PANTHER 4X4 MIMO RRH

MEDIUM POWER 5G NR & LTE

LTE/NR -48V version

Reference :
DES000113

Author :
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Revision :
A

1. Document

1.1. History

Date	Version	Author	Comments
11/08/2020	A	D.ARNAUD	Creation

1.2. Approbation

Date	Version	Reviewer(s)	Comments

2. Introduction

This document is a presentation of AW2S Panther Band NR n78/n77 and LTE B42 & B43 2W product version, how to install it and how to connect cables.

2.1. Audience

This document is applicable to the teams charged with designing, developing, integrating, verifying, validating, operating and maintaining the product.
It uses during all the development phases and during CUSTOMER's operations.

2.2. Convention

Symbol	Description
 DANGER	Indicates a hazard with high level of risk, which if is not avoided, will result in death or serious injury
 WARNING	Indicates a hazard with medium or low level of risk, which if not avoided, could result in minor or moderate injury.
 CAUTION	Indicates a potentially hazardous situation, which if is not avoided, could result in equipment damage, data loss, performance degradation, or unexpected results.
	Indicates for commanding a specifically required action.
	Indicates additional information as a reference.

3. Documentary Reference

This chapter provides a list of all the applicable and reference documents, their links with the industrial technical specification as well as the terminology used in drawing them up. Their name and reference designate the documents.

3.1. Applicable documents

Documents listed below are applicable to this DES.

Id.	Title of the document	Reference of the document	Notes / Version
DA1			
DA2			

3.2. Applicable norms and standards

Documents listed below are applicable to this DES.

Id.	Title of the document	Reference of the document	Notes / Version
DS1	LTE Evolved Universal Terrestrial Radio Access (E-UTRA) Base Station (BS) radio transmission and reception	ETSI TS 136104	V15.8.0
DS2	5G;NR; Base Station (BS) radio transmission and reception	ETSI TS 138104	V15.8.0
DS3	Classification of Environnemental Conditions Storage	ETSI EN 300 019-1-1	V2.1.4 (2003-04)
DS4	Classification of Environnemental Conditions Transportation.	ETSI EN 300 019-1-2	V2.2.1 (2014-04)
DS5	Classification of Stationary use at non-weather protected locations	ETSI EN 300 019-1-4	V2.2.1 (2014-04)
DS6	Specification of environmental tests; Storage	ETSI EN 300 019-2-1	V2.1.6 (2014-06)
DS7	Specification of environmental tests; Conditions Transportation.	ETSI EN 300 019-2-2	V2.2.1 (2011-11)
DS8	Specification of environmental tests; use at non-weather protected locations	ETSI EN 300 019-2-4	V2.3.1 (2012-12)
DS9	Degrees of Protection Provided by Enclosures – IP Code.	IEC 60529	
DS10	Safety of information technology equipment.	EN 60950	Ed.2001
DS11	Standard for Safety of information Technology Equipment-including Electrical Business Equipment	UL 60950	Ed.3 2000

Id.	Title of the document	Reference of the document	Notes / Version
DS12	Test for flammability of materials for parts in devices and appliances.	UL94	
DS13	Safety of Information Technology Equipment	CSA C22.2 No 60950	Ed.3 2000
DS14	Common Public Radio Interface (CPRI); Interface Specification	V6.0	2013-08
DS15	Open Radio equipment Interface (ORI); Requirements for Open Radio equipment Interface (ORI) (Release 1)	ETSI GS ORI 001	V4.1.1
DS16	Open Radio equipment Interface (ORI); ORI Interface Specification; Part 1: Low Layer	ETSI GS ORI 002-1	V4.1.1
DS17	Open Radio equipment Interface (ORI); ORI Interface Specification; Part 2: Control and Management	ETSI GS ORI 002-2	V4.1.1
DS18	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services	ETSI EN 301 489-23	1.5.1
DS19	ROHS2 requirements	2011/65/EU	27 January 2003
DS20	WEEE requirements	2012/19/EU	27 January 2003
DS21	REACH requirements	n°1907/2006/CE	SVCH 06/2014

3.3. Reference documents

These are documents which have no contractual nature and which have been the basis for drawing up the document.

Id.	Title of the document	Reference of the document	Notes / Version
DR1			
DR2			

4. Terminology

4.1. Abbreviations

CFR	Crest Factor Reduction
CPRI	Common Public Radio Interface
DPD	Digital Pre-Distortion
EVM	Error Vector Magnitude
IMD	Intermodulation
MCPA	Multi-Carrier Power Amplifier
PA	Power Amplifier
PAR	Power to Average Ratio
RF	Radio Frequency
SCPA	Single Carrier Power Amplifier
SEM	Spectral Emission Mask

4.2. Definitions

Crest Factor Reduction

This is a technic to reduce the power to average ratio while keeping EVM and SEM in specification.

Digital Pre-Distortion

This is a technic to enhance power amplifier linearity.

Power to Average Ratio

This is the Peak power over average power ratio.

5. Safety concern

The purpose of this section is to ensure the safety of users and prevent property damage. Please read this document carefully for proper use.

5.1. Power and grounding

 DANGER	***Watches, Rings and other Metallic accessories*** Do not wear accessories such as watches and rings in order to prevent electrical shock.

	**Power switch off** Make sure the power switch of power supply is off when installing the system. Installing with power switch on may cause system damage of fatal human injury when cables are not correctly connected.

 WARNING	***Warning for connecting the ground cable*** In cabling, the connection of cables without the connection of the ground cable may cause the damage of the equipment or the injury of the worker. Connect the ground cable first.

5.2. Installation

 DANGER	***Warning for Laser Beam Running through Optical Cables*** In the system, the laser beam emitting light runs through the optical cable. The exposure of the laser beam on worker's eye may cause serious injury so that it should be handled with care. 

DANGER	***Protection gloves and goggles*** Make sure that worker wears protection gloves and goggles to prevent damages from debris while drilling holes in a wall or ceiling	

5.3. Power and Feeder Line

CAUTION	***Cautions while cleaning power supply*** While cleaning the power supply device, take caution that the device does not come in contact with alien bodies that may cause power failure.

CAUTION	***Handling the Power Cable*** - Handling the power cable incorrectly may damage the rack or cause an electric shock through the cable. Ensure the power switch on the rectifier or the system is turned off before handling the power calbe. - The fixing materials for power cable must be tightly secured to prevent electrical accidents.

CAUTION	***Precautions for measuring insulation resistance*** Since high voltage is used for measuring insulation resistance, insulation resistance should not be measured when the system is in operation. Make sure to only measure the insulation resistance of the appointed part. Other components such as the system's internal components and the unit (system frame), components of the communication cables, units, etc. should not be measured.

	Cable work sequence When performing cable work for the system, proceed with the ground work before any other work to prevent errors occurring due to static electricity and other reasons.

CAUTION	**Connection of Feeder Cable Connector** Connecting the feeder cable connector is critical process, so the qualified workers who finished the related education should perform.

 CAUTION	**Radius of curvature of feeder line** When installing a feeder line, the radius of curvature of the sections where cables bent should be larger than the allowed radius of curvature. If the radius of curvature for the feeder line installation is less than the allowed radius curvature, it may affect the performance of the system.

 CAUTION	**Feeder cable and Antenna PIM** The installed antenna and feeder cable need to have an intermodulation level lower than -153dBc. Feeder return loss should be better than 20dB in the band. Antenna return loss should be better than 15dB. If the intermodulation or return loss is higher than allowed values, it may affect the performance of the system.

5.4. Installation and de-installation

 CAUTION	**Caution while cleaning RRH** Make sure that worker does not damage installed cable while cleaning the RRH

 CAUTION	**System installation and access** Only authorized and trained workers are allowed to install or access the system.

 DANGER	**Do not work by yourself** Worker must not work alone in any key process.

 CAUTION	**Management of unused ports** Cover the unused ports (conduit, cable, gland, etc.) with waterproff cap (sealing cap) to prevent infiltration of foreign material such as dust, moisture, bug or water.

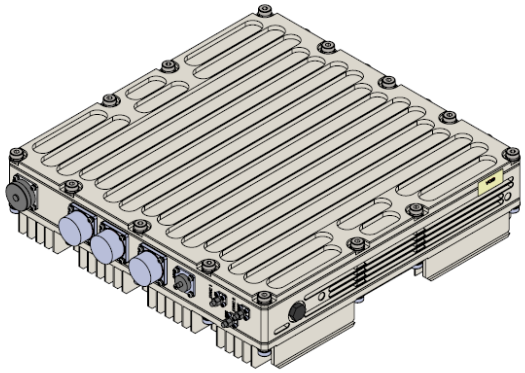
 CAUTION	**Caution when connecting the optical cable** When connecting the optical cable, be careful to keep the cutting section of the connector core away from dust and foreign substances. If the cable

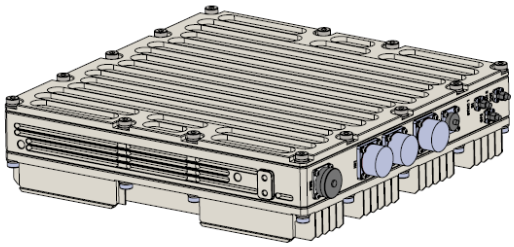
	is soiled with foreign substances, do not blow on the cable to remove them. Make sure to remove dust or foreign substances in accordance with the cleaning instructions provided by the connector manufacturer.

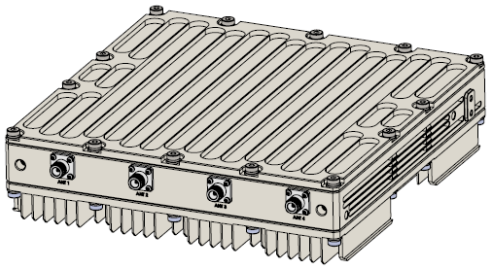
 CAUTION	**Installing the antenna** When you install the antenna, the distance and angle between the antenna and the lightning rod must be within the protective angle (left/right side 45° each from the central axis) to prevent the antenna for lightning damage.

6. Before Installation

6.1. System configuration and structure







7. Product Description

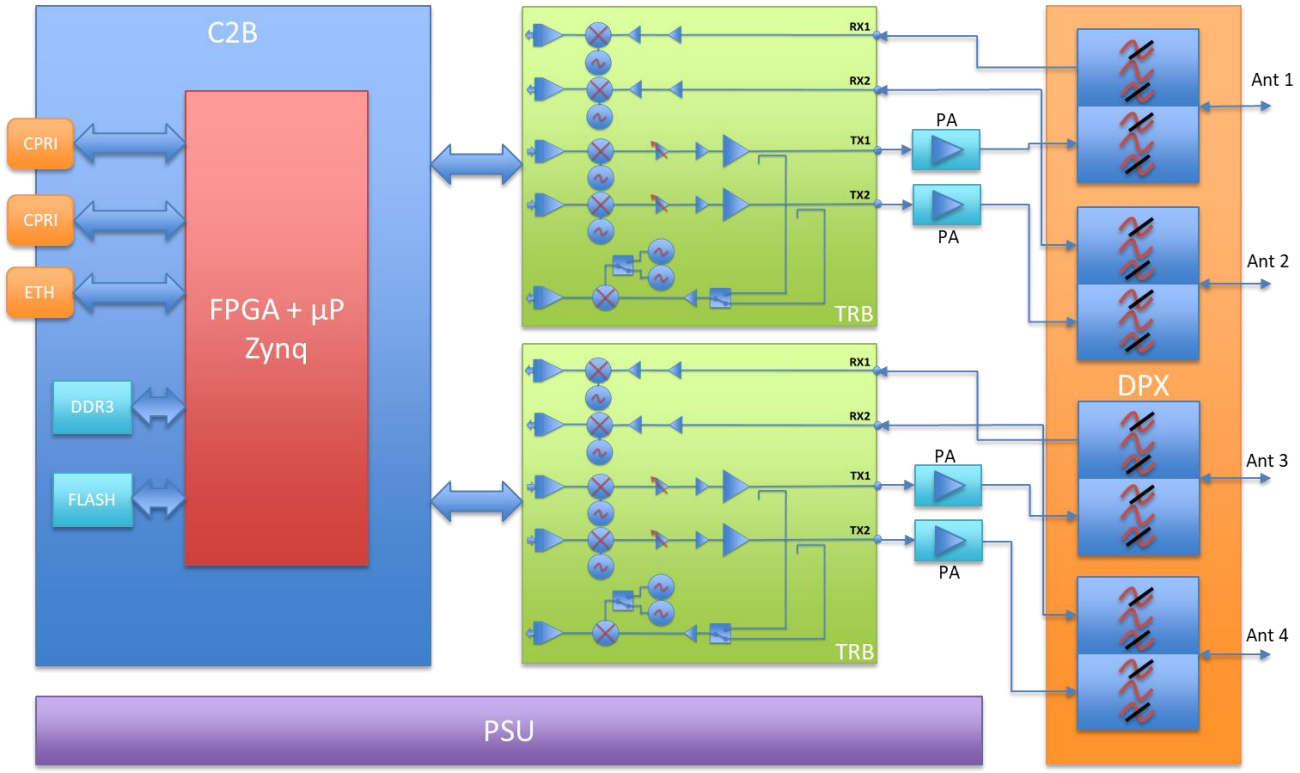
7.1. Model List

Frequency (MHZ)	Nr Band	Lte Band
3400-3800	N78	B42/B43
3800-4100	N77	

7.2. Platform Specifications

Parameters	*Value*	*Units*
Tx/Rx Ports	**4**	
Max. Nb Carriers per TX/RX	**2 LTE (5,10,15,20MHz)** **1 5G-NR (5 to 100MHz)**	**Or 1 LTE and 1 NR**
Tx Max Pout	**2**	**W Avg.**
Power Supply	**Isolated DC -40 to -58**	**V**
Power Consumption	**250**	**W typ.**
Weight	**<15**	**Kg Max.**
Dimensions	**370x369.2x91.3**	**mm**
I/Q connectivity	**2 CPRI up to rate 8**	
Local Management & debugging	**1 Gigabit Eth.**	

7.3. AW2S Platform block Diagram



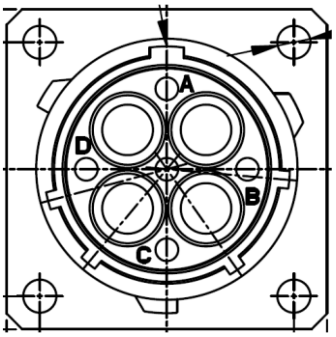
This is the basic diagram of the product.

8. General

Requirement	Parameter
GEN-000	Platform can be easily shifted in frequency
GEN-001	Support 4 Tx and 4 Rx in the products to avoid using two products to do MIMO 4x4
GEN-002	Keep dimension as low as possible
GEN-003	Outdoor product IP66 when installed and all ports connected.
GEN-004	Status needs to give a clear understanding of the state of the unit, in particular if the unit is transmitting.

9. Connectivity

Requirement	Parameter
CON-000	2 CPRI Links up to line rate 8 Ref. 20
CON-001	LTE user plane following E-UTRA mapping ORI Ref.21 or AW2S broadband Mapping
CON-002	LTE user plane can as well support MIMO interleaving
CON-003	Local C&M and Debug using Serial port and Gigabit Ethernet
CON-004	Power supply connector Amphenol reference RT00164PNH



A	GROUND
B	UNCONNECTED
C	0V
D	-48V

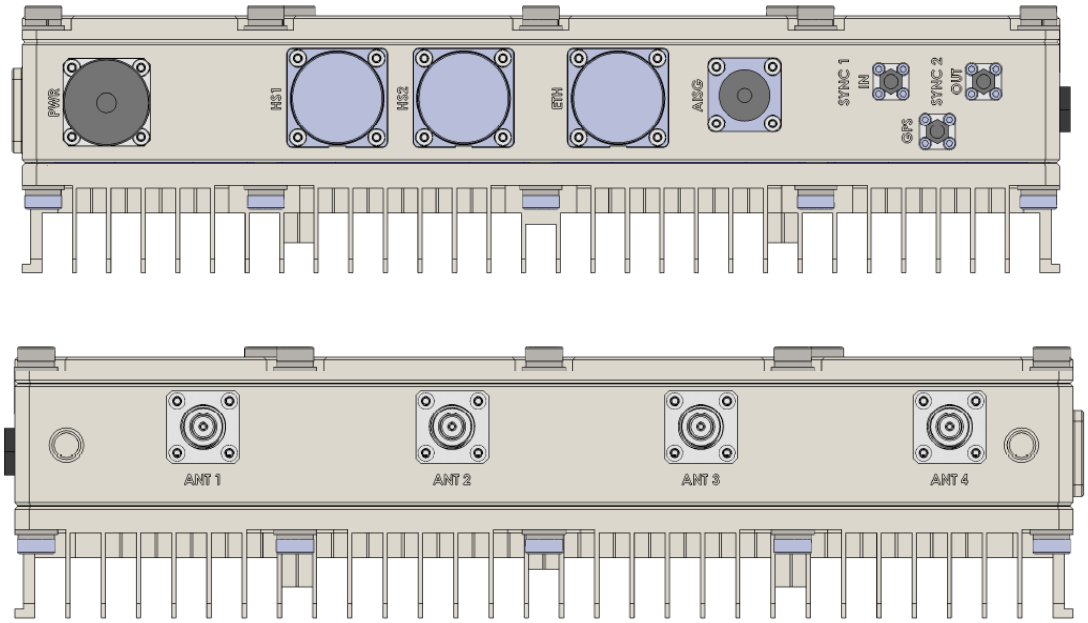
Amphenol reference RT06164SNH can be use as plug depending of the gauge used, however AWG-12 minimum is recommended for long cables, ref MS10A23S. Cable grip reference used is the RT0L-16CG-S1 or –S2.

CON-005	Fiber cable connection is done through SFP+ cages with R2CT connector for ingress protection

The R2CT plug reference R2CT 115 000 can be use from Amphenol or Radiall.

CON-006	Gigabit Ethernet connection is RJ45 connector with R2CT connector for ingress protection

The R2CT plug reference R2CT 127 000 can be use from Amphenol or Radiall.



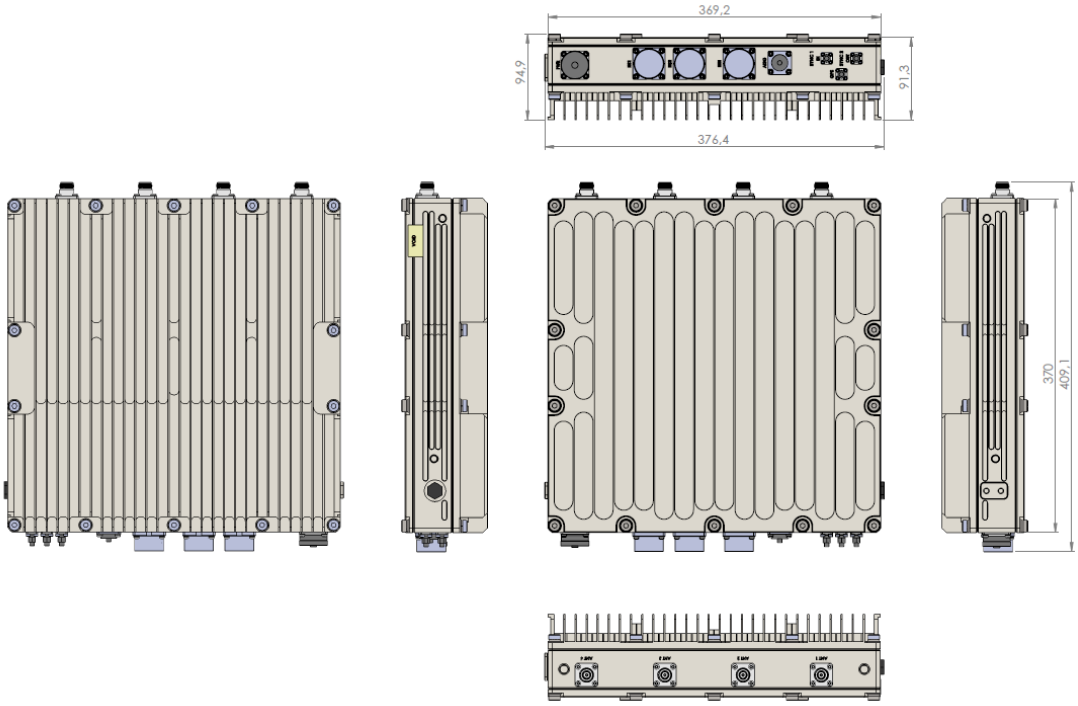
ANT 1	Antenna port 1	N Female
ANT 2	Antenna port 2	N Female
ANT 3	Antenna port 3	N Female
ANT 4	Antenna port 4	N Female
PSU	Power supply	RT06164PNH
CPRI 1	CPRI port 1	SFP+ cage with R2CT socket
CPRI 2	CPRI port 2	SFP+ cage with R2CT socket
ETH	GBEthernet Debug port	RJ45 with R2CT socket
GPS	GPS port	SMA female
Sync1	Sync In port	SMA female
Sync2	Sync out port	SMA female

10. Power Supply

Requirement	Parameter	Value	Unit	Comments
PSU-000	Operating Voltage Min.	-40	V	
PSU-001	Operating Voltage Max.	-58	V	
PSU-002	Typical consumption	130	W	At Pout 2W RMS for each Tx
PSU-003	Max Isolation	1500	V	

11. Mechanical

Requirement	Parameter	Value	Unit	Comments
MEC-000	The product shall fit in a IP66 outdoor passive cooling package			
MEC-001	Height	91.3	mm	
MEC-002	Depth	369.2	mm	
MEC-003	Length	370	mm	
MEC-004	Weight	<15	kg	



Dimensions are in mm

12. Transmitter

Requirement	Parameter	Value	Unit	Comments
TX-GEN-000	Number of Carriers	2x LTE or 1x NR		
TX-GEN-001	Max. Output power	33	dBm	
TX-GEN-002	Min. Output power	Max – 15dB	dBm	
TX-GEN-003	Power Precision	+/-0.5	dBm	10-40°C
TX-GEN-004	Power Precision	+/-0.75	dBm	Other Temperature
TX-GEN-005	Power Step	1+/-0.2	dB	

12.1. LTE

Requirement	Parameter	Value	Unit	Comments
TX-LTE-000	Number of Carriers	2		
TX-LTE-001	Channel Bandwidth	5/10/15/20	MHz	
TX-LTE-002	Channel Offset	200	kHz	
TX-LTE-003	TxOFF residual noise	<-145	dBm/Hz	
TX-LTE-004	LTE EVM 256QAM	<3.5	%	
TX-LTE-005	LTE EVM 64QAM	<6	%	
TX-LTE-006	LTE EVM 16QAM	<10.5	%	
TX-LTE-007	LTE EVM QPSK	<14.5	%	
TX-LTE-008	Spurious (9KHz-150KHz)	<-36	dBm	1KHz Bandwidth
TX-LTE-009	Spurious (150KHz-30MHz)	<-36	dBm	10KHz Bandwidth
TX-LTE-010	Spurious (30MHz-1GHz)	<-36	dBm	100KHz Bandwidth
TX-LTE-011	Spurious (1GHz-12.5GHz)	<-30	dBm	1MHz Bandwidth
TX-LTE-012	Spectrum Emission mask	>3	dB Margin	Category B (Option 1)
TX-LTE-013	ACLR	>50	dBc	No need to be better than -18dBm/1MHz
TX-LTE-014	Time Alignment	<90	nS	
TX-LTE-015	Output Return Loss	>12	dB	

12.2. NR

Requirement	Parameter	Value	Unit	Comments
TX-NR-000	Number of Carriers	1		
TX-NR-001	Channel Bandwidth	5 to 100	MHz	
TX-NR-002	Channel Offset	200	kHz	
TX-NR-003	TxOFF residual noise	<-85	dBm/MHz	
TX-NR-004	LTE EVM 256QAM	<3.5	%	
TX-NR-005	LTE EVM 64QAM	<6	%	
TX-NR-006	LTE EVM 16QAM	<10.5	%	
TX-NR-007	LTE EVM QPSK	<14.5	%	
TX-NR-008	Spurious (9KHz-150KHz)	<-36	dBm	1KHz Bandwidth
TX-NR-009	Spurious (150KHz-30MHz)	<-36	dBm	10KHz Bandwidth
TX-NR-010	Spurious (30MHz-1GHz)	<-36	dBm	100KHz Bandwidth
TX-NR-011	Spurious (1GHz-12.5GHz)	<-30	dBm	1MHz Bandwidth
TX-NR-012	Spectrum Emission mask	>3	dB Margin	Category B (Option 1)
TX-NR-013	ACLR	>50	dBc	No need to be better than -15dBm/1MHz
TX-NR-014	Time Alignment	<65	nS	
TX-NR-015	Output Return Loss	>12	dB	

13. Receiver

Requirement	Parameter	Value	Unit	Comments
RX-GEN-000	Number of Carriers	2x LTE or 1x NR		
RX-GEN-001	Max. Input power	<-35dBm	dBm	Composite Power

13.1. LTE

Requirement	Parameter	Value	Unit	Comments
RX-LTE-000	Number of Carriers	1		
RX-LTE-001	Channel Bandwidth	5/10/15/20	MHz	
RX-LTE-002	Channel Offset	200	kHz	
RX-LTE-003	Reference Sensitivity 5MHz	<-103.5	dBm	
RX-LTE-004	Reference Sensitivity 10MHz	<-103.5	dBm	
RX-LTE-005	Reference Sensitivity 20MHz	<-103.5	dBm	
RX-LTE-006	Dynamic Sensitivity 5MHz	<-72.2	dBm	Interferer -82.5dBm
RX-LTE-007	Dynamic Sensitivity 10MHz	<-72.2	dBm	Interferer -79.5dBm
RX-LTE-008	Dynamic Sensitivity 20MHz	<-72.2	dBm	Interferer -79.5dBm
RX-LTE-009	E-UTRA Narrow band Adj. Channel Selectivity 5MHz[1]	Pref + 1.5dB	dBm	Interferer -49dBm
RX-LTE-010	E-UTRA Narrow band Adj. Channel Selectivity 10MHz[1]	Pref + 1.5dB	dBm	Interferer -49dBm
RX-LTE-011	E-UTRA Narrow band Adj. Channel Selectivity 20MHz[1]	Pref + 1.5dB	dBm	Interferer -49dBm
RX-LTE-012	E-UTRA Adj. Channel Selectivity 5MHz[1]	Pref + 1.5dB	dBm	Interferer -52dBm
RX_LTE-013	E-UTRA Adj. Channel Selectivity 10MHz[1]	Pref + 1.5dB	dBm	Interferer -52dBm
RX_LTE-014	E-UTRA Adj. Channel Selectivity 20MHz[1]	Pref + 1.5dB	dBm	Interferer -52dBm

Note 1. See Ref 1§7.5 for interferer characteristics

Requirement	Parameter	Value	Unit	Comments
RX-LTE-016	Generic Blocking[1]	-43	dBm	+20/-20MHz
RX-LTE-017	Generic Blocking[1]	-15	dBm	+CW further
RX-LTE-018	Intermodulation[2]	-52	dBm	

Note 1. See Ref 1§7.6.1 for interferer characteristics
Note 2. See Ref 1§7.8.1 for measurement characteristics

13.2. NR

Requirement	Parameter	Value	Unit	Comments
RX-NR-000	Number of Carriers	1		
RX-NR-001	Channel Bandwidth	10 to 100	MHz	
RX-NR-002	Channel Offset	200	kHz	
RX-NR-003	Reference Sensitivity 5/10/15MHz SBS 15KHz	<-103.7	dBm	In 25 RB -> 4.5MHz
RX-NR-004	Reference Sensitivity 10/15MHz SBS 30KHz	<-103.8	dBm	In 11 RB -> 4MHz
RX-NR-005	Reference Sensitivity 10/15MHz SBS 60KHz	<-101.9	dBm	In 11 RB -> 7.9MHz
RX-NR-006	Reference Sensitivity 20-50MHz SBS 15KHz	<-98.3	dBm	In 106RB -> 19.1MHz
RX-NR-007	Reference Sensitivity 20-100MHz SBS 30KHz	<-98.6	dBm	In 51RB -> 18.4MHz
RX-NR-008	Reference Sensitivity 20-100MHz SBS 60KHz	<-9.78	dBm	In 24RB -> 17.3MHz
RX-NR-009	Dynamic Sensitivity 5-100MHz	Ref 2§7.3.2-1		
RX-NR-010	E-UTRA Narrow band Adj. Channel Selectivity 5-100MHz[1]	Pref + 1.5dB	dBm	Interferer -49dBm
RX_NR-011	E-UTRA Adj. Channel Selectivity 5-100MHz[1]	Pref + 1.5dB	dBm	Interferer -52dBm

Note 2. See Ref 1§7.5 for interferer characteristics

Requirement	Parameter	Value	Unit	Comments
RX-NR-013	Generic Blocking[2]	-43	dBm	+20/-20MHz
RX-NR-014	Generic Blocking[2]	-15	dBm	+CW further
RX-NR-015	Intermodulation[3]	-52	dBm	

Note 1. See Ref 2§7.6.1 for interferer characteristics
Note 2. See Ref 2§7.8.1 for measurement characteristics

14. Control & Management

Requirement	Parameter
CMM-000	Control & Management based on ORI specification Ref. 15,16 & 17.
CMM-001	Supported Object: - RE - TxSigPath_EUTRA - RxSigPath_EUTRA - TxSigPath_NR - RxSigPath_NR - oriLink - antPort
CMM-002	Supported Device Management Request: - HealthCheck - set Time - RE Reset
CMM-003	Supported Software Management Request : - Version Query - Software Update Preparation - Software Download - Software Activation
CMM-004	Support Fault Management

15. Environmental

Requirement	Parameter	Value	Unit	Comments
ENV-000	Operating Temp. Range Min.	-40	°C	Ref. 5 Class4.1
ENV-001	Operating Temp. Range Max.	+55	°C	Ref. 5 Class4.1 (with sun cover)
ENV-002	Storage Temp. Range Min.	-40	°C	Ref. 3 Class2.3
ENV-003	Storage Temp. Range Max.	+70	°C	Ref. 3 Class2.3
ENV-004	Transportation Temp. Range Min.	-40	°C	Ref. 4 Class1.2
ENV-005	Transportation Temp. Range Max.	+70	°C	Ref. 4 Class1.2
ENV-006	Shall respect at least IP66 as defined by the document Ref. 9 when in approved operational condition			
ENV-007	Shall not resonate in audibled range (20Hz-20KHz) when in approved operational condition			

16. Regulatory

Requirement	Parameter
REG-000	Product shall pass and have the CE marking
REG-001	For electrical safety product shall comply to requirement defined per Ref. 10
REG-002	Product shall comply to requirement defined per Ref. 11 & 12
REG-003	ROHS : the product and its internal components shall have to fulfill the requirements Ref. 19
REG-004	WEEE : the product and its internal components shall have to fulfill the requirements of Ref. 20
REG-005	REACH: AW2S shall fulfill at any time all requirements according to the regulation Ref 21 concerning the handling of chemical substances. AW2S shall especially fulfill all duties imposed upon him according to Articles 31 to 33 (incl.) and shall provide all information which the customer may require.