User manual

Integra Full Outdoor Unit

Proprietary notice

The information presented in this guide is the property of SAF Tehnika, JSC. No part of this document may be reproduced or transmitted without proper permission from SAF Tehnika, JSC.

The specifications or information contained in this document are subject to change without notice due to continuing introduction of design improvements. If there is any conflict between this document and compliance statements, the latter will supersede this document.

SAF Tehnika, JSC has no liability for typing errors in this document or damages of any kind that result from the use of this document.

To get up to date information about accessories and their availability, please contact sales representative.

 FODU does not contain serviceable parts. Warranty will not be applicable in the event FODU has been hermetically unsealed.

 SAF Tehnika, JSC is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Copyright Notice

Contents

Chapter 1: OVERVIEW

Technical specification

	Integra		Integra-S
General			
Concept / form factor	FODU with antenna integration		FODU slip-fit
Capacity	*up to **1Gbps** throughput with header compression**		
Frequency bands	15GHz, 17GHz UL, 18GHz, 23GHz, 24GHz UL, 25-26GHz, 38GHz, 42GHz *and more**		
Modulation	From 4QAM up to 1024QAM with hitless ACM		
Configurations	1+0, 2+0 link bonding		
ATPC	Yes		
Channel bandwidth	ETSI: from 3.5 MHz up to 56MHz FCC: from 5 MHz up to 60MHz		
Ports			
Gigabit Ethernet	1x RJx45	Electrical with built-in PoE splitter	
	2x SFP	Fiber Optics	
Service ports	3.5mm	Audible alignment and RSSI	
	USB B	Terminal Access	
	LED	Power On, Link Synchronization, RSL	
Ethernet			
Ethernet	Built-in Carrier Ethernet Gigabit Network Processor		
Managed Gigabit Switch functionality	802.1Q VLANs with QoS/CoS including WRED, shaping and DWRR, Spanning Tree Protocol, Jumbo frames *and more**		
Management	SNMP v1/2c/3, SSH, HTTPS, Serial, Radius, Network Time Protocol		
Performance monitoring	Performance graphs, constellation diagram, alarms, detailed counters		
Synchronization	SyncE, *IEEE 1588v2 PTP**		
Carrier Ethernet functionality	Provider Bridging, MEF9&14, High Efficiency Header Compression, AES 256-bit encryption, *MPLS-TP*, OAM**		
Max frame size	9600 bytes		
Antenna			
Sizes	0.3m / 1ft	0.6m / 2ft	External antenna
Antenna	High Performance and *Super High Performance**		
Electrical & Mechanical			
Power consumption	Typical: 20W, Max: <35W		
Temperature range	-33 ... +55 °C / -28 … +130 °F		
Size, w/o mount	378 x 378 x 227 mm / 14.9" x 14.9" x 9"	669 x 669 x 289 mm / 26.3" x 26.3" x 11.4"	235 x 250 x 72 mm / 9.26" x 9.85" x 2.84"
Weight, w/o mount	5 kg / 11 lbs	5 kg / 11 lbs	2.9 kg / 6.4 lbs
Mount	Mount size	292 x 176 x 250 mm / 11.5" x 7" x 10" max	Mount on antenna
	Pole size	Ø 40 – 120 mm / Ø 1.6" – 4.7"	
	Weight	2.55 kg / 5.6 lbs	

* Inquire SAF representative for more information

Preliminary RSL Threshold (dBm) and Link Capacity (Mbps)

ETSI channels	3.5 MHz		7 MHz		14 MHz		20 MHz		28 MHz		40 MHz		56 MHz	
Modulation	RSL	Eth	RSL	Eth	RSL	Eth	RSL	Eth	RSL	Eth	RSL	Eth	RSL	Eth
4QAM	-97	4	-95	8	-92	17	-91	25	-90	35	-89	50	-87	72
16QAM	-91	8	-88	16	-86	33	-85	51	-84	69	-82	98	-80	145
32QAM	-87	10	-85	20	-82	44	-81	64	-80	88	-78	125	-77	183
64QAM	-85	13	-82	27	-79	56	-78	85	-77	115	-76	165	-74	241
128QAM	-81	16	-78	33	-76	67	-75	102	-74	138	-73	198	-71	289
128QAM W	-79	17	-	-	-	-	-	-	-	-	-	-	-	-
256QAM	-	-	-75	39	-73	79	-72	119	-71	161	-69	231	-68	337
256QAM W	-	-	-73	41	-	-	-	-	-	-	-	-	-	-
512QAM	-	-	-	-	-70	90	-68	136	-68	184	-66	264	-64	385
512QAM W	-	-	-	-	-66	97	-	-	-	-	-	-	-	-
1024QAM	-	-	-	-	-	-	-65	153	-64	207	-62	298	-61	433
1024QAM W	-	-	-	-	-	-	-62	163	-61	220	-60	314	-58	456

FCC channels	5 MHz		10 MHz		20 MHz		25 MHz		30 MHz		40 MHz		50 MHz		60 MHz	
Modulation	RSL	Eth	RSL	Eth	RSL	Eth	RSL	Eth	RSL	Eth	RSL	Eth	RSL	Eth	RSL	Eth
4QAM	-96	5	-94	12	-91.5	24	-90	31	-90	37	-88	51	-87	63	-86	74
16QAM	-89	10	-88	24	-85	49	-84	62	-83.5	73	-82	101	-81	127	-80	151
32QAM	-85	12	-83	30	-81	62	-80	78	-80	93	-78	129	-77	160	-76	190
64QAM	-82	17	-80	40	-78.5	82	-77	104	-76.5	123	-75	170	-74	212	-73	251
128QAM	-79	20	-77	48	-75.5	99	-74	124	-73.5	148	-72	204	-71	255	-71	301
128QAM W	-76	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-
256QAM	-	-	-74	56	-72.5	115	-71	145	-70.5	173	-69	238	-68	297	-67	351
256QAM W	-	-	-71	60	-	-	-	-	-	-	-	-	-	-	-	-
512QAM	-	-	-	-	-68.5	132	-68	166	-67	197	-65.5	272	-64	340	-64	401
1024QAM	-	-	-	-	-65.5	148	-64	187	-63.5	222	-62	306	-61	382	-60	451
1024QAM W	-	-	-	-	-62.5	157	-61.5	198	-61	235	-60	323	-58	409	-58	474

Maximum Tx Power

Modulation	Tx power, dBm			
	15, 18, 23 GHz	17 GHz*	24 GHz*	38GHz
4 QAM	+20	-20 ... +5	-20 ... +5	+15
16 QAM	+19	-20 ... +5	-20 ... +5	+14
32 QAM	+18	-20 ... +5	-20 ... +5	+14
64 QAM	+17	-20 ... +5	-20 ... +5	+13
128 QAM	+17	-20 ... +5	-20 ... +5	+13
256 QAM	+16	-20 ... +5	-20 ... +5	+12
512 QAM	+15	-20 ... +5	-20 ... +5	+11
1024 QAM	+12	-20 ... +5	-20 ... +5	+10

* Max Tx power settings depend on national regulatory EIRP allowance and antenna size,

High Performance antenna specification

Size	Frequency, GHz	Gain, dBi	Half power beamwidth	XPD dB	F/B ratio, dB	Compliance	
						ETSI	FCC
0.3m	15	32.1	4.3°	30	58	Class 3	N/A
	18	34.2	3.3°	30	61	Class 3	B2
	23	35.3	3.0°	30	62	Class 3	A
0.6m	15	37.5	2.4°	32	62.5	Class 3	N/A
	18	39.1	1.9°	30	64.5	Class 3	A
	23	41.4	1.6°	30	66.5	Class 3	A

Integra

Integra-S

Ethernet header compression

Example shows that in 60MHz channel and 1024QAM modulation over **1Gbps** throughput can be achieved with Ethernet header compression of frame size of 64 bytes in 1+0 configuration, where link capacity is **465 Mbps**:

Frame size, bytes	Ethernet, Mbps	Throughput gain, %
64	1069.50	56.52
128	715.88	35.14
256	572.95	18.84
512	515.38	9.77
1024	489.38	4.98
1280	484.38	4.00
1518	481.27	3.38

Table shows maximum improvement achieved, when compressing IP header, QinQ VLANs headers, MAC addresses and Ethernet L1 overhead. Ethernet throughput for each frame size can be calculated for any link capacity by using calculated gain from the table. For example, at **465 Mbps** radio capacity with Ethernet compression gain of **56.52%** of 64 byte size packets can achieve **1069 Mbps** Ethernet throughput, i.e. **465 Mbps** / (1 − **56.52%**) = **1069 Mbps**.

Labelling

The label contains the following information (see samples in the picture below):

Product model name ("SAF Integra-18"). The FODU model name example is:
- SAF Integra-18 for 18GHz FODU,
- SAF Integra-23 for 23GHz FODU, etc

Product Number / Model Number (P/N or M/N) (D18B1R05LB): product/model number contains various information about the unit. Please see translation below.
Serial Number (3794701 00009): the serial number uniquely identifies the unit.

P/N or M/N translation:

"**D**" designates Integra series product;

"**18**" designates frequency band (18 GHz) of the radio;

"**B**" designates Integra-B product type;

"**1**" designates 1ft antenna diameter and ETSI Class 3;

- "**0**" - <1ft (20cm) antenna diameter and ETSI Class 3;
- "**2**" - 2ft antenna diameter and ETSI Class 3;
- "**3**" - 3ft antenna diameter and ETSI Class 3;
- "**4**" - 4ft antenna diameter and ETSI Class 3;
- "**5**" - <1ft (20cm) antenna diameter and ETSI Class 4;
- "**6**" - 1ft antenna diameter and ETSI Class 4;
- "**7**" - 2ft antenna diameter and ETSI Class 4;
- "**8**" - 3ft antenna diameter and ETSI Class 4;
- "**9**" - 4ft antenna diameter and ETSI Class 4

"**R**" is reserved;

"**05**" designates the version number of the radio;

"**L**" designates low side radio;

- "**H**" - high side radio

"**B**" designates B subband radio;

- "**A**" - A subband radio;
- "**C**" - C subband radio

Please note that frequency range is set from the central frequency of the first 3.5 MHz channel to the central frequency of the last 3.5 MHz channel (see the diagram below).

Frequency range of subband B low side Integra 18 GHz FODU:
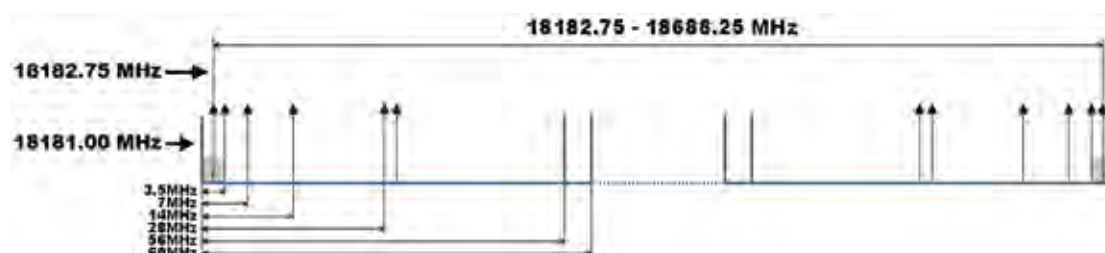
Microwave Radiation

In April 1998, ICNIRP (International Commission on Non-Ionizing Radiation Protection) published its ´Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300GHz)´. As shown in Table 2.2-1, the guidelines (Tables 6 and 7) specify the ´Reference levels on power density for occupational exposure and general public exposure to time-varying electric and magnetic fields (unperturbed rms values)´ between 2 and 300 GHz.
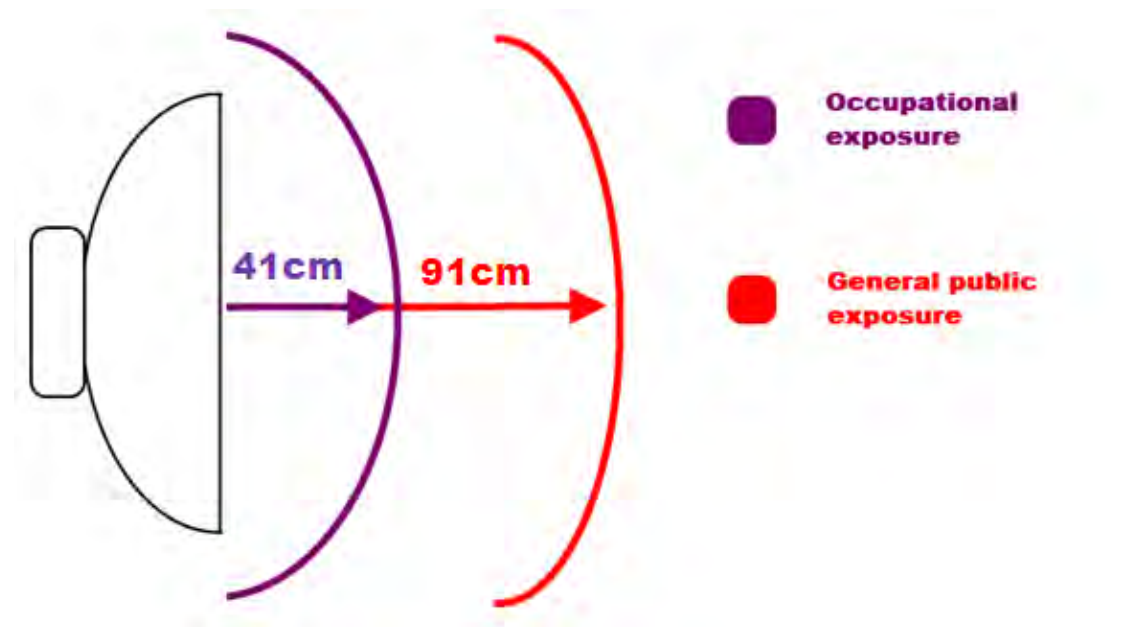
ICNIRP Reference levels within the frequency range 24 GHz

Frequency range	Exposure characteristics	Equivalent plane wave power density Seq (W/m2)	Average time period (min)
24GHz	occupational 41cm	50	$68/f^{1.05}$ (f in GHz)
	general public 91cm	10	$68/f^{1.05}$ (f in GHz)
Note: For pulsed signals it is suggested that the peak equivalent plane wave power density, as averaged over the pulse width, does not exceed 1000 times the Seq exposure levels given in the table. **Note:** Within the frequency range the $10 - 300$ GHz the basic restrictions are identical to the reference levels. Remarks to the definition of basic restrictions: 1. Power densities are to be averaged over any 20 cm2 of exposed area and any 68/f1.05 minute period (where f is in GHz) to compensate for progressively shorter penetration depth as the frequency increases. 2. Spatial maximum power densities, averaged over 1 cm2, should not exceed 20 times the values above.			

Compared to the ICNIRP restrictions, FCC CFR 47 specifies the Maximum Permissible Exposure (MPE) levels for occupational/controlled environment and general public/uncontrolled environment, as shown in the table below.

FCC MPE limits within the frequency range 1.5-100 GHz

Frequency range	Exposure characteristics	Equivalent plane wave power density Seq (W/m2)	Average time period (min)
24GHz	occupational 41cm	50	6
	general public 91cm	10	30

Quite a few other documents specify or refer to exposure limits comparable to those given above, e.g.:

- 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic

fields (0 Hz to 300 GHz)

- WHO: Environmental Health Criteria 137: ´Electromagnetic Fields (300 Hz to 300 GHz)´

- ANSI/IEEE C95.1, 1999:

´IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz´

- BRD, Bundesimmissionsschutzgesetz, 26. BImSchV Verordnung über elektromagnetische Felder

- Bundesamt für Umwelt, Wald und Landwirtschaft (BUWAL), Bern/Schweiz

Schriftenreihe Umwelt Nr. 164, Luft, Mai 1992

´Messung nichtionisierender elektromagnetischer Strahlung, 1. Teil: Frequenzbereich 100 kHz bis 300 GHz´

- DIN VDE 0848-2, Entwurf, Oktober 1991:

´Sicherheit in elektrischen, magnetischen und elektromagnetischen Feldern, ´Teil 2: Schutz von Personen im Frequenzbereich von

30 kHz bis 300 GHz´

- ENV 50166-2, January 1995 (withdrawed in December 1999 by CENELEC)

´Human Exposure to Electromagnetic Fields (10 kHz — 300 GHz)´

Chapter 2: INSTALLATION

Integra FODU: assembling mounting bracket and installing with antenna on a pole

Disassembled mounting bracket and tools required for assembly

Parts of disassembled mounting bracket: **1** — three (3) M8x1.25x16 hex flange bolts already attached to clamps for housing and pipe [7]; **2** — one (1) hex flange bolt M8x1.25x20; **3** — one (1) hex flange bolt M8x1.25x30, one (1) M10x1.5 hex flange nut and one (1) M8x80 eye screw already attached to clamps for housing and pipe [7]; **4** — one (1) M8x80 eye screw; **5** — two (2) M8x1.25 hex flange nuts already attached to M8x80 eye screw [3]; **6** — four (4) M8x160 threaded rods; **7** — clamps for housing and pipe interconnected with three (3) M8x1.25x16 hex flange bolts [1] and eye screw for horizontal alignment [3]; **8** — ten (10) M8x1.25 hex flange nuts; **9** — two (2) mounting bracket clamps.
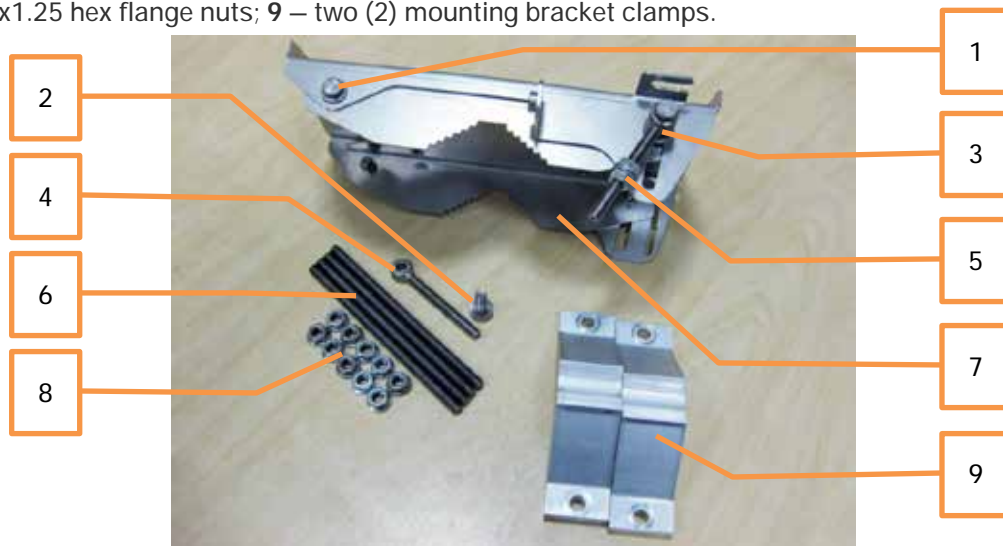
Parts of disassembled mounting bracket

Parts of Integra FODU: **10** — spacer hex flange nut; **11** — lifting eye nut; **12** — fixation plate; **13** — side screw flange nuts; **14** — grounding flange nut.
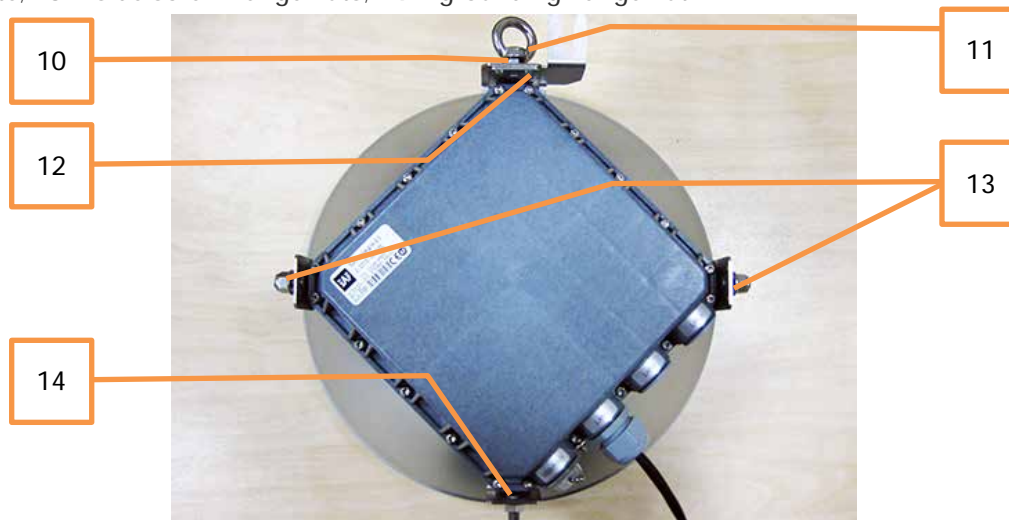
Numbers of mounting bracket and Integra FODU parts in next sections will be mentioned in square brackets [].

Changing polarization of Integra FODU and antenna

Tools required: 13mm (0.512″) wrench (comes in package)

1   Remove Integra FODU with antenna from mounting bracket.

Default polarization is vertical.
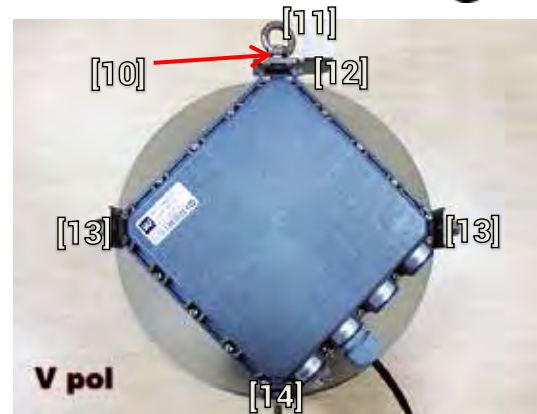
2   Using 13mm wrench remove indicated nuts and fixation plate [10, 11, 12, 13, 14].

3   Removed parts must be attached back with 90 degree offset (see above). Gap between side screw flange nuts [13] and fastening angles should be 5mm.

4   View of Integra FODU with swapped polarization.

5   30 cm antenna: when polarization is changed, make sure that drain hole cap located at grounding flange nut should be removed and inserted in previous drain hole.
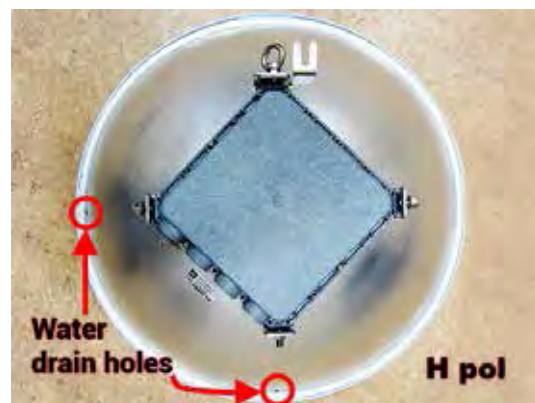
6   60 cm antenna: make sure that one of two water drain holes is aligned with Integra FODU's grounding flange nut.

Assembly procedure

Tools required: 13mm (0.512″) wrench (comes in package)

1. Using 13mm wrench slightly loosen three hex flange bolts [1] and hex flange bolt, nut and eye screw [3] interconnecting clamps for housing and pipe [7].
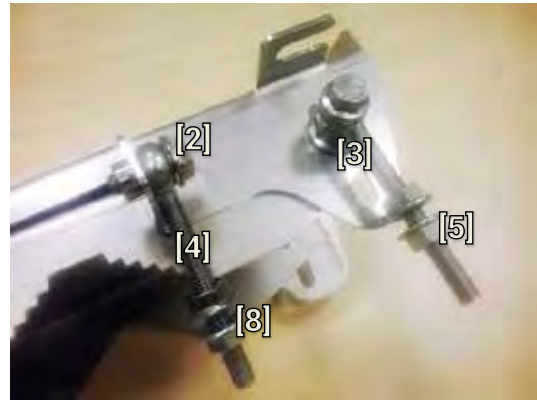
2. Attach vertical alignment eye screw [4] to clamps for housing and pipe [7] using hex flange bolt [2] and screw on two hex flange nuts [8]. Make sure that both eye screws are positioned as shown in the image (turned to the back side of clamps) and the gap between each two flange nuts on eye screws should be 15..20mm (0.6..0.8 in.). Do not tighten both hex flange bolts [3] and [2].

3. Screw on one hex flange nut [9] on each of threaded rods [8]. Note that flange nuts should be screwed on exposing approx. 15mm (0.6 in.) of threaded rods.
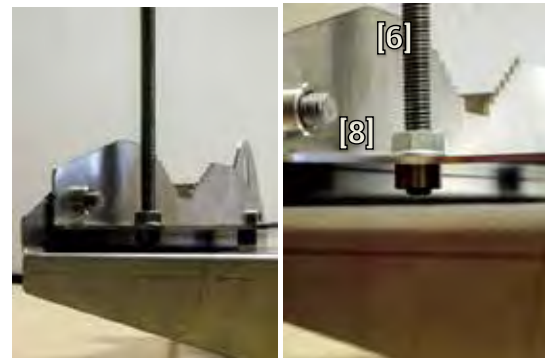
4. Screw on each threaded bolt into four available threaded holes of mounting clamp. Note that threaded bolt should be visible from other side of the clamp not more than 2mm. Tighten hex flange nuts [9] with torsion 20..25 N·m.
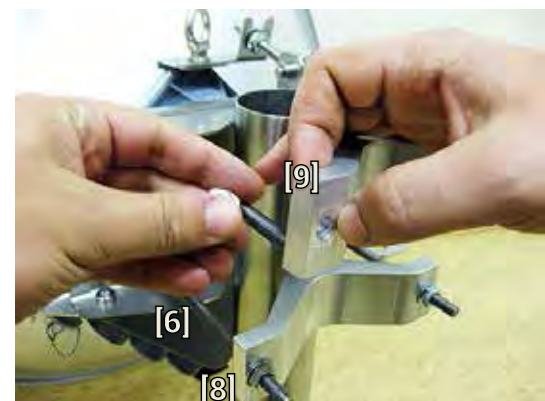
5 Attach mounting bracket clamps [2] on two threaded rods [8] as shown on the picture and afterwards screw on remaining hex flange nuts [9] on each of four threaded rods. No parts should remain left not assembled.

Bracket clamps in following position support mast ⌀ 55..120mm. Reversing clamps allows support of smaller masts ⌀ 25..75mm.
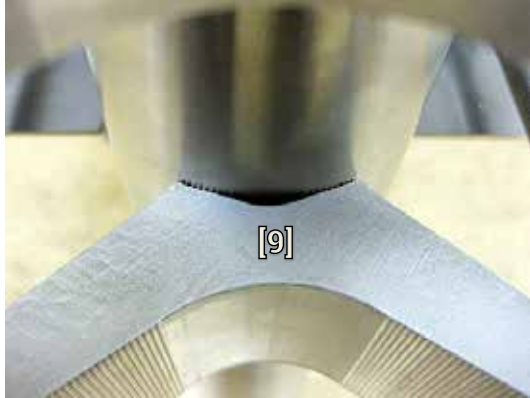
6 Unscrew hex flange nuts [9] from both free threaded bolts [8]. Make sure that hex flange nuts on opposite threaded bolts are not too far; otherwise adjust bolts' position accordingly. Put other end of mounting bracket clamp [2] on free threaded bolt.

7 Hex flange nuts should be evenly aligned on threaded bolts so that both mounting bracket clamps [9] are tightly attached to the pipe. Tighten hex flange nuts with torsion not exceeding 20 N·m.

8 View of assembled mounting bracket on the mast pole.

9 Make sure that both horizontal and vertical alignment eye screws are turned to the mast before attaching Integra FODU.

10 Attach Integra FODU with antenna to the mounting bracket so that side screws fit into grooves of the housing clamp [7].

11 Connect vertical alignment eye screw [4] to the upper groove on Integra housing.

12 View of assembled bracket on the mast pole with Integra FODU attached and secured.

⚠️ For extra protection from sun radiation it is recommended to install sun shield to cover the radio

Antenna alignment

Tools required: 13mm (0.512″) wrench (comes in package)
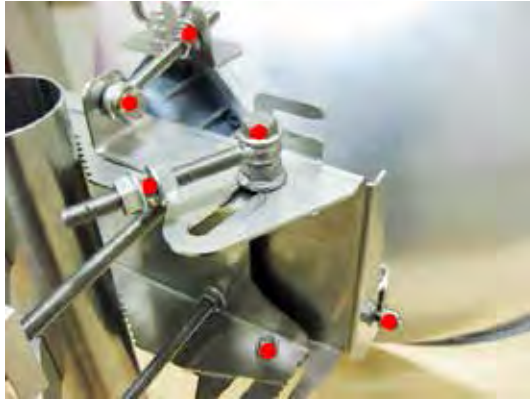
1 Before aligning the antenna, make sure that screws marked with red dots on the right side view of mounting bracket are loosened - hex flange nuts and bolts of azimuth and elevation eye screws, right side screw on Integra FODU and hex flange bolt on azimuth angle indicator.

2 Additionally loosen following screws marked with red dots on the left side view of mounting bracket: left side screw on Integra FODU and two hex flange bolts between both mounting bracket clamps for housing and pipe.

3 For initial alignment make sure that elevation is approximately at zero degree angle by adjusting hex flange nuts [9] on vertical alignment eye screw so that Integra's housing is parallel with the bracket.

4 Adjust azimuth angle by manually moving mounting bracket in horizontal axis. Note that all azimuth position fixing hex flange bolts [8], as well as horizontal alignment eye screw with flange bolt [3] need to be loosened ensuring free movement in horizontal axis.
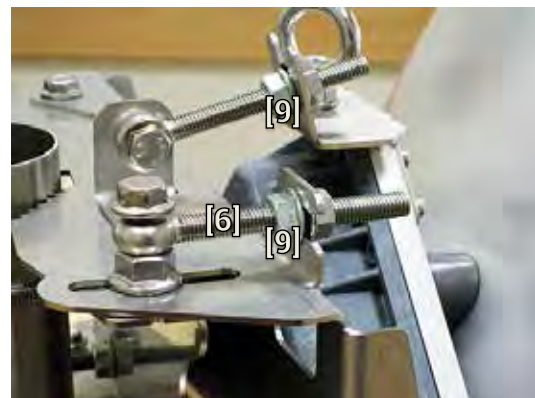
5 Each notch corresponds to one degree of azimuth angle. Half distance between notches (each lip) corresponds to 0.5 degree.

6 Fix azimuth angle on horizontal axis by adjusting position of flange nuts [9] on both horizontal and vertical alignment eye screws.

7 When alignment is finished tighten screws marked with red dots on the right side view of mounting bracket: hex flange nuts and bolts of azimuth and elevation eye screws, right side screw on Integra FODU and hex flange bolt on azimuth angle indicator with torsion 20..25 N·m.

8 Additionally tighten following screws marked with red dots on the left side view of mounting bracket: left side screw on Integra FODU and two hex flange bolts between both mounting bracket clamps for housing and pipe with torsion 20..25 N·m.

Integra-S FODU: attaching to the antenna

Parts of Integra-S FODU: **1** — O-ring; **2** — flange protecting sticker; **3** — wire handle; **4** — fixation clamps; **5** — grounding screws.
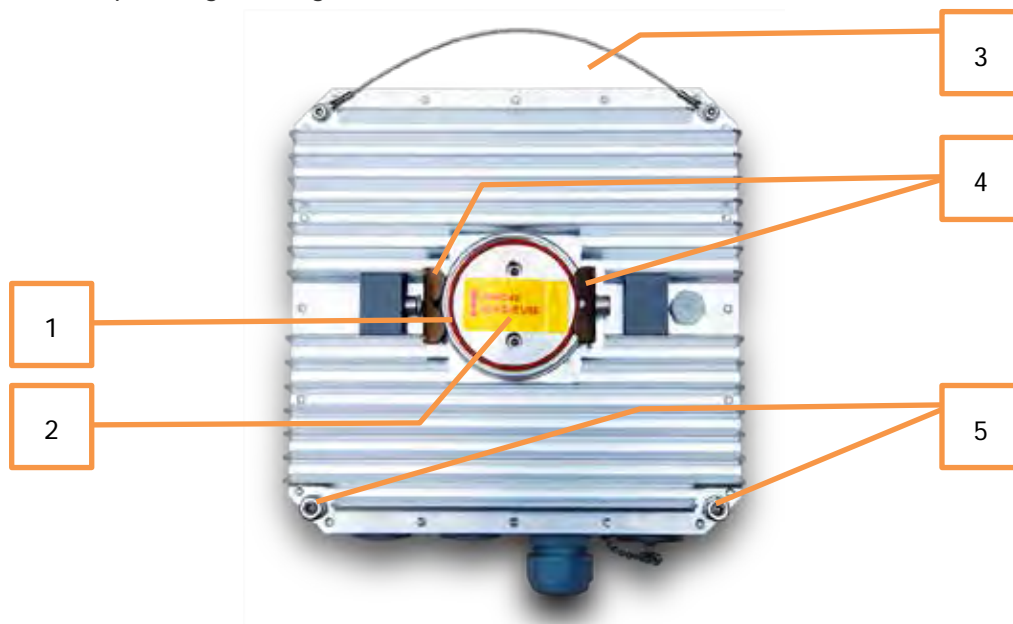
Tools required: Size 5 allen wrench

Level (not supplied)

1   Using size 5 allen wrench loosen one clamp completely and second clamp by a half-turn.

2   Put Integra-S on antenna adapter flange by hooking half-turn loosened clamp at the top and leaving the completely loosened clamp at the bottom. Make sure O-ring is in place and the adapter flange fits into the Integra-S transition flange socket.

Note! Protective sticker should be removed before attaching the Integra-S FODU to the antenna.

3   Secure the interconnection by tightening the bottom clamp (not fully). Make sure rotation of the Integra-S is still possible.

4   Rotate Integra-S to match the required polarization.

5   The sticker on the back lid indicates the polarization of the Integra-S. Adjust polarization so that the interface ports are located at the lower side of the Integra-S.

6   Verify polarization accuracy with a level, by placing it against the top edge of the Integra-S housing

7   Secure the position of the Integra-S by fully tightening both fixation clamps.

⚠️   For extra protection from sun radiation it is recommended to install sun shield to cover the radio

⚠️   If any further assistance is required please contact techsupport@saftehnika.com

Chapter 3: WEB GUI

Initial configuration

System requirements

Operating system:

· Microsoft Windows XP / Vista / 7 / 8;
· Linux

Web browser:

· Google Chrome;
· Mozilla Firefox;
· Internet Explorer 8 (or above)

Accessing Integra Web GUI

1. Launch your browser and in address field enter Integra FODU IP address. Default IP addresses are as follows:
    · 192.168.205.10 for low side Integra FODU (P/N D*******L*)
    · 192.168.205.11 for high side Integra FODU (P/N D*******H*)

2. Press "Enter" key (PC) or "Return" (Mac).
3. Login screen will appear.
4. Enter username and password. Default credentials are as follows:
    · Username: **admin**
    · Password: **changeme**

5. Select "Remember password" if you want browser to remember entered login credentials.
6. Press "Log in" button.

Main page

After login you will be automatically redirected to the Main page of Web GUI:

Web GUI is divided into 5 sections:

1 Top panel

Shows information about Integra FODU you are connected to including:

· System name
· IP address
· Serial number
· Uptime
· Firmware version

2 Menu panel

Allows navigating between Main page ("Main") and subpages of 4 sections:

· Over the air (radio configuration)
· Networking (Ethernet configuration)
· Performance
· System

3 Main Web GUI window

By default Main page ("Main") is shown. Contents will change according to menu panel selection.

4   MODIFY / SAVE / LOGOUT

Allows modifying parameters in the main window. If none can be modified, MODIFY button appears inactive. After modification SAVE button becomes active and indicates number of unsaved changes as well as type (when moving cursor over the button).

5   System summary

Shows two selected parameters of local and remote systems and Tx polarization (reading from internal accelometer

Modifying basic system parameters

In order to proceed with initial configuration, press MODIFY button and entry fields will appear for adjustable values:

1 Tx power

Available range depends on radio model and selected modulation. Actual range will be indicated in the brackets.

2 Tx frequency

Available range depends on frequency band, subband, radio side and channel bandwidth selected. Actual range will be indicated in the brackets.

Tx frequency range indicates range of central frequencies for configured channel bandwidth.

Default frequency range (indicated on the label) is defined for 3.5MHz channel bandwidth.

3 Standard

Allows choosing whether only FCC, ETSI or both channel bandwidth options are visible in "Configuration" selection field.

4 Bandwidth

Allows choosing between available channel bandwidth options along with indication of maximum modulation, as well as according standard of channel bandwidth — ETSI or FCC.

5 Modulation

Allows choosing between available modulations for selected channel bandwidth.

"FEC" suffix indicates better sensitivity mode (longer FEC overhead), while "Weak FEC" indicates higher capacity mode (shorter FEC overhead).

"Weak FEC" is available only for highest modulation for selected channel bandwidth.

6 State

Allows enabling/disabling each of three available LAN ports.

7 Execute

By pressing „Execute configuration" changes made to the corresponding section apply only for the local side Integra. If „Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

Pressing „Execute for both" applies changes made to the corresponding section both for local and remote side Integras.

Over The Air

Radio ➔ Configuration

Radio configuration page is available in "System" menu (Over The Air➔Radio➔Configuration).

1) **Tx power** — Available range depends on radio model and selected modulation. Actual range will be indicated in the brackets;

2) **Tx frequency** — Available range depends on frequency band, subband, radio side and channel bandwidth selected. Actual range will be indicated in the brackets.

   Tx frequency range indicates range of central frequencies for configured channel bandwidth.

   Default frequency range (indicated on the label) is defined for 3.5MHz channel bandwidth.

3) **Tx mute [>=10 sec]** — allows muting transmitter to limited time interval in seconds. Minimum value is 10 seconds. Note that transmitter will be muted only if valid value in seconds is entered;

4) **RSSI Audio** — allows disabling/enabling RSSI audio operation on 3.5mm jack beside USB port. By default RSSI Audio is enabled;

5) **RSSI LED** — allows disabling/enabling RSSI LED operation. By default RSSI LED is enabled. Please refer to RSSI LED section for further explanation;

6) **RSSI LED mode** — allows selecting RSSI LED operation mode. By default Mode 1 is enabled. Please refer to RSSI LED section for further explanation;

7) **Standard** — Allows choosing whether only FCC, ETSI or both channel bandwidth options are visible in "Configuration" selection field.

8) **Bandwidth** — Allows choosing between available channel bandwidth options along with indication of maximum modulation, as well as according standard of channel bandwidth — ETSI or FCC.

9) **Modulation** — Allows choosing between available modulations for selected channel bandwidth.
   "FEC" suffix indicates better sensitivity mode (longer FEC overhead), while "WeakFEC" indicates higher capacity mode (shorter FEC overhead).
   "Weak FEC" is available only for highest modulation in selected channel bandwidth.

10) By pressing „Execute configuration" changes made to the corresponding section apply only for the local side Integra. If „Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.
   Pressing „Execute for both" applies changes made to the corresponding section both for local and remote side Integras.

CLI commands:

radio status	Use to show radio status.
radio power <Tx power>	Use to set Tx power in dBm.
radio frequency <frequency>	Use to set Tx frequency in kHz.
radio rssi-led <enable|disable>	Use to enables or disable RSSI LED operation.
radio tx-mute <time|disable>	Use to mute transmitter on specific time in seconds or unmute.
radio factory	Use to reset radio settings to factory defaults — Tx power will be disabled and frequencies set to factory defaults.
radio upgrade	Use to upgrade radio software version.
radio version	Use to check radio software version
radio show-counters	Use to show radio interface counters.
modem configuration set <bandwidth> <min_mod> <max_mod>	Use to set modem configuration — bandwidth, minimum and maximum modulation. "_W" suffix indicates "Weak FEC" modulation.
modem configuration set factory	Use to reset modem settings to factory defaults — bandwidth and modulation will be reset to minimum.
modem loopback <digital|none>	Use to enable or disables modem loopback.
modem performance	Use to check modem statistics according to ITU-T G.826. Refer to description on Modem performance for further explanation.
modem allowed	Use to check list of available modem configurations.

Networking

Ethernet ⊋ VLAN

The VLAN configuration window provides configuration of port-based Ethernet Virtual Local Area Networks (VLANs), allowing using up to 4095 different VLAN IDs. It is possible to set VLAN IDs as tagged or untagged members on each LAN port.

In order to add VLAN tag to untagged packets on ingress direction, according "Default VLAN" (2) should be specified. By default "Default VLAN" value on all ports is VLAN ID 1.

An example below shows sample configuration with VLAN IDs 100-300 configured as tagged members on LAN2 and WAN ports (user traffic) and VLAN ID 500 as tagged member on LAN2 and WAN ports, and untagged member on MNG port (management traffic).

1) **VLAN state** — enable or disable 802.1Q support;
2) **Default VLAN** — specify default VLAN ID on each of LAN and WAN ports — indicating VLAN ID to be added to untagged packets entering particular port;
3) **VID (1 .. 4094)** — enter VLAN ID (or range) to be added;
4) **TAGGED MEMBER** — specify ports on which VLAN ID will be trunked;
5) **UNTAGGED MEMBER** — specify ports on which VLAN ID will be tagged/untagged (access type);
6) **MNG** — specify which individual VLAN ID will be used for management access;
7) **Add / Delete** — Press "Add" to add entered individual VLAN ID or range of VLAN IDs or press red cross (✗) to delete VLAN entry;
8) By pressing „Execute configuration" changes made to the corresponding section apply only for the local side Integra. If „Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

Ethernet ➔ Rate limit

1) **CIR** – Enable or disable CIR (Commited Information Rate) on available ports and specify CIR value in Mbps;
2) **CBS** – Enable or disable CBS (Commited Burst Size) on available ports and specify CBS value in Mbps;
3) By pressing „Execute configuration" changes made to the corresponding section apply only for the local side Integra. If „Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

network port <port> egress-rate show	Use to show committed information rate (CIR) and committed burst size (CBS) setting on particular port.
network port <port> egress-rate set cir <1...1000000> cbs <1...1000000>	Use to set committed information rate (CIR) and committed burst size (CBS) setting on particular port.

Ethernet ➔ Port status and configuration

1) **Port** — Lists available switch ports;
2) **State** — shows operation status of each port;
3) **Link status** — shows whether link with appropriate port is established and according link speed;
4) **Link speed** — shows whether link speed is configured to automatic speed setting or manual. Note that manual setting is available only for electric Ethernet port (LAN1).

In order to adjust Ethernet port settings, press MODIFY button

1) **Port** — lists available switch ports;
2) **State** — enable or disable port;
3) **Link status** — shows whether link with appropriate port is established and according link speed;
4) **Link speed** — allows manually adjusting link speed (available only for LAN1 port).
5) By pressing „Execute configuration" changes made to the corresponding section apply only for the local side Integra. If „Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

network status info	Use to show status of all ports.
network status config	Use to show configuration of all ports..
network port <port> set admin-state <enable|disable>	Use to enable or disable particular port.

network port <port> set mtu <60..9600>	Use to change supported L2 frame size on particular port. Default value is 9600 bytes.
network port <port> set speed <auto|100fdx|100hdx|10fdx|10hdx>	Use to change speed and duplex setting on particular port. Default value is "auto" (autonegotiation).

Synchronization ➔ SyncE

Synchronous Ethernet (SyncE) allows synchronizing Ethernet switch clock to an external source clock by specifying an ingress port.

⚠ Incorrect SyncE configuration may result in a loss of connectivity.

1) **Port** - Indicates SyncE source port (if enabled);
2) **State** — Indicates if SyncE is enabled;
3) **Status** — Indicates "Locked" if SyncE is operating normally;
4) **Source port configuration** — allows specifying SyncE source port;
5) **Disable/Enable** — Disable or Enable SyncE operation.

Configuration examples

1) Integra link with an external clock source
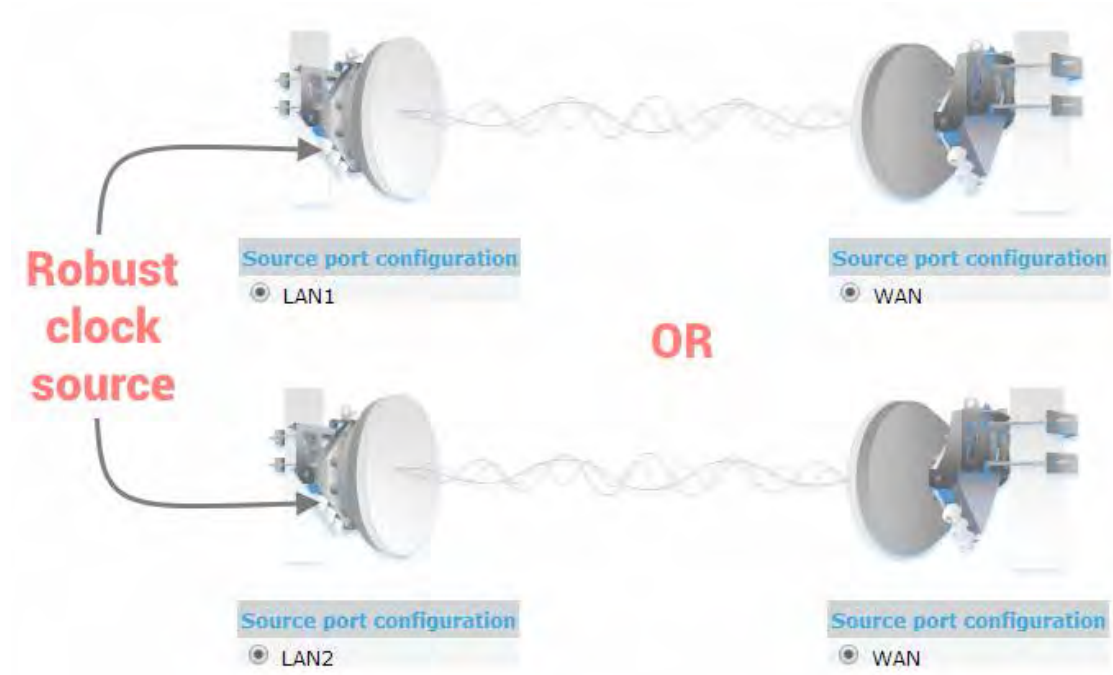
2) Integra back-to-back interconnection with an external clock source
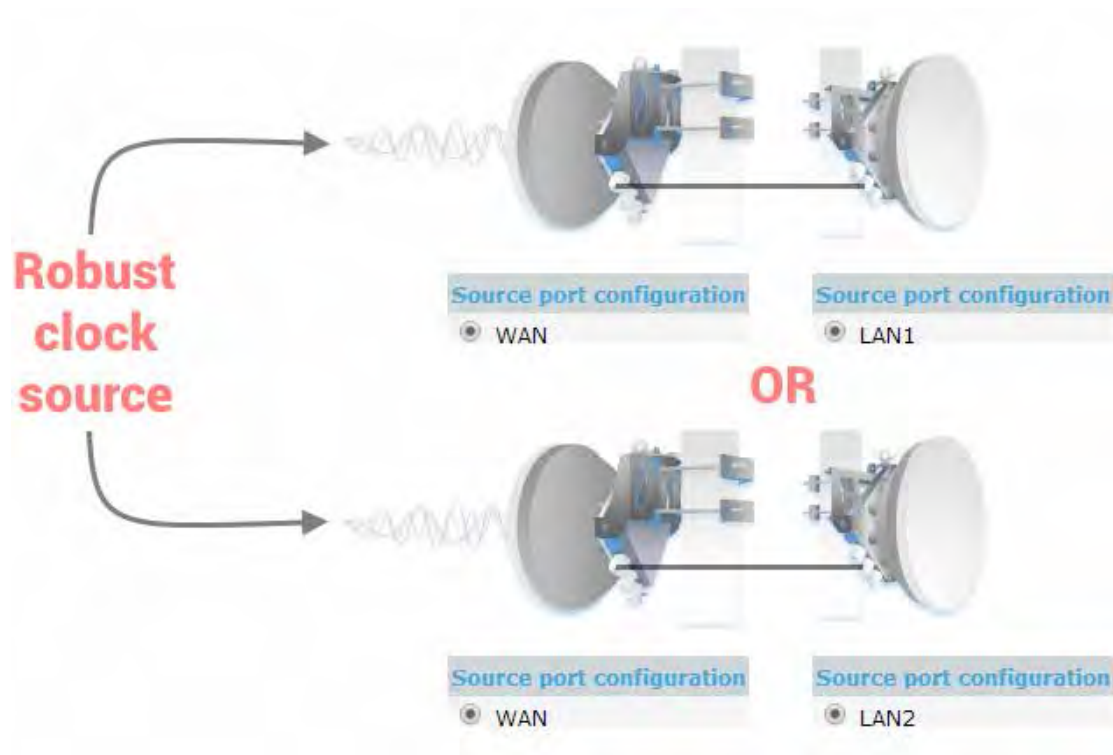
3) Integra as a master clock source

⚠ Autonegotiation will not function properly when the clock source ports on both Integras are pointing at each other (e.g. WAN-WAN in a link or LAN-LAN in a back-to-back connection).

⚠ SyncE will function properly on LAN2 and LAN3 ports only with appropriate SFP modules.

CLI commands:

network sync enable <port>	Enable SyncE on a port connected to a clock source. The selected port will become "slave", while other ports — "master". Autonegotiation will not function properly between two "slave" ports.
network sync disable	Disable SyncE on all ports.
network sync status	Enabled — shows if SyncE is enabled; Polling failed — indicates last data polling failure; Speed Grade — shows Ethernet speed on LAN1 port - 1000BASE-T(1G) or 100BASE-T(100M); Port — current port used as clock source; State — clock status, "Locked" if SyncE operates normally; State info — additional info
network status info	'SyncE_Act' and 'SyncE_Prio' field nonzero values indicate synchronous ethernet activity.

Performance

Alarm ➔ Alarm status

Alarm status page summarizes current alarms by showing date and time the alarm occurred and its name.

1) **Date** – shows date when alarm was initiated;
2) **Time** – shows time when alarm was initiated;
3) **Alarm** – shows name of the alarm.

Alarm ➔ Alarm log

Alarm log shows 20 latest alarm entries per page and about 400 latest alarm entries in total. Full alarm log can be downloaded by pressing on "Alarm event log file". Last 20 log entries are shown by default.

Alarm entries are mostly distributed in two groups – "Set"' when alarm appears and "Reset" when alarm disappears.

You also have fast access to alarm filtering, where it is possible to choose which alarm groups you are willing to filter out of all log entries.

Performance / Alarm log

1) **Clear alarm log** — deletes all alarm log entries;
2) **Toggle period selection** — opens period selection controls;
3) **Load the latest data** — refreshes alarm log and shows last 20 log entries;
4) List of alarm log entries — entry number, date and time, source node, status and event name;
5) Navigation controls. "<<" navigates to start of alarm log, while ">>" — to the end; "Previous 20" navigates to previous alarm log page showing 20 previous alarm log entries, while "Next 20" — to next alarm log page showing 20 next alarm log entries (if available).
6) Shows number of currently viewed alarm log page. In Web GUI only last 20 pages (400 entries) are shown. Download alarm log to view full list;
7) **Filter** — press to filter alarms from certain source node (e.g. Radio);
8) **Alarm event log file** — press on the link to download full alarm log text file.

Alarm ➔ Alarm threshold configuration

Page provides summary of parameters' alarm thresholds. All thresholds are predefined and some change dynamically according to system configuration. Thresholds can be modified if required.

Alarm activates when current value exceeds low-delta or high+delta values. Alarm deactivates when current value exceeds low+delta or high-delta values.

Performance / Alarm threshold configuration

Alarm name	Low value	High value	Delta value	Current value
License remaining time	1296000 s			2353752 s
System CPU temperature	-40.0 C	100.0 C	2.0 C	64.0 C
Rx level	-82 dBm	-35 dBm	0 dB	-42 dBm
Radio temperature	-40.0 C	80.0 C	2.0 C	60.0 C
Radial MSE		-9.6 dB	2.0 dB	-41.8 dB
FEC load		3.00e-03		0.00e+00
Carrier offset	-250.00 kHz	250.00 kHz	10.00 kHz	11.56 kHz
Modem temperature	-40.0 C	100.0 C	2.0 C	63.0 C
PSU power	20.00 W	40.00 W	2.00 W	33.20 W
PSU voltage	36.00 V	58.00 V	2.00 V	54.60 V
PSU current	0.350 A	1.100 A	0.050 A	0.608 A
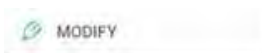
⚠ Press [MODIFY] button to enter configuration mode.

Performance / Alarm threshold configuration

Alarm name	Low value		High value		Delta value		Current value	Default value **1**
License remaining time	1296000	s					2353470 s	☑
System CPU temperature	-40.0	C	100.0	C	2.0	C	63.5 C	☑
Rx level	-82	dBm	-35	dBm	0	dB	-42 dBm	☑
Radio temperature	-40.0	C	80.0	C	2.0	C	60.0 C	☑
Radial MSE			-9.6	dB	2.0	dB	-41.7 dB	☑
FEC load			3.00e-03				8.78e-07	☑
Carrier offset	-250.00	kHz	250.00	kHz	10.00	kHz	7.67 kHz	☑
Modem temperature	-40.0	C	100.0	C	2.0	C	63.0 C	☑
PSU power	20.00	W	40.00	W	2.00	W	33.20 W	☑
PSU voltage	36.00	V	58.00	V	2.00	V	54.60 V	☑
PSU current	0.350	A	1.100	A	0.050	A	0.608 A	☑

2 (points to Low value / High value / Delta value fields)

Set all to default **3** **4** Execute configuration

1) **Default value** – deselect to activate manual threshold modification;
2) When "Default value" is deselected, "Low value", "High value" and "Delta value" fields for all parameters become editable;
3) **Set all to default** – resets "Low value", "High value" and "Delta value" for all parameters to factory defaults;
4) By pressing „Execute configuration" changes made to the corresponding section apply only for the local side Integra.

Performance ➔ Performance graph

Performance graph allows visualising various parameters over chosen time period as curves. It is possible to choose between System Uptime (s), System CPU temperature (C), Rx level (dBm), Radio temperature (C), Radial MSE (dB), Carrier offset (Hz), Modem temperature (C), PSU power (W) and PSU voltage (V). Any two parameters can be shown at a time. By default Rx level (dBm) and Radial MSE (dB) are selected.
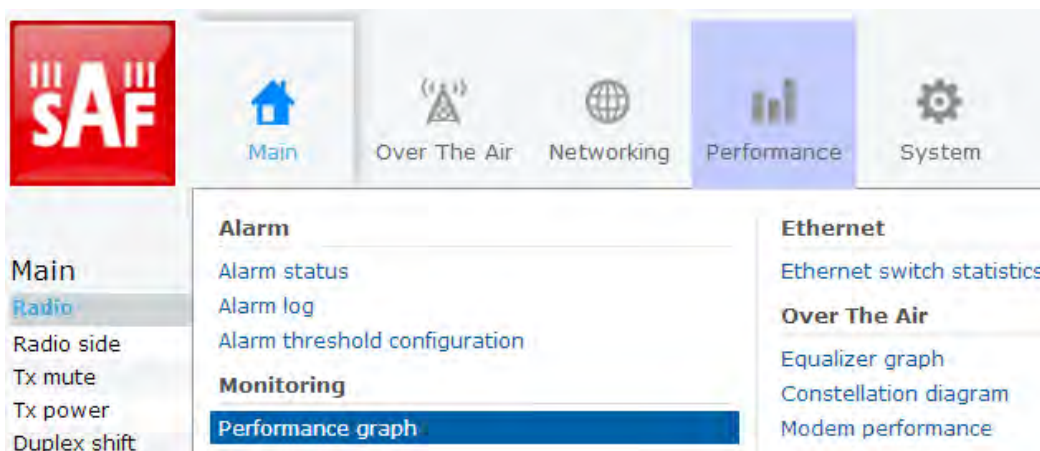
Performance / Performance graph
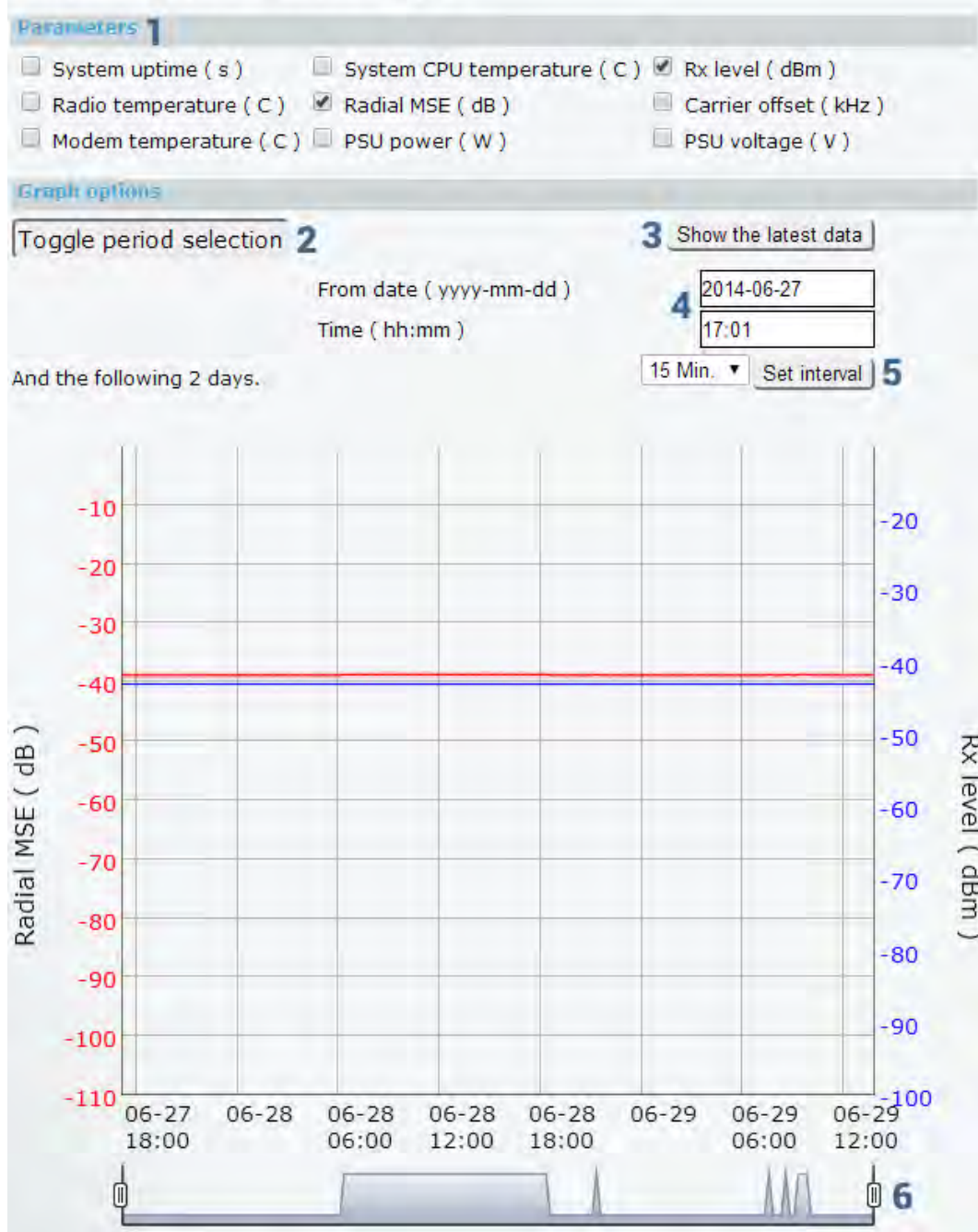
1) **Parameters** — choose the required parameters; Rx level (dBm) and Radial MSE (dB) are selected by default;
2) **Toggle period selection** — opens period selection controls;
3) **Show the latest data** — shows last 200 entries with 1min interval (3h20min);
4) Allows specifying start date and time;
5) Allows specifying interval granularity — 1min, 15min or 60min.
6) Left and right sliders allow to "zoom" currently selected time period.

Ethernet à Ethernet switch statistics

Performance / Ethernet switch statistics

		LAN1	LAN2	LAN3	WAN	MNG
IngressPackets	1	41.93 k	0	0	129.95 k	123.07 k
IngressBytes	2	11.65 M	0	0	154.83 M	148.54 M
EgressPackets	3	65.59 k	7.90 k	7.90 k	120.69 k	116.58 k
EgressBytes	4	51.71 M	1.10 M	1.10 M	133.32 M	132.06 M
EtherStatsMulticastPkts	5	1.48 k	1.48 k	1.48 k	N/A	73.69 k
EtherStatsBroadcastPkts	6	6.42 k	6.42 k	6.42 k	N/A	0
EtherStatsPkts64Octets	7	43.98 k	30	30	N/A	545
EtherStatsPkts65to127Octets	8	4.52 k	4.13 k	4.13 k	N/A	23.89 k
EtherStatsPkts128to255Octets	9	13.11 k	3.53 k	3.53 k	N/A	8.02 k
EtherStatsPkts256to511Octets	10	390	146	146	N/A	265
EtherStatsPkts512to1023Octets	11	12.13 k	44	44	N/A	38.51 k
EtherStatsPkts1024to1518Octets	12	33.40 k	24	24	N/A	2.48 k
EtherStatsOversizePkts	13	0	0	0	N/A	165.96 k
EtherRxOversizePkts	14	0	0	0	N/A	88.10 k
EtherTxOversizePkts	15	0	0	0	N/A	77.86 k
EtherStatsOctets	16	63.36 M	1.10 M	1.10 M	N/A	280.60 M
EtherStatsPkts	17	107.52 k	7.90 k	7.90 k	N/A	239.66 k
EtherStatsTXNoErrors	18	65.59 k	7.90 k	7.90 k	N/A	116.58 k
EtherStatsRXNoErrors	19	41.93 k	0	0	N/A	123.07 k
EtherStatsPkts1519to1522Octets	20	0	0	0	N/A	0
IfInOctets	21	11.65 M	0	0	N/A	148.54 M
IfOutOctets	22	51.71 M	1.10 M	1.10 M	N/A	132.06 M
Dot1dTpPortInFrames	23	41.93 k	0	0	N/A	123.07 k
Dot1dTpPortOutFrames	24	65.59 k	7.90 k	7.90 k	N/A	116.58 k
ReceivedPkts64Octets	25	24.25 k	0	0	N/A	440
TransmittedPkts64Octets	26	19.74 k	30	30	N/A	105
ReceivedPkts65to127Octets	27	4.29 k	0	0	N/A	9.04 k
TransmittedPkts65to127Octets	28	237	4.13 k	4.13 k	N/A	14.85 k
ReceivedPkts128to255Octets	29	3.53 k	0	0	N/A	4.47 k
TransmittedPkts128to255Octets	30	9.58 k	3.53 k	3.53 k	N/A	3.54 k
ReceivedPkts256to511Octets	31	146	0	0	N/A	119
TransmittedPkts256to511Octets	32	244	146	146	N/A	146
ReceivedPkts512to1023Octets	33	6.64 k	0	0	N/A	19.18 k
TransmittedPkts512to1023Octets	34	5.49 k	44	44	N/A	19.33 k
ReceivedPkts1024to1518Octets	35	3.09 k	0	0	N/A	1.73 k
TransmittedPkts1024to1518Octets	36	30.31 k	24	24	N/A	770
IfInBroadcastPkts	37	6.42 k	0	0	N/A	0
IfOutBroadcastPkts	38	1	6.43 k	6.43 k	N/A	0
IfInMulticastPkts	39	1.48 k	0	0	N/A	35.09 k
IfOutMulticastPkts	40	0	1.48 k	1.48 k	N/A	38.83 k
Dot3InPauseFrames	41	0	0	0	N/A	0
Dot3OutPauseFrames	42	0	0	0	N/A	0
EtherStatsUndersizePkts	43	0	0	0	N/A	0
EtherStatsFragments	44	0	0	0	N/A	0
EtherStatsCRCAlignErrors	45	0	0	0	N/A	0
EtherStatsJabbers	46	0	0	0	N/A	0

Clear all statistic **47**　**48** [Clear] [Clear] [Clear] [Clear] [Clear]

1) **IngressPackets** — Packets that ingress on the port;
2) **IngressBytes** — Bytes that ingress on the port;
3) **EgressPackets** — Packets that egress on the port;
4) **EgressBytes** — Bytes that egress on the port;
5) **EtherStatsMulticastPkts** — The total number of good packets received that were directed to a multicast address. Note that this number does not include packets directed to the broadcast address;
6) **EtherStatsBroadcastPkts** — The total number of good packets received that were directed to the broadcast address. Note that this does not include multicast packets;
7) **EtherStatsPkts64Octets** — The total number of packets (including bad packets) that were 64 octets in length (excluding framing bits but including FCS octets);
8) **EtherStatsPkts65to127Octets** —The total number of packets (including bad packets) that were between 65 and 127 octets in length inclusive (excluding framing bits but including FCS octets);
9) **EtherStatsPkts128to255Octets** — The total number of packets (including bad packets) that were between 128 and 255 octets in length inclusive (excluding framing bits but including FCS octets);
10) **EtherStatsPkts256to511Octets** — The total number of packets (including bad packets) that were between 256 and 511 octets in length inclusive (excluding framing bits but including FCS octets);
11) **EtherStatsPkts512to1023Octets** — The total number of packets (including bad packets) that were between 512 and 1023 octets in length inclusive (excluding framing bits but including FCS octets);
12) **EtherStatsPkts1024to1518Octets** —The total number of packets (including bad packets) that were between 1024 and 1518 octets in length inclusive (excluding framing bits but including FCS octets);
13) **EtherStatsOversizePkts** — The total number of packets that were longer than 1518 octets (excluding framing bits, but including FCS octets) and were otherwise well formed;
14) **EtherRxOversizePkts** — The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets) and were otherwise well formed;
15) **EtherTxOversizePkts** — The total number of packets transmitted that were longer than 1518 octets (excluding framing bits, but including FCS octets) and were otherwise well formed;
16) **EtherStatsOctets** — The total number of octets of data (including those in bad packets) received on the network (excluding framing bits but including FCS octets);
17) **EtherStatsPkts** — The total number of packets (including bad packets, broadcast packets, and multicast packets) received and transmitted;
18) **EtherStatsTXNoErrors** — The number of frames that have been transmitted by this port from its segment excluding fragmented and FCS error frames;
19) **EtherStatsRXNoErrors** — The number of frames that have been received by this port from its segment excluding fragmented and FCS error frames;
20) **EtherStatsPkts1519to1522Octets** — The total number of packets (including bad packets) that were between 1519 and 1522 octets in length inclusive (excluding framing bits but including FCS octets) ;
21) **IfInOctets** — The total number of octets received on the interface, including framing characters;

22) **IfOutOctets** — The total number of octets transmitted out of the interface, including framing characters;

23) **Dot1dTpPortInFrames** — The number of frames that have been received by this port from its segment. Note that a frame received on the interface corresponding to this port is only counted by this object if and only if it is for a protocol being processed by the local bridging function, including bridge management frames;

24) **Dot1dTpPortOutFrames** — The number of frames that have been transmitted by this port to its segment. Note that a frame transmitted on the interface corresponding to this port is only counted by this object if and only if it is for a protocol being processed by the local bridging function, including bridge management frames.;

25) **ReceivedPkts64Octets** — The total number of packets (including bad packets) received that were 64 octets in length (excluding framing bits but including FCS octets);

26) **TransmittedPkts64Octets** — The total number of packets (including bad packets) transmitted that were 64 octets in length (excluding framing bits but including FCS octets);

27) **ReceivedPkts65to127Octets** — The total number of packets (including bad packets) received that were between 65 and 127 octets in length inclusive (excluding framing bits but including FCS octets);

28) **TransmittedPkts65to127Octets** — The total number of packets (including bad packets) transmitted that were between 65 and 127 octets in length inclusive (excluding framing bits but including FCS octets);

29) **ReceivedPkts128to255Octets** — The total number of packets (including bad packets) received that were between 128 and 255 octets in length inclusive (excluding framing bits but including FCS octets);

30) **TransmittedPkts128to255Octets** — The total number of packets (including bad packets) transmitted that were between 128 and 255 octets in length inclusive (excluding framing bits but including FCS octets);

31) **ReceivedPkts256to511Octets** — The total number of packets (including bad packets) received that were between 256 and 511 octets in length inclusive (excluding framing bits but including FCS octets);

32) **TransmittedPkts256to511Octets** — The total number of packets (including bad packets) transmitted that were between 256 and 511 octets in length inclusive (excluding framing bits but including FCS octets);

33) **ReceivedPkts512to1023Octets** — The total number of packets (including bad packets) received that were between 512 and 1023 octets in length inclusive (excluding framing bits but including FCS octets);

34) **TransmittedPkts512to1023Octets** — The total number of packets (including bad packets) transmitted that were between 512 and 1023 octets in length inclusive (excluding framing bits but including FCS octets);

35) **ReceivedPkts1024to1518Octets** — The total number of packets (including bad packets) received that were between 1024 and 1518 octets in length inclusive (excluding framing bits but including FCS octets);

36) **TransmittedPkts1024to1518Octets** — The total number of packets (including bad packets) transmitted that were between 1024 and 1518 octets in length inclusive (excluding framing bits but including FCS octets);

37) **IfInBroadcastPkts** — The number of packets, delivered by this sub-layer to a higher (sub-)layer, which were addressed to a broadcast address at this sub-layer;

38) **IfOutBroadcastPkts** — The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a broadcast address at this sub-layer, including those that were discarded or not sent;

39) **IfInMulticastPkts** — The number of packets, delivered by this sub-layer to a higher (sub-)layer, which were addressed to a multicast address at this sub-layer. For a MAC layer protocol, this includes both Group and Functional addresses;

40) **IfOutMulticastPkts** — The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent. For a MAC layer protocol, this includes both Group and Functional addresses;

41) **Dot3InPauseFrames** — A count of MAC Control frames received on this interface with an opcode indicating the PAUSE operation. This counter does not increment when the interface is operating in half-duplex mode. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime.;

42) **Dot3OutPauseFrames** — A count of MAC Control frames transmitted on this interface with an opcode indicating the PAUSE operation. This counter does not increment when the interface is operating in half-duplex mode. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime;

43) **EtherStatsUndersizePkts** — The total number of packets received that were less than 64 octets long (excluding framing bits, but including FCS octets) and were otherwise well formed;

44) **EtherStatsFragments** — The total number of packets received that were less than 64 octets in length (excluding framing bits but including FCS octets) and had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).
Note that it is entirely normal for etherStatsFragments to increment. This is because it counts both runts (which are normal occurrences due to collisions) and noise hits;

45) **EtherStatsCRCAlignErrors** — The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but but had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error);

46) **EtherStatsJabbers** — The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets), and had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).
Note that this definition of jabber is different than the definition in IEEE-802.3 section 8.2.1.5 (10BASE5) and section 10.3.1.4 (10BASE2). These documents define jabber as the condition where any packet exceeds 20 ms. The allowed range to detect jabber is between 20 ms and 150 ms;

47) **Clear all statistic** — Clears statistics on all switch ports;

48) **Clear** — Clears statistics on particular port.

| network status statistics	Use to show Ethernet statistics on all ports.

Over The Air à Equalizer graph

Integra features adaptive equalizer, which is a filter that automatically adapts to time-varying properties of a communication channel with selective fading, having a target to compensate the inequalities in frequency response, mitigating the effects of multipath propagation. In wireless telecommunications, using QAM modulation this filter equalizes not only a separate quadrature channel, but provides a cancellation of cross-interference between them.

In Integra the adaptive equalizer is realized as complex-arithmetic 40-taps digital FIR (Finite Impulse Response) filter. In other words, equalizer is a selective frequency amplifier and attenuator, a device, which application to IF (Intermediate Frequency) band-limited signal is schematically shown in the picture below:
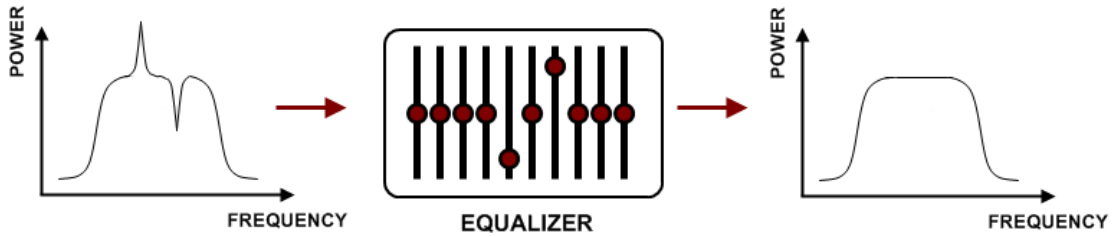
Equalizer graph window shows adaptive equalizer taps' coefficients, which at a set time moment minimize multipath fading effect in channel.
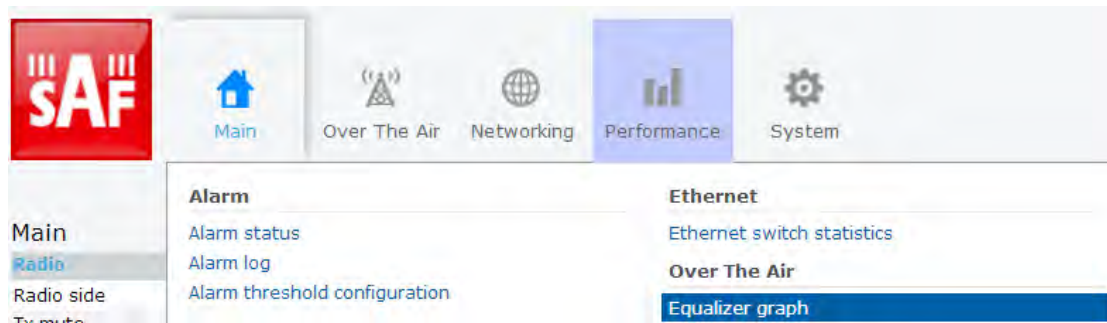
Example of equalizer taps' coefficients and its frequency response in case of a normal operation is shown below:
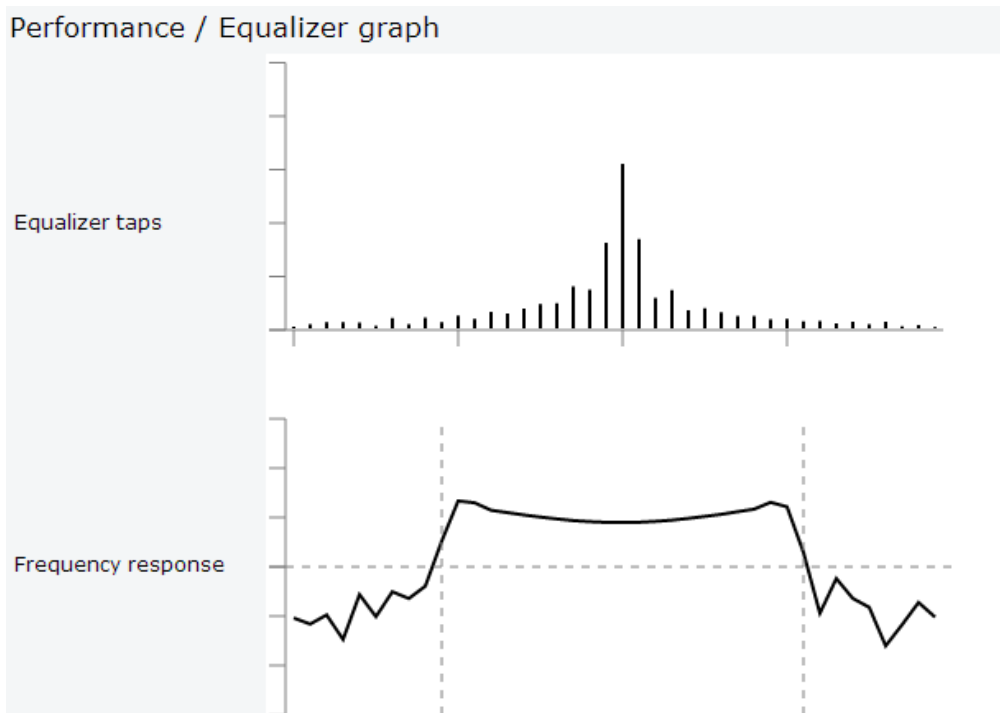
During normal operation frequency response curve is smooth at the centre and central equalizer tap is higher, while side towers evenly decrease. If equalizer taps and frequency response curve significantly differs from the one above, it may be indication of multipath issue, which must be inspected with use of precise and accurate path profiling. Higher taps mainly on the right side indicate a weaker reflected signal compared to the main signal, while higher taps mainly on the left side — stronger reflected signal.

Over The Air à Constellation diagram

A constellation diagram is a representation of a signal modulated by the digital modulation schemes 256QAM, 128QAM, 64QAM, 32QAM, 16QAM or 4QAM. It displays the signal as a two-dimensional scatter diagram in the complex plane at symbol sampling instants. Measured constellation diagram can be used to recognize the type of interference and distortion in a signal.
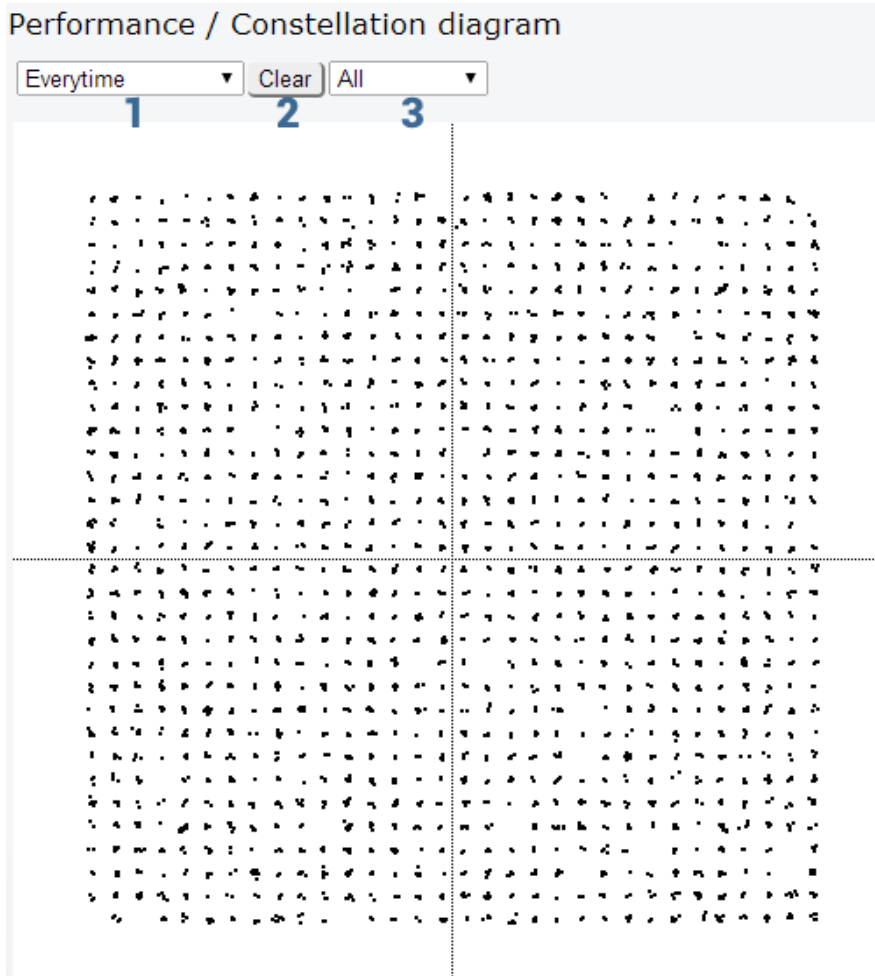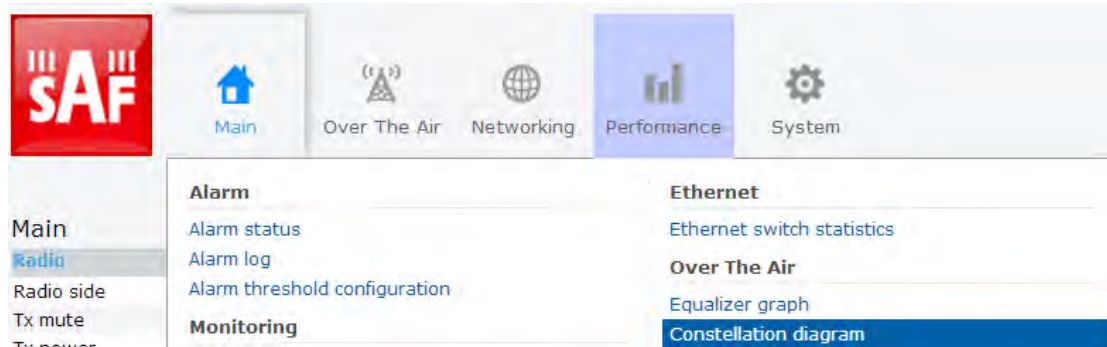
1) Allows choosing how often is constellation automatically cleared;
2) Manually clear current constellation;
3) Allows zooming to one of 4 constellation quadrants.

Examples of CFIP constellation diagrams under ideal conditions are shown below:
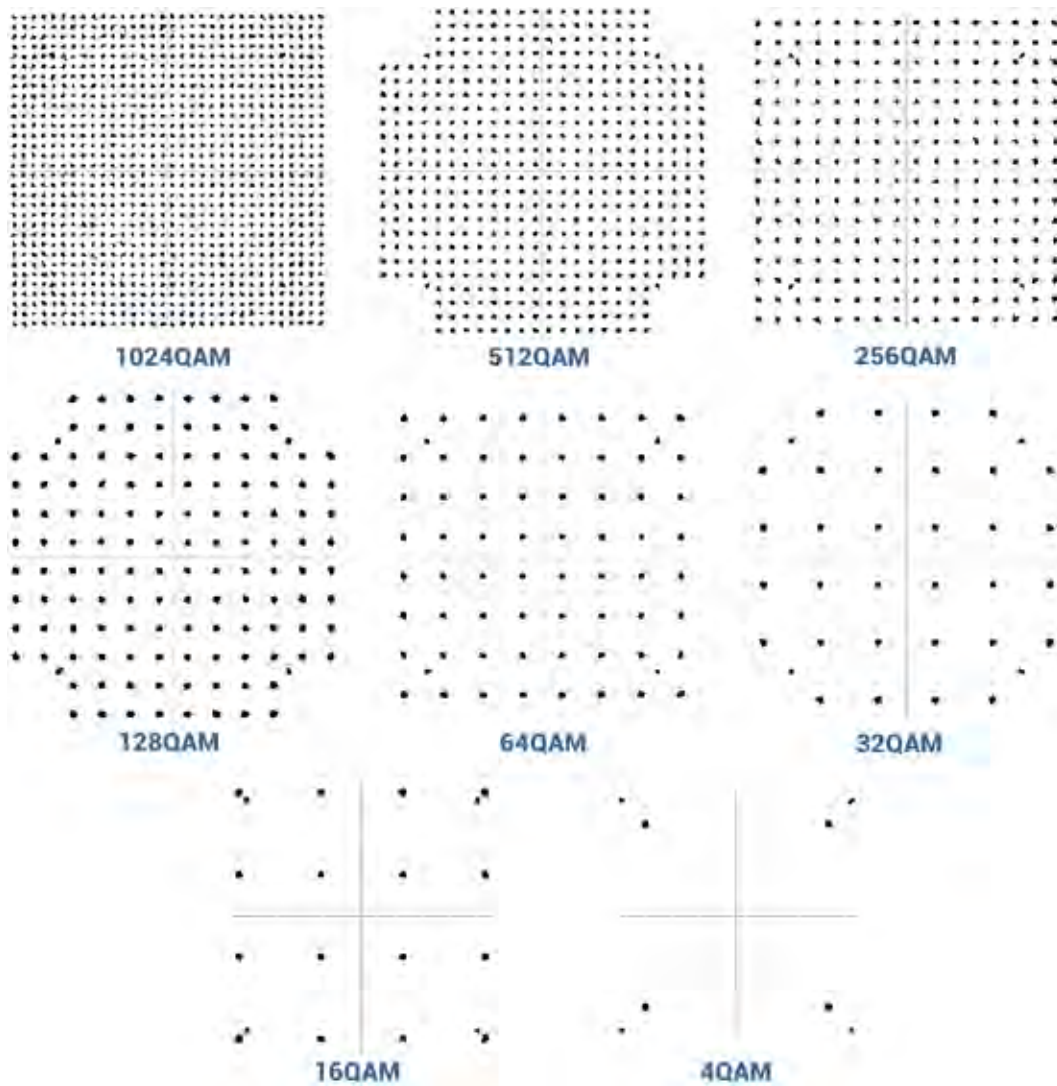
For the purpose of analysing the received signal quality, some types of corruption are evident in the constellation diagram. For example:

1) Gaussian noise is displayed as fuzzy constellation points:
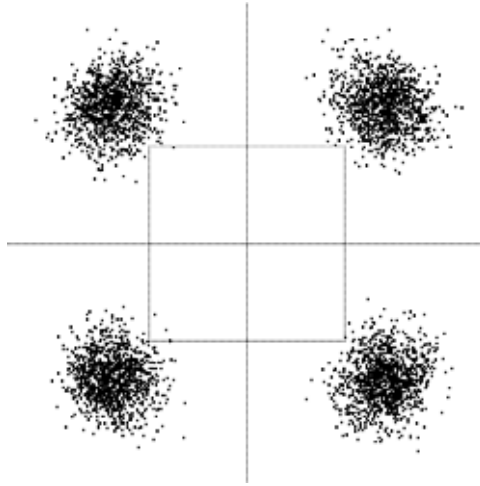
2) Non-coherent single frequency interference is displayed as circular constellation points:
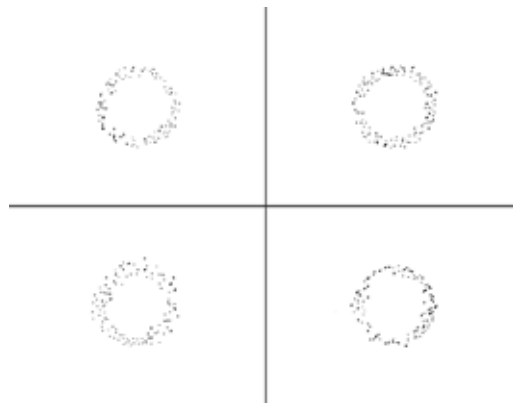
3) Phase noise is displayed as rotationally spreading constellation points:
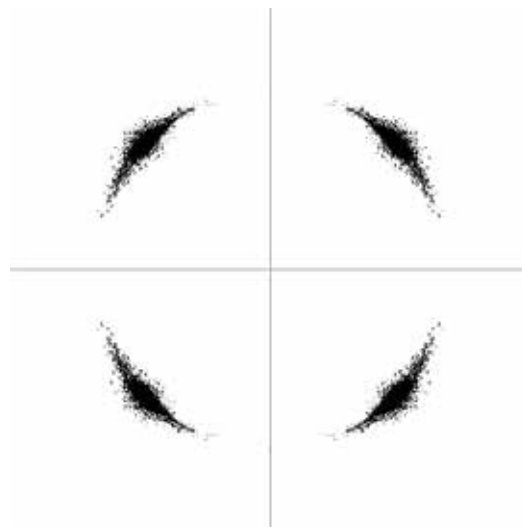
4) Amplitude compression causes the corner points to move towards the centre:
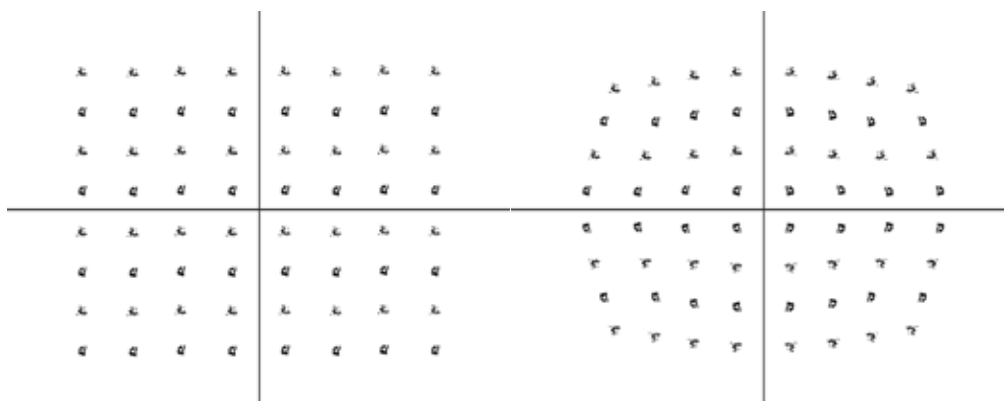
Over The Air ➔ Modem performance

Modem performance sections shows modem statistics according to ITU-T G.826.

1) **Count time** — time during which statistics are gathered;
2) **Errored Block (EB)** — Number of blocks having at least one bit error;
3) **Errored Second (ES)** — Amount of seconds during which errored blocks were registered;
4) **Severely Errored Seconds (SES)** — Amount of seconds which contain 30% errored blocks or one or more defects;
5) **Background Block Error (BBE)** — Amount of errored blocks which are not part of SES;
6) **Total Block number** - Amount of blocks received which are not part of SES;
7) **Errored Second Ratio (ESR)** — The ratio of ES to total seconds;
8) **Severely Errored Second Ratio (SESR)** — The ratio of SES to total seconds;

9) **Background Block Error Ratio (BBER)** — The ratio of BBE to total seconds;
10) **Uptime** — time in seconds during which link was synchronized;
11) **Unavailtime** — time in seconds during which link was not synchronized;
12) **Clear** — Clears all counters.

modem performance	Check modem statistics according to ITU-T G.826. See detailed description above.

System

FW à Firmware upgrade
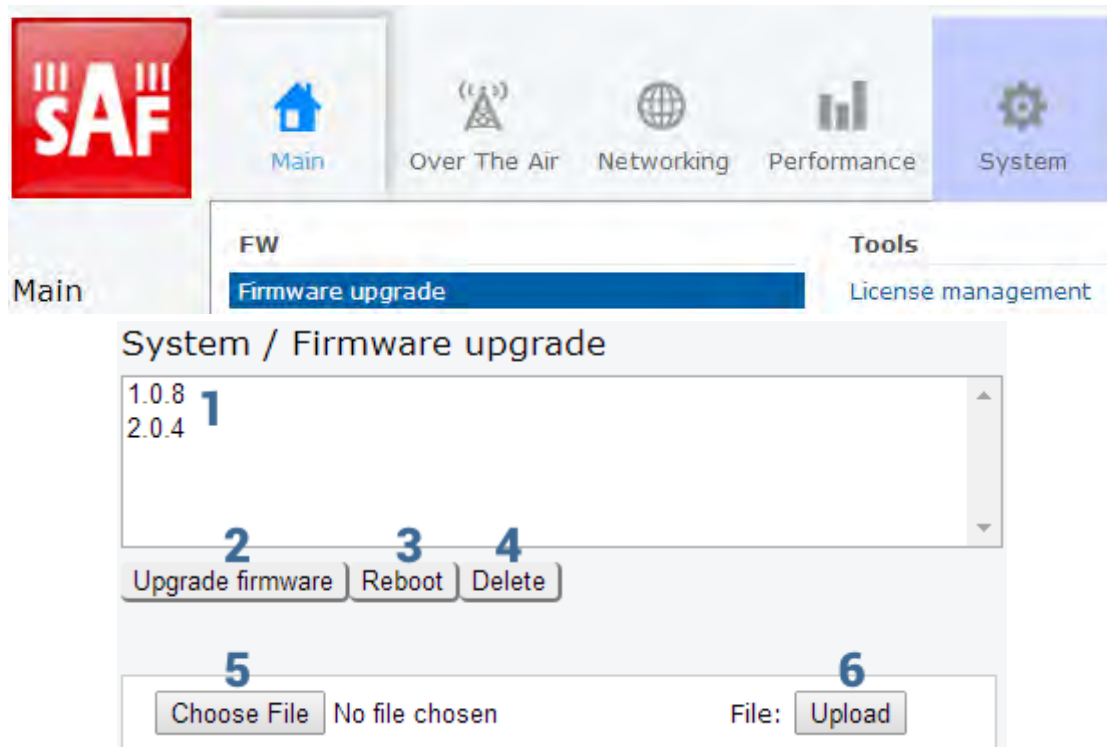
1) Shows list of available firmware files;
2) **Upgrade firmware** — click on preferred firmware in the list and press "Upgrade firmware" button to initiate firmware upgrade process;
3) **Reboot** — Reboots management CPU;
4) **Delete** — Deletes selected firmware file from the list;
5) **Choose File** — Press to browse for a firmware file on your hard disk drive;
6) **Upload** — Press to upload a firmware file to Integra.

firmware info	Use to show detailed information on Integra firmware.
firmware install <version>	Use to install firmware version uploaded. Note that exact version needs to be entered. Check available firmware versions using command "firmware list".
firmware list	Use to list uploaded firmware versions.
firmware remove <version>	Use to remove firmware version uploaded. Note that exact version needs to be entered. Check available firmware versions using command "firmware list".

firmware switch	Use to check running firmware bank and bank that will be used at the next boot.
firmware switch <fs|fw1|fw2|toggle>	Use to define bank that will be used at the next boot. "fw1" and "fw2" subcommands set appropriate bank, "toggle" forces to set other bank than the running one, "fs" is factory defined emergency bank, which is used if both "fw1" and "fw2" fail.

Configuration ➔ IP configuration

IP address configuration page is available in "System" menu (System➔Configuration➔IP configuration).

1) **IP address** - allows specifying IP address of Integra you are currently logged in. Default IP address is 192.168.205.10 or 192.168.205.11 — depending on which side the specific Integra is — low side has 192.168.205.10 IP address and high side — 192.168.205.11;

⚠ Integra IP addresses need to be in the same subnet..

2) **IP Mask** — allows specifying IP mask of Integra you are currently logged in. Default IP mask is 255.255.255.0;

3) **IP gateway** — allows specifying gateway of Integra you are currently logged in. By default gateway is not specified;

4) **Ethernet MAC address** — shows the MAC address of Integra you are currently connected to;

5) **Remote IP address** — shows IP address of remote (far-end) Integra. By default remote IP address is being retrieved automatically and therefore "Auto" checkbox is selected. Unselect it to enter remote IP address manually;

6) By pressing „Execute configuration" changes made to the corresponding section apply only for the local side Integra.

system ip addr <IP>	Use to set IP address of management CPU.
system ip gw <IP>	Use to set IP address of gateway.
system ip mask <mask>	Use to set subnet mask.
system ip mac	Use to show MAC address of management CPU.
system remoteip show	Use to show remote IP address.
system remoteip auto	Use to set automatic retrieving of remote IP address.
system remoteip set <IP>	Use to define remote IP address.

Configuration ➔ SNMP configuration

The SNMP configuration pages provide configuration of SNMP communities, host and trap addresses. SAF NMS system will work only when SNMP is properly configured.
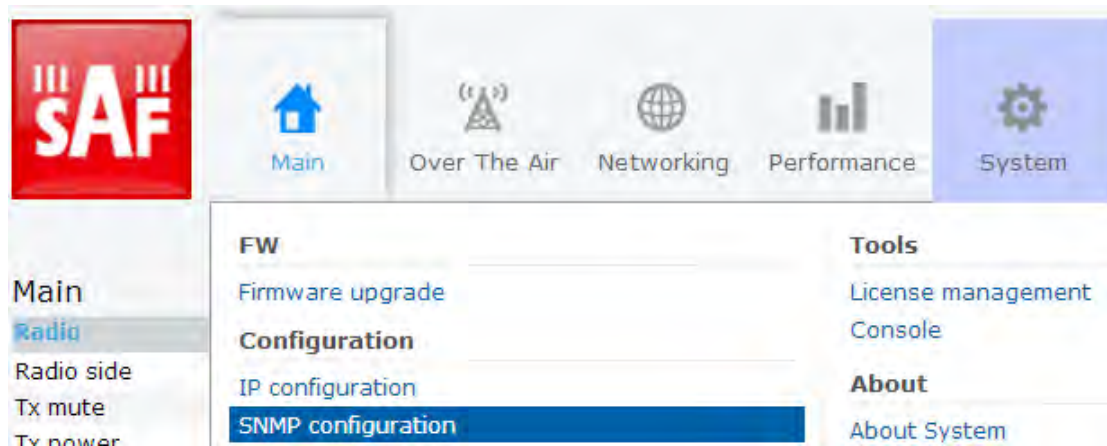
System / SNMP configuration

Read community	**1**	read
Write community	**2**	write
Trap community	**3**	trap

List of SNMP managers **4**
```
192.168.205.14
192.168.205.17
192.168.205.19
```
Add | Delete

List of trap V1 managers **5**
```
192.168.205.14
192.168.205.17
```
Add | Delete

List of trap V2c managers **6**
```
192.168.205.14
```
Add | Delete

7 Rollback on ☐ | Execute configuration

1) **Read community** — specifies the SNMP v1/v2c community name of the agent to enable parameters to be read;

2) **Write community** — specifies the SNMP v1/v2c community name of the agent to enable parameters to be written;

3) **Trap community** — specifies the SNMP v1/v2c trap community name for trap authentication in monitoring applications;

4) **List of SNMP managers** — shows the list of IP addresses of the management terminal with the installed Trap Manager software, based on SNMP v1/v2c platform. The Integra's management controller sends SNMP traps to the Trap Manager with IP address specified here. The SNMP Trap Manager is a PC with installed SNMP trap management software;

5) **List of trap V1 managers** — shows the list of IP addresses of SNMP v1 hosts; adds or deletes the host IP address to the Integra SNMP v1 host table. If the SNMP host connected to the Integra is not added to the SNMP v1 host table, Integra will not respond to the SNMP requests from that host;

6) **List of trap v2c managers** — shows the list of IP addresses of SNMP v2c hosts; adds or deletes the host IP address to the Integra SNMP v2c host table. If the SNMP host connected to the Integra is not added to the SNMP v2c host table, Integra will not respond to the SNMP requests from that host;

7) By pressing „Execute configuration" changes made to the corresponding section apply only for the local side Integra. If „Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

Configuration à Configuration file
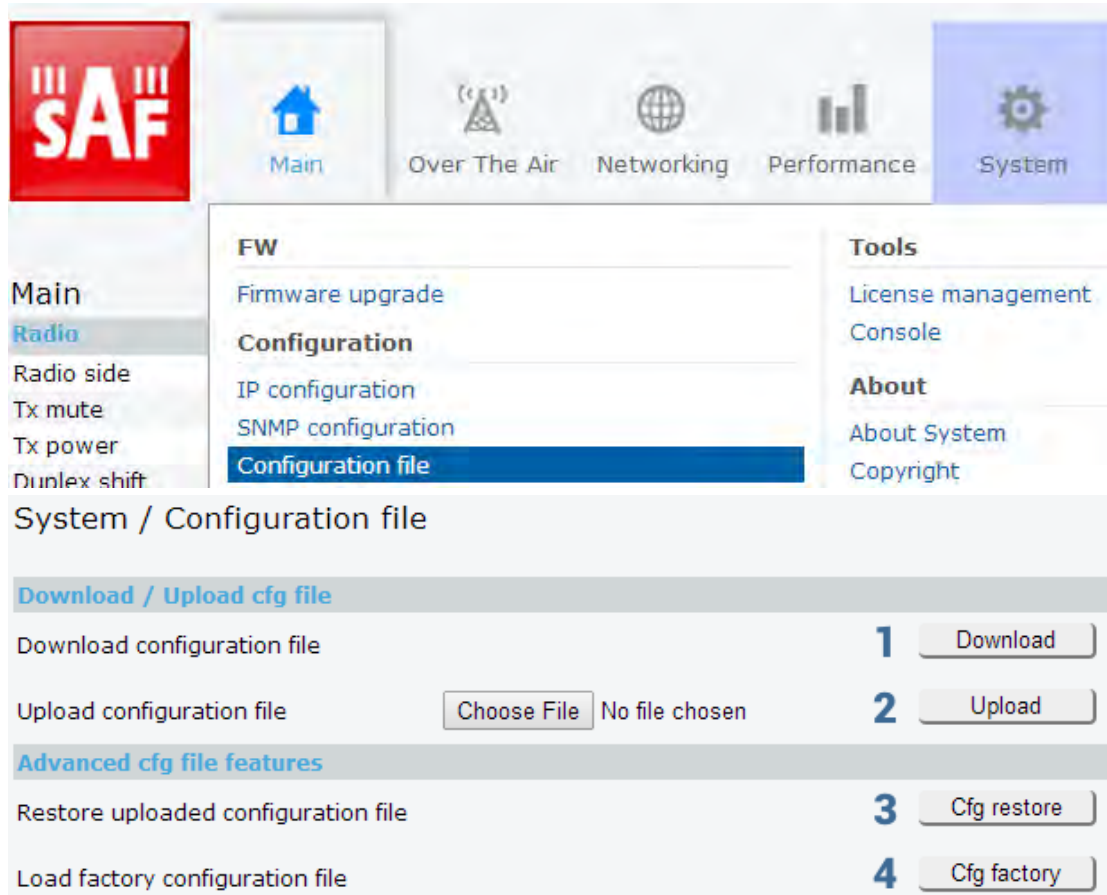
1) **Download configuration file** – allows downloading system configuration file and saving it on your hard drive;
2) **Upload configuration file** – allows uploading system configuration file from your hard disk drive to Integra;
3) **Restore uploaded configuration file** – restores uploaded system configuration;
4) **Load factory configuration file** – resets system configuration to factory defaults.

configuration factory	Use to reset system configuration to factory defaults.
configuration load	Use to load uploaded system configuration.
configuration status	Use to check whether running configuration is saved.
configuration store	Use to save running configuration.

Configuration ➔ System configuration

1) **Enter new password (4..30 characters)** — Allows defining preferable password for 'admin' account. Maximal length of the password name cannot exceed 30 symbols. By default password for 'admin' account is 'changeme'. Admin account has full control of the configuration process.
2) **Hide password** — Hides typed in password. This option unchecked will display typed in password in plaintext;
3) **System name (<=16 characters)** — allows entering preferable system name. Maximum length of the system name cannot exceed 16 symbols. Default name is 'SAF';
4) **Time (YY-MM-DD hh:mm:ss)** — allows changing system date and time manually by entering date and time in specific syntax;
5) **Set local machine time** — forces system to use the time set on your PC or laptop, from which you are connected to the Web GUI;
6) **Location** — allows entering preferable system location name. Maximum length of the location name cannot exceed 16 symbols. By default system location is not specified;
7) By pressing „Execute configuration" changes made to the corresponding section apply only for the local side Integra. If „Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

system datetime <datetime>	Use to enter system time and date. Use "YYYY-MM-DD/hh:mm:ss" syntax for date/time.
system name <name>	Use to define system name.
system location <location>	Use to define system location.
system user access	Use to show current user rights.
system password <password>	Use to define password for current user.
system uptime	Use to show system uptime since last system start.

Diagnostic ➔ Loopback configuration

1) **Modem loopback** – check to activate modem loopback, during which signal is looped back to local end after the modem and Integra should be able to synchronize to itself;
2) By pressing „Execute configuration" changes made to the corresponding section apply only for the local side Integra.

Diagnostic ➔ Download troubleshooting file

Downloads troubleshooting file to your hard disk drive. Note that for proper diagnostics additionally alarm log file ("Performance➔Alarm➔Alarm log➔Alarm event log file") needs to be downloaded.
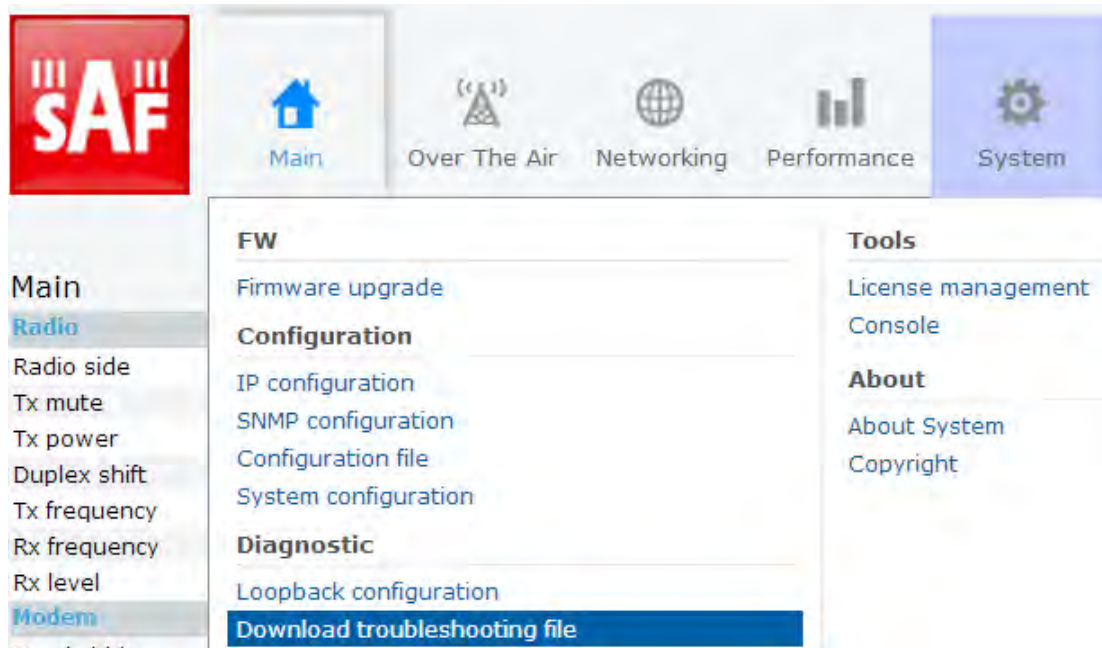
Tools ➔ License management

Provides list of available licenses, time left for each license and license upload.
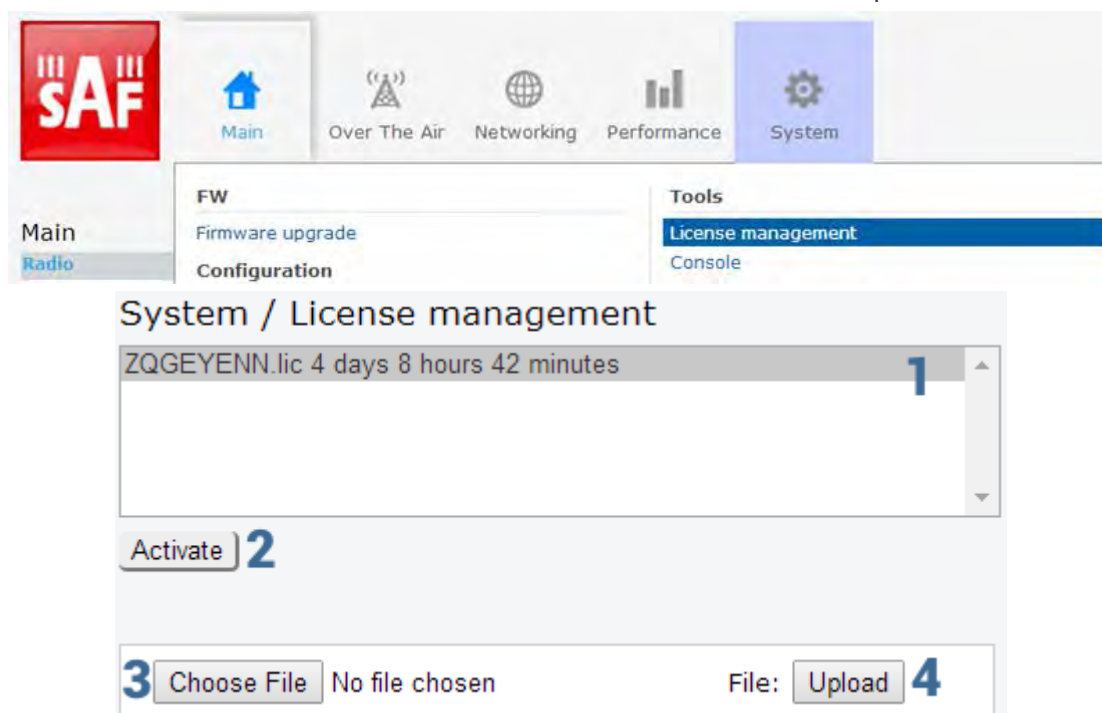
1) License list shows available license and time left;
2) **Activate** — Select license from the list and press "Activate" to switch to preferable license;
3) **Choose file** — Locate license file (*.lic) on your hard drive;
4) **Upload** — After locating license file use "Upload" button to add license to license list.

If new license supports previously running modem configuration, no changes will be applied.

If previously modem was configured to modem configuration, which is not supported by new license key, modem will be reconfigured to the maximal allowed configuration in chosen channel bandwidth.

When license expires modulation will drop to "4QAM FEC Limited" and link capacity will drop to 256Kbps.

When license expires next license in the list needs to be activated manually.

license list	Use to list available licenses.
license file list	Use to list available license files.
license file add <filename>	Use to add uploaded license file to license file list.
license file activate <filename>	Use to activate license file.
license file deactivate <filename>	Use to deactivate license file.

Tools à Console

Use syntax "<command> ?" to see information on subcommands.

Use ⏎ ENTER key to execute entered command.

List of valid CLI commands can be found at the end of each Web GUI page description.

About ➔ About System

Provides short description of Integra series products.
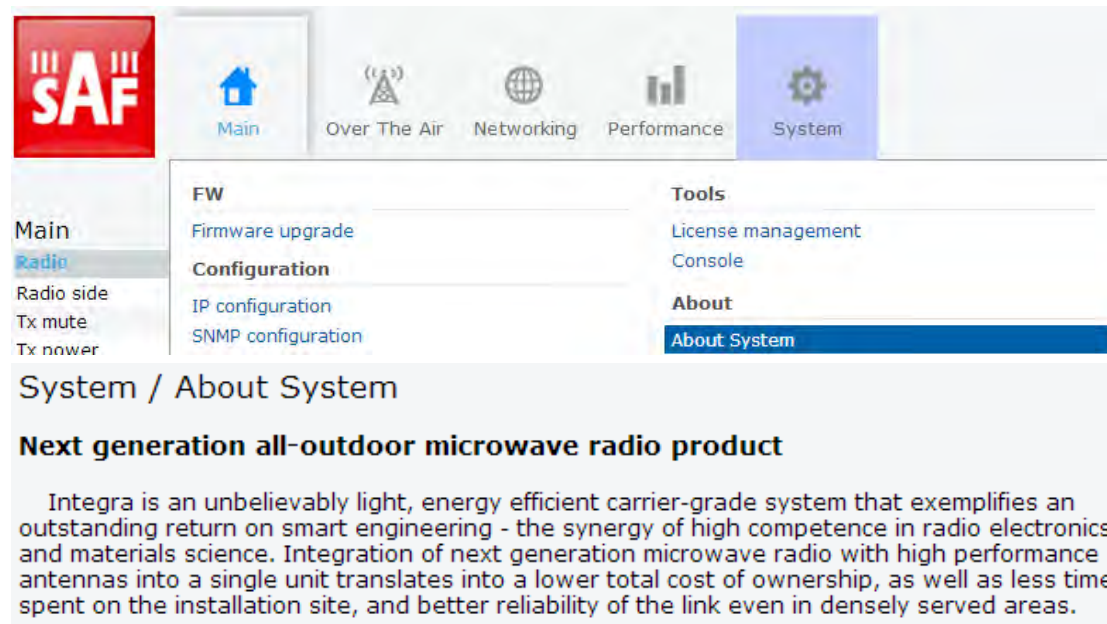
product info	Use to show detailed information on Integra FODU.
system number	Use to show Integra's serial number.

About ➔ Copyright

Provides copyright information.
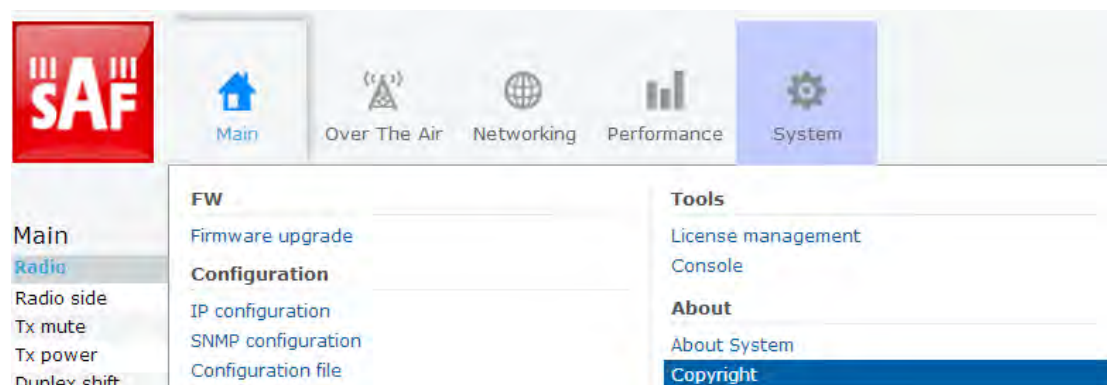
System / Copyright

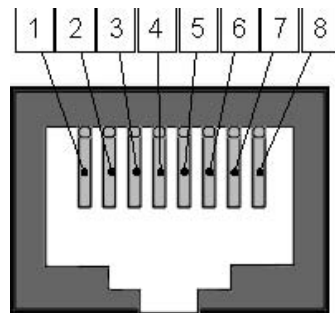### Copyright (c) 2013 SAF Tehnika JSC. All rights reserved.

Chapter 4: INTERFACES

RJ-45 port

RJ-45 port complies with IEEE 802.3-2005 1000Base-T, 100Base-T and 10Base-T Ethernet and IEEE 802.3at, LTPoE++ Power over Ethernet standards.
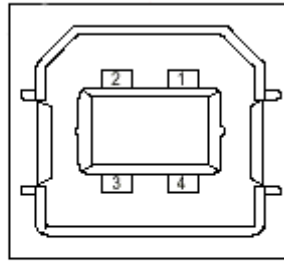

The pinouts of that socket are as follows:

Pin	Data	PoE
1	Bi-directional A+	VB1+
2	Bi-directional A-	VB1+
3	Bi-directional B+	VB1-
4	Bi-directional C+	VB2+
5	Bi-directional C-	VB2+
6	Bi-directional B-	VB1-
7	Bi-directional D+	VB2-
8	Bi-directional D-	VB2-

USB port

USB port provides serial terminal access to CLI. Socket is B type.

USB Type B Socket

1=Vbus (5V)
2=D−
3=D+
4=GND

RSSI LED

RSSI LED can be activated in three operational modes – Mode 1, Mode 2 and Mode 3. By default RSSI LED is enabled in Mode 1. For further details please refer to Radio configuration page.

Corresponding Rx signal levels and LED blinking pattern for each mode is represented in the figure below:
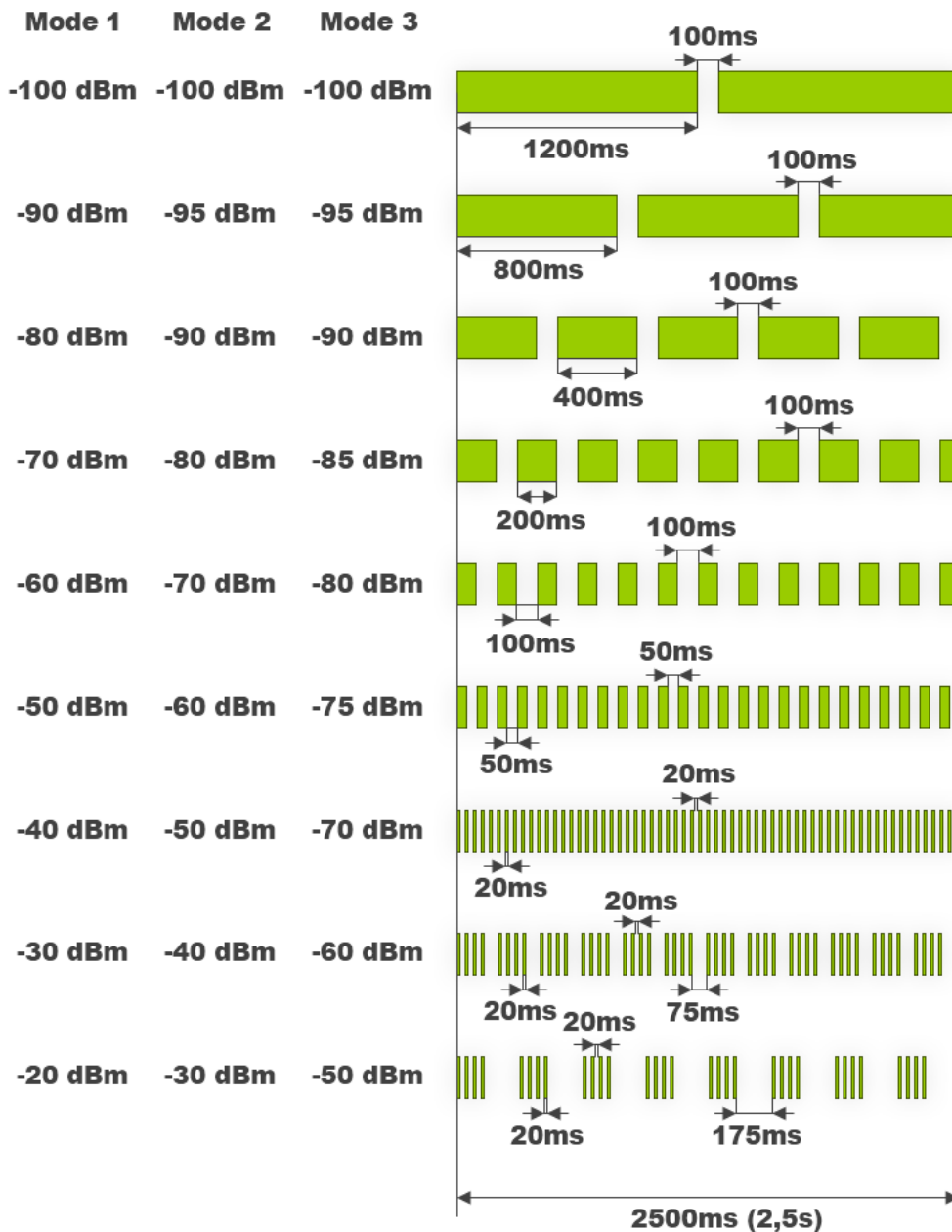
RSSI/audio port

RSSI (Received Signal Strength Indicator) port is used to adjust the alignment of antenna for best performance (for both rough and fine adjustment); this can be done using digital multimeter or headphones connected to the RSSI port. RSSI port is 3.5mm socket. The output of the RSSI port is DC voltage and audio frequency and varies depending on received signal level. Both are linear curves.

The following charts and tables show typical relationship of the received signal level (Rx level) displayed by CFIP vs. RSSI port output voltage (RSSI – Received Signal Strength Indicator) and audio frequency. The RSSI port is located on FODU. The evaluated Rx level has the error +/-2 dB.

Output voltage
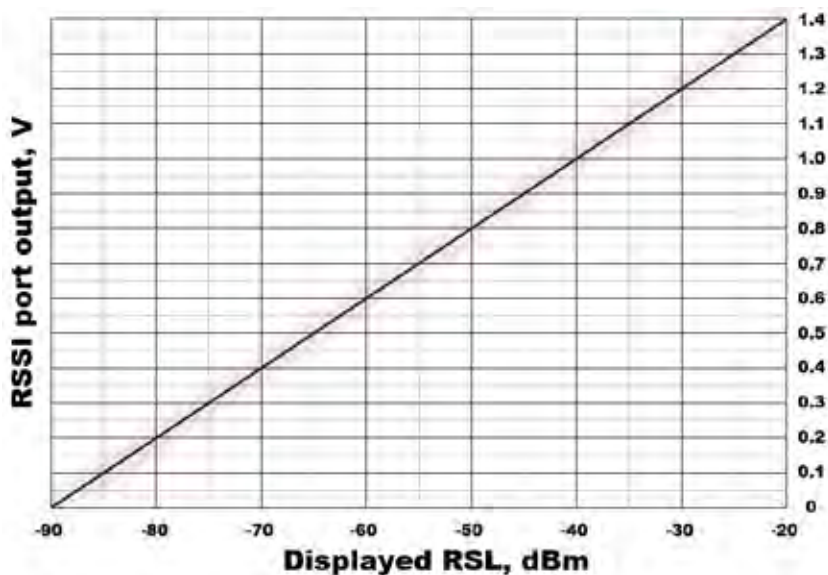
Rx level (dBm)	RSSI voltage (V)
-90	0
-85	0.1
-80	0.2
-75	0.3
-70	0.4
-65	0.5
-60	0.6
-55	0.7
-50	0.8
-45	0.9
-40	1.0
-35	1.1
-30	1.2
-25	1.3
-20	1.4

Output audio frequency
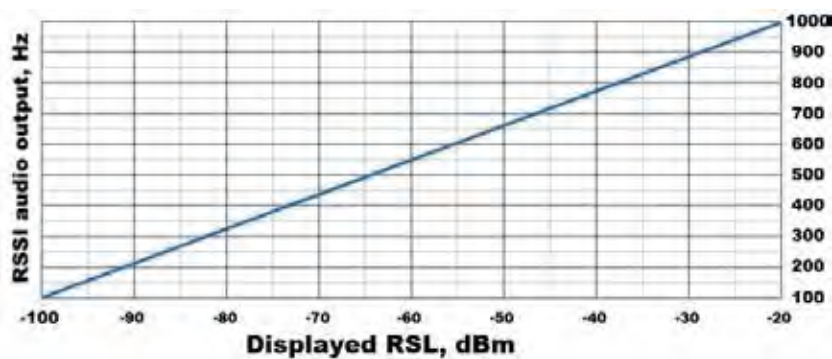
Rx level (dBm)	Audio frequency (Hz)
-100	100
-96	145
-92	190
-88	235
-84	280
-80	325
-76	370
-72	415
-68	460
-64	505
-60	550
-56	595
-52	640
-48	685
-44	730
-40	775
-36	820
-32	865
-28	910
-24	955
-20	1000

SAF Tehnika JSC

24a, Ganibu dambis, Riga, LV-1005, Latvia, EU

sales@saftehnika.com

www.saftehnika.com