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# **MEASUREMENT REPORT** FCC PART 15.247 / RSS-247

FCC ID:	DD4ULXD8X52
IC:	616A-ULXD8X52
APPLICANT:	Shure Incorporated
Application Type:	Certification
Product:	Wireless Gooseneck Transmitter
Model No.:	ULXD8 X52
Brand Name:	SHURE
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Part 15.247
IC Rule(s):	RSS-247 Issue 1, RSS-GEN Issue 4
Test Procedure(s):	ANSI C63.10-2013, KDB 558074 D01v03r05
Test Date:	August 06 ~ 27, 2016

Reviewed By Manager

CEO

Approved By

Robin Wu (Robin Wu) Marlinchen

(Marlin Chen)



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in KDB 558074 D01v03r05. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.



## **Revision History**

Report No.	Version	Description	Issue Date	Note
1608RSU00501	Rev. 01	Initial report	10-23-2016	Valid



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## §2.1033 General Information

Applicant:	Shure Incorporated	
Applicant Address:	5800 West Touhy Avenue	
Manufacturer:	Shure Incorporated	
Manufacturer Address:	5800 West Touhy Avenue	
Test Site:	MRT Technology (Suzhou) Co., Ltd	
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development	
	Zone, Suzhou, China	
FCC Registration No.:	809388	
IC Registration No.:	11384A	
FCC Rule Part(s):	Part 15.247	
IC Rule:	RSS-247 Issue 1, RSS-GEN Issue 4	
FCC ID:	DD4ULXD8X52	
IC:	616A-ULXD8X52	
Test Device Serial No.:	N/A Droduction Pre-Production Engineering	
FCC Classification:	Digital Transmission System (DTS)	

## **Test Facility / Accreditations**

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC registered (MRT Reg. No. 809388) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-4179, G-814, C-4664, T-2206) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications and Radio testing for FCC, Industry Canada, EU and TELEC Rules.

А	ccredited Laboratory
	A2LA has accredited
MRT TEC	CHNOLOGY (SUZHOU) CO., LTD. zhou, Jiangsu, People's Republic of China
	for technical competence in the field of
	Electrical Testing
This interesting is a second to a	in accordance with the recognized international Standard (COREC 17025-2005
General requirements for the co technical competence for a prefer	In deconductor with the decognised immension and the deconductor in accessed impetence of testing and califoration (aboratories. This accessibilities demonstration defined scope and the operation of a laboratory quality management system to joint SC-ILAC-IAF Communique dated 8 January 2009).
General requirements for the co- lectinical competence for a refer	ongelence of heriting and collocation laboratories. The accreditions demonster laboratorization and laboratorial sources and laboratorial system to joint SOAAC-WY Communique diated 8 January 2009). Presented this in day of September 2016.



## 1. INTRODUCTION

## 1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

## 1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on September 30, 2013.





## 2. PRODUCT INFORMATION

### 2.1. Equipment Description

Product Name	Wireless Gooseneck Transmitter
Model No.	ULXD8 X52
Frequency Range	902 ~ 928 MHz
Working Mode	Normal Mode and HD Mode
Power Level	0.25mW & 10mW & 20mW
Antenna Type	PIFA
Antenna Gain	Max Peak Gain 1.45dBi
Components	
Rechargeable	Model: SB900A
Li-ion Battery	OUTPUT: 3.7Vdc, 1320mAh,4.88Wh

Note 1: The EUT has two working modes (Normal Mode & HD Mode) and two modes can be switched from the digital wireless receiver.

Note 2: Normal mode has three power levels (0.25mW & 10mW & 20mW). Power levels are switchable among these power levels. HD mode means high density mode and it only has 0.25mW power level.

Note 3: The EUT is capable of operating with AA alkaline batteries or with the Shure SB900A rechargeable battery pack.

## 2.2. Product Specification Subjective to this Report

Working Mode	Normal Mode	
Frequency Range	902 ~ 928 MHz	
Power Level	0.25mW & 10mW & 20mW	
Maximum Peak Output Power	18.18dBm	
Type of Modulation	8PSK	
Channel Spacing	25kHz	
Date Rate	468.75kbps	

Note: For other features of this EUT, test report will be issued separately.



## 2.3. Operation Frequency / Channel List

#### X52 Band

Channel	Frequency
LOW	902.4 MHz
MID	915.0 MHz
HIG	927.6 MHz

## 2.4. Device Capabilities

This device contains the following capabilities:

902 ~ 928 MHz (DTS), 902 ~ 928 MHz (DXX)

**Note:** The maximum achievable duty cycle was determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Test Mode	Duty Cycle
902.4MHz	100%
915MHz	100%
927.6MHz	100%





927.6MHz - Duty Cycle		
Knjight Spectrum Andrez - Swept SA Rev 30 g CC Rev 30 g CC Settler: Trig: Free Run Settler:	equency	
10 dB/dlv Ref 20.60 dBm dBm dBm	Auto Tune	
	enter Freq 60000 MHz	
acco a. a.	Start Freq 600000 MHz	
194 294 1	Stop Freq 600000 MHz	
394	CF Step 00000 WHz Man	
	req Offset 0 Hz	
Center 927 60000 MHz Snan 0 Hz L0	Scale Type	
Center 527.500000 mm2     apart 0 m2		

### 2.5. Test Software

The test utility software used during testing was "ttermpro.exe".

### 2.6. Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.
Adapter	Supply by MRT	CYSK05-050100

### 2.7. Test Configuration

The **Wireless Gooseneck Transmitter** was tested per the guidance of KDB 558074 D01v03r05. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

### 2.8. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.



## 3. DESCRIPTION OF TEST

## 3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in KDB 558074 D01v03r05 were used in the measurement of the **Wireless Gooseneck Transmitter**.

Deviation from measurement procedure.....None

## 3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz,  $50\Omega/50$ uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

Line conducted emissions test results are shown in Section 7.8.



## 3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable. For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-25GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.



## 4. ANTENNA REQUIREMENTS

#### Excerpt from §15.203 of the FCC Rules/Regulations:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

- The antenna of the Wireless Gooseneck Transmitter is permanently attached.
- There are no provisions for connection to an external antenna.

#### Conclusion:

The **Wireless Gooseneck Transmitter FCC ID: DD4ULXD8X52** unit complies with the requirement of §15.203.



## 5. TEST EQUIPMENT CALIBRATION DATE

#### Conducted Emissions - SR2

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	101209	1 year	2016/11/03
Two-Line V-Network	R&S	ENV216	101683	1 year	2016/11/03
Two-Line V-Network	R&S	ENV216	101684	1 year	2016/11/03
Temperature/Humidity Meter	Yuhuaze	N/A	N/A	1 year	2016/12/20
Shielding Anechoic Chamber	MIX-BEP	Chamber-SR2	N/A	1 year	2017/05/10

#### Radiated Emission - AC1

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cali. Due Date
MXE EMI Receiver	Agilent	N9038A	MY51210182	1 year	2017/08/03
Preamplifier	Agilent	83017A	MY52090106	1 year	2017/03/28
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9721	1519-041	1 year	2017/04/11
Loop Antenna	Schwarzbeck	FMZB1519	9162-047	1 year	2016/12/14
TRILOG Antenna	Schwarzbeck	VULB9162	9120D-1167	1 year	2016/11/07
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	BBHA9170549	1 year	2016/11/07
Digital Thermometer & Hygrometer	Yuhuaze	HTC-2	N/A	1 year	2016/12/20
Anechoic Chamber	ток	Chamber-AC1	MY51210182	1 year	2017/05/10

#### Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MY52090106	1 year	2017/05/08
USB Wideband Power Sensor	Boonton	55006	8911	1 year	2017/05/08
Temperature/Humidity Meter	Yuhuaze	HTC-2	N/A	1 year	2016/12/20

Software	Version	Function
e3	V8.3.5	EMI Test Software



## 6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

AC Conducted Emission Measurement - SR2
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):
150kHz~30MHz: 3.46dB
Radiated Emission Measurement – AC1
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):
9kHz ~ 1GHz: 4.18dB
1GHz ~ 25GHz: 4.76dB
Spurious Emissions, Conducted - TR3
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):
0.78dB
Output Power - TR3
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):
1.13dB
Power Spectrum Density - TR3
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):
1.15dB
Occupied Bandwidth - TR3
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):
0.28%



## 7. TEST RESULT

#### 7.1. Summary

Company Name:	Shure Incorporated
FCC ID:	DD4ULXD8X52
IC:	616A-ULXD8X52
Data Rate(s) Tested:	468.75kbps

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference		
15.247(a)(2)	RSS-247 [5.2]	6dB Bandwidth	≥ 500kHz		Pass	Section 7.2		
15.247(b)(3)	RSS-247 [5.4(4)]	Output Power	≤ 1Watt & EIRP ≤ 4Watt		Oandustad	Conducted	Pass	Section 7.3
15.247(e)	RSS-247 [5.2]	Power Spectral Density	≤ 8dBm / 3kHz Band	Conducted	Pass	Section 7.4		
15.247(d)	RSS-247 [5.5]	Band Edge / Out-of-Band Emissions	≥ 20dBc(Peak)		Pass	Section 7.5		
15.205 15.209	RSS-247 [5.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	Radiated	Pass	Section 7.6&7.7		
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	Pass	Section 7.8		

#### Notes:

All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.

- 2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.
- 4) For the test items "6dB Bandwidth & Band Edge / Out-of-Band Emissions & Radiated Spurious Emission & Radiated Band-edge", we only evaluated the low/high power level mode.



## 7.2. 6dB Bandwidth Measurement

#### 7.2.1. Test Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

#### 7.2.2. Test Procedure used

KDB 558074 D01v03r05 - Section 8.2 Option 2

#### 7.2.3. Test Setting

- The Spectrum's automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 6. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
- 2. Set RBW = 100 kHz
- 3. VBW  $\ge$  3 × RBW
- 4. Detector = Peak
- 5. Trace mode = max hold
- 6. Sweep = auto couple
- 7. Allow the trace was allowed to stabilize

#### 7.2.4. Test Setup





#### 7.2.5. Test Result

Power Level (mW)	Frequency (MHz)	6dB Bandwidth (kHz)	Limit (kHz)	Result	99% Bandwidth (kHz)
	902.4	558.0	≥ 500	Pass	609.82
0.25	915.0	554.4	≥ 500	Pass	610.42
	927.6	558.2	≥ 500	Pass	610.56
	902.4	568.5	≥ 500	Pass	614.22
20	915.0	568.2	≥ 500	Pass	612.57
	927.6	564.4	≥ 500	Pass	613.32









## 7.3. Output Power Measurement

#### 7.3.1. Test Limit

The maximum output power shall be less 1 Watt (30dBm).

#### 7.3.2. Test Procedure Used

KDB 558074 D01v03r05 - Section 9.1.2 PKPM1 Peak Power Method (for signals with BW ≤

50MHz)

#### 7.3.3. Test Setting

#### Method PKPM1 (Peak Power Measurement of Signals with DTS BW ≤ 50MHz)

Peak power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The pulse sensor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was less than or equal to 50MHz.

#### 7.3.4. Test Setup





Power Level (mW)	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	E.I.R.P (dBm)	E.I.R.P Limit (dBm)	Result
0.25	902.4	-0.11	≤ 30	1.34	≤ 36	Pass
0.25	915.0	-0.15	≤ 30	1.30	≤ 36	Pass
0.25	927.6	-0.21	≤ 30	1.24	≤ 36	Pass
10	902.4	15.48	≤ 30	16.93	≤ 36	Pass
10	915.0	15.38	≤ 30	16.83	≤ 36	Pass
10	927.6	15.15	≤ 30	16.60	≤ 36	Pass
20	902.4	18.18	≤ 30	19.63	≤ 36	Pass
20	915.0	18.07	≤ 30	19.52	≤ 36	Pass
20	927.6	17.97	≤ 30	19.42	≤ 36	Pass

#### 7.3.5. Test Result of Output Power

Note: E.I.R.P (dBm) = Peak Output Power (dBm) + Antenna Gain (dBi).

#### 7.3.6. Test Result of Average Output Power (Reporting Only)

Power Level	Frequency (MHz)	Average Output Power	Limit (dBm)	E.I.R.P (dBm)	E.I.R.P Limit (dBm)	Result
()	(	(dBm)	(02)	(0211)	(abiii)	
0.25	902.4	-4.80	≤ 30	-3.35	≤ 36	Pass
0.25	915.0	-4.91	≤ 30	-3.46	≤ 36	Pass
0.25	927.6	-5.01	≤ 30	-3.56	≤ 36	Pass
10	902.4	11.26	≤ 30	12.71	≤ 36	Pass
10	915.0	11.15	≤ 30	12.60	≤ 36	Pass
10	927.6	11.05	≤ 30	12.50	≤ 36	Pass
20	902.4	14.16	≤ 30	15.61	≤ 36	Pass
20	915.0	14.07	≤ 30	15.52	≤ 36	Pass
20	927.6	13.92	≤ 30	15.37	≤ 36	Pass

Note: E.I.R.P (dBm) = Average Output Power (dBm) + Antenna Gain (dBi).



## 7.4. Power Spectral Density Measurement

#### 7.4.1. Test Limit

The maximum permissible power spectral density is 8dBm in any 3 kHz band.

#### 7.4.2. Test Procedure Used

KDB 558074 D01v03r05 - Section 10.2 Method PKPSD

#### 7.4.3. Test Setting

- 1. Analyzer was set to the center frequency of the DTS channel under investigation
- 2. Span = 1.5 times the DTS channel bandwidth
- 3. RBW = 3kHz
- 4. VBW = 10kHz
- 5. Detector = peak
- 6. Sweep time = auto couple
- 7. Trace mode = max hold
- 8. Trace was allowed to stabilize

#### 7.4.4. Test Setup

### Spectrum Analyzer





#### 7.4.5. Test Result

Power Level	Frequency	PSD Level	Limit	Result
(1111)	(IVIHZ)	(abm / 3kmz)	(abm / 3khz)	
0.25	902.4	-14.68	≤ 8.0	Pass
0.25	915.0	-15.07	≤ 8.0	Pass
0.25	927.6	-14.31	≤ 8.0	Pass
10	902.4	0.50	≤ 8.0	Pass
10	915.0	0.53	≤ 8.0	Pass
10	927.6	0.33	≤ 8.0	Pass
20	902.4	2.63	≤ 8.0	Pass
20	915.0	3.39	≤ 8.0	Pass
20	927.6	3.44	≤ 8.0	Pass

















## 7.5. Conducted Band Edge and Out-of-Band Emissions

#### 7.5.1. Test Limit

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100 kHz bandwidth per the PSD procedure.

#### 7.5.2. Test Procedure Used

KDB 558074 D01v03r05 - Section 11.2 & Section 11.3

#### 7.5.3. Test Settitng

#### 1. Reference level measurement

- (a) Set instrument center frequency to DTS channel center frequency
- (b) Set the span to  $\geq$  1.5 times the DTS bandwidth
- (c) Set the RBW = 100 kHz
- (d) Set the VBW  $\ge$  3 x RBW
- (e) Detector = peak
- (f) Sweep time = auto couple
- (g) Trace mode = max hold
- (h) Allow trace to fully stabilize

#### 2. Emission level measurement

- (a) Set the center frequency and span to encompass frequency range to be measured
- (b) RBW = 100kHz
- (c) VBW = 300kHz
- (d) Detector = Peak
- (e) Trace mode = max hold
- (f) Sweep time = auto couple
- (g) The trace was allowed to stabilize



## 7.5.4. Test Setup

## Spectrum Analyzer





#### 7.5.5. Test Result

Power Level (mW)	Frequency (MHz)	Limit	Result
0.25	902.4	20dBc	Pass
0.25	915.0	20dBc	Pass
0.25	927.6	20dBc	Pass
20	902.4	20dBc	Pass
20	915.0	20dBc	Pass
20	927.6	20dBc	Pass















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## 7.6. Radiated Spurious Emission Measurement

#### 7.6.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209							
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]					
0.009 – 0.490	2400/F (kHz)	300					
0.490 – 1.705	24000/F (kHz)	30					
1.705 - 30	30	30					
30 - 88	100	3					
88 - 216	150	3					
216 - 960	200	3					
Above 960	500	3					

#### 7.6.2. Test Procedure Used

KDB 558074 D01v03r05 - Section 12.2.3 (quasi-peak measurements)

KDB 558074 D01v03r05 – Section 12.2.4 (peak power measurements)

KDB 558074 D01v03r05 - Section 12.2.5 (average power measurements)

#### 7.6.3. Test Setting

#### Peak Field Strength Measurements per Section 12.2.4 of KDB 558074 D01v03r05

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

- 2. RBW = as specified in Table 1
- 3. VBW = 3MHz
- 4. Detector = peak
- 5. Sweep time = auto couple





- 6. Trace mode = max hold
- 7. Trace was allowed to stabilize

#### Table 1 - RBW as a function of frequency

Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

#### Average Field Strength Measurements per Section 12.2.5.3 of KDB 558074 D01v03r05

- 1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- 2. RBW = 1MHz
- 3. VBW ≥ 1/T
- 4. De As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode
- 5. Detector = Peak
- 6. Sweep time = auto
- 7. Trace mode = max hold
- 8. Allow max hold to run for at least 50 times (1/duty cycle) traces



## 7.6.4. Test Setup

9kHz ~ 30MHz Test Setup:





## <u>1GHz ~ 10GHz Test Setup:</u>





### 7.6.5. Test Result

Test Mode:	X52 Band - 0.25mW	Test Site:	AC1					
Frequency:	902.4MHz	Test Engineer:	Lewis Huang					
Remark:	1. Average measurement was not performed if peak level lower than average							
	limit.							
	2. Other frequency was 20dB bel	ow limit line within 1	-10GHz, there is not show					
	in the report.							

Mark	Frequency	Reading	Factor	Measure	Limit	Margin	Detector	Polarization
	(MHz)	Level	(dB)	Level	(dBµV/m)	(dB)		
		(dBµV)		(dBµV/m)				
*	1804.8	40.2	-6.9	33.3	74.0	-40.7	Peak	Horizontal
	2707.2	37.5	-2.7	34.8	74.0	-39.2	Peak	Horizontal
	3609.6	36.1	-0.7	35.4	74.0	-38.6	Peak	Horizontal
*	6316.8	35.5	5.0	40.5	74.0	-33.5	Peak	Horizontal
*	1804.8	39.0	-6.9	32.1	74.0	-41.9	Peak	Vertical
	2707.2	36.2	-2.7	33.5	74.0	-40.5	Peak	Vertical
	3609.6	35.4	-0.7	34.7	74.0	-39.3	Peak	Vertical
*	6316.8	33.7	5.0	38.7	74.0	-35.3	Peak	Vertical
Note 1	: "*" is not in r	estricted ban	d, its limit i	is 20dBc of th	ne fundamenta	emissior	n level (82	.9dBµV/m)

or 15.209 which is higher.

Note 2: Measure Level  $(dB\mu V/m) = Reading Level (dB\mu V) + Factor (dB)$ 



Test Mode:	X52 Band - 0.25mW	Test Site:	AC1				
Frequency:	915MHz	Test Engineer:	Lewis Huang				
Remark:	1. Average measurement was not performed if peak level lower than average						
	limit.						
	2. Other frequency was 20dB bel	ow limit line within 1	-10GHz, there is not show				
	in the report.						

Mark	Frequency	Reading	Factor	Measure	Limit	Margin	Detector	Polarization
	(MHz)	Level	(dB)	Level	(dBµV/m)	(dB)		
		(dBµV)		(dBµV/m)				
*	1830.0	37.9	-6.8	31.1	74.0	-42.9	Peak	Horizontal
	2745.0	37.5	-2.5	35.0	74.0	-39.0	Peak	Horizontal
	3660.0	35.1	-0.6	34.5	74.0	-39.5	Peak	Horizontal
*	6405.0	34.1	5.5	39.6	74.0	-34.4	Peak	Horizontal
*	1830.0	38.7	-6.8	31.9	74.0	-42.1	Peak	Vertical
	2745.0	37.0	-2.5	34.5	74.0	-39.5	Peak	Vertical
	3660.0	34.6	-0.6	34.0	74.0	-40.0	Peak	Vertical
*	6405.0	35.0	5.5	40.5	74.0	-33.5	Peak	Vertical

Note 1: "\*" is not in restricted band, its limit is 20dBc of the fundamental emission level (82.7dBµV/m) or 15.209 which is higher.

Note 2: Measure Level (dBµV/m) = Reading Level (dBµV) + Factor (dB)



Test Mode:	X52 Band - 0.25mW	Test Site:	AC1					
Frequency:	927.6MHz	Test Engineer:	Lewis Huang					
Remark:	1. Average measurement was no	1. Average measurement was not performed if peak level lower than average						
	limit.							
	2. Other frequency was 20dB bel	Other frequency was 20dB below limit line within 1-10GHz, there is not show						
	in the report.							

Mark	Frequency	Reading	Factor	Measure	Limit	Margin	Detector	Polarization
	(MHz)	Level	(dB)	Level	(dBµV/m)	(dB)		
		(dBµV)		(dBµV/m)				
*	1855.2	38.5	-6.6	31.9	74.0	-42.1	Peak	Horizontal
	2782.8	37.0	-2.4	34.6	74.0	-39.4	Peak	Horizontal
	3710.4	34.9	-0.5	34.4	74.0	-39.6	Peak	Horizontal
*	6493.2	33.3	5.9	39.2	74.0	-34.8	Peak	Horizontal
*	1855.2	38.6	-6.6	32.0	74.0	-42.0	Peak	Vertical
	2782.8	37.8	-2.4	35.4	74.0	-38.6	Peak	Vertical
	3710.4	35.6	-0.5	35.1	74.0	-38.9	Peak	Vertical
*	6493.2	33.8	5.9	39.7	74.0	-34.3	Peak	Vertical

Note 1: "\*" is not in restricted band, its limit is 20dBc of the fundamental emission level (82.6dBµV/m) or 15.209 which is higher.

Note 2: Measure Level (dBµV/m) = Reading Level (dBµV) + Factor (dB)



Test Mode:	X52 Band - 20mW	Test Site:	AC1					
Frequency:	902.4MHz	Test Engineer:	Lewis Huang					
Remark:	1. Average measurement was not performed if peak level lower than average							
	limit.							
	2. Other frequency was 20dB bel	ow limit line within 1	-10GHz, there is not show					
	in the report.							

Mark	Frequency	Reading	Factor	Measure	Limit	Margin	Detector	Polarization
	(MHz)	Level	(dB)	Level	(dBµV/m)	(dB)		
		(dBµV)		(dBµV/m)				
*	1804.8	41.5	-6.9	34.6	79.6	-45.0	Peak	Horizontal
	2707.2	38.3	-2.7	35.6	74.0	-38.4	Peak	Horizontal
	3609.6	35.6	-0.7	34.9	74.0	-39.1	Peak	Horizontal
*	6316.8	33.7	5.0	38.7	79.6	-40.9	Peak	Horizontal
*	1804.8	42.4	-6.9	35.5	79.6	-44.1	Peak	Vertical
	2707.2	37.7	-2.7	35.0	74.0	-39.0	Peak	Vertical
	3609.6	37.1	-0.7	36.4	74.0	-37.6	Peak	Vertical
*	6316.8	33.8	5.0	38.8	79.6	-40.8	Peak	Vertical

Note 1: "\*" is not in restricted band, its limit is 20dBc of the fundamental emission level (99.6dBµV/m) or 15.209 which is higher.

Note 2: Measure Level (dBµV/m) = Reading Level (dBµV) + Factor (dB)



Test Mode:	X52 Band - 20mW	Test Site:	AC1					
Frequency:	915MHz	Test Engineer:	Lewis Huang					
Remark:	1. Average measurement was not performed if peak level lower than average							
	limit.							
	2. Other frequency was 20dB bel	ow limit line within 1	-10GHz, there is not show					
	in the report.							

Mark	Frequency	Reading	Factor	Measure	Limit	Margin	Detector	Polarization
	(MHz)	Level	(dB)	Level	(dBµV/m)	(dB)		
		(dBµV)		(dBµV/m)				
*	1830.0	41.5	-6.8	34.7	79.5	-44.8	Peak	Horizontal
	2745.0	39.4	-2.5	36.9	74.0	-37.1	Peak	Horizontal
	3660.0	37.2	-0.6	36.6	74.0	-37.4	Peak	Horizontal
*	6405.0	33.9	5.5	39.4	79.5	-40.1	Peak	Horizontal
*	1830.0	42.5	-6.8	35.7	79.5	-43.8	Peak	Vertical
	2745.0	38.0	-2.5	35.5	74.0	-38.5	Peak	Vertical
	3660.0	35.5	-0.6	34.9	74.0	-39.1	Peak	Vertical
*	6405.0	34.5	5.5	40.0	79.5	-39.5	Peak	Vertical

Note 1: "\*" is not in restricted band, its limit is 20dBc of the fundamental emission level (99.5dBµV/m) or 15.209 which is higher.

Note 2: Measure Level (dBµV/m) = Reading Level (dBµV) + Factor (dB)



Test Mode:	X52 Band - 20mW	Test Site:	AC1					
Frequency:	927.6MHz	Test Engineer:	Lewis Huang					
Remark:	1. Average measurement was not performed if peak level lower than average							
	limit.							
	2. Other frequency was 20dB bel	2. Other frequency was 20dB below limit line within 1-10GHz, there is not show						
	in the report.							

Mark	Frequency	Reading	Factor	Measure	Limit	Margin	Detector	Polarization
	(MHz)	Level	(dB)	Level	(dBµV/m)	(dB)		
		(dBµV)		(dBµV/m)				
*	1855.2	39.8	-6.6	33.2	79.4	-46.2	Peak	Horizontal
	2782.8	36.9	-2.4	34.5	74.0	-39.5	Peak	Horizontal
	3710.4	35.8	-0.5	35.3	74.0	-38.7	Peak	Horizontal
*	6493.2	34.1	5.9	40.0	79.4	-39.4	Peak	Horizontal
*	1855.2	43.3	-6.6	36.7	79.4	-42.7	Peak	Vertical
	2782.8	38.1	-2.4	35.7	74.0	-38.3	Peak	Vertical
	3710.4	36.0	-0.5	35.5	74.0	-38.5	Peak	Vertical
*	6493.2	34.0	5.9	39.9	79.4	-39.5	Peak	Vertical

Note 1: "\*" is not in restricted band, its limit is 20dBc of the fundamental emission level (99.4dBµV/m) or 15.209 which is higher.

Note 2: Measure Level (dBµV/m) = Reading Level (dBµV) + Factor (dB)



#### The worst case of Radiated Emission below 1GHz:

Site	Site: AC1						Time: 2016/08/22 - 21:34			
Limi	t: FCC	_Part15	.209_RE(3m	)	E	Engineer: Lewis Huang				
Prob	e: VUI	B 9168	3_20-2000MI	Ηz	F	Polarity: Horiz	ontal			
EUT	: Wirel	ess Go	oseneck Tran	smitter	F	Power: By Bat	tery			
Wor	se Cas	se Mod	<b>e</b> : Transmit b	y X52 Band a	at Channel 92	27.6MHz (Pov	ver Level: 20ı	mW)		
80										
	70									
	60									
	50								- f	
E	40									
dBuV/	30							6	A STATE OF STATE	
Level(	20 1	3	2 3		4		5		and de la construction of the second	
	10	~~~	Manun Ma	unnumun	water and the second state of the second sec	alines an alphaniperson and an	weder that the stand and the second			
	0									
	-10									
	-20									
	30			100	Freque	ency(MHz)			1000	
No	Flag	Mark	Frequency	Measure	Reading	Over Limit	Limit	Factor	Type	
			(MHz)	Level	Level	(dB)	(dBuV/m)	(dB)		
			()	(dBuV/m)	(dBuV)	()	(	()		
1		*	32.425	17.735	4.027	-22.265	40.000	13.708	QP	
2			45.035	15.233	1.040	-24.767	40.000	14.193	QP	
3			65.890	13.149	0.884	-26.851	40.000	12.265	QP	
4			151.250	15.433	0.249	-28.067	43.500	15.184	QP	
5			413.635	17.393	0.549	-28.607	46.000	16.844	QP	
6			649.345	22.865	1.508	-23.135	46.000	21.357	QP	

Note: Measure Level  $(dB\mu V/m)$  = Reading Level  $(dB\mu V)$  + Factor (dB)



Site	AC1				Т	Time: 2016/08/22 - 21:36				
Limi	t: FCC	_Part15	.209_RE(3m)	)	E	Engineer: Lewis Huang				
Prot	be: VUI	_B 9168	3_20-2000MH	Ηz	F	olarity: Vertic	al			
EUT	: Wirel	ess Goo	oseneck Tran	smitter	F	ower: By Bat	tery			
Wor	se Cas	se Mod	e: Transmit b	y X52 Band a	at Channel 92	7.6MHz (Pov	ver Level: 20	mW)		
80										
	70									
	60									
	50								f	
Ê	40									
BuV/	30							6		
evel(c	20 (*	2			3		4	5	and the state of t	
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	10									
	0									
	-10									
	-20			100	-		he de la		1000	
Nie	Flag	Mark	<b>Freework</b>	Magazira	Frequer		Linait	Fastar	Turne	
INO	Flag	Mark	Frequency	Measure	Reading			Factor	туре	
			(MHZ)			(OB)	(abuv/m)	(ab)		
			00.405	(dBuV/m)		40.070	40.000	10 700	0.0	
1		*	32.425	21.121	7.413	-18.8/9	40.000	13.708	QP	
2			39.700	17.100	2.592	-22.900	40.000	14.508	QP	
3			156.100	16.127	0.944	-27.373	43.500	15.183	QP	
4			327.305	16.326	1.276	-29.674	46.000	15.050	QP	
5			493.660	21.015	2.618	-24.985	46.000	18.397	QP	
6			661.470	23.446	1.935	-22.554	46.000	21.511	QP	



Site	AC1					Time: 2016/08/23 - 22:18			
Limi	t: FCC	_Part15	.209_RE(3m)	)		Engineer: Roy Cheng			
Prot	Probe: FMZB1519_0.009-30MHz					Polarity: Fac	e on		
EUT	EUT: Wireless Gooseneck Transmitter						20V/60Hz		
Note: There is the ambient noise within frequency range 9kHz~30MHz.									
Level(dBuV/m)	130 80 70 60 50 40 30 0.009 0	0.01			Freque	1 ncy(MHz)			0.15
No	Flag	Mark	Frequency	Measure	Reading	Over Limit	Limit	Factor	Туре
			(MHz)	Level	Level	(dB)	(dBuV/m)	(dB)	
				(dBuV/m)	(dBuV)				
1			0.049	50.112	29.552	-63.688	113.800	20.560	AV

44.043

23.845

-63.137

107.180

20.198

QP

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

0.105

\*

2



Site: AC1	Time: 2016/08/23 - 22:20
Limit: FCC_Part15.209_RE(3m)	Engineer: Roy Cheng
Probe: FMZB1519_0.009-30MHz	Polarity: Face on
EUT: Wireless Gooseneck Transmitter	Power: AC 120V/60Hz

Note: There is the ambient noise within frequency range 9kHz~30MHz.



No	Flag	Mark	Frequency	Measure	Reading	Over Limit	Limit	Factor	Туре
			(MHz)	Level	Level	(dB)	(dBuV/m)	(dB)	
				(dBuV/m)	(dBuV)				
1		*	2.175	27.371	6.960	-42.129	69.500	20.412	QP
2			6.216	24.786	4.701	-44.714	69.500	20.085	QP

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)



## 7.7. Radiated Restricted Band Edge Measurement

#### 7.7.1. Test Result

Site: AC1	Time: 2016/08/25 - 18:58				
Limit: FCC_Part15.209_RE(3m)	Engineer: Lewis Huang				
Probe: VULB 9168 _20-2000MHz	Polarity: Horizontal				
EUT: Wireless Gooseneck Transmitter	Power: By Battery				
Test Meder Trenewither VEO Deed at Obernal 2027 CMUE (Devent Levels 2.05 mW)					

Test Mode: Transmit by X52 Band at Channel 927.6MHz (Power Level: 0.25mW)



Note: Measure Level  $(dB\mu V/m)$  = Reading Level  $(dB\mu V)$  + Factor (dB)

28.367

29.886

3.421

4.852

-17.633

-24.114

46.000

54.000

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

960.000

978.737

2

3

QP

QP

24.946

25.034















## 7.8. AC Conducted Emissions Measurement

#### 7.8.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits								
Frequency (MHz)	QP (dBuV)	AV (dBuV)						
0.15 - 0.50	66 - 56	56 – 46						
0.50 - 5.0	56	46						
5.0 - 30	60	50						

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

### 7.8.2. Test Setup





#### 7.8.3. Test Result

Site	: SR2				Т	Time: 2016/08/22 - 23:56					
Limi	t: FCC	Part15	.207 CE Cla	ass B	E	Engineer: Lewis Huang					
Prot	Probe: ENV216 101683 Filter On					olarity: Line	Ū				
EUT	: Wirel	ess Goo	oseneck Tran	smitter	F	Power: AC 120	)V/60Hz				
Worse Case Mode: Transmit by X52 Band at Channel						27 6MHz					
	70										
	/0										
	60										
	50 1	1.					1.	Ph. (	4		
S	40 * 3	Mha	nnam	MM MANMMAN	MAN MANAGER	WATTER AND A MANAGER		10	hu han had been been been been been been been bee		
el(dB	30 4	`  ¥	$\langle \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow$	6		*		*	12		
Lev	20	×	y y · y	*							
	10 *	_									
	0										
	10										
	-10										
	0.15			1				10	30		
					Frequer	ncy(MHz)	[	1			
No	Flag	Mark	Frequency	Measure	Reading	Over Limit	Limit	Factor	Туре		
			(MHz)	Level	Level	(dB)	(dBuV)	(dB)			
				(dBuV)	(dBuV)						
1			0.154	41.094	30.354	-24.688	65.781	10.740	QP		
2			0.154	10.317	-0.423	-45.465	55.781	10.740	AV		
3			0.170	35.216	25.139	-29.744	64.960	10.078	QP		
4			0.170	24.330	14.252	-30.631	54.960	10.078	AV		

Note: Measure Level (dB $\mu$ V) = Reading Level (dB $\mu$ V) + Factor (dB)

34.191

23.682

38.204

28.818

39.076

30.741

38.708

26.537

24.081

13.573

28.359

18.972

28.896

20.561

28.467

16.297

-21.809

-22.318

-17.796

-17.182

-20.924

-19.259

-21.292

-23.463

56.000

46.000

56.000

46.000

60.000

50.000

60.000

50.000

10.110

10.110

9.846

9.846

10.180

10.180

10.240

10.240

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)

0.610

0.610

2.842

2.842

8.498

8.498

26.874

26.874

\*

5

6

7

8

9

10

11

12

QP

AV

QP

AV

QP

 $\mathsf{AV}$ 

QP

AV



Site	Site: SR2					Time: 2016/08/22 - 23:54			
Limi	t: FCC	_Part15	5.207_CE_Cla	ass B	E	Engineer: Lewis Huang			
Prot	be: EN	V216_1	01683_Filter	On	F	Polarity: Neutral			
EUT	EUT: Wireless Gooseneck Transmitter					ower: AC 12	0V/60Hz		
Wor	rse Cas	se Mod	<b>e</b> : Transmit b	y X52 Band a	at Channel 92	7.6MHz			
80 70 60 50 40 30 20 10 0 -10 -20 15 1					Loghar Waldwington Maring M				12 *
					Freque	ncy(MHz)			_
No	Flag	Mark	Frequency	Measure	Reading	Over Limit	Limit	Factor	Туре
			(MHz)	Level	Level	(dB)	(dBuV)	(dB)	
			0.470	(dBuV)	(dBuV)			40.004	0.5
1			0.170	38.708	28.644	-26.253	64.960	10.064	QP
2			0.170	29.754	19.691	-25.206	54.960	10.064	AV
3			0.510	40.884	30.707	-15.116	56.000	10.176	QP
4			0.510	30.337	20.160	-15.663	46.000	10.176	AV
5			2.838	40.210	30.359	-15.790	56.000	9.851	QP
6		*	2.838	32.044	22.193	-13.956	46.000	9.851	AV
7			4.770	39.268	29.238	-16.732	56.000	10.029	QP
8			4.770	31.540	21.511	-14.460	46.000	10.029	AV
9			8.694	42.264	32.070	-17.736	60.000	10.195	QP
10			8.694	34.160	23.965	-15.840	50.000	10.195	AV
11			26.414	39.145	28.790	-20.855	60.000	10.355	QP
12			26.414	28.145	17.790	-21.855	50.000	10.355	AV

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)



## 8. CONCLUSION

The data collected relate only the item(s) tested and show that the Wireless Gooseneck

Transmitter FCC ID: DD4ULXD8X52 is in compliance with Part 15C of the FCC Rules.

The End