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Dates of Tests: July 10 ~ 30, 2013

Test Report S/N: LR500111307M

Test Site : LTA CO., LTD.

CERTIFICATION OF COMPLIANCE

FCC ID

TO8-TKR-371MP

APPLICANT

TJ Media Co., Ltd.

Equipment Class : Part 74 Licensed Non-Broadcast Transmitter Held to Face (TNF)
Manufacturing Description : Wireless Microphone
Manufacturer : TJ Media CO., Ltd.
Model name : TKR-371MP
Variant Model name : TKR-361MP, TWM-301P
Test Device Serial No.: : Identical prototype
FCC Rule Part(s) : FCC Part 74 Subpart H; ANSI C-63.4-2003
Frequency : 494.0 ~ 505.2 MHz
RF Output Power : Max 0.00627W - Radiated
Data of issue : July 30, 2013

This test report is issued under the authority of:

The test was supervised by:

Jae-Ho Lee, Manager

Jong-Myoung Shin, 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. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.



NVLAP LAB Code.: 200723-0

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1. General information's

1-1 Test Performed

Company name : LTA Co., Ltd.
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Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the “General requirements for the competents 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	2013-09-30	ECT accredited Lab.
RRA	KOREA	KR0049	2015-03-06	EMC accredited Lab.
FCC	U.S.A	610755	2014-04-27	FCC filing
FCC	U.S.A	649054	UPDATING	FCC CAB
VCCI	JAPAN	R2133(10 m), C2307	2014-06-21	VCCI registration
VCCI	JAPAN	T-2009	2013-12-23	VCCI registration
VCCI	JAPAN	G-563	2015-05-28	VCCI registration
IC	CANADA	5799A-1	2015-06-21	IC filing

2. Information's about test item

2-1 Client & Manufacturer

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

2-2 Equipment Under Test (EUT)

Trade name : Wireless Microphone
 Model name : TKR-371MP
 Variant Model name : TKR-361MP, TWM-301P
 Serial number : Identical prototype
 Date of receipt : July 04, 2013
 EUT condition : Pre-production, not damaged
 Antenna type : PCB Pattern Antenna
 Frequency : 494.0 ~ 505.2 MHz
 RF output power : Max. 0.00627W - Radiated
 Power source : DC 3.0V by Battery(AA * 2EA)

	Low	Mid	High
Frequency (MHz)	494.0	-	505.2

2-3 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	2.55
T hot	+50	V max	3.45

3. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
2.1046 / 74.861(e)(1)(ii)	RF Output Power	250mW	Radiated	C
2.1047 / 74.861(e)(3)	Modulation Characteristics. – Frequency response	-	Conducted	C
2.1047	Modulation Characteristics. – Modulation Limiting	+/- 75kHz		C
2.1049 / 74.861(e)(5)	Occupied Bandwidth	200kHz		C
74.861	Unwanted radiation (spectrum mask)	-		C
2.1055 / 74.861(e)(4)	Frequency Stability	0.005%		C
2.1051 / 74.861(e)(6)(iii)	Field Strength of Spurious Radiation	-13dBm	Radiated	C
2.1051 / 74.861(e)(6)(iii)	Receiver spurious emissions	-		NA ⁴
15.207 / 15.107	AC Conducted Emissions	EN 55022	Line Conducted	NA ³

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

Note 1 : The sample was tested according to the following specification:

FCC Parts 2, Subpart J and Part 74, Subpart H; ANSI C-63.4-2003

3.2 Transmitter requirements

3.2.1 Carrier Output Power (Conducted)

Definition:

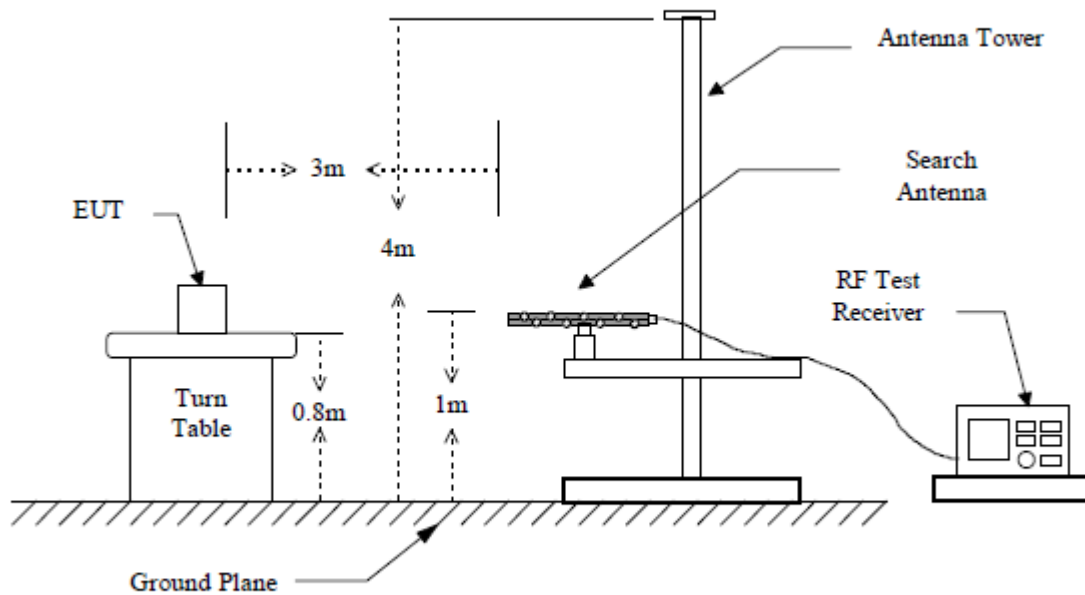
- The carrier power output for a transmitter for this service is the power available at the output terminals of the transmitter when the output terminals are connected to the standard transmitter load.

Test Requirements	: 47 CFR Part 2, Subpart J
Test method	: 47 CFR 2.1046

Measurement Procedure:

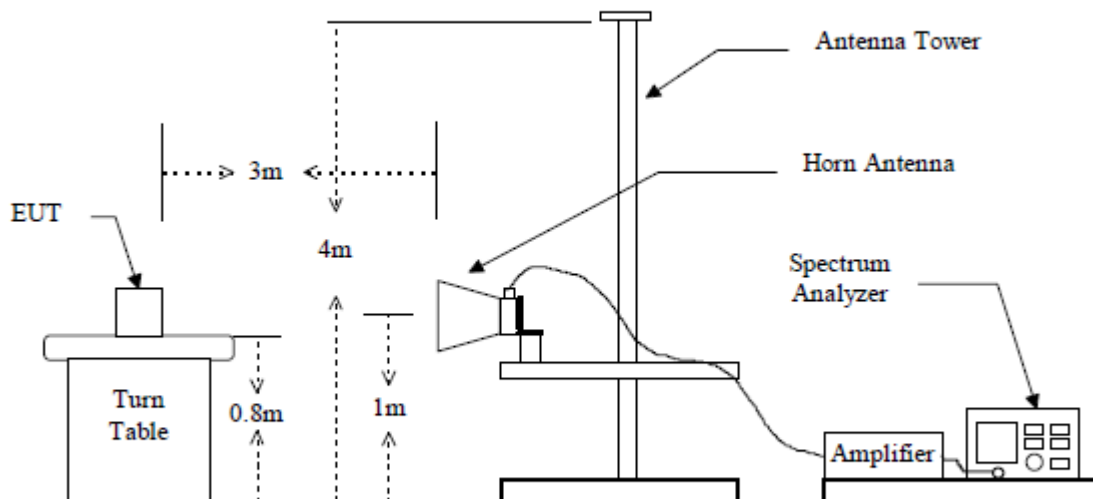
1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 1GHz respectively, adjusting the input voltage to produce the maximum power.
2. Adjust the analyzer for each frequency measured in chapter 6 on a 1 MHz frequency span and 1MHz resolution bandwidth.
3. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360°, and record the highest value indicated on spectrum analyzer as reference value.
4. Repeat step 3 until all frequencies need to be measured were complete.
5. Repeat step 4 with search antenna in vertical polarized orientations.
6. Replace the EUT with a tuned dipole antenna (horn antenna for above 1 GHz) relative to each frequency in horizontally polarized orientation and as the same polarized orientation with search antenna. Connect the tuned dipole antenna to a standard signal generator (SG) via a low loss cable. Power on the SG and tune the right frequency in measuring as well as set SG at a appreciated output level. Rise and lower the search antenna to get the highest value on spectrum analyzer, and then hold this position. Adjust the SG output to get a identical value derived from step 3 on spectrum analyzer. Record this value for result calculated.
7. Repeat step 6 until all frequencies need to be measured were complete.
8. Repeat step 7 with both dipole antenna (horn antenna for above 1 GHz) and search antenna in vertical polarized orientations.

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		
	dBm	mW	Result
494.0	7.64	5.81	Complies
505.2	7.97	6.27	Complies

Note: Result Calculation

Result calculation is as following

Result = SG Reading + Cable Loss + Antenna Gain Corrected

Antenna Gain Corrected : is used for antenna other than dipole than dipole to convert radiated power to ERP

$$\text{mW} = \log^{-1}[\text{Result(dBm)}/10]$$

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

250mW (24dBm)

3.2.2 Modulation Characteristics

3.2.2.1 Audio Frequency Response

Definition:

- The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic.

Test Requirements : 47 CFR Part 2, Subpart J

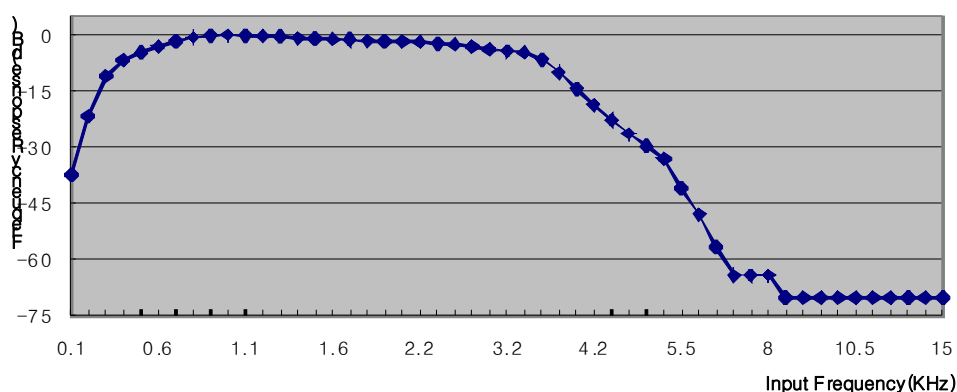
Test method : 47 CFR 2.1047

Measurement Procedure:

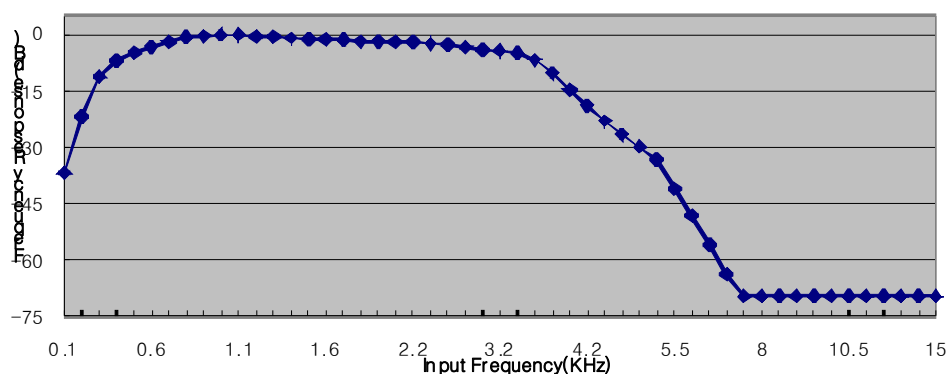
- The audio signal input was adjusted to obtain 20% modulation at 1kHz, and this point was taken as the 0dB reference level.
- With input levels held constant and below limiting at all frequencies, the audio signal generator was varied from 100 Hz to 15 kHz.
- The response in dB relative to 1 kHz was then measured, using the HP 8901A Modulation Analyzer.

Measurement Data:

- RF Frequency : 494.0MHz, REFERENCE LEVEL : 0dB @ 1kHz



- RF Frequency : 505.2MHz, REFERENCE LEVEL : 0dB @ 1kHz



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.

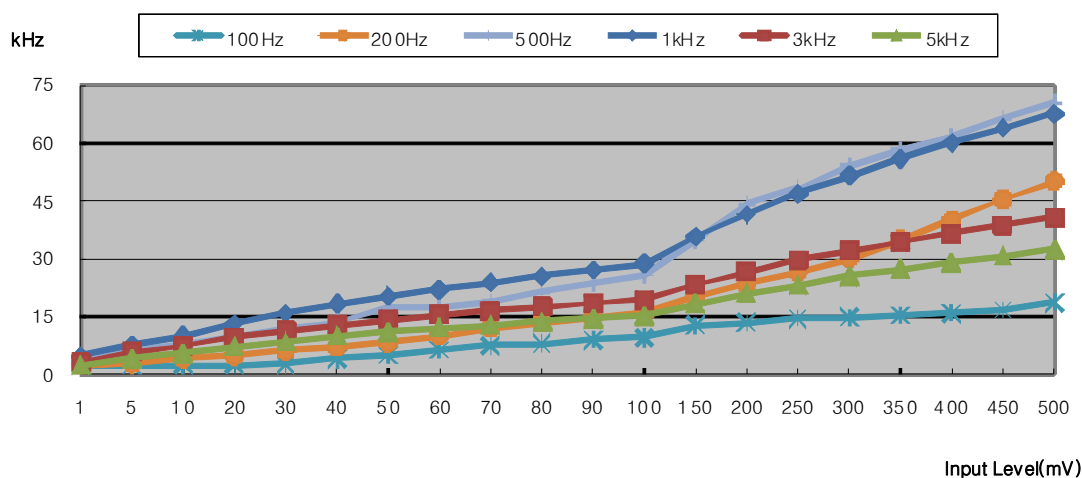
Test Requirements	: 47 CFR Part 2, Subpart J
Test method	: 47 CFR 2.1047
Limits	: none stated

Measurement Procedure:

- According to § 2.1047 (a), for Voice Modulated Communication Equipment, the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be measured.
- Adjust the audio input frequency to 100 Hz and the input level from 0V to maximum permitted input voltage with recording each carrier frequency deviation responding to respective input level
- Repeat step 1 with changing the input frequency for 200, 500, 1000, 3000, and 5000 Hz in sequence.

Measurement Data:

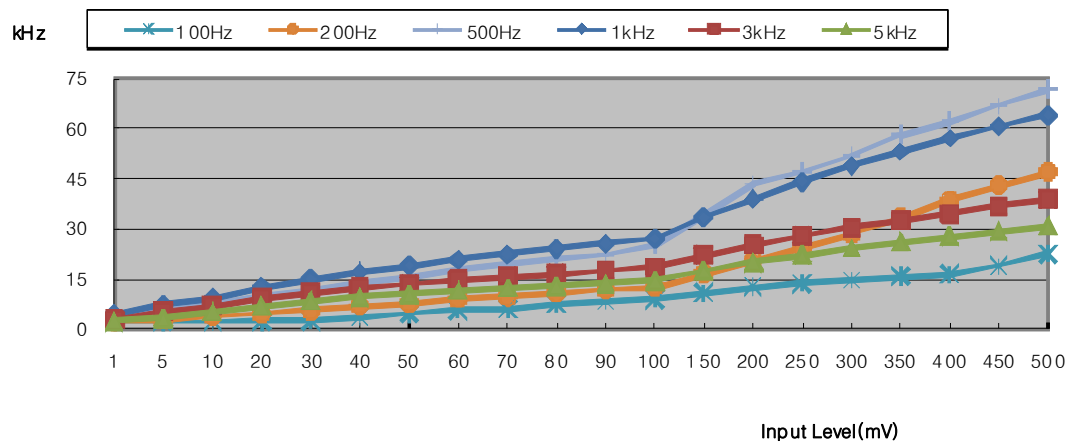
▪ RF Frequency : 494.0MHz



Minimum Standard: 47 CFR 74.861(e)(3)

Any form of modulation may be used. A maximum deviation of +/- 75kHz is permitted when FM is employed.

▪ RF Frequency : 505.2MHz



Minimum Standard: 47 CFR 74.861(e)(3)

Any form of modulation may be used. A maximum deviation of +/- 75kHz is permitted when FM is employed.

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 : 47 CFR Part 2, Subpart J

Test method : 47 CFR 2.1049

Measurement Procedure:

- The EUT and test equipment were set up as shown on the following page, with the Spectrum Analyzer connected.
- For EUTs supporting audio modulation, when modulated by a 2.5kHz tone at an input level 16dB greater than that necessary 50 percent modulation.
- For EUTs supporting digital modulation, the digital modulation mode was operated to its maximum extent.
- The Occupied Bandwidth was measured with the Spectrum Analyzer controls set as shown on the test results.

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.

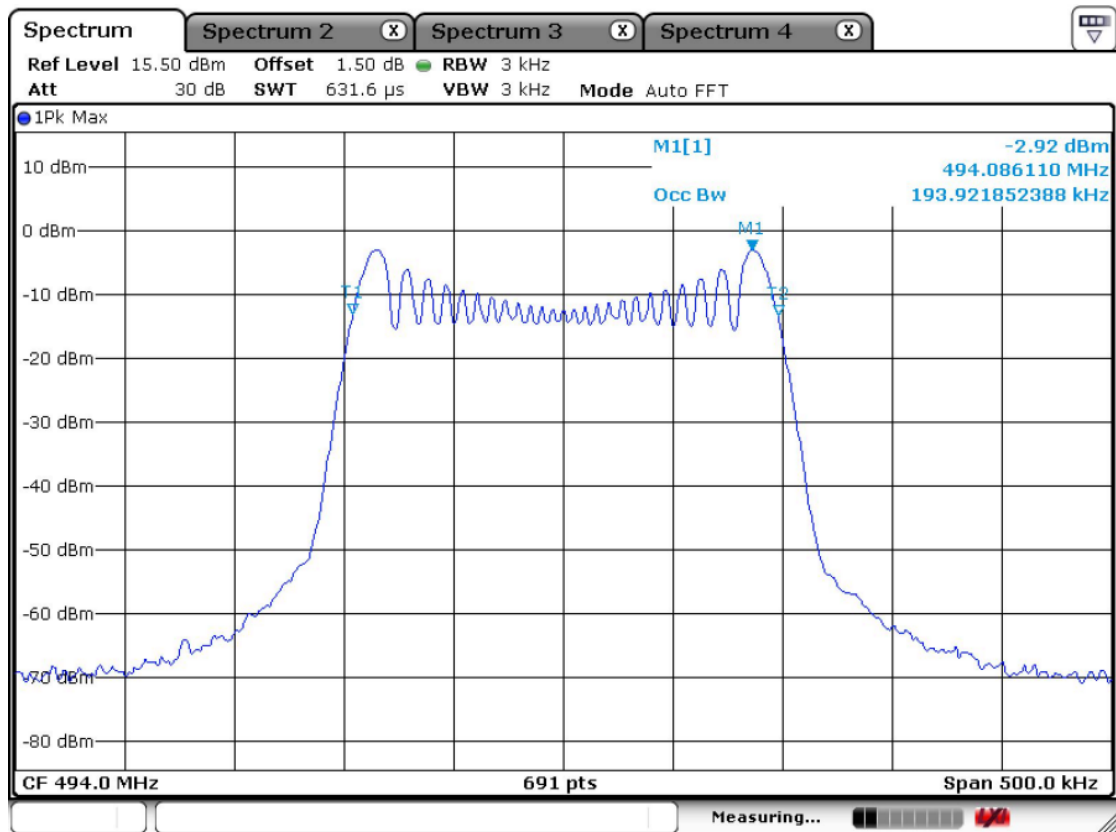
Minimum Standard: 47 CFR 74.861(e)(5)

200 kHz

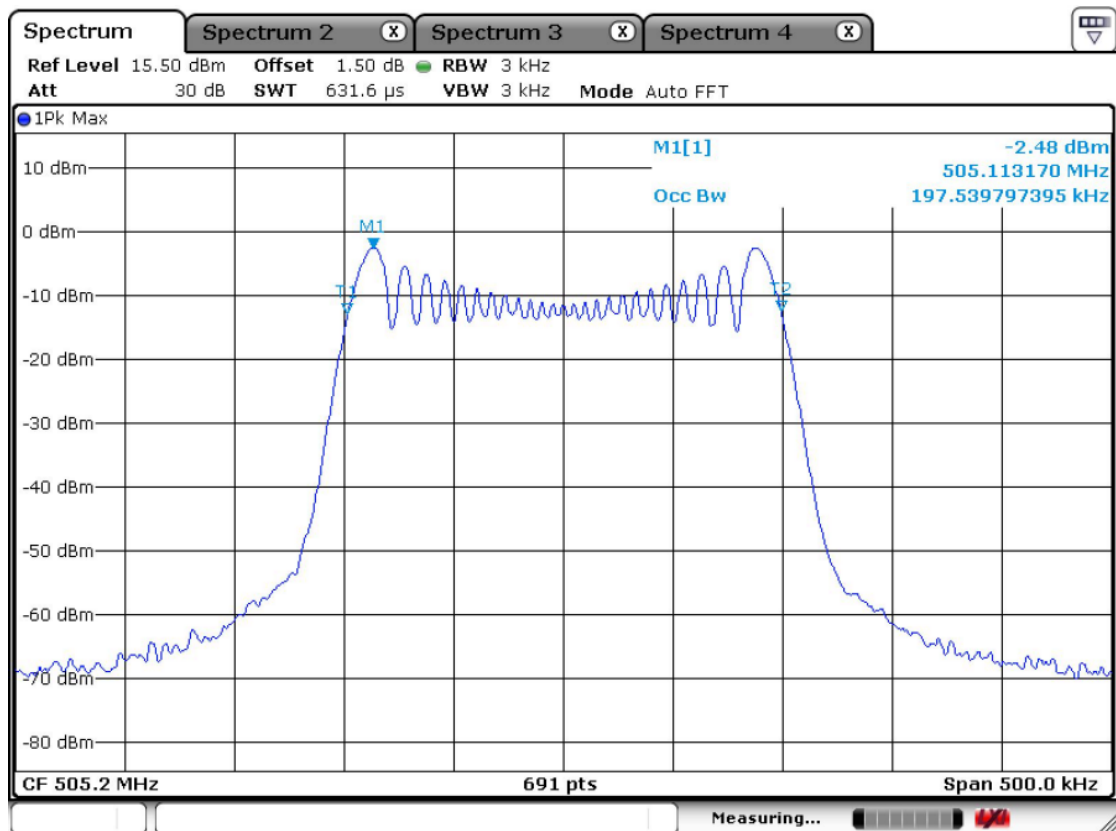
Emission Designator

$2M + 2D = (2 \times 15\text{kHz}) + (2 \times 71.2\text{kHz}) = 172K4F3E$

▪ RF Frequency : 494.0MHz



▪ RF Frequency : 505.2MHz



3.2.5 Field Strength of Harmonics

Procedure:

The EUT was placed on a 0.8m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in OATS. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

Test Requirements : 47 CFR Part 2, Subpart J

Test method : 47 CFR 2.1053

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 9 kHz ~ 10th harmonic.

RBW = 100 kHz (30MHz ~ 1 GHz)

VBW ≥ RBW

= 1 MHz (1 GHz ~ 10th harmonic)

Span = 100 MHz

Detector function = peak

Trace = max hold

Sweep = auto

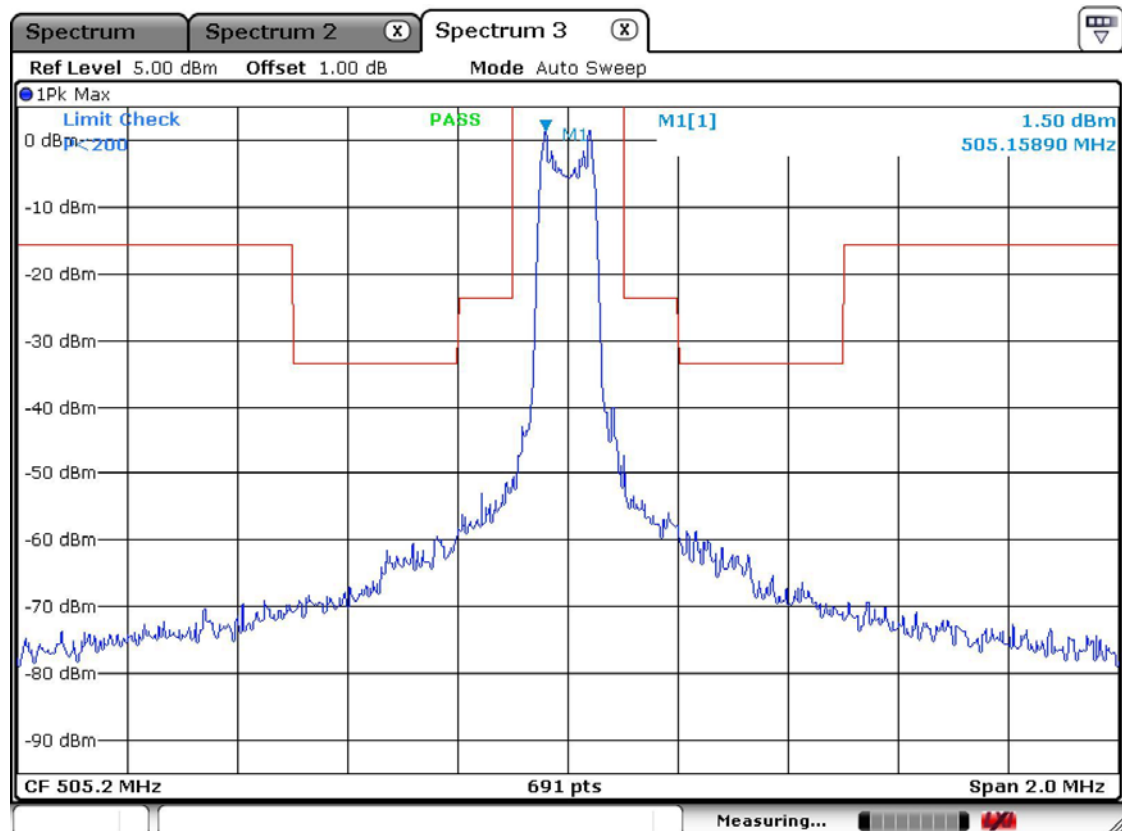
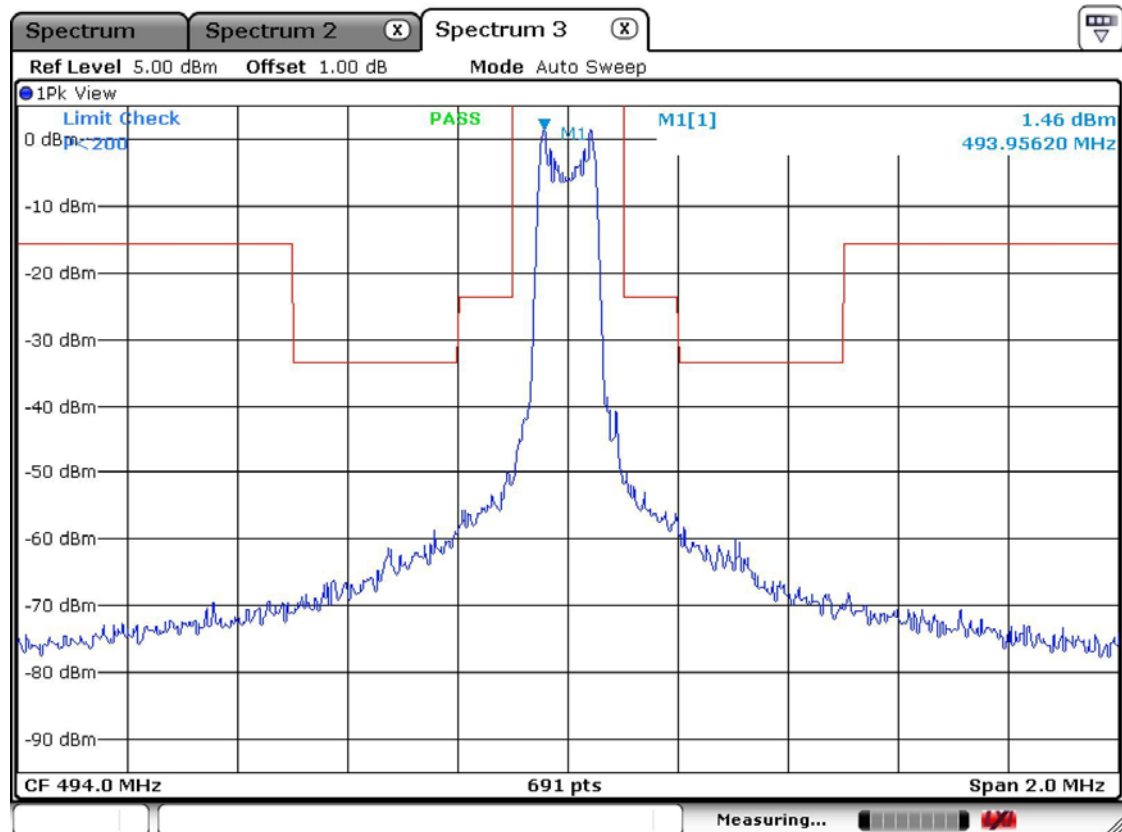
- (i) on any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB.
- (ii) on any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB.
- (iii) on any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth shall be attenuated below the unmodulated carrier by at least 43 plus 10 Log(output power in watts) dB.

Measurement Data: Complies

Channel 1		-		Channel 2	
Frequency (MHz)	Level (dBuV)	Frequency (MHz)	Level (dBuV)	Frequency (MHz)	Level (dBuV)
-	-	-	-	-	-
No emissions were detected at a level greater than 20dB below limit.					
-	-	-	-	-	-
Measurement uncertainty		± 6 dB			

Minimum Standard: 47 CFR 74.861(e)(6)(iii)

= 43 + 10 log₁₀ (P) dBc (or -13 dBm)





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EUT/Model No.: TKR-371MP

TEST MODE: TX mode

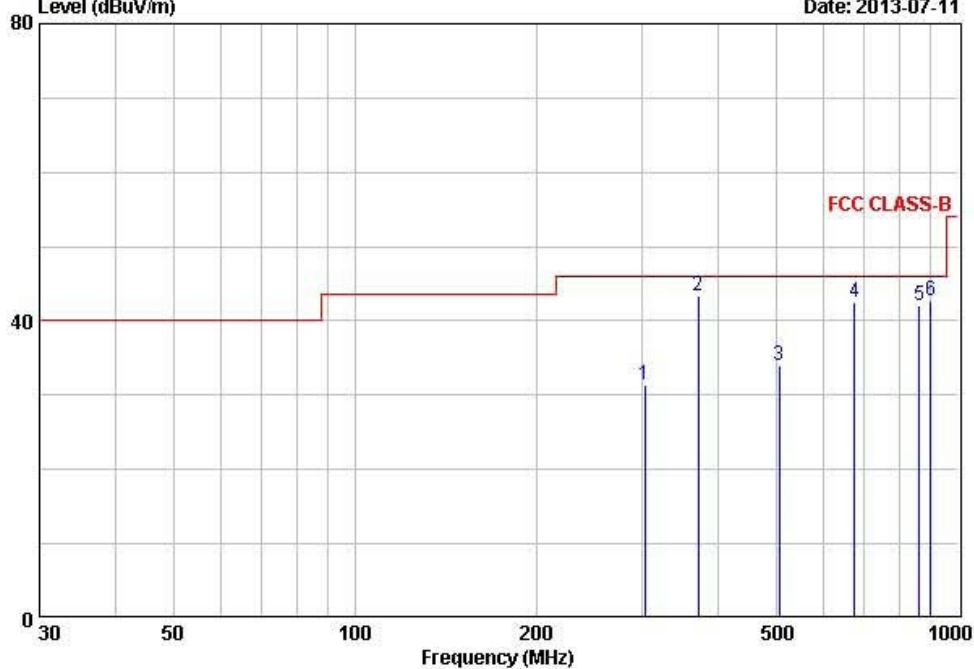
Temp Humi : 26 / 58

Tested by: PARK H W

Data: 44

Level (dBuV/m)

Date: 2013-07-11



	Freq	Reading	C.F	Result	Limit	Margin	Height	Angle	Polarity
	MHz	dBuV/m	dB/m	dBuV/m	QP	dB	cm	deg	
1	302.43	40.40	-9.00	31.40	46.00	14.60	198	228	HORIZONTAL
2	371.24	49.70	-6.28	43.42	46.00	2.58	100	349	HORIZONTAL
3	505.77	35.70	-1.73	33.97	46.00	12.03	100	360	HORIZONTAL
4	675.05	39.70	2.76	42.46	46.00	3.54	100	360	HORIZONTAL
5	864.06	34.30	7.67	41.97	46.00	4.03	100	321	VERTICAL
6	902.31	34.30	8.36	42.66	46.00	3.34	236	8	VERTICAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

3.2.6 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.

3.2.7 Frequency Stability

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 : 47 CFR Part 2, Subpart J

Test method : 47 CFR 2.1055

Measurement Procedure:

The frequency stability of the transmitter is measured by:

- Temperature: The temperature is varied from -30°C to +50°C using an environmental chamber.
- Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Specification- The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.005\%$ of the center frequency.

Time Period and Procedure:

1. The carrier frequency of the transmitter and the individual oscillators is measured at room temperature (25°C to 27°C to provide a reference).
2. The equipment is subjected to an overnight “soak” at -10°C without power applied.
3. After the overnight “soak” at 30°C (usually 14-16 hours), the equipment is turned on in a “standby” condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter and the individual oscillators is made within a three minute interval after applying power to the transmitter.
4. Frequency measurements are made at 10°C interval up to room temperature. At least a period of one and one half-hour is provided to allow stabilization of the equipment at each temperature level.
5. Again the transmitter carrier frequency and the individual oscillators is measured at room temperature to begin measurement of the upper temperature levels.
6. Frequency measurements are at 10 intervals starting at -30°C up to +50°C allowing at least two hours at each temperature for stabilization. In all measurements the frequency is measured within three minutes after re-applying power to the transmitter.
7. The artificial load is mounted external to the temperature chamber.

Measurement Data:

- See the next page.

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

$\pm 0.005 \%$

Frequency Stability Measurement Data:

OPERATING FREQUENCY : 494,000,000 Hz

REFERENCE VOLTAGE: 3.0 VDC

DEVIATION 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 Hz

REFERENCE VOLTAGE: 3.0 VDC

DEVIATION 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

3.2.8 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 1

TEST EQUIPMENT USED FOR TESTS

	Description	Model No.	Serial No.	Manufacturer	Interval	Last Cal. Date
1	Spectrum Analyzer (~30GHz)	FSV-30	100757	R&S	1 year	2013-01-15
2	Spectrum Analyzer (~2.9GHz)	8594E	3649A03649	HP	2 year	2012-03-26
3	VECTOR SIGNAL GENERATOR (~6GHz)	8648C	3623A02597	HP	1 year	2013-03-25
4	Signal Generator (1~20GHz)	83711B	US34490456	HP	1 year	2013-03-25
5	Attenuator (3dB)	8491A	37822	HP	2 year	2012-09-22
6	Attenuator (10dB)	8491A	63196	HP	2 year	2012-09-22
7	Test Receiver (~30MHz)	ESHS10	828404/009	R&S	1 year	2013-03-25
8	EMI Test Receiver (~7GHz)	ESCI7	100722	R&S	1 year	2012-09-22
9	RF Amplifier (~1.3GHz)	8447D OPT 010	2944A07684	HP	2 year	2012-09-22
10	RF Amplifier (1~18GHz)	8449B	3008A02126	HP	1 year	2013-03-25
11	Horn Antenna (1~18GHz)	3115	114105	ETS	2 year	2012-01-26
12	DRG Horn (Small)	3116B	81109	ETS-Lindgren	2 year	2012-03-15
13	DRG Horn (Small)	3116B	133350	ETS-Lindgren	2 year	2012-03-15
14	TRILOG Antenna	VULB 9160	9160-3172	SCHWARZBECK	2 year	2012-09-20
15	Hygro-Thermograph	THB-36	0041557-01	ISUZU	1 year	2012-10-12
16	Splitter (SMA)	ZFSC-2-2500	SF617800326	Mini-Circuits	-	-
17	Power Divider	11636A	06243	HP	2 year	2012-09-22
18	DC Power Supply	6674A	3637A01657	Agilent	-	-
19	Frequency Counter	5342A	2826A12411	HP	1 year	2013-03-25
20	Power Meter	EPM-441A	GB32481702	HP	1 year	2013-03-25
21	Power Sensor	8481A	US41030291	HP	1 year	2012-09-22
22	Audio Analyzer	8903B	3729A18901	HP	1 year	2012-09-22
23	Modulation Analyzer	8901B	3749A05878	HP	1 year	2012-09-22
24	TEMP & HUMIDITY Chamber	YJ-500	LTAS06041	JinYoung Tech	1 year	2012-09-22
25	Stop Watch	HS-3	601Q09R	CASIO	2 year	2012-03-26
26	LISN	ENV216	100408	R&S	1 year	2012-09-22
27	UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	106243	R&S	2 year	2012-06-27
28	Highpass Filter	WHKX1.5/15G-10SS	74	Wainwright Instruments	-	-
29	Highpass Filter	WHKX3.0/18G-10SS	118	Wainwright Instruments	-	-
30	Active Loop Antenna	FMZB 1519	1519-031	SCHWARZBECK	1 year	2012-12-14