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DELTA Test Report

TEST REPORT issued by an Accredited Testing Laboratory

1688
ISO/IEC 17025

Radio parameter test of Aperio radio in Server lock KS100-640-SE2

Performed for ASSA AB

REC-E704276_1 Rev. A
Project no.: E704276
Page 1 of 35

26 August 2015

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Title	Radio parameter test of Aperio radio in Server lock KS100-640-SE2
Test object	Server lock KS100-640-SE2
Report no.	REC-E704276_1 Rev. A
Project no.	E704276
Test period	23 April 2015 to 12 May 2015
Client	ASSA ABLOY 10027 S. 51st St. Ste. 102 Phoenix, AZ 85044 USA
Contact person	Joshua Peabody Tel: 623-582-4626
Client observer	Fredrik Thorsell WSI AB E-mail: frth@wsi.nu
Manufacturer	Hanchett Entry Systems, Inc.
Specifications	FCC CFR47 Part 15 subpart C, RSS-Gen, issue 4:2014, RSS-210, issue 8:2010
Results	The test object was found to be in compliance with the specifications, as listed in Section 1
Test personnel	Lars Johnsson
Date	26 August 2015

Project Manager

Lars Johnsson
DELTA

Responsible

Ulf Bjerke. Technical manager
DELTA

LAJ

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1. Summary of tests

Tests	Test methods	Results
Measurement of radio frequency voltage on mains (§15.207, RSS Gen 8.8)	ANSI C63.10:2013	Passed
Measurement of radio frequency electromagnetic field 30-1000 MHz (§15.209, 15.249 and RSS Gen 6.13)	ANSI C63.10:2013	Passed
Measurement of radio frequency electromagnetic field 1 – 25 GHz (§15.209, 15.249 and RSS Gen 6.13)	ANSI C63.10:2013	Passed
Measurement of field strength of fundamental (§15.249 (a) and RSS Gen 6.12)	ANSI C63.10:2013	Passed
Permitted frequency range of modulation BW (§15.215(c) and RSS Gen 6.6)	ANSI C63.10:2013	Passed
Measurement of band edge compliance (§15.215)	ANSI C63.10:2013	Passed
Measurement of 99% BW (RSS Gen)	ANSI C63.10:2013	Measured

This document covers the results from radio parameter tests performed on the 2.4 GHz Aperio radio. RFID radio on 13.56 MHz, which is a part of the complete test object, is not included in this report.

Conclusion

The test object(s) mentioned in this report meet(s) the requirements of the standard(s) stated below.

- FCC CFR 47 Part 15C (Intentional radiator at 2.4 GHz)
- Industry Canada IC Radio Standards Specification, RSS-Gen, issue 4:2014, *General Requirements and Information for the Certification of Radio Apparatus*
- Industry Canada IC Radio Standards Specification, RSS-210, issue 8:2010, *Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment*

The test results relate only to the object(s) tested.

2. Test object(s) and auxiliary equipment

2.1 Test object(s)

Photo 2.1.1 Test object.

Test object 2.1.1

Name of test object	Server lock
Model / type	KS100-640-SE2
Part no.	KS100-640-SE2
Serial no.	MAC adress: 06 05 F5
FCC ID	VC3-KKSR100SE
IC ID	7160A-KKSR100622SE
Manufacturer	Hanchett Entry Systems, Inc.
Supply voltage	IEEE 802.3af, 48VDC Power over Ethernet (PoE)
Software version	7.99.30479
Cycle time	-
Received	Date: 23 April 2015 Status: Prototype

Test object 2.1.2

Name of test object	Cabinet lock
Model / type	K100-622-PA2
Part no.	K100-622-PA2
Serial no.	MAC adress: 03 FF 83
FCC ID	VC3-KKSR100PA
IC ID	7160A-KKSR100622PA
Manufacturer	Hanchett Entry Systems, Inc.
Supply voltage	Battery operated. 3 V.
Software version	7.99.30479
Cycle time	-
Comment	Used for 99 % occupied bandwidth measurement
Received	Date: 23 April 2015 Status: Prototype

2.2 Radio specifications, receiver and transmitter

The Aperio radio (2.4 GHz) of the test object has the following specified RF parameters. The below mentioned information regarding the receiver and the transmitter is declared by the manufacturer.

Type of equipment	:	Low power device (2400-2483.5 MHz)
Operating frequency range	:	2405 to 2475 MHz
Antenna	:	Permanently attached PCB antenna
Maximum gain	:	-4.2 dBi
Power level	:	Fixed
No of channels	:	15 (11-25)
Bandwidth	:	
Occupied bandwidths (99%)	:	2.5 MHz (Measured)
Channel separation	:	5 MHz
Modulation	:	O-QPSK
Data rate	:	? Mbits
Temperature category	:	-20 to +50 ºC.

2.3 Auxiliary equipment

Photo 2.3.1 Auxiliary equipment. PoE injector with adaptor.

Photo 2.3.2 Auxiliary equipment. PoE injector with adaptor.

Auxiliary equipment 2.3.1

Name of auxiliary equipment	Aperio Hub
Model / type	AH30
Serial no.	MAC ID 00.17.7a.01.02.04.44.da
FCC ID	Y88-AH20R01
Manufacturer	ASSA ABLOY
Supply voltage	8-24 VDC
Comment	Auxiliary equipment supplied by the client, who also has the responsibility for its correct function and set up. Used to configure the test object before test.

Auxiliary equipment 2.3.2

Name of auxiliary equipment	Laptop PC
Model / type	HP Compaq 6910p
Part no.	gb949ET#ak8
Serial no.	cnd821lwtf
Manufacturer	HP
Supply voltage	230 VAC
Comment	Auxiliary equipment supplied by the client, who also has the responsibility for its correct function and set up. Used to configure the test object before test.

Auxiliary equipment 2.3.3

Name of auxiliary equipment	TriBee USB
Model / type	200300
Part no.	gb949ET#ak8
Serial no.	cnd821lwtf
FCC ID	YVB-200300
Manufacturer	TriTech
Supply voltage	5 VDC
Comment	Auxiliary equipment supplied by the client, who also has the responsibility for its correct function and set up. Used to configure the test object before test.

Auxiliary equipment 2.3.4

Name of auxiliary equipment	PoE Injector
Model / type	TL-POE150S
Part no.	TL-POE150S
Serial no.	2014B021001732
Manufacturer	TP-Link
Supply voltage	230 VAC to 48 VDC adaptor
Comment	Auxiliary equipment supplied by the client, who also has the responsibility for its correct function and set up. Adaptor: Leader Electronics. Model MU24-1480050-C5

3. General test conditions

3.1 Test setup during test

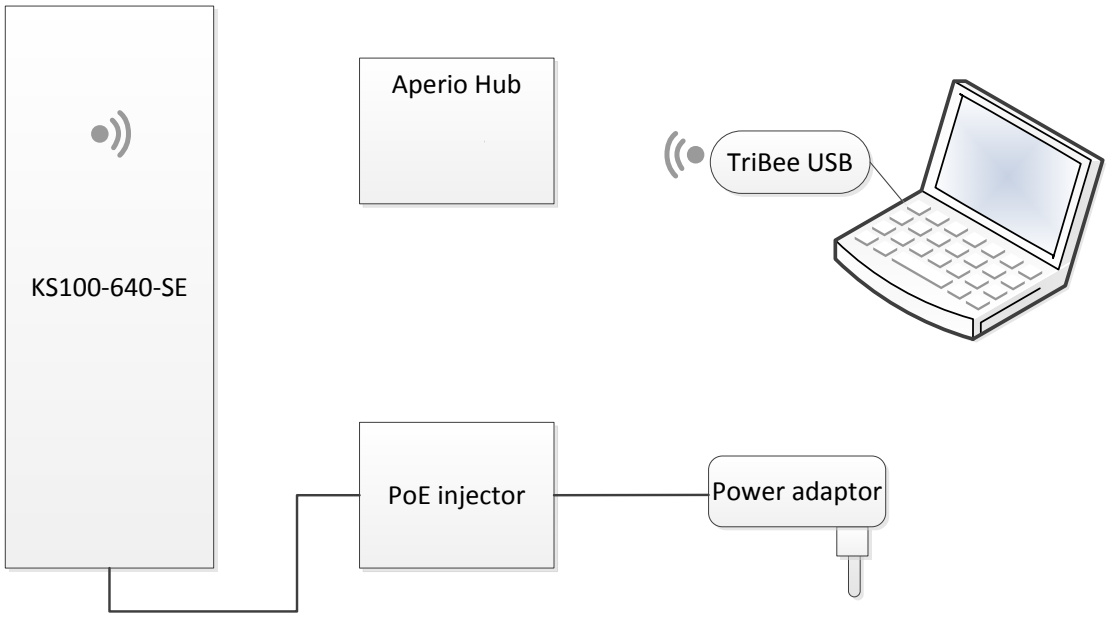


Figure 3.1.1 Block diagram of test object(s) with cables and auxiliary equipment.

3.1.1 Description and intended use of test object

The KS100-640-SE2 is a cabinet lock intended for server cabinets. It is paired to an Aperio Hub (2.4 GHz) to form real-time access control to individual server cabinet doors. It uses ID badges (13.56 MHz) for the access control.

3.2 Modifications of the test object

No modifications were incorporated.

3.3 Test sequence

The tests described in this test report were performed in the following sequence:

1. Measurement of radio frequency electromagnetic field 30-1000 MHz (§15.225,15.209 and RSS Gen 6.13)
2. Permitted frequency range of modulation BW (§15.215 and RSS Gen 6.6)
3. Measurement of radio frequency electromagnetic field 1 – 25 GHz (§15.209 and RSS Gen 6.13)
4. Measurement of 99% BW
5. Measurement of radio frequency voltage on AC (§15.207, RSS Gen 8.8)

4. Test results

4.1 Measurement of radio frequency voltage on mains

Test object	Server lock	Sheet	CE-1
Type	KS100-640-SE2	Project no.	E704276
Serial no.	MAC adress: 06 05 F5	Date	30 Apr. 2015
Client	ASSA AB	Initials	LAJ
Specification	FCC CFR47 Part 15 subpart C §15.207, RSS Gen 8.8)	Frequency	0.15-30 MHz

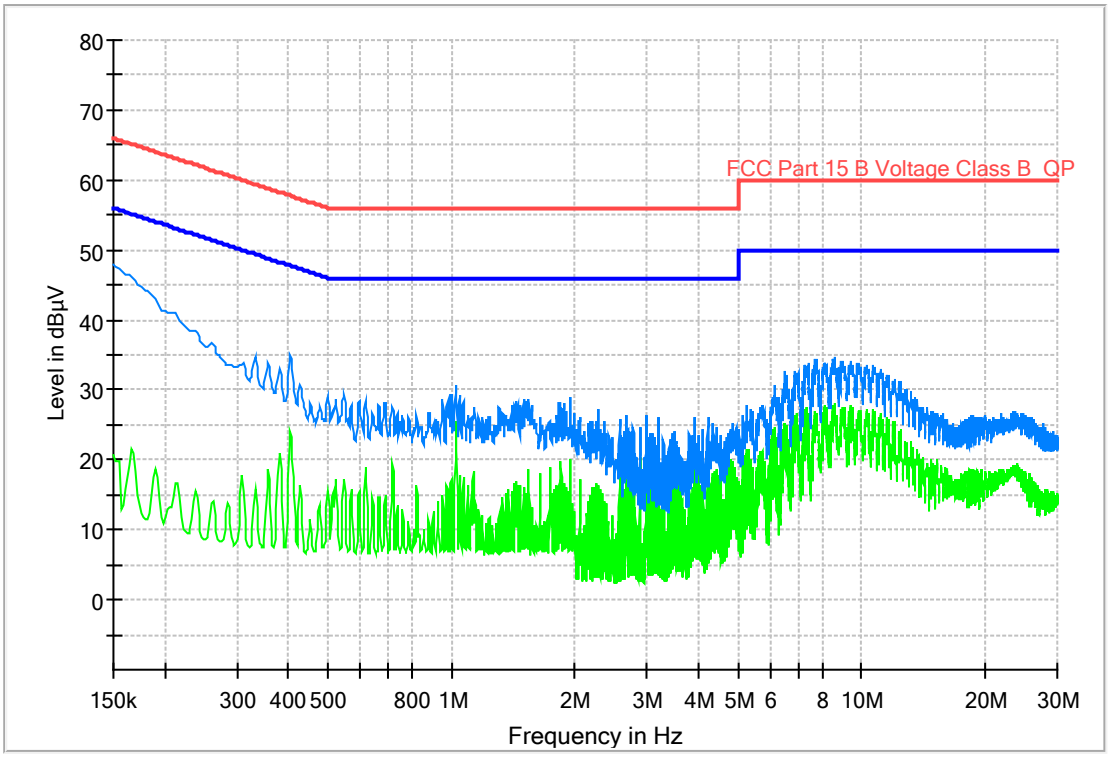
Test method Characteristics	ANSI C63.10:2013 Artificial mains network: 50 Ω, 50 μH	Temperature Humidity	21 °C 42 % RH
Detector	Peak, quasi peak, and average	Bandwidth	9 kHz
Test equipm.	EMC Hall A Västerås Setup VEA1	Uncertainty	1.8 dB

Line under test	Maximum of Line and Neutral
Test result	The measured voltages were below the limit
Compliant	Yes
Comments	Mains voltage: 115 VAC

Conducted Emission Test

Test Description:	Conducted emission. Complete measurement 150 kHz - 30 MHz
Date:	2015-04-30
EUT Name:	KS100-SE
Manufacturer:	ASSA AB
Serial Number:	MAC adress: 06 05 F5
Operating Conditions:	115 VAC, 60 Hz
Test Site:	DELTA Development Technology AB
Operator Name:	Lars J
Test Specification:	FCC Part 15 B Class B
Comment:	

Full Spectrum



Preview Result 2-AVG
FCC Part 15 B Voltage Class B QP
Final_Result QPK
Preview Result 1-PK+
FCC Part 15 B Voltage Class B AV
Final_Result AVG

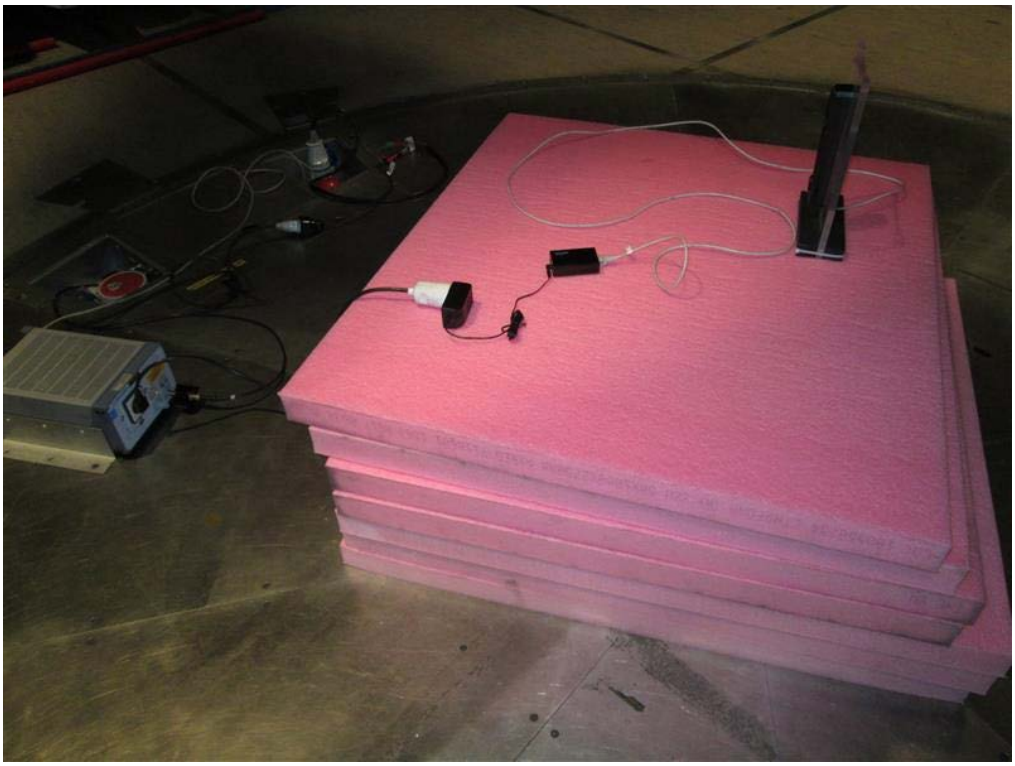


Photo 4.1.1 Test setup regarding measurement of radio frequency voltage on mains.

4.2 Measurement of radiated emission below 1 GHz

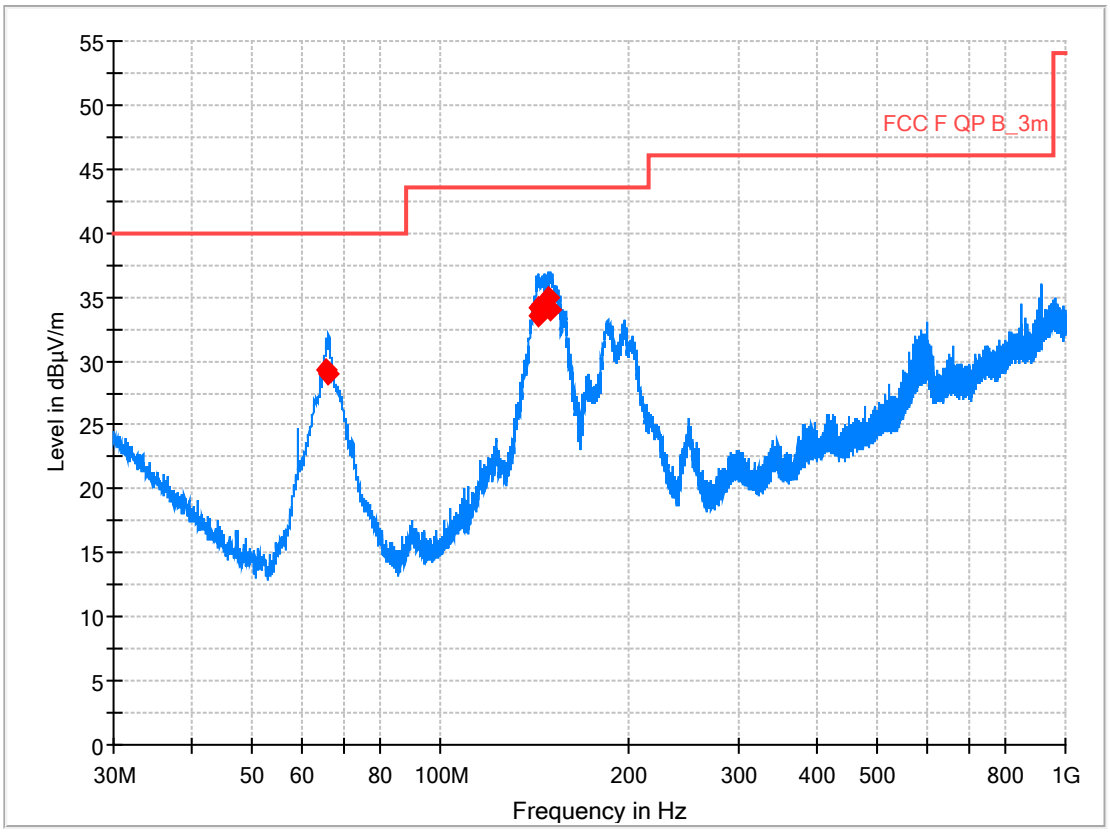
Test object	Server lock	Sheet	RE_Spur-1
Type	KS100-640-SE2	Project no.	E704276
Serial no.	MAC adress: 06 05 F5	Date	23 Apr. 2015
Client	ASSA AB	Initials	LAJ
Specification	FCC CFR47 Part 15 subpart C §15.209, 15.225, 15.249 and RSS Gen 6.13	Frequency	30-1000 MHz

Test method Characteristics	ANSI C63.10:2013 Complete search, Antenna distance 3 m	Temperature Humidity	21 °C 41 % RH
Detector	Peak and quasi peak	Bandwidth	120 kHz
Test equipm.	EMC Hall A Västerås Setup VEC1	Uncertainty	5.1 dB

Test result	The measured field strengths are below the limit
Test Port	Enclosure
Test mode	Continuous Tx - Normal modulation
Condition	Normal temperature and supply voltage.
Compliant	Yes

Radiated Emission Test

Test Description:	Radiated emission. Complete measurement 30 - 1000 MHz
Date:	23 Apr. 2015
EUT Name:	K100SE, KS100-SE, R100SE
Manufacturer:	ASSA AB
Serial Number:	MAC adress: 06 05 F5
Operating Conditions:	Continous 2.4 GHz Tx
Test Site:	DELTA Development Technology AB
Operator Name:	Lars J
Test Specification:	FCC CFR47 part 15. Subpart C. 15.209
Comment:	



Preview Result 1-PK+ FCC F QP B_3m Final_Result QPK

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
65.610000	29.36	40.00	10.64	1000.0	120.000	113.0	V	105.0	-15.6
66.330000	29.00	40.00	11.00	1000.0	120.000	128.0	V	107.0	-15.6
143.550000	33.54	43.50	9.96	1000.0	120.000	100.0	V	102.0	-9.1
143.580000	34.14	43.50	9.36	1000.0	120.000	100.0	V	109.0	-9.1
148.950000	34.87	43.50	8.63	1000.0	120.000	100.0	V	106.0	-9.4
150.390000	34.02	43.50	9.48	1000.0	120.000	100.0	V	118.0	-9.5

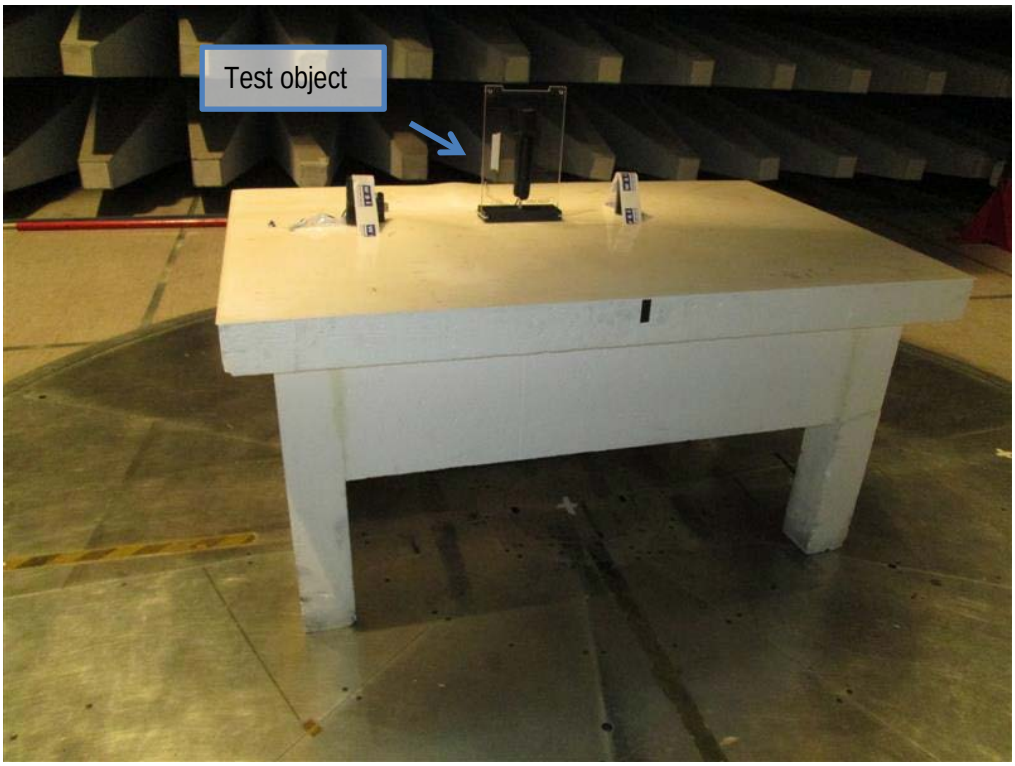


Photo 4.2.1 Test setup regarding measurement of radiated emission below 1 GHz.

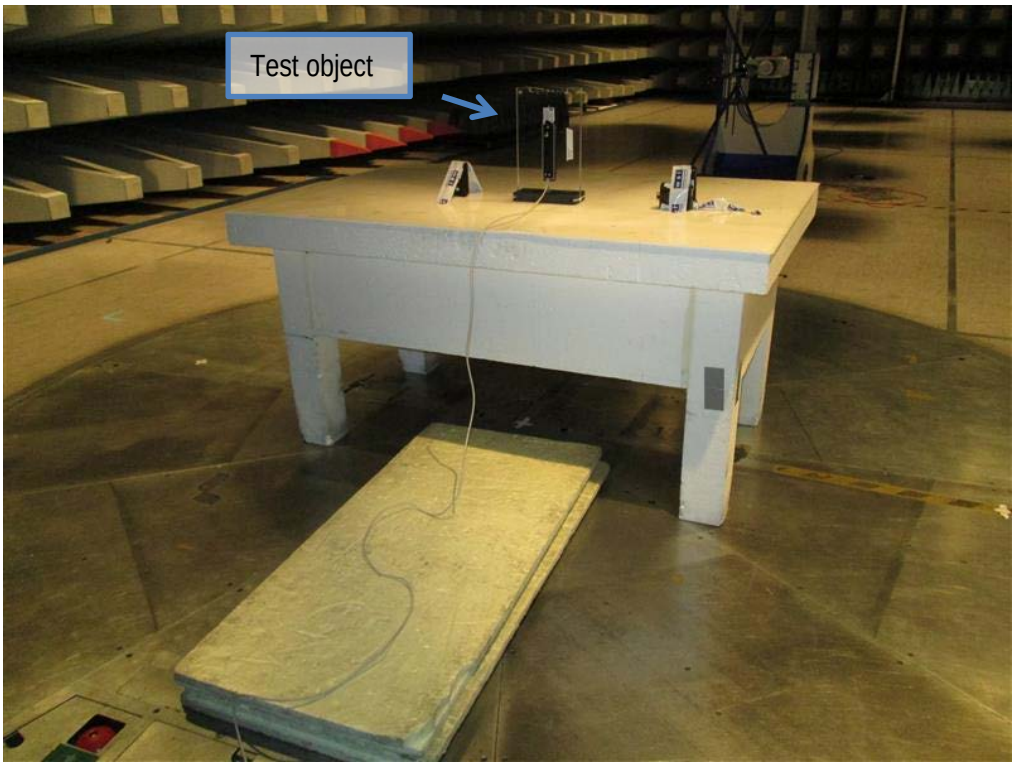


Photo 4.2.2 Test setup regarding measurement of radiated emission below 1 GHz.

4.3 Measurement of radiated emission above 1 GHz

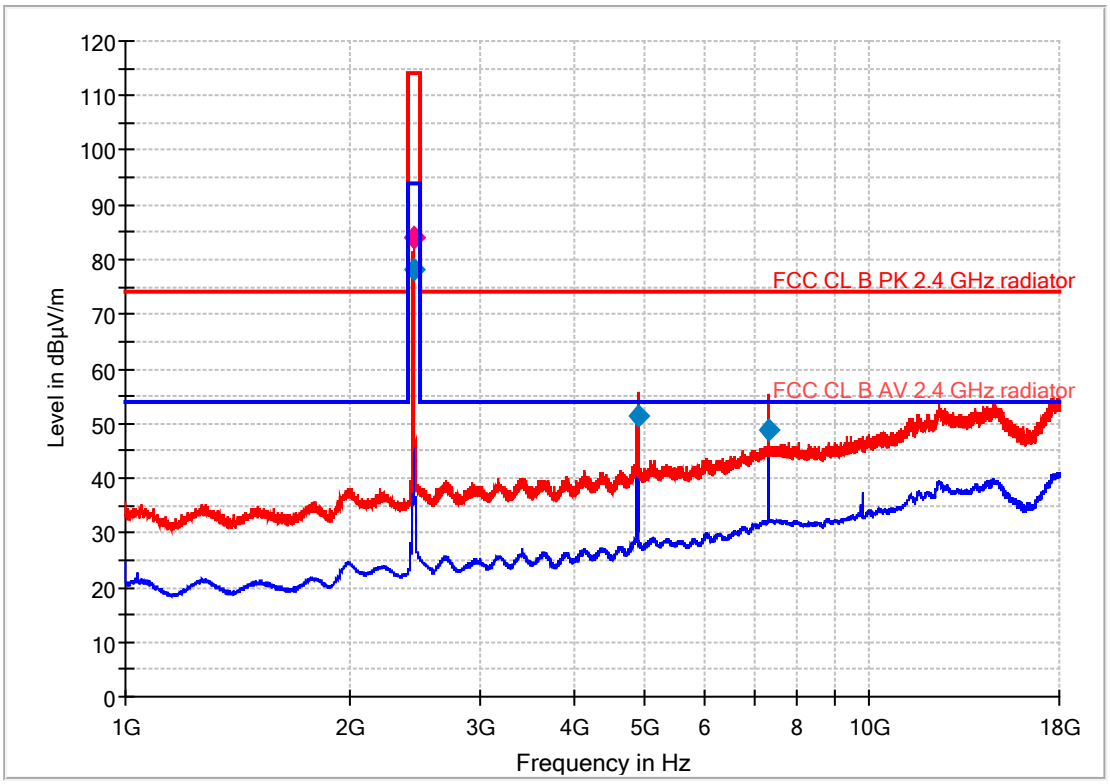
Test object	Server lock	Sheet	RE_Spur-2
Type	KS100-640-SE2	Project no.	E704276
Serial no.	MAC adress: 06 05 F5	Date	23 Apr. 2015
Client	ASSA AB	Initials	LAJ
Specification	FCC CFR47 Part 15 subpart C §15.209, 15.225, 15.249 and RSS Gen 6.13	Frequency	1 – 25 GHz

Test method Characteristics	ANSI C63.10:2013 Complete search, Antenna distance 3 m.	Temperature Humidity	21 °C 41 % RH
Detector	Peak for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMC Hall A Västerås 49086 49600 49624 49625	Uncertainty	4.9 dB

Test result	The measured average field strengths are below the average limit. The measured peak field strengths are less than 20 dB above the average limit.
Test Port	Enclosure
Test mode	Continuous Tx - Normal modulation
Condition	Normal temperature and supply voltage.
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height and antenna polarization. Test object placed 1.5 m above ground reference plane

Radiated Emission Test

Test Description:	Radiated emission. Complete measurement 1 – 18 GHz
Date:	2015-04-23
EUT Name:	KS100SE
Manufacturer:	ASSA AB
Serial Number:	MAC adress: 06 05 F5
Operating Conditions:	Continous 2.4 GHz Tx
Test Site:	DELTA Development Technology AB
Operator Name:	Lars J
Test Specification:	FCC CFR47 part 15. Subpart C. 15.209
Comment:	



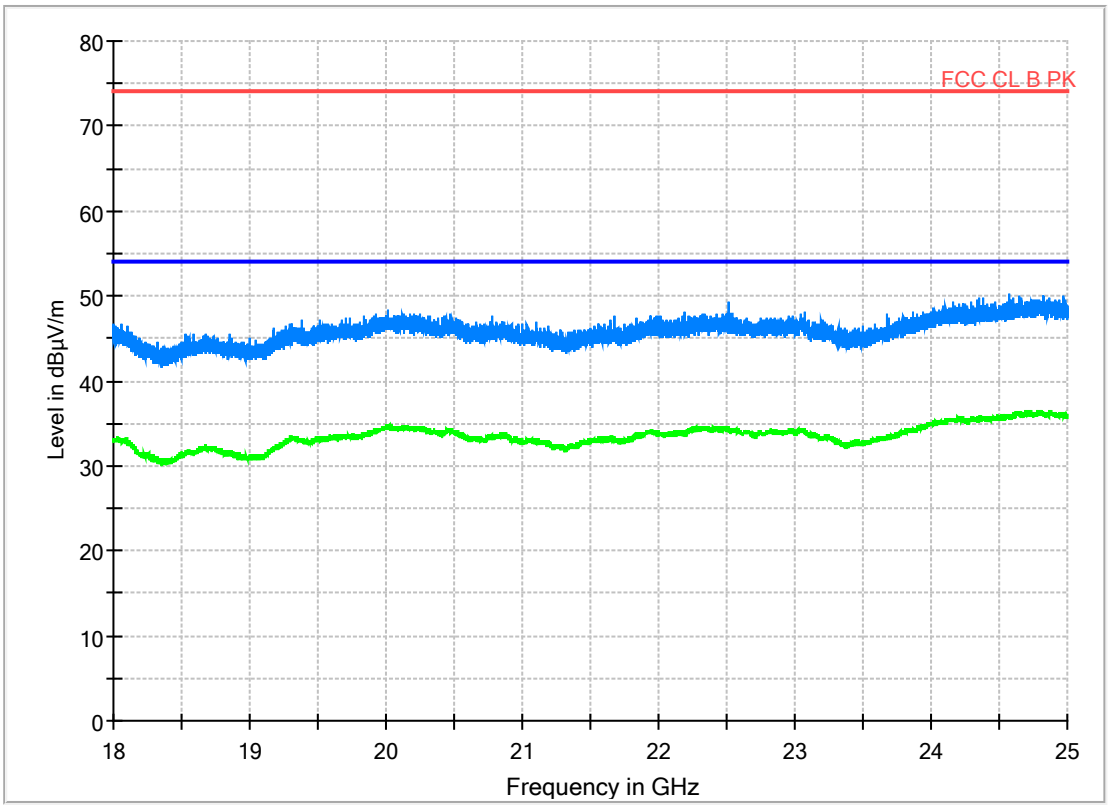
Preview Result 2-AVG
Final_Result PK+
FCC CL B PK 2.4 GHz radiator
Preview Result 1-PK+
Final_Result AVG
FCC CL B AV 2.4 GHz radiator

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2444.500000	84.13	---	114.00	29.87	1500.0	1000.000	145.0	H	282.0	-11.9
2445.000000	---	78.04	94.00	15.96	1500.0	1000.000	100.0	V	257.0	-11.9
2445.500000	84.16	---	114.00	29.84	1500.0	1000.000	144.0	H	282.0	-11.9
4891.000000	---	51.32	54.00	2.68	1500.0	1000.000	158.0	H	236.0	-5.1
7336.000000	---	48.88	54.00	5.12	1500.0	1000.000	196.0	H	227.0	0.8

Radiated Emission Test

Test Description:	Radiated emission. Complete measurement 18 – 25 GHz
Date:	2015-04-24
EUT Name:	KS100SE
Manufacturer:	ASSA AB
Serial Number:	MAC adress: 06 05 F5
Operating Conditions:	Continous 2.4 GHz Tx
Test Site:	DELTA Development Technology AB
Operator Name:	Lars J
Test Specification:	FCC CFR47 part 15. Subpart C. 15.209
Comment:	



Preview Result 2-AVG
FCC CL B PK
Preview Result 1-PK+
FCC CL B AV

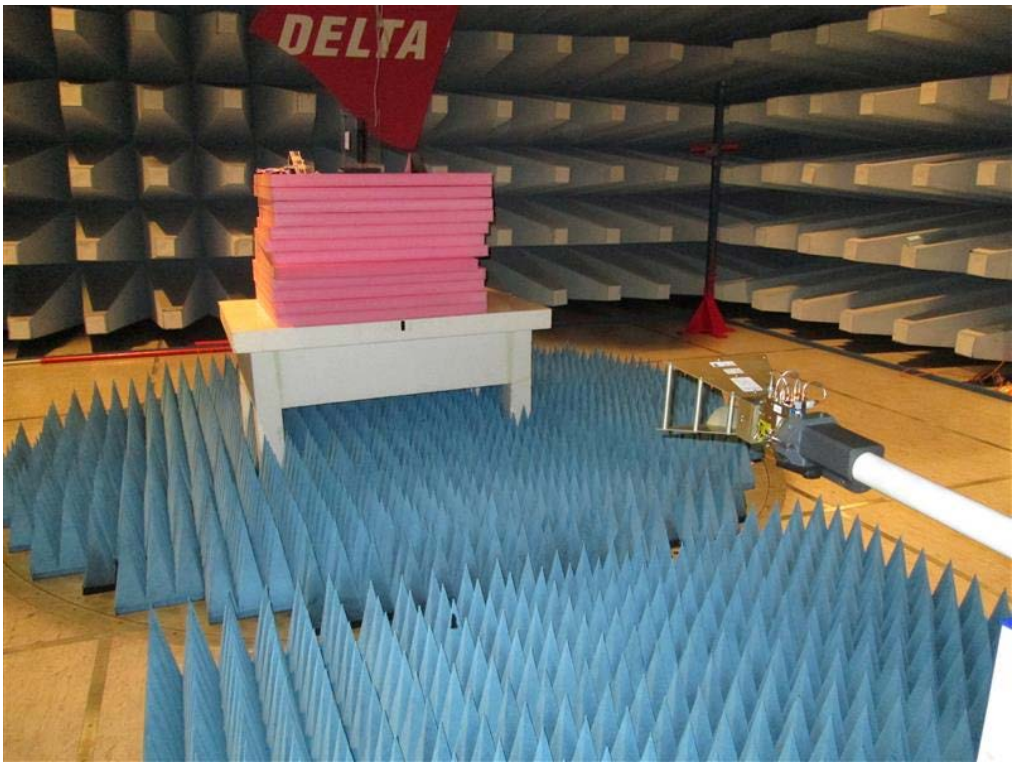


Photo 4.3.1 Test setup regarding measurement of radiated emission above 1 GHz.

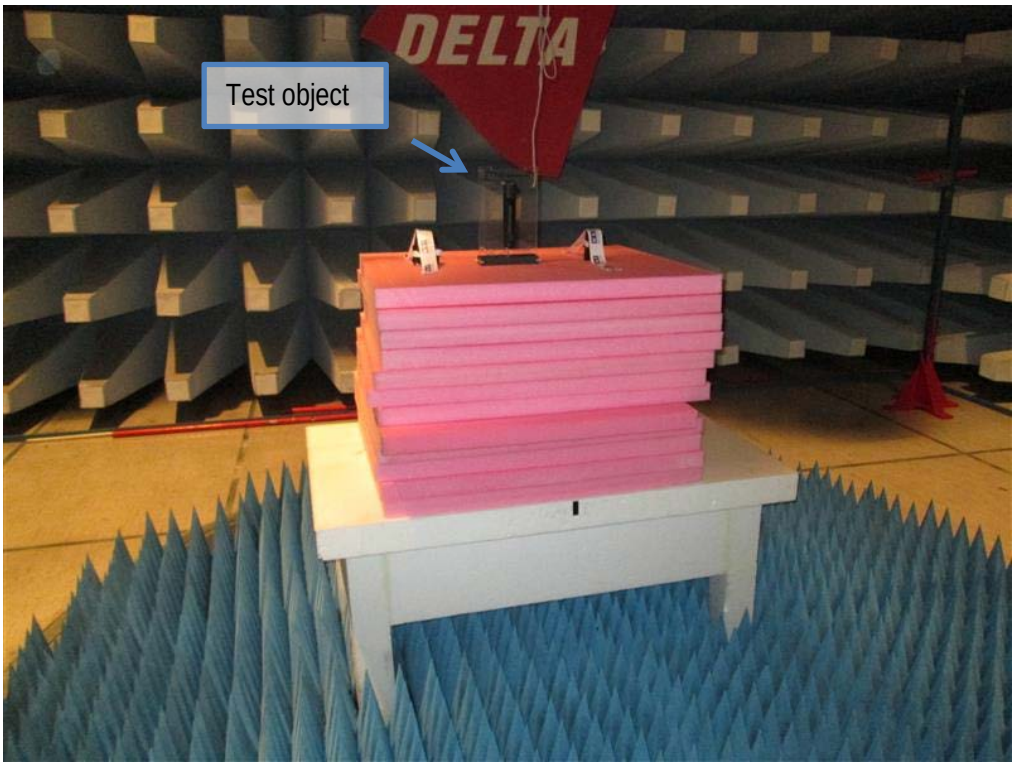


Photo 4.3.2 Test setup regarding measurement of radiated emission above 1 GHz.

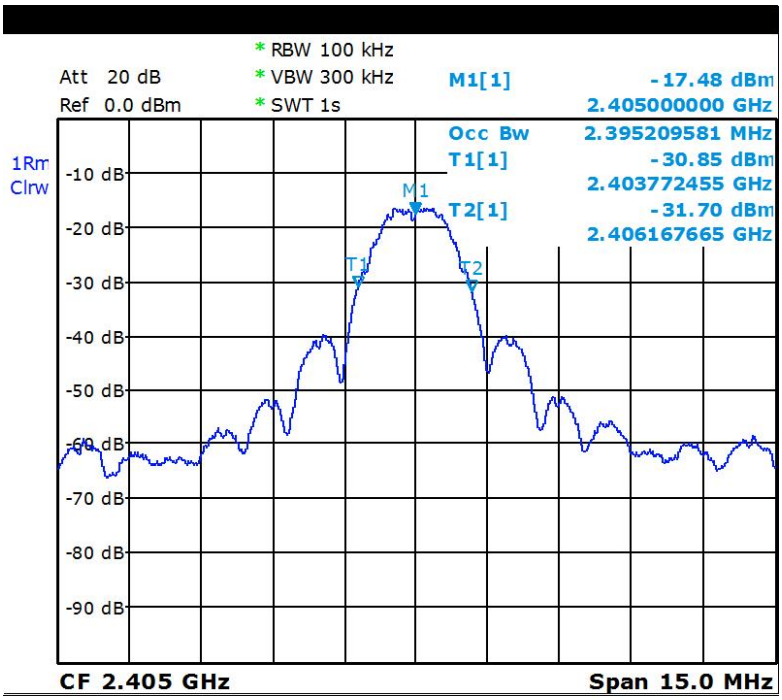
4.4 Measurement of occupied bandwidth, IC

Test object	Server lock	Sheet	PROF-1
Type	K100-622-PA2	Project no.	E704276
Serial no.	MAC adress: 03 FF 83	Date	24 Apr. 2015
Client	ASSA AB	Initials	LAJ
Specification	FCC CFR47 Part 15 subpart C		

Test method Characteristics	IC Standard RSS-Gen, Issue 4:2014 - Section 6.6 Test voltage: Supplied with fresh batteries (3 VDC)	Temperature Humidity	22 °C 40 % RH
Test equipm.	Västerås Setup VEC1	Uncertainty	
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 15 MHz DET: Peak Trace: Clrw		

Operating frequency [MHz]	Low frequency [MHz]	High frequency [MHz]	Measured 99% emission bandwidth [MHz]
2405	2403.7	2406.1	2.4
2435	2433.7	2436.2	2.5
2475	24737	24762	2.5

Band edge criteria	Measured 99 % emission bandwidth (23 dBc)
Test port	Enclosure
Test frequency	2405 MHz, 2435 MHz, 2475 MHz
Test mode	Continuous Tx - normal modulation
Condition	Normal temperature and supply voltage.
Comments	Measured on a K100-622-PA2 module. This module has the exact same radio as the KS100-640-SE2



Date: 24.APR.2015 15:11:03

Figure 0.1 99 % bandwidth. Lowest channel

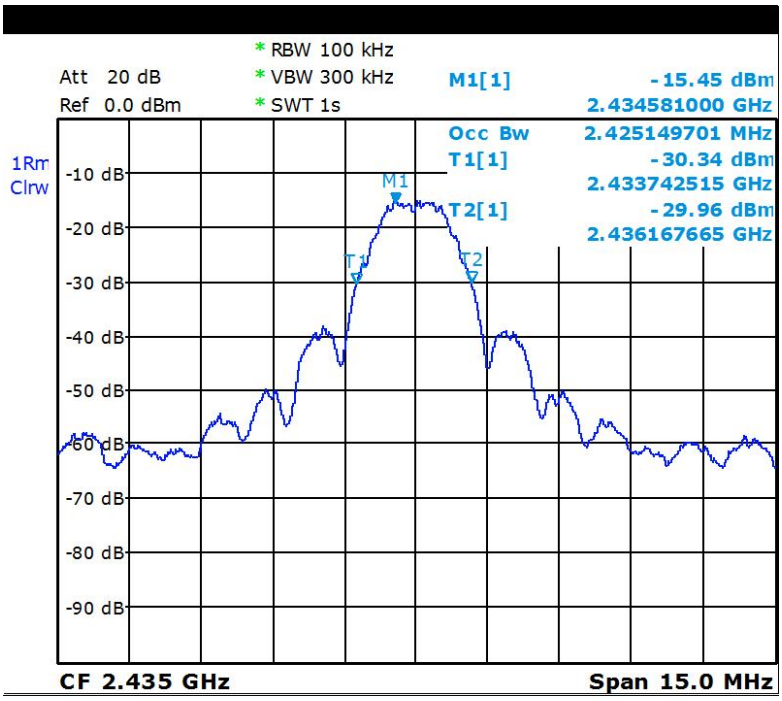


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Photo 0.2 99 % bandwidth. Middle channel

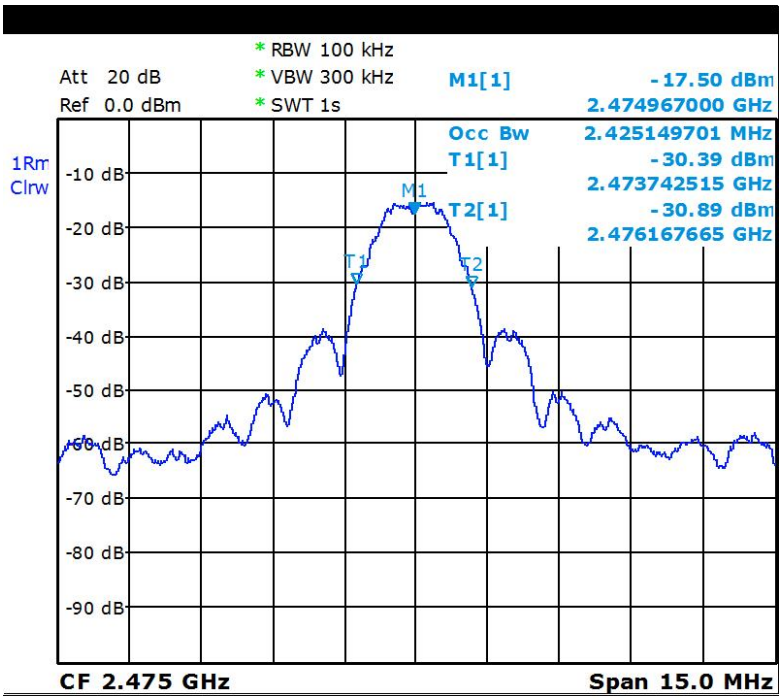

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Photo 0.3 99 % bandwidth. Highest channel

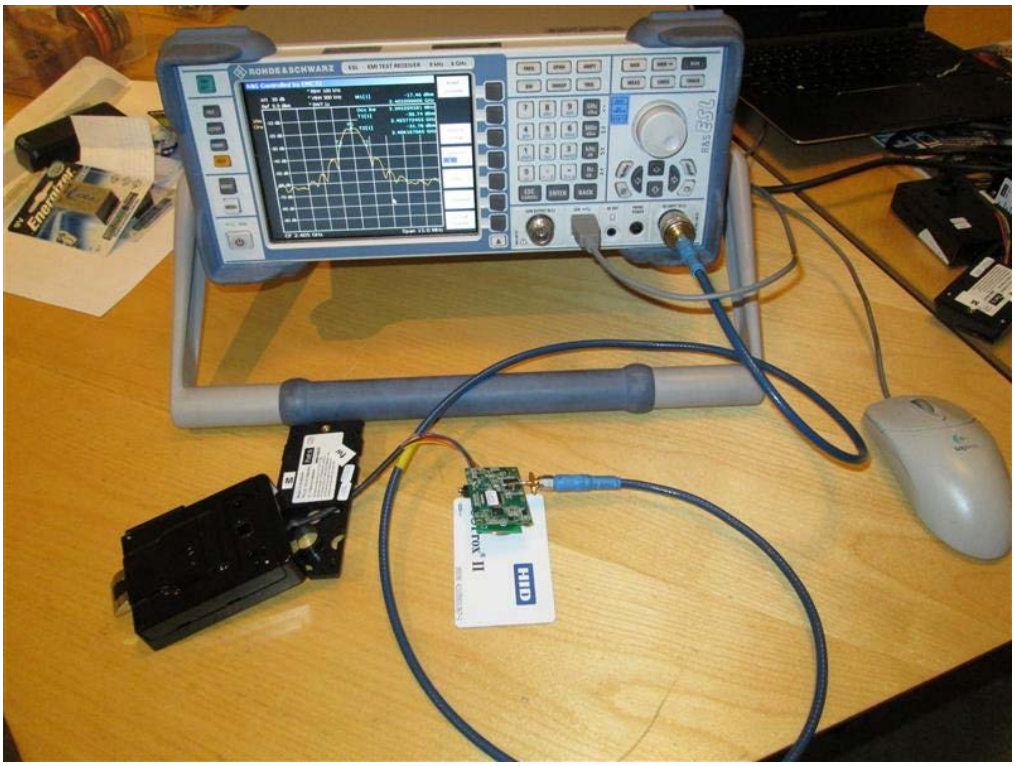


Photo 0.4 Test setup regarding measurement of occupied bandwidth

4.5 Measurement of band edge compliance

Test object	Server lock	Sheet	PROF-2
Type	KS100-640-SE2	Project no.	E704276
Serial no.	MAC adress: 06 05 F5	Date	24 Apr. 2015
Client	ASSA AB	Initials	LAJ
Specification	FCC CFR47 Part 15 subpart C §15.215(c)	Frequency	

Test method Characteristics	ANSI C63.10:2013 Complete search, Antenna distance 3 m.	Temperature Humidity	21 °C 41 % RH
Detector	Peak and average for 1GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMC Hall A Västerås Setup VEC1	Uncertainty	4.9 dB

Band Edge frequency [MHz]	Operating frequency [MHz]	Average / Peak	Fundamental field strengths [dBµV/m]	Fieldstrength at band edge [[dBµV/m]	Limit at Band Edge [dBµV/m]	Remarks
2400	2405	Average	78.8	32.0	54	
2400	2405	Peak	82.1	42.7	74	
2483.5	2475	Average	81.2	31.8	54	
2483.5	2475	Peak	84.6	43.1	74	

Test result The measured peak and average field strengths at the band edge are below the peak and average limits.

Test Port Enclosure

Test frequency 2405 and 2475 MHz

Test mode Continuous Tx - normal modulation -

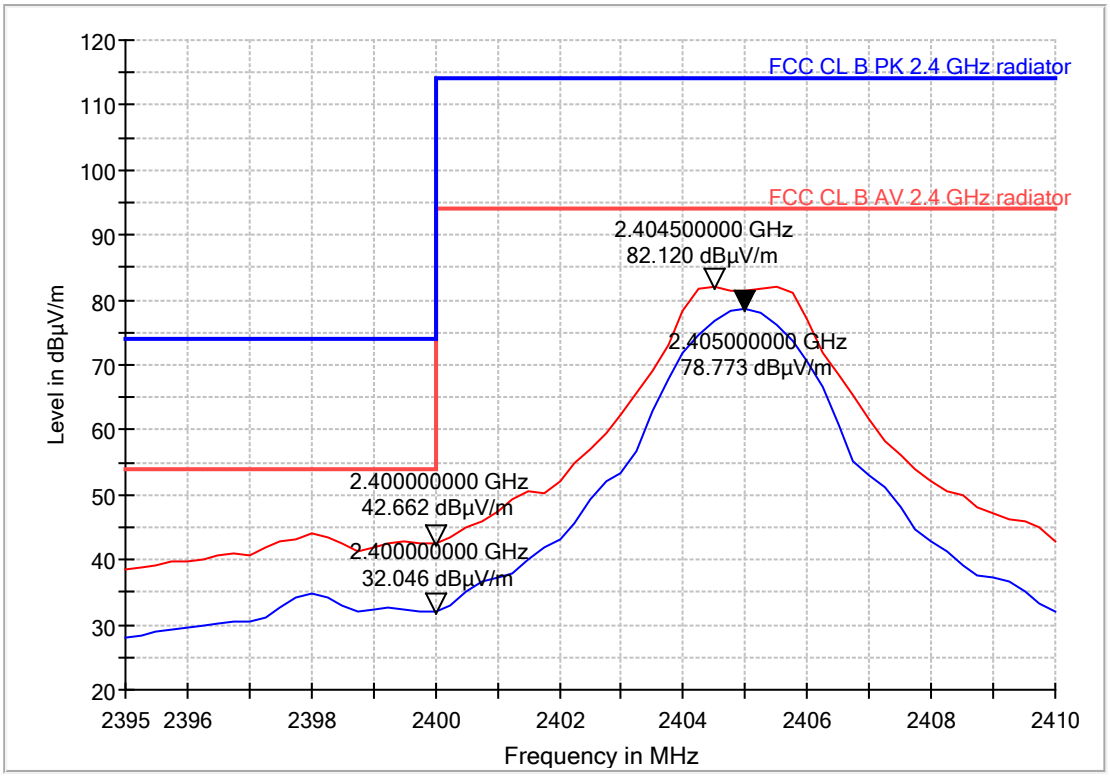
Condition Normal temperature and supply voltage.

Compliant Yes

Band edge compliance

Test Description:	Band edge compliance
Date:	2015-04-24
EUT Name:	KS100-SE
Manufacturer:	ASSA AB
Serial Number:	MAC adress: 06 05 F5
Operating Conditions:	Continous Tx
Test Site:	DELTA Development Technology AB
Operator Name:	Lars J
Test Specification:	FCC CFR47 part 15 subpart C. §15.249(a)
Comment:	Lowest and highest channel

RE 1G-14GHz FFT prescan Västerås



KS100-SE Lowest ch Pk
FCC CL B AV 2.4 GHz radiator
KS100-SE Lowest ch Av
FCC CL B PK 2.4 GHz radiator

Figure 4.5.1 Band edge compliance. Lowest channel

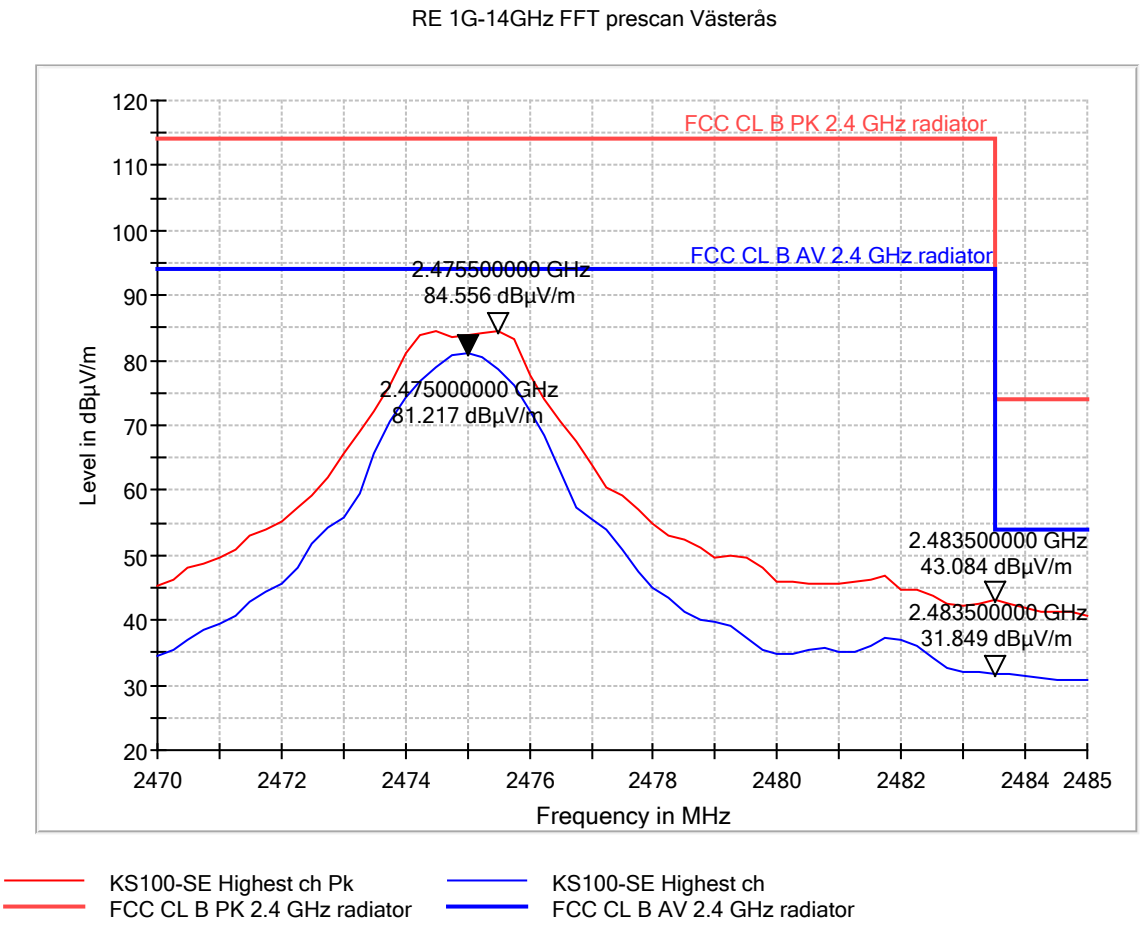


Figure 4.5.2 Band edge compliance. Highest channel

4.6 Measurement of field strength of fundamental

Test object	Server lock	Sheet	RE_Spur-3
Type	KS100-640-SE2	Project no.	E704276
Serial no.	MAC adress: 06 05 F5	Date	23 Apr. 2015
Client	ASSA AB	Initials	LAJ
Specification	FCC CFR47 Part 15 subpart C	Frequency	1-25 GHz

Test method Characteristics	ANSI C63.10:2013 Complete search, Antenna distance 3 m.	Temperature Humidity	21 °C 41 % RH
Detector	Peak for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMC Hall A Västerås Setup VEC1	Uncertainty	4.9 dB

Frequency [MHz]	Peak measurement [dBµV/m]	Peak limit [dBµV/m]	Average measurement [dBµV/m]	Average limit [dBµV/m]	Remarks
2405	82.1	114	78.8	94	
2445	83.3	114	79.8	94	
2475	84.6	114	81.2	94	

Test result	The measured peak field strengths are below the peak and average limits
Test Port	Enclosure
Test frequency	2445 MHz
Test mode	Continuous Tx - Normal modulation -
Condition	Normal temperature and supply voltage.
Compliant	Yes

Field strength of fundamental

Test Description:	Fieldstrength of fundamental
Date:	2015-04-23
EUT Name:	KS100-SE
Manufacturer:	ASSA AB
Serial Number:	MAC adress: 06 05 F5
Operating Conditions:	Continous Tx
Test Site:	DELTA Development Technology AB
Operator Name:	Lars J
Test Specification:	FCC CFR47 part 15 subpart C. §15.249(a)
Comment:	Lowest, middle and highest channel

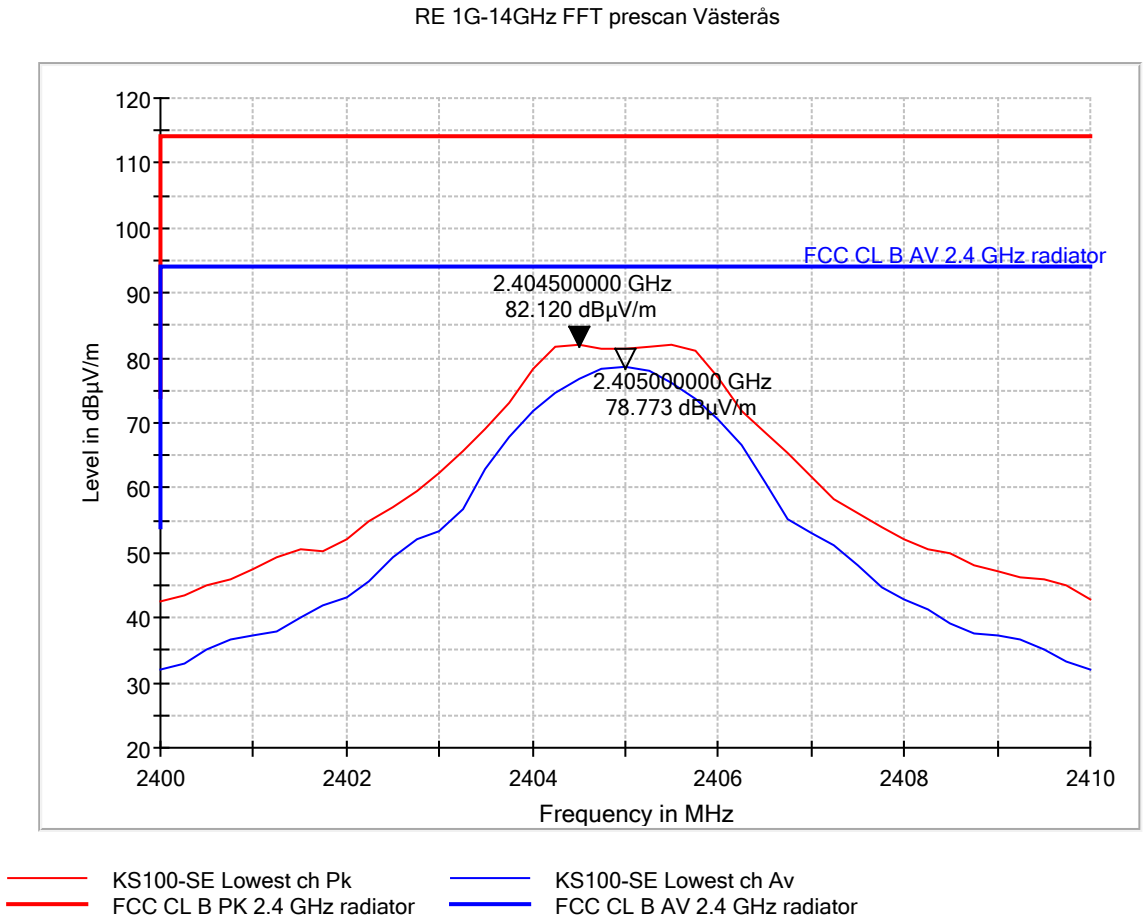


Figure 4.6.1 Field strength of fundamental. Lowest channel

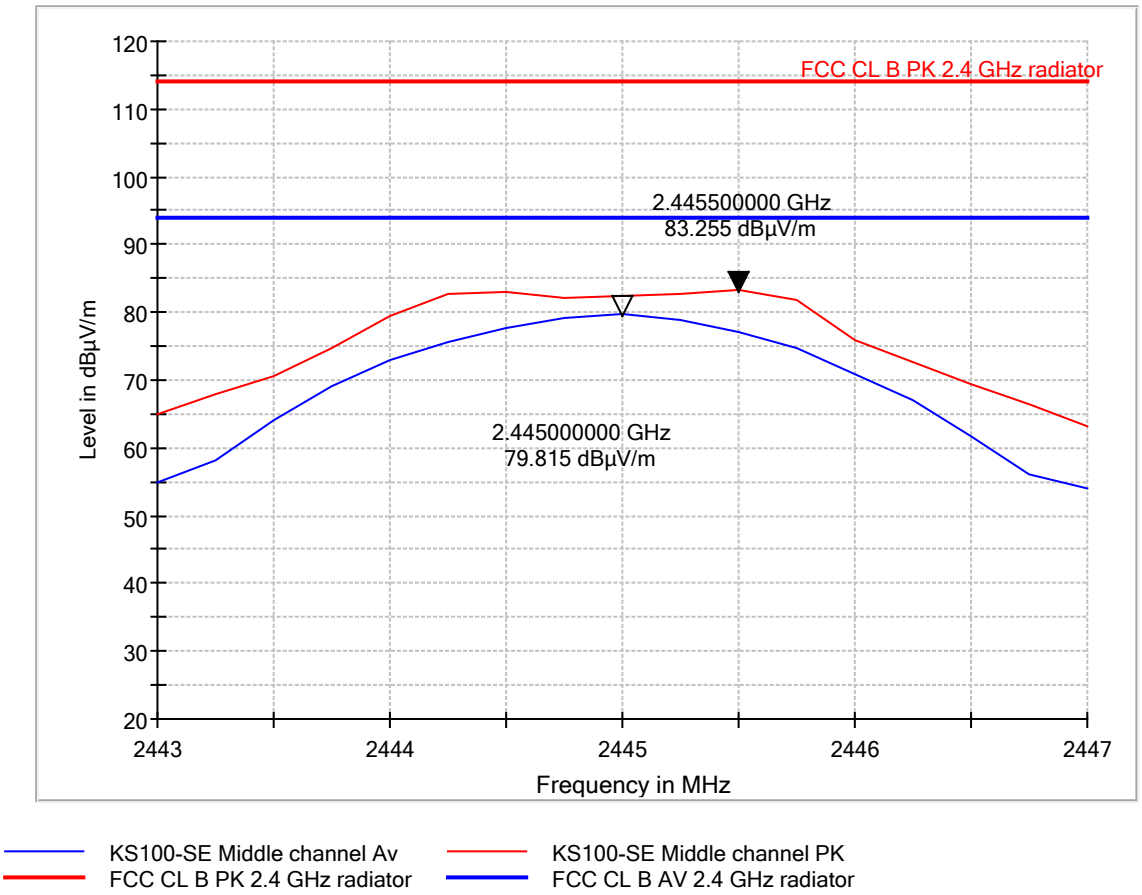


Figure 4.6.2 Field strength of fundamental. Middle channel

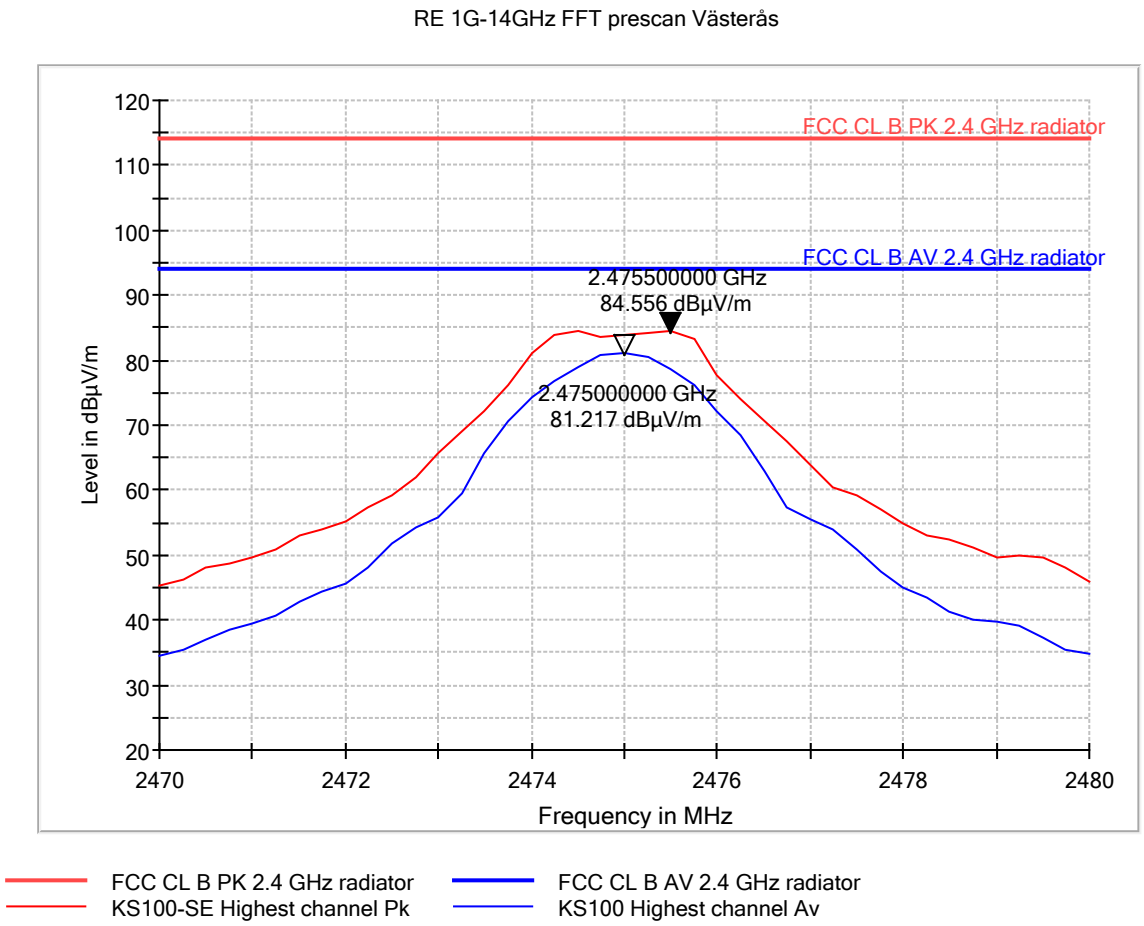


Figure 4.6.3 Field strength of fundamental. Highest channel

5. National registrations and accreditations

5.1 SWEDAC Accreditation

Organization: Swedish Board for Accreditation and Conformity Assessment - SWEDAC, see www.swedac.se and www.ilac.org

Registration Number: 1688

SWEDAC is part of ILAC (International Laboratory Accreditation Cooperation) including its MRA (Mutual Recognition Arrangement).

5.2 FCC Registrations

Organization: Federal Communications Commission, USA

Registration Number: 516880

Facilities: EMC chamber A 3 and 10 m

5.3 IC Registrations

Organization: Industry Canada, Certification and Engineering Bureau

Registration Number: 9347A

Facilities: EMC chamber A (9347A-1)

6. List of instruments

Setup VEA1						
Measurement of radio frequency voltage on mains						
Last Cal.	*Next Cal.*	*ID no.*	*Description*	*Manufacturer*	*Type no.*	*Setup uncertainty*
-	-	36070	Software	Rohde & Schwarz	EMC32 ver. 9.15.01	1.8 dB
2014-08	2015-09	36020	Measuring receiver	Rohde & Schwarz	ESU26	
2014-08	2015-09	IE-B919	LISN 2 x 10 A 250 V	Rohde & Schwarz	ESH3-Z5	
2014-04	2015-04	36078	Attenuator 6 dB 10 W	BIRD	10-A-MFB-06	
2014-06	2015-06	36062	Impulse Voltage Limiter	Rohde & Schwarz	ESH3-Z2	

Setup VEC1						
Measurement of radio frequency electromagnetic field						
Last Cal.	*Next Cal.*	*ID no.*	*Description*	*Manufacturer*	*Type no.*	*Setup uncertainty*
-	-	36070	Software	Rohde & Schwarz	EMC32 ver. 9.15.01	5.1 dB 30-1000 MHz (10 m) 6.2 dB 30-1000 MHz (3 m) 4.5 dB 1-6 GHz (3 m)
2014-08	2015-08	IE-B758	Preamplifier	HP	8447F	
2014-08	2015-08	36020	Measuring receiver	Rohde & Schwarz	ESU26	
2013-07	2015-07	IE-B928	Antenna Bilog	Chase	CBL6111A	
2013-07	2015-07	E-I839	Antenna Horn 1-18 GHz	ARA	DRG-118/A	
2014-05	2015-05	36021	Preamplifier	Quinstar	QLJ-01184040-J0	
-	-	36022	Power supply	DELTA	UVB	
2014-11	2015-11	36090	Antenna Horn 18-26.5 GHz	Com-Power Corp.	AH-826	
2015-03	2016-03	36091	Low Noise amplifier 18-26.5 GHz	Miteq	AMF-4F-18002650-20-10P-R	
2014-08	2015-08	36065	Measuring receiver	Rohde & Schwarz	ESL6	
-	-	36071	Controller	Maturo	NCD	
-	-	36072	Tilt antenna mast	Maturo	TAM 4.0-E	
-	-	-	Turntable	Heinrich Deisel	DT 440	

7. Revision

Rev. index	Description	Date/ Init
-	New document	12 May 2015/ LAJ
A	Standard references updated.	26 Aug 2015/ LAJ