EAS LABEL TEST WITH RTS200

Overview

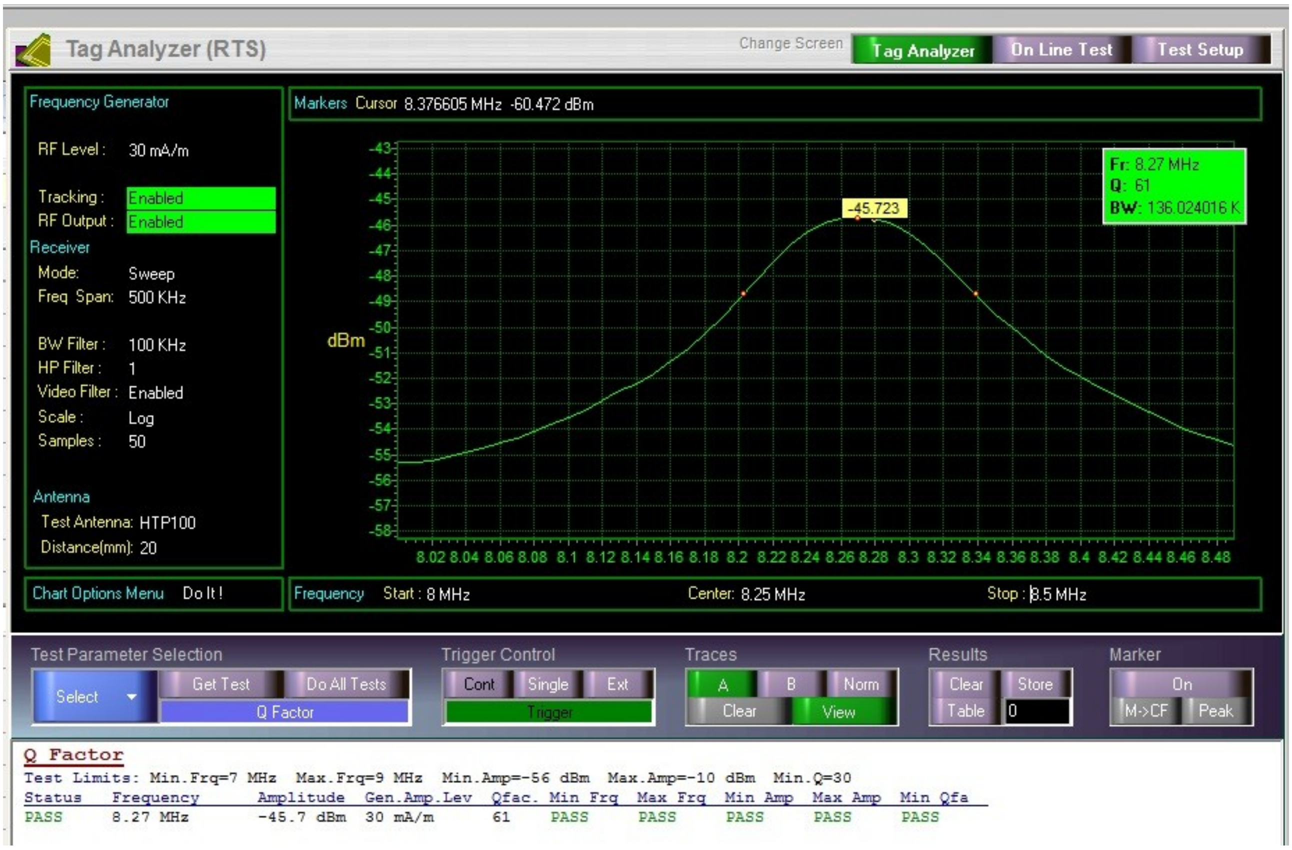
EAS labels and inlays are resonant circuits formed by an inductance (the coil in the inlay), and a capacitor (the plates in both sides of the inlay).

This L-C circuit is designed so that its resonant frequency lies around the normalized frequency of 8.5MHz.

The sensing antennas placed in the shop or supermarket doors, transmit an RF signal, sweeping in frequency around this resonant frequency, so they are able to detect the presence of an EAS tag by sensing the small ammount of energy absorbed by the tag at its resonant frequency.

Parameters to characterize an EAS tag

EAS tags are characterized by their resonant frequency and their Q factor (or the equivalent Bandwidth), and their peak amplitude level.



Resonant frequency

This is the peak frequency in the resonance curve of an EAS tag, that is, the frequency at which the tag is more effective in absorbing energy when it is placed inside the RF field generated by the EAS antennas.

The sensing system is tolerant to variations in resonant frequency. In fact, the resonant frequency of the tag will change when it is attached to the different products, depending on the material of the surface where they are attached. The resonant frequency can also change when it enters the test environment. The test antenna can make the resonant frequency higher if it is placed at less than 1cm of the tag during the test. Or in general any metal near the tag will make the frequency shift.

This shift has to be considered when defining the acceptance limits for the test.

Q factor

The Q factor is a measurement of the width of the resonant curve. The wider the resonant curve, the lower the Q factor. Higher Q factors make the tag better in terms of efficiency, but on the other hand they are more sensitive to the environment, so they get more easily untuned when attached to different materials.

Lower Q factors correspond to less efficient tags, but more consistent when attached to objects. So a compromise has to be found. Q factors between 40 and 60 are common.

Bandwidth

It is a different way of measuring the width of the resonance curve. It corresponds to the difference in frequencies between the two points at which the amplitude of the resonance curve drops by 3dB from the value at the resonance peak.

Resonance peak level

The peak level of the resonance curve. The measurement is always relative to the setup (RF level, distance to the antenna, …). But it is interesting to fix some limits, as tags with very low peak level will not be effective in operation.

EAS Test with the RTS200

The RTS200 with the HF antenna is able to work in the same way as the EAS sensing antennas in a supermarket. In an EAS test, the RTS200 will sweep the TX frequency between two frequencies, and detect in the RX side, the absorption of the signal by the EAS tag when it is placed in front of the antenna.

As a consequence it is possible to characterize the tag in the production line by measuring the relevant parameters, and set acceptance limits for each EAS tag in terms of minimum and maximum resonance frequency, minimum and maximum Q factor and minimum and maximum resonance peak level.

EAS Test setup

The HTP100 antenna will be used for the tests. The trigger will be adjusted as usual, so the test is performed when the tag is in front of the antenna.

It is better if the tag is separated by 0.5cm – 1cm from the antenna, so the tag resonance frequency is closer to the free air value. Anyway it is also possible to make the distance smaller, having into account that the measured resonance frequency will be higher than the free air value.

EAS tags are usually very important to shield the adjacent tags so their effect on the results of the measurement are minimized. The effect of non shielded tags is, in general, non predictable, from a shift in the resonant frequency, to the appearance of a double peak (due to mutual inductance), ...

As the test environment and conditions will have an impact on the results of the test, it is convenient to carry out an initial run, so the obtained results are used as a reference to define the right test parameters, as defined in the next section.

Test Parameters

Test parameters can be manually changed on the Tag Analyser screen. To use them for an online test they have to be changed in the .tst or .tsu files. These files can be changed either with a text editor, or via the setup screen. There are two different parameters, corresponding to TEST CONDITIONS (settings for the RTS200 to make the test), and TEST LIMITS (acceptance limits for the results of the tests).

TEST CONDITIONS

RF Level

The parameter in the test suite (.tsu) file is RF_LEVEL_ELECTRICAL. It has to be selected depending on the tag model and the antenna-tag distance, so the resonance peak level is around -45dBm. (this value is not critical anyway, just a reference, can be higher). 30mA/m is a good value to start.

Samples

This parameter sets the number of samples for the test, that is, the number of frequencies at which a measurement is made. The higher the number of samples, the better the resolution of the measurement, but the process is slower. For laboratory tests, this value can be high, 300 for instance. For production line, it is better to make faster tests, even if the resolution is not so high, so values around 50 are ok.

The parameter in the .tsu file is N_SAMPLES_ELECTRICAL.

Start and Stop frequencies

This parameter sets the minimum and maximum frequencies for the test. The expected resonant frequency should be centered between both values. The parameters in the test suite are START_FREQ and STOP_FREQ.

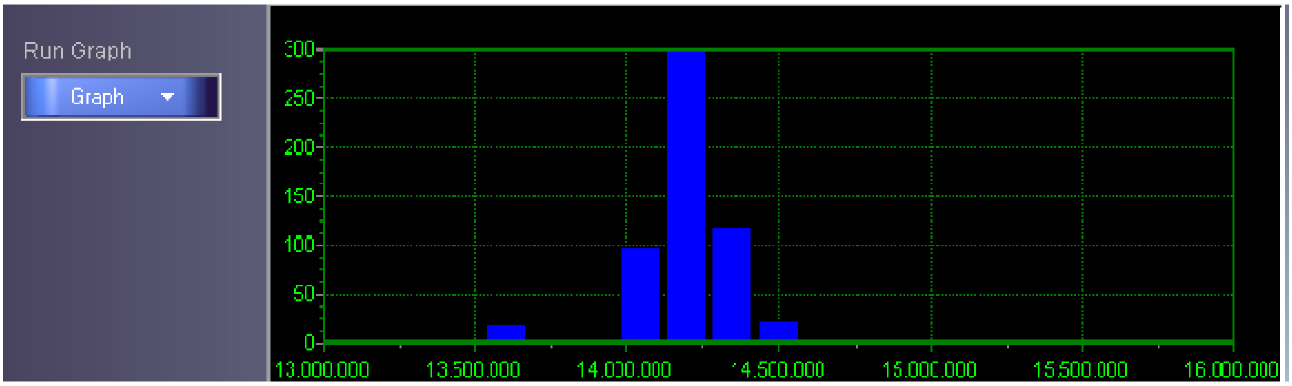
Tries

This is general to all tests with the RTS200. If the test fails, it is possible to setup the RTS so it performs a second test with the same parameters. The value of the parameter TRIES (in the .tst file) defines the number of times the test is performed before the tag is considered bad.

Min, Max Graph and Num Graph

This is used, in the online mode to show some real time information about statistical process control. There will be NUM_GRAPH bars between MIN_GRAPH and MAX_GRAPH corresponding to the different frequencies or Q factors. Each bar will show the number of results lying in the corresponding frequency or Q factor range.

For instance the screen below shows the SPC graph for a resonant frequency measurement. Most tags are around 14.2MHz, with some gaussian-like distribution around. Usually a separated bar (in this case at 13.6MHz) corresponds to faulty tags.



This chart can be used, during the pre-run to define the acceptance limits for the test. If the process is well controlled, most tags will be almost in the same frequency range, and it will be possible to define tight acceptance limits, while if we get the results spread in more frequencies, it will be better to choose wider acceptance limits.

TEST LIMITS

The acceptance limits for the tests are defined by the parameters (in the .tst file):

LIMIT_MIN_FRQ

LIMIT_MAX_FRQ

LIMIT_MIN_LEV

LIMIT_MAX_LEV

LIMIT_MIN_Q

These parameters correspond to the Minimum and maximum resonant frequency to consider a tag as valid, the minimum and maximum resonance peak level, and the minimum Q factor (there is no maximum in this case).

The values here have to be defined, as described in previous sections, to cover all the variance of the tags WHEN THEY ARE PLACED IN THE TEST ENVIRONMENT. This is very important, as the behaviour of the tags in this environment is not the same as when they are in free air.