Prüfbericht-Nr.: *Test Report No.:*	**10043757 001**	**Auftrags-Nr.:** *Order No.:*	114013947	Seite 1 von 47 *Page 1 of 47*
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 *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

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*

v04

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT
RESULT: Passed

5.1.2 PEAK OUTPUT POWER
RESULT: Passed

5.1.3 20DB BANDWIDTH
RESULT: Passed

5.1.4 99% BANDWIDTH
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

5.1.7 FREQUENCY SEPARATION
RESULT: Passed

5.1.8 NUMBER OF HOPPING FREQUENCY
RESULT: Passed

5.1.9 TIME OF OCCUPANCY
RESULT: Passed

5.2.1 MAINS CONDUCTED EMISSIONS
RESULT: Passed

6.1.1 ELECTROMAGNETIC FIELDS
RESULT: Passed

Contents

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: 10043757APPENDIX P)
Appendix D: Test Result of Radiated Emissions
(File Name: 10043757APPENDIX 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 C63.4:2009, Public Notice DA 00-705

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

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	± 1 x 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 ºC
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 MHz ~ 2480 MHz
Channel Spacing	1 MHz
Channel number	79
Operation Voltage	36 V
Modulation	GFSK, π/4 QPSK, 8 DPSK (BDR and EDR) GFSK (LE)
Antenna gain	2.34 dBi

Table 6: Frequency hopping information

Technical Specification	Description
Hopping Range	Hereby we declare that the maximum frequency of this device is: 2402-2480MHz. This is according the Bluetooth Core Specification V2.1+EDR for devices which will be operated in the USA. This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/04).
Hopping Sequence	Example of a 79 hopping sequence in data mode: 33,04,21,44,23,42,53,46,55,48,40,59,72,29,76,31,08,73, 07,75,09,45,60,39,58,13,47,11,77,52,35,50,65,54,67,56, 69,62,71,64, 7,25,27,66,57,70,74,61,78,63,10,41,05,43, 15,44,64,68,02,70,06,01,51,03,55,05,03,66,53,49,36,47,
Receiver input bandwidth	The input bandwidth of the receiver is 1MHz. In every connection one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also the slave of the connection will use these settings. Repeating of a packer has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

3.3 Independent Operation Modes

The 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
- PCB Layout
- Photo Document
- Technical Description
- Circuit Diagram
- Instruction Manual
- Rating Label

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

Test operation refers to test setup in chapter 4. All testing were performed according to the procedures in ANSI C63.10: 2009 and DA 00-705 of March 30, 2000.

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

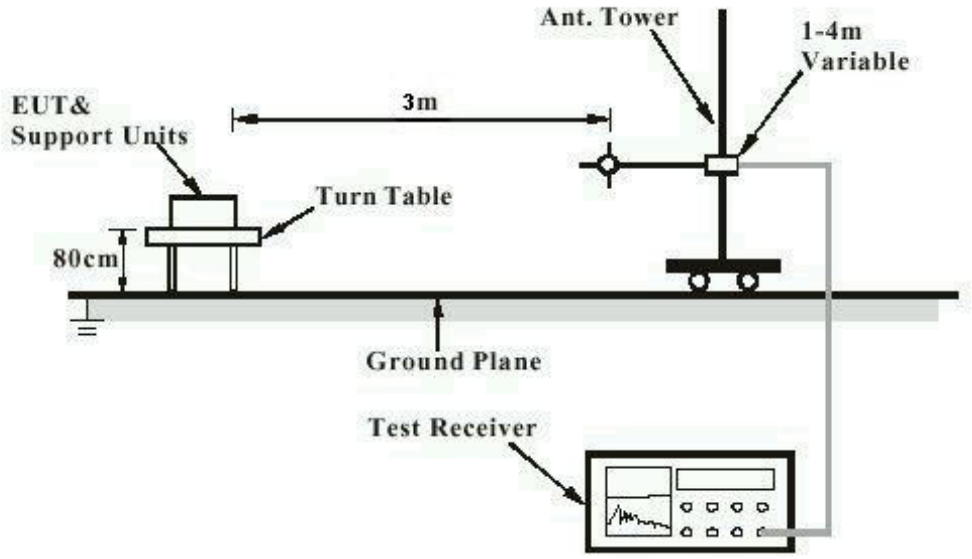


Diagram of Measurement Equipment Configuration for Mains Conduction Measurement

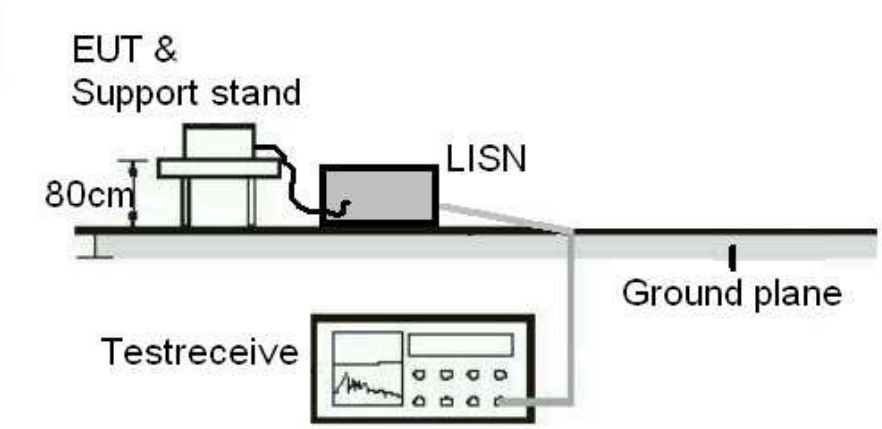
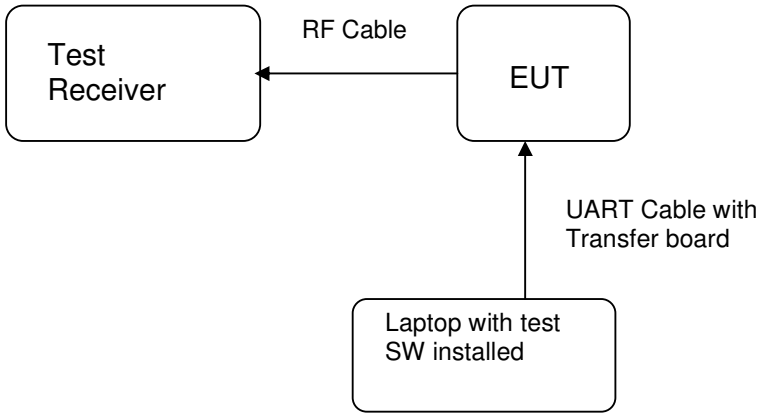


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement



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 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)(1), RSS-210 A8.4(2)
Basic standard : DA 00-705 of March 30, 2000
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 Peak Output Power, GFSK modulation

Channel	Channel Frequency	Peak Output Power		Limit
	(MHz)	(dBm)	(W)	(W)
Low Channel	2402	0.35	0.00108	0.125
Middle Channel	2441	-0.03	0.00099	0.125
High Channel	2480	-0.56	0.00088	0.125

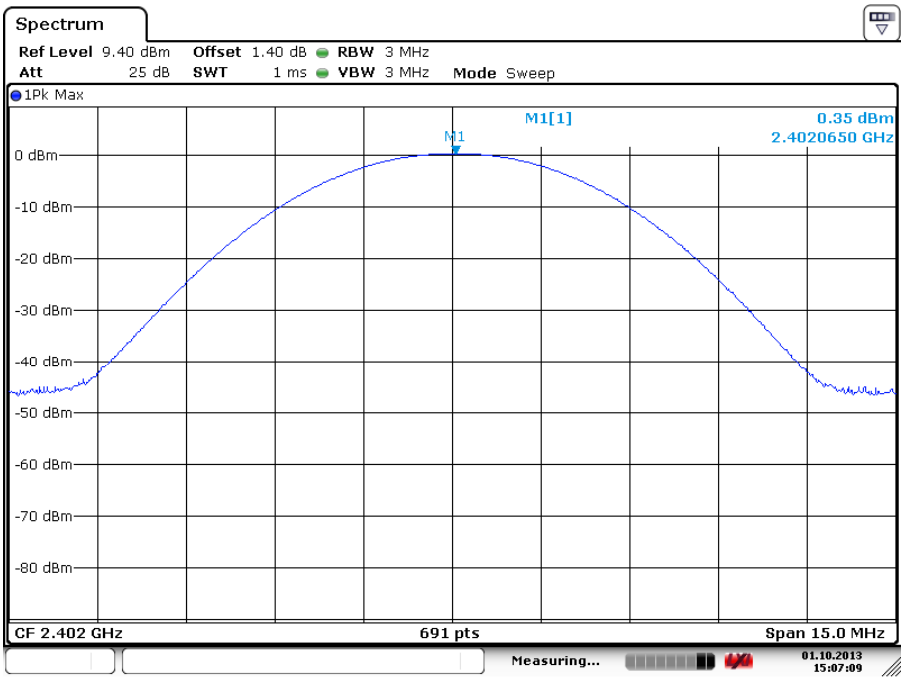
Table 8: Test result of Peak Output Power, 8DPSK modulation

Channel	Channel Frequency	Peak Output Power		Limit
	(MHz)	(dBm)	(W)	(W)
Low Channel	2402	0.55	0.00114	0.125
Middle Channel	2441	0.28	0.00107	0.125
High Channel	2480	-0.22	0.00095	0.125

Pmax: 1.1350 mW

Test Plot of Peak Output Power, GFSK modulation

Low Channel



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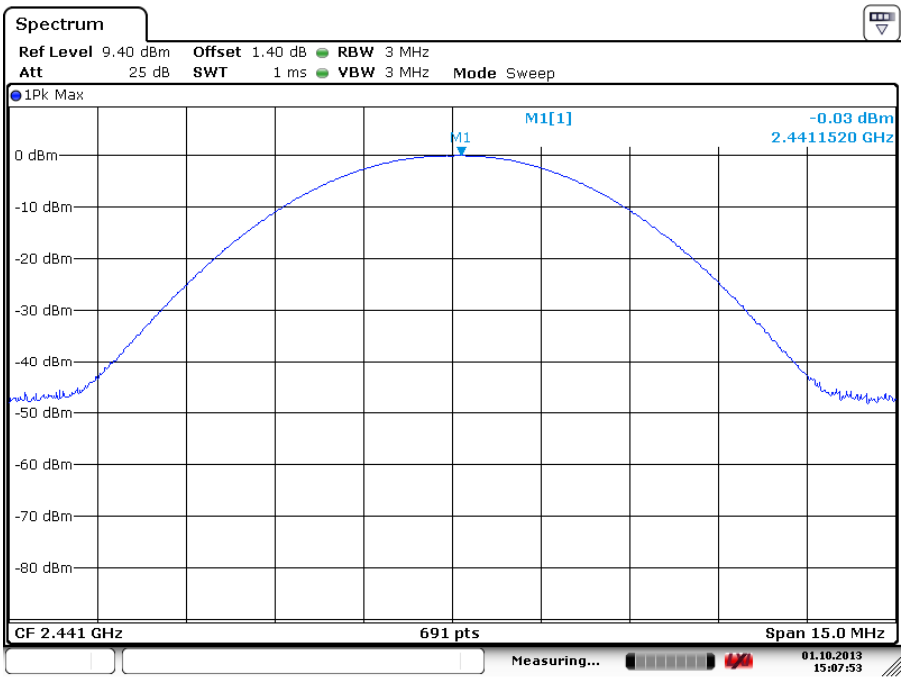
Middle Channel



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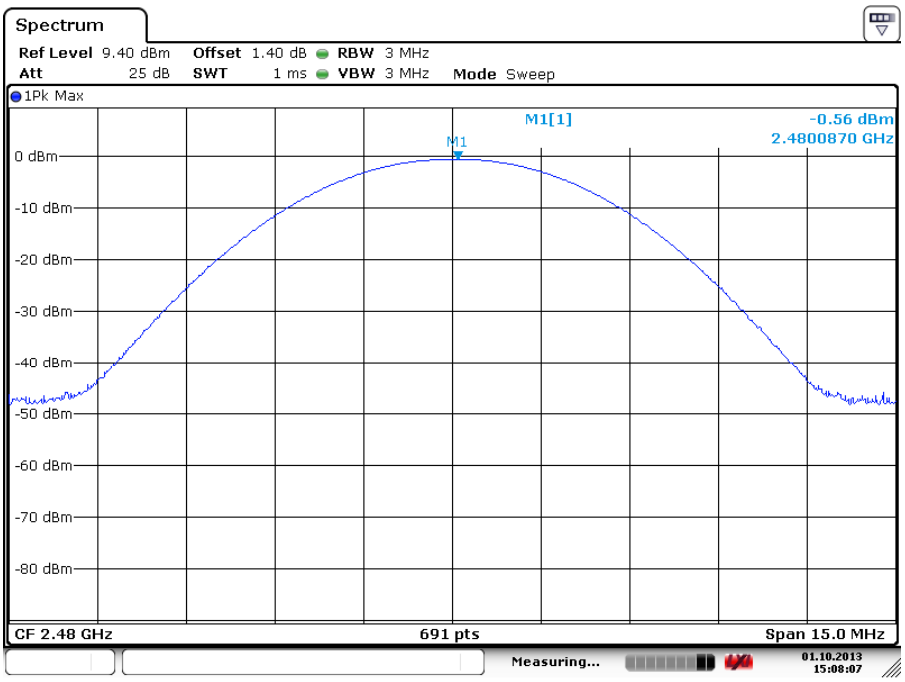
High Channel



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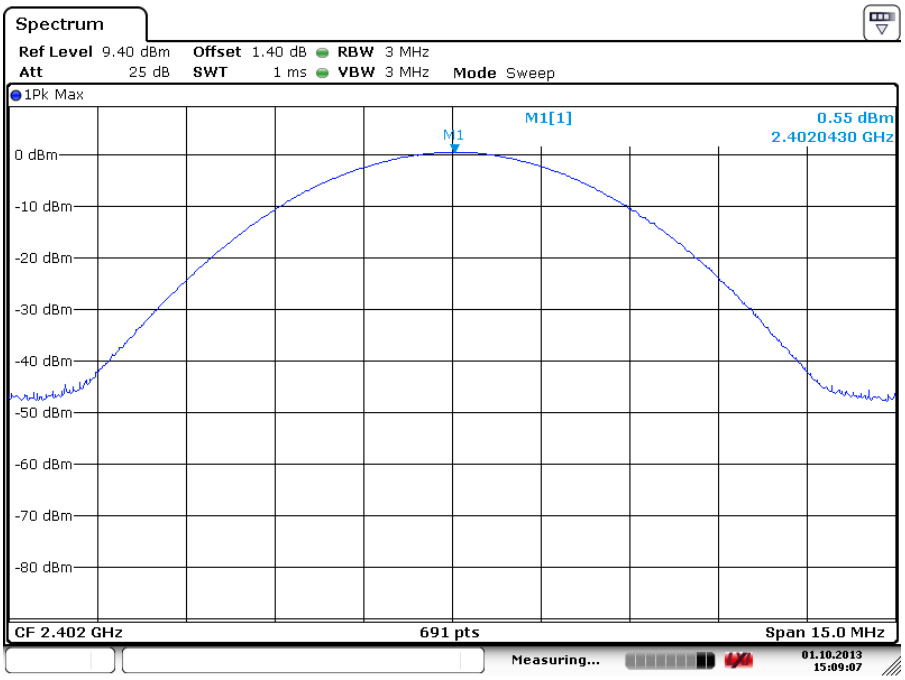
Test Plot of Peak Output Power, 8DPSK modulation

Low Channel



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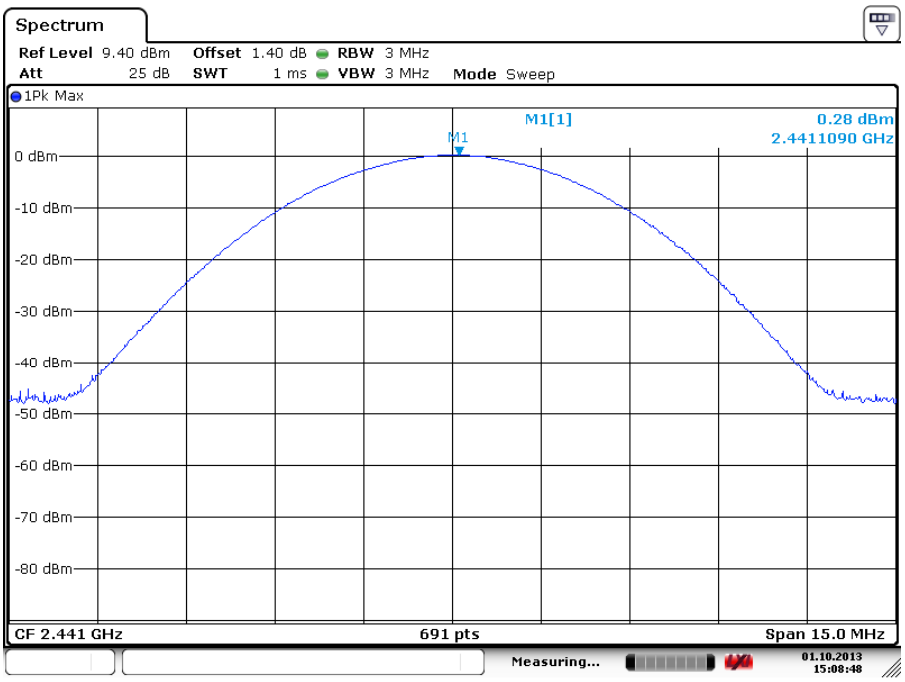
Middle Channel



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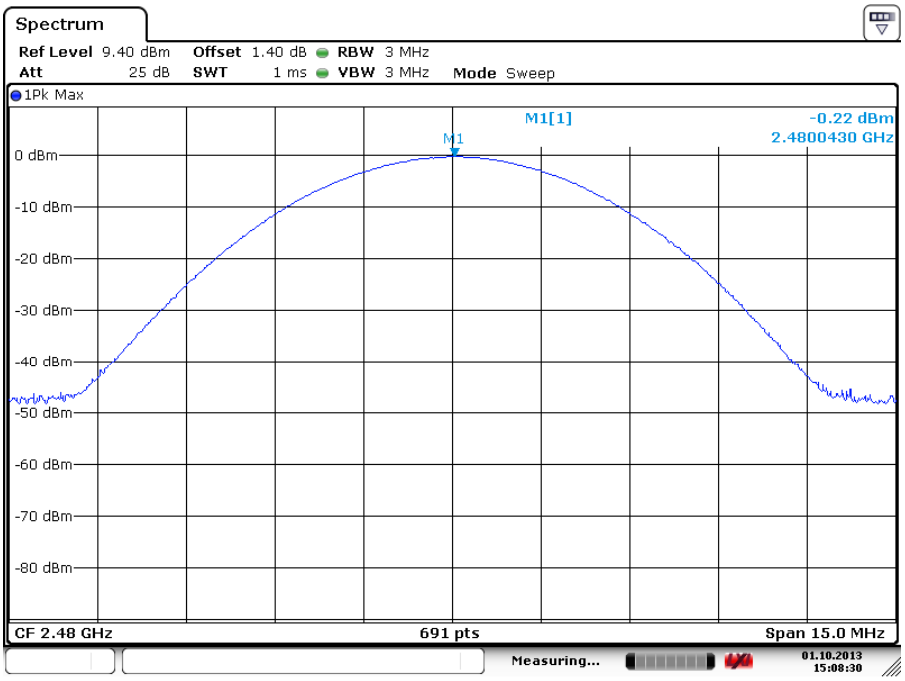
High Channel



Date: 1.OCT.2013 15:08:30

5.1.3 20dB Bandwidth

RESULT: **Passed**

Test standard	:	FCC Part 15.247(a)(1), RSS-210 A8.1(a)
Basic standard	:	DA 00-705 of March 30, 2000
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 20dB Bandwidth, GFSK modulation

Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (MHz)	Result
Low Channel	2402	946.5	1.5	Pass
Mid Channel	2441	933.4	1.5	Pass
High Channel	2480	937.8	1.5	Pass

Note: Limit is for Channel Separation of 1 MHz and a power limit of 125 mW.

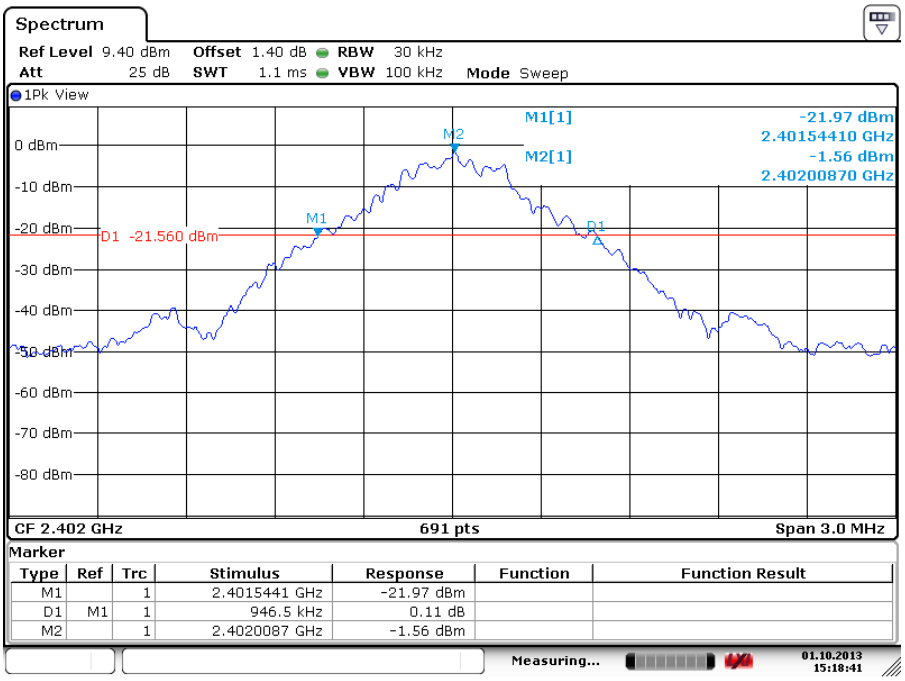
Table 10: Test result of 20dB Bandwidth, 8DPSK modulation

Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (MHz)	Result
Low Channel	2402	1250.4	1.5	Pass
Mid Channel	2441	1254.7	1.5	Pass
High Channel	2480	1250.4	1.5	Pass

Note: Limit is for Channel Separation of 1 MHz and a power limit of 125 mW.

Test Plot of 20dB Bandwidth, GFSK modulation

Low Channel



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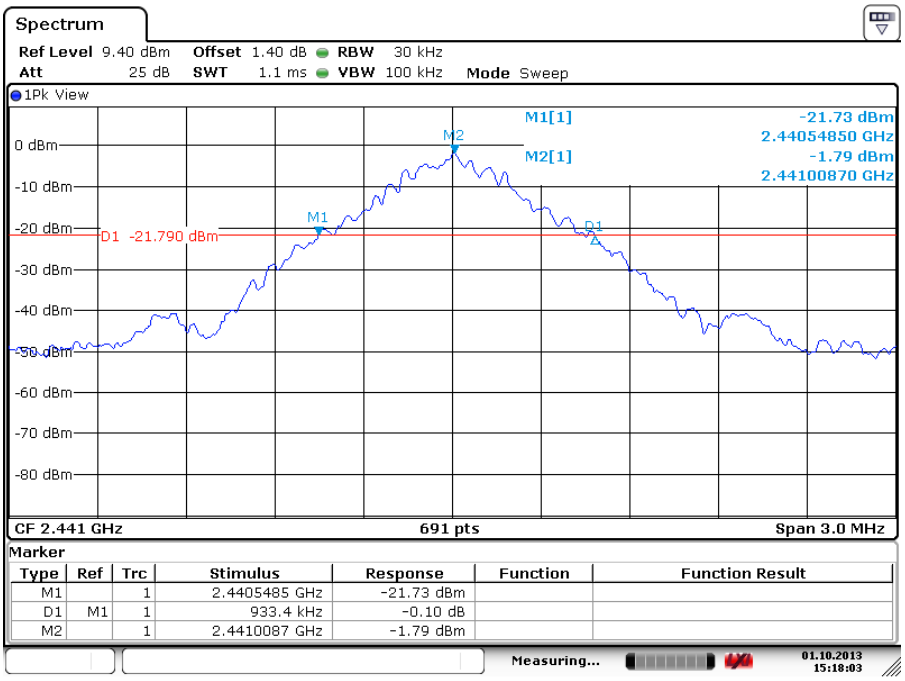
Middle Channel



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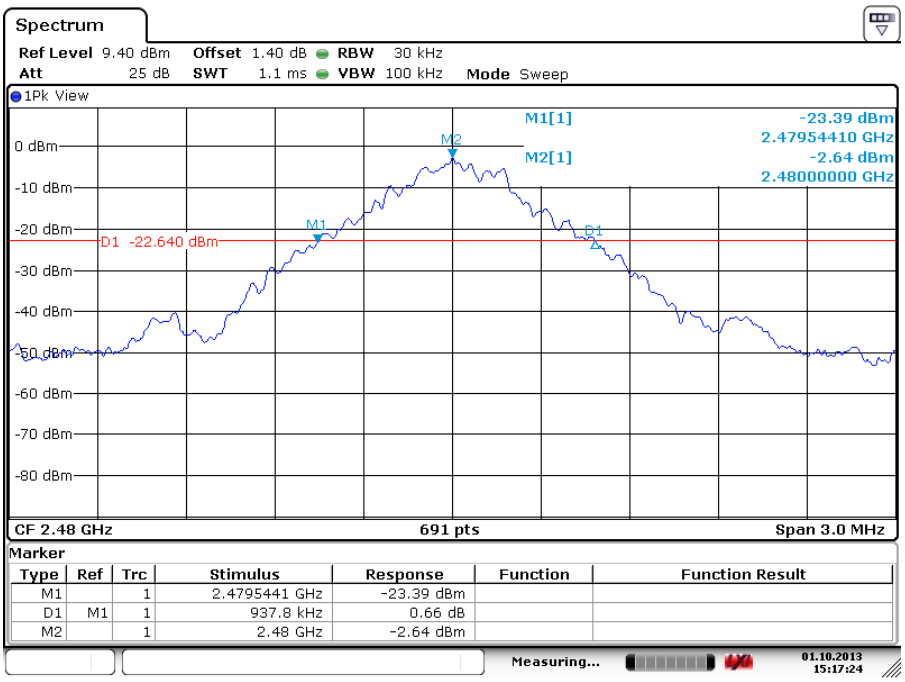
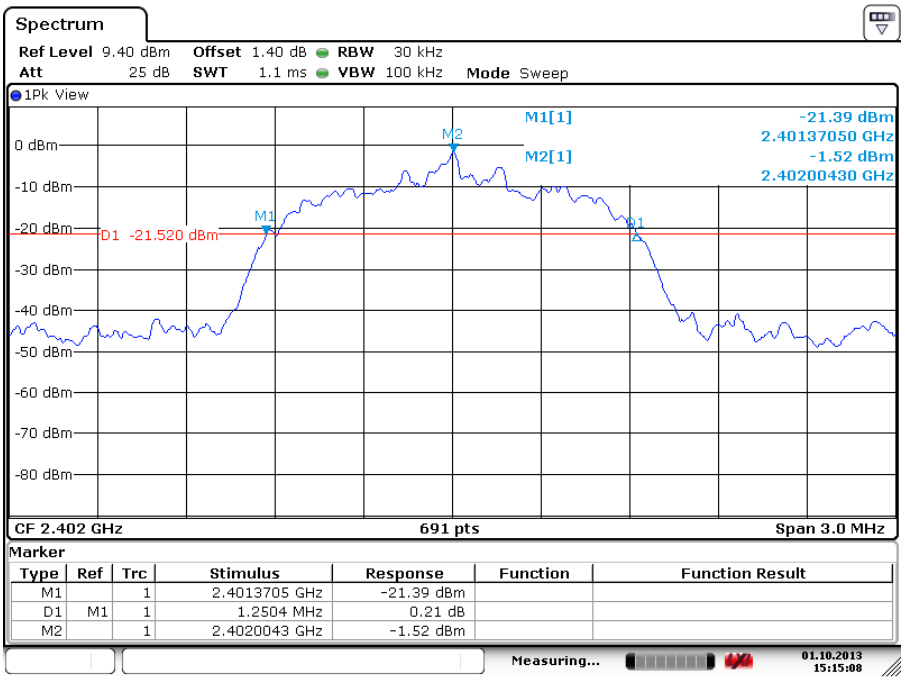
High Channel



Date: 1.OCT.2013 15:17:24

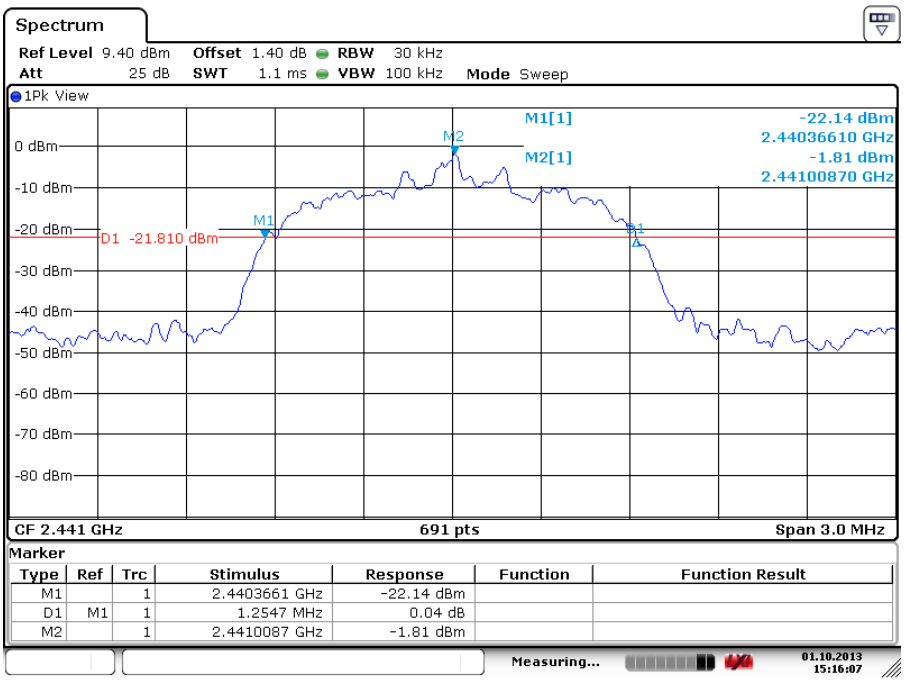
Test Plot of 20dB Bandwidth, 8DPSK modulation

Low Channel



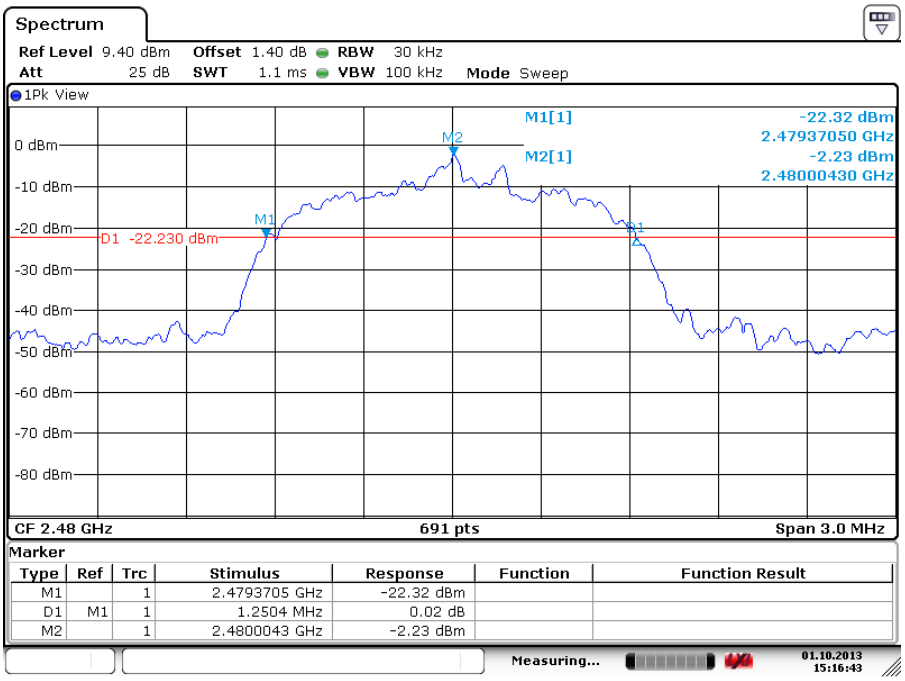
Date: 1.OCT.2013 15:15:08

Middle Channel



Date: 1.OCT.2013 15:16:07

High Channel



Date: 1.OCT.2013 15:16:43

5.1.4 99% Bandwidth

RESULT: **Passed**

Test standard : RSS-Gen (Issue 3) Dec. 2010
Basic standard : RSS-Gen (Issue 3) Dec. 2010
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 11: Test result of 99% Bandwidth, GFSK modulation

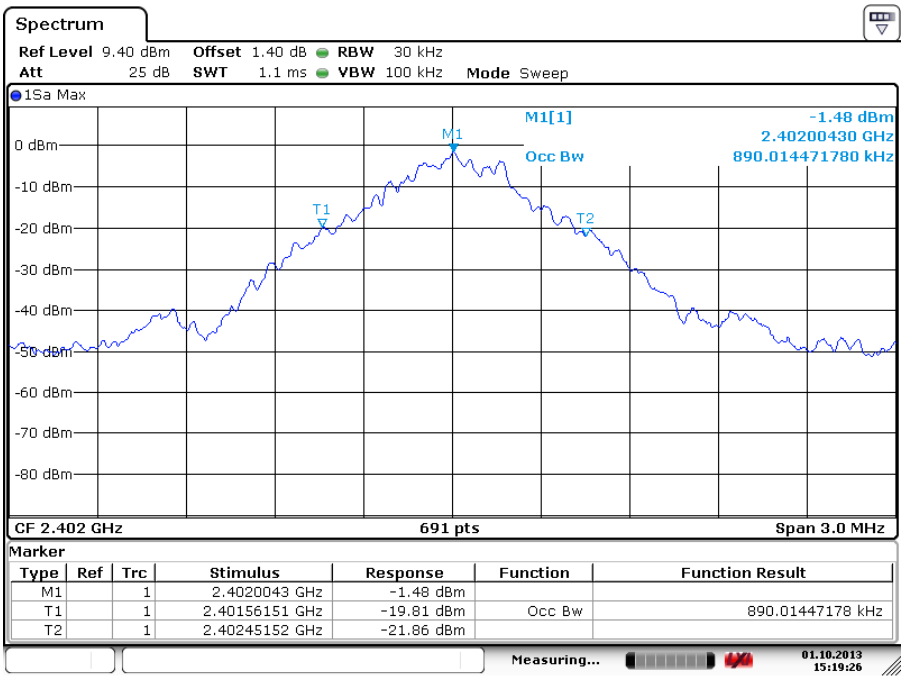
Channel	Channel Frequency (MHz)	99% Bandwidth (kHz)	Limit (MHz)	Result
Low Channel	2402	890	/	Pass
Mid Channel	2441	898.6	/	Pass
High Channel	2480	898.6	/	Pass

Table 12: Test result of 99% Bandwidth, PSK modulation

Channel	Channel Frequency (MHz)	99% Bandwidth (kHz)	Limit (MHz)	Result
Low Channel	2402	1163.3	/	Pass
Mid Channel	2441	1154.8	/	Pass
High Channel	2480	1172.2	/	Pass

Test Plot of 99% Bandwidth, GFSK modulation

Low Channel



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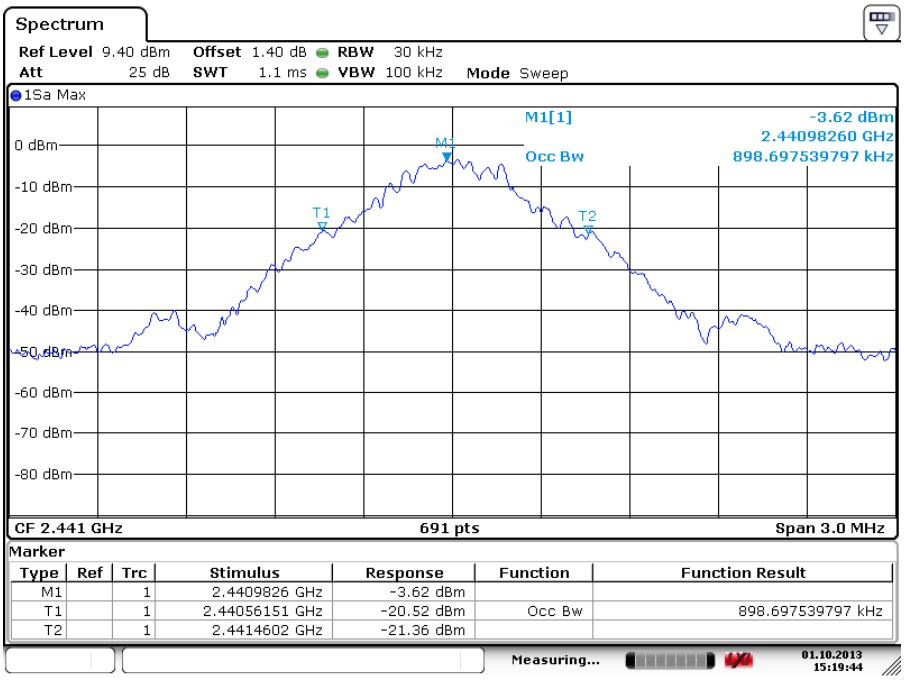
Middle Channel



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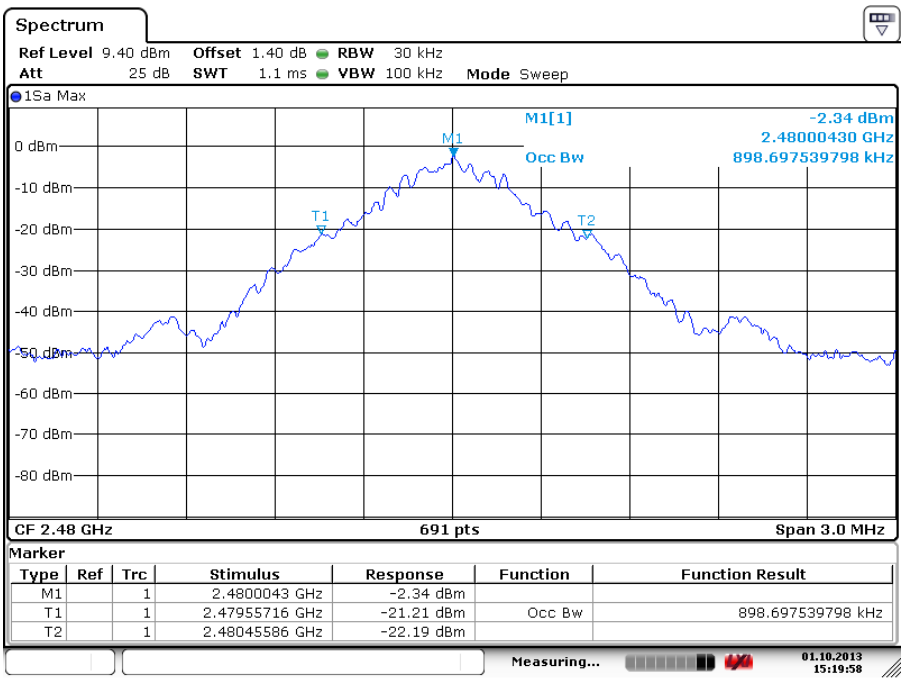
High Channel



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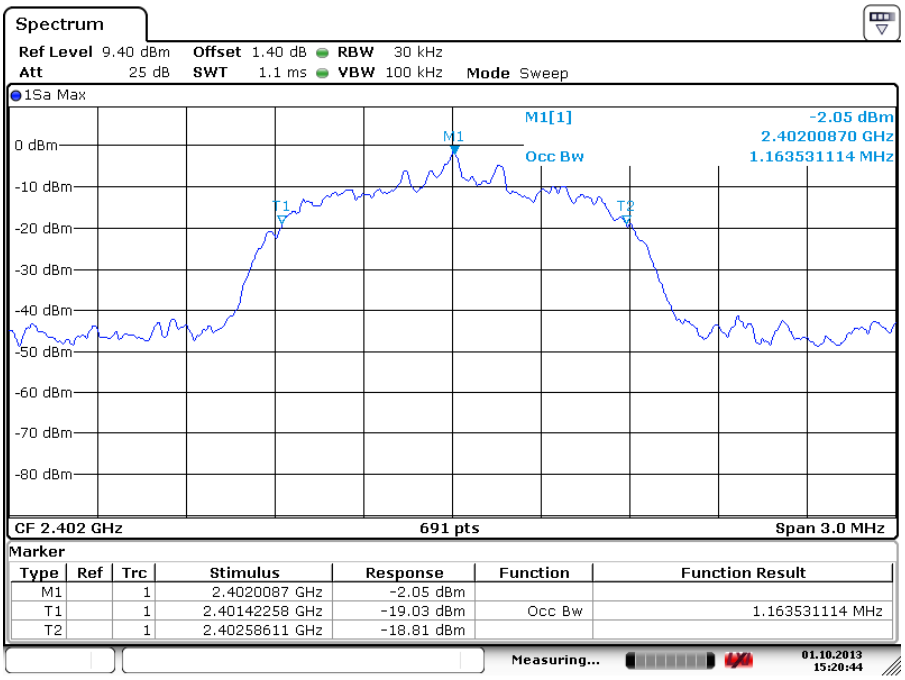
Test Plot of 99% Bandwidth, 8DPSK modulation

Low Channel



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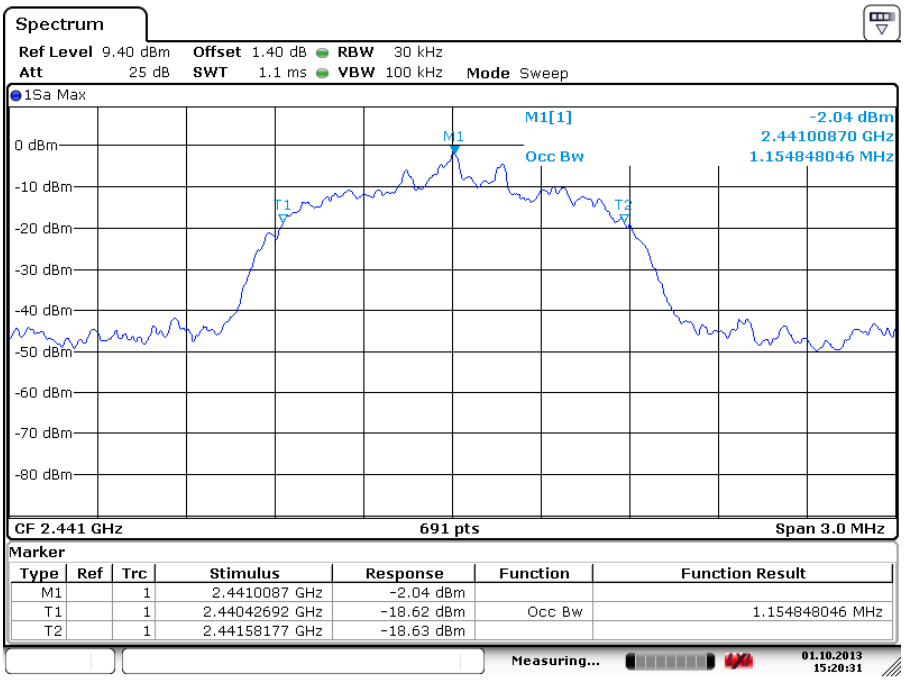
Middle Channel



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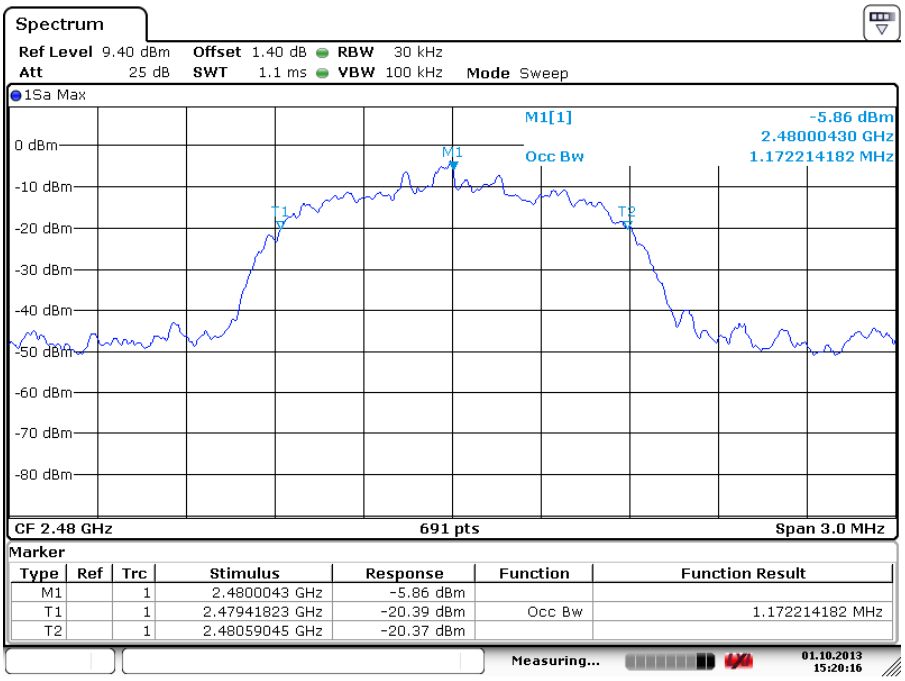
High Channel



Date: 1.OCT.2013 15:20:16

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	:	DA 00-705 of March 30, 2000
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

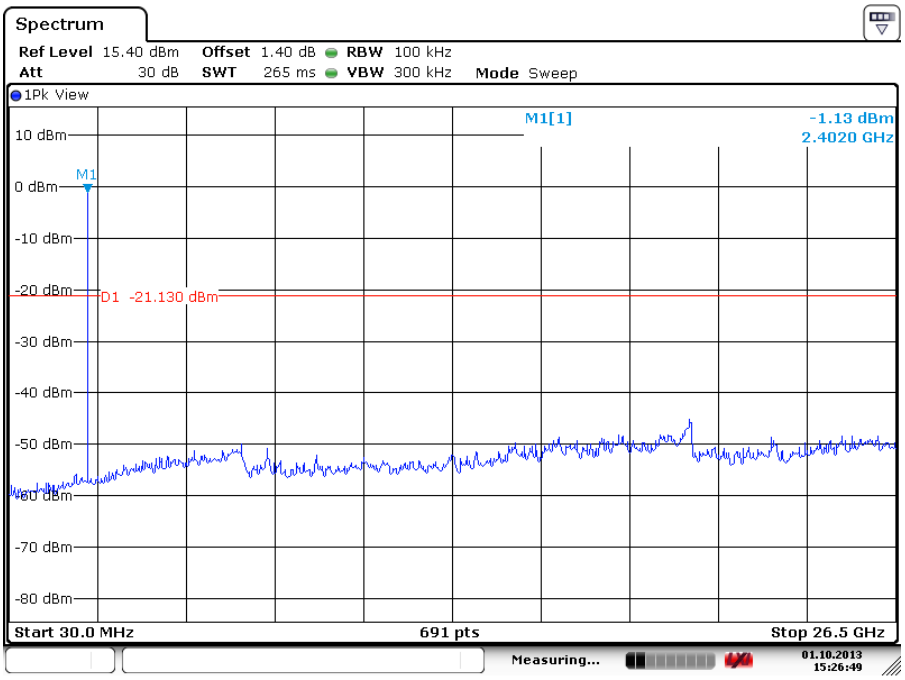
Test setup

Test Channel	:	Low/ Middle/ 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 achived 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



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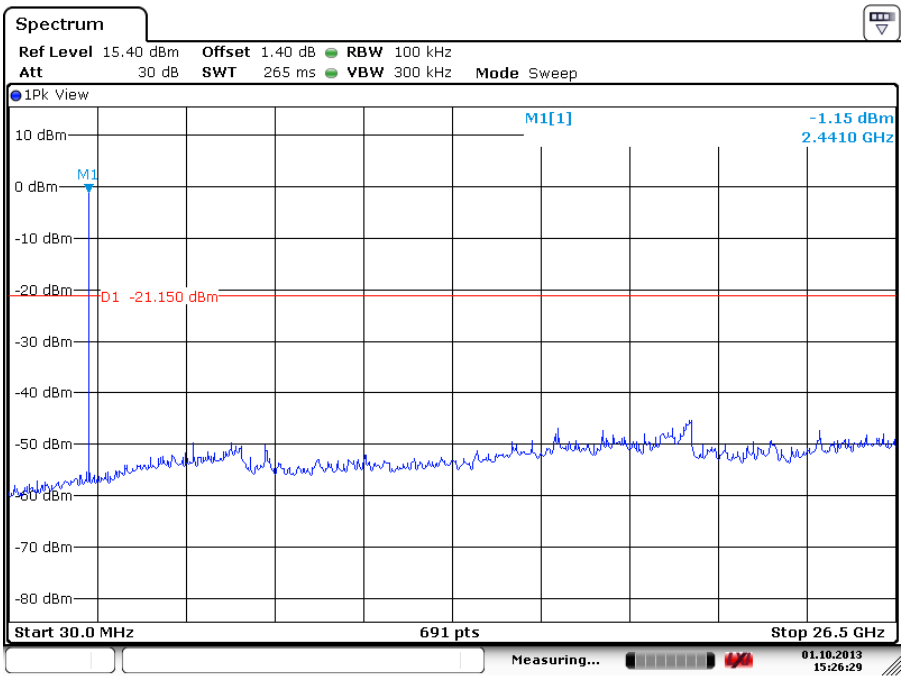
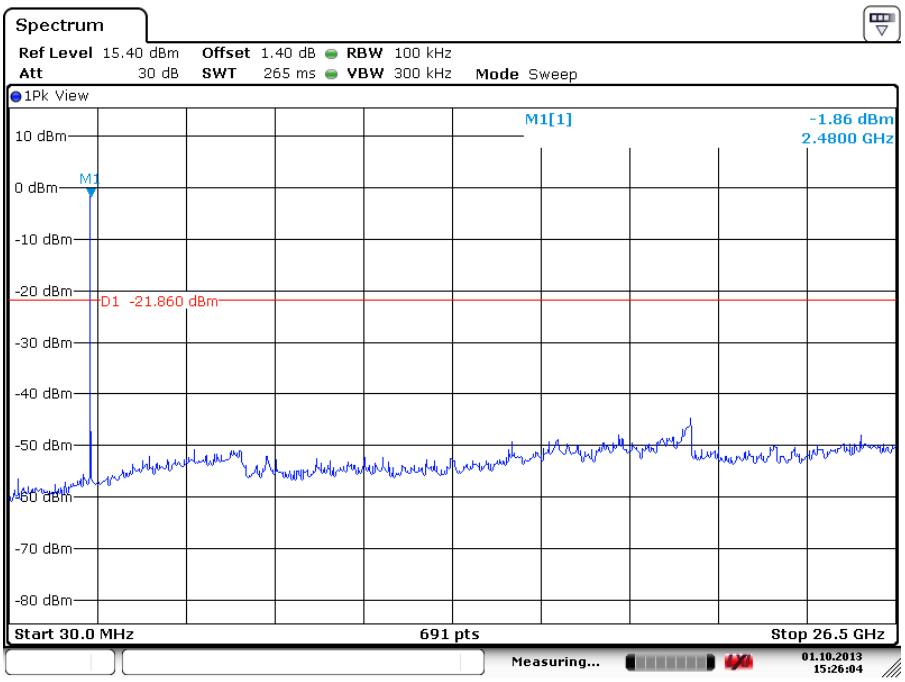
Middle Channel



Date: 1.OCT.2013 15:26:29

High Channel



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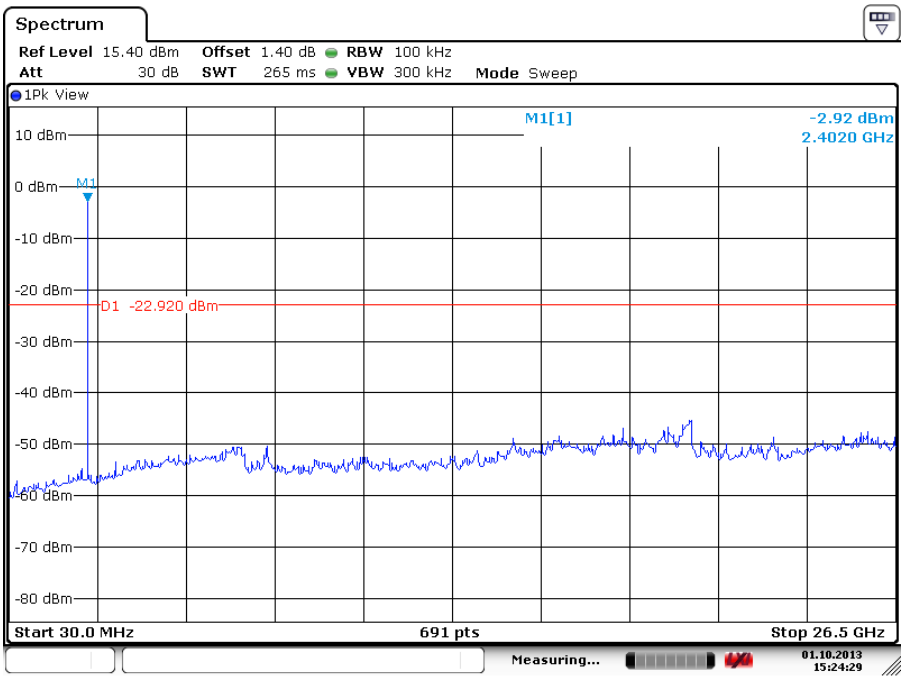
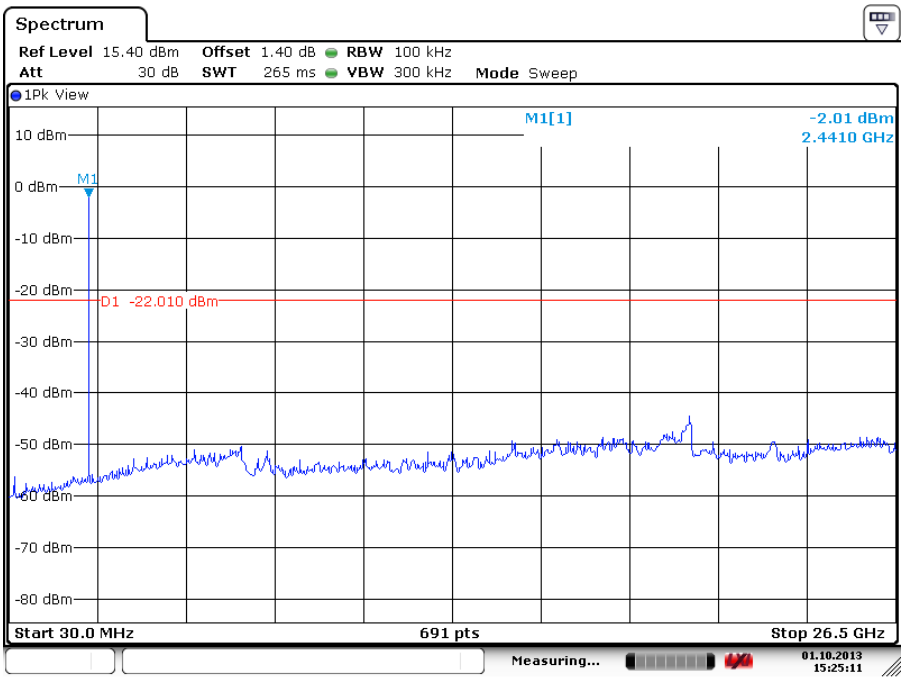
Test Plot of 100kHz Conducted Emissions, 8DPSK modulation

Low Channel



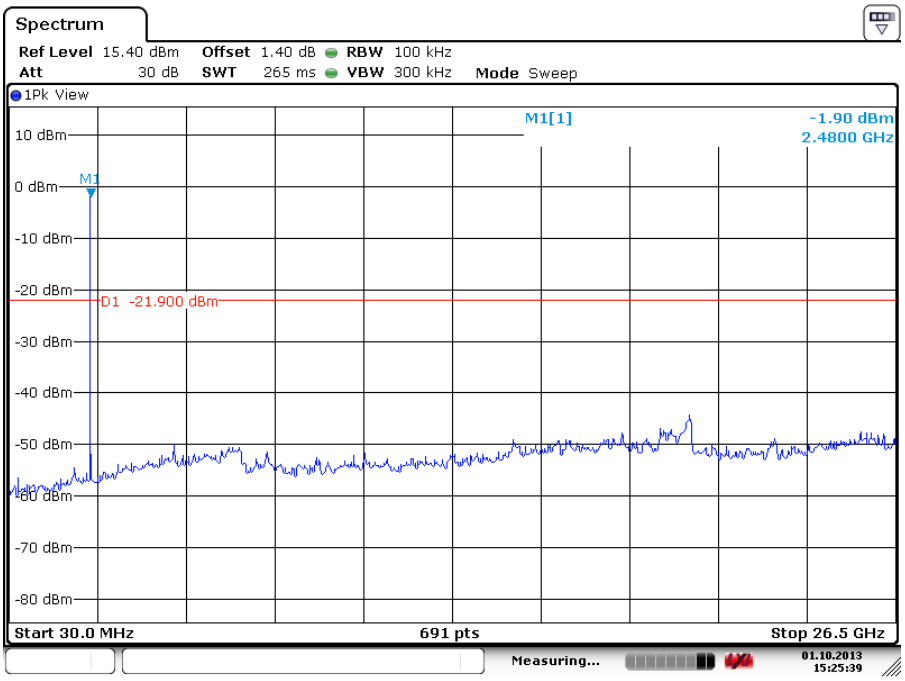
Date: 1.OCT.2013 15:24:29

Middle Channel



Date: 1.OCT.2013 15:25:11

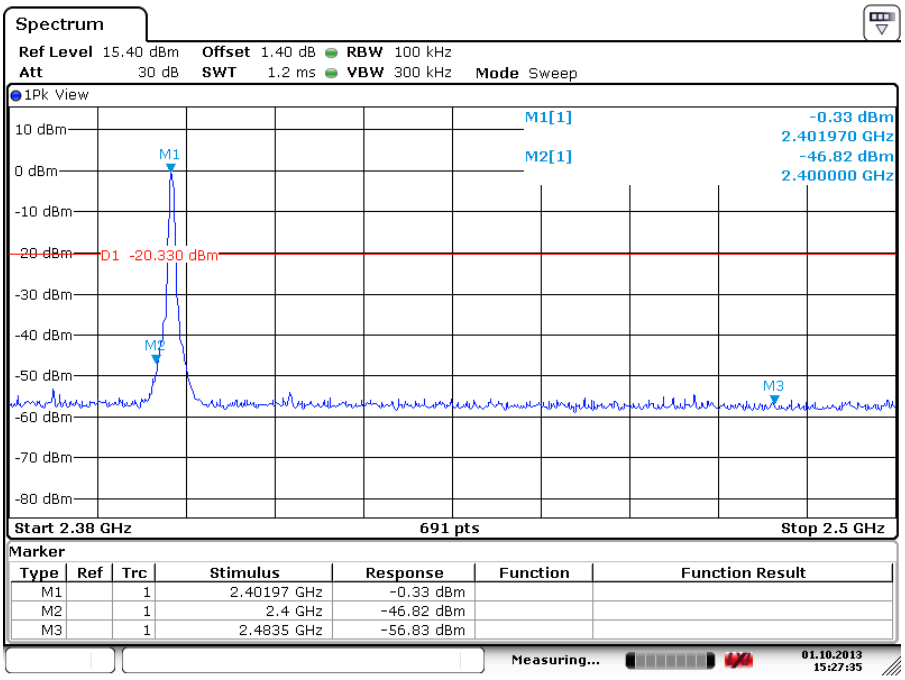
High Channel



Date: 1.OCT.2013 15:25:39

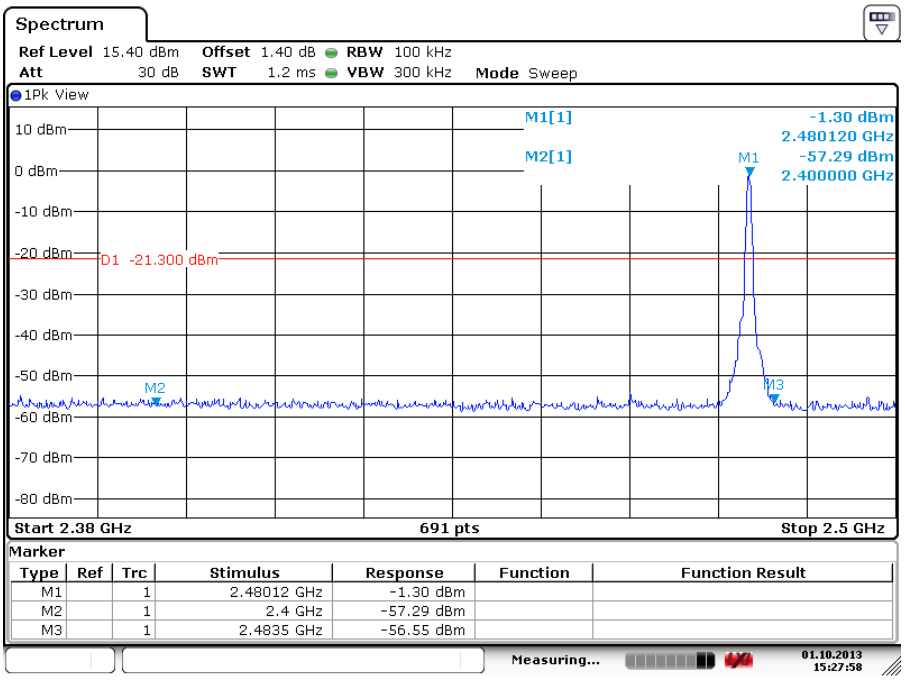
Test Plot of 100kHz Bandwidth of Frequency Band Edge, GFSK modulation

Low Channel



Date: 1.OCT.2013 15:27:35

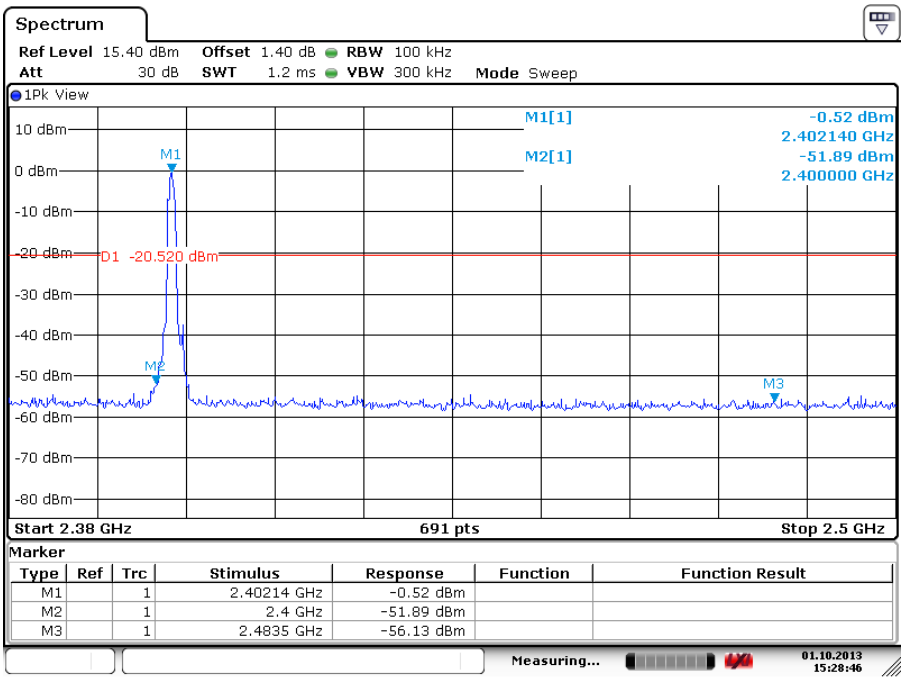
High Channel



Date: 1.OCT.2013 15:27:58

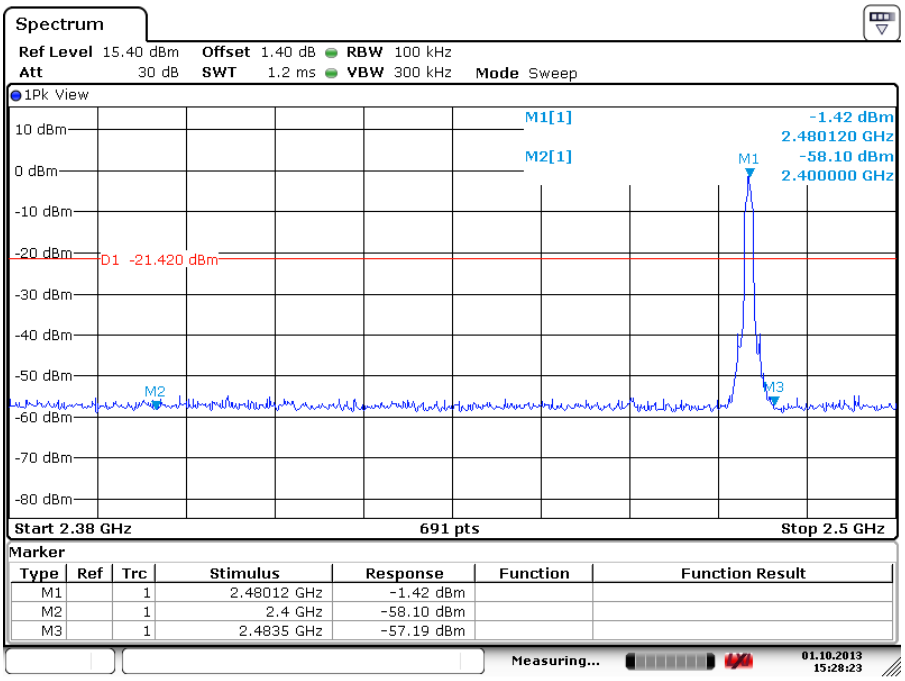
Test Plot of 100kHz Bandwidth of Frequency Band Edge, 8DPSK modulation

Low Channel



Date: 1.OCT.2013 15:28:46

High Channel



Date: 1.OCT.2013 15:28:23

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) and RSS-210 2.7 (Table 1), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-210 2.7 (Table 2 and 3). 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), RSS-210 2.7 (Table 2 and 3) and RSS-210 A2.9(a).
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

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

Remark: Testing was carried out within frequency range 30MHz to the tenth harmonic. For details refer to Appendix 2. 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.

5.1.7 Frequency Separation

RESULT: **Passed**

Test standard	:	FCC part 15.247(a)(1), RSS-210 A8.1(b)
Basic standard	:	DA 00-705 of March 30, 2000
Limit	:	≥ 25kHz or 2/3 of 20dB bandwidth, whichever is greater

Test setup

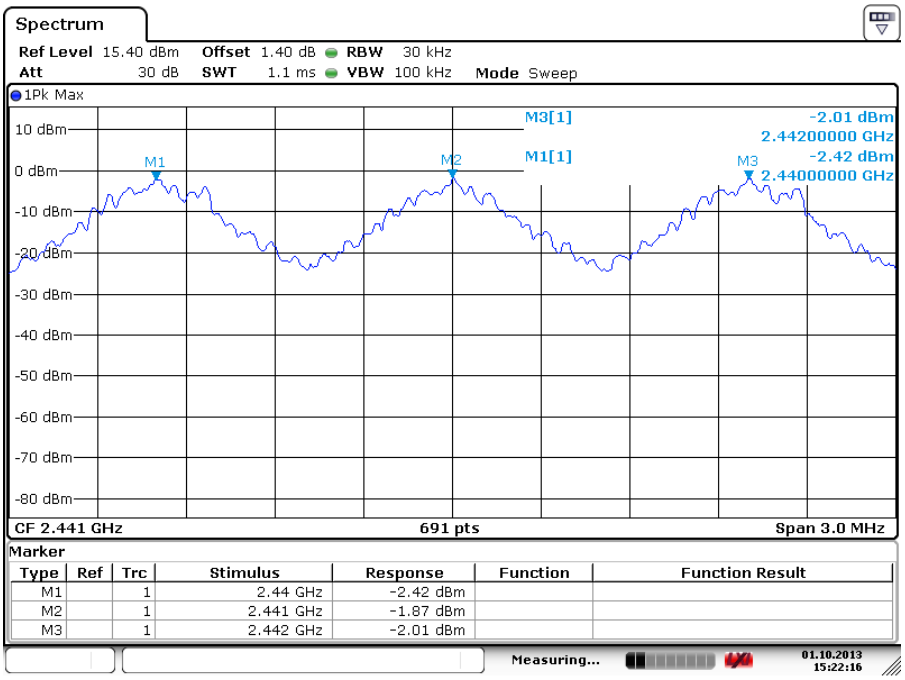
Test Channel	:	Low/ Middle/ High
Operation Mode	:	A
Ambient temperature	:	24℃
Relative humidity	:	53%

Table 13: Test result of Frequency Separation

Channel	Channel Frequency (MHz)	Measured Channel Separation (MHz)	Limit (kHz)	Result
Record Channel	2441	1	≥ 25kHz or 2/3 of 20dB bandwidth	Pass
Record Channel adj 1	2440			
Record Channel adj 2	2442			

Test Plot of Frequency Separation

GFSK



Date: 1.OCT.2013 15:22:16

5.1.8 Number of hopping frequency

RESULT: **Passed**

Test standard	:	FCC part 15.247(a)(1)(iii), RSS-210 A8.1(d)
Basic standard	:	DA 00-705 of March 30, 2000
Limits	:	≥ 15 non-overlapping channels
Kind of test site	:	Shield room

Test setup

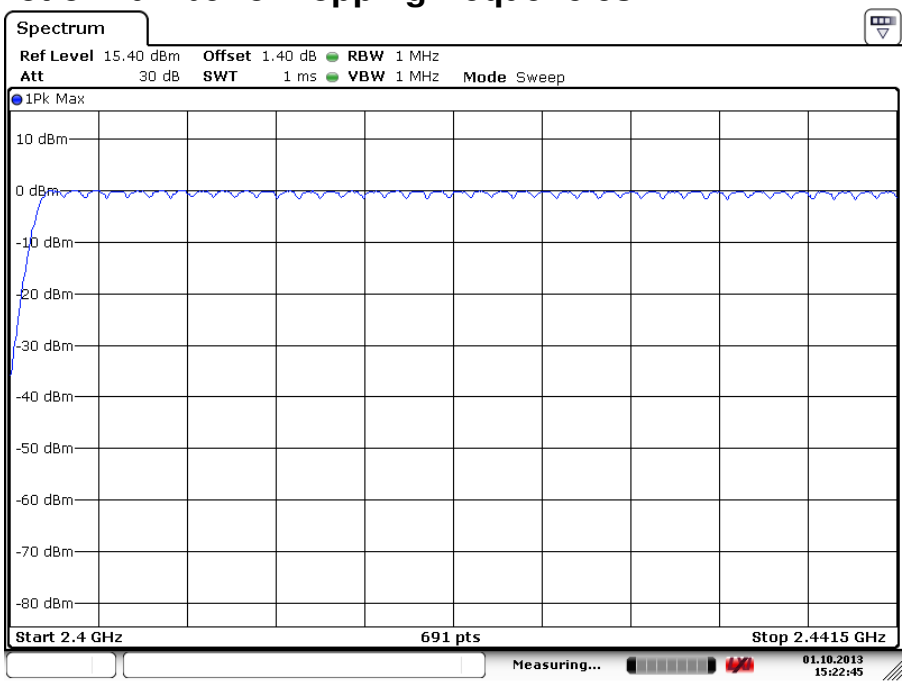
Test Channel	:	Low/ Middle/ High
Operation Mode	:	A

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

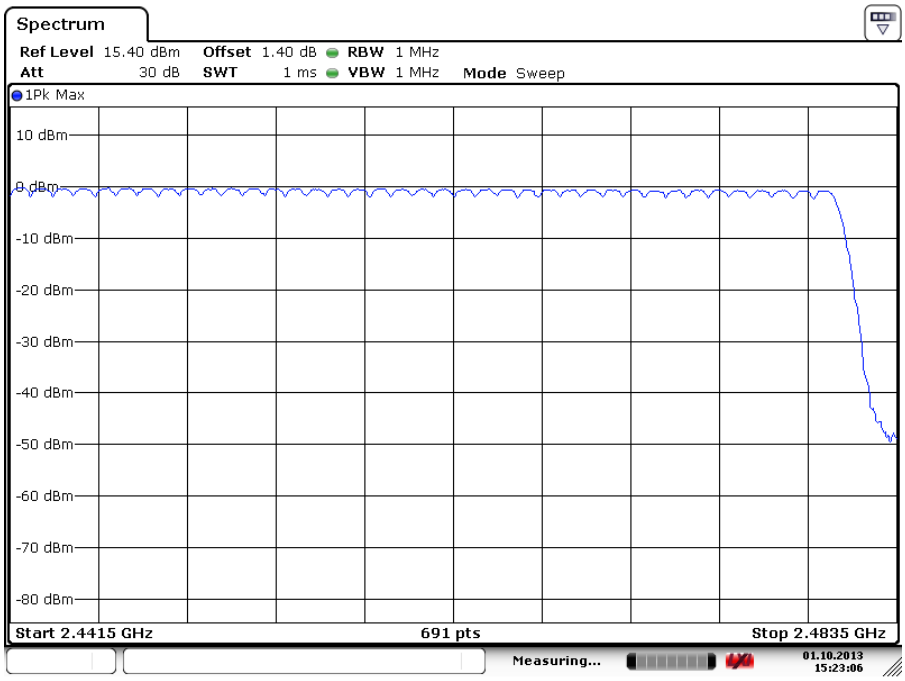
Table 14: Test result of Number of hopping frequency

Frequency Range	Measured Quantity of Hopping Channel	Limit	Result
2400 to 2483.5 MHz	79	≥15	Pass

Test Plot of Number of hopping frequencies



Date: 1.OCT.2013 15:22:45



Date: 1.OCT.2013 15:23:06

5.1.9 Time of Occupancy

RESULT: **Passed**

Test standard	:	FCC part 15.247(a)(1)(iii) , RSS-210 A8.1(d)
Basic standard	:	DA 00-705 of March 30, 2000
Limits	:	0.4s
Kind of test site	:	Shield 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

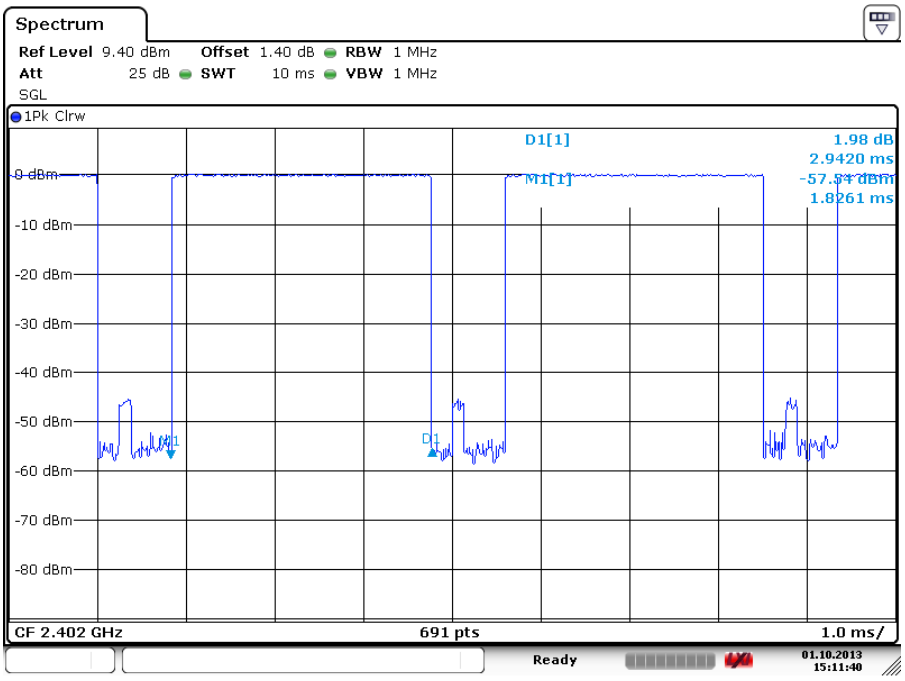
Table 15: Test result of Time of Occupancy

Data Mode	Captured Burst (s)	Dwell time (s)	On+Off time (s)	Limit (s)	Result
DH5	0.0029	0.3135	0.003754	0.4	Pass
3DH5	0.0030	0.3154	0.003768	0.4	Pass

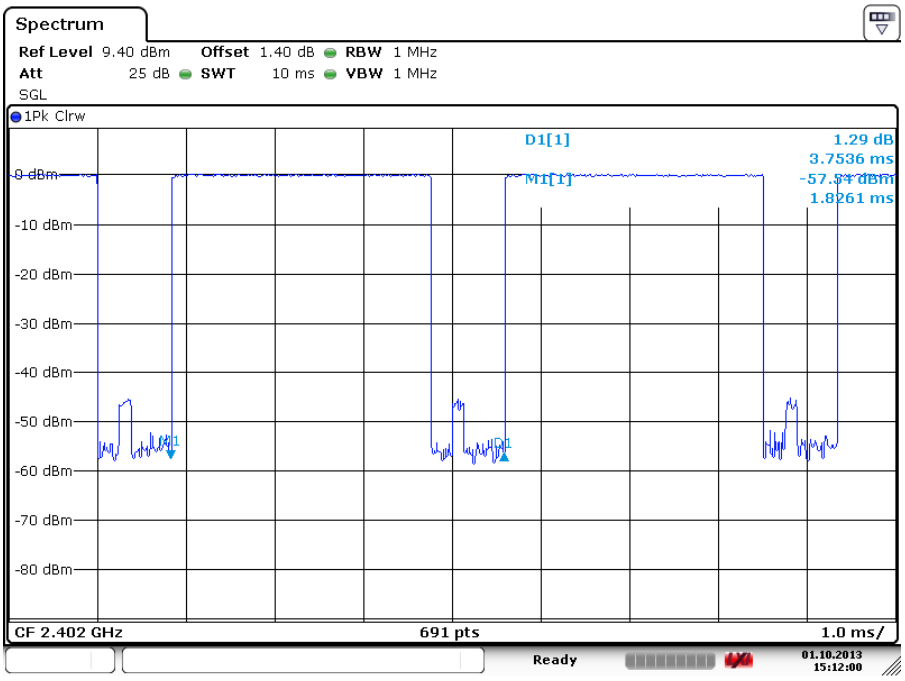
Note:
Dwell time = Pulse width x (Hopping rate / Number of channels) x Period

Period = 0.4 (seconds/ channel) x 79 (channel) = 31.6 seconds.

Test Plot of Time of Occupancy, GFSK modulation

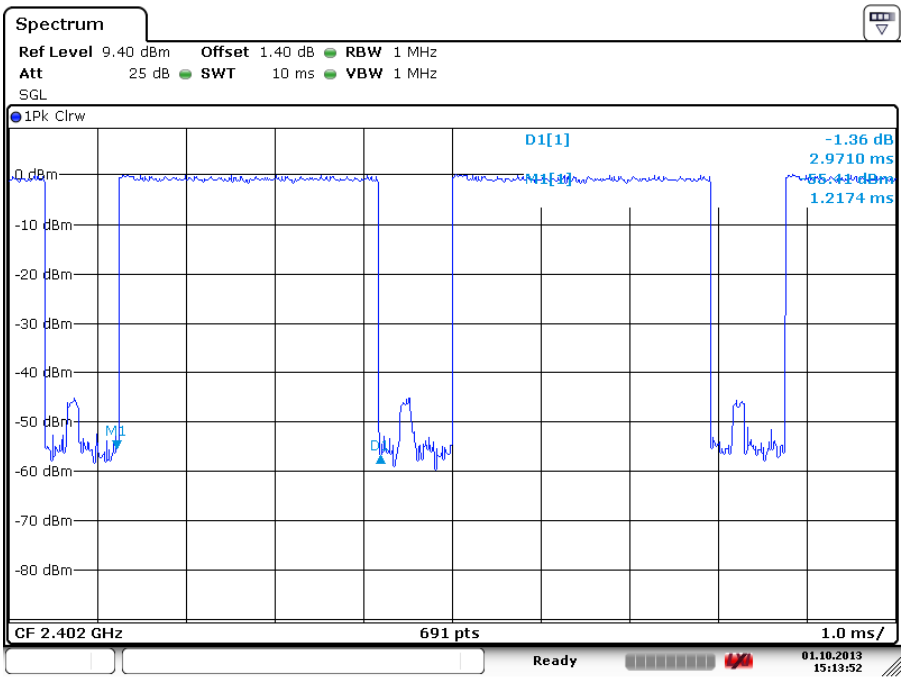


Date: 1.OCT.2013 15:11:40

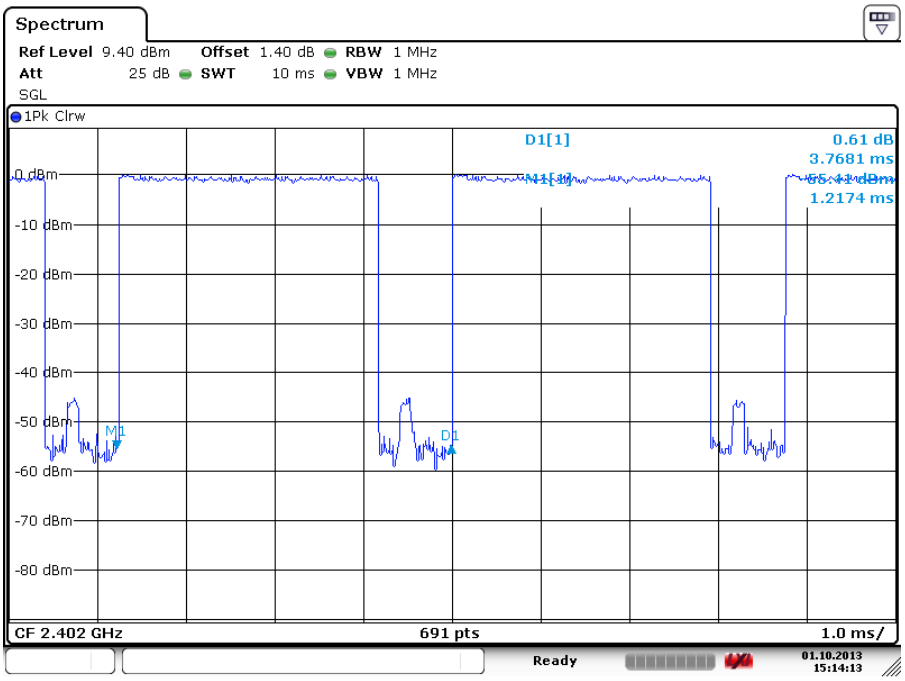


Date: 1.OCT.2013 15:12:01

Test Plot of Time of Occupancy, 8DPSK modulation



Date: 1.OCT.2013 15:13:52



Date: 1.OCT.2013 15:14:13

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

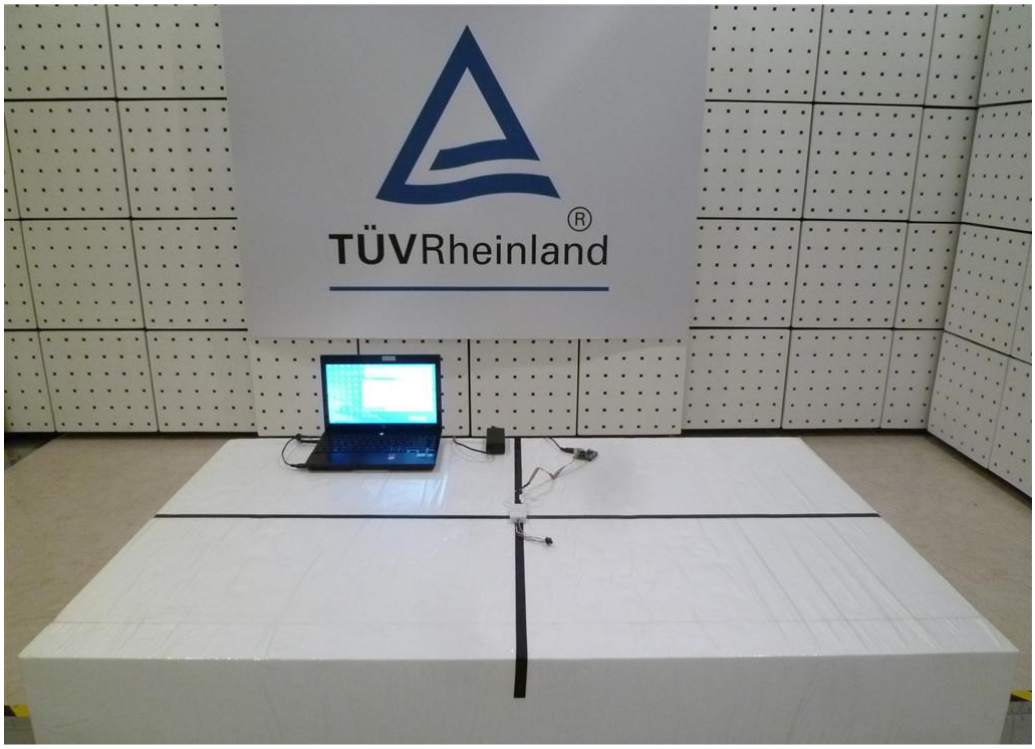
RESULT: **Passed**

Test standard : FCC KDB Publication 447498

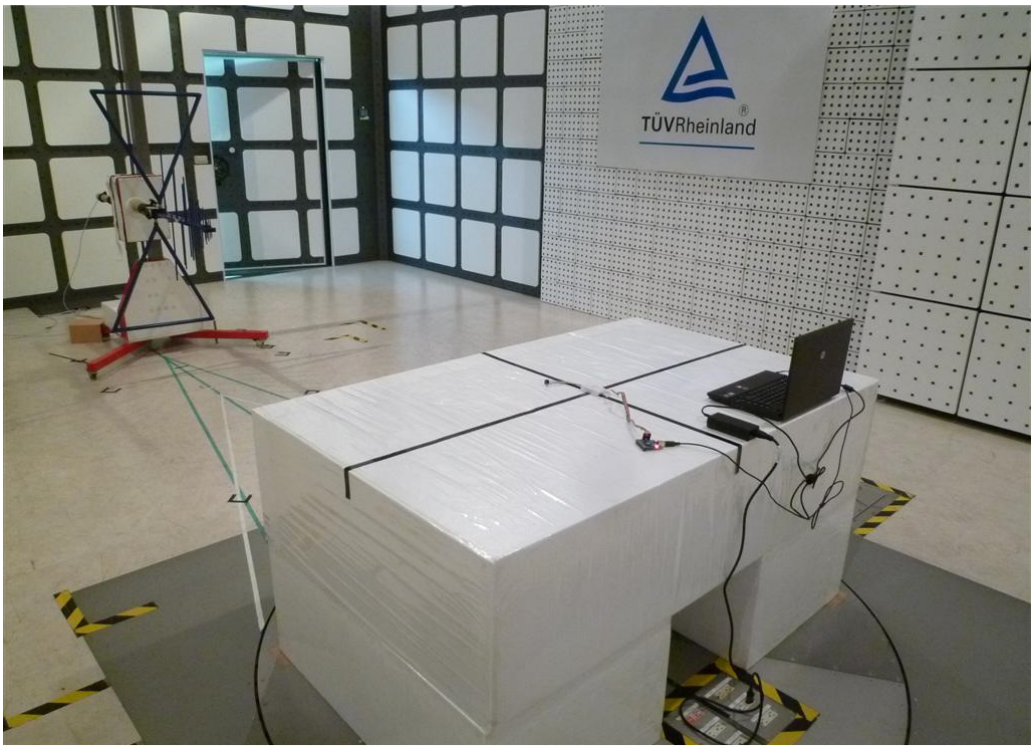
Since maximum peak output power of the transmitter is <1mW, hence the EUT is exclueded from SAR evaluation according to FCC KDB publication 447498 D01: Mobile Portable RF Exposure..

7. Photographs of the Test Set-Up

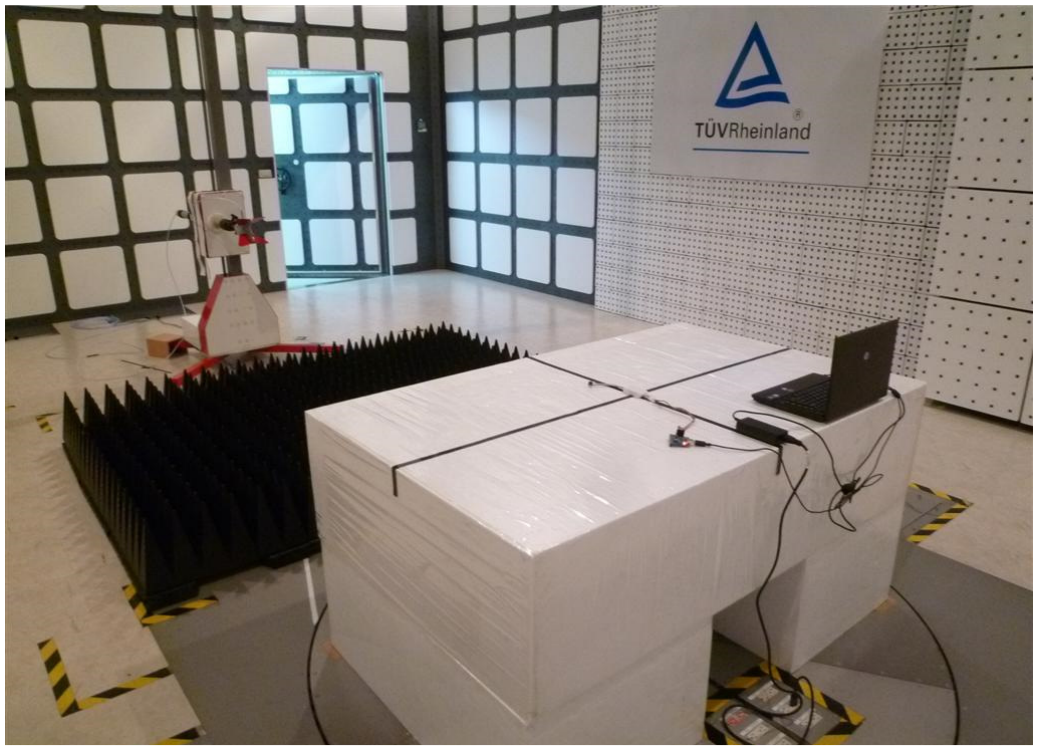
Photograph 1: Set-up for Spurious Emissions (Front View)



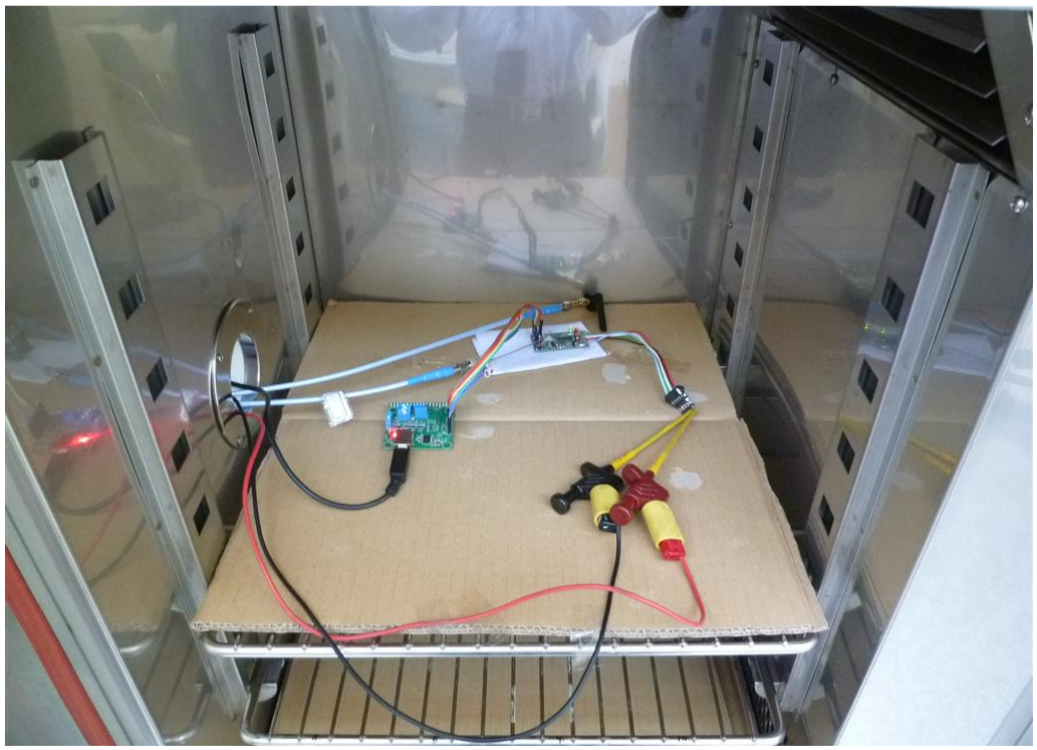
Photograph 2: Set-up for Spurious Emissions (Back View 1)



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

9. List of Photographs