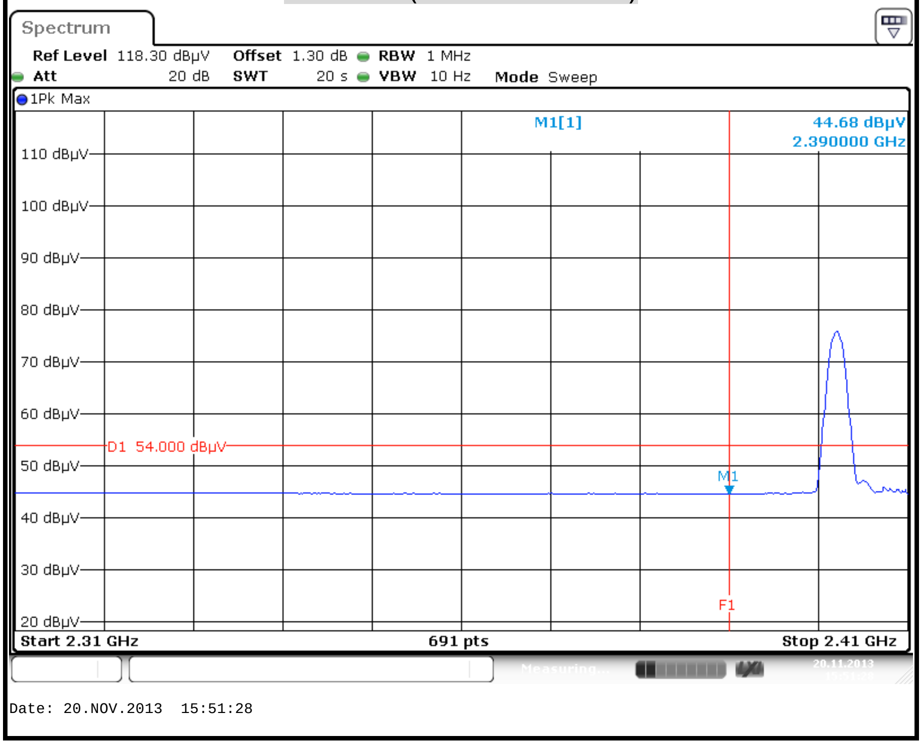
Detector mode : Peak **Polarity : Horizontal**

CH Low (GFSK MODE)



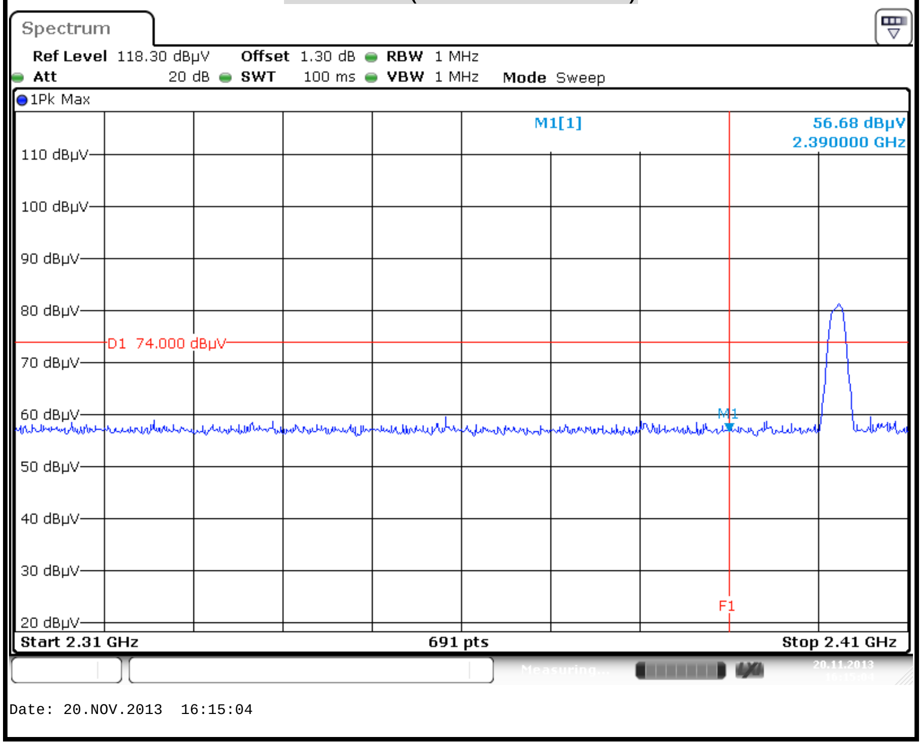
Detector mode : Average **Polarity : Horizontal**

CH Low (GFSK MODE)



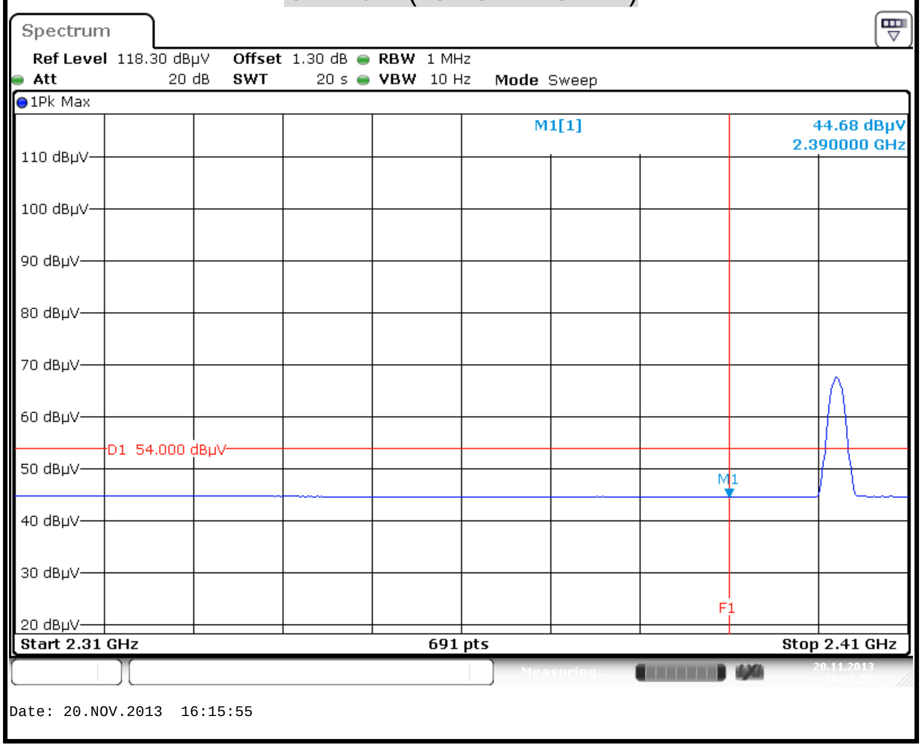
Detector mode : Peak **Polarity : Vertical**

CH Low (GFSK MODE)

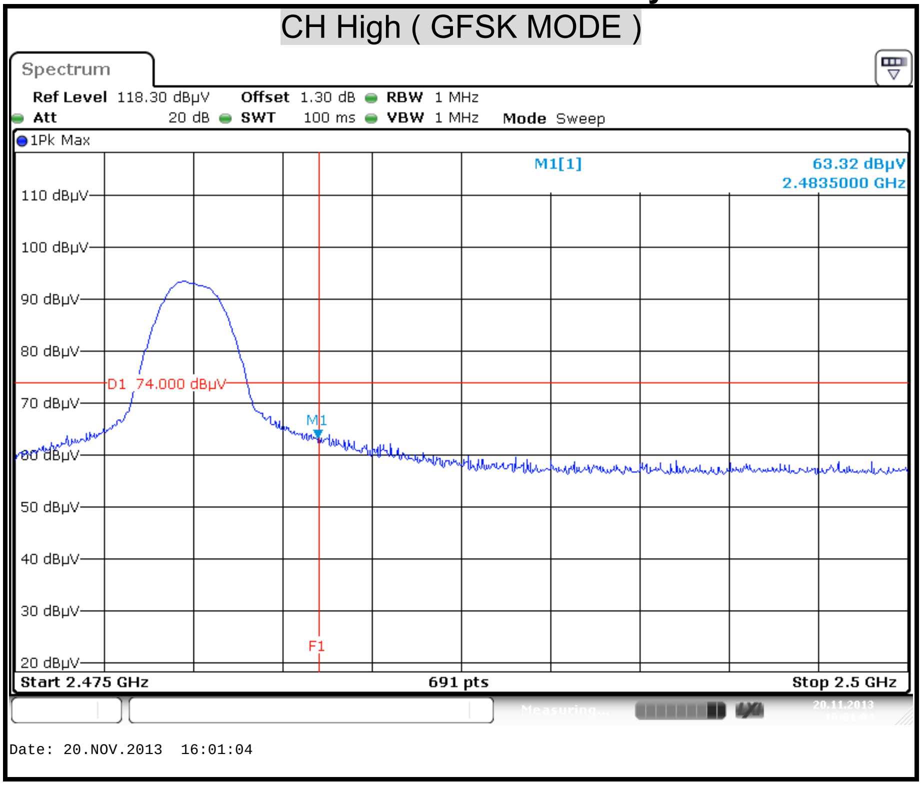


Detector mode : Average **Polarity : Vertical**

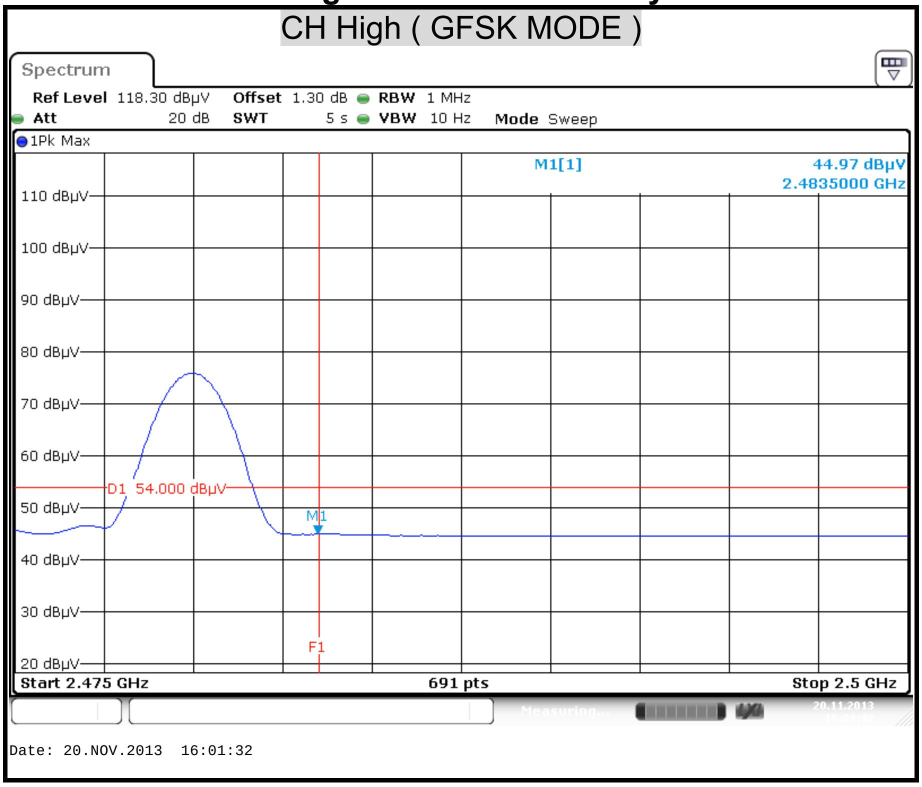
CH Low (GFSK MODE)



Detector mode : Peak **Polarity : Horizontal**

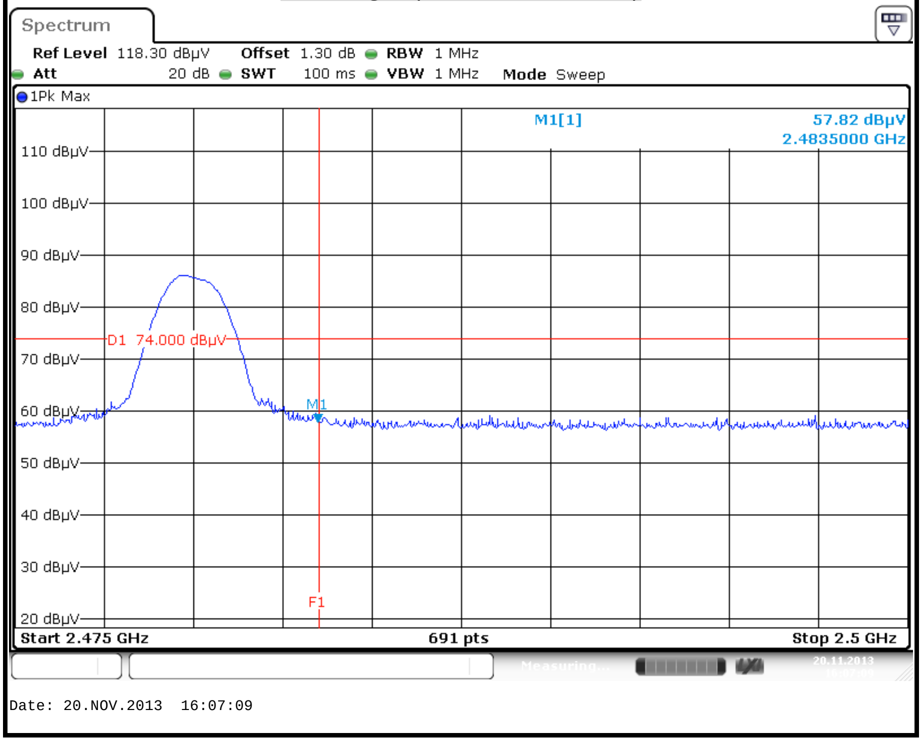


Detector mode : Average **Polarity : Horizontal**



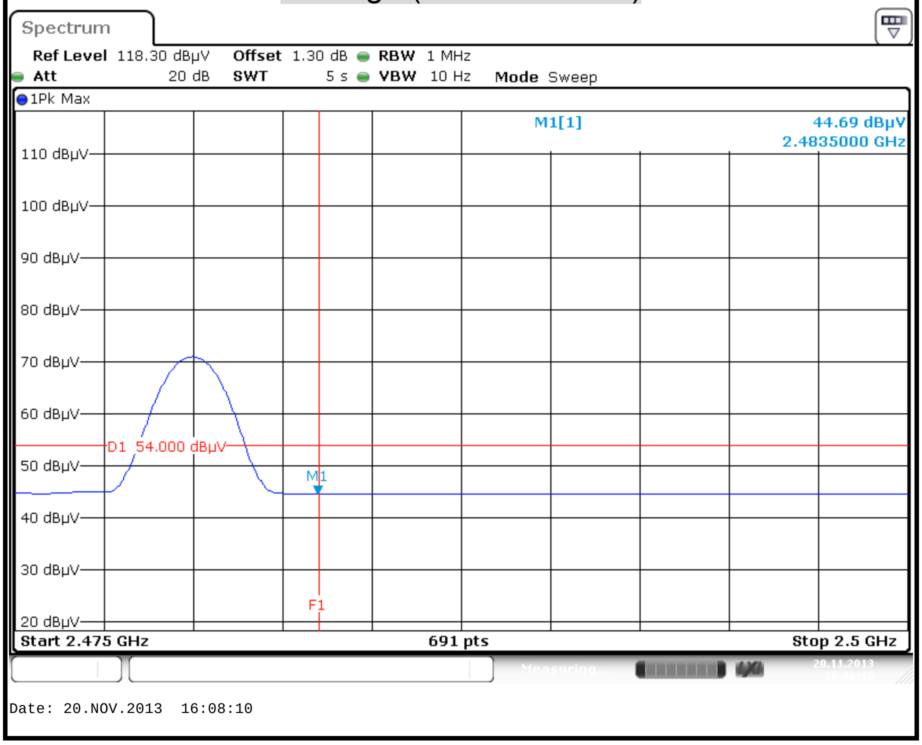
Detector mode : Peak **Polarity : Vertical**

CH High (GFSK MODE)



Detector mode : Average **Polarity : Vertical**

CH High (GFSK MODE)



8.8 POWERLINE CONDUCTED EMISSIONS

LIMITS

§ 15.207 (a) Except as shown in paragraph (b) and (c) this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/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.

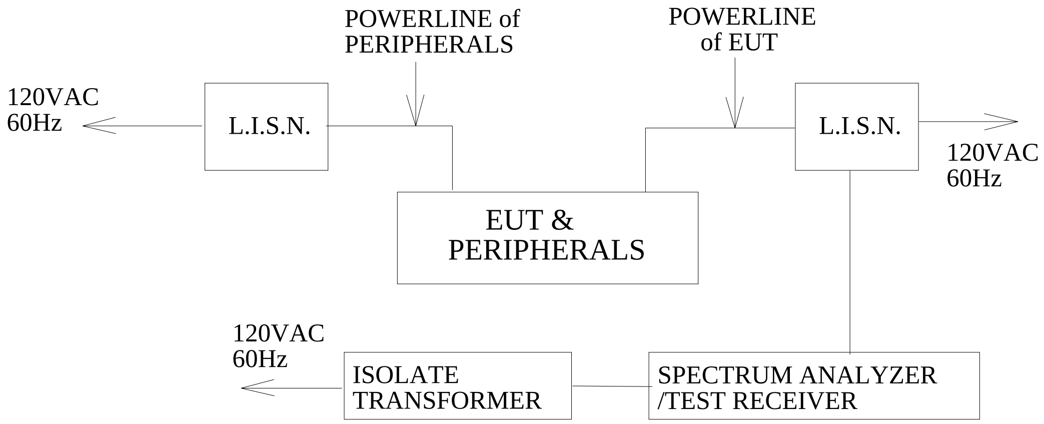
Frequency of Emission (MHz)	Conducted limit (dBμv)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.5 - 5	56	46
5 - 30	60	50

TEST EQUIPMENTS

The following test equipments are used during the conducted power line tests：

Conducted Emission room #1				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
L.I.S.N.	SCHWARZBECK	NNLK 8130	8130124	AUG. 12, 2014
	Rohde & Schwarz	ESH 3-Z5	840062/021	SEP. 09, 2014
TEST RECEIVER	Rohde & Schwarz	ESCS 30	100348	AUG. 09, 2014
TYPE N COAXIAL CABLE	CCS	BNC50	11	NOV. 19, 2014
Test S/W	e-3 (5.04211c) R&S (2.27)			

TEST SETUP



TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80cm above the horizontal ground plane. The EUT IS CONFIGURED IN ACCORDANCE WITH ANSI C63.4.

The resolution bandwidth is set to 9 kHz for both quasi-peak detection and average detection measurements.

Line conducted data is recorded for both NEUTRAL and LINE.

TEST RESULTS

No non-compliance noted.

※ **This EUT do not connect to AC Source directly. Not applicability for this test.**

9. ANTENNA REQUIREMENT

9.1 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 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

9.2 ANTENNA CONNECTED CONSTRUCTION

Type: Multilayer Chip Antenna
Model: AT8010-E2R9HAA_
Brand: ACX
Gain: 2.5 dBi