

# OFFICIAL TEST REPORT RF

**Report No. E2/2016/40091****Standard :Terminal Equipment Article 9 (BLE+Zigbee)**

Test Result :	PASS
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In the configuration tested, the EUT complied with the standards specified above.

**Applicant :** Texas Instruments Incorporated  
12500 TI Boulevard, M/S 8751, Dallas, TX75243, USA

**Product Name:** BLE and 802.15.4 module

**Brand Name:** Texas Instruments Incorporated

**Model No.:** CC2650MODA

**Model Difference:** N/A

**Date of test:** May 04, 2016 ~ May 15, 2016

**Date of EUT Received:** May 04, 2016

**Test By:****Date:**

Jun. 22, 2016

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**Jerry Lu / Sr. Engineer****Prepared By:****Date:**

Jun. 22, 2016

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**Violetta Tang / Clerk****Approved By:****Date:**

Jun. 22, 2016

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**Jim Chang / Asst. Manager**

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## 1. TEST RESULT REPORT

### Texas Instruments Incorporated

Date of issue: Jun. 22, 2016

Test Laboratory:

SGS Taiwan Ltd.

Inspection result of Specified Terminal Equipment is reported as mention in the following.

#### Description

1. Model Name:	CC2650MODA
2. Serial Number:	N/A
3. Hardware Version:	N/A
4. Software Version:	N/A
5. Number of Tested Equipment:	1
6. Test Method:	Specific test method by Technical Condition or Rational test method in case of the specific test method is not set.
7. Date of Testing:	2016/06/15
8. Place of Testing:	SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Township, Taoyuan County, Taiwan 333
9. Test Result:	PASS(Refer to attachment)
10. Measurement Equipment :	Refer to Item 3

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## 2. TEST RESULTS

Environment of Test Room	
Temperature 24°C	Humidity 60%

Spec of EUT 1	Leased Line Terminal Equipment		Number of	1
Spec of EUT 2			Number of	
Spec of EUT 3			Number of	

General Conditions		Result
<b>Article 3 .Demarcation of Responsibility</b> Communication method Disconnected separately for each circuits	By front equipment Possible	
<b>Article 4.Prohibition of discrimination of leaked communications</b> Amplification Circuit	No amplification circuit	
<b>Article 5. Prevention of Causing Singing</b> Measuring method Worst value Condition	dB	Test Unnecessary
<b>Article 6. Insulation Resistance etc.</b> Utilization voltage Insulation resistance Dielectric strength Grounding strength	Self declaration and verification  Not Applicable Not Applicable Ω	Refer to AP Form K06-1. Test Unnecessary Test Unnecessary
<b>Article 7. Prevention of the occurrence of Excessive Acoustic Shock</b> Prevention circuit	Not Applicable	
<b>Article 8.Wiring Facilities, etc.</b>	Not Applicable	
<b>Article 9. Terminal facilities using Electrical waves within Terminal facilities</b> Classification of radio facilities Code length of ID code Criteria of determining that the frequency of an electric wave to be used is open The range of cabinet (Attached sheet) Construct that is difficult to open	(Second generation) Low power data communication 48 Bit  Correlation signal sensing See Block diagram Guaranteed by RF section - Please refer to the test report.	PASSED  PASSED

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<b>Article 10. Basic Functions</b> Possibility of open and close for extraordinary DC circuit	None	
<b>Article 11. Calling Functions</b> Automatic output power signal : Time of sending address signals (min. value=worst value) Automatic detect answer : Time of release line (max. value=worst value) Automatic redial function : Method / The number of times (worst value) Emergency message function	Sec  Sec  Not Applicable Not Applicable	Test Unnecessary  Test Unnecessary  Test Unnecessary
<b>Article 12. Requirements for selection signal</b> <b>Dial Pulse</b> 10PPS pulse speed 10PPS dial pulse make ratio 10PPS minimum pause 20PPS pulse speed 20PPS dial pulse make ratio 20PPS minimum pause <b>Push button dial</b> Signal Component Frequency Variation Signal output permissible range of Low group frequencies Signal output permissible range of High group frequencies Difference of powers in two group frequencies Signal-On Time Minimum Pause Cycle Time	pps % ms pps % ms  %  Attached sheet  Attached sheet dB ms ms ms	Test Unnecessary Test Unnecessary Test Unnecessary Test Unnecessary Test Unnecessary Test Unnecessary  Test Unnecessary  Test Unnecessary Test Unnecessary Test Unnecessary Test Unnecessary Test Unnecessary
<b>Article 13. Electrical Requirements for the DC Loop etc.</b> DC resistance value from 20mA to 120mA (worst value) Conditions The electrostatic capacitance when sending out address signal by dial pulse Value of release DC resistance Insulation resistance between DC loop and ground  Capacitance of the DC loop during the receiving state of the ringing signal Impedance of the DC loop during the receiving state of the ringing signal Elements and circuit that prevent the adding of DC voltage	$\Omega$  Not Applicable  $\mu F$ $\Omega$ (or more) $\Omega$ (or more)  $\mu F$  k $\Omega$  Not Applicable	Test Unnecessary   Test Unnecessary Test Unnecessary Test Unnecessary  Test Unnecessary  Test Unnecessary  Test Unnecessary

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Analog Telephone Terminals		Result
<b>Article 14 Signal Output Power</b>		
Signal output level up to 4kHz (Average)	dBm	Test Unnecessary
Signal output level up to 4kHz (Max.)	dBm	Test Unnecessary
Unwanted signal output level (4-8kHz)	dBm	Test Unnecessary
Unwanted signal output level (8-12kHz)	dBm	Test Unnecessary
Unwanted signal output level (12kHz more)	dBm	Test Unnecessary
<b>Article 15 Crosstalk Attenuation</b>		
Crosstalk attenuation between communications circuit	dB	Test Unnecessary

Mobile telephone terminals		Result
<b>Article 17 Basic Functions</b>		
Send a signal requesting call before a call is originated.		Test Unnecessary
Send a signal confirming answer before a answering is done.		Test Unnecessary
Send a signal to disconnect the channels.		Test Unnecessary
<b>Article 18 Calling Functions</b>		
Automatic detect answer :	Sec	Test Unnecessary
Time of release line (max. value=worst value)		
Automatic redial function :	time	Test Unnecessary
The number of times (worst value)		
Emergency message function	Not Applicable	Test Unnecessary
<b>Article 19 Transmission Timing</b>		
EUT must have transmission function which is applicable under Notification	Not Applicable	
Transmission timing	μs	Test Unnecessary
Deviation of standard transmission timing	symbol	Test Unnecessary
<b>Article 20 Random Access Control</b>		
EUT must have random access control function which is applicable under Notification	Not Applicable	Test Unnecessary

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Mobile telephone terminals		Result
<b>Article 21 Time Alignment Control</b> EUT must have time alignment control function which is applicable under Notification	Not Applicable	Test Unnecessary
<b>Article 22 Location Registration Control</b> Signal which requests registration of the location information Signal which confirms registration of the location information		Test Unnecessary Test Unnecessary
<b>Article 23 Function for complying with channels switching indication</b> Signal which designates channel when it has received a signal Function to switch designated channel		Test Unnecessary Test Unnecessary
<b>Article 24 Functions for receiving level reports</b> Transmission signal at each designated time interval Transmission signal when designated condition is satisfied	Not Applicable Not Applicable	Test Unnecessary Test Unnecessary
<b>Article 25 Functions to comply with the direction to stop transmission</b> Request signal for channel disconnection Signal for its confirmation		Test Unnecessary Test Unnecessary
<b>Article 26 Function automatically to suspend transmission when the receiving level has become degraded</b> How to suspend transmission to meet this article	Not Applicable	Test Unnecessary
<b>Article 27 Function automatically to suspend transmission</b> How to suspend transmission by fault		Test Unnecessary
<b>Article 28 Function to ensure important communication</b> Request signal for call restriction		Test Unnecessary
<b>Article 29 Function to prevent change of inherent information that is part of the mobile telephone terminal information</b> It shall not be easy to remove the mobile telephone terminal inherent information memory It shall not be easy to rewrite the mobile telephone terminal inherent information. Terminal inherent information, except that directly used by the user, shall not be revealed easily.		Test Unnecessary Test Unnecessary Test Unnecessary
<b>Article 30 Signal Output Power in the case of communications with an analog telephone terminals, etc.</b> Average level Max. level	dBm dBm	Test Unnecessary Test Unnecessary
<b>Article 31 Crosstalk Attenuation</b> Crosstalk attenuation between communications circuit	dB	Test Unnecessary

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ISDN Terminals		Result
<b>Article 34-2 Basic Functions</b>		
Call set-up message when calling and connecting	Not Applicable	Test Unnecessary
Call disconnect message when terminating	Not Applicable	Test Unnecessary
<b>Article 34-3 Calling Functions</b>		
Automatic detect answer :	Sec	Test Unnecessary
Time of release line (max. value=worst value)		Test Unnecessary
Automatic redial function :	Not Applicable	Test Unnecessary
Method/The number of times (worst value)		Test Unnecessary
Emergency message function	Not Applicable	
<b>Article 34-4 Electrical Requirement, etc.</b>		
The kind of the interface	Not Applicable	Test Unnecessary
Measurement value (Attached sheet)		Test Unnecessary
Elements and circuit that prevent the adding of DC voltage		Test Unnecessary
<b>Article 34-5 Signal Output Power in the case of communications with an analog telephone terminal, etc.</b>		
Output Power	dBm	Test Unnecessary

Leased Communication Line Terminal Equipment, Digital Data Transm		Result
<b>Article 34-7 Electrical Requirement, etc.</b>		
The kind of the interface	Not Applicable	Test Unnecessary
Measurement value (Attached sheet)		Test Unnecessary
Elements and circuit that prevent the adding of DC voltage		Test Unnecessary
<b>Article 34-8 Crosstalk Attenuation</b>		
Crosstalk attenuation between communications circuit	dB	Test Unnecessary

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### 3. Measurement Equipment

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Calibration Authority	Last Calibration date	Next Calibration date
1	Notebook	Lenovo	L440	R9-007LAZ	N/A	N/A	N/A
2	BLE and 802.15.4 module (EUT 2)	Texas Instruments Incorporated	CC2650MODA	N/A	N/A	N/A	N/A
3.	Attenuator	Agilent	8495B	3308A22470	SGS	01/02/2016	01/01/2017
4.	Signal Generator	Agilent	E4438C	MY45093613	ETC	07/31/2015	07/30/2016
5.	Splitter	Agilent	11636B	N/A	SGS	01/02/2016	01/01/2017

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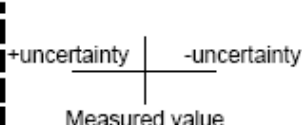
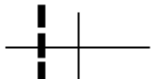
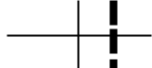

#### 4. About Uncertainty of Measured Value

\*In this test, the influence of an error or uncertainty may be done according to the following factors.

- Bias of a measurement equipment, Change by aging, Attrition, Noise
- Environment (Temperature, Humidity)
- Dispersion in a EUT (Equipment Under Test)
- Uncertainty of calibration of a measurement equipment
- Skill and capability of an inspector

Therefore, Synthetic uncertainty is calculated using "k=2" of coverage factor, and about 95% of confidence level shall be obtained.

In consideration of the above, it judged as follows.

JUDGE	Measured value and Standard limit value	
PASS	<b>Case1</b> 	*Even if it takes uncertainty into consideration, a standard limit value is fulfilled.
	<b>Case2</b> 	*Although measured value is in a standard limit value, a limit value won't be fulfilled if uncertainty is taken into consideration.
FAIL	<b>Case3</b> 	*Although measured value exceeds a standard limit value, a limit value will be fulfilled if uncertainty is taken into consideration.
	<b>Case4</b> 	*Even if it takes uncertainty into consideration, a standard limit value isn't fulfilled.

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## 5. Measurement procedure and result

Confirming Identification Code



- (a) Prepare two devices that has different ID.
- (b) Register only EUT(1) with Notebook.  
(Enable a MAC address Filtering function of Notebook and set only EUT(1) to admit a communication.)
- (c) Establish a communication between EUT(1) and Notebook by infrastructure mode.
- (d) Check a Mac address (48bits) of EUT(1) by protocol monitor and record.
- (e) Try to establish a connection between EUT(2) and Notebook, and confirm they are not established a communication.

Test result for BLE function

Mac Address	EUT(1): 0xB0B448D79680
	EUT(2): 0xB0B448D91081
Did the EUT(1) establish a communication channel?	<b>Yes</b>
Did the EUT(2) establish a communication channel?	<b>NO</b>

Test result for Zigbee function

Mac Address	EUT(1): 0x00124B0007D9ED03
	EUT(2): 0x00124B0007D81085
Did the EUT(1) establish a communication channel?	<b>Yes</b>
Did the EUT(2) establish a communication channel?	<b>NO</b>

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BLE

EUT 1 address



EUT 2 address



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## Zigbee

### EUT 1 address

Texas Instruments SmartRF Packet Sniffer IEEE 802.15.4 MAC and ZigBee 2007/PRO

File Settings Help

ZigBee 2007/PRO

Pkbr.	Time (us)	Length	Frame control field	Sequence number	Dest. PAN	Dest. Address	Source Address	LQI	FCS
RX	+2022309	26	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 1	0x0E	0x78CA	0x34E908980039768F	(destination requested)	0	ERR
RX	+124748	10	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x0F	0xFFFF	0xFFFF	Beacon request	115	OK
RX	+1979	16	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x07	0xAABB	0xAABB	Superframe specification BO SO F,CAP BLE Coord Assoc 15 15 15 0 1 1	0	0
RX	+2131036	16	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x07	0xAABB	0xAABB	Superframe specification BO SO F,CAP BLE Coord Assoc 15 15 15 0 1 1	0	0
RX	+139579	22	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 1	0x09	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK
RX	+2290615	22	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 1	0x09	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK
RX	+1036	5	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x09	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK
RX	+2291475	5	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x09	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK
RX	+1979	16	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x07	0xAABB	0xAABB	Superframe specification BO SO F,CAP BLE Coord Assoc 15 15 15 0 1 1	0	0
RX	+2131036	16	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x07	0xAABB	0xAABB	Superframe specification BO SO F,CAP BLE Coord Assoc 15 15 15 0 1 1	0	0
RX	+139579	22	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 1	0x09	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK
RX	+2290615	22	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 1	0x09	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK
RX	+1036	5	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x09	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK
RX	+2291475	5	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x09	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK
RX	+1979	16	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x07	0xAABB	0xAABB	Superframe specification BO SO F,CAP BLE Coord Assoc 15 15 15 0 1 1	0	0
RX	+2131036	16	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x07	0xAABB	0xAABB	Superframe specification BO SO F,CAP BLE Coord Assoc 15 15 15 0 1 1	0	0
RX	+139579	22	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 1	0x09	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK
RX	+2290615	22	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 1	0x09	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK
RX	+1036	5	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x09	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK
RX	+2291475	5	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x09	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK

MAC1

Capturing device: Radio Configuration | Select fields | Packet details | Address book | Display filter | Time line

Select capturing device:

CC2531 USB Dongle (USB Device 0x0424 - CC2531)

Packet count: 462 | Error count: 1 | Filter off | RF device: CC2531 | Channel: 11 (0x0B) | Packet broadcast OFF

### EUT 2 address

Texas Instruments SmartRF Packet Sniffer IEEE 802.15.4 MAC and ZigBee 2007/PRO

File Settings Help

ZigBee 2007/PRO

Pkbr.	Time (us)	Length	Frame control field	Sequence number	Dest. PAN	Dest. Address	Source Address	LQI	FCS
RX	+0	10	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x1A	0xFFFF	0xFFFF	Beacon request	97	OK
RX	+1054284	10	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x12	0xFFFF	0xFFFF	Beacon request	115	OK
RX	+1054284	10	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x12	0xFFFF	0xFFFF	Beacon request	115	OK
RX	+10144338	10	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x12	0xFFFF	0xFFFF	Beacon request	115	OK
RX	+11400422	10	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x12	0xFFFF	0xFFFF	Beacon request	115	OK
RX	+553486	10	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x1B	0xFFFF	0xFFFF	Beacon request	94	OK
RX	+12254105	10	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x1B	0xFFFF	0xFFFF	Beacon request	94	OK
RX	+1659	16	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x1C	0xAABB	0xAABB	Superframe specification BO SO F,CAP BLE Coord Assoc 15 15 15 0 1 1	0	0
RX	+12255767	16	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x1C	0xAABB	0xAABB	Superframe specification BO SO F,CAP BLE Coord Assoc 15 15 15 0 1 1	0	0
RX	+140051	22	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 1	0x1C	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK
RX	+12394398	22	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 1	0x1C	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK
RX	+1055	5	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x1C	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK
RX	+12397453	5	Type: Sec Pnd Ack.req PAN_compr CHD 0 0 0 0	0x1C	0xAABB	0xFFFF	Source Address 0x00124B0007D9ED03	115	OK

MAC 2

Capturing device: Radio Configuration | Select fields | Packet details | Address book | Display filter | Time line

IEEE 802.15.4 Channel: 0x0B (2405 MHz)

Packet count: 140 | Error count: 1 | Filter off | RF device: CC2531 | Channel: 11 (0x0B) | Packet broadcast OFF

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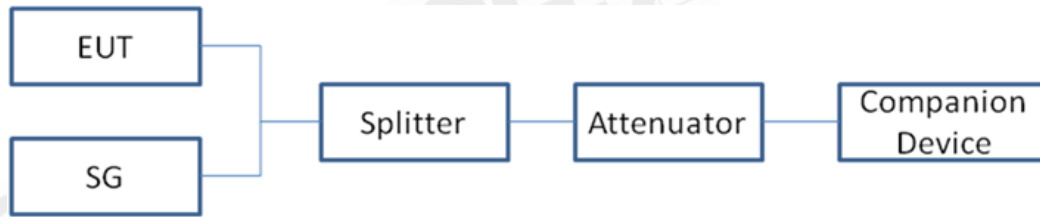
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## 6. Communication path test procedure and result



- (a) When the communication quality is normal will be to communication is established by protocol monitor.
- (b) When the communication quality is debased using shield case will be communication is disconnected by protocol monitor.

### (Test Result)

- When the communication quality is normal

Result: PASS (communication is established) \*Please refer to next page

- When the communication quality is debased

Result: PASS (communication is disconnected) \*Please refer to next page

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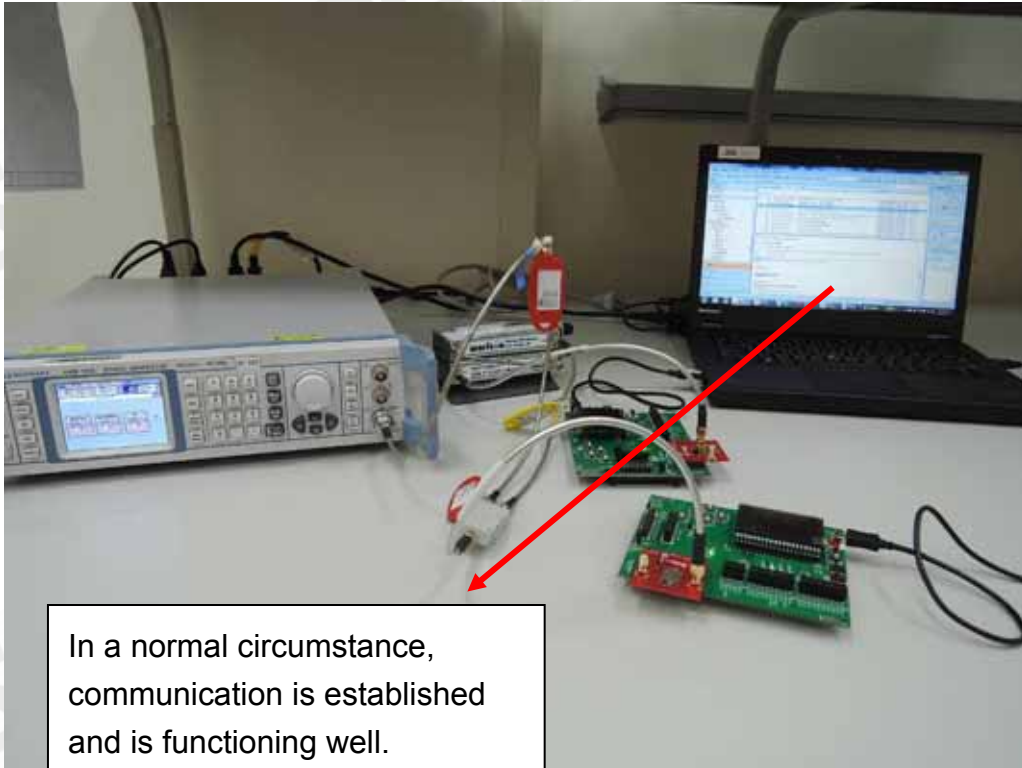
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BLE

Communication is established.



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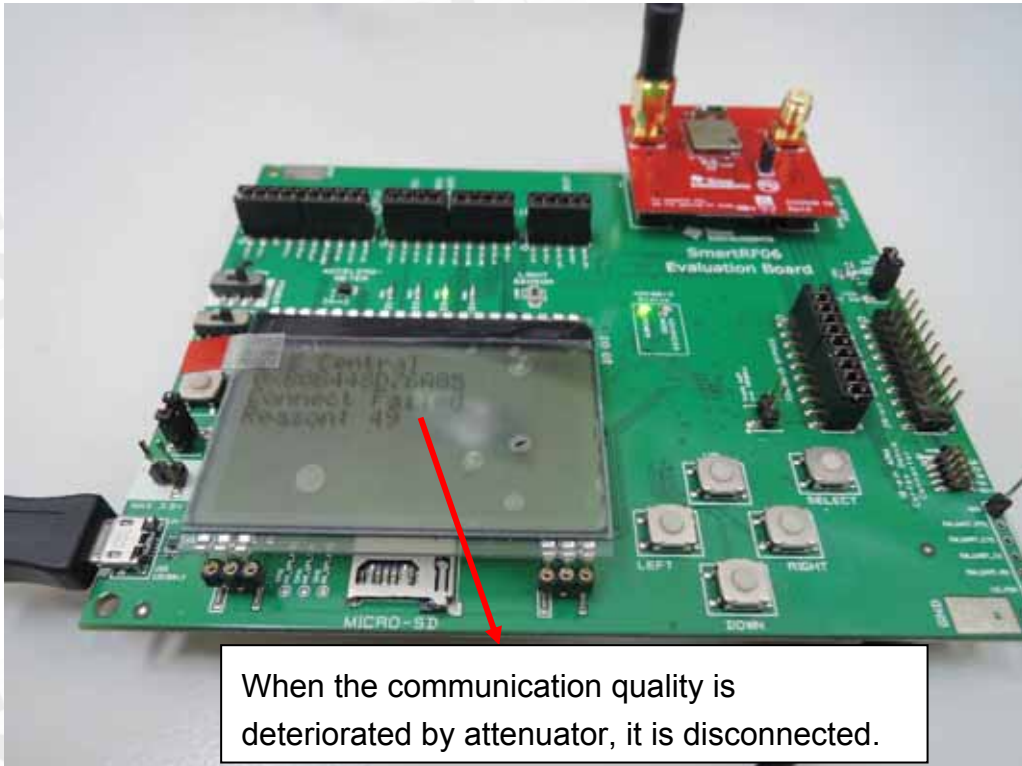
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Communication is disconnected.



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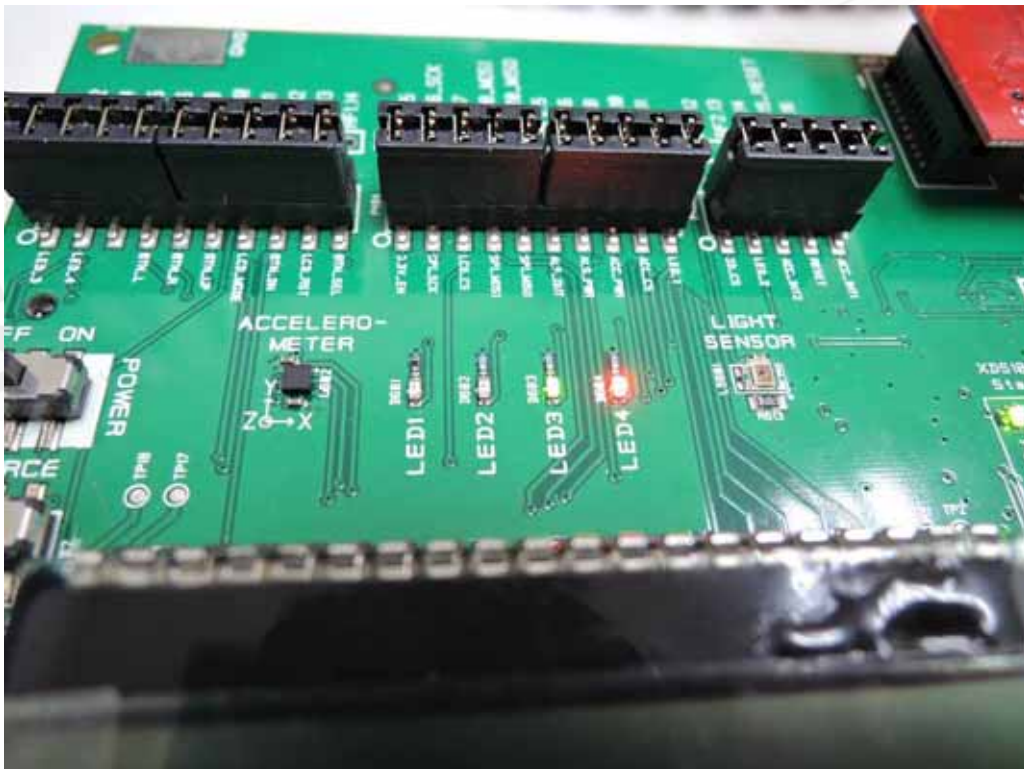
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## Zigbee Communication is established.



## Communication is disconnected.



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## PHOTOGRAPHS OF SETUP

BLE



Zigbee



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