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TEST REPORT

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

Equipment Under Test	FRS / GMRS
Model Name	LXT560
FCC ID	MMALXT560
IC Certification	3690A-LXT560
Applicant	Midland Radio Corporation
Manufacturer	Global Link
Date of test(s)	2011.11.15 ~ 2011.12.08
Date of issue	2012.02.01

Issued to

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

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Revision history

Revision	Date of issue	Test report No.	Description
-	2012.02.01	KES-RF-120002	Initial

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1.0 General product description

Equipment under test	FRS / GMRS
Model name	LXT560
Serial number	N/A
Frequency Range	462.562 5 ㎒ ~ 462.712 5 ㎒(GMRS Channels 1 ~7)
	467.562 5 ㎒ ~ 467.712 5 ㎒(FRS Channels 8 ~ 14)
	462.550 0 ㎒ ~ 462.725 0 ㎒(GMRS Channels 15 ~ 22)
Emission type	11K0F3E
E.R.P.	GMRS: 0.423 6 W(High power), 0.222 3 W(Low power) / FRS: 0.246 0 W
Number of channel	462.562 5 ㎒ ~ 462.712 5 ㎒(GMRS Channels 1 ~7)
	467.562 5 ㎒ ~ 467.712 5 ㎒(FRS Channels 8 ~ 14)
	462.550 0 ㎒ ~ 462.725 0 ㎒(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

N/A

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, Yeoju-eup, Yeoju-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.

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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

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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(㎒)	High / Low	Output power (W)	
				DC 6 V	DC 4.8 V
GMRS	1	462.562 5	**High**	**1.29**	**0.96**
			Low	**0.318**	**0.263**
	2	462.587 5	High	1.28	0.96
			Low	0.317	0.260
	3	462.612 5	High	1.29	0.96
			Low	0.317	0.262
	4	462.637 5	High	1.27	0.95
			Low	0.319	0.261
	5	462.662 5	High	1.29	0.95
			Low	0.321	0.262
	6	462.687 5	High	1.29	0.95
			Low	0.322	0.259
	7	462.712 5	High	1.29	0.95
			Low	0.322	0.259
FRS	8	467.562 5	N/A	0.302	0.252
	9	467.587 5		0.309	0.251
	10	467.612 5		0.310	0.251
	11	467.637 5		0.313	0.249
	12	467.662 5		0.311	0.249
	13	467.687 5		0.313	0.249
	14	467.712 5		**0.316**	**0.254**
GMRS	15	462.550 0	High	1.28	0.95
			Low	0.315	0.261
	16	462.575 0	High	1.29	0.95
			Low	0.316	0.261
	17	462.600 0	High	1.29	0.94
			Low	0.316	0.261
	18	462.625 0	High	1.28	0.95
			Low	0.317	0.261
	19	462.650 0	High	1.27	0.94
			Low	0.317	0.259
	20	462.675 0	High	1.29	0.95
			Low	0.316	0.261
	21	462.700 0	High	1.29	0.93
			Low	0.317	0.257
	22	462.725 0	High	1.28	0.94
			Low	0.316	0.258

Therefore all applicable requirements were tested to the two channels, the 1st for GMRS and the 14th for FRS.

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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		

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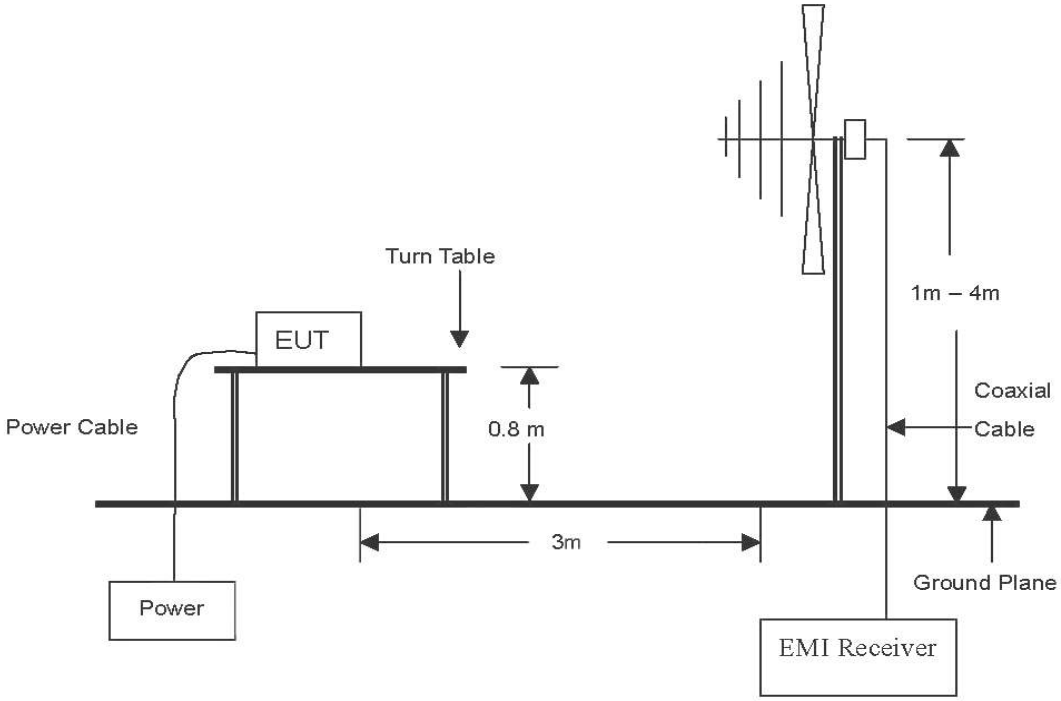
2.1 Test data

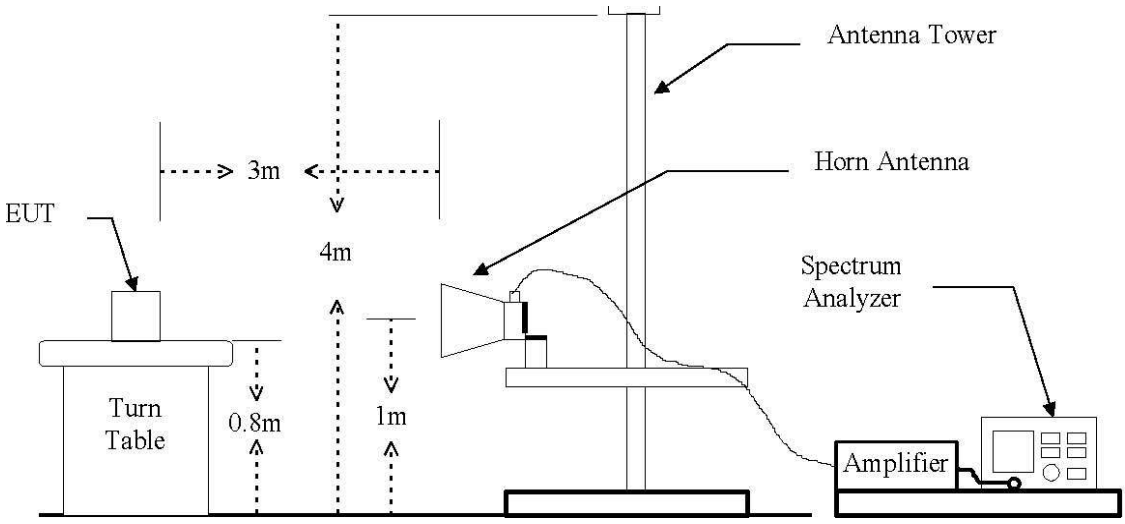
2.1.1 RF output power and radiated spurious emission (Tx & Rx)

Test setup

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



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



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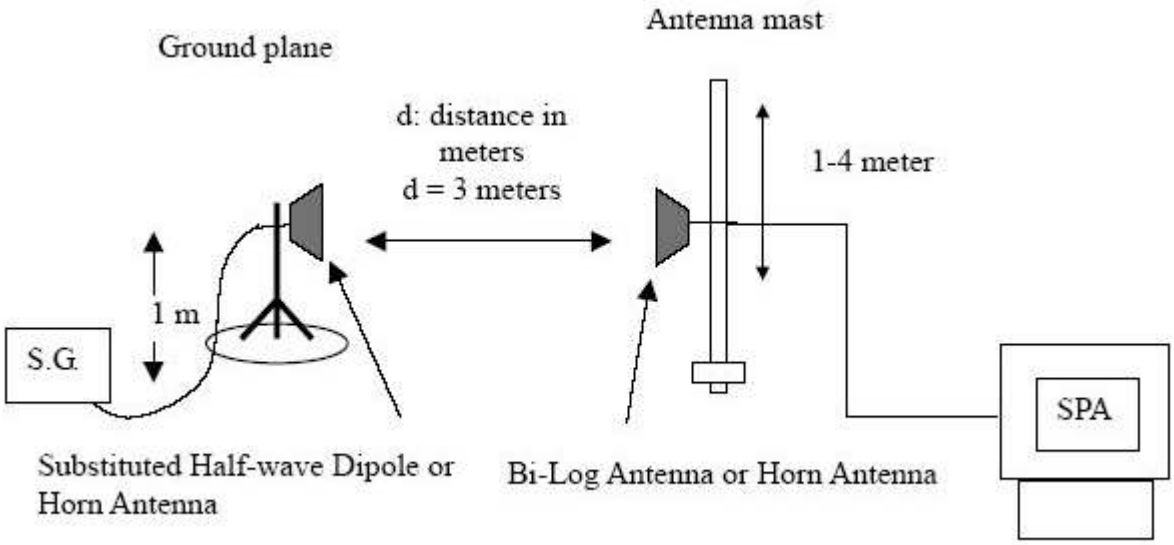
The diagram below shows the test setup for substituted method



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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 ㎝ 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 ㎒ and the video bandwidth was set to 1 ㎒
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 the 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 ㎒) or horn antenna(above 1000 ㎒) 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 received, 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 ㏈m, 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.

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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 ㎓, 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 ㎓, 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 ㏈ 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 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

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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) ㏈ on any frequency removed from the center of the authorized bandwidth by more than 250%.

Radiated spurious emissions – Rx

RSS-Gen 6.1

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

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Test results

RF output power

GMRS (High power), DC 6 V

Frequency (㎒)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	E.R.P.	
				(dBm)	(W)
462.562 5	H	18.50	4.88	23.38	0.217 8
462.562 5	V	21.00	5.27	26.27	0.423 6

GMRS (Low power), DC 6 V

Frequency (㎒)	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 (㎒)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	E.R.P.	
				(dBm)	(W)
467.712 5	H	18.50	-0.04	18.46	0.070 1
467.712 5	V	19.00	4.91	23.91	0.246 0

GMRS (High power), DC 4.8 V

Frequency (㎒)	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 (㎒)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	E.R.P.	
				(dBm)	(W)
462.562 5	H	18.50	2.10	20.60	0.114 8
462.562 5	V	21.00	1.36	22.36	0.172 2

FRS, DC 4.8 V

Frequency (㎒)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	E.R.P.	
				(dBm)	(W)
467.712 5	H	18.50	-0.91	17.59	0.057 4
467.712 5	V	19.00	4.02	23.02	0.200 4

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Radiated spurious emissions for DC 6 V(Tx)

GMRS (High power)

Frequency (㎒)	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	47.26	39.27	7.99
925.125 0	V	-23.00	2.53	-20.47	46.74	39.27	7.47
1387.687 5	H	-27.00	9.51	-17.49	43.76	39.27	4.49
1387.687 5	V	-27.00	10.70	-16.30	42.57	39.27	3.30
1850.250 0	H	-37.00	9.56	-27.44	53.71	39.27	14.44
1850.250 0	V	-37.00	11.70	-25.30	51.57	39.27	12.30
2312.812 5	H	-20.00	5.76	-14.24	40.51	39.27	1.24
2312.812 5	V	-20.00	5.85	-14.15	40.42	39.27	1.15
2775.375 0	H	-33.00	12.02	-20.98	47.25	39.27	7.98
2775.375 0	V	-33.00	12.55	-20.45	46.72	39.27	7.45
3237.937 5	H	-33.00	14.58	-18.42	44.69	39.27	5.42
3237.937 5	V	-35.00	13.16	-21.84	48.11	39.27	8.84
3700.500 0	H	-48.00	14.82	-33.18	59.45	39.27	20.18
3700.500 0	V	-44.00	13.72	-30.28	56.55	39.27	17.28
4163.062 5	H	-44.00	15.26	-28.74	55.01	39.27	15.74
4163.062 5	V	-44.00	12.82	-31.18	57.45	39.27	18.18
4625.625 0	H	-56.00	12.81	-43.19	69.46	39.27	30.19
4625.625 0	V	-56.00	16.01	-39.99	66.26	39.27	26.99

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

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GMRS (Low power)

Frequency (㎒)	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	20.30	-14.70	38.17	36.47	1.70
3700.500 0	H	-48.00	27.32	-20.68	44.15	36.47	7.68
3700.500 0	V	-44.00	29.57	-14.43	37.90	36.47	1.43
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(㏈m) - absolute level
2. Spurious attenuation limit in ㏈ = 43 + 10log(power in watts)

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FRS

Frequency (㎒)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	Absolute level (dBm)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
1403.137 5	H	-30.00	0.78	-29.22	52.69	36.91	15.78
1403.137 5	V	-28.00	-7.42	-35.42	58.89	36.91	21.98
1870.850 0	H	-30.00	-0.10	-30.10	53.57	36.91	16.66
1870.850 0	V	-31.00	-1.14	-32.14	55.61	36.91	18.70
2338.562 5	H	-21.00	-18.53	-39.53	63.00	36.91	26.09
2338.562 5	V	-21.00	-16.13	-37.13	60.60	36.91	23.69
2806.275 0	H	-30.00	-2.23	-32.23	55.70	36.91	18.79
2806.275 0	V	-26.00	-3.20	-29.20	52.67	36.91	15.76
3273.987 5	H	-25.00	7.94	-17.06	40.53	36.91	3.62
3273.987 5	V	-20.00	5.37	-14.63	38.10	36.91	1.19
3741.700 0	H	-27.00	-4.09	-31.09	54.56	36.91	17.65
3741.700 0	V	-22.00	-6.64	-28.64	52.11	36.91	15.20
4209.412 5	H	-34.00	-1.64	-35.64	59.11	36.91	22.20
4209.412 5	V	-34.00	4.43	-29.57	53.04	36.91	16.13
4677.125 0	H	-36.00	8.77	-27.23	50.70	36.91	13.79
4677.125 0	V	-32.00	-1.83	-33.83	57.30	36.91	20.39

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

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Radiated spurious emissions for DC 4.8 V(Tx)

GMRS (High power)

Frequency (㎒)	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	1.14	-21.86	45.78	36.92	8.86
925.125 0	V	-23.00	0.91	-22.09	46.01	36.92	9.09
1387.687 5	H	-27.00	7.38	-19.62	43.54	36.92	6.62
1387.687 5	V	-27.00	6.60	-20.40	44.32	36.92	7.40
1850.250 0	H	-37.00	8.40	-28.60	52.52	36.92	15.60
1850.250 0	V	-37.00	8.24	-28.76	52.68	36.92	15.76
2312.812 5	H	-20.00	5.34	-14.66	38.58	36.92	1.66
2312.812 5	V	-20.00	4.01	-15.99	39.91	36.92	2.99
2775.375 0	H	-33.00	15.02	-17.98	41.90	36.92	4.98
2775.375 0	V	-33.00	18.59	-14.41	38.33	36.92	1.41
3237.937 5	H	-33.00	17.23	-15.77	39.69	36.92	2.77
3237.937 5	V	-35.00	19.15	-15.85	39.77	36.92	2.85
3700.500 0	H	-48.00	25.70	-22.30	46.22	36.92	9.30
3700.500 0	V	-44.00	29.24	-14.76	38.68	36.92	1.76
4163.062 5	H	-44.00	22.91	-21.09	45.01	36.92	8.09
4163.062 5	V	-44.00	19.95	-24.05	47.97	36.92	11.05
4625.625 0	H	-56.00	17.07	-38.93	62.85	36.92	25.93
4625.625 0	V	-56.00	27.60	-28.40	52.32	36.92	15.40

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

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GMRS (Low power)

Frequency (㎒)	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	-1.31	-24.31	46.67	35.36	11.31
925.125 0	V	-23.00	-1.87	-24.87	47.23	35.36	11.87
1387.687 5	H	-27.00	7.13	-19.87	42.23	35.36	6.87
1387.687 5	V	-27.00	7.84	-19.16	41.52	35.36	6.16
1850.250 0	H	-37.00	8.35	-28.65	51.01	35.36	15.65
1850.250 0	V	-37.00	8.26	-28.74	51.10	35.36	15.74
2312.812 5	H	-20.00	4.81	-15.19	37.55	35.36	2.19
2312.812 5	V	-20.00	3.69	-16.31	38.67	35.36	3.31
2775.375 0	H	-33.00	15.78	-17.22	39.58	35.36	4.22
2775.375 0	V	-33.00	17.84	-15.16	37.52	35.36	2.16
3237.937 5	H	-33.00	18.32	-14.68	37.04	35.36	1.68
3237.937 5	V	-35.00	19.93	-15.07	37.43	35.36	2.07
3700.500 0	H	-48.00	26.55	-21.45	43.81	35.36	8.45
3700.500 0	V	-44.00	29.11	-14.89	37.25	35.36	1.89
4163.062 5	H	-44.00	22.46	-21.54	43.90	35.36	8.54
4163.062 5	V	-44.00	18.64	-25.36	47.72	35.36	12.36
4625.625 0	H	-56.00	17.72	-38.28	60.64	35.36	25.28
4625.625 0	V	-56.00	27.24	-28.76	51.12	35.36	15.76

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

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

FRS

Frequency (㎒)	Ant. Pol. (H/V)	S.G. Level (dBm)	Correction factor (dB)	Absolute level (dBm)	Spurious attenuation (dBc)	Limit (dBc)	Margin (dB)
1403.137 5	H	-30.00	0.22	-29.78	52.14	36.02	16.12
1403.137 5	V	-28.00	-14.84	-42.84	65.20	36.02	29.18
1870.850 0	H	-30.00	-2.20	-32.20	54.56	36.02	18.54
1870.850 0	V	-31.00	-2.57	-33.57	55.93	36.02	19.91
2338.562 5	H	-21.00	-20.72	-41.72	64.08	36.02	28.06
2338.562 5	V	-21.00	-18.16	-39.16	61.52	36.02	25.50
2806.275 0	H	-30.00	-4.87	-34.87	57.23	36.02	21.21
2806.275 0	V	-26.00	-5.04	-31.04	53.40	36.02	17.38
3273.987 5	H	-25.00	6.44	-18.56	40.92	36.02	4.90
3273.987 5	V	-20.00	4.11	-15.89	38.25	36.02	2.23
3741.700 0	H	-27.00	-5.16	-32.16	54.52	36.02	18.50
3741.700 0	V	-22.00	-7.59	-29.59	51.95	36.02	15.93
4209.412 5	H	-34.00	-5.16	-39.16	61.52	36.02	25.50
4209.412 5	V	-34.00	0.79	-33.21	55.57	36.02	19.55
4677.125 0	H	-36.00	-2.54	-38.54	60.90	36.02	24.88
4677.125 0	V	-32.00	-3.84	-35.84	58.20	36.02	22.18

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

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Radiated spurious emissions (Rx)

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
151.3	10.81	H	13.04	1.54	25.39	43.52	18.13
151.3	9.71	V	13.04	1.54	24.29	43.52	19.23
161.0	9.44	H	13.23	1.61	24.28	43.52	19.24
177.9	11.59	H	11.82	1.63	25.04	43.52	18.48
192.5	11.29	V	10.58	1.72	23.59	43.52	19.93
207.0	12.34	V	10.18	1.79	24.31	43.52	19.21

Remark
1. All spurious emission at channels are almost the same below 1 ㎓, 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 ㎒ to 1 000 ㎒ was investigated. Emission levels are not reported much lower than the limits by over 20 ㏈.
6. The data is voluntarily submitted for verification procedure.

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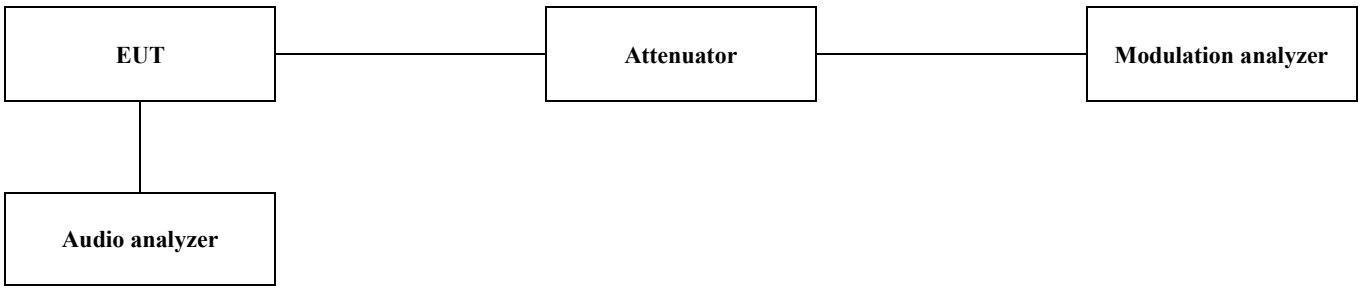
2.1.2 Modulation limiting

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

RSS-210 A6.1.2
(c) The peak frequency deviation shall not exceed ±2.5 ㎑. 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 ㎑. 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 ㎑ ≤ f ≤ 20 ㎑, the attenuation is at least 60 $\log_{10}$(f, ㎑/3) ㏈ greater than the attenuation at 1 ㎑; and for f > 20 ㎑, the attenuation is at least 50 ㏈ greater than the attenuation at 1 ㎑.

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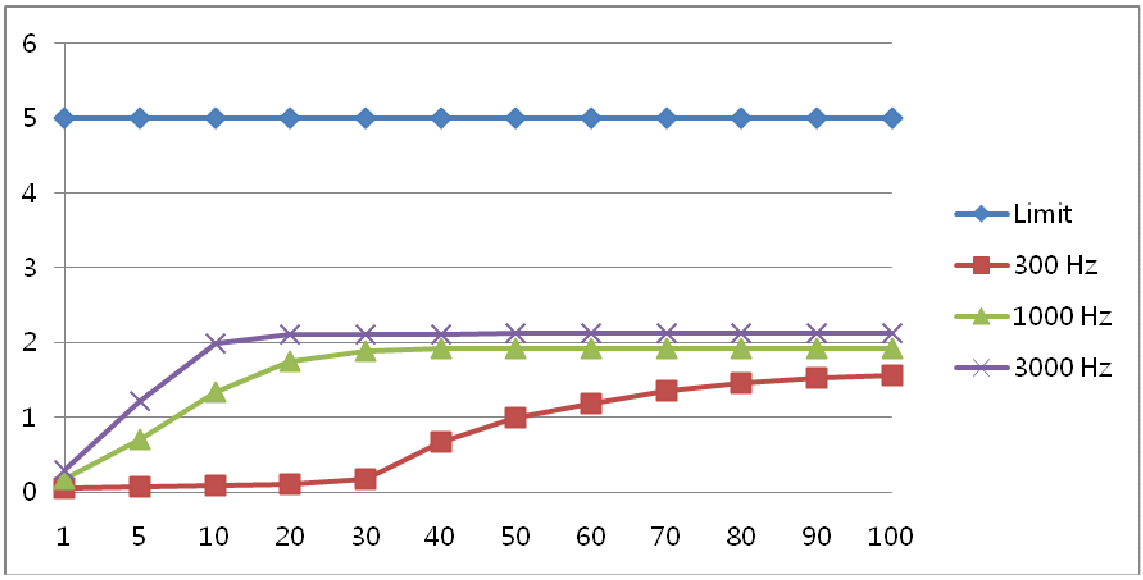
Test results

GMRS (High power), DC 6 V

Audio level (㎷)	Deviation at 300 ㎐	Deviation at 1 ㎑	Deviation at 3 ㎑	Limit (㎑)
1	0.06	0.18	0.28	5
5	0.07	0.70	1.21	5
10	0.09	1.34	1.99	5
20	0.11	1.74	2.10	5
30	0.16	1.89	2.11	5
40	0.67	1.91	2.11	5
50	0.99	1.91	2.12	5
60	1.19	1.92	2.12	5
70	1.36	1.92	2.12	5
80	1.46	1.92	2.12	5
90	1.52	1.92	2.13	5
100	1.56	1.92	2.12	5



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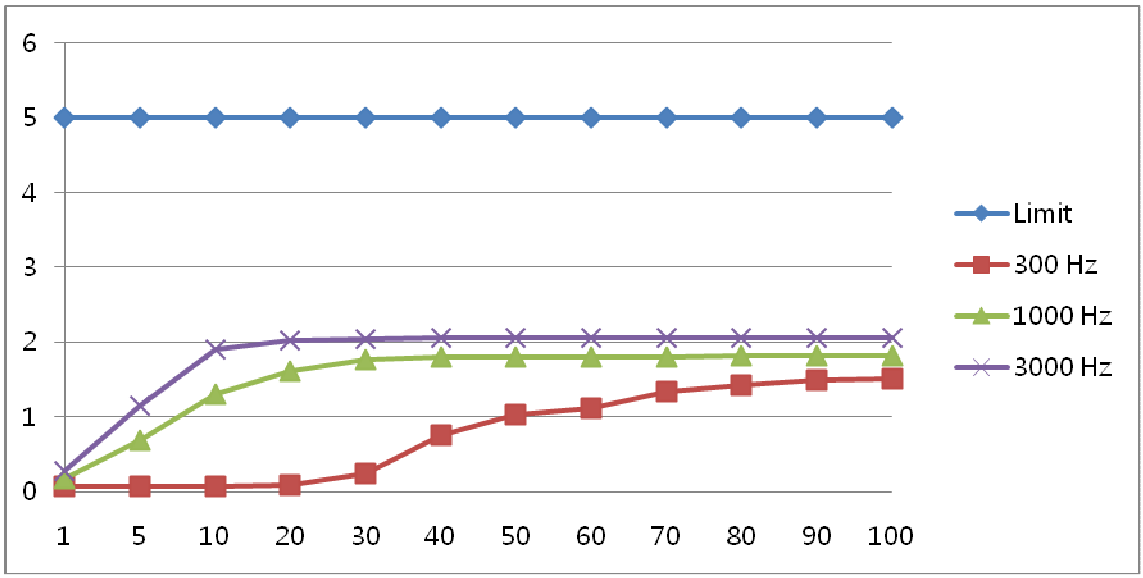
The test results in the report only apply to the tested sample.

GMRS (Low power), DC 6 V

Audio level (㎷)	Deviation at 300 ㎐	Deviation at 1 ㎑	Deviation at 3 ㎑	Limit (㎑)
1	0.06	0.18	0.28	5
5	0.07	0.68	1.15	5
10	0.08	1.31	1.90	5
20	0.08	1.61	2.02	5
30	0.25	1.76	2.03	5
40	0.76	1.79	2.05	5
50	1.02	1.80	2.06	5
60	1.11	1.80	2.05	5
70	1.34	1.80	2.05	5
80	1.42	1.81	2.05	5
90	1.49	1.81	2.06	5
100	1.50	1.81	2.05	5



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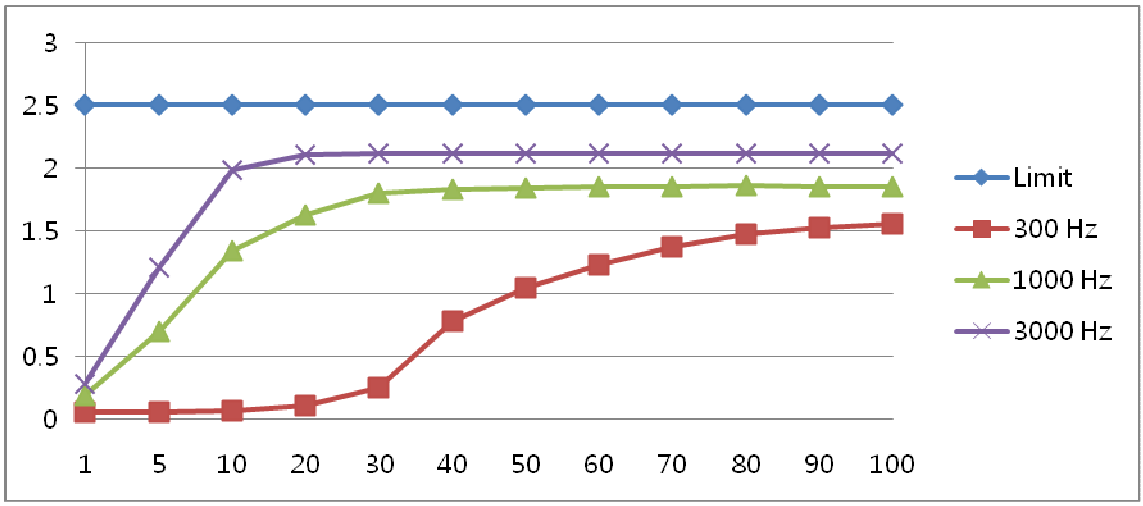
FRS, DC 6 V

Audio level (㎷)	Deviation at 300 ㎐	Deviation at 1 ㎑	Deviation at 3 ㎑	Limit (㎑)
1	0.06	0.19	0.29	2.5
5	0.06	0.70	1.21	2.5
10	0.07	1.34	1.99	2.5
20	0.11	1.63	2.10	2.5
30	0.26	1.80	2.12	2.5
40	0.78	1.83	2.12	2.5
50	1.05	1.84	2.12	2.5
60	1.23	1.85	2.12	2.5
70	1.37	1.85	2.12	2.5
80	1.47	1.86	2.12	2.5
90	1.53	1.85	2.12	2.5
100	1.56	1.86	2.12	2.5



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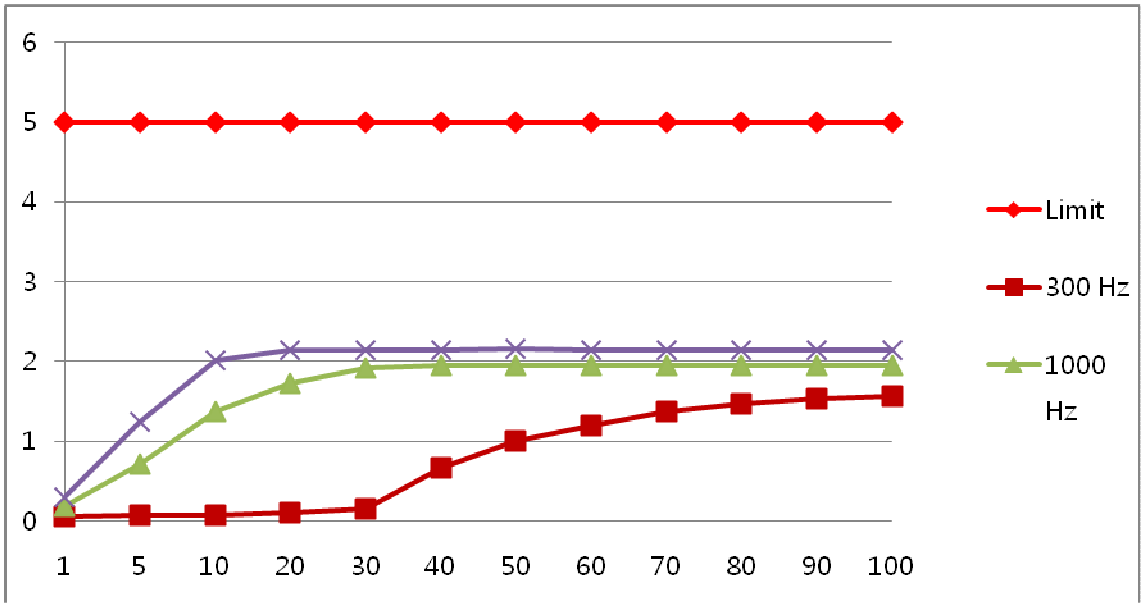
GMRS (High power) DC 4.8 V

Audio level (㎷)	Deviation at 300 ㎐	Deviation at 1 ㎑	Deviation at 3 ㎑	Limit (㎑)
1	0.06	0.18	0.29	5
5	0.07	0.71	1.24	5
10	0.08	1.37	2.02	5
20	0.11	1.73	2.14	5
30	0.16	1.92	2.14	5
40	0.66	1.95	2.15	5
50	1.00	1.95	2.15	5
60	1.20	1.95	2.15	5
70	1.37	1.95	2.14	5
80	1.47	1.95	2.14	5
90	1.53	1.95	2.14	5
100	1.57	1.95	2.14	5



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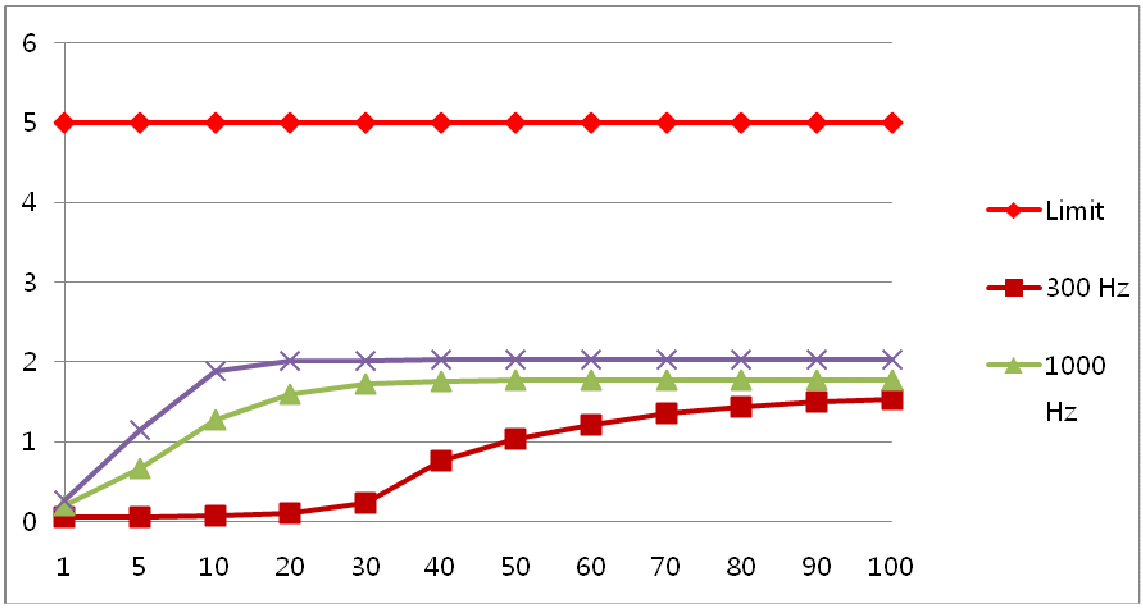
GMRS (Low power), DC 4.8 V

Audio level (㎷)	Deviation at 300 ㎐	Deviation at 1 ㎑	Deviation at 3 ㎑	Limit (㎑)
1	0.06	0.20	0.27	5
5	0.06	0.67	1.15	5
10	0.08	1.28	1.89	5
20	0.10	1.59	2.01	5
30	0.23	1.73	2.02	5
40	0.77	1.75	2.03	5
50	1.04	1.77	2.03	5
60	1.21	1.77	2.03	5
70	1.36	1.77	2.03	5
80	1.44	1.77	2.03	5
90	1.49	1.78	2.03	5
100	1.53	1.78	2.03	5



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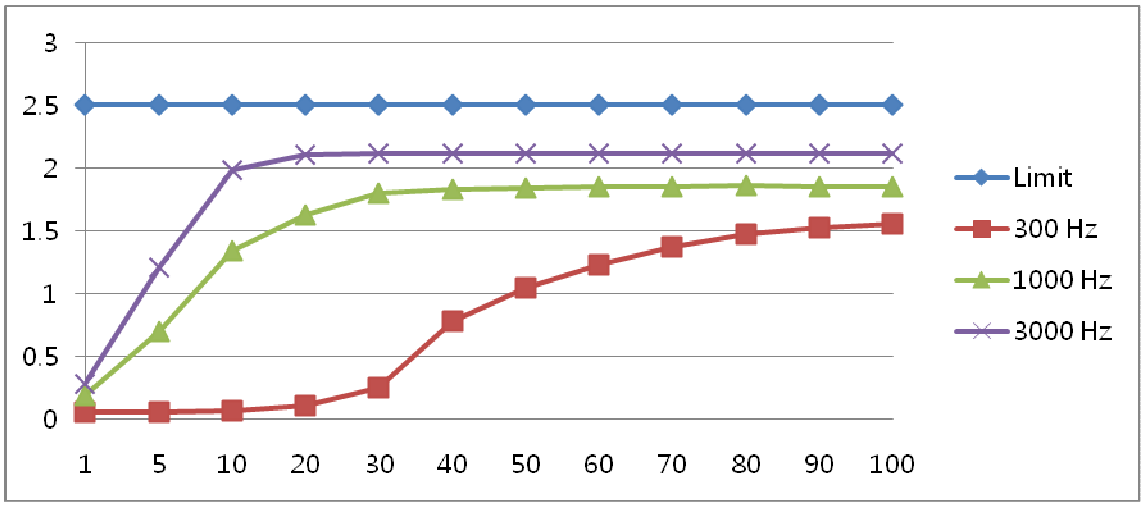
FRS, DC 4.8 V

Audio level (㎷)	Deviation at 300 ㎐	Deviation at 1 ㎑	Deviation at 3 ㎑	Limit (㎑)
1	0.06	0.19	0.29	2.5
5	0.06	0.70	1.21	2.5
10	0.07	1.34	1.99	2.5
20	0.11	1.63	2.10	2.5
30	0.26	1.80	2.12	2.5
40	0.78	1.83	2.12	2.5
50	1.05	1.84	2.12	2.5
60	1.23	1.85	2.12	2.5
70	1.37	1.85	2.12	2.5
80	1.47	1.86	2.12	2.5
90	1.53	1.85	2.12	2.5
100	1.56	1.86	2.12	2.5



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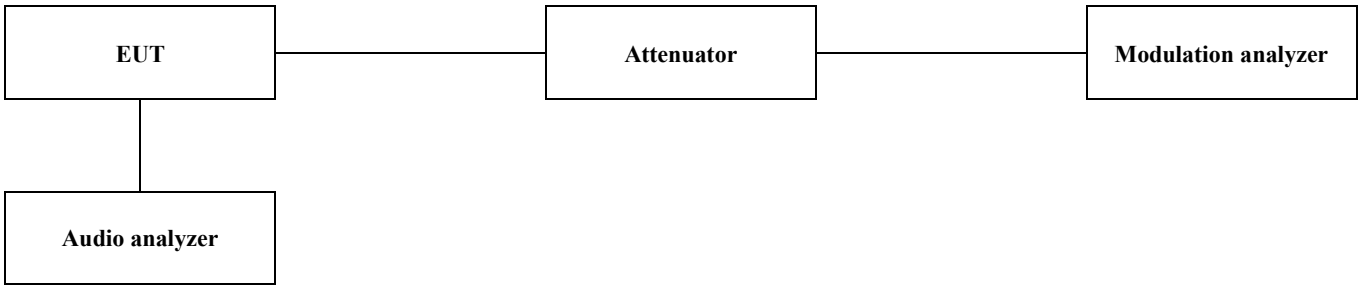
2.1.3 Audio frequency response

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 ㎐ 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.

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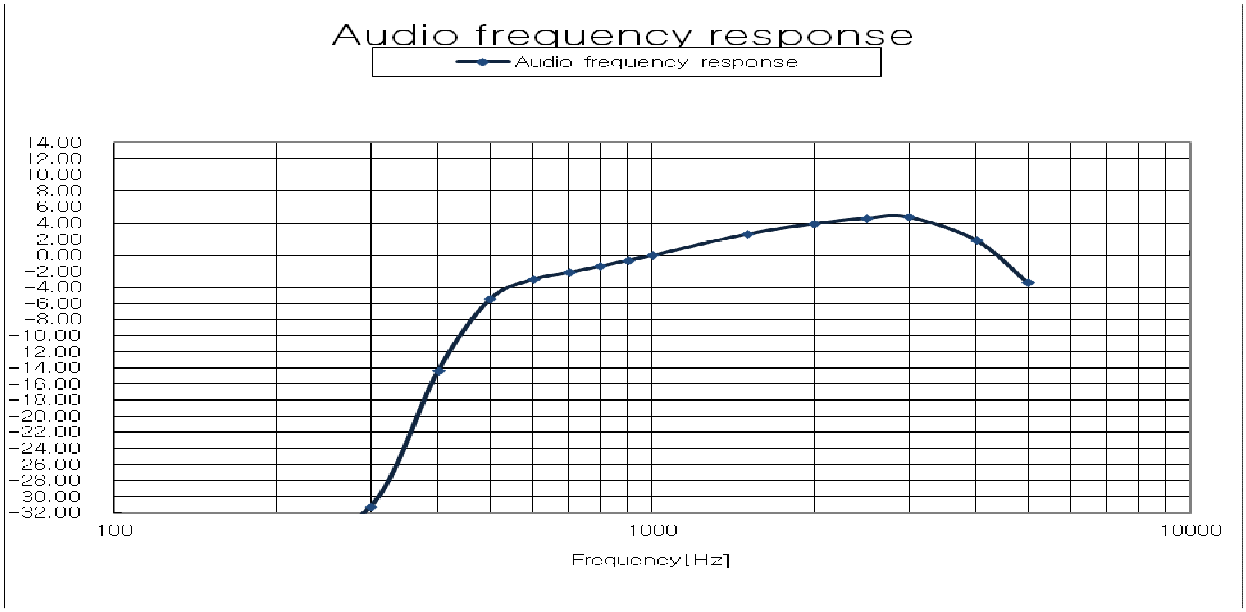
Test results

GMRS (High power), DC 6 V

Audio frequency(㎐)	Deviation(㎑)	Response(㏈)
100	0.01	-34.96
200	0.01	-34.96
300	0.02	-31.22
400	0.14	-14.38
500	0.39	-5.42
600	0.52	-3.01
700	0.57	-2.13
800	0.62	-1.35
900	0.68	-0.61
1000	**0.73**	**0.00**
1500	0.99	2.66
2000	1.15	3.94
2500	1.24	4.63
3000	1.26	4.76
4000	0.91	1.92
5000	0.49	-3.40



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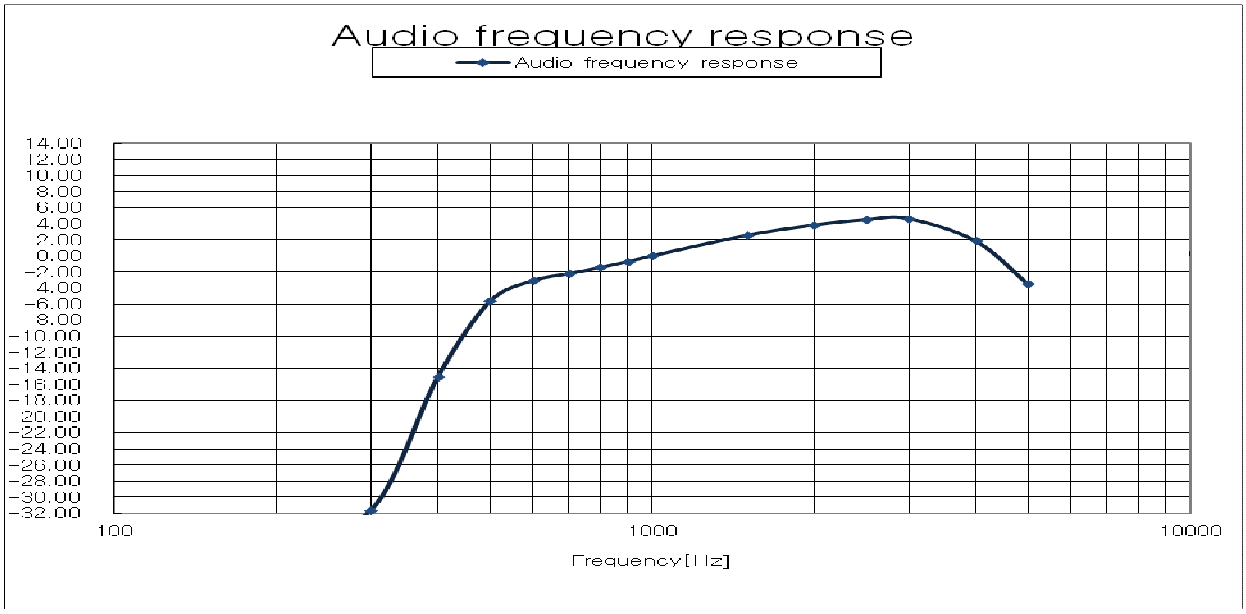
GMRS (Low power), DC 6 V

Audio frequency(㎐)	Deviation(㎑)	Response(㏈)
100	0.01	-34.30
200	0.01	-34.94
300	0.02	-31.64
400	0.13	-15.01
500	0.38	-5.65
600	0.51	-3.10
700	0.56	-2.22
800	0.61	-1.47
900	0.67	-0.72
1000	**0.73**	**0.00**
1500	0.97	2.55
2000	1.13	3.84
2500	1.22	4.51
3000	1.24	4.64
4000	0.90	1.83
5000	0.49	-3.50



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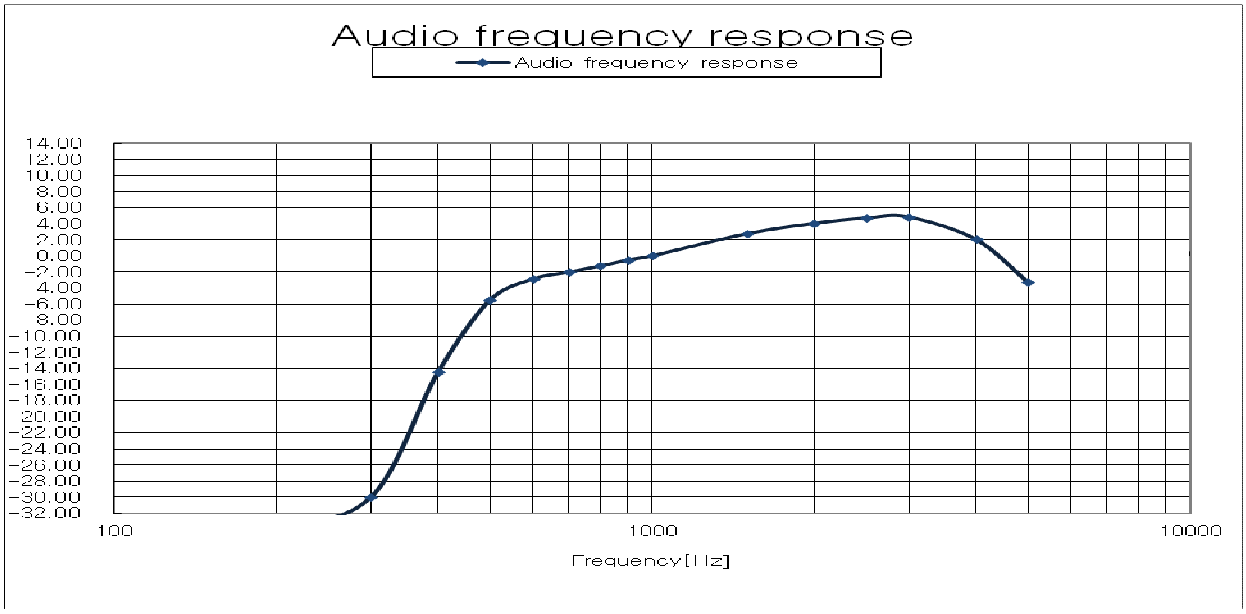
FRS, DC 6 V

Audio frequency(㎐)	Deviation(㎑)	Response(㏈)
100	0.02	-33.46
200	0.02	-33.23
300	0.02	-30.01
400	0.14	-14.47
500	0.39	-5.50
600	0.52	-2.90
700	0.57	-2.03
800	0.63	-1.28
900	0.68	-0.53
1000	**0.73**	**0.00**
1500	1.00	2.75
2000	1.16	4.04
2500	1.25	4.70
3000	1.26	4.83
4000	0.92	2.05
5000	0.50	-3.26



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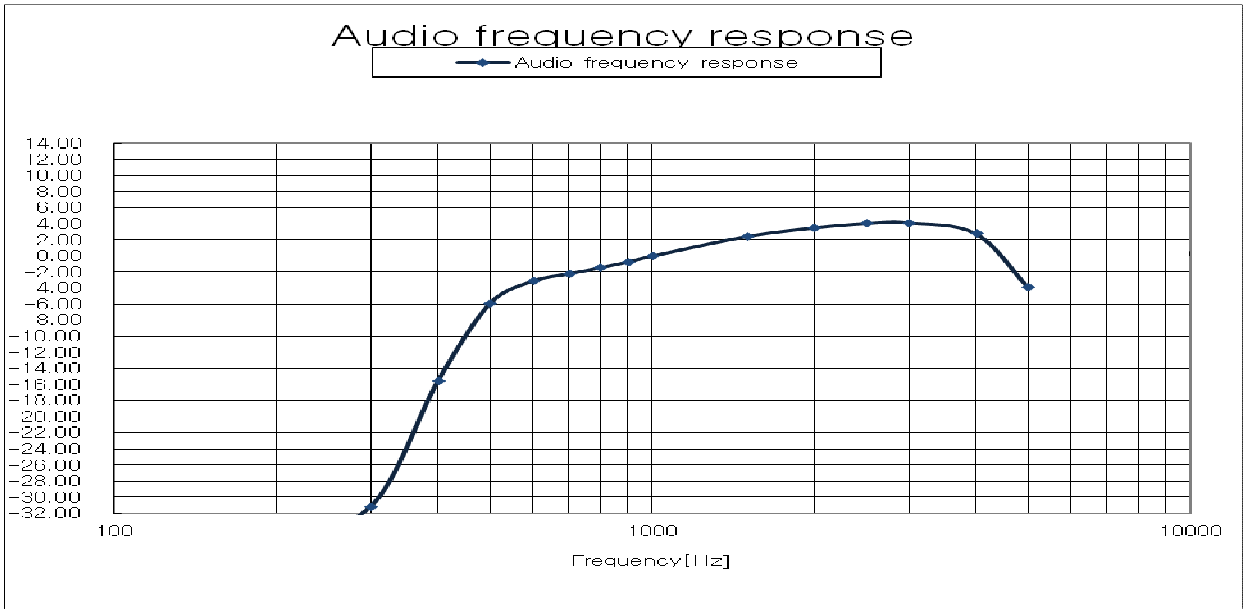
GMRS (High power), DC 4.8 V

Audio frequency(㎐)	Deviation(㎑)	Response(㏈)
100	0.02	-34.73
200	0.02	-34.57
300	0.02	-31.13
400	0.15	-15.52
500	0.44	-5.88
600	0.61	-3.12
700	0.68	-2.21
800	0.74	-1.46
900	0.80	-0.73
1000	**0.87**	**0.00**
1500	1.16	2.44
2000	1.31	3.52
2500	1.39	4.07
3000	1.41	4.14
4000	1.20	2.80
5000	0.56	-3.85



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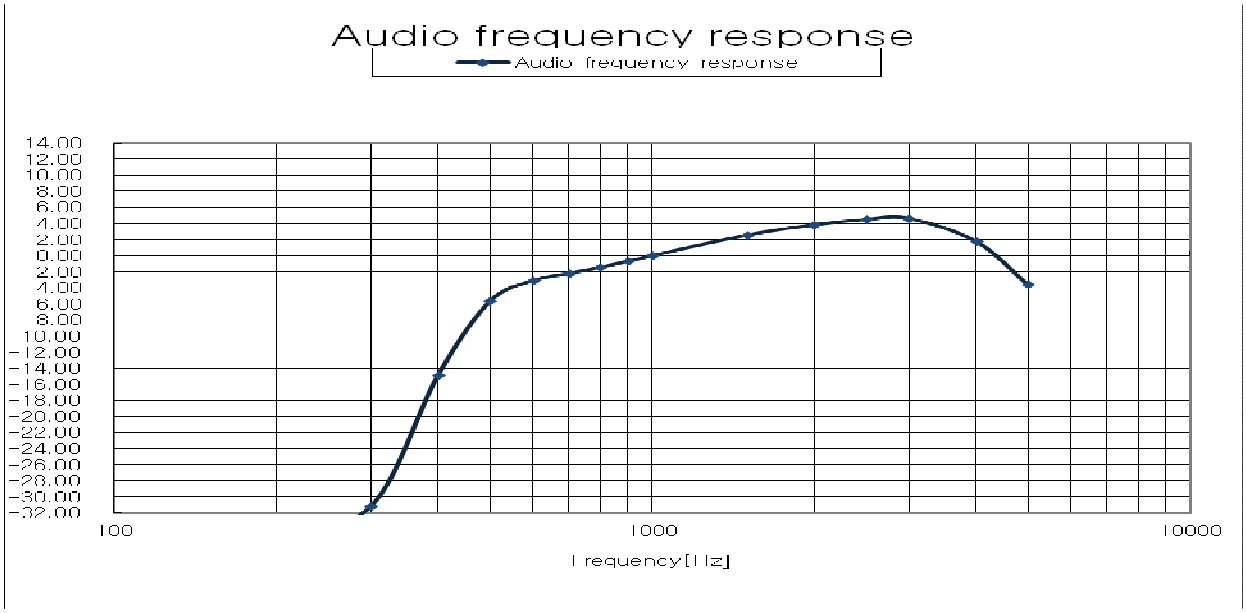
GMRS (Low power), DC 4.8 V

Audio frequency(㎐)	Deviation(㎑)	Response(㏈)
100	0.01	-34.26
200	0.01	-34.26
300	0.02	-31.16
400	0.13	-14.84
500	0.38	-5.61
600	0.51	-3.10
700	0.56	-2.20
800	0.61	-1.46
900	0.67	-0.70
1000	**0.72**	**0.00**
1500	0.97	2.57
2000	1.13	3.84
2500	1.22	4.51
3000	1.23	4.64
4000	0.89	1.80
5000	0.48	-3.59



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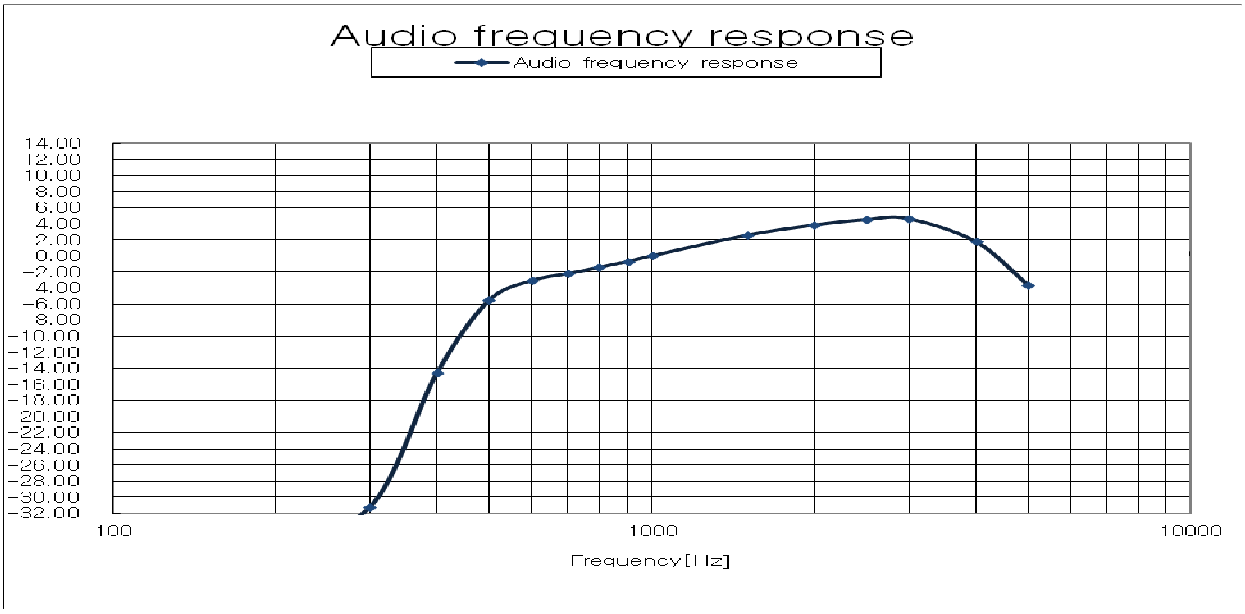
The test results in the report only apply to the tested sample.

FRS, DC 4.8 V

Audio frequency(㎐)	Deviation(㎑)	Response(㏈)
100	0.01	-34.38
200	0.01	-34.38
300	0.02	-31.28
400	0.14	-14.57
500	0.39	-5.55
600	0.51	-3.10
700	0.57	-2.23
800	0.62	-1.47
900	0.68	-0.72
1000	**0.73**	**0.00**
1500	0.98	2.55
2000	1.14	3.82
2500	1.23	4.50
3000	1.25	4.61
4000	0.90	1.75
5000	0.48	-3.62



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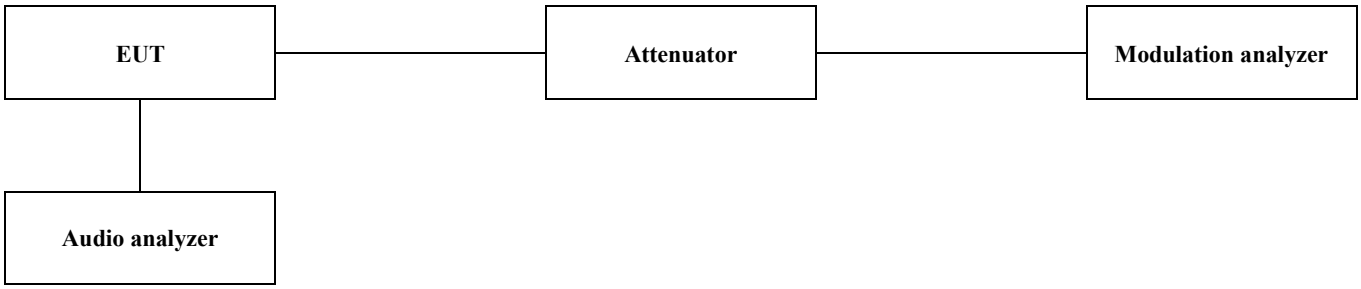
2.1.4 Low-pass filter response

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 ㎑) between 3 and 20 ㎑, the filter must have an attenuation of at least 60 $\log_{10}$(f/3) ㏈ greater than the attenuation at 1 ㎑. Above 20 ㎑, it must have an attenuation of at least 50 ㏈ greater than the attenuation at 1 ㎑.

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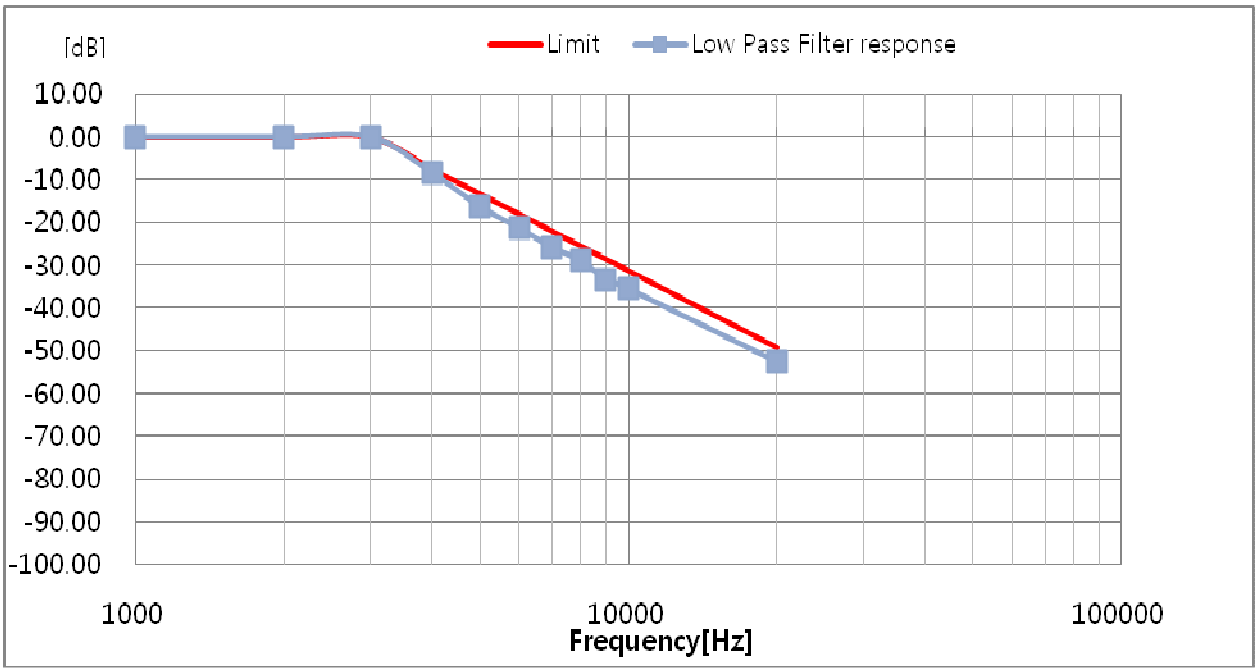
The test results in the report only apply to the tested sample.

Test results

DC 6 V

Audio frequency(Hz)	Deviation(㎑)	Response(dB)
1000	0.00	0.00
2000	0.00	0.00
3000	0.00	0.00
4000	-8.50	-7.50
5000	-16.30	-13.31
6000	-21.30	-18.06
7000	-25.80	-22.08
8000	-28.90	-25.56
9000	-33.30	-28.63
10000	-35.50	-31.37
20000	-52.50	-49.43



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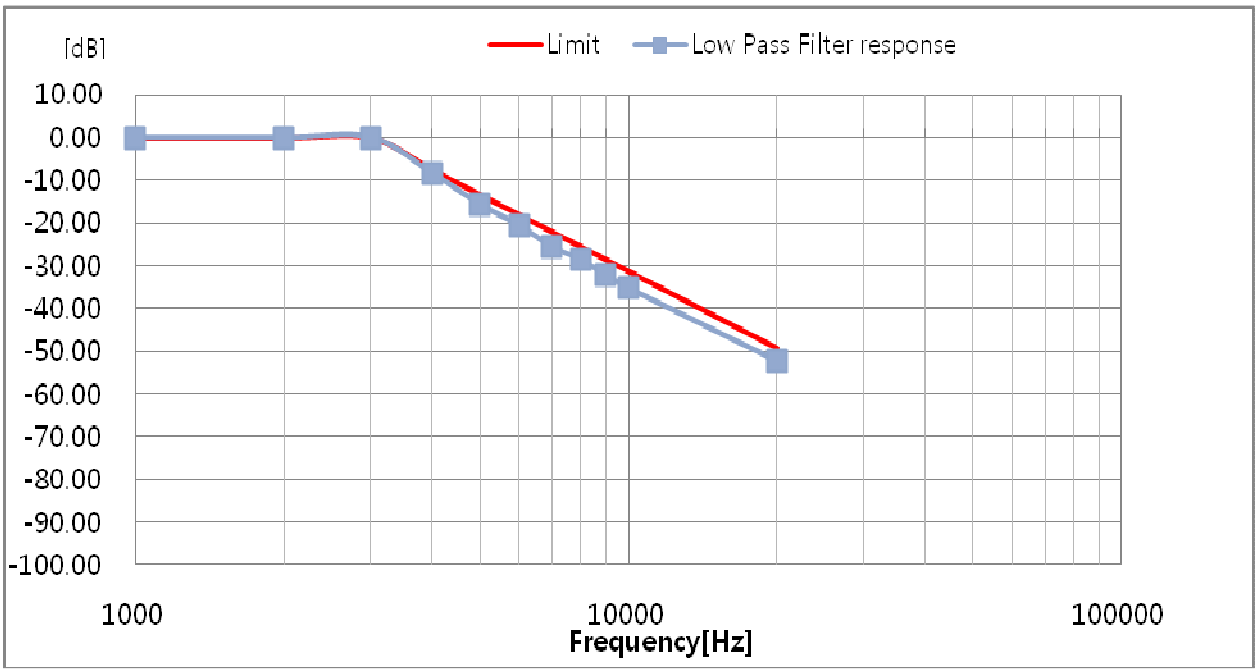
DC 4.8 V

Audio frequency(㎐)	Deviation(㎑)	Response(㏈)
1000	0.00	0.00
2000	0.00	0.00
3000	0.00	0.00
4000	-8.30	-7.50
5000	-15.60	-13.31
6000	-20.50	-18.06
7000	-25.50	-22.08
8000	-28.50	-25.56
9000	-32.10	-28.63
10000	-35.10	-31.37
20000	-52.10	-49.43



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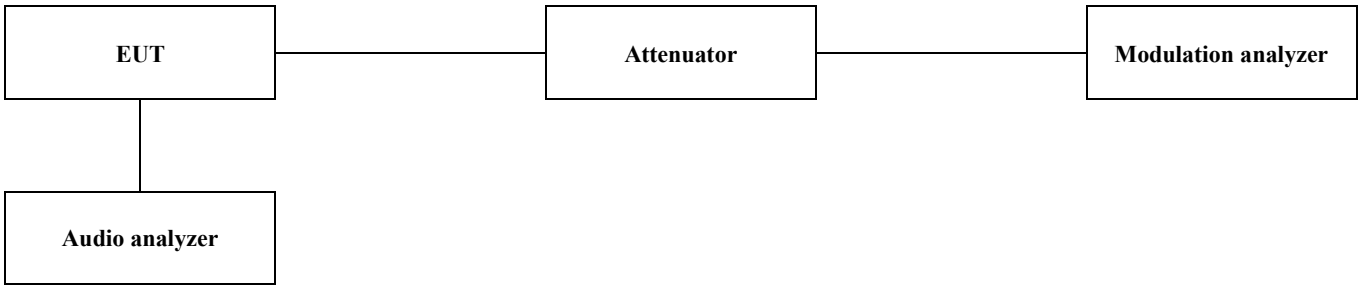
2.1.5 Occupied bandwidth and emission mask

Test setup



Test procedure
TIA/EIA-603-C section 2.2.11
(Modulate the transmitter with a 2 500 ㎐ sine wave at an input level 16 ㏈ 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 ㎑. The authorized bandwidth for emission type A1D or A3E is 8 ㎑. The authorized bandwidth for emission type F1D, G1D, F3E or G3E is 20 ㎑.

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

§95.635 & RSS-210 A6.1.5, A6.2.5
At least 25 ㏈ (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 ㏈ 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) ㏈ on any frequency removed from the center of the authorized bandwidth by more than 250 %.

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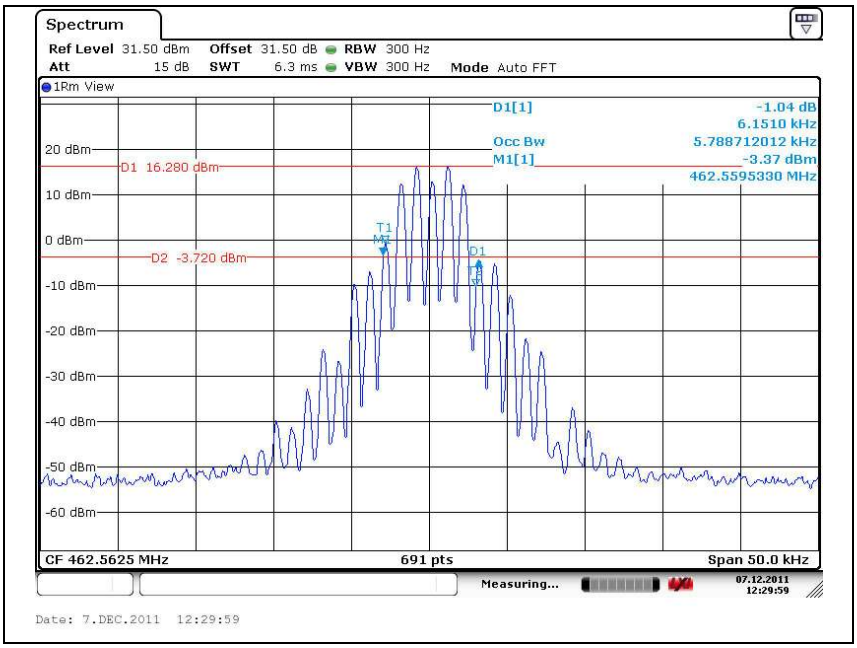
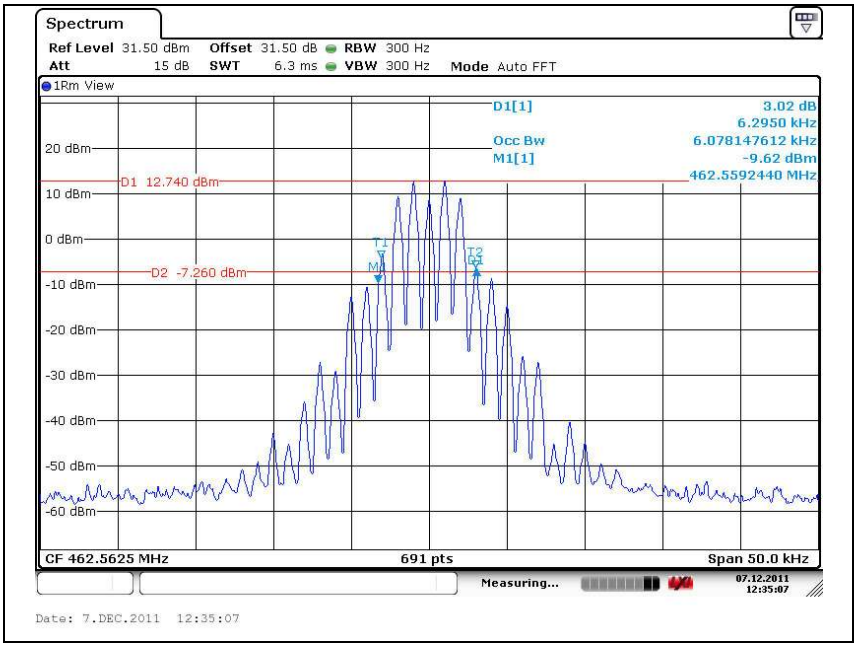
Test results

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



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



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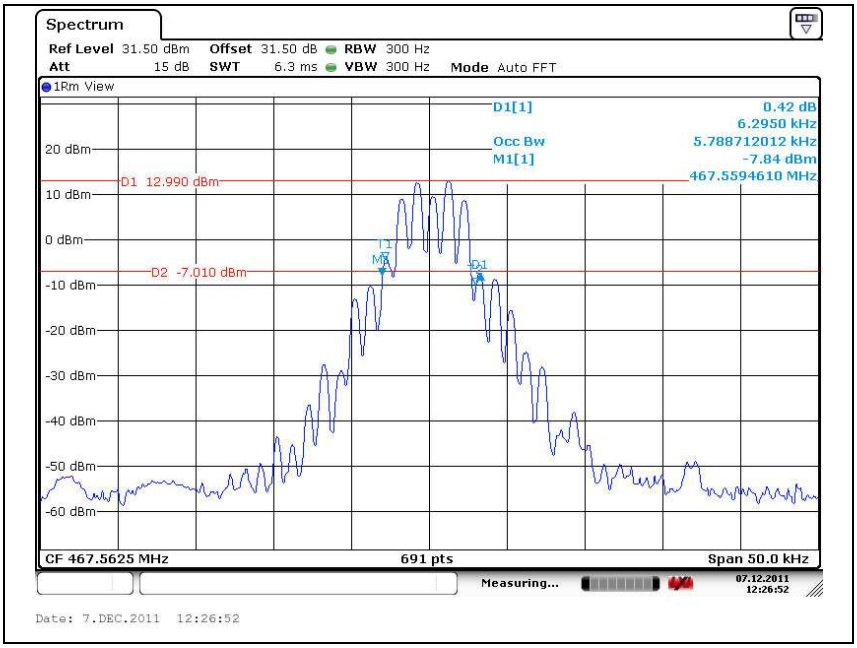
20 dB bandwidth for FRS, DC 6 V



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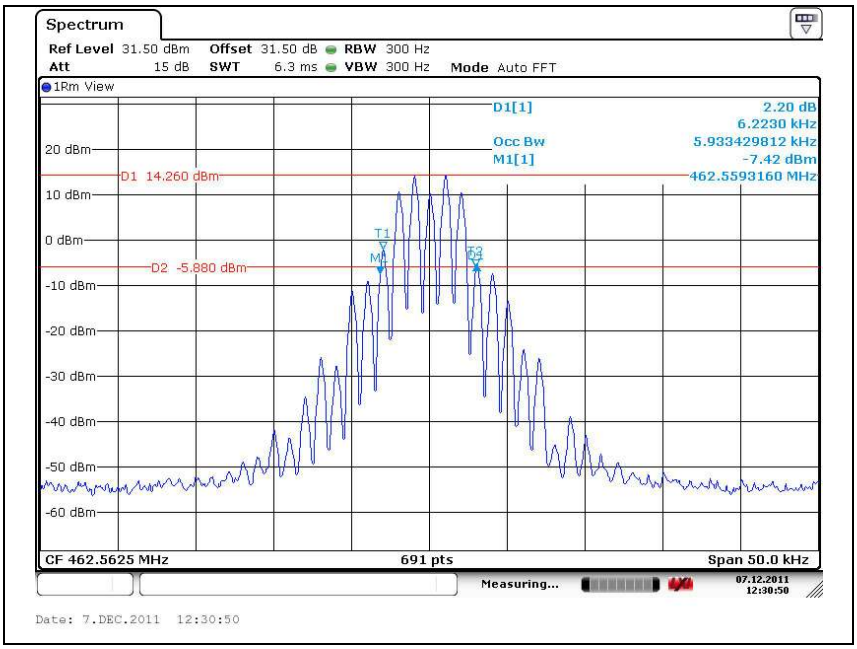
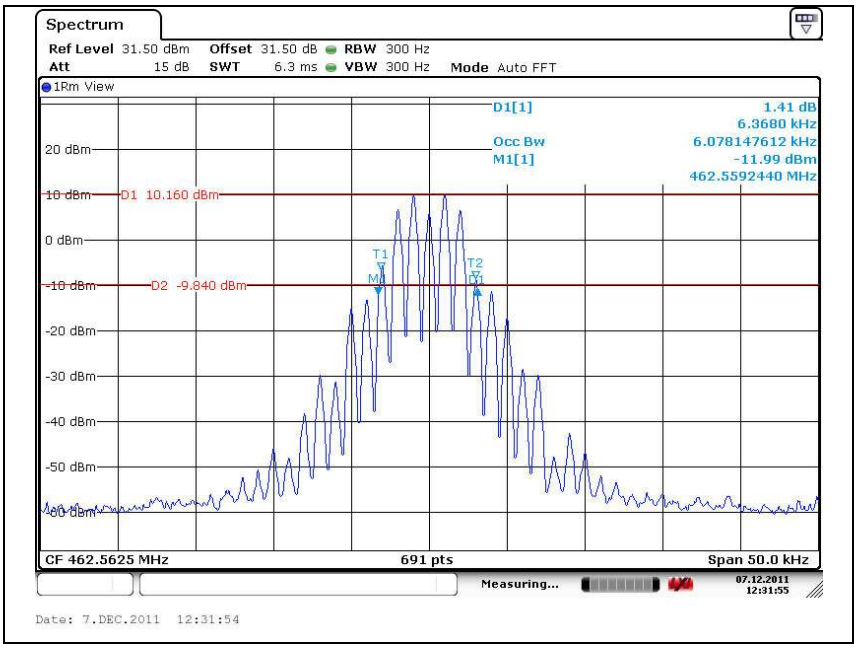
20 dB bandwidth for GMRS (High power), DC 4.8 V



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



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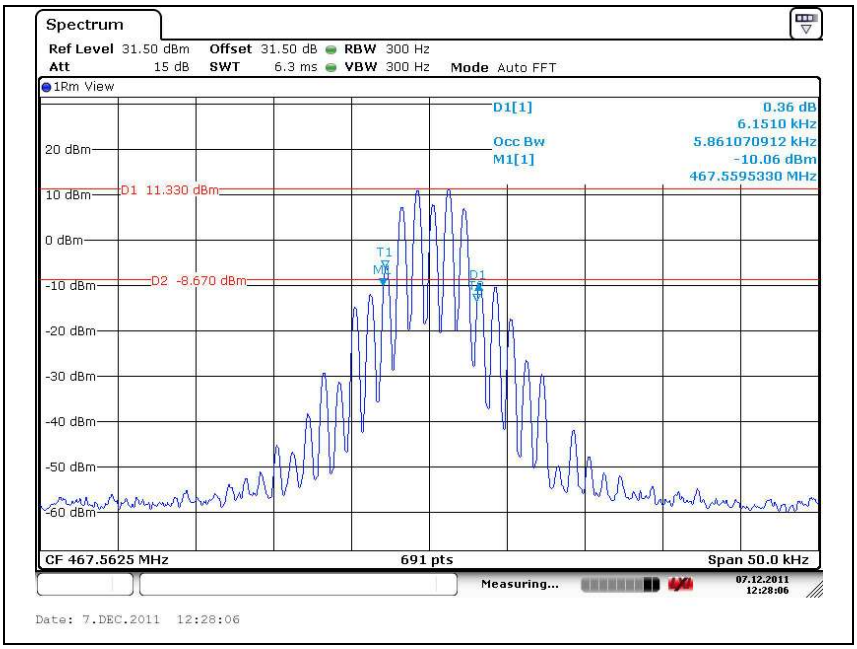
20 dB bandwidth for FRS, DC 4.8 V



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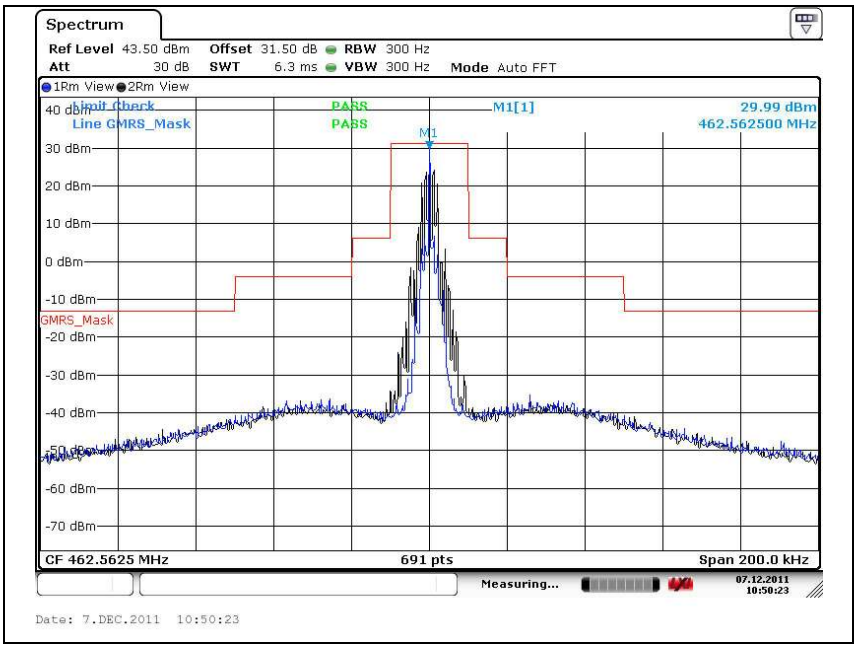
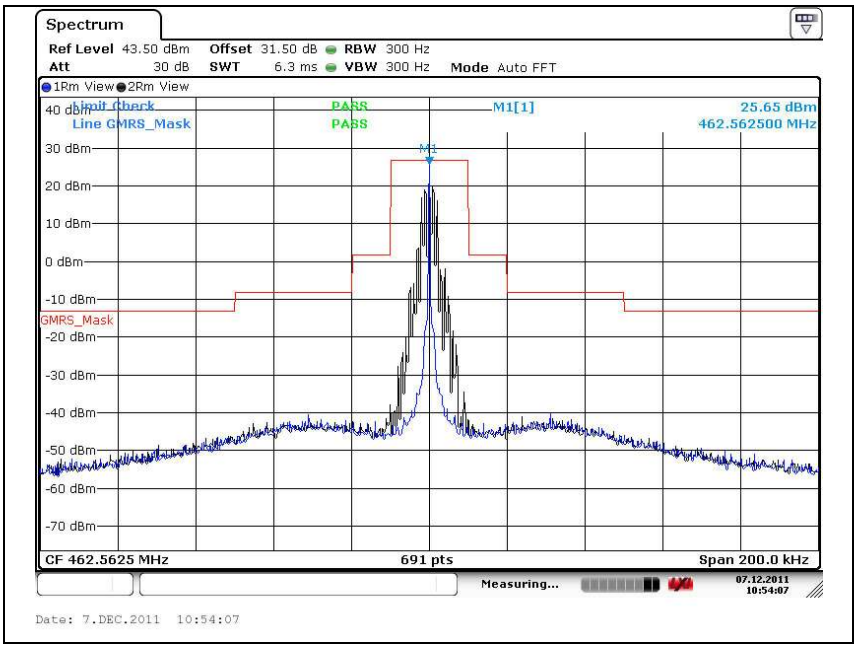
Emission mask for GMRS (High power), DC 6 V



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



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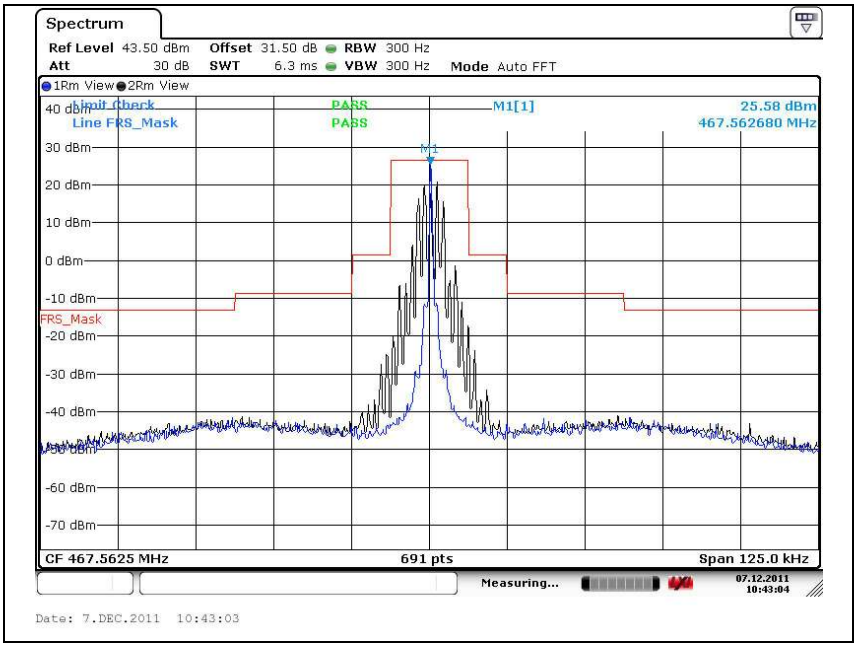
Emission mask for FRS, DC 6 V



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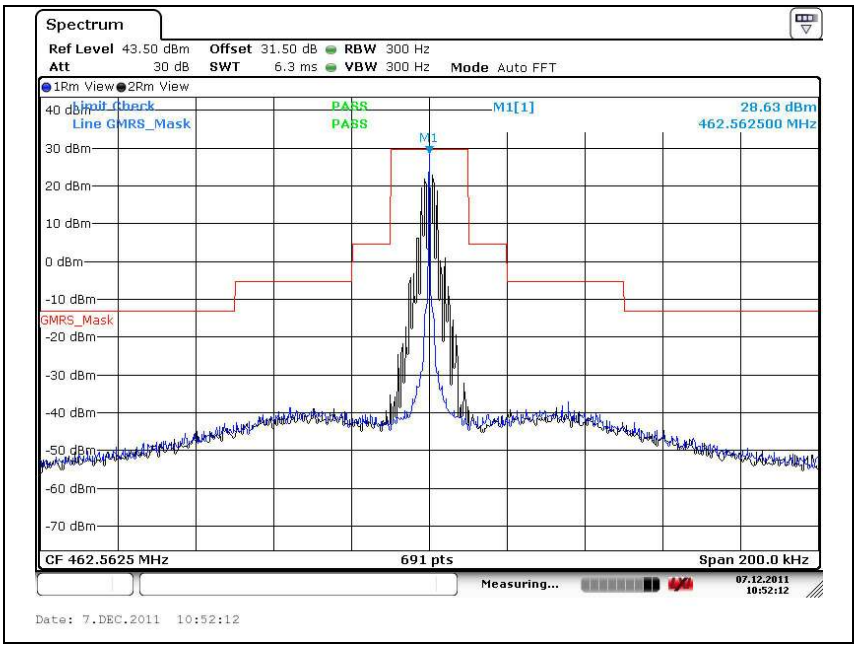
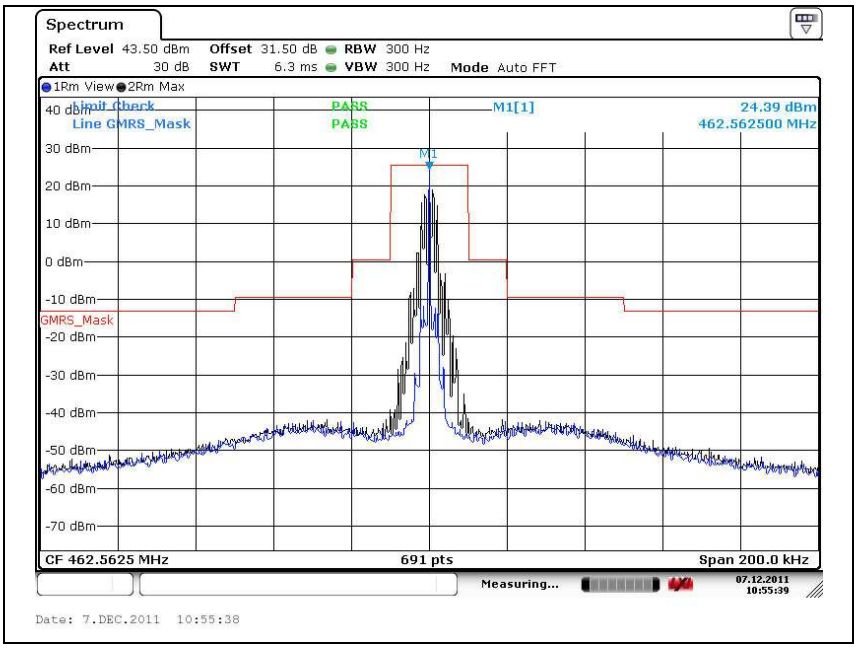
Emission mask for GMRS (High power), DC 4.8 V



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



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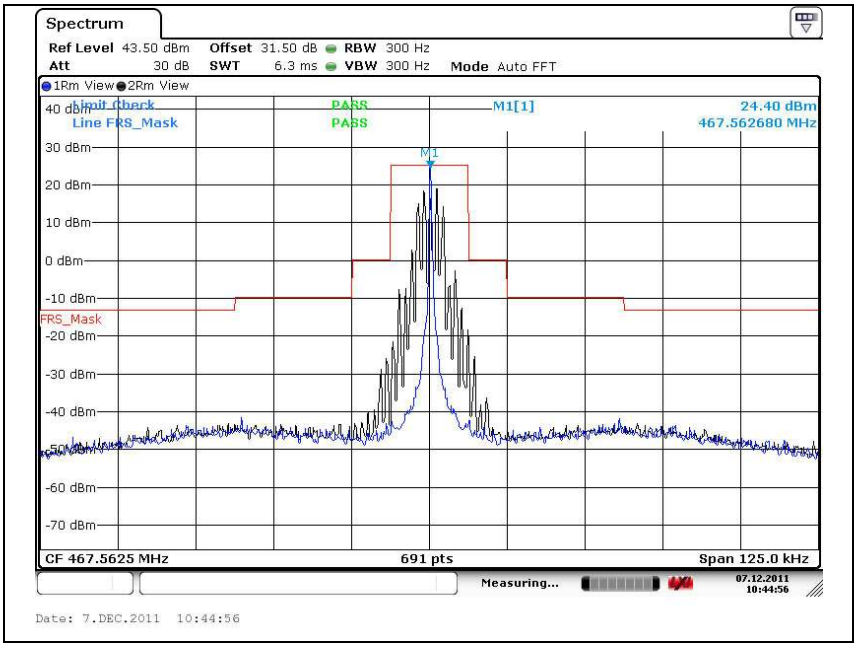
Emission mask for FRS, DC 4.8 V



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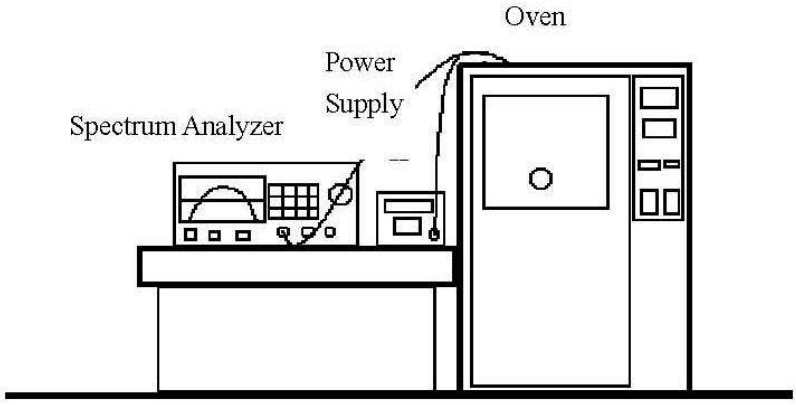
2.1.6 Frequency stability

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 ㎑, VBW=1 ㎑.
3. Set the temperature of chamber to -30℃. 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℃ decreased per stage until the highest temperature 50℃ 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 that ±5 ppm

RSS-210 A6.2.6

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

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Test results

GMRS for High power, DC 6 V

Assigned frequency (㎒): 462.562 5

Temperature (℃)	Measure frequency (㎒)	Frequency deviation (㎐)	Frequency deviation (ppm)	Frequency deviation (%)
-30	462.562 594	94	0.203	0.000 020
-20	462.562 646	146	0.316	0.000 032
-10	462.562 498	-2	-0.004	0.000 000
0	462.562 548	48	0.104	0.000 010
10	462.562 390	-110	-0.238	-0.000 024
20	462.562 780	280	0.605	0.000 061
30	462.562 397	-103	-0.223	-0.000 022
40	462.562 359	-141	-0.305	-0.000 031
50	462.562 180	-320	-0.692	-0.000 069

Temperature (℃)	Voltage (V)	Measure frequency (㎒)	Frequency deviation (ppm)	Frequency deviation (%)
20	5.10	462.562 784	0.614	0.000 061
20	6.90	462.562 784	0.614	0.000 061

GMRS for Low power, DC 6 V

Assigned frequency (㎒)**:** 462.562 5

Temperature (℃)	Measure frequency (㎒)	Frequency deviation (㎐)	Frequency deviation (ppm)	Frequency deviation (%)
-30	462.562 541	41	0.089	0.000 009
-20	462.562 594	94	0.203	0.000 020
-10	462.562 437	-63	-0.136	-0.000 014
0	462.562 379	-121	-0.262	-0.000 026
10	462.562 483	-17	-0.037	-0.000 004
20	462.562 660	160	0.346	0.000 035
30	462.562 302	-198	-0.428	-0.000 043
40	462.562 556	56	0.121	0.000 012
50	462.562 180	-320	-0.692	-0.000 069

Temperature (℃)	Voltage (V)	Measure frequency (㎒)	Frequency deviation (ppm)	Frequency deviation (%)
20	5.10	462.562 684	0.398	0.000 040
20	6.90	462.562 684	0.398	0.000 040

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FRS for Low power, DC 6 V

Assigned frequency (㎒): 467.712 5

Temperature (℃)	Measure frequency (㎒)	Frequency deviation (㎐)	Frequency deviation (ppm)	Frequency deviation (%)
-30	467.712 633	133	0.284	0.000 028
-20	467.712 573	73	0.156	0.000 016
-10	467.712 467	-33	-0.071	-0.000 007
0	467.712 628	128	0.274	0.000 027
10	467.712 594	94	0.201	0.000 020
20	467.712 599	99	0.212	0.000 021
30	467.712 597	97	0.207	0.000 021
40	467.712 379	-121	-0.259	-0.000 026
50	467.712 351	-149	-0.319	-0.000 032

Temperature (℃)	Voltage (V)	Measure frequency (㎒)	Frequency deviation (ppm)	Frequency deviation (%)
20	5.10	467.712 623	0.263	0.000 026
20	6.90	467.712 623	0.263	0.000 026

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GMRS for High power, DC 4.8 V

Assigned frequency (㎒): 462.562 5

Temperature (℃)	Measure frequency (㎒)	Frequency deviation (㎐)	Frequency deviation (ppm)	Frequency deviation (%)
-30	462.562 453	-47	-0.102	-0.000 010
-20	462.562 425	-75	-0.162	-0.000 016
-10	462.562 644	144	0.311	0.000 031
0	462.562 371	-129	-0.279	-0.000 028
10	462.562 402	-98	-0.212	-0.000 021
20	462.562 369	-131	-0.283	-0.000 028
30	462.562 586	86	0.186	0.000 019
40	462.562 693	193	0.417	0.000 042
50	462.562 648	148	0.320	0.000 032

Temperature (℃)	Voltage (V)	Measure frequency (㎒)	Frequency deviation (ppm)	Frequency deviation (%)
20	4.08	462.562 374	-0.272	-0.000 027
20	5.52	462.562 374	-0.272	-0.000 027

GMRS for Low power, DC 4.8 V

Assigned frequency (㎒): 462.562 5

Temperature (℃)	Measure frequency (㎒)	Frequency deviation (㎐)	Frequency deviation (ppm)	Frequency deviation (%)
-30	462.562 597	97	0.210	0.000 021
-20	462.562 428	-72	-0.156	-0.000 016
-10	462.562 300	-200	-0.432	-0.000 043
0	462.562 478	-22	-0.048	-0.000 005
10	462.562 385	-115	-0.249	-0.000 025
20	462.562 661	161	0.348	0.000 035
30	462.562 650	150	0.324	0.000 032
40	462.562 676	176	0.380	0.000 038
50	462.562 409	-91	-0.197	-0.000 020

Temperature (℃)	Voltage (V)	Measure frequency (㎒)	Frequency deviation (ppm)	Frequency deviation (%)
20	4.08	462.562 681	0.391	0.000 039
20	5.52	462.562 681	0.391	0.000 039

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FRS for Low power, DC 4.8 V

Assigned frequency (㎒): 467.712 5

Temperature (℃)	Measure frequency (㎒)	Frequency deviation (㎐)	Frequency deviation (ppm)	Frequency deviation (%)
-30	467.712 539	39	0.083	0.000 008
-20	467.712 329	-171	-0.366	-0.000 037
-10	467.712 332	-168	-0.359	-0.000 036
0	467.712 421	-79	-0.169	-0.000 017
10	467.712 377	-123	-0.263	-0.000 026
20	467.712 514	14	0.030	0.000 003
30	467.712 333	-167	-0.357	-0.000 036
40	467.712 614	114	0.244	0.000 024
50	467.712 593	93	0.199	0.000 020

Temperature (℃)	Voltage (V)	Measure frequency (㎒)	Frequency deviation (ppm)	Frequency deviation (%)
20	4.08	467.712 534	0.073	0.000 007
20	5.52	467.712 534	0.073	0.000 007

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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			

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Appendix B. Test setup photo

Radiated field emissions

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