GME3FR10

Technology Manual for FM Digital Audio Broadcasting Exciter

一、 Overview

The GME3FR10 1W FM band digital audio broadcasting exciter complies with the GY/T 268.1-2013 "FM frequency band digital audio broadcasting Part 1: Digital broadcasting channel frame structure, channel coding and modulation" (hereinafter referred to as CDR) standard. Exciter supports in band simulcasting of FM radio digital and analog signals. This exciter is a new product developed with standardized and serialized appearance and structure, as well as aesthetic effects and practicality. The overall performance is stable and reliable, technologically advanced, easy to operate, and easy to maintain.

1、System Characteristics

- The GME3FR10 CDR exciter supports three transmission modes and all spectrum modes required by the standard, and the three working modes of digital, analog, and digital+analog can be set by the customer through the front panel. The exciter can achieve full digital processing (1000MHz D/A converter) of 87-108MHz RF signals from audio input to output. This system has flexibility, compatibility, and high performance indicators. Mainly manifested in the following aspects:
- By using a 1000MHz D/A converter, RF output from 87MHz to 108MHz can be directly achieved. The output frequency resolution can reach 32 bits (0.1Hz). Frequency stability<10-8 when working independently;
- When using an external GPS10MHz reference source for synchronous operation, the frequency stability is less than 10-9;
- It has digital audio signal (AES/EBU), left and right channel analog signal interfaces, and the entire process (binary)

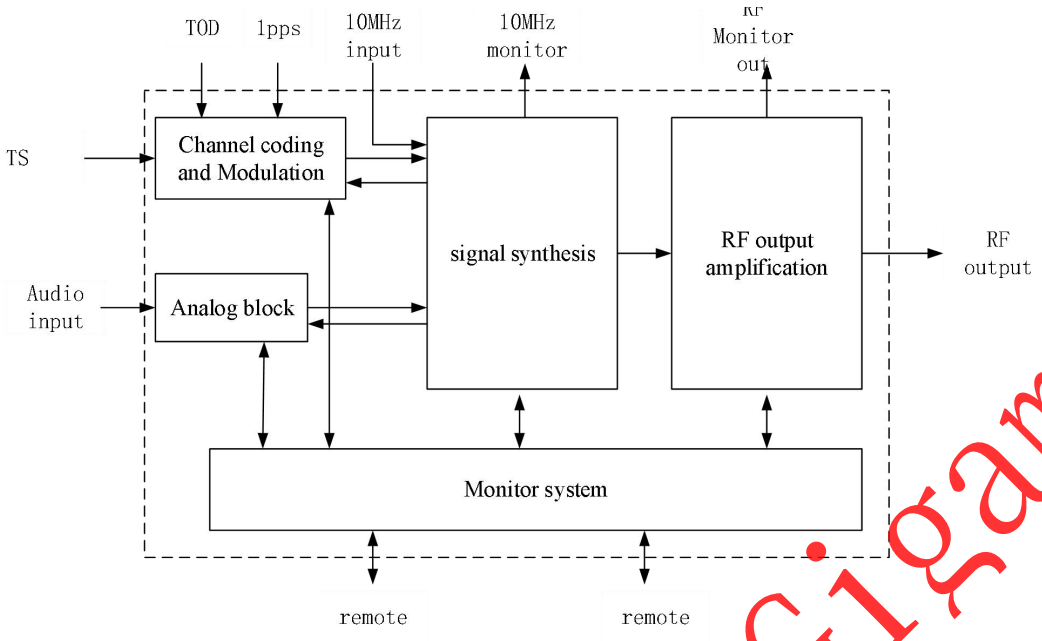
numerical operation from audio sampling to RF output is at least 24 bit precision and 40 bit accumulator tail processing;

- Equipped with IP and ASI digital audio input interfaces, the input stream complies with DRA (DRA+) standards;
- Using a color touch screen display, it is clearer and more convenient to operate than an LCD screen.

2、Appearance

3、System composition

The main circuit of GME3FR10 exciter includes core motherboard (implementing CDR standard coding and modulation, analog frequency modulation, digital analog signal baseband mixing, pre distortion correction, display and control, and external communication algorithm implementation), backplane (external interface circuit and related control interface circuit), frequency conversion board (up conversion TX, down conversion RX, loop and power control), color touch display screen, LED fault display, switch stabilized power supply, fan, and power amplifier modules.



二、 Technical parameters

1、General parameters

Working voltage

1) 176V～264V AC;

2) 50Hz±1Hz。

Interface

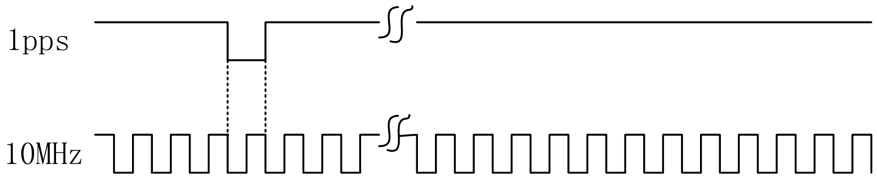
1) Equipped with analog audio input interface and digital AES/EBU audio input interface, analog audio interface

2) The input impedance is 600 Ω balanced, the input level is -3dBu~8dBu, and the AES/EBU interface input impedance is 110 Ω balanced;

3) The data input of digital signals adopts RJ45 Ethernet interface and ASI interface, and the data format complies with the relevant regulations of GY/T 268.2-2013;

4) The 10MHz clock input adopts BNC connector, negative, input impedance of 50 Ω, input power of 5dBm~15dBm (the frequency accuracy of 10MHz clock signal is 10-9, sine wave);

5) 4) The 1pps input adopts BNC connector, female type, TTL level, input impedance of 50 Ω, and interface signal waveform is shown below.



6) TOD message input adopts RS232 serial port, DB9 connector, female type, baud rate of 9600, data bits of 8, stop bit of 1, no parity check bit, data encapsulation adopts BCD code.

7) RF output adopts N-type connector, female type, with an output impedance of 50 Ω.

8) The monitoring output adopts BNC connector, female type, with an output impedance of 50 Ω.

9) The RF feedback input adopts BNC connector, female type, with an input impedance of 50 Ω and an input power of -15dBm~5dBm.

10) RS485 is used for management configuration, remote control, and monitoring interfaces, DB9 connector, male type.

2、Function parameters

Supports all working modes specified in GY/T 268.1-2013 standard, supports analog FM stereo (mono) broadcasting, supports pure digital mode, analog mode, analog-to-digital simulcast mode and their switching.

Working mode	TS stream	TS stream status	RF output
Auto	normal Manual ASI/manual IP/auto	Spectrum model、2	digital
		Spectrum mode9、10、22、23	Analog and digital simulcast
		The selected input stream is abnormal	No output

	test	Spectrum mode1、2	digital
		Spectrum mode9、10、22、23	Analog and digital simulcast
Digital	normal Manual ASI/manual IP/auto	Spectrum mode1、2	digital
		Spectrum mode9、10、22、23	digital
		The selected input stream is abnormal	No output
	test	Set spectrum mode1、2	digital
		Set spectrum mode9、10、22、23	digital
Analog	-	-	analog

Stream backup and switching

Provide two inputs as backups for each other, with manual and automatic switching functions, one for ASI input and one for RJ45 Ethernet input.

Pre correction

It has linear and nonlinear pre correction functions.

Frequency: 87MHz~108MHz

Frequency reference source

When there is an external reference source, the exciter should prioritize using the external reference source; When there is no external reference source, the exciter will automatically activate the internal reference source. Internal and external reference sources can be manually or automatically switched.

Power Control

Provide two power control modes: manual level control (MLC) and automatic level control (ALC).

Monitoring and alarm

It can provide real-time monitoring and alarm functions, including device working status, parameter configuration, and interface working status. When an abnormal situation occurs in the device, an alarm indication can be given, and the alarm situation can be queried through the remote control port or control panel.

Configuration

By setting the working parameters and interface configuration of the exciter through remote monitoring interface or control panel, it can automatically restore the original setting state after power failure or restart.

Automatic protection function

When certain components of the exciter experience serious malfunctions (such as output overload, amplifier overheating, etc.), or when the exciter is damaged due to external reasons, the monitoring system will automatically cut off the exciter's RF output or shut down.

Monitor output

The front panel has a 10MHz clock monitoring output and RF monitoring output interface, with SMA interface.

Networking mode

Support MFN or SFN.

3、Technical parameters

No.	Mode			Content		parameters
	Digital	D+A	analog			
1	*	*		frequency		87MHz~108 MHz
2	*	*		step	MFN	≤1kHz
					SFN	≤1Hz
3	*	*		Frequency stability	Internal reference source	$\leqslant 1\times10^{-7}$

					External reference sources	≤1×10^{-9}
4	*	*		Frequency accuracy	MFN	±100Hz
					SFN	±1Hz
5	*	*		Output power		≥0dBm
6	*	*		Phrase noise		≤-60dBc/Hz @10Hz ≤-75dBc/Hz @100Hz ≤-85dBc/Hz @1kHz ≤-95dBc/Hz @10kHz ≤-110dBc/Hz @100kHz ≤-120dBc/Hz @1MHz
7	*	*		RF output power stability（24hours）		±0.3dB
8	*	*		bandwidth		GD/J 061-2014
9	*	*		In band spectrum compliance		≤1dB
10	*	*		Power uniformity between sub bands		≤0.3dB
11	*			With shoulders		≤-45dB
12	*	*		MER		≥36dB
13	*			peak-to-average power ratio		CCDF
14	*	*		Out-of-band and spurious	Unused transmission power in adjacent	≤-50dB

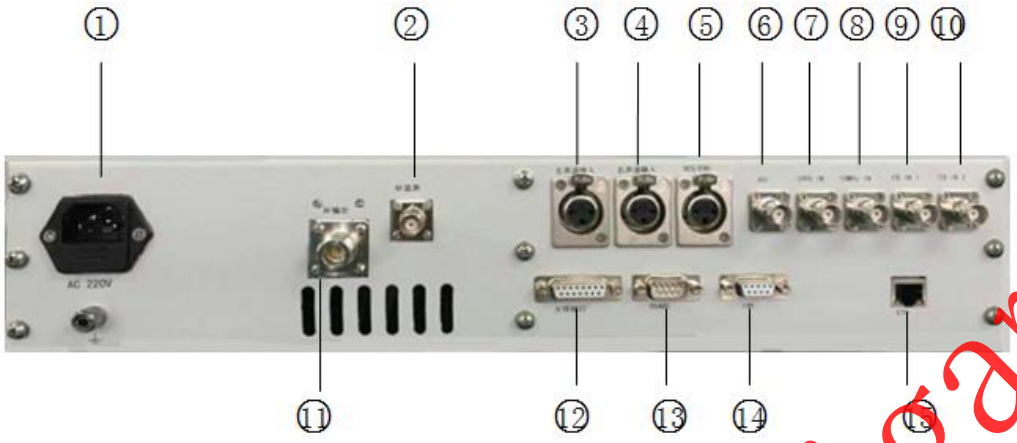
					channels	
					Unused transmission power outside adjacent frequency channels	≤-55dB
15		*	*	Residual radiation		≤-40dB<25uW(<25W)
16		*	*	Parasitic amplitude modulation noise		<-50dB
17		*	*	Pilot frequency deviation		±1Hz
18		*	*	38kHz residual component in S signal		<1% (<-40dB)
19		*	*	100% modulation frequency offset		±75KHz
20		*	*	Pre emphasis		50us
21		*	*	distort		<0.5%
22		*	*	frequency response		±0.5dB (Not aggravating, not reducing) ±1dB(Increase and decrease weight)
23		*	*	Signal to Noise Ratio		>60dB
24		*	*	Separation degree of left and right channels		>40dB
25		*	*	Left and right channel level difference		<0.4dB

三、 Panel definition and description

1、Front panel

The front panel mainly includes: power switch, operation touch screen, RF monitoring, 10MHz clock monitoring, pre distortion correction, RS232 communication, and working status and alarm indicator lights.

2、Back panel



① AC220V input

② RF output detector

③ L input

④ R input

⑤ AES/EBU input

⑥ ASI input

⑦ 1PPS input

⑧ 10MHz input

⑨ FB IN1 RF feedback signal input

⑩ FB IN2RF feedback signal input

⑪ RF output

⑫ Loop input

⑬ RS485

⑭ TOD

⑮ IP input

四、 Introduction to Main Circuit Functions

The main implementation circuit for simultaneous broadcasting of FM radio digital and analog signals is in the exciter, so it is necessary to understand the working principle and composition of CDR exciters. As shown in Figure 23, the circuit diagram of the CDR exciter is the entire processing flow of the CDR signal from the input stream to the output RF signal. The main circuit inside the exciter is divided into three parts in terms of hardware: the base board, core processing board, and frequency conversion board. The remaining auxiliary circuits include power supply, front panel working status indicator circuit, exciter small power amplifier, etc. These auxiliary circuits or interface control circuits that ensure the normal operation of the main circuit board will not be further elaborated. The functions and working principles of several main circuit boards: The main function of the motherboard is to serve as the substrate for the core board and to design external input/output interface circuits. The CDR stream is input through the ASI port or RJ45 interface on the motherboard, while the FM audio signal is input through the AES/EBU port or L/R interface. The bottom board and the core board are connected through pin/socket connections, while the core board and the frequency converter board are connected through wire connections. The main functions of the core board are input data parsing, encoding and modulation, as well as digital to analog mixing, pre distortion correction, etc. Among them, digital to analog mixing is the process of mixing digital baseband signals and frequency modulation signals in the digital domain; The TX channel of the frequency conversion board converts the modulated mixed baseband signal into radio frequency, which is then sent to the small power amplifier module of the exciter for amplification. The RX channel converts the feedback radio frequency signal into an intermediate frequency digital signal and sends

it to the core board to achieve pre distortion function. It also includes a loop and power control module to monitor and control the output power.

五、 Power supply module

- This power amplification module is a broadband linear amplifier that operates in Class A mode. Changing the frequency within 87-108MHz does not require any adjustments to the amplifier. Use two-stage MOSFET power transistors to amplify the RF signal output by the encoding board.
- 1. Function
- After changing the frequency within 87-108MHz without any adjustment, achieve 1W RF power output (spectrum mode 9);
- RF power monitoring function;
- Operating voltage 2~48VDC;
- Equipped with a low-pass filter to ensure the level of RF output harmonics.

2、Parameters

- RF
  - ✧ output: N-K
  - ✧ input: SMA-K
  - ✧ frequency: 87 ~ 108MHz
  - ✧ Input power: ≤1mW(0dBm)
  - ✧ Output power: ≤1W（mode 9）
  - ✧ gain: ～33dB
  - ✧ Gain flatness: ±0.5dB
- Power supply
  - ✧ Power supply: +48V ≤1A（MAX）
  - ✧ Power supply: +12V ≤0.15A（MAX）
- Detector and display
  - ✧ RF detector interface: BNC-K

✧ RF monitor output: -20dBc

六、 Power supply system

- The exciter adopts two switch stabilized power supplies, with a maximum power of about 150W, and requires three types of voltages:+ 48. ± 12V switch power module. The power supply has protection functions such as short circuit, overload, and over voltage.
- +48V is a separate power module that supplies power to the amplifier
- Input voltage and frequency range: AC88V—264V/47~63Hz
- Output voltage: DC:+48V (± 10% adjustable)
- Power efficiency: 88%
- Ripple: 120mV
- Work environment:- 25~70℃; 20%~90% RH (non condensing)
- ± 12V is integrated into another switch stabilized power module, and this power supply also has a 5V output to supply power to the exciter motherboard.
- Input voltage and frequency range: AC88V—264V/47~63Hz
- Output voltage: DC: ± 12V+ 5V
- Power efficiency: 84%
- Ripple: 80mV
- Work environment:- 25~70℃; 20%~90% RH (non condensing)