



CETECOM ICT Services

consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-0303/15-02-05





Testing laboratory

CETECOM ICT Services GmbH

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Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with

the registration number: D-PL-12076-01-00

Applicant

ASSA ABLOY Czech & Slovakia s.r.o.

V. Opatrného 1050

CZ-517 21 Týnište nad Orlicí / CZECH REPUBLIC

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Manufacturer

ASSA ABLOY Czech & Slovakia s.r.o.

V. Opatrného 1050

CZ-517 21 Týnište nad Orlicí / CZECH REPUBLIC

Test standard/s

47 CFR Part 15 Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency

devices

RSS - 210 Issue 8 Spectrum Management and Telecommunications Radio Standards Specification -

Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

RSS - 210 Issue 8 RSS-210, Amendment 1 — Licence-Exempt, Low-Power Radio Apparatus

Amendment 1 Operating in the Television Bands (February 2015)

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item: Bentley Key

Model name: YK1

FCC ID: 2AHMV-YK1
IC: 21263-YK1
Frequency: 21.85 kHz
Technology tested: Proprietary
Antenna: Internal antenna

Power supply: 3.0 V DC by CR2032 battery

Temperature range: +23°C



This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:	•
Stefan Bös Lab Manager	
Radio Communications & FMC	

T 1	C -	
100+	norto	rmaa:
1621	neno	rmed:

p.o.

Rene Oelmann Lab Manager Radio Communications & EMC



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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order: 2015-12-04
Date of receipt of test item: 2016-02-08
Start of test: 2016-02-10
End of test: 2016-02-16

Person(s) present during the test: -/-

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 15	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 8	December 2010	Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS - 210 Issue 8 Amendment 1	February 2015	RSS-210, Amendment 1 — Licence-Exempt, Low-Power Radio Apparatus Operating in the Television Bands (February 2015)
Guidance	Version	Description
ANSI C63.10-2013	-/-	American national standard of procedures for compliance testing of unlicensed wireless devices



4 Test environment

Temperature	:	$T_{nom} \ T_{max} \ T_{min}$	+23 °C during room temperature tests No tests under extreme conditions required. No tests under extreme conditions required.
Relative humidity content	:		55 %
Barometric pressure	:		not relevant for this kind of testing
Power supply		V_{nom} V_{max}	3.0 V DC by CR2032 battery No tests under extreme conditions required.
Power supply	•	V _{max} V _{min}	No tests under extreme conditions required. No tests under extreme conditions required.

5 Test item

5.1 General description

Kind of test item	:	Bentley Key
Type identification	:	YK1
HMN	:	-/-
PMN	:	YK1
HVIN	:	YK1
FVIN	:	-/-
S/N serial number	:	Pair 101
HW hardware status	:	No information available!
SW software status	:	No information available!
Frequency band	:	21.85 kHz
Type of radio transmission Use of frequency spectrum		Single modulated carrier
Type of modulation	:	BPSK
Number of channels	:	1
Antenna	:	Internal antenna
Power supply	:	3.0 V DC by CR2032 battery
Temperature range	:	-20°C to +70°C

5.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report: 1-0303/15-02-01_AnnexA 1-0303/15-02-01_AnnexB

1-0303/15-02-01_AnnexD

6 Test laboratories sub-contracted

None



7 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

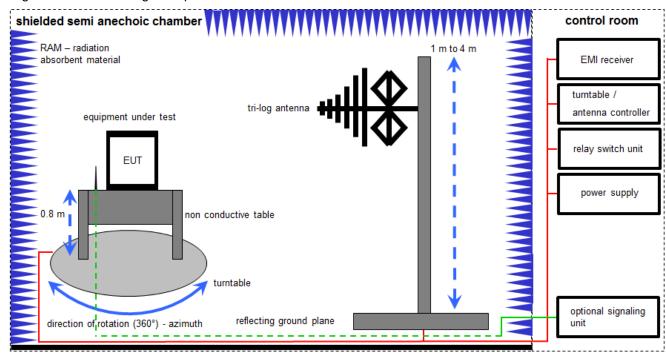
Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	ZW	cyclical maintenance (external cyclical
			maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlkl!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress



7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter

FS = UR + CL + AF

(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:

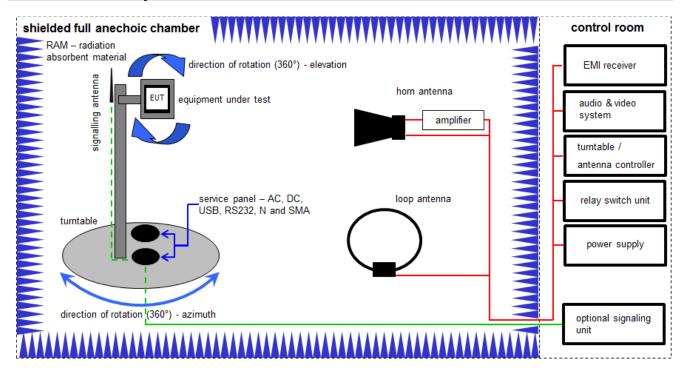
FS $[dB\mu V/m] = 12.35 [dB\mu V/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dB\mu V/m] (35.69 \(\mu V/m \))$

Equipment table:

No.	Lab / Item	Equipment	Туре	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	Α	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	Α	software	SPS_PHE 1.4f	Spitzenberger & Spiess	B5981; 5D1081;B5979	300000210	ne	-/-	-/-
3	Α	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2015	26.01.2016
4	А	Analyzer-Reference- System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	11.02.2014	11.02.2016
5	Α	Amplifier	JS42-00502650-28- 5A	MITEQ	1084532	300003379	ev	-/-	-/-
6	Α	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
7	Α	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
8	Α	Turntable Interface- Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
9	А	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016



7.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter; loop antenna 3 meter

FS = UR + CA + AF

(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:

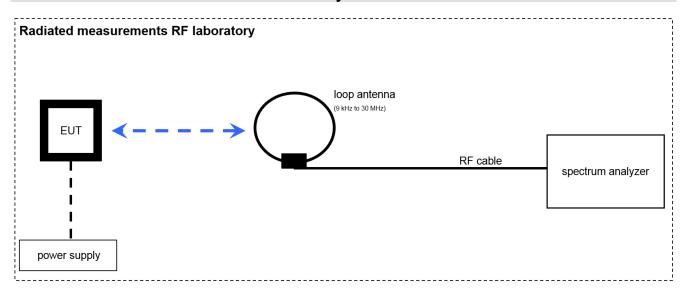
 $FS [dB\mu V/m] = 40.0 [dB\mu V/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dB\mu V/m] (71.61 \ \mu V/m)$

Equipment table:

	No	•	Lab / Item	Equipment	Туре	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	I	1	Α	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9709-5290	300000212	k	13.08.2015	13.08.2017
2	2	2	Α	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	22.01.2016	22.01.2017
3	3	3	Α	HF- Schaltmatrixgrundge rät	TS-RSP 1144.1500K03	R&S	100300	300003556	ev	-/-	-/-
4	1	4	Α	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne	-/-	-/-
5	5	5	Α	Messrechner und Monitor	Intel Core i3 3220/3,3 GHz, Prozessor	Agilent Technologies	2V2403033A54 21	300004591	ne	-/-	-/-
6	6	6	Α	Highpass Filter	WHKX2.6/18G- 10SS	Wainwright	12	300004651	ne	-/-	-/-
7	7	7	Α	NEXIO EMV- Software	BAT EMC	EMCO	12	300004682	ne	-/-	-/-
8	3	8	Α	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017



7.3 Radiated measurements RF laboratory



Equipment table:

No.	Lab / Item	Equipment	Туре	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	EMI Test Receiver 9 kHz - 3 GHz incl. Preselector	ESPI3	R&S	101713	300004059	k	23.01.2016	23.01.2017
2	А	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017



8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.10.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.10) see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.5 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all
 emissions.

Final measurement

- Identified emissions during the premeasurement are maximized by the software by rotating the turntable from 0° to 360°. In case of the 2-axis positioner is used the elevation axis is also rotated from 0° to 360°.
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.10).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.



8.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position ± 45° and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.



9 Summary of measurement results

\boxtimes	No deviations from the technical specifications were ascertained
	There were deviations from the technical specifications ascertained
	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS 210, Issue 8	See table!	2016-07-27	-/-

Test Specification Clause	Test Case	Temperature Conditions	Power Source Voltages	С	NC	NA	NP	Remark
§ 15.209(a) RSS-210 Issue 8	Fieldstrength of Fundamental	Nominal	Nominal	\boxtimes				-/-
RSS-GEN Issue 3	Bandwidth of the modulated carrier	Nominal	Nominal	\boxtimes				-/-
§ 15.209/ RSS-210 Issue 8	Fieldstrength of harmonics and spurious	Nominal	Nominal	\boxtimes				-/-
§ 15.209 RSS-GEN Issue 3	Receiver spurious emissions (radiated)	Nominal	Nominal			\boxtimes		-/-
§15.107 §15.207	Conducted limits	Nominal	Nominal			\boxtimes		-/-

 $\underline{\textbf{Note:}} \ C = \textbf{Compliant;} \ \textbf{NC} = \textbf{Not compliant;} \ \textbf{NA} = \textbf{Not Applicable;} \ \textbf{NP} = \textbf{Not Performed}$



10 Additional comments

Reference documents: None

Special test descriptions: We perform the radiated pre-scans in different spherical positions and

consolidate the results in one result plot. The test procedure includes scans in the theta axes every 90° and in phi axes @ 0° and 90° for both polarizations

vertical & horizontal or magnetic emissions.

Configuration descriptions: The EUT is a passive device which needs to have an initialization device for the

21.85 kHz application. Therefore the EUT was tested in combination with a test transceiver (normally built in in a car). So the emissions show the complete

emissions generated by the test transceiver and the EUT.

Additional information: None



11 Measurement results

11.1 Field strength of the fundamental

Measurement:

Measurement parameter					
Detector:	Average (15.209(d))				
Resolution bandwidth:	10kHz				
Trace-Mode:	Max Hold				

Limits:

FCC		IC	
Fundamental Frequency (MHz)	Field strength o (μV/		Measurement distance (m)
0.009 – 0.490	2400 / F	-(kHz)	300

Results: (Transmissions generated by the test-transceiver in combination with the EUT)

Test c	onditions	Radiated field strength / (dBμV/m)			
Frequency		21.85 kHz			
Mode		at 3 m distance	at 300 m distance		
T _{nom}	V _{nom}	114.5 34.5*			
Measurement uncertainty		±30	dB		

^{*}Re-calculated from 3m to 300m with 40 dB/decade according to FCC 15.31 (f2)



11.1 Bandwidth of the modulated carrier

Limits:

FCC	IC
Bandwidth of the	modulated carrier

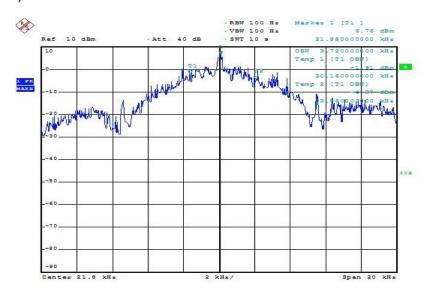
Measured with the integrated OBW-function of the spectrum analyser (measurement criteria is the integrated power in %)

Result: (Transmissions generated by the test transceiver in combination with the EUT)

	Occupied Bandwidth (kHz)
6 dB (75%)	3.72
20 dB (99%)	15.56

Plots:

Plot 1: 6 dB (75%) – bandwidth

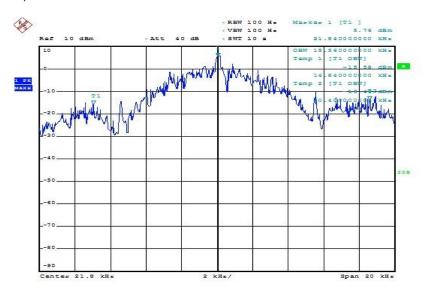


NOP

Date: 10.FEB.2016 15:08:31



Plot 2: 20 dB (99%) - bandwidth



NOP

Date: 10.FEB.2016 15:28:12



11.2 Field strength of the harmonics and spurious

Measurement:

Measurement parameter					
Detector:	Average / Quasi Peak				
Sweep time:	Auto				
Resolution bandwidth:	F < 150 kHz: 200 Hz 150 kHz > F > 30 MHz: 9 kHz 9 kHz F > 30 MHz: 120 kHz				
Video bandwidth:	F < 150 kHz: 1 kHz 150 kHz > F > 30 MHz: 100 kHz 9 kHz F > 30 MHz: 300 kHz				
Span:	See plots!				
Trace mode:	Max hold				

Limits:

FCC			IC		
Field strength of the harmonics and spurious.					
Frequency / (MHz)	requency / (MHz) Field streng		Measurement distance / (m)		
0.009 - 0.490	2400/F	(kHz)	300		
0.490 - 1.705	24000/F(kHz)		30		
1.705 – 30	30 (29.5 dBμV/m)		30		
30 – 88	100 (40 dBµV/m)		3		
88 – 216	150 (43.5 dBµV/m)		3		
216 – 960	200 (46 d	IBμV/m)	3		

Result: (Transmissions generated by the test transceiver in combination with the EUT)

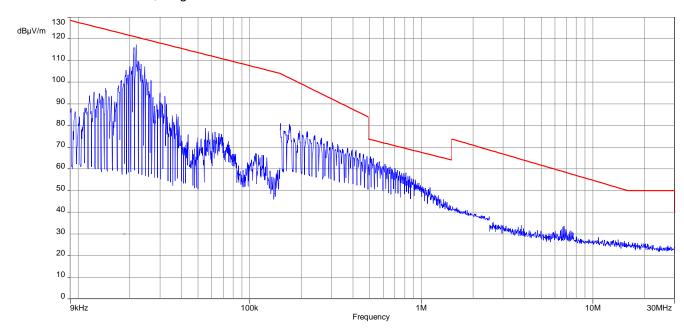
	Spurious emissions							
f [MHz]	Detector	Results						
		All detected pea	k emissions are below the average limit!					

Note: The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)



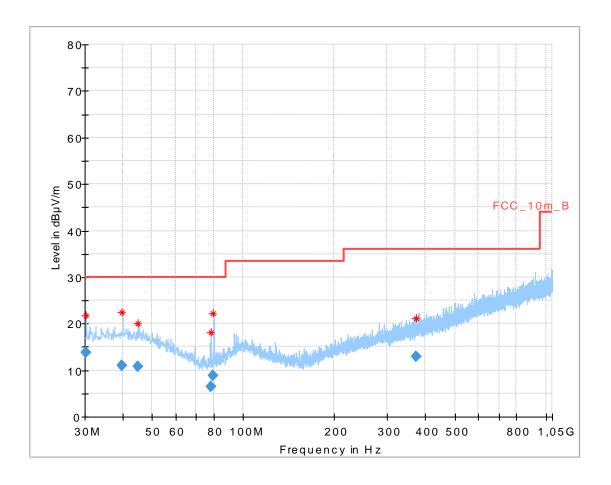
Plots: TX mode

Plot 1: 9 kHz - 30 MHz; magnetic





Plot 2: 30 MHz – 1000 MHz, vertical and horizontal polarization



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.305342	13.88	30.00	16.12	1000.0	120.000	170.0	٧	81.0	13.4
39.835950	11.03	30.00	18.97	1000.0	120.000	101.0	٧	100.0	14.0
44.921700	10.82	30.00	19.18	1000.0	120.000	98.0	٧	190.0	13.9
78.086550	6.49	30.00	23.51	1000.0	120.000	101.0	٧	280.0	8.1
79.648200	8.77	30.00	21.23	1000.0	120.000	101.0	٧	280.0	8.1
373.234650	13.03	36.00	22.97	1000.0	120.000	170.0	٧	-10.0	16.4



Annex A Document history

Version	Applied changes	Date of release
	Initial release	2016-07-27

Annex B Further information

Glossary

AVG - Average

DUT - Device under test

EMC - Electromagnetic Compatibility

EN - European Standard EUT - Equipment under test

ETSI - European Telecommunications Standard Institute

FCC - Federal Communication Commission

FCC ID - Company Identifier at FCC

HW - Hardware

IC - Industry Canada
Inv. No. - Inventory number
N/A - Not applicable
PP - Positive peak
QP - Quasi peak
S/N - Serial number
SW - Software

PMN - Product marketing name HMN - Host marketing name

HVIN - Hardware version identification number FVIN - Firmware version identification number



Annex C Accreditation Certificate

Front side of certificate Back side of certificate



Note:

The current certificate including annex can be received from CETECOM ICT Services GmbH on request.