

Prüfbericht-Nr.: Test Report No.:	10043758 001	Auftrags-Nr.: Order No.:	114013947	Seite 1 von 36 Page 1 of 36
Kunden-Referenz-Nr.: Client Reference No.:	N/A	Auftragsdatum: Order date:	September 11, 2013	
Auftraggeber: Client:	JINGTEK ELECTRONICS TECHNOLOGY CO., LTD. , 2F., No.183, Xingjin Rd., North Dist, Taichung 40455, Taiwan			
Prüfgegenstand: Test item:	Smart Ebox			
Bezeichnung / Typ-Nr.: Identification / Type No.:	E-Box SMA01			
Auftrags-Inhalt: Order content:	FCC Part 15C Test report			
Prüfgrundlage: Test specification:	FCC 47CFR Part 15: Subpart C Section 15.247 RSS-210 (12-2010) A8			
Wareneingangsdatum: Date of receipt:	08/2/2013			
Prüfmuster-Nr.: Test sample No.:	A000028172-002 A000019616-001			
Prüfzeitraum: Testing period:	October 1, 2013 - January 17, 2014			
Ort der Prüfung: Place of testing:	EMC Laboratory Taipei			
Prüflaboratorium: Testing laboratory:	TUV Rheinland Taiwan Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
				
2014-01-22	Danny S. C. Sung/Project Manager	2014-01-22	Rene Charton/Senior Project Manager	
Datum	Name / Stellung	Unterschrift	Datum	Name / Stellung
Date	Name / Position	Signature	Date	Name / Position
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: Passed

5.1.2 PEAK OUTPUT POWER

RESULT: Passed

5.1.3 6dB BANDWIDTH AND 99% BANDWIDTH

RESULT: Passed

5.1.4 POWER DENSITY

RESULT: Passed

5.1.5 CONDUCTED SPURIOUS EMISSIONS AND FREQUENCY BAND EDGE MEASURED IN 100kHz BANDWIDTH

RESULT: Passed

5.1.6 SPURIOUS EMISSION

RESULT: Passed

5.2.1 MAINS CONDUCTED EMISSIONS

RESULT: Passed

6.1.1 ELECTROMAGNETIC FIELDS

RESULT: Passed

Contents

1.	GENERAL REMARKS	5
1.1	COMPLEMENTARY MATERIALS.....	5
2.	TEST SITES	6
2.1	TEST FACILITIES	6
2.2	LIST OF TEST AND MEASUREMENT INSTRUMENTS.....	7
2.3	TRACEABILITY	7
2.4	CALIBRATION	8
2.5	MEASUREMENT UNCERTAINTY	8
3.	GENERAL PRODUCT INFORMATION.....	9
3.1	PRODUCT FUNCTION AND INTENDED USE	9
3.2	SYSTEM DETAILS AND RATINGS.....	9
3.3	INDEPENDENT OPERATION MODES.....	10
3.4	NOISE GENERATING AND NOISE SUPPRESSING PARTS	10
3.5	SUBMITTED DOCUMENTS.....	10
4.	TEST SET-UP AND OPERATION MODES.....	11
4.1	PRINCIPLE OF CONFIGURATION SELECTION	11
4.2	TEST OPERATION AND TEST SOFTWARE.....	11
4.3	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	11
4.4	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE.....	12
4.5	TEST SETUP DIAGRAM	12
5.	TEST RESULTS	14
5.1	TRANSMITTER REQUIREMENT & TEST SUITES	14
5.1.1	<i>Antenna Requirement</i>	<i>14</i>
5.1.2	<i>Peak Output Power</i>	<i>15</i>
5.1.3	<i>6dB Bandwidth and 99% Bandwidth.....</i>	<i>18</i>
5.1.4	<i>Power Density</i>	<i>22</i>
5.1.5	<i>Conducted spurious emissions and Frequency Band Edge measured in 100kHz Bandwidth.....</i>	<i>25</i>
5.1.6	<i>Spurious Emission</i>	<i>29</i>
5.2	MAINS EMISSIONS.....	30
5.2.1	<i>Mains Conducted Emissions.....</i>	<i>30</i>
6.	SAFETY HUMAN EXPOSURE	31
6.1	RADIO FREQUENCY EXPOSURE COMPLIANCE	31
6.1.1	<i>Electromagnetic Fields.....</i>	<i>31</i>

7.	PHOTOGRAPHS OF THE TEST SET-UP.....	32
8.	LIST OF TABLES	36
9.	LIST OF PHOTOGRAPHS.....	36

1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix P: Photo Documentation
(File Name: 10043758APPENDIX P)

Appendix D: Test Result of Radiated Emissions
(File Name: 10043758APPENDIX D)

Test Specifications

The following standards were applied.

Table 1: Applied Standard and Test Levels

Radio
FCC CFR47 Part 15: Subpart C Section 15.247
ANSI C63.10:2009, KDB558074 D01 DTS Meas Guidance v02

2. Test Sites

2.1 Test Facilities

TUV Rheinland Taiwan Ltd.

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

FCC Registration No.: 365730
TAF Accredited NCC Test Lab. No.:0759
TAF ISO17025 Certification effective periods: 2010-Jul-1st to 2013-Jun-30th



Testing Laboratory
0759

2.2 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Kind of Equipment	Manufacturer	Type	S/N	Calibrated until
EMI Test Receiver	R&S	ESCI 7	101062	1-Sep-14
Bilog Antenna	TESEQ	CBL6111D	29802	29-Jun-14
Spectrum Analyzer	R&S	FSV 40	100921	10-Dec-14
Horn Antenna	ETS-Lindgren	3117	138160	10-Jan-15
Horn Antenna (18GHz~40GHz)	COM-POWER	AH840	101031	29-Oct-15
Preamplifier (30MHz -1GHz)	HP	8447F	2805A03335	2-Sep-14
Preamplifier (18 GHz -40 GHz)	COM-POWER	PAM-840	461257	2-Sep-14
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM30180	60558	23-Oct-14
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	28-Sep-14
EMI Test Receiver	R&S	ESCI	101094	29-Aug-14
LISN (1 phase)	R&S	ENV216	101243	5-Jun-14
LISN	Rolf Heine	NNB-2/16Z	99080	30-Aug-14

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular schedule using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements are:

Table 3: Emission Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-7}$
RF power, conducted	± 1 dB
Adjacent channel power	± 3 dB
Radiated emission of transmitter, valid up to 26 GHz	± 6 dB
Radiated emission of receiver, valid up to 26 GHz	± 6 dB
Temperature	± 2 °C
Humidity	± 10 %

3. General Product Information

3.1 Product Function and Intended Use

The SMART EBOX can be connected to the controller of an Electric Bicycle . It can connect to the APP of a wireless device and display the speed and status of the bicycle.
For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Table 4: Basic Information of EUT

Item	EUT information
Kind of Equipment	Smart Ebox
Type Designation	E-Box SMA01
FCC ID	2AAK7-E-BOX-SMA01 IC ID: 11247A-EBOXSMA01

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequency	2402~2480 MHz
Channel Spacing	2 MHz
Channel number	40
Operation Voltage	36 V
Modulation	GFSK, $\pi/4$ QPSK, 8 DPSK (BDR and EDR) GFSK (LE)
Antenna gain	2.34 dBi

3.3 Independent Operation Modes

Basic operation modes are:

- A. Transmitting
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel
- B. Receiving
- C. Standby
- D. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- | | |
|-------------------------|----------------------|
| - Bill of Material | - Circuit Diagram |
| - PCB Layout | - Instruction Manual |
| - Photo Document | - Rating Label |
| - Technical Description | |

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Setup for testing: Test samples are provided with an UART interface which makes it possible to control them through a test software installed on a notebook computer.

This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed in section 3.3 as appropriate. The samples were used as follows:

The samples were used as follows:

Conducted: A000019616-001

Radiation: A000028172-002

Full test was applied on all test modes, but only worst case was shown.

4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

Kind of Equipment	Manufacturer	Model Name	S/N
Notebook	HP	HSTNN-Q78C-3	CNF0339QBM

4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test

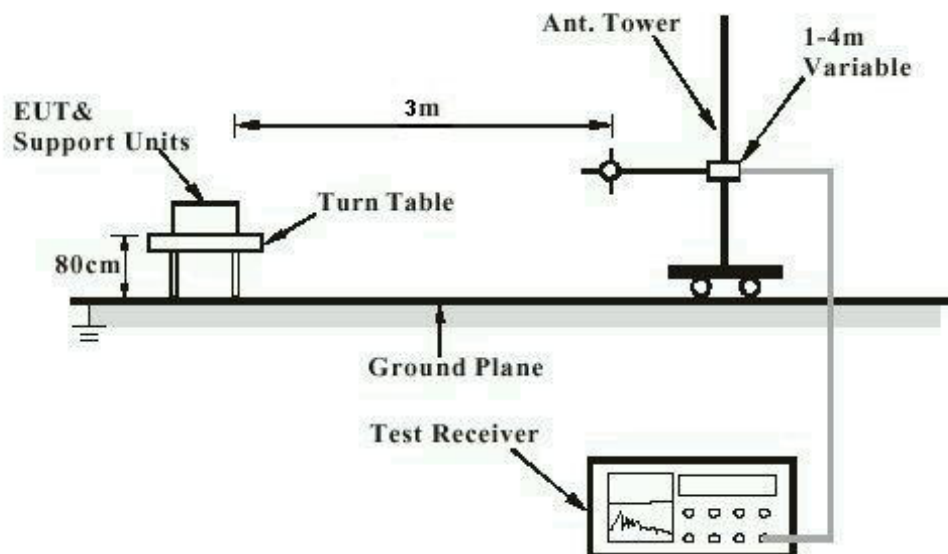


Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)

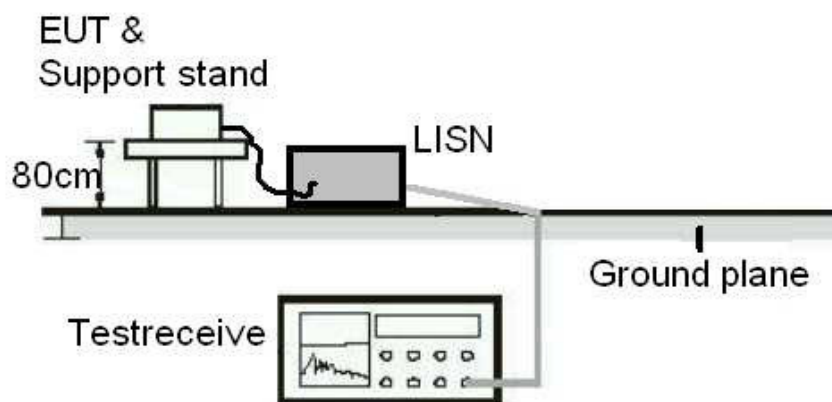
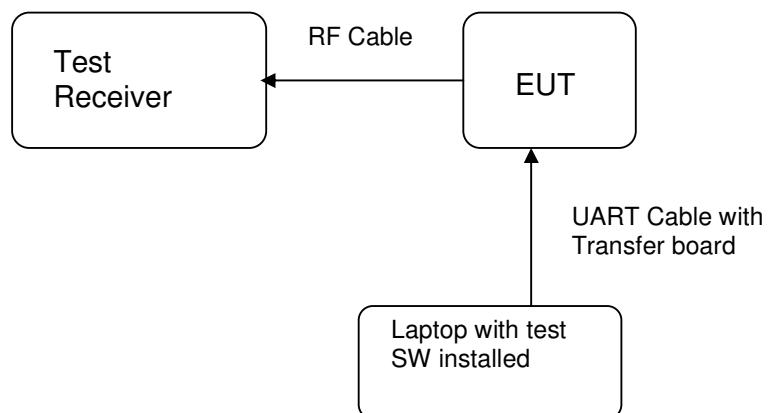


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Test standard	:	FCC Part 15.247(b)(4), Part 15.203 and RSS-Gen 7.1.4
Limit	:	the use of antennas with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 2.34 dBi. The antenna is a Chip Antenna soldered to the PCB with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

Refer to EUT photo for details.

5.1.2 Peak Output Power

RESULT:**Passed**

Test standard : FCC Part 15.247(b)(3), RSS-210 A8.4(4)
Basic standard : ANSI C63.10:2009, KDB558074
Limit : 1 Watt
Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
Operation Mode : A

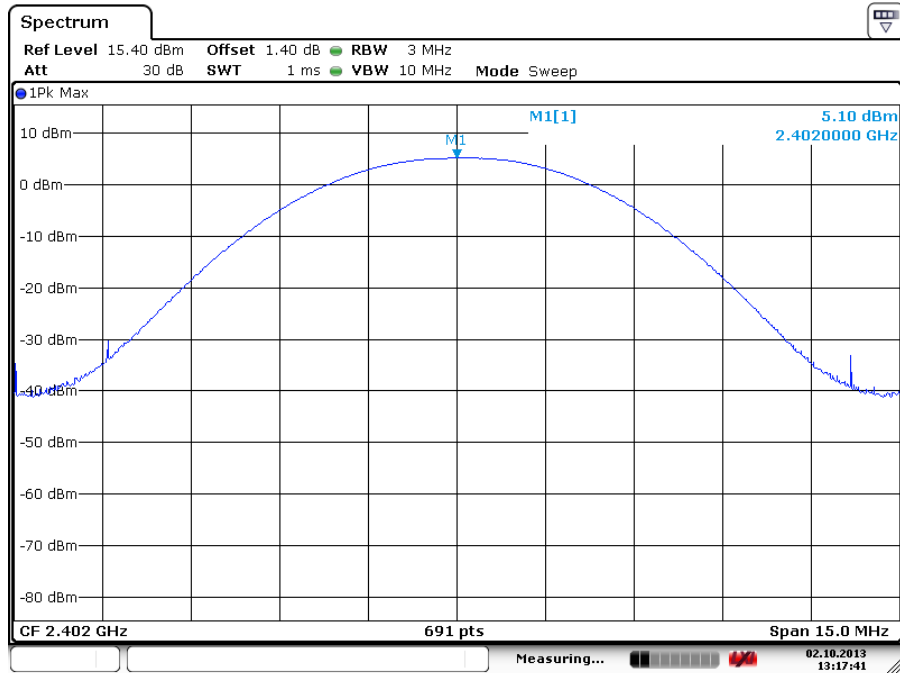
Ambient temperature : 22-26 °C
Relative humidity : 50-65 %
Atmospheric pressure : 100-103 kPa

Table 6: Test result of Peak Output Power, GFSK modulation

Channel	Channel Frequency (MHz)	Peak Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2402	5.1	0.0032	1
Mid Channel	2442	4.88	0.0031	1
High Channel	2480	4.45	0.0028	1

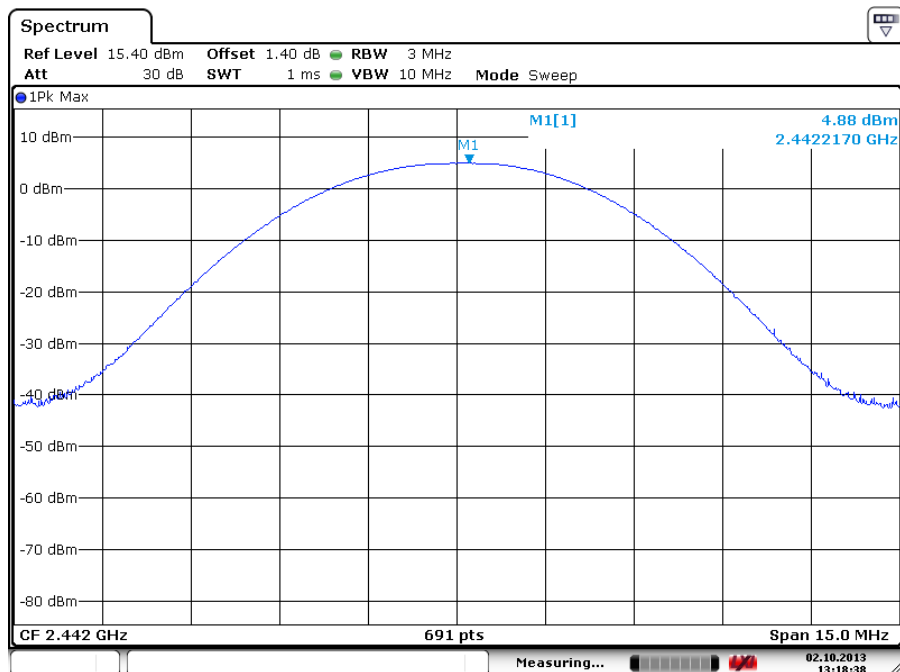
Test Plot of Peak Output Power, GFSK modulation

Low Channel



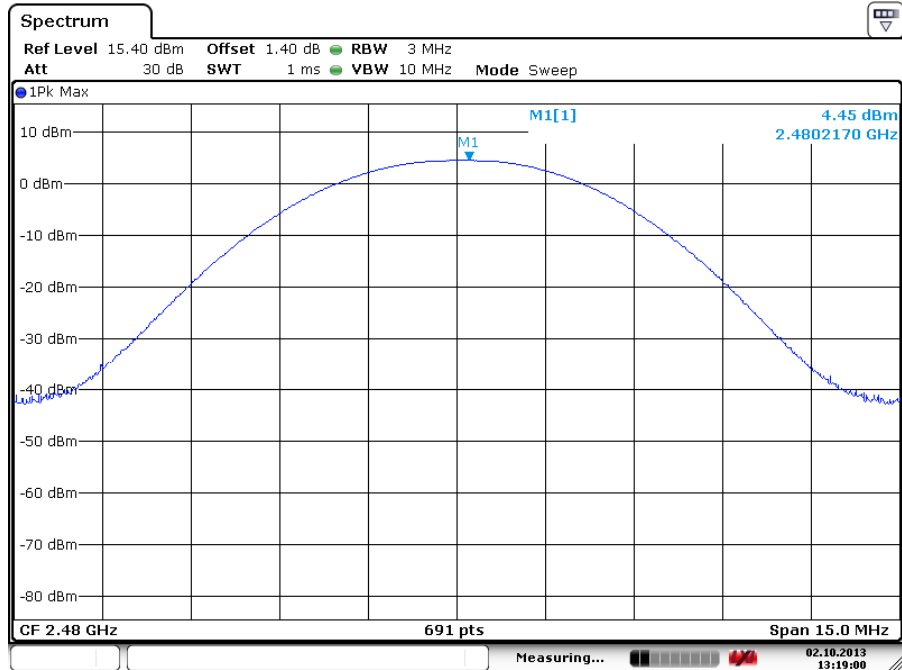
Date: 2.OCT.2013 13:17:41

Middle Channel



Date: 2.OCT.2013 13:18:38

High Channel



Date: 2.OCT.2013 13:19:01

5.1.3 6dB Bandwidth and 99% Bandwidth

RESULT:
Passed

Test standard : FCC Part 15.247(a)(2), RSS-210 A8.2(1)
 Basic standard : ANSI C63.10:2009, KDB558074
 Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A

Ambient temperature : 22-26°C
 Relative humidity : 50-65%
 Atmospheric pressure : 100-103 kPa

Table 7: Test result of 6 dB Bandwidth, GFSK modulation

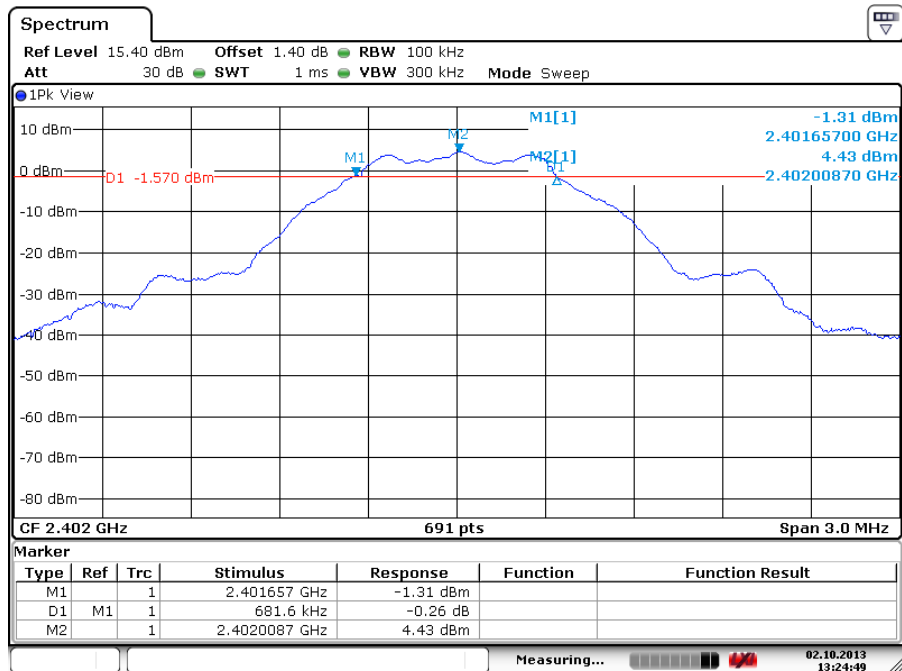
Channel	Channel Frequency (MHz)	6 dB Bandwidth (kHz)	Limit (kHz)	Result
Low Channel	2402	681.6	> 500	Pass
Mid Channel	2442	681.6	> 500	Pass
High Channel	2480	677.3	> 500	Pass

Table 8: Test result of 99% Bandwidth, GFSK modulation

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)	
Low Channel	2402	1.0463	
Mid Channel	2442	1.0506	
High Channel	2480	1.0419	

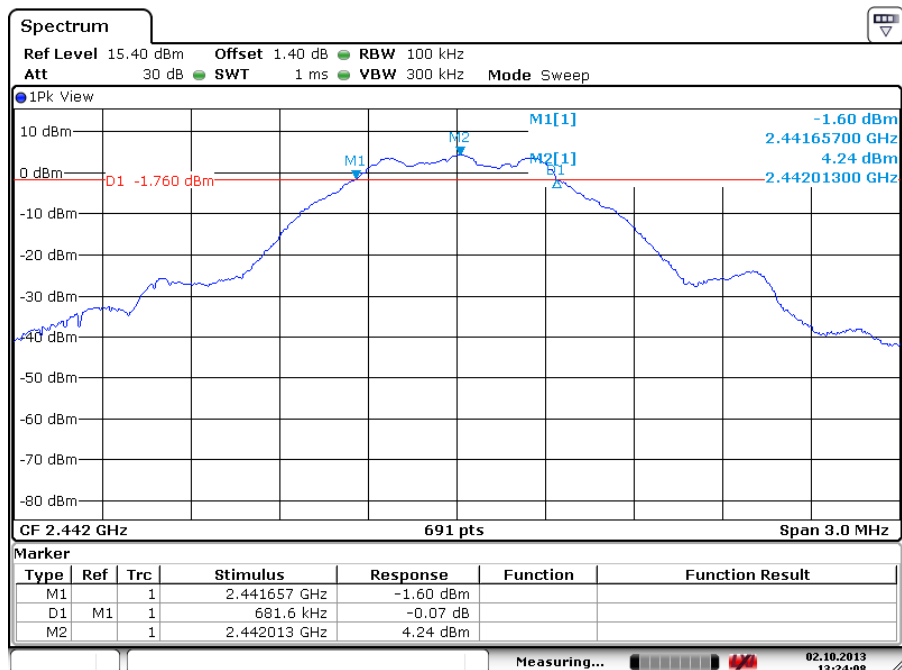
Test Plot of 6dB Bandwidth, GFSK modulation

Low Channel

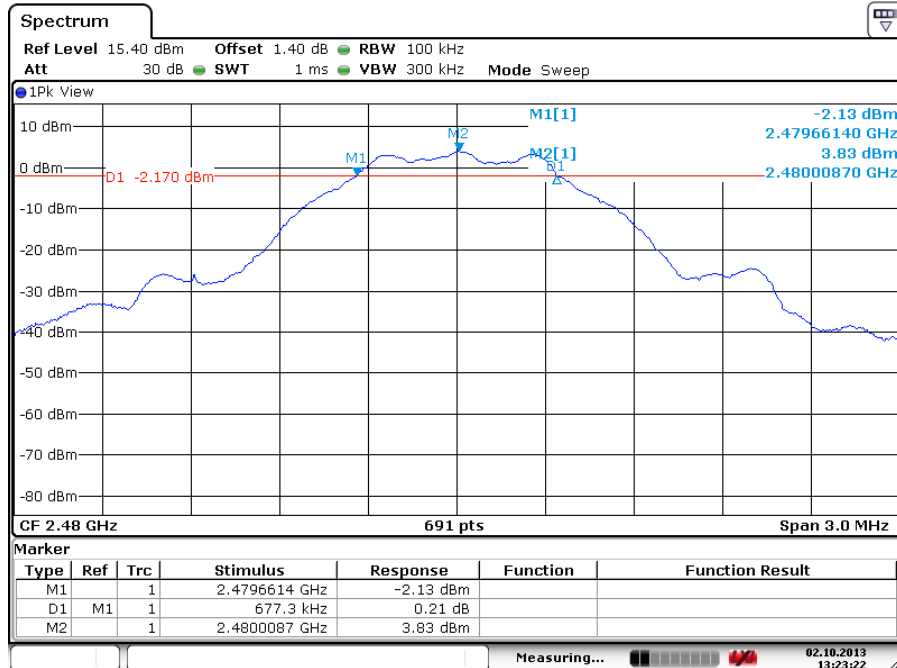


Date: 2.OCT.2013 13:24:50

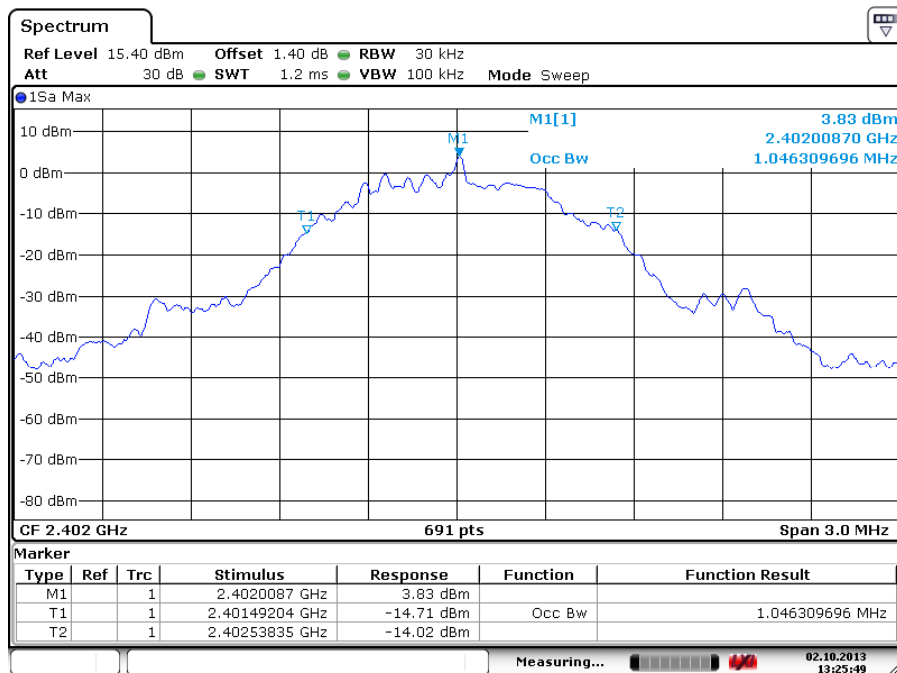
Middle Channel



Date: 2.OCT.2013 13:24:08

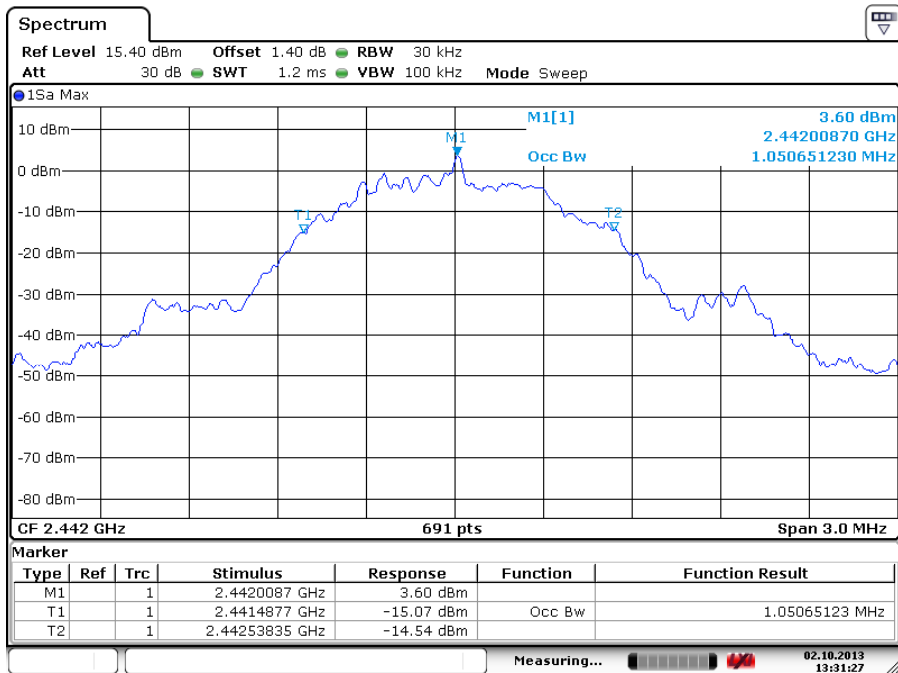
High Channel


Date: 2.OCT.2013 13:23:22

Test Plot of Occupied Bandwidth, GFSK modulation
Low Channel


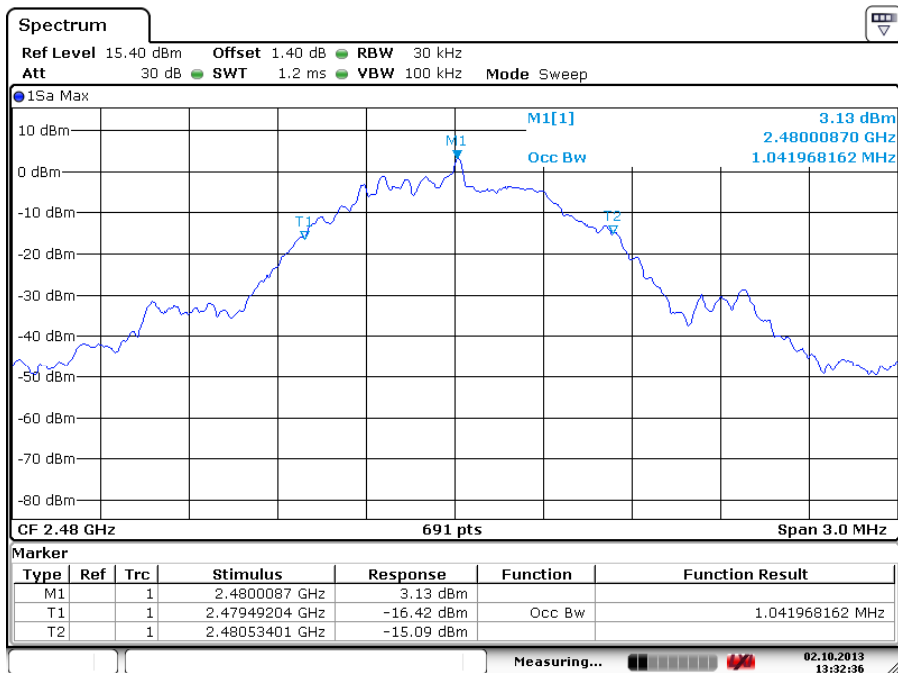
Date: 2.OCT.2013 13:25:49

Middle Channel



Date: 2.OCT.2013 13:31:28

High Channel



Date: 2.OCT.2013 13:32:36

5.1.4 Power Density

RESULT:**Passed**

Test standard : FCC Part 15.247(e) , RSS-210 A8.2(2)
Basic standard : ANSI C63.10:2009, KDB558074
Kind of test site : Shielded room

Test setup

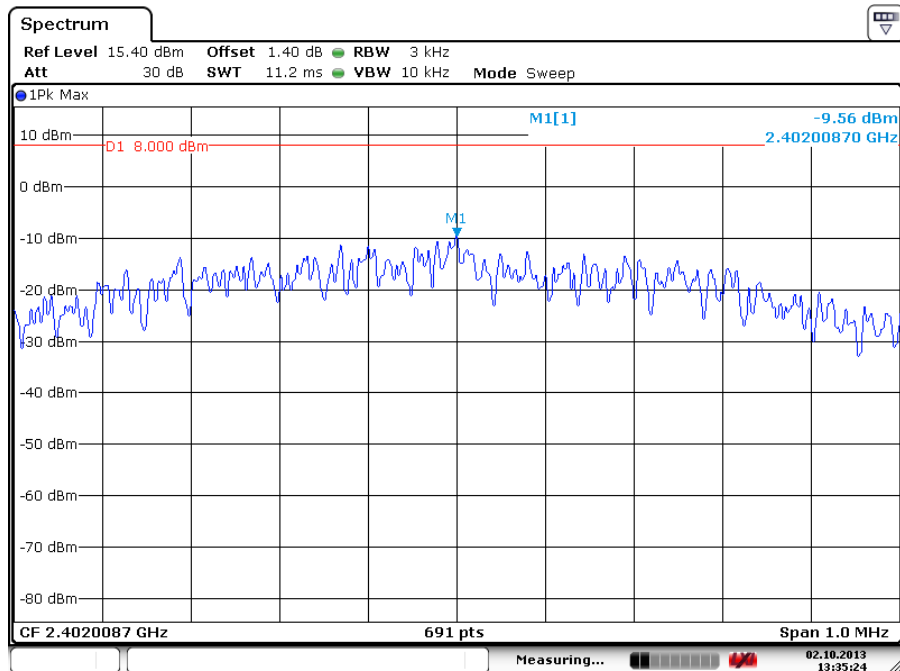
Test Channel : Low/ Middle/ High
Operation Mode : A
Ambient temperature : 22-26°C
Relative humidity : 50-65%
Atmospheric pressure : 100-103 kPa

Table 9: Test result of Power Density, GFSK modulation

Channel	Channel Frequency (MHz)	Peak Power Density (dBm/100kHz)	Peak Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	2402	5.67	-9.56	8	Pass
Mid Channel	2442	5.16	-10.07	8	Pass
High Channel	2480	4.77	-10.46	8	Pass

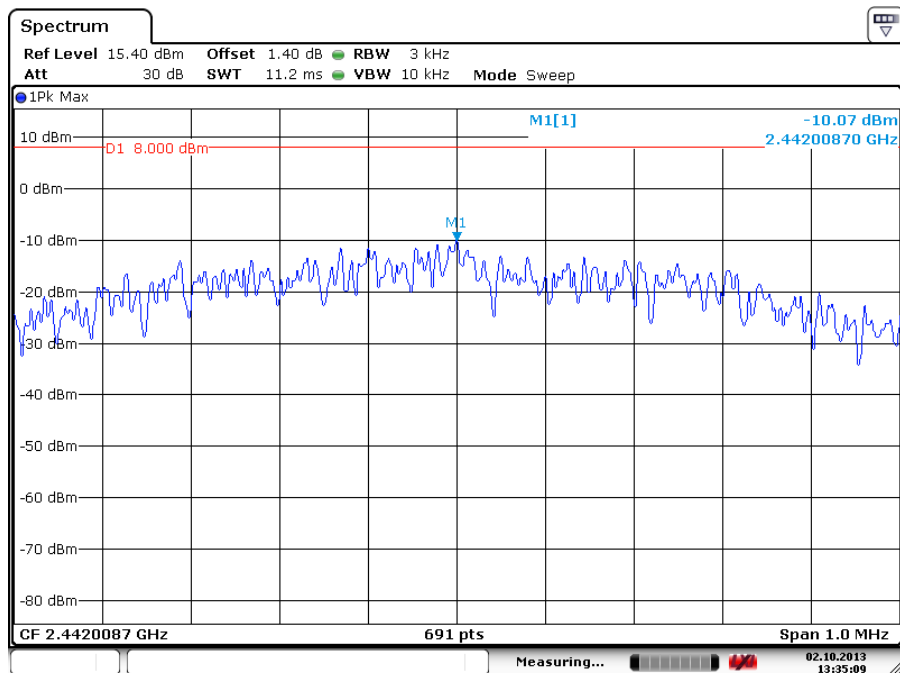
Test Plot of Power Density, GFSK modulation

Low Channel



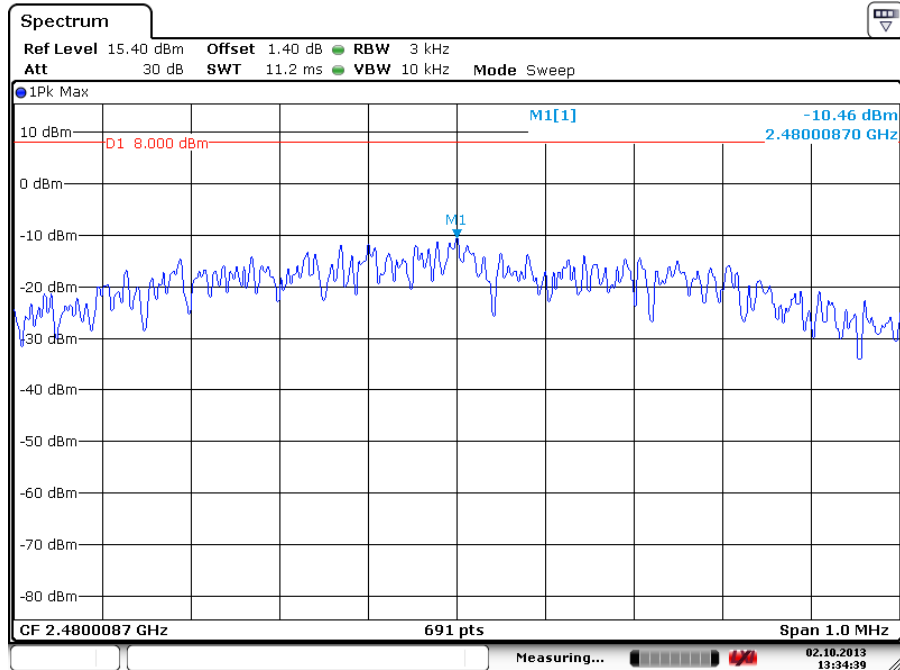
Date: 2.OCT.2013 13:35:24

Middle Channel



Date: 2.OCT.2013 13:35:09

High Channel



Date: 2.OCT.2013 13:34:39

5.1.5 Conducted spurious emissions and Frequency Band Edge measured in 100kHz Bandwidth

RESULT:**Passed**

Test standard	:	FCC part 15.247(d), RSS-210 A8.5
Basic standard	:	ANSI C63.10:2009, KDB558074
Limit	:	20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power)
Kind of test site	:	Shielded room

Test setup

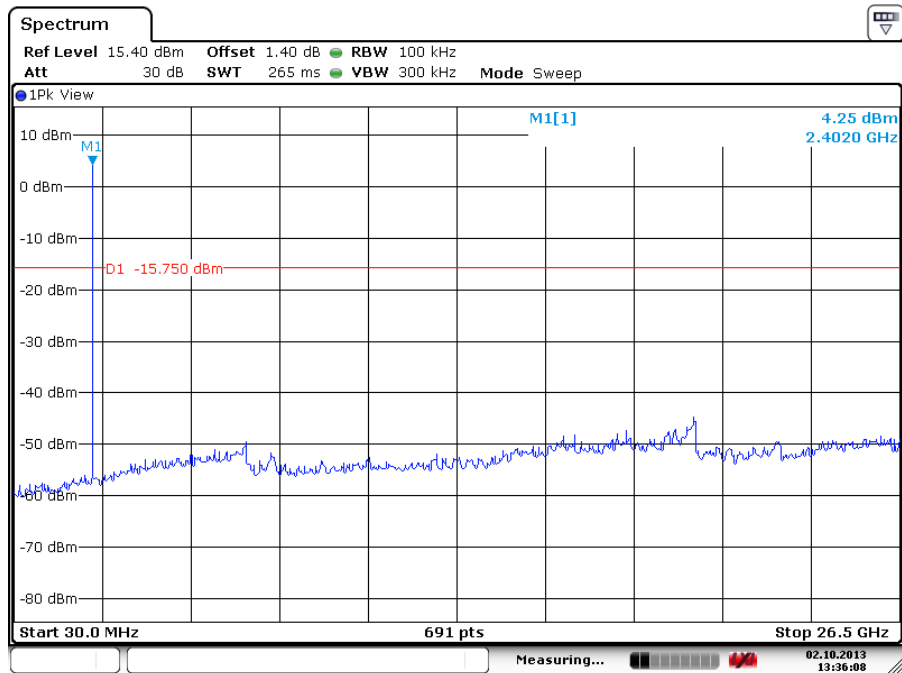
Test Channel	:	Low/ High
Operation mode	:	A
Ambient temperature	:	22-26°C
Relative humidity	:	50-65%
Atmospheric pressure	:	100-103 kPa

All emissions are more than 20dB below fundamental, details refer to following test plot, and compliance is achieved as well.

Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

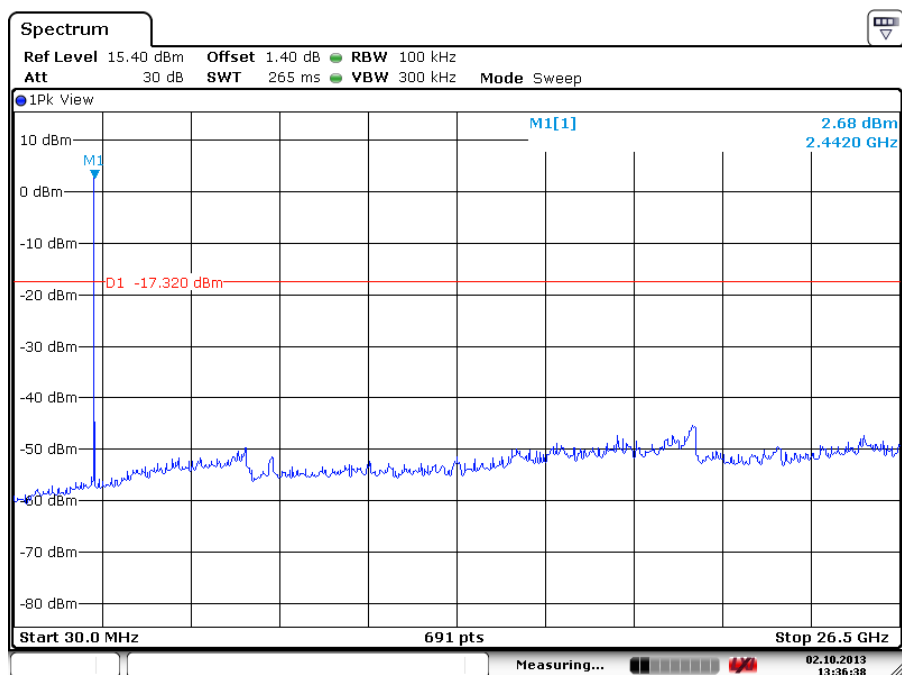
Test Plot of 100kHz Conducted Emissions, GFSK modulation

Low Channel



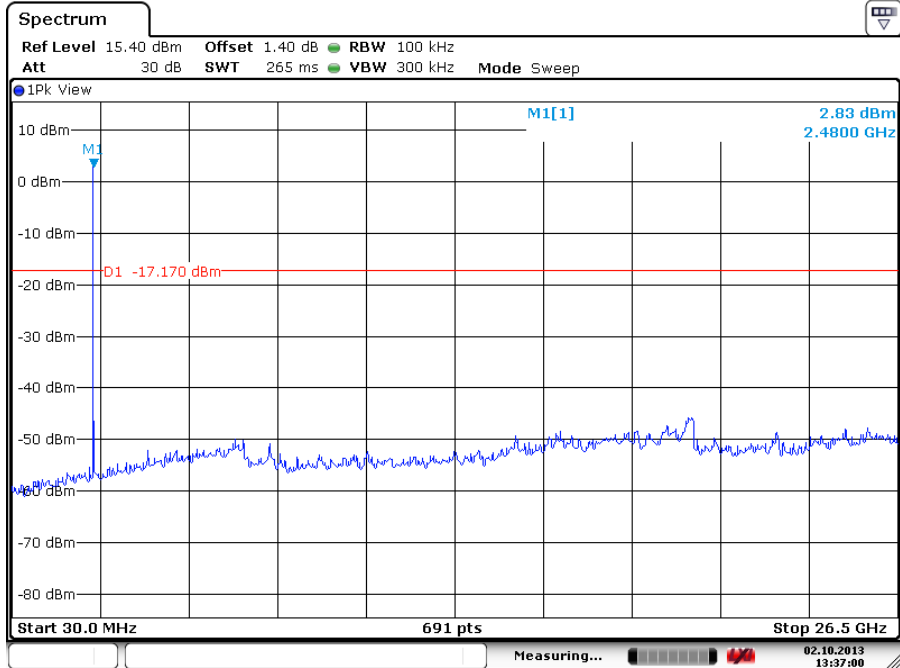
Date: 2.OCT.2013 13:36:08

Middle Channel



Date: 2.OCT.2013 13:36:38

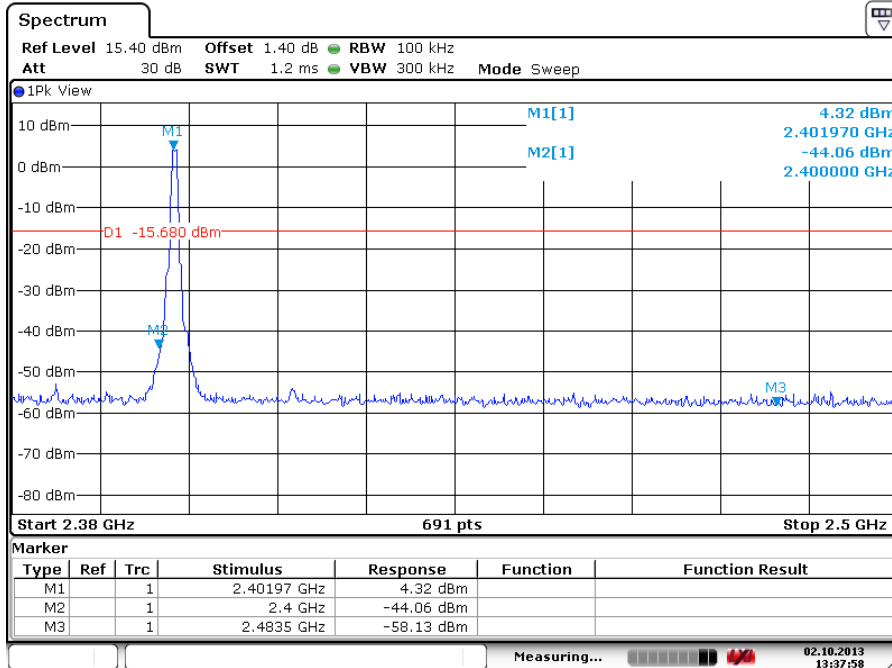
High Channel



Date: 2.OCT.2013 13:37:00

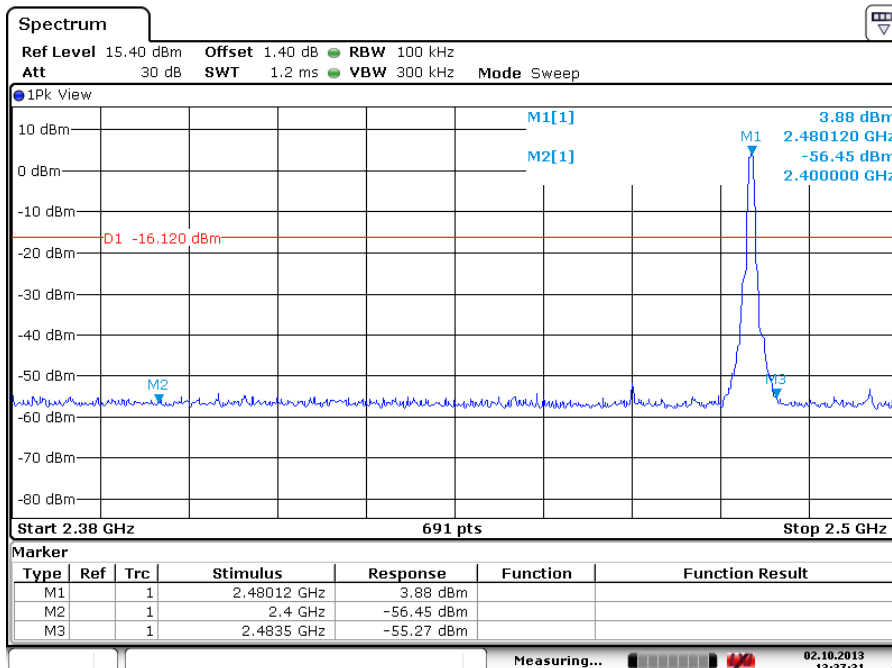
Test Plot of 100kHz Bandwidth of Frequency Band Edge, GFSK modulation

Low Channel



Date: 2.OCT.2013 13:37:58

High Channel



Date: 2.OCT.2013 13:37:31

5.1.6 Spurious Emission

RESULT:**Passed**

Test standard	:	FCC part 15.247(d), FCC 15.205, FCC 15.209, RSS-210 2.2, RSS-210 A8.5 and RSS-Gen 7.2.1
Basic standard	:	ANSI C63.10: 2009
Limits	:	Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a), must comply with the radiated emission limits specified in FCC 15.209(a). Emission radiated outside the specified frequency bands must comply with the radiated emission limits specified in FCC 15.209(a) and FCC 15.249(a).
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

Test Channel	:	Low/ Middle/ High
Operation mode	:	A, C

Remark: Testing was carried out within frequency range 30MHz to the tenth harmonic.

For details refer to Appendix D.

The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The X Axis orientation is the worst-case and recorded in this test report. Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

5.2 Mains Emissions

5.2.1 Mains Conducted Emissions

RESULT:**Passed**

Test standard	:	FCC Part 15.207 FCC Part 15.107 LP0002: 2.3
Limits	:	Mains Conducted emissions as defined in above standards
Kind of test site	:	Shielded Room

Test setup

Test Channel	:	Middle
Operation mode	:	A

Remark: For details refer to Appendix D.

6. Safety Human exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT:**Passed**

Test standard : FCC KDB Publication 447498 D01 v05

Since maximum peak output power of the transmitter is < 1mW, hence the EUT is excluded from SAR evaluation according to FCC KDB publication 447498 D01 v05: Mobile Portable RF Exposure.

The maximum peak output power of the transmitter is 3.2 mW.
The separation between hand and antenna is more than 2mm.

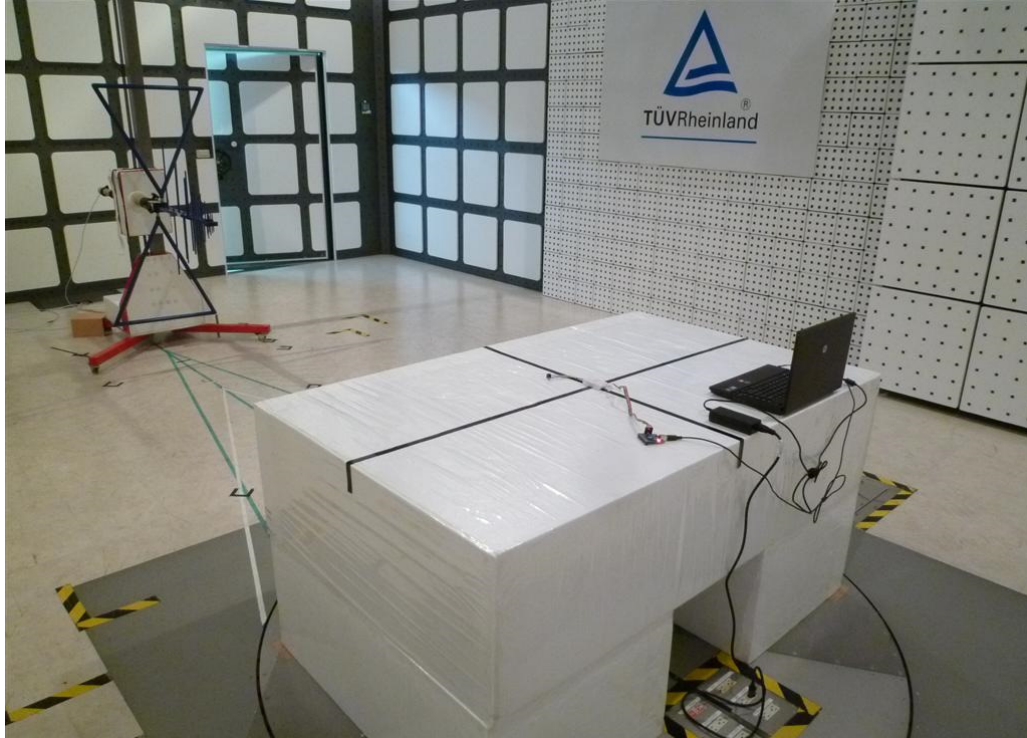
Hence the EUT is excluded from SAR evaluation.
Please also refer to FCC KDB publication 447498 D01 v05: Mobile Portable RF Exposure

7. Photographs of the Test Set-Up

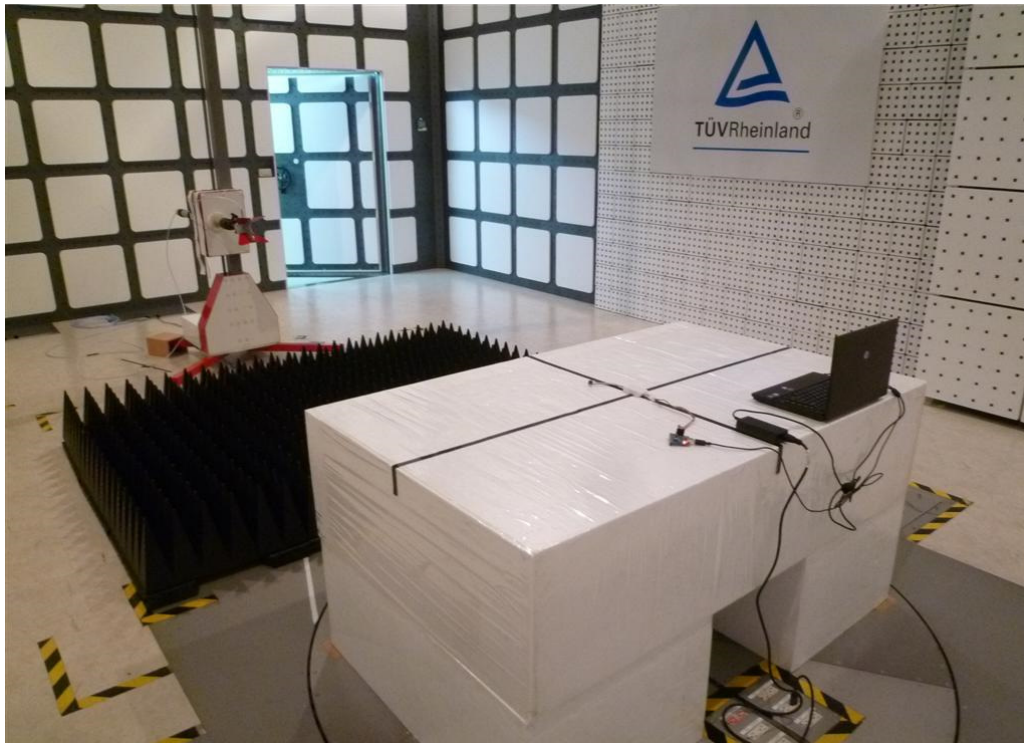
Photograph 1: Set-up for Spurious Emissions (Front View)



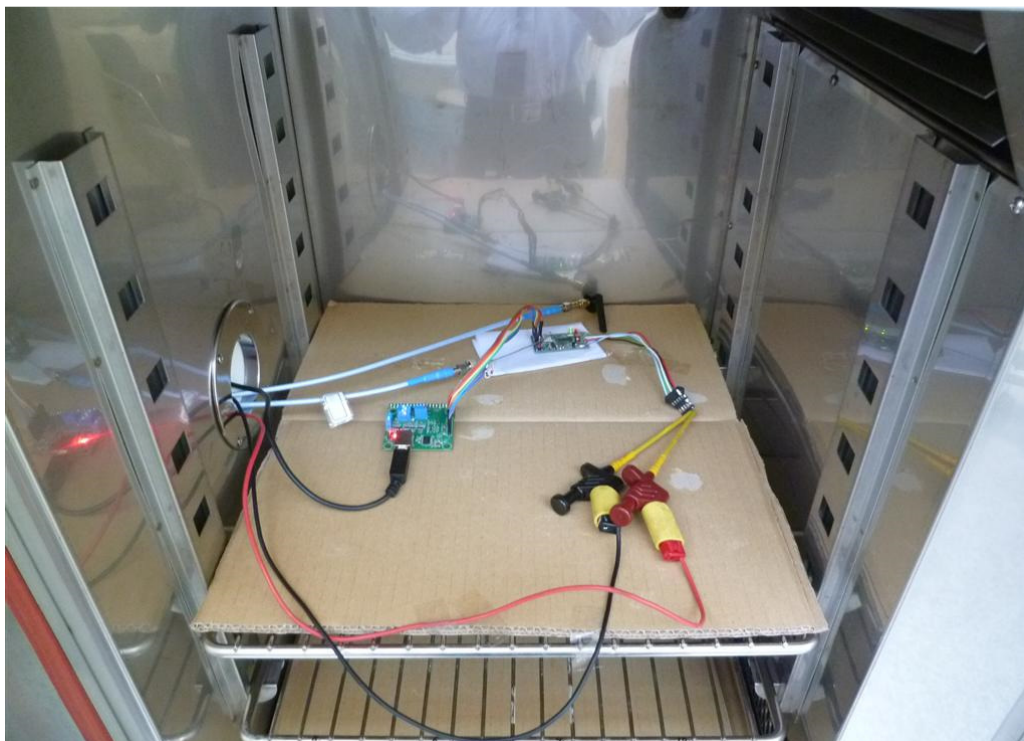
Photograph 2: Set-up for Spurious Emissions (Back View 1)



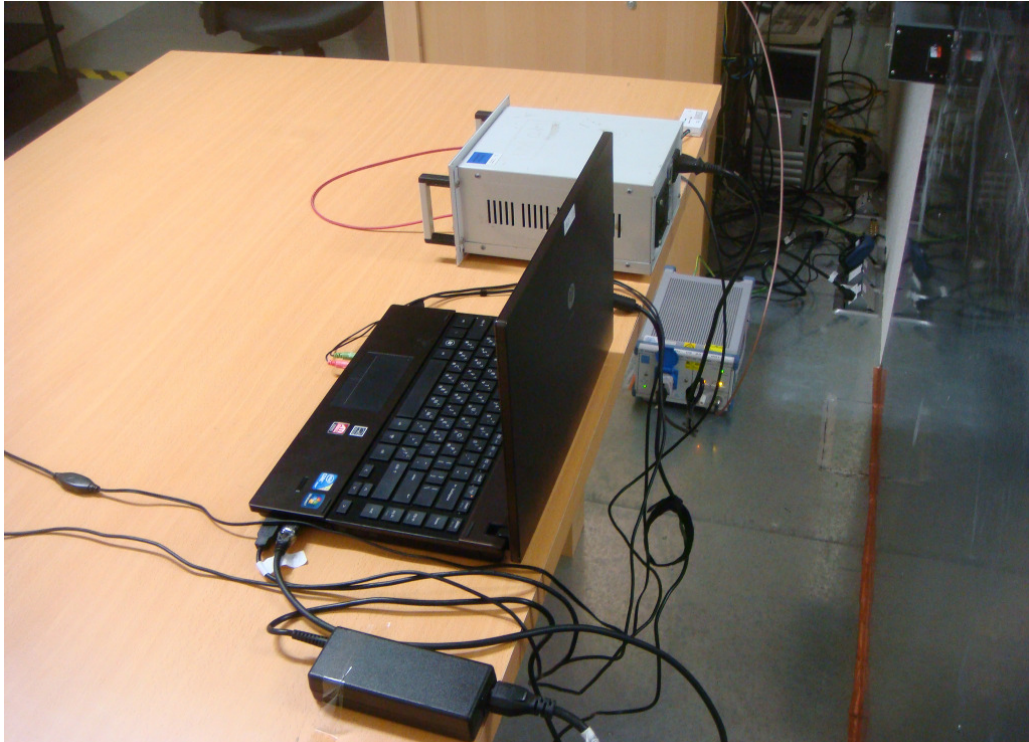
Photograph 3: Set-up for Spurious Emissions (Back View 2)



Photograph 4: Set-up for Conducted testing



Photograph 5: Set-up for for Mains Conducted testing Back



Photograph 6: Set-up for for Mains Conducted testing Front



8. List of Tables

Table 1: Applied Standard and Test Levels	5
Table 2: List of Test and Measurement Equipment	7
Table 3: Emission Measurement Uncertainty.....	8
Table 4: Basic Information of EUT	9
Table 5: Technical Specification of EUT	9
Table 6: Test result of Peak Output Power, GFSK modulation.....	15
Table 7: Test result of 6 dB Bandwidth, GFSK modulation.....	18
Table 8: Test result of 99% Bandwidth, GFSK modulation.....	18
Table 9: Test result of Power Density, GFSK modulation.....	22

9. List of Photographs

Photograph 1: Set-up for Spurious Emissions (Front View).....	32
Photograph 2: Set-up for Spurious Emissions (Back View 1)	33
Photograph 3: Set-up for Spurious Emissions (Back View 2)	34
Photograph 4: Set-up for Conducted testing	34
Photograph 5: Set-up for for Mains Conducted testing Back	35
Photograph 6: Set-up for for Mains Conducted testing Front.....	35