Sensitivity measurement

Sensitivity measurements are done on the version 1.0 of the FM receiver. They are done using a Siglent SDS1202X-E oscilloscope. Wherever possible the 10x probe was used. When the signal was too small, the 1x probe was used.

Sensitivity is the lowest signal at the antenna which can still be detected and decoded into audio.

Sensitivity is calculated by finding the smallest signal at the antenna which produces an audible signal at the output. 'Audible' is somewhat subjective.

The ITU Radiocommunication Assembly mentions "that the sensitivity of a receiver is a measure of its ability to receive weak signals and to produce an output having a usable level and acceptable quality" [1].

This is also fairly subjective.

In the FM receiver under test, I tested the station with the weakest signal which can be received in my neighbourhood. This is at a frequency of 88.0 MHz . It is received with great clarity. There may be weaker signals, but selectivity also plays a role to receive weak signals if they are close to stations with stronger signals.

To test if the signal at which it enters the receiver is the weakest signal the receiver can detect and decode, a 50Ω 20dB resistive attenuator is inserted between the antenna and the receiver. Even with this 20dB attenuator the station is received. Audio quality is not great anymore, but can still be listened to with great ease. Because the definition of sensitivity is fairly weak, I define the signal of the station at 88.0 MHz with the 20dB attenuator as the smallest signal the receiver can detect and decode.

The measurement is taken as part of the characterisation of the IF amplifier. For the station at 88.0 MHz (with attenuator) the signal at the collector of Q315 is at the limiting level 8dBm. The signal level at the antenna entrance is -113dBm. It must be noted that signal levels this low are at the limit of what I can measure with my equipment. The signal nearly disappears in the noise of my oscilloscope.

-113dBm (50Ω) is equal 50µV.

The sensitivity of the FM receiver version 1.0 is 50µV.

---

[1] R-REC-SM.1840-0-200712, in https://www.itu.int/dms_pubrec/itu-r/rec/sm/R-REC-SM.1840-0-200712-I!!PDF-E.pdf

Signal Strength (dBm)

	97.5 MHz	103.4 MHz	95.3 MHz	88.0 MHz	88.0 MHz (att.)	89.6 MHz
ANT	-48	-75	-78	-74	-113	-79
$Q_{201,C}$	-35	-61	-67	-52	-108	-73
$Q_{301,E}$	-50	-76	-78	-68		-80
$Q_{301,C}$	-22	-49	-53	-39	-66	-59
$Q_{303,C}$	-12	-38	-39	-26	-61	-45
$Q_{305,C}$	-3	-33	-31	-19	-61	-38
$Q_{307,C}$	6	-10	-9	2	-57	-17
$Q_{309,C}$	0	-2	-2	1	-51	-8
$Q_{311,C}$	6	7	8	9	-28	8
$Q_{313,C}$	2	2.6	3.2	3.8	-18	3.8
$Q_{315,C}$	7	7.4	9	9	7.6	9

Signal strength (dBm)