



243 Jubug-Ri, Yangji-Myeon, Yongin-Si, Gyeonggi-
Do, Korea 17159

Tel: +82-31-444-7270 Fax: +82-31-444-7271

<http://www.ltalab.com>

Dates of Tests: May 23 ~ May 31, 2019

Test Report S/N: LR500111906C

Test Site : LTA CO., LTD.

RF TEST REPORT

FCC ID

TO8-TKR-372MP2

APPLICANT

TJ Media Co.,Ltd.

Device Category	:	Part 74 Licensed Non-Broadcast Transmitter Held to Face (TNF)
Manufacturing Description	:	Wireless Microphone
Manufacturer	:	TJ Media CO., Ltd.
Model name	:	TKR-372MP PRO PLUS
Serial number	:	Identical prototype
FCC Rule Part(s)	:	FCC Part 74 Subpart H; Part 74.861 of the FCC Rules
Frequency Range	:	494.0 ~ 505.2 MHz
RF Output Power	:	0.01W
Data of issue	:	June 10, 2019

This test report is issued under the authority of:

The test was supervised by:

JaBeom.Koo

Eun-Hwan Jung

Ja-Beom Koo, Manager

Eun-Hwan Jung, Test Engineer

This test result only responds to the tested sample. It is not allowed to copy this report even partly without the allowance of the test laboratory. This report must not be used by the applicant to claim product endorsement by NVLAP or any agency of the U.S. Government.

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1. General information

1-1 Test Performed

Company name : LTA Co., Ltd.
 Address : 243, Jubug-ri, Yangji-Myeon, Youngin-Si, Kyunggi-Do, Korea. 17159
 Web site : <http://www.ltalab.com>
 E-mail : chahn@ltalab.com
 Telephone : +82-31-323-6008
 Facsimile : +82-31-323-6010

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the “General requirements for the competent of calibration and testing laboratory”.

1-2 Accredited agencies

LTA Co., Ltd. is approved to perform EMC testing by the following agencies:

Agency	Country	Accreditation No.	Validity	Reference
NVLAP	U.S.A	200723-0	2019-09-30	ECT accredited Lab.
RRA	KOREA	KR0049	-	EMC accredited Lab.
FCC	U.S.A	649054	2021-04-11	FCC CAB
VCCI	JAPAN	C-4948,	2020-09-10	VCCI registration
VCCI	JAPAN	T-2416,	2020-09-10	VCCI registration
VCCI	JAPAN	R-4483(10 m),	2020-10-15	VCCI registration
VCCI	JAPAN	G-847	2021-12-13	VCCI registration
IC	CANADA	5799A-1	2019-11-07	IC filing
KOLAS	KOREA	NO.551	2021-08-20	KOLAS accredited Lab.

2. Information about test item

2-1 Client & Manufacturer

Company name : TJ Media Co., Ltd.
 Address : 640-8, Deungchon-Dong, Gangseo-Gu, Seoul, Korea
 TEL / FAX : +82-2-3663-4700 / +82-2-3664-0194

2-2 Equipment Under Test (EUT)

Model name : TKR-372MP PRO PLUS
 Date of receipt : May 31, 2019
 EUT condition : Identical prototype
 Frequency Range : 494.0 ~ 505.2 MHz
 Antenna type : PCB Pattern Antenna
 RF output power : Max. 0.00627W - Radiated
 Power Source : DC 3.0V by Battery(AA * 2EA)
 Firmware version : V1.0

2-3 Tested frequency

	LOW	MID	HIGH
Frequency (MHz)	494.0	-	505.2

2-4 Test at Extremes of Temperature and Voltage

Temperature Test Conditions		Voltage Test Conditions	
T nom	Per ambient conditions	V nom	3.0
T cold	-30	V min(-15%)	2.55
T hot	+50	V max(+15%)	3.45

3. Test Report

3.1 Summary of tests

FCC Rules	Description of Test	Results
Part 74.861 e) 1)	Carrier Radiated Power	C
Part 74.861 e) 3)	Modulation Characteristics. – Frequency response	C
	Modulation Characteristics. – Modulation Limiting	C
Part 74.861 e) 5)	Occupied Bandwidth	C
FCC Part 74.861 e) 6)	Unwanted radiation (spectrum mask)	C
FCC Part 74.861 e) 4)	Frequency Stability	C
FCC Part 74.861 d) 3)	Radiated Spurious Emission	C
2.1051 / 74.861(e)(6)(iii)	Receiver spurious emissions	NA4
15.207 / 15.107	AC Conducted Emissions	NA3

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

Note3: This device is only operated by DC

Note4: *This device is only Transmitter*

The sample was tested according to the following specification :

- FCC Parts 2, Subpart J and Part 74, Subpart H; ANSI C-63.10-2013

3.2 TEST RESULTS

3.2.1 Carrier Output Power

Definition:

- The carrier power output for a transmitter for this service is the power available at the output terminals of the transmitter when the output terminals are connected to the standard transmitter load.

Test Requirements : FCC Part 74.861 e) 1)

Test method : Subclause 5.2.5.5 of ANSI C63.26-2015
KDB 971168 D01

Measurement Procedure:

The relevant equation for determining the ERP or EIRP from the conducted RF output power measured using the guidance provided above is:

$$\text{ERP or EIRP} = \text{PMeas} + \text{GT} - \text{LC}$$

where:

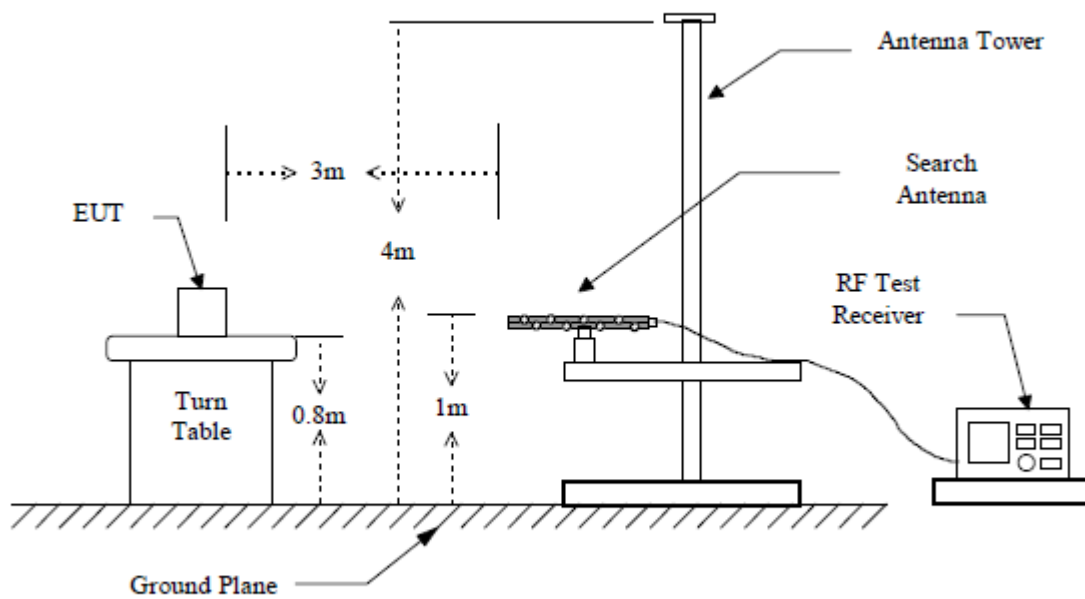
ERP or EIRP = effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);

PMeas = measured transmitter output power or PSD, in dBm or dBW;

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

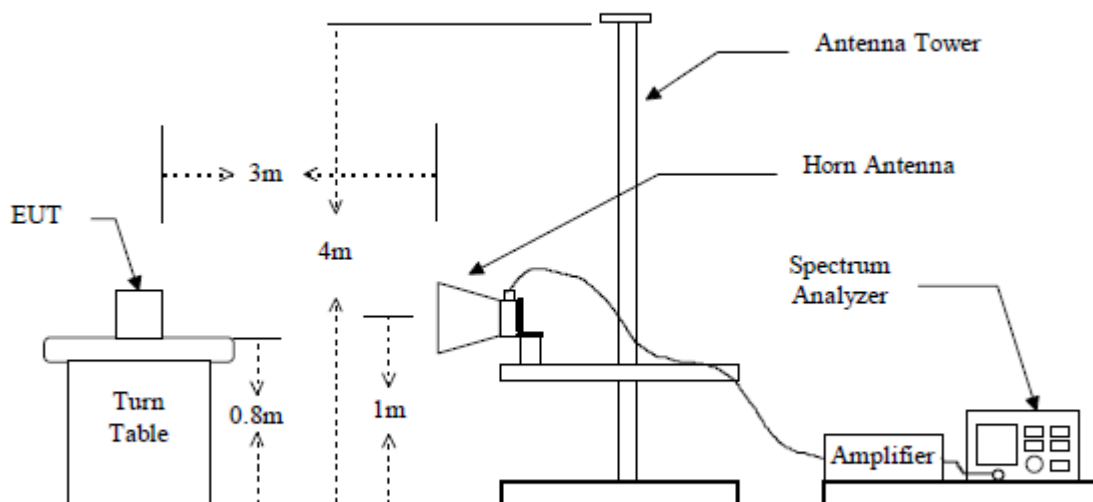
LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

Figure 1 : Frequencies measured below 1 GHz configuration



Note: For substitution method, replace the EUT with a tuned dipole antenna relative to each frequency and connect to a standard signal generator (SG) via a low loss cable.

Figure 2 : Frequencies measured above 1 GHz configuration



Note: For substitution method, replace the EUT with a horn antenna and connect to a standard signal generator (SG) via a low loss cable.

Measurement Data

Frequency (MHz)	Test Results (EIRP)			
	dBm	mW	Limit	Result
494.0	-13.31	0.047	24 dBm (250 mW)	Complies
505.2	-13.25	0.047	24 dBm (250 mW)	Complies

Minimum Standard: 47 CFR 74.861(e)(1)(ii)

250mW (24dBm)

Measurement Data : 494.0 MHz

Frequency [MHz]	Factual Level Horizontal (dBm)	Factual Level Vertical (dBm)	Limits [dBm]	Margin [dB]
988.2	-33.5	-24.6	-13.0	11.6
1433.5	< -33	< -33	-13.0	20
1974.5	< -33	< -33	-13.0	20
2237.0	< -33	< -33	-13.0	20

Measurement Data : 505.2 MHz

Frequency [MHz]	Factual Level Horizontal (dBm)	Factual Level Vertical (dBm)	Limits [dBm]	Margin [dB]
1153.8	-34.2	-23.6	-13.0	10.6
1576.8	< -33	< -33	-13.0	20
2024.6	< -33	< -33	-13.0	20
2782.6	< -33	< -33	-13.0	20

The peak emission of other frequency in rang from 30MHz up to 10 times carrier were 20dB lower than the limit, hence no data was recorded in the report.

NA: Not applicable, since the level is over 20dB lower than the limit.

TEST RESULTS: The unit does meet the FCC requirements.

3.2.2 Modulation Characteristics

3.2.2.1 Audio Frequency Response

Definition:

(e) For low power auxiliary stations operating in the bands allocated for TV broadcasting, the following technical requirements apply:

(3) Any form of modulation may be used. A maximum deviation of ± 75 kHz is permitted when frequency modulation is employed.

Measurement Procedure:

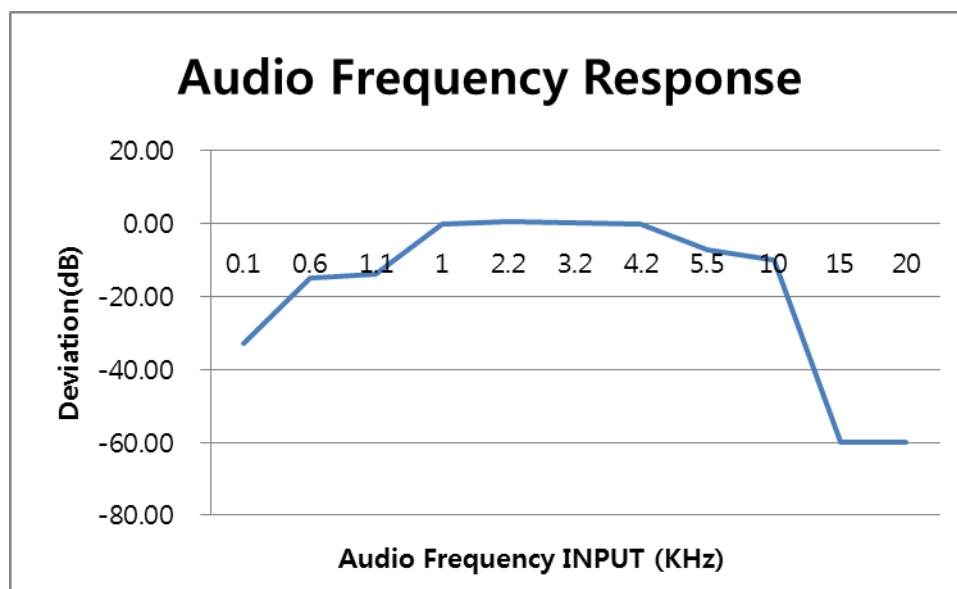
The RF output of the transceiver was connected to the input of FSP 30 with FM deviation module through sufficient attenuation so as not to overload the meter or distort the reading. An audio signal generator was connected to the audio input of microphone.

The audio signal input level was adjusted to obtain 20% of the maximum rated system deviation at 1 kHz, and recorded as DEV REF . With the audio signal generator level unchanged, set the generator frequency between 100 to 5000 Hz. The transmitter deviations (DEV FREQ) were measured and the audio frequency response was calculated as $20\log_{10} [\text{DEV FREQ} / \text{DEV REF}]$

The plot(s) of Audio Frequency Response is presented hereinafter as reference.

Measurement Data:

RF Frequency : REFERENCE LEVEL : 0dB @ 1kHz



Note : tested for conducted output power.

3.2.2.2 Modulation Limiting

Definition:

Modulation limiting refers to the transmitter circuits ability to limit the transmitter from producing deviations due to modulation in excess of a rated system deviation.

Test Requirements : FCC Part 74.861 e) 3)

Test method : ANSI/TIA-603, clause 2.2.6

Limits : none stated

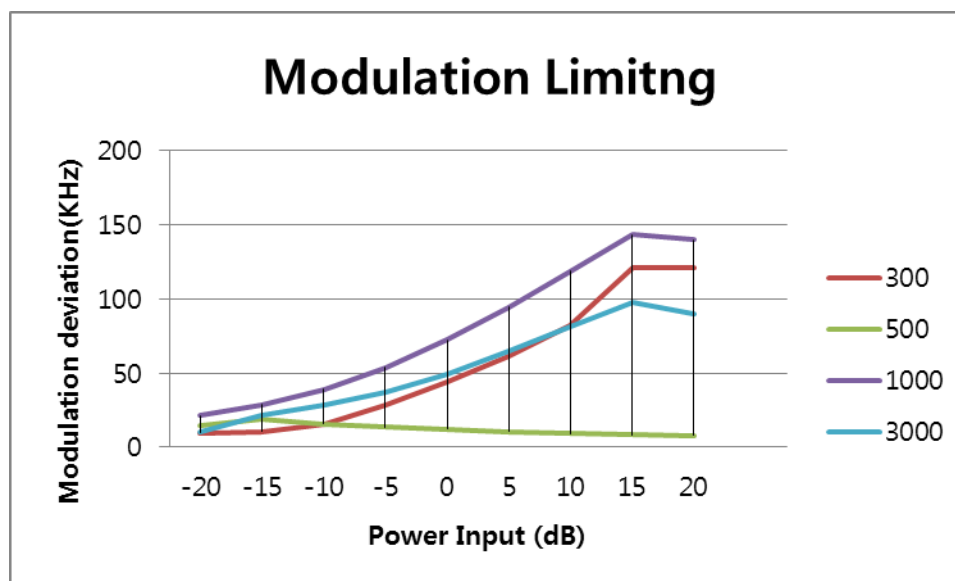
Measurement Procedure:

- Adjust the transmitter per the manufacturer's procedure for full rated system deviation.
- Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤ 0.25 Hz to $\geq 15,000$ Hz. Turn the de-emphasis function off.
- Apply a **1000 Hz** modulating signal to the transmitter from the audio frequency generator, and adjust the level to obtain **60% of full rated system deviation**.
- Increase the level from the audio frequency generator by 20 dB in one step (rise time between the 10% and 90% points shall be 0.1 second maximum).
- Measure both the instantaneous and steady-state deviation at and after the time of increasing the audio input level.
- With the level from the audio frequency generator held constant at the level obtained in step e), slowly vary the audio frequency from 100 to 5000 Hz and observe the steady-state deviation. Record the maximum deviation.

Measurement Data:

Test at five different modulating frequencies (300Hz, 500Hz, 1KHz, 3kHz), the output level of the audio generator was varied up to 1V and the FM deviation level was recorded.

Positive peak deviation



3.2.3 Occupied Bandwidth

Definition:

- The term transmitter Sideband Spectrum denotes the sideband energy produced at a discrete frequency separation from the carrier up to the test bandwidth due to all sources of unwanted noise within the transmitter in a modulated condition.

Test Requirements : FCC Part 74.861 e) 5)

Test method : ANSI/TIA-603, clause 2.2.11

Measurement Procedure:

- (5) The operating bandwidth shall not exceed 200 kHz.
- (6) The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:
- (i) On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB;
 - (ii) On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB;
 - (iii) On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least $43 + 10\log_{10}$ (mean output power in watts) dB.

Measurement Data:

Frequency (MHz)	Test Results	
	Measured Bandwidth (kHz)	Result
494.0	193.9	Complies
505.2	197.5	Complies

- See next pages for actual measured spectrum plots.

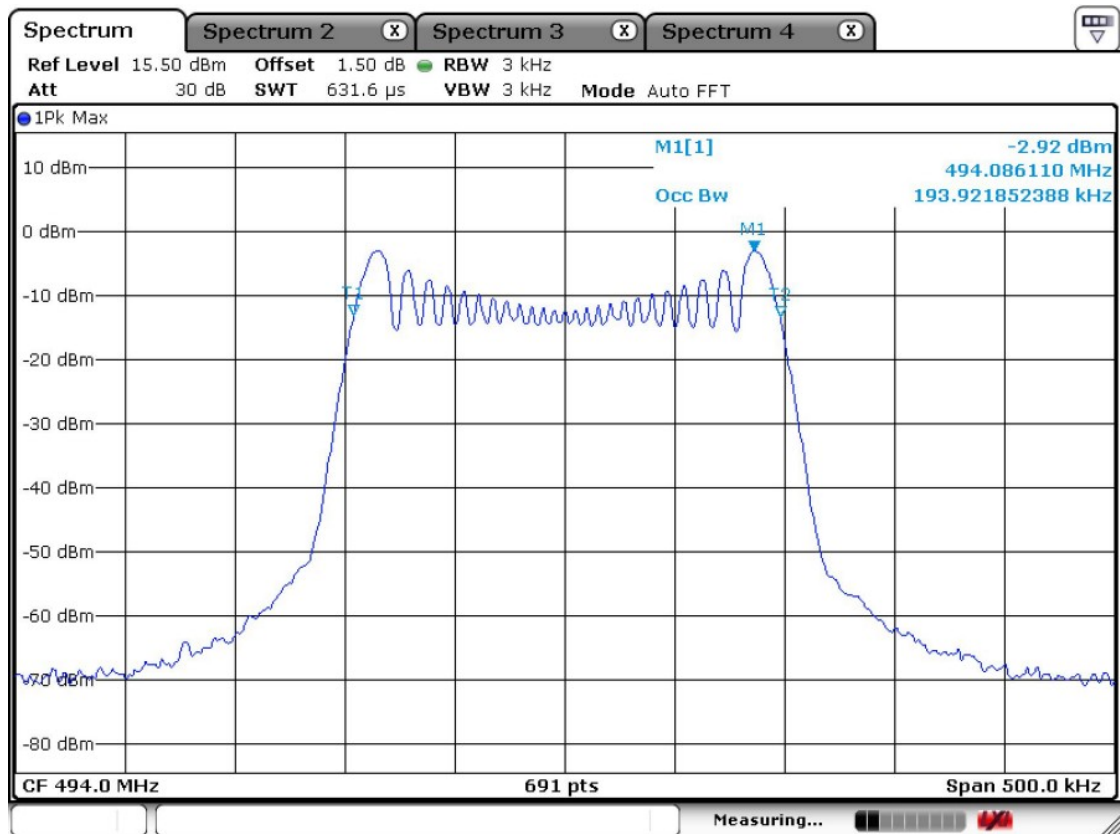
Minimum Standard: 47 CFR 74.861(e)(5)

200 kHz

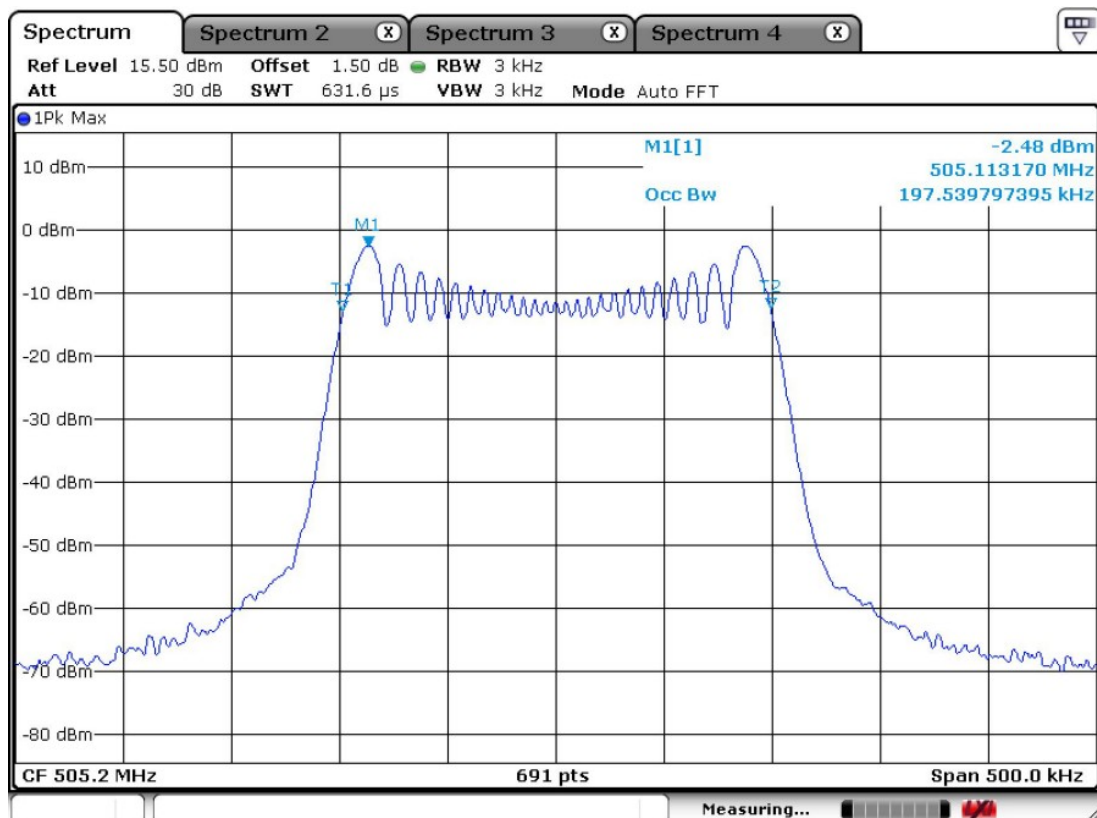
Emission Designator

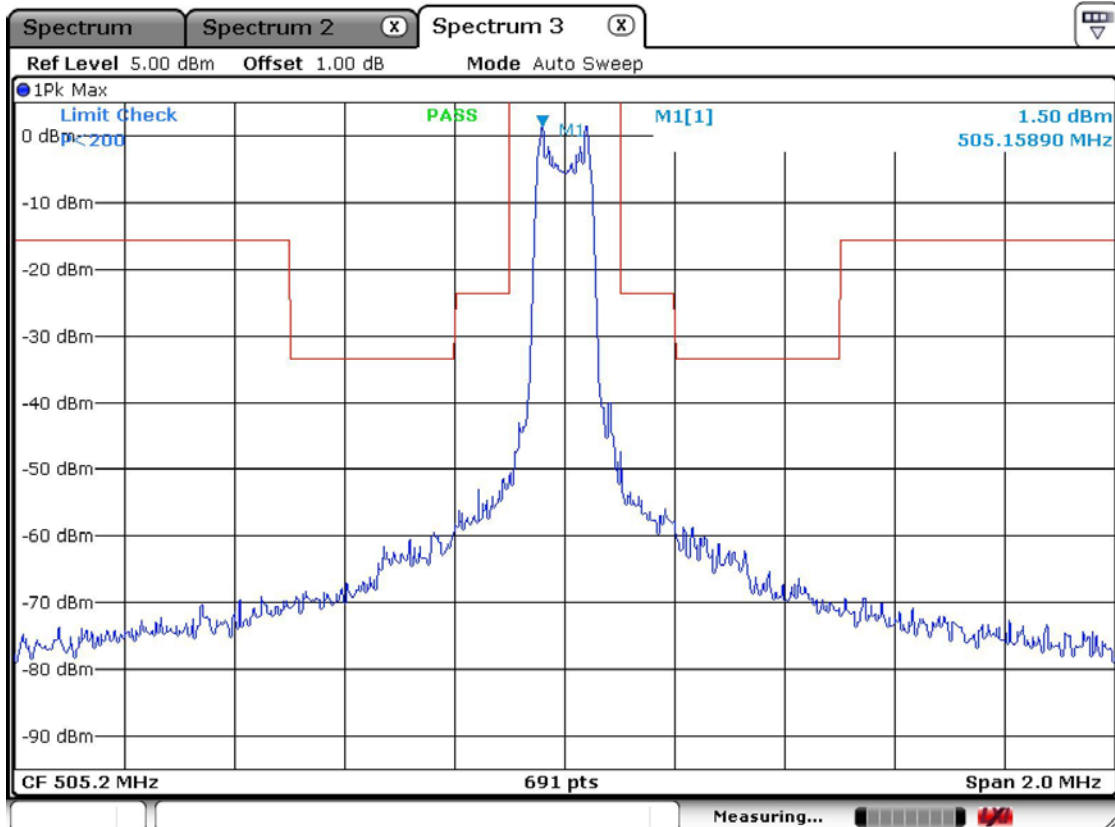
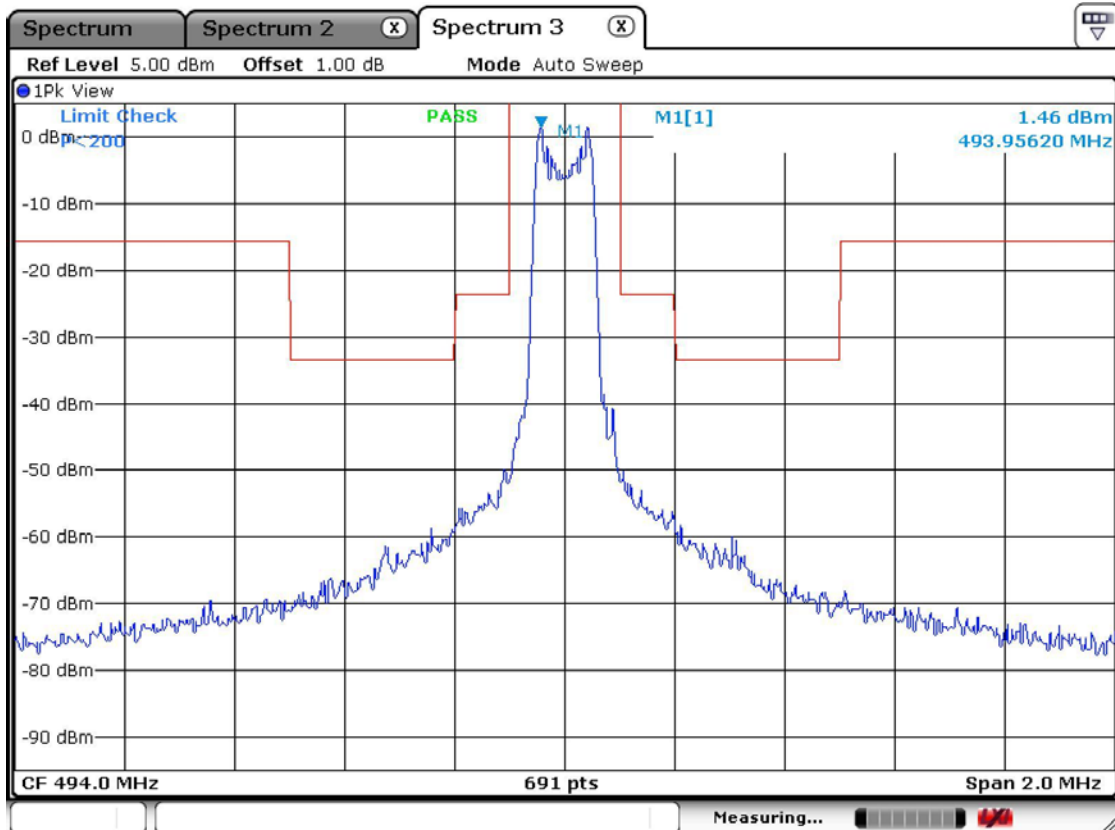
2M + 2D = (2*15kHz) + (2*71.2kHz) = 172K4F3E

▪ RF Frequency : 494.0MHz



▪ RF Frequency : 505.2MHz





3.2.4 Field Strength of Harmonics - Receivers

Definition:

The field strength of emissions from intentional radiators was measured. In case of the air temperature of the test site is out of the range is 10 to 40°C before the testing proceeds the warm-up time of EUT maintain adequately

Test method	FCC Part 15.209
Frequency Range	30 MHz ~ 10 th harmonic.
Bandwidth	120 kHz (F < 1GHz) 1 MHz (F > 1GHz)
Distance of antenna	3 meters
Test mode	Rx mode
Result	Not Applicable

Measurement Data:

- The EUT operates only Transmitter

Field Strength Limit

Part 15.209 LIMIT:

Frequency (MHz)	Limit (uV/m) @ 3m
30 ~ 88	100**
88 ~ 216	150**
216 ~ 960	200**
Above 960	500

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

3.2.5 FREQUENCY STABILITY

Definition:

+/-50 ppm

(e) For low power auxiliary stations operating in the 600 MHz duplex gap and the bands allocated for TV broadcasting, the following technical requirements apply:

(4) The frequency tolerance of the transmitter shall be 0.005 percent.

Test Requirements: FCC Part 74.861 e) 4)

Test method: FCC Part 74.861 e) 4)

Measurement Procedure:

Frequency stability versus Environmental Temperature

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed through attenuators. The EUT was placed inside the temperature chamber. After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.

Frequency Stability versus Input Voltage

At room temperature ($25 \pm 5^{\circ}\text{C}$), an external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for 115%, 100% and 85% of the nominal operating input voltage. For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

Measurement Data:

- See the next page.

Minimum Standard: 47 CFR 74.861(e)(4)

± 0.005 %

Frequency Stability Measurement Data:

OPERATING FREQUENCY : 494,000,000 HzREFERENCE VOLTAGE : 3.0 VDCDEVIATION LIMIT : ☐ 0.005 %

VOLTAGE (%)	POWER (VDC)	TEMP (dB)	FREQ (Hz)	Deviation (%)
100%	3.0	-30	493,997,031	0.00060
		-20	493,997,203	0.00057
		-10	493,997,512	0.00050
		0	493,997,836	0.00044
		+10	493,998,378	0.00033
		+20	494,001,049	-0.00021
		+30	494,002,344	-0.00047
		+40	494,002,028	-0.00041
		+50	494,005,702	-0.00115
85%	2.55	+20	494,000,276	-0.00006
115%	3.45	+20	494,000,727	-0.00015

Frequency Stability Measurement Data:

OPERATING FREQUENCY : 505,200,000 HzREFERENCE VOLTAGE : 3.0 VDCDEVIATION LIMIT : ☐ ☐ 0.005 %

VOLTAGE (%)	POWER (VDC)	TEMP (dB)	FREQ (Hz)	Deviation (%)
100%	3.0	-30	505,197,009	0.00059
		-20	505,197,322	0.00053
		-10	505,197,471	0.00050
		0	505,198,136	0.00037
		+10	505,198,731	0.00025
		+20	505,201,177	-0.00023
		+30	505,203,482	-0.00069
		+40	505,205,091	-0.00101
		+50	505,205,992	-0.00119
85%	2.55	+20	505,200,764	-0.00015
115%	3.45	+20	505,200,902	-0.00018

3.2.6 AC Conducted Emissions

Procedure:

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m).

Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation.

The highest emissions relative to the limit are listed.

Measurement Data: **Not Applicable**

- The EUT operates by DC

Minimum Standard: FCC Part 15.207(a)/EN 55022

Frequency Range (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

* Note: The limits will decrease with the frequency logarithmically within 0.15MHz to 0.5MHz

APPENDIX

TEST EQUIPMENT USED FOR TESTS

	Use	Description	Model No.	Serial No.	Manufacturer	Interval	Nest Cal. Date
1	■	Signal Analyzer (9 kHz ~ 30 GHz)	FSV30	100757	R&S	1 year	2019-09-07
2		Signal Generator (~3.2 GHz)	8648C	3623A02597	HP	1 year	2020-03-20
3		SYNTHESIZED CW GENERATOR	83711B	US34490456	HP	1 year	2020-03-20
4		Attenuator (3 dB)	8491A	37822	HP	1 year	2019-09-07
5		Attenuator (10 dB)	8491A	63196	HP	1 year	2019-09-07
6	■	EMI Test Receiver (~7 GHz)	ESCI7	100722	R&S	1 year	2019-09-07
7		RF Amplifier (~1.3 GHz)	8447D OPT 010	2944A07684	HP	1 year	2019-09-07
8		RF Amplifier (1~26.5 GHz)	8449B	3008A02126	HP	1 year	2019-03-21
9		Horn Antenna (1~18 GHz)	3115	00114105	ETS	2 year	2020-08-04
10		DRG Horn (Small)	3116B	81109	ETS-Lindgren	2 year	2020-03-18
11		DRG Horn (Small)	3116B	133350	ETS-Lindgren	2 year	2020-03-18
12	■	TRILOG Antenna	VULB 9160	9160-3237	SCHWARZBECK	2 year	2021-03-20
13		Temp.Humidity Data Logger	SK-L200TH II A	00801	SATO	1 year	2020-03-20
14		Splitter (SMA)	ZFSC-2-2500	SF617800326	Mini-Circuits	-	-
15	■	DC Power Supply	6674A	3637A01657	Agilent	-	-
17	■	Power Meter	EPM-441A	GB32481702	HP	1 year	2020-03-20
18	■	Power Sensor	8481A	3318A94972	HP	1 year	2019-09-07
19	■	Audio Analyzer	8903B	3729A18901	HP	1 year	2019-09-07
20	■	Modulation Analyzer	8901B	3749A05878	HP	1 year	2019-09-07
21		TEMP & HUMIDITY Chamber	YJ-500	LTAS06041	JinYoung Tech	1 year	2019-09-07
22		Stop Watch	HS-3	812Q08R	CASIO	2 year	2020-03-18
23		LISN	KNW-407	8-1430-1	Kyoritsu	1 year	2019-09-07
24		Two-Lime V-Network	ESH3-Z5	893045/017	R&S	1 year	2020-03-18
25		UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	106243	R&S	1 year	2020-03-18
26		Highpass Filter	WHKX1.5/15G-10SS	74	Wainwright Instruments	1 year	2020-03-18
27		Highpass Filter	WHKX3.0/18G-10SS	118	Wainwright Instruments	1 year	2020-03-18
28		OSP120 BASE UNIT	OSP120	101230	R&S	1 year	2020-03-18
29		Signal Generator(100 kHz ~ 40 GHz)	SMB100A03	177621	R&S	1 year	2020-03-18
30	■	Signal Analyzer (10 Hz ~ 40 GHz)	FSV40	101367	R&S	1 year	2020-03-18
31	■	Active Loop Antenna	FMZB 1519	1519-031	SCHWARZBECK	2 year	2021-02-26