PITFALLS OF RF TESTING FROM A BLUETOOTH ANGLE

Halam Rose
7 layers UK - Germany.

7 layers provide testing services for Bluetooth, GSM, 3G and other radio comms. applications from offices and labs around the world. We also set up and support test labs helping companies who want to run the facilities themselves but don't feel the need to invent and document all the procedures that a high quality organisation needs.

Since this Octobers ARMMS meeting is near Gloucester the link to Dr Foster is obvious, our formal subject title is Pitfalls of RF testing from a Bluetooth angle, but for people who actually have to push products through qualification testing the real interest is avoiding that 'puddle upto his middle'.

With proper care, and learning from the experience (mistakes) of others we hope to make the process more like a warm bath, but perhaps we don't want to let everyone know how smoothly things can run...

We are going to discuss some typical problems of RF testing and of course provide hints for preventing those problems. 7 layers provides Preparation Guidelines to our customers to help them arrive at the test facility properly equipped, the puddles are there to be stepped in, but we can float on them instead if we follow the check list and pack the dingy.

Typical problems in Bluetooth RF testing tend to be attributable to lack of preparation. At upto £250 an hour messing about at the test lab is not only costly, its tough on the people doing it if they know they could be better prepared. Here are some problems that better preparation would prevent:

- Too few Devices. With many tests to perform, customers often want to run tests in parallel, this of course requires more than one device. Not only that but for each device we need a power supply, possibly a controlling PC or laptop, and all the other bits and pieces to get the equipment working – perhaps even an extra operator. It's also worth having a spare device or two in case of damage.

- The wrong sample. Certain tests have to be done on the finished product. For example the spurious emissions tests are only valid if the device is in its final housing. The

conducted tests on the other hand may require a RF connector that will not be present on the finished product.

- Inadequate control software. For Bluetooth devices it's a requirement that they can not be put into test mode by an ordinary user. That's because the product would be operating illegally under some test settings – for example with frequency hopping turned off. Special test software is often required but not always supplied.

- Along with test software of course physical interfaces need to be present. We have already mentioned the RF connector but also the TCI Test Control interface needs to be physically available. This is another item that may be omitted in the production product and so overlooked.

- Inadequate information for testing. We need to know the features to be tested and basic things like the Bluetooth address of each test sample.

- Failure of interworking between test system and sample. Most of the problems occur at the start of the project simply getting the sample and the test system to talk to each other. Apart from getting the documentation correct, we recommend a short proving session before testing starts for real – this gives time for any unexpected problems to be sorted out without affecting the completion date.

- Not following the preparation guideline. These documents have developed rather like aircraft safety requirements where most of the items are there because someone has lost their life. Our preparation guidelines are not the result of quite so much bloodshed but the principle is the same. These guidelines are distilled from the anguish of those that trod this path before. Some of the questions are hard to find the answers to, but it must be easier to find the answers at your office than ours.

As an example, to measure immunity from extrinsic radiation we set up a connection and see if it can be interfered with. The customer must therefore supply two devices to set up the connection, supporting software and a mechanism to count the damaged and good packets received. Clearly this test requires some preparation by the client.

Conducted RF testing implies the need to reset the device and place the device in various modes. Also the timings of some events and the delays between commands being received and carried out need

to be input to the tester. These things are not common knowledge and though some of them can be discovered by iteration correct documentation saves a lot of time.

The Bluetooth PIXIT questionnaire gathers these numbers and settings so we can set up the tester correctly. Because they are often deeply embedded in the device they can be difficult to establish. If you're filling in a PIXIT and have to guess then at least tell us what you're not sure about so we can save time in the diagnostics.

Well prepared test sessions have many benefits, not least a reduction in stress for all who are involved:

- Interworking problems are reduced or prevented and their resolution is smooth and straightforward.

- Testing is easier, faster and a lot more satisfying.

- The project time schedule is not jeopardised, the Boss is happier.

- The testing is not interrupted while waiting for changes with the associated difficulty of re-arranging mutually workable test dates.

- Testing time and cost are reduced.

- Re-work and re-test are reduced, test already passed may have to be re run if initial values were not set correctly.

- Prepares for a smooth qualification service. Testing is not the end. The test results will be assessed before the device gets Bluetooth approval, this assessment is carried out by a person called a BQB (7 layers employ 4 of the worlds 32 BQBs). Finding things that have to be changed during testing complicates the results reports, which may need more paperwork or even retesting.

So success is all in the preparation and preparation means paperwork. The important documents for RF testing are:

- PICS / PIXIT Part A. These are standard documents comprising mainly of check boxes for supported features rather than requiring long prose answers. Get the latest version from the Bluetooth SIG web site and fill them in within the Adobe Acrobat viewer because they are active documents with embedded intelligence. Part A is the RF section and more

of the alphabet is used working up through the protocol stack. Part B is baseband for example.

- Preparation Guidelines for RF measurement and if you require these services the Prep. Guidelines for ETS and FCC approval measurements. These are 7 layers documents, filling them in may not be fun but getting them wrong will make you wish the effort had been put in sooner. Despite all the warnings we give about the value of getting the right numbers in these documents, people still guess some of them. If you have to do that for whatever reason then please make a not of that fact so we know where to start to look for the causes of interop problems and failed tests.

Bluetooth RF testing can go smoothly, and it often does once you have the experience. We have put a lot of effort into capturing the experience of many projects in the Preparation Guidelines, follow them and you will maximise your chances of smooth and enjoyable testing and qualification.

Contact the Author Halam Rose by
email Halam.rose@7layers-uk.com
or telephone +44 (0) 1763 262524