



TEST REPORT

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

Equipment Under Test FRS / GMRS

Model Name LXT500(Variant model: LXT535)

FCC ID MMALXT500

IC Certification 3690A-LXT500

Applicant Midland Radio Corporation

Manufacturer Global Link

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Midland Radio Corporation

5900 Parretta Drive Kansas City Missouri United States 64120

Issued by

KES Co., Ltd.

C3701 Dongil Techno Town, 889-1, Gwanyang 2-dong, Dongan-gu, Anyang-si,
Gyeonggi-do, 431-716, Korea

477-6, Hageo-ri, Yeoju-eup, Yeoju-gun, Gyeonggi-do, 469-803, Korea

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

Test and report completed by :	Report approval by :
	
Jeff Do Test engineer	Gyu-cheol Shin Technical manager



KES Co., Ltd.

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Revision history

Revision	Date of issue	Test report No.	Description
-	2012.02.01	KES-RF-120001	Initial



KES Co., Ltd.

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

TABLE OF CONTENTS

1.0	General product description	4
1.1	Information about variant model	4
1.2	Device modifications	5
1.3	Test facility	5
1.4	Laboratory accreditations and listings	5
1.5	Conclusion of worst-case for each mode of representative channel respectively	6
2.0	Summary of tests	7
2.1	Test data	8
2.1.1	RF output power and radiated spurious emission (Tx & Rx)	8
2.1.2	Modulation limiting	21
2.1.3	Audio frequency response	28
2.1.4	Low-pass filter response	35
2.1.5	Occupied bandwidth and emission mask	38
2.1.6	Frequency stability	47
Appendix A.	Test equipment used for test	53
Appendix B.	Test setup photo	54

1.0 General product description

Equipment under test	FRS / GMRS
Model name	LXT500(Variant model: LXT535)
Serial number	N/A
Frequency Range	462.562 5 MHz ~ 462.712 5 MHz(GMRS Channels 1 ~7)
	467.562 5 MHz ~ 467.712 5 MHz(FRS Channels 8 ~ 14)
	462.550 0 MHz ~ 462.725 0 MHz(GMRS Channels 15 ~ 22)
Emission type	11K0F3E
E.R.P.	GMRS: 0.390 8 W(High power), 0.246 6 W(Low power) / FRS: 0.231 7 W
Number of channel	462.562 5 MHz ~ 462.712 5 MHz(GMRS Channels 1 ~7)
	467.562 5 MHz ~ 467.712 5 MHz(FRS Channels 8 ~ 14)
	462.550 0 MHz ~ 462.725 0 MHz(GMRS Channels 15 ~ 22)
Power source	4 × AAA Alkaline(6 V) / Rechargeable Ni-MH battery pack(4.8 V)

1.1 Information about variant model

Variant model (LXT535) is same as basic model (LXT500) for hardware, software and mechanical. Only variant model is different front panel than basic model. For detailed information, refer to the following;

	Basic model(LXT500)	Variant model(LXT535)
Front panel		

1.2 Device modifications

N/A

1.3 Test facility

C3701 Dongil Techno Town, 889-1, Gwanyang 2-dong, Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
477-6, Hageo-ri, Yeosu-eup, Yeosu-gun, Gyeonggi-do, 469-803, Korea

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.4 Laboratory accreditations and listings

Country	Agency	Scope of accreditation	Logo
USA	FCC	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	 343818
KOREA	KC	EMI (10 meter Open Area Test Site and two conducted sites) Radio (3 & 10 meter Open Area Test Sites and one conducted site)	 KR0100
Canada	IC	3 & 10 meter Open Area Test Sites and one conducted site	 4769B-1



1.5 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	Output power (W)	
				DC 6 V	DC 4.8 V
GMRS	1	462.562 5	High	0.933	0.700
			Low	0.461	0.217
	2	462.587 5	High	0.920	0.690
			Low	0.461	0.217
	3	462.612 5	High	0.930	0.680
			Low	0.461	0.216
	4	462.637 5	High	0.920	0.700
			Low	0.461	0.217
	5	462.662 5	High	0.920	0.680
			Low	0.460	0.216
	6	462.687 5	High	0.920	0.700
			Low	0.457	0.215
	7	462.712 5	High	0.920	0.670
			Low	0.454	0.214
FRS	8	467.562 5	N/A	0.416	0.256
	9	467.587 5		0.415	0.254
	10	467.612 5		0.416	0.254
	11	467.637 5		0.412	0.252
	12	467.662 5		0.411	0.251
	13	467.687 5		0.410	0.251
	14	467.712 5		0.316	0.254
GMRS	15	462.550 0	High	0.930	0.700
			Low	0.456	0.214
	16	462.575 0	High	0.920	0.700
			Low	0.456	0.214
	17	462.600 0	High	0.920	0.670
			Low	0.454	0.213
	18	462.625 0	High	0.910	0.690
			Low	0.451	0.213
	19	462.650 0	High	0.910	0.670
			Low	0.455	0.214
	20	462.675 0	High	0.900	0.680
			Low	0.454	0.214
	21	462.700 0	High	0.910	0.670
			Low	0.454	0.214
	22	462.725 0	High	0.900	0.680
			Low	0.453	0.213

Therefore all applicable requirements were tested to the two channels, the 1st for GMRS and the 8th for FRS.

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

2.0 Summary of tests

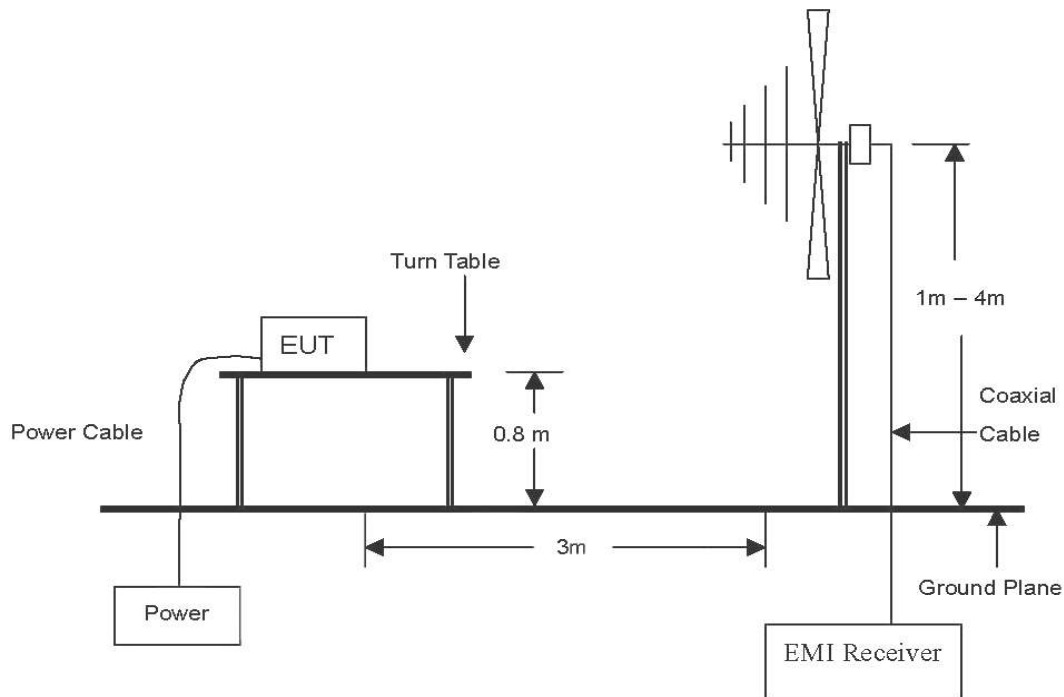
Section in FCC Part 95 & RSS-210	Parameter	Status
95.639 RSS-210 A6.1.4 RSS-210 A6.2.4	RF output power	C
95.637 RSS-210 A6.1.2 RSS-210 A6.2.2	Modulation limiting	C
2.1047	Audio frequency response	C
95.637 RSS-210 A6.2.2	Low-pass filter response	C
95.633, 95.635 RSS-210 A6.1.3 RSS-210 A6.2.3 RSS-210 A6.1.5 RSS-210 A6.2.5	Occupied bandwidth and emission mask	C
95.635 RSS-210 A6.1.5 RSS-201 A6.2.5	Radiated spurious emissions – Tx	C
RSS-Gen 6 (a)	Radiated spurious emissions – Rx	C
95.621, 95.627 RSS-210 A6.1.6 RSS-201 A6.2.6	Frequency stability	C
Note: C=Complies NC=Not complies NT=Not tested NA=Not applicable		

2.1 Test data

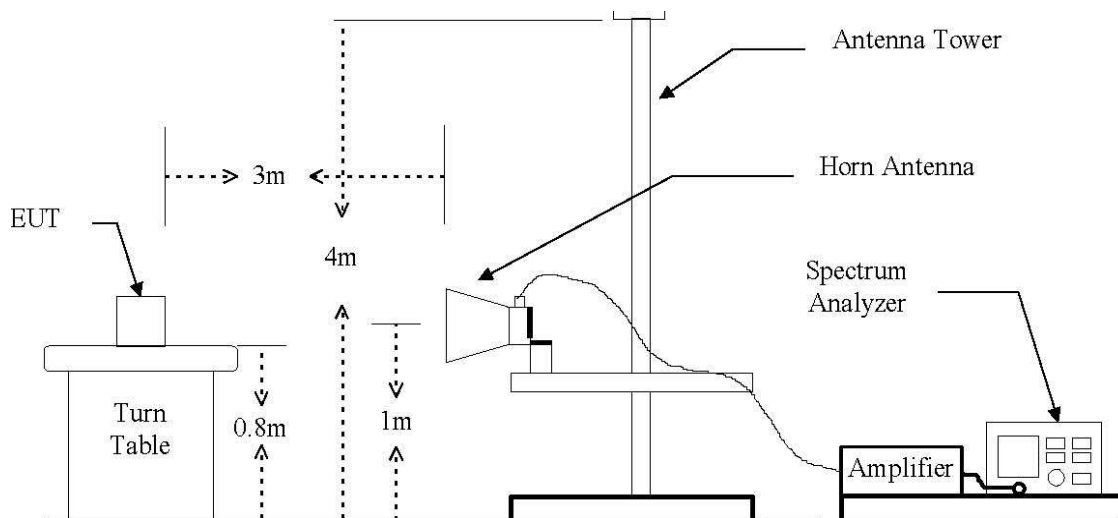
2.1.1 RF output power and radiated spurious emission (Tx & Rx)

Test setup

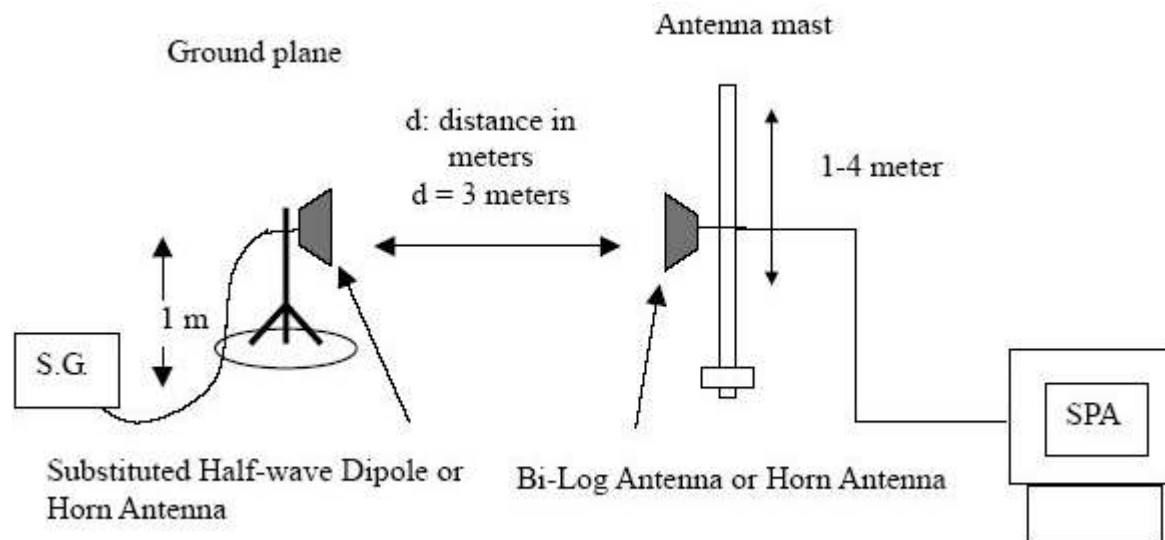
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



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: Tx

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.



Radiated spurious emissions – Rx

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter OATS. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3 meters away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to peak detect Function and specified bandwidth with maximum hold mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.



KES Co., Ltd.

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

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 – Tx

§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%.

Radiated spurious emissions – Rx

RSS-Gen 6.1

Frequency (MHz)	Field Strength (microvolt/m at 3 meters)
30 ~ 88	100
88 ~ 216	150
216 ~ 960	200
Above 960	500



Test results

RF output power

GMRS (High power), DC 6 V

Frequency (MHz)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	E.R.P.	
				(dBm)	(W)
462.562 5	H	18.50	3.02	21.52	0.141 9
462.562 5	V	21.00	4.92	25.92	0.390 8

GMRS (Low power), DC 6 V

Frequency (MHz)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	E.R.P.	
				(dBm)	(W)
462.562 5	H	18.50	3.46	21.96	0.157 0
462.562 5	V	21.00	2.47	23.47	0.222 3

FRS, DC 6 V

Frequency (MHz)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	E.R.P.	
				(dBm)	(W)
467.562 5	H	18.50	4.23	22.73	0.187 5
467.562 5	V	19.00	4.65	23.65	0.231 7

GMRS (High power), DC 4.8 V

Frequency (MHz)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	E.R.P.	
				(dBm)	(W)
462.562 5	H	18.50	3.68	22.18	0.165 2
462.562 5	V	21.00	2.92	23.92	0.246 6

GMRS (Low power), DC 4.8 V

Frequency (MHz)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	E.R.P.	
				(dBm)	(W)
18.50	2.10	20.60	2.10	20.60	0.114 8
21.00	1.36	22.36	1.36	22.36	0.172 2

FRS, DC 4.8 V

Frequency (MHz)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	E.R.P.	
				(dBm)	(W)
467.5625	H	18.50	2.73	21.23	0.132 7
467.5625	V	19.00	3.66	22.66	0.184 5

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Radiated spurious emissions for DC 6 V(Tx)**GMRS (High power)**

Frequency (MHz)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	Absolute level (dBm)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
925.125 0	H	-23.00	2.01	-20.99	46.91	38.92	7.99
925.125 0	V	-23.00	2.53	-20.47	46.39	38.92	7.47
1387.687 5	H	-27.00	7.36	-19.64	45.56	38.92	6.64
1387.687 5	V	-27.00	8.55	-18.45	44.37	38.92	5.45
1850.250 0	H	-37.00	7.41	-29.59	55.51	38.92	16.59
1850.250 0	V	-37.00	9.55	-27.45	53.37	38.92	14.45
2312.812 5	H	-20.00	1.96	-18.04	43.96	38.92	5.04
2312.812 5	V	-20.00	4.96	-15.04	40.96	38.92	2.04
2775.375 0	H	-33.00	9.87	-23.13	49.05	38.92	10.13
2775.375 0	V	-33.00	10.40	-22.60	48.52	38.92	9.60
3237.937 5	H	-33.00	12.43	-20.57	46.49	38.92	7.57
3237.937 5	V	-35.00	11.01	-23.99	49.91	38.92	10.99
3700.500 0	H	-48.00	12.67	-35.33	61.25	38.92	22.33
3700.500 0	V	-44.00	11.57	-32.43	58.35	38.92	19.43
4163.062 5	H	-44.00	13.11	-30.89	56.81	38.92	17.89
4163.062 5	V	-44.00	10.67	-33.33	59.25	38.92	20.33
4625.625 0	H	-56.00	10.66	-45.34	71.26	38.92	32.34
4625.625 0	V	-56.00	13.86	-42.14	68.06	38.92	29.14

Remark;

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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Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
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GMRS (Low power)

Frequency (MHz)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	Absolute level (dBm)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
925.125 0	H	-23.00	-0.70	-23.70	47.17	36.47	10.70
925.125 0	V	-23.00	-1.03	-24.03	47.50	36.47	11.03
1387.687 5	H	-27.00	7.99	-19.01	42.48	36.47	6.01
1387.687 5	V	-27.00	8.17	-18.83	42.30	36.47	5.83
1850.250 0	H	-37.00	8.79	-28.21	51.68	36.47	15.21
1850.250 0	V	-37.00	10.02	-26.98	50.45	36.47	13.98
2312.812 5	H	-20.00	5.53	-14.47	37.94	36.47	1.47
2312.812 5	V	-20.00	5.17	-14.83	38.30	36.47	1.83
2775.375 0	H	-33.00	16.67	-16.33	39.80	36.47	3.33
2775.375 0	V	-33.00	18.70	-14.30	37.77	36.47	1.30
3237.937 5	H	-33.00	18.71	-14.29	37.76	36.47	1.29
3237.937 5	V	-35.00	19.30	-15.70	39.17	36.47	2.70
3700.500 0	H	-48.00	27.32	-20.68	44.15	36.47	7.68
3700.500 0	V	-44.00	27.57	-16.43	39.90	36.47	3.43
4163.062 5	H	-44.00	23.90	-20.10	43.57	36.47	7.10
4163.062 5	V	-44.00	20.10	-23.90	47.37	36.47	10.90
4625.625 0	H	-56.00	18.09	-37.91	61.38	36.47	24.91
4625.625 0	V	-56.00	27.89	-28.11	51.58	36.47	15.11

Remark;

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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FRS

Frequency (MHz)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	Absolute level (dBm)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
935.125 0	H	-23.00	1.08	-21.92	45.57	36.65	8.92
935.125 0	V	-23.00	1.63	-21.37	45.02	36.65	8.37
1402.687 5	H	-30.00	10.43	-19.57	43.22	36.65	6.57
1402.687 5	V	-28.00	10.57	-17.43	41.08	36.65	4.43
1870.250 0	H	-30.00	11.69	-18.31	41.96	36.65	5.31
1870.250 0	V	-31.00	11.44	-19.56	43.21	36.65	6.56
2337.812 5	H	-21.00	5.93	-15.07	38.72	36.65	2.07
2337.812 5	V	-21.00	6.64	-14.36	38.01	36.65	1.36
2805.375 0	H	-30.00	11.90	-18.10	41.75	36.65	5.10
2805.375 0	V	-26.00	11.94	-14.06	37.71	36.65	1.06
3272.937 5	H	-25.00	9.54	-15.46	39.11	36.65	2.46
3272.937 5	V	-20.00	4.69	-15.31	38.96	36.65	2.31
3740.500 0	H	-27.00	12.16	-14.84	38.49	36.65	1.84
3740.500 0	V	-22.00	7.58	-14.42	38.07	36.65	1.42
4208.062 5	H	-34.00	12.07	-21.93	45.58	36.65	8.93
4208.062 5	V	-34.00	12.58	-21.42	45.07	36.65	8.42
4675.625 0	H	-36.00	13.20	-22.80	46.45	36.65	9.80
4675.625 0	V	-32.00	13.37	-18.63	42.28	36.65	5.63

Remark;

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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www.kes.co.kr

Radiated spurious emissions for DC 4.8 V(Tx)**GMRS (High power)**

Frequency (MHz)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	Absolute level (dBm)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
925.125 0	H	-23.00	0.33	-22.67	46.59	36.92	9.67
925.125 0	V	-23.00	0.68	-22.32	46.24	36.92	9.32
1387.687 5	H	-27.00	7.57	-19.43	43.35	36.92	6.43
1387.687 5	V	-27.00	9.17	-17.83	41.75	36.92	4.83
1850.250 0	H	-37.00	8.18	-28.82	52.74	36.92	15.82
1850.250 0	V	-37.00	10.63	-26.37	50.29	36.92	13.37
2312.812 5	H	-20.00	0.02	-19.98	43.90	36.92	6.98
2312.812 5	V	-20.00	3.39	-16.61	40.53	36.92	3.61
2775.375 0	H	-33.00	11.00	-22.00	45.92	36.92	9.00
2775.375 0	V	-33.00	11.25	-21.75	45.67	36.92	8.75
3237.937 5	H	-33.00	13.31	-19.69	43.61	36.92	6.69
3237.937 5	V	-35.00	11.34	-23.66	47.58	36.92	10.66
3700.500 0	H	-48.00	13.35	-34.65	58.57	36.92	21.65
3700.500 0	V	-44.00	12.36	-31.64	55.56	36.92	18.64
4163.062 5	H	-44.00	13.46	-30.54	54.46	36.92	17.54
4163.062 5	V	-44.00	11.50	-32.50	56.42	36.92	19.50
4625.625 0	H	-56.00	11.68	-44.32	68.24	36.92	31.32
4625.625 0	V	-56.00	14.26	-41.74	65.66	36.92	28.74

Remark;

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

**KES Co., Ltd.**

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
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GMRS (Low power)

Frequency (MHz)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	Absolute level (dBm)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
925.125 0	H	-23.00	-2.50	-25.50	47.86	35.36	12.50
925.125 0	V	-23.00	-2.40	-25.40	47.76	35.36	12.40
1387.687 5	H	-27.00	6.63	-20.37	42.73	35.36	7.37
1387.687 5	V	-27.00	7.08	-19.92	42.28	35.36	6.92
1850.250 0	H	-37.00	6.80	-30.20	52.56	35.36	17.20
1850.250 0	V	-37.00	8.93	-28.07	50.43	35.36	15.07
2312.812 5	H	-20.00	3.85	-16.15	38.51	35.36	3.15
2312.812 5	V	-20.00	3.45	-16.55	38.91	35.36	3.55
2775.375 0	H	-33.00	15.27	-17.73	40.09	35.36	4.73
2775.375 0	V	-33.00	17.65	-15.35	37.71	35.36	2.35
3237.937 5	H	-33.00	17.53	-15.47	37.83	35.36	2.47
3237.937 5	V	-35.00	17.94	-17.06	39.42	35.36	4.06
3700.500 0	H	-48.00	25.53	-22.47	44.83	35.36	9.47
3700.500 0	V	-44.00	26.48	-17.52	39.88	35.36	4.52
4163.062 5	H	-44.00	22.05	-21.95	44.31	35.36	8.95
4163.062 5	V	-44.00	18.59	-25.41	47.77	35.36	12.41
4625.625 0	H	-56.00	16.33	-39.67	62.03	35.36	26.67
4625.625 0	V	-56.00	26.61	-29.39	51.75	35.36	16.39

Remark;

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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FRS

Frequency (MHz)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	Absolute level (dBm)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
935.125 0	H	-23.00	-0.69	-23.69	46.35	35.66	10.69
935.125 0	V	-23.00	-0.07	-23.07	45.73	35.66	10.07
1402.687 5	H	-30.00	9.42	-20.58	43.24	35.66	7.58
1402.687 5	V	-28.00	9.31	-18.69	41.35	35.66	5.69
1870.250 0	H	-30.00	10.23	-19.77	42.43	35.66	6.77
1870.250 0	V	-31.00	9.89	-21.11	43.77	35.66	8.11
2337.812 5	H	-21.00	4.70	-16.30	38.96	35.66	3.30
2337.812 5	V	-21.00	5.19	-15.81	38.47	35.66	2.81
2805.375 0	H	-30.00	10.44	-19.56	42.22	35.66	6.56
2805.375 0	V	-26.00	10.47	-15.53	38.19	35.66	2.53
3272.937 5	H	-25.00	8.36	-16.64	39.30	35.66	3.64
3272.937 5	V	-20.00	3.05	-16.95	39.61	35.66	3.95
3740.500 0	H	-27.00	11.07	-15.93	38.59	35.66	2.93
3740.500 0	V	-22.00	5.85	-16.15	38.81	35.66	3.15
4208.062 5	H	-34.00	10.07	-23.93	46.59	35.66	10.93
4208.062 5	V	-34.00	11.20	-22.80	45.46	35.66	9.80
4675.625 0	H	-36.00	11.49	-24.51	47.17	35.66	11.51
4675.625 0	V	-32.00	12.10	-19.90	42.56	35.66	6.90

Remark;

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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Radiated spurious emissions(Rx)

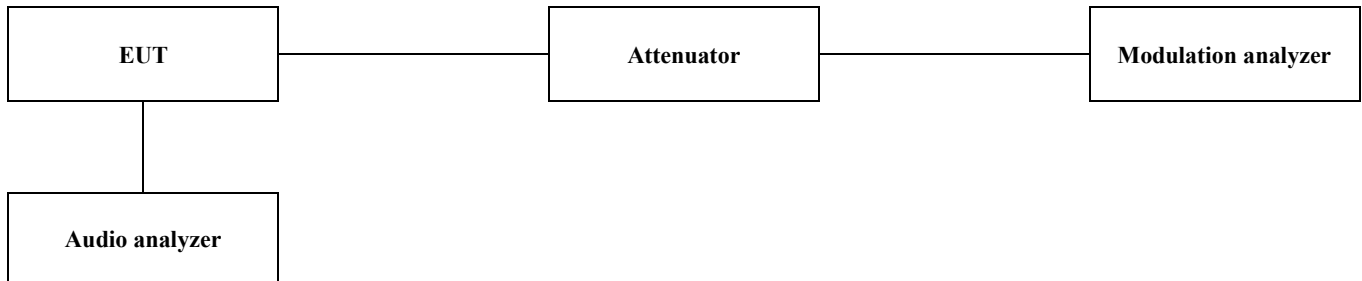
Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
42.1	8.54	V	13.37	0.86	22.77	40.00	17.23
95.5	15.13	V	8.24	1.22	24.59	43.52	18.93
129.4	16.72	V	11.91	1.31	29.94	43.52	13.58
161.0	14.49	V	13.23	1.61	29.33	43.52	14.19
173.1	14.83	V	12.22	1.63	28.68	43.52	14.84
192.5	13.09	H	10.58	1.72	25.93	43.52	18.13
219.2	13.70	V	10.60	1.82	26.12	46.02	19.90

Remark

1. All spurious emission at channels are almost the same below 1 GHz, so that 1st for GMRS(DC 6 V) was chosen at representative in final test.
2. Actual = Reading + Ant. factor + Cable loss
3. Detector mode: Quasi peak
4. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.
5. The frequency spectrum from 30 MHz to 1 000 MHz was investigated. Emission levels are not reported much lower than the limits by over 20 dB.
6. The data is voluntarily submitted for verification procedure.

2.1.2 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 ± 2.5 kHz. The limiter shall be followed by a low-pass filter to remove unwanted harmonics.

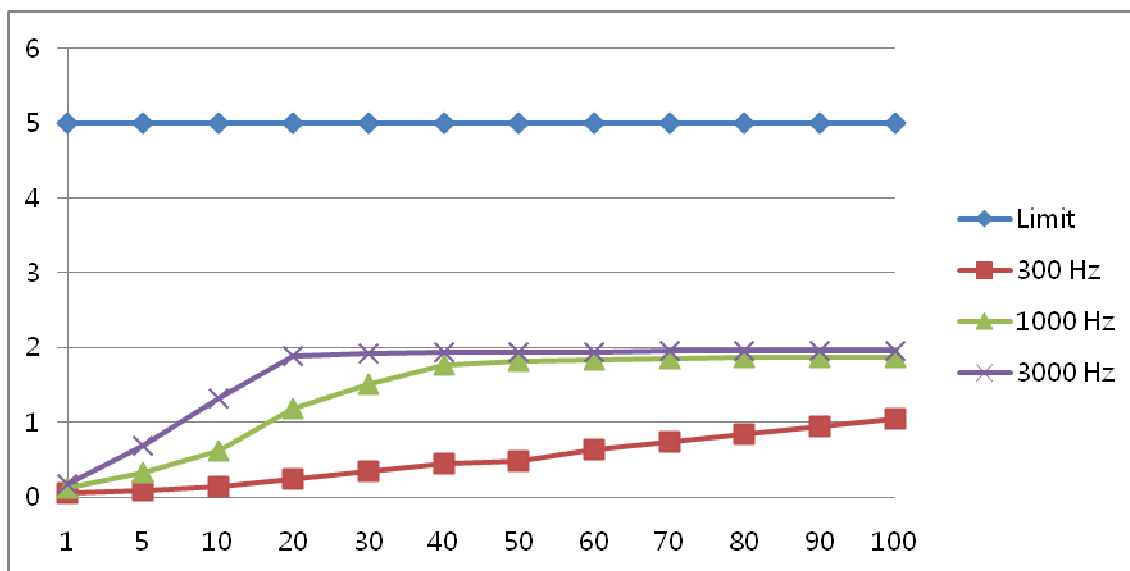
RSS-210 A6.2.2

(b) For emission types F1D, G1D, G3E, F3E or F2D, the peak frequency deviation shall not exceed ± 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 (High power), DC 6 V

Audio level (mV)	Deviation at 300 Hz	Deviation at 1 kHz	Deviation at 3 kHz	Limit (kHz)
1	0.06	0.12	0.17	5
5	0.09	0.33	0.68	5
10	0.14	0.61	1.32	5
20	0.24	1.18	1.88	5
30	0.34	1.50	1.92	5
40	0.44	1.76	1.94	5
50	0.48	1.81	1.94	5
60	0.64	1.84	1.94	5
70	0.74	1.85	1.95	5
80	0.84	1.86	1.95	5
90	0.94	1.86	1.95	5
100	1.04	1.87	1.96	5



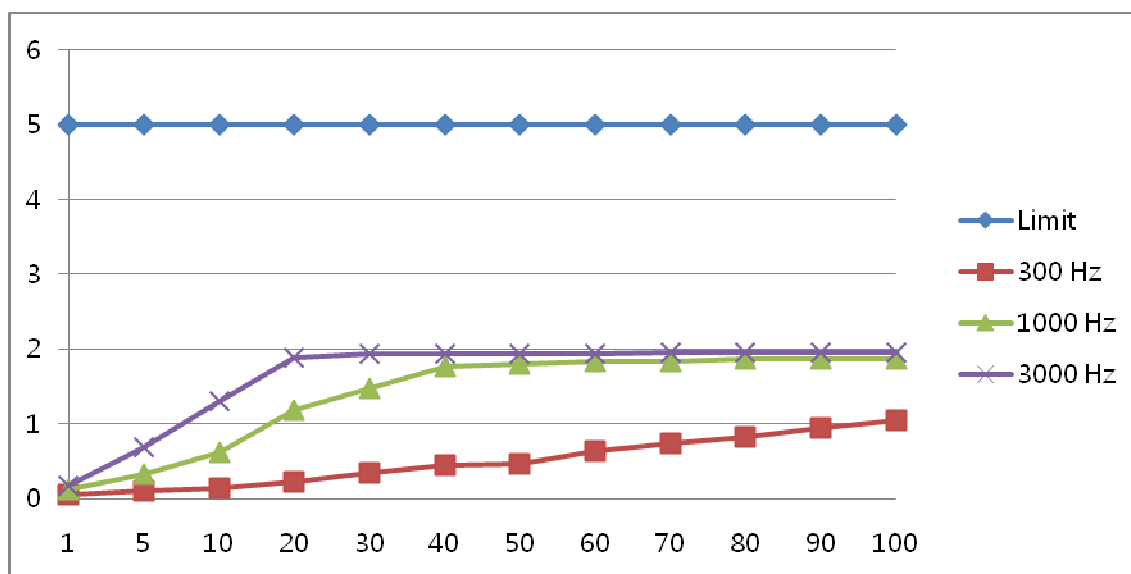


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C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
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GMRS (Low power), DC 6 V

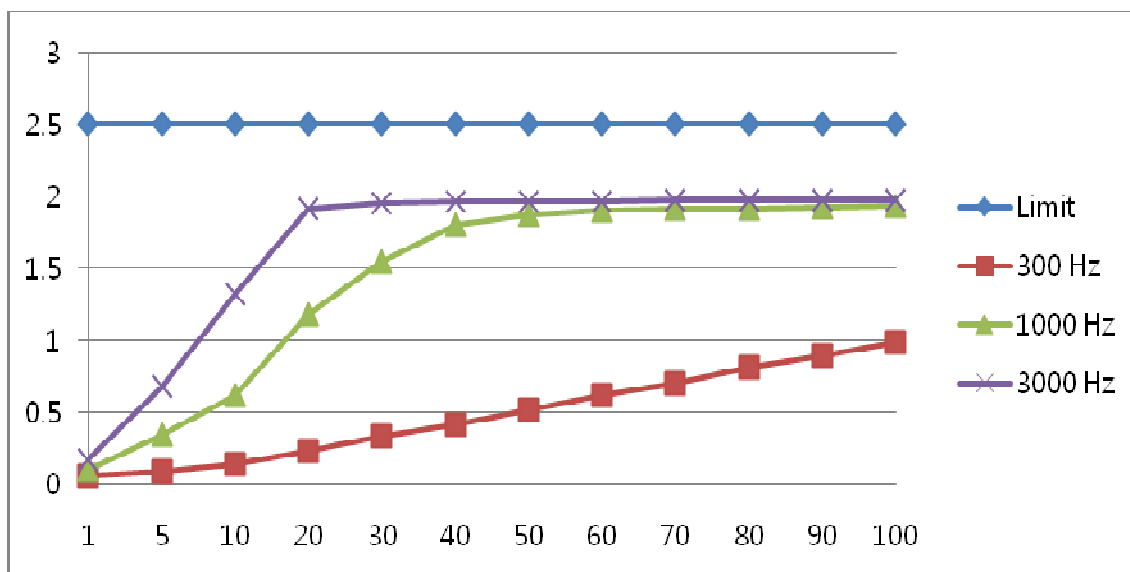
Audio level (mV)	Deviation at 300 Hz	Deviation at 1 kHz	Deviation at 3 kHz	Limit (kHz)
1	0.06	0.12	0.17	5
5	0.10	0.32	0.69	5
10	0.13	0.62	1.31	5
20	0.23	1.19	1.89	5
30	0.34	1.48	1.93	5
40	0.45	1.77	1.94	5
50	0.47	1.80	1.94	5
60	0.64	1.84	1.94	5
70	0.74	1.84	1.95	5
80	0.83	1.86	1.95	5
90	0.95	1.86	1.95	5
100	1.05	1.86	1.96	5





FRS, DC 6 V

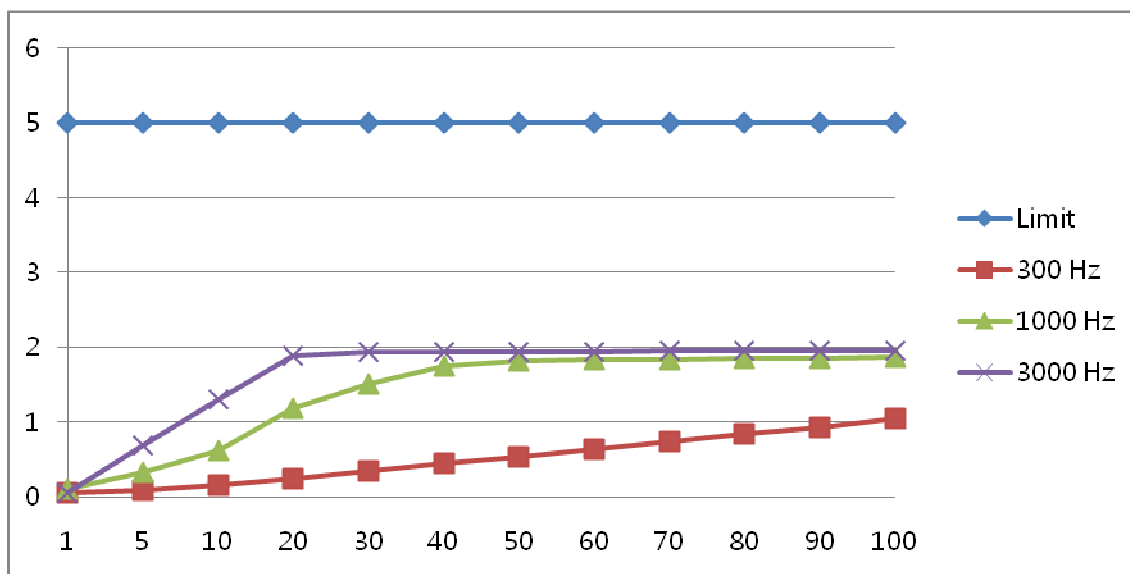
Audio level (mV)	Deviation at 300 Hz	Deviation at 1 kHz	Deviation at 3 kHz	Limit (kHz)
1	0.06	0.10	0.17	2.5
5	0.09	0.34	0.68	2.5
10	0.14	0.62	1.32	2.5
20	0.23	1.18	1.91	2.5
30	0.33	1.55	1.95	2.5
40	0.42	1.80	1.96	2.5
50	0.52	1.87	1.97	2.5
60	0.62	1.90	1.97	2.5
70	0.70	1.91	1.98	2.5
80	0.81	1.91	1.98	2.5
90	0.89	1.92	1.98	2.5
100	0.99	1.93	1.98	2.5





GMRS (High power) DC 4.8 V

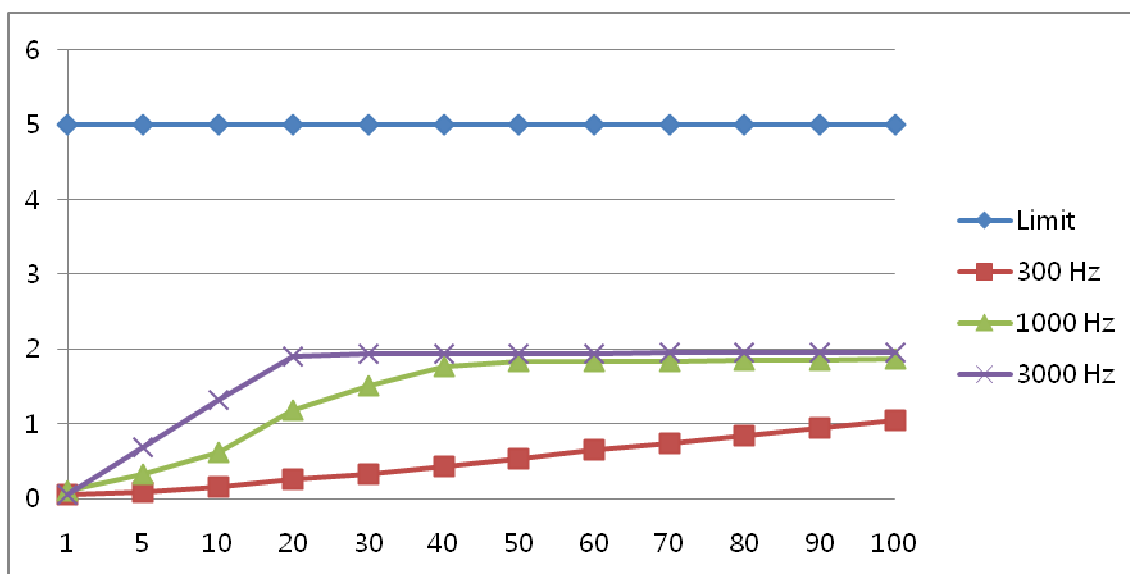
Audio level (mV)	Deviation at 300 Hz	Deviation at 1 kHz	Deviation at 3 kHz	Limit (kHz)
1	0.06	0.10	0.06	5
5	0.09	0.32	0.68	5
10	0.16	0.61	1.31	5
20	0.24	1.18	1.89	5
30	0.34	1.50	1.93	5
40	0.44	1.75	1.94	5
50	0.53	1.82	1.94	5
60	0.64	1.83	1.94	5
70	0.74	1.84	1.95	5
80	0.84	1.85	1.95	5
90	0.93	1.85	1.95	5
100	1.04	1.86	1.95	5





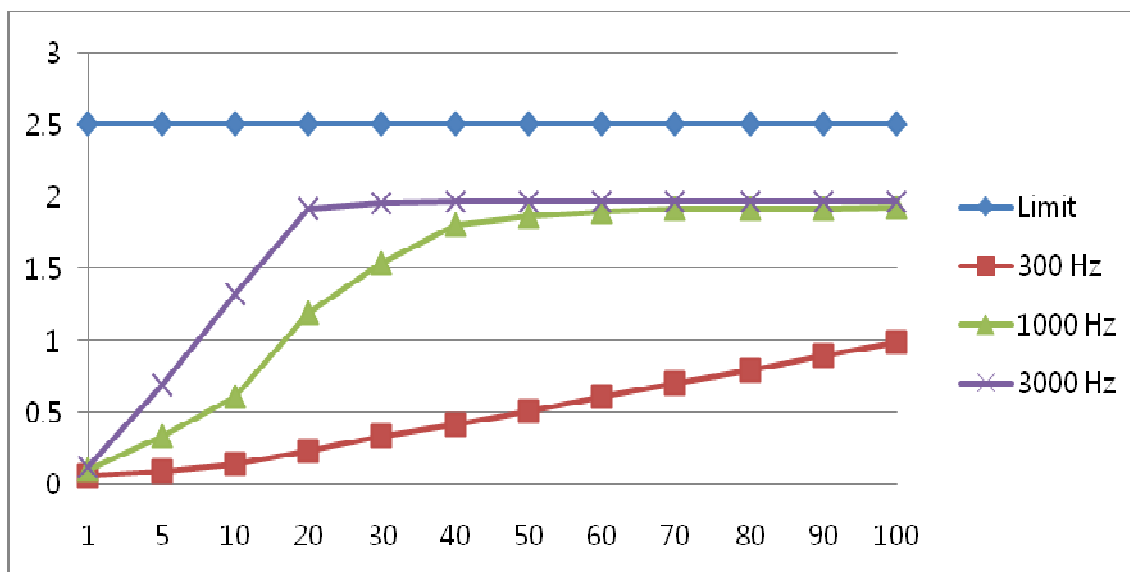
GMRS (Low power), DC 4.8 V

Audio level (mV)	Deviation at 300 Hz	Deviation at 1 kHz	Deviation at 3 kHz	Limit (kHz)
1	0.06	0.10	0.06	5
5	0.09	0.33	0.69	5
10	0.15	0.62	1.32	5
20	0.25	1.19	1.90	5
30	0.33	1.51	1.93	5
40	0.43	1.76	1.94	5
50	0.54	1.83	1.94	5
60	0.65	1.83	1.94	5
70	0.73	1.84	1.95	5
80	0.84	1.85	1.95	5
90	0.94	1.85	1.95	5
100	1.04	1.86	1.95	5



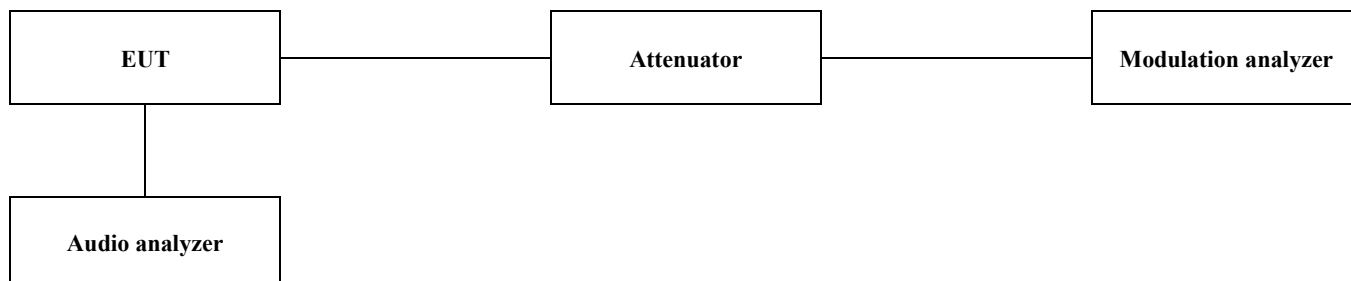
FRS, DC 4.8 V

Audio level (mV)	Deviation at 300 Hz	Deviation at 1 kHz	Deviation at 3 kHz	Limit (kHz)
1	0.06	0.10	0.12	2.5
5	0.09	0.33	0.69	2.5
10	0.14	0.61	1.32	2.5
20	0.23	1.19	1.91	2.5
30	0.33	1.54	1.95	2.5
40	0.42	1.80	1.96	2.5
50	0.51	1.86	1.96	2.5
60	0.61	1.89	1.97	2.5
70	0.70	1.91	1.97	2.5
80	0.79	1.91	1.97	2.5
90	0.89	1.91	1.97	2.5
100	0.99	1.92	1.97	2.5



2.1.3 Audio frequency response

Test setup



Test procedure

TIA/EIA-603-C

Limit

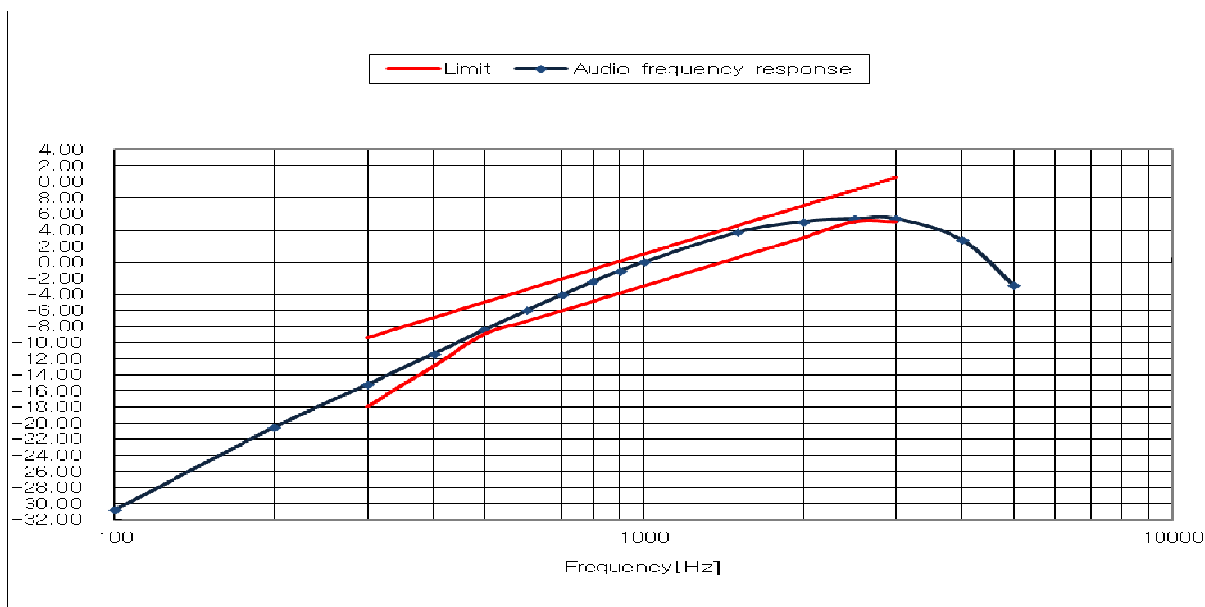
§2.1047

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

GMRS (High power), DC 6 V

Audio frequency(Hz)	Deviation(kHz)	Response(dB)
100	0.02	-30.77
200	0.07	-20.53
300	0.12	-15.21
400	0.19	-11.40
500	0.26	-8.42
600	0.35	-6.03
700	0.43	-4.08
800	0.52	-2.44
900	0.61	-1.11
1000	0.69	0.00
1500	1.06	3.68
2000	1.23	5.02
2500	1.28	5.35
3000	1.29	5.39
4000	0.95	2.77
5000	0.50	-2.86



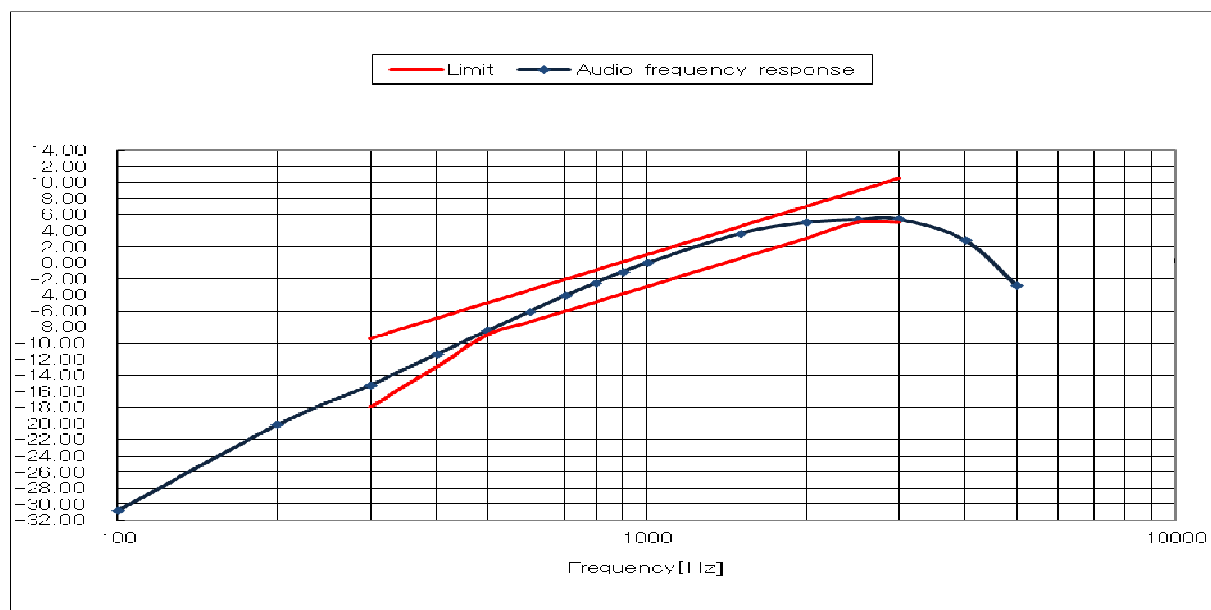


KES Co., Ltd.

C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

GMRS (Low power), DC 6 V

Audio frequency(Hz)	Deviation(kHz)	Response(dB)
100	0.02	-30.76
200	0.07	-20.13
300	0.12	-15.19
400	0.19	-11.35
500	0.26	-8.43
600	0.34	-6.05
700	0.43	-4.07
800	0.52	-2.46
900	0.61	-1.11
1000	0.69	0.00
1500	1.05	3.66
2000	1.23	5.04
2500	1.28	5.39
3000	1.29	5.44
4000	0.96	2.85
5000	0.50	-2.80



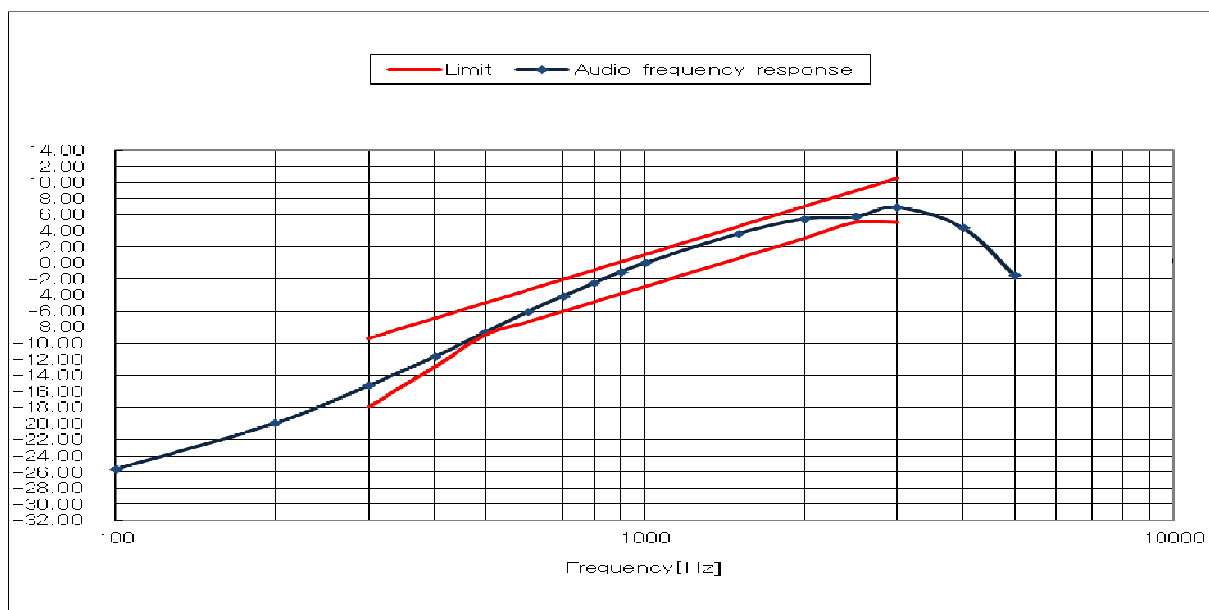


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C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
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FRS, DC 6 V

Audio frequency(Hz)	Deviation(kHz)	Response(dB)
100	0.02	-25.63
200	0.03	-19.92
300	0.06	-15.27
400	0.08	-11.66
500	0.12	-8.60
600	0.16	-6.08
700	0.20	-4.14
800	0.24	-2.53
900	0.29	-1.13
1000	0.33	0.00
1500	0.49	3.64
2000	0.61	5.50
2500	0.63	5.75
3000	0.72	6.91
4000	0.54	4.39
5000	0.27	-1.55



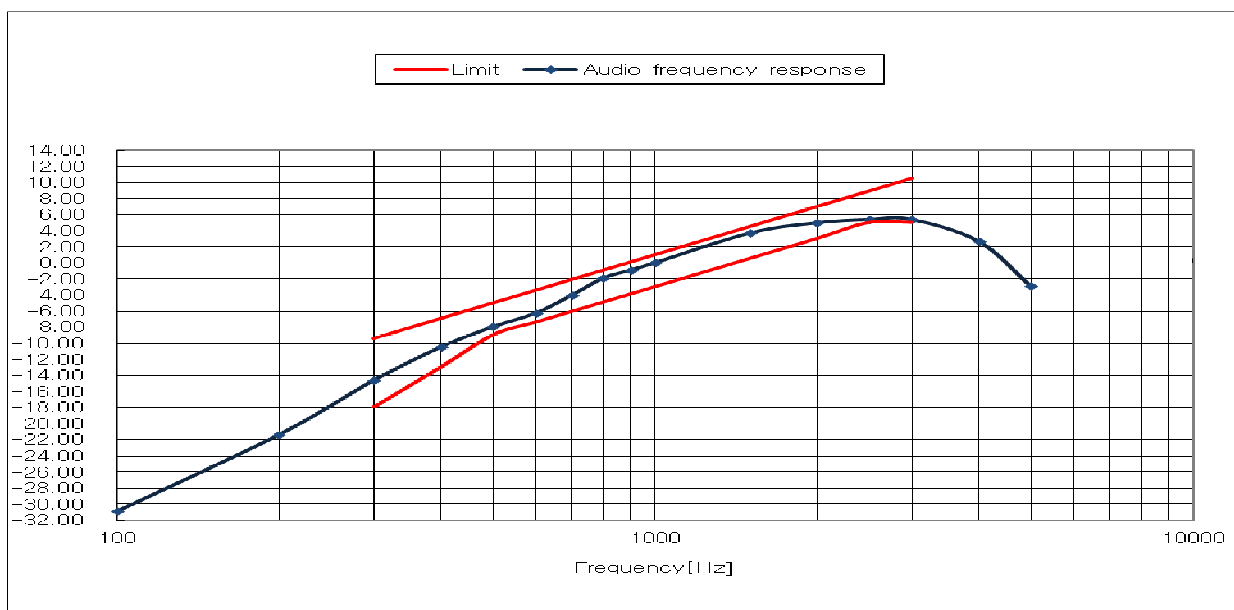


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GMRS (High power), DC 4.8 V

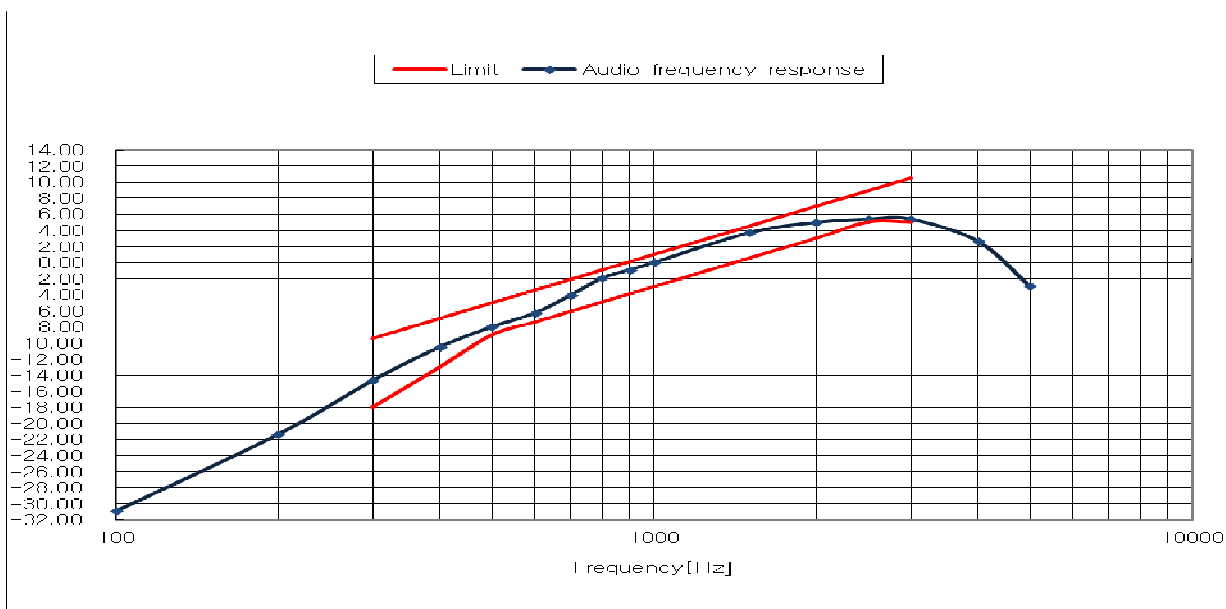
Audio frequency(Hz)	Deviation(kHz)	Response(dB)
100	0.02	-30.88
200	0.06	-21.34
300	0.13	-14.62
400	0.21	-10.46
500	0.28	-7.96
600	0.34	-6.27
700	0.44	-4.03
800	0.56	-1.94
900	0.63	-0.92
1000	0.70	0.00
1500	1.07	3.69
2000	1.24	4.97
2500	1.30	5.38
3000	1.30	5.38
4000	0.95	2.65
5000	0.50	-2.92





GMRS (Low power), DC 4.8 V

Audio frequency(Hz)	Deviation(kHz)	Response(dB)
100	0.02	-30.88
200	0.06	-21.34
300	0.13	-14.62
400	0.21	-10.46
500	0.28	-7.96
600	0.34	-6.27
700	0.44	-4.03
800	0.56	-1.94
900	0.63	-0.92
1000	0.70	0.00
1500	1.07	3.69
2000	1.24	4.97
2500	1.30	5.38
3000	1.30	5.38
4000	0.95	2.65
5000	0.50	-2.92



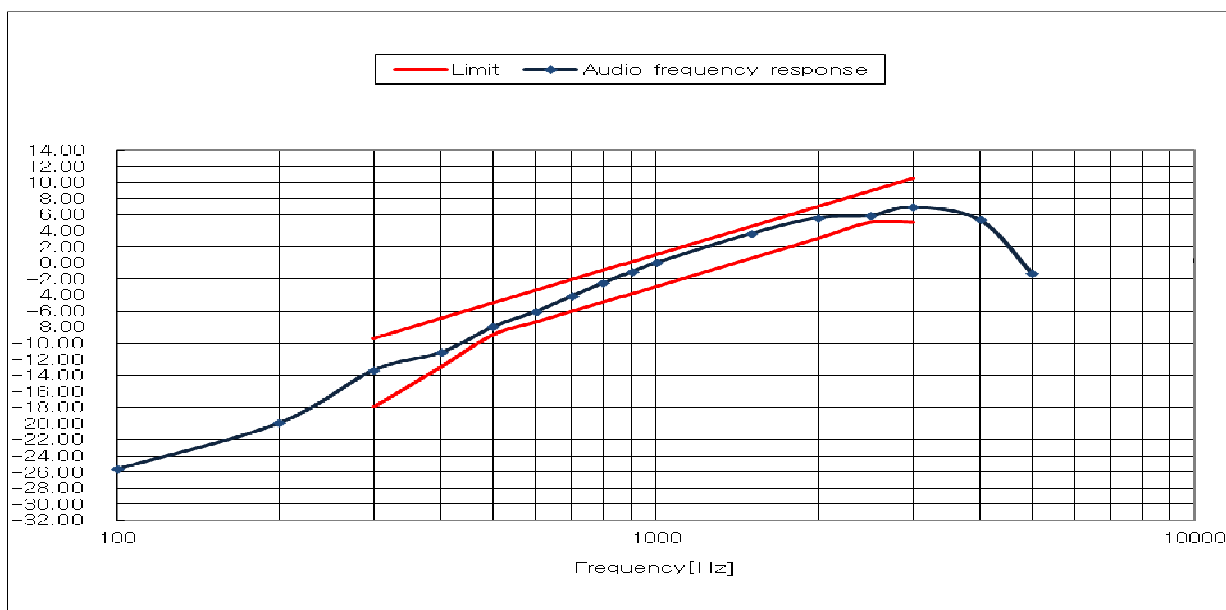


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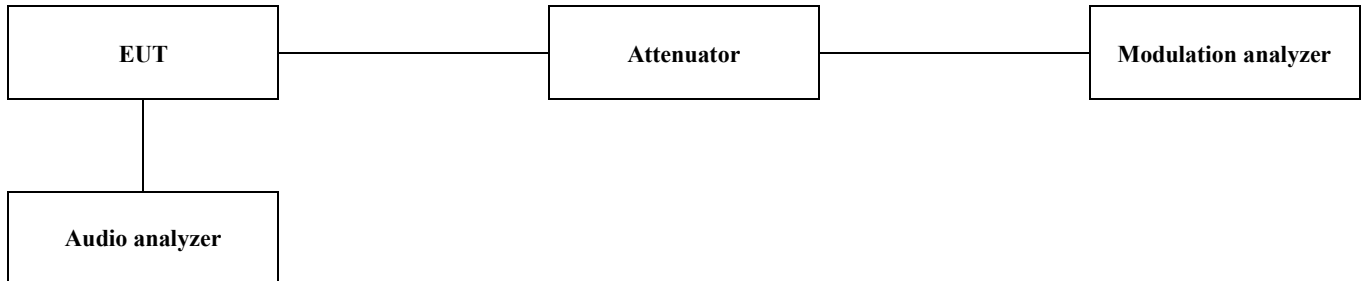
FRS, DC 4.8 V

Audio frequency(Hz)	Deviation(kHz)	Response(dB)
100	0.02	-25.63
200	0.03	-19.92
300	0.07	-13.34
400	0.09	-11.15
500	0.13	-7.96
600	0.16	-6.08
700	0.20	-4.14
800	0.24	-2.53
900	0.29	-1.13
1000	0.33	0.00
1500	0.49	3.64
2000	0.62	5.61
2500	0.64	5.89
3000	0.72	6.91
4000	0.60	5.33
5000	0.28	-1.29



2.1.4 Low-pass filter response

Test setup



Test procedure

TIA/EIA-603-C

Limit

§95.637 & RSS-210 A6.2.2

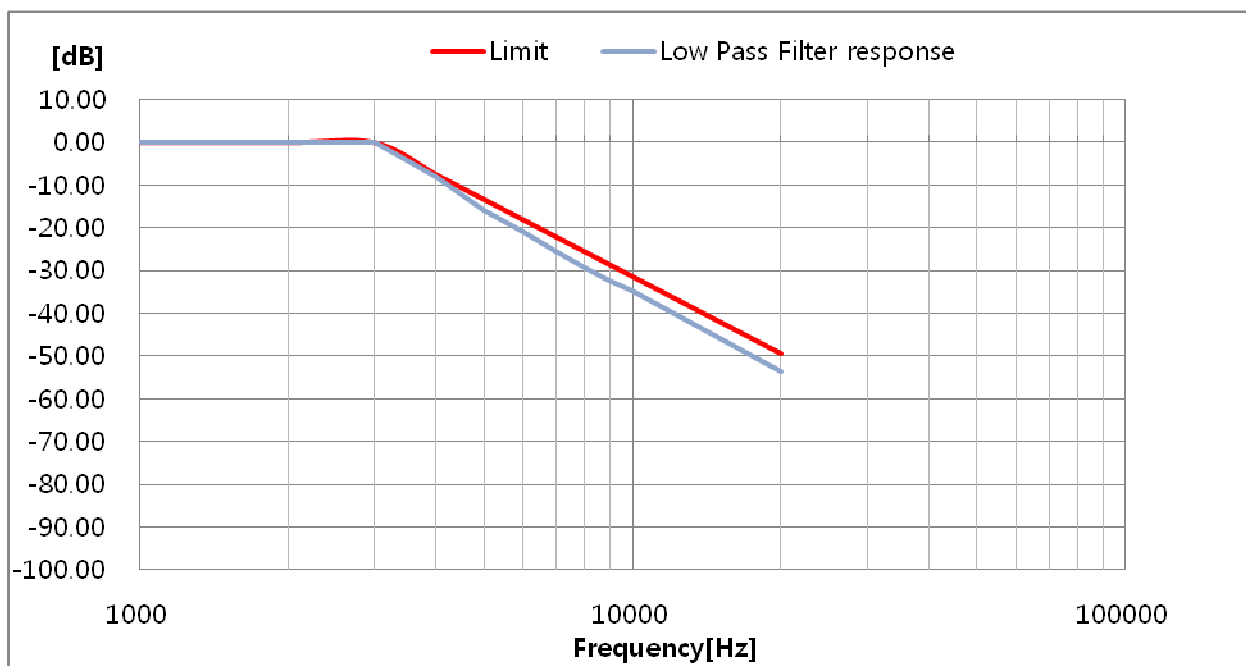
(b) Each GMRS transmitter, except a mobile station transmitter with a power output of 2.5 W or less, must automatically prevent a greater than normal audio level from causing over modulation. The transmitter also must include audio frequency low pass filtering, unless it complies with the applicable 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

DC 6 V

Audio frequency(Hz)	Deviation(kHz)	Response(dB)
1000	0.00	0.00
2000	0.00	0.00
3000	0.00	0.00
4000	-8.20	-7.50
5000	-15.80	-13.31
6000	-21.00	-18.06
7000	-25.40	-22.08
8000	-29.40	-25.56
9000	-32.40	-28.63
10000	-34.90	-31.37
20000	-53.50	-49.43



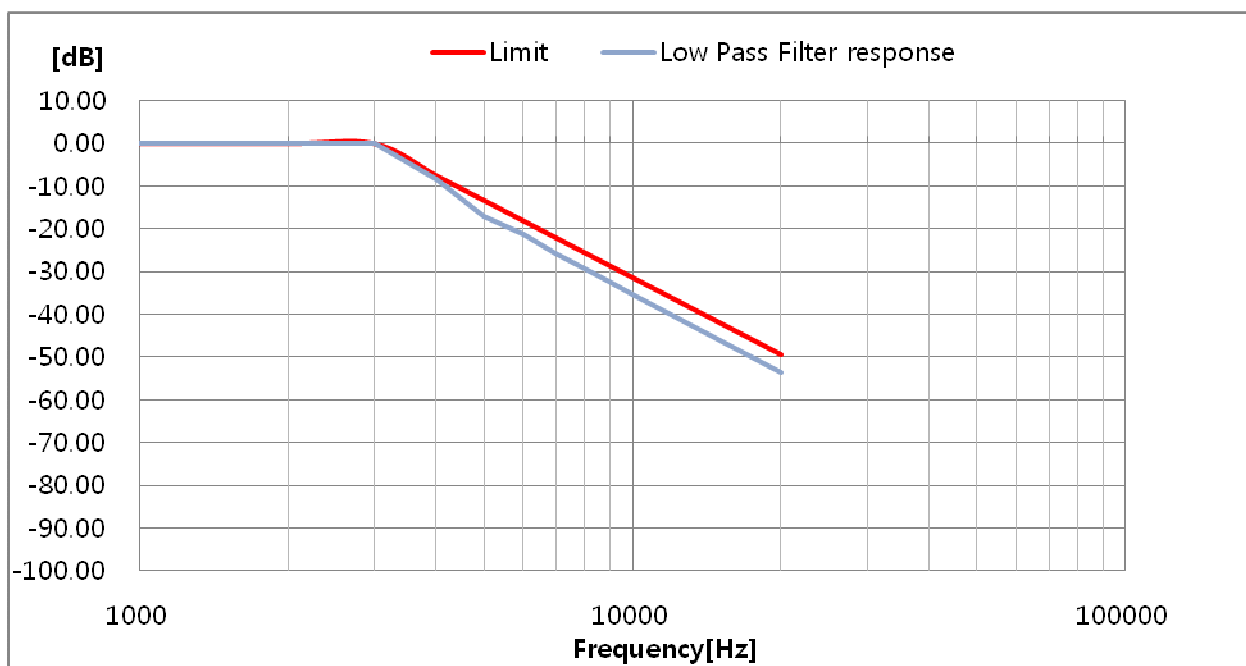


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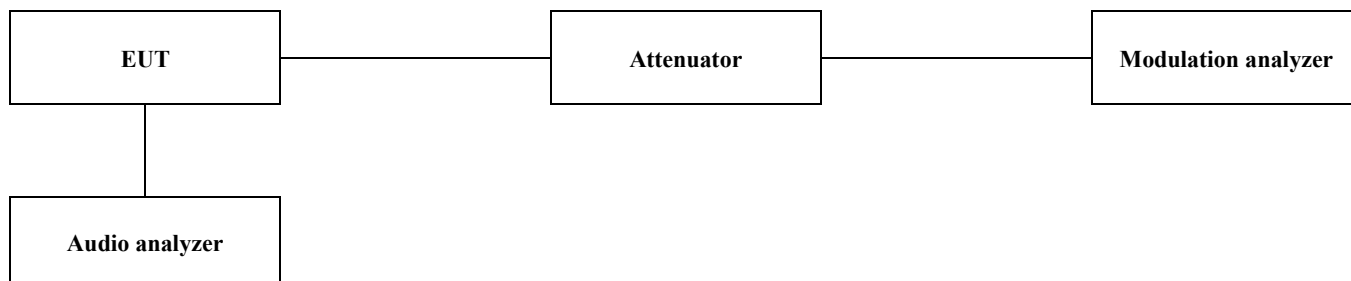
DC 4.8 V

Audio frequency(Hz)	Deviation(kHz)	Response(dB)
1000	0.00	0.00
2000	0.00	0.00
3000	0.00	0.00
4000	-8.50	-7.50
5000	-17.10	-13.31
6000	-21.30	-18.06
7000	-25.70	-22.08
8000	-29.50	-25.56
9000	-32.50	-28.63
10000	-35.30	-31.37
20000	-53.50	-49.43



2.1.5 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.

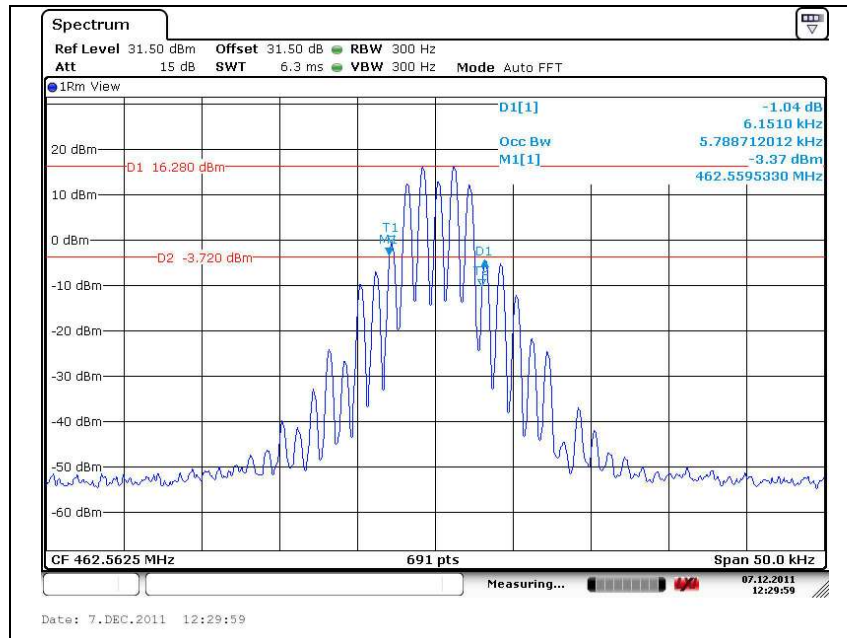
At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100 % up to and including 250 % of the authorized bandwidth.

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

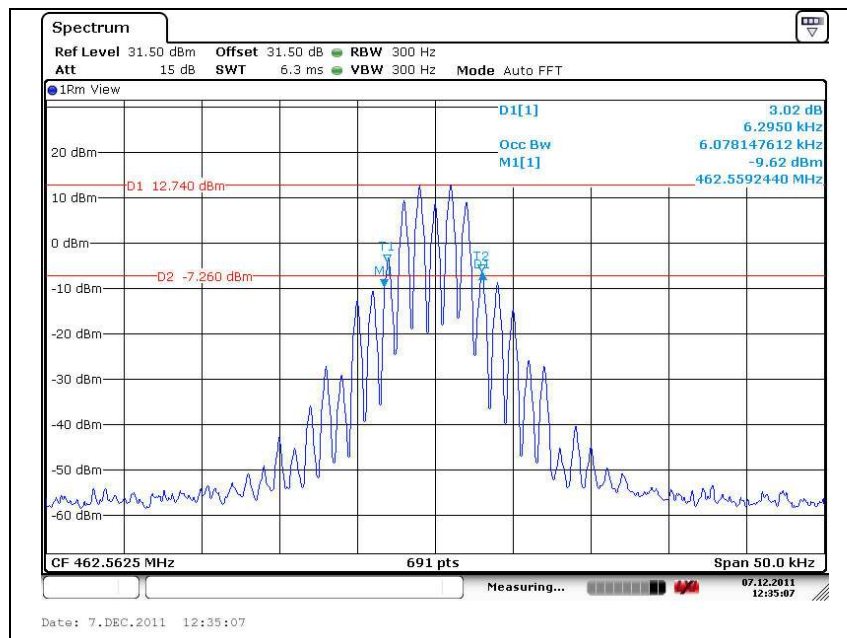


Test results

20 dB bandwidth for GMRS (High power), DC 6 V

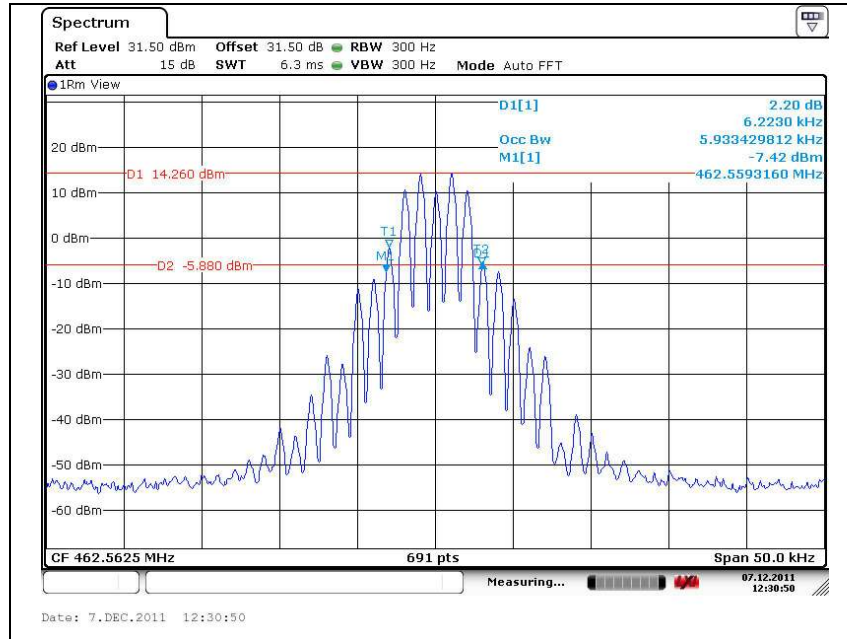


20 dB bandwidth for GMRS (Low power), DC 6 V

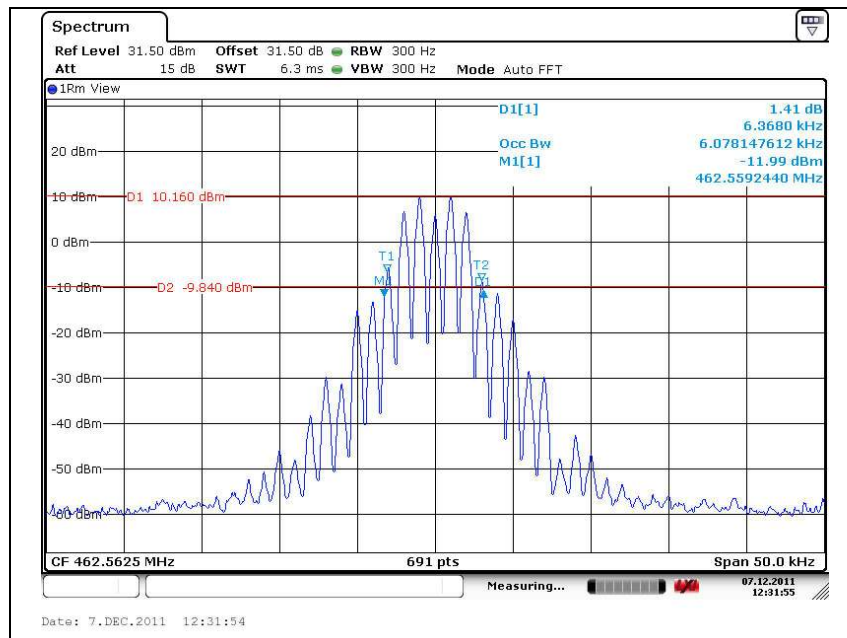




20 dB bandwidth for GMRS (High power), DC 4.8 V



20 dB bandwidth for GMRS (Low power), DC 4.8 V

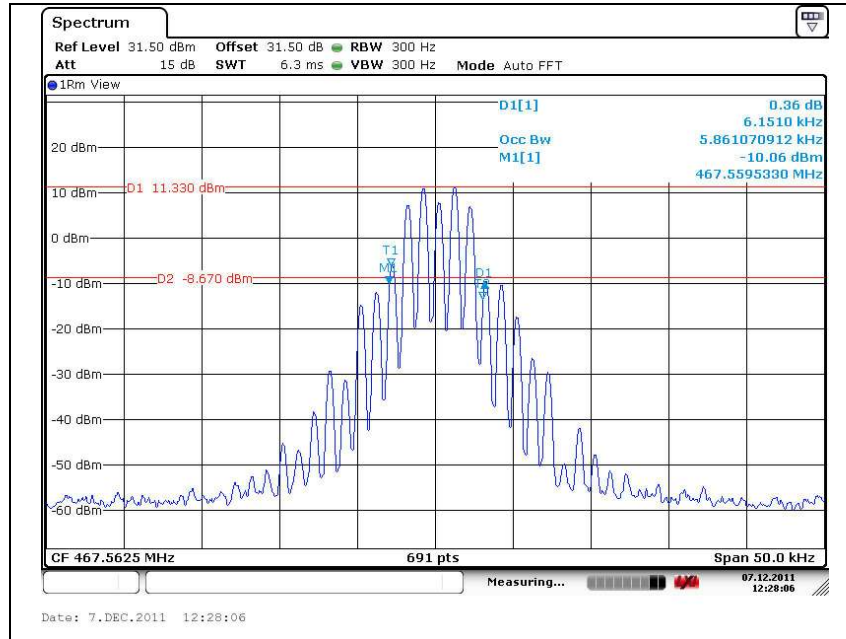




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C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
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www.kes.co.kr

20 dB bandwidth for FRS, DC 4.8 V

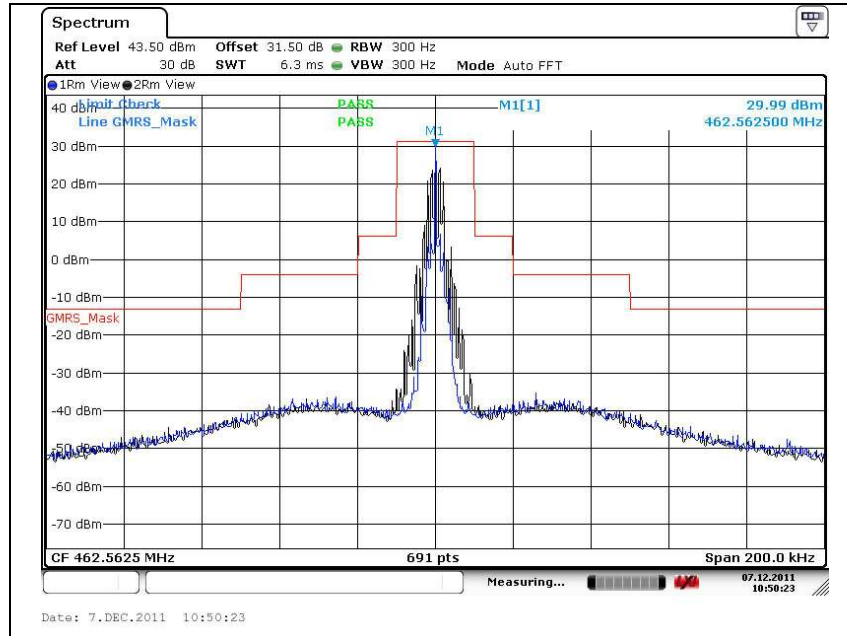




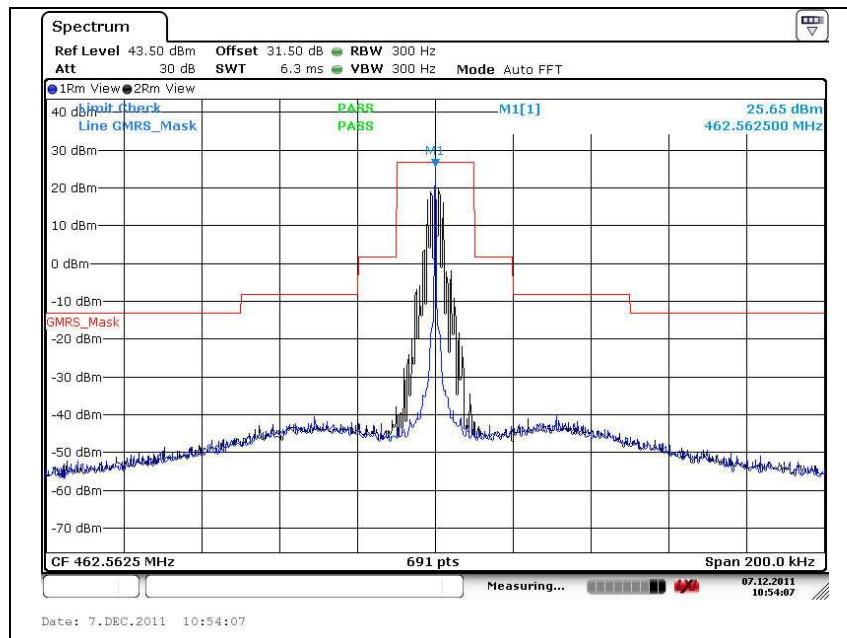
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Emission mask for GMRS (High power), DC 6 V



Emission mask for GMRS (Low power), DC 6 V

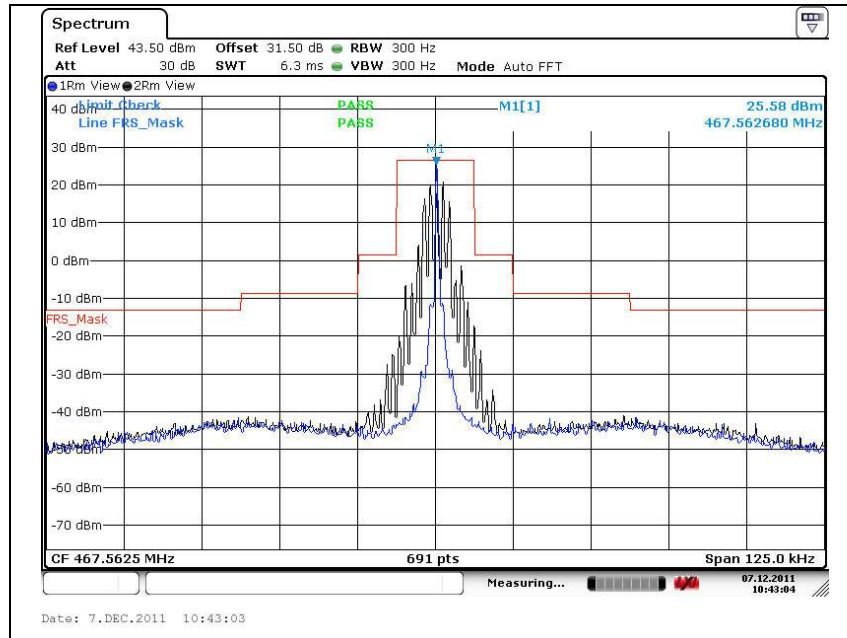




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Emission mask for FRS, DC 6 V

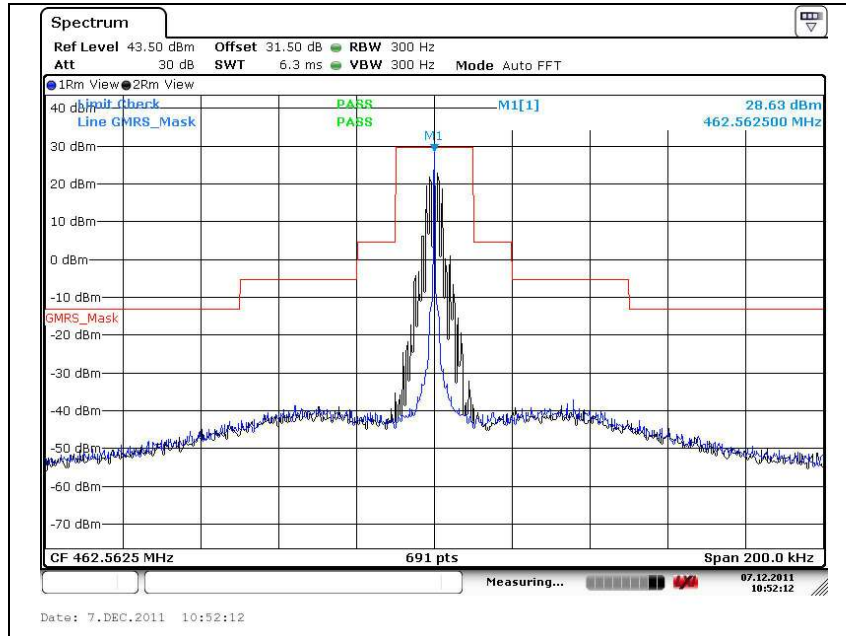




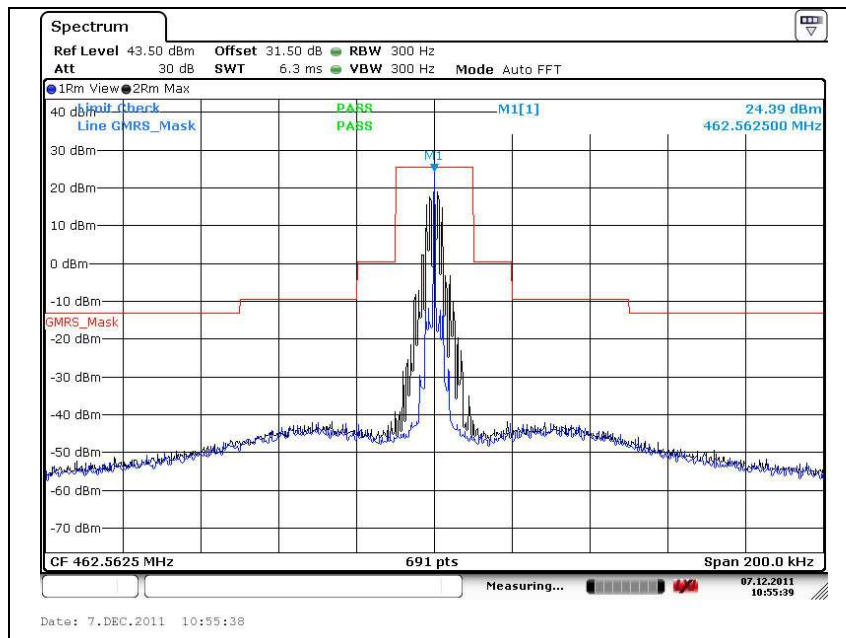
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Emission mask for GMRS (High power), DC 4.8 V



Emission mask for GMRS (Low power), DC 4.8 V

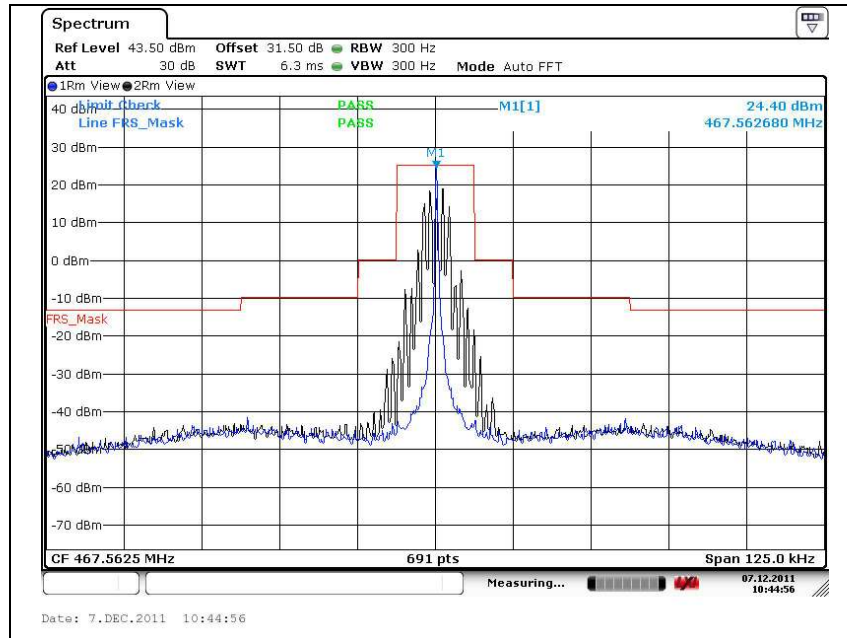




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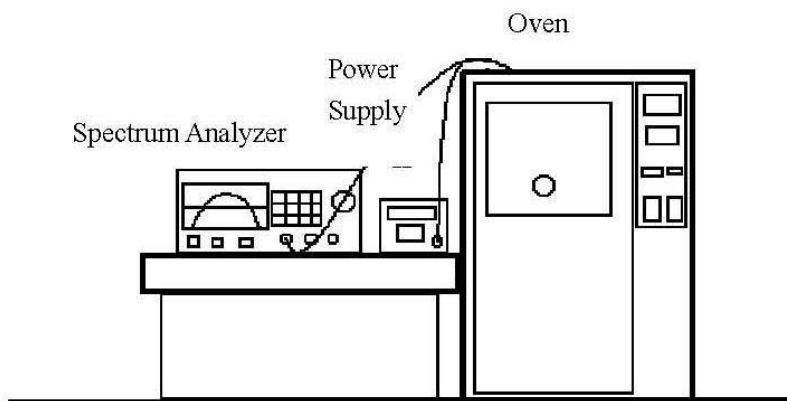
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Emission mask for FRS, DC 4.8 V



2.1.6 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.



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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 ± 5 ppm

RSS-210 A6.2.6

GMRS Devices: Carrier frequency tolerance shall be better than ± 5 ppm

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Test results**GMRS for High power, DC 6 V**

Assigned frequency (MHz): 462.562 5

Temperature (°C)	Measure frequency (MHz)	Frequency deviation (Hz)	Frequency deviation (ppm)	Frequency deviation (%)
-30	462.562 300	-200	-0.432	-0.000 043
-20	462.562 328	-172	-0.372	-0.000 037
-10	462.562 387	-113	-0.244	-0.000 024
0	462.562 452	-48	-0.104	-0.000 010
10	462.562 568	68	0.147	0.000 015
20	462.562 740	240	0.519	0.000 052
30	462.562 387	-113	-0.244	-0.000 024
40	462.562 328	-172	-0.372	-0.000 037
50	462.562 500	0	0.000	0.000 000

Temperature (°C)	Voltage (V)	Measure frequency (MHz)	Frequency deviation (ppm)	Frequency deviation (%)
20	5.10	462.562 700	0.432	0.000 043
20	6.90	462.562 700	0.432	0.000 043

GMRS for Low power, DC 6 V

Assigned frequency (MHz): 462.562 5

Temperature (°C)	Measure frequency (MHz)	Frequency deviation (Hz)	Frequency deviation (ppm)	Frequency deviation (%)
-30	462.562 420	-80	-0.173	-0.000 017
-20	462.562 685	185	0.400	0.000 040
-10	462.562 545	45	0.097	0.000 010
0	462.562 332	-168	-0.363	-0.000 036
10	462.562 394	-106	-0.229	-0.000 023
20	462.562 660	160	0.346	0.000 035
30	462.562 593	93	0.201	0.000 020
40	462.562 327	-173	-0.374	-0.000 037
50	462.562 460	-40	-0.086	-0.000 009

Temperature (°C)	Voltage (V)	Measure frequency (MHz)	Frequency deviation (ppm)	Frequency deviation (%)
20	5.10	462.562 660	0.346	0.000 035
20	6.90	462.562 620	0.259	0.000 026

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FRS for Low power, DC 6 V

Assigned frequency (MHz): 467.562 5

Temperature (°C)	Measure frequency (MHz)	Frequency deviation (Hz)	Frequency deviation (ppm)	Frequency deviation (%)
-30	467.562 740	240	0.513	0.000 051
-20	467.562 510	10	0.021	0.000 002
-10	467.562 487	-13	-0.028	-0.000 003
0	467.562 512	12	0.026	0.000 003
10	467.562 448	-52	-0.111	-0.000 011
20	467.562 460	-40	-0.086	-0.000 009
30	467.562 317	-183	-0.391	-0.000 039
40	467.562 578	78	0.167	0.000 017
50	467.562 500	0	0.000	0.000 000

Temperature (°C)	Voltage (V)	Measure frequency (MHz)	Frequency deviation (ppm)	Frequency deviation (%)
20	5.10	467.562 460	-0.086	-0.000009
20	6.90	467.562 460	-0.086	-0.000009

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GMRS for High power, DC 4.8 V

Assigned frequency (MHz): 462.562 5

Temperature (°C)	Measure frequency (MHz)	Frequency deviation (Hz)	Frequency deviation (ppm)	Frequency deviation (%)
-30	462.562 364	-136	-0.294	-0.000 029
-20	462.562 423	-77	-0.166	-0.000 017
-10	462.562 615	115	0.249	0.000 025
0	462.562 345	-155	-0.335	-0.000 034
10	462.562 511	11	0.024	0.000 002
20	462.562 375	-125	-0.270	-0.000 027
30	462.562 387	-113	-0.244	-0.000 024
40	462.562 466	-34	-0.074	-0.000 007
50	462.562 424	-76	-0.164	-0.000 016

Temperature (°C)	Voltage (V)	Measure frequency (MHz)	Frequency deviation (ppm)	Frequency deviation (%)
20	4.08	462.562 378	-0.264	-0.000 026
20	5.52	462.562 380	-0.259	-0.000 026

GMRS for Low power, DC 4.8 V

Assigned frequency (MHz): 462.562 5

Temperature (°C)	Measure frequency (MHz)	Frequency deviation (Hz)	Frequency deviation (ppm)	Frequency deviation (%)
-30	462.562 623	123	0.266	0.000 027
-20	462.562 575	75	0.162	0.000 016
-10	462.562 434	-66	-0.143	-0.000 014
0	462.562 691	191	0.413	0.000 041
10	462.562 644	144	0.311	0.000 031
20	462.562 366	-134	-0.290	-0.000 029
30	462.562 452	-48	-0.104	-0.000 010
40	462.562 615	115	0.249	0.000 025
50	462.562 493	-7	-0.015	-0.000 002

Temperature (°C)	Voltage (V)	Measure frequency (MHz)	Frequency deviation (ppm)	Frequency deviation (%)
20	4.08	462.562 370	-0.281	-0.000 028
20	5.52	462.562 370	-0.281	-0.000 028

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FRS for Low power, DC 4.8 V

Assigned frequency (MHz): 467.562 5

Temperature (°C)	Measure frequency (MHz)	Frequency deviation (Hz)	Frequency deviation (ppm)	Frequency deviation (%)
-30	467.562 520	20	0.043	0.000 004
-20	467.562 374	-126	-0.269	-0.000 027
-10	467.562 637	137	0.293	0.000 029
0	467.562 395	-105	-0.225	-0.000 023
10	467.562 462	-38	-0.081	-0.000 008
20	467.562 567	67	0.143	0.000 014
30	467.562 368	-132	-0.282	-0.000 028
40	467.562 658	158	0.338	0.000 034
50	467.562 560	60	0.128	0.000 013

Temperature (°C)	Voltage (V)	Measure frequency (MHz)	Frequency deviation (ppm)	Frequency deviation (%)
20	4.08	467.562 560	0.128	0.000 013
20	5.52	467.562 564	0.137	0.000 014

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Appendix A. Test equipment used for test

Equipment	Manufacturer	Model	Calibration due.
EMC Analyzer	Agilent	E7405A	2012.08.22
Spectrum analyzer	R&S	FSV30	2013.01.01
Vector signal generator	R&S	SMBV2100A	2013.01.10
Modulation analyzer	HP	8901B	2013.01.10
Audio analyzer	HP	8903B	2012.12.29
DC power supply	HP	6674A	2012.12.05
Temperature chamber	TABAI	MC711P	2012.05.06
Attenuator	BRID	8325	2012.05.04
Preamplifier	HP	2805A02570	2012.05.04
Trilog-BroadBand Antenna	Schwarzbeck	VULB 9168	2013.03.18
Horn Antenna	A.H.	SAS-571	2013.03.22
Horn Antenna	A.H.	SAS-571	2013.03.22
Dipole Antenna	R&S	VHAP	2013.04.29
Dipole Antenna	R&S	UHAP	2013.04.29
High pass filter	Mini-circuits	NHP-800+	2012.08.05

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
N/A			

Appendix B. Test setup photo

Radiated field emissions

