# SCA system (Subsidiary Communications Authorization) Implementation of Text Transmission on Broadcasting System

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*Abstract* – *FM Radio broadcasting systems almost entirely have used the stereo system. A transmitter and receiver FM able to process the information signal with the frequency more than 75 kHz so that stereo system can be realized easily. Stereo broadcast bandwidth requirement is equal to 53 kHz, the rest bandwidth is applicable to be other that is by adding SCA system (Subsidiary Communications Authorization).*

*SCA used to deliver and accept the text data. Bandwidth of SCA system requires being limited in order not to bother the main broadcast program. Band from the limited SCA system used to deliver the digital information, for the reason need a digital modulation to optimize the bandwidth. Speed of data also require to be paid attention because the limited bandwidth. Data delivered have the start code so that only just certain receiver able to accept the data.*

*Information delivery of SCA system is by using frequency modulation with the 67 kHz carrier frequency. To limit the bandwidth hence require to be filtered before transmitted. Digital information beforehand converted to in the form of analogue with the digital modulation FSK. Baud rate of delivery and data acceptance is same that is equal to 600 bps. Data delivered use the start code in the form of certain character which not present at the computer keyboard. Data Acceptance method represent the process which have reverse from delivery process.*

*System have earned realized that is data sent acceptable successful and not bother the main broadcast program. By adding this system, modulation signal from stereo signal have to be decrease 11,11 %.*

*Keyword: SCA, asynchronous serial, FSK, FM, Broadcasting system*

## I. INTRODUCTION

Bandwidth from from transmitter FM in the reality not yet been exploited maximally. Bandwidth of sinyal stereo occupy until frequency 53 kHz, rest can be exploited for the delivery of other information in the form of voice and or data. Bandwidth use of broadcasting FM system in this time there is 2 kinds of way of used by that is system of RDS and SCA. RDS ( radio of data system) coming from English ( precisely from European Broadcasting Union, EBU), and SCA (subsidiary communications authorization) coming from United States. RDS use the sub-frekuensi carrier as far as 57 kHz from frequency center with the system of amplitude modulation of type DSBSC ( double sideband suppressed carrier) and wide of bandwidth of equal to + 2 kHz, while SCA use the sub-frekuensi carrier as far as 67 kHz from frequency center with the system of frequency modulation ( FM). Because using frequency modulation, hence clear that system SCA more impenetrable to noise compared to [by] system RDS. Other excellence [is] accelerateing higher level data delivery ( its bandwidth [is] bigger) and more simple receiver circuit. Because excellence of that's hence system SCA selected as object research. In other country, this facility have since llama exploited to deliver the sinyal of audio of music monoural. What more interesting this facility [is] data delivery applicable to text ( teleteks). Because sent with the system of broadcast FM stereo and accepted with the special receiver FM stereo ( owning demodulator SCA and penampil) hence this information teleteks [is] very practical and good for. In my country (Indonesia) have not implemented yet

Target of our research is making hardware and also software module of transmitter and receiver text data, exploiting the rest of frequency band of radio FM by SCA/ Subsidiary Communications Authorization.

SCA represent one of the form system of communications simplex with the system of frequency modulation as mode or appliance to exploit the bandwidth at system of broadcasting FM. Information brought at system SCA can in the form of voice or data depended a system wanted side of broadcasting company.
Middle frequency from a modulator SCA seen from frequency domain located in to the spectrum of frequency of stereo signal. For the frequency of middle equal to 67 kHz and by maximal deviation 7,5 kHz [of] hence frequency spectrum for the system of this [is] visible theoretically [at] Picture 1.
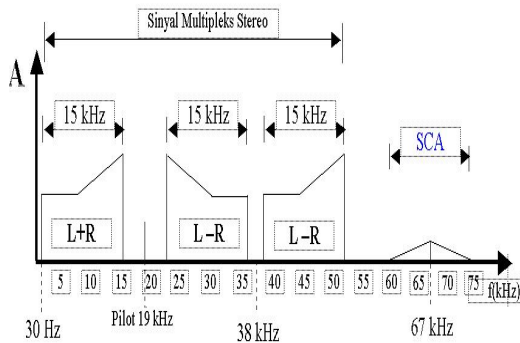


Fig 1. spectrum of Frequency of system of
broadcasting FM accompanied
With SCA

Structure element implementation SCA PLL (Phase Lock Loop)

PLL consisted of [by] 3 elementary shares that is voltage controlled oscillator ( VCO), Phase Detector ( PD), and also filter the tress with the reinforcement. diagram of Block PLL showed at Picture 2. VCO is an oscillator able to yield the off the cuff frequency able to change as according to input tension. Output from VCO can be in

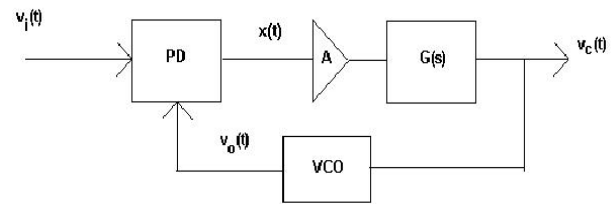the form of waving sine of waving and also box other periodic waveform.



Fig 2 PLL Block Diagram

Detector Fasa ( PD) have two input and one output. If [both/second] input is periodic and have the same period hence component dc from output PD is proportional with the level of angle;corner difference between second of the periodic input sinyal
Third fundamental component from PLL [is] volute filter accompaniedly with the reinforcement. Existing Filter usually use the separate external component, in this way network PLL ready for harmonius cavity. Intention of network filter this is to obtain;get the component dc from output PD ( x(t)). Output PD consisted of [by] the frequency which chime in with the quantifying and also reduction of frequency vi(t) and vo(t)

Applying PLL as demodulator SCA
To accept the broadcast SCA of hence required by demodulator SCA demodulation to information signal SCA. System SCA using frequency modulation so that one of the way for the demodulation by using network PLL showed at Picture 3
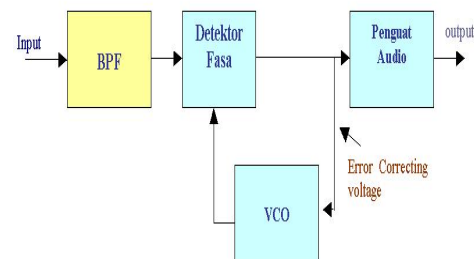


Fig 3. Receiver SCA Block diagram

Input signal represent the composite signal result of demodulation at receiver FM. Band Pass Filter ( BPF) used to get away the sinyal SCA residing in to stereo signal bandwidth. the SCA signal is input to fase detector to be compared to an output frequency yielded by VCO. Because SCA use the system of frequency modulation so that output fase detector will change as according to change of frequency of sinyal SCA. Corrective Difference of tension ( error correcting voltage) correspond represent information SCA signal.

Frequency of Shift Keying

Binary FSK is a modulation by constant envelope which like conventional FM, except that in modulation FSK, modulation signal in the form of binary stream pulsa which vary among two level of tension diskrit so that differ from the change form which analogous wave continues.

a binary modulator FSK, center from frequency carrier shifted by binary data input. As its consequence, output at one particular binary modulator FSK is a function step at domain frequency. According to binary change sinyal input from a[n logic 0 to logic 1, conversely, output FSK shift among two frequency: a mark of frequency or logic 1 and a space of frequency or logic 0.
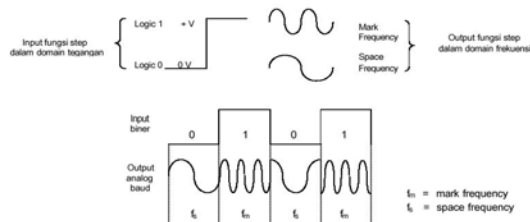


Fig 4. Binary Modulation FSK system

Active filter

Filtering is a network designed by] overcoming a certain frequency band and weaken all signal outside this frequency band. Active filter [is] filtering which is woke up by using active component, as does operational amplifier.

Filtering Butterworth have the comments which flatten at frequency passband from filtering and owning dilution which enough sharply at frequency stopband

Table1. Table Of Coefficient For The Scheme of Filter Butterworth

| Orde n | α | β |
|---|---|---|
| 2 | 0,7071 | 0,7071 |
| 3 | 1,0000 | |
| | 0,5000 | 0,8660 |
| 4 | 0,9239 | 0,3827 |
| | 0,3827 | 0,9239 |
| 5 | 1,0000 | |
| | 0,8090 | 0,5878 |
| | 0,3090 | 0,9511 |
| 6 | 0,9659 | 0,2588 |
| | 0,7071 | 0,7071 |
| | 0,2588 | 0,9659 |
| 7 | 1,0000 | |
| | 0,9010 | 0,4339 |
| | 0,6235 | 0,7818 |
| | 0,2225 | 0,9749 |
| 8 | 0,9808 | 0,1951 |
| | 0,8315 | 0,5556 |
| | 0,5556 | 0,8315 |
| | 0,1951 | 0,9808 |

Filter to get away to lower active earn directly designed from coefficient filter the ( a and b). Function displace the configuraton filter to get away to lower one pole showed at Equation 1.

$$\frac{V_o}{V_i} = T(s) = \frac{1}{C_0 s + 1} \qquad \text{... (1)}$$

Function displace the configuraton filter to get away to lower one pole expressed in coefficient filter showed at Equation 2.

$$T(s) = \frac{1}{\frac{1}{\alpha_o} s + 1} \qquad \text{... (2)}$$

Function displace the configuraton filter to get away to lower two pole expressed in coefficient filter showed at Equation 3.

$$T(s) = \frac{1}{\frac{1}{\alpha^2 + \beta^2} s^2 + \frac{2\alpha}{\alpha^2 + \beta^2} s + 1} \qquad \text{...(3)}$$
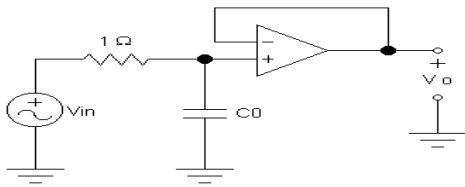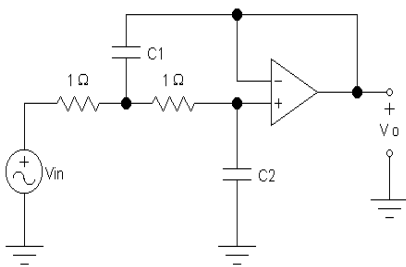
Fig 5.a. Section one pole.



Fig. 5b. Section two pole

Fig 5. a,b  Configuraton Network filter to get away to lower active reinforcement one

Network scheme filter the obtainable band pass from result of network filter transformation the low pass.
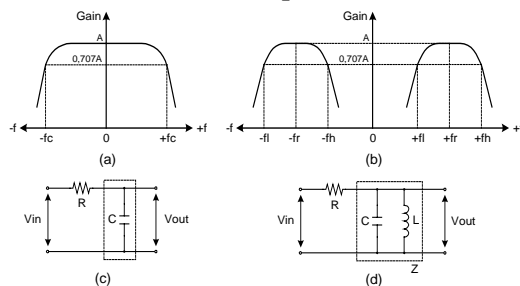


Fig. 6( a) Respon frequency filter the low pass ( b) Respon frequency filter the band pass ( c ) Network filter the low pass modestly ( d) Filter the band pass [of] result of transformation

In general function displace for the network of pass filter of order second bandwidth given with Equation 4.

$$T(s) = \frac{Hs}{s^2 + \frac{\omega_0}{Q} s + \omega_0^2}$$  …….. (4)

H is a reinforcement constant 4.

Mikrokontroler AT90S8515
this Mikrokontroler Atmel AT90S8515 have the the following characteristic
1. Architecture RISC
2. 118 instruction of most one instruction cycle
3. 32x8 multipurpose register [job/activity]
4. 8 MIPS ( Mega Instructions per Second) at 8 MHZ
5. Can use of Ianguage C as Ianguage programming
6. Programmable Flash Memory [of] equal to 8 K Byte ( 1000 times cycle vanish / write
7. 512 bytes SRAM
8. 512 Bytes Programable EEPROM ( 100.000 cycle vanish / write the
9. Pemrograman locked for the program of Flash and data security of  EEPROM,

Transmitter-receiver SCA design system
Peripheral of SCA transmitter
Hardware of SCA transmitter
Hardware design of SCA require to be specified by a things to be made a directive. such is :
1. frequency of carrier SCA [is] equal to 67 kHz + 0,2
2. maximal deviation frequency is 7,5 kHz
3. Baudrate equal to 600 bps.

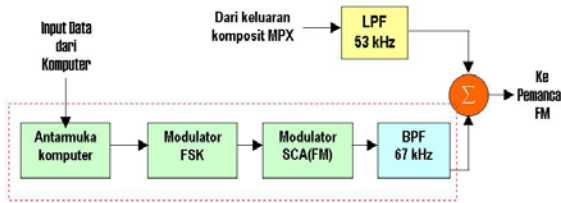SCA transmitter block diagram at Fig.6.

Fig 6. SCA Transmitter Block Diagram

Table 2.Operation mode on FSK modulator TCM3105

| TRS | TXR1 | TXR2 | Baudrate | Frequency | |
|-----|------|------|----------|-----------|------|
| | | | | mark | space |
| L | L | L | 1200 | 1300 | 2100 |
| H | L | L | 1200 | 1300 | 2100 |
| L | L | H | 600 | 1300 | 1700 |
| H | L | H | 600 | 1300 | 1700 |
| L | H | L | 75 | 390 | 450 |
| H | H | L | 75 | 390 | 450 |
| L | H | H | 75 | 390 | 450 |

For simpifly device of hence every block used by a network integrated the (IC). Network integrated by the MAX232 used as a computer Interface. Writer use the IC break evenly is TCM3105 as Modulator FSK. IC LM565 used as Modulator SCA. IC TL082 which in it represent the lasing operate for used as by block LPF 53 kHz and BPF 67 kHz, integrator.

Serial Interface RS232
To link the serial communications RS232 Computer with the system SCA [of] hence required [by] a Serial Interface RS232.
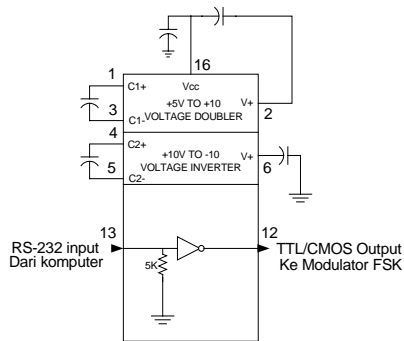
the Operation mode used to arrange the baudrate at its modulator. In data delivery use the baudrate [of] equal to 600 bps so that TXR1 given [by] the low logic input (L) And TXR2 given [by] the high logic input (H).

SCA Modulator
To bring the sinyal information [of] above sinyal multipleks stereo [of] hence needed SCA modulator. SCA Modulator in principle use the frequency modulation with the carrier [of] equal to 67 kHz. the Sinyal Carrier [of] its frequency will fluctuate as according to its sinyal input. Sinyal of Input of modulator SCA [is] from analogous output [of] modulator FSK.



Fig. 7 serial Interface [of] RS232 by IC [is] MAX232



Fig 8. SCA Modulator block diagram

Modulator FSK
TCM3105 represent the modem FSK with the specification [of] according to standard of CCITT V.23 and BELL 202. Mode operate for the modulator selected in final duty scheme [is] according to standard CCITT. To arrange [it] hence needing to see the Tables 2
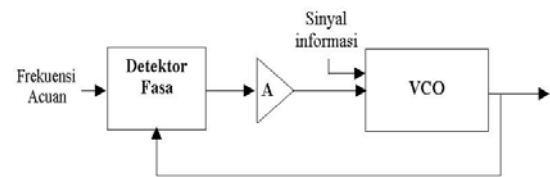
Network Bandpass Filter 67 kHz
Use network filter the active band pass [of] butterworth order 2, [is] such as those which showed [at] Fig.9
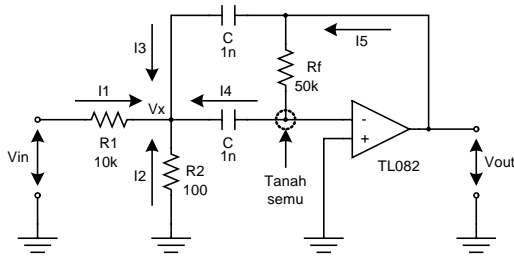
Fig 9. Band pass filter Butterworth second

Filter to get away to lower 53 kHz use the category Butterworth with the cutoff frequency ( cut-off) 53 kHz. Order (n) filter [is] 4. Reinforcement filter designed [by] equal to one. Low filter 53 kHz shown by Fig. 10.
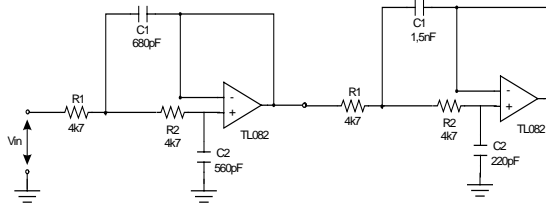


Fig 10. Low pass filter 53 kHz

Peripheral of Receiver SCA
Hardware of Receiver SCA
Specification of receiver peripheral have to be adapted by transmitter. Specification for the receiver of SCA shall be as follows
1. acceptance frequency [of] equal to 67 kHz
2. Baudrate of data Acceptance equal to 600 bps
3. As penampil used by LCD 2 x 16 line.
Block formation forming a visible receiver SCA [at] Fig.11



Fig 11. Receiver SCA Block diagram

IC TL082 which in it use for operational amplifier; build the BPF 67 kHz. IC LM565 used for the Demodulator of SCA. IC break evenly [is] TCM3105 used as [by] Demodulator FSK. We use the Mikrokontroler ATMEL AVR 90S8515 to process the data.We LCD M1632 to display data.

Band-Pass Filter 67 kHz
Scheme BPF to filter the pelewat band ( BPF) 67 kHz for the receiver of SCA same as at transmitter.

Demodulator SCA
Block PLL used to develop demodulator SCA. Block PLL of there are IC LM565. Important matter to design a demodulator SCA by IC LM565 is parameter found on the IC
1. frequency of Free running
2. Loop Gain
3. Hold In range
4. Loop Filter
Loop Gain function to connect the amount of change fasa between input signal by VCO signal to a friction at frequency of input signal. Hold In range frequency gyration where loop admit of remain to be locked after is previously locked. Loop Filter is to obtain;get the compone component dc from output of detector fasa. Information signal obtained from error corecting voltage at output of detector fasa. Output from detector fasa still contain the high frequency. For the reason need the

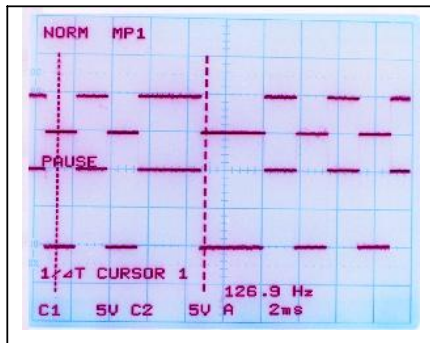difilter to get result of good demodulation. Information signal have the frequency 1300 Hz and 1700 Hz so that writer set mind on to use to filter to get away to lower equal to 2 kHz

Demodulator FSK
According to standard CCITT to arrange the mode operate for the acceptance of demodulator SCA using visible IC TCM3105 at Table 3

Table 3 Mode operate for the demodulator FSK at TCM3105

| TRS | TXR1 | TXR2 | Baurate | Frekuensi | |
| --- | --- | --- | --- | --- | --- |
| | | | | mark | space |
| L | L | L | 1200 | 1300 | 2100 |
| H | L | L | 75 | 390 | 450 |
| L | L | H | 75 | 390 | 450 |
| H | L | H | 600 | 1300 | 1700 |
| L | H | L | 1200 | 1300 | 2100 |
| H | H | L | 600 | 1300 | 1700 |
| L | H | H | 75 | 390 | 450 |

the Operation mode used to arrange the demodulator baudrate. In data acceptance selected [by] baudrate equal to 600 bps



Fig 12 Demodulator FSK with IC TCM3105

Acceptance conditioner
Acceptance conditioner function to deactivate the data of moment input [of] [there] no sinyal of input SCA. Output from demodulator FSK [is] random data when its input random signal. This matter it is of course will bother receiver system if the random data recognized by prefiks

Mikrokontroler AT90S8515

Mikrokontroler AT90S8515 used for the data process from output of demodulator FSK. To avoid the mistake of pencuplikan data [of] hence value of crystal frequency have to earn [is] precisely divided by 16(UBRR + 1) and quotient represent the original number ( without there [is] comma). Crystal used [by] [is] 1,8432 MHZ fulfilling all criterion [of]

Mikrokontroler AT90S8515 consisted of 4 port; A,B,C,D. Each can function as input and also as output. usage of Port AT90S8515 in this final duty [is] visible [at] Table 4.

Table 4. using AT90S8515 ports

| Port AT90S8515 | | Use to |
| --- | --- | --- |
| Port A | PA0-PA2, PA4 – PA7 | LCD Output |
| Port B | PB0 - PB7 | - |
| Port C | PC4 | SCA signal detection |
| | PC0, PC1, PC5, PC6, PC7 | Keypad |
| Port D | PD0 | receiver (RXD) pin |
| | PD2 | receiver (RXD) pin |

Analyse SCA transmitter

Testing and Analyse The Serial Interface Block RS232
Network integrated the ( IC) of Type MAX232 used as [by] a serial interface, functioning to alter the level of tension RS232 become the level of tension TTL.

Fig 13.  Interfacing RS232 testing

**Block of Modulator FSK testing**
Photo form the sinyal output from block of modulator FSK [at] oscilloscope shown by Fig.14
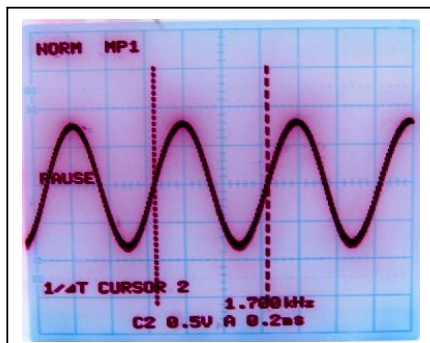


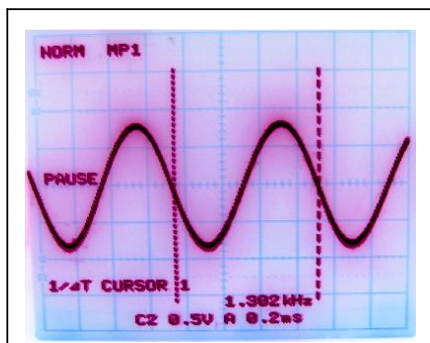Fig 14 a. output at input signal 0



Fig 14 b. Output at input signal 1

**Testing and Analyse SCA Block Modulator**
Modulator SCA contain block PLL and also block of generating of reference frequency. To know performance hence needing to see its output generating of reference Frequency represent the crystal oscillator which [is] later;then divided in order to become 67 kHz.
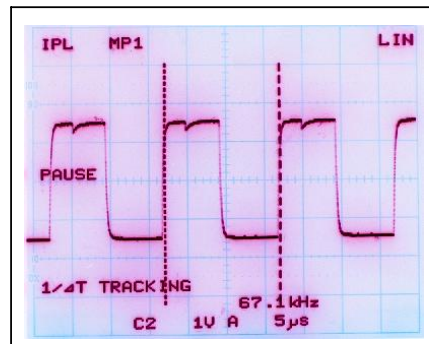


Fig 15. Output frequency generator 67 kHz

Photo form the sinyal of input and sinyal output from block of modulator SCA without input of modulator signal at oscilloscope shown by Picture 15.
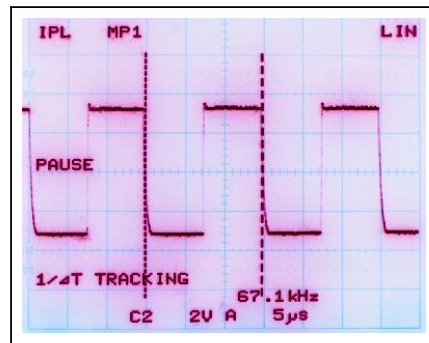


Fig 16. Output signal SCA Modulator

**Testing Block BPF 67 kHz**
Network examination filter to get this band is with giving input [of] waving sine the certain frequency (in this test which we

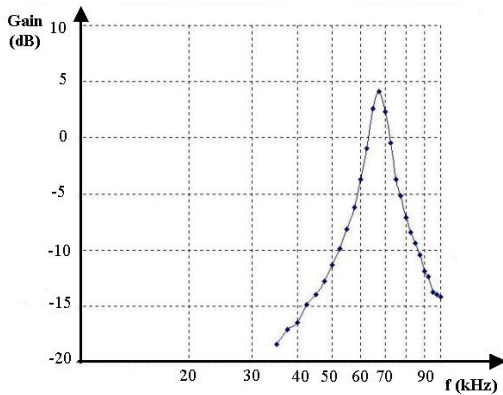give] its input frequency [is] 35 kHz until 100 kHz



Fig. 17 Band pass filter 67 kHz frequency respond

Photo of testing output oscilloscope from BPF 67 kHz with the input from output of modulator SCA which not yet modulation.
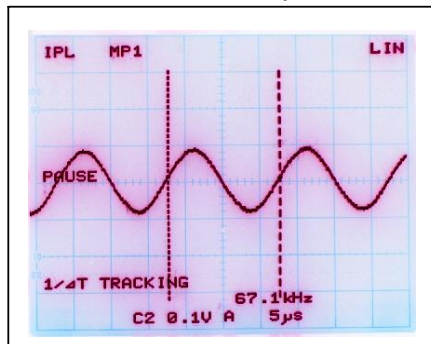


Fig 18 Output signal BPF 67 kHz (Input/output SCA modulator)

Testing and Analyse the Block LPF 53 kHz graph filter to get lower 53 kHz shown by Fig 19. This graph [is] represent the frequency graph to its gain.
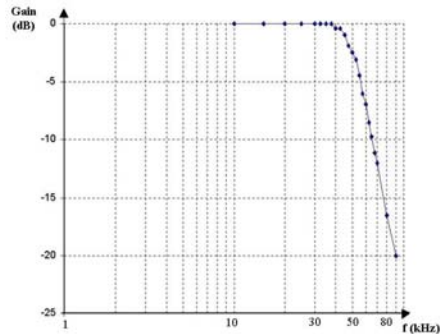


Fig 19 Low pass filter 53 kHz respond

Testing and analyse SCA Receiver
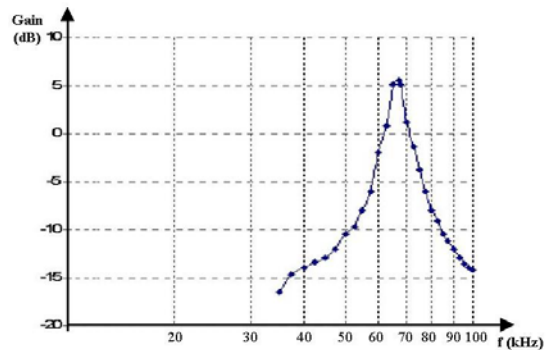Testing and analyse BPF 67 kHz receiver graphic low pass filter 67 kHz respond as shown Fig 20.



Fig 20. Low pass filter 67 kHz frequency respond

Testing and Analyse SCA Demodulator
Block of Demodulator SCA use the network PLL integrated [by] the LM565. Testing by way of input the frequency [of] [about/around] middle frequency [of] at VCO ( 67 KHZ + 10%). Output VCO have to have the frequency and fase which is equal to input frequency.
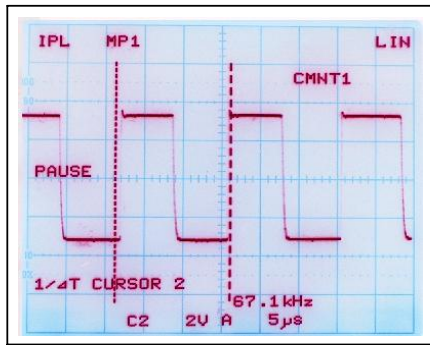
Fig. 21  Output VCO signal PLL
demodulator SCA

Tension conduct the VCO will be corrected [by] if happened [by] the difference fase between output VCO with the input of block PLL ( at fase detector). this Corrective tension represent the sinyal information from block of demodulator SCA. Information signal still mixed with high frequency so that still required filter to get away to lower.

Testing low pass filter 2 kHz
Low pass filter 2 kHz function to obtain;get the result of demodulation signal of SCA demodulator.This graphic comments filter to get away to lower the audio as shown Fig. 22



Fig 22  Graphic respond  low pass filter 2 kHz

Testing SCA Demodulator by FM signal SCA Modulator which used by a modulation input by output signal from modulator FSK with the frequency 1300 Hz or 1700. Result obtained from visible output demodulator SCA as shown Fig 23.



Fig 23 a. SCA modulator 1700 Hz
signal  modulated



Fig 23 b. SCA modulator 1300 Hz
signal  modulated

Testing  and Analyse The Block of FSK Demodulator
Block of Demodulator FSK use TCM3105. Baud Rate of data delivery [is] equal to 600 bps. Table 10 representing result of examination of  FSK demodulator.

Table 5   Demodulator FSK testing result.

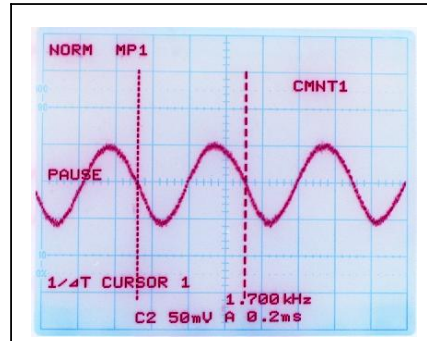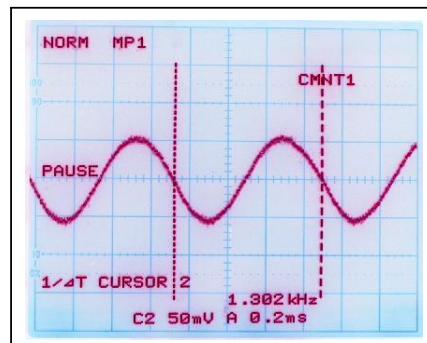| $f$ (Hz) | Keluaran | $f$ (Hz) | Keluaran |
|---|---|---|---|
| 900 | H | 2100 | L |
| 1000 | H | 2200 | L |
| 1100 | H | 2300 | L |
| 1200 | H | 2400 | L |
| 1300 | H | 2500 | L |
| 1400 | H | 2600 | L |
| 1500 | H/L | 2700 | L |
| 1600 | L | 2800 | H |
| 1700 | L | 2900 | H |
| 1800 | L | 3000 | H |
| 1900 | L | 3100<< | H |
| 2000 | L | <<900 | H |

**Influence of SCA modulation to system composition**

SCA require 10 % from total modulation so that the sinyal of total stereo audio required [by] [is] equal to 80 % cause 10 % used as pilot signal 19 kHz. So thatvisible clearer [at] Table 6.

Table 6 SCA Modulation system

| Modulation system | L+R | SCA | Pilot |
|---|---|---|---|
| Mono not use SCA | 100 % | 0 % | 0 % |
| Mono with SCA | 90 % | 10 % | 0 % |
| Stereo not use SCA | 90 % | 0 % | 10 % |
| Stereo withSCA | 80 % | 10 % | 10 % |

Mostly existing broadcasting radio station now use the stereo system without SCA. [Is] if we like to added with the system SCA [of] hence have to degrade the amplitude audio input signal equal to 10 % so that reduction audio quality equal to :

$$\frac{10\ \%}{90\ \%} \times 100\ \% = 11,11\ \%$$

**Testing Audio Distortion**

In sure information delivery there [is] distortion. Distortion can be generated from existence of noise and also existence of other sinyal [is] which follow delivered.

Table 7 Output Tuner FM distorsion with input sinusoid (not use SCA)

| $f$ (KHz) | % Distorsi ($V_{in}$ = 1,5 Vpp) | % Distorsi ($V_{in}$ = 2 Vpp) | % Distorsi ($V_{in}$ = 2,5 Vpp) |
|---|---|---|---|
| 0,05 | 2,4 | 2,7 | 4 |
| 0,1 | 2,2 | 2,7 | 4 |
| 0,5 | 2,3 | 2,8 | 4 |
| 1 | 2,4 | 2,9 | 4 |
| 2 | 2,6 | 2,9 | 4 |
| 3 | 2,6 | 2,9 | 4 |
| 4 | 2,6 | 2,9 | 4 |
| 5 | 2,6 | 2,9 | 4 |
| 6 | 2,5 | 3,0 | 4 |
| 7 | 2,5 | 3,0 | 4,2 |
| 8 | 2,5 | 3,0 | 4,2 |
| 9 | 2,5 | 3,0 | 4,2 |
| 10 | 2,6 | 3,1 | 4,2 |
| 15 | 3,0 | 3,4 | 5 |
| 20 | 3,6 | 3,8 | 5,2 |

Table 8 Output Tuner FM distorsion with input sinusoid with SCA

| $f$ (KHz) | % Distorsi ($V_{in}$ = 1,5 Vpp) | % Distorsi ($V_{in}$ = 2 Vpp) | % Distorsi ($V_{in}$ = 2,5 Vpp) |
|---|---|---|---|
| 0,05 | 20 | 15 | 11 |
| 0,1 | 20 | 15 | 11 |
| 0,5 | 20 | 15 | 11 |
| 1 | 20 | 15 | 11 |
| 2 | 20,5 | 15 | 11 |
| 3 | 21 | 15 | 11 |
| 4 | 21 | 16 | 12 |
| 5 | 21 | 16 | 12 |
| 6 | 21,5 | 16 | 12 |
| 7 | 22 | 16 | 12 |
| 8 | 22 | 16 | 12 |
| 9 | 22,5 | 16,5 | 12 |
| 10 | 22,5 | 16,5 | 12,5 |
| 15 | 23 | 17 | 13 |
| 20 | 23 | 17 | 13 |

addition Distortion given [by] addition of sinyal SCA at the (time) of sine modulation 1,5 Vpp mean 18,73 %. moment of Modulation of sine of its 2 Vpp addition [is] mean [is] 12,8 %. While moment given [by] a sine modulation [of] equal to 2,5 Vpp [of] hence will add the mean distortion [of] equal to 7,56 %. Optimal modulation input between 2 Vpp up to 2,5 Vpp so that SCA will give the mean distortion that is

equal to 10,18 % at the (time) of system given an optimal input modulation.

Testing of Distortion of Demodulator SCA
Input signal which too big will influence the output from demodulator SCA. Input which too big distortion will result of demodulation SCA. This Distortion can cause the mistake convert the demodulator FSK so that data delivered - distorsion.

Table 9  Testing of SCA demodulator with maximal input before error conversion at SCA modulator 1300 Hz input.

| $f$ (KHz) | Vinmax (Vpp) | % Distorsi | $f$ (KHz) | Vinmax (Vpp) | % Distorsi |
|---|---|---|---|---|---|
| 0,05 | 3 | 40 | 7 | 3,5 | 45 |
| 0,1 | 3 | 40 | 8 | 3,5 | 45 |
| 0,5 | 2,6 | 40 | 9 | 3,5 | 45 |
| 1 | 3 | 40 | 10 | 3,8 | 50 |
| 2 | 3 | 45 | 15 | 3,5 | 50 |
| 3 | 3 | 42 | 20 | 3,6 | 45 |
| 4 | 3,2 | 45 | 30 | 3,5 | 45 |
| 5 | 3,4 | 50 | 40 | 3,4 | 45 |
| 6 | 3,5 | 45 | 50 | 3 | 40 |

Table 10  Testing of SCA demodulator with maximal input before error conversion at SCA modulator 1700 Hz input.

| $f$ (KHz) | Vinmax (Vpp) | % Distorsi | $f$ (KHz) | Vinmax (Vpp) | % Distorsi |
|---|---|---|---|---|---|
| 0,05 | 3 | 20 | 7 | 3,2 | 20 |
| 0,1 | 3 | 30 | 8 | 3,5 | 40 |
| 0,5 | 3 | 40 | 9 | 3,5 | 30 |
| 1 | 3,1 | 32 | 10 | 3,5 | 40 |
| 2 | 3 | 30 | 15 | 3,3 | 25 |
| 3 | 3 | 33 | 20 | 3,4 | 15 |
| 4 | 3,1 | 30 | 30 | 3,5 | 10 |
| 5 | 3 | 40 | 40 | 3,6 | 13 |
| 6 | 3,2 | 30 | 50 | 3 | 15 |

All above testing done with transmitter and receiver apart to bunch up if conducted with the distance which progressively far hence distortion that happened will be ever greater and will cause the demodulation mistake demodulator FSK.

Error Bit  rate testing
Error Bit  rate testing comparison accepted wrong with entire/all sent bit. Examination done] by delivering concevutive bit in the form of character with the certain quantity
Result of test [is] not get a bit  mistake accepted on the promise that distortion that happened still in level which small relative (Tables 14 and 15) and deviasi of transmitter frequency [not far exceed 75 kHz

CONCLUSION

1. Bandwidth rest of at one particular system of broadcasting FM can be exploited to deliver the data by broadcast [through SCA
2. Information signal experience of the distortion equal to 10,18 % effect of bandwidth exploiting rest because SCA use.
3. Digital sytem modulation FSK type applicable to deliver and also accept the data by baudrate 600 bps, BER [of] equal to 0 %. Low Baudrate [not the problem of considering system broadcast so that data [not need high-speed
4. To limit bandwidth of stereo signal in order not to bother the sinyal SCA used filter to get away to lower 53 kHz
5. To limit wide bandwidth of SCA signal at transmitter and filter SCA signal receiver of hence used band pas filter 67 kHz.
6. PLL system used to modulator and demodulator SCA
7. Low pass filter 2 kHz have earned to give the censorship to high frequency signal accompanying information signal SCA that got signal which is clear of noise
8. Butterworth filter type used to get stop band with less reduction.

9. SCA require the modulation room equal to 10 %, addition of SCA at one particular system of broadcasting of FM stereo will degrade the sinyal of stereo modulation equal to 11,11 %.

10. Big distortion ( more than 50 %) [at] demodulator SCA will result the demodulation mistake by demodulator FSK.

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