DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29 507 456

ACCREDITED
Test Lab
Cert 3350.01

Test report No:
NIE: 62000RBT.001

Test report
Bluetooth Low Energy RF-PHY Test Specification

(*) Identification of item tested	DA14531 Bluetooth LE SoC
(*) Trademark	SmartBond
(*) Model and /or type reference tested	FCGQFN 24 pins
Other identification of the product	N/A
(*) Features	Bluetooth® Low Energy 5.1 standard Final HW version: DA14531-AC Final SW Version: 6.0.12
(*) Manufacturer	Dialog Semiconductor BV Het Zuiderkruis 53, 5215 MV°s, Hertogenbosch Netherlands
Test method requested, standard	Full RF-PHY testing according to Bluetooth RF-PHY Test Specification, Document Number RF-PHY.TS/5.1.0
Standard.....:	RF-PHY.TS.5.1.0
Test Spec Errata(s) .....:	N/A
(*)ICS.....:	RF-PHY.ICS.5.1.0
TCRL version.....:	Core.TCRL.2018-2
Test procedure(s) .....:	PEBT006_07 BluetoothRFConductedTesting
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Juan Manuel Gómez BQTF Technical Responsible JUAN MANUEL GOMEZ GARCIA Firmado digitalmente por JUAN MANUEL GOMEZ GARCIA Fecha: 2019.08.08 09:55:17 +02'00'
Date of issue	2019-08-08
Report template No	FBT039_10 (*) “Data provided by the client”

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Competences and guarantees

DEKRA Testing and Certification, S.A.U is a BQTF competent to carry out the tests described in this report.

DEKRA Testing and Certification, S.A.U is a testing laboratory accredited by A2LA (The American Association for Laboratory Accreditation) to perform the test indicated in the Certificate 3350.01.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification, S.A.U has a calibration and maintenance program for its measurement equipment.

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The results presented in this Test Report apply only to the particular item under test established in this document.

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1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
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Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification, S.A.U internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested", “Manufacturer”).

2. The ICS and IXIT provided by the customer and used for testing are indicated in Annex B and C

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: Dialog Semiconductor BV

Sample M/01, is composed of the following elements:

Control Nº 62000/003	Model and/or type reference:	FCGQFN 24 pins
	Serial number:	1929-00008
	Hw version:	DA14531-AC
	Sw version:	6.0.12
	Features supported:	Bluetooth® Low Energy 5.1 standard
	Description of test sample	Test module
	Date of reception	2019-08-05

Control Nº 62000/004	Model and/or type reference:	-
	Serial number:	3515-480056302
	Hw version:	-
	Sw version:	-
	Features supported:	Bluetooth® Low Energy 5.1 standard
	Description of test sample	Mother board
	Date of reception	2019-08-05

The sample used for each test case is specified in the" Observations" field of the results annex

Test sample description

Ultra Low Power Bluetooth 5.1 SoC

Identification of the client

Dialog Semiconductor BV

Het Zuiderkruis 53, 5215 MV°s, Hertogenbosch

Netherlands

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-08-05
Date (finish)	2019-08-05

Document history

Report number	Date	Description
62000RBT.001	2019-08-08	First release

Environmental conditions

The following limits were not exceeded during the test:

Temperature	Min= 18 ºC Max= 28 ºC
Relative humidity	Min= 20 % Max= 75 %

Remarks and comments

N/A

Means of testing identification

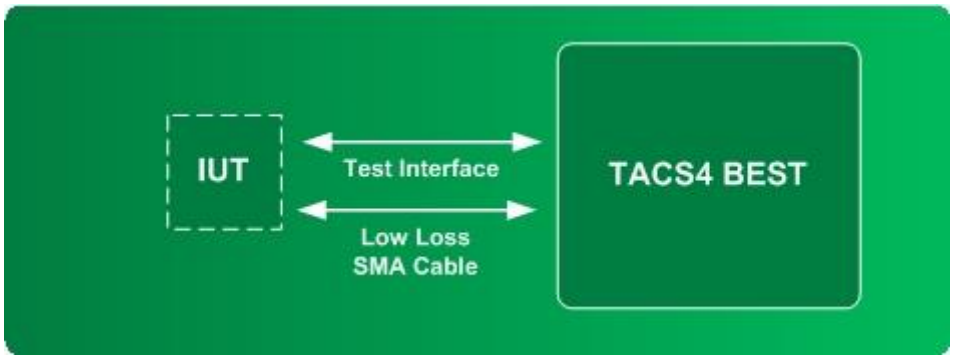
Test System	TACS4 BEST Bluetooth RF Test System				
Control No.	5852				
Hardware:	Control No.	Equipment	Serial No.	Latest Calibration Date	Next Calibration Date
	5767	LAN/GPIB/USB E5810B	MY56030024	N/A	N/A
	5398	Power Supply Agilent 66311B	MY52002833	2019-12-17	2019-12-17
	5399	Sweep Generator AGILENT E8257D	MY53401729	2018-12-20	2019-12-20
	5749	R&S® CMW270	100651	2019-02-01	2020-02-01
	5853	T4BCU100A	000001	N/A	N/A
Software:	5902	User Interface TACS4 BEST v1.12.0			
	5903	Technology Package Version: v3.5.0 R1			
Test Setup:	Conducted measurements: IUT (Item Under Test) connected directly to measuring instruments using low loss SMA cable. IUT controlled by test software. See “Test Setup” section.				

	Control No.	Equipment	Serial No.	Latest Calibration Date	Next Calibration Date
Hardware:	3379	Shielded Chamber	06825	N/A	N/A

	Control No.	Equipment	Serial No.	Latest Calibration Date	Next Calibration Date
Hardware:	2624	HUMIDIPROBE	IFY97/067	2019-04-24	2020-04-24
Software:	4762	Control temp_Hum v2.5.1			

Test setup

The configuration used for Test Cases in nominal temperature conditions was the following one:



Measurement uncertainty

TACS4 BEST Bluetooth RF Test System uncertainty values1, 2 and the corresponding limits, according to the RF-PHY Bluetooth Test Specification, can be found below:

Measurement uncertainty	RF Tester uncertainty	Specification limit	Test Case
Absolute RF power (wanted channel)	±0.98 dB	±1.2dB	RF-PHY/TRM/BV-01-C
Absolute RF power (for unwanted emissions in the BT band)	±2.46 dB	±3dB	RF-PHY/TRM/BV-03-C
Absolute radio frequency	±4.70 kHz	±5 kHz	RF-PHY/TRM/BV-05-C RF-PHY/TRM/BV-06-C
Relative drift radio frequency	±1.00 kHz	±1 kHz	RF-PHY/TRM/BV-06-C
Frequency deviation	±3.96 kHz	±4 kHz	RF-PHY/TRM/BV-05-C

Note 1: All values reflect a 95% confidence level.
Note 2: All values are valid for a temperature range of 23±5ºC

Testing verdicts

Not applicable :	N/A
Pass :	P
Fail :	F
Not measured :	N/M

Appendix A: Test results

Test campaign report

The abbreviations used in the header row of the test campaign report tables are:

Test Case ID : As it can be found on the standard

Verdict: Records the verdict assigned to each Test Case run to completion (Testing verdicts)

Date: Date of the beginning of the execution.

Observations: Provides a reference to additional information relevant to the test presented in “Test Setup” section.

Test Case ID	Description	Verdict	Date	Observations
RF-PHY/TRM/BV-01-C	Output power	P	2019-08-05	M/01
RF-PHY/TRM/BV-03-C	In-band emissions	P	2019-08-05	M/01
RF-PHY/TRM/BV-05-C	Modulation characteristics	P	2019-08-05	M/01
RF-PHY/TRM/BV-06-C	Carrier frequency offset and drift	P	2019-08-05	M/01
RF-PHY/TRM/BV-08-C	In-band emissions at 2 Ms/s	N/A	-	-
RF-PHY/TRM/BV-09-C	Stable Modulation Characteristics at 1 Ms/s	N/A	-	-
RF-PHY/TRM/BV-10-C	Modulation Characteristics at 2 Ms/s	N/A	-	-
RF-PHY/TRM/BV-11-C	Stable Modulation Characteristics at 2 Ms/s	N/A	-	-
RF-PHY/TRM/BV-12-C	Carrier frequency offset and drift at 2 Ms/s	N/A	-	-
RF-PHY/TRM/BV-13-C	Modulation Characteristics, LE Coded (S=8)	N/A	-	-
RF-PHY/TRM/BV-14-C	Carrier frequency offset and drift, LE Coded (S=8)	N/A	-	-
RF-PHY/RCV/BV-01-C	Receiver sensitivity	P	2019-08-05	M/01
RF-PHY/RCV/BV-03-C	C/I and receiver selectivity performance	P	2019-08-05	M/01
RF-PHY/RCV/BV-04-C	Blocking performance	P	2019-08-05	M/01
RF-PHY/RCV/BV-05-C	Intermodulation performance	P	2019-08-05	M/01
RF-PHY/RCV/BV-06-C	Maximum input signal level	P	2019-08-05	M/01
RF-PHY/RCV/BV-07-C	PER Report Integrity	P	2019-08-05	M/01
RF-PHY/RCV/BV-08-C	Receiver sensitivity at 2 Ms/s	N/A	-	-
RF-PHY/RCV/BV-09-C	C/I and Receiver Selectivity Performance at 2 Ms/s	N/A	-	-
RF-PHY/RCV/BV-10-C	Blocking performance at 2 Ms/s	N/A	-	-
RF-PHY/RCV/BV-11-C	Intermodulation performance at 2 Ms/s	N/A	-	-

Test Case ID	Description	Verdict	Date	Observations
RF-PHY/RCV/BV-12-C	Maximum input signal level at 2 Ms/s	N/A	-	-
RF-PHY/RCV/BV-13-C	PER Report Integrity at 2 Ms/s	N/A	-	-
RF-PHY/RCV/BV-14-C	Receiver Sensitivity at NOC, Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-15-C	C/I and Receiver Selectivity Performance, Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-16-C	Blocking Performance, Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-17-C	Intermodulation Performance, Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-18-C	Maximum input signal level, Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-19-C	PER Report Integrity, Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-20-C	Receiver sensitivity at 2 Ms/s, Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-21-C	C/I and Receiver Selectivity Performance at 2 Ms/s, Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-22-C	Blocking performance at 2 Ms/s, Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-23-C	Intermodulation performance at 2 Ms/s, Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-24-C	Maximum input signal level at 2 Ms/s, Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-25-C	PER Report Integrity at 2 Ms/s, Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-26-C	Receiver sensitivity, LE Coded (S=2)	N/A	-	-
RF-PHY/RCV/BV-27-C	Receiver sensitivity, LE Coded (S=8)	N/A	-	-
RF-PHY/RCV/BV-28-C	C/I and Receiver Selectivity Performance, LE Coded (S=2)	N/A	-	-
RF-PHY/RCV/BV-29-C	C/I and Receiver Selectivity Performance, LE Coded (S=8)	N/A	-	-
RF-PHY/RCV/BV-30-C	PER Report Integrity, LE Coded (S=2)	N/A		-
RF-PHY/RCV/BV-31-C	PER Report Integrity, LE Coded (S=8)	N/A	-	-
RF-PHY/RCV/BV-32-C	Receiver sensitivity, LE Coded (S=2), Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-33-C	Receiver sensitivity, LE Coded (S=8), Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-34-C	C/I and Receiver Selectivity Performance, LE Coded (S=2), Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-35-C	C/I and Receiver Selectivity Performance, LE Coded (S=8), Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-36-C	PER Report Integrity, LE Coded (S=2), Stable Modulation Index	N/A	-	-
RF-PHY/RCV/BV-37-C	PER Report Integrity, LE Coded (S=8), Stable Modulation Index	N/A	-	-

Relevant numerical results

Test Case ID	Parameter	Value
RF-PHY/TRM/BV-01-C Output power measurements for each frequency.	Peak Power; f=2402	2.41 dBm
	Peak Power; f=2440	2.40 dBm
	Peak Power; f=2480	2.27 dBm
	Average Power; f=2402	2.39 dBm
	Average Power; f=2440	2.38 dBm
	Average Power; f=2480	2.25 dBm

Appendix B: ICS

Implementation Conformance Statement (ICS)

The ICS set for this IUT is consistent with the static conformance requirements in the referenced base specification.
The qualified ICS and IXIT menus of the test system were defined in accordance with the client.

Bluetooth LE RF Capabilities

Item	Capability	Reference	Status	Support: Yes or No
1	LE Transmitter (Non-connectable, Broadcaster)	[2], [3]	C.1	No
2	LE Receiver (Non-connectable, Observer)	[2], [4]	C.1	No
3	LE Transceiver (Connectable, Peripheral/Central)	[2], [3] & [4]	C.1	Yes
4	LE 2M PHY	[6] 3, 4	C.2	No
5	Stable Modulation Index - Transmitter	[6] 3.1.1	C.3	No
6	Stable Modulation Index - Receiver	[6] 3.1.1	C.4	No
7	LE Coded PHY	[6] 3, 4	C.2	No

C.1: Mandatory to support at least one of these capabilities.
C.2: Optional IF SUM ICS 21/16 “Core 5.0” AND RF PHY 1/3 “LE Transceiver” are supported, otherwise Excluded.
C.3: Optional IF SUM ICS 21/16 “Core 5.0” AND (RF PHY 1/1 “LE Transmitter” OR RF PHY 1/3 “LE Transceiver”) are supported, otherwise Excluded.
C.4: Optional IF SUM ICS 21/16 “Core 5.0” AND (RF PHY 1/2 “LE Receiver” OR RF PHY 1/3 “LE Transceiver”) are supported, otherwise Excluded.

References:
[1] Specification of the Bluetooth System, Error Codes, Volume 2, Part E, Version 4.0 or later
[2] Specification of the Bluetooth System, Physical Layer Specification (PHY) Volume 6, Part A, Version 4.0 or later
[3] Specification of the Bluetooth System, Direct Test Mode, Volume 6, Part F, Version 4.0 or later
[4] ICS Proforma for Radio (RF) System Specification [5] Summary ICS
[6] Specification of the Bluetooth System, Physical Layer Specification (PHY) Volume 6, Part A, Version 5.0 or later

Appendix C: IXIT

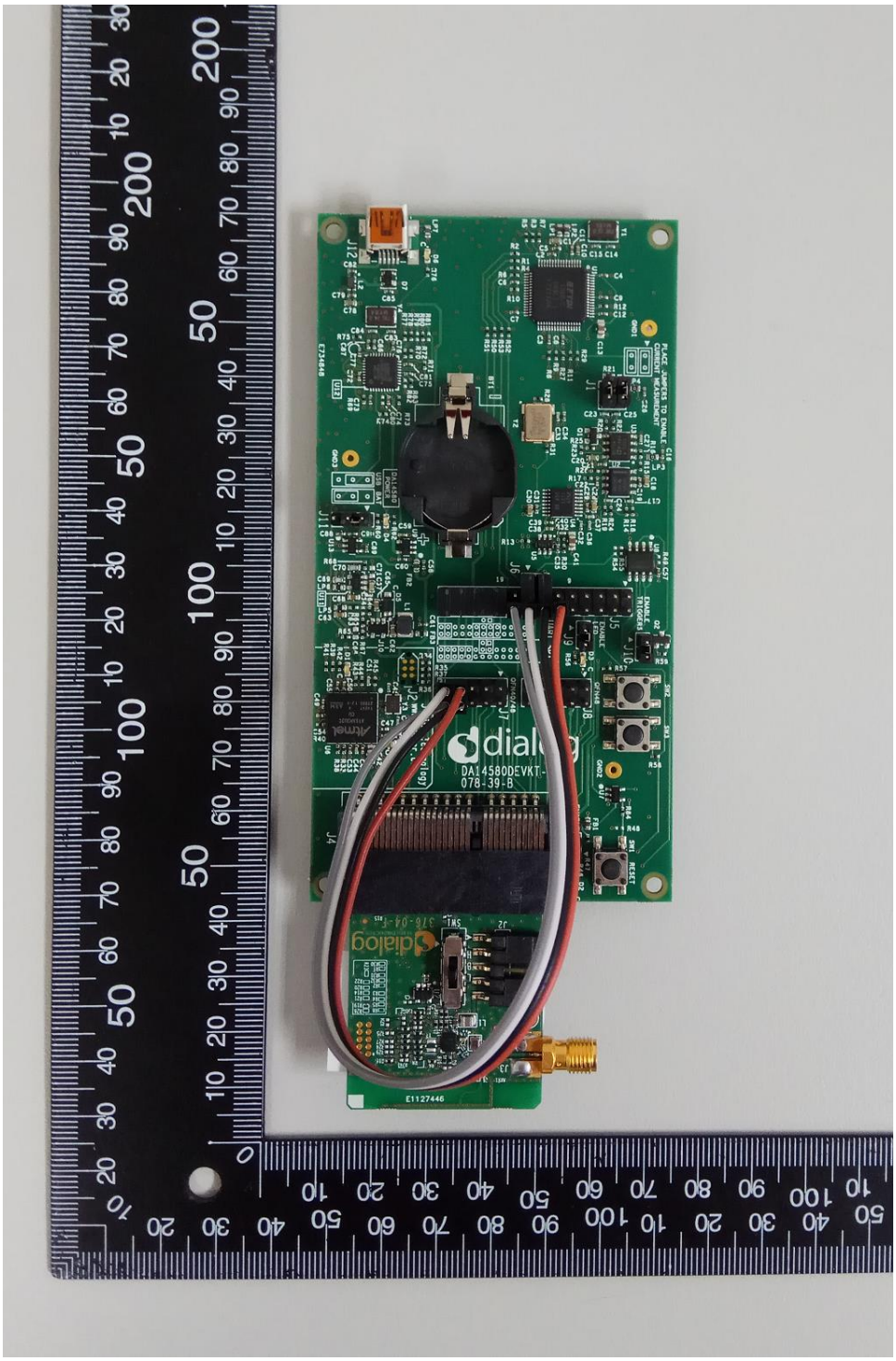
Implementation eXtra Information for Test, IXIT

The IXIT set for this IUT is consistent with the static conformance requirements in the referenced base specification. The qualified ICS and IXIT menus of the test system were defined in accordance with the client

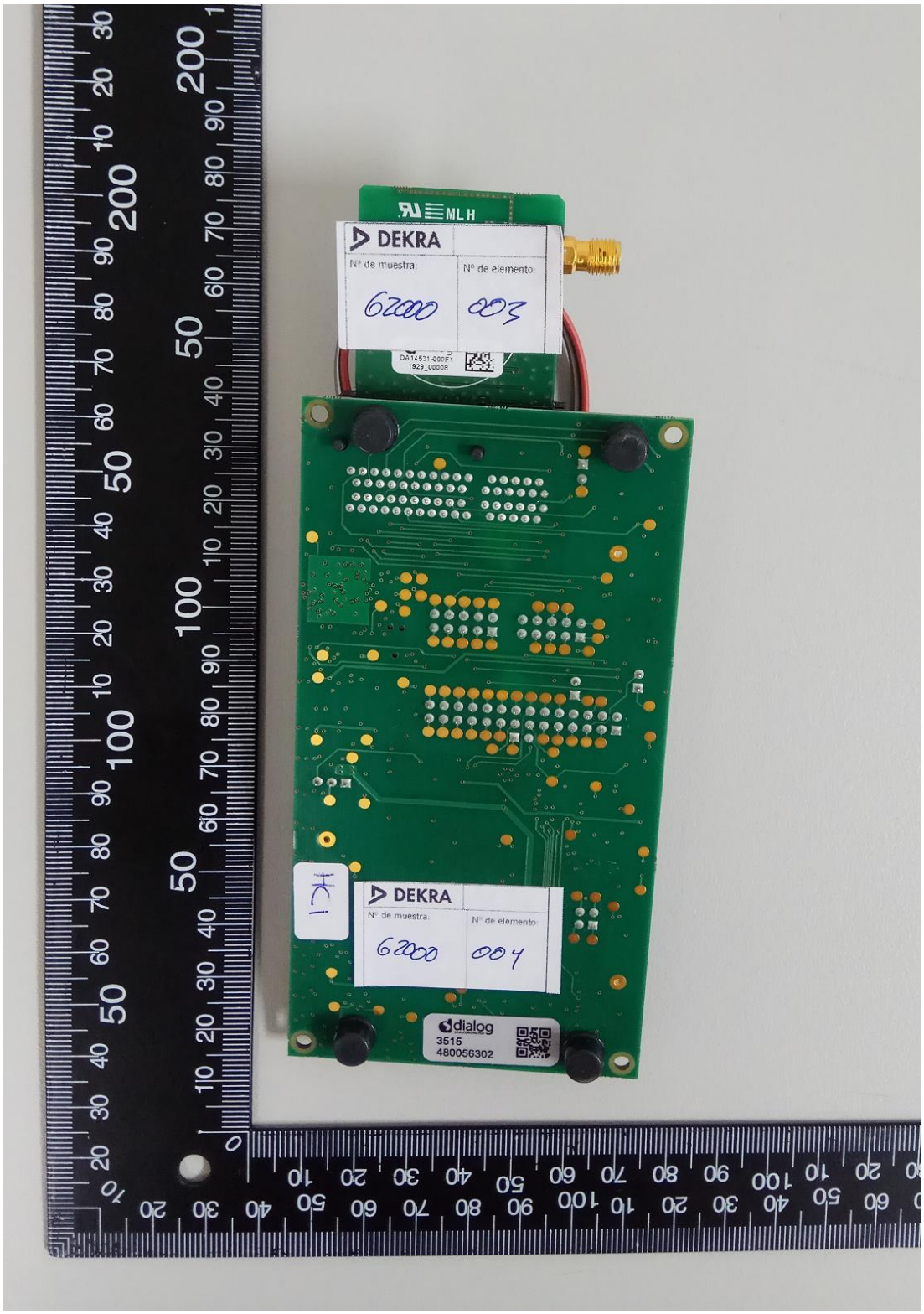
PIXIT Reference	Identifier	Sub-Identifier (Optional)	Value	Units
RF-PHY:P1:1	Inband Image frequency	Low frequency	1	MHz
RF-PHY:P1:2		Middle frequency	1	MHz
RF-PHY:P1:3		High frequency	1	MHz
RF-PHY:P2:1	Value n for Intermodulation test	Low frequency	3	Integer
RF-PHY:P2:2		Middle frequency	3	Integer
RF-PHY:P2:3		High frequency	3	Integer
RF-PHY:P4	Power source voltage		3	V
RF-PHY:P5	Normal operating temperature		20	°C
RF-PHY:P6:1	Air humidity range (relative)	Maximum (EOC)	95	%
RF-PHY:P6:2		Minimum (EOC)	40	%
RF-PHY:P6:3		Air humidity level for NOC/EOC tests	45	%
RF-PHY:P7:1	Direct Test Mode	Method	HCI	-
RF-PHY:P7:2		Interface	USB/UART	-
		Data rate	115200	bps
		Additional configuration	-	-
RF-PHY:P9:1	Maximum TX packet length (MAX_TX_LENGTH) – LE1M		255	Bytes
RF-PHY:P9:2	Maximum RX packet length (MAX_RX_LENGTH) – LE1M		255	Bytes
RF-PHY:P9:3	Maximum TX packet length (MAX_TX_LENGTH) – LE2M		-	Bytes
RF-PHY:P9:6	Maximum RX packet length (MAX_RX_LENGTH) – LE2M		-	Bytes
RF-PHY:P9:4	Maximum TX packet length (MAX_TX_LENGTH) – LE Coded (S=2)		-	Bytes
RF-PHY:P9:7	Maximum RX packet length (MAX_RX_LENGTH) – LE Coded (S=2)		-	Bytes
RF-PHY:P9:5	Maximum TX packet length (MAX_TX_LENGTH) – LE Coded (S=8)		-	Bytes
RF-PHY:P9:8	Maximum RX packet length (MAX_RX_LENGTH) – LE Coded (S=8)		-	Bytes
RF-PHY:P10:1	Maximum TX mode output power		3	dBm
RF-PHY:P11:1	Inband Image Frequency (2Ms/s)	Low frequency	N/A	MHz
RF-PHY:P11:2		Middle frequency	N/A	MHz
RF-PHY:P11:3		High frequency	N/A	MHz
RF-PHY:P12:1	Value n for Intermodulation test (2Ms/s)	Low frequency	N/A	Integer
RF-PHY:P12:2		Middle frequency	N/A	Integer
RF-PHY:P12:3		High frequency	N/A	Integer
RF-PHY:P13:1	Inband Image Frequency (Stable Modulation Receiver)	Low frequency	N/A	MHz
RF-PHY:P13:2		Middle frequency	N/A	MHz
RF-PHY:P13:3		High frequency	N/A	MHz
RF-PHY:P14:1	Value n for Intermodulation test (Stable Modulation Receiver)	Low frequency	N/A	Integer
RF-PHY:P14:2		Middle frequency	N/A	Integer
RF-PHY:P14:3		High frequency	N/A	Integer
RF-PHY:P15:1	Inband Image Frequency (Stable Modulation Receiver, 2Ms/s)	Low frequency	N/A	MHz
RF-PHY:P15:2		Middle frequency	N/A	MHz
RF-PHY:P15:3		High frequency	N/A	MHz
RF-PHY:P16:1	Value n for Intermodulation test (Stable Modulation Receiver, 2Ms/s)	Low frequency	N/A	Integer
RF-PHY:P16:2		Middle frequency	N/A	Integer
RF-PHY:P16:3		High frequency	N/A	Integer

Appendix D: Photographs

Front view



Rear view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