



Test Lab
Cert 3350.01

Test report No:
NIE: 61492RBT.001

Test report

Bluetooth Low Energy RF-PHY Test Specification

(*) Identification of item tested	SoC
(*) Trademark	Nordic
(*) Model and /or type reference tested	nRF52805
Other identification of the product	N/A
(*) Features	Final HW version: CAAA AA0 Final SW Version: V1.1
(*) Manufacturer	NORDIC SEMICONDUCTOR Otto Nielsen veg 12, 7052 Trondheim, Norway
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
Date of issue	2019-06-25
Report template No	FBT039_10
	(*) "Data provided by the client"

Index

Competences and guarantees3

General conditions3

Uncertainty3

Data provided by the client.....3

Usage of samples4

Test sample description4

Identification of the client.....4

Testing period and place.....4

Document history4

Environmental conditions5

Remarks and comments5

Means of testing identification5

Test setup6

Measurement uncertainty.....7

Testing verdicts.....7

Appendix A: Test results8

Appendix B: ICS10

Appendix C: IXIT11

Appendix D: Photographs12

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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DEKRA Testing and Certification, S.A.U is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

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.
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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: NORDIC SEMICONDUCTOR

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

Control Nº 61492B/001	Model and/or type reference:	nRF52805
	Serial number:	Not provided
	Hw version:	CAAA AA0
	Sw version:	V1.1
	Features supported:	Bluetooth 5.0
	Description of test sample	Module
	Date of reception	2019-06-17

Control Nº 60433/005	Model and/or type reference:	PCA20035
	Serial number:	Not provided
	Hw version:	N/A
	Sw version:	N/A
	Features supported:	N/A
	Description of test sample	Test board
	Date of reception	2019-04-03

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

Test sample description

Not provided

Identification of the client

NORDIC SEMICONDUCTOR
Otto Nielsen veg 12, 7052 Trondheim, Norway

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-06-24
Date (finish)	2019-06-25

Document history

Report number	Date	Description
61492RBT.001	2019-06-25	First release

Environmental conditions

The following limits were not exceeded during the test:

Temperature	Min= 18 °C Max= 28 °C
Relative humidity	Min= 20 % Max= 75 %

Remarks and comments

N/A

Means of testing identification

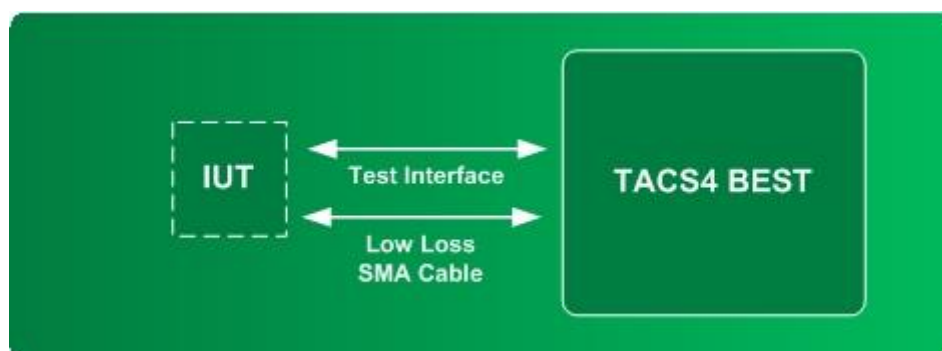
Test System	TACS4 BEST Bluetooth RF Test System				
Control No.	5852				
Hardware:	Control No.	Equipment	Serial No.	Latest Calibration Date	Next Calibration Date
	5767	LAN/GPIB/USB E5810B	MY56030024	N/A	N/A
	5398	Power Supply Agilent 66311B	MY52002833	2019-12-17	2019-12-17
	5399	Sweep Generator AGILENT 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 v1.11.0			
	5903	Technology Package Version: v34.0 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	2018-03-15	2019-03-15
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 values^{1, 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±5°C

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	2019-06-24	M/01
RF-PHY/TRM/BV-03-C	In-band emissions	P	2019-06-24	M/01
RF-PHY/TRM/BV-05-C	Modulation characteristics	P	2019-06-24	M/01
RF-PHY/TRM/BV-06-C	Carrier frequency offset and drift	P	2019-06-24	M/01
RF-PHY/TRM/BV-08-C	In-band emissions at 2 Ms/s	P	2019-06-25	M/01
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	P	2019-06-24	M/01
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	P	2019-06-24	M/01
RF-PHY/TRM/BV-13-C	Modulation Characteristics, LE Coded (S=8)	P	2019-06-24	M/01
RF-PHY/TRM/BV-14-C	Carrier frequency offset and drift, LE Coded (S=8)	P	2019-06-24	M/01
RF-PHY/RCV/BV-01-C	Receiver sensitivity	P	2019-06-24	M/01
RF-PHY/RCV/BV-03-C	C/I and receiver selectivity performance	P	2019-06-24	M/01
RF-PHY/RCV/BV-04-C	Blocking performance	P	2019-06-24	M/01
RF-PHY/RCV/BV-05-C	Intermodulation performance	P	2019-06-24	M/01
RF-PHY/RCV/BV-06-C	Maximum input signal level	P	2019-06-24	M/01
RF-PHY/RCV/BV-07-C	PER Report Integrity	P	2019-06-24	M/01
RF-PHY/RCV/BV-08-C	Receiver sensitivity at 2 Ms/s	P	2019-06-24	M/01
RF-PHY/RCV/BV-09-C	C/I and Receiver Selectivity Performance at 2 Ms/s	P	2019-06-24	M/01
RF-PHY/RCV/BV-10-C	Blocking performance at 2 Ms/s	P	2019-06-24	M/01
RF-PHY/RCV/BV-11-C	Intermodulation performance at 2 Ms/s	P	2019-06-24	M/01

Test Case ID	Description	Verdict	Date	Observations
RF-PHY/RCV/BV-12-C	Maximum input signal level at 2 Ms/s	P	2019-06-24	M/01
RF-PHY/RCV/BV-13-C	PER Report Integrity at 2 Ms/s	P	2019-06-24	M/01
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)	P	2019-06-24	M/01
RF-PHY/RCV/BV-27-C	Receiver sensitivity, LE Coded (S=8)	P	2019-06-24	M/01
RF-PHY/RCV/BV-28-C	C/I and Receiver Selectivity Performance, LE Coded (S=2)	P	2019-06-24	M/01
RF-PHY/RCV/BV-29-C	C/I and Receiver Selectivity Performance, LE Coded (S=8)	P	2019-06-24	M/01
RF-PHY/RCV/BV-30-C	PER Report Integrity, LE Coded (S=2)	P	2019-06-24	M/01
RF-PHY/RCV/BV-31-C	PER Report Integrity, LE Coded (S=8)	P	2019-06-24	M/01
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	3.63 dBm
	Peak Power; f=2440	3.7 dBm
	Peak Power; f=2480	3.76 dBm
	Average Power; f=2402	3.6 dBm
	Average Power; f=2440	3.66 dBm
	Average Power; f=2480	3.73 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	Yes
2	LE Receiver (Non-connectable, Observer)	[2], [4]	C.1	Yes
3	LE Transceiver (Connectable, Peripheral/Central)	[2], [3] & [4]	C.1	Yes
4	LE 2M PHY	[6] 3, 4	C.2	Yes
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	Yes

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

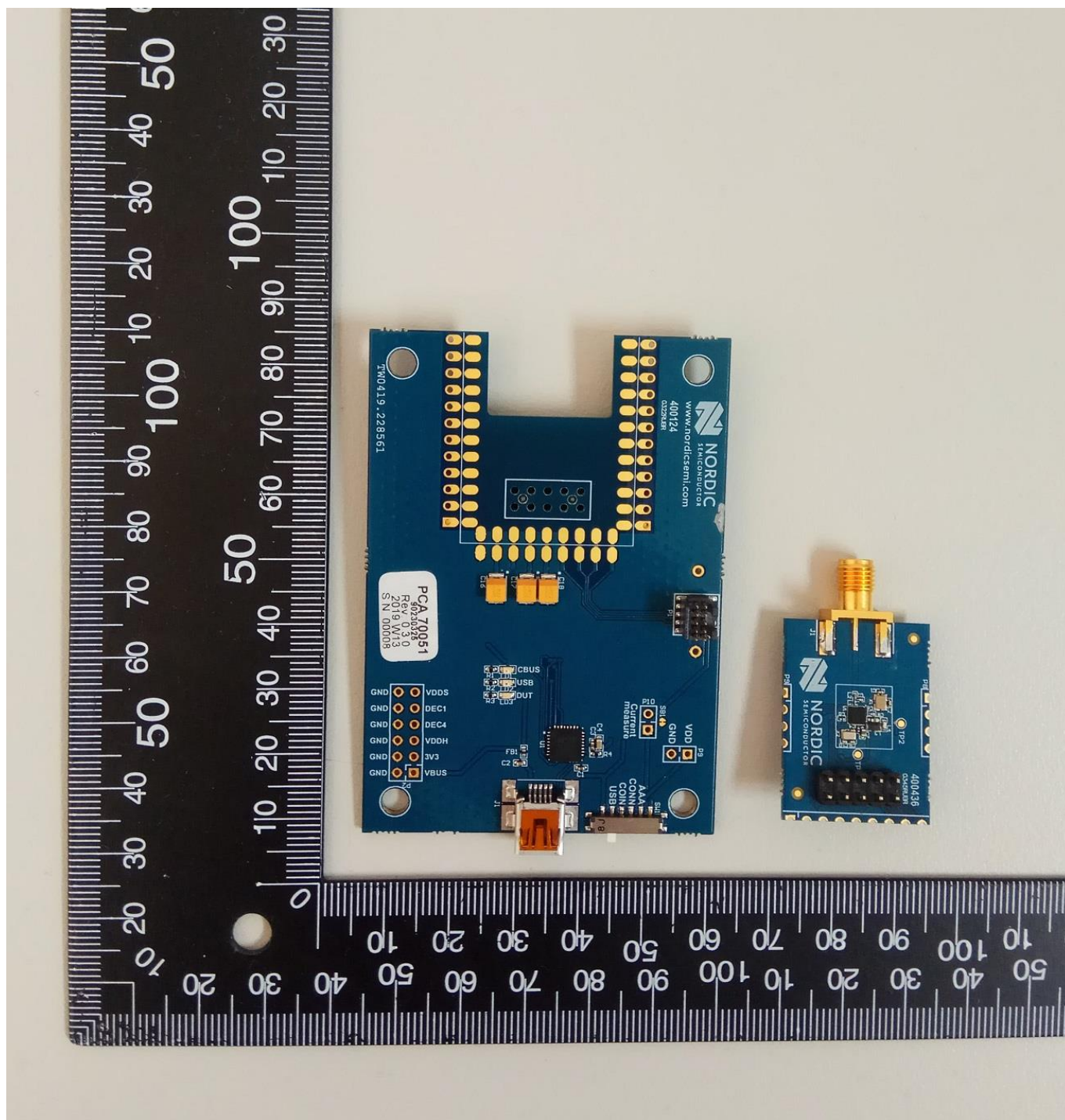
Implementation eXtra Information for Test, IXIT

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 RF-PHY:P1:2 RF-PHY:P1:3	Inband Image frequency	Low frequency	-2	MHz
		Middle frequency	-2	MHz
		High frequency	-2	MHz
RF-PHY:P2:1 RF-PHY:P2:2 RF-PHY:P2:3	Value n for Intermodulation test	Low frequency	3	Integer
		Middle frequency	3	Integer
		High frequency	3	Integer
RF-PHY:P4	Power source voltage		3	V
RF-PHY:P5	Normal operating temperature		25	°C
RF-PHY:P6:1 RF-PHY:P6:2 RF-PHY:P6:3	Air humidity range (relative)	Maximum (EOC)	-	%
		Minimum (EOC)	-	%
		Air humidity level for NOC/EOC tests	60	%
RF-PHY:P7:1 RF-PHY:P7:2	Direct Test Mode	Method	2-wire	-
		Interface	USB/UART	-
		Data rate	19200	bps
		Additional configuration	255	-
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		255	Bytes
RF-PHY:P9:6	Maximum RX packet length (MAX_RX_LENGTH) – LE2M		255	Bytes
RF-PHY:P9:4	Maximum TX packet length (MAX_TX_LENGTH) – LE Coded (S=2)		255	Bytes
RF-PHY:P9:7	Maximum RX packet length (MAX_RX_LENGTH) – LE Coded (S=2)		255	Bytes
RF-PHY:P9:5	Maximum TX packet length (MAX_TX_LENGTH) – LE Coded (S=8)		255	Bytes
RF-PHY:P9:8	Maximum RX packet length (MAX_RX_LENGTH) – LE Coded (S=8)		255	Bytes
RF-PHY:P10:1	Maximum TX mode output power		4	dBm
RF-PHY:P11:1 RF-PHY:P11:2 RF-PHY:P11:3	Inband Image Frequency (2Ms/s)	Low frequency	-4	MHz
		Middle frequency	-4	MHz
		High frequency	-4	MHz
RF-PHY:P12:1 RF-PHY:P12:2 RF-PHY:P12:3	Value n for Intermodulation test (2Ms/s)	Low frequency	5	Integer
		Middle frequency	5	Integer
		High frequency	5	Integer
RF-PHY:P13:1 RF-PHY:P13:2 RF-PHY:P13:3	Inband Image Frequency (Stable Modulation Receiver)	Low frequency	N/A	MHz
		Middle frequency	N/A	MHz
		High frequency	N/A	MHz
RF-PHY:P14:1 RF-PHY:P14:2 RF-PHY:P14:3	Value n for Intermodulation test (Stable Modulation Receiver)	Low frequency	N/A	Integer
		Middle frequency	N/A	Integer
		High frequency	N/A	Integer
RF-PHY:P15:1 RF-PHY:P15:2 RF-PHY:P15:3	Inband Image Frequency (Stable Modulation Receiver, 2Ms/s)	Low frequency	N/A	MHz
		Middle frequency	N/A	MHz
		High frequency	N/A	MHz
RF-PHY:P16:1 RF-PHY:P16:2 RF-PHY:P16:3	Value n for Intermodulation test (Stable Modulation Receiver, 2Ms/s)	Low frequency	N/A	Integer
		Middle frequency	N/A	Integer
		High frequency	N/A	Integer

Appendix D: Photographs

Front view



Rear view

