

The Frequency Test from 2YA

Comprehensive Discussion on Note Losses and Amplifications

[By "Megohm."]



THE frequency test conducted by Mr. Bellingham from 2YA on July 24 was a matter of considerable importance to radio listeners. It gave the owners of good receivers an opportunity of getting a fairly exact indication of the desirable qualities incorporated within them, and it afforded all and sundry a useful gauge of the small or great shortcomings of their receivers, whether factory ready-made or home-built. Mr. Bellingham set a high standard, which is good, because an ideal to be aimed at should always be high, and from this moment, experimenters and constructors should aim at reproducing as evenly as possible, all frequencies between 10,000 and 22. Generally speaking, this is no easy matter, and in many cases will involve a considerable amount of experiment. But the knowledge gained will be great, and the improved tone and clarity of reproduction will well repay the trouble, and although it may be found impossible to actually reach the range mentioned, any improvement made to increase range in either an upward or downward direction will be rewarded by an improvement in quality, provided that accompanying essential factors have also been attended to.

The Ideal Range.

THE ideal frequency range would be from 10,000 to 16 cycles, but it must be said that this near approach to perfection is not entirely necessary, and for practical purposes a fairly even reproduction from the loudspeaker of 30 to 7000 cycles is very high quality, and is still very good if all frequencies between 80 and 4000 are delivered. This latter is the minimum range in-

dedicated on the recording chart. But, as was pointed out in the lecture, with a maximum frequency of only 4000, the reproduction of certain musical instruments will be found to lack the characteristic quality in a greater or less degree, on account of the fact that some of these sounds contain high harmonics with frequencies varying from an octave above the fundamental to as high as 30,000, the complete sound being composed of the fundamental intermixed with several harmonics or higher notes at varying frequencies. The human ear reaches its limit of audibility at 30,000 or somewhat below that figure, and many of the higher audible frequencies will be so weak, comparatively, that they may well be omitted from musical sounds without their absence being readily detected. It is when the cutting out of harmonics or overtones is carried downwards, approaching too near the fundamental, that the stronger harmonics are lost, quality suffers noticeably, and reproduction ceases to approximate faithfulness.

Even Amplification.

SIDE-by-side with a suitable range of reproduction, the ideal is an even amplification of every note from the highest to the lowest, so that all have the same volume as sounded at the studio. This is perhaps the most difficult condition to fulfil, and only an approximation to it will be expected. All audio amplification systems have in a greater or less degree the fault of reproducing easily the middle frequencies, and falling off badly in their handling of the higher and lower frequencies, as to both amplification and

purity. To extend our range of reproduction in either direction it is necessary not only to secure greater amplification, but to obtain it free from distortion. In some types of audio amplifiers it will be found easy to extend the range in one direction by losing range at the other extreme, but extension in both directions is desired.

Generally speaking, reproduction of higher notes is a simpler matter than of the lower sounds, and the average receiver easily handles the middle and higher, but not the highest frequencies, whilst making a more or less hopeless attempt to deal with the deeper sounds. If the loss of high notes begins too low in the scale, the clarity of speech is affected, and to reproduce the S and Z perfectly a receiver must reach 6400 cycles. At 5000 speech begins to suffer very noticeably, though it may not actually lose much in intelligibility.

Yet although the average receiver will handle high notes of normal volume fairly well, any increase in the volume of, say, a singer's voice, will produce more or less obvious distortion or "blasting." Likely enough, this trouble is caused by the overloading of the detector, for it is in the radio-frequency and detector stages that high notes are inclined to suffer most, and low notes meet trouble chiefly in the audio system.

Megohm's Receiver.

THE writer's receiver acquitted itself in the test just about as was expected. This receiver gives good quality reproduction of music, including all bass notes, and also brings out with good volume the high-pitched instruments, such as flute, piccolo, cornet, and violin. In its present form the set is a three-valve Browning-Drake tuner, followed by a two-stage amplifier, the first stage of dual impedance as described on April 6, with a specially-designed plate impedance, with an inductance of 250 henries, obtained by employing an inch-square core of stalloy. This, coupled to a PM 3A as detector, gives high amplification of low notes, without unduly losing the higher ones, as evenness of amplification is a characteristic of impedance coupling. The first audio valve is a PM4, followed by a Ferranti AF.3 transformer and a PM 256 super-power valve and choke-condenser output filter. An addition has been contemplated for some time to increase amplification of high notes, but more pressing matters continually assist its postponement. Two speakers are employed, a Brandes Ellipticon to ensure full justice being done to the lowest notes as well as the remainder of the scale, and to add brilliance to the whole, a small horn speaker is connected in parallel. This horn is not capable of properly reproducing the lower notes, and is not required to do so, therefore a fixed condenser of about .01 capacity has been placed within the base in series with one of the leads. By experiment the value of this condenser is decided so that all notes below about middle C are cut out, though

actually some are only weakened so much as to be negligible. The higher the value of the condenser the lower the frequencies passed.

When actually listening to the test arrangements were made so that the valve receiver could be easily switched on and off, to give an opportunity of testing the range of a crystal also, listening on head-phones. This showed that the crystal—a fixed carborundum—has a range from 26 to 7000 cycles, weakening considerably on the higher notes. The valve set took the whole of the frequencies from 26 to 7000, losing them at the 8000 mark. Some of the lowest frequencies could not be produced by valve oscillations, the method adopted for most of the tones, so a bass viol and piano were used, and this caused the production of overtones as well. In the case of the 26-cycle note, the overtone appeared to be stronger than the fundamental. The low E, 40 cycles, on the drums, reproduced well, giving the true quality of the instrument. At 32 the overtone and fundamental were both heard, but on the crystal the overtone was not noticeable. All these low notes came through with good volume, which shows that the low-note amplification consistently aimed at has been accomplished. From 5000 to 7000 the volume weakened considerably, and work will now be put in to increase amplification on the high notes without, if possible, sacrificing anything on the low.

If low notes are to be heard, they must be amplified much more than high ones, and this the average reproduction system is unable to do, so the low notes remain weak and are lost, or are sufficiently heard to have a blurring effect. A broadcast station can determine how low and how high a note shall be put out. The cut-off may be at 40 and 5000 cycles, or at 30 and 6000, or as predetermined. The lowest musical notes are put out by 2YA, but it always appears to the writer that 3YA has a higher cut-off, and does not put out the lowest frequencies, so that receivers unable to reproduce these low notes do not have them present to distort.

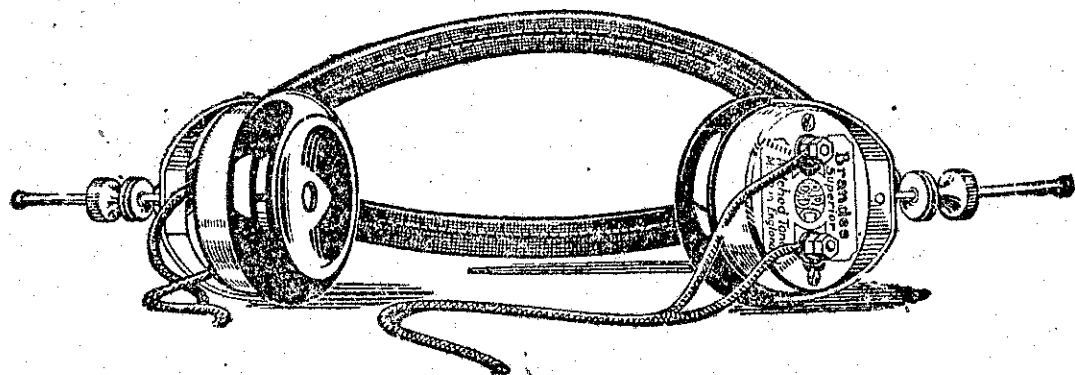
Loss of High Notes.

IN this discussion of radio reproduction, it must be remembered that judgment is passed upon the sounds as reproduced by the loudspeaker, and that faithfulness of reproduction depends not upon one unit or portion of the receivers alone, but upon the whole combination, including the loudspeaker. The loudspeakers used at the 2YA studio, it was mentioned, reproduced every frequency from 26 to 13,000. The speaker in question is the Western Electric balanced-armature cone, a very popular speaker in the United States, though little effort has been made to popularise it in New Zealand.

The majority of radio sets in combination with their loudspeakers are deficient in the frequencies above 3000 cycles, which means that the amplification obtained at these frequencies is not so great as it should be. So much stress has latterly been laid on the reproduction of deep notes that this is

Brandes

The Name to know in Radio



Made in England

Price 15/-

OBTAINABLE FROM ALL RADIO DEALERS or
INTERNATIONAL RADIO Co. Ltd., Ford Bldgs., Wellington