

TEST REPORT

Part 74 Subpart H

Equipment under test MIC Karaoke

Model name TKR-373MU

Derivation Model TKR-373MP

FCC ID TO8-TKR-373MP

Applicant TJ Media Co., Ltd.

Manufacturer TJ Media Co., Ltd.

Date of test(s) 2017.06.12 ~ 2017.06.26

Date of issue 2017.07.05

Issued to

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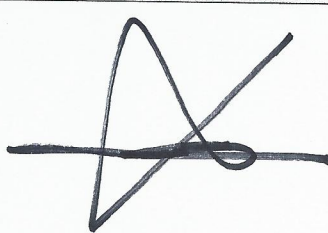
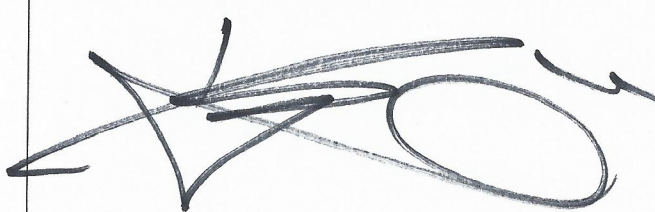
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Test report No.:
KES-RF-17T0064
Page (2) of (33)

Revision history

Revision	Date of issue	Test report No.	Description
-	2017.07.05	KES-RF-17T0064	Initial

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The test results in the report only apply to the tested sample.



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1. General information

Applicant: TJ Media Co., Ltd.
Applicant address: 640-8, Deungchon-Dong, Gangseo-Gu, Seoul, South Korea
Test site: KES Co., Ltd.
Test site address: C-3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, Korea
473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
FCC rule part(s): Part 74
FCC ID: TO8-TKR-373MP
Test device serial No.: ☐ Production ☒ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test MIC Karaoke
Frequency range 494.0 MHz ~ 505.2 MHz
Model TKR-373MU
Derivation Model TKR-373MP
Modulation technique FM
Number of channels 16 ch
Antenna specification UHF Antenna type: Helical, Peak gain: -0.52 dBi
Power source DC 3.0 V

1.2. Test configuration

The **TJ Media Co., Ltd. MIC Karaoke FCC ID: TO8-TKR-373MP** was tested according to the specification of EUT, the EUT must comply with following standards.

FCC Part 74.861
FCC Part 2
TIA-603-E (2016)
ANSI C63.4-2014

1.3. Device modifications

N/A

1.4. Frequency/channel operations

Ch.	Frequency (MHz)	Mode
01	494.0	FM
⋮	⋮	⋮
08	499.4	FM
⋮	⋮	⋮
16	505.2	FM

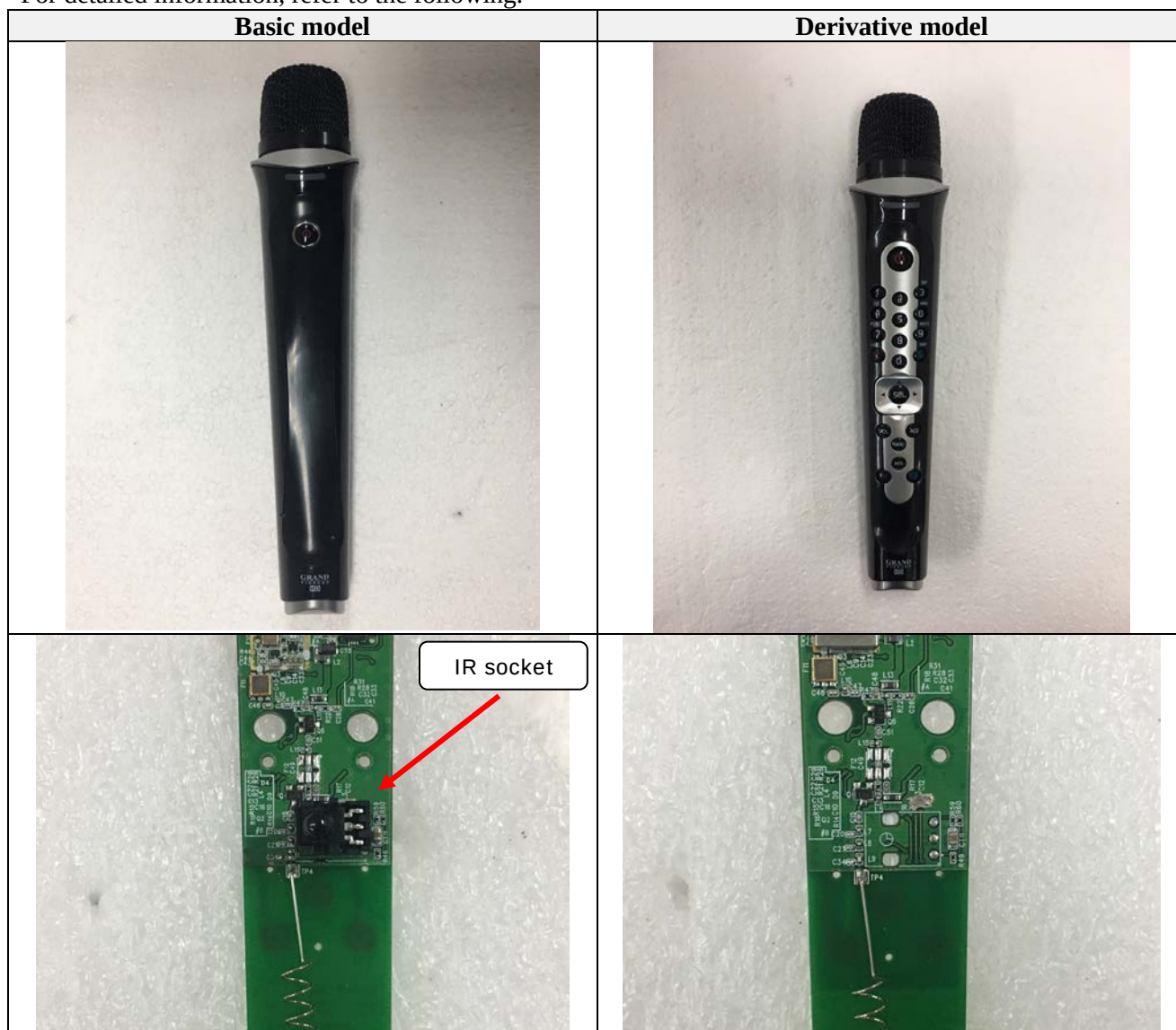
1.5. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Remote controller	Sinsunglim electronics Co., Ltd.	TR-20P	-	Battery (1.5V *2)

1.6. Information about derivative model

Derivative model use the same software of basic model. In case of derivative model, the IR socket is removed in basic model and added button key.

For detailed information, refer to the following:





2. Summary of tests

Reference	Parameter	Test results
74.861(e)(1) 2.1046	RF output power	Pass
74.861(e)(3) 2.1047	Modulation characteristics	Pass
74.861(e)(5)(6) 2.1049	Occupied bandwidth and emission mask	Pass
74.861(e)(4) 2.1055	Frequency stability	Pass
74.861(e)(6) 2.1053	Field strength of spurious radiation	Pass
74.861(e)(6) 2.1051	Spurious emissions at antenna terminals	Pass

3. Test results

3.1. RF output power

Test procedure

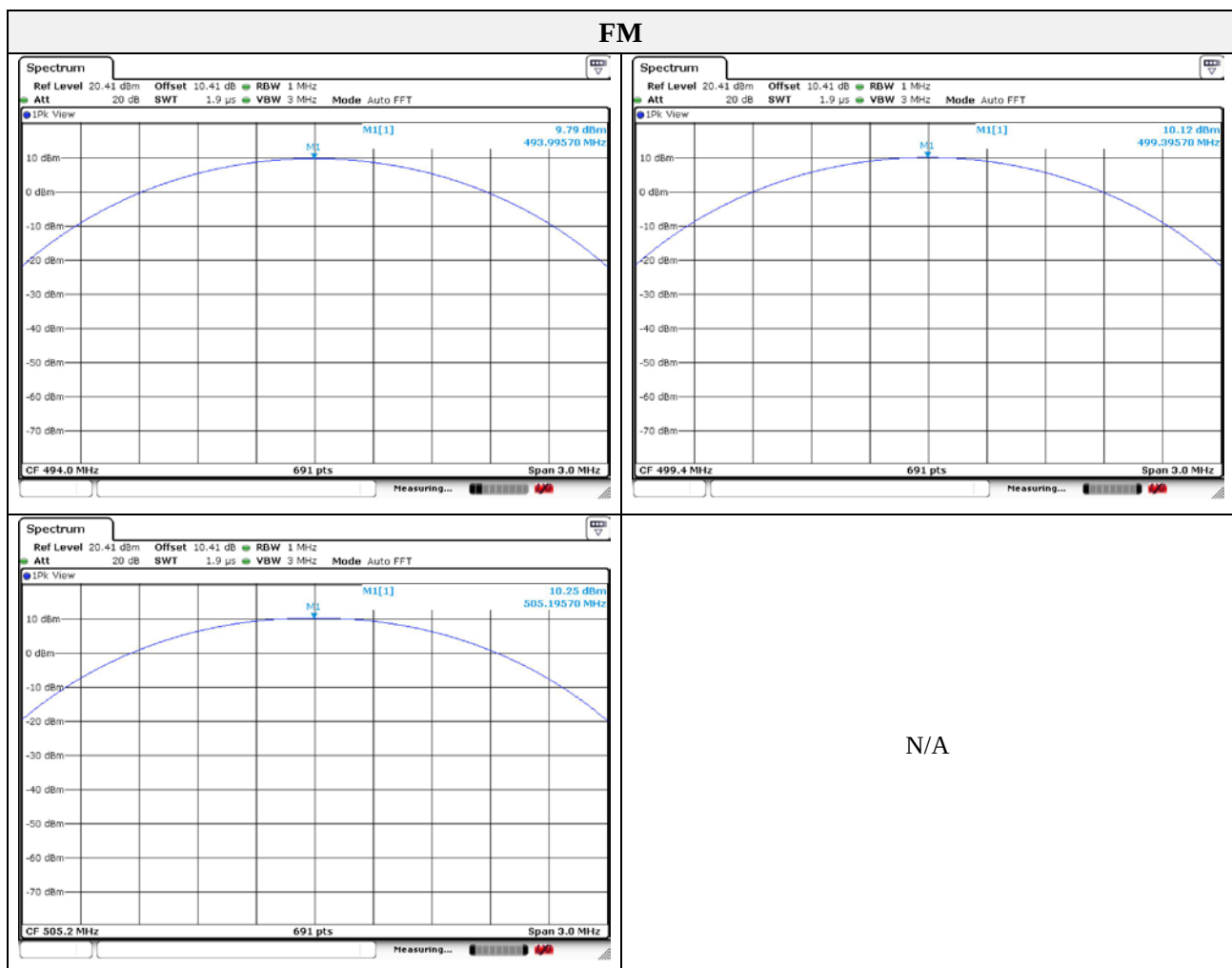
TIA-603-E – Section 2.2.1

Limit

According to §74.861(e)(1)(ii), the operating frequency at 470 ~ 608 MHz, 614 ~ 698 MHz shall not exceed 250 mW conducted power.

Test results

Frequency(MHz)	Peak output power(dBm)	Limit(dBm)
494.0	9.79	23.98
499.4	10.12	
505.2	10.25	



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3.2. Modulation characteristics

Test procedure

TIA-603-E – Section 2.2.3, 2.2.6, FCC Part 2.1047(a) & (b)

(a) Audio frequency response

Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

Section 2.2.6

1. Connect the equipment as illustrated.
2. Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤ 50 Hz to ≥ 15000 Hz. Turn the de-emphasis function off.
3. Adjust the transmitter per the manufacturer's procedure for full rated system deviation.
4. Apply a 1000 Hz tone and adjust the audio frequency generator to produce 20% of the rated system deviation.
5. Set the test receiver to measure rms deviation and record the deviation reading as DEV_{REF} .
6. Set the audio frequency generator to the desired test frequency between 300 Hz and 3000 Hz.
7. Record the test receiver deviation reading as DEV_{FREQ} .
8. Calculate the audio frequency response at the present frequency as:

$$\text{audio frequency response} = 20 \log_{10} \left(\frac{DEV_{FREQ}}{DEV_{REF}} \right)$$

9. Repeat steps 6 through 8 for all the desired test frequencies.

(b) Modulation limiting

Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

Section 2.2.3

1. Connect the equipment as illustrated.
2. Adjust the transmitter per the manufacturer's procedure for full rated system deviation.
3. Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤ 0.25 Hz to ≥ 15000 Hz. Turn the de-emphasis function off.
4. 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.
5. Increase the level from the audio frequency generator by 20dB in on step (rise time between the 10% and 90% points shall be 0.1 second maximum).
6. Measure both the instantaneous and steady-state deviation at and after the time of increasing the audio input level.
7. With the level from the audio frequency generator held constant at the level obtained in step 5, slowly vary the audio frequency from 100 Hz to 3000 Hz and observe the steady-state deviation. Record the maximum deviation.
8. Set the test receiver to measure peak negative deviation and repeat steps 4 through 7.
9. The values recorded in steps 7 and 8 are the modulation limiting.



Limit

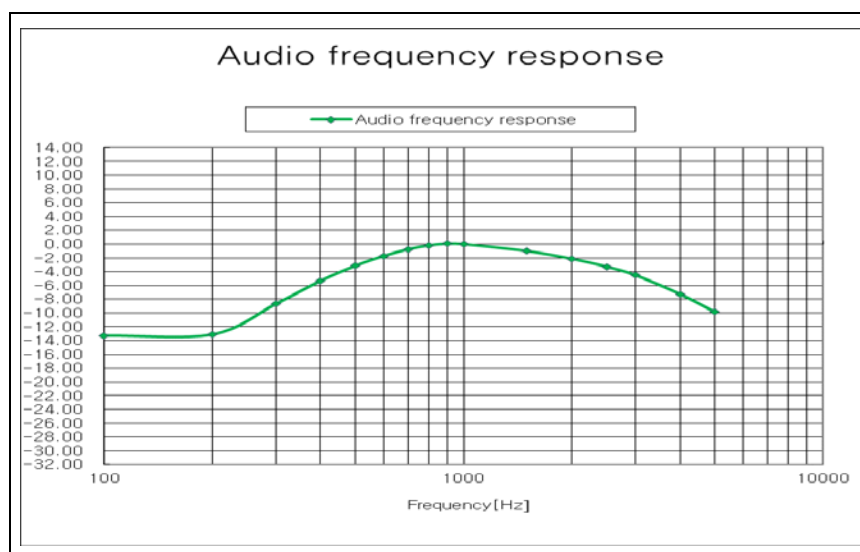
According to §74.861(e)(3), Any form of modulation may be used. A maximum deviation of ± 75 kHz is permitted when frequency modulation is employed.

Test results

(a) Audio frequency response

Frequency: 494.0 MHz
Channel: 01

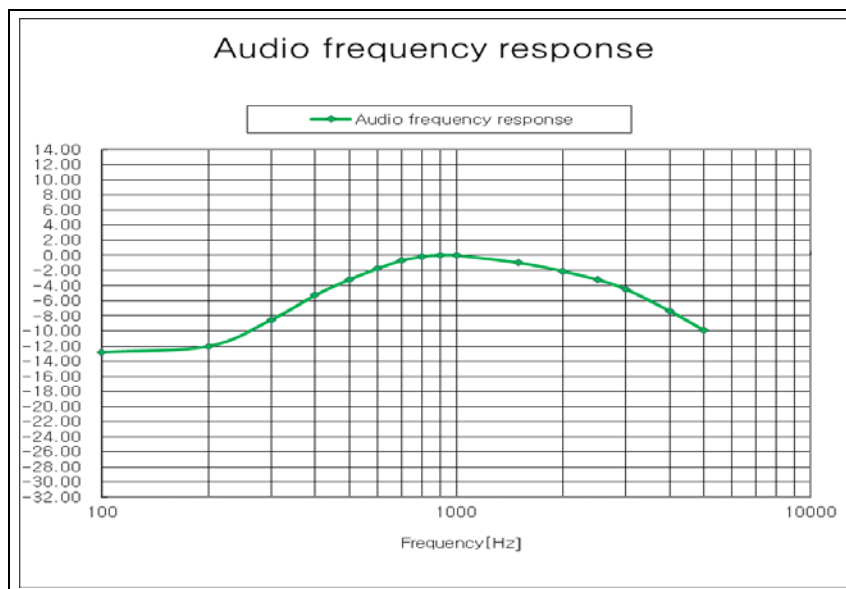
Audio frequency(Hz)	Frequency deviation(kHz)	1kHz Reference deviation(kHz)	Audio frequency response (dB)
100	0.56	2.58	-13.27
200	0.57	2.58	-13.11
300	0.95	2.58	-8.68
400	1.40	2.58	-5.31
500	1.80	2.58	-3.13
600	2.12	2.58	-1.71
700	2.37	2.58	-0.74
800	2.53	2.58	-0.17
900	2.60	2.58	-0.07
1000	2.58	2.58	0.00
1500	2.30	2.58	-1.00
2000	2.02	2.58	-2.13
2500	1.77	2.58	-3.27
3000	1.54	2.58	-4.48
4000	1.12	2.58	-7.25
5000	0.83	2.58	-9.85



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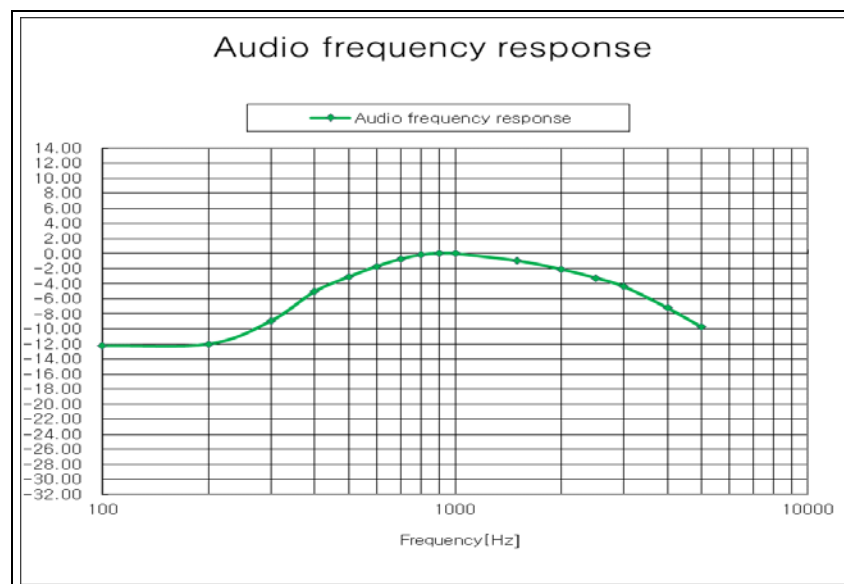
Frequency: 499.4 MHz
Channel: 08

Audio frequency(Hz)	Frequency deviation(kHz)	1kHz Reference deviation(kHz)	Audio frequency response (dB)
100	0.63	2.75	-12.80
200	0.69	2.75	-12.01
300	1.03	2.75	-8.53
400	1.50	2.75	-5.26
500	1.91	2.75	-3.17
600	2.25	2.75	-1.74
700	2.54	2.75	-0.69
800	2.70	2.75	-0.16
900	2.76	2.75	0.03
1000	2.75	2.75	0.00
1500	2.46	2.75	-0.97
2000	2.16	2.75	-2.10
2500	1.90	2.75	-3.21
3000	1.65	2.75	-4.44
4000	1.18	2.75	-7.35
5000	0.88	2.75	-9.90



Frequency: 505.2 MHz
Channel: 16

Audio frequency(Hz)	Frequency deviation(kHz)	1kHz Reference deviation(kHz)	Audio frequency response (dB)
100	0.78	3.19	-12.23
200	0.80	3.19	-12.01
300	1.14	3.19	-8.94
400	1.79	3.19	-5.02
500	2.24	3.19	-3.07
600	2.63	3.19	-1.68
700	2.94	3.19	-0.71
800	3.14	3.19	-0.14
900	3.20	3.19	0.03
1000	3.19	3.19	0.00
1500	2.86	3.19	-0.95
2000	2.51	3.19	-2.08
2500	2.20	3.19	-3.23
3000	1.93	3.19	-4.36
4000	1.39	3.19	-7.22
5000	1.04	3.19	-9.74

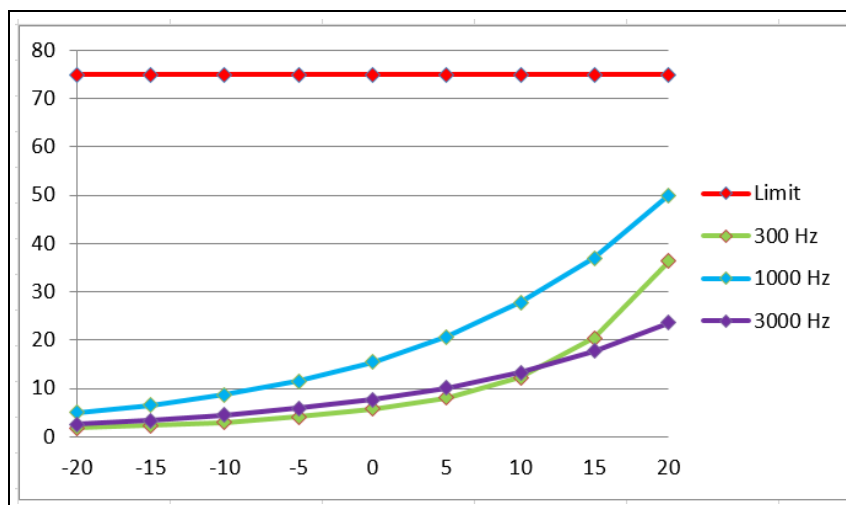


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(b) Modulation limiting

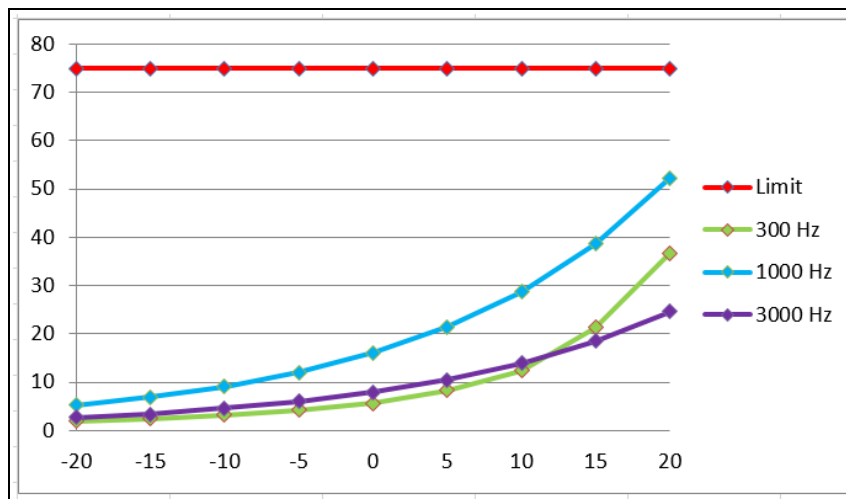
Operating frequency: 494.0 MHz
Channel: 01

Audio level (dB)	Deviation 300 Hz	Deviation 1 kHz	Deviation 3 kHz	Limit (kHz)
-52.6	1.87	5.05	2.56	± 75
-47.6	2.30	6.56	3.30	± 75
-42.6	3.01	8.65	4.43	± 75
-37.6	4.14	11.48	5.83	± 75
-32.6	5.70	15.43	7.62	± 75
-27.6	8.00	20.72	10.11	± 75
-22.6	12.21	27.75	13.30	± 75
-17.6	20.43	37.03	17.74	± 75
-12.6	36.30	50.00	23.56	± 75



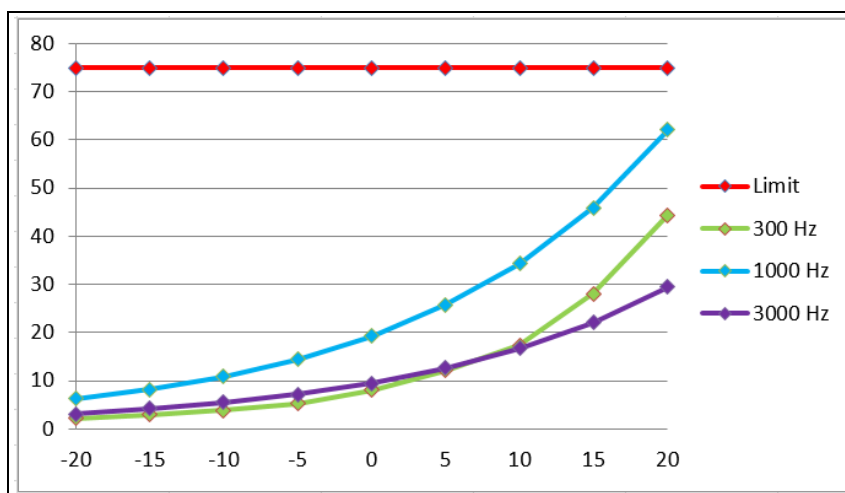
Operating frequency: 499.4 MHz
Channel: 08

Audio level (dB)	Deviation 300 Hz	Deviation 1 kHz	Deviation 3 kHz	Limit (kHz)
-52.6	1.89	5.23	2.66	±75
-47.6	2.51	6.89	3.39	±75
-42.6	3.17	9.07	4.61	±75
-37.6	4.18	12.04	6.05	±75
-32.6	5.64	16.05	7.96	±75
-27.6	8.33	21.41	10.50	±75
-22.6	12.43	28.76	13.93	±75
-17.6	21.33	38.66	18.53	±75
-12.6	36.74	52.33	24.66	±75



Operating frequency: 505.2 MHz
Channel: 16

Audio level (dB)	Deviation 300 Hz	Deviation 1 kHz	Deviation 3 kHz	Limit (kHz)
-52.6	2.25	6.24	3.09	± 75
-47.6	2.98	8.21	4.29	± 75
-42.6	3.84	10.87	5.50	± 75
-37.6	5.20	14.43	7.18	± 75
-32.6	8.07	19.23	9.50	± 75
-27.6	12.19	25.75	12.58	± 75
-22.6	17.41	34.35	16.68	± 75
-17.6	28.08	45.90	22.14	± 75
-12.6	44.43	62.10	29.47	± 75



3.3. Occupied bandwidth and emission mask

Test procedure

TIA-603-E – Section 2.2.11, FCC Part 2.1049

TIA-603-E – Section 2.2.11

1. Adjust the spectrum analyzer for the following settings:
 - RBW : 3 kHz
 - VBW : 10 kHz
 - Sweep speed slow enough to maintain measurement calibration.
 - Detector mode : Peak
 - Span that will allow proper viewing of the test bandwidth
2. Set the center frequency of the spectrum analyzer to the assigned transmitter frequency. Turn on the transmitter, and set the level of the unmodulated carrier to a full scale reference line. This is the 0 dB reference for the measurement.
3. Modulate the transmitter with a 2500 Hz sine wave at input level 16 dB greater than that necessary to produce 50% of rated system deviation. The input level shall be established at the frequency of maximum response of the audio modulating circuit. Transmitters employing digital modulation techniques that bypass the limiter and the audio low pass filter shall be modulated as specified by the manufacturer.

FCC Part 2.1049

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(1) Other than single sideband or independent sideband transmitters – when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

Limit

According to §74.861(e)(5),(6) the operating bandwidth shall not exceed 200 kHz.

At least 25 dB 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 35 dB 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 $43 + 10 \log_{10}(P)$ dB on any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth.

Note.

1. P is mean in watts.

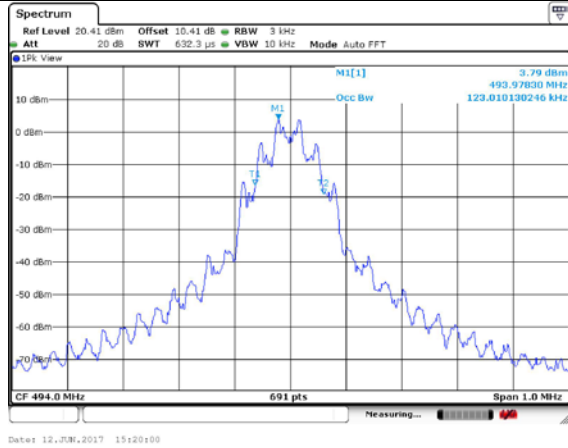


Test results

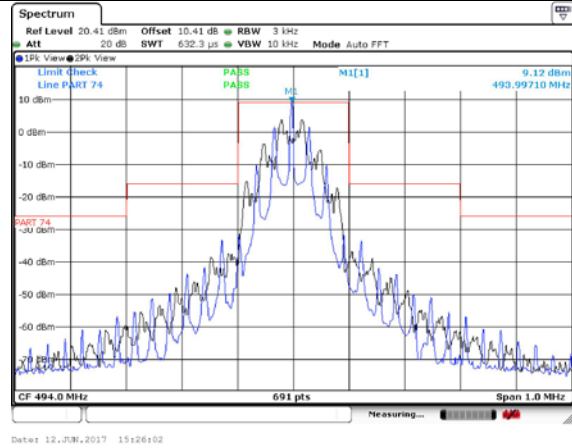
Frequency(MHz)	99% bandwidth(kHz)	Limit(kHz)
494.0	123.01	200
499.4	138.93	
505.2	153.40	

494.0 MHz

Occupied bandwidth

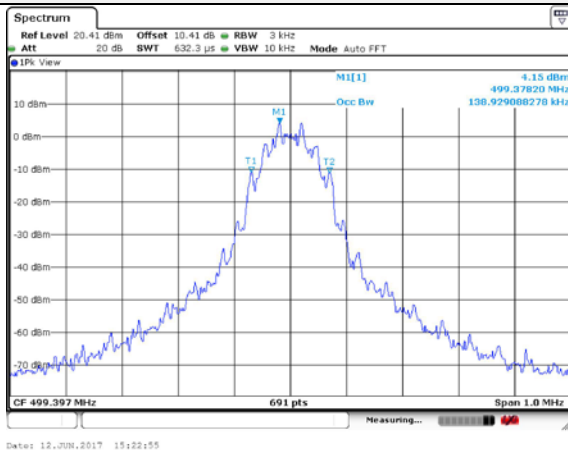


Emission mask

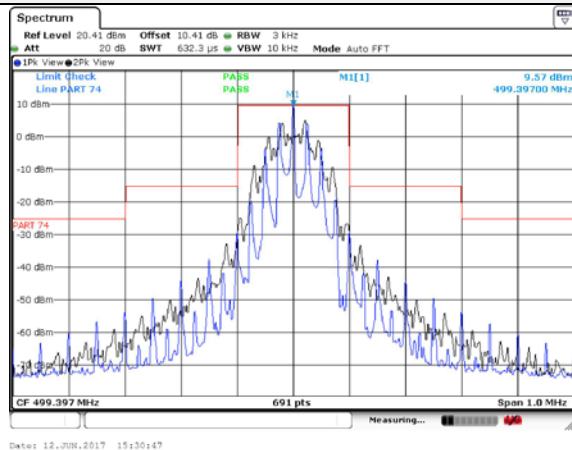


499.4 MHz

Occupied bandwidth

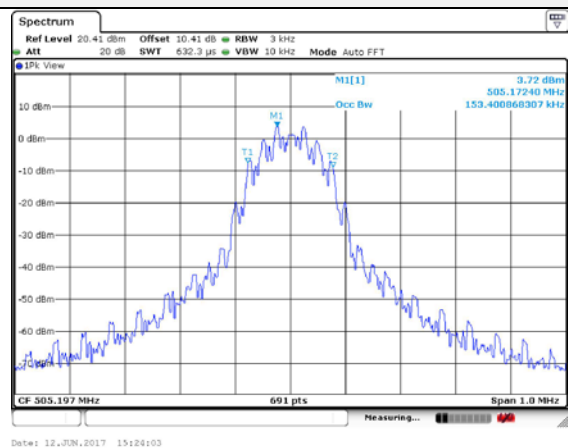


Emission mask

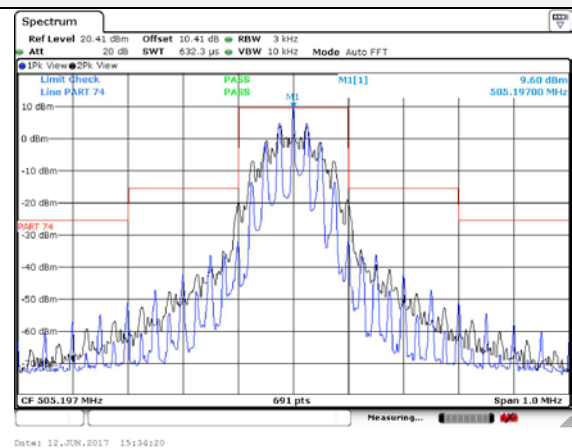


505.2 MHz

Occupied bandwidth



Emission mask



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3.4. Frequency stability

Test procedure

TIA-603-E – Section 2.2.2, FCC Part 2.1055

TIA-603-E – Section 2.2.2

1. Connect the equipment as illustrated.
2. Operate the equipment in standby conditions for 15 minutes before proceeding.
3. Record the carrier frequency of the transmitter as MCF_{MHz} .
4. Calculate the ppm frequency error by the following:

$$ppm\ error = \left(\frac{MCF_{MHz}}{ACF_{MHz}} - 1 \right) * 10^6$$

Where

MCF_{MHz} is the Measured Carrier Frequency in MHz

ACF_{MHz} is the Assigned Carrier Frequency in MHz

5. The value recorded in step 4 is the carrier frequency stability.

FCC Part 2.1055

- (1) From -30° to + 50° centigrade for all equipment except that specified in paragraphs (a)(2) and (3) of this section.

Limit

According to §74.861(e)(4), the frequency tolerance of the transmitter shall be 0.005 percent.



Test results

Operating frequency: 494.0 MHz

Channel: 01

Test voltage (%)	Test voltage (V)	Temperature (°C)	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (%)
100 %	DC 3.0	-30	494.007 742	7 742	0.001 567
100 %		-20	494.007 699	7 699	0.001 558
100 %		-10	494.006 252	6 252	0.001 266
100 %		0	494.004 284	4 284	0.000 867
100 %		10	494.001 795	1 795	0.000 363
100 %		20	493.995 631	-4 369	-0.000 884
100 %		30	493.996 035	-3 965	-0.000 803
100 %		40	493.992 562	-7 438	-0.001 506
100 %		50	493.991 751	-8 249	-0.001 670
Battery end point	DC 2.4	23	493.993 277	-6 723	-0.001 361

Operating frequency: 499.4 MHz

Channel: 08

Test voltage (%)	Test voltage (V)	Temperature (°C)	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (%)
100 %	DC 3.0	-30	499.407 709	7 709	0.001 544
100 %		-20	499.407 709	7 709	0.001 544
100 %		-10	499.406 493	6 493	0.001 300
100 %		0	499.404 207	4 207	0.000 842
100 %		10	499.401 949	1 949	0.000 390
100 %		20	499.395 524	-4 476	-0.000 896
100 %		30	499.395 958	-4 042	-0.000 809
100 %		40	499.392 398	-7 602	-0.001 522
100 %		50	499.391 906	-8 094	-0.001 621
Battery end point	DC 2.4	23	499.395 664	-4 336	-0.000 868



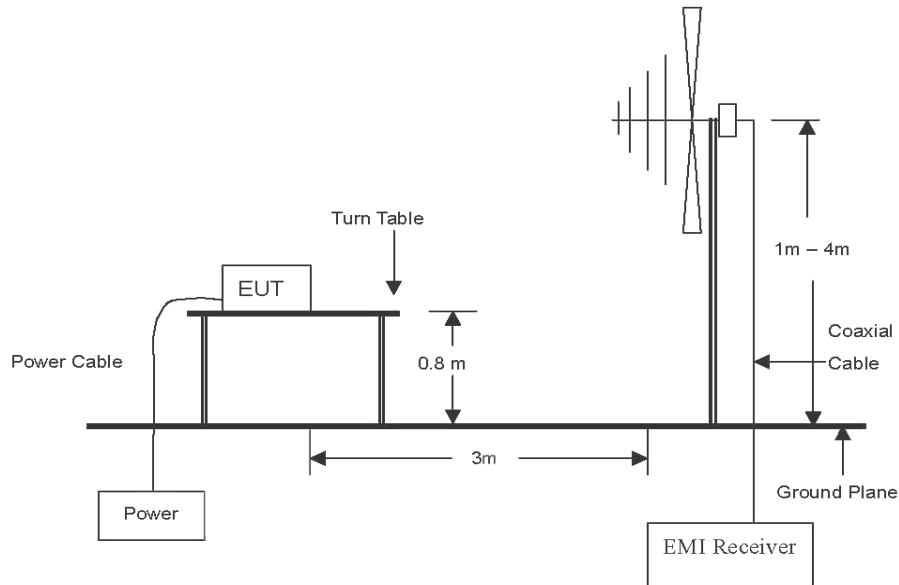
Operating frequency: 505.2 MHz
Channel: 16

Test voltage (%)	Test voltage (V)	Temperature (°C)	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (%)
100 %	DC 3.0	-30	505.207 781	7 781	0.001 540
100 %		-20	505.207 781	7 781	0.001 540
100 %		-10	505.206 638	6 638	0.001 314
100 %		0	505.203 918	3 918	0.000 776
100 %		10	505.202 094	2 094	0.000 414
100 %		20	505.195 495	-4 505	-0.000 892
100 %		30	505.195 929	-4 071	-0.000 806
100 %		40	505.192 311	-7 689	-0.001 522
100 %		50	505.189 884	-10 116	-0.002 002
Battery end point	DC 2.4	23	505.195 577	-4 423	-0.000 876

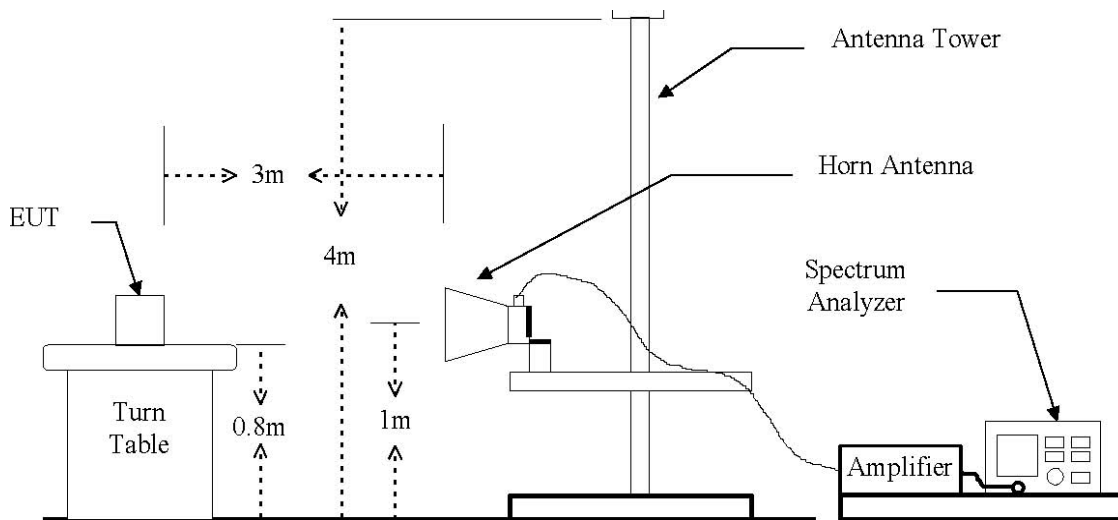
3.5. Field strength of spurious radiation

Test setup

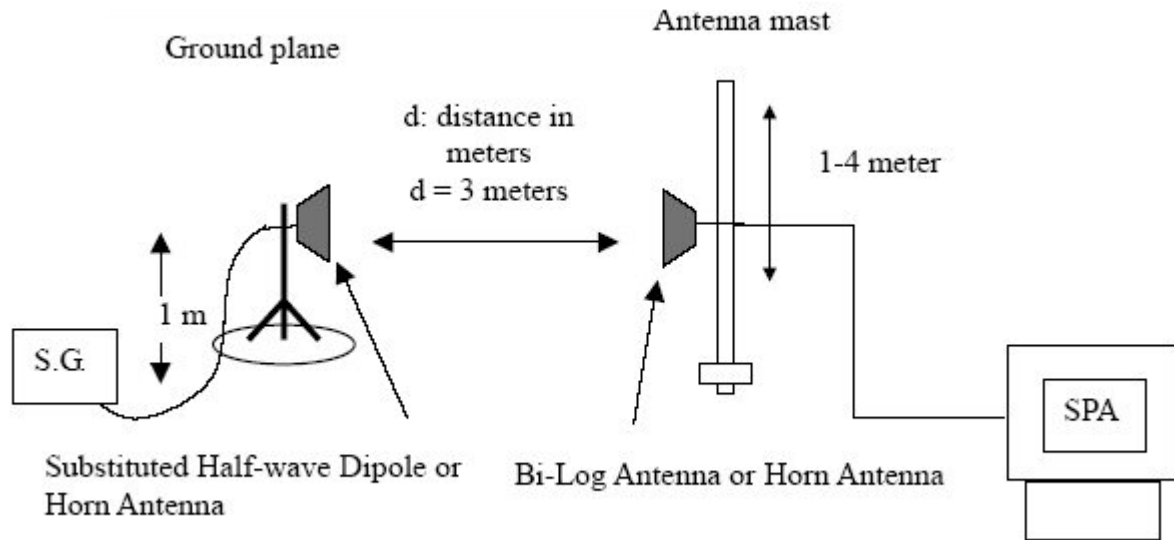
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz emissions, whichever is lower.



The diagram below shows the test setup for substituted method



Test procedure above 30 MHz

1. On a test site, the EUT shall be placed at 80cm height on a turn table, and in the position closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3m from EUT to correspond to the frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a horn (substitution antenna).
10. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. In necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
17. The measure of the effective radiated power is the large of the two levels recorded, at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.

Limit

According to §2.1053, measurements shall be made to detect spurious emission that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal condition of installation and operation. Information submitted shall include the relative radiated power of spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from a half wave dipole antenna.

According to §74.861(e)(ii)(6), the mean power of emission shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

- (i) 470 ~ 608 MHz and 614 ~ 698 MHz : 250 mW (23.98 dBm)
- (ii) 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
- (iii) 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 23 dB
- (iv) 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 $43 + 10\log(P)$ dB.

Test results (Below 1 000 MHz)

Mode: FM
Distance of measurement: 3 meter
Channel: 01

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.	
		(dBm)	(W)
494.00	H	-13.50	0.000 045
494.00	V	10.11	0.010 257

Mode: FM
Distance of measurement: 3 meter
Channel: 08

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.	
		(dBm)	(W)
499.40	H	-14.71	0.000 034
499.40	V	10.19	0.010 447

Mode: FM
Distance of measurement: 3 meter
Channel: 16

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.	
		(dBm)	(W)
505.20	H	-13.20	0.000 048
505.20	V	10.50	0.011 220



Test results (Above 1 000 MHz)

Mode: FM
Distance of measurement: 3 meter
Channel: 01

Frequency (MHz)	Ant. Pol. (H/V)	Spurious attenuation (dBc)	Limit (dBm)	Margin (dB)
988.10	H	66.26	-13.00	43.15
988.10	V	55.50	-13.00	32.39
1 483.40	H	77.93	-13.00	54.82
1 483.40	V	66.11	-13.00	43.00
1 836.50	H	79.19	-13.00	56.08
1 975.40	V	66.35	-13.00	43.24
2 455.86	V	66.65	-13.00	43.54
3 457.30	H	66.84	-13.00	43.73
3 457.30	V	64.49	-13.00	41.38

Note.

1. Spurious attenuation = EUT max. output power(dBm) - absolute level
2. Spurious attenuation limit in dB = $43 + 10\log(\text{power in watts})$

Mode: FM
Distance of measurement: 3 meter
Channel: 08

Frequency (MHz)	Ant. Pol. (H/V)	Spurious attenuation (dBc)	Limit (dBm)	Margin (dB)
998.778	H	55.40	-13.00	32.21
998.778	V	55.53	-13.00	32.34
1 498.167	H	58.49	-13.00	35.30
1 498.167	V	66.50	-13.00	43.31
1 997.556	H	60.35	-13.00	37.16
1 997.556	V	59.77	-13.00	36.58
2 496.945	H	60.17	-13.00	36.98
2 496.945	V	72.28	-13.00	49.09
2 996.334	H	60.41	-13.00	37.22
2 996.334	V	65.05	-13.00	41.86
3 495.723	H	67.19	-13.00	44.00
3 495.723	V	62.42	-13.00	39.23

Note.

1. Spurious attenuation = EUT max. output power(dBm) - absolute level
2. Spurious attenuation limit in dB = $43 + 10\log(\text{power in watts})$

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The test results in the report only apply to the tested sample.



Mode: FM
Distance of measurement: 3 meter
Channel: 16

Frequency (MHz)	Ant. Pol. (H/V)	Spurious attenuation (dBc)	Limit (dBm)	Margin (dB)
1 010.384	H	71.52	-13.00	48.02
1 010.384	V	57.63	-13.00	34.13
1 515.576	H	76.68	-13.00	53.18
1 515.576	V	65.45	-13.00	41.95
2 020.768	H	67.56	-13.00	44.06
2 020.768	V	60.21	-13.00	36.71
2 525.960	H	67.91	-13.00	44.41
2 525.960	V	77.24	-13.00	53.74
3 031.152	H	67.26	-13.00	43.76
3 536.344	H	66.15	-13.00	42.65
3 536.344	V	60.71	-13.00	37.21

Note.

1. Spurious attenuation = EUT max. output power(dBm) - absolute level
2. Spurious attenuation limit in dB = $43 + 10\log(\text{power in watts})$

3.6. Spurious emission at antenna terminals

Test procedure

TIA-603-E – Section 2.2.13, FCC Part 74.861(e)(6)(iii)

TIA-603-E –Section 2.2.13

1. Set the center frequency of the spectrum analyzer to the assigned transmitter frequency, key the transmitter, and set the level of the carrier to the full scale reference line.
2. Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation.
The input level shall be established at the frequency of maximum response of the audio modulating circuit.
3. Record the frequencies and levels of spurious emissions.

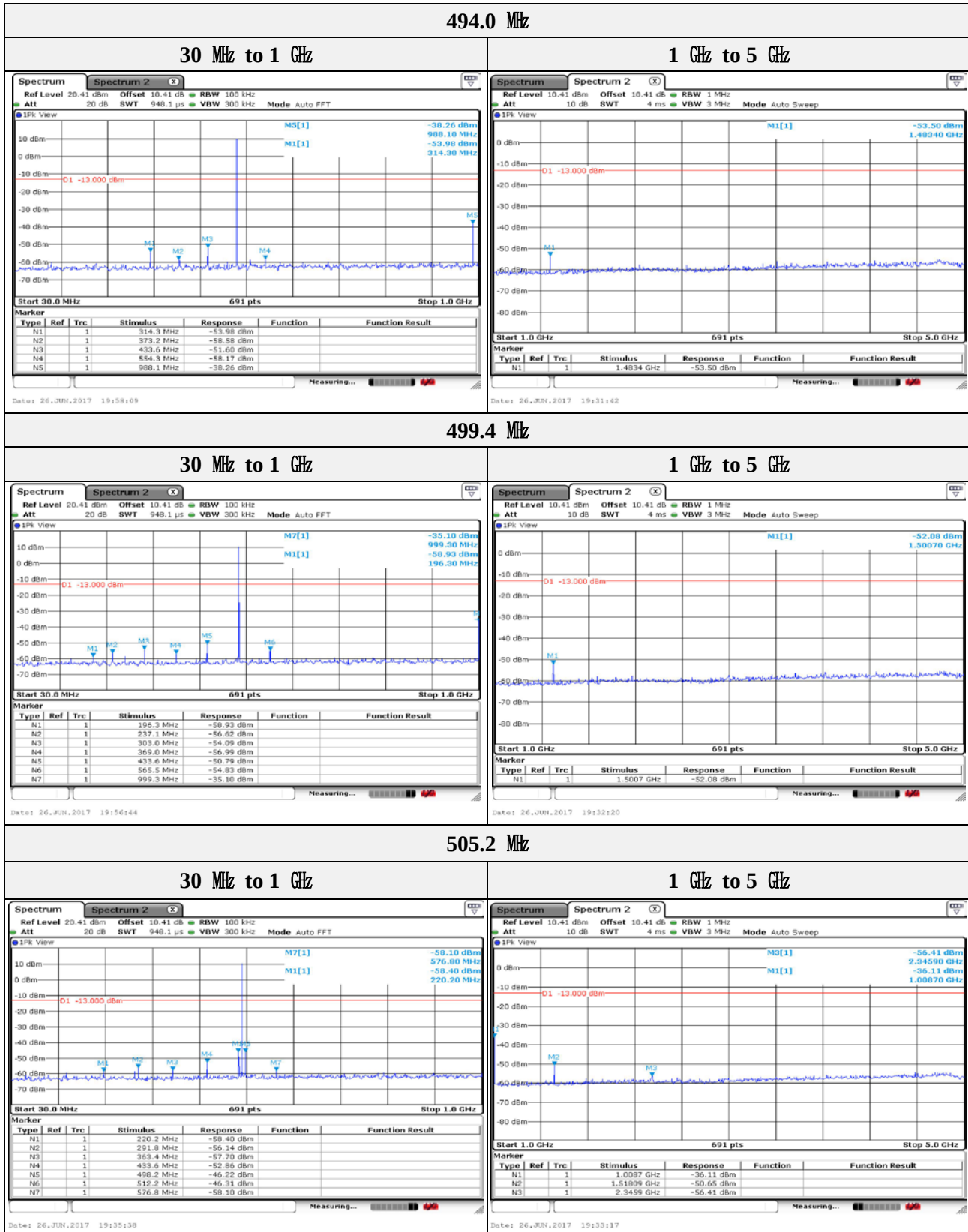
FCC Part 74.861(e)(6)(iii)

1. On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth : at least $43 + 10\log(P)$ dB.

Note.

1. P is mean in watts.

Test results



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Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
Spectrum Analyzer	R&S	FSV30	101389	1 year	2018.01.23
8360B Series Swept Signal Generator	HP	83630B	3844A00786	1 year	2018.01.23
MXG Vector Signal Generator	Agilent	N5182A	MY50143829	1 year	2018.01.19
DC Power Supply	Agilent	6632B	US36351824	1 year	2018.01.19
Attenuator	KEYSIGHT	8493C	82507	1 year	2018.01.23
Modulation Analyzer	HP	8901B	3438A05094	1 year	2018.01.20
Audio Analyzer	HP	8903B	3413A14728	1 year	2018.07.03
Trilog-broadband antenna	SCHWARZBECK	VULB 9163	9168-714	2 years	2018.11.28
Dipole antenna	SCHWARZBECK	VHA9103	3093	2 years	2019.05.19
Dipole antenna	SCHWARZBECK	UHA9105	2703	2 years	2019.05.19
Dipole antenna	SCHWARZBECK	VHA9103	3101	2 years	2019.05.19
Dipole antenna	SCHWARZBECK	UHA9105	2702	2 years	2019.05.19
Horn Antenna	A.H.	SAS-571	781	2 years	2019.05.02
Horn Antenna	A.H SYSTEMS	SAS-571	414	2 years	2019.02.15
High Pass Filter	Mini-Circuits	NHP-800+	15542	1 year	2018.07.03
Preamplifier	SCHWARZBECK	BBV-9718	9718-246	1 year	2017.10.14
Preamplifier	HP	8447F	2805A02570	1 year	2018.01.19
EMI Test Receiver	R&S	ESU26	100552	1 year	2018.04.19
Temperature & Humidity Chamber	Daehan Engineering	DH-1000	DH1000060628	1 year	2018.02.03

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
-	-	-	-