1 = sehr gut

1 = very good

2 = gut

2 = good

P(ass) = entspricht o.g. Prüfgrundlage(n)

P(ass) = passed a.m. test specification(s)

\* Legende:

Legend:



Prüfbericht-Nr.: Test Report No.:	50089455 001	<b>Auftrags-Nr.:</b> Order No.:	114064018	Seite 1 von 42 Page 1 of 42
Kunden-Referenz-Nr.: Client Reference No.:	N/A	Auftragsdatum: Order date:	24-Apr-2017	
Auftraggeber: Client:	Kwang Yang Motor Co., Ltd. No. 35 Wansing St., Sanmin D	ristrict, Kaohsiung C	City 80794,Taiwan(R.	O.C.)
Prüfgegenstand: Test item:	Noodoe			
Bezeichnung / Typ-Nr.: Identification / Type No.:	37130-LGC6, 37140-AEB9			
Auftrags-Inhalt: Order content.	FCC Part15C Test report (BR	/EDR)		
Prüfgrundlage: Test specification:	FCC 47CFR Part 15: Subpart	C Section 15.247		
Wareneingangsdatum: Date of receipt:	28-Nov-2016			
Prüfmuster-Nr.: Test sample No.:	A000450488-003 A000450488-001			
Prüfzeitraum: Testing period:	29-Nov-2016 - 14-Feb-2017			
Ort der Prüfung: Place of testing:	EMC Laboratory Taipei			
Prüflaboratorium: Testing laboratory:	TUV Rheinland Taiwan Ltd.			
Prüfergebnis*: Test result*:	Pass		1	
Report date / tested by:		kontrolliert von /	reviewed by:	
2017-08-25 Ryan W.	T. Chen / Project Manager	2017-08-25 Arv	vin Ho/Vice General I	Manager
Datum Name / Stell	ung Unterschrift	Datum Nam	ne / Stellung	Unterschrift
Date Name / Posit	ion Signature	Date Nam	ne / Position	Signature
<ul><li>Sonstiges / Other.</li><li>The RF characteristic are the model name.</li></ul>	cs and PCB layout of 37140-AE	B9 are the same as	37130-LGC6, the or	nly differences
Zustand des Prüfgegen Condition of the test item	standes bei Anlieferung: at delivery:		indig und unbeschäd te and undamaged	igt

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.

F(ail) = failed a.m. test specification(s)

F(ail) = entspricht nicht o.g. Prüfgrundlage(n)

3 = befriedigend

3 = satisfactory

4 = ausreichend

4 = sufficient

N/A = nicht anwendbar

N/A = not applicable

5 = mangelhaft

N/T = not tested

5 = poor

N/T = nicht getestet

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.



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### **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

6.1.1 ELECTROMAGNETIC FIELDS

RESULT: Passed



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### 1. General Remarks

## 1.1 Complementary Materials

The following attachments are integral parts of this test report:

**Appendix P: Photo Documentation** 

(File Name: 50089455APPENDIX P)

**Appendix D: Test Result of Radiated Emissions** 

(File Name: 50089455APPENDIX 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 C63.10:2013



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### 2. Test Sites

# 2.1 Test Facility

TUV Rheinland Taiwan Ltd. Taipei Office

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

FCC Registration No.: 340738

IC Canada Registration No.: 9465A-1 TAF Accredited NCC Test Lab. No.:0759

TAF ISO17025 Certification effective periods: 2016-Jul-1st to 2019-Jun-30th



Testing Laboratory 0759

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### 2.2 List of Test and Measurement Instruments

### **Table 2: List of Test and Measurement Equipment**

Kind of Equipment	Manu-facturer	Туре	S/N	Last Calibration	Next Calibration
Test Software	Farad	EZ_EMC	Ver. TUV3A1	N/A	N/A
EMI Test Receiver	R&S	ESR7	101062	2016/09/12	2017/09/12
Spectrum Analyzer	R&S	FSV 40	100921	2016/04/21	2017/04/21
Spectrum Analyzer	Agilent	N9010A	MY53470241	2016/04/25	2017/04/24
Preamplifier (30MHz -1GHz)	HP	8447F	2805A03335	2016/07/29	2017/07/29
Preamplifier (18 GHz -40 GHz)	COM- POWER	PAM-840	461257	2016/11/01	2017/11/01
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G	060558	2016/11/17	2017/11/17
Bilog Antenna	TESEQ	CBL6111D	29804	2016/06/23	2017/06/23
Horn Antenna	ETS- Lindgren	3117	138160	2016/05/03	2017/05/03
Horn Antenna (18GHz~40GHz)	COM- POWER	AH840	101029	2016/10/11	2017/10/11
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2016/05/11	2017/05/11
Spectrum Analyzer	R&S	FSL3	101943	2015/09/07	2017/09/07
Temp. & Humid. Chamber	Giant Force	GCT-099- 40-S	MAF0103- 007	2015/07/13	2017/07/12
LISN (1 phase)	R&S	ENV216	101243	2016/06/02	2017/06/02
LISN	R&S	ENV216	101262	2016/06/16	2017/06/16

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# 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

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

# 2.5 Measurement Uncertainty

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

**Table 3: Emission Measurement Uncertainty** 

Parameter	Uncertainty
RF power, conducted	± 1.5 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 %



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### 3. General Product Information

### 3.1 Product Function and Intended Use

The EUT is a bluetooth Speedometer. It contains a Bluetooth 4.0 dual mode compatible module enabling the user to communicate data through a Wireless interface. 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/Test Item	Noodoe
Type Identification	37130-LGC6, 37140-AEB9
FCC ID	2AM4E37130-LGC6

### **Table 5: Technical Specification of EUT**

Technical Specification	Value
Operating Frequency	2402 MHz ~ 2480 MHz
Channel Spacing	1 MHz
Channel number	79
Operation Voltage	12 Vdc
Modulation	GFSK, $\pi$ /4 DQPSK, 8 DPSK
Antenna gain	1.12 dBi

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**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



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# 3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

### 3.5 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description



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# 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: 2013

The samples were used as follows:

Conducted: **A000450488-001** Radiation: **A000450488-003** 

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:

Description	Manufacturer	Model No.	Serial No.
Notebook(EMC-06)	Lenovo	TP00048A	PB-0F8B2

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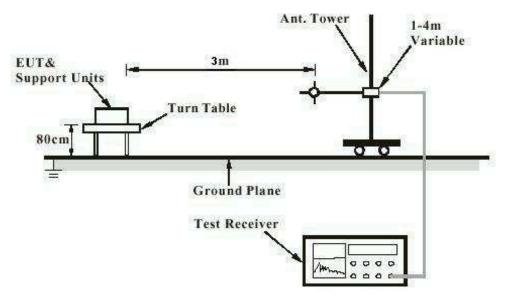
Test Report No.

### 4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested containing the noise suppression parts as in the Photo Appendix and the Test Setup Photos. No additional measures were employed to achieve compliance.

### 4.5 Test Setup Diagram

**Diagram of Measurement Configuration for Radiation Test** 



Note: Measurements above 1 GHz are done with a table height of 1.5m



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Diagram of Measurement Equipment Configuration for Mains Conduction Measurement

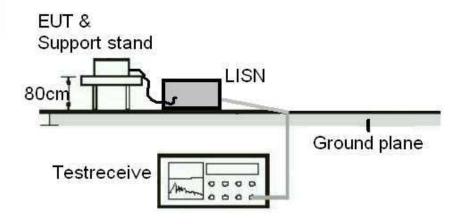
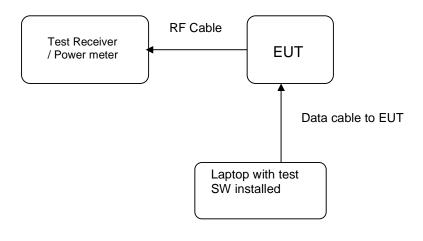


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement





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### 5. Test Results

# 5.1 Transmitter Requirement & Test Suites

### 5.1.1 Antenna Requirement

**RESULT: Passed** 

Test standard LP0002(2016): 2.2, 3.10.1, (3)

FCC Part 15.247(b)(4), Part 15.203 and RSS-

Requirement use of approved antennas only with directional gains that

do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 1.12 dBi. The antenna is a printed PCB trace 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.



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### 5.1.2 Peak Output Power

RESULT: Passed

Test standard : FCC Part 15.247(b)(1),

RSS-247 5.4(2)

LP0002(2016): 3.10.1, (2)

Basic standard : ANSI C63.10:2013

LP0002(2016) Appendix II

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	10.31	0.01074	0.125
Middle Channel	2441	8.31	0.00677	0.125
High Channel	2480	8.31	0.00678	0.125

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

Channel	Channel Frequency	Peak Output Power (dBm) (W)		Limit
	(MHz)			(W)
Low Channel	2402	9.13	0.00818	0.125
Middle Channel	2441	8.85	0.00766	0.125
High Channel	2480	8.84	0.00765	0.125

Pmax: 10.31 mW



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Produkte Products

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#### 5.1.3 20dB Bandwidth

RESULT: Passed

Test standard : FCC Part 15.247(a)(1),

RSS-247 5.1(1)

LP0002(2016): 3.10.1, (6.1.1)

Basic standard : ANSI C63.10:2013

LP0002(2016) Appendix II

**Test setup** 

Test Channel : Low/ Middle/ High

Operation Mode : A

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

Table 9: Test result of 20dB Bandwidth, GFSK modulation

Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (MHz)	Result
Low Channel	2402	952.5	1.5	Pass
Mid Channel	2440	956.7	1.5	Pass
High Channel	2480	956.3	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	1377	1.5	Pass
Mid Channel	2440	1379	1.5	Pass
High Channel	2480	1375	1.5	Pass

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

If the carrier separation frequency of a Bluetooth Device is set at 1 MHz due to the firmware setting and the Bluetooth Standard, then for power <125 mW the limit for the 20 dB Bandwidth, becomes 1 MHz / 0.66666 = 1.5 MHz.

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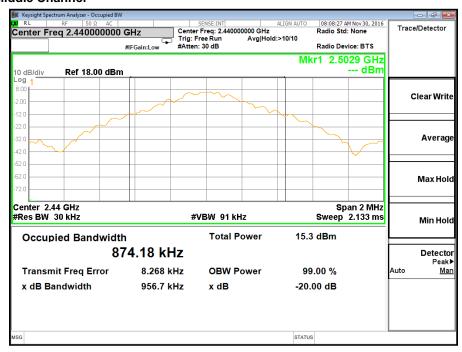
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### Test Plot of 20dB Bandwidth, GFSK modulation

#### **Low Channel**



### **Middle Channel**



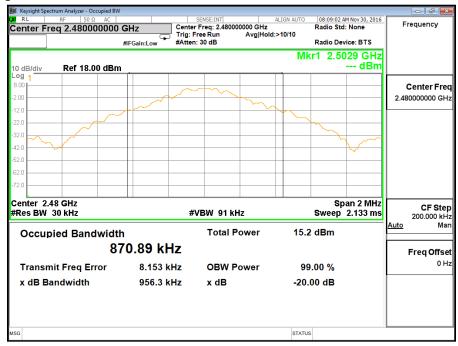


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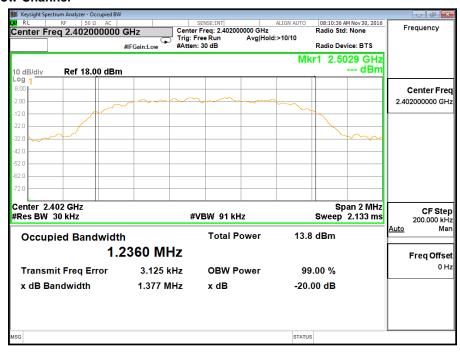
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#### **High Channel**



### Test Plot of 20dB Bandwidth, 8DPSK modulation

#### **Low Channel**





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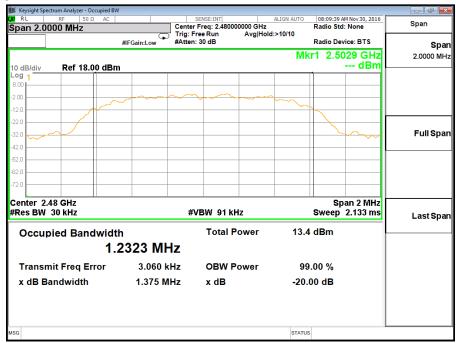
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#### Middle Channel



### **High Channel**





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#### Produkte Products

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### 5.1.4 99% Bandwidth

RESULT: Passed

Test standard : RSS-Gen (Issue 4)
Basic standard : RSS-Gen (Issue 4)
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 : 100-103kPa

### Table 11: Test result of 99% Bandwidth, GFSK modulation

Channel	Channel Frequency (MHz)	99% Bandwidth (kHz)
Mid Channel	2440	874.18

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

Channel	Channel Frequency (MHz)	99% Bandwidth (kHz)
Mid Channel	2440	1235.1



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

**RESULT: Passed** 

FCC part 15.247(d), Test standard

RSS-247 5.5

LP0002(2016): 3.10.1, (5)

Basic standard ANSI C63.10:2013

LP0002(2016) Appendix II

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

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.

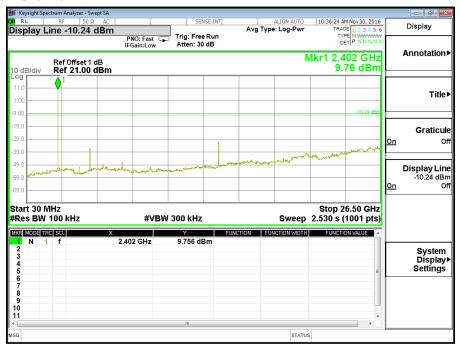


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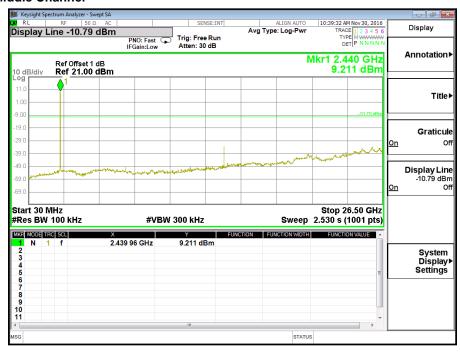
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# Test Plot of 100kHz Conducted Emissions, GFSK modulation

#### **Low Channel**



#### **Middle Channel**





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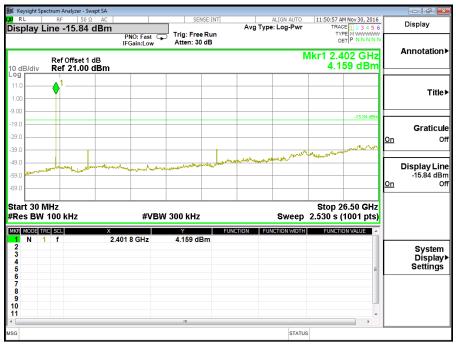
#### **High Channel**

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### Test Plot of 100kHz Conducted Emissions, 8DPSK modulation

#### **Low Channel**



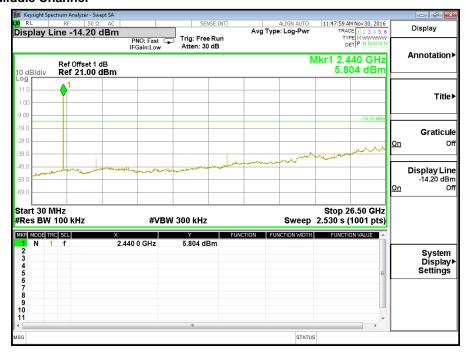


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#### **Middle Channel**

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#### **High Channel**

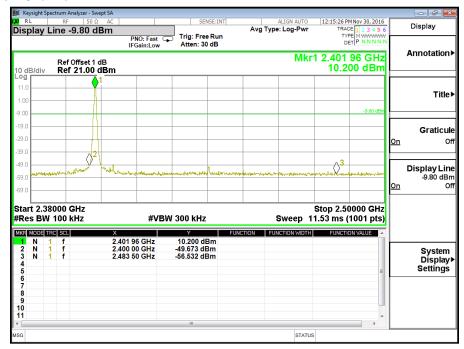


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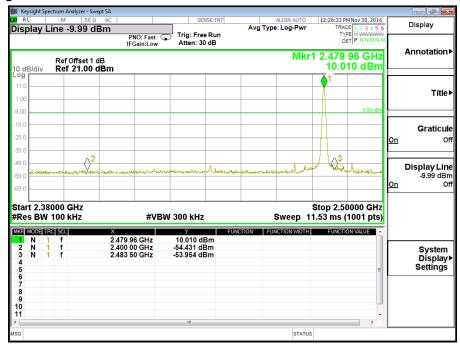
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# Test Plot of 100kHz Bandwidth of Frequency Band Edge, GFSK modulation

#### **Low Channel**



#### **High Channel**



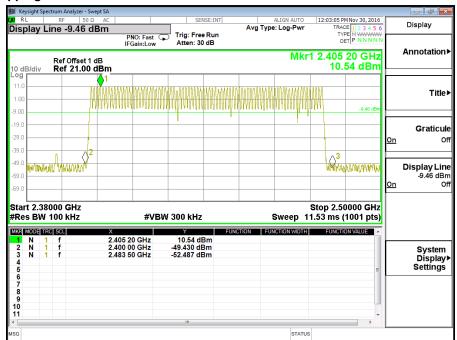


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#### **Hopping ON**

Test Report No.

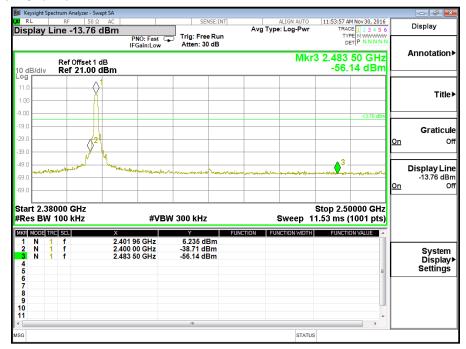


> 50089455 001 Prüfbericht - Nr.: Test Report No.

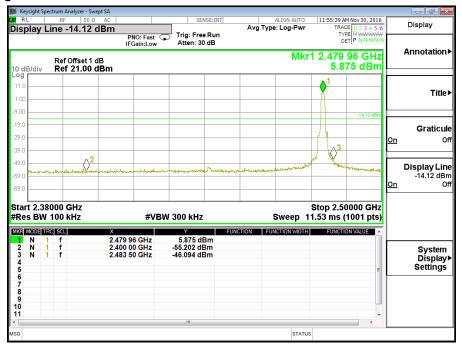
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### Test Plot of 100kHz Bandwidth of Frequency Band Edge, 8DPSK modulation

#### **Low Channel**



#### **High Channel**





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Test Report No.

#### **Hopping ON**





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Test Report No.

### **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-247 5.5 and RSS-Gen 8.9

LP0002(2016): 3.10.1, (5)

Basic standard ANSI C63.10

Limits Radiated emissions which fall in the restricted bands,

> as defined in FCC 15.205(a) and RSS-Gen i4, 8.9 (Table 6), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-Gen i4,

8.9 (Table 4 and 5).

Radiated emissions which fall in the restricted bands, as defined in LP0002(2016): 2.7, must comply with

the radiated emission limits specified in

LP0002(2016): 2.8

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-Gen i4, 8.9 (Table 4 and 5) and RSS-210 A2.9(a). Emission radiated outside the specified frequency bands must comply with the radiated emission limits

specified in LP0002(2016): 2.8

Kind of test site 3m Semi-Anechoic Chamber

**Test setup** 

Test Channel Low/ Middle/ High

Operation Mode A, B

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 worst-case Axis orientation is 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.



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### **5.1.7 Frequency Separation**

**RESULT: Passed** 

Test standard FCC part 15.247(a)(1)

RSS-247 5.1

LP0002(2016): 3.10.1, (6.1.1)

Basic standard ANSI C63.10:2013

LP0002(2016) Appendix II

≥ 25kHz or 2/3 of 20dB bandwidth, whichever is greater Limit

**Test setup** 

Test Channel Low/ Middle/ High

Operation Mode Ambient temperature **24**℃ 53% Relative humidity

### **Table 13: Test result of Frequency Separation**

Channel	Channel Frequency (MHz)	Measured Channel Separation (MHz)	Limit (kHz)	Result
Record Channel	2441		> 05111 0/0 (	
Record Channel adj 1	2440	1	≥ 25kHz or 2/3 of 20dB bandwidth	Pass
Record Channel adj 2	2442		200B bandwidth	



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# **Test Plot of Frequency Separation**

#### **GFSK**





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### 5.1.8 Number of hopping frequency

RESULT: Passed

Test standard : FCC part 15.247(a)(1)(iii)

RSS-247 5.1(5)

LP0002(2016): 3.10.1, (6.1.2)

Basic standard : ANSI C63.10:2013

LP0002(2016) Appendix II

**Test setup** 

Test Channel : Hopping On

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

### Table 14: Test result of Number of hopping frequency

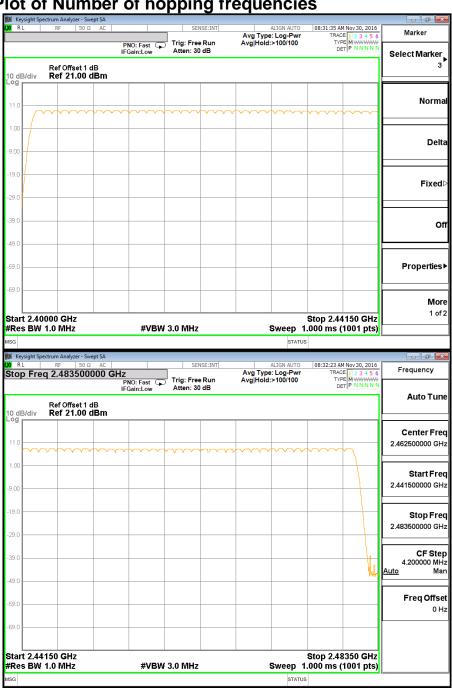
Frequency Range	Measured Quantity of Hopping Channel	Limit	Result
2400 to 2483.5 MHz	79	≥15	Pass

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**Test Plot of Number of hopping frequencies** 





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#### Produkte Products

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### **5.1.9 Time of Occupancy**

RESULT: Passed

Test standard : FCC part 15.247(a)(1)(iii)

RSS-247 5.1(5)

LP0002(2016): 3.10.1, (6.1.2)

Basic standard : ANSI C63.10:2013

LP0002(2016) Appendix II

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	0.00290	0.3118	0.00372	0.4	Pass
3DH5	0.00290	0.3118	0.00372	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.

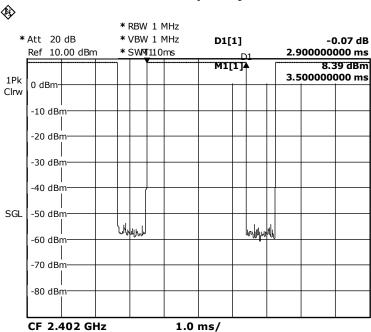
Hopping rate = 1 / (On+Off time) = 266 Hz

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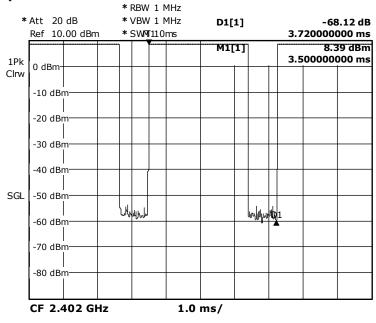
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### Test Plot of Time of Occupancy, GFSK modulation



Date: 17.FEB.2017 09:52:11



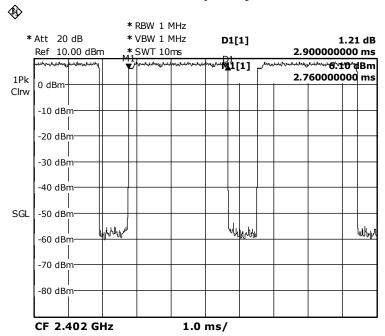


Date: 17.FEB.2017 09:52:24

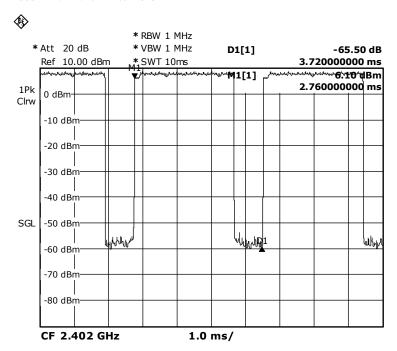
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### Test Plot of Time of Occupancy, 8DPSK modulation



Date: 17.FEB.2017 09:48:52



Date: 17.FEB.2017 09:49:07



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# 6. Safety Human exposure

# **6.1 Radio Frequency Exposure Compliance**

### 6.1.1 Electromagnetic Fields

**RESULT: Passed** 

FCC KDB Publication 447498 D01 v06 Test standard

RSS--102

Separation distance is more than 20 cm, thus mobile device exposure limits can be applied

**Maximum Exposure:** 

Power to Antenna (mW)	10.739 mW
Power to Antenna (dBm)	10.3 dBm
Antenna Gain	1.12 dBi
Power+Ant Gain	13.9 mW
Distance	20 cm
S=	0.003 mW/cm^2

Limit FCC:

0.3-1.34 MHz (100) mW/cm<sup>2</sup> 1.34-30 MHz (180/f2) mW/cm<sup>2</sup> 30-300 MHz 0.2 mW/cm<sup>2</sup> 300-1500 MHz f/1500 mW/cm<sup>2</sup> (180/f2) mW/cm<sup>2</sup> 1500-100,000 MHz 1.0 mW/cm<sup>2</sup>

**Limit Canada:**  $0.02619f^{0.6834}$ 

---End---



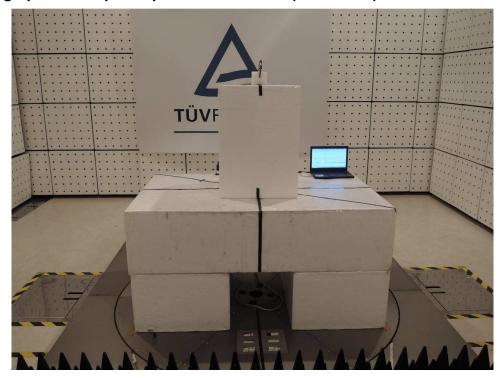
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# **Photographs of the Test Set-Up**

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

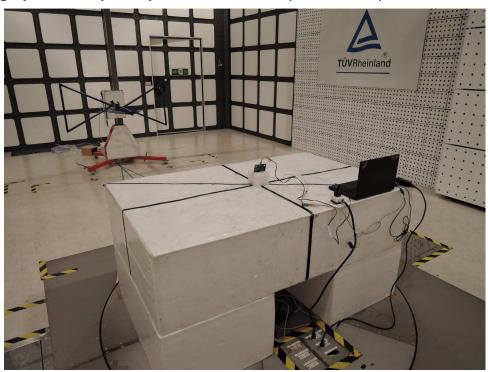




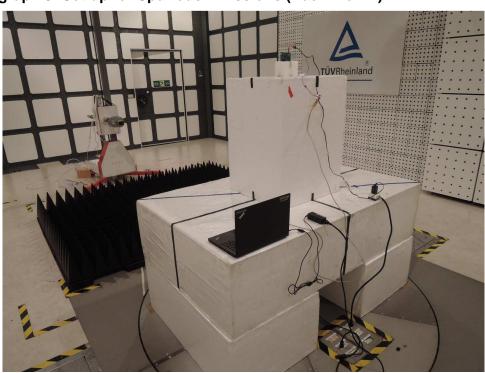
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### Photograph 2: Set-up for Spurious Emissions (Back View 1)



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





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### Photograph 4: Set-up for Conducted testing





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