TS9095

FM Modulation Analyser + AF Spectrum Analyser

TS9095   Dual bandwidth + 8 bit AGC
TS9095A Triple bandwidth + 12bit AGC + RDS RTplus decoder

TS9095G + GPS receiver
TS9095AG + GPS receiver

2013 Technical specification
Issue 1.0

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TS9095

The TS9095 FM Modulation and AF Spectrum Analyser, has been designed for precision monitoring of FM Radio Broadcasts. Connected to a standard Windows PC, via a USB port, their user friendly interface displays all modulation data for on-screen analysis.

Audio outputs are provided for high quality headphone or loudspeaker monitoring, with full RDS decoding available and live 'off-air' data recording. Extensive automatic logging of broadcast data with the included **iLog** software. Remote control is possible with simple text file commands allowing the unit to be controlled from 3rd party software.

FFT Spectrum Analyser
Unique to this class of product is a 16 bit FFT Spectrum Analyser for precise FM baseband analysis.

GPS The iLog software includes GPS decoding to the NMEA global standard. It will automatically scan the PC for any connected GPS NMEA compliant devices. Google Earth .kml files are generated for GPS tagged field measurement. The TS9095 units can be supplied with their own optional USB GPS receiver module.

The enclosure is a solid aluminium casting, with excellent screening against external interference. This case is extremely robust for field use.

This combination provides broadcast engineers, whether working on-site or as a mobile unit, with a high performance, reference class instrument.

10.7MHz IF input provides IF monitoring with the front-end shut down.

10.7MHz IF output provides IF feed through to external equipment.

Antenna attenuator providing up to 30 dB attenuation, with user selectable 10dB steps. Different attenuator values can be assigned to each frequency on the channel list.

Balanced audio outputs for left and right channels

Class AB audio amplifier for high quality audio monitoring on headphones or external loudspeakers. Additional audio stereo monitoring is available on the PC sound system.

USB powered means that no other power source is required. Running from a Laptop computer, provides for mobile monitoring and logging of radio broadcasts.

Windows iLog software is supplied with the unit, providing complete control and display of all measurements. This will run on a standard desktop or laptop PC.

The iLog software is compatible with Windows XP, Vista, Windows 7 and Windows 8.

Triple bandwidth IF filters Three IF filter bandwidths are provided on the TS9095A models, providing wideband, narrowband and ultra-narrowband filters. The TS9095 has just wideband and narrowband filters.

The wideband filter response, is set with a proprietary three stage, six pole Gaussian response LC filter, computer optimised and equalised for minimum overshoot and low distortion.

The narrow and ultra-narrow band filters use a two stage, individually selected, 4 pole ceramic filter networks, utilising discreet low noise IF amplifier buffers.

These filters allow precise 'off-air' measurements, offering low levels of distortion for high quality audio monitoring, via the headphone output or loudspeakers

FM demodulator with distortion cancellation for linear operation. A feedback loop maintains accuracy over time and temperature by comparing deviation amplitude and phase with a DC voltage reference.
All measurements of deviation, modulation power, pilot level and RDS sub-carrier are referenced to this, as are any other baseband measurements made with the spectrum analyser.

FFT Spectrum Analyser 10Hz to 100kHz with 16 bit sampling, achieves a 100dB dynamic range. This can be extended to greater than 110dB with waveform averaging, allowing signals below noise to be observed and measured.
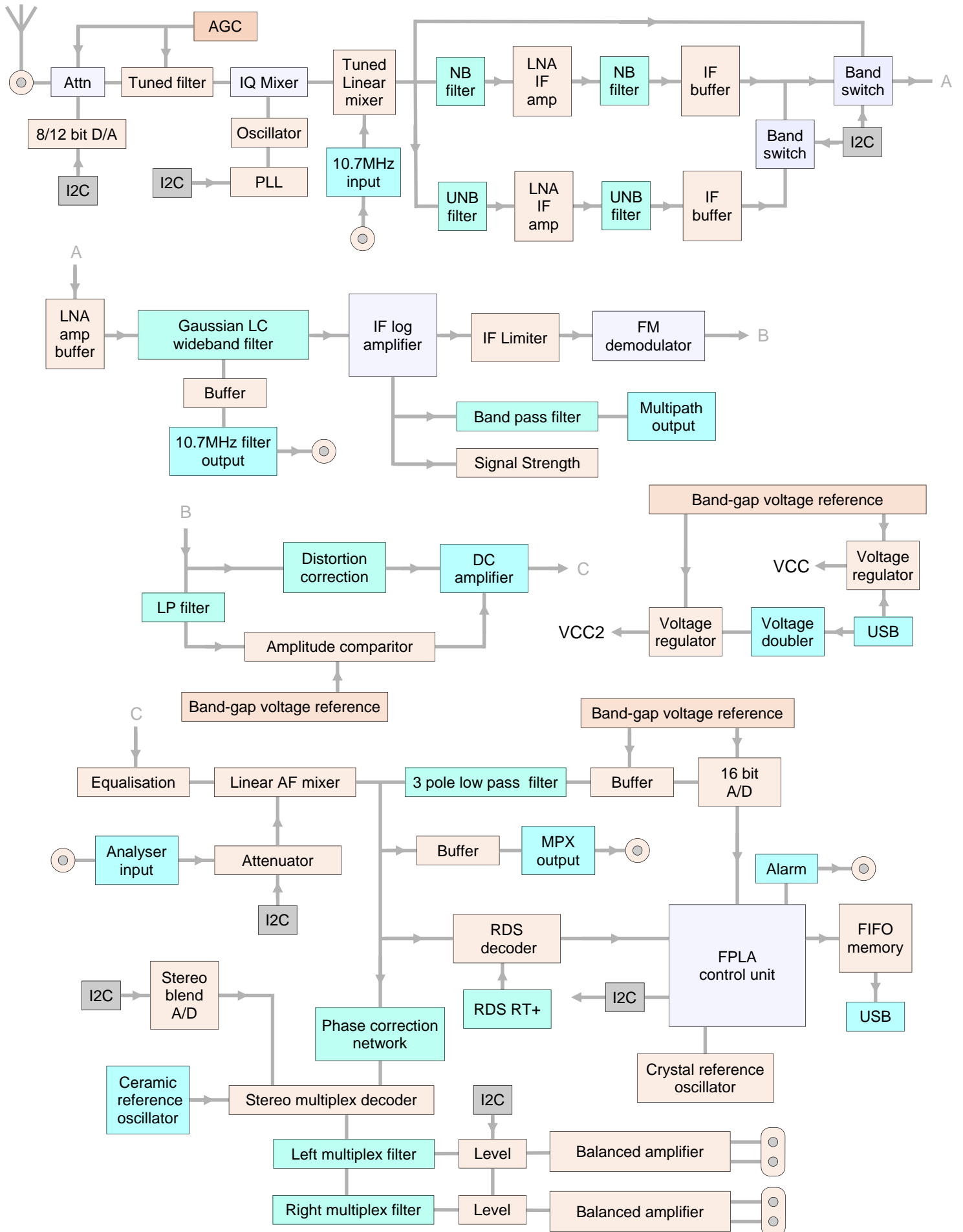
Software DSP stereo decoder with excellent phase matching between channels, with lower distortion and noise than traditional analogue types.

Stereo monitor with left and right channels shown on a time domain display. An additional 2D vector stereo quality display gives a visible guide to left and right channel behaviour.

Stereo blend of left and right channels can be set for automatic noise control for poor signals.

Multiplex record and playback with full stereo audio monitoring using PC sound system. This feature records the raw USB data from the TS9095 directly to hard disk. This can then be replayed at any time, giving a live 'off-air' monitor. A recording can be made from any frequency on the channel list and is only limited

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TS9095 system diagram

Antenna → Attn → Tuned filter → IQ Mixer → Tuned Linear mixer

- AGC (connects to Attn / Tuned filter)
- Attn → 8/12 bit D/A → I2C
- IQ Mixer → Oscillator → PLL → I2C
- Tuned Linear mixer → 10.7MHz input

Tuned Linear mixer branches:
- NB filter → LNA IF amp → NB filter → IF buffer → Band switch → **A**
- UNB filter → LNA IF amp → UNB filter → IF buffer → Band switch
- Band switch → I2C

A → LNA amp buffer → Gaussian LC wideband filter → IF log amplifier → IF Limiter → FM demodulator → **B**

- Gaussian LC wideband filter → Buffer → 10.7MHz filter output
- IF log amplifier → Band pass filter → Multipath output
- IF log amplifier → Signal Strength

B → LP filter / Distortion correction → DC amplifier → **C**

- Distortion correction → DC amplifier
- LP filter → Amplitude comparitor → DC amplifier
- Amplitude comparitor ← Band-gap voltage reference

Power section:
- Band-gap voltage reference → Voltage regulator → VCC
- Voltage regulator → VCC2
- Voltage regulator ← Voltage doubler ← USB

C → Equalisation → Linear AF mixer → 3 pole low pass filter → Buffer → 16 bit A/D

- Band-gap voltage reference → Buffer / 16 bit A/D
- Analyser input → Attenuator → Linear AF mixer
- Attenuator ← I2C
- Buffer → MPX output
- 16 bit A/D → FPLA control unit
- Alarm → (output)
- FPLA control unit → FIFO memory → USB
- RDS decoder → FPLA control unit
- RDS decoder ← I2C
- RDS decoder → RDS RT+
- Crystal reference oscillator → FPLA control unit

- Stereo blend A/D ← I2C
- Stereo blend A/D → Stereo multiplex decoder
- Ceramic reference oscillator → Stereo multiplex decoder
- Phase correction network → Stereo multiplex decoder
- Stereo multiplex decoder → Left multiplex filter → Level → Balanced amplifier
- Stereo multiplex decoder → Right multiplex filter → Level → Balanced amplifier
- Level ← I2C

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iLog Windows software

Microgen iLog TS9095 FM Modulation Analyser v5.57 — Select channel

CAPITAL 95.80 MHz

Freq:	95.80 MHz	MS: Music
PI:	C479	ECC:
PS:	CAPITAL	TP = 1
PTY:	Pop Music	TA = 0
PIN:		QLT = 99.94 %

AF data: #2 95.8
Mthd: A 103.2 'F'

RT: Now on Capital: Avicii with Wake Me Up

RDS:
0A C479 0548 E253 4341
2A C479 2551 6F6E 2043
8A C479 8548 1080 0CD9
0A C479 0549 9DCD 5049

CT time and date
16:03:24
Thu 15th Aug 2013

Pilot 19kHz 6.65 kHz   RDS 57kHz 3.11 kHz

dBu . . . MHz Signal Qlty: 99.01 % Site01_scan1

Frequency 95.80 MHz Signal strength 79.1 dBu

Modulation Power Time: 00:03:22   Average Power +6.67 dBr

Spectrum analyser Mode: Log Y gain: x10 Filter: Mean Fade: Short
Frequency 0.0 kHz Deviation −5.0 dB

Multipath XY plot x:dev y:mpath   Mpath 0.71 dB

Deviation Histogram
Time: 00:03:28
Smpls: 4160
M=72.9
D=3.3
S=0.4
%=1.6
K=0.0

Dev: pk to pk 200us/div
Dev history 500ms/div
Stereo monitor 200us/div
Stereo quality

usb: 4.823v
Sn: 2075001
Spd: 0.94ms

Volume 01 Bright 0

FM Modulation analyser features:

- High performance FM receiver and Modulation Analyser
- Signal strength 84dB range with frequency scanning
- FM deviation 0 to 100kHz with histogram
- Modulation Power calculated with 32bit floating-point precision
- Multipath XY plot
- Pilot 19kHz amplitude
- RDS 57kHz sub-carrier amplitude
- Left and right channel decoding, with stereo quality vector readout
- Automatic logging of signal strength, pilot and RDS carrier
- Software remote control with simple text file commands
- I2C hardware remote control
- 12 bit AGC for TS9095A and 8 bit AGC for TS9095
- Stereo blend, user selectable for automatic noise reduction

RDS/RBDS decoder features:

- Full RDS/RBDS decoding, with signal quality readout.
- Decoded groups PI,PTY,PS,RT,CT,PIN,AF,TA,TP,DI,MS,EON
- RT messages saved to file
- RT+ decoding with Title and Artist automatically saved to file (TS9095A)

Select channel

Setup Band Attn File Copy

Site01
93.50 BBC R4 C204
94.90 BBCLondn CC11
95.80 CAPITAL C586
97.30 LBC 97.3 C581
98.50 Radio 1 C201
98.80 Radio 1 C201
100.00 Kiss 100 C483
100.60 Classic C2A1
100.90 Classic C2A1
102.20 SMOOTH C787
104.90 X F M C0B8
105.40 MAGIC C788
105.80 Absolute C4B4
106.20 Heart C3A6
Site02

Narrowband 180kHz
RF attenuator = 0dB

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Microgen iLog TS9095 FM Modulation Analyser v5.57

Select channel

Site01_scan1

Setup
File
Cal
Antenna
Monitor
Palette
About
Help
AutoLog
Capture
RdsLog
ScanLog

CAPITAL 95.00 MHz

Freq: 95.80 MHz
PI: C479
PS: CAPITAL
PIN:
RT:
Now on Capital: Katy Perry with Roar

MS: Music
DI: Stereo
TP = 1
TA = 1
QLT = 99.94 %

ECC:

AF data: #2 95.8
Mthd: A 103.2 'F'

RDS: 0A C479 0548 E253 4341
0A C479 0549 9DCD 5049
2A C479 2542 6170 6974
8A C479 8548 486E 0E01

RDS errors

CT time and date
12:30:57
Thu 15th Aug 2013

Save
Delete
Scan
AutoTune
Print
Setup
Copy
Size
Time
RT
EON
AF
TMC
RDS
Volume

Bright 0
Colour
Record
GPS
Copy
Exit

Signal Quality:

dBu . . . MHz

90
80
70
60
50
40
30
20
10
0

91.4 91.8 92.2 92.6 93.0 93.4 93.8 94.2 94.6 95.0 95.4 95.8 96.2 96.6 97.0 97.4 97.8 98.2 98.6 99.0 99.4 99.8 100.2

BCR3
BBC R4
BBCLondn
CAPITAL 95.80 dBu
BBCLondn
flames
ChoiceFM
98.00
LBC 97.3
Radio 1
MESSAGE
Kiss 100

Latitude 5 1 : 2 1 : 3 5 . 7 5 N
Longitude 0 0 0 : 0 9 : 5 5 . 7 4 W

dB
50
40
30
20
10
0

ID   29 25 31 02 12 14 21 10 23
Ev   78 62 60 285 21 17 06 02 01
Azi 170 088 049 093 224 174 039 344
SN   35 34 22 29 34 16

Stereo quality
% L
100 80 60 40 20 0

Frequency 95.00 MHz
Y gain: x10
Mode: Log Filter: Mean Fade: Short

Spectrum analyser

+10
0dB
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100

kHz 5 10 15 20 25 30 35 40 45 50 55 60 65 70

Deviation -5.0 dB
Signal strength 72.1.1 dBu

Multipath XY plot xdev y:mpath
dB
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.2
0.8
0.4
0.0

0 20 40 60 80 KHz

Mpath 0.07
Agc

RDS 57kHz 6.00 kHz
Pilot 19kHz 6.00 kHz

Modulation Power Time: 00:41:54

dB
12
10
8
6
4
2
0
-2
-4
-6
-8

0.79 dBr

Average Power

Deviation Histogram Smpls: 3940 Time: 00:03:17 M=72.9kHz

D=2.3
S=0.5
%=1.4
K=0.0

kHz 90 kHz

1.0
0.8
0.6
0.4
0.2
0.0

Deviation history 500ms/div kHz
90 80 70 60 50 40 30 20 10 0

Deviation: pk to pk 200us/div
kHz
80 60 40 20 0 -20 -40 -60 -80 -100

Stereo monitor 200us/div
%
100 L 0 -50 -100
100 R 0 -50 -100

usb: 4.823v
Sn: 2075001
Spd 0.86ms

FFT Spectrum Analyser

The FFT Spectrum Analyser, utilises the 16 bit data from a high quality SAR A/D convertor. Using 32bit calculations, and advanced signal processing, it is able to extract frequency detail well into the noise of the signal.

This convertor is fed by an ultra low distortion buffer, via a computer optimised LC anti-alias filter. A software controlled passive input attenuator network, allows for scaling of the signal under measurement for greater flexibility. Any measurements taken can be cut and pasted into other applications. This high quality analyser can also be used as a general purpose AF spectrum analyser, over a bandwidth of 100kHz.

- Precision base-band FFT Spectrum Analyser covering 10Hz to 100kHz
- 16 bit sampling
- Maximum 16,000 point resolution
- Dynamic range of 100dB with a resolution of 20Hz

- Linear or logarithmic scale with full cursor measurement of frequency and amplitude
- Multiplex signal analysis
- External BNC multiplex analyser
- External BNC audio analyser
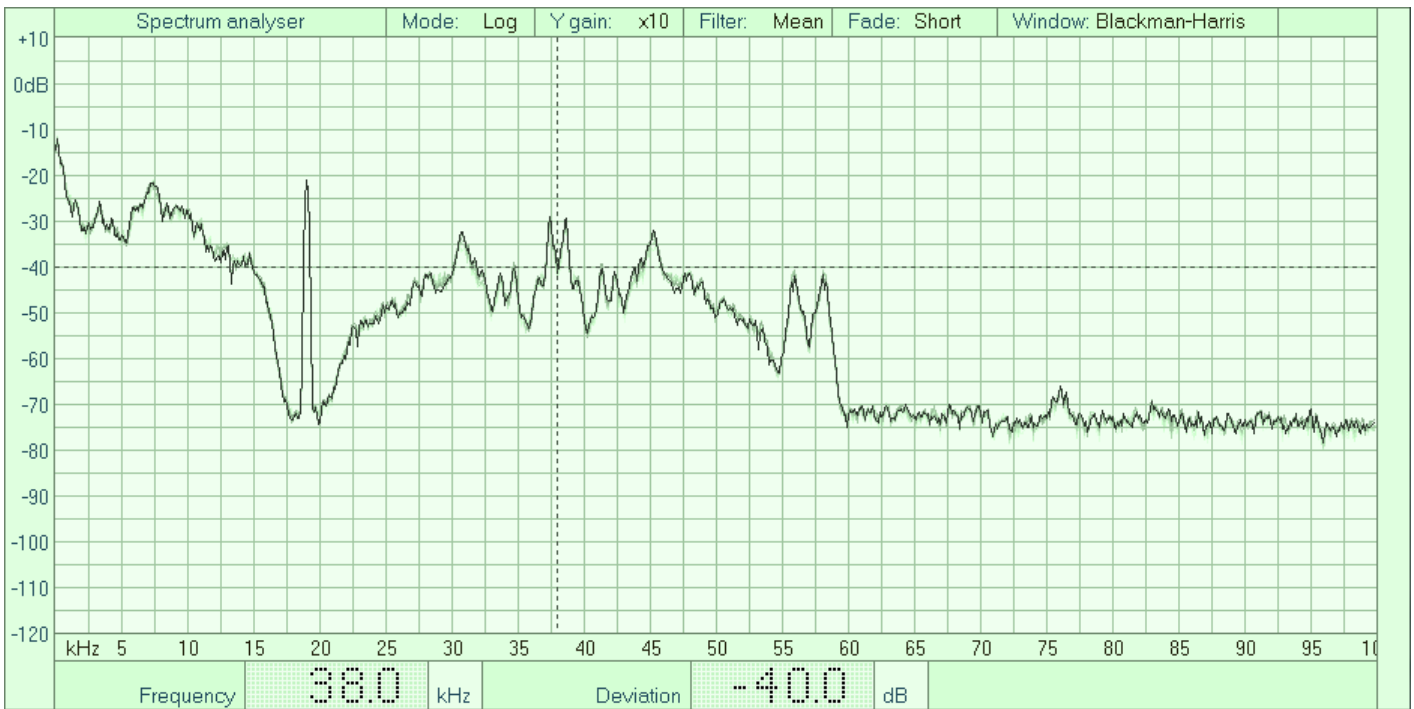
The FFT spectrum analyser, provides a valuable tool for examining the FM multiplex signal. The A/D converter has a very low spurious output, coupled with low distortion and noise. With signal averaging it is possible to detect signals below noise. This will extend range to greater than 110dB. Various sample windows can be applied, Hanning, Hamming, Blackman-Harris etc, providing versatile measurement.
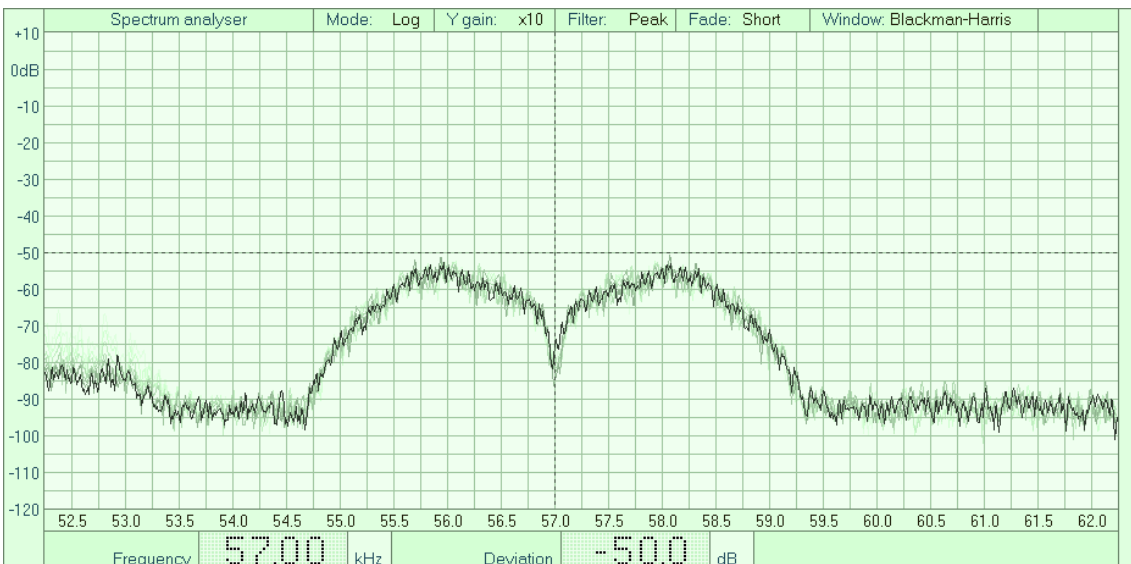
The spectrum, shown left, details just the FM broadcast 57KHz RDS sub-carrier.

It details the sideband modulation at a resolution of 250Hz per division.

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FM BROADCAST RF SPECTRUM

The FM Broadcast frequency band can be continually scanned with a 10kHz resolution. This window can be re-sized to view any particular frequency. If the channel is transmitting its PS name then this will be automatically displayed.

The AutoTune feature provides a completely automatic channel search and save function. The Windows **iLog** software provides extensive logging, manual or automatic, with an alarm on error.
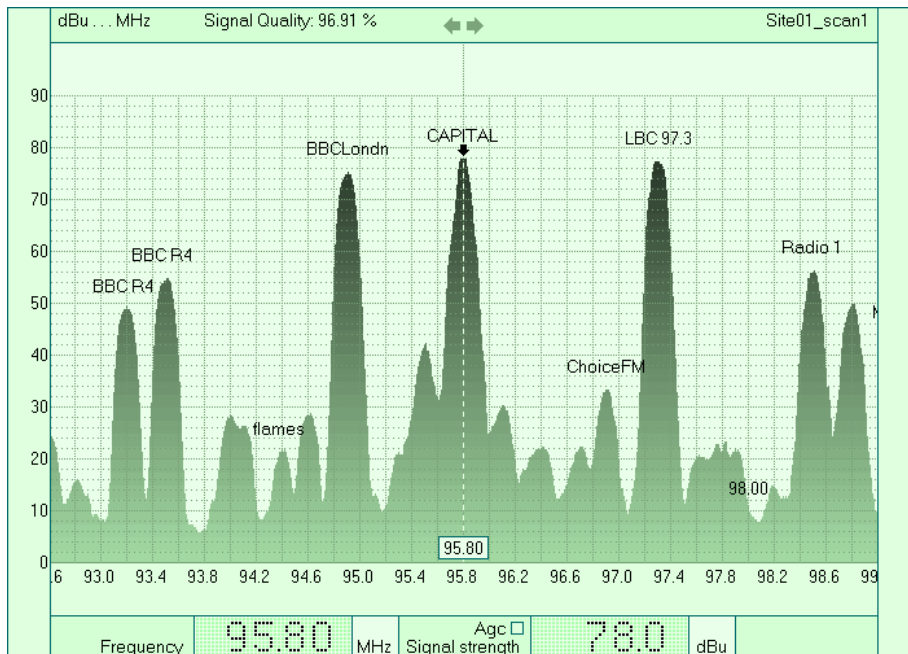
RF broadcast RF band amplitude spectrum
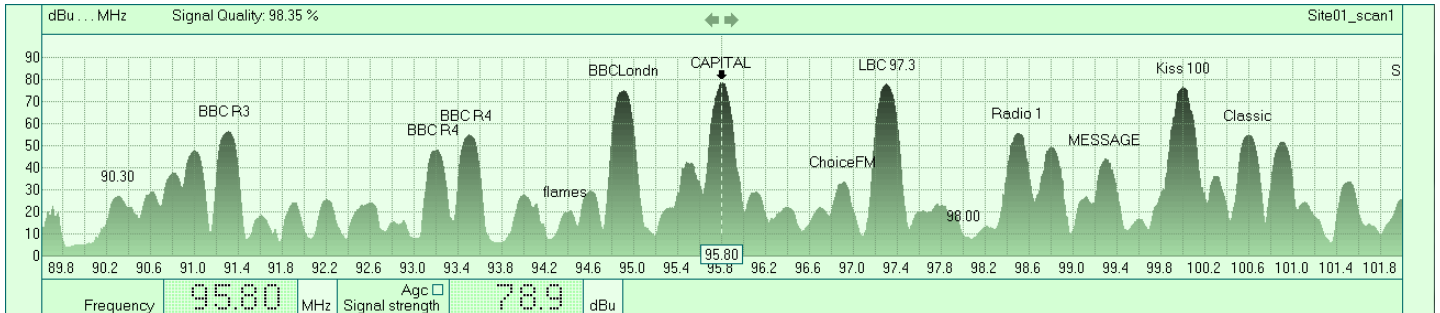
Ultra-narrowband IF filter 100kHz (TS9095A models only)
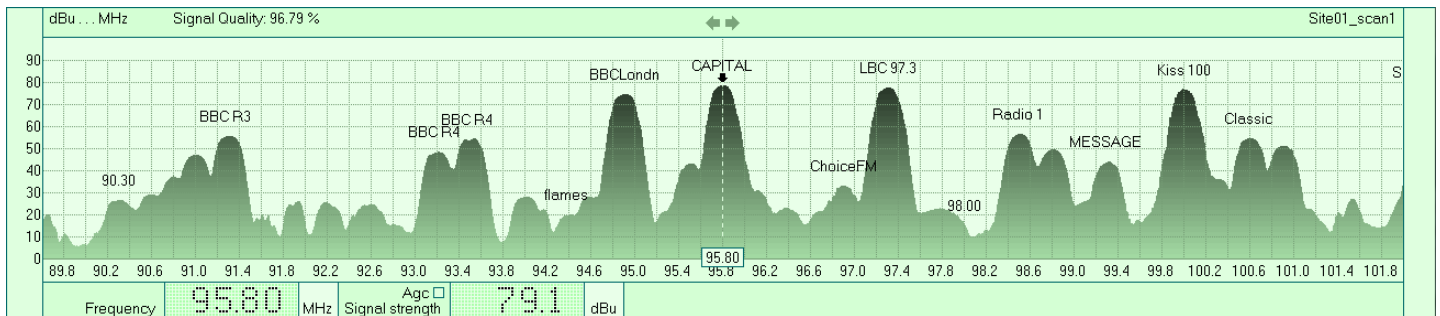
Narrowband IF filter 180kHz

The graph shown above, scanned with UNB selected, details just a small frequency range at 10kHz resolution. The vertical scale has doubled to show 2dB increments. This frequency scan can be dragged with the computer mouse to show any frequency of interest. For strong signal areas, a user settable antenna attenuator can be selected. This has three settings of -10dB, -20dB and –30dB. These windows can be copied and pasted into any suitable application.

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FREQUENCY DEVIATION

Time domain oscilloscope: The FM multiplex signal can be viewed in the time domain, with a standard view XY oscilloscope display.
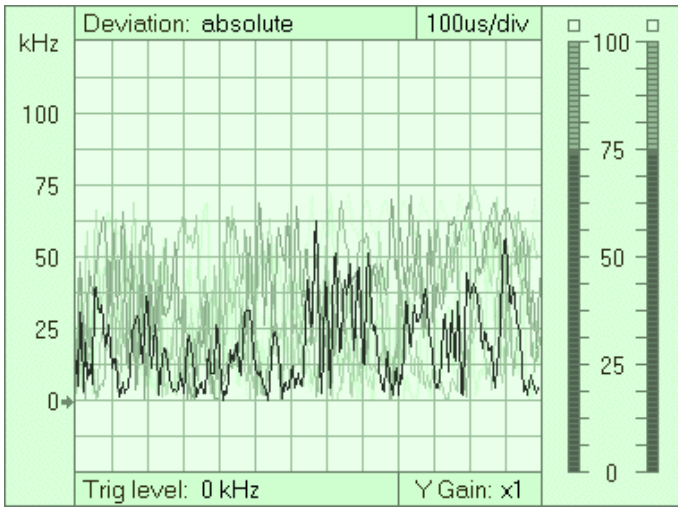
Oscilloscope:

The FM multiplex signal can be viewed in the time domain, with a standard type oscilloscope display.

The Y-axis has been calibrated for frequency deviation measurement, with a user selectable x10 function. The X-axis time-base can be set from 10ms/div to 10us/div.

The waveform trigger point is automatic or user settable.

The deviation window, shown here, is a typical broadcast trace set for absolute signal readings. Alternately the display can be set positive and negative deviation.

A bar graph is also provided for a convenient peak style reading for absolute or positive or negative deviation.

FREQUENCY DEVIATION HISTORY
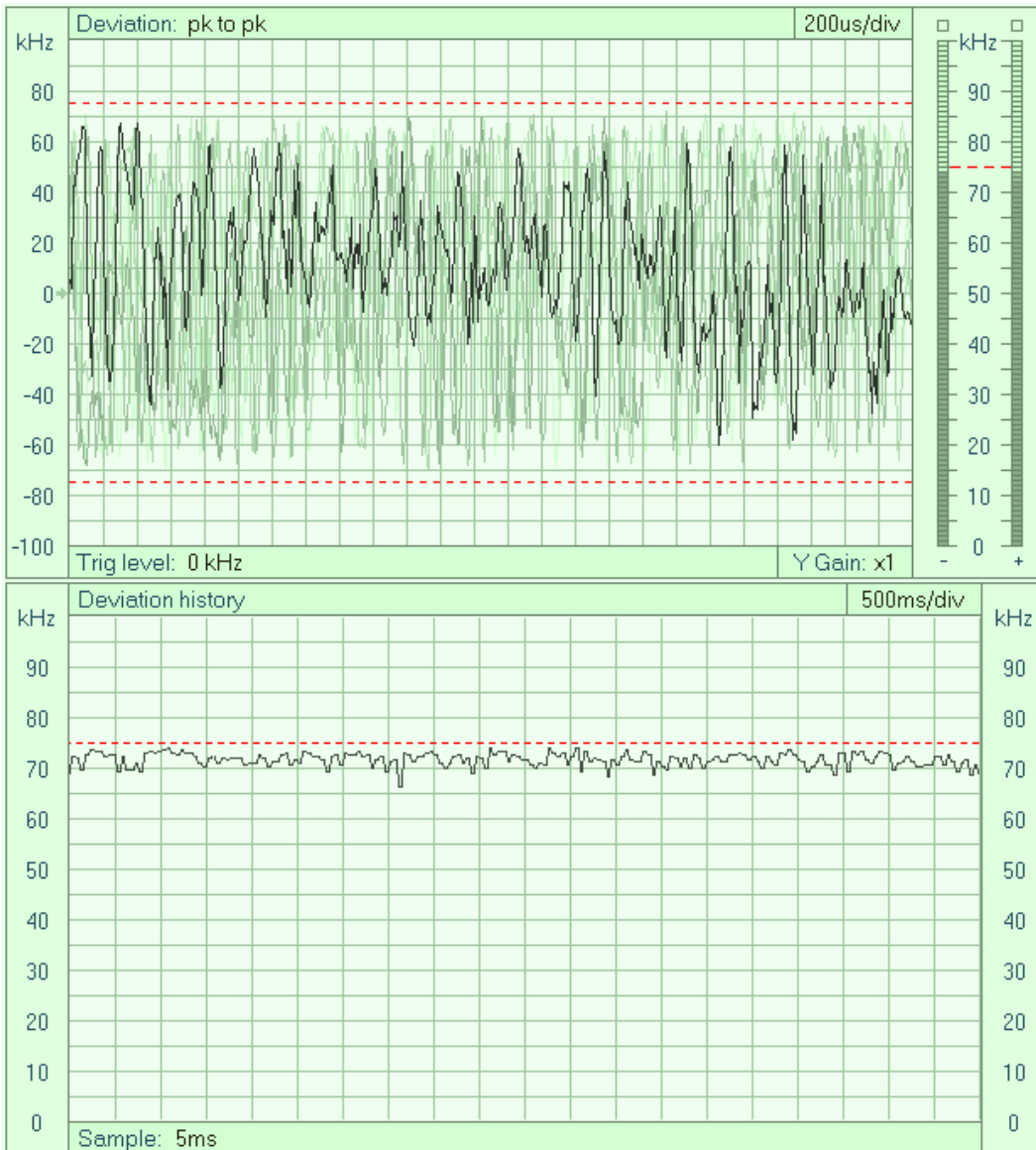
Deviation history:

With the introduction of iLog V5.00 a new frequency deviation history window has been added.

This graph has a much slower time-base, with a sample accumulator.

The sample algorithm takes the highest value of deviation within the sample period. This ensures no modulation peaks are missed.

The time-base can set from 100ms/div to 10sec/div, displaying absolute frequency deviation.

This history feature allows the operator to assess frequency deviation over a very long period of time. This makes it very easy to spot over modulation peaks.

The display can be set for a normal left to right update or can be configured to automatically scroll continuously.

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FREQUENCY DEVIATION HISTOGRAM AND ACCUMULATED DISTRIBUTION

Frequency deviation histogram: The frequency deviation histogram method provides an accurate way to asses the frequency deviation level over a set period of time.

The multiplex signal is sampled with a peak hold system, to the recommended standard size 50ms bins. These samples are normalised and then separated into frequency bins over a range of 100kHz.

The histogram resolution can be set for 0.25kHz, 0.5kHz and 1kHz bins. The graph shown below, was sampled with 0.5kHz bins.

The histogram window is updated in real time, with the following deviation variables calculated once per second, from the accumulated data.

- T Lapse time measured in minutes and seconds
- The number of samples taken
- M The mean value of deviation
- D The quadratic mean value of deviation
- S The mean of samples above 75KHz
- % The percentage of samples above 75KHz
- K Equals S*(%/100)

The frequency deviation histogram meets the CEPT/ERC REC 54-01 E standard.
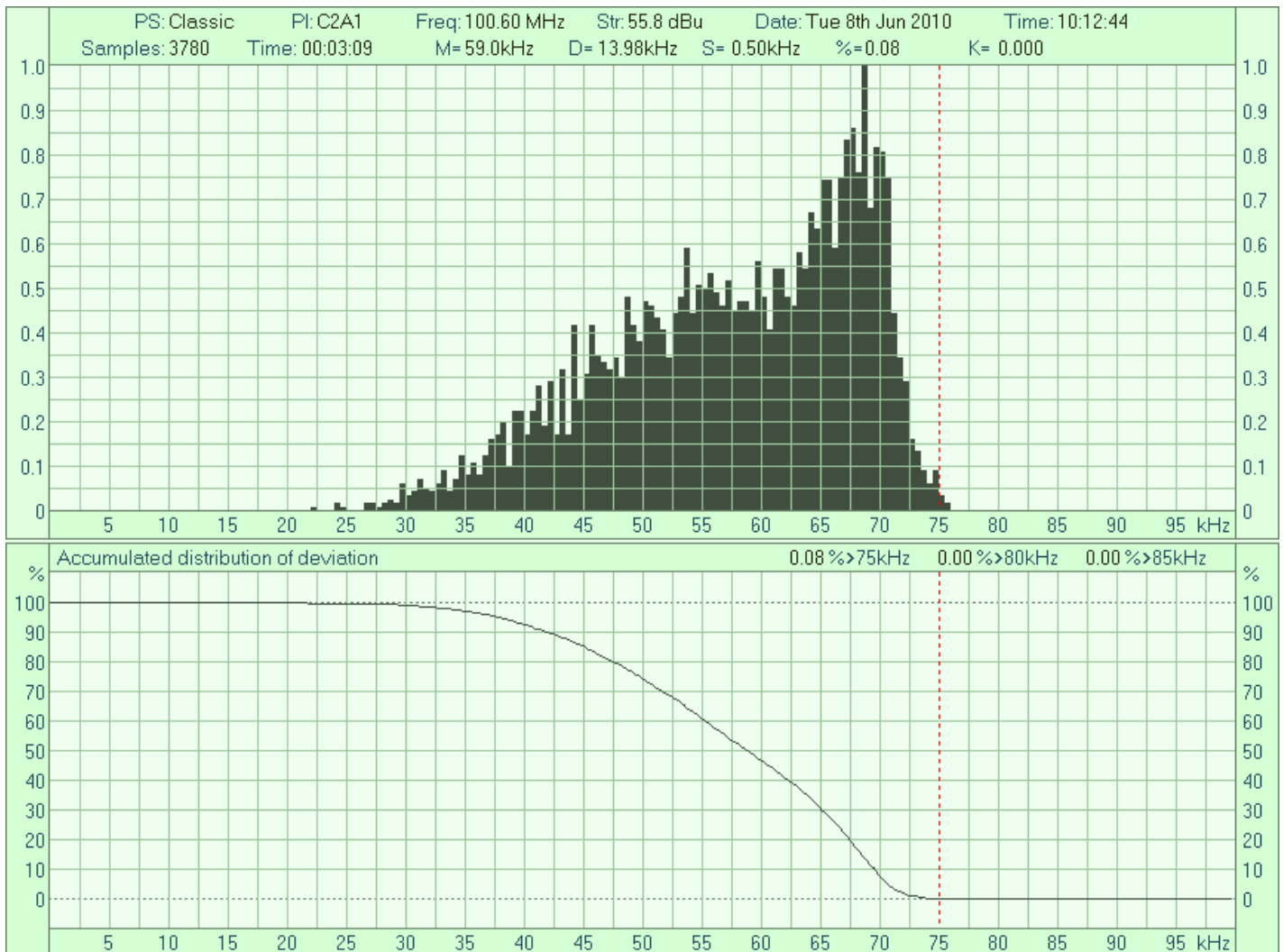

Accumulated distribution of deviation:
The accumulated distribution of deviation, is calculated by summing all bins in ascending order. These are normalised to the total number of samples taken and shown graphically over a range of 100kHz. The percentage of samples over 75kHz, 80kHz and 85kHz are calculated every second.

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MODULATION POWER

Modulation Power is calculated with 32bit floating-point precision from the 16bit digitally sampled multiplex signal. This provides the most accurate way of calculating modulation power compared to the more traditional analogue method with it's inherent problem of dynamic range and temperature drift.
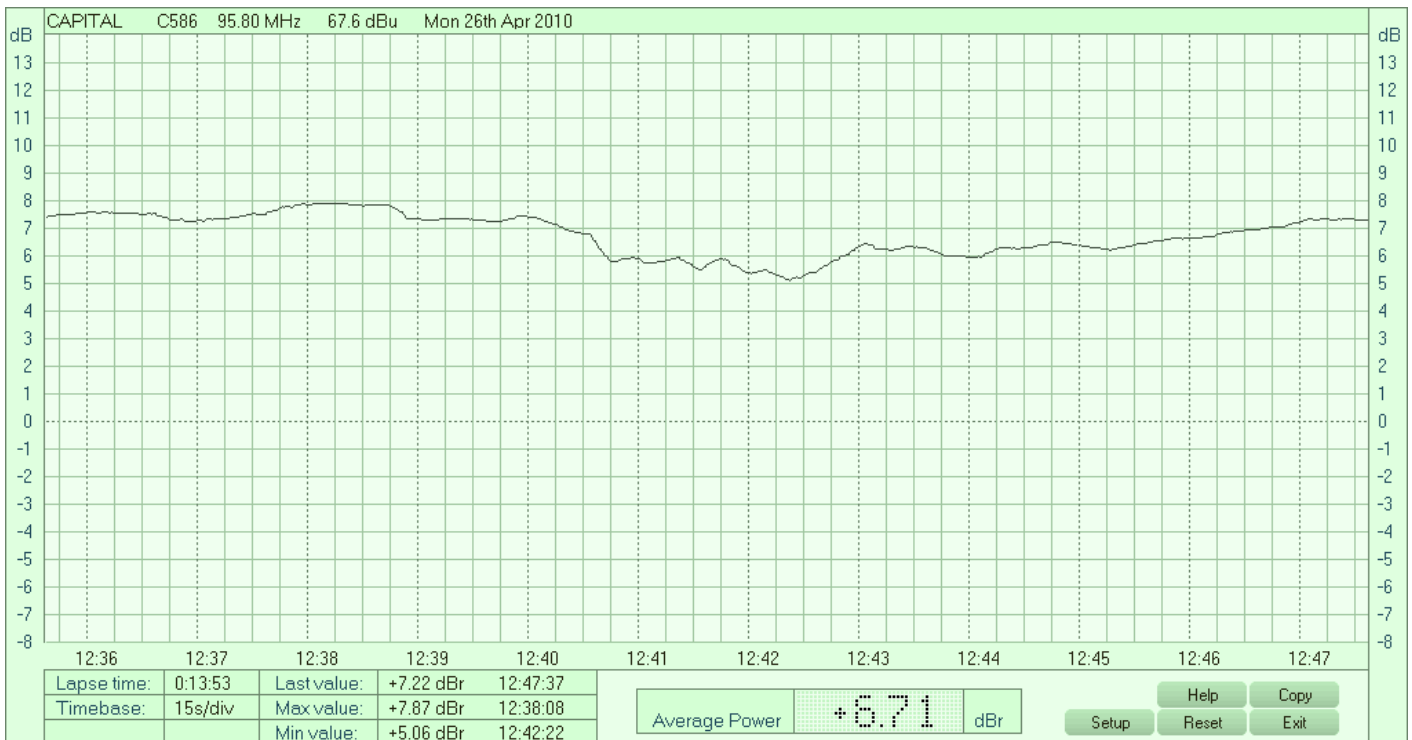

- The full scale measurement range is from –8dB to +12dB

- The average power is calculated with reference to the EBU standard 0dBr.

- The time-base can be set to run from 15sec/div to 10min/div and automatically resets on channel frequency change, or can be user reset at any time. There are lapse time or real time x-axis options.

- The graph continuously scrolls over any period of time and can be printed as required

- Every minute the minimum and maximum values are recorded, with the last value shown for the previous recorded minute.

- The Lapse time gives the recorded time from frequency change or user reset.

- By simply clicking the Copy button the graph can be copied, via the clip-board, and pasted to any other application.

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STEREO MONITOR

Unique to the TS9095 analyser, is that the stereo multiplex audio is decoded by a software algorithm. The 19kHz pilot is detected and phased locked to a narrowband filter. The left and right channels are then extracted with a synchronous detector. This new method of decoding gives excellent phase matching between channels. De-emphasis is finally applied with a further digital filter. Since all this processing is achieved using DSP techniques, no hardware close tolerance components are required or any alignment necessary. The extracted 16 bit left and right audio signals are then passed, via Windows, to the Sound Card for audio monitor-

The stereo monitor software also provides for digital recording of the USB data. This allows the complete monitoring of a Radio Channel, i.e. it's multiplex data is decoded for deviation, RDS data, and it's stereo audio signal. This gives an engineer the opportunity to take a snap-shot of a radio channel, save it to file, and later play it as a live 'off-air' broadcast.
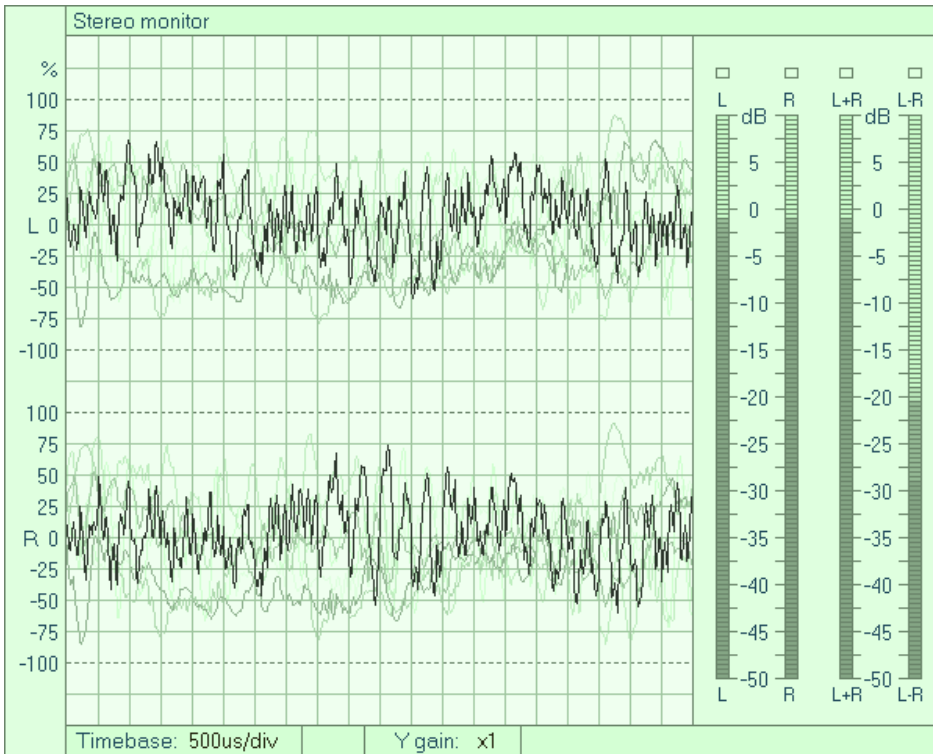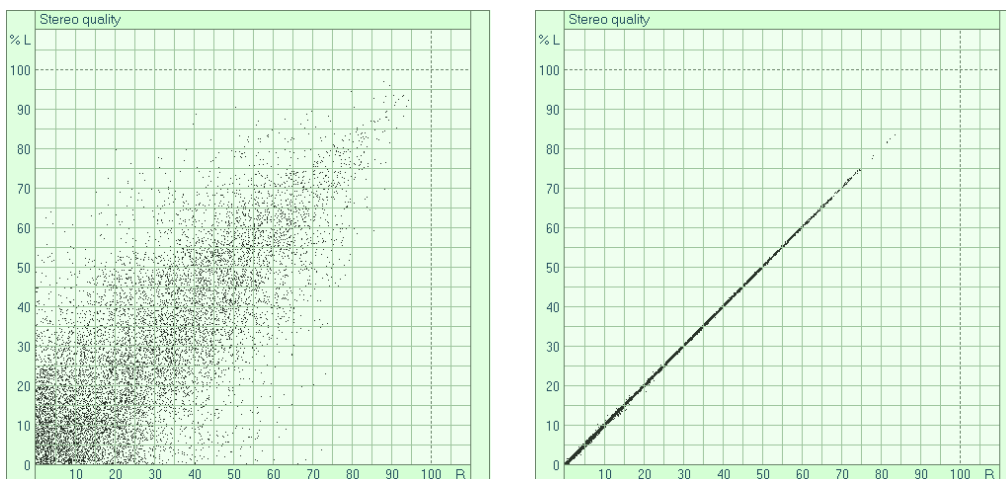

Stereo Monitor display

Shown here is a typical 'off-air' music broadcast of the   left and right channels.

The time-base can set as required and the vertical gain can be set to x1 or x10, for detailed inspection.

Left and right channel PPM style bar-graphs show program content. These are calibrated to automatically compensate for stereo pilot and RDS sub-carrier injection levels.

Additional bar-graphs show L+R and L-R channels.

Stereo quality display on vectored axis

To visualise the stereo quality, the left channel is set to the vertical axis and the right channel to the horizontal axis. The resultant 2D vector display gives an instant assessment of the stereo content from the channel being monitored. The graph on the left displays a typical stereo broadcast and on the right, a good quality mono broadcast. In this case it was for speech. If either the left or right channels are missing then the display will not show symmetrically.

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RDS DECODER

The RDS decoder, will decode groups PI,PTY,PS,RT,CT,PIN,AF,TA,TP,DI,MS,EON. This data can be viewed on-screen as it arrives and it can be stored directly to hard-disk.

RDS group rates			
0A	37.5%	0B	
1A	9.5%	1B	
2A	18.6%	2B	
3A	0.2%	3B	
4A		4B	
5A		5B	
6A	1.6%	6B	
7A		7B	
8A		8B	
9A		9B	
10A		10B	
11A		11B	
12A		12B	
13A		13B	
14A	26.7%	14B	5.9%
15A		15B	

Received Blocks	2100
Block errors	0
Block error ratio	-
RDS quality %	100.0000

0A	C203	01D9	2C2D	4320
2A	C203	21DB	2020	2020
14A	C203	E1D2	0053	C712
0A	C203	01DA	2B20	5233
2A	C203	21DC	2020	2020
0A	C203	01DF	2A21	2020
1A	C203	11C0	80E1	B380
14A	C203	E1D3	0066	C712
0A	C203	01DC	242E	4242
14A	C203	E1DD	4800	C712
6A	C203	61DE	0000	8255
2A	C203	21DD	2020	2020

Group data

- Un-decoded continuous RDS data is displayed in this window.

- Group repetition rates are calculated over a sixty second period.

- RDS quality is given to four decimal places.

Group:	14A	Network:	2	TA: 0	PI: C201	PS: Radio 1			
PTY: Pop Music				LINK: 8001	PIN: B340 22nd at 13:00				

AF		Map 1		Map 2		Map 3		Map 4		AM	
ON	ON	TN	ON	TN	ON	TN	ON	TN	ON	TN	ON
		93.5	98.8	94.4	99.6						
		93.2	98.5	94.2	97.7						
		92.5	97.7								
		94.4	99.5								
		94.5	99.7								
		94.6	99.2								
		93.1	98.3								
		94.1	99.3								
		94.2	99.4								
		92.8	98.0								
		92.9	98.2								
		93.9	99.1								
		93.0	98.2								
		93.3	98.5								
		94.3	99.5								
		92.7	97.9								

Group:	14B	PI: C814	TP: 1
			TA: 0

EON data

- A continuous update of EON data is available for all networks received.

- When all data has been captured, it can be stepped through for inspection, or printed out for hard copy.

Classic 100.90 MHz	Radio Text	Text flag: ☐ 00:00:12	Tue 22nd Jan 2013
14:36:30	Classic FM on the Internet at www.classicfm.com..............		
14:36:45	Classic FM on FM, DAB and online at www.classicfm.com..........		
14:36:00	For information about our programmes visit www.classicfm.com....		
14:37:15	Classic FM - Playing a relaxing mix of popular classical music..		
14:37:30	Classic FM on the Internet at www.classicfm.com..............		
14:37:45	Classic FM on FM, DAB and online at www.classicfm.com..........		
14:38:15	Classic FM - Playing a relaxing mix of popular classical music..		
14:38:45	Classic FM on FM, DAB and online at www.classicfm.com..........		
14:38:00	For information about our programmes visit www.classicfm.com....		
14:39:15	Classic FM - Playing a relaxing mix of popular classical music..		
14:39:30	Classic FM on the Internet at www.classicfm.com..............		
14:39:45	Classic FM on FM, DAB and online at www.classicfm.com..........		
14:39:00	For information about our programmes visit www.classicfm.com....		
14:41:30	Classic FM on FM, DAB and online at www.classicfm.com..........		
14:41:45	For information about our programmes visit www.classicfm.com....		
14:41:59	Classic FM - Playing a relaxing mix of popular classical mus		

RT history

- Sixteen RT messages are captured and displayed in the RT window.

- These messages can be logged directly to hard disk.

- Any number of messages to capture can be set and they will be stored as ASCII text.

- These can be cut and pasted into any text file. Any repeat messages can be ignored.

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RDS DECODER RT+   Radiotext plus (TS9095A)

The TS9095A models have additional RDS decoding of the RT+ group 11A.
Along with the standard RT text, the music Title and Artist, are decoded and displayed in this window.

Kiss 100 100.00 MHz		Mon 14th Jan 2013	Text flag: ☐ 00:01:38	RT+ AGT code: 11A			
				Item toggle bit:			1
Content type:		Radio Text		Item running bit:			1
14:36:34	Monday afternoon and this is Kiss 100						
Item.Title	Blow Me One Last Kiss			SM1	13	LM1	20
Item.Artist	Pink			SM2	37	LM2	3
14:36:54	You're listening to Kiss 100						
Item.Title	Blow Me One Last Kiss			SM1	13	LM1	20
Item.Artist	Pink			SM2	37	LM2	3
14:37:18	For the best Dance, Hip-Hop and R&B, this is Kiss						
Item.Title				SM1		LM1	
Item.Artist				SM2		LM2	
14:37:34	Kiss 100 - It's 2:37 pm						
				SM1		LM1	
				SM2		LM2	
14:37:58	Kiss 100 - for the best Dance, Hip-Hop and R&B						
				SM1		LM1	
				SM2		LM2	
14:38:18	Monday afternoon and this is Kiss 100						
				SM1		LM1	
				SM2		LM2	
14:38:37	You're listening to Kiss 100						
				SM1		LM1	
				SM2		LM2	
14:38:54	Now Playing: Troublemaker by Olly Murs / Flo Rida						
Item.Title	Troublemaker			SM1	13	LM1	11
Item.Artist	y Olly Murs / Flo Rid			SM2	27	LM2	19

Up to eight Titles and Artists can be displayed at any time, as they arrive. The window automatically scrolls when more than eight entries are received. This continuous data stream can be logged directly to hard disk, by means of a RT+ text file. The Titles and Artists can then be extracted from this file.

File name: RTdata
Recorded: Mon 14th Jan 2013
PS name: Kiss 100
Frequency: 100.0MHz

15:40:14 Kiss 100 - for the best Dance, Hip-Hop and R&B
15:40:33 Monday afternoon and this is Kiss 100
15:40:52 Now Playing: Payphone by Maroon 5
15:43:28 For the best Dance, Hip-Hop and R&B, this is Kiss
15:43:45 Kiss 100 - It's 3:43 pm
16:06:11 Now Playing: Beauty And A Beat by Justin Bieber / Nicki Minaj
16:09:25 Now Playing: Don't You Worry by Swedish House Mafia
16:12:56 Monday afternoon and this is Kiss 100
16:13:16 You're listening to Kiss 100
16:22:31 Now Playing: Troublemaker by Olly Murs / Flo Rida
16:25:12 Kiss 100 - It's 4:25 pm
16:27:31 Now Playing: Starships by Nicki Minaj
16:29:55 Kiss 100 - for the best Dance, Hip-Hop and R&B
16:30:13 Monday afternoon and this is Kiss 100

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GPS log

The iLog software includes GPS decoding to the NMEA global standard. It will automatically scan the PC for any connected GPS NMEA compliant devices. Google Earth .kml files are generated for GPS tagged field measurement. The TS9095AG and TS9095G units are supplied with their own USB GPS receiver module.

The GPS software decodes the following standard NMEA messages:

- GPGSV
- GPGGA
- GPGSA
- GPRMC

These will provide latitude, longitude and altitude along with comprehensive satellite information:

The bar graph displays the active satellites with their relative signal strengths.

ID: Unique satellite ID
Ev: Satellite elevation in degrees
Azi: Satellite azimuth in degrees
SN: Signal noise ratio in dBHz

The scrolling data displays all the GPS groups transmitted by the GPS antenna/decoder

Fix Mode: 2D or 3D

Altitude: This displays altitude of the GPS antenna.

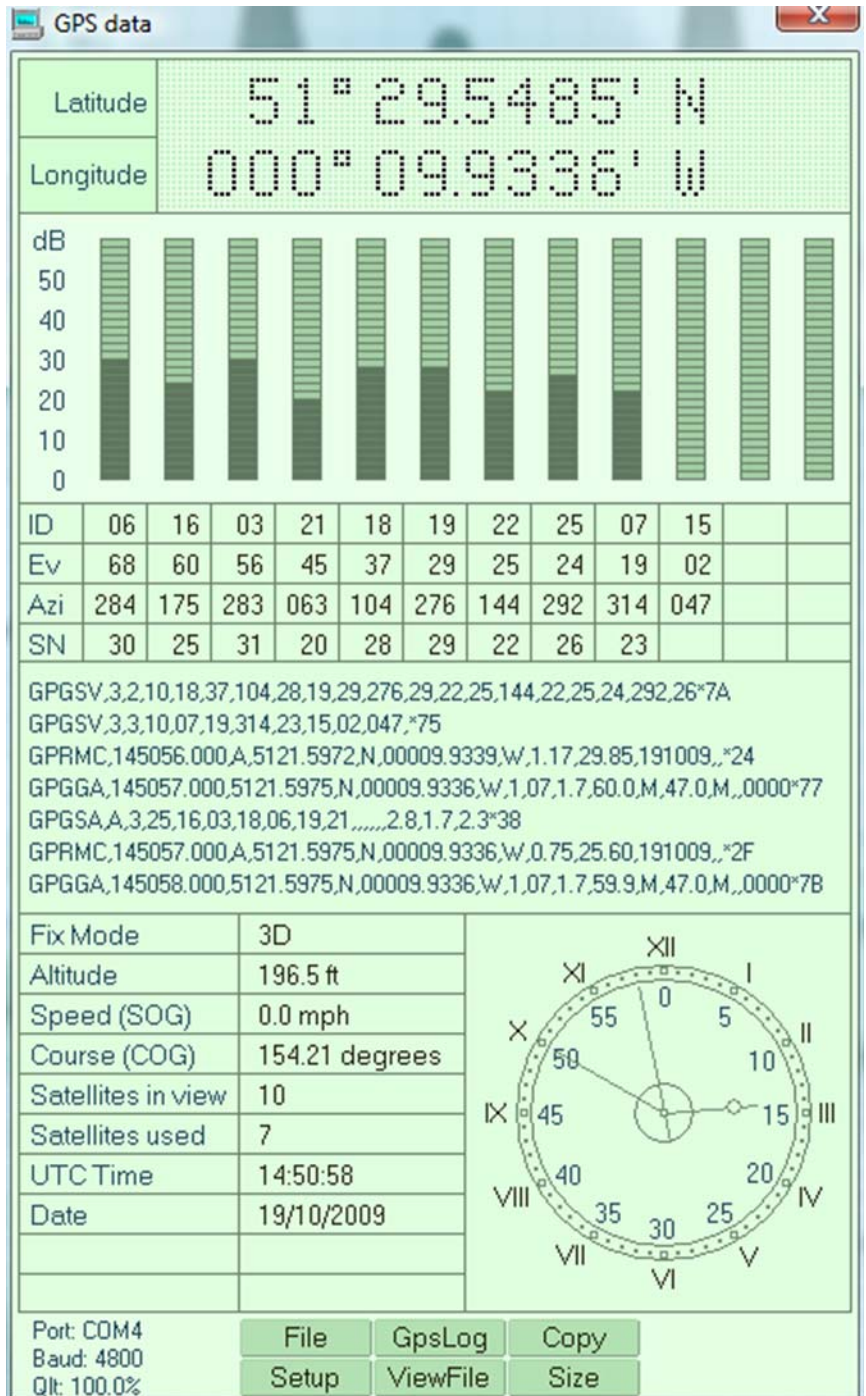Speed: Gives speed over ground

Course: Course over ground

Satellites in view: Number of satellites being received

Satellites used: Number of satellites actually being used for calculating position

UTC Time: Universal time code. This is not local time

Date: The current date

GPS data

Latitude 51° 29.5485' N
Longitude 000° 09.9336' W

ID	06	16	03	21	18	19	22	25	07	15		
Ev	68	60	56	45	37	29	25	24	19	02		
Azi	284	175	283	063	104	276	144	292	314	047		
SN	30	25	31	20	28	29	22	26	23			

GPGSV,3,2,10,18,37,104,28,19,29,276,29,22,25,144,22,25,24,292,26*7A
GPGSV,3,3,10,07,19,314,23,15,02,047,*75
GPRMC,145056.000,A,5121.5972,N,00009.9339,W,1.17,29.85,191009,,*24
GPGGA,145057.000,5121.5975,N,00009.9336,W,1,07,1.7,60.0,M,47.0,M,,0000*77
GPGSA,A,3,25,16,03,18,06,19,21,,,,,,2.8,1.7,2.3*38
GPRMC,145057.000,A,5121.5975,N,00009.9336,W,0.75,25.60,191009,,*2F
GPGGA,145058.000,5121.5975,N,00009.9336,W,1,07,1.7,59.9,M,47.0,M,,0000*7B

Fix Mode	3D
Altitude	196.5 ft
Speed (SOG)	0.0 mph
Course (COG)	154.21 degrees
Satellites in view	10
Satellites used	7
UTC Time	14:50:58
Date	19/10/2009

Port: COM4
Baud: 4800
Qlt: 100.0%

File | GpsLog | Copy
Setup | ViewFile | Size

GPS Google Earth

The iLog software will generate standard Google Earth mapping .kml files. These will contain signal strength measurement at each sample point, say every 100 metres, and can be tagged with channel frequency, PS name and PI code.

These files can be displayed at any time during the logging process, or they can automatically displayed at each sample point. This gives a real-time update of signal parameters, whilst logging a particular geographic area.

With it's auto incrementing file name feature, a large area can be mapped with ease, with all results saved to hard disk.

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GPS Google Earth Mapping

The iLog GPS mapping software, records FM measurements to a standard ACII text file. These files can then be converted to Google Earth compatible .kml files. Various user options can be selected in how to display the recorded data on the Google map.
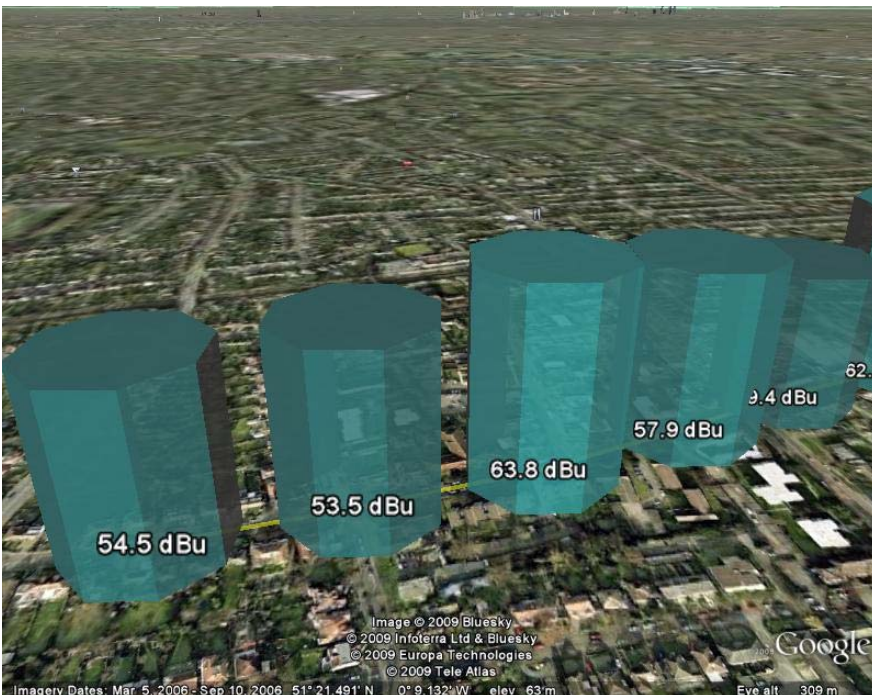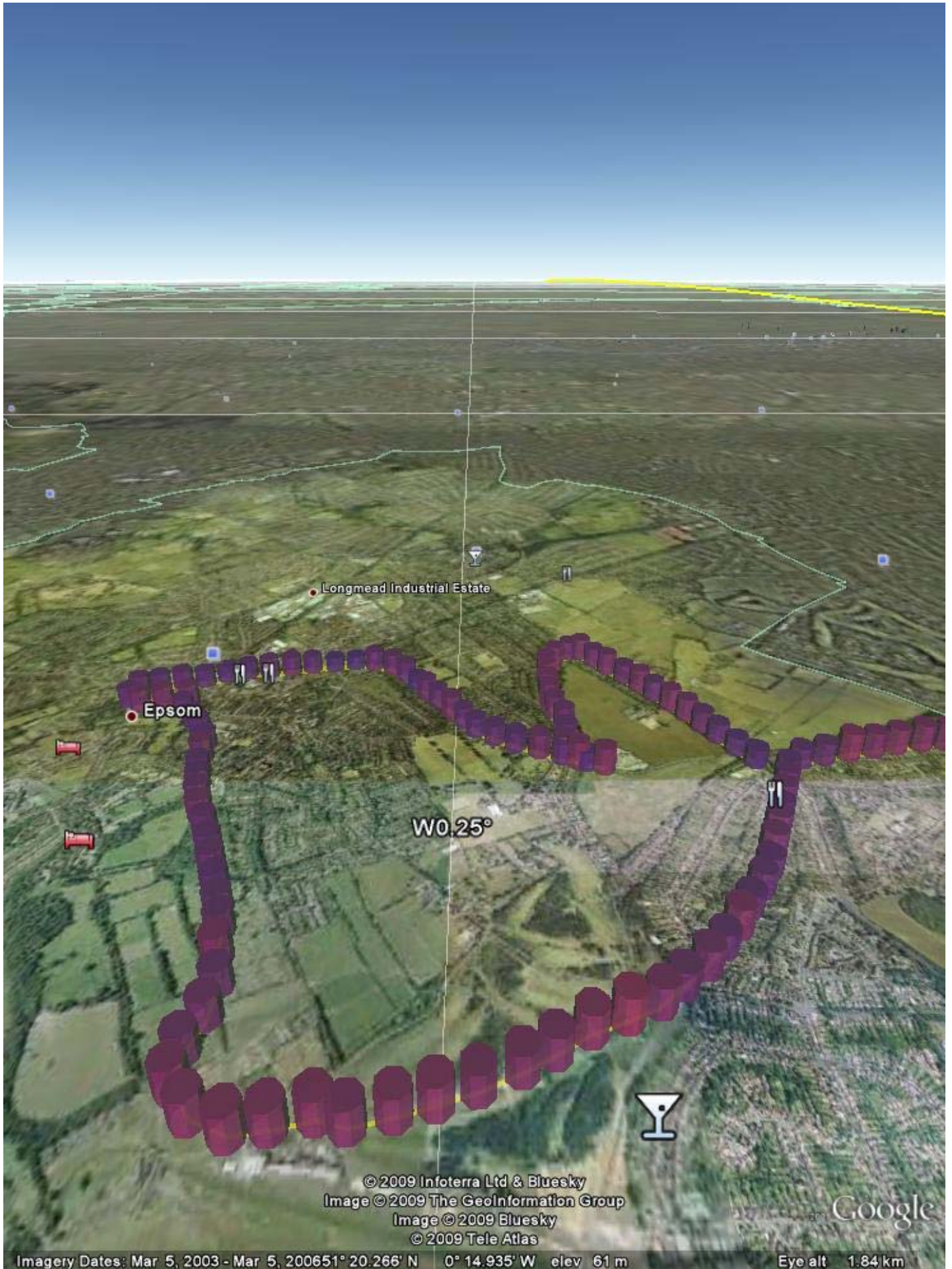

GPS receiver

The TS9095G units are supplied with their own SiRFstarIII USB GPS magnetic receivers.

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iLog Remote Control

We had many requests to control our earlier analysers, the TS9000, TS9050, TS9085 etc, with remote software. This had been possible in the past by providing the USB software protocol for the hardware. However, as the control commands grew, the complexity of the returned data posed considerable problems for would-be software developers. To solve this, a new and extremely simple shared text file system was introduced into the iLog software. This has now been extended to the TS9095 analyser.

Basic operation:

1. When the iLog application is running it automatically generates a simple text file called iLog.txt

2. An application can now control the TS9095 by writing a single line of text to this file.

3. The iLog application automatically reads this line of text every 1 to 100ms, executes its commands and returns an acknowledge by overwriting this control text with an 'action complete code'.

4. If the application has requested data, the iLog application will write this data back as a single line of text.
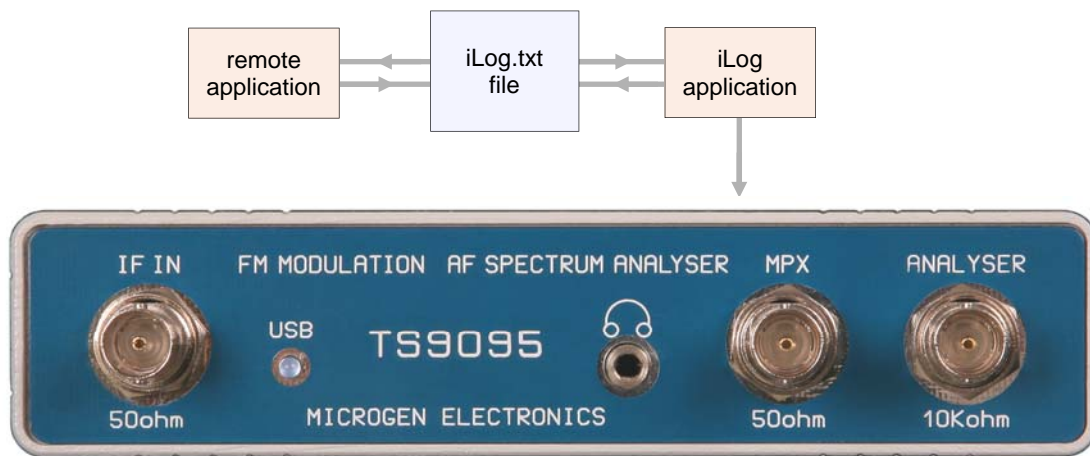
To control the TS9095:

Tx=Control code, frequency, attenuator, volume, screen size, clear histogram, clear modulation power
Control code: 2
Frequency: frequency x100
Attenuator: 0=0dB   1=-10dB   2=-20dB   3=-30dB
Volume: 0 to 63
Screen size: 0: normal large screen   1: collapsed small window
Clear histogram: 0: clear histogram data   1: normal operation
Clear modulation power: 0: clear modulation power data   1: normal operation

Example:
Tx=2,9580,2,40,1,0,0
This will set frequency to 95.8MHz, attenuator -20dB, volume 40, small screen, and clears histogram and power

To receive data from the TS9095:

Tx=3 This will request to receive information, in the format:

Info: frequency, PS, PI, signal strength, pilot level, rds carrier, multipath level, average modulation power, time, date,TA

Example:
Info: 95.80 MHz,CAPITAL,C586,72.6 dBu,6.45 kHz,2.47 kHz,1.2 dBu,3.86 dBr,20:33:54,Tue 17th Mar 2009,0

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TS9095 I/O connects and control

* BNC multiplex signal unbalanced output.

* BNC analyser input, for external multiplex signal or any AF signal for evaluation with the internal Spectrum Analyser.

* BNC External IF 50 ohm 10.7MHz input

* 3.5mm jack for AF stereo headphone monitoring.

* USB power blue LED

* BNC 50 ohm unbalanced antenna input.

* BNC alarm output. This will sink 10mA.

* BNC IF 10.7MHz filter out

* 3.5mm stereo jack balanced output for left and right   channels. These outputs are designed to be very low impedance, for driving balanced line or loudspeakers.

* USB connector. This is compatible with USB1.1 and USB2 standards. The unit is powered from this. All control and data signals are fed to and from this connector.

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TS9095 TECHNICAL SPECIFICATION

System Measurements:	
Deviation:	+100kHz to -100kHz
Modulation Power:	-8dBr to +12dBr (0dBr ref 19kHz)
Pilot 19KHZ:	dB or %
RDS carrier 57KHz:	dB or %
Signal Strength:	85dBu full scale range
Multipath:	10dBu full scale range
Stereo:	0 to 100% modulation

Multiplex signal:	
Bandwidth: Wideband	0.1Hz to 80kHz < 0.4dB
	0.1Hz to 100KHz < 1.0dB
Narrowband	0.1Hz to 80kHz < 1.0dB
	0.1Hz to 100KHz < 2.5dB
Ultra-Narrowband (TS9095A)	0.1Hz to 80kHz < 6.0dB
	0.1Hz to 100KHz < 12.0dB
IF filter bandwidth	WB: 320kHz NB: 180kHz UNB: 100kHz
Deviation accuracy:	0 to 75kHz < +/-0.5% (1kHz test sinusoid)
Sub-carrier accuracy:	WB: +/-2.0% NB: +/-3.5% UNB: +/-3.5%

System parameters	Min	Typical	Max	Units
RF Bandwidth	87.5	-	107.95	MHz
Input impedance		50		ohms
Image rejection		85		dB
Sensitivity		2.8		uV
RSSI resolution		0.1		dB
RSSI accuracy			+/-2.0	dB
Multipath resolution		0.1		dB
Pilot 19KHz range	18.95		19.05	kHz
RDS 57kHz range	55.5		58.5	kHz
THD Wideband Narrowband Ultra-narrowband		0.035 0.150 0.450		% @ 1kHz
Stereo cross-talk		42		dB
AGC TS9095A		12 8		Bits

Signal connections: TS9085
Front connections:
BNC 50 ohm IF input at 10.7MHz
BNC MPX multiplex. Output 50ohms 0dBm at 75KHz
Jack 3.5mm Stereo monitor for headphone listening
BNC Analyser input ~10Kohms 0dBm (FM multiplex or audio spectrum analyser)
Rear connections:
BNC 50 ohm Alarm 10mA output
BNC 50 ohm IF filter output 300mV RMS at 10.7Mhz with 80dBu antenna signal
BNC Antenna input 50ohms
USB 1.1 and 2 compatible (Not suitable for non-powered hubs)
Jack 3.5mm Left channel balanced output
Jack 3.5mm Right channel balanced output

Spectrum Analyser:	
Resolution	16 bits
Points	2,000 to 16,000
Input impedance	9.0k, 12.0k ,14.4k
Input attenuator	0dB,-6dB,-12dB
Dynamic range:	>100dB
Dynamic range averaged:	>110dB
Bandwidth	100kHz
Resolution:	20Hz

Screen resolutions:	
XGA	1024 x 768
WXGA	1280 x 800
SXGA	1280 x 1024
WXGA+	1440 x 900
SXGA+	1400 x 1050
UXGA	1600 x 1200
WSXGA	1680 x 1050
WUXGA	1920 x 1200

System requirements:
TS9095 iLog software runs under Windows XP, Vista, Windows 7 and Windows 8.
Minimum usable system: Windows XP running on a 1.5 GHz Celeron.
Recommended system: Windows 7 running on 2+ GHz Pentium/Athlon.
Requires a minimum of 64MBytes of RAM.
Temperature: Operating: 5degC to 40degC   Storage: -10degC to 50degC

Dimensions: TS9095
295mm x 147mm x 36.5mm
Weight 1.1 Kgm

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SiRFstarlll GPS receiver USB specification

Electrical characteristics	
GPS chipset	SiRFstarlll e/LP
Frequency	L1, 1575.42MHz
C/A Code	1.023 MHz chip rate
Channels	20 all-in-view tracking
Sensitivity	-159dBm
Accuracy	
Position horizontal	5m WAAS enabled (2D RMS) 10m WAAS disabled (2D RMS)
Velocity	0.1/sec 95% (SA off)
Time	1us synchronised to GPS time
WAAS	Enabled for North America Products
DATUM	
Datum	WGS_84
Acquisition rate	
Hot start	1 sec. Average (with ephemeris and almanac valid)
Warm start	38 sec. Average (with ephemeris but not almanac valid)
Reacquisition	0.1 sec. Average (interruption recovery time)
Protocol	
Default protocol	NMEA 0183 V2.2 Secondary: SirF Binary >>position, velocity, altitude, status and control
GPS output data	Supports commands: GGA,GSA,GSV,RMC,VTG,GLL
GPS transfer rate	Default: 4800,n,8,1 for NMEA compliance
Temperature	
Operating	-40 to 85 deg.C
Storage	-40 to 85 deg.C
Humidity	Up to 95% non-condensing
Dynamic condition	
Acceleration limit	< 4g
Altitude limit	18,000 meters max.
Velocity limit	515 meters/sec (1,000 knots) max
Jerk limit	20 m/sec
Low noise amplifier	
LNA amplifier gain	27 dB typical
Filtering	-25dB (>100MHz)
Output VSWR	2.0 max.
Power	
Voltage	4.5 to 5.5 volts DC
Current	80mA typical
Physical characteristics	
Dimensions	53 mm dia. x 19.2 mm
USB cable length	1.52 meter

GPS LED status	
Steady ON	No GPS fix with satellite signals
Flashing	GPS position if fixed (Signal received)

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