LMX9838 Radio Performance Tests

This test data is for TI Designs TIDA-00186

1 Horizontal and vertical antenna emissions in transmit mode

1.1 Description

The purpose of the test is to detect the radiated emissions in the horizontal and vertical dimension from the transmitting DUT forming the antenna lob.

1.2 Preparation

SimplyBlueCommander application has been used to set up the DUTs in correct mode. The following commands have been used.

Command name	Hexadecimal bytes
Enter test mode	02 52 24 01 00 77 01 03
Constant transmit mode, channel 0, PRBS9, DH1, whitening off	02 52 4B 0E 00 AB 02 00 00 02 55 55 55 55 55 55 55 55 AA 00 03

1.3 Test setup

The turntable, on which the DUT is placed, is turned 5˚ before each measurement giving an outline of the transmitted power. The frequency range between 2.4GHz and 2.5GHz is analyzed in steps of 600kHz. The DUTs are setup to transmit constantly on channel 0 with a frequency of 2.402GHz. Four measurements are made with each PCB:

- PCB placed horizontally
- PCB placed vertically
- Antenna turned horizontally
- Antenna turned vertically

The battery voltage was monitored during the tests and never fell below 5.2V which guaranties that the same power could be supplied to the module working at 3.3V from the SEPIC converter of the board.

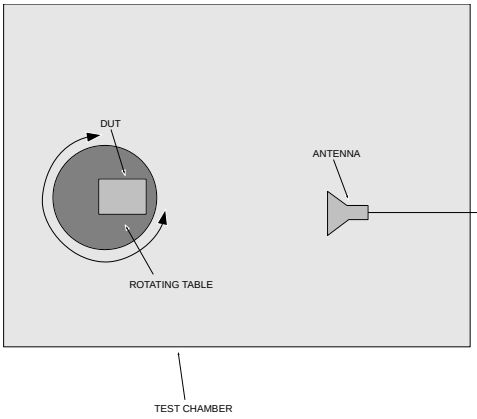


Figure 1. top view

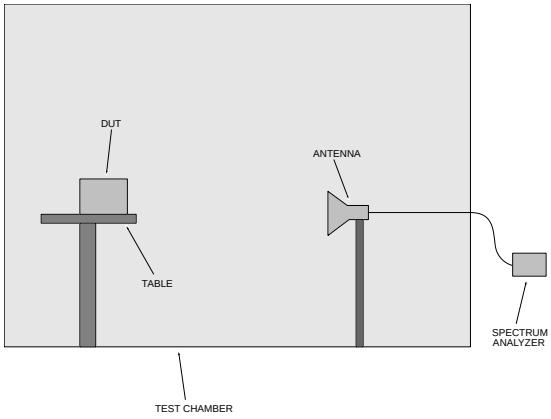


Figure 2. front view

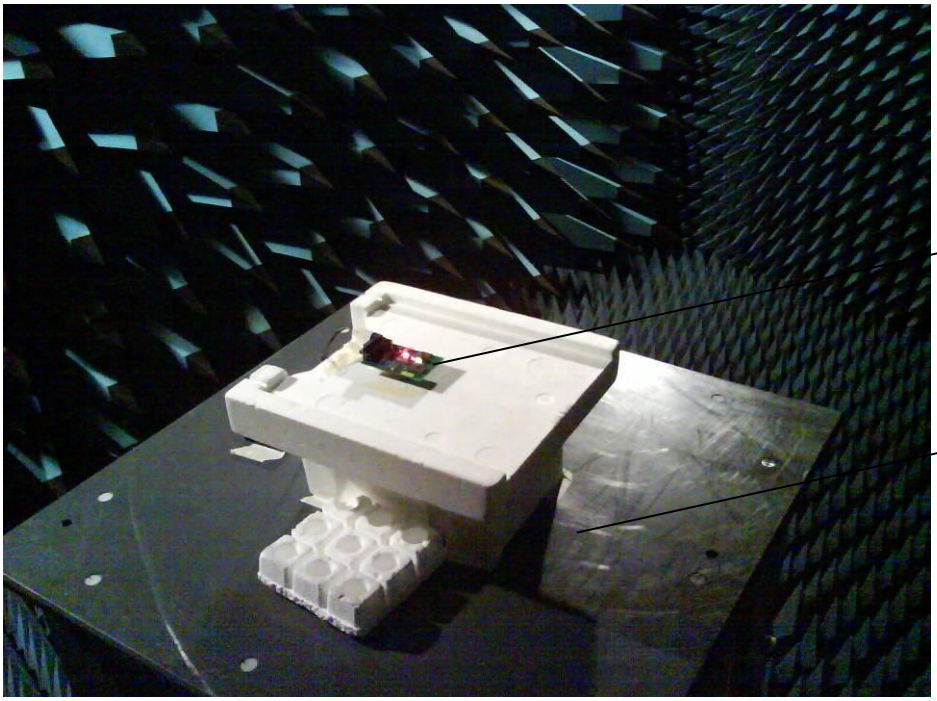


Figure 3.

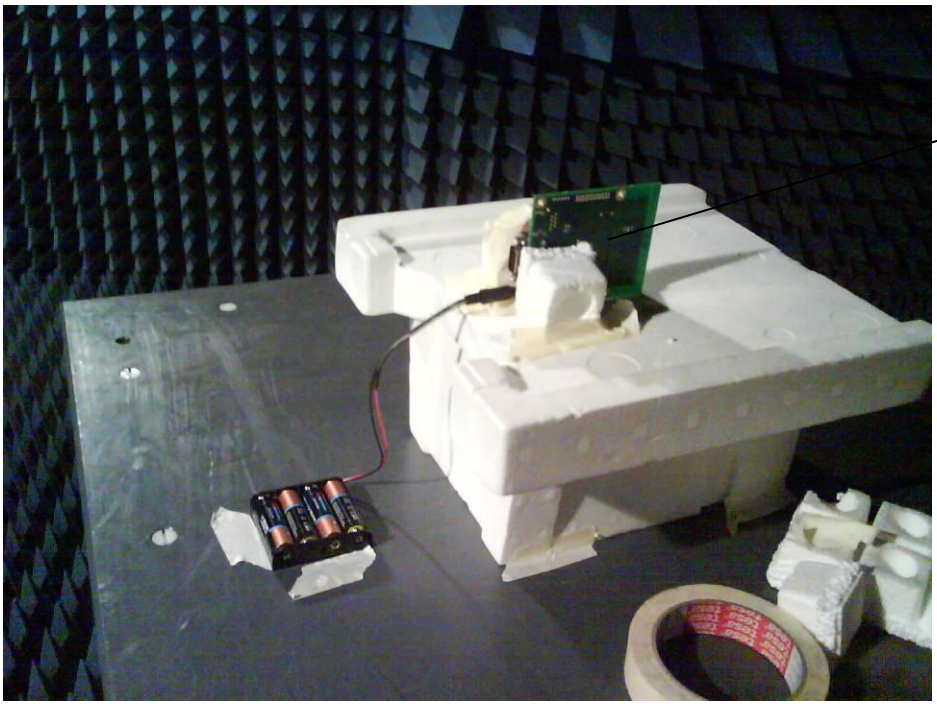


Figure 4.

1.4 Test equipment

The following test and measurement equipment was utilized for the test.

TEST EQUIPMENT LIST			
Description	**Manufacturer**	**Model**	**Serial number**
Antenna	EMCO	3115 AG	-
Spectrum analyzer	ROHDE&SCHWARZ	FSIQ40 20Hz-40GHz	832682/005
Software	ROHDE&SCHWARZ	ES-K1 v.1.70	-

1.5 Results

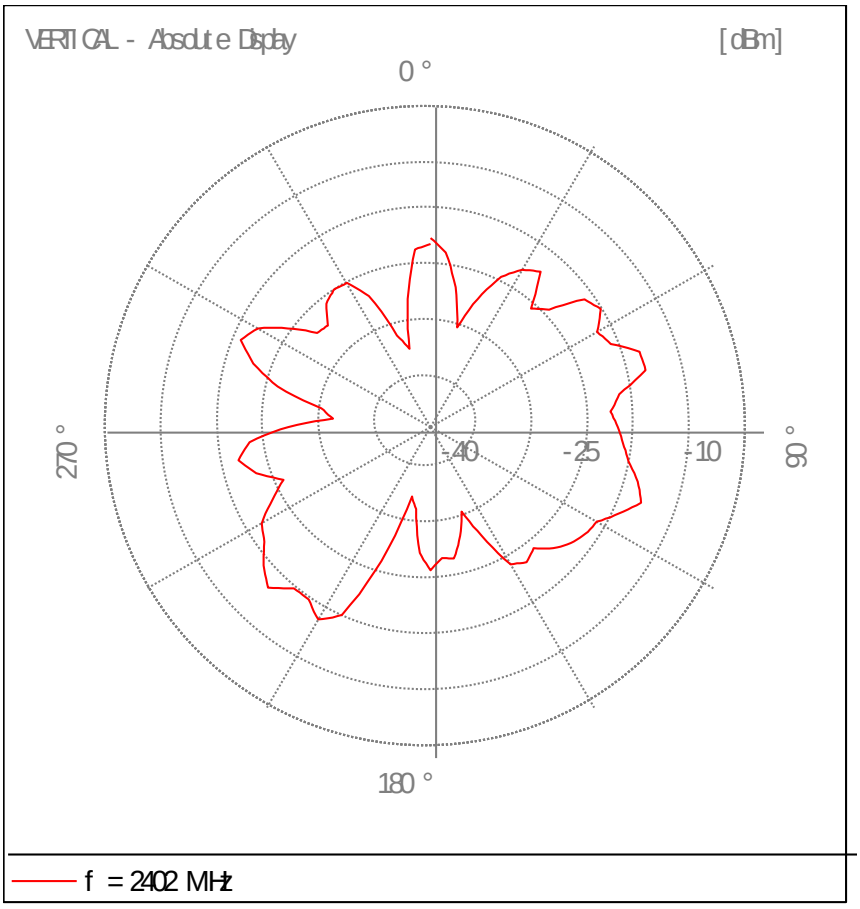


Figure 5.

PCB type	Version	Serial nr.	PCB alignment	Antenna alignment
9838 only	6	1	Horizontal	Vertical

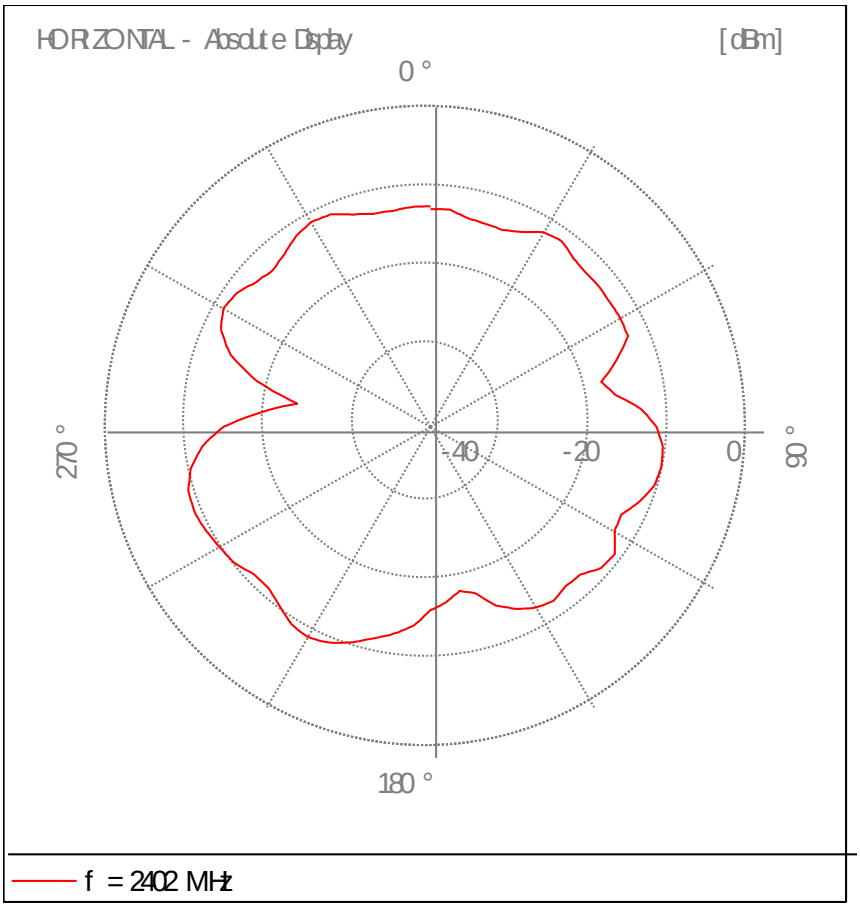


Figure 6.

PCB type	Version	Serial nr.	PCB alignment	Antenna alignment
9838 only	6	1	Horizontal	Horizontal

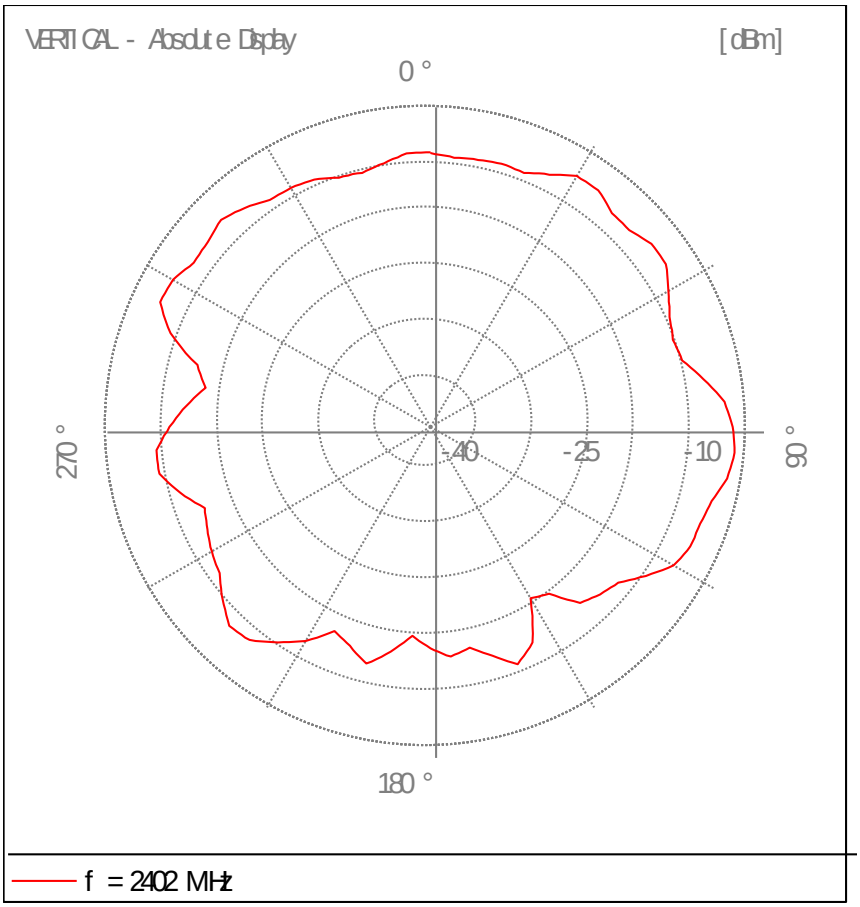


Figure 7.

PCB type	Version	Serial nr.	PCB alignment	Antenna alignment
9838 only	6	1	Vertical	Vertical

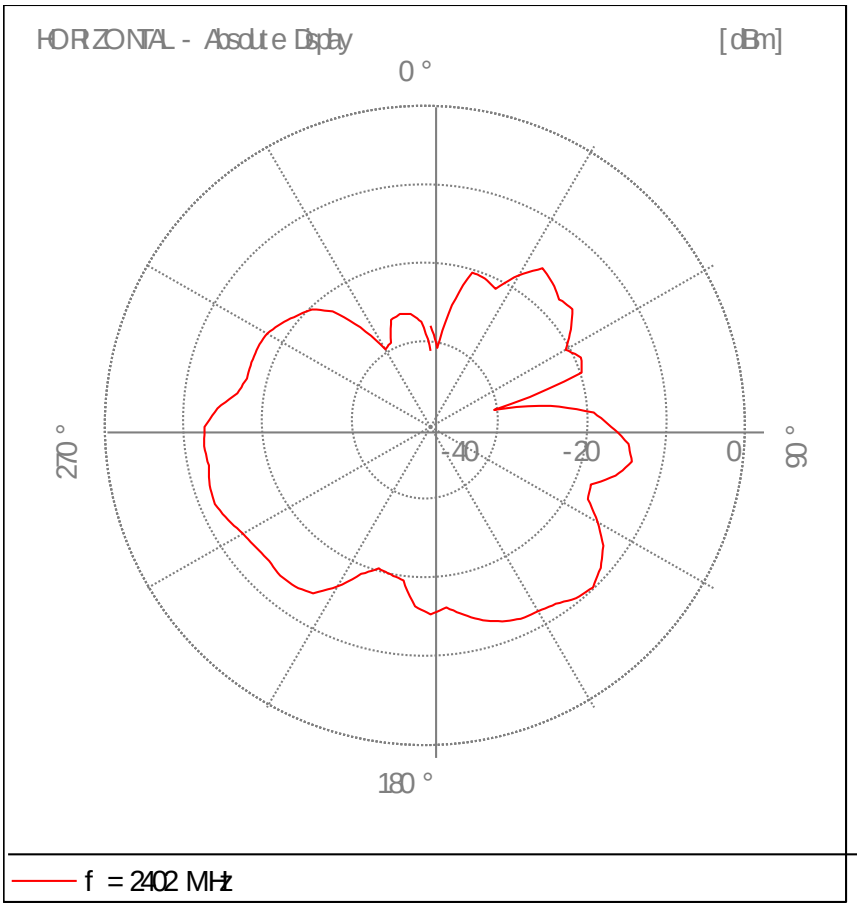


Figure 8.

PCB type	Version	Serial nr.	PCB alignment	Antenna alignment
9838 only	6	1	Vertical	Horizontal

2 Remote name inquiries with file transfer tests in various distances and environments

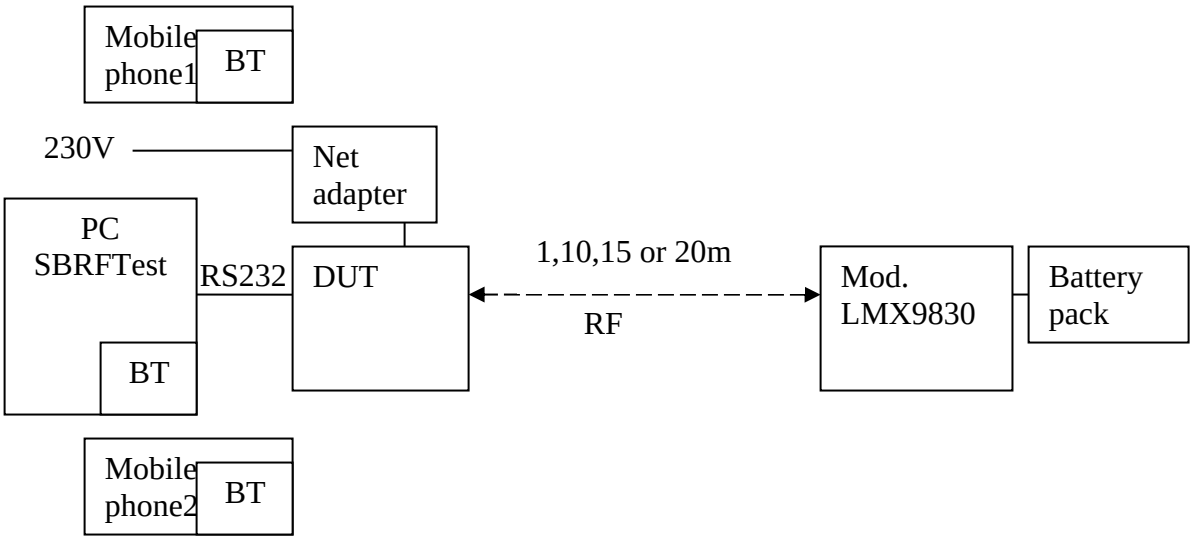
2.1 Description

The purpose of the test is to perform multiple inquiries and name requests on Bluetooth devices in range to determine the hit rate. After that a file transfer is made in order to measure the speed of the data transfer between the DUT and a test device. The tests are done with various distances between the devices.

2.2 Preparation

SBRFTest application has been used to run the DUTs. The application generates an excel file with the results. The DUT is powered by a net adapter while the test device, a LMX9830 evaluation board modified for creating a loop for the sent data, is powered by a battery pack and moved to different distances. For the outdoors test battery packs for both devices were used.

2.3 Test setup



The testing is setup indoors with line of sight between the DUT and the LMX9830 test device. The outdoors tests are performed in an open field with the mobile phones placed on the box of the DUT. The DUTs and the test device are fixed to boxes in order to perform the test under as similar conditions as possible for each DUT.

2.3.1 Outdoors test setup:

Sunny weather, -2˚C

Figure 9. modified LMX9830 test device

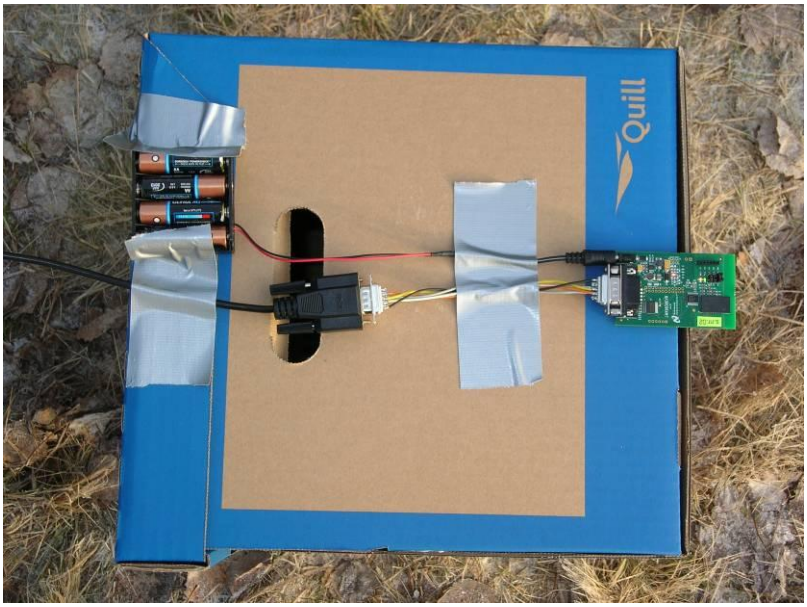


Figure 10. DUT

Figure 11. Outdoors setup

2.3.2 Indoors setup

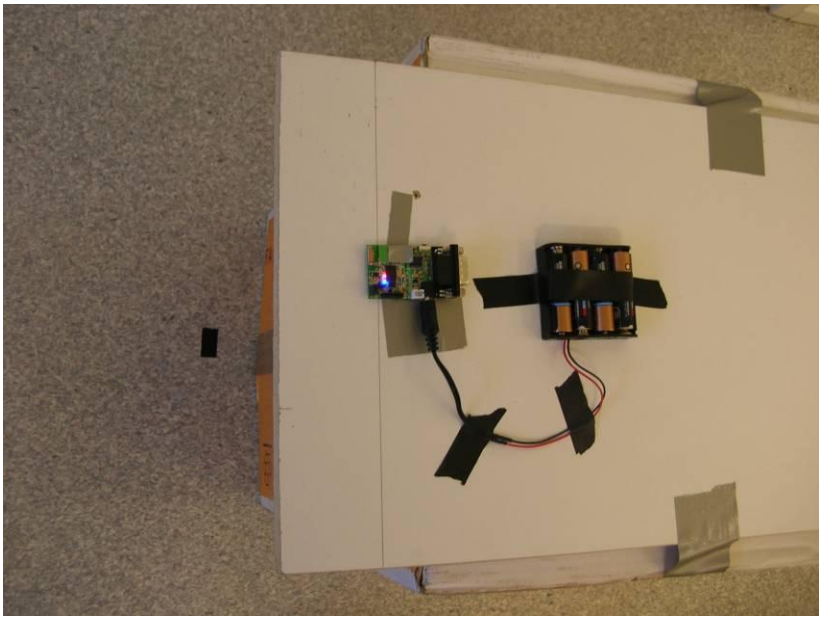


Figure 12. modified LMX9830 eval. PCB

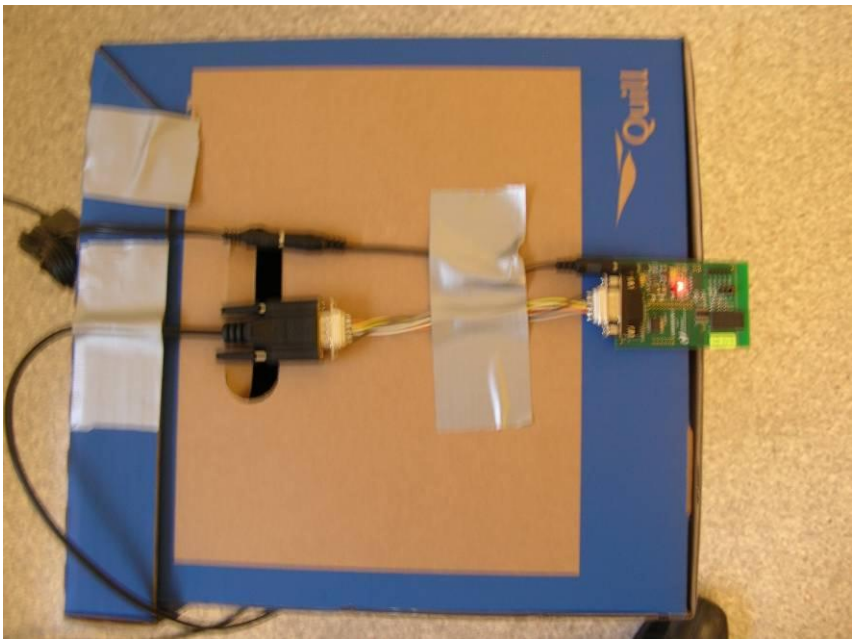


Figure 13. DUT

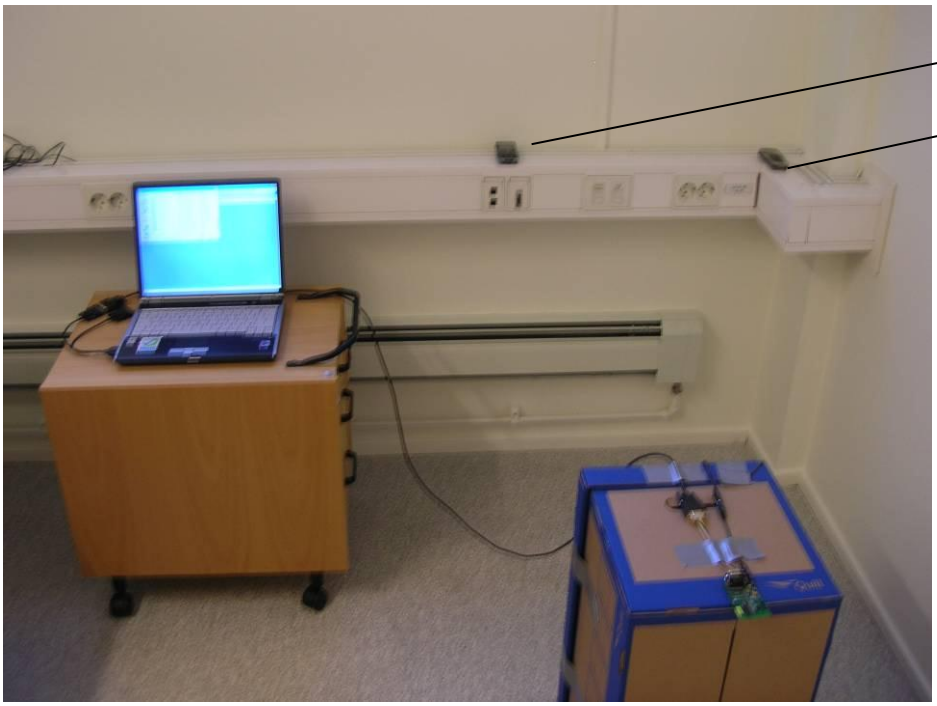


Figure 14. Test setup

2.4 Test equipment

The following test and measurement equipment was utilized for the tests.

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**BT address**	**Device name**
Mod. LMX9830	National	LMX9830	1000e816e6ad	Dev1 Ser54
Serial adapter PC card	Quatech	DSP-100	-	-
PC laptop	Fujitsu Siemens	S	000b5da2fc27	FSC-MANKAN
Mobile phone 1	Nokia	6230	001262d111f9	Christians mobile
Mobile phone 2	Sony Ericsson	K750i	000fde96e65b	K750i-Mankan
Car radio		KD-BT1	00121cf0d55e	KD-BT1

2.5 Results

2.5.1 Indoor tests

A connection was successfully established up to 15m indoors.

LMX9838EVB v.1 full, s.nr.3

LocalBDAddr	LocalName	Num of Inquiries	Range	DevAddr	DevName	Inquiries	NameReq	FTPMax	FTPAvg
'1000e86c4e2e	Serial Port Device	10	1	'000b5da2fc27	FSC-MANKAN	10			
'1000e86c4e2e	Serial Port Device	10	1	'001262d111f9		0			
'1000e86c4e2e	Serial Port Device	10	1	'000fde96e65b	K750i-Mankan	0			
'1000e86c4e2e	Serial Port Device	10	1	'1000e816e6ad	Dev1 Ser54	0			
'1000e86c4e2e	Serial Port Device	10	1	'000b5da2fc27	FSC-MANKAN		10		
'1000e86c4e2e	Serial Port Device	10	1	'001262d111f9			10		
'1000e86c4e2e	Serial Port Device	10	1	'000fde96e65b	K750i-Mankan		8		
'1000e86c4e2e	Serial Port Device	10	1	'1000e816e6ad	Dev1 Ser54		10		
'1000e86c4e2e	Serial Port Device	10	1	'1000e816e6ad	Dev1 Ser54			86.960846	84.367844
'1000e86c4e2e	Serial Port Device	10	1	'1000e816e6ad	Dev1 Ser54			86.960846	84.262901
'1000e86c4e2e	Serial Port Device	10	1	'1000e816e6ad	Dev1 Ser54			87.449074	84.633057
'1000e86c4e2e	Serial Port Device	10	10	'000b5da2fc27	FSC-MANKAN	10			
'1000e86c4e2e	Serial Port Device	10	10	'000fde96e65b	K750i-Mankan	0			
'1000e86c4e2e	Serial Port Device	10	10	'001262d111f9	Christians mobil	0			
'1000e86c4e2e	Serial Port Device	10	10	'1000e816e6ad	Dev1 Ser54	0			
'1000e86c4e2e	Serial Port Device	10	10	'000b5da2fc27	FSC-MANKAN		10		
'1000e86c4e2e	Serial Port Device	10	10	'000fde96e65b	K750i-Mankan		10		
'1000e86c4e2e	Serial Port Device	10	10	'001262d111f9	Christians mobile		10		
'1000e86c4e2e	Serial Port Device	10	10	'1000e816e6ad	Dev1 Ser54		6		
'1000e86c4e2e	Serial Port Device	10	10	'1000e816e6ad	Dev1 Ser54			31.802822	30.120914
'1000e86c4e2e	Serial Port Device	10	10	'1000e816e6ad	Dev1 Ser54			32.296532	30.614923
'1000e86c4e2e	Serial Port Device	10	10	'1000e816e6ad	Dev1 Ser54			31.305902	29.141573
'1000e86c4e2e	Serial Port Device	10	15	'001262d111f9	Christians mobil	10			
'1000e86c4e2e	Serial Port Device	10	15	'000b5da2fc27	FSC-MANKAN	0			
'1000e86c4e2e	Serial Port Device	10	15	'000fde96e65b	K750i-Mankan	0			
'1000e86c4e2e	Serial Port Device	10	15	'1000e816e6ad		0			
'1000e86c4e2e	Serial Port Device	10	15	'001262d111f9	Christians mobile		9		
'1000e86c4e2e	Serial Port Device	10	15	'000b5da2fc27	FSC-MANKAN		10		
'1000e86c4e2e	Serial Port Device	10	15	'000fde96e65b	K750i-Mankan		10		
'1000e86c4e2e	Serial Port Device	10	15	'1000e816e6ad			1		
'1000e86c4e2e	Serial Port Device	10	15	'1000e816e6ad				7.949915	5.064060

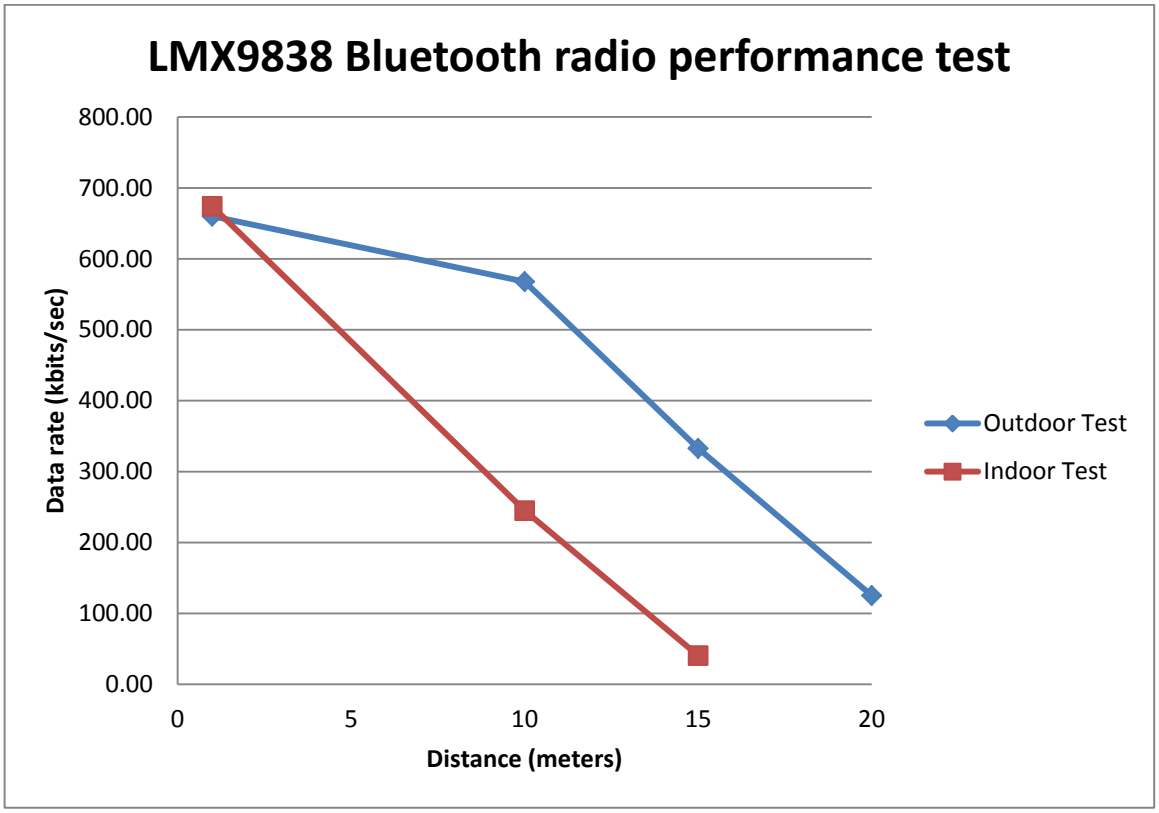
2.5.2 Outdoor tests

A connection was successfully established up to 20m outdoors.

LMX9838EVB v.1 full s.nr.3

LocalBDAddr	LocalName	Num of Inquiries	Range	DevAddr	DevName	Inquiries	NameReq	FTPMax	FTPAvg
'1000e86c4e2e	Serial Port Device	10	1	'001262d111f9	Christians mobile	10			
'1000e86c4e2e	Serial Port Device	10	1	'000b5da2fc27	FSC-MANKAN	0			
'1000e86c4e2e	Serial Port Device	10	1	'000fde96e65b	K750i-Mankan	0			
'1000e86c4e2e	Serial Port Device	10	1	'00121cf0d55e		0			
'1000e86c4e2e	Serial Port Device	10	1	'1000e816e6ad	Dev1 Ser54	0			
'1000e86c4e2e	Serial Port Device	10	1	'001262d111f9	Christians mobile		10		
'1000e86c4e2e	Serial Port Device	10	1	'000b5da2fc27	FSC-MANKAN		10		
'1000e86c4e2e	Serial Port Device	10	1	'000fde96e65b	K750i-Mankan		10		
'1000e86c4e2e	Serial Port Device	10	1	'00121cf0d55e			0		
'1000e86c4e2e	Serial Port Device	10	1	'1000e816e6ad	Dev1 Ser54		10		
'1000e86c4e2e	Serial Port Device	10	1	'1000e816e6ad	Dev1 Ser54			85.967003	82.453178
'1000e86c4e2e	Serial Port Device	10	1	'1000e816e6ad	Dev1 Ser54			86.960846	82.505013
'1000e86c4e2e	Serial Port Device	10	1	'1000e816e6ad	Dev1 Ser54			85.967003	82.101807
'1000e86c4e2e	Serial Port Device	10	10	'000fde96e65b	K750i-Mankan	10			
'1000e86c4e2e	Serial Port Device	10	10	'001262d111f9	Christians mobile	0			
'1000e86c4e2e	Serial Port Device	10	10	'000b5da2fc27	FSC-MANKAN	0			
'1000e86c4e2e	Serial Port Device	10	10	'1000e816e6ad	Dev1 Ser54	0			
'1000e86c4e2e	Serial Port Device	10	10	'00121cf0d55e		0			
'1000e86c4e2e	Serial Port Device	10	10	'000fde96e65b	K750i-Mankan		10		
'1000e86c4e2e	Serial Port Device	10	10	'001262d111f9	Christians mobile		10		
'1000e86c4e2e	Serial Port Device	10	10	'000b5da2fc27	FSC-MANKAN		10		
'1000e86c4e2e	Serial Port Device	10	10	'1000e816e6ad	Dev1 Ser54		10		
'1000e86c4e2e	Serial Port Device	10	10	'00121cf0d55e			0		
'1000e86c4e2e	Serial Port Device	10	10	'1000e816e6ad	Dev1 Ser54			72.542976	71.758072
'1000e86c4e2e	Serial Port Device	10	10	'1000e816e6ad	Dev1 Ser54			73.039848	70.962730
'1000e86c4e2e	Serial Port Device	10	10	'1000e816e6ad	Dev1 Ser54			72.550186	70.847809
'1000e86c4e2e	Serial Port Device	10	15	'000b5da2fc27	FSC-MANKAN	10			
'1000e86c4e2e	Serial Port Device	10	15	'000fde96e65b	K750i-Mankan	0			
'1000e86c4e2e	Serial Port Device	10	15	'001262d111f9	Christians mobile	0			
'1000e86c4e2e	Serial Port Device	10	15	'1000e816e6ad	Dev1 Ser54	0			
'1000e86c4e2e	Serial Port Device	10	15	'00121cf0d55e		0			
'1000e86c4e2e	Serial Port Device	10	15	'000b5da2fc27	FSC-MANKAN		8		
'1000e86c4e2e	Serial Port Device	10	15	'000fde96e65b	K750i-Mankan		5		
'1000e86c4e2e	Serial Port Device	10	15	'001262d111f9	Christians mobile		9		
'1000e86c4e2e	Serial Port Device	10	15	'1000e816e6ad	Dev1 Ser54		10		
'1000e86c4e2e	Serial Port Device	10	15	'00121cf0d55e			2		
'1000e86c4e2e	Serial Port Device	10	15	'1000e816e6ad	Dev1 Ser54			42.436344	42.052986
'1000e86c4e2e	Serial Port Device	10	15	'1000e816e6ad	Dev1 Ser54			42.735043	41.597340
'1000e86c4e2e	Serial Port Device	10	15	'1000e816e6ad	Dev1 Ser54			42.233925	40.615814
1000e86c4e2e	Serial Port Device	10	20	'001262d111f9	Christians mobile	9			
'1000e86c4e2e	Serial Port Device	10	20	'1000e816e6ad		8			
'1000e86c4e2e	Serial Port Device	10	20	'000b5da2fc27	FSC-MANKAN	0			
'1000e86c4e2e	Serial Port Device	10	20	'000fde96e65b	K750i-Mankan	0			
'1000e86c4e2e	Serial Port Device	10	20	'00121cf0d55e	KD-BT1	0			
'1000e86c4e2e	Serial Port Device	10	20	'001262d111f9	Christians mobile		10		
'1000e86c4e2e	Serial Port Device	10	20	'1000e816e6ad			5		
'1000e86c4e2e	Serial Port Device	10	20	'000b5da2fc27	FSC-MANKAN		10		
'1000e86c4e2e	Serial Port Device	10	20	'000fde96e65b	K750i-Mankan		10		
'1000e86c4e2e	Serial Port Device	10	20	'00121cf0d55e	KD-BT1		1		
'1000e86c4e2e	Serial Port Device	10	20	'1000e816e6ad				17.887310	14.818055
'1000e86c4e2e	Serial Port Device	10	20	'1000e816e6ad				18.384180	15.647936
'1000e86c4e2e	Serial Port Device	10	20	'1000e816e6ad				19.379845	16.598692

2.6 Tests graphs



2.7 Summary

Achieving a successful test indoors was more dependent of the excact placement of the two devices in relation to each other which was probably due to reflected emissions from walls and humans. Successful connections from distances longer than 10m were not stable.

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