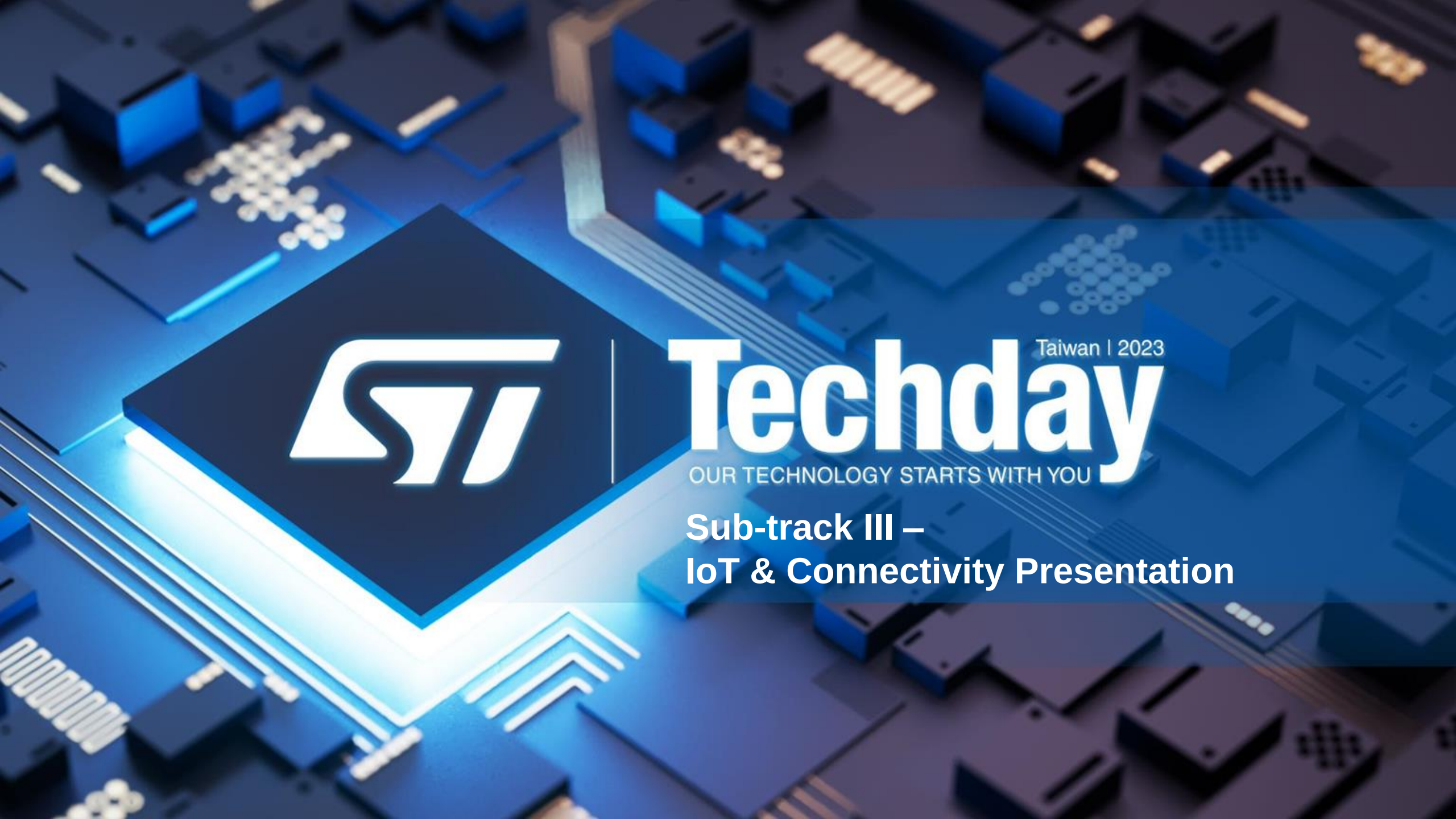

Sub-track III –
IoT & Connectivity Presentation

ST60 video trailer

https://youtu.be/NHRDrtExZgY

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ST60
contactless connectivity

Liam Park

STMicroelectronics

ST60

Agenda

1 ST60 positioning

2 ST60 Roadmap

3 ST60 A2 product presentation

4 ST60 A3 Product presentation

5 ST60 Turnkey solution

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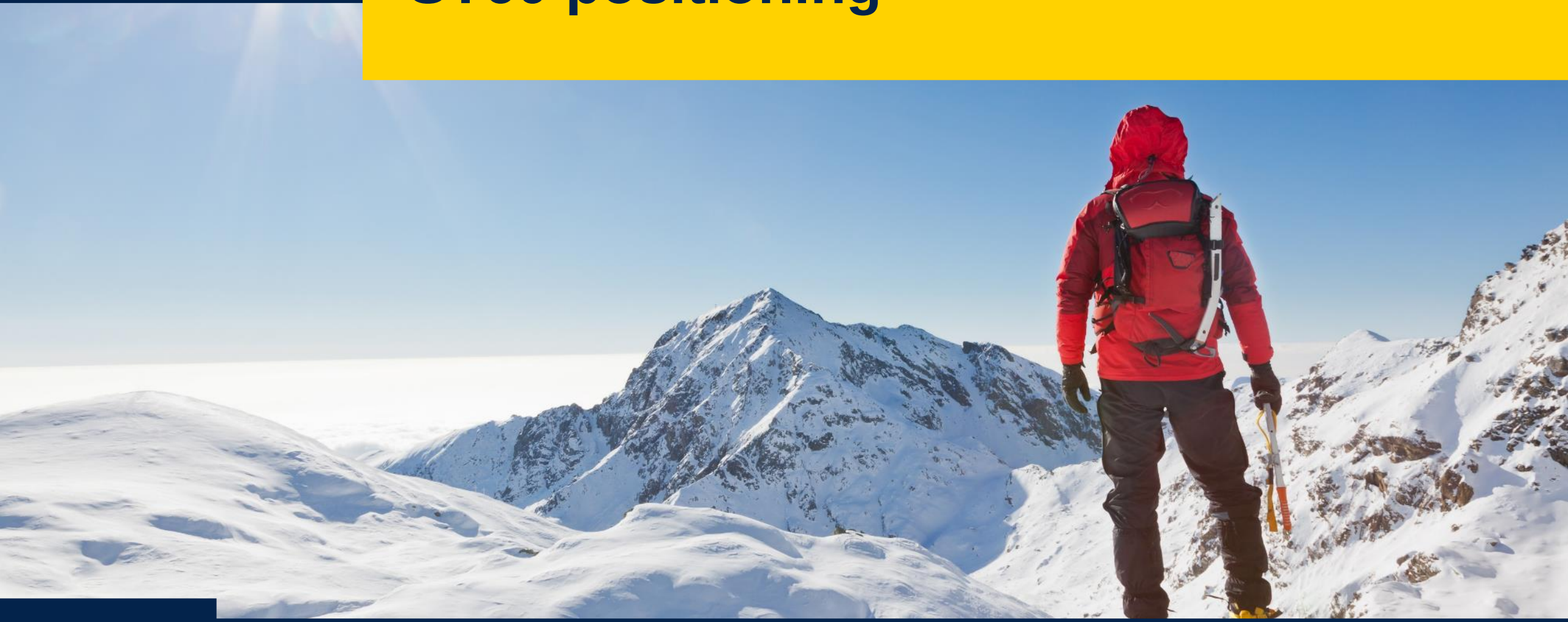
ST60 positioning



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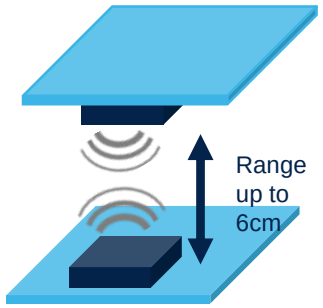
ST60: a new solution for contactless connectivity

High-speed, low-power, short range, point to point 60 GHz RF link



- Up to 6 Gbps
- Small footprint
- Ultra low power
- -40°C to 105°C

Replace cables for board-to-board connection
Enable connector-free solutions

- Immune to water / dust / vibration
- Rotation support
- Electrical isolation
- Improved Reliability
- Waterproof devices
- Sleeker design for devices
- ….

Solve product design challenges

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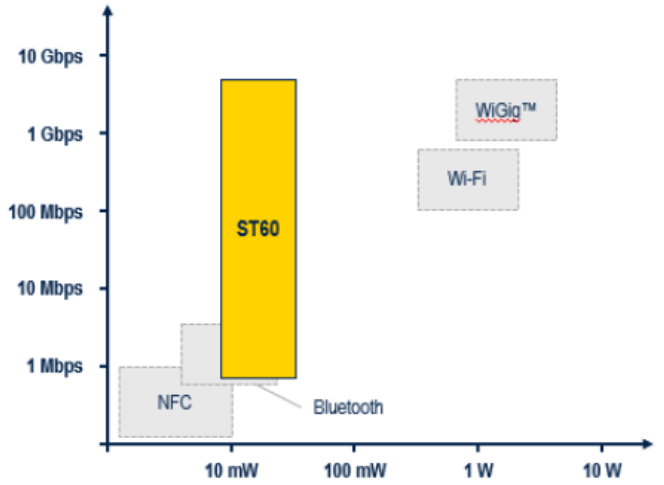
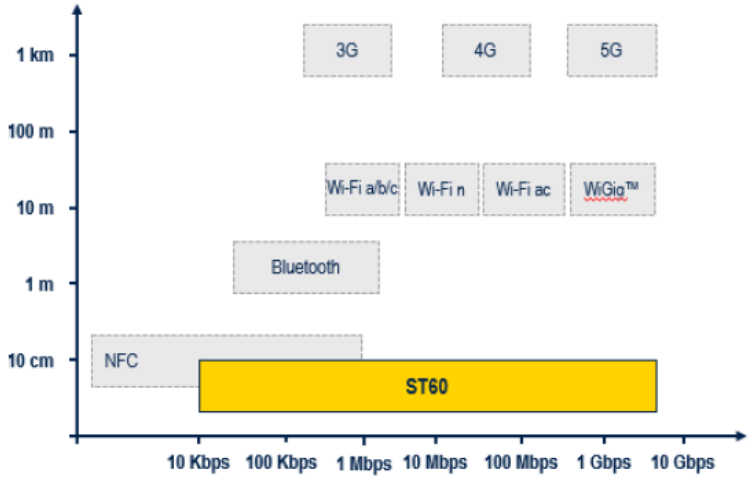
60 GHz contactless connectivity

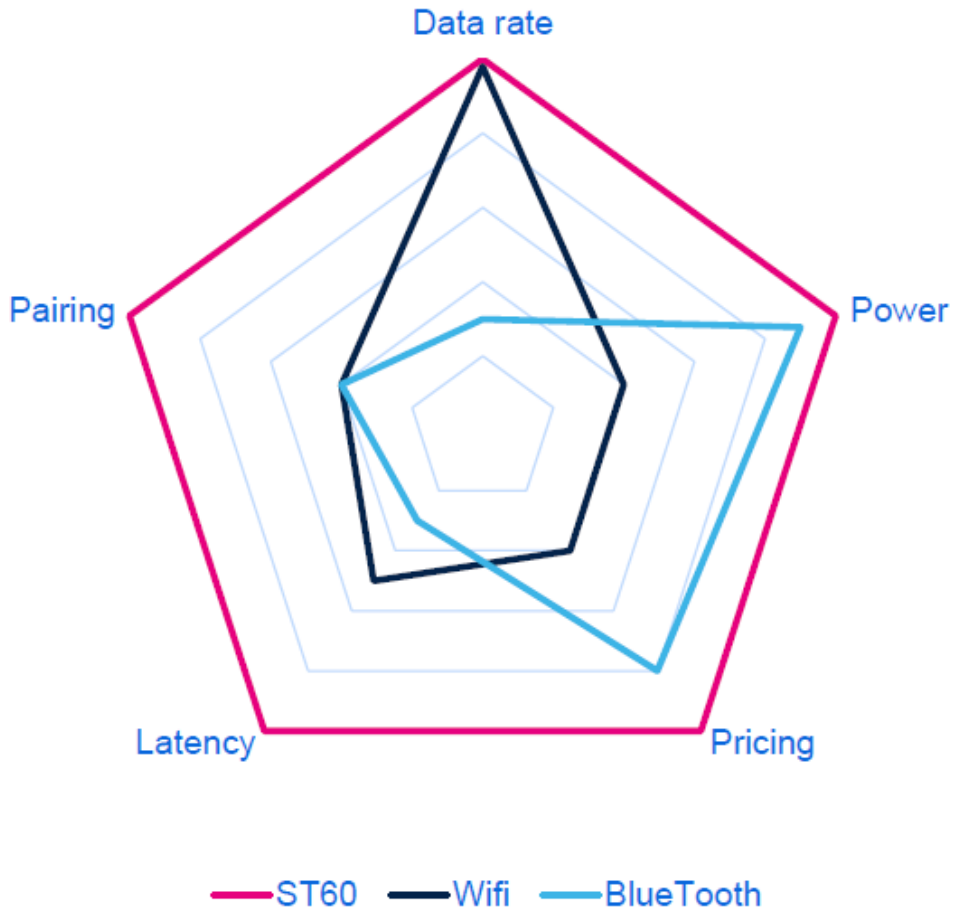
Industry Best Power per Bit
6.6pJ/bit for Tx & 4.1pJ/bit for Rx



Up to 6.25 Gbps speed



ST60 Benefits: Extreme Speed performance at very Low-Power, small Form Factor, integration easiness



Application examples

Electronic Appliance

Factory Automation

Robotics

Accessories & modular devices (camera, etc)

Low Data Rate transfer
Consumer & Industrial
Factory Automation, Debug and FW transfer
Safe & reliable rotation

Up to High Data Rate
Consumer & Industrial
GbE, Video, Camera
Safe & reliable rotation

Slipring
Lidar Applications

Personal Electronics
(docking, FW transfer)

Industrial Safety

Video Walls

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ST60 roadmap

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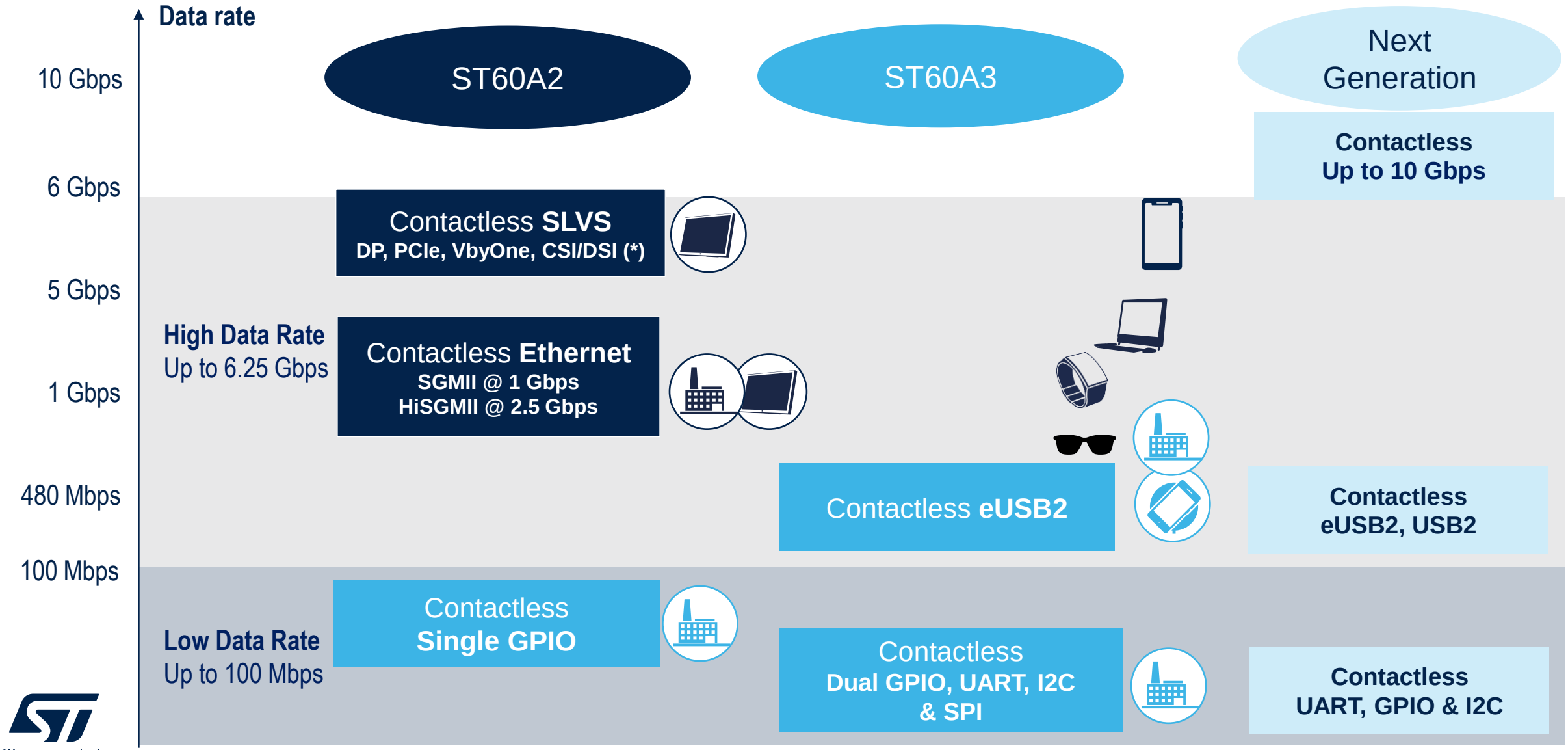
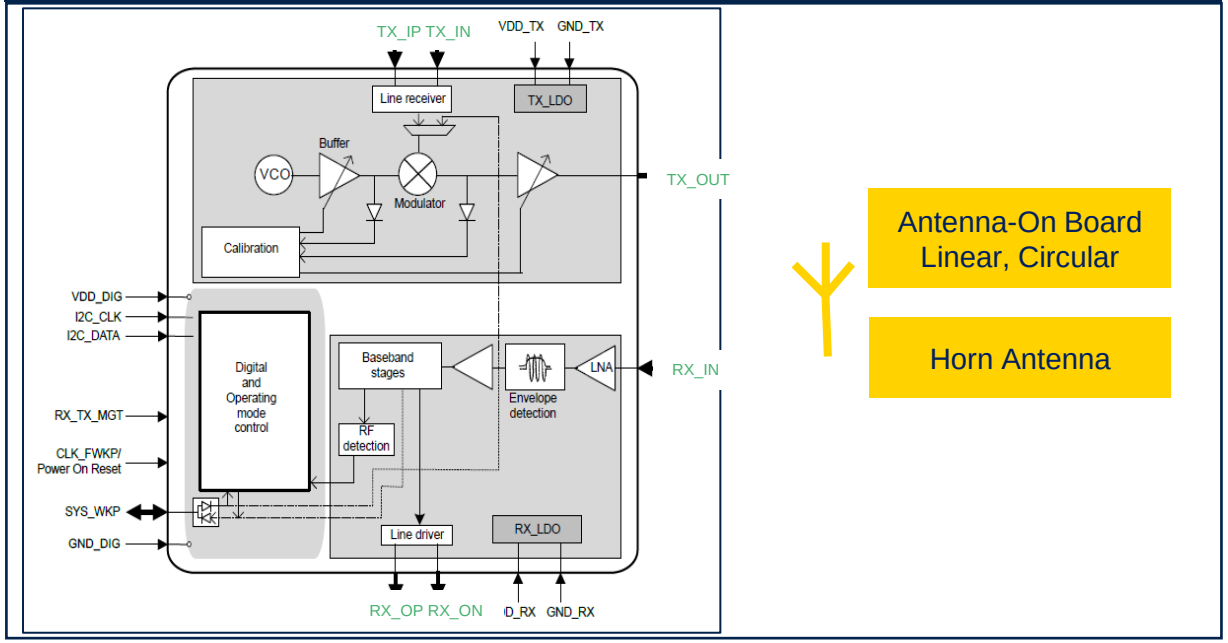
ST60 portfolio – Applications



(*) leveraging companion chips / serializer

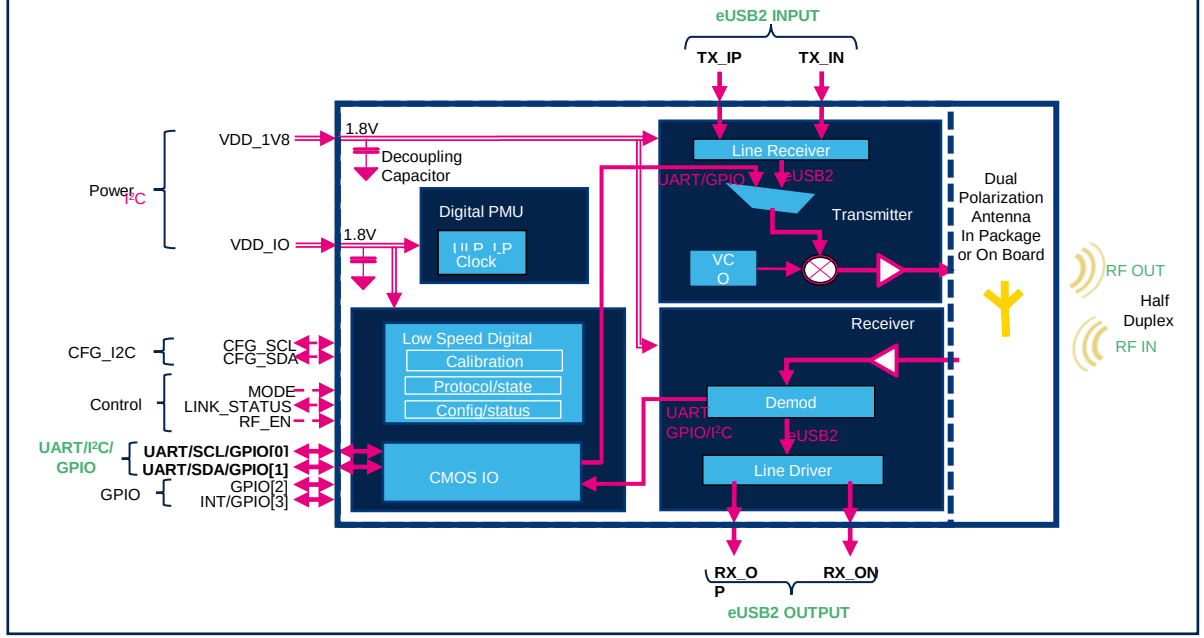
ST60 portfolio – Features

ST60A2 external antenna
GPIO up to 100 Mbps, SLVS up to 6 Gbps



- **Protocol agnostic tunneling in low power mode (44 mW max)**
- Configuration by I²C or HW force mode (no MPU/MCU integrated)
- 60 GHz ASK modulation
- Small footprint VFBGA 2.2 x 2.2 x 0.8 mm
- Compliancy with existing 60 GHz regulation, with adequate antenna design

ST60A3 antenna in package or on board
eUSB2 480 Mbps, UART I2C GPIO up to 6 Mbps



- **Multi-protocols tunneling in low power mode (130 mW max)**
- Simple configuration by I²C and OTA (no MPU/MCU integrated)
- 60 GHz ASK modulation
- Small footprint package: VFBGA 2.9 x 4.1 x 0.8 mm AiP or VFBGA 2.2 x 2.6 x 0.8 mm with external antenna
- Compliancy with existing 60 GHz regulation

ST60 portfolio – Features

Features	ST60A2G0	ST60A3H0	ST60A3H1
Antenna	• External Antenna • PCB patch antennas or directive SMT horn antennas supporting both end-fire and broadside radiation patterns	• External antenna • Multiple solutions available (vertical, horizontal radiation) • Compatible with H1 internal antenna	• Antenna In Package (AiP) • Broadside radiation, Up to 5 cm FSPL • Smallest footprint, Ease of integration
Low Data Rate	• GPIO: Single GPIO, Up to 100Mbps	• GPIO: up to 6 Mbps, Dual CMOS IO, LP and ULP modes, single and bi-directional tunneling, • UART: up to 6 Mbps, Dual CMOS IOs, LP & ULP modes • I^2C: up to 1 Mbps, Standard, Fast-and Fast-mode Plus modes, Dual CMOS IOs	• GPIO: up to 6 Mbps, Dual CMOS IO, LP and ULP modes, single and bi-directional tunneling, • UART: up to 6 Mbps, Dual CMOS IOs, LP & ULP modes • I^2C: up to 1 Mbps, Standard, Fast-and Fast-mode Plus modes, Dual CMOS IOs

USB		• eUSB2
		  • Hybrid repeater
		  • LS, FS & HS modes, up to 480 Mbps
		  • Several eUSB2 configurations supported
			• eUSB2
			  • Hybrid repeater
			  • LS, FS & HS modes, up to 480 Mbps
			  • Several eUSB2 configurations supported

HDR/FDR (SLVS)	• SLVS Half Duplex @ 6.25 Gbps max • SGMII @ 1.25 Gbps		
Package	• BGA 2.2x2.2x0.8 mm • 0.4mm pitch	• BGA 2.2x2.6x0.8 mm, • 0.4mm pitch	• BGA 2.9x4.1x0.8 mm, • 0.4mm pitch • Antenna in Package,

Power	• VCC 1.8V - 1.45V
	• SLVS @ 5 Gbps:
	  • Rx : 27 mW,
	  • Tx: 44 mW
	• GPIO @ 100 Mbps:
	  • Rx: 16 mW
	  • Tx: 40 mW
		• VCC: 1.2/1.8V
		• eUSB2 HS Rx/Tx tunneling – 110/130 mW
		• UART Rx/Tx tunneling – 90 mW / 15 mW (ULP)
		• I^2C tunneling – 90 mW
		• GPIO tunneling – 90 mW
		• Low power mode – 120 µW
		• Standby mode – 13 µW
			• VCC: 1.8V
			• eUSB2 HS Rx/Tx tunneling – 110/130 mW
			• UART Rx/Tx tunneling – 90 mW / 15 mW (ULP)
			• I^2C tunneling – 90 mW
			• GPIO tunneling – 90 mW
			• Low power mode – 120 µW
			• Standby mode – 13 µW

Temp range	• Consumer: -20,+85 °C • Industrial: -40,+105 °C	• Consumer: -20,+85 °C	• Consumer: -20,+85 °C
Schedule	• Mass production: now	• Samples: Now • Mass Production: now	• Samples: Now • Mass Production: now

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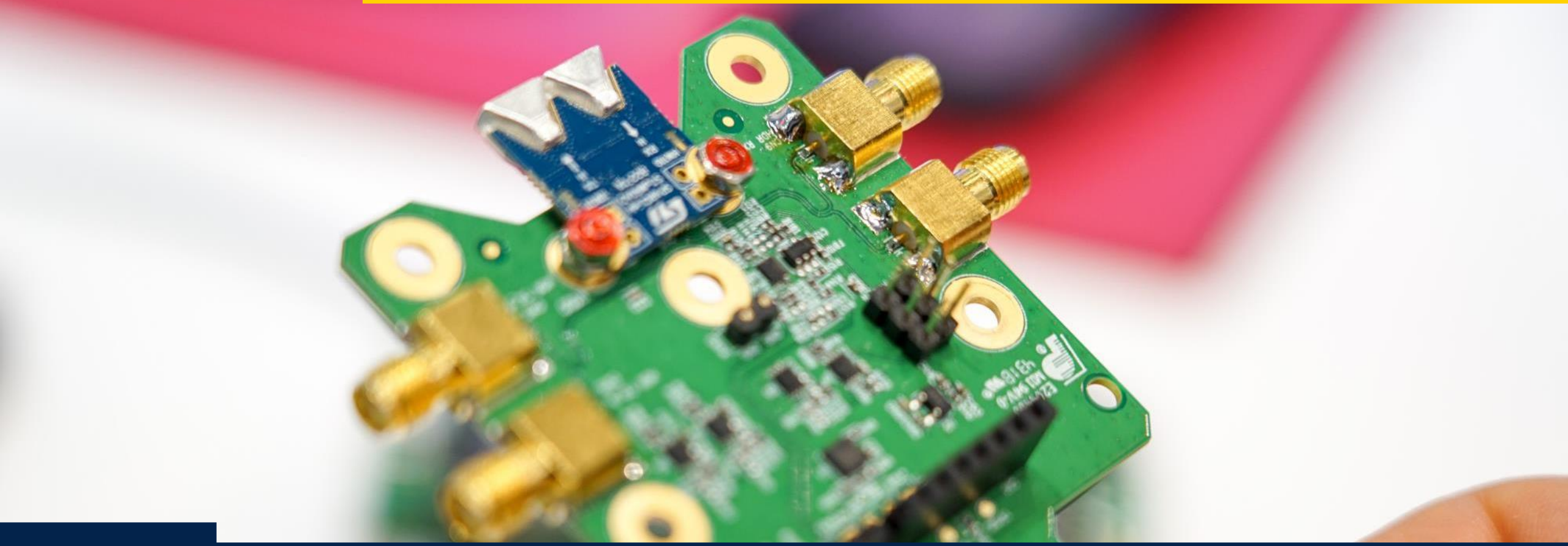
ST60A2 product overview



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ST60A2 overview

Compact solution integrating full 60 GHz RF transceiver

Point to Point
Short range
Half Duplex

- Up to 6.25 Gbps
- Small Footprint
- Ultra low power
- -40°C to 105°C

ST60A2 operating modes

Full / High Data Rate modes: FDR/HDR

- SLVS differential input-output port (TX/RX)
- Need DC balanced data 8b/10b coded
- FDR mode: from 1 Mbps to 5 Gbps
- HDR mode: from 500 Mbps to 6.25 Gbps
- Typical interfaces:
  - LVDS (need level adaptation)
  - Ethernet SGMII

Contactless Gigabit Ethernet Bridge (SLVS/HDR)

Low Data Rate mode: LDR

- Single-ended CMOS IO: from 9.6 kbps to 100 Mbps
- Typical interfaces: UART, GPIO

Contactless Full Duplex UART (GPIO/LDR)

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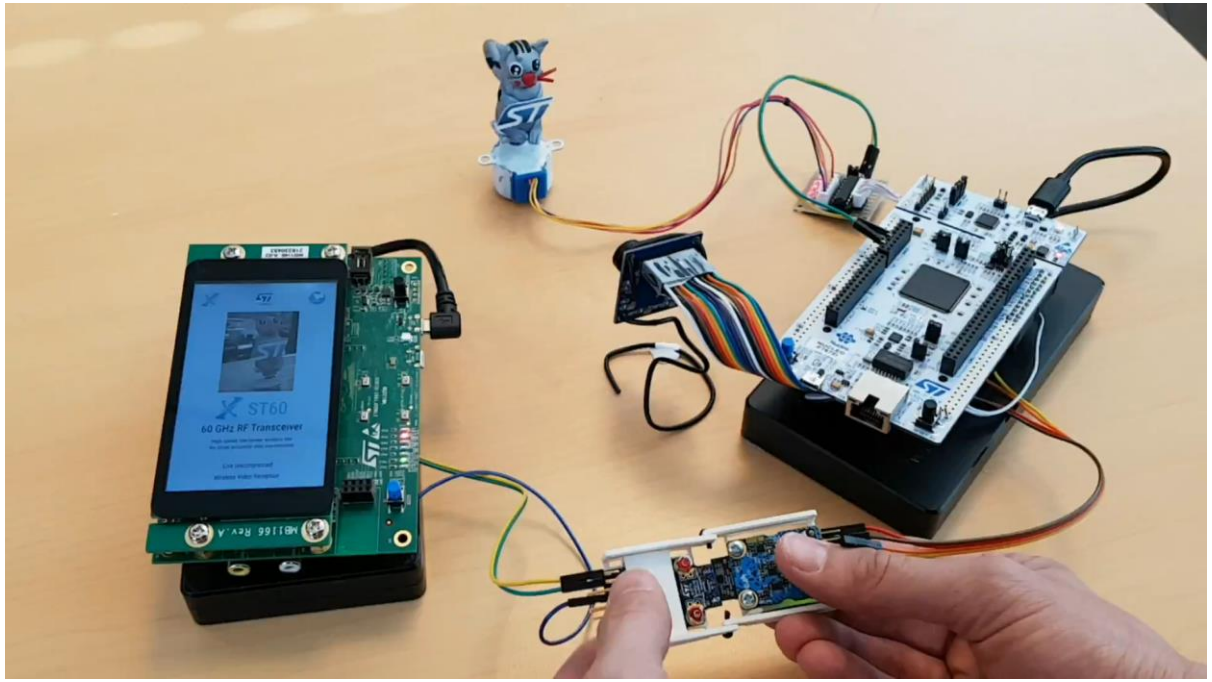
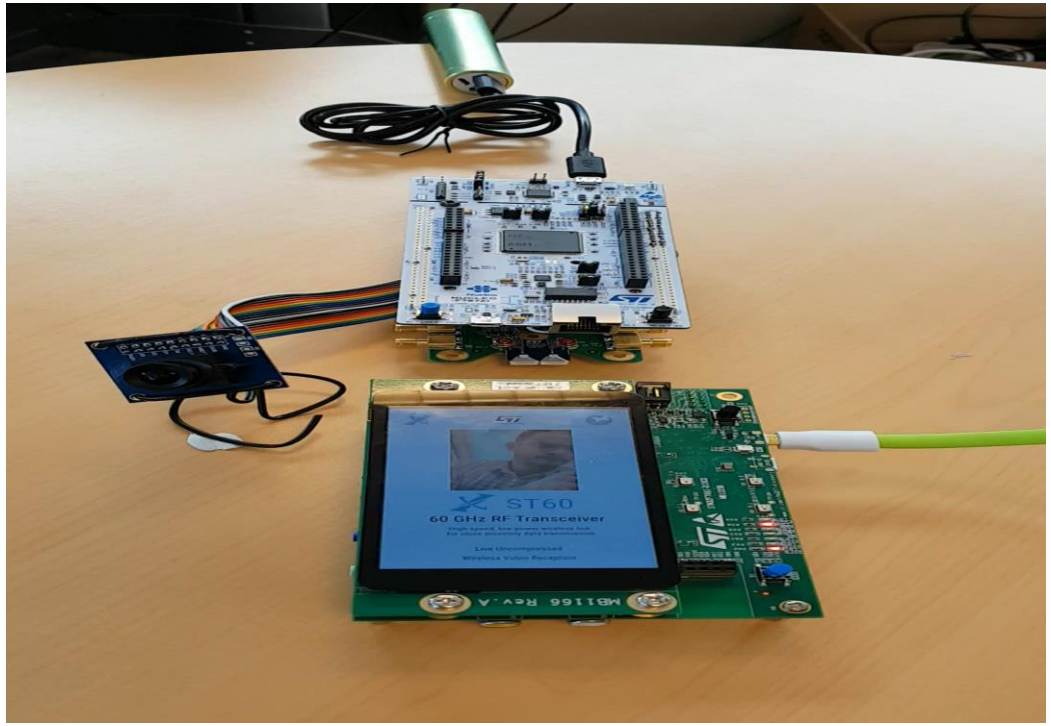
ST60A2 LDR Demo





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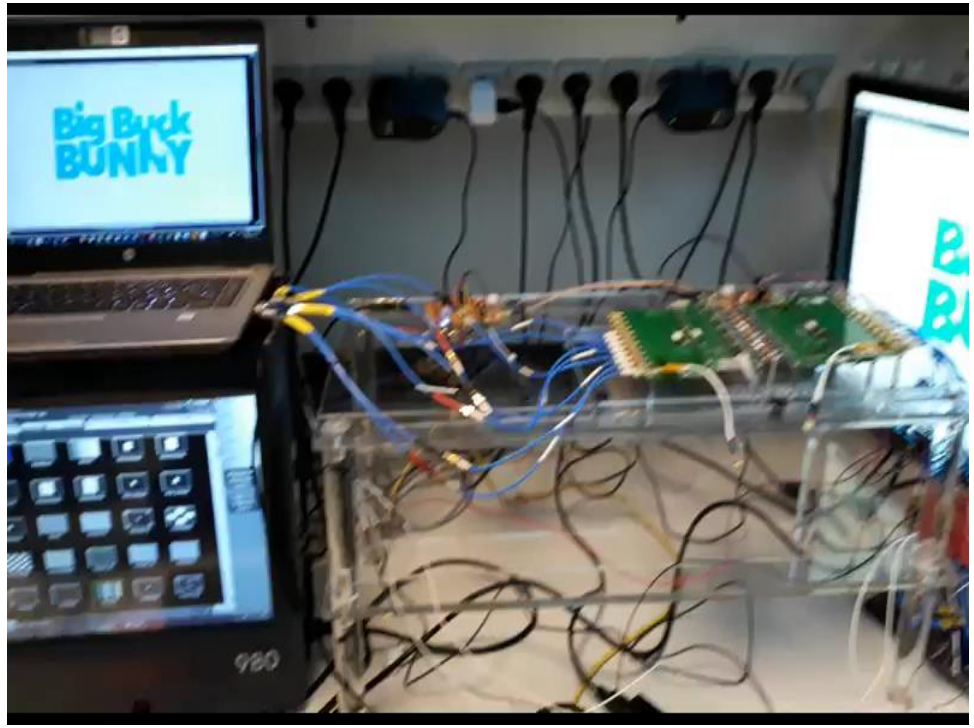
ST60A2 HDR Demo



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ST60A3 product overview

ST60A3 – Overview

60 GHz V-Band transceiver for contactless connectivity up to 480 Mbps

Short range, point to point, low power, self mate detection RF link

eUSB2, GPIO, UART, I2C or SPI RF tunneling

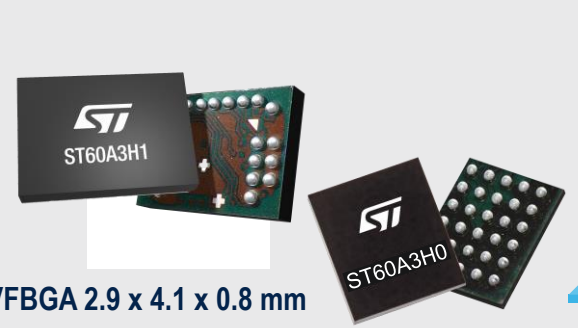
Antenna in Package (AiP) suited for footprint-constrained applications

- Broadside radiation, 42 dB typical link budget, up to 5 cm Free Space Propagation Loss

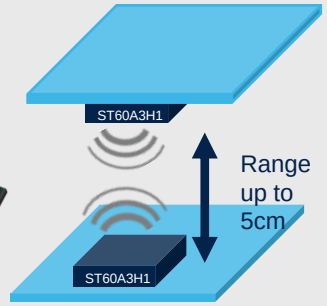
Optimized BoM

Low power consumption

- eUSB2 HS Rx/Tx – 110 / 130 mW typ.
- UART/I2C/GPIO – 90 mW typ.
- Low power mode – 120 µW
- Standby mode – 13 µW typ.



VFBGA 2.9 x 4.1 x 0.8 mm



VFBGA 2.2 x 2.6 x 0.8 mm

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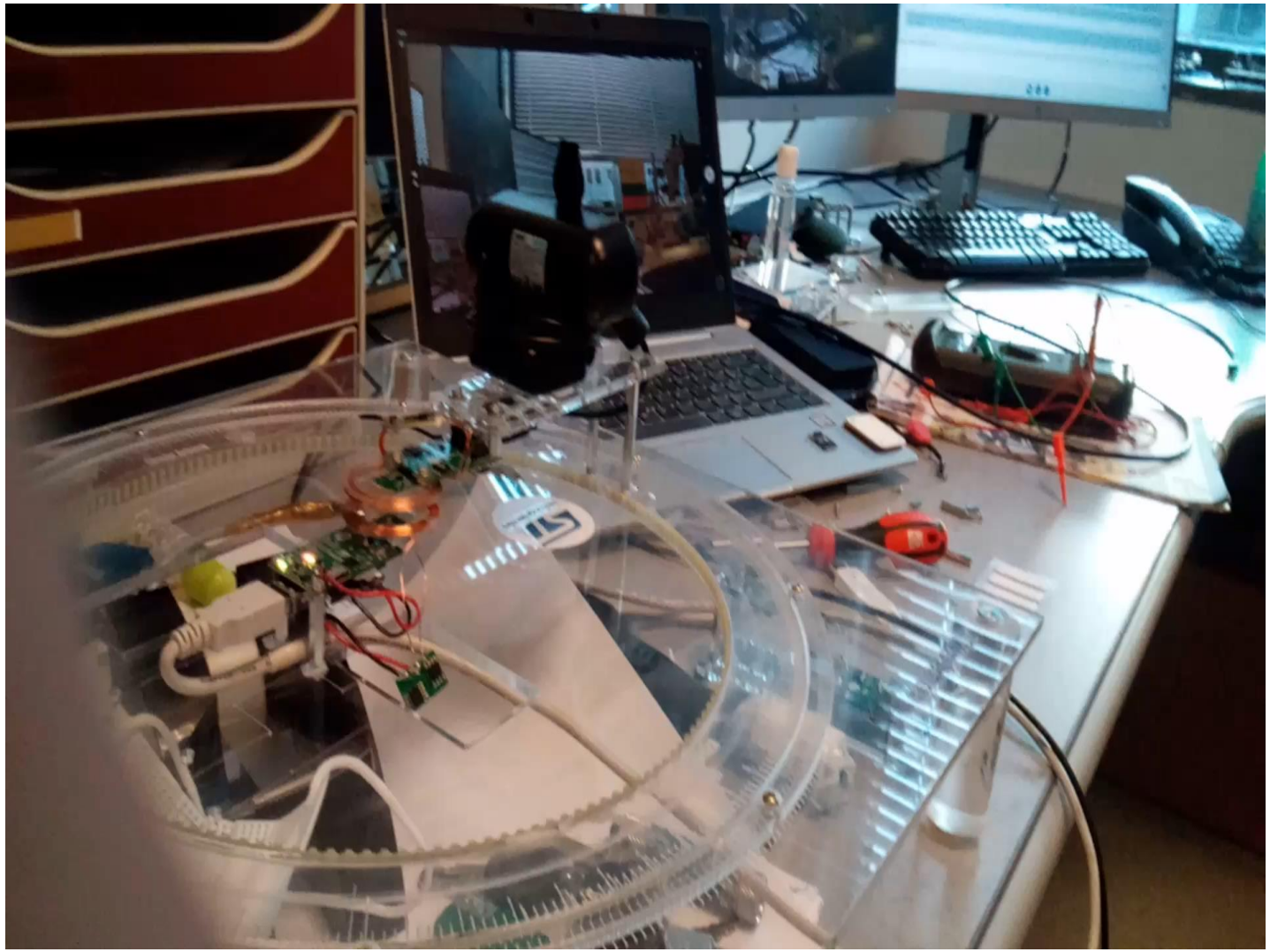
ST60A3 eUSB Tunneling



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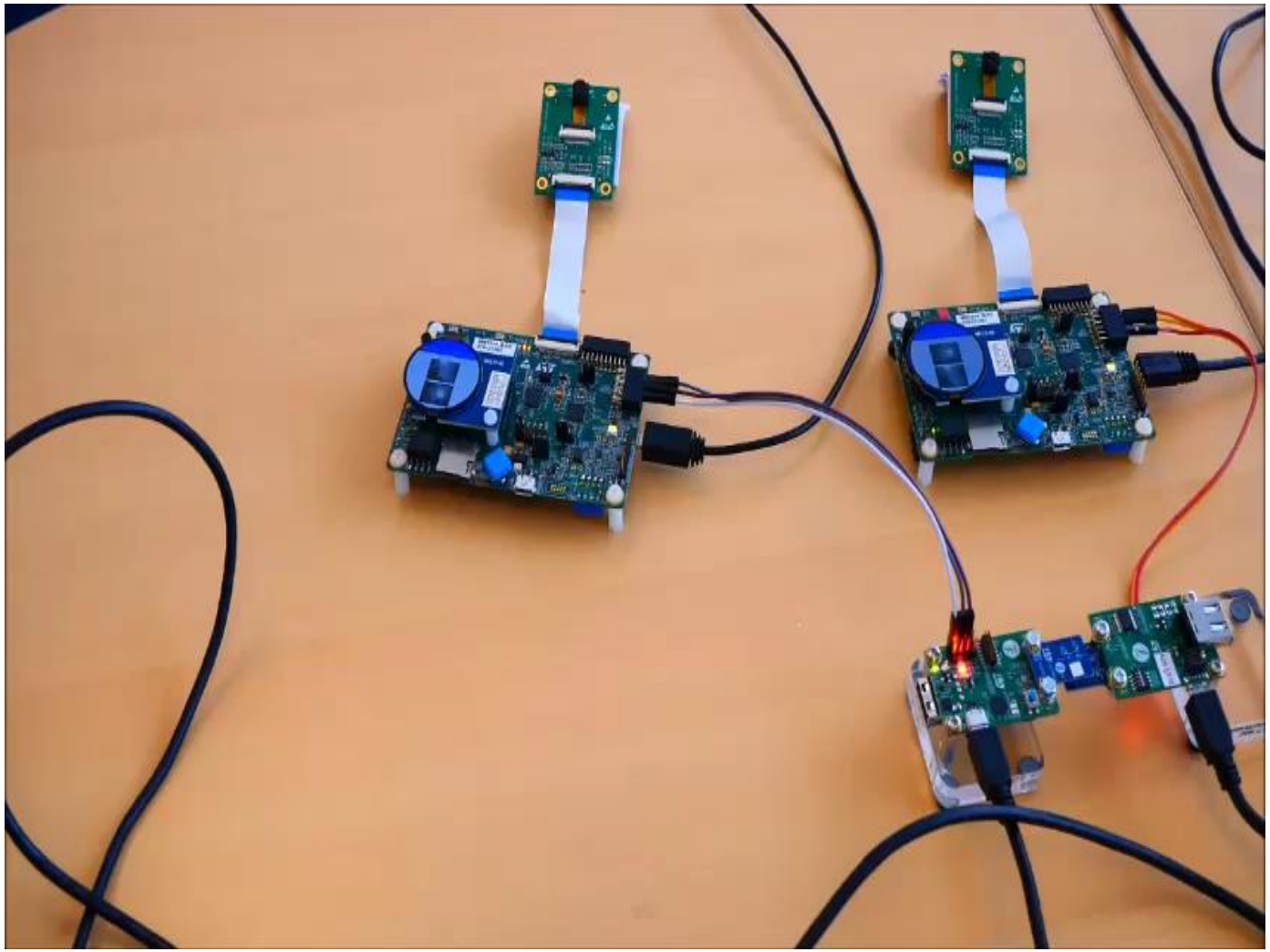
ST60A3 2ch UART Tunneling



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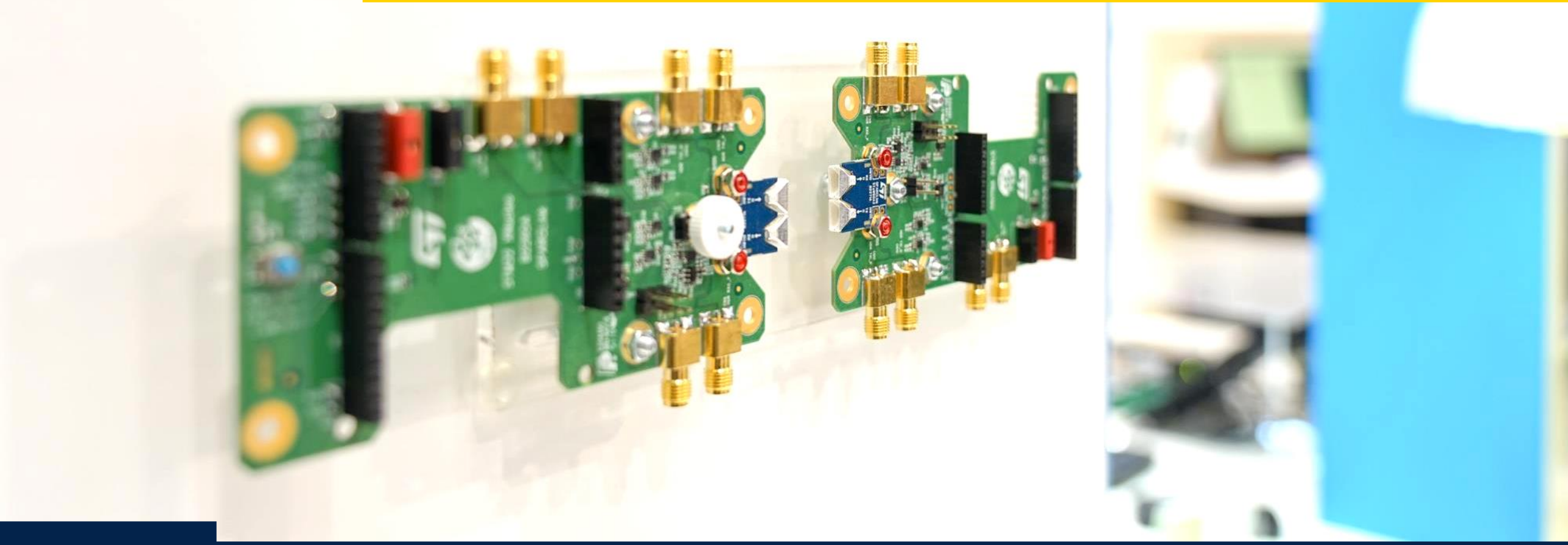
ST60A2 evaluation kit overview



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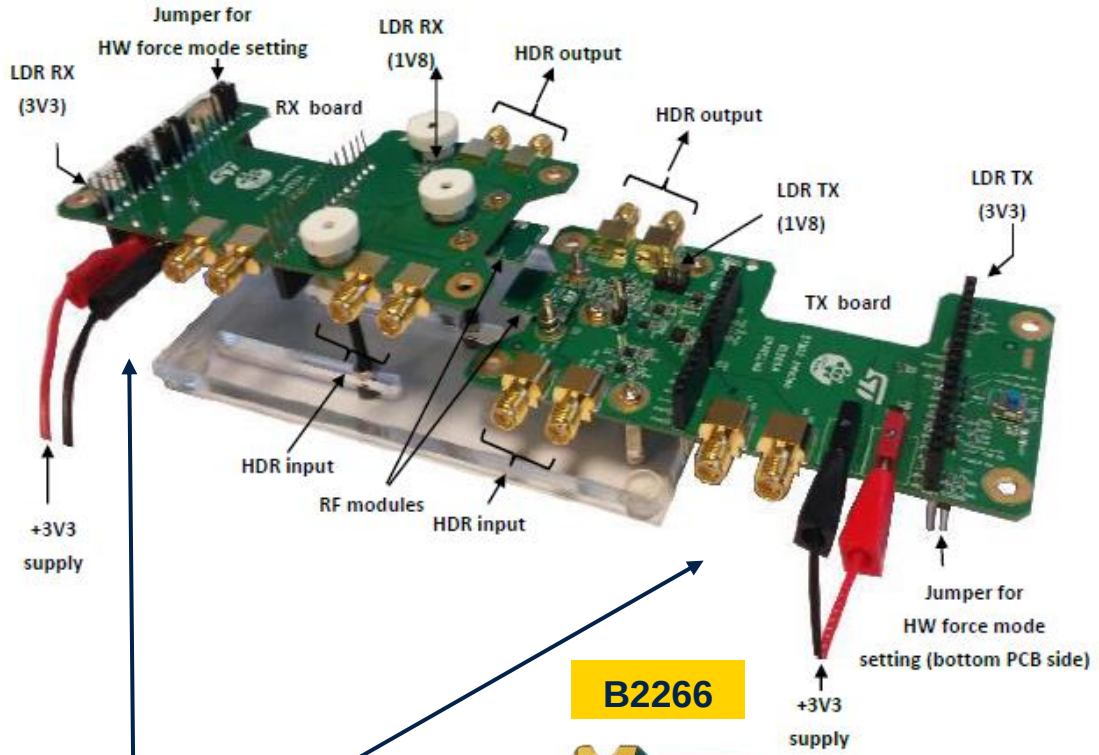
ST60A2 RF evaluation kit

Stand-alone set-up



B2265

XNucleo adapter boards

- Versatile evaluation kit supporting:
  - Low and high data rates modes
  - HW forced and I²C/SW controlled modes
- Compatible with ST60 RF modules featuring integrated, patch & horn antennas variants
- Designed for RF validation & measurements
  - Eye diagram, BER, Jitter

B2266

Single ST60A2
printed patch antenna
half duplex

B2275/76

Dual ST60A2
H&V horn antenna
full duplex

B2279

Single ST60A2
circular antenna
half duplex

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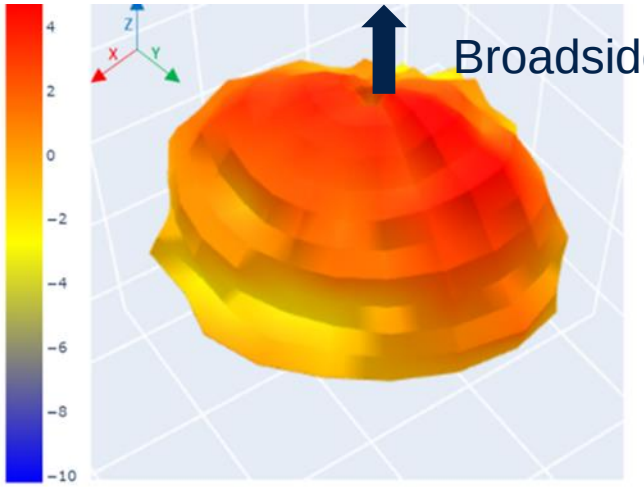
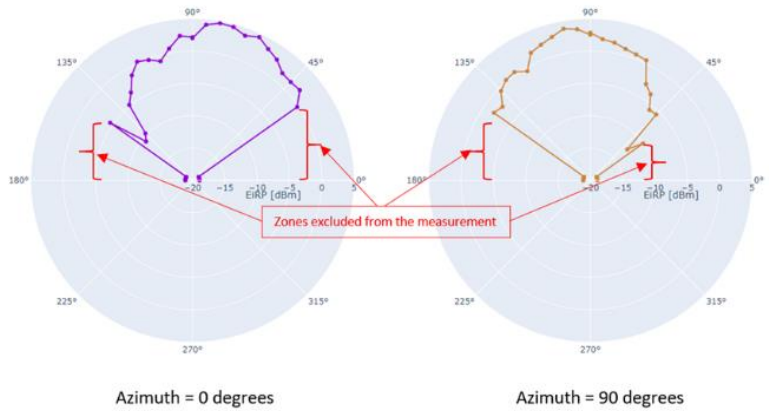
B2266 – RF daughter board

Far-Field radiated feature:
EIRP max = 4.8 dBm

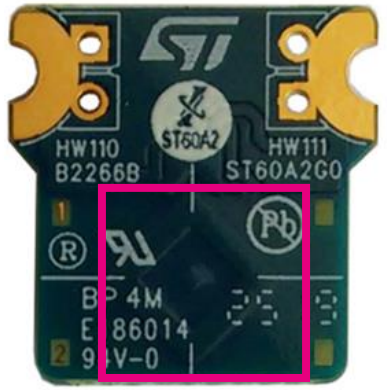


Measurement on B2266 Board (CW signal)



Far-field radiation properties (3D and 2D views)

ST60A2G0 side's view



Opposite view

AoB

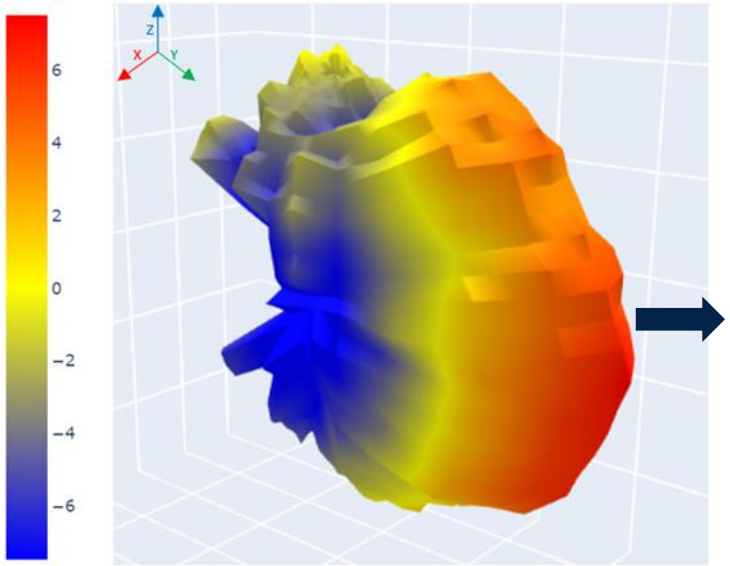
~8mm

~8mm

Daughter board used with Evaluation Kits

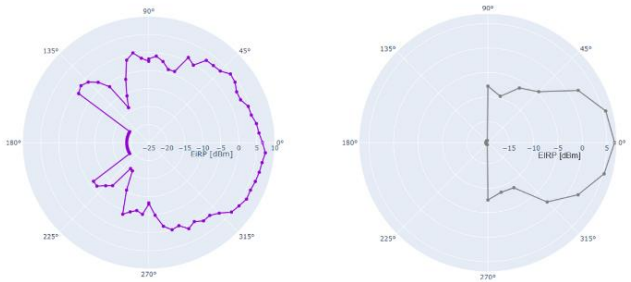
B2275 / 76 – RF daughter board

Far-Field radiated feature:
EIRP max = 7.5 dBm



End Fire direction

Measurement on B2275 Board (CW signal)

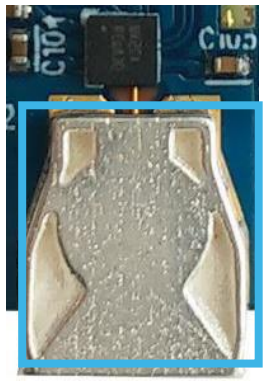


Azimuth = 0 degrees

Elevation = 0 degrees

Far-field radiation properties (3D and 2D views)

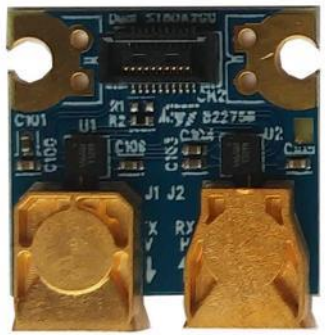
Horn Antenna



8mm

Radiall SIMPLIFICATION is our INNOVATION

B2275



ST60A2G0s side's view

Opposite view

B2276

ST60A2G0s side's view

Opposite view

Daughter board used with Evaluation Kits

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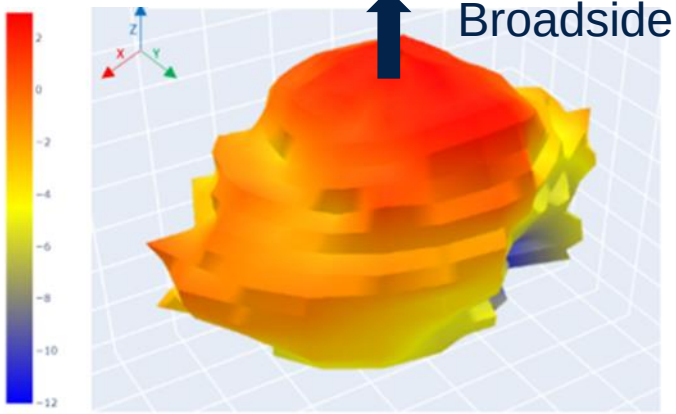
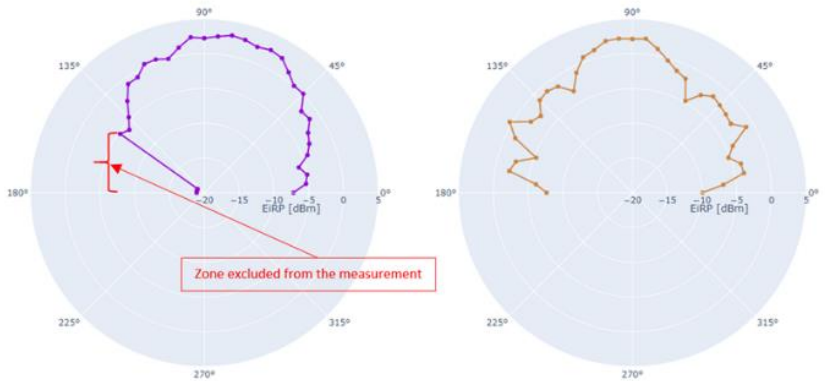
B2279 – RF daughter board

Far-Field radiated feature:
EIRP max = 3 dBm

Broadside direction



Measurement on B2312 Board (CW signal)



Far-field radiation properties (3D and 2D views)

ST60A3G0 side's view

Opposite view

B2279 AoB – Patch Antenna Circular

Note: B2279 to be used in combination with B2266

Daughter board used in both Discovery and Evaluation Kits

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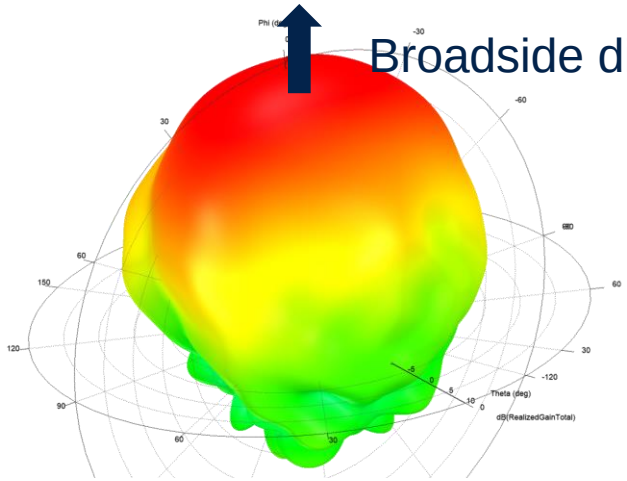
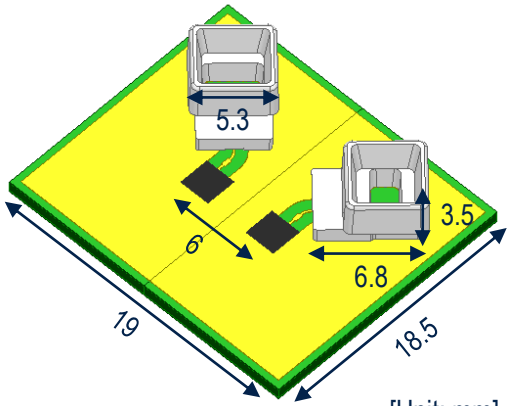
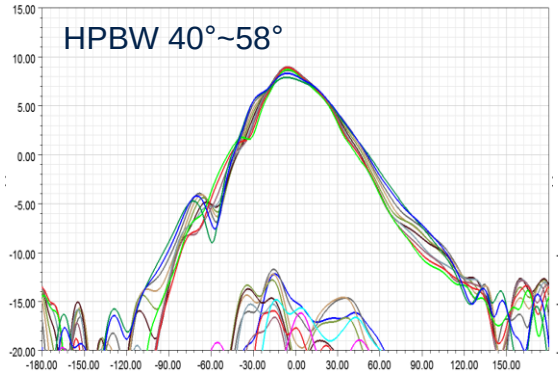
Broadside Horn – RF daughter board

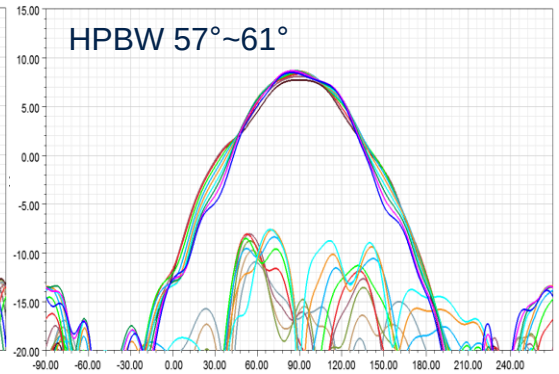
Far-Field radiated feature:
EIRP max = 7.8 dBm





[Unit: mm]





SENSORVIEW

Daughter board used with Evaluation Kits

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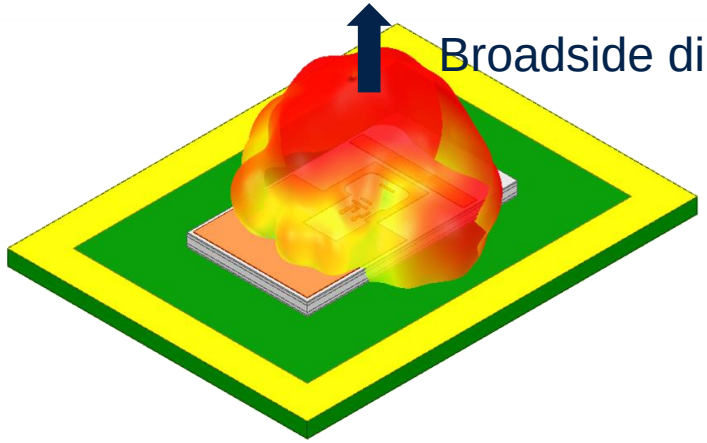
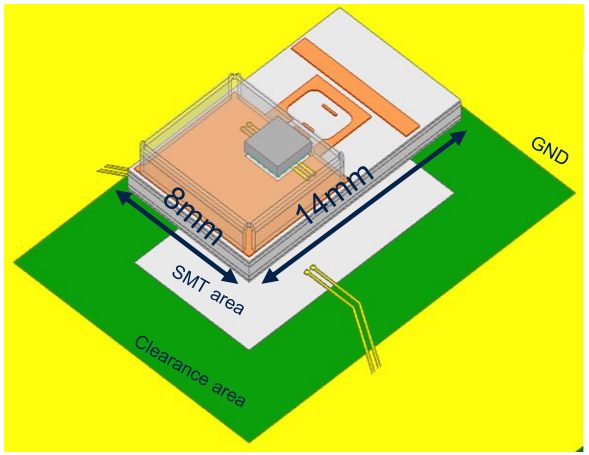
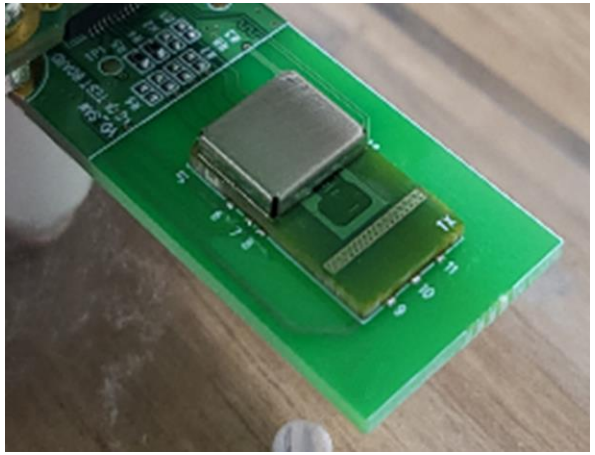
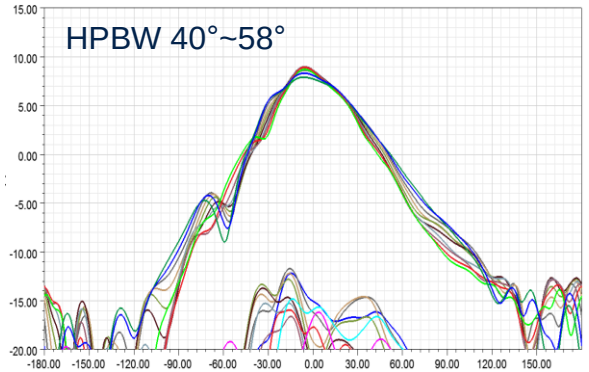
Solderable Antenna Module(SAM) – RF board

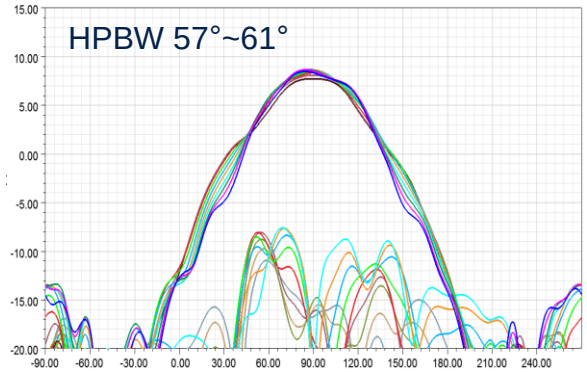
Far-Field radiated feature:
EIRP max = 5.5 dBm











SENSORVIEW

Daughter board used with Evaluation Kits

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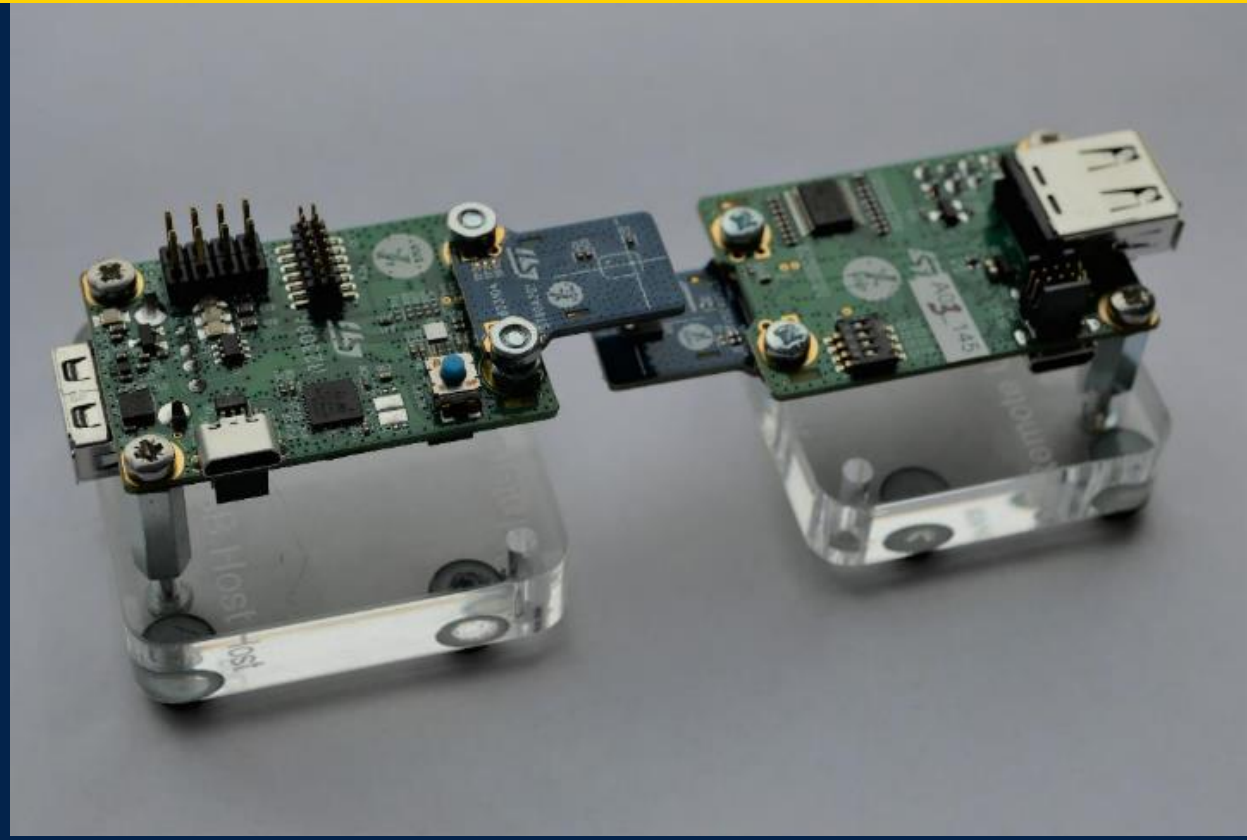
ST60A3
Discovery & evaluation kits



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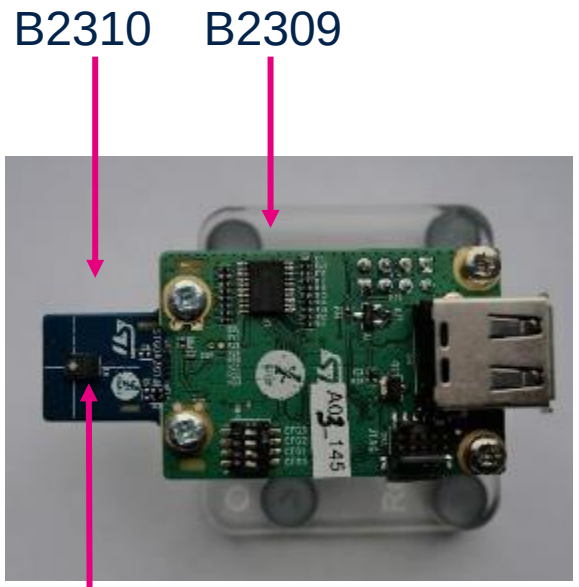
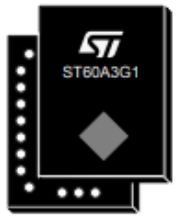
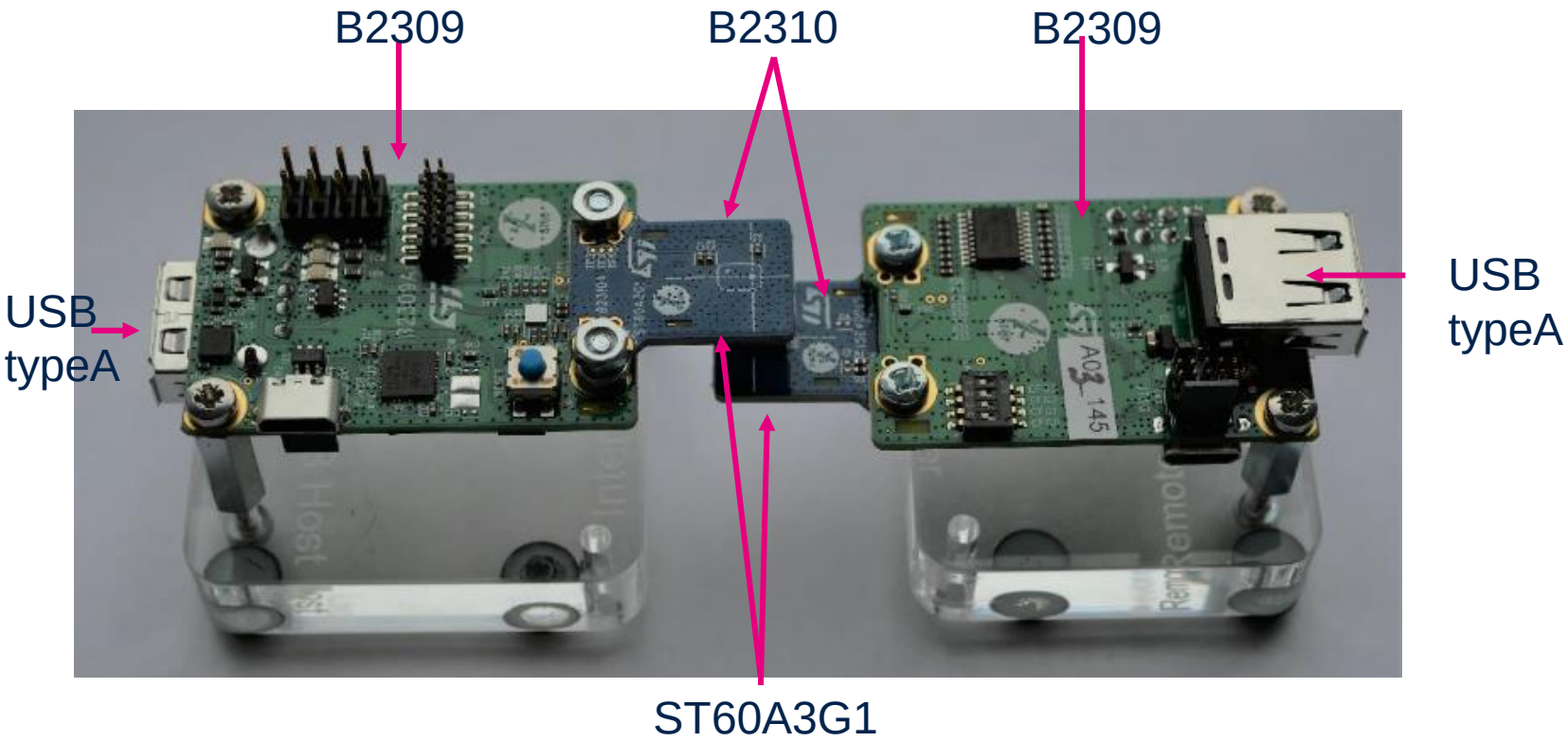
ST60A3G1 discovery kit – USB2 type A B2309/B2310 & B2309/B2310







ST60A3G1Discovery Kit is a hardware and software package to demonstrate USB2, eUSB2, UART, GPIO and I2C communications of a ST60A3G1 RF link

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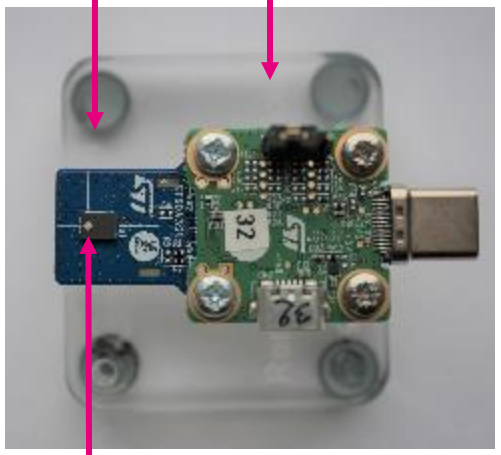
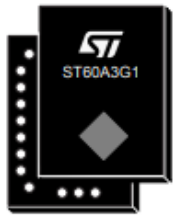
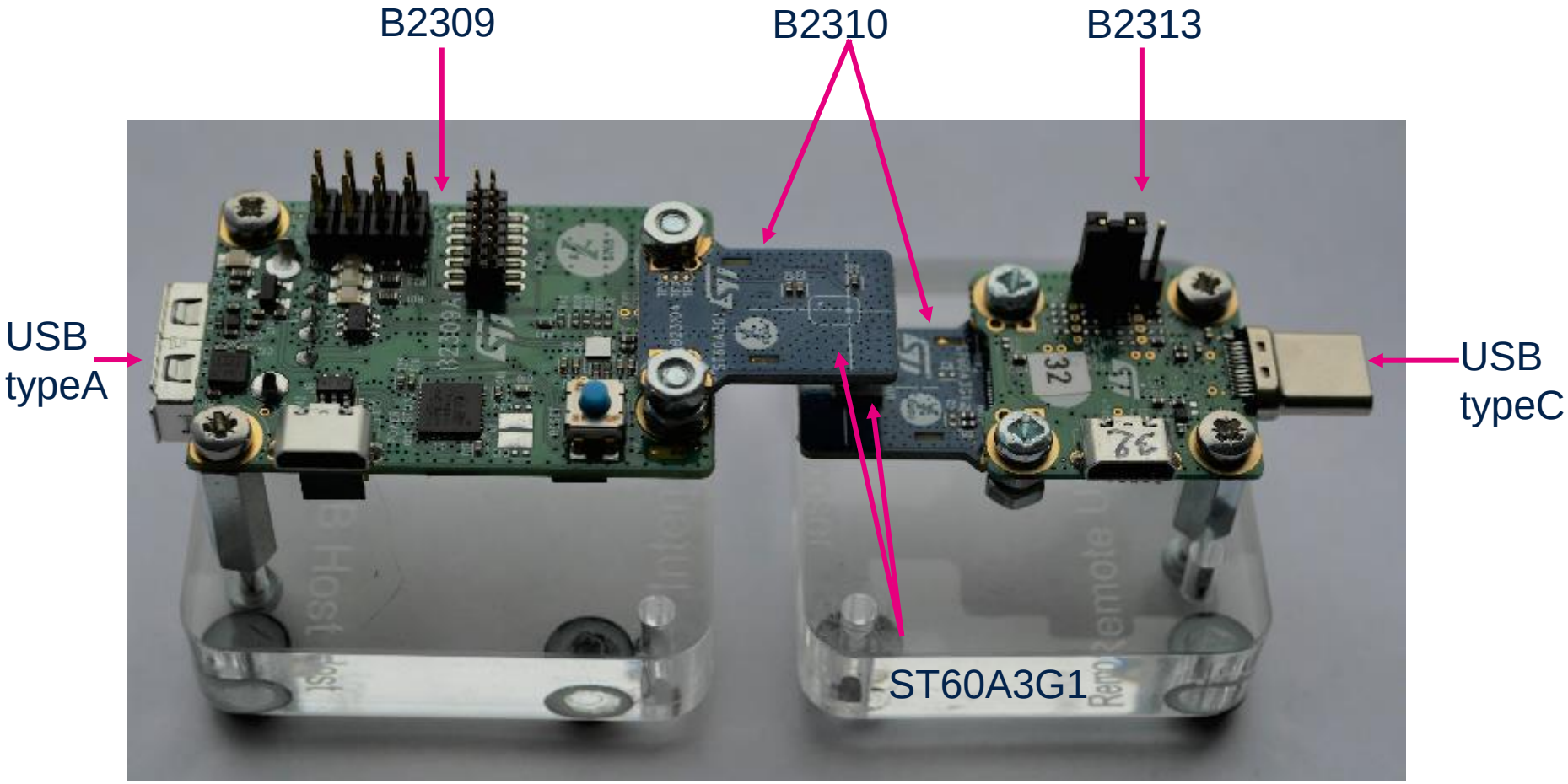
ST60A3G1 discovery kit – USB type C B2309/B2310 & B2313/B2310

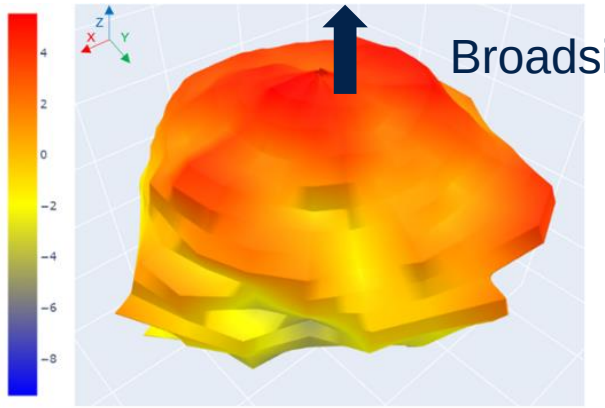




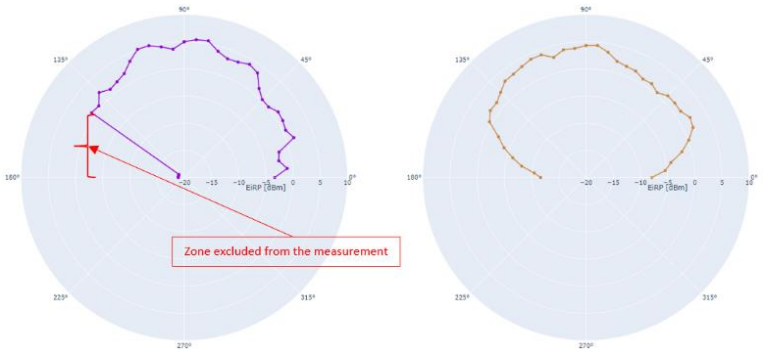


B2310A02 RF daughter board

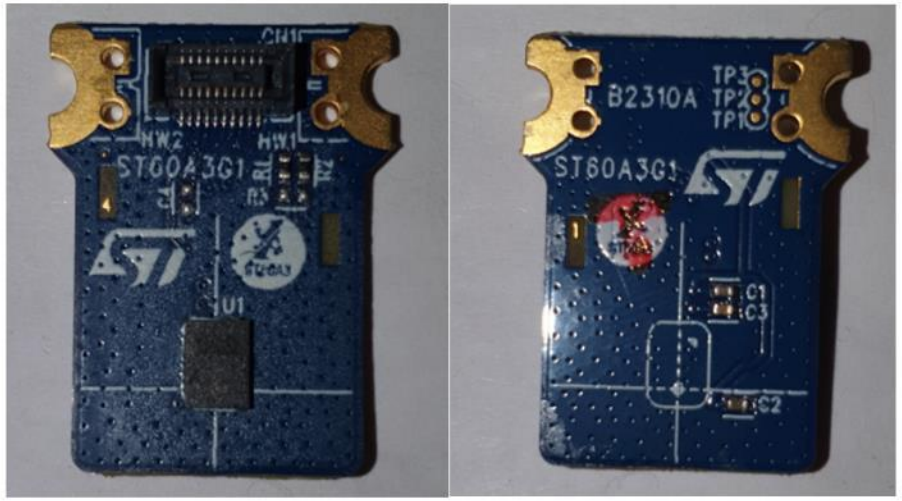
Far-Field radiated feature:
EIRP max=5.5dBm



Measurement on B2310 Board (CW signal)



Far-field radiation properties (3D and 2D views)



ST60A3G1 side's view

Opposite view

Daughter board used in both Discovery and Evaluation Kits

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ST60
Turnkey solutions

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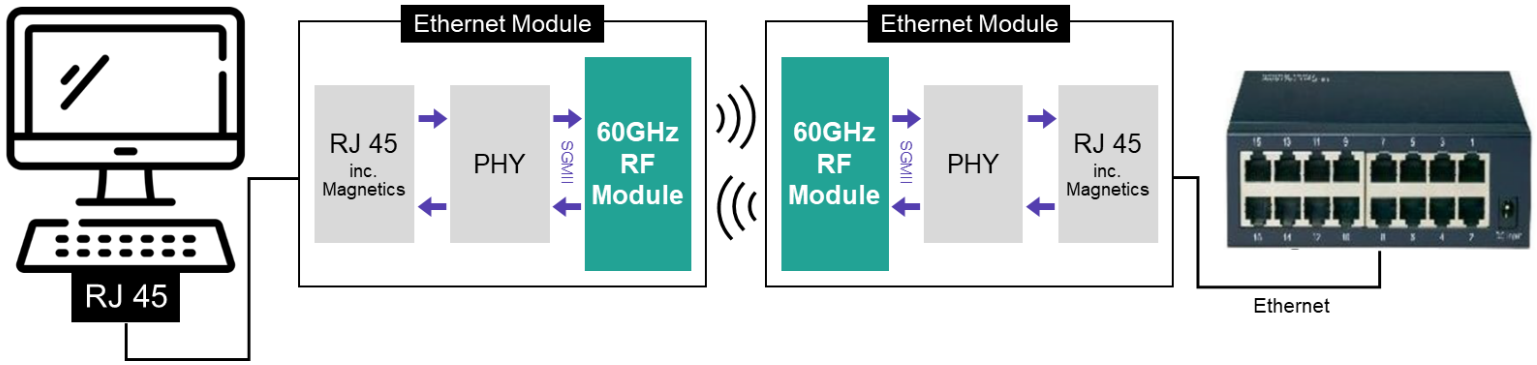
Ethernet module



Type	Figure	Frequency [GHz]	Peak gain [dBi]	Feature	Module Size (mm)	Max data rate (Gbps)	Max. Distance (mm)	ST Partner
S2S		55 ~ 66	6.5	RF to Ethernet conversion/ Full-duplexing	50 X 60	1.25	30	SensorView

Items	2023			2024			Remark
	Oct	Nov	Dec	Jan	Feb	Mar	
Ethernet Module (Full duplex)							S2S Patch antenna
Ethernet Module (Full duplex)							S2S Horn antenna
Ethernet Module (Full duplex+Rotation)							Target spec: - Speed: 1Gbps - Power: 20~40w
Ethernet Module (Full duplex+Rotation+Power Transfer)							

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Solderable Antenna Module(SAM)

Type		Frequency [GHz]	Peak gain [dBi]	Substrate (FR4) (Layer/Thickness mm)	Feature	Module Size (mm)	Product	Max data rate (Gbps)	Max. Distance (mm)	
F2F	SAM1	55 ~ 65	6dBi	6L 1.2T	Single No R/C No shield can	6.4 x 7.4	S60PVS3A	2.83 ~ 5.66	20 ~ 12	Verified
	SAM2	55 ~ 65	6dBi	6L 1.2T	Loopback + R/C	6.4 x 10	S60PVS4A	2.83 ~ 5.66	20 ~ 12	On-going
	SAM3	55 ~ 65	5dBi	6L 1.2T	SAM2 + R/C + Shield can	8 x 14	S60PVS4B	2.83 ~ 5.66	16 ~ 8	On-going
	SAM4	56 ~ 66	8dBi	4L 1.2T (v1) 6L 1.2T (v2)	Horn + R/C	8 x 14	S60HVS1A	2.83 ~ 5.66	22 ~ 14	to be update
	SAM5	56 ~ 66	8dBi	6L 1.2T	Horn + R/C + Shield can	8 x 14	S60HVS1B	2.83 ~ 5.66	22 ~ 14	to be update
S2S	SAM1	55 ~ 65	6dBi	6L 1.2T	Single + R/C	8 x 12	S60PHS3A	2.83 ~ 5.66	20 ~ 12	On-going
	SAM2	55 ~ 65	6dBi	6L 1.2T	Single + R/C + Shield can	8 x 12	S60PHS3B	2.83 ~ 5.66	20 ~ 12	On-going

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Various serialize modules

Type	Figure	Status
GPIO	multiple GPIOs transfer GPIO, UART, I2C, I2S and so on	ES
LVDS	multiple LVDS transfer	ES
MIPI	Multiple MIPI CSI-2	Under developing

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