

Prüfbericht-Nr.: Auftrags-Nr.: Seite 1 von 44 16068945 001 174036115 Test Report No .: Order No.: Page 1 of 44 Kunden-Referenz-Nr.: Auftragsdatum: 10 Jun, 2015 628017 Client Reference No.: Order date .: Auftraggeber: Adam Hall GmbH Client: Daimlerstrasse 9, 61267 Neu-Anspach, Germany Prüfgegenstand: FCC ID: 2AFF6- LDCURV500 Loudspeaker System Test item: FCC ID: Bezeichnung / Typ-Nr.: CURV500S Identification / Type No .: Auftrags-Inhalt: TUV Rheinland - EMC service Order content: FCC Part 15: 2014-10 Prüfgrundlage: Subpart C section 15.207, 15.209 and 15.247 Test specification: ANSI C63.10: 2013 Wareneingangsdatum: 22 Jul, 2015 Date of receipt: Prüfmuster-Nr.: Engineering samples Test sample No .: Prüfzeitraum: Refer to test report Testing period: TÜV Rheinland Ort der Prüfung: Place of testing: (Guangdong) Ltd. Prüflaboratorium: TÜV Rheinland Testing laboratory: (Guangdong) Ltd. Prüfergebnis\*: Pass Test result\*: kontrolliert von I reviewed by: geprüft von I tested by: 14 Aug 2015 Frank Du / Project Manager Yao/ Department Manager 29 Jul, 2015 Datum Name/Stellung Unterschrift Datum Name/Stellung Unterschrift Name/Position Signature Date Date Name/Position Signature Sonstiges I Other: Prüfmuster vollständig und unbeschädigt Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery: Test item complete and undamaged: 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhalt \* Legende: 1 = sehr gut N/A = nicht anwendbar N/T = nicht getestet P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) 1 = very good 2 = good3 = satisfactory 4 = sufficient 5 = poor Legend: N/T = not tested P(ass) = passed a.m. test specifications(s) F(ail) = failed a.m. test specifications(s) N/A = not applicable

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 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHZ BANDWIDTH

RESULT: Passed

5.1.4 Spurious Emission

RESULT: Passed

5.1.5 20DB BANDWIDTH

RESULT: Passed

5.1.6 FREQUENCY SEPARATION

RESULT: Passed

5.1.7 NUMBER OF HOPPING FREQUENCY

RESULT: Passed

5.1.8 TIME OF OCCUPANCY

RESULT: Passed

5.1.9 CONDUCTED EMISSIONS

RESULT: Passed

6.1.1 ELECTROMAGNETIC FIELDS

RESULT: Passed



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### 1 General Remarks

# 1.1 Complementary Materials

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

Appendix 1: Test result

# 2 Test Sites

# 2.1 Test Facilities

### **TÜV Rheinland (Guangdong) Ltd. EMC Laboratory**

No.102, 1F of Southwest and No.205, 2F of West Warehouse Building, No.767 Tianyuan Road, Tianhe District, Guangzhou, Guangdong, P.R.China

Test item: others

FCC Registration No. 833845



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2.2 List of Test and Measurement Instruments

### **Table 1: List of Test and Measurement Equipment**

Kind of Equipment	Туре	Manufacturer	S/N	Calibrated until	Calibrated Interval
EMI Test Receiver	ESCI-3	Rohde & Schwarz	100216	16.Mar.2016	1 year
Spectrum Analyzer	FSP30	Rohde & Schwarz	100286	16.Mar.2016	1 year
Trilog-Broadband Antenna	VULB9168 (30MHz-1GHz)	SCHWARZBECK MESSELEKTRO NIK	209	16.Mar.2016	2 years
Double-Ridged Waveguide Horn Antenna	HF906 (1-18GHz)	Rohde & Schwarz	100385	16.Mar.2016	2 years
Pre-amplifier	AFS42-00101800- 25-S-42	MITEQ	1101599	16.Mar.2016	2 years
Band Reject Filter	BRM50702	Micro-Tronics	023	16.Mar.2016	2 years
Standard Gain Horn Antenna	3160-09 (18-26.5GHz)	EMCO	21642	16.Mar.2016	5 years
Pre-amplifier	AFS33-18002650- 30-8P-44	MITEQ	1108282	16.Mar.2016	2 years
3m Anechoic Chamber	N/A	Albatross Project GmbH	N/A	16.Mar.2016	1 year
Loop Antenna	HFH2-Z2 (<30MHz)	Rohde & Schwarz	100111	16.Mar.2016	2 years
EMI Test Receiver	ESCS30	Rohde & Schwarz	100316	16.Mar.2016	1 year
Two-Line V- Network	ESH3-Z5	Rohde & Schwarz	100308	16.Mar.2016	1 year
Pulse Limiter	ESH3-Z2	Rohde & Schwarz	100701	16.Mar.2016	1 year

# 2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

### 2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basic using in house standards or comparisons.



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### 2.5 Measurement Uncertainty

Uncertainty for conducted emissions measurements is 2.68dB.

Uncertainty for radiated emissions measurements is 4.42dB (9KHz-30MHz), 5.16dB (30M-1GHz) and 2.22dB (> 1GHz)

The reported expanded uncertainty is based on a standard uncertainty multiply by a coverage factor k=2, providing a level of confidence of approximately 95%.

## 2.6 Location of original data

The original copies of test data taken during actual testing were attached at Appendix 1 of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Guangdong) file for certification follow-up purposes.

# 2.7 Status of facility used for testing

TÜV Rheinland (Guangdong) Ltd. EMC Laboratory

No.102, 1F of Southwest and No.205, 2F of West Warehouse Building, No.767 Tianyuan Road, Tianhe District, Guangzhou, Guangdong, P.R.China FCC Registration No. 833845



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## 3 General Product Information

## 3.1 Product Function and Intended Use

The EUT is a Speaker with Bluetooth 2.1+EDR, which is intended to enable Bluetooth connectivity with Notebook or smart phone, and play the music from Bluetooth device.

For more details refer to the Technical Documentation or User manual.

# 3.2 Ratings and System Details

**Table 2: Rating of EUT** 

Kind of Equipment	Loudspeaker System
Type Designation	CURV500S
FCC ID	2AFF6- LDCURV500



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## Table 3: Technical Specification of Bluetooth (BDR & EDR)

Technical Specification	Value
Operating Frequency band	2402 – 2480 MHz
Bluetooth Core Version	V2.1+EDR
Channel separation	1MHz
Extreme Temperature Range	-10°C to +55°C
Operation Voltage	100~240Vac, 50/60Hz;
Modulation	GFSK, 8DPSK, π/4DQPSK
Antenna Type	Internal Antenna, Non-User Replaceable
Antenna Gain	0 dBi
RF Output Power	0.00101W (0.06dBm)

Table 4: RF channel and frequency of Bluetooth (BDR & EDR mode)

RF Channel	Frequency (MHz)						
0	2402.00	20	2422.00	40	2442.00	60	2462.00
1	2403.00	21	2423.00	41	2443.00	61	2463.00
2	2404.00	22	2424.00	42	2444.00	62	2464.00
3	2405.00	23	2425.00	43	2445.00	63	2465.00
4	2406.00	24	2426.00	44	2446.00	64	2466.00
5	2407.00	25	2427.00	45	2447.00	65	2467.00
6	2408.00	26	2428.00	46	2448.00	66	2468.00
7	2409.00	27	2429.00	47	2449.00	67	2469.00
8	2410.00	28	2430.00	48	2450.00	68	2470.00
9	2411.00	29	2431.00	49	2451.00	69	2471.00
10	2412.00	30	2432.00	50	2452.00	70	2472.00
11	2413.00	31	2433.00	51	2453.00	71	2473.00
12	2414.00	32	2434.00	52	2454.00	72	2474.00
13	2415.00	33	2435.00	53	2455.00	73	2475.00
14	2416.00	34	2436.00	54	2456.00	74	2476.00
15	2417.00	35	2437.00	55	2457.00	75	2477.00
16	2418.00	36	2438.00	56	2458.00	76	2478.00
17	2419.00	37	2439.00	57	2459.00	77	2479.00
18	2420.00	38	2440.00	58	2460.00	78	2480.00
19	2421.00	39	2441.00	59	2461.00	1	/



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# 3.3 Independent Operation Modes

The basic operation modes are:

- A. On, Traditional Bluetooth
  - 1. Transmitting on low channel
  - 2. Transmitting on middle channel
  - 3. Transmitting on high channel
- B. On, Traditional Bluetooth on Hopping channel
- C. On, Bluetooth connecting mode
- D. Off

# 3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

### 3.5 Submitted Documents

- 1. Block Diagram
- 2. Circuit Diagram
- 3. Operation Description
- 4. PCB Layout
- 5. BOM
- 6. FCC label and location
- 7. User Manual
- 8. Internal Photos
- 9. External Photos
- 10. Application form



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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 5.

All testing were performed according to the procedures in ANSI C63.10: 2013.

### 4.3 Special Accessories and Auxiliary Equipment

None.

# 4.4 Countermeasures to achieve EMC Compliance

The test sample, which has been tested, contained the noise suppression parts as described in the technical document. No additional measures were employed to achieve compliance.



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# 4.5 Test set-up

Diagram of Measurement Configuration for Radiation Test below 1GHz

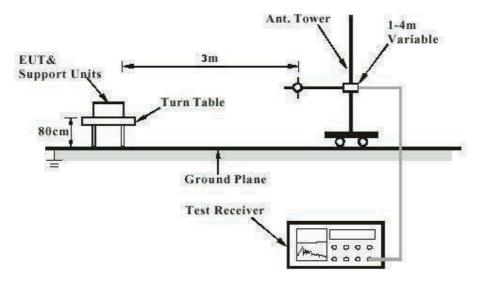
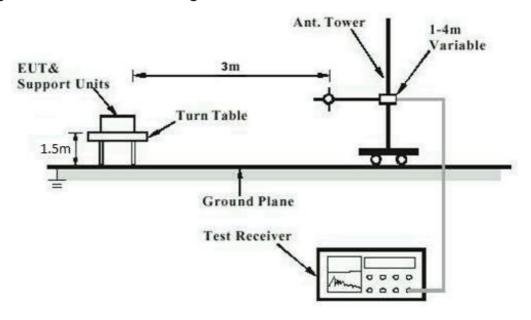


Diagram of Measurement Configuration for Radiation Test above 1GHz

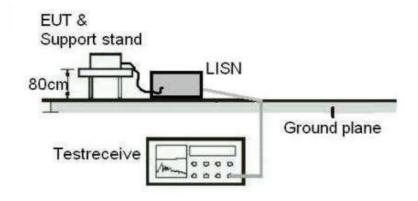




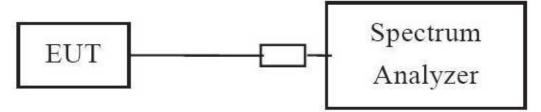
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### **Diagram of Measurement Configuration for Mains Conduction Measurement**



**Diagram of Measurement 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 Specification** 

Test standard : FCC Part 15.247(b)(4) and Part 15.203

Limits : the use of antennas with directional gains that

do not exceed 6 dBi

According to the manufacturer declared, the EUT has an internal antenna, the directional gain of antenna is 3.14 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement.

Therefore the EUT is considered sufficient to comply with the provision.

For more details, refer to EUT photo.



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### 5.1.2 Peak Output Power

RESULT: Passed

**Test Specification** 

Test standard : FCC Part 15.247(b)(1) & (b)(3)

Basic standard : ANSI C63.10: 2013 Limits : BDR/ EDR: 0.125 Watts

Kind of test site : Shielded Room

**Test Setup** 

Date of testing : 21 Jul, 2015
Power supply : 120Vac, 60Hz
Operation mode : A (See 3.3)

Test channel : Low / Middle / High

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

Table 5: Test result of Peak Output Power, GFSK

Channel	Channel	Peak Out	Limit	
Channel	Frequency (MHz)	(dBm)	(W)	(W)
Low Channel	2402	-0.06	0.00099	0.125
Middle Channel	2441	0.06	0.00101	0.125
High Channel	2480	-0.06	0.00099	0.125

Table 6: Test result of Peak Output Power, 8DPSK

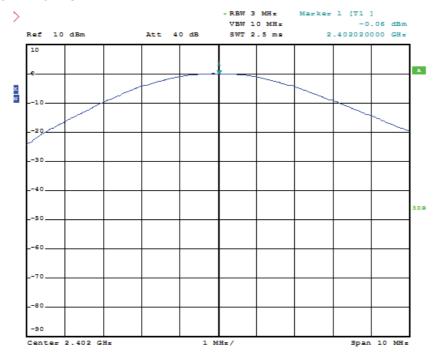
Channel	Channel	Peak Out	Limit	
Channel	Frequency (MHz)	(dBm)	(W)	(W)
Low Channel	2402	-1.47	0.00071	0.125
Middle Channel	2441	-1.95	0.00064	0.125
High Channel	2480	-2.41	0.00057	0.125



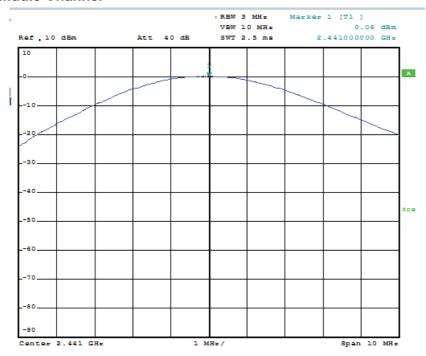
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# Test Plot of Peak Output Power, GFSK modulation Low Channel



### **Middle Channel**





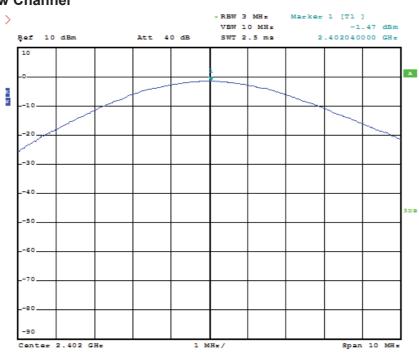
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### **High Channel**



# Test Plot of Peak Output Power, 8DPSK modulation

### **Low Channel**



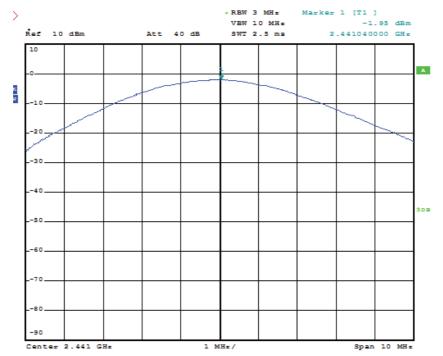


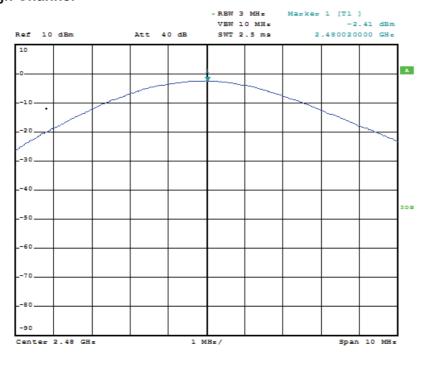
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#### **Middle Channel**







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### 5.1.3 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

RESULT: Passed

**Test Specification** 

Test standard : FCC Part 15.247(d)
Basic standard : ANSI C63.10: 2013

Limits : 20dB (below that in the 100kHz bandwidth within

the band that contains the highest level of the

desired power);

In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a)

Kind of test site : Shielded Room

**Test Setup** 

Date of testing : 21 Jul, 2015
Power supply : 120Vac, 60Hz
Operation mode : A(See 3.3)

Test channel : Low / Middle / High

Ambient temperature : 22-26 °C Relative Humidity : 50-65 % Atmospheric pressure : 101 kPa

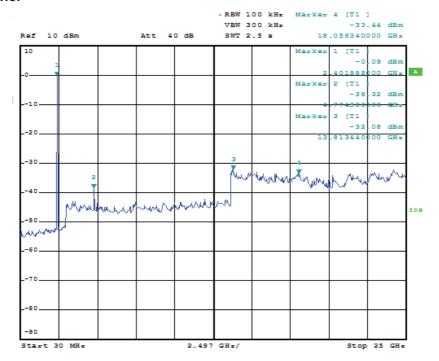
All emissions are more than 20dB below fundamental, details refer to following test plot, and compliance is achived as well.

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.

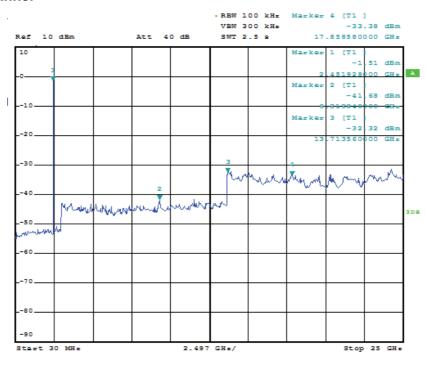


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## Test Plot of 100kHz Conducted Emissions, GFSK modulation Low Channel



### **Middle Channel**



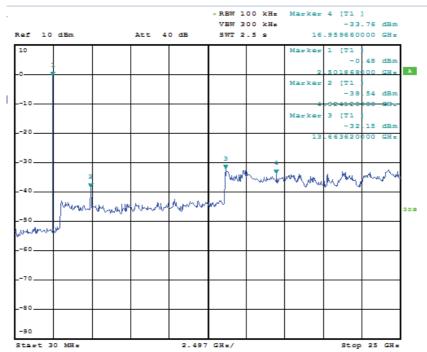


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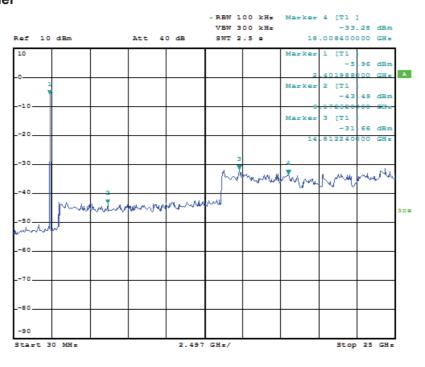
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### **High Channel**



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



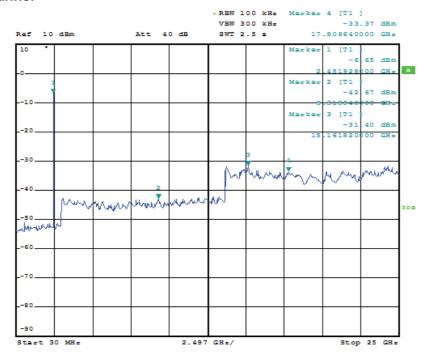


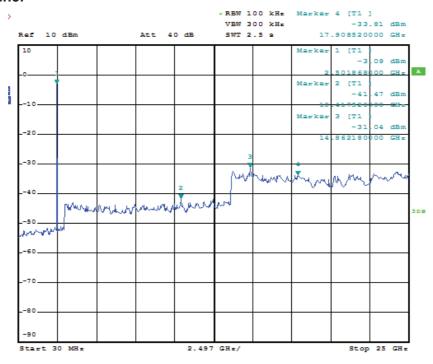
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### **Middle Channel**

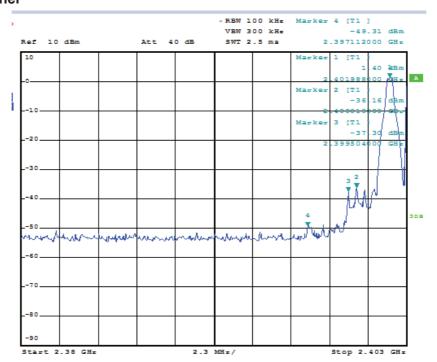


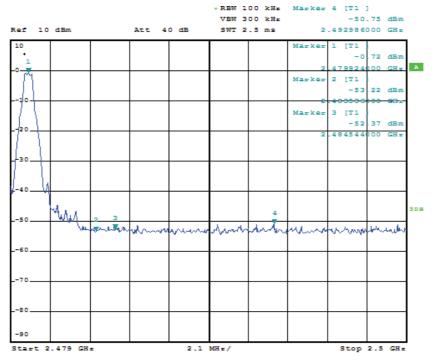




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# Test Plot of 100kHz Bandwidth of Frequency Band Edge, GFSK modulation Low Channel

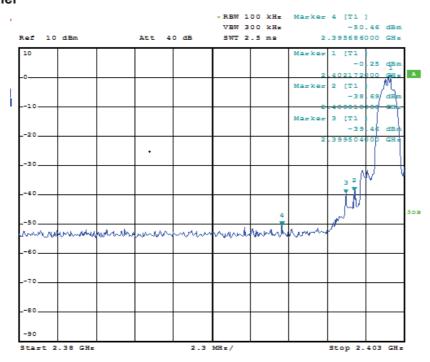


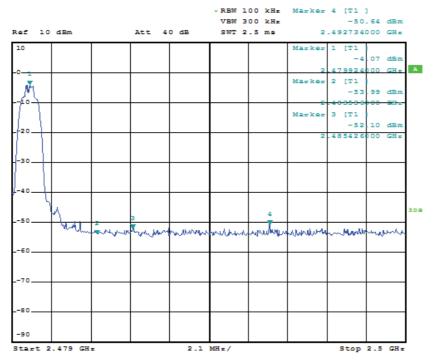




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# Test Plot of 100kHz Bandwidth of Frequency Band Edge, 8DPSK modulation Low Channel







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### **5.1.4 Spurious Emission**

RESULT: Passed

**Test Specification** 

Test standard : FCC Part 15.247(d), FCC Part 15.205

Basic standard : ANSI C63.10: 2013

Limits : Refer to 15.209(a) of FCC part 15.247(d)

Kind of test site : 3m Semi-anechoic chamber

**Test Setup** 

Date of testing : Refer to the appendix 1.

Power supply : 120Vac, 60Hz
Operation mode : A (See 3.3)

Test channel : Low / Middle / High
Ambient temperature : Refer to the appendix 1.
Relative Humidity : Refer to the appendix 1.
Atmospheric pressure : Refer to the appendix 1.

#### Remark:

During the pretest the EUT was rotated through three orthogonal axes to determine the attitude that maximizes the emissions. After that the EUT was manually handled to find the orientation that has the maximum emission, which is the orientation shown in the test setup photos.

Testing was carried out within frequency range 9kHz to the tenth harmonics.

For the measurement records, refer to the appendix 1.



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### 5.1.5 20dB Bandwidth

RESULT: Passed

**Test Specification** 

Test standard : FCC Part 15.247(a)(1)
Basic standard : ANSI C63.10: 2013
Kind of test site : Shielded Room

**Test Setup** 

Date of testing : 30 Mar, 2015
Power supply : 120Vac, 60Hz
Operation mode : A (See 3.3)

Test channel : Low / Middle / High

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

Table 7: Test result of 20dB Bandwidth, BDR mode

Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (MHz)	Result
Low Channel	2402	943	1	Pass
Mid Channel	2441	942	/	Pass
High Channel	2480	939	/	Pass

Table 8: Test result of 20dB Bandwidth, EDR mode

Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (MHz)	Result
Low Channel	2402	1263	1	Pass
Mid Channel	2441	1261	1	Pass
High Channel	2480	1262	1	Pass

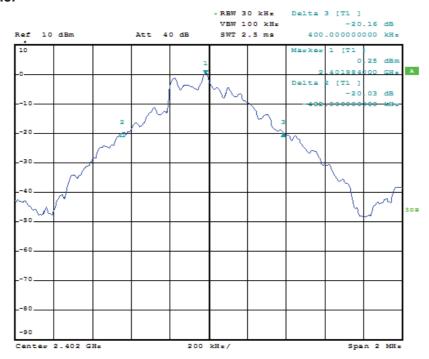


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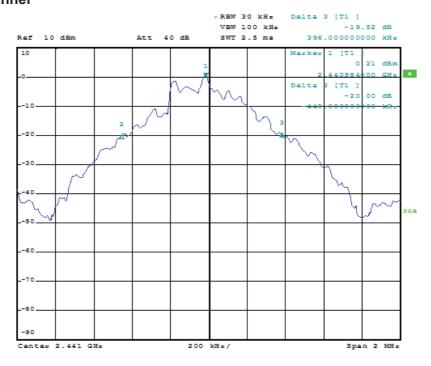
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## Test Plot of 20dB Bandwidth, GFSK modulation

### **Low Channel**



### **Middle Channel**

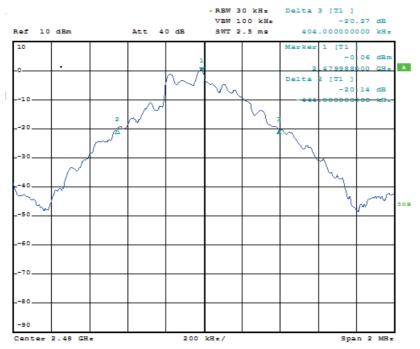




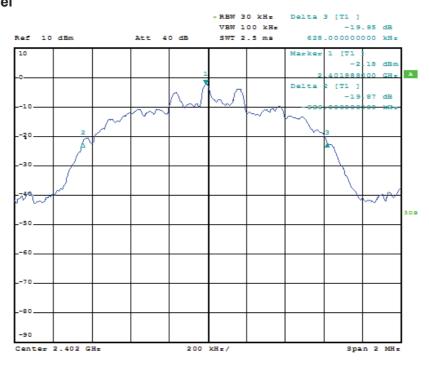
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### **High Channel**



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



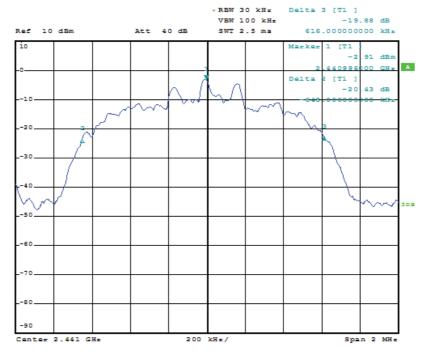


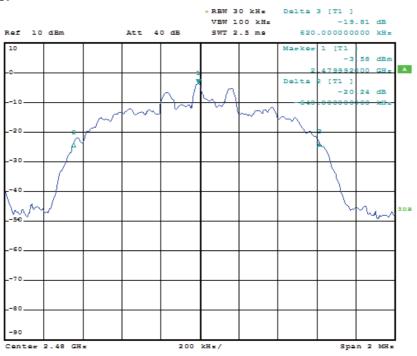
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### **Middle Channel**







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### 5.1.6 Frequency Separation

RESULT: Passed

**Test Specification** 

Test standard : FCC Part 15.247(a)(1)
Basic standard : ANSI C63.10: 2013

Limits : ≥ 25kHz or 2/3 of 20dB bandwidth, whichever is

greater

Kind of test site : Shielded Room

**Test Setup** 

Date of testing : 15 Jul, 2015
Power supply : 120Vac, 60Hz
Operation mode : A (See 3.3)

Test channel : Low / Middle / High

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

### **Table 9: Test result of Frequency Separation**

Channel	Channel Frequency (MHz)	Measured Channel Separation (MHz)	Limit (kHz)	Result
Low Channel	2400	1.0		Pass
Adjacency Channel	2401	1.0		F a 5 5
Mid Channel	2440	1.0	≥ 25kHz or 2/3 of 20dB bandwidth	Pass
Adjacency Channel	2439	1.0		F a 5 5
High Channel	2480	1.0		Pass
Adjacency Channel	2479	1.0		F a 5 5

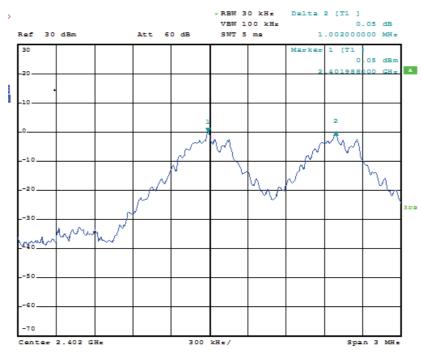


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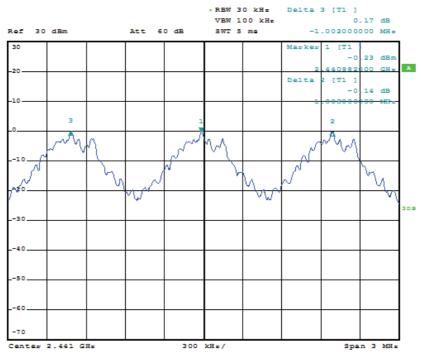
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Test Plot of Frequency Separation, GFSK

### **Low Channel**



### **Middle Channel**

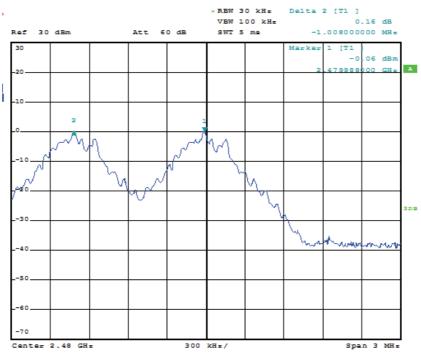




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# 5.1.7 Number of Hopping Frequency

RESULT: Passed

**Test Specification** 

Test standard : FCC part 15.247(a)(1)(iii)
Basic standard : ANSI C63.10: 2013

Limits : ≥ 15 non-overlapping channels

Kind of test site : Shielded Room

**Test Setup** 

Date of testing : 15 Jul, 2015

Power supply : 120Vac, 60Hz

Operation mode : B (See 3.3)

Ambient temperature : 22-26 °C

Relative humidity : 50-65 %

Atmospheric pressure : 100-103 kPa

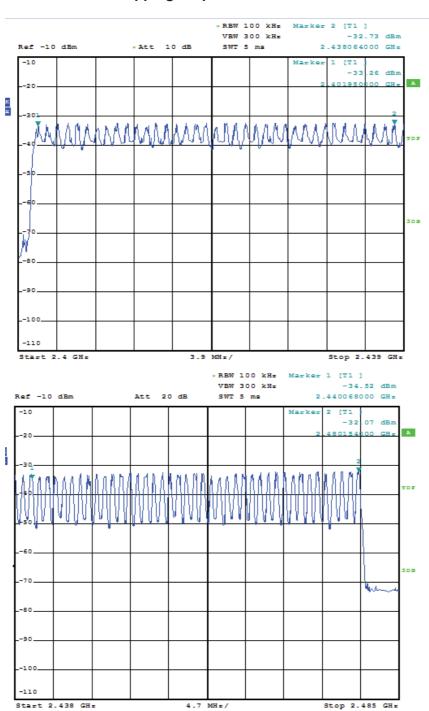
### Table 10: Test result of Number of hopping frequency

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**



4.7 MH±/



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5.1.8 Time of Occupancy

RESULT: Passed

**Test Specification** 

Test standard : FCC part 15.247(a)(1)(iii)
Basic standard : ANSI C63.10: 2013

Limits : 0.4s

Kind of test site : Shielded Room

**Test Setup** 

Date of testing : 15 Jul, 2015
Power supply : 120Vac, 60Hz
Operation mode : A (See 3.3)

Test channel : Low / Middle / High

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

Table 11: Test result of Time of Occupancy, GFSK mode

Channel	Data Mode	Pulse width (ms)	Measured Dwell time (s)	Limit (s)	Result
Low Channel	DH1	0.44	0.141	0.4	Pass
	DH3	1.40	0.224	0.4	Pass
	DH5	2.90	0.309	0.4	Pass
Mid Channel	DH1	0.46	0.147	0.4	Pass
	DH3	2.41	0.386	0.4	Pass
	DH5	2.96	0.316	0.4	Pass
High Channel	DH1	0.31	0.099	0.4	Pass
	DH3	1.51	0.242	0.4	Pass
	DH5	2.97	0.317	0.4	Pass



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Table 12: Test result of Time of Occupancy, 8DPSK mode

Channel	Data Mode	Pulse width (ms)	Measured Dwell time (s)	Limit (s)	Result
Low Channel	DH1	0.48	0.154	0.4	Pass
	DH3	1.73	0.277	0.4	Pass
	DH5	2.99	0.319	0.4	Pass
Mid Channel	DH1	0.47	0.150	0.4	Pass
	DH3	1.72	0.386	0.4	Pass
	DH5	3.00	0.320	0.4	Pass
High Channel	DH1	0.47	0.150	0.4	Pass
	DH3	1.73	0.277	0.4	Pass
	DH5	2.99	0.319	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.

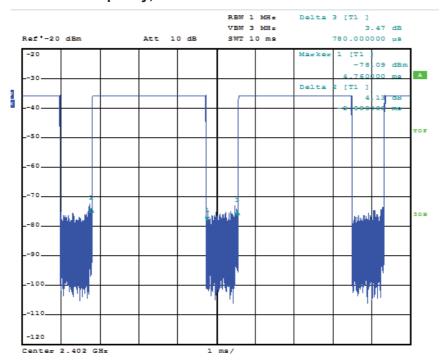


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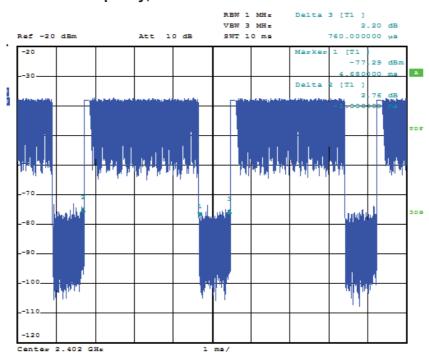
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# Test Plot of Time of Occupancy, GFSK modulation



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





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5.1.9 Conducted Emissions

RESULT: Passed

**Test Specification** 

Test standard : FCC part 15.207
Basic standard : ANSI C63.4: 2009
Frequency range : 0.15 – 30MHz
Limits : FCC Part 15.207(a)

Kind of test site : Shielded Room

**Test Setup** 

Date of testing : 15 Jul, 2015
Power supply : 120Vac, 60Hz
Operation mode : C (See 3.3)
Earthing : Not connected

Ambient temperature : 22 °C
Relative Humidity : 53 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix 1.



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# 6 Safety Human exposure

# **6.1 Radio Frequency Exposure Compliance**

### **6.1.1 Electromagnetic Fields**

RESULT: Passed

**Test Specification** 

Test standard : FCC KDB Publication 447498 v05r02

The maximum peak output power of the transmitter is 1.01mW, only, which less than 20mW.

The minimum distance for the EUT is 5mm, since maximum peak output power of the transmitter is 1.01mW <10 mW, hence the EUT is excluded from SAR evaluation according to FCC KDB Publication 447498 D01 General RF Exposure Guidance v05r02.



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7 Photographs of the Test Set-Up

Photograph 1: Set-up for Spurious Emissions (9kHz - 30MHz)





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# Photograph 2: Set-up for Spurious Emissions (30MHz-1GHz)

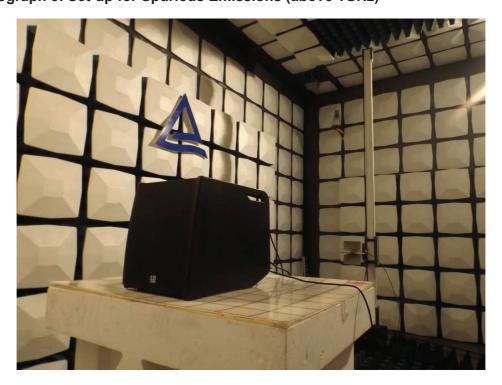


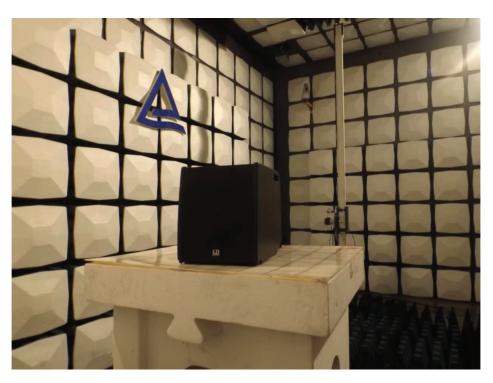


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# Photograph 3: Set-up for Spurious Emissions (above 1GHz)







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# Photograph 4: Set-up for Conducted Emissions





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