



User manual

Integra Full Outdoor Unit

VER 1.7

FW 1.0.8

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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.

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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
Antenna		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"
Weight, w/o mount		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	
	Pole size	Ø 40 – 120 mm / Ø 1.6" – 4.7"	
	Weight	2.55 kg / 5.6 lbs	
		Mount on antenna	

* 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. $465 \text{ Mbps} / (1 - 56.52\%) = 1069 \text{ Mbps}$.



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;

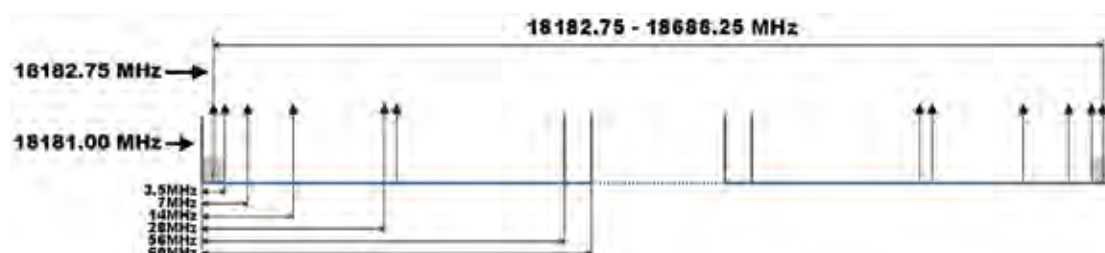
- “H” - high side radio

“B” designates B subband radio;

- “A” - A subband radio;
- “C” - C subband radio

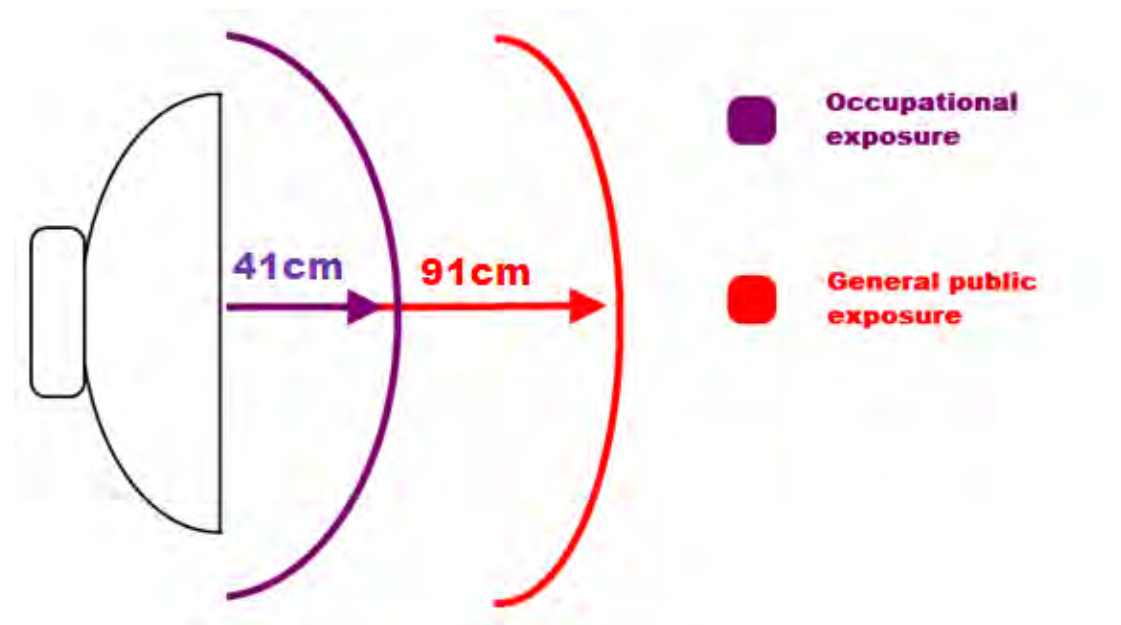
Please note that frequency range is set from the central frequency of the first 3.5 MHz channel to the central frequency of the last 3.5 MHz channel (see the diagram below).

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/f^{1.05} 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.:

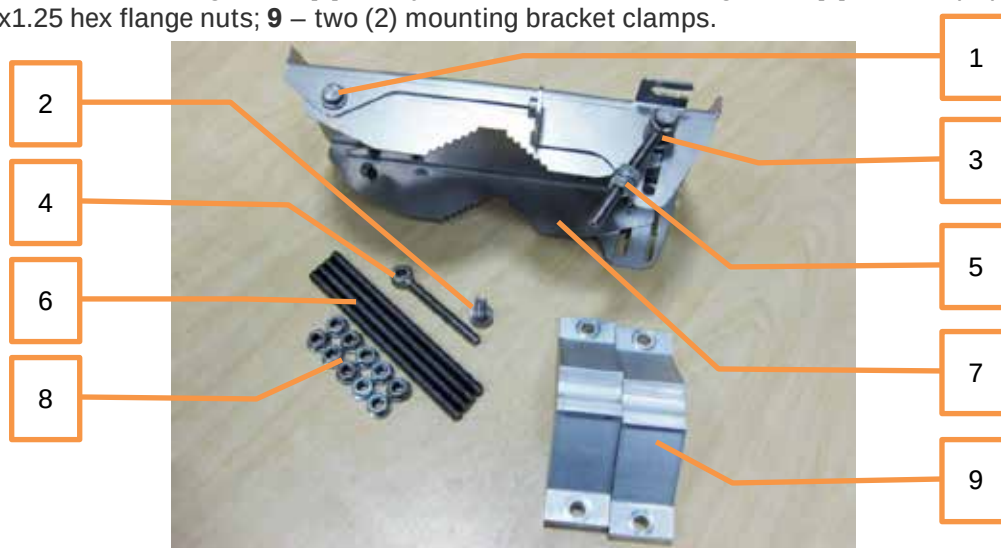
- 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz)
- WHO: Environmental Health Criteria 137: 'Electromagnetic Fields (300 Hz to 300 GHz)'
- ANSI/IEEE C95.1, 1999:
'IEEE Standard for Safety Levels with Respect 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 (withdrawn 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

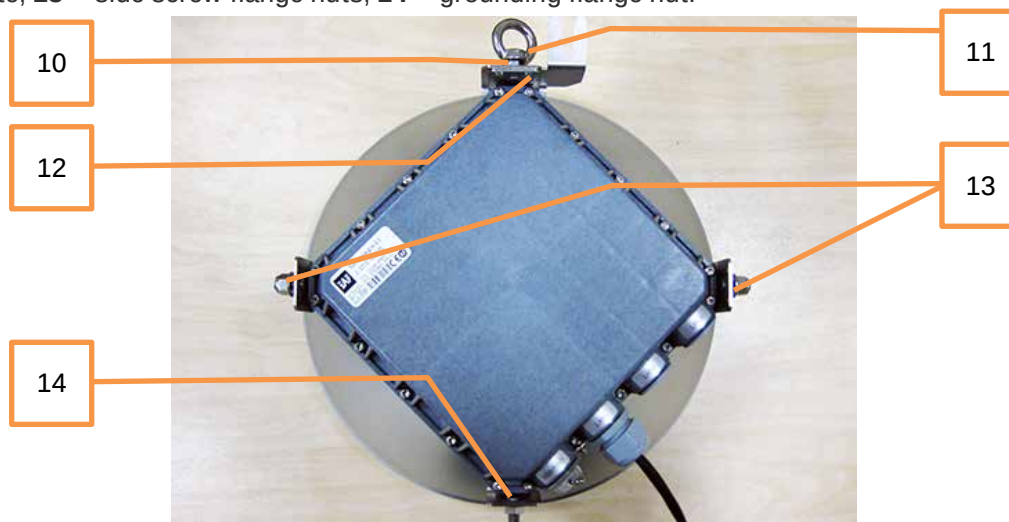
Disassembled mounting bracket and tools required for assembly

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].



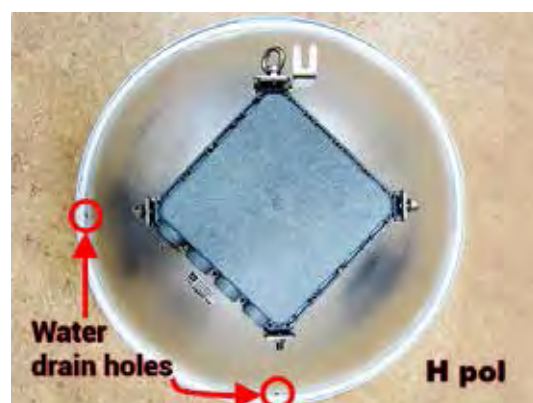
- 3 Removed parts must be attached back with 90 degree offset (see above). Gap between side screw flange nuts [13] and fastening angles should be 5mm.



- 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.

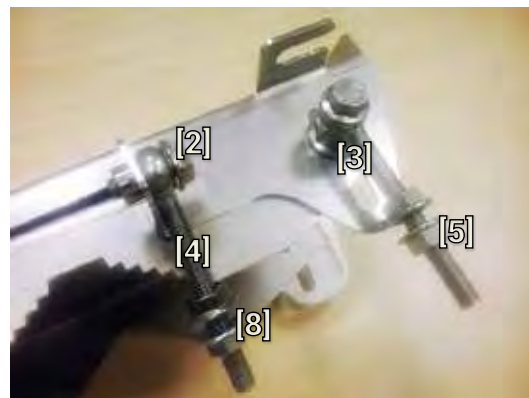
Assembly procedure

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].



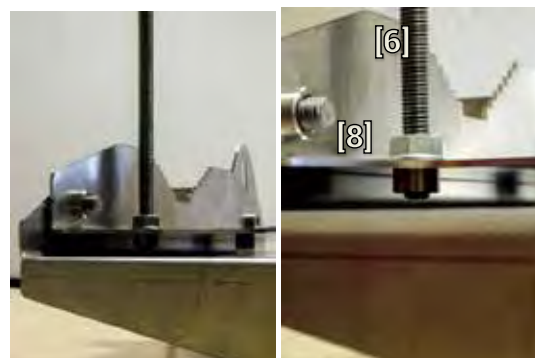
2

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 [5]. 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 $\varnothing$ 55..120mm. Reversing clamps allows support of smaller masts $\varnothing$ 25..75mm.



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.



9

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



11

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

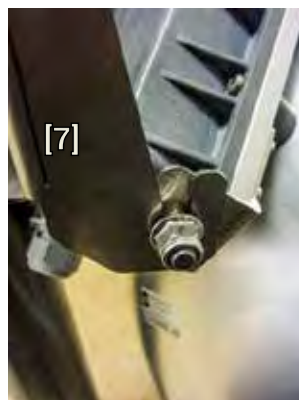
6

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.



8

View of assembled mounting bracket on the mast pole.



10

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



12

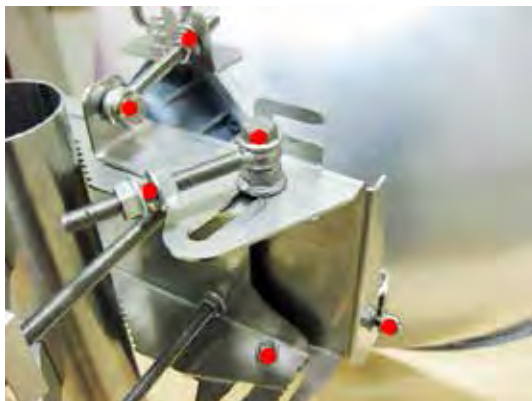
View of assembled bracket on the mast pole with Integra FODU attached and secured.



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)



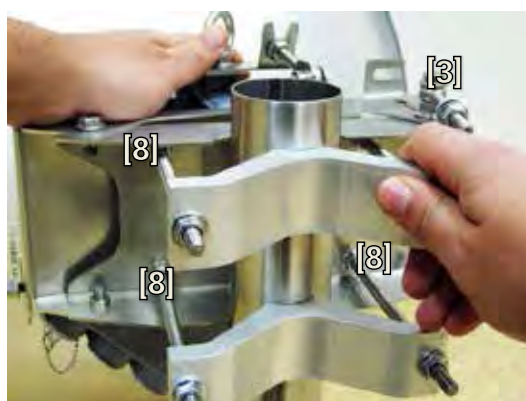
- 1 Before aligning the antenna, make sure that screws marked with red dots on the right side view of mounting bracket are loosened - hex flange nuts and bolts of azimuth and elevation eye screws, right side screw on Integra FODU and hex flange bolt on azimuth angle indicator.



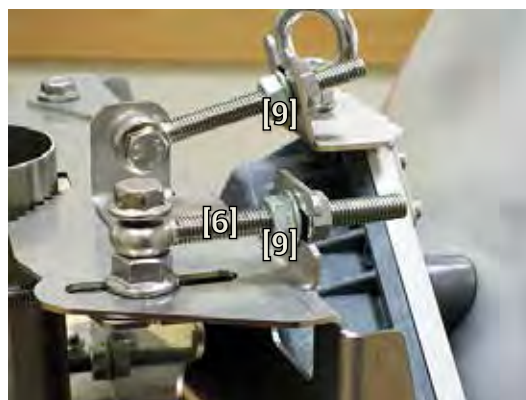
- 2 Additionally loosen following screws marked with red dots on the left side view of mounting bracket: left side screw on Integra FODU and two hex flange bolts between both mounting bracket clamps for housing and pipe.



- 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.

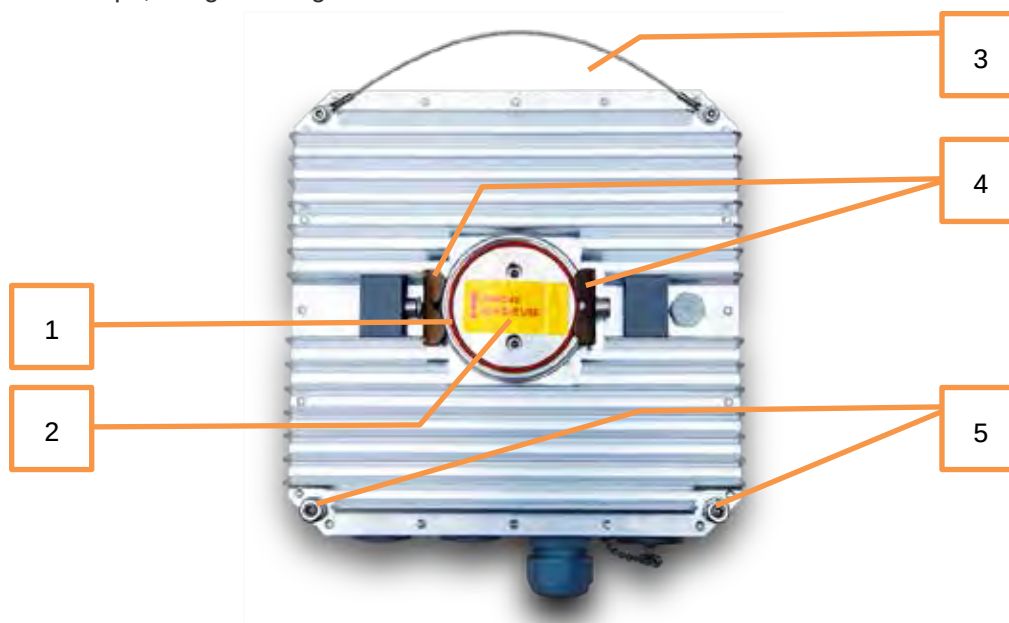


- 7** When alignment is finished tighten screws marked with red dots on the right side view of mounting bracket: hex flange nuts and bolts of azimuth and elevation eye screws, right side screw on Integra FODU and hex flange bolt on azimuth angle indicator with torsion 20..25 N·m.

- 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 accelerometer)

Modifying basic system parameters

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

SAF WEB GUI Main Page

Status Bar: Name: SAF, IP address: 192.168.205.10, Serial number: 276760100019, Uptime: 0d 01:29:50, Firmware version: 1.0.8

Navigation Menu: Main, Over The Air, Networking, Performance, System

Main Section:

Radio	Local	Remote
Radio side	Low	High
Tx mute	Disabled	Disabled
Tx power (0 .. 12 dBm for 1024QAM)	12 dBm	12 dBm
Duplex shift	1008 MHz	1008 MHz
Tx frequency (22030.00 .. 22566.00 MHz)	22566.00 MHz	23574 MHz
Rx frequency	23574 MHz	22566 MHz
Rx level	-41 dBm	-43 dBm

Modem Section:

Local	Remote
Standard: All (selected), FCC, ETSI	
Bandwidth: 40 MHz ETSI, 50 MHz FCC, 56 MHz ETSI, 56 MHz ETSI class 4L, 60 MHz FCC	
Modulation: 512QAM FEC ACM, 1024QAM FEC, 1024QAM FEC ACM, 1024QAM WeakFEC, 1024QAM WeakFEC ACM	
ACM engine: Enabled	Enabled
Acquire status: Locked	Locked
Radial MSE: -39.3 dB	-42.2 dB
FEC load: 2.8e-05	3.6e-06
Current Rx modulation: 1024QAM WeakFEC	1024QAM WeakFEC
Current Tx modulation: 1024QAM WeakFEC	1024QAM WeakFEC
Current Rx Ethernet capacity: 474.9 Mbps	474.9 Mbps
Current Tx Ethernet capacity: 474.9 Mbps	474.9 Mbps

Ethernet Section:

Port	LAN1 (Electrical)	LAN2 (SFP)	LAN3 (SFP)
State	☒ Enable	☒ Enable	☒ Enable
Status	Up	Down	Down

Buttons: MODIFY, SAVE, LOGOUT

System summary:

Local: -41 dBm, Remote: -43 dBm

Rx level: -39.3 dB, -42.2 dB

Radial MSE: [Diagram]

Tx polarization: [Diagram]

Footer: Rollback on ☐ Execute configuration Execute for both

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 à Configuration

Radio configuration page is available in “System” menu (Over The Air à Radio à Configuration).

Radio Configuration

Over The Air / Radio configuration

Tx power (0 .. 12 dBm for 1024QAM) **1** dBm

Tx frequency (22030.00 .. 22566.00 MHz) **2** MHz

Tx mute [>= 10 sec] **3** ☐ Tx mute sec

RSSI Audio **4** ☒ Enable

RSSI LED **5** ☒ Enable

RSSI LED mode **6** ▼

Standard **7** ☒ All ☐ FCC ☐ ETSI

Bandwidth **8** ▲

 ▼

Modulation **9** ▲

 ▼

10 Rollback on ☐

- 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 à 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).

Networking / VLAN

VLAN state 1

☒ Enable
☐ Disable

Default VLAN 2

Port	LAN1	LAN2	LAN3	WAN
Default VLAN ID	1	1	1	1

VLAN configuration

VID 3 (1 .. 4094)	TAGGED MEMBER 4				UNTAGGED MEMBER 5				MNG 6	Add / Delete 7
	LAN1	LAN2	LAN3	WAN	LAN1	LAN2	LAN3	WAN		
	☐	☐	☐	☐	☐	☐	☐	☐		Add
100-300	☐	☒	☐	☒	☐	☐	☐	☐		✗
500	☐	☒	☐	☒	☐	☐	☐	☐	☒	✗

8 Rollback on ☐ Execute configuration

- 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 à Rate limit

Ethernet

VLAN

Rate limit

Port status and configuration

Networking / Rate limit

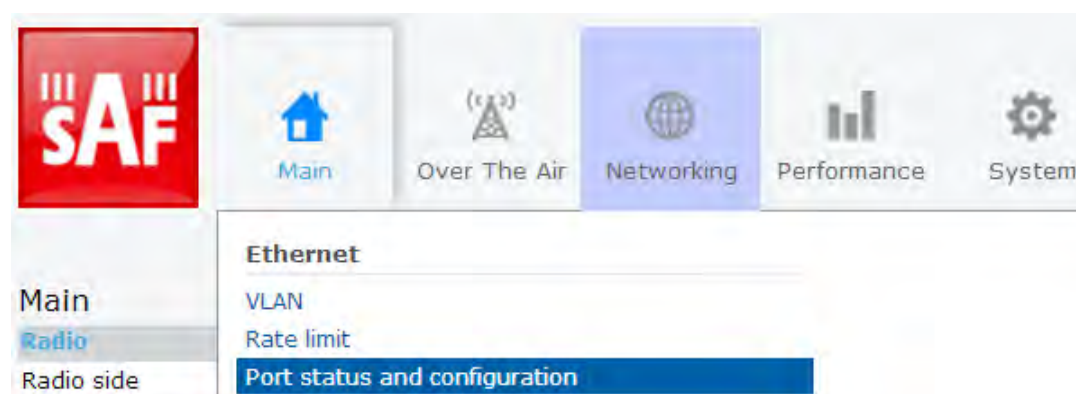
Egress rate					
Port		CIR 1		CBS 2	
LAN1 (0.064 .. 1000) Mbps	☒ Enable	1000	Mbps	☒ Enable	1 Mbps
LAN2 (0.064 .. 1000) Mbps	☒ Enable	1000	Mbps	☒ Enable	1 Mbps
LAN3 (0.064 .. 1000) Mbps	☒ Enable	200	Mbps	☒ Enable	1 Mbps
WAN (0.064 .. 1000) Mbps	☒ Enable	1000	Mbps	☒ Enable	1 Mbps
MNG (0.064 .. 1000) Mbps	☒ Enable	1000	Mbps	☒ Enable	1 Mbps

3 Rollback on ☐ [Execute configuration](#)

- 1) **CIR** – Enable or disable CIR (Committed Information Rate) on available ports and specify CIR value in Mbps;
- 2) **CBS** – Enable or disable CBS (Committed 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 à Port status and configuration



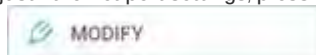
Networking / Port status and configuration

Port 1	State 2	Link status 3	Link speed 4
LAN1	Enabled	1000 Mbps	Auto
LAN2	Enabled	Down	Auto
LAN3	Enabled	Down	Auto

- 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



Networking / Port status and configuration

Port 1	State 2	Link status 3	Link speed 4
LAN1	☒ Enable	1000 Mbps	Auto ▼
LAN2	☒ Enable	Down	Auto
LAN3	☒ Enable	Down	Auto
5 Rollback on ☐ Execute configuration			

- 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 à 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.

Networking / SyncE

Status

Port 1	State 2	Status 3
LAN1	Enabled	Locked

Source port configuration **4**

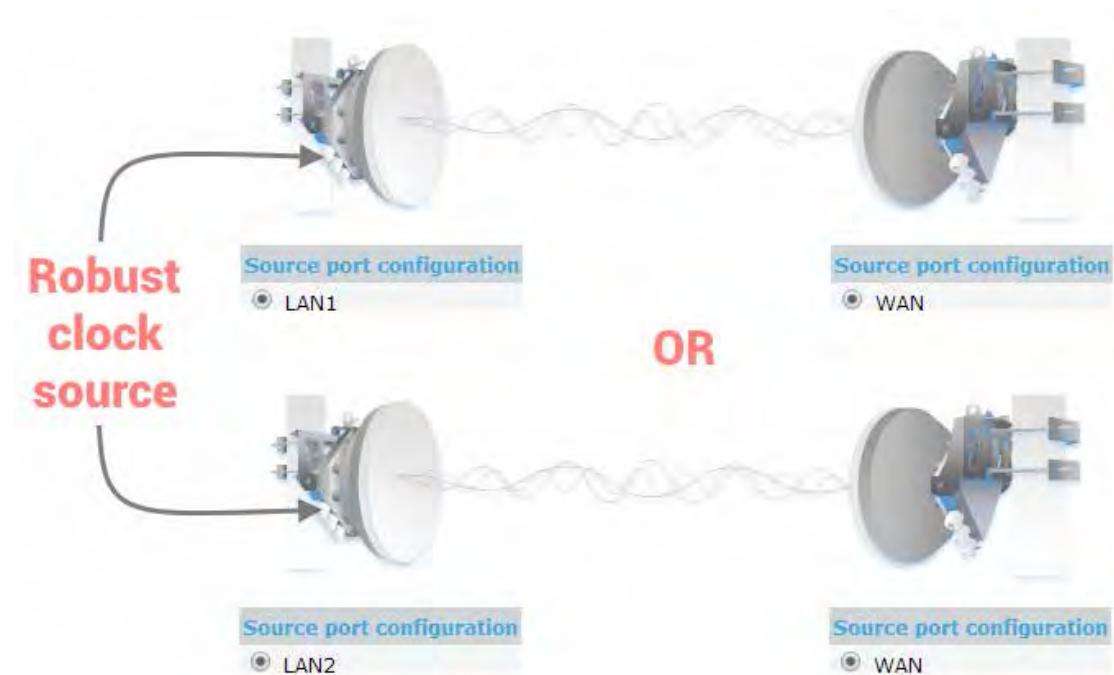
☒ LAN1
 ☐ LAN2
 ☐ WAN

Disable Enable **5**

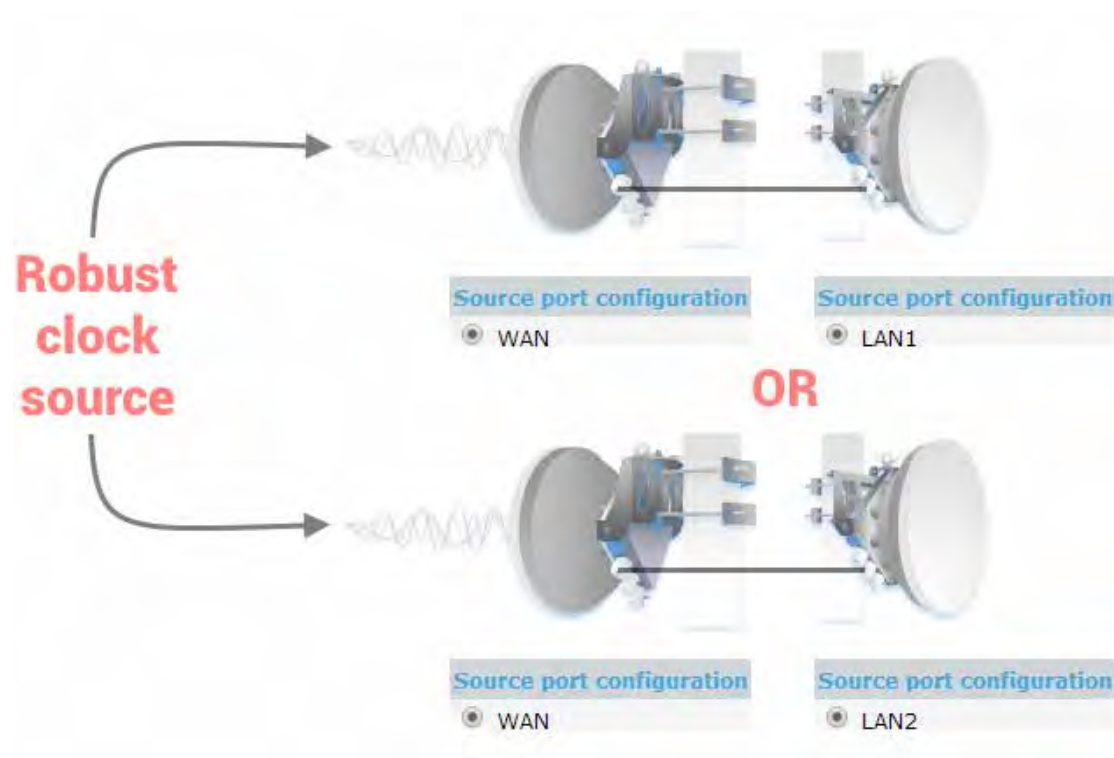
- 1) **Port** - Indicates SyncE source port (if enabled);
- 2) **State** – Indicates if SyncE is enabled;
- 3) **Status** – Indicates “Locked” if SyncE is operating normally;
- 4) **Source port configuration** – allows specifying SyncE source port;
- 5) **Disable/Enable** – Disable or Enable SyncE operation.

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.

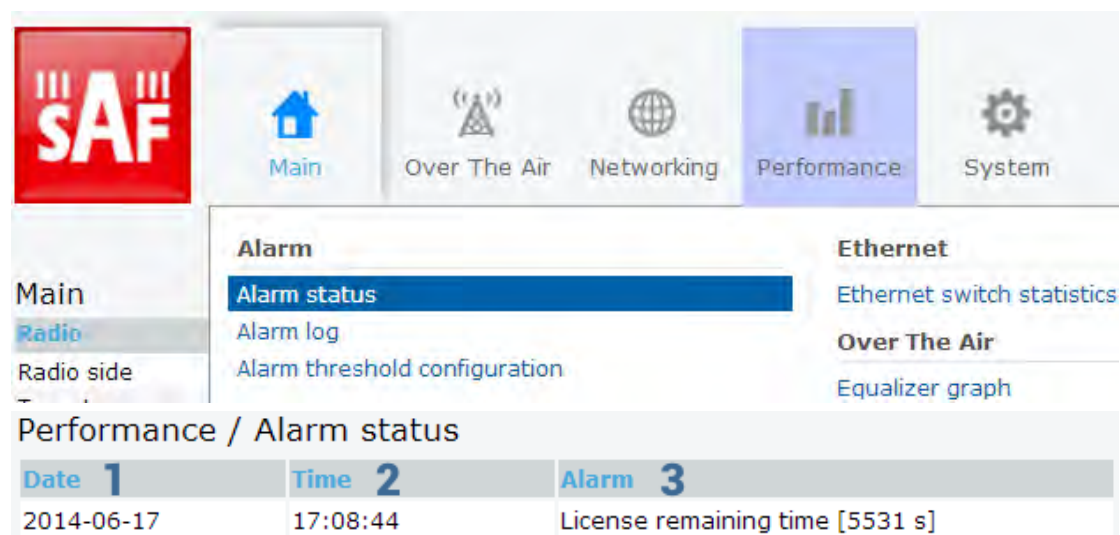
CLI commands:

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 à Alarm status

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



Date 1	Time 2	Alarm 3
2014-06-17	17:08:44	License remaining time [5531 s]

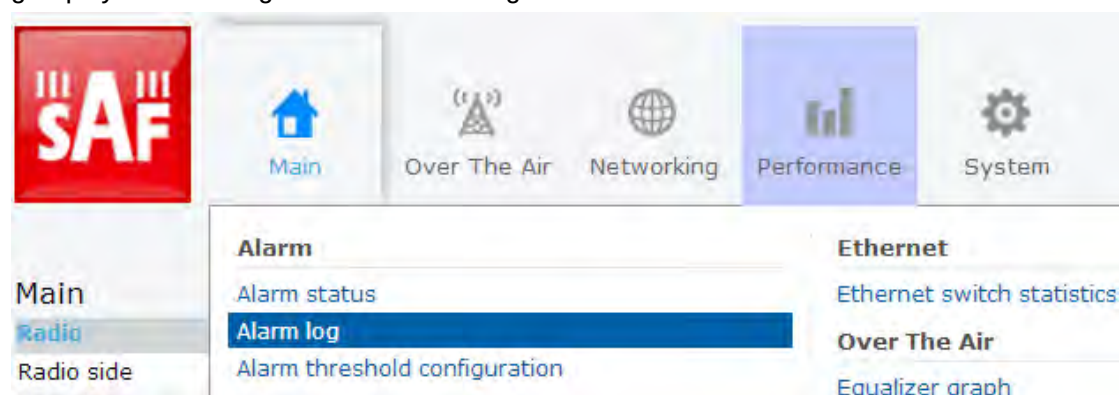
- 1) **Date** – shows date when alarm was initiated;
- 2) **Time** – shows time when alarm was initiated;
- 3) **Alarm** – shows name of the alarm.

Alarm à 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

3

1

2

Toggle period selection

Load the latest data

No.	Date and Time	Source	Status	Event
361	2014-06-17 15:20:46	Radio	RESET	Rx level [-79 dBm]
362	2014-06-17 15:20:46	Radio	SET	Rx level [-83 dBm]
363	2014-06-17 15:20:48	Modem		ACM Tx profile history [4QAM 16QAM 32QAM 64QAM 128QAM 256QAM 512QAM 1024QAM 1024QAM_W] [0x0000D556]
364	2014-06-17 15:20:49	Modem		ACM Tx profile history [4QAM] [0x00000002]
365	2014-06-17 15:44:17	radiod[rpc]		tx mute disabled (#6DAA72E8:-3)
366	2014-06-17 15:45:40	Radio		radio cant make params dependency req (#1B909EE4:-2)
367	2014-06-17 15:45:41	Modem		ACM Tx profile history [0x00000000]
368	2014-06-17 15:45:43	Modem		ACM Tx profile history [4QAM 1024QAM_W] [0x00008002]
369	2014-06-17 15:45:44	Modem		ACM Tx profile history [4QAM] [0x00000002]
370	2014-06-17 15:46:07	Radio		radio cant make params dependency req (#1B909EE4:-2)
371	2014-06-17 15:46:08	Modem		ACM Tx profile history [0x00000000]
372	2014-06-17 15:46:10	Modem		ACM Tx profile history [4QAM 1024QAM_W] [0x00008002]
373	2014-06-17 15:46:11	Modem		ACM Tx profile history [4QAM] [0x00000002]
374	2014-06-17 15:46:44	Modem		ACM Tx profile history [4QAM 1024QAM_W] [0x00008002]
375	2014-06-17 15:46:45	Modem		ACM Tx profile history [4QAM] [0x00000002]
376	2014-06-17 15:50:00	Modem		ACM Tx profile history [4QAM 16QAM 32QAM 64QAM 128QAM 256QAM 512QAM 1024QAM 1024QAM_W] [0x0000D556]
377	2014-06-17 15:50:01	Modem		ACM Tx profile history [1024QAM_W] [0x00008000]
378	2014-06-17 15:50:04	Modem	RESET	Modem acquire error [0x00000000]
379	2014-06-17 15:50:16	Modem	SET	Modem acquire error [0x00000008]
380	2014-06-17 15:50:19	Modem		ACM Tx profile history [4QAM] [0x00000002]

5

<<

Previous 20

Next 20

>>

6

Select page (1 -20)

19

Select

7

Filter:

No filter

8

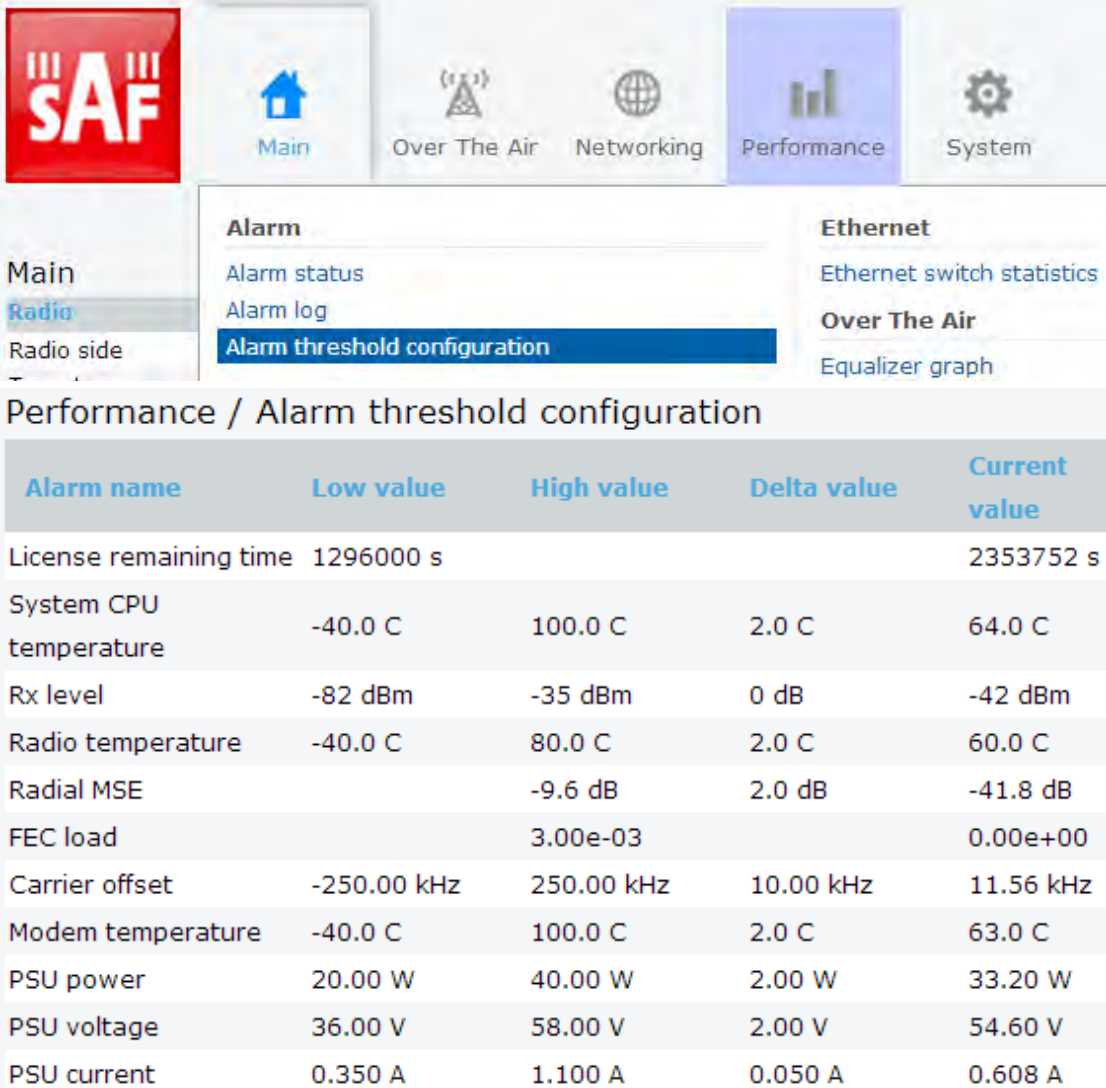
Alarm event log file

- 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 à 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.



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



button to enter configuration mode.

Performance / Alarm threshold configuration

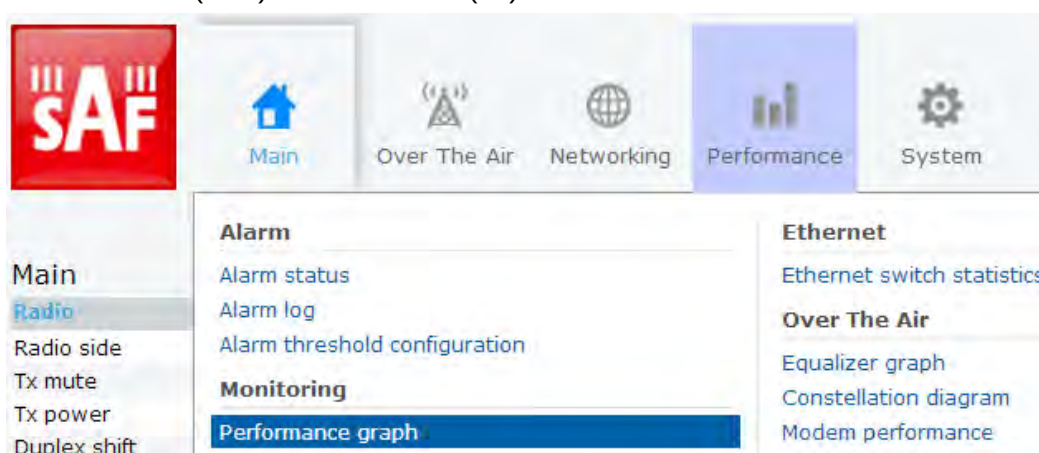
Alarm name	Low value	High value	Delta value	Current value	Default value ¹
License remaining time	1296000 s			2353470 s	☒
System CPU temperature	-40.0 C	100.0 C	2.0 C	63.5 C	☒
Rx level	-82 dBm	-35 dBm	0 dB	-42 dBm	☒
Radio temperature	-40.0 C	80.0 C	2.0 C	60.0 C	☒
Radial MSE		-9.6 dB	2.0 dB	-41.7 dB	☒
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	☒

³
 ⁴

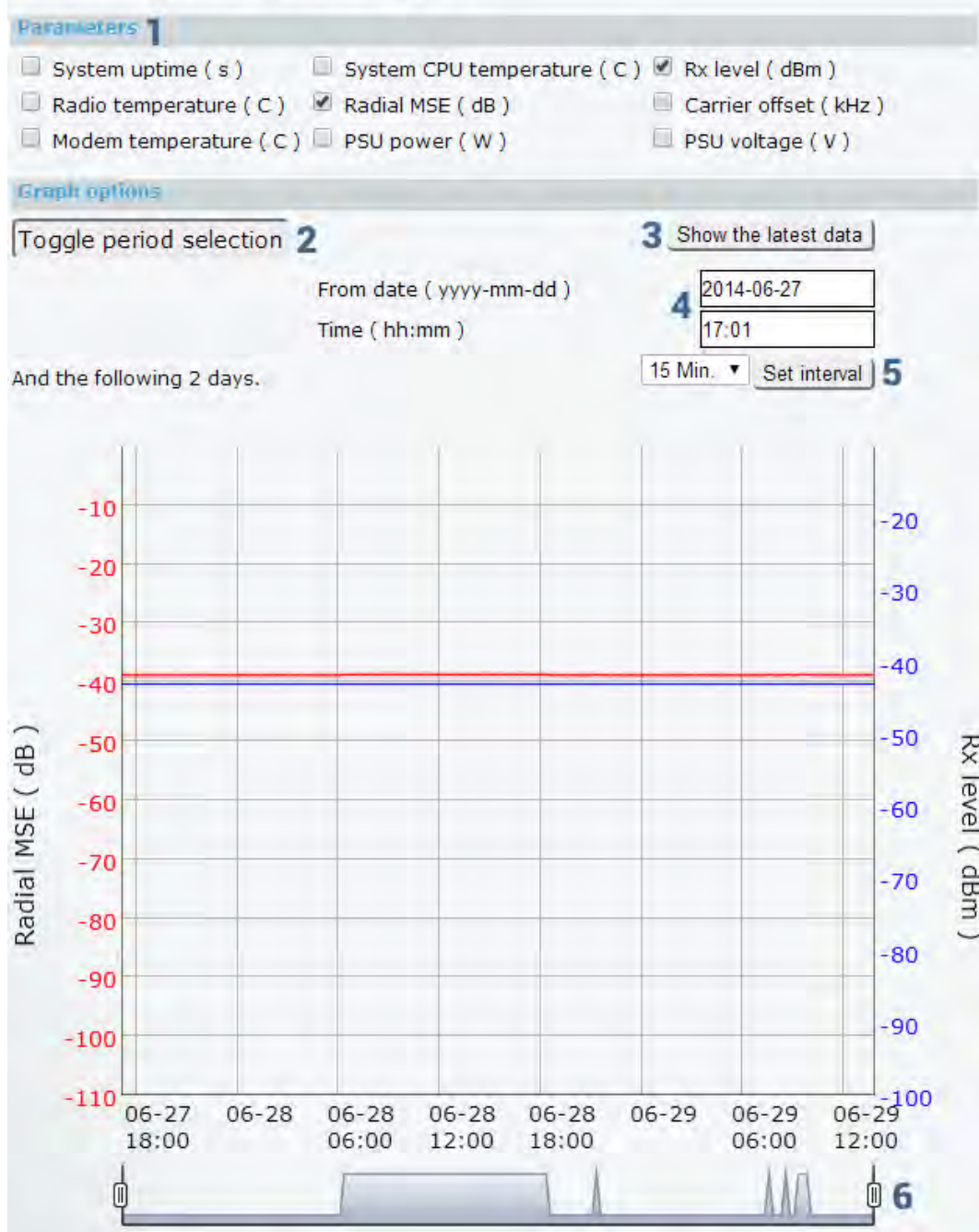
- 1) **Default value** – deselect to activate manual threshold modification;
- 2) When “Default value” is deselected, “Low value”, “High value” and “Delta value” fields for all parameters become editable;
- 3) **Set all to default** – resets “Low value”, “High value” and “Delta value” for all parameters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

Performance à 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



 Main

 Over The Air

 Networking

 Performance

 System

Main

Alarm

Alarm status

Ethernet

Ethernet switch statistics

Performance / Ethernet switch statistics

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 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.

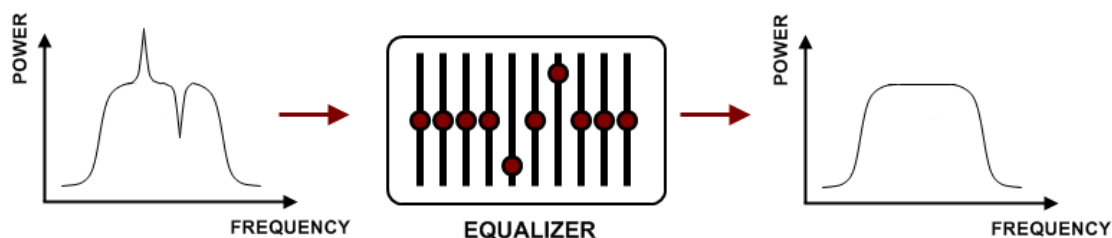
network status statistics

Use to show Ethernet statistics on all ports.

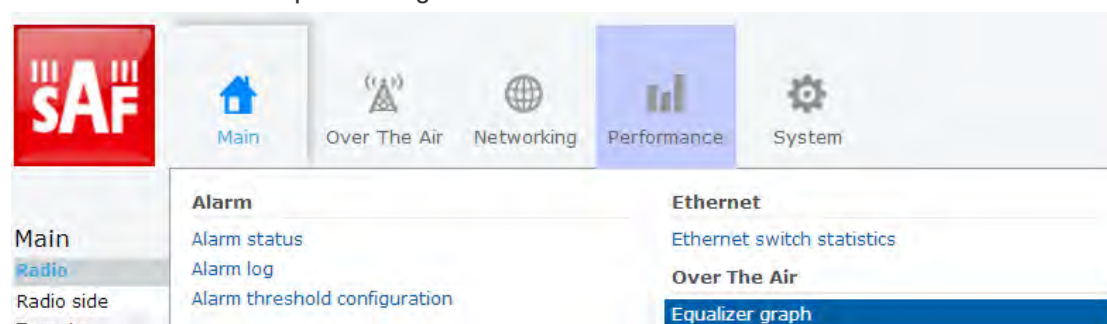
Over The Air à Equalizer graph

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.

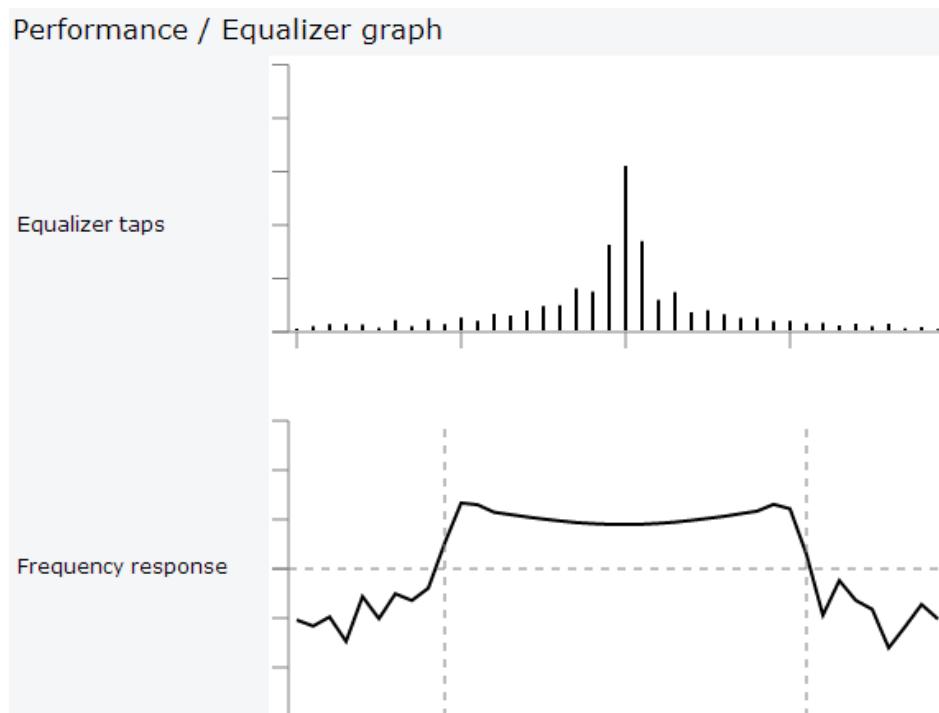
In Integra the adaptive equalizer is realized as complex-arithmetic 40-taps digital FIR (Finite Impulse Response) filter. In other words, equalizer is a selective frequency amplifier and attenuator, a device, which application to IF (Intermediate Frequency) band-limited signal is schematically shown in the picture below:



Equalizer graph window shows adaptive equalizer taps' coefficients, which at a set time moment minimize multipath fading effect in channel.



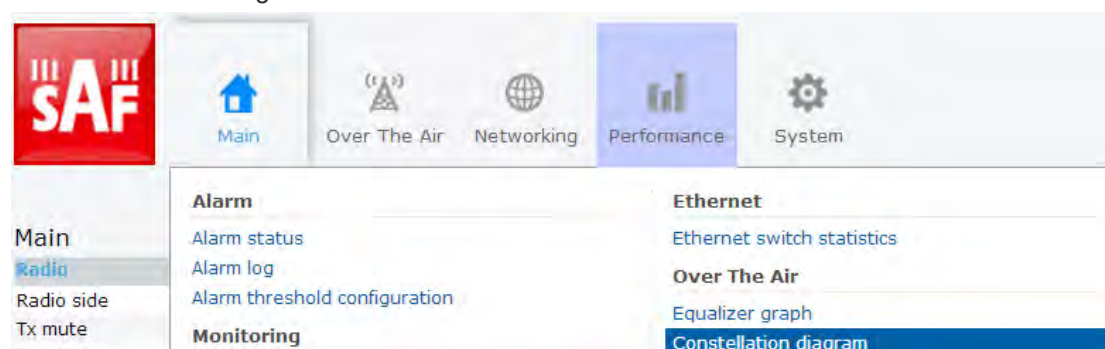
Example of equalizer taps' coefficients and its frequency response in case of a normal operation is shown below:



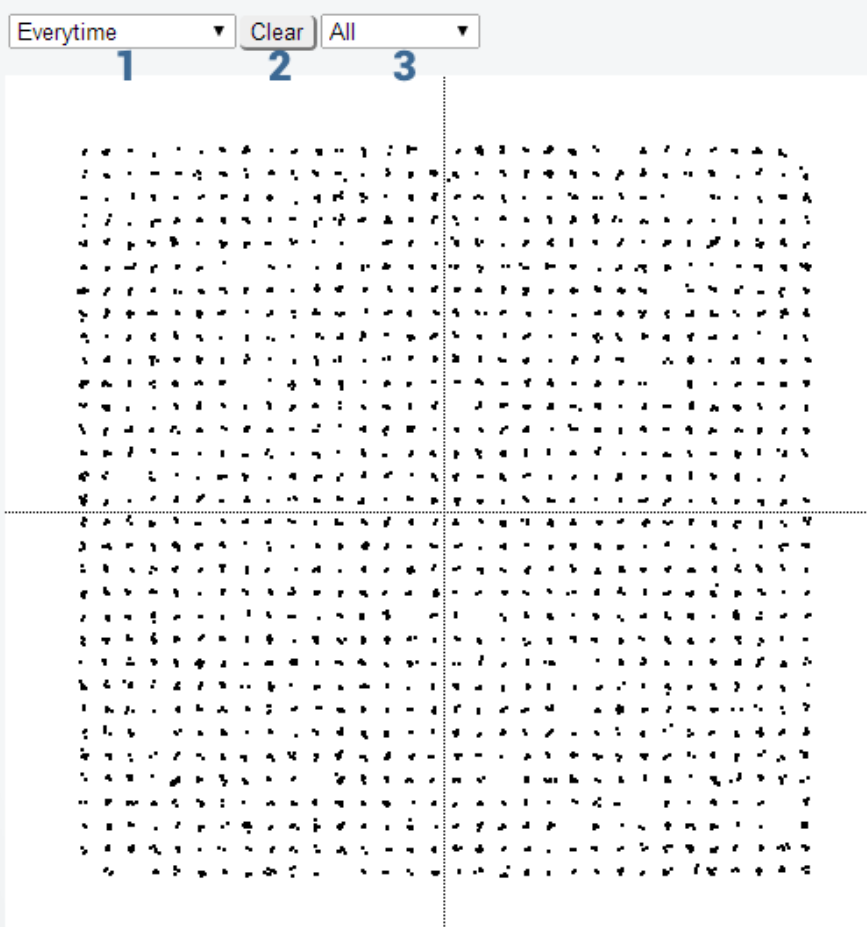
During normal operation frequency response curve is smooth at the centre and central equalizer tap is higher, while side towers evenly decrease. If equalizer taps and frequency response curve significantly differs from the one above, it may be indication of multipath issue, which must be inspected with 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.

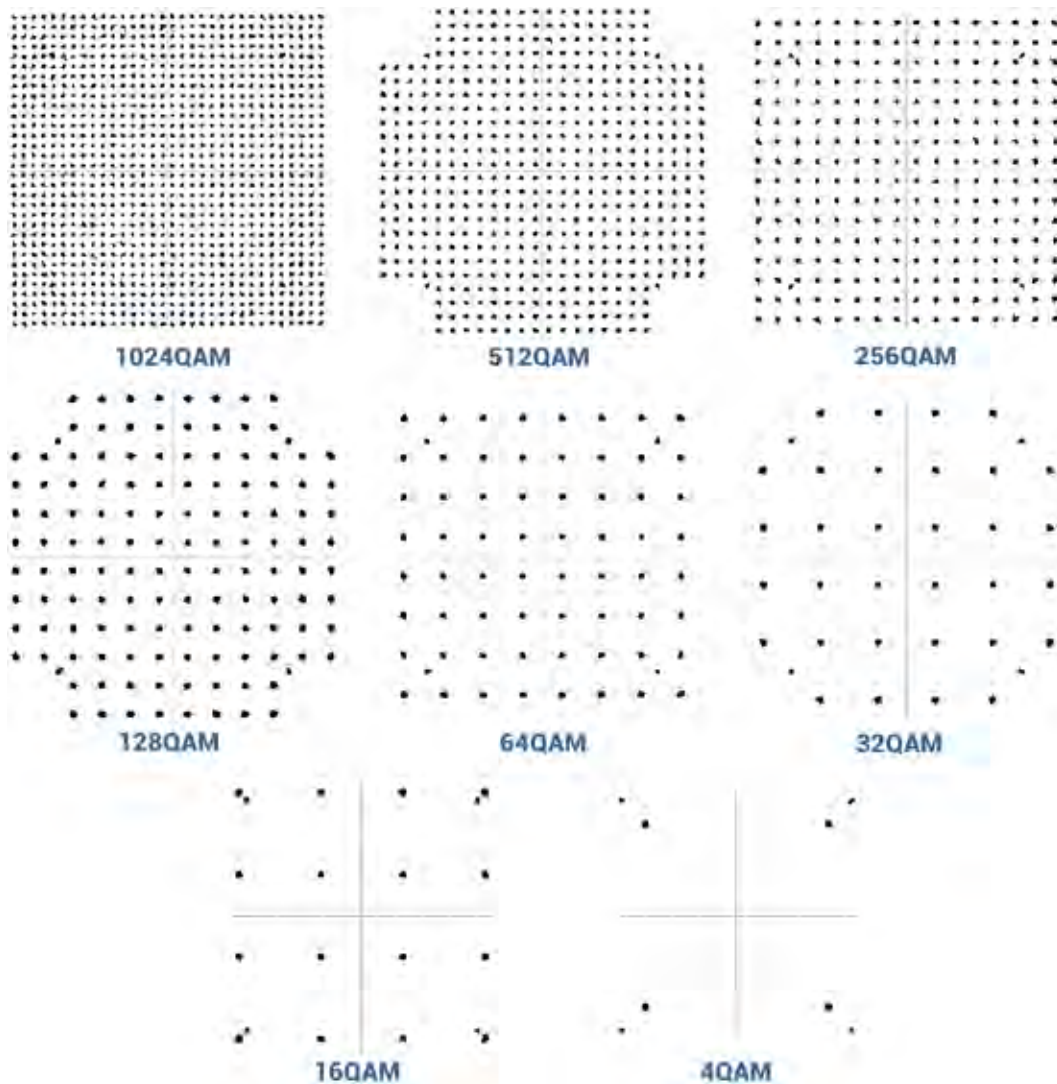


Performance / Constellation diagram



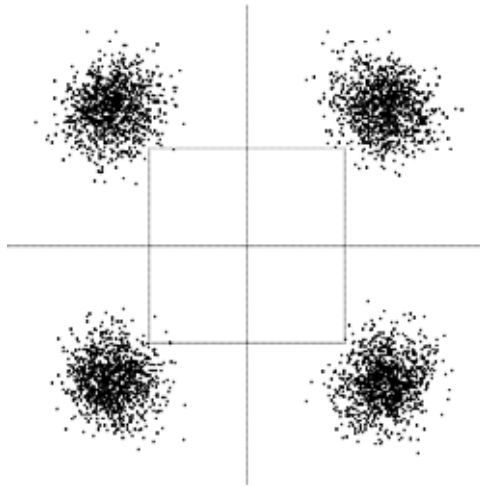
- 1) Allows choosing how often is constellation automatically cleared;
- 2) Manually clear current constellation;
- 3) Allows zooming to one of 4 constellation quadrants.

Examples of CFIP constellation diagrams under ideal conditions are shown below:

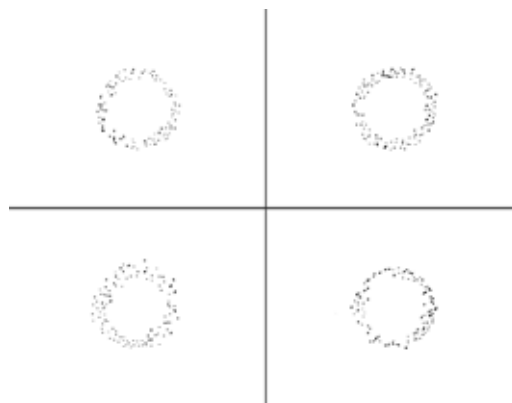


For the purpose of analysing the received signal quality, some types of corruption are evident in the constellation diagram. For example:

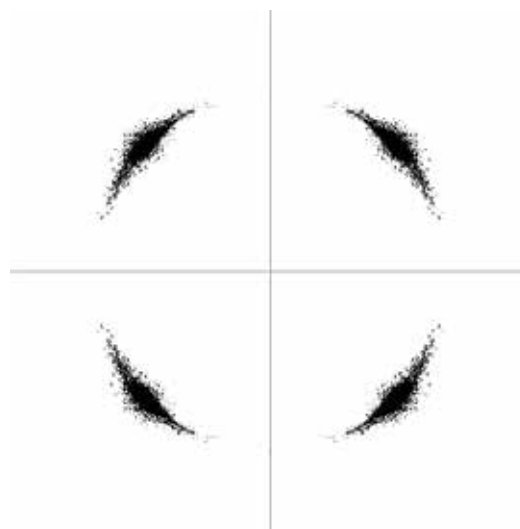
- 1) Gaussian noise is displayed as fuzzy constellation points:



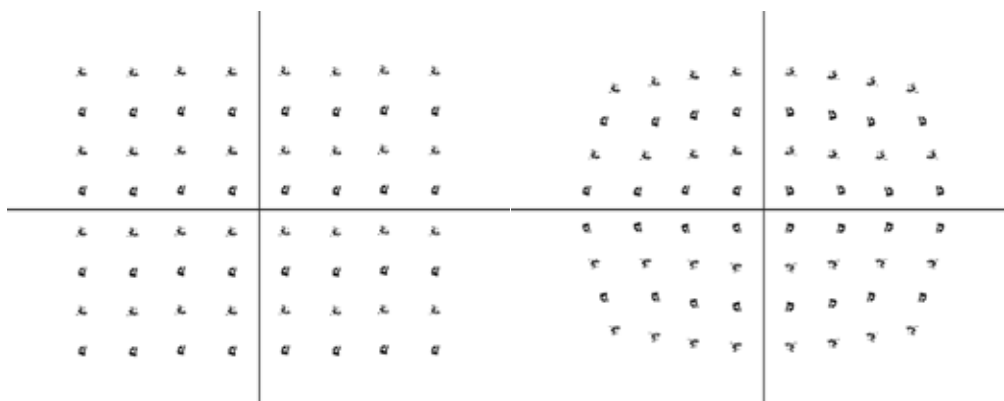
- 2) Non-coherent single frequency interference is displayed as circular constellation points:



- 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 à Modem performance

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

[Main](#)
[Over The Air](#)
[Networking](#)
[Performance](#)
[System](#)

[Main](#)
[Radio](#)
[Radio side](#)
[Tx mute](#)
[Tx power](#)
[Duplex shift](#)

Alarm
[Alarm status](#)
[Alarm log](#)
[Alarm threshold configuration](#)
Monitoring
[Performance graph](#)

Ethernet
[Ethernet switch statistics](#)
Over The Air
[Equalizer graph](#)
[Constellation diagram](#)
[Modem performance](#)

Performance / Modem performance

Count Time	1	1 day 01:28:05
Errored Block	2	472
Errored Second	3	53
Severely Errored Second	4	35
Background Block Error	5	472
Total Block Number	6	2639001109
Errored Second Ratio	7	5.8e-04
Severely Errored Second Ratio	8	3.8e-04
Background Block Error Ratio	9	1.8e-07
Uptime	10	1 day 01:27:30
Unavailtime	11	00:00:35

12 Clear

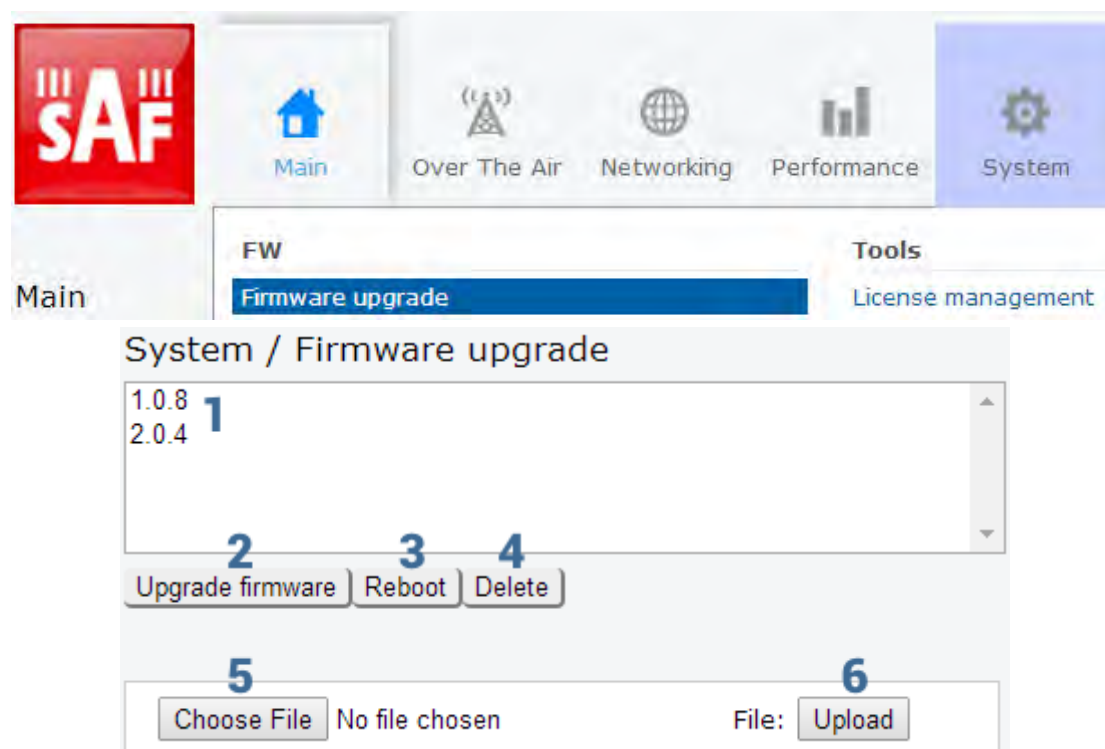
- 1) **Count time** – time during which statistics are gathered;
- 2) **Errored Block (EB)** – Number of blocks having at least one bit error;
- 3) **Errored Second (ES)** – Amount of seconds during which errored blocks were registered;
- 4) **Severely Errored Seconds (SES)** – Amount of seconds which 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.
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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 à IP configuration

IP address configuration page is available in “System” menu (System à Configuration à IP configuration).

System / IP configuration

IP address	1	192.168.205.10
IP Mask	2	255.255.255.0
IP gateway	3	
Ethernet MAC address	4	00:04:a6:81:18:02
Remote IP address	5	192.168.205.11 ☒ Auto

6 Execute 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;



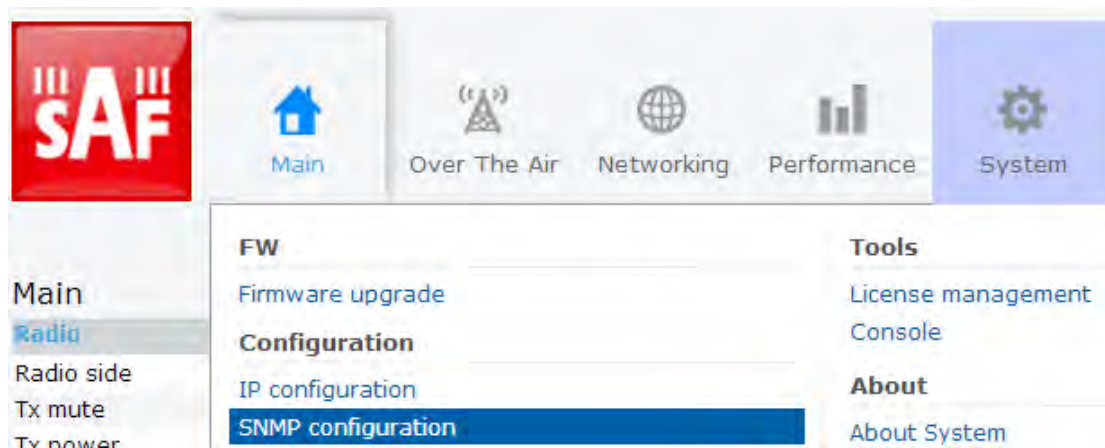
Integra IP addresses need to be in the same subnet..

- 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 à 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

SAF

Main Over The Air Networking Performance System

Main

Radio

Radio side

Tx mute

Tx power

Duplex shift

FW

Firmware upgrade

Configuration

IP configuration

SNMP configuration

Configuration file

Tools

License management

Console

About

About System

Copyright

System / Configuration file

Download / Upload cfg file

Download configuration file **1** Download

Upload configuration file Choose File No file chosen **2** Upload

Advanced cfg file features

Restore uploaded configuration file **3** Cfg restore

Load factory configuration file **4** Cfg factory

- 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 à System configuration

SAF

Main Over The Air Networking Performance **System**

Main

Radio

Radio side

Tx mute

Tx power

Duplex shift

Tx frequency

FW

Firmware upgrade

Configuration

IP configuration

SNMP configuration

Configuration file

System configuration

Tools

License management

Console

About

About System

Copyright

System / System configuration

User configuration *

User name: admin

Enter new password (4..30 characters) 1

Hide password ☒ 2

System configuration

System name (<= 16 characters) 3 SAF

Time (YY-MM-DD hh:mm:ss) 4 2014-07-03 17:07:12

Set local machine time 5

Location 6

* Leave blank in order to keep existing password.

7 Rollback on ☐ Execute 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.

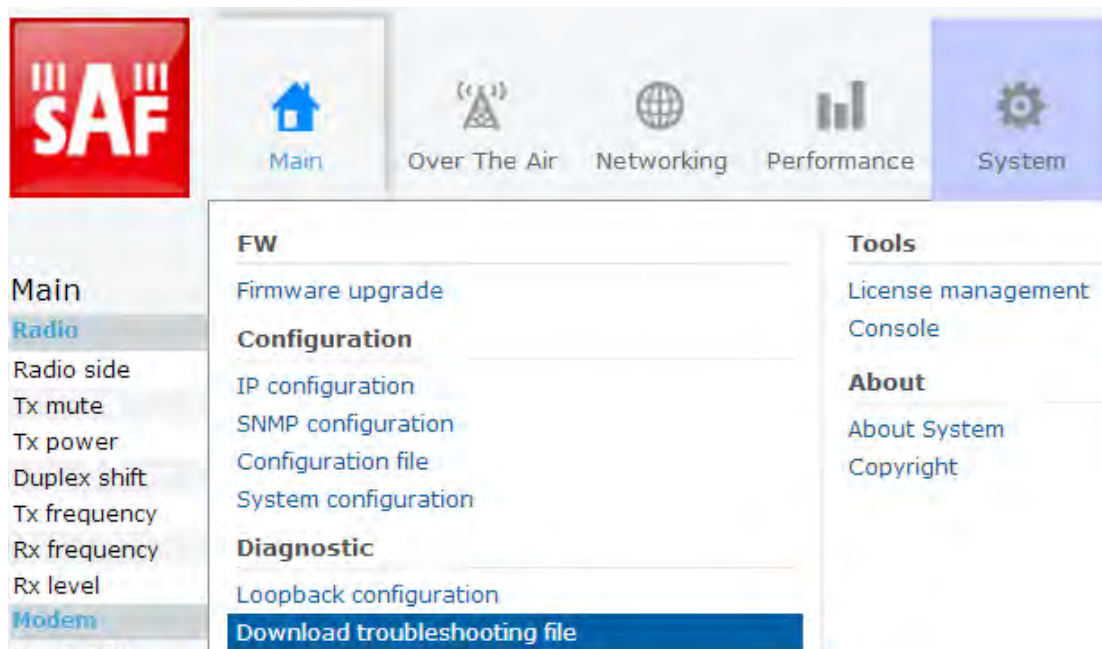
Diagnostic à Loopback configuration

The screenshot displays the SAF WEB GUI interface. At the top, there is a navigation bar with icons for Main, Over The Air, Networking, Performance, and System. Below this, a sidebar on the left lists various radio parameters. The main content area shows the 'Loopback configuration' section, which includes a checkbox for 'Modem loopback' and an 'Execute configuration' button. The page title is 'System / 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.

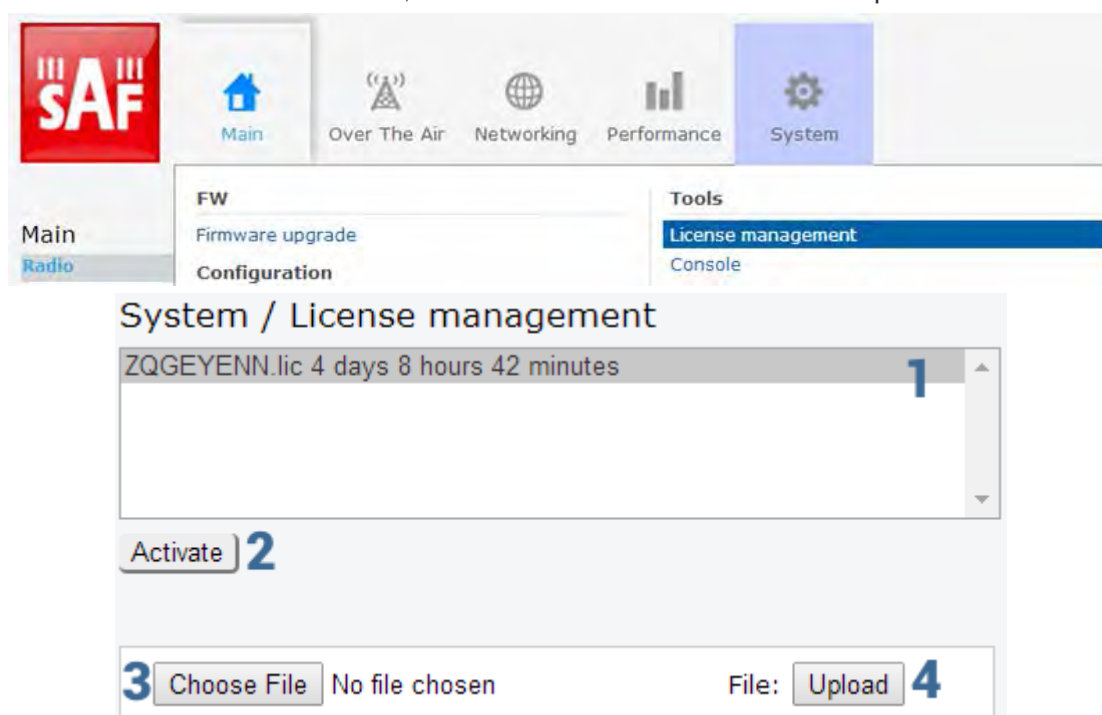
Diagnostic à Download troubleshooting file

Downloads troubleshooting file to your hard disk drive. Note that for proper diagnostics additionally alarm log file (“Performance à Alarm à Alarm log à Alarm event log file”) needs to be downloaded.



Tools à 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

SAF

Main Over The Air Networking Performance System

Main Radio

FW
Firmware upgrade
Configuration

Tools
License management
Console

System / Console

```
SAF>SAF>
SAF>
configuration      - User configuration commands
firmware           - Firmware update and information
help               - CLI usage
license            - License commands
log                - Event / Performance log control and configuration
modem              - Modem commands
network            - Network functionality
product            - Product toolbox
radio              - Radio commands
system             - System configuration
```

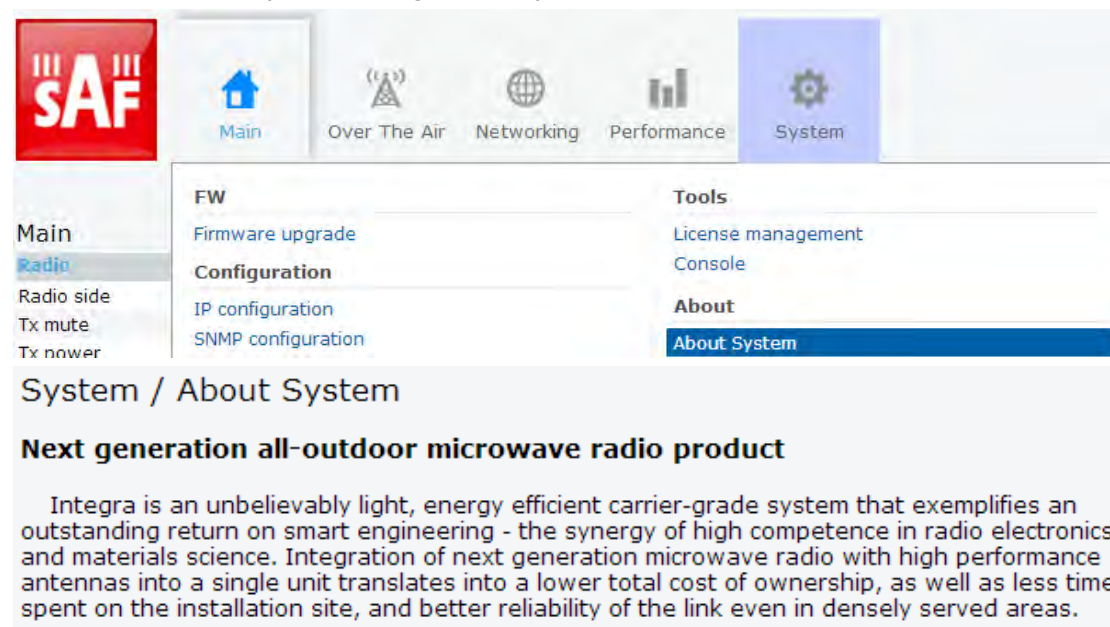
Use syntax “<command> ?” to see information on subcommands.

Use8 ENTER key to execute entered command.

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

About à About System

Provides short description of Integra series products.



System / About System

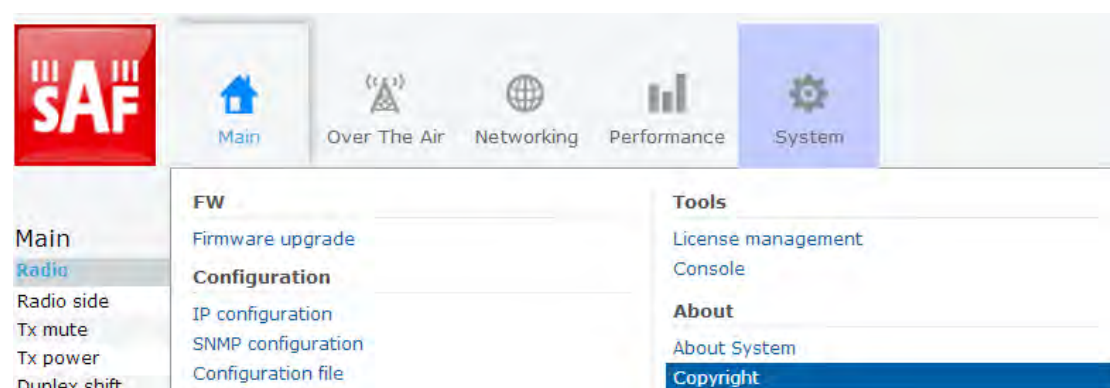
Next generation all-outdoor microwave radio product

Integra is an unbelieveably light, energy efficient carrier-grade system that exemplifies an outstanding return on smart engineering - the synergy of high competence in radio electronics and materials science. Integration of next generation microwave radio with high performance antennas into a single unit translates into a lower total cost of ownership, as well as less time spent on the installation site, and better reliability of the link even in densely served areas.

product info	Use to show detailed information on Integra FODU.
system number	Use to show Integra's serial number.

About à Copyright

Provides copyright information.



System / Copyright

Copyright

System / Copyright

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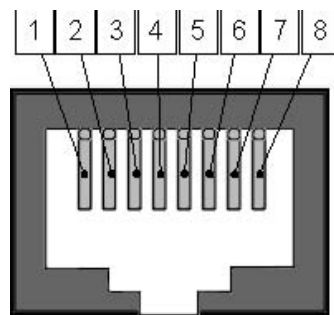
Chapter 4: INTERFACES

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:



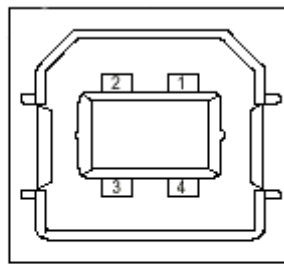
Pin	Data	PoE
1	Bi-directional A+	VB1+
2	Bi-directional A-	VB1+
3	Bi-directional B+	VB1-
4	Bi-directional C+	VB2+
5	Bi-directional C-	VB2+
6	Bi-directional B-	VB1-
7	Bi-directional D+	VB2-
8	Bi-directional D-	VB2-

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+

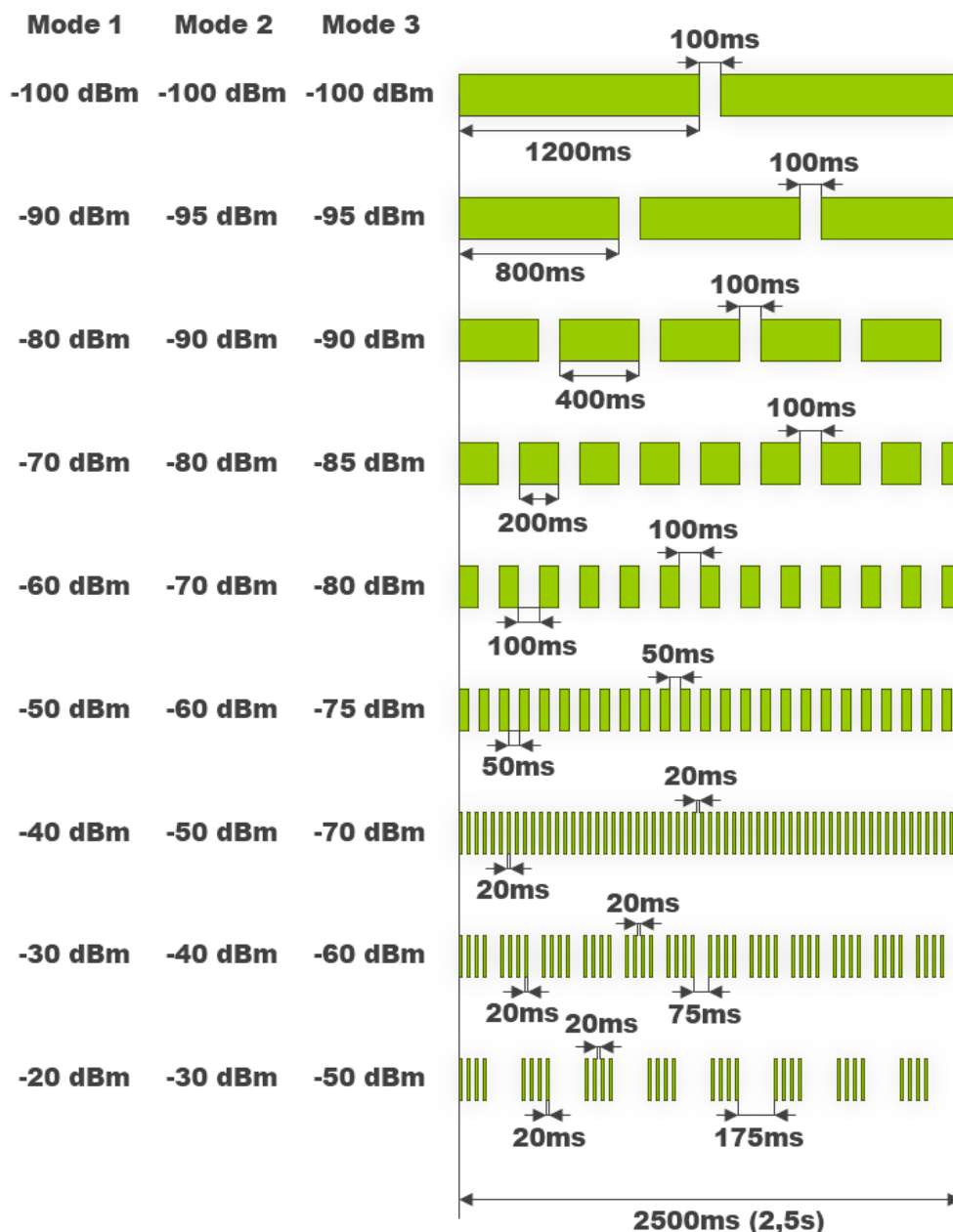
4=GND

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:



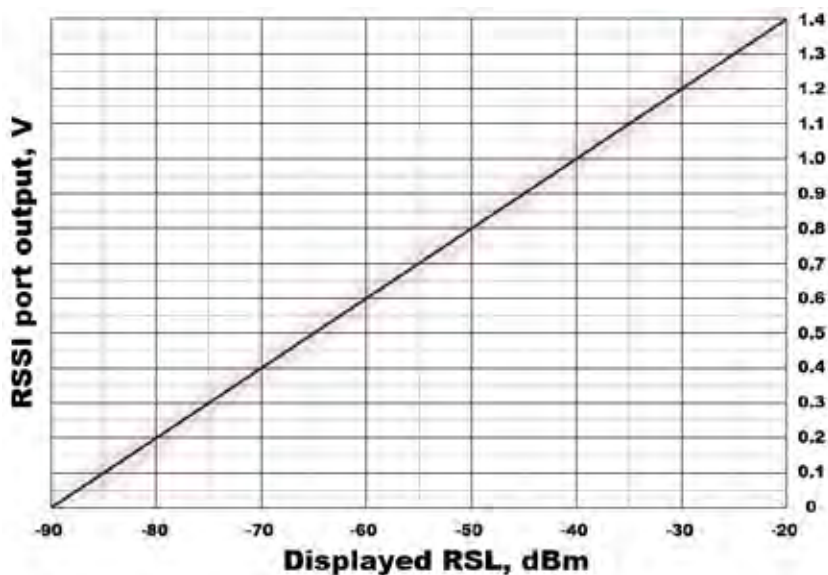
RSSI/audio port

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.



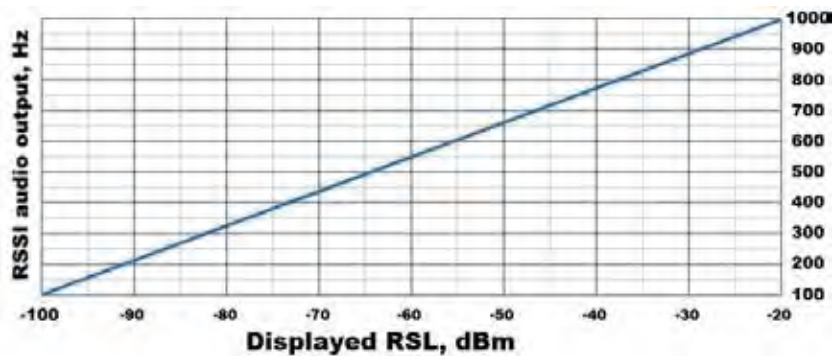
The following charts and tables show typical relationship of the received signal level (Rx level) displayed by CFIP vs. RSSI port output voltage (RSSI – Received Signal Strength Indicator) and audio frequency. The RSSI port is located on FODU. The evaluated Rx level has the error +/- 2 dB.

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



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