Callidus UHF RFID POS

(FW RFID_ReaderGen2_v0.94)

INSTALLATION AND SERVICE GUIDE



Version 1.0 May 2022



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FEATURES

The "Callidus UHF RFID POS" is device for reading data from UHF RFID GEN2 tags and editing via user adjustable algorithm.

This can be used to:

- change the data stored on the tag, which will trigger alarm when passing through RFID EAS system (for example pedestal with Callidus UHF RFID reader)
- sending read data from the tag on a pay server (future implementation)

REFERENCE MANUAL

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1. OPERATION GUIDELINES

CAUTION! Before operating this device, all operating technicians should study this manual and device technical data to understand and follow the safety instructions. Keep these instructions with the device for further reference. If you have any questions, contact your device representative or distributor.

This is a Class A product. In a domestic environment, this product may cause high-frequency interference. In this case, it may require the user to take appropriate precautions.

2. BASIC INFORMATION

- "Callidus UHF RFID POS" is device for reading and editing data in UHF RFID GEN2 tags, via user adjustable algorithm
- user interface is designed for simple control and consists of two robust backlit buttons, status RGB LED light and internal buzzer
- it is powered via POE
- all configuration parameters and device functionality can be configured and controlled with browser via internal webserver or with customized software that communicate with reader via REST API

3. PRE-INSTALL TASKS

3.1 Installation equipment for UHF RFID POS

- 1x POS
- 1x LAN cable (PC <-> switch/injector)
- 1x PoE injector or switch with PoE feature
- Laptop with browser (Google Chrome recommended)

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4. SPECIFICATIONS

4.1 UHF RFID

Operating frequency US version	902 - 928 MHz
Operating frequency EU version	865,6 - 867,6 MHz
RFID protocol support	GEN2
Editing speed	Up to 5 tags/sec
Editing distance	Up to 1m (depending on multiple factors as set
	transmit power, GEN2 settings, used tags, and
	more)
Transmit power	Adjustable from -10 dBm to +30 dBm in 1 dBm steps

4.2 Power

Power over Ethernet	PoE 802.3 af
Power consumption	Max. 12 W

4.3 Connectivity

LAN	10/100Mbit Ethernet, IPv4 DHCP or static IP,
	2 m (78.7 in) cable length

4.4 User interface

Button	2x backlit button
Status light indicator	RGB LED
Sound indicator	Internal buzzer

4.5 Software interface

4.6 Mechanical specifications

Width	220 mm
Length	300 mm
Height	48 mm
Weight	1.8 kg

4.7 Environmental

Ambient temperature	0 - 35 °C (equipment for normal indoor use)
Relative humidity	0 - 90 % (non-condensing)

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5. UHF RFID POS

5.1 Operation description

The cashier's services of this device consist of 2 simple actions, that will write specific data sequence into the EPC bank GEN2 tags and lock them against further unauthorized actions as overwriting them. Depending on the settings described below (Buttons settings, POS settings), two algorithms will be created. The first algorithm, activated by pressing the "Activation button" will be used in case when tag should trigger an alarm while passing through RFID EAS system. Pressing the button will result in rewriting specific alarm sequence into the tags. The second algorithm, activated by pressing "Deactivation button" should be used in case when tag should NOT trigger an alarm. Pressing the button will result in rewriting non-alarm sequence to the tags. Writing according to selected algorithm will be performed with all visible tags and the result will be optically and acoustically indicated.

5.2 Controls description

- 1. SPACE FOR TAGS - that should be activated or deactivated
- 2. STATUS RGB LED LIGHT – indicating status and performed operations
- ACTIVATION BUTTON

 red backlit button for tags activation (will trigger alarm)
- DEACTIVATION BUTTON

 green backlit button for tags deactivation (will NOT trigger alarm)



Glows blue	vs blue Device is idle and ready to use	
Glows orange	Tag editing is in progress	
Flashes green	Tag editing is complete, writing to all visible tags was successful	
Flashes red	Tag editing is complete, writing to one or more tags failed	

Table 1 "status RGB light" colors and their meaning

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6.1 Connecting to the PC/Laptop

The device can be powered by ethernet cable itself if the network supports PoE feature or PoE injector has to be used.

- The ethernet cable must be connected with the device and the PC/Laptop in the same ethernet network.
- Then the device has to be discovered. RFID reader is very simple to find. Just open up "eComm Discoverer" and search for name "C8PURDR". Then just double click on that row and new window with login should appear.

Discover eComm	n Devices				
IP Address	Host Name	MAC Address	Other Info		1
-	of the second se	100.000			
10.00	(programme)	0.0.0-0.0-0.7			
10.101	100, 100, 100001	the state of states of	the design of the		
100.000	Second Sciences	0.000.000.00.0			
10.00	one the second	and company.	the summer lines.		
	Contraction of the	and the second second			
	1000	and the second second	100.000		
	Contraction of the local division of the loc				
	and the contract	and the second second			
	and in case of the local division of the loc	Contraction of the	the second second		
192.168.1.127	C8PURDRG2C29A9F	04-91-62-C2-9A-9F	SN:00000587407		
10.000	Charlenger 1				
100100-010	or Television	0.0-0.0-0.0			
100.0001-000	OF TERMENOL	0.040.040			
	AL 1994 (1979)	Bell reported to	in house in the		
10.101	Concentration of the local distribution of t	0000000			
100-100-1-100	Statements'	BORNER BRIDE			
<)	>



Figure 1 Device discovery software - eComm Discoverer



6.2 Login details

Username for user with limited rights:	user
Default password:	Call + last 6 numbers of MAC
Example for MAC '1A:2B:3C:4D:5E:6F':	Call4D5E6F
Username for admin with full rights:	admin
Username for admin with full rights: Default password:	admin Call + last 6 numbers of MAC with reverted double digits

6.3 Software description

After successful login as admin, Dashboard page should appear. On the left side is menu consisting of 12 tabs:

- 1. Dashboard basic information about reader such as device and system statuses, tags memory etc.
- 2. Tags list of saved tags, reading statistics, start/stop inventorying
- 3. Edit tags used for editing access or kill password, EPC, user memory, tag locks or simply for inspection of all banks
- **4. RFID** all settings about RFID like region, power, antenna ports, hop table, protocols and filters
- 5. Autonomous mode settings for triggering an alarm in autonomous mode, settings for POS mode
- 6. People counting PC settings, status and counters if internal PC used (irrelevant settings for POS)
- 7. Alarms alarm indication settings (irrelevant settings for POS)
- 8. GPIO input and output configuration and settings for POS actions
- 9. Date & time time synchronization and time zone offset settings
- 10. Networking IP settings like DHCP, IP address, etc.
- 11. Firmware update
- 12. Factory reset

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6.4 Buttons settings

This setting is used to select POS action that will be performed with all GEN2 tags once the activation or deactivation button is pressed.

il RFID System	=		â root 👲
🚯 Dashboard	DOMŮ > GPIO		
🌑 Tags	Input configuration	G Output configuration	Test output
System configuration	GPI1	GPO1 🧶	GP01
RFID RFID	Action Edge	Trigger	State Time (ms)
🕫 Autonomous mode	POS - activate tag • Rising •	None	Do not change 🔹 0
People counting	GPI2	GPO2	GPO2
📢 Alarms			Distr. Time (m)
🕏 бріо	POS - deactivate tag and remove Rising	None 👻	Do not change
O Date & time			
📥 Networking	None Save settings	Save settings	Send command
🖹 Firmware update	Alarm trigger		
🗲 Factory reset	POS - deactivate tag POS - deactivate tag		
🕸 Developer	pasaword		
		Copyright @ 2007-2022 Callidus trading, Ltd RFID WebInterface v0.6	

Figure 3 The Buttons settings are located in "GPIO" tab

It is possible to choose from these actions:

- POS activate tag activates all GEN2 tags in range by writing alarm sequence (specified in the POS settings) to the EPC bank and then locks the bank with a password against further unauthorized overwriting
- POS deactivate tag deactivates all GEN2 tags in range by writing NON-alarm sequence (specified in the POS settings) to the EPC bank and then locks the bank with a password against further unauthorized overwriting
- POS deactivate tag and remove password deactivates all GEN2 tags in range by writing NON-alarm sequence (specified in the POS settings) to the EPC bank, access password will be reset to zeros and locks will NOT be applied. This is default setting for deactivation.

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6.5 POS settings

These settings are used to create two algorithms, which will be used for activation (alarm) sequence and deactivation (nonalarm) sequence. Those sequences will be written to the EPC bank in GEN2 tags.

	il RFID System	Ξ							💄 ROOT 👻	ወ
Syste	m contiguration		Sound indication			FPC TD		15		
۳	RFID		Only once		Ŧ					
•:	Autonomous mode		Reevaluate tag after X seconds			Regex 😧		Repeat alarm interval (s)		
-	People counting		10			*FFFF.*S		300		
4	Alarms		Tag direction can be reevaluate a time. Also tag in field flag will be r	ifter tag is not visible for given removed. If disabled (set to 0),		Validation by people counter				
٠	GPIO		once the tag is evaluated, direction tag is marked as tag in field, it sta	on cannot be changed and onc ays there forever!	90	Disabled	*			
	Date & time									
ሐ	Networking							Save settings		
8	Firmware update	1	POS settings							
۶	Factory reset		in POS settings)			
ŵ	Developer		Password type			Access password				
			Static password		*	0000000				
			Rewrite EPC mode							
			TID combined with flag		٣					
			Activated tag flag	Offset (chars)		EPC preview after activation				
			↓ FFFF	0		FFFFxx				
			Deactivated/sold tag flag	Offset (chars)		EPC preview after deactivation				
			玲 0000	0		0000xx				
						Sav	e settings			

Figure 4 The POS settings are located in "Autonomous mode" tab

It is possible to set these parameters.

Password type:



NOTE: Access password is a 32-bit value stored in Reserved memory bank in GEN2 tag. If non zero value is used and lock for memory bank is activated then it is not possible perform writing to EPC or USER bank, and reading/writing to Reserved bank GEN2 tag without knowledge of this password.

- No password no password will be used when reading and writing from/to the GEN2 tag, this configuration is not secure and not recommended
- Static password when reading and writing from/to the all GEN2 tags same password will be used, password is specified as "Access password" parameter
- Dynamic password for each GEN2 tag will be used unique internally generated password

Activated tag flag: content to be inserted when the "Activation" button is pressed

Deactivated tag flag: content to be inserted when the "Deactivation" button is pressed

Offset: determines the insert position for "Activated tag flag" or "Deactivated tag flag" content

If it is positive or zero, the content of "Tag flag" will be inserted at the beginning of new EPC ID shifted by this value to the right side.

If it is negative, the content of "Tag flag" will be inserted to the end of new EPC ID shifted by this value to the left side.

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Rewrite EPC mode: defines how the new content of EPC bank will be created

- TID combined with flag - new EPC ID will be created by copying the current content of the TID and then pasting the content of the "Tag flag" into the position specified by the value "Offset".

If the offset is zero, then "Tag flag" will be inserted at the begging of the new EPC ID. If the offset is positive, then "Tag flag" will be shifted to the right from the start by "Offset" value.

If the offset is negative, then "Tag flag" will be inserted to the end of the new EPC ID and shifted to the left from the end by "Offset" value. The new EPC ID will be written instead of the current EPC ID.

EPC memory ban	k (1)					
	EPCI	0				
57F0 3400	A04	A1A2A3A4A5A6A7A8A9AAAB				
Extended EPC memory (H	IEX)					
• HEX	ASCII	Reverse base 36				
	current content o	of EPC ID				
			DOS settings			
TID memory bank	(2)		Password type		Access password	
CIs ID, vendor ID, model ID	(HEX)		Static password	¥	0000000	
E2 801 170			Rewrite EPC mode			
Unique ID (HEX)			TID combined with flag	v		
200012B1A4DE097A			Activated tag flag	Offset (chars)	EPC preview after act	livation
				1	xFFFFxx	
			Deactivated/sold tag flag	Offset (chars)	EPC preview after de	activation
co	ntent of TID mem	ory bank	R 0000	1	x0000xx	
						Save settin
			current POS settings,	offset is set t the	to 1 characte EPC ID	r from the beginning
EPC memory bar	nk (1)		EPC memory	/ bank (1)		
RC & PC (HEX)	EP	CID	CRC & PC (HEX)		EPC ID	
E91E 3400	E	FFFF170200012B1A4DE097A	7843 3400		E00001	70200012B1A4DE097A
xtended EPC memory (HEX)		Extended EPC mer	nory (HEX)		
• HEX	ASCII	Reverse base 36	• HEX	04	ASCII	Reverse base 36

Figure 5 Principle of content creation for new EPC ID with "TID combined with flag" settings

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EPC combined with flag – new EPC ID will be created by copying the current contents of the EPC ID and then pasting the contents of the "Tag flag" into the position specified by the value "Offset".
 Offset has the same meaning as before in case of "TID combined with flag".
 If offset will be bigger than length of actual EPC, then writing will fail. The new EPC ID will be written instead of the current EPC ID.

EPC memory bank (1) CRC & PC (HEX) EPC ID					
CRC & PC (HEX) EPC ID					
5/F0 3400 AUA1A2A3A4A5A	6A7A8A9AAAB				
Extended EPC memory (HEX)					
HEX ASCII	Reverse base 36				
current content of EPC ID)				
	DOS	settings			
TID memory bank (2)	Passwor	d type		Access password	
Cis ID, vendor ID, model ID (HEX)	Static	password	Ŧ	0000000	
E2 801 170	Rewrite	-PC mode			
	EPC	ombined with flag	Ψ.		
Unique ID (HEX)					
2000128174020917	Activated	tag flag	Offset (chars)	EPC preview after activa	tion
	4		-4		
content of TID memory bank	Deactiva	ted/sold tag flag	Offset (chars)	EPC preview after deact	vation
content of the memory bank	×	0000	-4	xx0000	
					Save settings
	currer	nt POS settings, of	fset is set to	4 characters	from the end of EPC ID
EPC memory bank (1)		EPC memory ba	ank (1)		
CRC & PC (HEX) EPC ID		CRC & PC (HEX)		EPC ID	
BCCB 3400 A0A1A2A3A4/	45A6A7A8A9FFFF	A1C4 3400		A0A1A2A3	A4A5A6A7A8A90000
Extended EPC memory (HEX)		Extended EPC memory	(HEX)		
HEX ASCII	Reverse base 36	• HEX) as	CII	Reverse base 36
content of EPC ID after tag ac	tivation	conte	nt of EPC ID	after tag dea	ctivation

Figure 6 Principle of content creation for new EPC ID with "EPC combined with flag" setting

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Only flag at specific location - the content of the "Tag flag" will be written to EPC memory bank to start position of EPC ID depending on "Offset" value. Content of the flag in this mode has to have full words (multiple of 4 hexadecimal characters, e.g. FFAAFFAA). If the offset is zero, then "Tag flag" will be inserted at the begging of the new EPC ID. If the offset is positive, then "Tag flag" will be shifted to the right from the start by "Offset" value, but offset has to be a multiple of 4 (valid values: 0, 4, 8, 12, ...). Negative offset is not allowed in this setting. This setting allows writing the contents of the "tag flag" in any valid position of the EPC bank, with the exception of the position for CRC and PC.

EPC memory bank (1)						
CRC & PC (HEX)	EPC ID					
57F0 3400	A0A1A2A3A4A5A6A7A	8A9AAAB				
Extended EPC memory (HEX)						
• HEX	ASCII	erse base 36				
curre	ent content of EPC ID					
		D P	OS settings			
TID memory bank (2)		Pas	sword type		Access password	
Cls ID, vendor ID, model ID (HEX)		S	tatic password	¥	0000000	
E2 801 170		Rew	rite EPC mode			
Unique ID (HEX)		0	nly flag at specific location	•		
200012B1A4DE097A		Activ	vated tag flag	Offset (chars)	EPC preview after activation	
		4	FFFF	24	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	xFFFFxx
		Dea	ctivated/sold tag flag	Offset (chars)	EPC preview after deactivation	n
content	of TID memory bank	F	0000	24	***********************	x0000xx
EPC memory bank (1)			EPC mem	ory bank (1)		
CRC & PC (HEX)	EPC ID		CRC & PC (HE	X)	EPC ID	
57F0 3400	A0A1A2A3A4A5	A6A7A8A9AAAB	57F0 3400		A0A1A2A3A4A5	A6A7A8A9AAAB
Extended EPC memory (HEX)			Extended EPC	memory (HEX)		
• HEX	ASCI	Reverse base 36	• HEX	O ASC	an	Reverse base 36
EPC ID afte	er tag activation stays th	e same	Tags action	PC ID after tag deo	activation stays t	he same
Inspector R Password C El	PC Bank editor Tag locks	í Kill tag	Q Inspector	& Password	Ink editor	Kill tag
howing tag: EPC ID = A0A1A2A3A4A5A6A	атавазааав		Showing tag: EPC	D = A0A1A2A3A4A5A6A7A8A9AAAB		
emory bank	Offset (words)	Length (v	vords. Memory bank		Offset (words)	Length (wo
EPC	• 0	10	EPC		0	10
litor			Editor			
00 01 02 03 04 05	06 07 08 09 0A 0B 0C 0D 0E 0F	0123456789ABCDEF	0000000	00 01 02 03 04 05 06 07 08 09	0A 0B 0C 0D 0E 0F	0123456789ABCDEF
00000000 57 FF 34 00 A0 A1 00000010 FF FF AE AF	HL HD A4 AD A0 A/ A8 AY AA A8	ÀÀ@. Mot létux!? Da«	00000010	00 00 AE AF	DY DY NO NO NA NO	
content of EPC ID ren	mains same, the activat after EPC ID area	ion flag is inserted	content c	of EPC ID remains s afte	ame, the deactive er EPC ID area	ation flag is inserte

Figure 7 Principle of content creation for new value in EPC bank when setting is "Only flag at specific location

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Table 2 examples of creation content EPC bank according to setting "Rewrite EPC mode" and "Offset"

Tag flag Current TID		Current EPC ID	Current value in EPC bank (EPC ID area and area after the EPC ID)		
FFFF	A0A1A2A3A4A5A6A7A8A9AAAB	B0B1B2B3B4B5B6B7B8B9BABB	C0C1C2C3C4C5C6C7C8C9CACB CCCDCECF		

Rewrite EPC mode	TID combined with flag	EPC combined with flag	Only flag at specific location		
Offset	New EPC ID	New EPC ID	New value in EPC bank		
0	FFFFA2A3A4A5A6A7A8A9AAAB	FFFF <mark>B2B3B4B5B6B7B8B9BABB</mark>	FFFFC2C3C4C5C6C7C8C9CACB CCCDCECF		
3	A0A <mark>FFFF</mark> 3A4A5A6A7A8A9AAAB	BØB <mark>FFFF</mark> 3B4B5B6B7B8B9BABB	Offset has to be a multiple of 4 in this mode. Data in EPC bank will be unchanged.		
8	A0A1A2A3 <mark>FFFF</mark> A6A7A8A9AAAB	B0B1B2B3 <mark>FFFF</mark> B6B7B8B9BABB	C0C1C2C3FFFFC6C7C8C9CACB CCCDCECF		
24	Offset is out of bounds. EPC ID will be unchanged.	Offset is out of bounds. EPC ID will be unchanged.	C0C1C2C3C4C5C6C7C8C9CACB FFFFCECF		
-3	Flag length is bigger than offset. EPC ID will be unchanged.	Flag length is bigger than offset EPC ID will be unchanged.	Negative offset is not possible in this mode. Data in EPC bank will be unchanged.		
-5	A0A1A2A3A4A5A6A7A8A <mark>FFFF</mark> B	B0B1B2B3B4B5B6B7B8B <mark>FFFF</mark> B	Negative offset is not possible in this mode. Data in EPC bank will be unchanged.		
-16	A0A1A2A3 <mark>FFFF</mark> A6A7A8A9AAAB	B0B1B2B3 <mark>FFFF</mark> B6B7B8B9BABB	Negative offset is not possible in this mode. Data in EPC bank will be unchanged.		

6.5 Read and write power settings

The setting of the read and write power values has a fundamental effect on the maximum distance at which the data in the tag can be edited. This setting must be chosen as a compromise between maximal data editing reliability and limiting the maximum distance above, where editing tags is no longer desired.



NOTE: Default values are set 20dB for reading and 23dBm for writing. This setting appears as optimal for reliable editing at distance up to 30cm and at the same time labels at a distance greater than approx. 120cm are not visible.

If you need to increase the editing distance, it is possible to increase the reading and writing power and vice versa. For reliable writing into the tag, it is advisable to follow the principle of setting the writing power by approximately 3dBm greater than the reading power.

រ៍រ៍ RFID System				≜ ROOT 🔤 💆
🚯 Dashboard	DOMŮ > RFID			
🏷 Tags				
🖋 Edit tags	a Basic	E Protocols		1 Info
Sustain confineration	Region	GEN2 protocol		Reader
S PEID	European Union 3 👻	Access password	#0000000	Serial number: 619129
				MAC address: E8:E8:1B:39:86:AD
C Autonomous mode	Hop settings	BLF	250 *	Firmware: v0.94.1 @ Apr 4 2022 13:29:46
People counting	Hop time (ms)	Tari	25 *	Radio
📢 Alarms	3975			Serial number: 3221528010252KH+
🔅 дрю		Tag encoding	M4 *	Hardware: 20.00.00.01
O Date # time		Session	S0 *	Software: 01.0D.01.28-20.21.04.09-BL12.12.13.00
-				Model: M6e Micro
💑 Networking		Target	× *	Product group: Embedded Reader
🖺 Firmware update	Power settings	۵	0	Supported protocols: GEN2
🗲 Factory reset	Read power (dBm) Write power (dBm)			Others
🔆 Developer	20	Send select every query	Disabled	Radio temperature: 34°C
				Successful tags operation: 0
	Save settings		Save settings	Failed tags operation: 0

Figure 8 Read and write power settings are located in "RFID" tab

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7. **REST API IMPLEMENTATION**

UHF RFID POS supports REST API based interface for directly getting data from device.

Request are done via an HTTP GET or POST request. These requests are sent to corresponding RFID device IP address and port 80, where they are processed by embedded web server.

For all commands is necessary to have HASH key, that is used for verification. This HASH key is obtained as an answer after authorization and is valid 10 minutes after last command. If no command is sent in that interval, new authorization has to be performed.

All responses to commands are JSON objects.

All commands and responses are described in detail in the documentation: UHF RFID POS – REST API description.

7.1 Advantages of REST API

- Customer has full control over data, no 3rd party servers required •
- Unlimited access, no monthly fee, no fee per store or tags limitation
- Very low requirements on hardware
- Simple implementation for new or already existing systems
- Flexibility with other systems or devices



Figure 9 Example in PowerShell (Windows)

🛃 debian@localhost: ~			K
<pre>debian@localhost:~\$ curl -H "Content-Type: application/json" -d "EPC"],"hash":"ll535477646959966"}' http://192.168.1.136/control, on json_pp -json_opt pretty,canonical</pre>	{"targ /tagIns	etBank": pector.j:	(^ 8
% fotal % Received % Xierd Average Speed fime fime Dload Upload Total Spent	Left	Speed	
100 220 0 171 100 49 314 90:::		- 405	
"status" : "ok",			
"tags" : [
"EPCBank" : "FF9A3000E2005179981901422820026E", "EPCID" : "E2005179981901422820026E", "count" : 2, "frequency" : 866300, "lastRSSI" : -70, "phase" : 109, "port" : 4			
debian@localhost:~\$			
			÷

Figure 10 Example in Bash (Linux)

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9. RECOMENDED LITERATURE ABOUT UHF RFID

- Specification for RFID Air Interface Protocol https://www.gs1.org/sites/default/files/docs/epc/gs1-epc-gen2v2-uhf-airinterface i21 r 2018-09-04.pdf

10. NOTES

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