

# TEST REPORT



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970  
Fax: +82-31-624-9501

Report No.:  
CTK-2017-02357  
Page (1) / (40) Pages

## 1. Client

- Name : WISOL CO., LTD
- Address : 531-7, Gajang-ro, Osan-si, Gyeonggi-do, 18103, Korea
- Date of Receipt : 2017-11-20

## 2. Manufacturer

- Name : WISOL CO., LTD
- Address : 531-7, Gajang-ro, Osan-si, Gyeonggi-do, 18103, Korea

**3. Use of Report** : For FCC / ISED Certification

**4. Test Sample / Model**: AUDIO TRANSCEIVER / ATM100


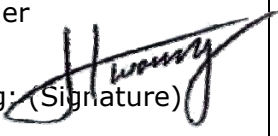
**5. Date of Test** : 2017-11-30 to 2017-12-28

**6. Test Standard(method) used** : FCC 47 CFR part 15 subpart C 15.247  
ISED RSS-247

**7. Testing Environment**: Temp.:  $(24 \pm 5) ^\circ\text{C}$ , Humidity:  $(48 \pm 3) \% \text{ R.H.}$

**8. Test Results** : Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by  Ji-Hye, Kim: (Signature)	Technical Manager  Won-Jae, Hwang: (Signature)
-------------	--	---

2017-12-29

Republic of KOREA **CTK Co., Ltd.**



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970  
Fax: +82-31-624-9501

Report No.:  
CTK-2017-02357  
Page (2) / (40)Pages

## REPORT REVISION HISTORY

Date	Revision	Page No
2017-12-29	Issued (CTK-2017-02357)	all

*This report shall not be reproduced except in full, without the written approval of CTK Co., Ltd. This document may be altered or revised by CTK Co., Ltd. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by CTK Co., Ltd. will constitute fraud and shall nullify the document.*



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970  
Fax: +82-31-624-9501

Report No.:  
CTK-2017-02357  
Page (3) / (40)Pages

## CONTENTS

1.0 General Product Description .....	4
2.0 Facility and Accreditations .....	5
2.1 Test Facility .....	5
2.2 Laboratory Accreditations and Listings.....	5
2.3 Calibration Details of Equipment Used for Measurement.....	5
3.0 Test Specifications .....	6
3.1 Standards .....	6
3.2 Mode of operation during the test .....	7
3.3 Device Modifications .....	7
3.4 Peripheral Devices .....	8
3.5 Maximum Measurement Uncertainty .....	8
3.6 Test Software .....	8
4.0 Technical Characteristic Test .....	9
4.1 ON Time, Duty Cycle.....	9
4.2 6dB Bandwidth .....	10
4.3 OUTPUT POWER.....	14
4.4 Power Spectral Density .....	18
4.5 Band - edge .....	22
4.6 Field Strength of Emissions.....	25
4.7 AC Conducted Emissions .....	37
APPENDIX A – Test Equipment Used For Tests .....	40



**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (4) / (40)Pages

## 1.0 General Product Description





FCC ID	2ABA2ATM100				
Certification Number ISED	11534A-ATM100				
Equipment model name	ATM100				
Serial number	Prototype				
EUT condition	Pre-production, not damaged				
Frequency Range	2 403.35 MHz – 2 477.35 MHz				
<table border="1"> <tr> <td>Frequency Range(MHz)</td> <td>2 403.35 – 2 477.35</td> </tr> <tr> <td>RF output power (dBm)</td> <td>2.67</td> </tr> </table>		Frequency Range(MHz)	2 403.35 – 2 477.35	RF output power (dBm)	2.67
Frequency Range(MHz)	2 403.35 – 2 477.35				
RF output power (dBm)	2.67				
Number of channels	38				
Type of Modulation	Pi/4 DQPSK				
Power Source	DC 5 V				
Duty Cycle	100 %				
Antenna Type	PCB Antenna				
Antenna Gain	ANT1, ANT2 : 4.8 dBi				
Hardware Rev	REV1.0				
Software Rev	71.1.1(Tx), 71.1.2(Rx)				

## 2.0 Facility and Accreditations

### 2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

### 2.2 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Registration Number	Logo
USA	FCC	FCC Part 15 & 18 EMI (Electromagnetic Interference / Emission)	KR0025 (805871)	
CANADA	ISED	ISED EMI (3/10m test site)	8737A-2	
JAPAN	VCCI	VCCI V-3 EMI (Electromagnetic Interference / Emission)	C-986 T-1843 R-3627 G-387	
KOREA	RRA	EMI (Electromagnetic Interference / Emission) EMS (Electromagnetic Susceptibility / Immunity)	KR0025	

### 2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.



**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (6) / (40)Pages

### 3.0 Test Specifications

#### 3.1 Standards

FCC Part Section(s)	Requirement(s)	Limit	Status (Note 1)	Test Condition
15.247(a)	6 dB Bandwidth	> 500 kHz	C	Conducted
15.247(b)	Maximum Output Power	< 1 Watt	C	
15.247(d)	Conducted Spurious emission	> 30 dBc	C	
15.247(d)	Band Edge	> 30 dBc	C	
15.247(e)	Transmitter Power Spectral Density	< 8 dBm @ 3 kHz	C	
15.209	Field Strength of Harmonics	15.209(a)	C	Radiated
15.207	AC Conducted Emissions	15.207(a)	C	Line Conducted
<i>Note 1:</i> C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable				
<i>Note 2:</i> The data in this test report are traceable to the national or international standards.				

ISED Part Section(s)	Requirement(s)	Limit	Status (Note 1)	Test Condition
RSS-Gen 6.6	6 dB Bandwidth	NA	C	Conducted
RSS-247 5.4(d)	Maximum Output Power	< 1 Watt	C	
RSS-Gen 6.13	Conducted Spurious emission	RSS-247 5.5	C	
RSS-Gen 6.13	Band Edge	RSS-247 5.5	C	
RSS-247 5.2(b)	Transmitter Power Spectral Density	< 8 dBm @ 3 kHz	C	
RSS-Gen 6.13	Field Strength of Harmonics	RSS-247 5.5	C	Radiated
RSS-Gen 5	Receiver Spurious Emissions	RSS-Gen 7.1.2	C	
RSS-Gen 8.8	AC Conducted Emissions	RSS-Gen 8.8	C	Line Conducted
<i>Note 1:</i> C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable				
<i>Note 2:</i> The data in this test report are traceable to the national or international standards.				

The sample was tested according to the following specification:  
 FCC Part 15.247, ANSI C63.10-2013, RSS-247 Issue 2, RSS-GEN Issue 4

The tests were performed according to the method of measurements prescribed in  
 KDB No.558074.



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970  
Fax: +82-31-624-9501

Report No.:  
CTK-2017-02357  
Page (7) / (40)Pages

### 3.2 Mode of operation during the test

The EUT is operated in a manner representative of the typical of the equipments. During at testing, system components were manipulated within the confines of typical usage to maximize each emission. The engineering test program was provided and enabled to make EUT continuous transmit/receive. All modulation modes were tests. The results are only attached worst cases.

#### Test mode

Test Item	Modulation	Mode
6 dB Bandwidth Maximum Output Power Conducted Spurious emission Band Edge Power Spectral Density Radiated Emissions Above 1GHz AC Conducted Emissions	Pi/4 DQPSK	Continuous

#### Test Frequency

Channel	1	19	38
Frequency (MHz)	2 403.35	2 439.35	2 477.35

### 3.3 Device Modifications

The following modifications were necessary for compliance:

Not applicable



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970  
Fax: +82-31-624-9501

Report No.:  
CTK-2017-02357  
Page (8) / (40)Pages

### 3.4 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	15-bs563TU	CND7253R5S
AC/DC Adapter	HP	HSTNN-CA40	-

### 3.5 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.  
Coverage factor  $k = 2$ , Confidence levels of 95 %

Description	Uncertainty
Conducted RF Output Power	$\pm 1.5$ dB
Power Spectral Density	$\pm 1.5$ dB
Occupied Bandwidth	$\pm 0.1$ MHz
Unwanted Emission(conducted)	$\pm 3.0$ dB
Radiated Emissions ( $f \leq 1$ GHz)	$\pm 4.0$ dB
Radiated Emissions ( $f > 1$ GHz)	$\pm 5.0$ dB

### 3.6 Test Software

Conducted Test	Ics Pro Ver. 6.0.3
Radiated Test	TOYO EMI software EP5RE Ver. 5.1.0
Line Conducted Test	ESCI7, ESCI3 : EMC32 Ver. 8.50.0 ESR7 : EMC32 Ver. 8.53.0





**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (9) / (40)Pages

## 4.0 Technical Characteristic Test

### 4.1 ON Time, Duty Cycle

#### Test Procedures

KDB 558074 Zero-Span Spectrum Analyzer Method.

#### Test Data:

ON Time (ms)	Period (ms)	TX OFF (ms)	Duty Cycle (linear)	Duty Cycle (%)
5.00	5.00	0	1.00	100



ANT1



ANT2



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970  
Fax: +82-31-624-9501

Report No.:  
CTK-2017-02357  
Page (10) / (40)Pages

## 4.2 6dB Bandwidth

### Test Procedures

ANSI C63.10-2013 6.9.2  
RSS-GEN Issue 4 6.6

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### Test Procedures

ANSI C63.10-2013 6.9.3  
RSS-GEN Issue 4 6.6

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

### Test Settings :

Center frequency = the highest, middle and the lowest channels

- a) RBW = 100 kHz
- b) VBW  $\geq 3 \times$  RBW
- c) Detector = peak
- d) Trace mode = Max hold
- e) Sweep = auto couple
- f) Allow trace to fully stabilize
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### **Minimum Standard:**

---

---

6 dB Bandwidth > 500kHz

---

---



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970  
Fax: +82-31-624-9501

Report No.:  
CTK-2017-02357  
Page (11) / (40)Pages

**Test Data:**

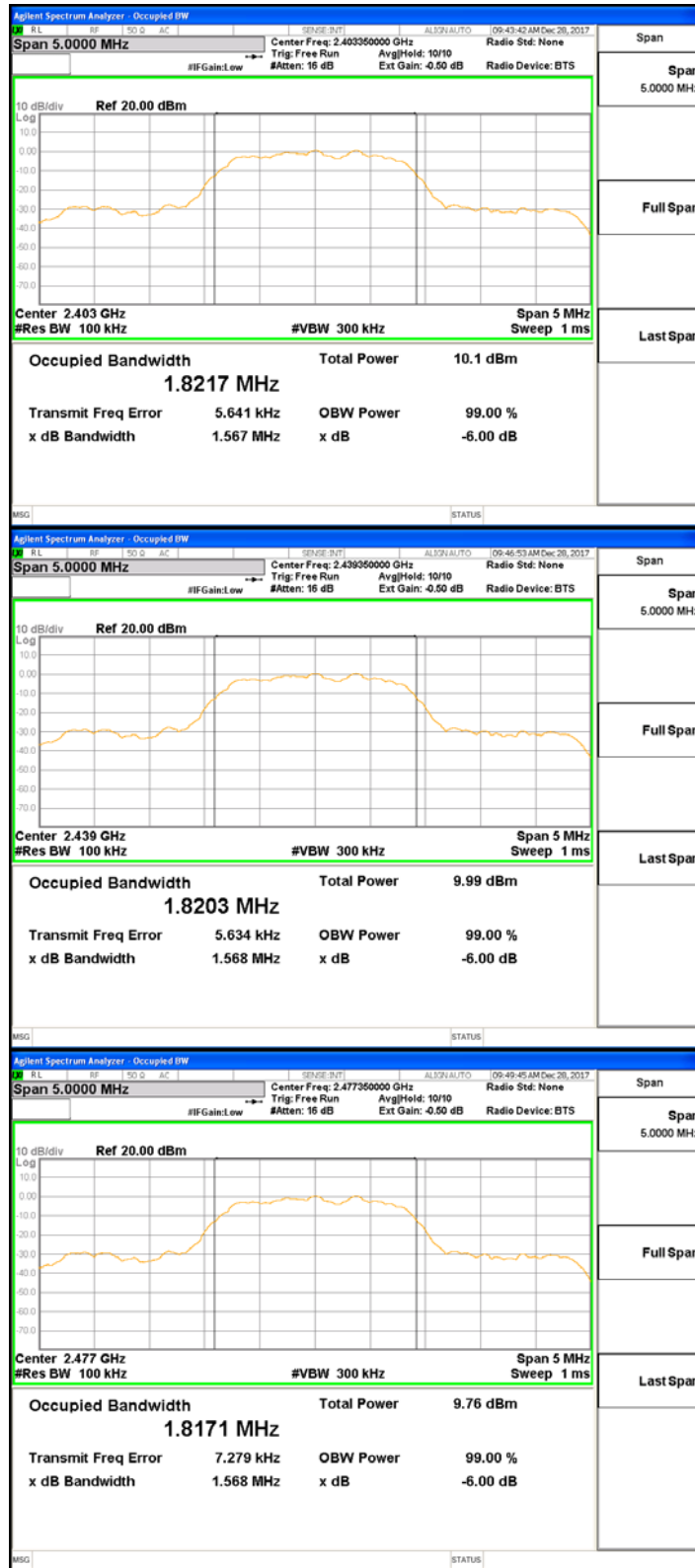
	6 dB Bandwidth and 99% Bandwidth (MHz)			
Mode	ANT1		ANT2	
Frequency	6 dB	99%	6 dB	99%
2 403.35 MHz	1.567	1.821	1.566	1.821
2 439.35 MHz	1.568	1.820	1.567	1.820
2 477.35 MHz	1.568	1.817	1.568	1.819

See next pages for actual measured spectrum plots.



**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (12) / (40)Pages

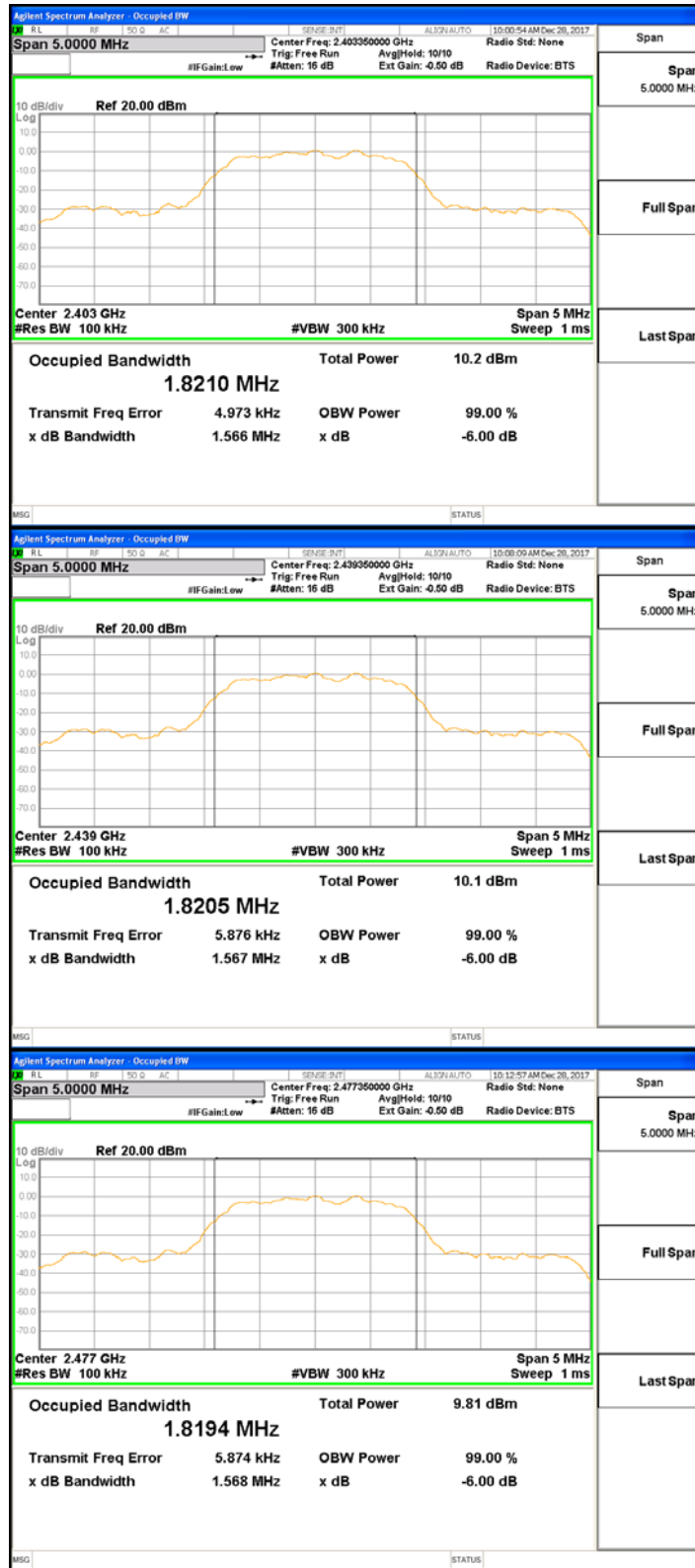


ANT1



**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (13) / (40)Pages



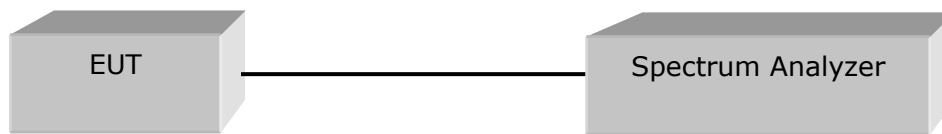
ANT2

## 4.3 OUTPUT POWER

### Test Procedures

Average Power(Procedure 9.2.2.2 in KDB 558074, Method AVGSA-1)  
RSS-GEN Issue 4 6.12

The transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.



### Test Settings:

Center frequency = the highest, middle and the lowest channels

- a) span  $\geq 1.5 \times \text{OBW}$
- b) RBW = 1 MHz
- c) VBW  $\geq 3 \times \text{RBW}$
- d) Sweep time = auto
- e) Detector = RMS
- f) average at least 100

Limit

< 1 W



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970  
Fax: +82-31-624-9501

Report No.:  
CTK-2017-02357  
Page (15) / (40)Pages

## Test Data

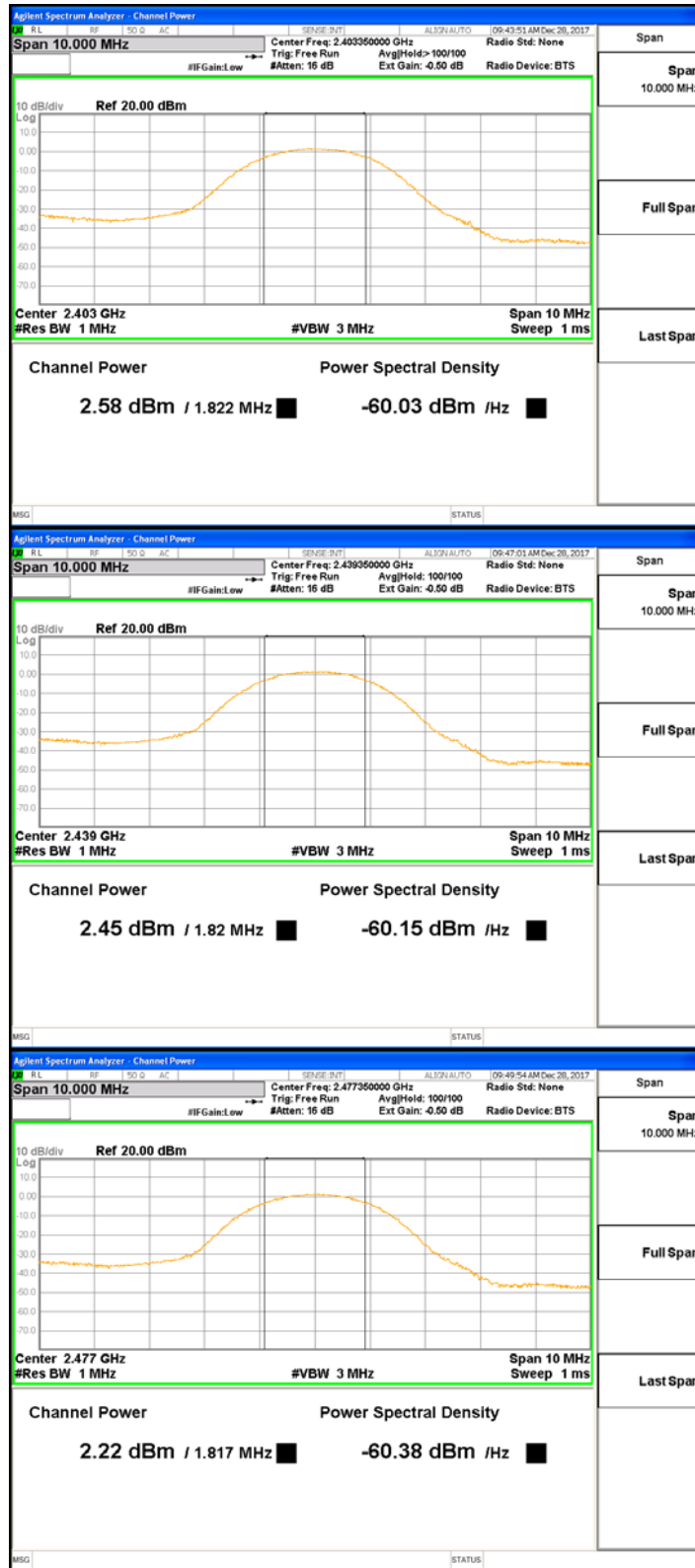
Mode	Measured Output Power (dBm)					
	ANT1			ANT2		
Frequency	Result (dBm)	Limit (dBm)	Margin (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
2 403.35 MHz	2.58	30	27.42	2.67	30	27.33
2 439.35 MHz	2.45	30	27.55	2.56	30	27.44
2 477.35 MHz	2.22	30	27.78	2.28	30	27.72

See next pages for actual measured spectrum plots.



**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (16) / (40)Pages



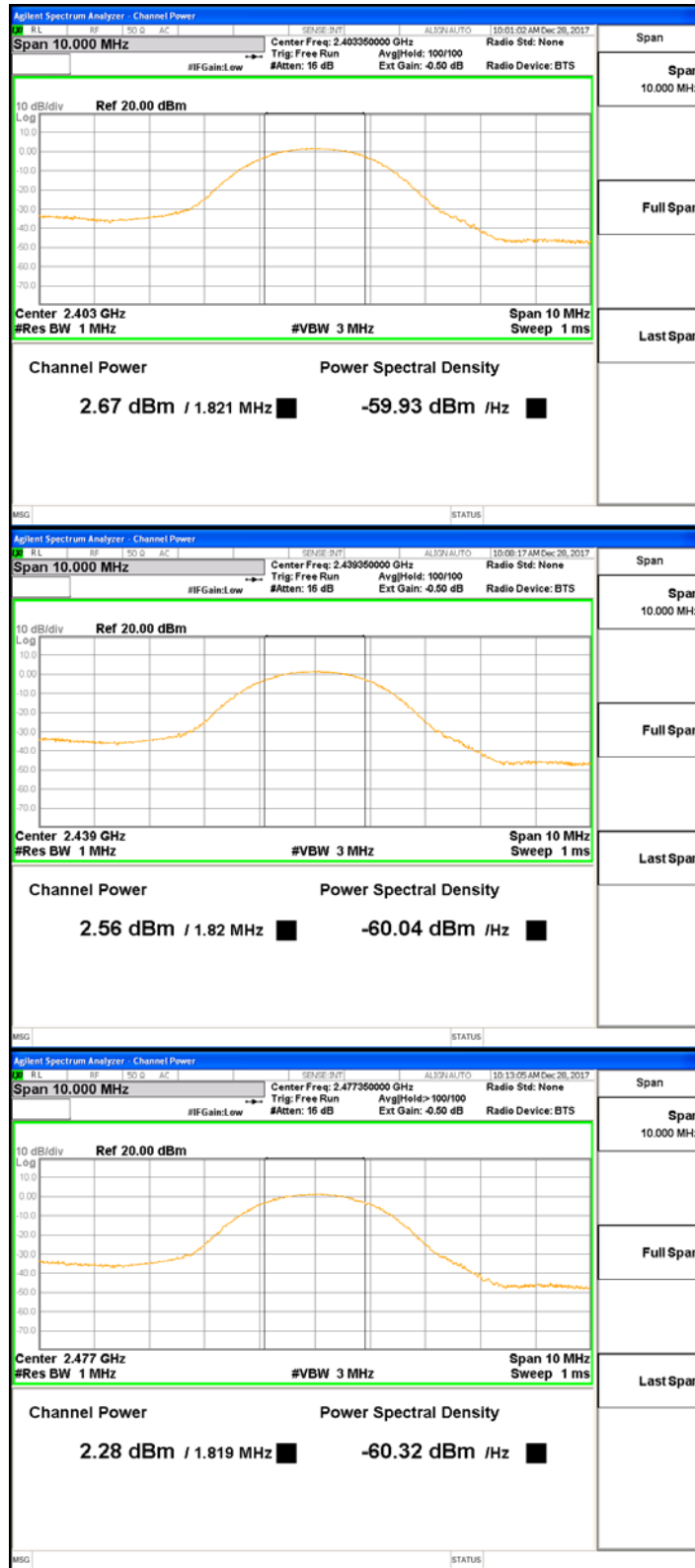
ANT1





**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (17) / (40)Pages



ANT2



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970  
Fax: +82-31-624-9501

Report No.:  
CTK-2017-02357  
Page (18) / (40)Pages

## 4.4 Power Spectral Density

### Test Procedures

Procedure 10.2 in KDB 558074, Method Peak PSD  
RSS-247 Issue 2 5.2(b)

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

### Test Settings:

Center frequency = the highest, middle and the lowest channels

- a)  $RBW : 3 \text{ kHz} \leq RBW \leq 100 \text{ kHz}$
- b)  $VBW \geq 3 \times RBW$
- c)  $span \geq 1.5 \times DTS \text{ bandwidth}$
- d) Sweep time = auto couple
- e) Detector = peak
- f) Trace mode = max hold
- g) Allow trace to fully stabilize
- h) Use the peak marker function to determine the maximum amplitude level within the RBW.

### Limit

Power Spectral Density	< 8dBm @ 3 kHz BW
------------------------	-------------------



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970  
Fax: +82-31-624-9501

Report No.:  
CTK-2017-02357  
Page (19) / (40)Pages

## Test Data

Mode	Measured Power Density (dBm/3kHz)					
	ANT1			ANT2		
Frequency	Result (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)	Result (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
2 403.35 MHz	-13.989	8	21.989	-13.848	8	21.848
2 439.35 MHz	-14.115	8	22.115	-14.060	8	22.060
2 477.35 MHz	-14.364	8	22.364	-14.276	8	22.276

See next pages for actual measured spectrum plots.



**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (20) / (40)Pages



ANT1



**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (21) / (40)Pages



ANT2



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970  
Fax: +82-31-624-9501

Report No.:  
CTK-2017-02357  
Page (22) / (40)Pages

## 4.5 Band - edge

### Test Procedures

Procedure 11.2 in KDB 558074  
RSS-Gen Issue 4 6.13

The bandwidth at 20dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

#### Test Settings:

Center frequency = the highest, middle and the lowest channels

- a) RBW = 100 kHz
- b) VBW  $\geq 3 \times$  RBW
- c) Detector = peak
- d) Sweep time = auto couple
- e) Trace mode= max hold
- f) Allow trace to fully stabilize
- g) Use the peak marker function to determine the maximum amplitude level.

#### **Limit :**

---

Emission level < 30 dBc

---

#### **Test Data: Complies**

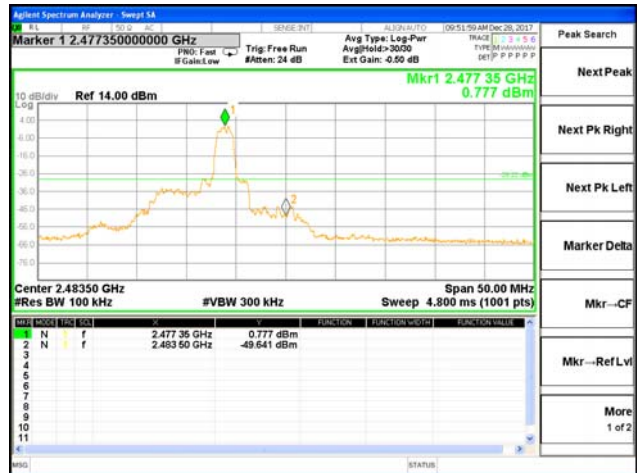
- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 30dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.

See next pages for actual measured spectrum plots.



**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (23) / (40)Pages

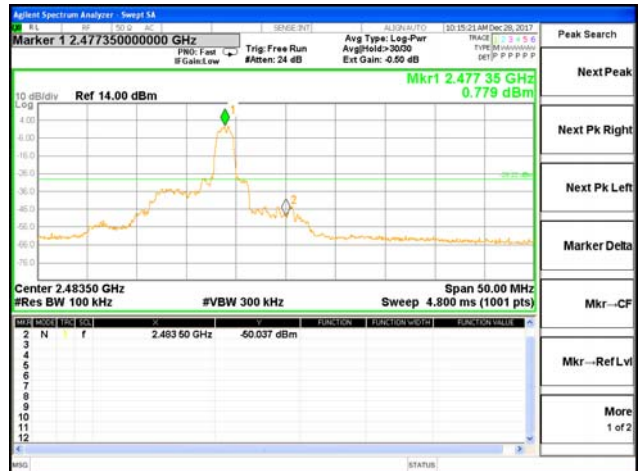
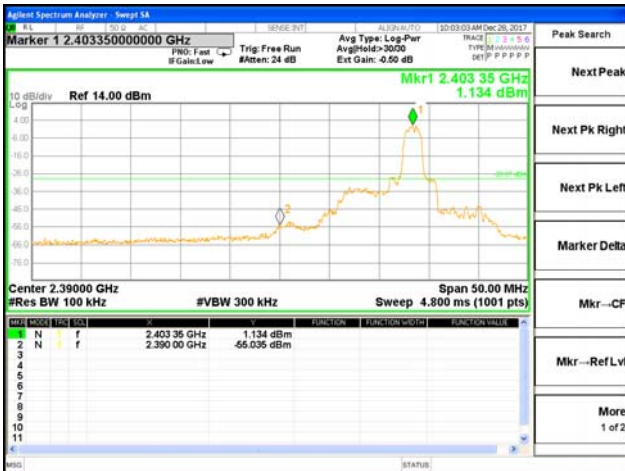


ANT1



**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (24) / (40)Pages



ANT2





## 4.6 Field Strength of Emissions

Test Location

- 10 m SAC (test distance :  10 m,  3 m)  
 3 m SAC (test distance : 3 m)

### Test Procedures

Procedure 12.2.7 in KDB 558074  
 RSS-Gen Issue 4 6.13

- 1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency range above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

### Test Settings:

Frequency Range = 9 kHz ~ 25 GHz (2.4 GHz 10<sup>th</sup> harmonic)

- a) RBW = 1 MHz for  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz, 9 kHz for  $f < 30$  MHz
- b) VBW  $\geq$  RBW
- c) Sweep time = auto couple

Limit

### - 15.209(a)

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m	Measurement Distance (meters)
0.009-0.490	2 400/F(kHz)	-	300
0.490-1.705	24 000/F(kHz)	-	30
1.705-30	30	-	30
30-88	100**	40	3
88-216	150**	43.5	3
216-960	200**	46	3
Above 960	500	54	3

\*\* Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Note :

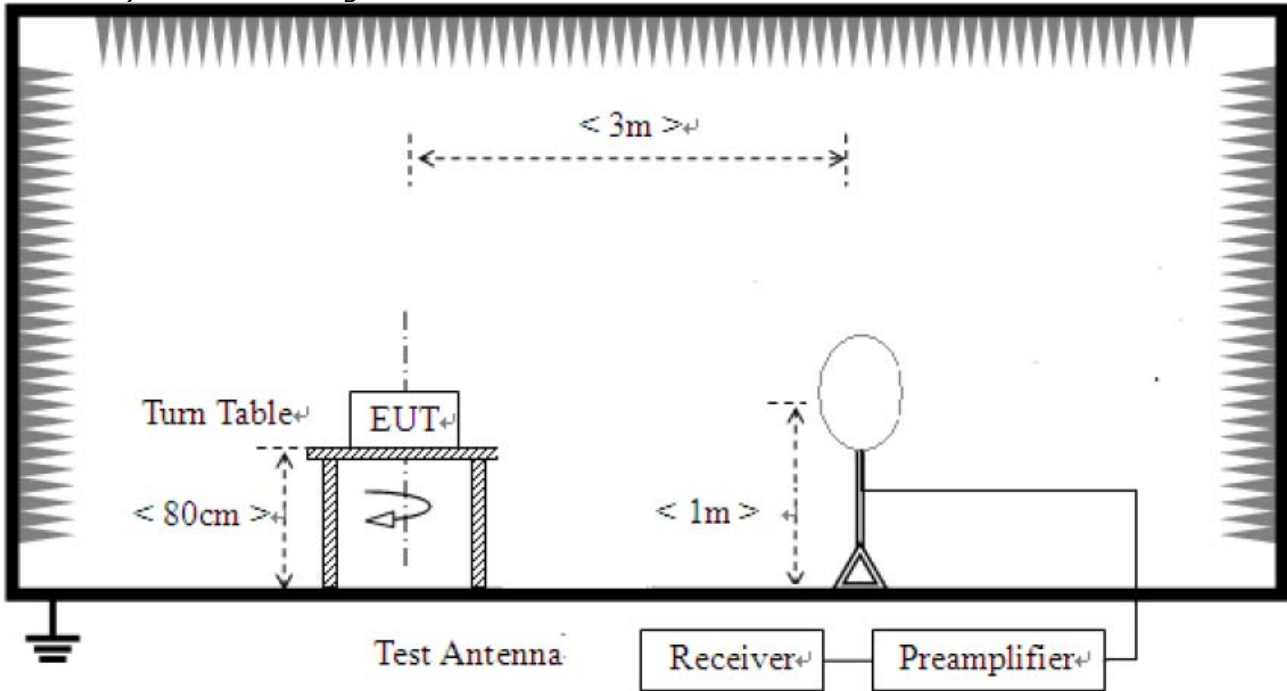
- 1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the

maximum permitted average limit.

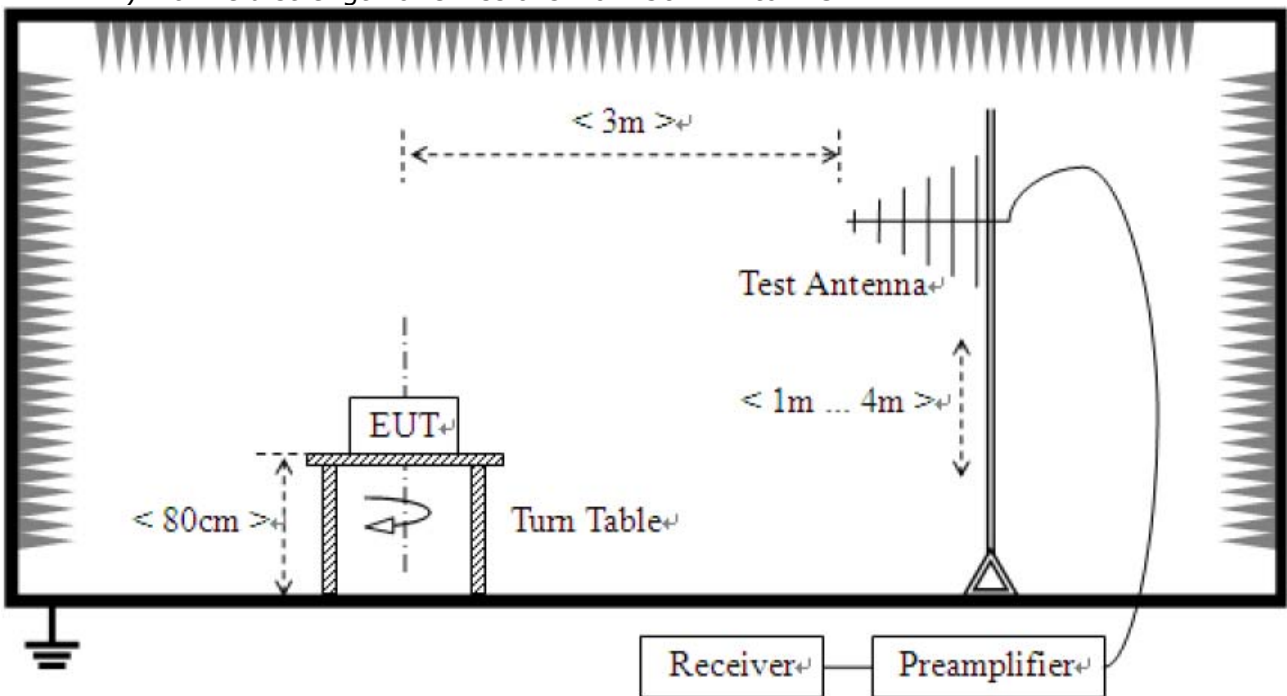
- 2) For above 1 GHz, limit field strength of harmonics : 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK)

**Test Setup:**

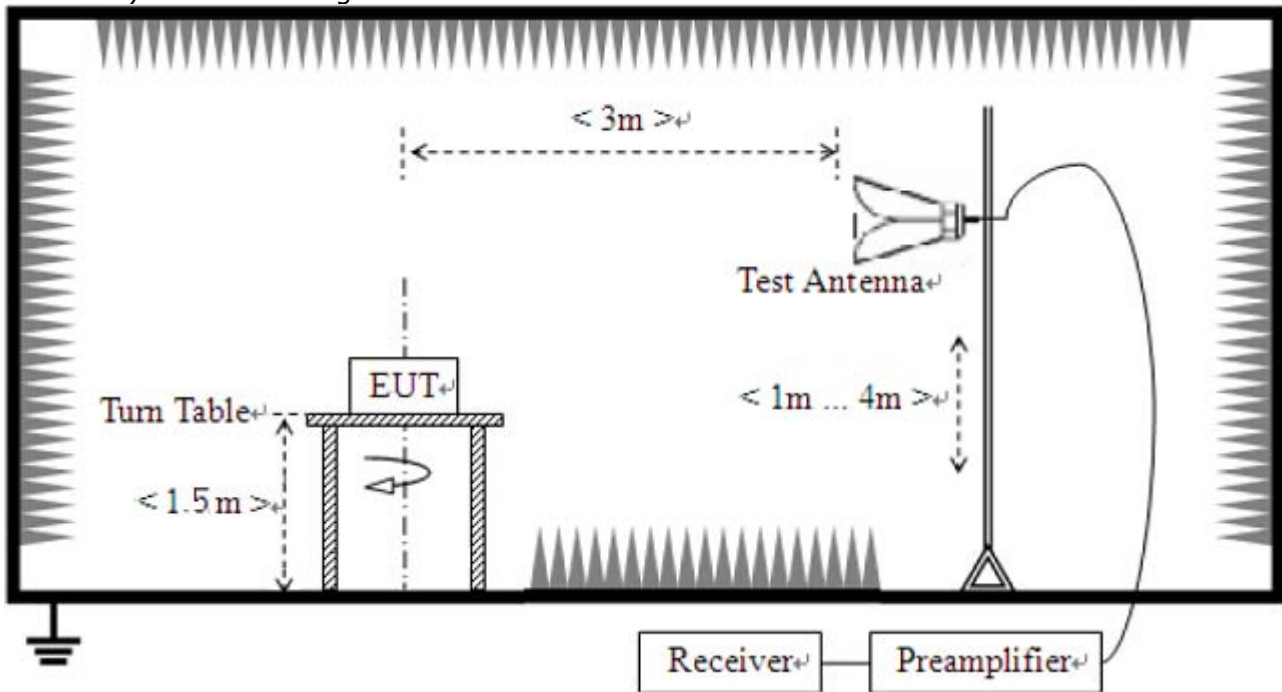
- 1) For field strength of emissions from 9 kHz to 30 MHz



- 2) For field strength of emissions from 30 MHz to 1 GHz



3) For field strength of emissions above 1 GHz



 <b>CTK Co., Ltd.</b> <small>The Prime Leader of Global Regulatory Certification</small>	<b>CTK Co., Ltd.</b> (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel: +82-31-339-9970 Fax: +82-31-624-9501	Report No.: CTK-2017-02357 Page (28) / (40)Pages	
---	---	--	--

## Test Results

### 1) 9 kHz to 30 MHz

#### Test mode : Pi/4 DQPSK

EUT	AUDIO TRANSCEIVER	Measurement Detail	
Model	ATM100	Frequency Range	9 kHz - 30 MHz
Test mode	ANT1, ANT2	Detector function	Quasi-Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
-	-	-	See note

#### Note :

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log(\text{specific distance} / \text{test distance})$  (dB)

## 2) 30 MHz to 1 GHz

Test mode : Pi/4 DQPSK

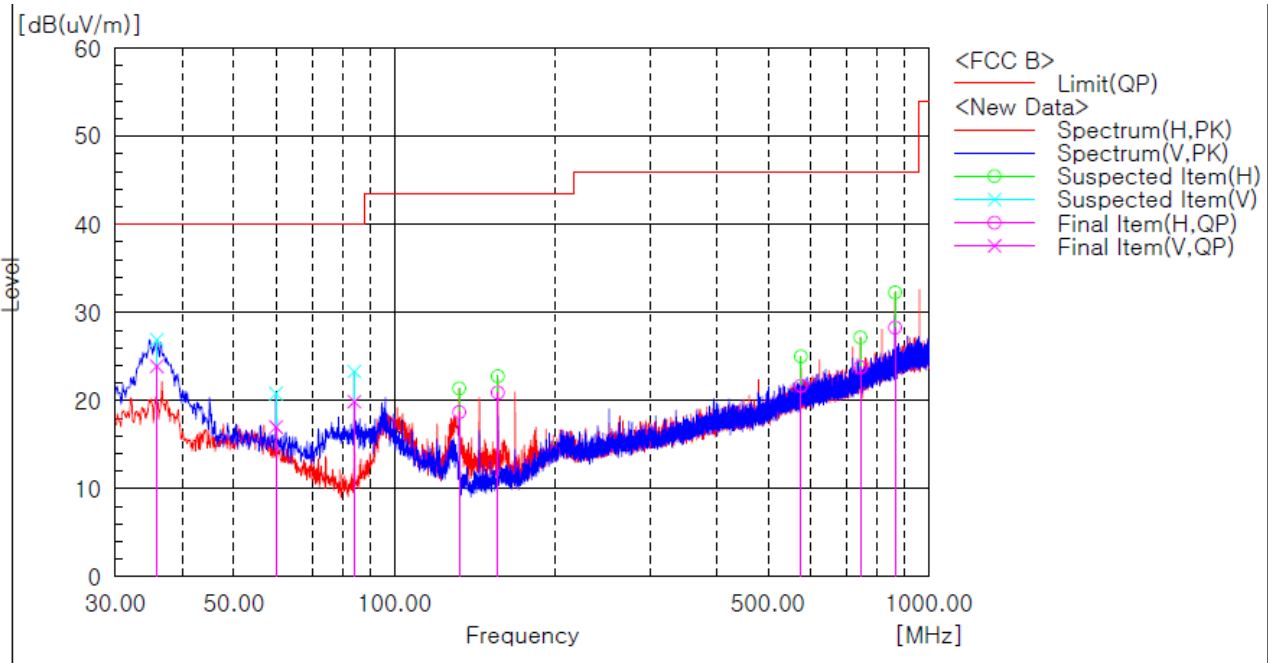
EUT	AUDIO TRANSCEIVER	Measurement Detail	
Model	ATM100	Frequency Range	Below 1 000 MHz
Configuration	ANT1	Detector function	Quasi-Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
35.821	23.9	16.1	Quasi-Peak

### Test Data



### Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Angle [deg]	Remark
1	35.821	V	38.8	-14.9	23.9	40.0	16.1	6.1	
2	59.952	V	30.9	-13.9	17.0	40.0	23.0	257.2	
3	83.963	V	37.6	-17.7	19.9	40.0	20.1	353.9	
4	131.984	H	36.0	-17.3	18.7	43.5	24.8	66.2	
5	155.995	H	38.1	-17.2	20.9	43.5	22.6	248.5	
6	576.178	H	29.8	-8.1	21.7	46.0	24.3	261.9	
7	744.131	H	30.0	-6.2	23.8	46.0	22.2	8.3	
8	864.183	H	32.8	-4.5	28.3	46.0	17.7	8.3	

### Remark :

- The EUT was tested in three orientations in order to determine that "Z axis" was the worst case.
- Result = Reading + c.f(Correction factor)
- Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain



**Test mode : Pi/4 DQPSK**

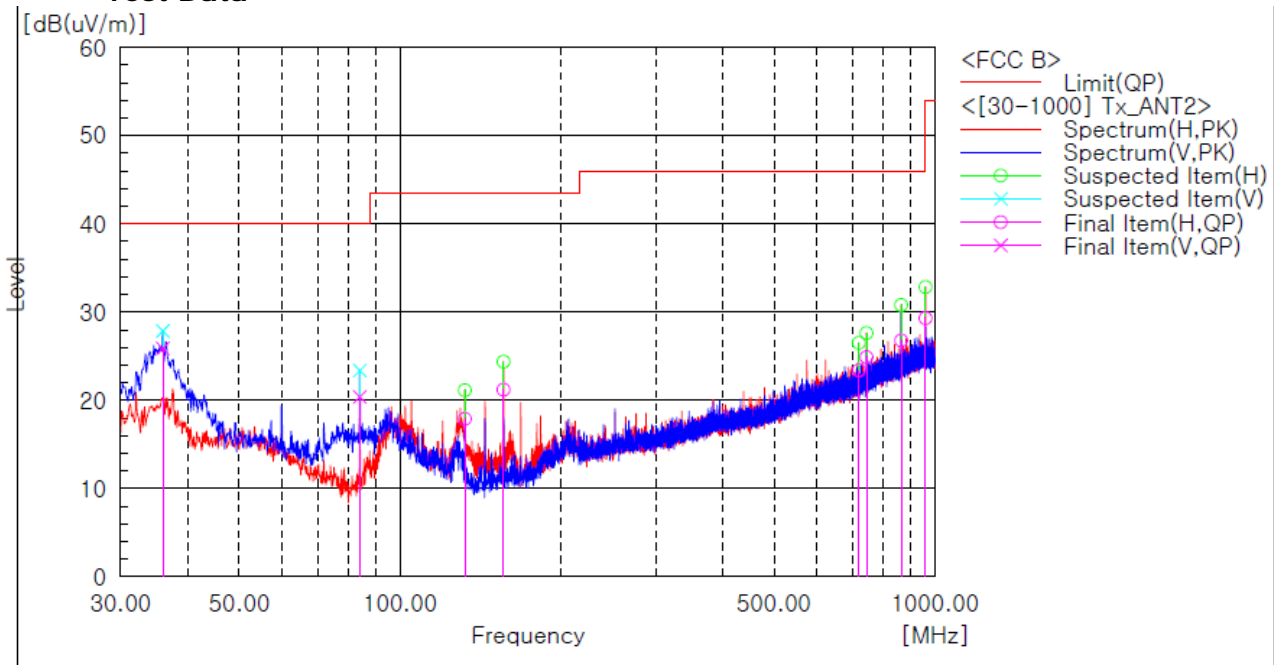
EUT	AUDIO TRANSCEIVER	Measurement Detail	
Model	ATM100	Frequency Range	Below 1 000 MHz
Configuration	ANT2	Detector function	Quasi-Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
35.942	25.9	14.1	Quasi-Peak

**Test Data**



**Final Result**

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Angle [deg]	Remark
1	35.942	V	40.8	-14.9	25.9	40.0	14.1	3.3	
2	83.963	V	38.1	-17.7	20.4	40.0	19.6	265.1	
3	131.984	H	35.2	-17.3	17.9	43.5	25.6	230.2	
4	155.995	H	38.4	-17.2	21.2	43.5	22.3	230.2	
5	720.120	H	30.0	-6.6	23.4	46.0	22.6	354.7	
6	744.131	H	31.1	-6.2	24.9	46.0	21.1	355.2	
7	864.183	H	31.3	-4.5	26.8	46.0	19.2	358.9	
8	960.225	H	32.7	-3.4	29.3	54.0	24.7	203.2	

**Remark :**

1. The EUT was tested in three orientations in order to determine that "Z axis" was the worst case.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain



**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (31) / (40)Pages

**Test mode : Receiver**

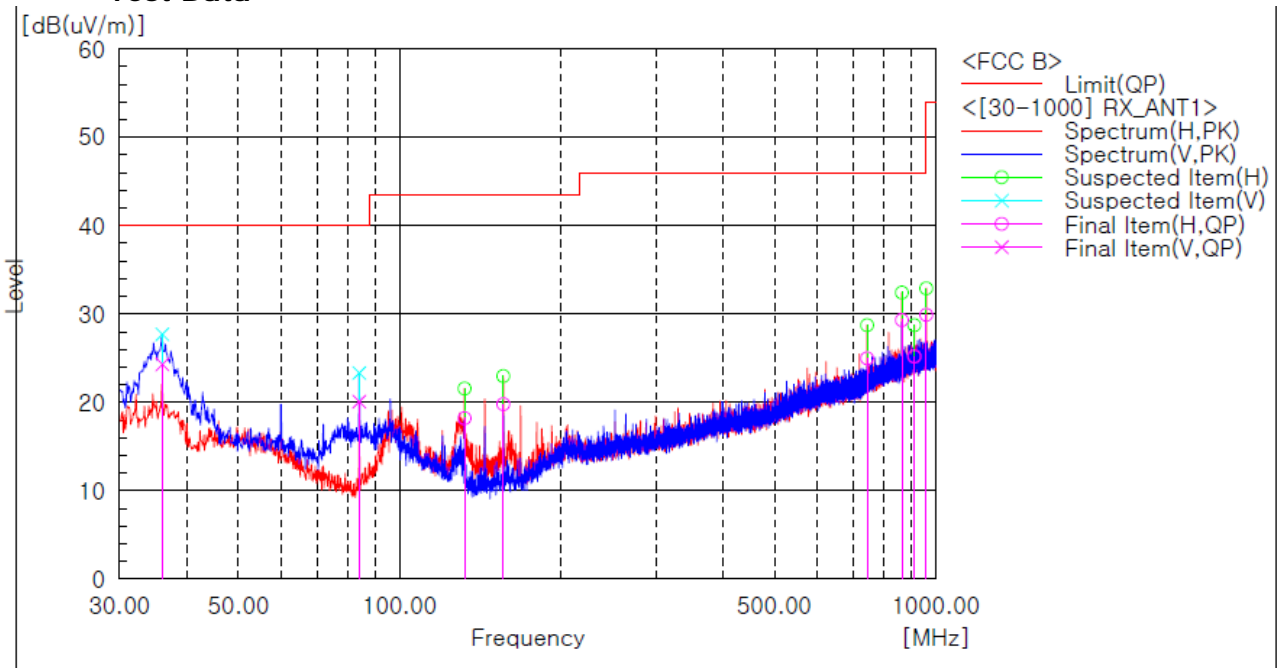
EUT	AUDIO TRANSCEIVER	Measurement Detail	
Model	ATM100	Frequency Range	Below 1 000 MHz
Configuration	ANT1	Detector function	Quasi-Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
36.063	24.3	15.7	Quasi-Peak

**Test Data**



**Final Result**

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Angle [deg]	Remark
1	36.063	V	39.2	-14.9	24.3	40.0	15.7	1.1	
2	83.963	V	37.8	-17.7	20.1	40.0	19.9	355.3	
3	131.984	H	35.5	-17.3	18.2	43.5	25.3	254.3	
4	155.995	H	37.0	-17.2	19.8	43.5	23.7	241.0	
5	744.131	H	31.2	-6.2	25.0	46.0	21.0	6.1	
6	864.183	H	33.8	-4.5	29.3	46.0	16.7	6.1	
7	912.204	H	29.1	-3.9	25.2	46.0	20.8	21.4	
8	960.225	H	33.3	-3.4	29.9	54.0	24.1	6.1	

**Remark :**

1. The EUT was tested in three orientations in order to determine that "Z axis" was the worst case.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain





**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (32) / (40)Pages

**Test mode : Receiver**

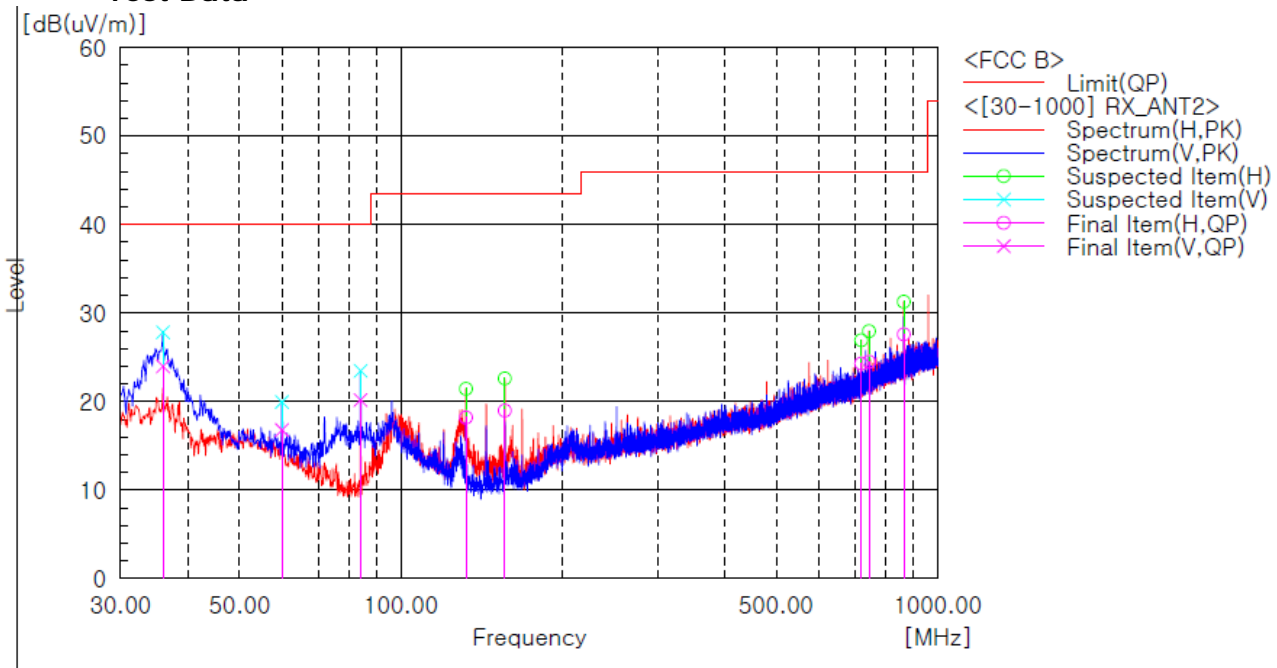
EUT	AUDIO TRANSCEIVER	Measurement Detail	
Model	ATM100	Frequency Range	Below 1 000 MHz
Configuration	ANT2	Detector function	Quasi-Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
35.942	24.0	16.0	Quasi-Peak

**Test Data**



**Final Result**

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Angle [deg]	Remark
1	35.942	V	38.9	-14.9	24.0	40.0	16.0	2.9	
2	59.952	V	30.7	-13.9	16.8	40.0	23.2	247.1	
3	83.963	V	37.9	-17.7	20.2	40.0	19.8	314.7	
4	131.984	H	35.5	-17.3	18.2	43.5	25.3	240.6	
5	155.995	H	36.2	-17.2	19.0	43.5	24.5	240.6	
6	720.120	H	30.9	-6.6	24.3	46.0	21.7	358.5	
7	744.131	H	30.7	-6.2	24.5	46.0	21.5	354.6	
8	864.183	H	32.1	-4.5	27.6	46.0	18.4	358.9	

**Remark :**

1. The EUT was tested in three orientations in order to determine that "Z axis" was the worst case.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain





**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (33) / (40)Pages

### 3) above 1 GHz

Test mode : Pi/4 DQPSK

EUT	AUDIO TRANSCEIVER	Measurement Detail	
Model	ATM100	Frequency Range	1 - 25 GHz
Mode	ANT1	Detector function	Average / Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
2483.50	43.29	10.71	Average

#### Ch.1(2 403.35 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2390.00	H	54.00	74.00	31.76	48.15	22.24	25.85
2390.00	V	54.00	74.00	28.97	42.65	25.03	31.35
2483.50	H	54.00	74.00	26.94	40.30	27.06	33.70
2483.50	V	54.00	74.00	26.39	40.27	27.61	33.73

#### Ch.19(2 439.35 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2390.00	H	54.00	74.00	28.70	40.92	25.30	33.08
2390.00	V	54.00	74.00	26.34	40.40	27.66	33.60
2483.50	H	54.00	74.00	26.24	40.11	27.76	33.89
2483.50	V	54.00	74.00	25.87	40.54	28.13	33.46

#### Ch.38(2 477.35 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2390.00	H	54.00	74.00	26.88	40.97	27.12	33.03
2390.00	V	54.00	74.00	26.45	40.63	27.55	33.37
2483.50	H	54.00	74.00	43.29	57.62	10.71	16.38
2483.50	V	54.00	74.00	35.30	49.19	18.70	24.81

#### Remarks

1. The EUT was tested in three orientations in order to determine that "Z axis" was the worst case.



**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (34) / (40)Pages

**Test mode : Pi/4 DQPSK**

EUT	AUDIO TRANSCEIVER	Measurement Detail	
Model	ATM100	Frequency Range	1 - 25 GHz
Mode	ANT2	Detector function	Average / Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
2483.50	42.69	11.31	Average

**Ch.1(2 403.35 MHz)**

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2390.00	H	54.00	74.00	28.27	42.78	25.73	31.22
2390.00	V	54.00	74.00	26.48	41.51	27.52	32.49
2483.50	H	54.00	74.00	26.71	40.70	27.29	33.30
2483.50	V	54.00	74.00	26.36	41.45	27.64	32.55

**Ch.19(2 439.35 MHz)**

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2390.00	H	54.00	74.00	26.35	40.30	27.65	33.70
2390.00	V	54.00	74.00	26.00	40.30	28.00	33.70
2483.50	H	54.00	74.00	26.46	40.21	27.54	33.79
2483.50	V	54.00	74.00	25.92	40.27	28.08	33.73

**Ch.38(2 477.35 MHz)**

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2390.00	H	54.00	74.00	25.87	39.85	28.13	34.15
2390.00	V	54.00	74.00	25.81	40.27	28.19	33.73
2483.50	H	54.00	74.00	42.69	57.02	11.31	16.98
2483.50	V	54.00	74.00	33.64	47.78	20.36	26.22

**Remarks**

1. The EUT was tested in three orientations in order to determine that "Z axis" was the worst case.



**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (35) / (40)Pages

**Test mode : Receiver**

EUT	AUDIO TRANSCEIVER	Measurement Detail	
Model	ATM100	Frequency Range	1 - 25 GHz
Mode	ANT1	Detector function	Average / Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
No emissions were detected at a level greater than 20dB below limit.			

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
-----------------	-----	---------------------	---------------------	---------------------	---------------------	----------------	----------------

No emissions were detected at a level greater than 20dB below limit.

**Remarks**

1. The EUT was tested in three orientations in order to determine that "Z axis" was the worst case.



**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (36) / (40)Pages

**Test mode : Receiver**

EUT	AUDIO TRANSCEIVER	Measurement Detail	
Model	ATM100	Frequency Range	1 - 25 GHz
Mode	ANT2	Detector function	Average / Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
No emissions were detected at a level greater than 20dB below limit.			

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
-----------------	-----	---------------------	---------------------	---------------------	---------------------	----------------	----------------

No emissions were detected at a level greater than 20dB below limit.

**Remarks**

1. The EUT was tested in three orientations in order to determine that "Z axis" was the worst case.



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970  
Fax: +82-31-624-9501

Report No.:  
CTK-2017-02357  
Page (37) / (40)Pages

## 4.7 AC Conducted Emissions

Test Location  
Shielded Room

Frequency Range of Measurement  
150 kHz to 30 MHz

Instrument Settings  
IF Band Width: 9 kHz

### Test Procedures

ANSI C63.10-2013 6.2.2  
RSS-GEN Issue 4 8.8

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.

Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit

### - 15.207(a)

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56*	56 to 46*
0.5 ~ 5	56	46
5 ~ 30	60	50

\* Decreases with the logarithm of the frequency.

Test Results

The requirements are:

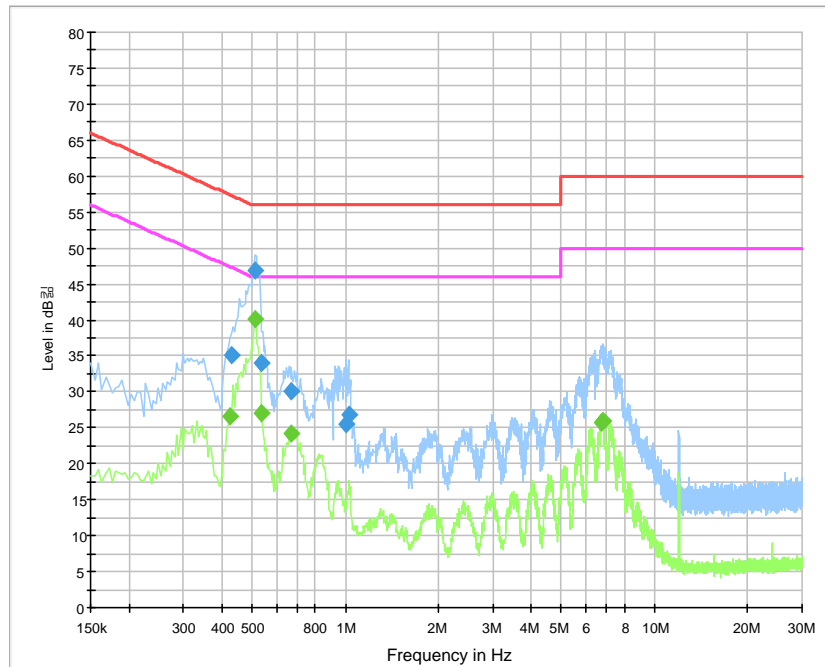
Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
0.510	40.0	6.0	Average

Test Data

[LINE]

Class B\_L1



**Final Result 1**

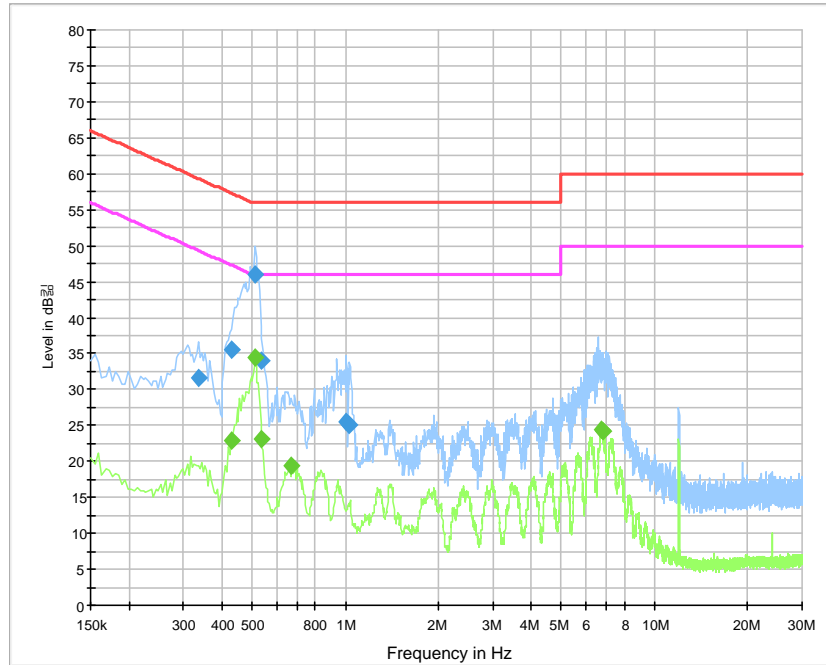
Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.429000	35.1	1000.0	9.000	On	L1	9.9	22.2	57.3
0.510000	46.8	1000.0	9.000	On	L1	9.9	9.2	56.0
0.537000	33.9	1000.0	9.000	On	L1	9.9	22.1	56.0
0.672000	30.2	1000.0	9.000	On	L1	9.9	25.8	56.0
1.009500	25.5	1000.0	9.000	On	L1	9.7	30.5	56.0
1.027500	26.7	1000.0	9.000	On	L1	9.7	29.3	56.0

**Final Result 2**

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.424500	26.6	1000.0	9.000	On	L1	9.9	20.8	47.4
0.510000	40.0	1000.0	9.000	On	L1	9.9	6.0	46.0
0.537000	26.9	1000.0	9.000	On	L1	9.9	19.1	46.0
0.672000	24.2	1000.0	9.000	On	L1	9.9	21.8	46.0
6.702000	25.8	1000.0	9.000	On	L1	9.8	24.2	50.0
6.814500	25.9	1000.0	9.000	On	L1	9.8	24.1	50.0

[NEUTRAL]

Class B\_N



**Final Result 1**

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.334500	31.6	1000.0	9.000	On	N	9.8	27.7	59.3
0.429000	35.6	1000.0	9.000	On	N	9.9	21.7	57.3
0.510000	46.0	1000.0	9.000	On	N	9.9	10.0	56.0
0.537000	33.9	1000.0	9.000	On	N	9.9	22.1	56.0
1.005000	25.6	1000.0	9.000	On	N	9.8	30.4	56.0
1.032000	25.1	1000.0	9.000	On	N	9.8	30.9	56.0

**Final Result 2**

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.429000	23.0	1000.0	9.000	On	N	9.9	24.3	47.3
0.510000	34.4	1000.0	9.000	On	N	9.9	11.6	46.0
0.537000	23.1	1000.0	9.000	On	N	9.9	22.9	46.0
0.672000	19.3	1000.0	9.000	On	N	9.9	26.7	46.0
6.751500	24.4	1000.0	9.000	On	N	9.8	25.6	50.0
6.828000	24.3	1000.0	9.000	On	N	9.8	25.7	50.0



**CTK Co., Ltd.**  
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,  
 Yongin-si, Gyeonggi-do, Korea  
 Tel: +82-31-339-9970  
 Fax: +82-31-624-9501

Report No.:  
 CTK-2017-02357  
 Page (40) / (40)Pages

## APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Signal Analyzer	Agilent	N9020A	MY48011598	2017-11-01	2018-11-01
2	Signal Generator	Rohde & Schwarz	SMB100A	175528	2017-11-01	2018-11-01
3	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2017-11-01	2018-11-01
4	Bilog Antenna	Schaffner	CBL6111C	2551	2016-05-13	2018-05-13
5	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2016-05-16	2018-05-16
6	6dB Attenuator	R&S	DNF	272.4110.50-2	2017-11-01	2018-11-01
7	6dB Attenuator	R&S	DNF	272.4110.50-1	2017-02-03	2018-02-03
8	AMPLIFIER	SONOMA	310	291721	2017-02-02	2018-02-02
9	LISN	Rohde & Schwarz	ENV216	101235	2017-05-09	2018-05-09
10	Preamplifier	Agilent	8449B	3008A02011	2017-11-30	2018-11-30
11	Horn Antenna	ETS-Lindgren	3115	00078895	2017-04-25	2019-04-25
12	Horn Antenna	ETS-Lindgren	3116	00062916	2017-04-25	2019-04-25
13	Horn Antenna	ETS-Lindgren	3117	00154525	2017-09-14	2019-09-14
14	Band Reject Filter	Micro Tronics	BRM50702	G233	2017-02-03	2018-02-03
15	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2017-05-12	2018-05-12