



APLAC

Asia Pacific Laboratory Accreditation Cooperation

APLAC T054 Bluetooth Proficiency Testing Program

Final Report

April 2008

ACKNOWLEDGEMENTS

The APLAC secretariat wishes to acknowledge gratefully Electric & Communication Laboratory of SGS Taiwan Ltd. for coordinating the supply, packaging and pre-testing of the samples and technical advice for this program. Thank Mr. Mike Lu (SGS) for acting as a technical adviser for this program.

Contents

	Page
1. Introduction	1
2. Program Feature	1
3. Content of Appendices	3
4. Statistical design of the program	3
5. Technical Comments	4
Appendix A	
Summary Results of RF	A1
Summary Results of Object Push Profile (OPP)	A9
Appendix B	
Test Case Reference List (TCRL)	A13
Appendix C	
Instructions to Participants	A20
Results Sheet	A22

1. Introduction

This report summarizes the results of APLAC T054 Bluetooth Proficiency Testing Program involving testing laboratories for the Asia Pacific Laboratory Accreditation Cooperation (APLAC), European co-operation for Accreditation (EA) and unaffiliated ILAC bodies. Testing cases (refer to the TCRL for related profile/protocol) and parameters which depends upon the ICS pro forma published by the SIG. The objective of this proficiency testing program is to ensure the consistency on testing result from recognized testing facility as well as the performance on Bluetooth functionalities of commercial products and evaluate the capability from the laboratories via this proficiency program to define the work scope for qualifying laboratory's capability.

Taiwan Accreditation Foundation (TAF) conducted this program. The aim of the program was to assess laboratories' ability to competently perform the tests examined.

2. Program Feature

APLAC, EA and unaffiliated ILAC bodies members were invited to participate. There were in total 14 laboratory participants nominated by 9 accreditation bodies (ABs) in this program. Testing samples were sent to the ABs and transferred to the participating laboratories. Those test samples had been circulated between laboratories which had been divided into two groups. 6 participating laboratories did not return results, hence the analysis of the results did not include those laboratories.

No	Economy	No. of Participants
1	Canada	2
2	Finland	1
3	Germany	2
4	Indonesia	2
5	Israel	1
6	Portugal	1
7	Singapore	1
8	South Korea	2
9	Taiwan	2
	Total	14

- (a) Participating laboratories were supplied commercial product (Dongle v1.2) with user manual or working instructions to describe how to operate/implement the Bluetooth functionality.

- (b) Each participating laboratory is required to ensure the consistency on testing result from recognized testing facility as well as the performance on Bluetooth functionalities of commercial products and evaluate the capability from the participants.
- (c) As the samples will be circulated among the participating laboratories, they will be returned to the reference laboratory in the before, mid-way and after the circulation for stability monitoring. The samples were checked against specification before delivering.
- (d) Laboratories were requested to perform the tests according to their copy of the Instructions to Participants and to record their results on the accompanying Results Sheet, both of which were distributed to participants with the sample. (Appendix A)
- (e) Each laboratory was randomly allocated a unique code number for the program to enable confidentiality of results. Its code number makes reference to each laboratory in this report.

3. Content of Appendices

APPENDIX A contains the summary results of RF and OPP.

APPENDIX B contains Test Case Reference List (TCRL)

APPENDIX C contains a copy of the Instructions to Participants and the Results Sheet, as supplied to participants.

4. Statistical design of the program

- 4.1 For the RF, quantitative measures were used because of few participants, 5 laboratories for the Group I and 3 laboratories for the Group II. Compare the results of the reference laboratory to the participating laboratories.
- 4.2 For the OPP, qualitative measures were defined and the Test Case Reference List was used to define the testing platform and requirements as well. Please see Appendix B

5. Technical Comments

4.1 Comments for RF

Group I

Output Power:

1. According to the Bluetooth RF test spec the Dongle output power should be between -6 and +4 dBm with a definition on power class 2.
2. Lab7: The test results were so different from the other test labs. Maybe it was caused by test equipment or something wrong in calculation. Maybe the lab didn't consider the cal factor.
3. Lab4: It could be typing error or calculation error.

Power Density

1. According to the Bluetooth RF test spec the Dongle power density should verify the maximum RF output power density.
2. Lab7: The test results maybe caused by test equipment or something wrong in calculation. Maybe the lab didn't consider the cal factor.

Low Frequency

1. According to the Bluetooth RF test spec the low and high frequency should between be 2400 and 2483.5 MHz.
2. Lab4: Since it didn't provide the test data, we discharge it from the table.
3. Lab7: Perhaps there was something wrong in test equipment or in the measure method or maybe the test operator didn't use the right setting to test this test item.

High Frequency

1. According to the Bluetooth RF test spec the low and high frequency should be between 2400 and 2483.5 MHz
2. Lab4: Since it didn't provide the test data we discharge it from the table.

20dB Band Width

1. According to the Bluetooth RF test spec 20 dB bandwidth of the test item should be smaller than 1MHz.
2. Lab7: Maybe the spectrum's RBW and VBW setting were different from the RF test spec.

Group II

Since the test sample was broken many times and several testing lab never sent back their test data (We expect there are 7 test lab, but just 3 test lab send their test data back.), so we didn't have enough testing data to analysis them.

Output Power:

1. According to the Bluetooth RF test spec the Dongle output power should be between -6 and +4 dBm.
2. Lab 1: The test result may be caused by test equipment or something wrong in calculation or maybe the lab didn't consider the cal factor.
3. Lab 3: The output power 2441 MHz (Peak value) seems to be negative in value and it maybe lack a "minus" sign
4. Lab 5: The lab should consider any possible error in the setting by the operator.

Power Density

According to the Bluetooth RF test spec the Dongle power density should verify the maximum RF output power density.

Sensitivity

1. According to the Bluetooth RF test spec the Dongle sensitivity BER should be smaller or equal to 0.1% (Minimum number of samples, 1600000 returned payload bits)
2. N/A means no feedback from the test lab.

Receiver

1. According to the Bluetooth RF test spec the Dongle sensitivity BER should be smaller or equal to 0.1%
2. The labs in the first group are all passed
3. The labs in the second one are all passed, too.

4.2 Comments for OPP

1. Only two participants provided the results of OPP, which were Lab 1 and Lab 6. With these two labs are BQTF and supported by their BQB, to recognize the testing result was necessary, there're some variant findings in the verdict as the testing result sheet. The background for testing the OPP (Object Push Profile) at the beginning which is used to check the testing capability on the OBEX and default formats (Vcard, vcal, Vmsg and vnotes) implementations defined in the Bluetooth specification/Test specification with the specific TCRL (Test case reference list).
2. With the different delivery time which the Bluetooth SIG defined the different test methods and requirement than project started, refer to the TCRL, there're testing platform "Prod vs Prod" and testing with PTS which means the members can test the interoperability with listed device(s) to meet the testing specification and qualification policy.
3. The sample was qualified at OPP/1.1.1 and both labs tested in OPP/1.1.3 as well as different qualification criteria.

4. Lab 6 did the testing with TCRL 2006-Aug-1 (see attachment) which define the PTS testing and Lab 6 used PTS v2.0.
5. Lab 1 did the testing using PTS v2.1 with the same TCRL which defined the TS is OPP/1.1.3. Some test cases w/ w/o test verdict might caused by a different PICS and TCMT followed (OPH10, 14,18 and BCP02). Lab 1 identified some PTS and PDU issues could be caused by the PTS verification and new adopted profile version, some of them can be recognized by manual review and it could be caused by the innovated specification improvement.

4.3 General Comments

For the future program as below:

1. Shorten the delivery time and/or samples preparation for profile testing
2. Selecting the latest announced profile version and defined the latest tool a common or consistency tool/ version (for instance PTS- Profile Tuning Suite) for testing ensure the same background to check the proficiency
3. Asking the participants feedback the testing evidence or raw data instead result sheet only.
4. Test plan should be applicable after agreement among participants.
5. Understanding on the testing content and test standard when seeking agreement from participants.
6. Select the sample with solid/specific SMA connector for the further program to avoid re-work on sampling. We would like to recommend selecting a sample so good prepare samples good to operation that we needn't to solder manually and needn't to worry about the cable lose , impedance nor return loss.
7. Recommend test cases performed at the validated test equipment or system which approved by the Bluetooth SIG, defined the testing requirement and parameters with specific standard defined in RTTE and FCC.

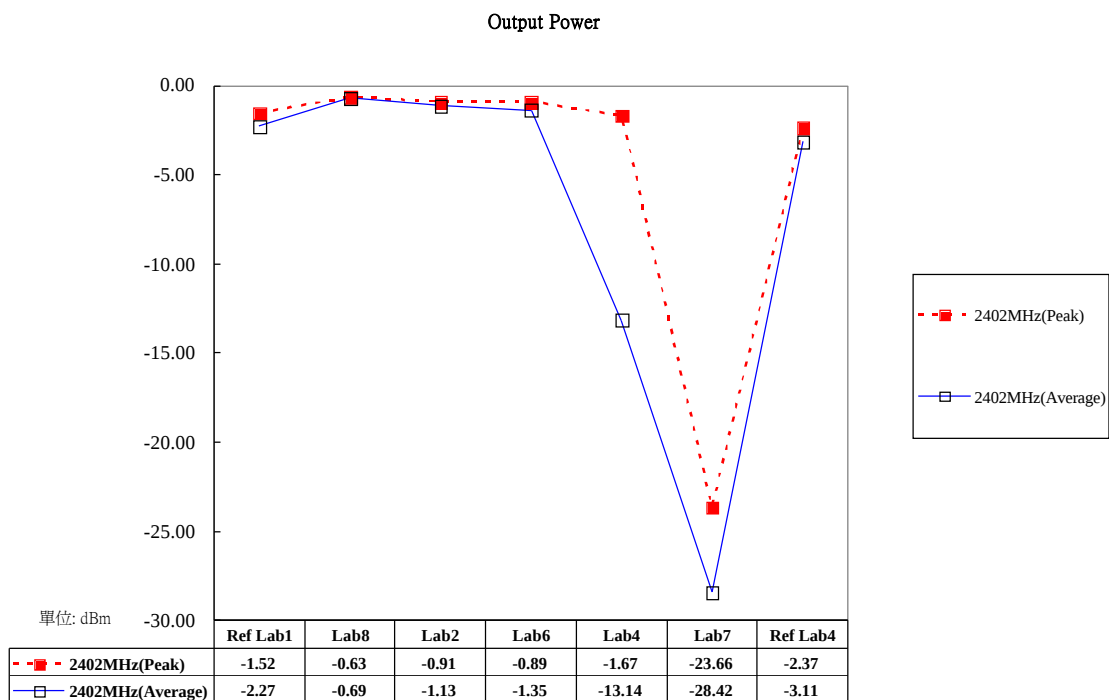
Appendix A

Summary Results of RF

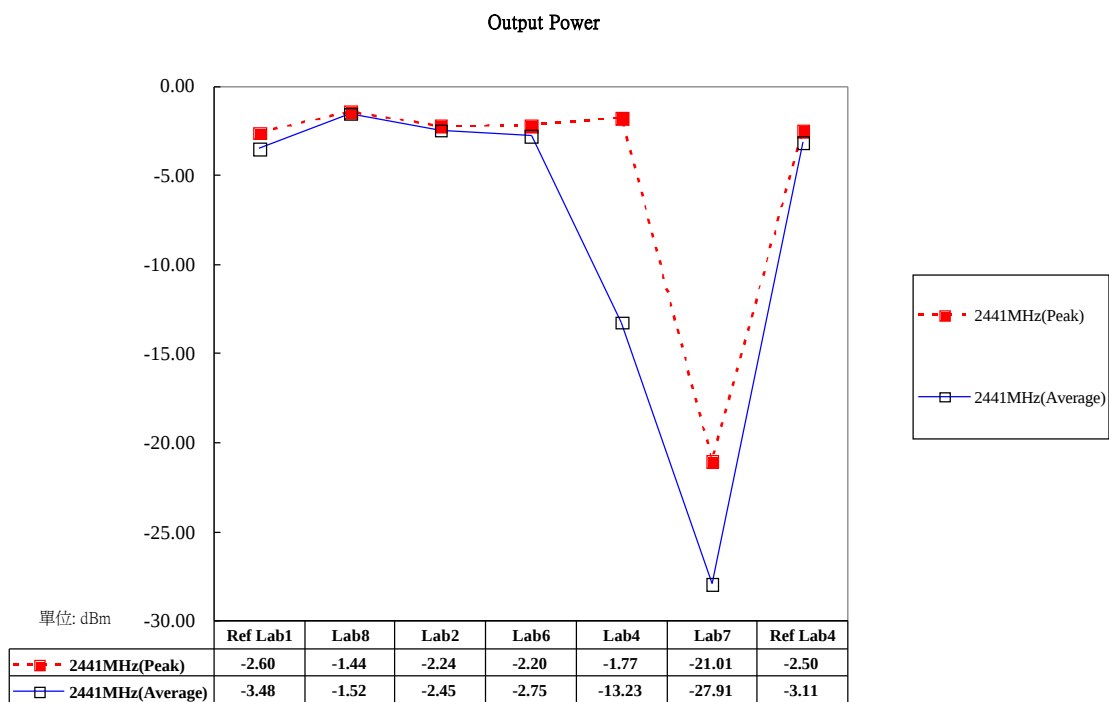
Summary Results of OPP

A1. Summary Results of RF Group I

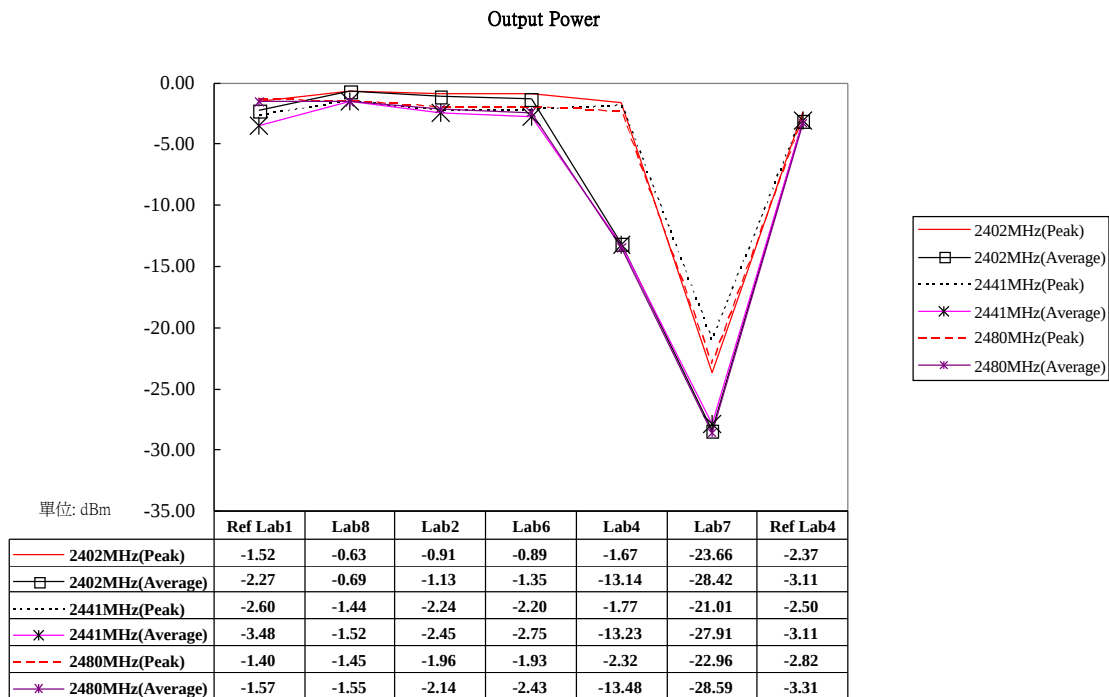
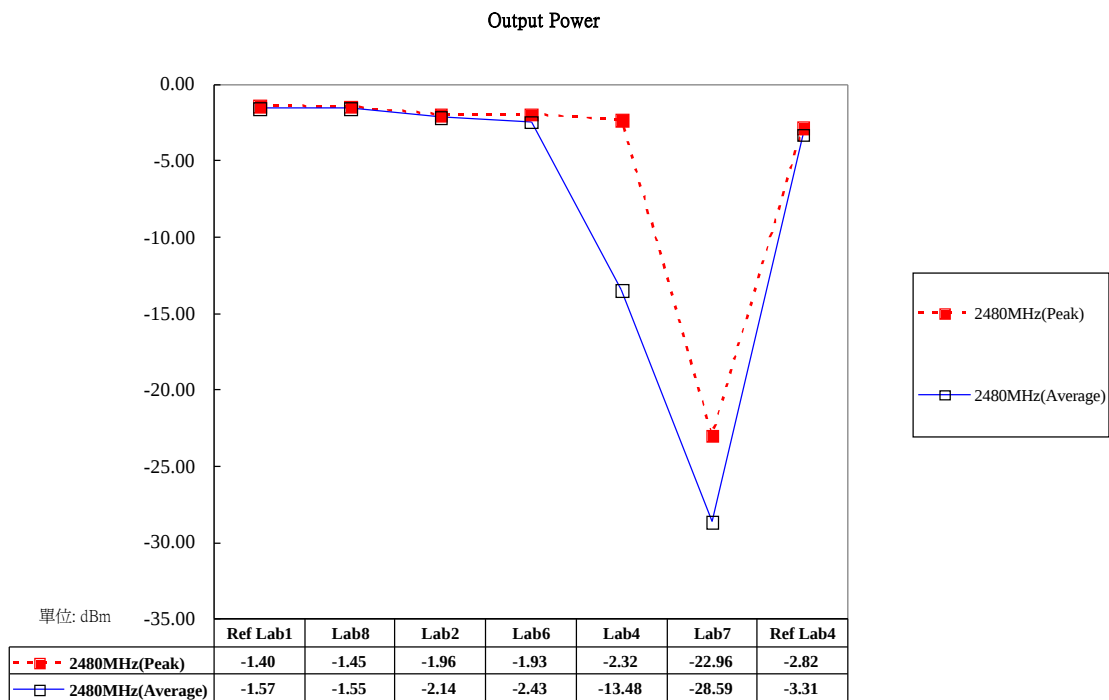
Output Power 2402

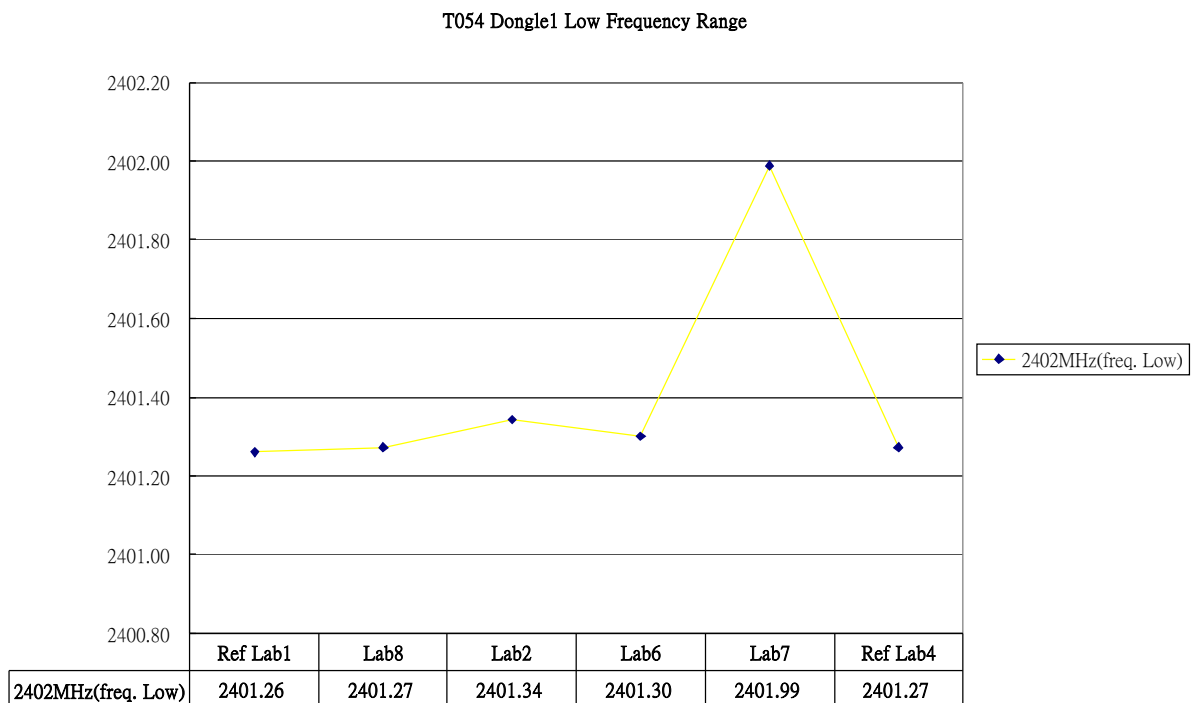
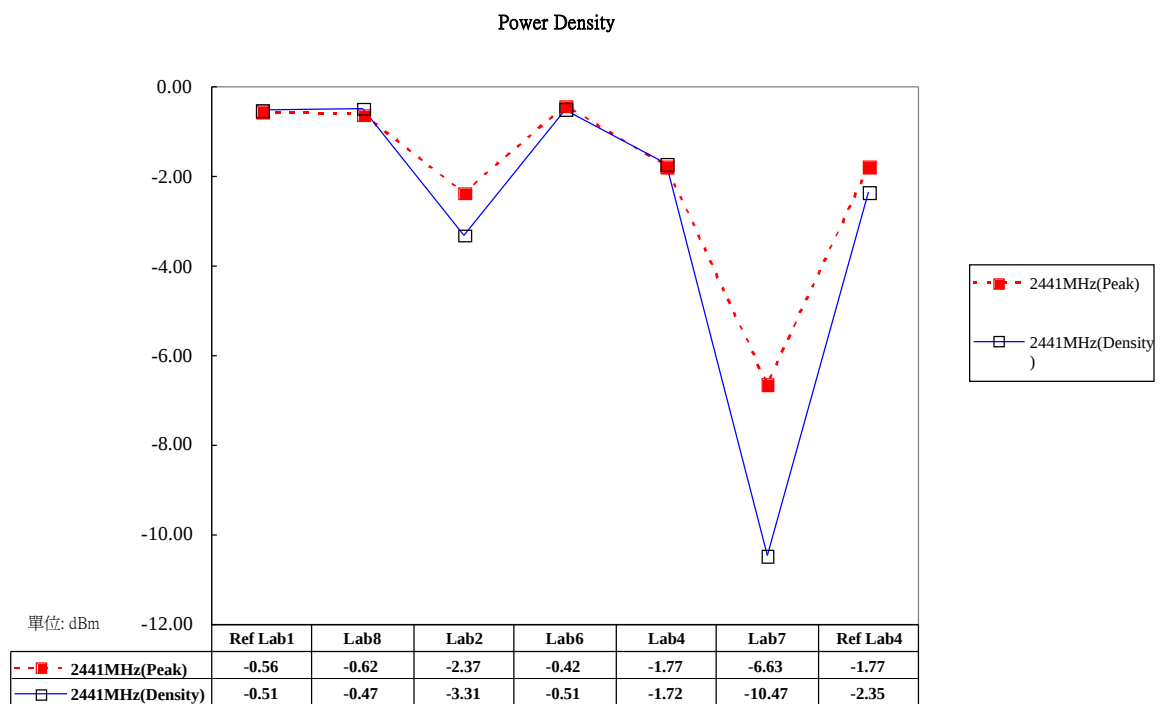


Output Power 2441

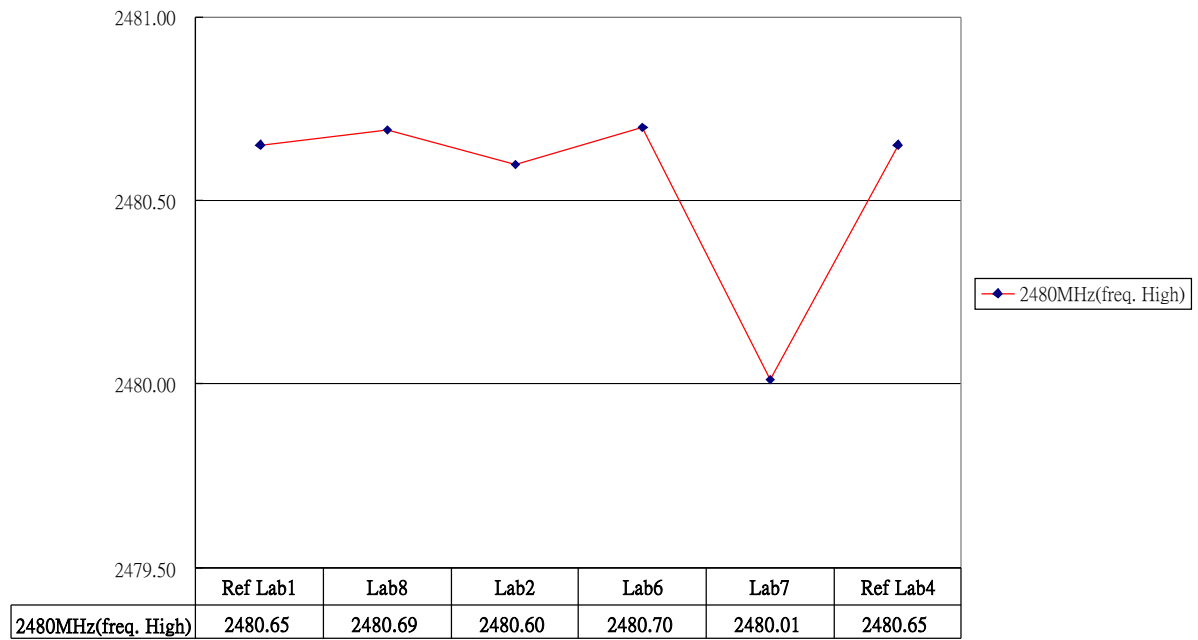


Output Power 2480

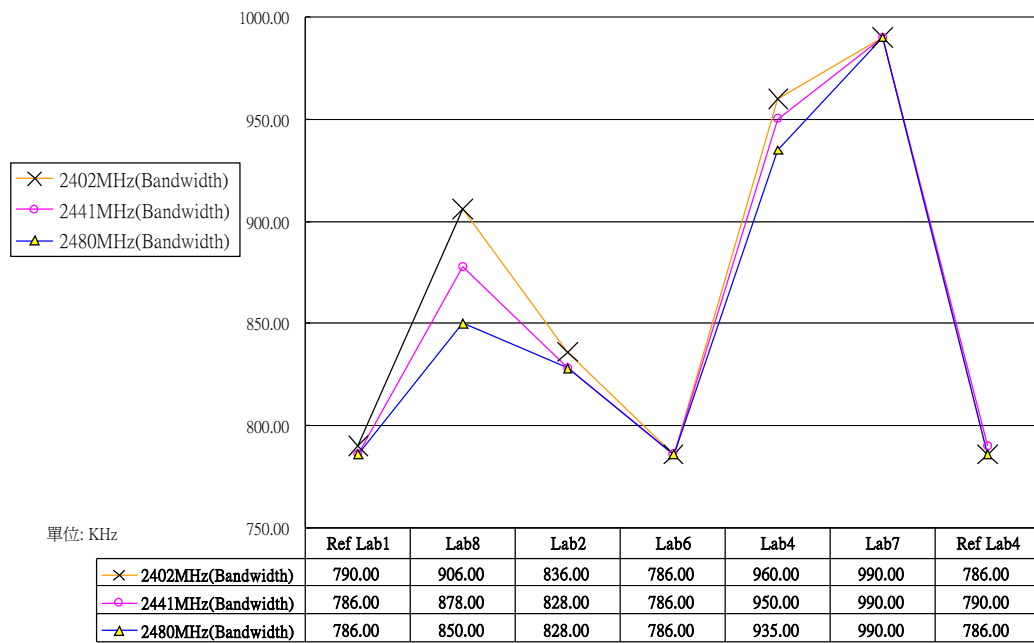




T054 Dongle1 High Frequency Range



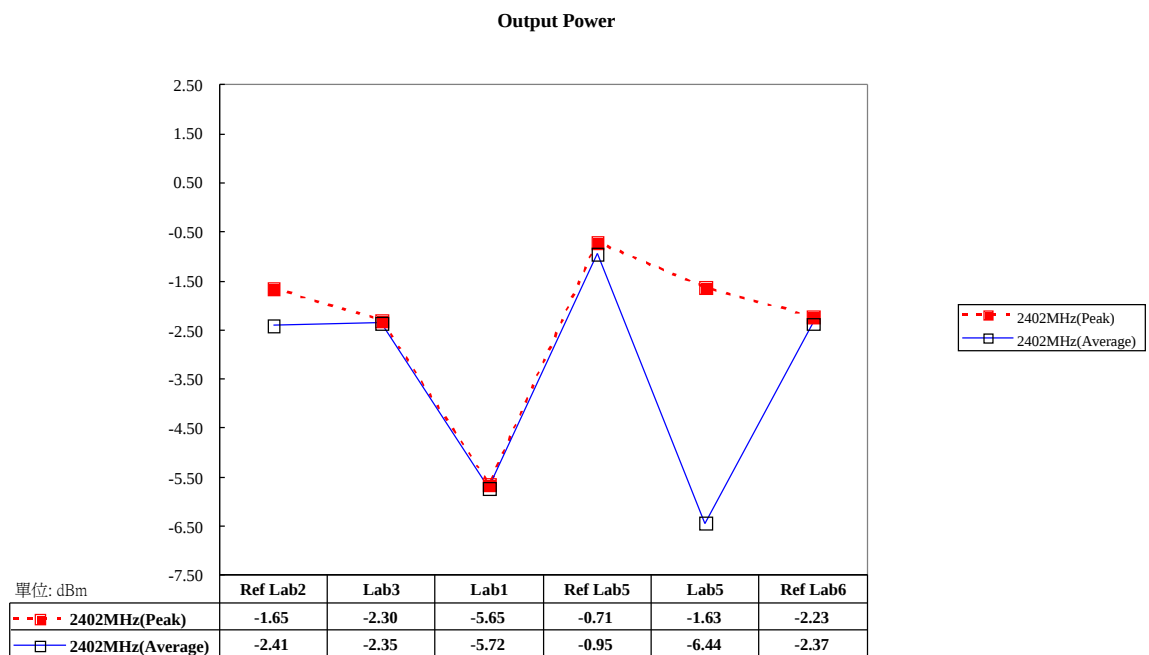
20dB Band Width



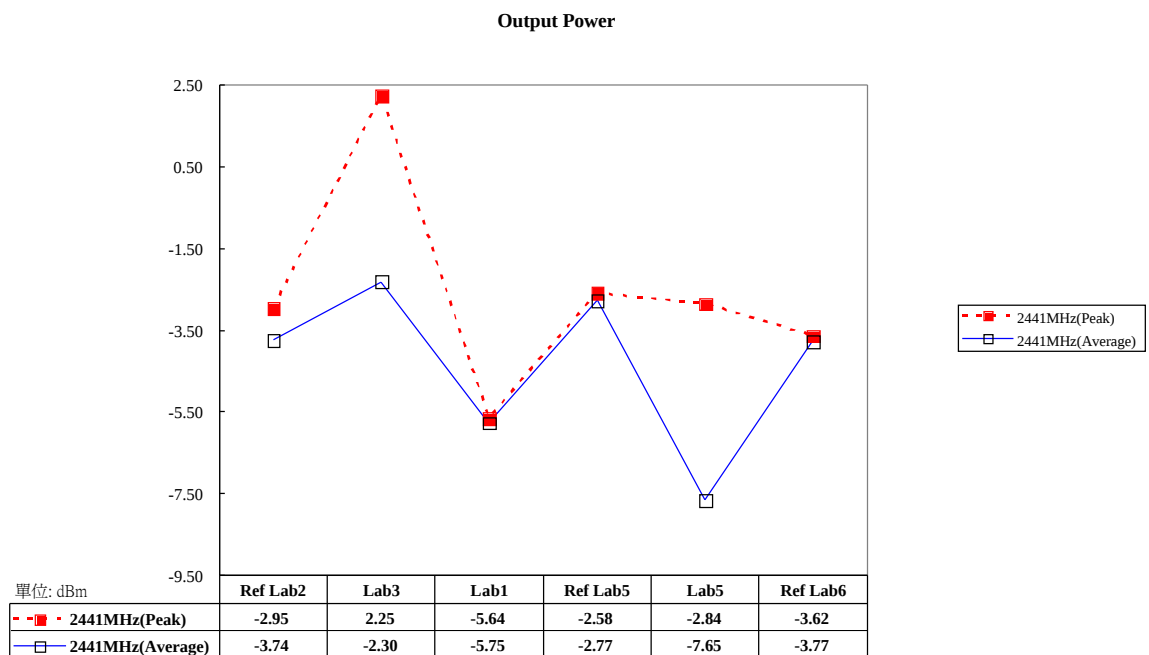
A1. Summary Results of RF

Group II

Output Power 2402

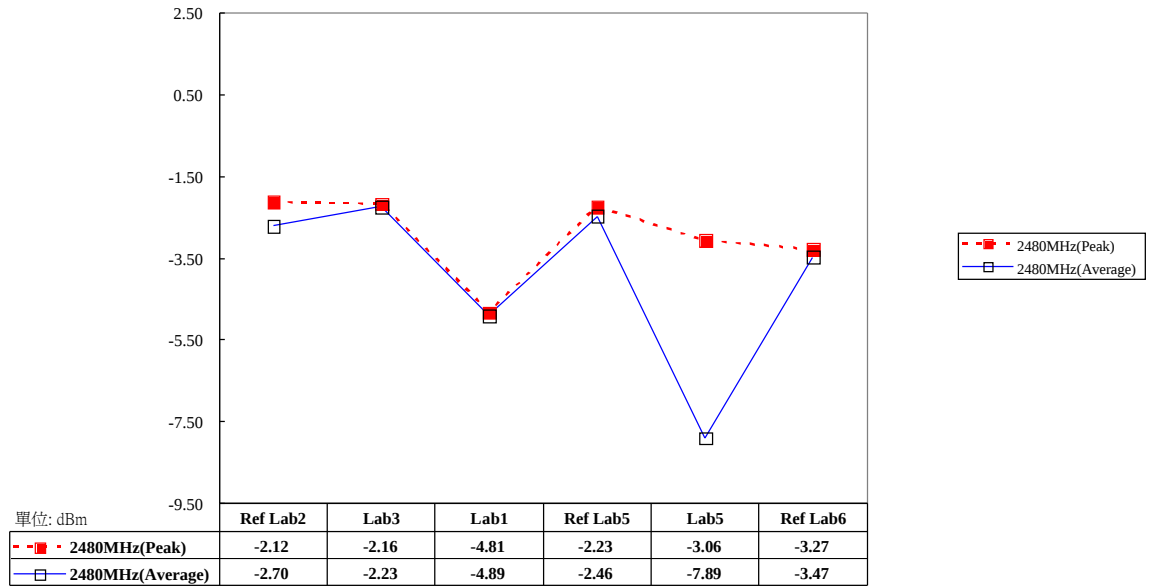


Output Power 2441

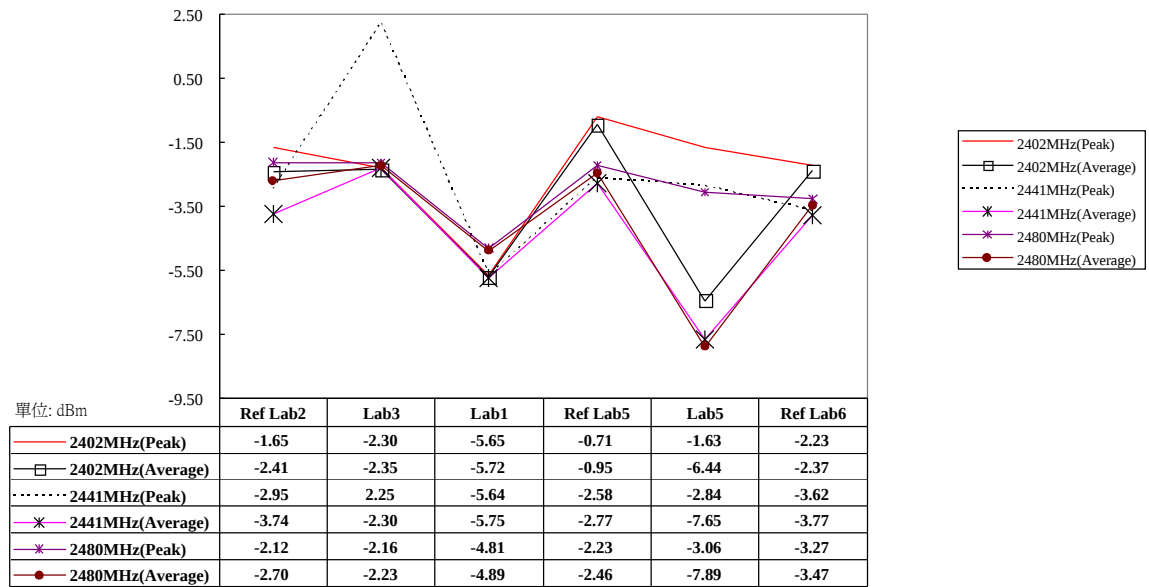


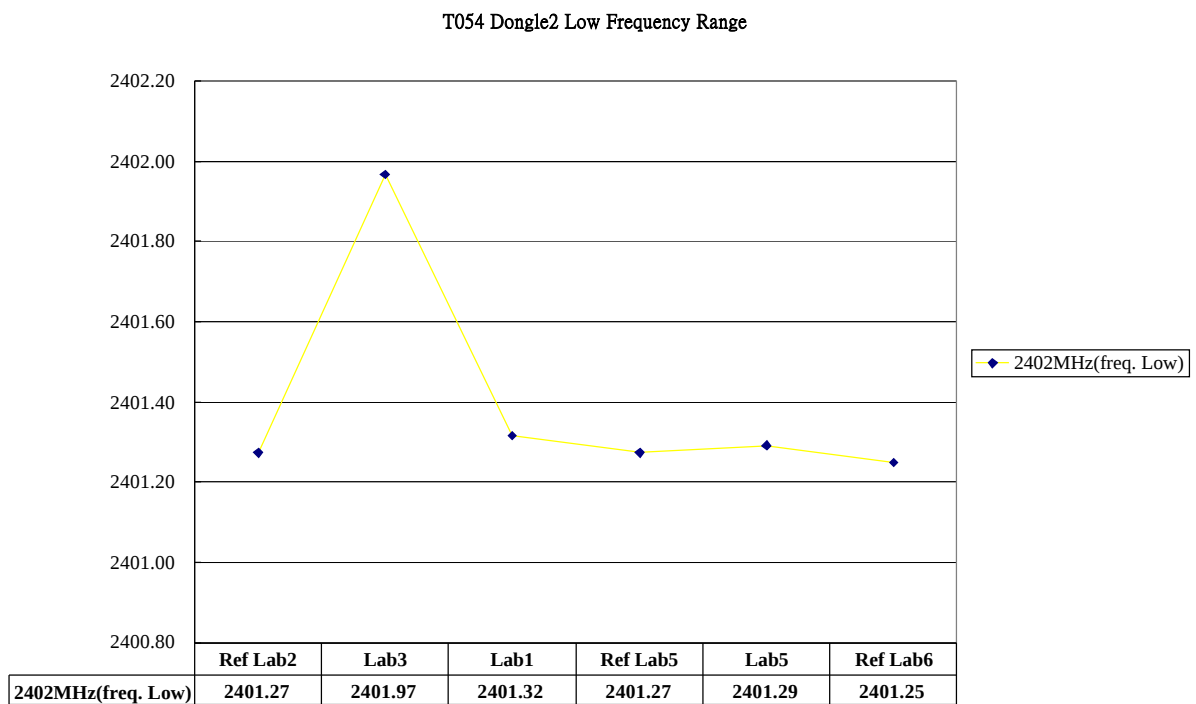
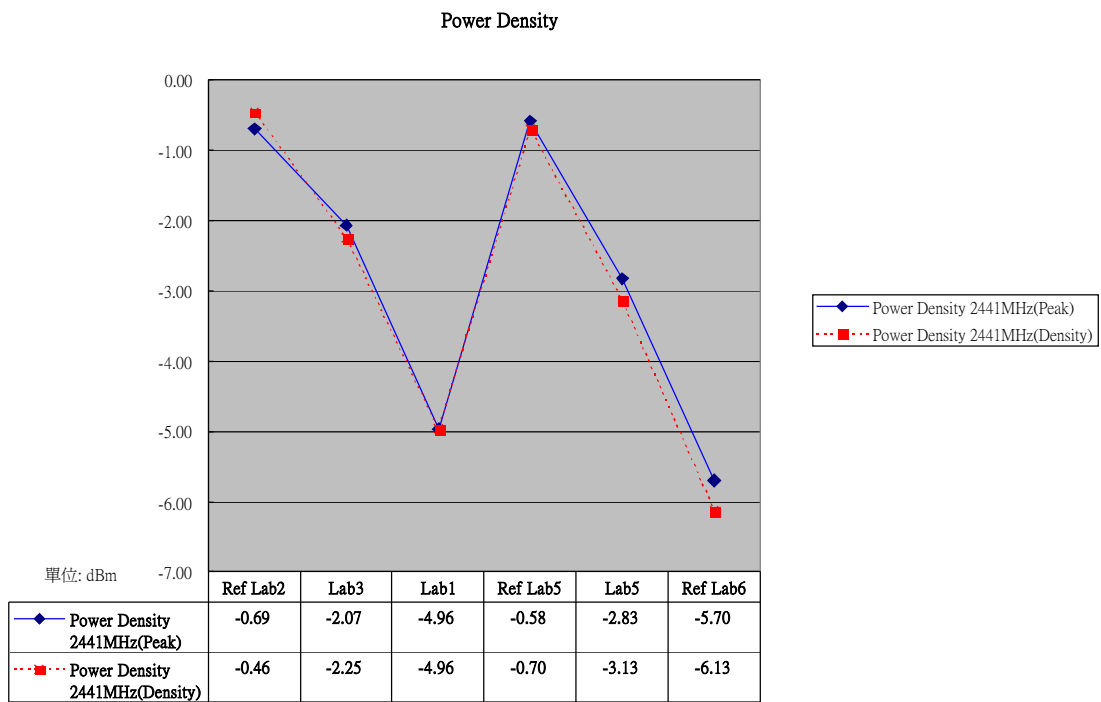
Output Power 2480

Output Power

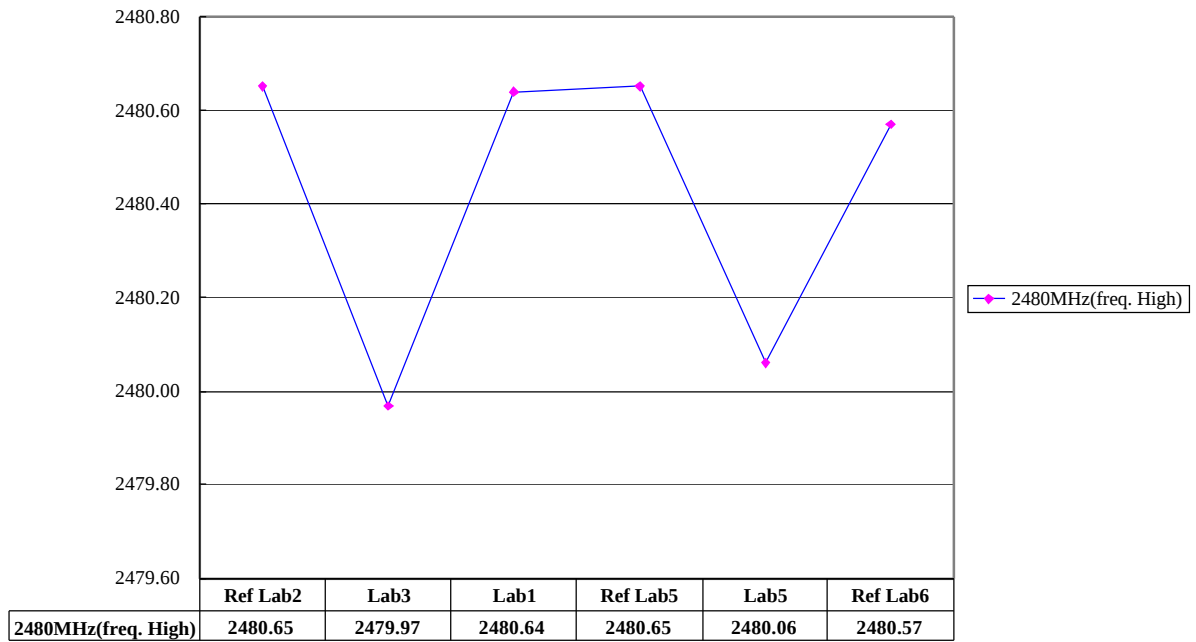


Output Power

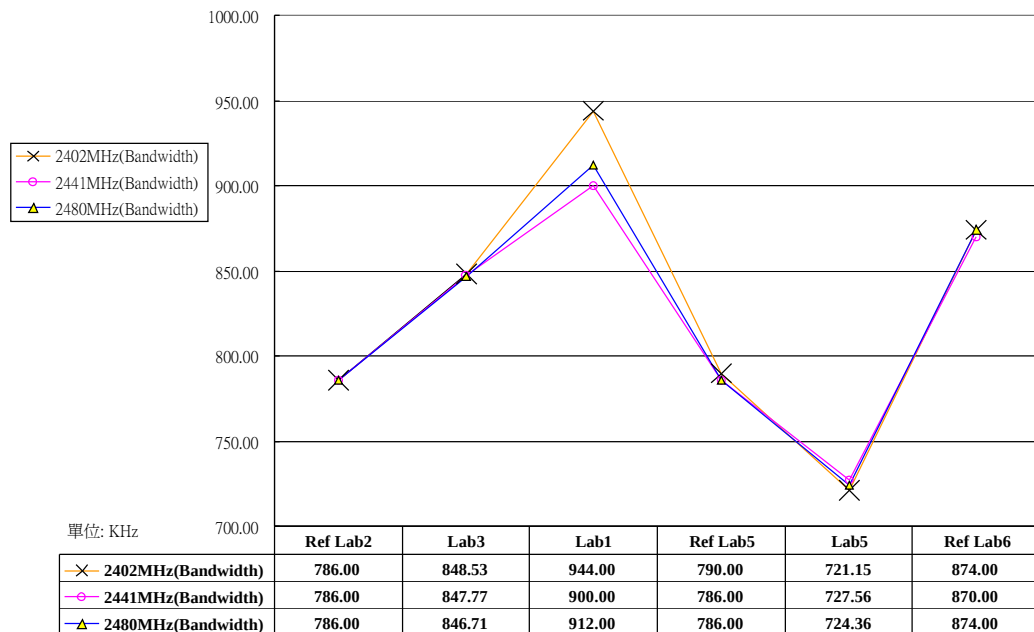




T054 Dongle2 High Frequency Range



20dB Band Width



A2. Summary Results of OPP

Lab 1

Test Case	Client	Observation	Server	Observation
OPH_BV01	passed		passed	
OPH_BV02	passed		passed	
OPH_BV03	passed		passed	
OPH_BV04	passed* (* Manual verdict verification)	Implementation error on PTS. While verifying the content of the vCard the PTS showed a message with switched content	passed* (* Manual verdict verification)	Recognized an implementation error on PTS. While verifying the content of the vCard the PTS showed a message with switched content
OPH_BV05	passed		passed	
OPH_BV07	passed		passed	
OPH_BV08	passed		passed	
OPH_BV09	passed		passed	
OPH_BV10	passed		passed	
OPH_BV11	passed		passed	
OPH_BV12	passed		passed	
OPH_BV13	passed		passed	
OPH_BV14	passed		passed	
OPH_BV15	passed		passed	
OPH_BV16	passed		passed	In Note 2 one more line "EGIN" was included in file. All requirements against the test specification are fulfilled.
OPH_BV17	passed		passed	
OPH_BV18	passed		passed	
BCP_BV01	passed		Passed	
BCP_BV02	failed/	PTS expects different PDU opcode or length.	passed	

		According to test case coverage list from 15 th Feb 2007 of BT SIG this test is not validated on PTS yet		
	(passed vs PROD*)	Testing against a PROD* and the result is passed.		
BCP_BV03	passed		passed	
BCP_BV04	failed/	PTS expects different PDU opcode or length. According to test case coverage list from 15 th Feb 2007 of BT SIG this test is not validated on PTS yet	passed	
	(passed vs PROD*)	Testing against a PROD* and the result is passed.		
BCP_BV05	failed/	PTS expects different PDU opcode or length. According to test case coverage list from 15 th Feb 2007 of BT SIG this test is not validated on PTS yet.	passed	
	(passed vs PROD*)	Testing against a PROD* and the result is passed.		
BCE_BV01	passed		passed	
BCE_BV03	passed		passed	
BCE_BV04	failed/	PTS expects different PDU opcode or length. According to TCRL from 15 th Feb 2007 it is not required to test against the PTS yet and testing against a PROD is currently allowed.	passed	
	(passed vs PROD*)	Due to this condition the OUT was tested against a PROD* and the result is passed.		
BCE_BV05	inconclusive/	PTS receives unexpected HCI event. According to TCRL from 15 th Feb 2007 it is not required to test against the PTS yet and testing against a PROD is currently allowed.	passed	
	(passed vs PROD*)	Due to this condition the OUT was tested against a PROD* and the result is passed.		
BCE_BV06	failed/	PTS expects different PDU opcode or length. . According to TCRL from 15 th Feb 2007 it is not required to test against the PTS yet and testing against a PROD is currently allowed.	passed	
	(passed vs PROD*)	Due to this condition the OUT was tested against a PROD* and the result is passed.		
BCE_BV07	passed		passed	

Lab 6

Test Case	Client	Observation(Test Platform)	Server	Observation(Test Platform)
OPH_BV01	PASS	Profile Tuning Suite V2.0	PASS	Profile Tuning Suite V2.0
OPH_BV02	PASS	Profile Tuning Suite V2.0	PASS	Profile Tuning Suite V2.0
OPH_BV03	PASS	Profile Tuning Suite V2.0	PASS	Profile Tuning Suite V2.0
OPH_BV04	PASS	Profile Tuning Suite V2.0	PASS	Profile Tuning Suite V2.0
OPH_BV05	PASS	Profile Tuning Suite V2.0	PASS	Profile Tuning Suite V2.0
OPH_BV07	PASS	Profile Tuning Suite V2.0	PASS	Profile Tuning Suite V2.0
OPH_BV08	PASS	Profile Tuning Suite V2.0	PASS	Profile Tuning Suite V2.0
OPH_BV09	PASS	Profile Tuning Suite V2.0	PASS	Profile Tuning Suite V2.0
OPH_BV10	PASS	Profile Tuning Suite V2.0	N/A	
OPH_BV11	PASS	Profile Tuning Suite V2.0	PASS	Profile Tuning Suite V2.0
OPH_BV12	PASS	Profile Tuning Suite V2.0	PASS	Profile Tuning Suite V2.0
OPH_BV13	PASS	Profile Tuning Suite V2.0	PASS	Profile Tuning Suite V2.0
OPH_BV14	PASS	Profile Tuning Suite V2.0	N/A	
OPH_BV15	PASS	Profile Tuning Suite V2.0	PASS	Profile Tuning Suite V2.0
OPH_BV16	PASS	Profile Tuning Suite V2.0	PASS	Profile Tuning Suite V2.0
OPH_BV17	PASS	Profile Tuning Suite V2.0	PASS	Profile Tuning Suite V2.0
OPH_BV18	PASS	Profile Tuning Suite V2.0	N/A	
BCP_BV01	PASS	SGH-Z650i	PASS	Profile Tuning Suite V2.0
BCP_BV02	PASS	SGH-Z720	N/A	
BCP_BV03	PASS	SGH-Z650i	PASS	Profile Tuning Suite V2.0
BCP_BV04	PASS	SGH-Z650i	PASS	Profile Tuning Suite V2.0
BCP_BV05	PASS	SGH-Z650i	PASS	IVT BPTS
BCE_BV01	PASS	SGH-Z650i	PASS	Profile Tuning Suite V2.0
BCE_BV03	PASS	SGH-Z650i	PASS	Profile Tuning Suite V2.0
BCE_BV04	PASS	SGH-Z650i	PASS	IVT BPTS
BCE_BV05	PASS	SGH-Z650i	PASS	IVT BPTS
BCE_BV06	PASS	SGH-Z650i	PASS	IVT BPTS
BCE_BV07	PASS	SGH-Z650i	PASS	IVT BPTS

Appendix B

Test Case Reference List (TCRL)

Test Case Reference List for the Bluetooth Qualification Program (external to core protocols and profile parts).

For external to Core and Profile implementations utilizing Bluetooth Core 1.1 and later versions

- The Bluetooth System Specifications 1.1 and later are accessible to Promoters, Associates and Members following the 1.2 version of the Adopters Agreement.
- Qualification using this TCRL is enabled for Members with access to the Bluetooth System Specifications 1.1 and later and only together with applicable Bluetooth Core TCRLs
- For definition and how to apply the test case category A, B, C, D, please refer to the applicable Qualification Program Reference Document (PRD)

Release date: 1-Aug-2006				Previous Requirements		Updated Requirements		PTS Config	
Key to the Tables of the Test Case Reference List								2.0	
Table	Contents	Specification Version	Adoption Date	Test Spec	PICS	Test Spec	PICS	Notes	ETS* ver. in PTS
IOP	Interoperability Test Specification	1.1 and later	2)	IOPT.TS.2.E.4	2)	IOPT.TS/2.0.E.6	2)	1), 4)	3.0.0.1
RFCOMM	RFCOMM Protocol	1.1 Part F:1	22-Feb-01	RFCOMM.TS/1.1.0	RFCOMM.ICS/1.1.0			4)	3.0.1.1
BNEP	Binary Network Encapsulation Protocol	BNEP 1.0	20-Feb-03	BNEP 1.0	PAN.ICS.1.0.1	BNEP.TS/1.0.1	PAN.ICS/1.0.2	4)	3.1.0.1
SDAP	Service Discovery Application Profile	1.1 Part K:2	22-Feb-01	22.B.359/0.1	23.B.307/0.71	SDAP.TS/1.2.1	SDAP.ICS/1.2.0		
CTP	Cordless Telephony Profile	1.1 Part K:3	22-Feb-01	22.B.360/1.1	23.B.308/0.71	CTP.TS/1.2.1	CTP.ICS/1.2.1		
ICP	Intercom Profile	1.1 Part K:4	22-Feb-01	ICP.TS/1.1.1	ICP.ICS/1.1.1				
SPP	Serial Port Profile	1.1 Part K:5	22-Feb-01	SPP.TS/1.1.1	SPP.ICS/1.1.1			4)	3.2.0.1
HSP	Headset Profile	1.1 Part K:6	22-Feb-01	HSP.TS/1.1.2	HSP.ICS/1.1.1	HSP.TS/1.1.2	HSP.ICS/1.1.1	5)	4.4.0.0
DUN	Dial Up Networking Profile	1.1 Part K:7	22-Feb-01	DUN.TS/1.1.1	DUN.ICS/1.1.1	DUN.TS/1.2.1	DUN.ICS/1.2.2	4)	3.2.0.0
FAX	FAX Profile	1.1 Part K:8	22-Feb-01	FAX.TS/1.1.0	FAX.ICS/1.1.0	FAX.TS/1.1.1	FAX.ICS/1.1.0		
OPP	Object Push Profile	1.1 Part K:11	22-Feb-01	OPP.TS/1.1.1	OPP.ICS/1.1.0	OPP.TS/1.1.3	OPP.ICS/1.1.0	5)	4.4.0.0
FTP	File Transfer Profile	1.1 Part K:12	22-Feb-01	FTP.TS/1.1.1	FTP.ICS/1.1.1	FTP.TS/1.1.2	FTP.ICS/1.1.2	5)	4.4.0.0

SYP	Synchronisation Profile	1.1 Part K:13	22-Feb-01	22.B.369/1.1	23.B.317/0.71	SYNC.TS/1.2.0	SYNC.ICS/1.2.0	4)	3.2.0.1
ESDP UPnP	ESDP for UPnP Profile	ESDP UPnP 0.95b	31-Jan-01	ESDP UPnP: 0.90b	23.B.600/0.9	ESDP.TS/1.2.1	ESDP.ICS/1.2.1		
PAN	Personal Area Networking Profile	PAN 1.0	20-Feb-03	PAN.TS.1.0.1	PAN.ICS.1.0.1	PAN.TS/1.0.2	PAN.ICS/1.0.2	4)	3.3.0.0
BPP v0.95	Basic Printing Profile v0.95	BPP 0.95a	5-Oct-01	23.B.602/0.9	23.B.602/0.9			3)	
BPP v1.0	Basic Printing Profile v1.0	1.0	10-Feb-05	BPP.TS/1.0.1	BPP.ICS/1.0.1	BPP.TS/1.2.0	BPP.ICS/1.2.0	4), 6)	5.0.0.1
BPP v1.2	Basic Printing Profile v1.2	1.2	27-Apr-06	BPP.TS/1.0.2	BPP.ICS/1.0.2	BPP.TS/1.2.0	BPP.ICS/1.2.0	4), 6)	5.0.0.1
HCRP v1.0	Hard Copy Cable Replacement Profile v1.0	HCRP 1.0	23-Jan-03	HCRP TS 1.1	July-2002/1.0	HCRP.TS/1.2.2	HCRP.ICS/1.2.1	5)	5.0.2.0
HCRP v1.2	Hard Copy Cable Replacement Profile v1.2	1.2	27-Apr-06	HCRP.TS/1.2.1	HCRP.ICS/1.2.1	HCRP.TS/1.2.2	HCRP.ICS/1.2.1	5), 6)	5.0.2.0
HFP v1.0	Hands-Free Profile v1.0	1.0m	24-Apr-03	HFP-V1.0.TS.1.1.3	HFP-V1.0.ICS.1. 1.3	HFP.TS/1.1.5	HFP.ICS/1.1.5	5), 8)	4.4.0.1
HFP v1.5	Hands-Free Profile v1.5	1.5	25-Nov-05	HFP.TS/1.5.4	HFP.ICS/1.5.1	HFP.TS/1.5.5	HFP.ICS/1.5.2	6)	
BIP	Basic Imaging Profile	1.0	25-Jul-03	BIP.TS.1.1.2	BIP.ICS/1.0.1	BIP.TS/1.1.3	BIP.ICS/1.0.1	4)	4.4.0.0
AVDTP	Audio/Video Distribution Transport Protocol	1.0	24-May-03	AVDTP.TS/1.2.4	AVDTP.ICS/1.2. 3	AVDTP.TS/1.2.6	AVDTP.ICS/1.2.4	4)	3.0.0.2
AVCTP	Audio/Video Control Transport Protocol	1.0	25-May-03	AVCTP.TS/1.2.1	AVCTP.ICS/1.2. 1	AVCTP.TS/1.2.2	AVCTP.ICS/1.2.2	4)	3.0.0.2
GAVDP	Generic Audio/Video Distribution Profile	1.0	26-May-03	GAVDP.TS/1.1.3	GAVDP.ICS/1.1. 2			4)	3.1.0.1
A2DP	Advanced Audio Distribution Profile	1.0	27-May-03	A2DP.TS/1.1.2	A2DP.ICS/1.1.1	A2DP.TS/1.1.4	A2DP.ICS/1.1.2	5)	4.4.0.0
AVRCP	Audio/Video Remote Control Profile	1.0	28-May-03	AVRCP TS 1.0	AV165/1.0	AVRCP.TS/1.2.0	AVRCP.ICS/1.2.0	5)	4.4.0.0
HID	Human Interface Device Profile	1.0+SE747	2003-05-29 &	HID.TS/1.0.2	HID.ICS/1.0.2	HID.TS/1.0.3	HID.ICS/1.0.2	5), 6)	4.4.0.1

			2005-11-25						
CIP	Common ISDN Access Profile	1.0b1	23-Jan-03	CIP TSSC 1.0	CIP ICS 1.0	CIP.TS/1.0.1	CIP.ICS/1.01		
SAP v0.95	SIM Access Profile v0.95	0.95c	10-Aug-02	SAP.TS/0.95.3	SAP.ICS/0.95.3			3)	3.0.0.1
SAP v1.0	SIM Access Profile v1.0	1.0	12-May-05	SAP.TS/1.0.1	SAP.ICS/1.0.1	SAP.TS/1.2.1	SAP.ICS/1.2.1	4), 6)	3.0.0.1
VDP	Video Distribution Profile	1.0	9-Sep-04	VDP TS 1.0	VDP_PICS_1.0	VDP.TS/1.2.0	VDP.ICS/1.2.0		
DI	Device ID	1.2	27-Apr-06	DI.TS/1.2.1	DI.ICS/1.2.0			6)	
PBAP	Phone Book Access Profile	1.0	27-Apr-06	PBAP.TS/1.0.0	PBAP.ICS/1.0.0			6)	

Notes

About TSE references: With the introduction of the new Test Specification Errata system June 1st 2006, a new errata numbering was also introduced. The TSE references utilized in this TCRL and in associated TS & ICS documents are all original TSE-numbers; these numbers are referred to as legacy ids "L-ID" in the new Test Specification Errata system

* ETS: Executable Test Suite on the Profile Tuning Suite platform

- 1) The interoperability test specification is used to establish Profile Conformance and Interoperability in an End-Product comprising an arbitrary set of Bluetooth Profiles. It is mandatory only for End-Products and Subsystem combinations as defined in the PRD.
- 2) Test case mapping for these TCs builds upon supported SDP, therefore "Adoption Date" and "Associated PICS reference " equals the applicable SDP reference for the object under qualification
- 3) Deprecation notice issued 9 Feb'06. From 9 Aug'06 the 0.95 version is deprecated. From 9 Feb'07 the 0.95 version will no longer be qualifiable
- 4) Test case coverage available within the Profile Tuning Suite, but test cases not validated.
- 5) Test case coverage and validation status achieved for test coverage within the Profile Tuning Suite.
- 6) "Updated Requirements" for this profile equal those published in a TCRL Addendum since the last complete TCRL publication.
- 7) "Updated Requirements" in the HPF1.5 TCRL equals those which were released 2005-11-25 as a result of the Adoption of HFP 1.5. The release date for this sheet is therefore different than what is given as the release date for this compiled Profile TCRL.

8) Deprecation notice issued 14 March '06. From 14 March '07 the 1.0 version is deprecated. From 14 September '07 the 1.0 version will no longer be qualifiable

Document naming of Test Documents/ ICS and IXIT (when applicable) has followed variable schema in the past.

The current naming conventions are as follows

<Profile Spec abbreviation (3-5char).<Doc Type>/<Ref to ver nr of Spec that it is tested>.<Sequence Number> <rZ> where:

<Sequence Number>: is used to indicate the version of the document. The number is incremented +1 with each version

<rZ>: is used to indicate the number of a given draft of a document in development. r1 is used for the first draft of a document. The number is incremented +1 with each new draft of a draft document. "Z "can be any integer number other than zero (0). This rZ number is removed from the document number and filename when the document is approved and posted/published.

1. Methods for Bluetooth interoperability testing: Members shall accomplish qualification testing using one of the following methods as indicated in the 'Test Platform' field:

a. 'Prod vs Prod' means that Members are required to perform interoperability testing, preferably using a qualified Bluetooth End Product or, if applicable the Profile Tuning Suite or, alternatively a user defined test setup.

b. 'Prod vs. PTS' means that Members are required to perform interoperability testing using the associated validated test case in the applicable Executable Test Suite (ETS) of the Profile Tuning Suite. When qualifying an IUT, the Member shall use the ETS version as indicated in this TCRL or, at the Member's discretion, a later version, if available maintained according to the PTS Quality Plan and traceable in the PTS roadmap.

c. 'Prod vs Tester' means that Members are required to perform interoperability testing using a user defined test setup or, if applicable the Profile Tuning Suite.

2. Alternate Testing Evidence: Applicable where the Member believes that a validated PTS test case is in error and is failing to give a 'pass' verdict for their IUT, and that their design is compliant with the specification and can meet the applicable testing requirements.

If such test case is at **Category A:**

2.1 The Member requires a Test Case Waiver granted by Bluetooth SIG as a pre-requisite before being able to proceed as under 2.2.

If such test case is at **Category B**:

2.2 In the event that the member is unable to achieve a Pass verdict using the PTS, the Member may pursue alternate means of test evidence using the method specified as 'Prod vs. Prod' and perform the following actions:

a) Raise one or more issues using the PTS Issue Tracking system (<http://programs.bluetooth.org/pts/issues>) describing the circumstances of the test case execution. This must include the PTS log from the test case executions and may be done anonymously. One issue may be sufficient for multiple failed test cases if they all fail for the same reason.

b) Submit the test report for the alternative 'Prod vs. Prod' evidence that shows a Pass verdict to the Bluetooth SIG as part of their 'Test Declaration Upload'.

The Bluetooth SIG may at any time request additional information from the Member with regard to how the PTS test was applied, and the member should cooperate with the Bluetooth SIG in order to resolve any error in the PTS.

Members not concerned with confidentiality, may additionally submit identified issues not precluding qualification to

<http://programs.bluetooth.org/pts/feedback>

Test Case Reference List

Object Push Profile			Previous test specification: OPP.TS/1.1.1				Updated test specification: OPP.TS/1.1.3						
Release date:	1-Aug-2006		Previous ICS: OPP.ICS/1.1.0				Updated PICS: OPP.ICS/1.1.0						
go to Top			Previously published test requirements				Updated requirements through this release						
											Test Platform for IUT in role		
TC identifier	Description	Test Spec Version	TC Category	Active Date	Test Platform	Notes	Test Spec Version	TC Category	Available Date	Active Date	Server	Client	Notes*
TP/OPH/BV-01-I	Push – List	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.	TSE572	OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	
TP/OPH/BV-02-I	PIN Check	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	TSE 825
TP/OPH/BV-03-I	Push vCard – accepted	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	
TP/OPH/BV-04-I	Push two vCard items – accepted	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	
TP/OPH/BV-05-I	Push vCard – rejected	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.	TSE580	OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	
TP/OPH/BV-07-I	Push vCal – accepted	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	
TP/OPH/BV-08-I	Push two vCal items – accepted	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	
TP/OPH/BV-	Push vCal –	OPP.TS/1.	B	1-Aug-05	Prod. vs	TSE580	OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	

Test Case Reference List

Object Push Profile			Previous test specification: OPP.TS/1.1.1				Updated test specification: OPP.TS/1.1.3						
Release date:		1-Aug-2006	Previous ICS: OPP.ICS/1.1.0				Updated PICS: OPP.ICS/1.1.0						
go to Top			Previously published test requirements				Updated requirements through this release						
											Test Platform for IUT in role		
TC identifier	Description	Test Spec Version	TC Category	Active Date	Test Platform	Notes	Test Spec Version	TC Category	Available Date	Active Date	Server	Client	Notes*
09-I	rejected	1.1			Prod.								
TP/OPH/BV-10-I	Push vCal - non support	OPP.TS/1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	Prod. vs Prod.	4)	TSE562
TP/OPH/BV-11-I	Push vMsg – accepted	OPP.TS/1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	
TP/OPH/BV-12-I	Push two vMsg items – accepted	OPP.TS/1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	
TP/OPH/BV-13-I	Push vMsg – rejected	OPP.TS/1.1	B	1-Aug-05	Prod. vs Prod.	TSE580	OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	
TP/OPH/BV-14-I	Push vMsg - non support	OPP.TS/1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	TSE 562
TP/OPH/BV-15-I	Push vNote – accepted	OPP.TS/1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	
TP/OPH/BV-16-I	Push two vNote items – accepted	OPP.TS/1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	
TP/OPH/BV-17-I	Push vNote – rejected	OPP.TS/1.1	B	1-Aug-05	Prod. vs Prod.	TSE580	OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	

Test Case Reference List

Object Push Profile		Previous test specification: OPP.TS/1.1.1					Updated test specification: OPP.TS/1.1.3						
Release date:	1-Aug-2006	Previous ICS: OPP.ICS/1.1.0					Updated PICS: OPP.ICS/1.1.0						
go to Top		Previously published test requirements					Updated requirements through this release						
											Test Platform for IUT in role		
TC identifier	Description	Test Spec Version	TC Category	Active Date	Test Platform	Notes	Test Spec Version	TC Category	Available Date	Active Date	Server	Client	Notes*
TP/OPH/BV-18-I	Push vNote - non support	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	4)	TSE562
TP/BCP/BV-01-I	Pull – List	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	Prod. vs Prod.	
TP/BCP/BV-02-I	Pull - non support	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	Prod. vs Prod.	TSE562
TP/BCP/BV-03-I	PIN Check	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	Prod. vs Prod.	TSE 825
TP/BCP/BV-04-I	Pull vCard – accepted	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	Prod. vs Prod.	
TP/BCP/BV-05-I	Pull vCard – rejected	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	Prod. vs Prod.	Prod. vs Prod.	
TP/BCE/BV-01-I	Exchange – List	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	Prod. vs Prod.	
TP/BCE/BV-03-I	Exchange - PIN Check	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	4)	Prod. vs Prod.	TSE 825
TP/BCE/BV-	Exchange -	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	Prod. vs Prod.	Prod. vs Prod.	

Test Case Reference List

Object Push Profile			Previous test specification: OPP.TS/1.1.1				Updated test specification: OPP.TS/1.1.3						
Release date:		1-Aug-2006	Previous ICS: OPP.ICS/1.1.0				Updated PICS: OPP.ICS/1.1.0						
go to Top			Previously published test requirements				Updated requirements through this release						
											Test Platform for IUT in role		
TC identifier	Description	Test Spec Version	TC Category	Active Date	Test Platform	Notes	Test Spec Version	TC Category	Available Date	Active Date	Server	Client	Notes*
04-I	accept-accept	1.1			Prod.								
TP/BCE/BV-05-I	Exchange - accept-reject	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	Prod. vs Prod.	Prod. vs Prod.	
TP/BCE/BV-06-I	Exchange - reject-accept	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.	2)	OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	Prod. vs Prod.	Prod. vs Prod.	
TP/BCE/BV-07-I	Exchange - reject-reject	OPP.TS/1.1.1	B	1-Aug-05	Prod. vs Prod.		OPP.TS/1.1.3	B	1-Aug-06	1-Nov-06	Prod. vs Prod.	Prod. vs Prod.	
TCMT	Test Case Mapping Table	OPP.TS/1.1.1		1-Aug-05			OPP.TS/1.1.3		1-Aug-06	1-Nov-06			
PICS	Profile Implementation Statement			1-Aug-05									

* Any technical changes in this release are indicated in the Notes column.

2) Test case updated per approved test case waiver TCWR_OPP_05_15_JLIN_Appealed_Approved

4) When qualifying an IUT that enables the specified role, the Member shall use Profile Tuning Suite 2.0, OPP-ETS v. 4.4.0.0

In certain cases, testing a compliant IUT against the validated PTS may fail since the PTS may for example not yet have included all valid alternate events or message sequences that apply to the test case purpose. The Bluetooth SIG publishes a list of IUT exemptions (based on filed PTS issues) where testing vs the validated PTS is waived. Whenever the PTS waiver applies for a particular IUT, it is the qualifying members obligation to satisfy the test case using engineering evidence with alternate means

[The list of waivers for Profile Tuning Suite 2.0, OPP-ETS v. 4.4.0.0 is found on http://programs.bluetooth.org/pts/exemptions/index.cfm?id=28&release_id=2](http://programs.bluetooth.org/pts/exemptions/index.cfm?id=28&release_id=2)
[For status updates on the OPP test coverage within the Profile Tuning Suite, please visit: http://programs.bluetooth.org/pts/coverage/index.cfm?layer_id=36](http://programs.bluetooth.org/pts/coverage/index.cfm?layer_id=36)

Appendix C

Instructions to Participants

Results Sheet



APLAC Bluetooth Application Interlaboratory Comparison APT054

Instructions to Participating Laboratories

To ensure that results from this program can be analyzed properly, participants are asked to adhere carefully to the following instructions.

1.Sample

This package contains two Bluetooth samples and two compact disks of the documents. The lab. Code is identified on the results sheet.

The Bluetooth test sample ID number is Blue Expert Bluetooth USB Dongle BED002

On receipt, unpack the artifacts and inspect them for any defects.

Contact your accreditation body if there is damage.

2.Test items and Test methods

Test items : Commercial product (Dongle v1.2) with user manual or working instructions to describe how to operate/implement the Bluetooth functionality.

Test to be conducted : Testing cases (refer to the TCRL for related profile/protocol) and parameters which depends upon the ICS pro forma published by the SIG.

Test method : It' s recommended follow the testing procedure or tester' s release note or user guide to carry out testing or method for which accreditation is held.

3.Documents to be submitted (Result sheet)

Within one week of the completion of the tests, participating laboratories are required to fax to their accreditation body and TAF:

No other documents are required. Laboratories should make a copy of all documents and worksheets for their own records and keep these on file for an adequate period of time (at least until a final report has been issued).

A final report will be issued at the end of the program with each laboratory only identified by a confidential code number.

4. Confidentially

For this program your laboratory has been allocated the code number shown on the results sheet. All reference to your laboratory in reports associated with this program will be with this code number, thus ensuring confidentiality of results.

5. General Information

For general queries, please contact your accreditation body.

Additional information may be obtained from:

Mr. Hung-Chang Huang

Deputy Director of Laboratory Accreditation

No.30, Ta-Hsieh Road, Hsin-Chu 300, Taiwan

TEL: +886-3-5714848 ext.208

FAX: +886-3-5726308

E-mail: hchuang@taftw.org.tw

Ms. Jean Yang

Accreditation Service Officer

No.30, Ta-Hsieh Road, Hsin-Chu 300, Taiwan

TEL: +886-3-5714848 ext.224

E-mail: jeanyang@taftw.org.tw

FAX: +886-3-5726308

Results Sheet

LAB. Code Number

Please complete this results sheet and return it to your national accreditation body and TAF.

Sample No.: Dongle 1

BT Address: 0011B10971C2

Test Lab:

Test Platform: CETECOM BITE V1.3.0

Standard(s): Bluetooth RF Test Specification Version 1.2, revision 20.B.353/1.2.3

Test Temperature: 23°C

Test Voltage: 5V

Test Case	Tx frequency	Rx frequency	Test Value			Test Result
Output Power	2402MHz		Peak		dBm	
			Average		dBm	
	2441MHz		Peak		dBm	
			Average		dBm	
	2480MHz		Peak		dBm	
			Average		dBm	
Power Density	2441MHz		Peak		dBm	
			Density		dBm	
Frequency Range	2402MHz		freq. Low		MHz	
	2480MHz		freq. High		MHz	
20dB Band Width	2402MHz		Bandwidth		KHz	
	2441MHz		Bandwidth		KHz	
	2480MHz		Bandwidth		KHz	
Sensitivity single slot packets	2480MHz	2402MHz	BER		%	
	2402MHz	2441MHz	BER		%	
	2402MHz	2480MHz	BER		%	
Sensitivity multi slot packets	2480MHz	2402MHz	BER		%	
	2402MHz	2441MHz	BER		%	
	2402MHz	2480MHz	BER		%	
Intermodulation Performance	2402MHz	2402MHz	BER		%	
	2441MHz	2441MHz	BER		%	
	2480MHz	2480MHz	BER		%	
Maximun Input Level	2402MHz	2402MHz	BER		%	
	2441MHz	2441MHz	BER		%	
	2480MHz	2480MHz	BER		%	

APLAC Bluetooth Application Interlaboratory Comparison APT054



Results Sheet

LAB. Code Number

Sample No.: Dongle 1

BT Address: 0011B10971C5

Test Lab:

Test Platform: Bluetooth Profile Tuning Suite V2.0

Test Reference: Bluetooth Profile Tuning Suite V2.0

Standard(s): Bluetooth Object Push Profile Test Specification OPP.TS/1.1.3

Test Temperature: 24°C

Test Case	Client	Observation	Server	Observation
OPH_BV01				
OPH_BV02				
OPH_BV03				
OPH_BV04				
OPH_BV05				
OPH_BV07				
OPH_BV08				
OPH_BV09				
OPH_BV10				
OPH_BV11				
OPH_BV12				
OPH_BV13				
OPH_BV14				
OPH_BV15				
OPH_BV16				
OPH_BV17				
OPH_BV18				
BCP_BV01				
BCP_BV02				
BCP_BV03				
BCP_BV04				
BCP_BV05				
BCE_BV01				
BCE_BV03				
BCE_BV04				
BCE_BV05				
BCE_BV06				
BCE_BV07				

Measurement Uncertainty Budget

Items	Factors of Uncertainty x_i	Type A / Type B	Probability Distribution	Standard Uncertainty $u(x_i)$	Coverage Factor k
Combined Standard Uncertainty $u_c(Y)$:					
Expanded Uncertainty (95 % confidence interval) $U_{exp} = k \cdot u_c(Y)$:					

Note : Please participating laboratories provide test original data (curve diagrams) e-mail or fax to TAF.

Signature : _____ **Date :** _____

INSTRUCTIONS – MEASUREMENT UNCERTAINTY

Part (1) Background information & justification for this change

ISO/IEC 17025 requires that, except under specified conditions, the uncertainty of measurement associated with the results of tests and measurements must be estimated.

What is uncertainty of measurement?

Uncertainty of measurement is defined as a “parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand” (the measurand is the particular quantity subject to measurement).

The result of a test or measurement is our best estimate of the true value of the measurand. The result is imperfect. The true value of the measurand is contained within a range of values about the measurement result and the “uncertainty of measurement” is an estimate of the magnitude of that range expressed at a given level of confidence (confidence interval). Uncertainty of measurement is usually given as a 95% confidence interval and would normally be expressed in the appropriate SI units (ie. mm, °C, g/l, MPa etc).

For example, the result of a measurement might be 5.1 mg/l with an uncertainty of ± 0.2 mg/l at a 95% level of confidence. This means that there is an estimated 95% probability that the true value is in the range 4.9 mg/l to 5.3 mg/l. The 95% probability means that there is an estimated one in twenty chance that the true value is outside that range.

Uncertainty of measurement may also be expressed as a percentage where appropriate.

To assist laboratories to comply with the requirements of ISO/IEC 17025 for estimating uncertainty and to promote a uniform methodology in its estimation, information packages for APLAC PT testing program participants now include general guidance relating to estimating uncertainties for the specific testing involved, and final program reports will now include relevant worked examples. All program participants are required to report their estimates of uncertainty to their accreditation bodies along with their results unless the Technical Adviser to the program specifically waives any requirement to estimate uncertainties. The estimates of uncertainty provided by participants will be incorporated into the final program reports enabling direct comparison of uncertainty estimates across the program participants. The uncertainty estimates will not be used in the evaluation of the results on the primary samples.

How is uncertainty of measurement to be estimated?

APLAC expects that program participants’ uncertainties of measurement would be estimated in accordance with the requirements of the respective member accreditation bodies. There are different approaches and methodologies available. Worked examples provided in APLAC PT program reports will generally be based on ISO GUM but will recognise other methodologies in accordance with 5.4.6.3 NOTE 3 in ISO 17025.

Estimates of uncertainty of measurement provided by program participants are required to be given at the 95% level of confidence.

ISO GUM methodology

An estimate of uncertainty of measurement would usually be based on the combination of a number of influencing parameters (components of uncertainty) such as errors in reference values, instrument errors, repeatability, thermal effects, weighing errors, inhomogeneity etc. ISO GUM methodology requires that the influence of each component of uncertainty on the measurement result be quantified and expressed numerically as a standard deviation. These values are then combined according to the rules of the propagation of uncertainty to produce a combined standard deviation (combined standard uncertainty) and the combined standard uncertainty is multiplied by a coverage factor to produce an expanded uncertainty at the required level of confidence. Detailed descriptions and information on the implementation of this methodology have been published by ISO², UKAS³ and Eurachem/CITAC⁴ and made available over the internet⁷.

Uncertainty of measurement is best estimated within the individual laboratory environment. All factors which will have a significant influence on the test or measurement result must be included in the estimation process. There must be suitable programs utilising reference standards, instruments and materials to ensure on-going and adequate quality control and repeatability and reproducibility of methods and equipment over time. In many instances, it will be possible to utilise quality control data in assessing uncertainty components such as precision. Where these data are not available, it may be necessary to carry out precision studies or to rely on published information about the method or portions of it until the laboratory can obtain its own estimates.

APLAC is aware of the general need for better estimates of uncertainty, and estimates that are obtained under similar conditions in all laboratories. PT programs are useful mechanisms for spreading awareness of uncertainty of measurement and the effects of different ways of estimating it. We anticipate that the information made available through PT programs will help focus discussions on uncertainty of measurement.

APLAC Technical Committees will interpret the information and report on current practices. They will also make recommendations for improving the collection of uncertainty data, the estimation of uncertainties and incorporating data and information on uncertainty of measurement into PT program reports. Therefore we anticipate an evolution in the mechanisms for collecting and reporting uncertainty data and associated information over the next few years.

Participation in APLAC PT programs should assist laboratories to develop appropriate estimates of uncertainty, help to guide accreditation bodies to adopting common and consistent approaches leading to enhanced understanding and international comparability of measurements among the member nations.

APLAC will consider the use of estimates of uncertainty of measurement in the evaluation of its PT testing program results after it is satisfied that participating laboratories are estimating uncertainties of measurement in an appropriate and consistent manner.

Here are a few important terms:

Standard uncertainty ($u(x_i)$) is an input component of uncertainty x_i expressed as a standard deviation. It should be expressed in the units of the influencing parameter, but may be expressed as a percentage where convenient.

Type A evaluation estimates of standard uncertainty are evaluated by applying statistical techniques to a series of repeatability or curve fitting data. For example, a standard uncertainty estimated from the repeatability of measurements on replicate samples is a Type A evaluation.

Type B evaluation estimates of standard uncertainty are based on assumed probability distributions, experience, laboratory records, or other information. For example, a standard uncertainty estimated using data provided on a calibration certificate is a Type B evaluation.

Sensitivity coefficient (c_i) is the mathematical relationship between an influencing parameter and its effect on the result of a measurement. In many instances it is unity. That is, there is a one to one relationship between the value of the influence and its effect on the measurement result. For example, when weighing a sample of material, any uncertainty due to errors in the balance reading will have a one to one effect on the measurement result. On the other hand, if we are considering the influence of temperature on the length of a metal bar then the sensitivity coefficient is equal to the coefficient of linear thermal expansion for the metal bar multiplied by the length of the bar. It is important to note that a sensitivity coefficient has units. It is also important to note that the calculation methodology used by Eurachem/CITAC4 incorporates sensitivity coefficients in a manner that does not require their specific evaluation.

Combined standard uncertainty ($uc(y)$) is the final estimate of uncertainty for the test or measurement result y expressed as a standard deviation. It is calculated by multiplying the standard uncertainty $u(x_i)$ for each input component (x_i) with its respective sensitivity coefficient c_i to produce $c_i u(x_i)$ and then combining those values by taking the square root of the sum of their squares. Note that the products $c_i u(x_i)$ must each be expressed in the same units as those required for expressing the combined estimate $uc(y)$.

Expanded uncertainty (U) is the final result of our estimate of uncertainty expressed as a confidence interval. It is calculated by multiplying the combined standard uncertainty by a coverage factor to produce the desired level of confidence (usually 95%).

Coverage factor (k) is a multiplier used to expand the combined standard uncertainty $uc(y)$ to an interval that is estimated to contain the true value of the measurand at a given level of confidence ($U = k \cdot uc(y)$). The coverage factor then represents the number of standard deviations in the expanded uncertainty and is determined according to the Student-t distribution. A coverage factor of 2 is commonly used to approximate the expanded uncertainty to the 95% confidence level.

References

1. ISO-IEC 17025:1999. General requirements for the competence of testing and calibration laboratories. ISO, Geneva (1999)
2. Guide to the Expression of Uncertainty in Measurement. ISO, Geneva (1993)
3. UKAS LAB 12: The Expression of Uncertainty in Testing. UKAS, London (2000)
4. Eurachem / CITAC Guide QUAM: 2000.P1. Quantifying Uncertainty in Analytical Measurement, 2nd Edition (2000)
5. ISO/DTS 21748:2002 Guide for the use of repeatability, reproducibility, and trueness estimates in measurement uncertainty estimation.
6. APLAC TC 005, Interpretation and Guidance on the Estimation of Uncertainty of Measurement in Testing
7. www.A2LA.org / (for A2LA policies, links to guidance documents, including the UKAS Guide, and the Eurachem/CITAC Guide, at no cost), www.measurementuncertainty.org / (Eurachem/CITAC Guide), www.fasor.com/iso25 / (general information, links, and discussion of ISO-IEC 17025)