

# TEST REPORT

## Part 95(A/B) & IC RSS-210(Issue 8)

**Equipment under test** GMRS / FRS 2-way Radio

**Model name** T65

**FCC ID** MMAT65

**IC Certification** 3690A-T65

**Applicant** Midland Radio Corporation

**Manufacturer** Global Link Corporation Ltd.

**Date of test(s)** 2014.12.15~2014.12.20

**Date of issue** 2014.12.24

**Issued to**

**Midland Radio Corporation**

5900 Parretta Drive, Kansas City, Missouri United States 64120

Tel.: +1-816-241-8500 / Fax.: +1-816-241-571

**Issued by**

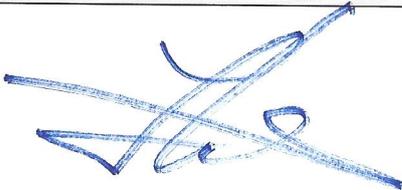
**KES Co., Ltd.**

C-3701, Simin-daero 365-40, Dongan-gu, Anyang-si,

Gyeonggi-do, 431-716, Korea

473-29, Gayeo-ro, Yeosu-si, Gyeonggi-do, Korea

Tel: +82-31-425-6200 / Fax: +82-31-424-0450

Test and report completed by :	Report approval by :
	
Hyeon-Su Jang Test engineer	Jeff Do Technical manager

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.  
 The test results in the report only apply to the tested sample.



---

### Revision history

Revision	Date of issue	Test report No.	Description
-	2014.12.24	KES-RF-14T0063	Initial

---

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.  
The test results in the report only apply to the tested sample.



---

## TABLE OF CONTENTS

1. General information .....	4
1.1. EUT description .....	4
1.2. Test configuration .....	4
1.3. Frequency/channel operations .....	5
1.4. Information about derivative model .....	5
1.5. Device modifications .....	5
1.6. Conclusion of worst-case for each mode of representative channel respectively .....	6
2. Summary of tests .....	8
3. Test results .....	9
3.1. RF output power and radiated spurious emission .....	9
3.2. Modulation limiting .....	17
3.3. Audio frequency response .....	20
3.4. Low-pass filter response .....	22
3.5. Occupied bandwidth and emission mask .....	24
3.6. Frequency stability .....	29
Appendix A. Measurement equipment .....	32
Appendix B. Test setup photo .....	33



## 1. General information

Applicant: Midland Radio Corporation  
Applicant address: 5900 Parretta Drive, Kansas City, Missouri United States 64120  
Test site: KES Co., Ltd.  
Test site address: C-3701, Simin-daero 365-40, Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea  
473-29, Gayeo-ro, Yeosu-si, Gyeonggi-do, Korea  
FCC rule part(s): FCC Part 95  
IC rule part(s): RSS-210  
Model: T65  
FCC ID: MMAT65  
IC Certification: 3690A-T65  
Test device serial No.:  Production  Pre-production  Engineering

### 1.1. EUT description

Equipment under test FRS / GMRS  
Serial number S1409000001  
Frequency range 462.562 5 MHz ~ 462.712 5 MHz (GMRS Channels 1 ~7, 23 ~ 26, 31 ~ 33)  
467.562 5 MHz ~ 467.712 5 MHz (FRS Channels 8 ~ 14, 34 ~ 36)  
462.550 0 MHz ~ 462.725 0 MHz (GMRS Channels 15 ~ 22, 27 ~ 30)  
Type of Emission 11K0F3E  
E.R.P. GMRS: 0.545 W(High power), 0.162 W(Low power) // FRS: 0.095 W  
Number of channels 36  
Power source Rechargeable Ni-MH battery pack(DC 3.6 V)

### 1.2. Test configuration

The GMRS / FRS 2-way Radio FCC ID: MMAT65 was tested per the guidance of ANSI C63.10-2009, ANSI/TIA 603C: 2004 and RSS-210 (Issue 8) was used to reference the appropriate EUT setup for radiated spurious emissions testing.

### 1.3. Frequency/channel operations

Mode	Ch.	Frequency (MHz)
GMRS	1 / 23	462.562 5
	2 / 31	462.587 5
	3 / 24	462.612 5
	4 / 32	462.637 5
	5 / 25	462.662 5
	6 / 33	462.687 5
	7 / 26	462.712 5
FRS	8 / 34	467.562 5
	9	467.587 5
	10 / 35	467.612 5
	11	467.637 5
	12 / 36	467.662 5
	13	467.687 5
	14	467.712 5
GMRS	15 / 27	462.550 0
	16	462.575 0
	17 / 28	462.600 0
	18	462.625 0
	19 / 29	462.650 0
	20	462.675 0
	21 / 30	462.700 0
	22	462.725 0

### 1.4. Information about derivative model

N/A

### 1.5. Device modifications

N/A

### 1.6. Conclusion of worst-case for each mode of representative channel respectively

The EUT has 2 type of mode (GMRS and FRS). Each conducted output power as following;

Mode	Channel No.	Frequency(MHz)	High / Low	Conducted output power	
				dBm	W
GMRS	<b>1</b>	<b>462.562 5</b>	<b>High</b>	<b>28.20</b>	<b>0.661</b>
			<b>Low</b>	<b>23.80</b>	<b>0.240</b>
	2	462.587 5	High	28.14	0.652
			Low	23.77	0.238
	3	462.612 5	High	28.12	0.649
			Low	23.70	0.234
	4	462.637 5	High	28.10	0.646
			Low	23.70	0.234
	5	462.662 5	High	28.08	0.643
			Low	23.68	0.233
	6	462.687 5	High	28.08	0.643
			Low	23.70	0.234
	7	462.712 5	High	28.07	0.641
			Low	23.68	0.233
FRS	<b>8</b>	<b>467.562 5</b>	N/A	<b>21.76</b>	<b>0.150</b>
				21.75	0.150
	21.67	0.147			
	21.72	0.149			
	21.69	0.148			
	21.66	0.147			
	21.64	0.146			
GMRS	15	462.550 0	High	28.06	0.640
			Low	23.76	0.238
	16	462.575 0	High	28.06	0.640
			Low	23.76	0.238
	17	462.600 0	High	28.05	0.638
			Low	23.74	0.237
	18	462.625 0	High	28.04	0.637
			Low	23.70	0.234
	19	462.650 0	High	28.02	0.634
			Low	23.70	0.234
	20	462.675 0	High	28.01	0.632
			Low	23.71	0.235
	21	462.700 0	High	28.00	0.631
			Low	23.67	0.233
22	462.725 0	High	28.00	0.631	
		Low	23.66	0.232	

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.  
 The test results in the report only apply to the tested sample.



Mode	Channel No.	Frequency(MHz)	High / Low	Conducted output power	
				dBm	W
GMRS	23	462.562 5	High	28.06	0.640
			Low	23.79	0.239
	24	462.612 5	High	28.01	0.632
			Low	23.77	0.238
	25	462.662 5	High	28.00	0.631
			Low	23.76	0.238
	26	462.712 5	High	28.00	0.631
			Low	23.69	0.234
	27	462.550 0	High	28.01	0.632
			Low	23.74	0.237
	28	462.600 0	High	28.00	0.631
			Low	23.72	0.236
	29	462.650 0	High	27.99	0.630
			Low	23.69	0.234
	30	462.700 0	High	27.99	0.630
			Low	23.70	0.234
	31	462.587 5	High	27.99	0.630
			Low	23.73	0.236
32	462.637 5	High	27.98	0.628	
		Low	23.71	0.235	
33	462.687 5	High	27.98	0.628	
		Low	23.68	0.233	
FRS	34	467.562 5	N/A	21.70	0.148
	35	467.612 5		21.65	0.146
	36	467.662 5		21.64	0.146

Therefore all applicable requirements were tested to the two channels, the 1<sup>th</sup> for GMRS and the 8<sup>th</sup> for FRS.

DC input into the final amplifier

Mode	Voltage(V)	Current(A)	Power(W)
GMRS(High power)	3.6	0.60	2.16
GMRS(Low power)	3.6	0.42	1.51
FRS	3.6	0.38	1.37

## 2. Summary of tests

Reference	Test description	Test results
95.639 RSS-210 A6.1.4 RSS-210 A6.2.4	RF output power	PASS
95.635 RSS-210 A6.1.5 RSS-201 A6.2.5	Radiated spurious emissions	PASS
95.637 RSS-210 A6.1.2 RSS-210 A6.2.2	Modulation limiting	PASS
2.1047	Audio frequency response	PASS
95.637 RSS-210 A6.2.2	Low-pass filter response	PASS
2.1049, 95.633, 95.635 RSS-210 A6.1.3 RSS-210 A6.2.3 RSS-210 A6.1.5 RSS-210 A6.2.5	Occupied bandwidth and emission mask	PASS
2.1055, 95.621, 95.627 RSS-210 A6.1.6 RSS-201 A6.2.6	Frequency stability	PASS

### Note:

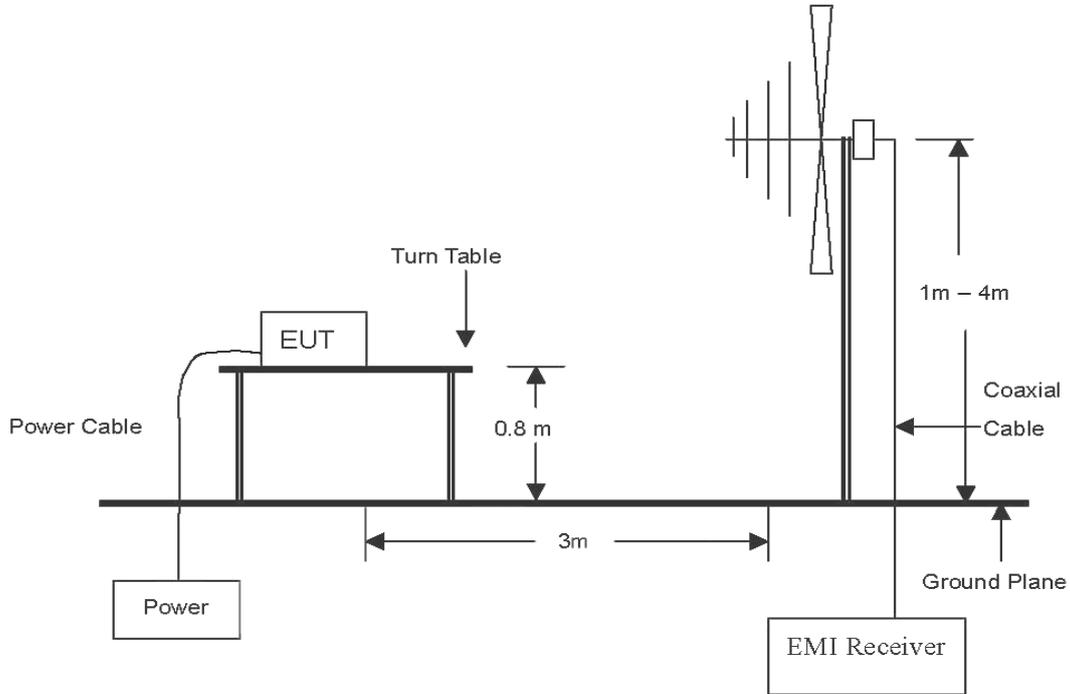
- The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2009, ANSI/TIA 603C: 2004), RSS-210 (Issue 8) were used in the measurement of the DUT.
- All modes of operation were investigated. The test results shown in the following sections represent the worst case emissions.

### 3. Test results

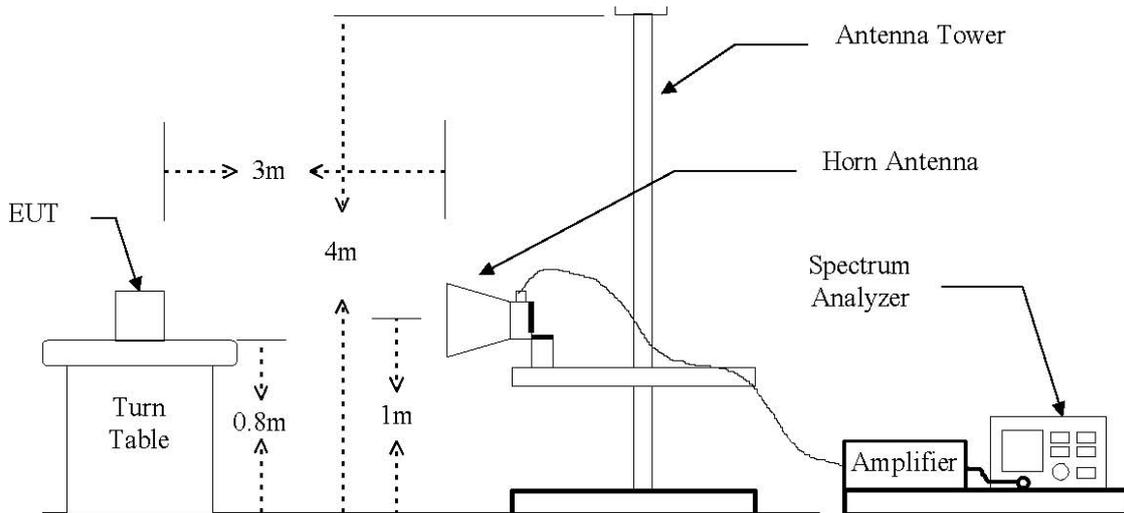
#### 3.1. RF power and radiated spurious emission

##### Test setup

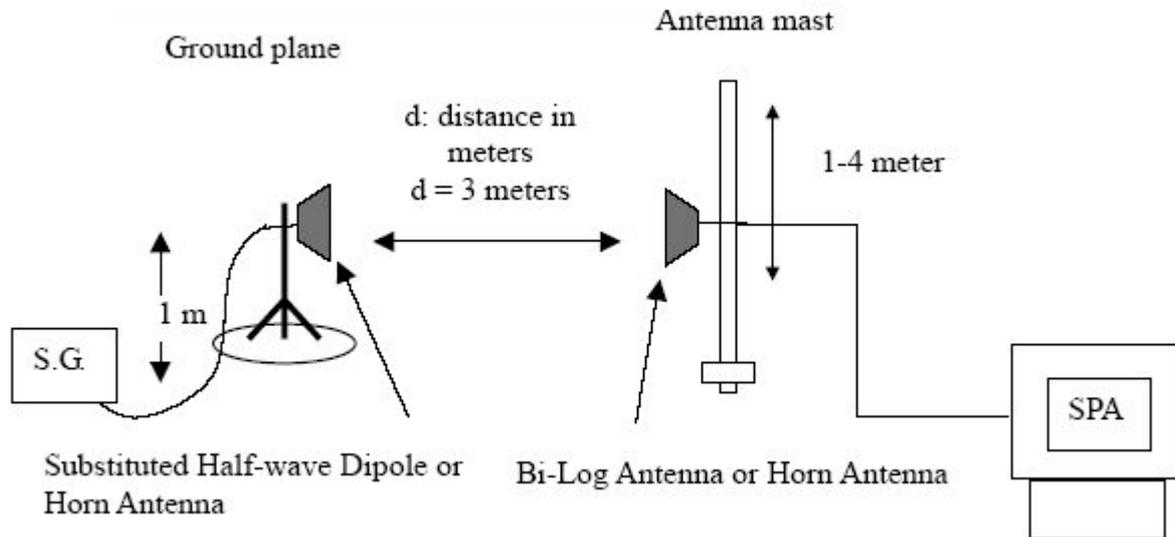
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 18 GHz Emissions.



The diagram below shows the test setup for substituted method



---

**Test procedure: Based on ANSI/TIA 603C: 2004**

**RF output power & radiated spurious emissions**

1. On a test site, the EUT shall be placed at 80 cm 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 fundamental 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. During the measurement of the EUT, the resolution bandwidth was to 1 MHz and the video bandwidth was set to 1 MHz
5. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
6. 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.
7. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
8. 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.
9. The maximum signal level detected by the measuring receiver shall be noted.
10. The EUT was replaced by half-wave dipole(below 1000 MHz) or horn antenna(above 1000 MHz) connected to a signal generator.
11. In necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
12. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
13. 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.
14. 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.
15. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

---

## Limit

### RF output power

#### §95.639

Power output shall not exceed 0.50 Watts effective radiated power for the FRS channels. There can be no provisions for increasing the power or varying the power.

No GMRS channel, under any condition of modulation, shall exceed:

1. 50W Carrier power (average TP during one modulated RF cycle) when transmitting emissions type A1D, F1D, G1D, A3E, F3E, or G3E.
2. 50W peak envelope TP when transmitting emission type H1D, J1D, R1D, H3E, J3E or R3E.

#### RSS-210 A6.1.4

The maximum permissible transmitter output power under any operating conditions is 0.5 W effective radiated power (e.r.p.). The radio shall be equipped with an integral antenna.

#### RSS-210 A6.2.4

A GMRS transmitter may transmit with a maximum power of 2 W e.r.p.

### Radiated spurious emissions

#### §95.635 & RSS-201 A6.1.5, A6.2.5

(7) At least  $43 + 10 \log_{10}(T)$  dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

## Test results

### RF output power

Mode: GMRS (High power)  
 Distance of measurement: 3 meter  
 Operating frequency: 462.5625 MHz  
 Channel: 01

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.	
		(dBm)	(W)
462.5625	H	27.36	0.545
462.5625	V	25.54	0.358

Mode: GMRS (Low power)  
 Distance of measurement: 3 meter  
 Operating frequency: 462.5625 MHz  
 Channel: 01

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.	
		(dBm)	(W)
462.5625	H	22.10	0.162
462.5625	V	20.47	0.111

Mode: FRS  
 Distance of measurement: 3 meter  
 Operating frequency: 467.5625 MHz  
 Channel: 08

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.	
		(dBm)	(W)
467.5625	H	19.77	0.095
467.5625	V	18.88	0.077

### Radiated spurious emissions

Mode: GMRS (High power)  
 Distance of measurement: 3 meter  
 Operating frequency: 462.5625 MHz  
 Channel: 01

Frequency (MHz)	Ant. Pol. (H/V)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
925.125	H	58.81	40.36	18.45
925.125	V	59.55	40.36	19.19
1387.688	H	51.75	40.36	11.39
1387.688	V	59.29	40.36	18.93
1850.250	H	55.11	40.36	14.75
1850.250	V	58.04	40.36	17.68
2312.813	H	54.88	40.36	14.52
2312.813	V	56.36	40.36	16.00
2775.375	H	52.59	40.36	12.23
2775.375	V	51.11	40.36	10.75
3237.938	H	54.18	40.36	13.82
3237.938	V	59.43	40.36	19.07
3700.500	H	52.68	40.36	12.32
3700.500	V	53.45	40.36	13.09
4163.063	H	64.75	40.36	24.39
4163.063	V	66.72	40.36	26.36
4625.625	H	68.54	40.36	28.18
4625.625	V	70.41	40.36	30.05

Remark;

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

Mode: GMRS (Low power)  
 Distance of measurement: 3 meter  
 Operating frequency: 462.5625 MHz  
 Channel: 01

Frequency (MHz)	Ant. Pol. (H/V)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
925.125	H	55.26	35.10	20.16
925.125	V	56.94	35.10	21.84
1387.688	H	47.07	35.10	11.97
1387.688	V	53.73	35.10	18.63
1850.250	H	49.28	35.10	14.18
1850.250	V	52.69	35.10	17.59
2312.813	H	50.02	35.10	14.92
2312.813	V	52.92	35.10	17.82
2775.375	H	47.85	35.10	12.75
2775.375	V	45.88	35.10	10.78
3237.938	H	49.14	35.10	14.04
3237.938	V	53.91	35.10	18.81
3700.500	H	47.71	35.10	12.61
3700.500	V	48.22	35.10	13.12
4163.063	H	58.26	35.10	23.16
4163.063	V	61.82	35.10	26.72
4625.625	H	63.82	35.10	28.72
4625.625	V	65.80	35.10	30.70

Remark;

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

Mode: FRS  
 Distance of measurement: 3 meter  
 Operating frequency: 467.5625 MHz  
 Channel: 08

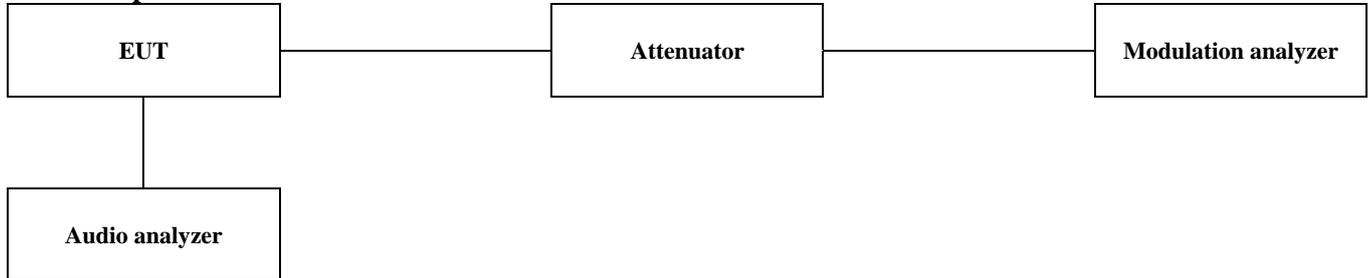
Frequency (MHz)	Ant. Pol. (H/V)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
935.125	H	49.57	32.77	16.80
935.125	V	50.54	32.77	17.77
1402.688	H	46.53	32.77	13.76
1402.688	V	53.73	32.77	20.96
1870.250	H	49.75	32.77	16.98
1870.250	V	50.94	32.77	18.17
2337.813	H	47.29	32.77	14.52
2337.813	V	47.93	32.77	15.16
2805.375	H	46.14	32.77	13.37
2805.375	V	43.43	32.77	10.66
3272.938	H	49.02	32.77	16.25
3272.938	V	51.48	32.77	18.71
3740.500	H	44.84	32.77	12.07
3740.500	V	46.68	32.77	13.91
4208.063	H	59.26	32.77	26.49
4208.063	V	60.63	32.77	27.86
4675.625	H	64.19	32.77	31.42
4675.625	V	64.16	32.77	31.39

Remark;

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

### 3.2. Modulation limiting

#### Test setup



#### Test procedure

TIA/EIA-603-C

#### Limit

##### §95.639

(a) A GMRS transmitter that transmits emission types F1D, G1D, or G3E must not exceed a peak frequency deviation of plus or minus 5 kHz. A GMRS transmitter that transmits emission type F3E must not exceed a peak frequency deviation of plus or minus 5 kHz. A FRS unit that transmits emission type F3E must not exceed a peak frequency deviation of plus or minus 2.5 kHz, and the audio frequency response must not exceed 3.125 kHz.

##### RSS-210 A6.1.2

(c) The peak frequency deviation shall not exceed  $\pm 2.5$  kHz. The limiter shall be followed by a low-pass filter to remove unwanted harmonics.

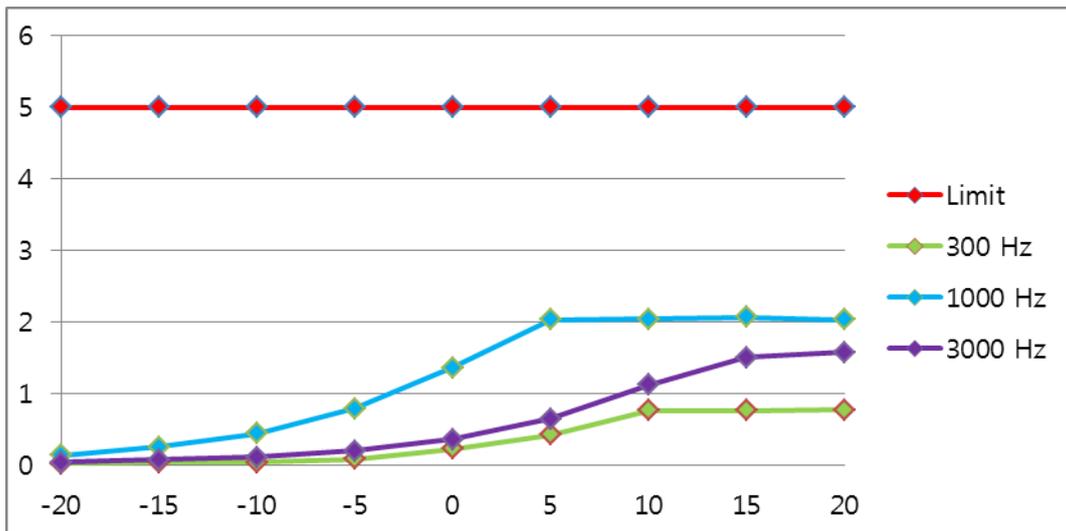
##### RSS-210 A6.2.2

(b) For emission types F1D, G1D, G3E, F3E or F2D, the peak frequency deviation shall not exceed  $\pm 5$  kHz. GMRS transmitters must include an audio frequency low-pass filter, unless they comply with the appropriate emission masks in Section A6.2.5 below. The filter must be between the modulation limiter and the modulated stage of the transmitter. The filter attenuation must be as follows: for  $3 \text{ kHz} \leq f \leq 20 \text{ kHz}$ , the attenuation is at least  $60 \log_{10}(f, \text{ kHz}/3)$  dB greater than the attenuation at 1 kHz; and for  $f > 20 \text{ kHz}$ , the attenuation is at least 50 dB greater than the attenuation at 1 kHz.

**Test results**

**GMRS**

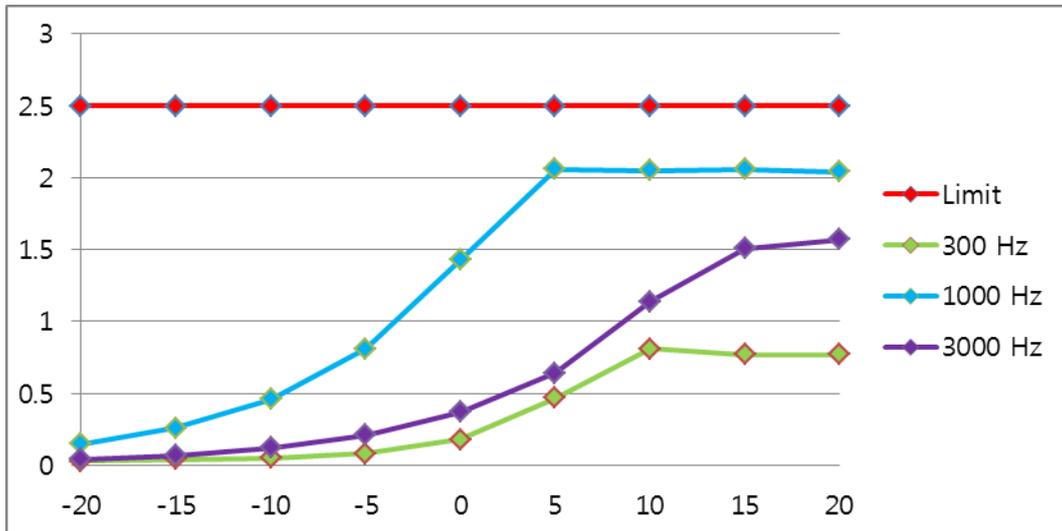
Audio level (dB)	Deviation at 300 Hz	Deviation at 1 kHz	Deviation at 3 kHz	Limit (kHz)
-20	0.03	0.14	0.05	5
-15	0.05	0.26	0.08	5
-10	0.05	0.45	0.12	5
-5	0.09	0.80	0.21	5
0	0.23	1.37	0.37	5
5	0.43	2.04	0.65	5
10	0.77	2.05	1.13	5
15	0.77	2.07	1.51	5
20	0.78	2.04	1.58	5



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.  
 The test results in the report only apply to the tested sample.

**FRS**

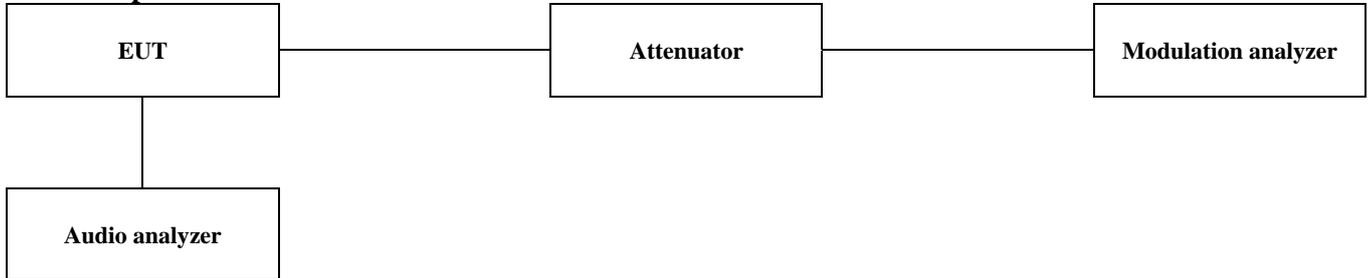
Audio level (dB)	Deviation at 300 Hz	Deviation at 1 kHz	Deviation at 3 kHz	Limit (kHz)
-20	0.03	0.15	0.04	2.5
-15	0.04	0.26	0.07	2.5
-10	0.05	0.46	0.12	2.5
-5	0.08	0.81	0.21	2.5
0	0.18	1.43	0.37	2.5
5	0.47	2.06	0.64	2.5
10	0.81	2.05	1.14	2.5
15	0.77	2.06	1.51	2.5
20	0.77	2.04	1.57	2.5



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.  
 The test results in the report only apply to the tested sample.

### 3.3. Audio frequency response

#### Test setup



#### Test procedure

TIA/EIA-603-C

#### Limit

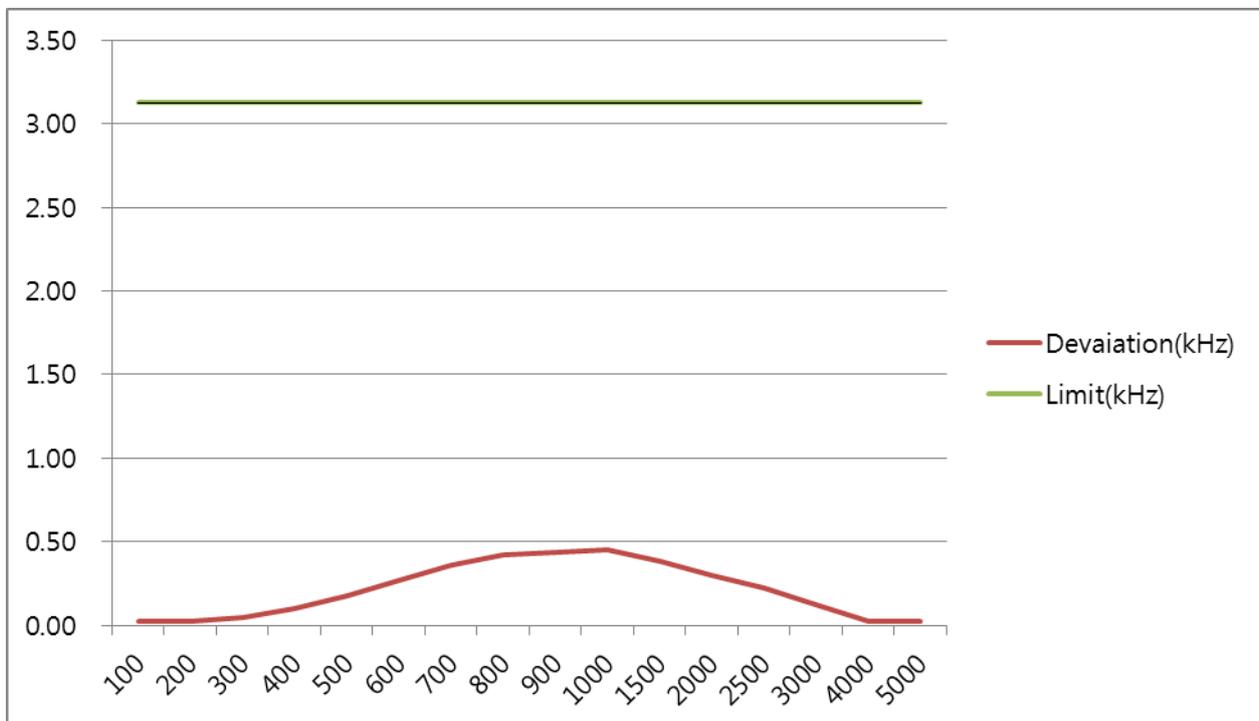
##### §2.1047

a) 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.

**Test results**

**FRS**

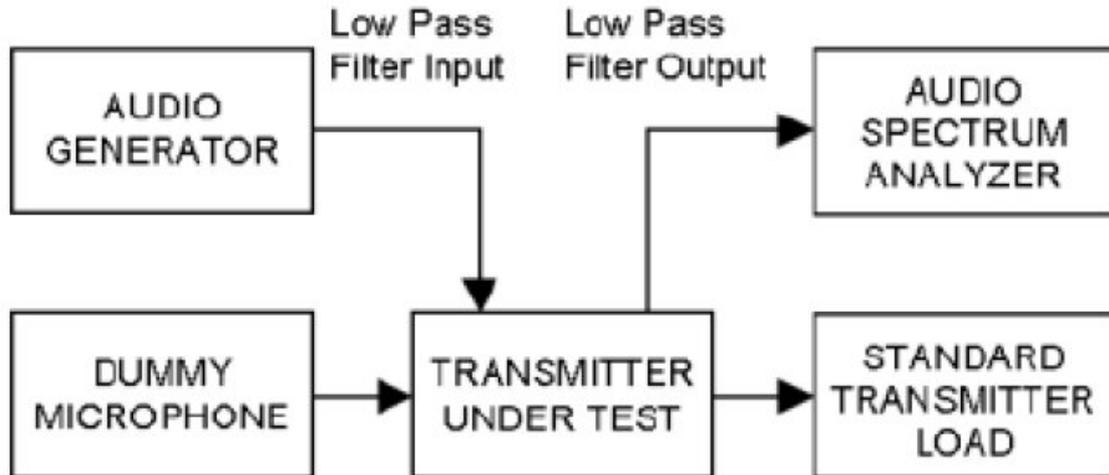
Audio frequency(Hz)	Deviation(kHz)	Limit(kHz)
100	0.02	3.125
200	0.02	3.125
300	0.05	3.125
400	0.10	3.125
500	0.18	3.125
600	0.27	3.125
700	0.36	3.125
800	0.42	3.125
900	0.44	3.125
1000	0.45	3.125
1500	0.38	3.125
2000	0.30	3.125
2500	0.22	3.125
3000	0.12	3.125
4000	0.02	3.125
5000	0.02	3.125



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.  
 The test results in the report only apply to the tested sample.

### 3.4. Low-pass filter response

#### Test setup



**Test procedure**  
 TIA/EIA-603-C

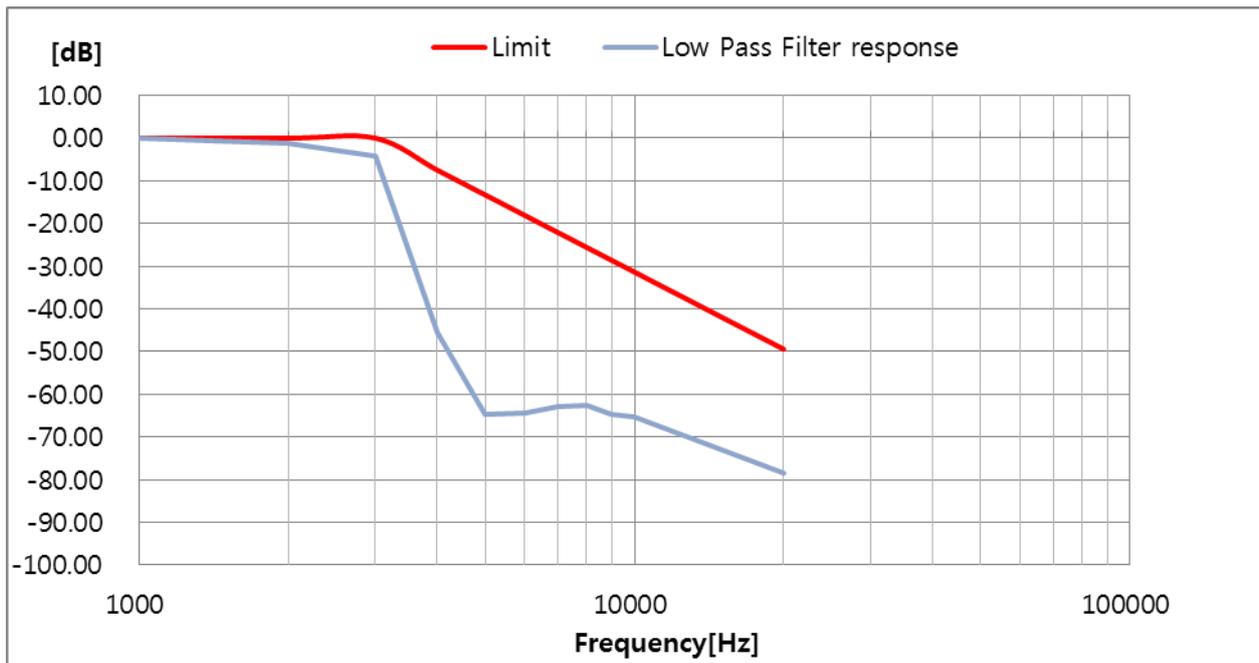
#### Limit

##### §95.637 & RSS-210 A6.2.2

(b) Each GMRS transmitter, except a mobile station transmitter with a power output of 2.5 W or less, must automatically prevent a greater than normal audio level from causing over modulation. The transmitter also must include audio frequency low pass filtering, unless it complies with the applicable paragraphs of §95.631 (without filtering.) The filter must be between the modulation limiter and the modulated stage of the transmitter. At any frequency ( $f$  in kHz) between 3 and 20 kHz, the filter must have an attenuation of at least  $60 \log_{10}(f/3)$  dB greater than the attenuation at 1 kHz. Above 20 kHz, it must have an attenuation of at least 50 dB greater than the attenuation at 1 kHz.

**Test results**

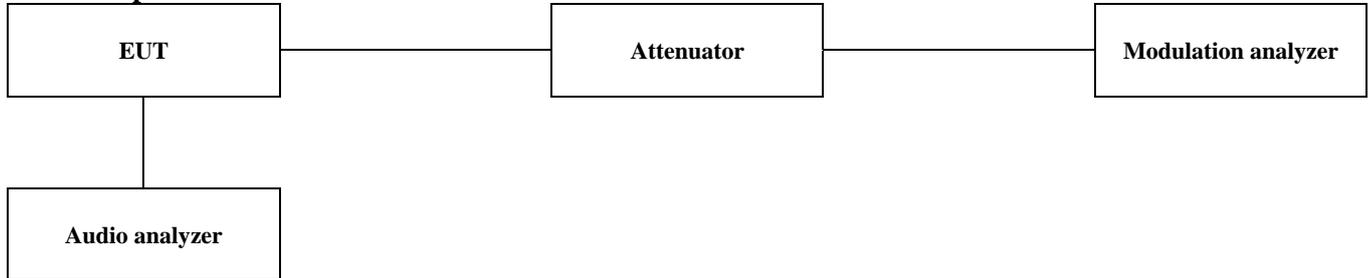
Audio frequency(Hz)	Response(dB)	Limit(dB)
1000	0.00	0.00
2000	-1.31	0.00
3000	-4.16	0.00
4000	-45.47	-7.50
5000	-64.73	-13.31
6000	-64.27	-18.06
7000	-62.94	-22.08
8000	-62.66	-25.56
9000	-64.74	-28.63
10000	-65.27	-31.37
20000	-78.36	-49.43



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.  
 The test results in the report only apply to the tested sample.

### 3.5. Occupied bandwidth and emission mask

#### Test setup



#### Test procedure

TIA/EIA-603-C section 2.2.11

(Modulate the transmitter with a 2 500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50 % of rated system deviation.)

#### Limit

##### §95.633 & RSS-210 A6.1.3, A6.2.3

The authorized bandwidth (maximum permissible bandwidth of a transmission) for emission type H1D, J1D, R1D, H3E, J3E or R3E is 4 kHz. The authorized bandwidth for emission type A1D or A3E is 8 kHz. The authorized bandwidth for emission type F1D, G1D, F3E or G3E is 20 kHz.

The authorized bandwidth for emission type F3E or F2D transmitted by a FRS unit is 12.5 kHz.

##### §95.635 & RSS-210 A6.1.5, A6.2.5

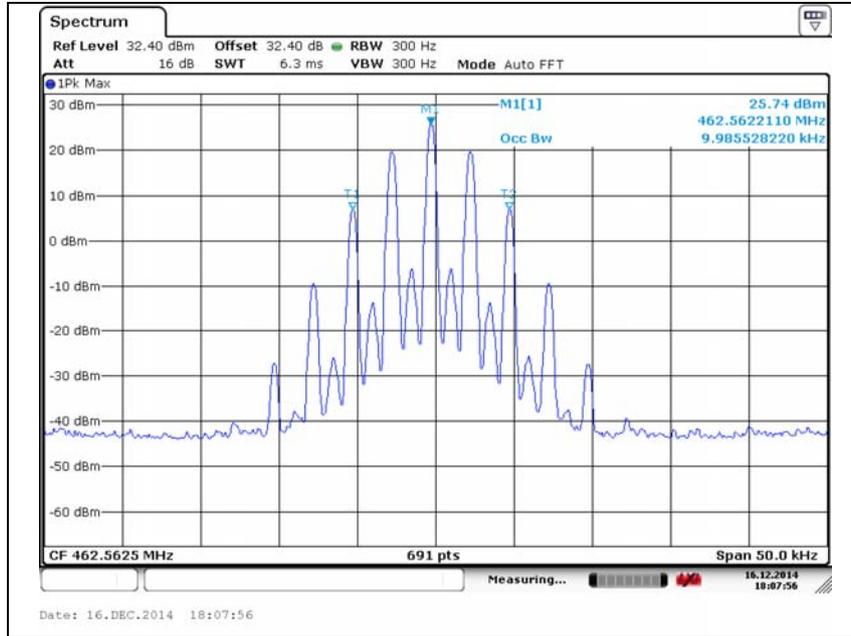
At least 25 dB (decibels) on any frequency removed from the center of the authorized bandwidth by more than 50 % up to and including 100 % of the authorized bandwidth.

At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100 % up to and including 250 % of the authorized bandwidth.

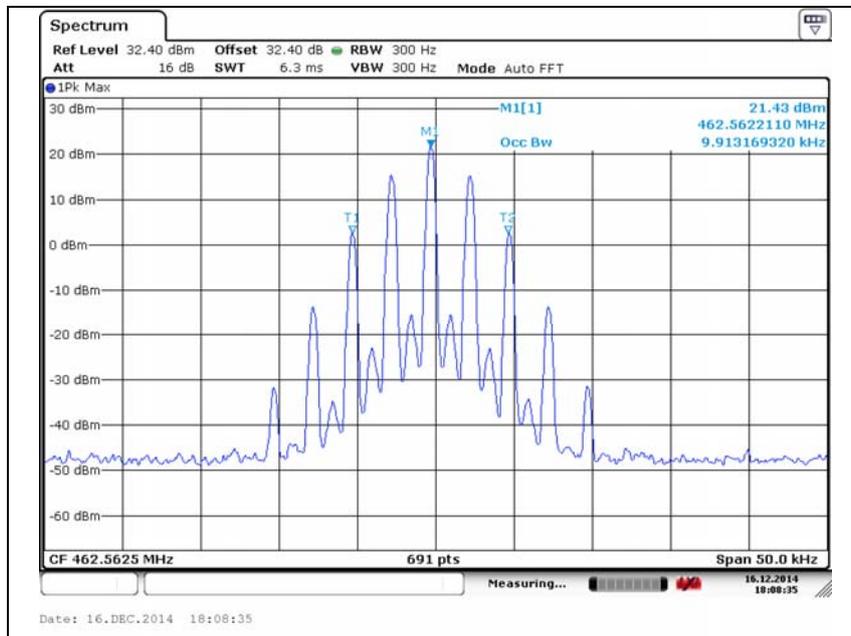
At least  $43 + 10 \log_{10}(T)$  dB on any frequency removed from the center of the authorized bandwidth by more than 250 %.

**Test results**

**99 % bandwidth for GMRS (High power)**

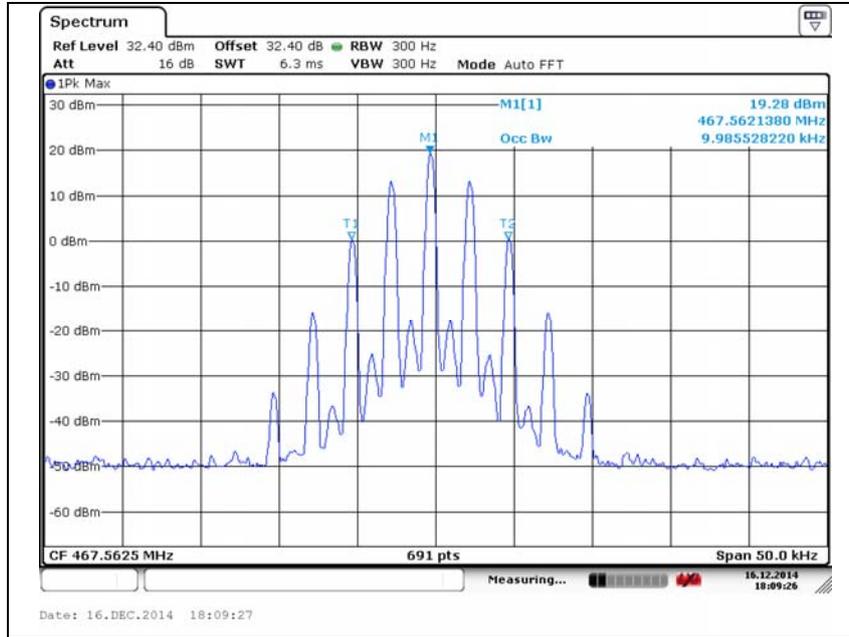


**99 % bandwidth for GMRS (Low power)**



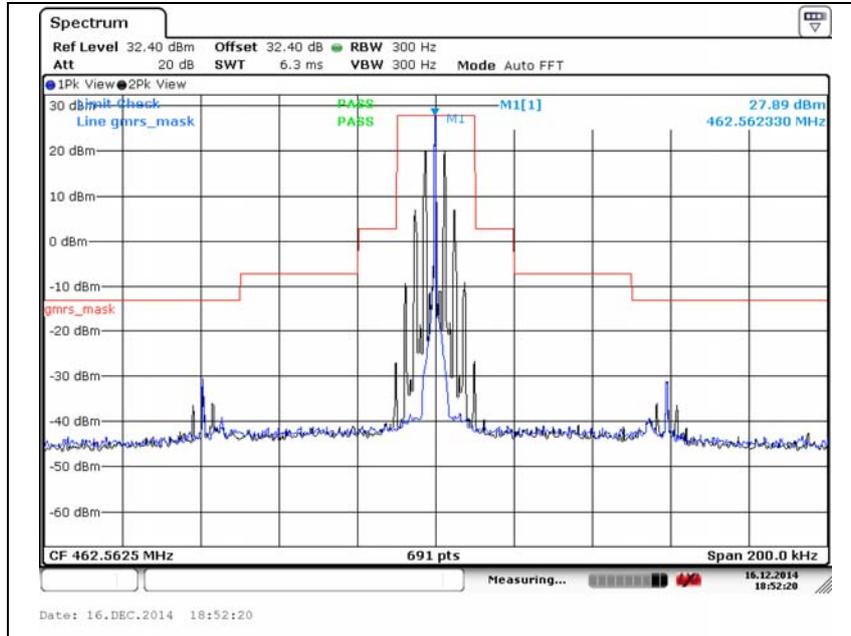
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.  
 The test results in the report only apply to the tested sample.

### 99 % bandwidth for FRS

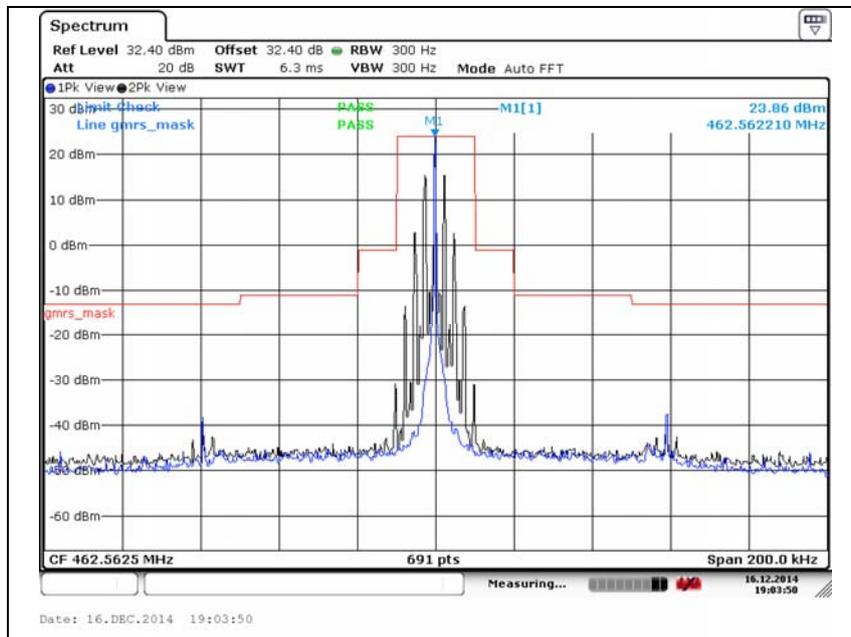


This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.  
 The test results in the report only apply to the tested sample.

### Emission mask for GMRS (High power)

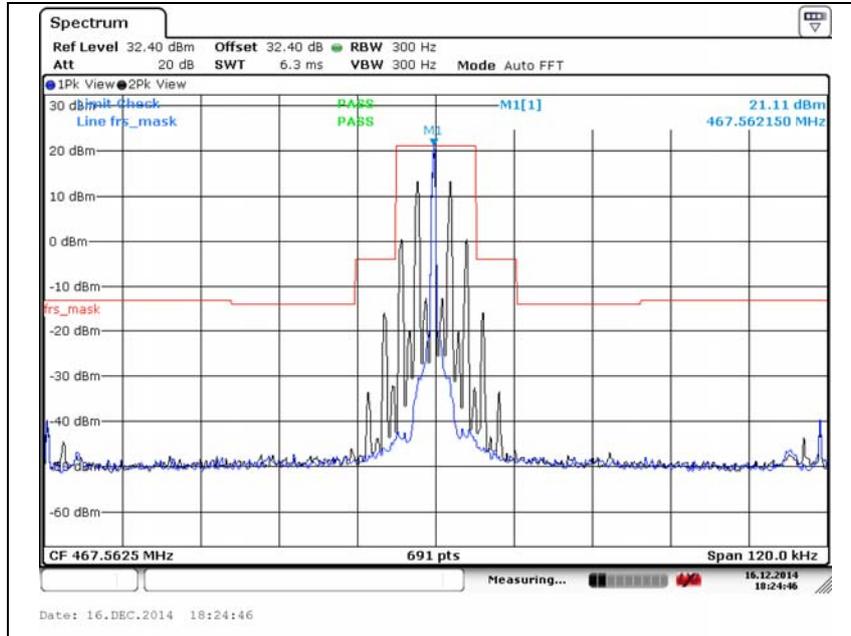


### Emission mask for GMRS (Low power)



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.  
 The test results in the report only apply to the tested sample.

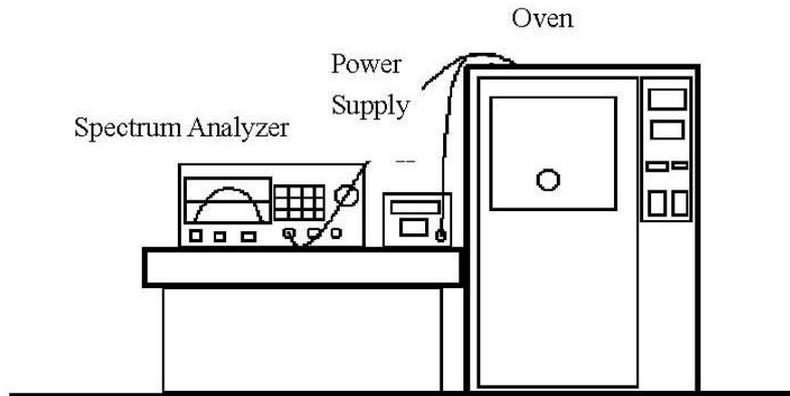
### Emission mask for FRS



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.  
 The test results in the report only apply to the tested sample.

### 3.6. Frequency stability

#### Test setup



#### Test procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. The transmission time was measured with the spectrum analyzer using RBW=1 kHz, VBW=1 kHz.
3. Set the temperature of chamber to -30°C. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a 10°C decreased per stage until the highest temperature 50°C is measured, record all measured frequencies on each temperature step.

#### Frequency stability vs voltage;

1. Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment
2. For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

The output frequency was recorded for each voltage.

---

**Limit**

**§95.621**

(b) Each GMRS transmitter for mobile station, small base station and control station operation must be maintained within a frequency tolerance of 0.000 5%. Each GMRS transmitter for base station (except small base), mobile relay station or fixed station operation must be maintained within a frequency tolerance of 0.000 25%.

**§95.627**

(b) Each FRS unit must be maintained within a frequency tolerance of 0.000 25%.

**RSS-210 A6.1.6**

FRS Devices: Carrier frequency tolerance shall be better than  $\pm 5$  ppm

**RSS-210 A6.2.6**

GMRS Devices: Carrier frequency tolerance shall be better than  $\pm 5$  ppm



**Test results**

Assigned frequency (MHz): 462.562 5

Temperature (°C)	Measure frequency (MHz)	Frequency deviation (Hz)	Frequency deviation (ppm)	Frequency deviation (%)
-30	462.562001	-499	-1.079	-0.000108
-20	462.562019	-481	-1.040	-0.000104
-10	462.562081	-419	-0.906	-0.000091
0	462.562119	-381	-0.824	-0.000082
10	462.562122	-378	-0.817	-0.000082
20	462.562148	-352	-0.761	-0.000076
30	462.562175	-325	-0.703	-0.000070
40	462.562959	459	0.992	0.000099
50	462.563301	801	1.732	0.000173

Temperature (°C)	Voltage (V)	Measure frequency (MHz)	Frequency deviation (ppm)	Frequency deviation (%)
25	3.06	462.562142	-0.774	-0.000077
25	4.14	462.562149	-0.759	-0.000076

Assigned frequency (MHz): 467.562 5

Temperature (°C)	Measure frequency (MHz)	Frequency deviation (Hz)	Frequency deviation (ppm)	Frequency deviation (%)
-30	467.561694	-806	-1.724	-0.000172
-20	467.561850	-650	-1.390	-0.000139
-10	467.561913	-587	-1.255	-0.000126
0	467.561975	-525	-1.123	-0.000112
10	467.562020	-480	-1.027	-0.000103
20	467.562149	-351	-0.751	-0.000075
30	467.562188	-312	-0.667	-0.000067
40	467.562782	282	0.603	0.000060
50	467.563310	810	1.732	0.000173

Temperature (°C)	Voltage (V)	Measure frequency (MHz)	Frequency deviation (ppm)	Frequency deviation (%)
25	3.06	467.562154	-0.740	-0.000074
25	4.14	467.562151	-0.746	-0.000075

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.  
 The test results in the report only apply to the tested sample.

## Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
Spectrum analyzer	R&S	FSV30	101389	1 year	2015.04.30
Wideband Power Sensor	R&S	NRP-Z81	1137.9009.02-101886-ds	1 year	2015.01.07
Vector signal generator	R&S	SMBV2100A	1407.6004K02	1 year	2015.01.06
Trilog-broadband antenna	Schwarzbeck	VULB 9168	9168-385	2 years	2015.05.09
Dipole antenna	R&S	VHAP	574	2 years	2015.05.09
Dipole antenna	R&S	VHAP	575	2 years	2015.05.09
Dipole antenna	R&S	UHAP	545	2 years	2015.05.09
Dipole antenna	R&S	UHAP	546	2 years	2015.05.09
Horn antenna	A.H.	SAS-571	414	2 years	2015.02.28
Horn antenna	A.H.	SAS-571	781	2 years	2015.05.13
Preamplifier	HP	8447F	2805A02570	1 year	2015.04.30
Preamplifier	Schwarzbeck	BBV 9721	9721-003	2 years	2015.09.04
Broadband coaxial preamplifier	Schwarzbeck Mess-Elektronik	BB9718	9718-245	1 year	2015.08.13
Attenuator	HP	8494B	2630A12857	1 year	2015.04.30
Attenuator	BRID	8325	4676	1 year	2015.04.30
EMI Test Receiver	LIG NEX1	ISA-80	L0912K014	1 year	2015.11.14
High pass filter	Mini-circuits	NHP-800+	15542	1 year	2015.07.23
High pass filter	Weinschel	WHKX1.2/15G-6TT	1	1 year	2015.07.23
Modulation analyzer	HP	8901B	3438A05094	1 year	2015.04.30
Audio analyzer	HP	8903B	3413A14728	1 year	2015.07.23
DC power supply	HP	6674A	US36370369	1 year	2015.07.23
Temperature chamber	TABAI	MC711P	112000492	1 year	2015.04.30

## Peripheral devices

Device	Manufacturer	Model No.	Serial No.
N/A			

**Appendix B. Test setup photo**

**Radiated field emissions**



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.  
The test results in the report only apply to the tested sample.