

FCC Test Report

Report No.: AGC01284211001FE10

FCC ID : MMAMXT400A
PRODUCT DESIGNATION : GMRS Mobile Radio
BRAND NAME : MIDLAND
MODEL NAME : MXT400
APPLICANT : Midland Radio Corporation
DATE OF ISSUE : Oct. 26, 2021
STANDARD(S) : FCC Part 95 Rules
REPORT VERSION : V 1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd



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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Oct. 26, 2021	Valid	Initial Release

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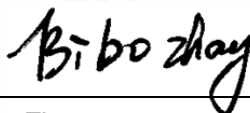
1. GENERAL INFORMATION

Applicant	Midland Radio Corporation
Address	5900 Parretta Drive, Kansas City, MO 64120-2134,USA
Manufacturer	Midland Radio Corporation
Address	5900 Parretta Drive, Kansas City, MO 64120-2134,USA
Factory	Midland Radio Corporation
Address	5900 Parretta Drive, Kansas City, MO 64120-2134,USA
Product Designation	GMRS Mobile Radio
Brand Name	MIDLAND
Test Model	MXT400
Deviation from Standard	No any deviation from the test method.
Date of Receipt	Oct.11, 2021
Date of Test	Oct. 11, 2021~Oct. 26, 2021
Test Result	Pass

WE HEREBY CERTIFY THAT:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI/TIA-603-E-2016. The sample tested as described in this report is in compliance with the FCC Rules Part 95. The test results of this report relate only to the tested sample identified in this report.

Prepared By



Bibo Zhang
(Project Engineer)

Oct. 26, 2021

Reviewed By



Calvin Liu
(Reviewer)

Oct. 26, 2021

Approved By



Max Zhang
Authorized Officer

Oct. 26, 2021

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2. PRODUCT INFORMATION

2.1 PRODUCT TECHNICAL DESCRIPTION

Hardware Version	VER2.1
Software Version	V1
Power Supply	DC 13.8V
Communication Type	Voice / Tone only
Operation Frequency Range	462.5500MHz-462.7250MHz (GMRS 462 MHz main channels) 462.5625MHz-462.7125MHz (GMRS 462 MHz interstitial channels) 467.5500MHz-467.7250MHz (GMRS 467 MHz main channels)
Modulation Type	FM
Channel Separation	12.5 KHz/25 KHz
Emission Bandwidth	10.50 KHz-(5W-12.5KHz), 10.49 KHz-(40W-12.5KHz) 15.68 KHz-(5W-25KHz), 15.68 KHz-(40W-25KHz)
Emission Designator	11K0F3E 16K0F3E
Number of Channels:	23 Channels
Rated Output Power	5W/40W (It was fixed by the manufacturer, any individual can't arbitrarily change it.)
Maximum Transmitter Power	GMRS: 36.98dBm (5W-12.5KHz) GMRS: 46.02dBm (40W-12.5KHz)
	GMRS: 36.96dBm (5W-25KHz) GMRS: 46.12dBm (40W-25KHz)
Antenna Designation	Detachable Antenna
Antenna Gain	0dBi (Typical), 2.1dBi (Max)
Frequency Tolerance	1.090ppm

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2.2 TEST FREQUENCY LIST

According to ANSI C63.26 section 5.1.2.1:

Measurements of transmitters shall be performed and, if required, reported for each frequency band in which the EUT can be operated with the device transmitting at the number of frequencies in each band specified in Table 2.

Frequency range Over which EUT operates	Number of Frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle, and 1 near bottom

Channel. No	CH. Freq	Rated Power	CH. No	CH. Freq	Rated Power
1	462.5625	5W	16	467.5500	40W
2	462.5875		17	467.5750	
3	462.6125		18	467.6000	
4	462.6375		19	467.6250	
5	462.6625		20	467.6500	
6	462.6875		21	467.6750	
7	462.7125		22	467.7000	
8	462.5500	40W	23	467.7250	-
9	462.5750		24	-	
10	462.6000		25	-	
11	462.6250		26	-	
12	462.6500		27	-	
13	462.6750		28	-	
14	462.7000		29	-	
15	462.7250		30	-	

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2.3 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for FCC ID: **MMAMXT400A**, filing to comply with Part 2, Part 95 of the Federal Communication Commission rules.

2.4 TEST METHODOLOGY

The tests were performed according to following standards:

No.	Identity	Document Title
1	FCC 47 CFR Part 95	Personal Radio Services
2	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
3	ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
4	ANSI/TIA-603-E-2016	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
5	KDB 888861 D01	888861 D01 Part 95 GMRS FRS v01

2.5 CALCULATION OF EMISSION INDICATORS

FCC Rules and Regulations Part 2.202: Necessary Bandwidth and Emission Bandwidth

For FM Mode (Channel Spacing: 12.5kHz)

Emission Designator 11K0F3E

In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation.

$$BW = 2(M+D) = 2*(3.0 \text{ kHz} + 2.5 \text{ kHz}) = 11 \text{ kHz} = 11K0$$

F3E portion of the designator represents an FM voice transmission.

Therefore, the entire designator for 12.5 kHz channel spacing FM mode is 11K0F3E.

For FM Mode (Channel Spacing: 25kHz)

Emission Designator 16K0F3E

In this case, the maximum modulating frequency is 3.0 kHz with a 5.0 kHz deviation.

$$BW = 2(M+D) = 2*(3.0 \text{ kHz} + 5.0 \text{ kHz}) = 16 \text{ kHz} = 16K0$$

F3E portion of the designator represents an FM voice transmission.

Therefore, the entire designator for 25 kHz channel spacing FM mode is 16K0F3E.

2.6 SPECIAL ACCESSORIES

Not available for this EUT intended for grant.

2.7 EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

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2.8 ANTENNA REQUIREMENT

Excerpt from §95.1787 of the FCC Rules/Regulations:

The antenna of each GMRS transmitter type must meet the following requirements.

- (1) The antenna must be a non-removable integral part of the GMRS transmitter type.
- (2) The non-detachable antenna is only for handheld portable GMRS equipment.

- This GMRS device has a fixed antenna port
- This GMRS equipment is a mobile station or a fixed station, which can be connected to an external antenna

Conclusion: The unit complies with the requirement of §95.1787.

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3. TEST ENVIRONMENT

3.1 ADDRESS OF THE TEST LABORATORY

Laboratory: Attestation of Global Compliance (Shenzhen) Co., Ltd.

Address: 1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

3.2 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L5488

Attestation of Global Compliance (Shenzhen) Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2017 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 5054.02

Attestation of Global Compliance (Shenzhen) Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 975832

Attestation of Global Compliance (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files with Registration 975832.

IC-Registration No.: 24842

Attestation of Global Compliance (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the Certification and Engineering Bureau of Industry Canada. The acceptance letter from the IC is maintained in our files with Registration 24842.

3.3 ENVIRONMENTAL CONDITIONS

	NORMAL CONDITIONS	EXTREME CONDITIONS
Temperature range (°C)	15 - 35	-30 - 50
Relative humidity range	20 % - 75 %	20 % - 75 %
Pressure range (kPa)	86 - 106	86 - 106
Power supply	DC 13.8V	LV DC 11.73V/HV DC 15.87V
Note: The Extreme Temperature and Extreme Voltages declared by the manufacturer.		

3.4 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

Test Items	Measurement Uncertainty
Frequency stability	$\pm 0.5\%$
Transmitter power conducted	$\pm 0.8\text{dB}$
Transmitter power Radiated	$\pm 1.3\text{dB}$
Conducted spurious emission 9kHz-40 GHz	$\pm 2.7\text{dB}$
Conducted Emission	$\pm 3.2\text{ dB}$
Radiated Emission below 1GHz	$\pm 3.9\text{ dB}$
Radiated Emission above 1GHz	$\pm 4.8\text{ dB}$
Occupied Channel Bandwidth	$\pm 2\%$
FM deviation	$\pm 2\%$
Audio level	$\pm 0.98\text{dB}$
Low Pass Filter Response	$\pm 0.65\text{dB}$
Modulation Limiting	0.42 %
Transient Frequency Behavior	6.8 %

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3.5 LIST OF EQUIPMENTS USED

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Apr. 14, 2021	Apr. 13, 2022
EXA Signal Analyzer	Aglient	N9020A	W1312-60196	Aug. 18, 2021	Aug. 17, 2022
EXA Signal Analyzer	Aglient	N9020A	MY52090123	Sep. 06, 2021	Sep. 05, 2022
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Oct. 07, 2021	Oct. 06, 2022
preamplifier	ChengYi	EMC184045SE	980508	Sep. 21, 2021	Sep. 20, 2022
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	Apr. 23, 2021	Apr. 22, 2023
Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-205	Jun. 07, 2021	Jun. 06, 2022
HORN ANTENNA	EM	EM-AH-10180	/	Feb.26, 2021	Feb.25, 2022
SIGNAL GENERATOR	AGILENT	E4421B	MY43351603	May 11, 2021	May 10, 2022
SIGNAL GENERATOR	R&S	SMT03	A0304261	Jun. 07, 2021	Jun. 06, 2022
ANTENNA	SCHWARZBECK	VULB9168	VULB9168-494	Jan. 08, 2021	Jan. 07, 2023
ANTENNA	SCHWARZBECK	VULB9168	D69250	Sep.26, 2018	Sep.25, 2020
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	May 22, 2020	May 21, 2022
Modulation Domain Analyzer	HP	53310A	3121A02467	Jul. 03, 2020	Jul. 02, 2022
Small environmental tester	ESPEC	SH-242	--	Sep. 03, 2020	Sep. 02, 2022
RF Communication Test Set	HP	8920B	US35010161	Sep. 06, 2021	Sep. 05, 2022
Attenuator	Weinachel Corp	58-30-33	ML030	Oct. 26, 2020	Oct. 25, 2021
Attenuator	Weinachel Corp	58-30-33	ML030	Oct. 24, 2021	Oct. 23, 2022
RF Cable	R&S	1#	--	Each time	N/A
RF Cable	R&S	2#	--	Each time	N/A
Fliter-UHF	Microwave	N25155M2	498705	May 09, 2021	May 08, 2022

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4.SYSTEM TEST CONFIGURATION

4.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

4.2 EUT EXERCISE

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

4.3 CONFIGURATION OF TESTED SYSTEM

Fig. 2-1 Configuration of Tested System



Table 2-1 Equipment Used in Tested System

4.4 EQUIPMENT USED IN TESTED SYSTEM

The Following Peripheral Devices And Interface Cables Were Connected During The Measurement:

☒ Test Accessories Come From The Manufacturer

Item	Equipment	Model No.	Identifier	Note
1	Mobile GMRS Transceiver	MXT400	FCC ID: MMAMXT400A	EUT
2	Hand microphone	N/A	N/A	Accessories

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4.5 SUMMARY OF TEST RESULTS

Item	FCC Rules	Description Of Test	Result
1	FCC 47 CFR PART 95	Antenna Equipment	Pass
2	§ 95.1767& 2.1046(a)	Maximum Transmitter Power	Pass
3	§95.1755& 2.1047(a) (b)	Modulation Limit	Pass
4	§95.1755& 2.1047(a)	Audio Frequency Response	Pass
4	§95.1755(e)	Audio Low Pass Filter Response	Pass
5	§95.1779& 2.1049	Emission Bandwidth	Pass
6	§95.1779& 2.1049	Emission Mask	Pass
7	§95.1765& 2.1055(a) (1)	Frequency Stability	Pass
9	§95.1779& 2.1051	Spurious Emission on Antenna Port	Pass
10	§95.1779& 2.1053	Spurious Radiated Emission	Pass

Note:

- 1) N/A: In this whole report not application.
- 2) The EUT is External Antenna.

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5. DESCRIPTION OF TEST MODES

The EUT (**GMRS Mobile Radio**) has been tested under normal operating condition. (GMRS TX) are chosen for testing at each channel separation.

NO.	TEST MODE DESCRIPTION	CHANNEL SEPARATION
1	GMRS TX CHANNEL 4	12.5 kHz/25 kHz
2	GMRS TX CHANNEL 12	12.5 kHz/25 kHz
3	GMRS TX CHANNEL 20	12.5 kHz/25 kHz

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
3. Manufacturers use computer PC programming software to switch and operate frequency points, refer to the instructions for details

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6.FREQUENCY STABILITY

6.1 PROVISIONS APPLICABLE

Standard Applicable [Part 95.1765] The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

GMRs: The carrier frequency of each GMRs transmitter transmitting an emission with an occupied bandwidth of 12.5 kHz or less must remain within 2.5 ppm

The carrier frequency of each GMRs transmitter transmitting an emission with an occupied bandwidth greater than 12.5 kHz must remain within 5 ppm

6.2 MEASUREMENT PROCEDURE

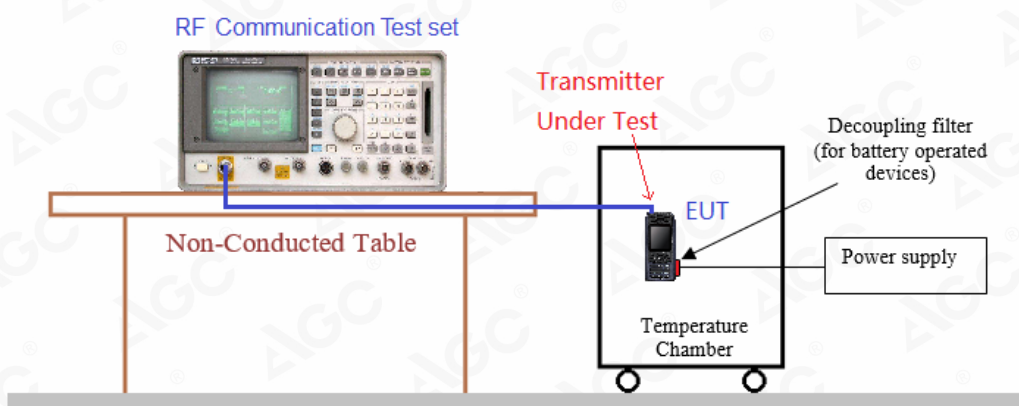
6.2.1 Frequency stability versus environmental temperature

1. Setup the configuration per figure 1 for frequencies measurement inside an environment chamber, Install new battery in the EUT.
2. Turn on EUT and set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1kHz and Video Resolution Bandwidth to 1kHz and Frequency Span to 50kHz. Record this frequency as reference frequency.
3. Set the temperature of chamber to 50°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 lowest temperature -30°C is measured, record all measured frequencies on each temperature step.

6.2.2 Frequency stability versus input voltage

1. Setup the configuration per figure 1 for frequencies measured at temperature if it is within 15°C to 25°C. Otherwise, an environment chamber set for a temperature of 20°C shall be used. The EUT shall be powered by DC 13.8V.
2. Set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1 kHz and Video Resolution Bandwidth to 1kHz. Record this frequency as reference frequency.
3. Supply the EUT primary voltage at the operating end point which is specified by manufacturer and record the frequency.

6.3 MEASUREMENT SETUP



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6.4 MEASUREMENT RESULTS

12.5 kHz Channel Separation, FM modulation, Assigned Frequency For GMRS						
Test conditions		Frequency error (ppm)			Limit (ppm)	Result
Voltage (V)	Temp (°C)	Test Frequency (MHz)				
		462.6375	462.6500	467.6500		
13.80	-30	0.549	0.653	0.543	2.5	Pass
	-20	0.730	0.955	1.000		
	-10	0.798	0.887	0.953		
	0	0.640	1.043	0.674		
	10	0.914	0.763	0.759		
	20	0.791	1.056	0.896		
	30	0.590	1.090	0.960		
	40	0.603	0.788	0.822		
	50	0.963	0.918	0.892		
15.87	20	0.893	0.711	1.077		
11.73	20	0.762	0.528	0.533		

25 kHz Channel Separation, FM modulation, Assigned Frequency For GMRS						
Test conditions		Frequency error (ppm)			Limit (ppm)	Result
Voltage (V)	Temp (°C)	Test Frequency (MHz)				
		462.6375	462.6500	467.6500		
13.80	-30	0.521	0.708	0.398	5	Pass
	-20	0.646	0.755	0.582		
	-10	0.402	0.953	0.842		
	0	0.464	0.933	0.896		
	10	0.826	0.841	0.559		
	20	0.348	0.628	0.308		
	30	0.655	0.809	0.891		
	40	0.411	0.596	0.369		
	50	0.617	0.817	0.906		
15.87	20	0.941	0.910	0.733		
11.73	20	0.814	0.961	0.375		

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7. EMISSION BANDWIDTH

7.1 PROVISIONS APPLICABLE

FCC Part 95.1773: GMRS: Main channels. The authorized bandwidth is 20 kHz for GMRS transmitters operating on any of the 462 MHz main channels, or any of the 467 MHz main channels.

Interstitial channels. The authorized bandwidth is 20 kHz for GMRS transmitters operating on any of the 462 MHz interstitial channels, and is 12.5 kHz for GMRS transmitters operating on any of the 467 MHz interstitial channels.

Occupied Bandwidth: The EUT was connected to the audio signal generator and the spectrum analyzer via the main RF connector, and through an appropriate attenuator. The EUT was controlled to transmit its maximum power. Then the bandwidth of 99% power can be measured by the spectrum analyzer.

7.2 MEASUREMENT PROCEDURE

1.The EUT was modulated by 2.5kHz sine wave audio signal; the level of the audio signal employed is 16dB greater than that necessary to produce 50% of rated system deviation.

Rated system deviation is 2.5 kHz for 12.5kHz channel spacing).

2.Spectrum set as follow:

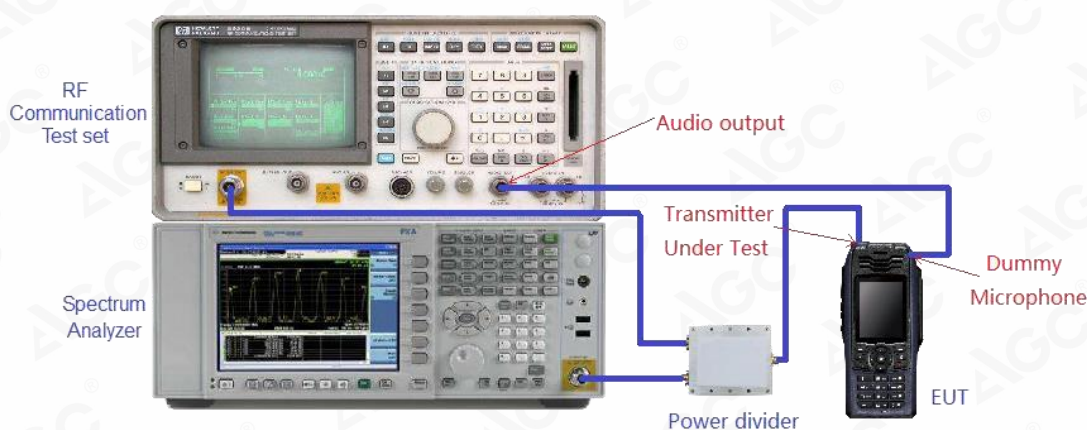
Centre frequency = fundamental frequency, span=50kHz for 12.5kHz channel spacing, RBW=300Hz, VBW=1KHz, Sweep = auto,

Detector function = peak, Trace = max hold

3.Set 99% Occupied Bandwidth and 26dB Occupied Bandwidth.

4.Measure and record the results in the test report.

7.3 MEASUREMENT SETUP



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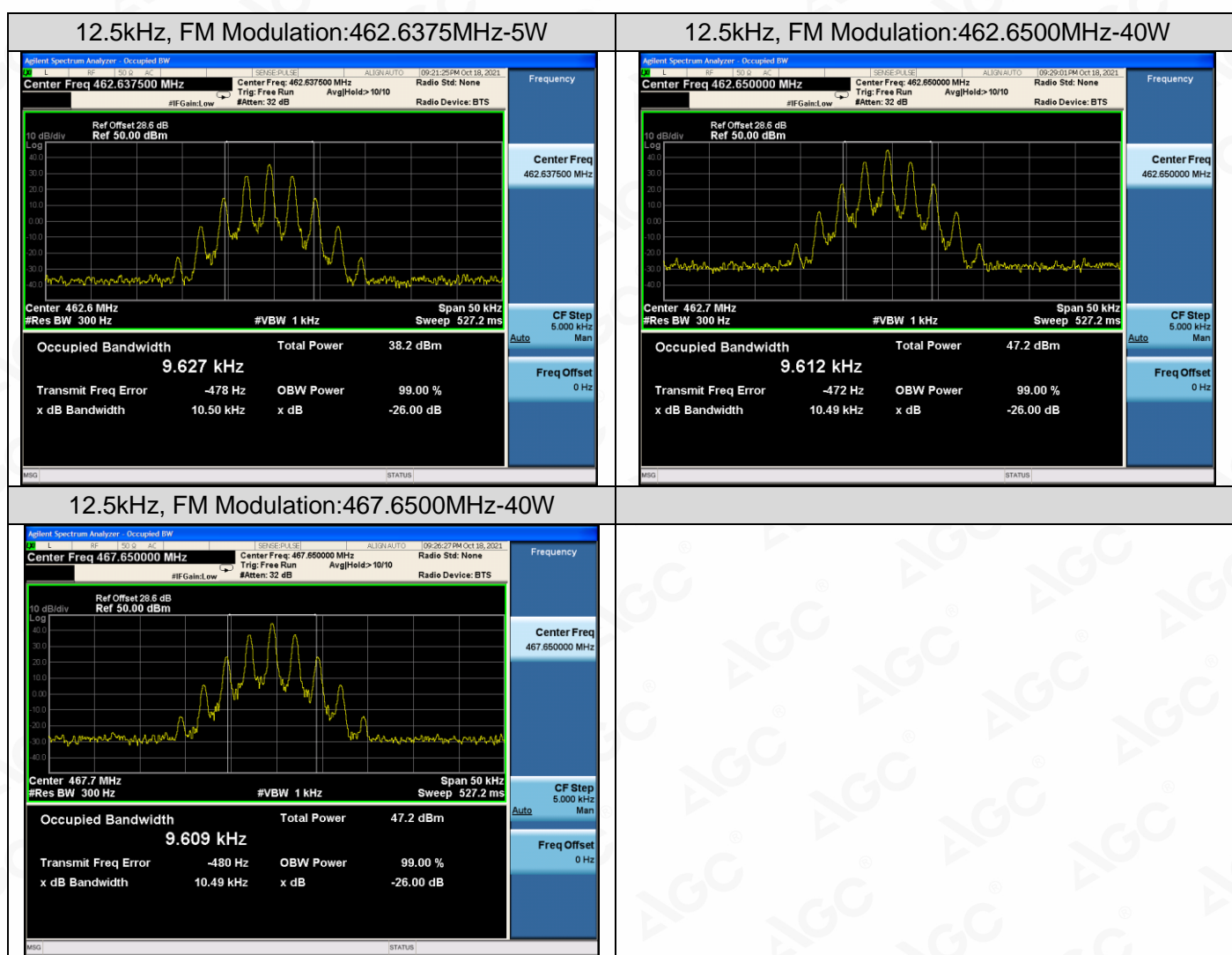
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7.4 MEASUREMENT RESULTS

Emission Bandwidth Measurement Result-GMRS				
Operating Frequency	12.5 kHz Channel Separation			
	Occupied Bandwidth	Emission Bandwidth	Limits	Result
462.6375 MHz	9.627 kHz	10.50 kHz	20.0 kHz	Pass
462.6500 MHz	9.612 kHz	10.49 kHz	20.0 kHz	Pass
467.6500 MHz	9.609 kHz	10.49 kHz	20.0 kHz	Pass

Test plot as follows:



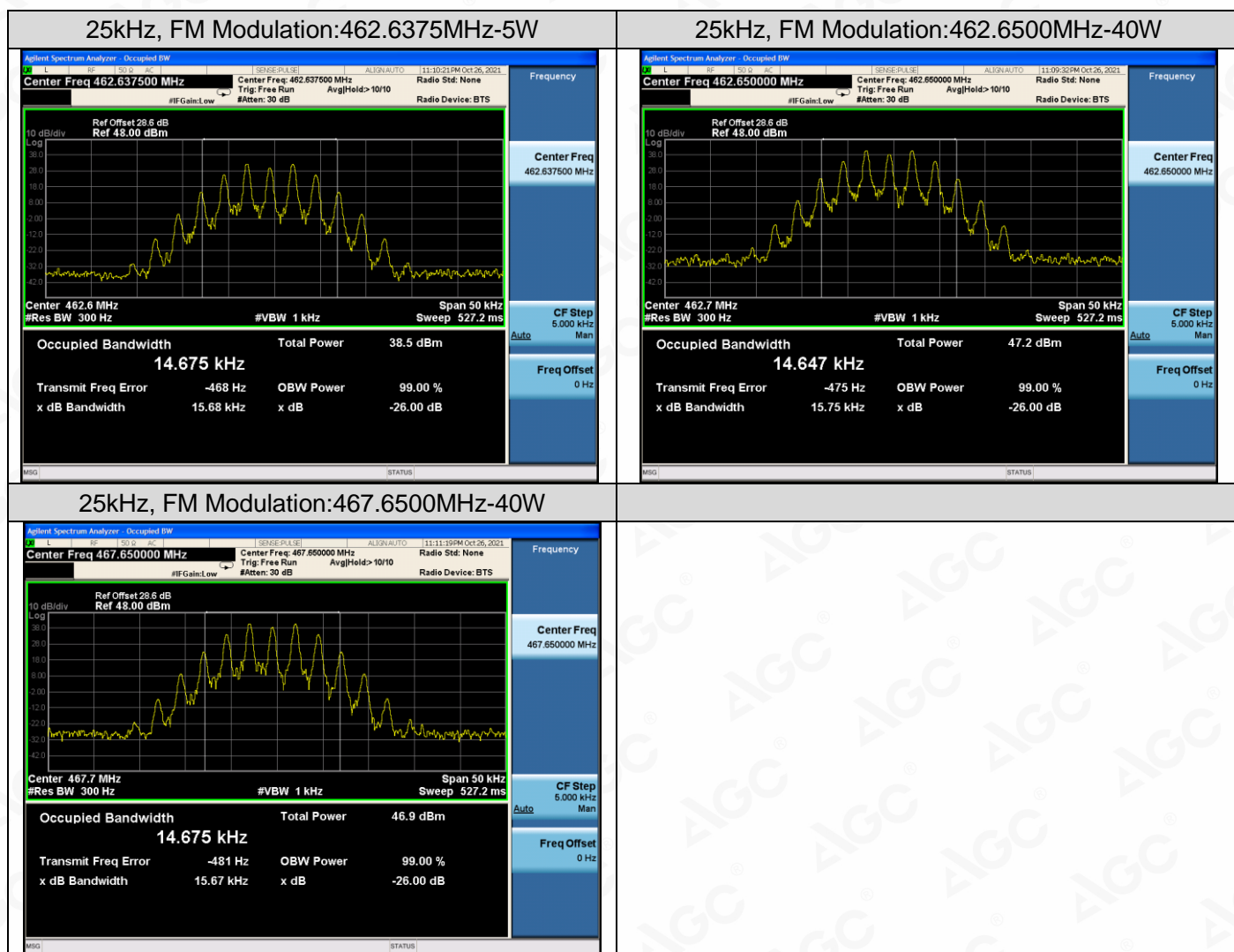
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Emission Bandwidth Measurement Result-GMRS				
Operating Frequency	25 kHz Channel Separation			
	Occupied Bandwidth	Emission Bandwidth	Limits	Result
462.6375 MHz	14.675 kHz	15.68 kHz	20.0 kHz	Pass
462.6500 MHz	14.647 kHz	15.67 kHz	20.0 kHz	Pass
467.6500 MHz	14.675 kHz	15.68 kHz	20.0 kHz	Pass

Test plot as follows:



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8. SPURIOUS RADIATED EMISSION

8.1 PROVISIONS APPLICABLE

Standard Applicable [FCC Part 95.1779] According to FCC section 95.1779, the unwanted emission should be attenuated below TP by at least $43 + 10 \log$ (Transmit Power) dB

8.2 MEASUREMENT PROCEDURE

Each GMRS transmitter type must be designed to comply with the applicable unwanted emissions limits in this section.

- a) Emission masks. Emission masks applicable to transmitting equipment in the GMRS are defined by the requirements in the following table. The numbers in the attenuation requirements column refer to rule paragraph numbers under paragraph (b) of this section.

Emission types filter	Attenuation requirements
A1D, A3E, F1D, G1D, F2D, F3E, G3E with audio filter	(1), (2), (7)
A1D, A3E, F1D, G1D, F3E, G3E without audio filter	(3), (4), (7)
H1D, J1D, R1D, H3E, J3E, R2E	(5), (6), (7)

- 1) Filtering noted for GMRS transmitters refers to the requirement in §95.1775(e).
- 2) Unwanted emission power may be measured as either mean power or peak envelope power, provided that the transmitter output power is measured the same way.
- b) Attenuation requirements. The power of unwanted emissions must be attenuated below the transmitter output power in Watts (P) by at least:
 - 1) 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.
 - 2) 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.
 - 3) $83 \log (f_d \div 5)$ dB on any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz up to and including 10 kHz.
 - 4) $116 \log (f_d \div 6.1)$ dB or $50 + 10 \log (P)$ dB, whichever is the lesser attenuation, on any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz), of more than 10 kHz up to and including 250% of the authorized bandwidth.
 - 5) 25 dB on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 150% of the authorized bandwidth.
 - 6) 35 dB on any frequency removed from the center of the authorized bandwidth by more than 150% up to and including 250% of the authorized bandwidth.
 - 7) $43 + 10 \log (P)$ dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

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DETAILED OVERVIEW OF THE TEST METHOD IS AS FOLLOWS:

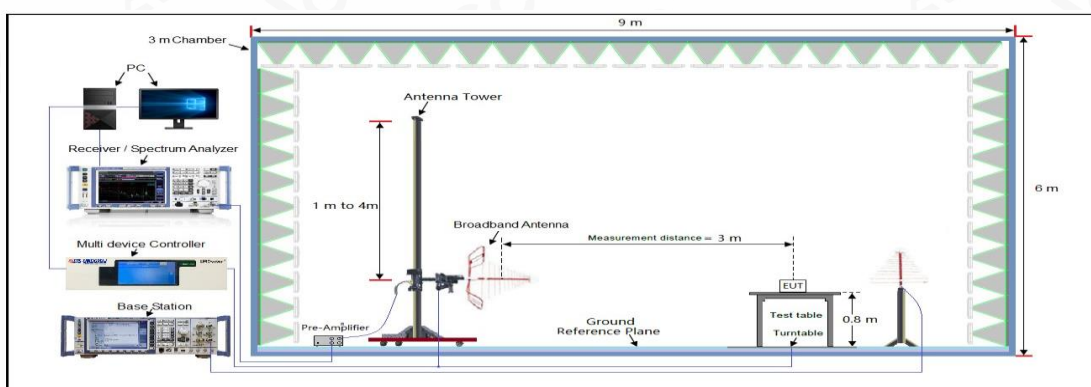
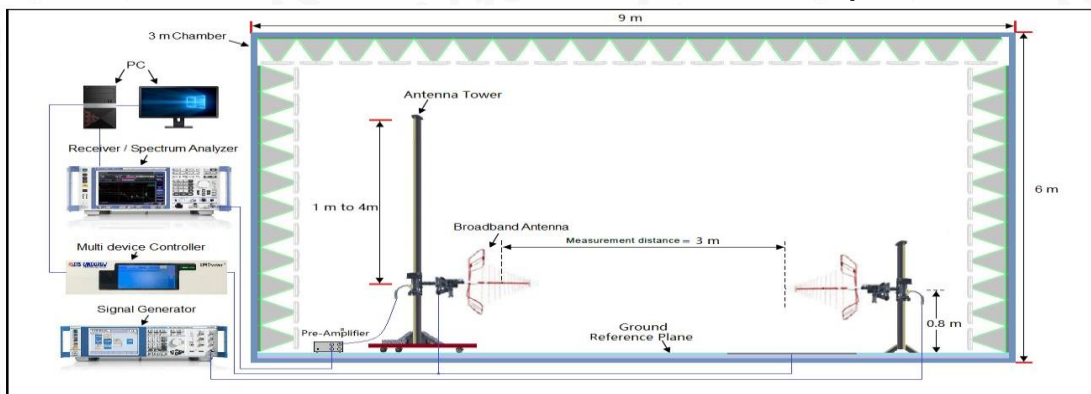
- 1) EUT was placed on a 0.8 or 1.5meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made. The radiated emission measurements of all transmit frequencies in all channels were measured with peak detector.
- 2) A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
- 3) The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz for above 1GHz and RBW=100kHz, VBW=300kHz for 30MHz to 1GHz, And the maximum value of the receiver should be recorded as (Pr).
- 4) The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
- 5) A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test
- 6) The measurement results are obtained as described below: $\text{Power(EIRP)} = \text{PMea} - \text{PAg} - \text{Pcl} - \text{Ga}$ The measurement results are amend as described below: $\text{Power(EIRP)} = \text{PMea} - \text{Pcl} - \text{Ga}$
- 7) This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
- 8) ERP can be calculated from EIRP by subtracting the gain of the dipole, $\text{ERP} = \text{EIRP} - 2.15\text{dBi}$.
- 9) Test the EUT in the lowest channel, the middle channel the Highest channel

8.3 MEASUREMENT SETUP

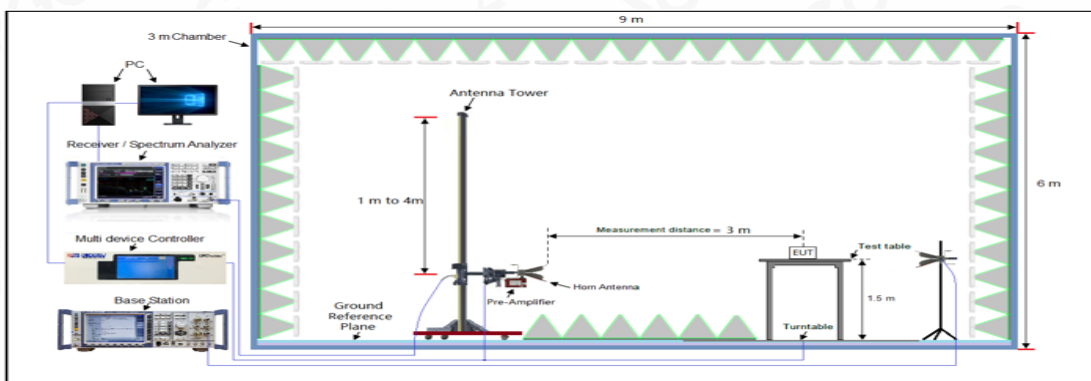
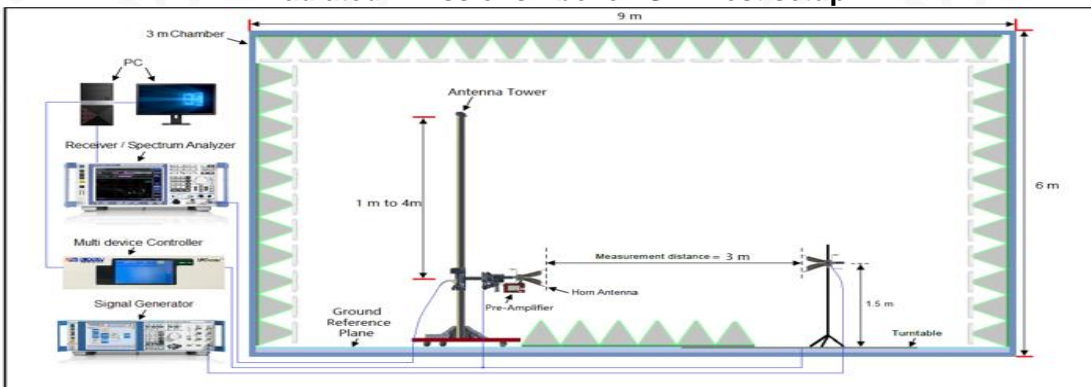
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Radiated Emissions 30MHz to 1GHz Test setup



Radiated Emissions Above 1GHz Test setup



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8.4 MEASUREMENT RESULTS

Preliminary calculation	Final Result
At least $43+10 \log (P) = 43+10 \log (5) = 49.99$ (dB)	Limit=P- Preliminary calculation= $36.99-49.99=-13$ dBm
At least $43+10 \log (P) = 43+10 \log (40) = 59.02$ (dB)	Limit=P- Preliminary calculation= $46.02-59.02=-13$ dBm

1. Factor=Antenna Factor + Cable loss. (Below 1GHz)
2. Factor=Antenna Factor+ Cable loss -Pre-amplifier. (Above 1 GHz)
3. Margin=Limit- Level

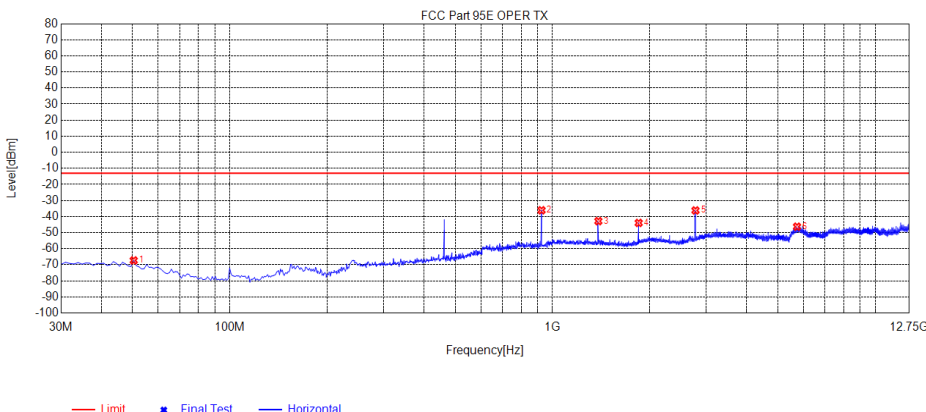
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Test Mode:	TX CH4	Polarity:	Horizontal
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FCC Part 95E OPER TX

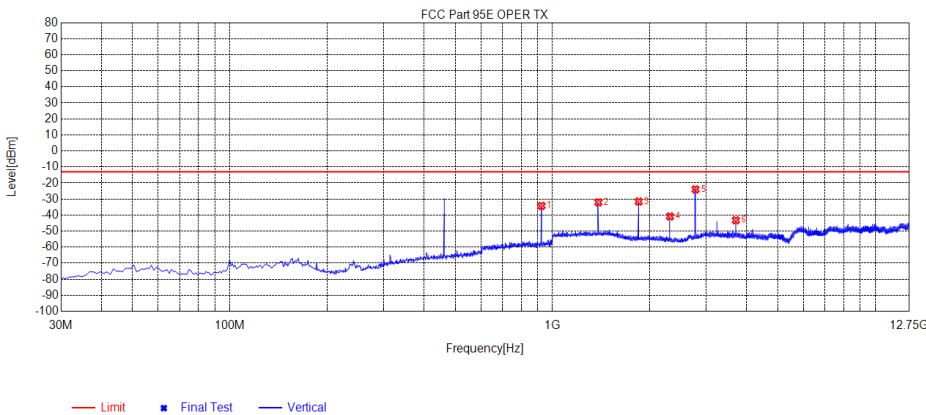


— Limit ■ Final Test — Horizontal

NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	50.3904	-100.86	-67.31	-13.00	54.31	33.55	75	Horizontal
2	925.2352	-79.58	-36.09	-13.00	23.09	43.49	217	Horizontal
3	1387.7888	-39.40	-42.85	-13.00	29.85	-3.45	1	Horizontal
4	1850.7851	-43.36	-43.95	-13.00	30.95	-0.59	284	Horizontal
5	2775.6026	-37.37	-36.20	-13.00	23.20	1.17	342	Horizontal
6	5727.4978	-56.09	-46.31	-13.00	33.31	9.78	10	Horizontal

Test Mode:	TX CH4	Polarity:	Vertical
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FCC Part 95E OPER TX



— Limit ■ Final Test — Vertical

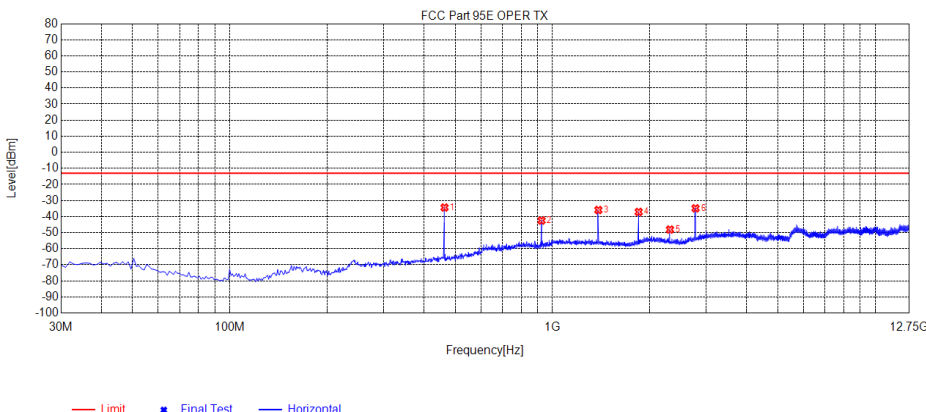
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	925.2352	-77.82	-34.25	-13.00	21.25	43.57	162	Vertical
2	1387.7888	-33.51	-32.10	-13.00	19.10	1.41	124	Vertical
3	1850.7851	-32.53	-31.60	-13.00	18.60	0.93	238	Vertical
4	2313.7814	-40.33	-40.86	-13.00	27.86	-0.53	343	Vertical
5	2775.6026	-25.26	-23.98	-13.00	10.98	1.28	152	Vertical
6	3701.5952	-46.42	-43.27	-13.00	30.27	3.15	334	Vertical

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Test Mode:	TX CH12	Polarity:	Horizontal
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FCC Part 95E OPER TX

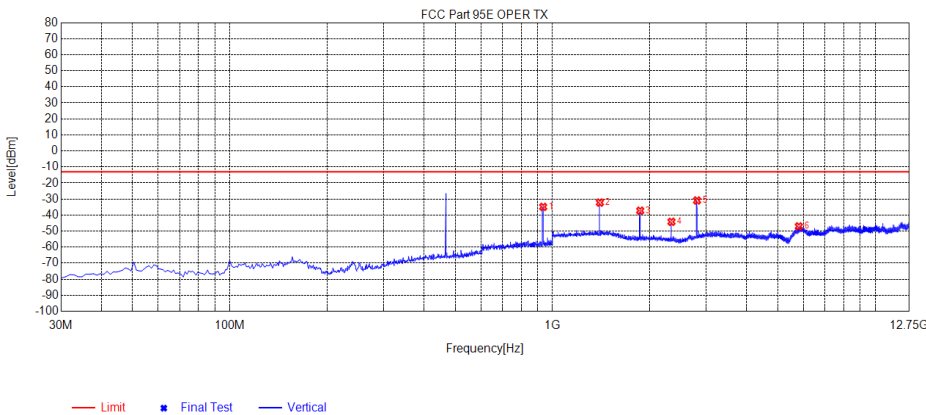


— Limit ■ Final Test — Horizontal

NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	463.0531	-69.98	-34.36	-13.00	21.36	35.62	121	Horizontal
2	925.2352	-85.94	-42.45	-13.00	29.45	43.49	237	Horizontal
3	1387.7888	-32.47	-35.92	-13.00	22.92	-3.45	284	Horizontal
4	1850.7851	-36.52	-37.11	-13.00	24.11	-0.59	112	Horizontal
5	2313.7814	-47.38	-48.09	-13.00	35.09	-0.71	199	Horizontal
6	2776.7777	-36.06	-34.88	-13.00	21.88	1.18	332	Horizontal

Test Mode:	TX CH12	Polarity:	Vertical
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FCC Part 95E OPER TX



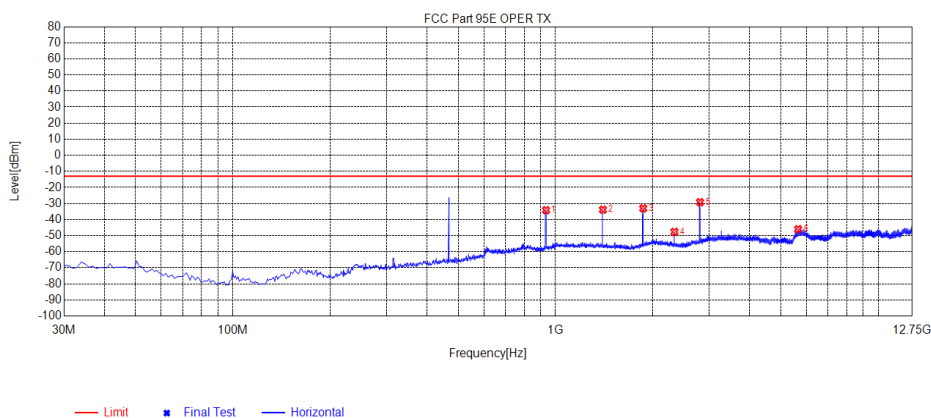
— Limit ■ Final Test — Vertical

NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	935.9159	-78.57	-34.89	-13.00	21.89	43.68	12	Vertical
2	1403.0653	-33.72	-32.20	-13.00	19.20	1.52	124	Vertical
3	1870.7621	-38.13	-37.27	-13.00	24.27	0.86	200	Vertical
4	2338.4588	-43.59	-44.20	-13.00	31.20	-0.61	162	Vertical
5	2806.1556	-32.44	-30.90	-13.00	17.90	1.54	153	Vertical
6	5802.7053	-56.08	-47.06	-13.00	34.06	9.02	359	Vertical

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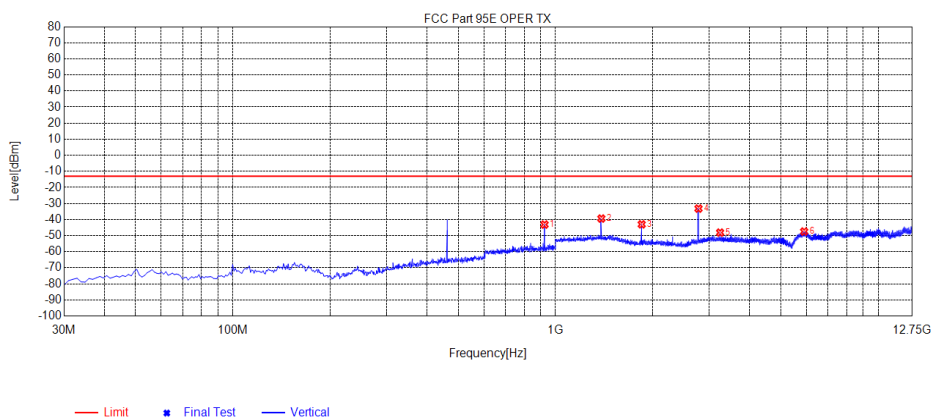


Test Mode:	TX CH20	Polarity:	Horizontal
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NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	934.9449	-77.87	-34.17	-13.00	21.17	43.70	236	Horizontal
2	1403.0653	-30.45	-33.86	-13.00	20.86	-3.41	349	Horizontal
3	1870.7621	-32.61	-33.05	-13.00	20.05	-0.44	284	Horizontal
4	2338.4588	-46.87	-47.67	-13.00	34.67	-0.80	284	Horizontal
5	2806.1556	-30.67	-29.21	-13.00	16.21	1.46	340	Horizontal
6	5651.1151	-55.47	-45.98	-13.00	32.98	9.49	103	Horizontal

Test Mode:	TX CH20	Polarity:	Vertical
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NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Angle [°]	Polarity
1	925.2352	-86.68	-43.11	-13.00	30.11	43.57	21	Vertical
2	1387.7888	-40.78	-39.37	-13.00	26.37	1.41	135	Vertical
3	1850.7851	-43.92	-42.99	-13.00	29.99	0.93	239	Vertical
4	2775.6026	-34.44	-33.16	-13.00	20.16	1.28	153	Vertical
5	3238.5989	-51.26	-48.12	-13.00	35.12	3.14	343	Vertical
6	5899.0649	-57.41	-47.46	-13.00	34.46	9.95	163	Vertical

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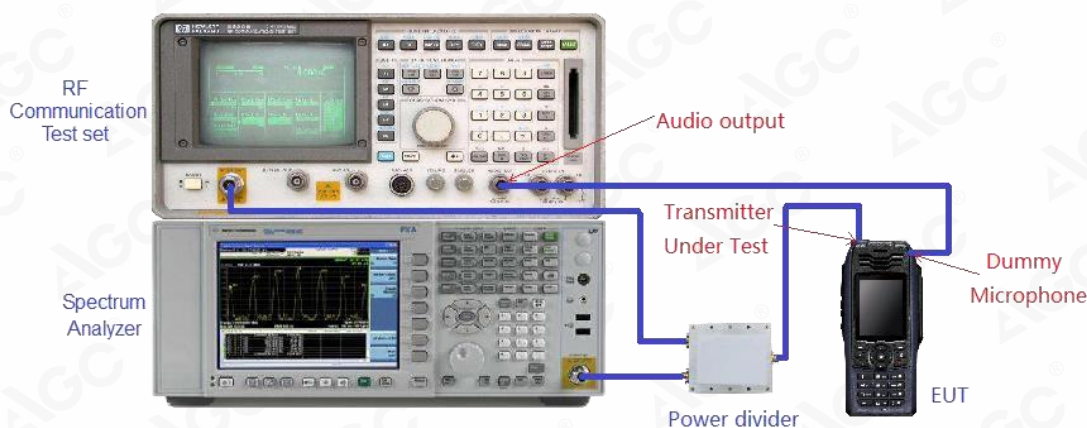
8.5 EMISSION MASK PLOT

The detailed procedure employed for Emission Mask measurements are specified as following:

-Connect the equipment as illustrated.

-Spectrum set as follow:

1. Centre frequency = fundamental frequency, Span=50kHz for 12.5kHz and 25kHz channel spacing, RBW=100Hz, VBW=300Hz for 12.5kHz, RBW=300Hz, VBW=1000Hz for 25kHz, Sweep = auto, Detector function = peak, Trace = max hold
2. Key the transmitter, and set the level of the unmodulated carrier to a full scale reference line. This is the 0dB reference for the measurement.
3. Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation (Rated system deviation is 2.5 kHz for 12.5kHz channel spacing). The input level shall be established at the frequency of maximum response of the audio modulating circuit.
4. Transmitters employing digital modulation techniques that bypass the limiter and the audio low-pass filter shall be modulated as specified by the manufacturer.
5. Measure and record the results in the test report.

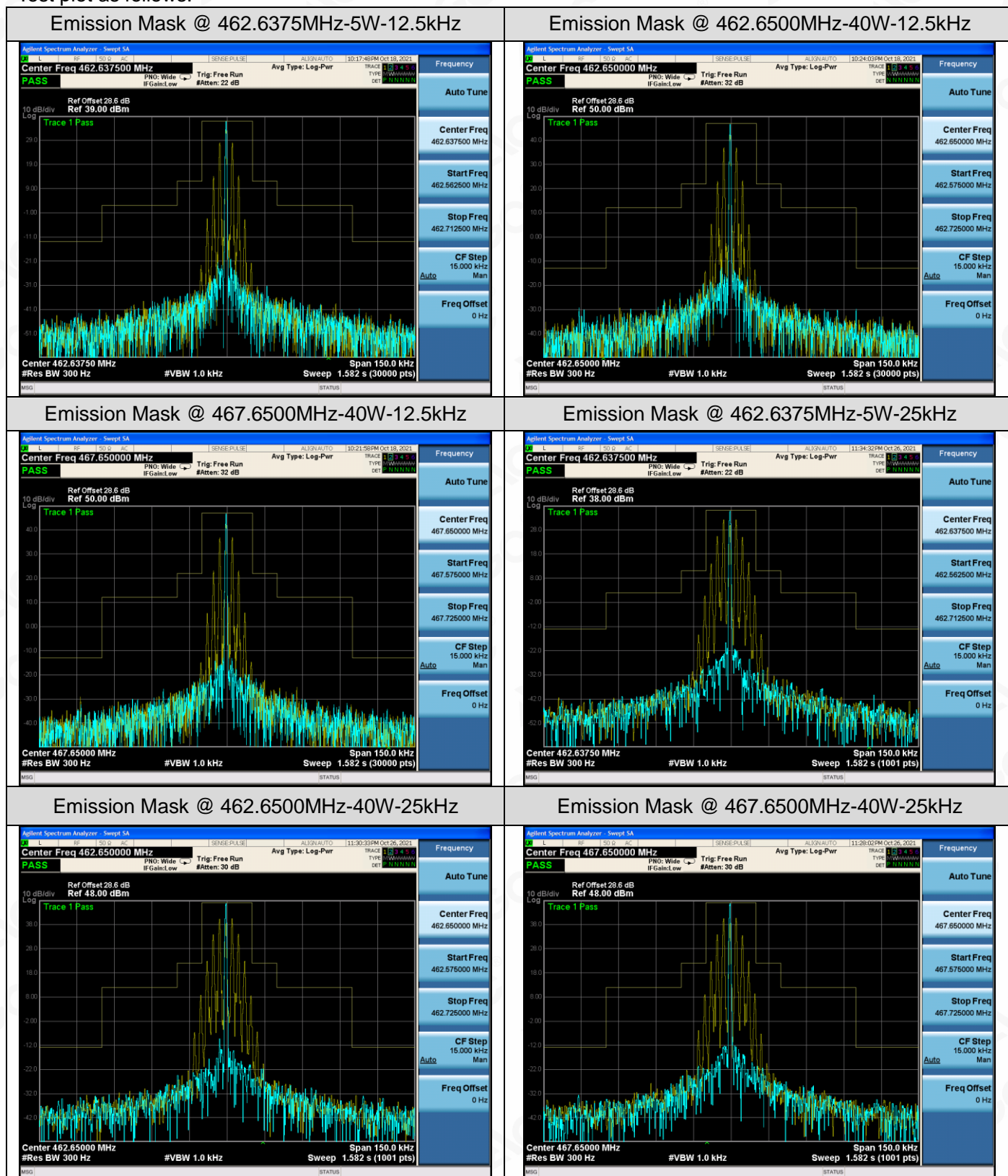


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Test plot as follows:



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9. MODULATION CHARACTERISTICS

9.1 PROVISIONS APPLICABLE

According to FCC§2.1047 and §95.1775, for Voice Modulation Communication Equipment, the frequency response of the audio modulation circuit over a range of 100 to 5000Hz shall be measured.

Each GMRS transmitter type must be designed to satisfy the modulation requirements in this section. Operation of GMRS stations must also be in compliance with these requirements.

(a) Main channels. The peak frequency deviation for emissions to be transmitted on the main channels must not exceed ± 5 kHz.

(b) 462 MHz interstitial channels. The peak frequency deviation for emissions to be transmitted on the 462 MHz interstitial channels must not exceed ± 5 kHz.

(c) 467 MHz interstitial channels. The peak frequency deviation for emissions to be transmitted on the 467 MHz interstitial channels must not exceed ± 2.5 kHz, and the highest audio frequency contributing substantially to modulation must not exceed 3.125 kHz.

9.2 MEASUREMENT METHOD

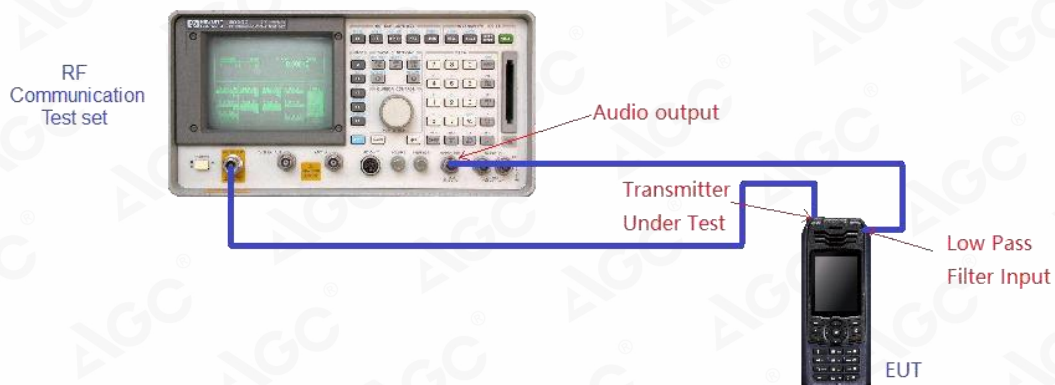
9.2.1 Modulation Limit

- (1). Configure the EUT as shown in figure 1, adjust the audio input for 60% of rated system deviation at 1kHz using this level as a reference (0dB) and vary the input level from -20 to $+20$ dB. Record the frequency deviation obtained as a function of the input level.
- (2). Repeat step 1 with input frequency changing to 300, 1000, 1500 and 3000Hz in sequence.

9.2.2 Audio Frequency Response

- (1). Configure the EUT as shown in figure 1.
- (2). Adjust the audio input for 20% of rated system deviation at 1 kHz using this level as a reference (0 dB).
- (3). Vary the Audio frequency from 100 Hz to 10 kHz and record the frequency deviation.
- (4). Audio Frequency Response = $20\log_{10} (\text{Deviation of test frequency} / \text{Deviation of 1 kHz reference})$.

9.3 MEASUREMENT SETUP



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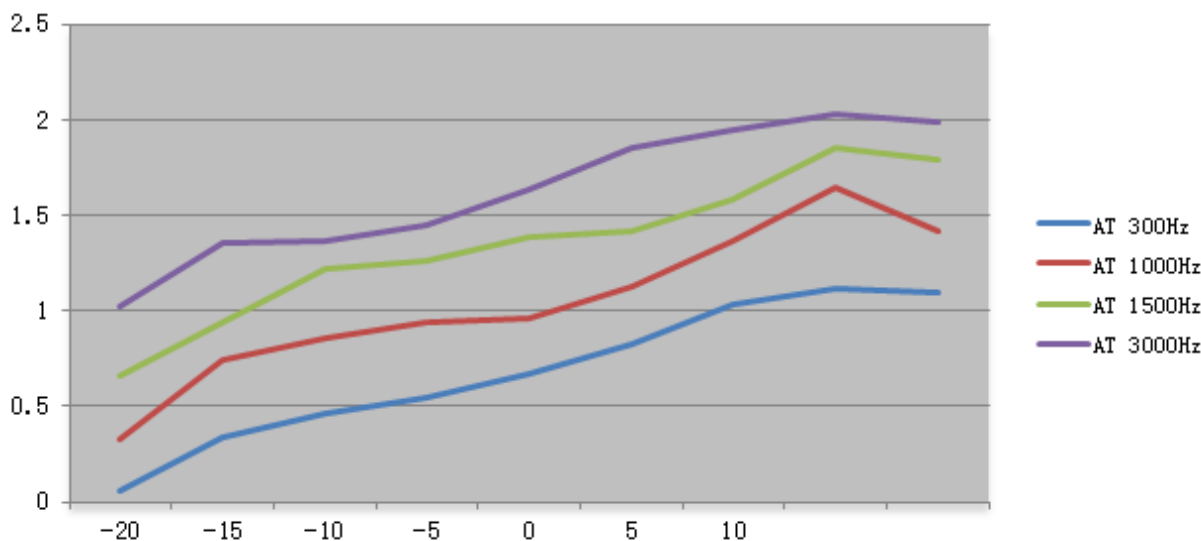
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9.4 MEASUREMENT RESULTS

(A). MODULATION LIMIT:

12.5kHz, FM modulation, Assigned Frequency:462.6500MHz-40W				
Modulation Level (dB)	Peak Freq. Deviation At 300 Hz (kHz)	Peak Freq. Deviation At 1000 Hz (kHz)	Peak Freq. Deviation At 1500 Hz (kHz)	Peak Freq. Deviation At 3000 Hz (kHz)
-20	0.06	0.33	0.66	1.02
-15	0.34	0.74	0.94	1.35
-10	0.46	0.86	1.22	1.36
-5	0.54	0.94	1.26	1.45
0	0.67	0.96	1.38	1.63
+5	0.82	1.13	1.42	1.85
+10	1.03	1.36	1.58	1.94
+15	1.12	1.64	1.85	2.03
+20	1.09	1.42	1.79	1.99



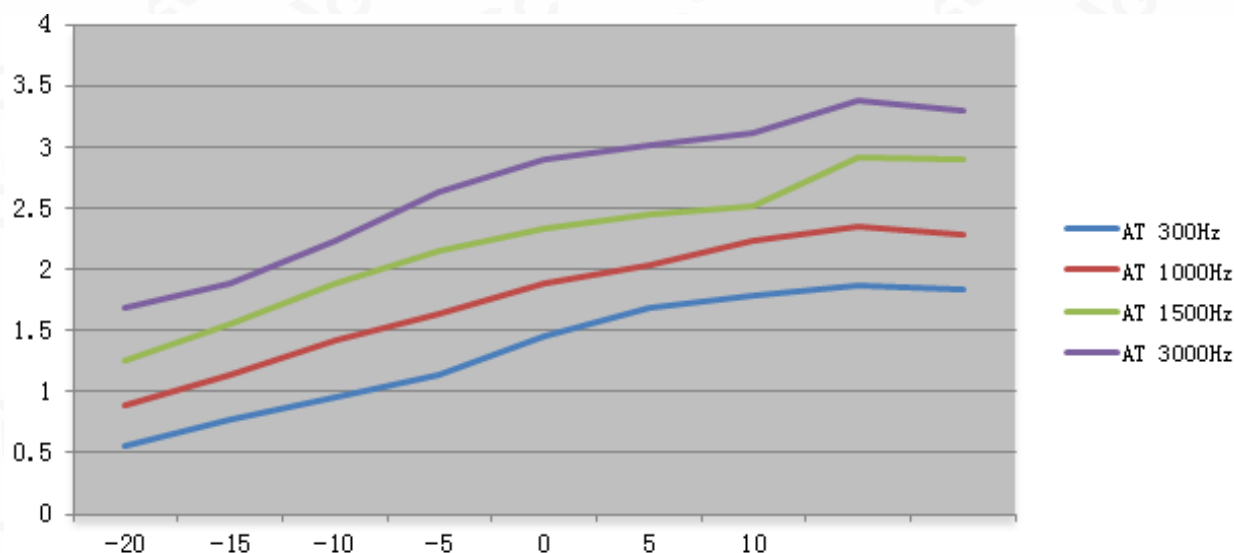
Note: All the modes had been tested, but only the worst data recorded in the report

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25kHz, FM modulation, Assigned Frequency:462.6500MHz-40W				
Modulation Level (dB)	Peak Freq. Deviation At 300 Hz (kHz)	Peak Freq. Deviation At 1000 Hz (kHz)	Peak Freq. Deviation At 1500 Hz (kHz)	Peak Freq. Deviation At 3000 Hz (kHz)
-20	0.56	0.88	1.25	1.69
-15	0.78	1.13	1.56	1.88
-10	0.96	1.42	1.89	2.23
-5	1.13	1.63	2.15	2.63
0	1.45	1.89	2.33	2.89
+5	1.68	2.03	2.45	3.01
+10	1.79	2.24	2.51	3.12
+15	1.86	2.35	2.91	3.37
+20	1.83	2.29	2.89	3.29



Note: All the modes had been tested, but only the worst data recorded in the report

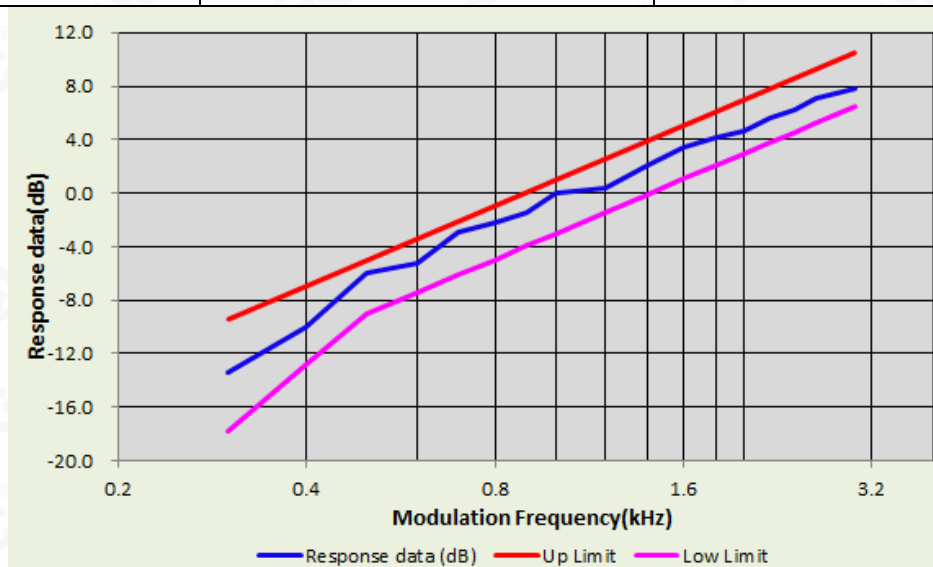
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(B). AUDIO FREQUENCY RESPONSE:

12.5kHz, Analog modulation, Assigned Frequency:462.6500MHz-40W		
Frequency (Hz)	Deviation (kHz)	Audio Frequency Response(dB)
100	--	--
200	--	--
300	0.14	-13.47
400	0.21	-9.95
500	0.33	-6.02
600	0.36	-5.26
700	0.47	-2.95
800	0.51	-2.24
900	0.56	-1.43
1000	0.66	0.00
1200	0.69	0.39
1400	0.84	2.09
1600	0.98	3.43
1800	1.06	4.12
2000	1.12	4.59
2400	1.26	5.62
2500	1.36	6.28
2800	1.49	7.07
3000	1.55	7.42



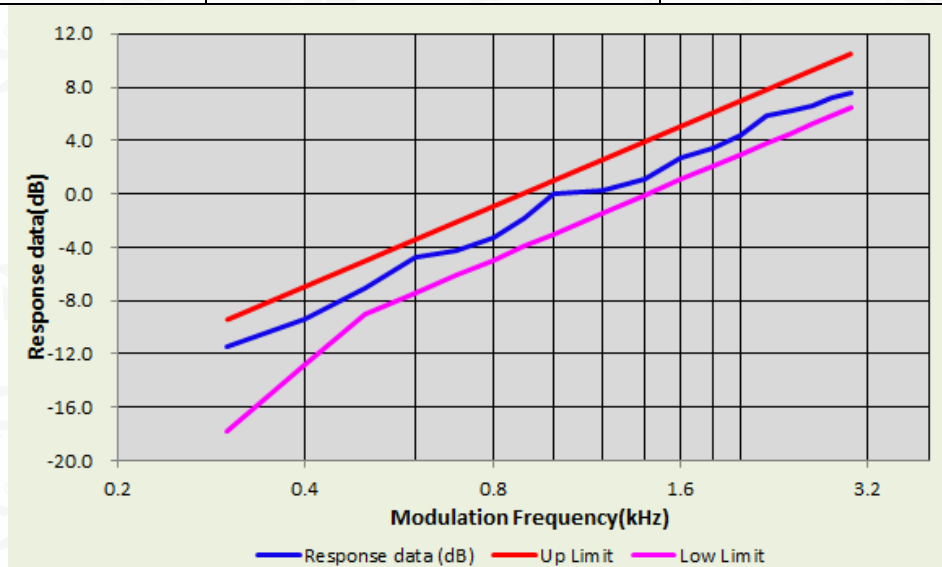
Note: All the modes had been tested, but only the worst data recorded in the report.

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25kHz, Analog modulation, Assigned Frequency:462.6500MHz-40W		
Frequency (Hz)	Deviation (kHz)	Audio Frequency Response(dB)
100	--	--
200	--	--
300	0.32	-11.48
400	0.41	-9.33
500	0.53	-7.10
600	0.69	-4.81
700	0.74	-4.20
800	0.82	-3.31
900	0.97	-1.85
1000	1.20	0.00
1200	1.23	0.21
1400	1.36	1.09
1600	1.63	2.66
1800	1.79	3.47
2000	1.98	4.35
2400	2.36	5.87
2500	2.46	6.24
2800	2.58	6.65
3000	2.74	7.17



Note: All the modes had been tested, but only the worst data recorded in the report.

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