

# A Global Car Radio IC with Inaudible Frequency Jumps

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## Abstract

### The Receiver IC Features:

- A global tuner concept**
  - meets different geographical requirements
- No mechanical alignments**
  - all tuner alignments are bus-controlled
- Total system price reduction**
  - fewer and cheaper external components
- Tuner performance improvement**
  - increased receiver dynamic range
- Feature enhancement**
  - inaudible signal quality checks

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## Tuning System Topology

- Single VCO tunes all reception bands with internal divider circuits
- Single loop filter for all reception bands
- Fast frequency jumps for inaudible quality checks
  - adaptive PLL to achieve both speed and frequency stability
- Local timing control
  - reduces microcontroller communication time

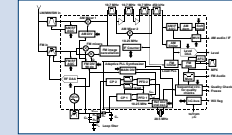
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## Reception Bands with Corresponding Tuning System Parameters

Band	$f_{VCO}$ (MHz)	$f_{VCO}$ (MHz)	$f_{VCO\_DIV}$ (MHz)	FM DIV	AM DIV	CP1	CP2
LW/MW (Eur. + USA)	1.750	200.000	114.3	1	2	10	1
SW	5.05	100.5	19.3	2	3	1	
W	102.00	172.10	25	1			0.13
FM (Eur.)	45	101.4	20	2			1
FM (USA)	70	100.4	10	2			
FM (Eur. + USA)	87.5	100.4	100	2			0.13
FM (USA)	100	201.4	50	2			0.13

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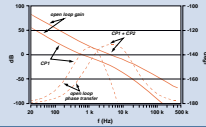
## Simplified Block Diagram of the Receiver IC



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## Adaptive PLL Synthesizer

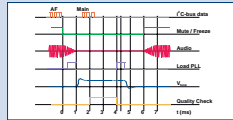
Open-loop Transfers for Frequency Jumps and In-Lock



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## "The Sequential Circuit"

Inaudible Frequency Jumps Control Signals Timing



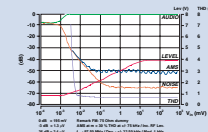
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## FM Receiver Topology

- Standard 10.7 MHz IF
  - cheap external components
- Integrated image rejection
  - reduced external components
- No external RF amplifier
  - reduced external components
- Keyed RF AGC possibility
  - improved desensitization behavior
- RF tuned circuit tracking and level curve alignment by Digital Automatic Alignment (DAA)
  - Weather Band compatible

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## FM S/N Measurement of the NICE IC



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## Microphotograph of the Receiver IC



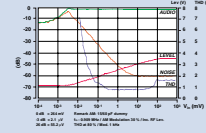
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## AM Receiver Topology

- Double conversion (10.7 MHz / 450 kHz)
  - cheap external components
- Linear RF AGC with a new AM PIN diode
  - no AGC pops, active antenna compatibility
- No mechanical alignments
  - wideband RF input and level curve alignment by DAA
- AM stereo compatible
- AM IF noise blanker

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## AM S/N Measurement of the NICE IC



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## Conclusions

- Single-chip Car Radio IC in Bipolar process
- Few external components
- Suitable for global application
- Requires no mechanical alignments
- High-end AM and FM performance
- Provides inaudible signal quality checks on other channels