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A STUDY

FOR

OCEAN SOUND LIMITED WHITTLE AVENUE SEGENSWORTH WEST FAREHAM HAMPSHIRE PO15 5PA

Date: 13th January 1989

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TERMS OF REFERENCE

Surrey Electronics Limited was asked to make field strength measurements of the medium frequency (MF) services of Ocean Sound and County Sound in the more populated areas of Haslemere, Hindhead, Farnham and Alton.

We were also asked to measure the BBC national services available on the MF band as well as BBC Radio Solent and BBC Radio Sussex.

In each area we were requested to make a subjective assessment of reception quality of the Ocean Sound and County Sound services and note any other services greater in strength than Ocean Sound.

MF SERVICES FOR INDEPENDENT LOCAL RADIO

The MF (also known as medium wave) transmitters used by Ocean ound Sound and County Sound were provided by the Independent Broadcasting Authority and described as giving a 'back-up' service to the VHF stereo signal.

The IBA state that the daytime coverage achieved by MF transmitters is designed to match as closely as practicable the coverage contour of the VHF service, but no guarantee of MF coverage is provided and the IBA warn of the considerably reduced coverage during the hours of darkness.

In choosing station characteristics there is a duty for the IBA to have regard to international agreements on frequency planning, while also considering the effect new installations will have on stations already operating within the Unitied Kingdom.

Transmitter locations, frequencies and operating powers are submitted by the IBA to the Department of Trade and Industry for their approval and licencing. Any subsequent alteration in station characteristics would require DTI approval.

TRANSMITTER INSTALLATIONS

Ocean Sound has two MF transmitters. The main one of interest here has operated on 1170kHz from Farlington Marshes, Portsmouth, at National Grid Reference SU680 052 since 14th October 1975 (previously being Radio Victory).

The antenna consists of a 12 section insulated stayed lattice mast. No top loading is installed and the effective monopole radiated power (EMRP) is 120 watts omnidirectional.

The site is bounded by a railway line running within one wavelength and to the north.

Ocean Sound has a second site to serve the western part of their coastal franchise area at Veal's Farm, Marchwood, Southampton; NGR SU397 095.

This service commenced on 12th October 1986 and has an omnidirectional EMRP of 500 watts on 1557kHz.

County Sound has one MF transmitter on 1476kHz near Peasmarsh. The site, at Artington between Guildford and Godalming, has been operational since 4th April 1983 and the NGR is SU984 459.

The antenna is a 15 section insulated stayed lattice mast and 4 top loading wires are fitted which extend nearly half way down towards the staying points. The installation has a substantially omnidirectional EMRP of 500 watts.

The site was originally engineered with a view to future shared transmissions for the BBC on 1260kHz (BBC Radio Surrey) and is bounded within one wavelength on its west side by a railway line.

All antenna installations are provided with extensive earth mats consisting of buried wires of copper or aluminium and are likely to maintain their designed EMRP figures through all the seasons.

It is not thought that the presence of railway lines is likely to distort significantly the radiation patterns from these installations.

DISTANCES AND POPULATION

The distances in kilometres from the various transmitter sites to the places under study are listed along with the approximate population.

	HASLEMERE	HINDHEAD	FARNHAM	ALTON
Population	15,000	4,000	34,000	13,000
County Sound Peasmarsh 1476kHz	15.5	13.7	14.0	25,2
Ocean Sound Farlington Marsh 1170kHz	34.07	36.7	<u>4</u> 4.•0	35.0
Ocean Sound Veal's Farm 1557kHz	54•5	54•7	57.0	44.7

INTERFERING SIGNALS FROM THE UNIT ED KINGDOM

1476kHz	Co-channel:	NIL				
	Adjacent channel	: 1	467kHz: 485kHz:	NIL BBC Radio Su Southwick ne	assex, ear Shoreham	
1170kHz	Co-channel:	Radio (Swansea Signal Radio I	Drwell, Foxhal a Sound, Winsh Radio, Sidewa lees, Stocktor	ll Heath, Ip: n-wen: 580 wa ay, Stoke-on- n, Teeside: 3	wich: 280 wa atts -Trent: 200 w 320 watts	tts atts

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Adjacent channel:

1161kHz:

1179kHz:

BBC Radio Sussex, Bexhill NIL

Only the predominant adjacent channel signal is listed.

PROPAGATION OF RADIO SIGNALS AT MEDIUM FREQUENCIES

Signals leaving a transmitting aerial reduce in strength as the distance covered increases. Apart from the inverse square law reduction (one quarter the power for every doubling of distance) signals at MF suffer additional attenuation due to the earth's surface not being an ideally conductive medium.

The signal currents thus flow partly beneath the surface of the earth and suffer losses in the sub-soil or rock. In the situations of concern here the depth of penetration of significant current density is about 14 metres below the surface of the earth.

Topography also has an effect on signal propagation at MF and any topographical features which are significant compared to the wavelength of the radio signal will cast shadows and reduce the field strength.

The wavelengths corresponding to the Ocean Sound and County Sound transmitters are as follows:

1170kHz	 256.4	metres	
1476kHz	 203.25	metres	
1557kHz	 192.7	metres	

THE SIGNAL PATHS

The whole of the Peasmarsh to Haslemere or Hindhead path, and the great majority of the paths to Alton and Farnham traverse Lower Greensand and Specton Series: variable course sand and clay, with ironstone.

For the Farlington Marsh to Haslemere or Hindhead path there are several significant topographical features and the path traverses the following geological areas:

Starting from Farlington Marsh -

Approximately 6km of Oligocene and Eocene: sand and clay, loam, limestone bands, shell beds and pebbles

> 14km of Chalk: friable limestone with soft and hard beds, flint and marl

4km of Upper Greensand and Gault: stiff bluegrey clay partly overlain by finegrained green sand or sandstone

- 5km of Lower Greensand and Speeton Series
- 5km of Wealden: alternations of clay and fine grained sandstone
- 1km of Lower Greensand and Speeton Series

The paths from Farlington Marsh to Farnham and Alton are similar but miss the Wealden belt.

The attenuation rate experienced by signals from the Farlington Marsh site and travelling north can be expected to be significantly greater than that experienced by signals from Peasmarsh travelling west or south-west.

The effective conductivity over frequencies in the MF band for the paths concerned varies between the limits of 2 and 10 milli-Siemens/metre.

SERVICE PLANNING STANDARDS

In service planning the accepted criterion for the field strength at the limit of service in suburban areas is 2-3mV/m, equivalent to $+66/70dB\mu V/m$ (IBA Technical Review No. 5, September 1974, page 52).

Many receivers will provide good entertainment quality signals at field strengths down to 1mV/m, equivalent to +60dBµV/m.

MEASUREMENT METHOD

Apparatus was installed in a measuring vehicle having its own mains power source. A Surrey Electronics Advanced Active Aerial was mounted vertically above the roof and provided a replica of the electric field parallel to the aerial rod over a frequency range between 8kHz and 30MHz within 1dB.

All the transmitters concerned radiate vertically polarised waves and this system is the same as that provided for the Department of Trade and Industry and other organisations for the measurement of field strengths.

Two independent measuring systems were used. A Marconi Instruments. TF2370 Spectrum Analyser allowed photographs of the spectrum to be taken.

For greater accuracy a Marconi Instruments TF2018 signal generator with -0.2dB level stability was used as a substitution source for the signal coming from the Active Aerial. These sources were fed via switchable attenuators to a Surrey Electronics Broadcast and Communications Receiver 2, which also allowed subjective quality assessment.

Measurement sites were chosen as far as was practicable, within the requirements of vehicle safety and remaining on public land, to avoid overhead cables and conductive vertical monopole structures, such as street lamps, which disturb the local fields.

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Obviously, no account could be taken of buried cables and pipes and they are also liable to produce errors at particular locations.

Measurements were made during the middle part of the daylight hours, well away from the dawn and dusk periods when great changes in MF propagation occur.

At each location notes were mede of all stations broadcasting predominantly in English which were equal to or stronger than Ocean Sound 1170kHz.

ACCURACY AND ERRORS

For locations 1-4 the field strengths were determined to the nearest 0.5dB and to the nearest 1dB at other locations.

Where a signal was experiencing fading the peak strength was used for the synchronous national networks, while, for instances where co-channel fading was caused by a different programme, the average strength was noted.

The spectrum analyser was used with a display of 100 kHz/division horizontally, 1100 kHz centre screen, and 10 dB/major division vertically with $+70 \text{dB} \mu \text{V/m}$ as the centre graticule.

When using a wide sweep for the photographs the bandwidth has to be 500Hz to complete a sweep in a reasonable time so low frequency modulation components can cause variations in displayed level from sweep to sweep. Two peak accumulated sweeps were used to minimise this effect but the photographs need a -3dB tolerance applying if they are to be used for assesing amplitudes.

The system is capable of measuring down to at least $OdB\mu V/m$ so inherent system noise has no effect on the accuracy or repeatability of measurements. The system gain chosen for the spectrum analyser photographs allowed the same setting for all locations as well as giving a good visual impression of band occupancy.

RESULTS

Measurements were made on 11th and 12th January between 1000 and 1400 hours UTC. Before commencing measurements it was established, by reference to observations dating back several years at Cranleigh, that the transmitters on 1170, 1476 and 1557 kHz were operating at their normal power levels.

At no locations was Ocean Sound found to be stronger than County Sound.

In Hindhead, Haslemere and North Bordon the Ocean Sound 1170kHz suffered from co-channel beats at a rate varying between 0.5 and 2 per second as the crystal oven in one of the transmitters was temperature cycling. The addition of adjacent channel interference from BBC Radio Sussex 1161kHz ensures that the signal is not commercially viable.

In Farnham, Ocean Sound 1170kHz was consistently substantially weaker than County Sound and the adjacent channel level from BBC Radio Sussex 1161kHz between 1 and 8dB below 1170kHz results in constant audible (monkey chatter'.

In Alton the adjacent channel protection ratio has improved to between 6 and 11dB, which still results in some 'monkey chatter', and the signal remains weaker than County Sound 1476kHz which also enjoys better adjacent channel protection between 13 and 24dB.

All the survey locations were in regions bordering the limit of service of County Sound 1476kHz. At no time was any perturbation noted during reception, with co-channel and adjacent channel protection ratios exceeding the planning requirements (IBA Technical Review No. 7, July 1976, page 14).

The Ocean Sound 1557kHz service was found to increase in strength in Alton but not at any location to become comparable with the 1170kHz outlet.

At all locations, apart from Alton, there were a considerable number of other services audible at greater strengths than the Ocean Sound 1170kHz signal.

Separately, at the Cranleigh fixed location, narrowband accumulated sweeps were made of the 1170 and 1476kHz signals. Both showed adequate and effective modulation sidebands with similar high frequency roll-off filtering of -10dB at -6kHz from the carrier frequencies.

[10	Frequency	1 Haslemere Gateway Car Park SU903 330	2 Haslemere Haste Hill SU914 317	3 Haslemere West SU893 329	4 Hindhead Tilford Road SU886 359	5 Hindhead Tower Road SU885 356	6 Hindhead St. Alban's Ch. SU880 368
	648 BBC World Service	59	59	62	57	58	60
	909 BBC Radio 2	73.5	76.5	73•5	73	76	75
	999 BBC Radio Solent	51	57•5	59•5	57	55	57
	1089 BBC Radio 1	69	70.5	62.5	63	63	63
	1161 BBC Radio Sussex	51	45	49.5	45	44	43
	1170 Ocean Sound	48.5	49•5	52.5	48.5	50	46
	1215 BBC Radio 3	62	64	65	64	63	63
	1458 BBC GLR	60.5	60.5	58.5	57	59	57
	1476 County Sound	60.5	65.5	64.5	62	64	66
	1485 BBC Radio Sussex	50	49.5	50	47	47	49
	1548 Capital Radio Gold	58	56	54	53•5	55	56 go 193 1911 - 1917 - 211
	1557 Ocean Sound	40	40	46	39•5	44	39

558 Radio Caroline	X	(52)	OFF AIR	X	X	X	Х
630 BBC R. Bedfordshire	X	(48.5)	0	0	X	0	X
693 BBC Radio 2	X	(73)	X	X	X	X	X
720 BBC Radio 4	X	(53)	X	0	X	X	X
882 BBC Radio Wales	X	(51)	X	X	X	X	Х
1053 BBC Radio 1	X	(62)	Х	X	X	X	X
1152 LBC Radio	X	(55)	X	X	X	X	X
1323 Southern Sound	X	(50)	X	0	X	0	X
1368 BBC Radio Sussex	X	(54)	X	X	0	0	0
1430 210 Thames Valley	0		0	0	0	0	0
1521 Radio Mercury	X	(54)	X	X	Х	X	X

Stronger or equal to 1170 marked X

[12	Frequency	7 1km from Peasmarsh SU975 462	8 North Bordon Sleaford SU319 388	9 Farnham Hungry Hill SU828 493	10 Farnham Waverley Estate SU843 463	11 Farnham Wrecclesham Rd. SU827 447	12 Alton Anstey SU725 402
	648 BBC World Service	2,	59	61	59	58	60
	909 BBC Radio 2		77	83	81	80	79
	999 BBC Radio Solent	*	56	63	58	61	67
	1089 BBC Radio 1		71	81	72	73	73
	1161 BBC Radio Sussex		47	47	40	46	49
	1170 Ocean Sound		49	54	48	47	55
	1215 BBC Radio 3		67	71	70	63	74
	1458 BBC GLR		59	61	62	63	66
	1476 County Sound	106.5	61	74	68	63	64
	1485 BBC Radio Sussex		44	50	42	46	40 0
	1548 Capital Radio Gold	62.5	59	60	60	58	57
	1557 Ocean Sound		37	49	46	46	47

558 Radio Caroline	X	0	0	0	0
630 BBC R. Bedfordshire	X	X	Х	X	0
693 BBC Radio 2	X	X	X	Х	X
720 BBC Radio 4	0	X	X	X	Х
882 BBC Radio Wales	X	X	X	X	Х
1053 BBC Radio 1	X	X	X	X	X
1152 LBC Radio	X	X	X	X	X
1323 Southern Sound	0	0	0	X	0
1368 BBC Radio Sussex	0	0	0	0	0
1430 210 Thames Valley	X	X	X	X	0
1521 Radio Mercury	0	0	X	0	0

Stronger or equal to 1170 marked X

- 4	Frequency	13 Alton North SU714 405	14 Alton Weydale Rise SU319 388 approximate: new e	estate not on latest OS map.
	648 BBC World Service	55	61	
	909 BBC Radio 2	77	82	
	999 BBC Radio Solent	68	53	
	1089 BBC Radio 1	74	75	
	1161 BBC Radio Sussex	47	50	
	1170 Ocean Sound	58	60	
	1215 BBC Radio 3	68	74-	
	1458 BBC GLR	61	64.	
	1476 County Sound	61	61	
	1485 BBC Radio Sussex	49	48	
	1548 Capital Radio Gold	56	61	
	1557 Ocean Sound	52	52	All measurements in $dB\mu V/m$

558 Radio Caroline	0			0			
630 BBC R. Bedfordshire	0 ? 0			0			
693 BBC Radio 2	X			X			
720 BBC Radio 4	0			0			
882 BBC Radio Wales	0			0			
1053 BBC Radio 1	X			X			
1152 LBC Radio	X			X			
1323 Southern Sound	0			0			
1368 BBC Radio Sussex	0			0			
1430 210 Thames Valley	0			0			
1521 Radio Mercury	0			0			
	Stronger	or	equal	to	1170	marked	Х



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