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Test Report

Report Number: 145554E3

Applicant:

Tyco Electronics AMP GmbH

Manufacturer:

Tyco Electronics AMP GmbH

Equipment under Test (EUT):

TXM030S012PNP8A

DAkkS
Deutsche
Akkreditierungsstelle
D-PL-17186-01-01
D-PL-17186-01-02
D-PL-17186-01-03

Laboratory (CAB) accredited by
Deutsche Akkreditierungsstelle GmbH (DAkkS)
in compliance with DIN EN ISO/IEC 17025
under the Reg. No. D-PL-17186-01-02,
FCC Test site registration number 90877

REFERENCES

[1] ANSI C63.4-2009 American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

[2] FCC CFR 47 Part 18 (August 2014) Radio Frequency Devices

[3] FCC/OST MP-5 (1986) FCC methods of measurement of radio noise emissions from industrial, scientific and medical equipment.

TEST RESULT

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test.
The complete test results are presented in the following.

	Name	Signature	Date
Test engineer:	Thomas KÜHN		26 November 2014
Authorized reviewer:	Michael DINTER		26 November 2014

RESERVATION

This test report is only valid in its original form.

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1 Identification

1.1 Applicant

Name:	Tyco Electronics AMP GmbH
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Country:	Germany
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eMail Address:	rhossaini@te.com
Applicant represented during the test by the following person:	Mr. Wouter HEBBEN (wouter.hebben@te.com)

1.2 Manufacturer

Name:	Tyco Electronics AMP GmbH
Address:	Pfnorstr.1 64293 Darmstadt
Country:	Germany
Name for contact purposes:	Mr. Reza Hossaini
Phone:	+49 6151 607 3464
Fax:	+49 6151 607 1472
eMail Address:	rhossaini@te.com
Applicant represented during the test by the following person:	Mr. Wouter HEBBEN (wouter.hebben@te.com)

1.3 Test laboratory

The tests were carried out at:

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Germany

accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025 under Reg. No. D-PL-17186-01-02, FCC Test site registration number 90877.

1.4 EUT (Equipment Under Test)

Equipment under test: *	Short Range Device
Model name: *	TXM030S012PNP8A
Type of equipment: *	Contactless connectivity System
Serial number: *	2287598 (TX)
PCB identifier: *	M30 Tx V01R05
Hardware version: *	A1
Software version: *	V01R05
Highest internal frequency: *	16 MHz
FCC ID	2ADK2-ARISOTX

*: Declared by the applicant.

1.5 Technical data of equipment

Rated RF output power: *	12.5 W					
Emission classification: *	NONE (continuous wave emission)					
Antenna type: *	Integral					
Power supply: *	U_{nom}=	24.0 V DC	U_{min}=	21.6 V DC	U_{max}=	26.4 V DC
Type of modulation: *	None					
Operating frequency range:*	196.2 kHz					
Number of channels: *	1					
Temperature range: *	-20 °C to +55 °C					

*: Declared by the applicant.

The following external I/O cables were used:

Identification	Connector		Length
	EUT	Ancillary	
TX	12 pole M12 connector	12 pole M12 connector	3 m
RX	12 pole M12 connector	12 pole M12 connector	3 m

*: Length during the test if no other specified.

1.6 Dates

Date of receipt of test sample:	13 October 2014
Start of test:	13 October 2013
End of test:	21 October 2014

2 Operational states

All tests were carried out with unmodified samples, which were operating in normal operation mode. The ARISO system consists of two parts:

- EUT:
  A 200 kHz transmitter (TXM030S012PNP8A). This device transmits an unmodulated carrier and will be supplied with 24 V DC. It contains also a 2.483 GHz receiver. As declared by the applicant, the 200 kHz transmission will be stopped, if no 2.483 GHz signal is received.
- Auxiliary equipment:
  A 2.483 GHz transmitter (RXM030S012PNP8A). This device will be powered by the 200 kHz carrier and transmits data to the 200 kHz transmitter. It will be not able to transmit, if no 200 kHz signal is received.

Because the functionality from the other system part is necessary for operation both devices could only tested together. Therefore no separate measurements of the receiver emissions could be carried out, because the receiver needs the signal from the collocated simultaneously operating transmitter.

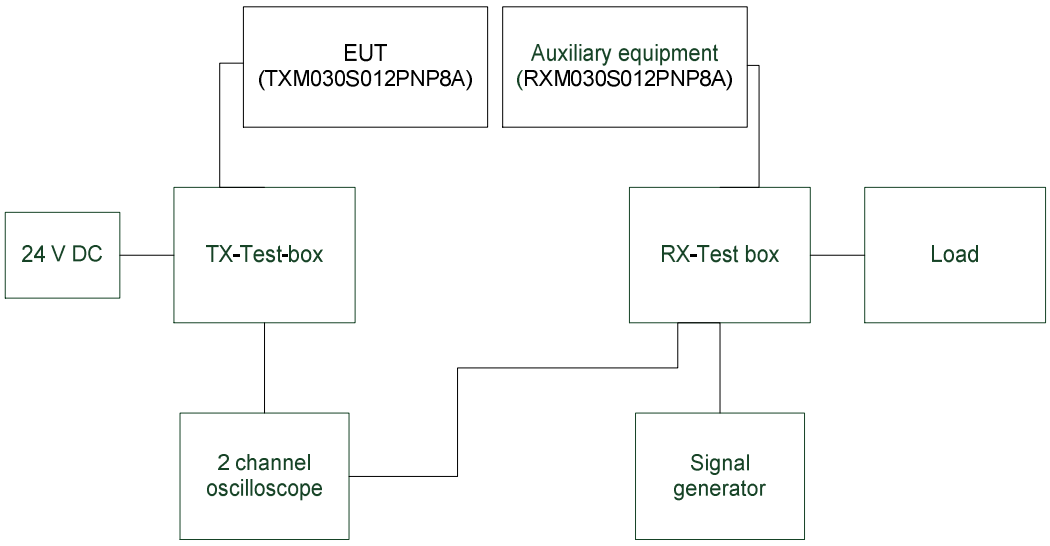
The measurement results of the auxiliary equipment (2.483 GHz transmitter) are not object of this test report, they will be documented in a separate test report (F145554E2).

Both parts of the system were positioned in its maximum distance to each other (7 mm). With higher distances both parts of the system will cease function.

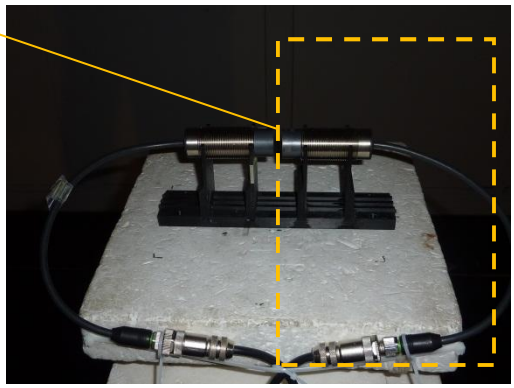
During all tests the EUT part (TXM030S012PNP8A) of the system connected to a test-box and was supplied with 24 V DC. The received data was monitored on channel one of a two channel oscilloscope.

The auxiliary part (RXM030S012PNP8A) of the system was also connected to a test box. One input channel of the auxiliary equipment was connected via the test box to a signal generator. In order to simulate the maximum power consumption of the auxiliary equipment part it was connected to a programmable load. The signal of the signal generator was displayed on the second channel of the two channel oscilloscope.

The drawing below shows the setup schematically:



Physical boundaries of the EUT:



3 Additional information

As stated by the applicant, the ARISO system is available in two different versions. One version has a four pole connector and one a 12 pole connector. Both versions are using the same PCB; the only difference is the use of different connectors. All tests were carried out with the 12 pole version of the system, because it was regarded as worst case configuration concerning the power consumption and transmitted data rate.

As declared by the applicant the following FCC IDs / IC were used:

Modelname	Version	FCC ID	IC
TXM030S012PNP2A	Four pole	2ADK7-ARISOTX	12496A-ARISOTX
TXM030S012PNP8A	12 pole		
RXM030S012PNP2A	Four pole	2ADK7-ARISORX	12496A-ARISORX
RXM030S012PNP8A and RXM030S012PNP8B	12 pole		

4 Overview

Application	CFR section	Status	Refer page
Field strength limits (Spurious and harmonic emissions)	18.305	Passed	8 et seq.
AC line conducted emissions	18.307	Passed	12 et seq.

5 Test results

5.1 Radiated emissions

5.1.1 Method of measurement (Radiated emissions)

The measurement techniques which will be used by the FCC to determine compliance with the technical requirements of this part are set out in FCC Measurement Procedure MP–5, ‘‘Methods of Measurements of Radio Noise Emissions from ISM equipment’’. Although the procedures in MP–5 are not mandated, manufacturers are encouraged to follow the same techniques which will be used by the FCC.

Section 18.309 Frequency range of measurements:

For field strength measurements:

Frequency band in which device operates (MHz)	Range of frequency measurements	
	Lowest frequency	Highest frequency
Below 1.705	Lowest frequency generated in the device, but not lower than 9 kHz.	30 MHz.
1.705 to 30	Lowest frequency generated in the device, but not lower than 9 kHz.	400 MHz.
30 to 500	Lowest frequency generated in the device or 25 MHz, whichever is lower.	Tenth harmonic or 1,000 MHz, whichever is higher.
500 to 1000	Lowest frequency generated in the device or 100 MHz, whichever is lower.	Tenth harmonic.
Above 1000	do	Tenth harmonic or highest detectable emission.

OET MP-5
Section 2.2.2
For radio noise meters or spectrum analysers which include weighting circuits, the detector function shall be linear. The detector function selector shall be set to average, unless otherwise specified for a given device. For RF lighting devices, the measuring instrument shall have the detector function set to the CISPR quasi-peak function. The 6 dB bandwidth of the measuring instrument shall not be less than:

- 200 Hz for measurements below 150 kHz
- 9 kHz for measurements from 150 kHz to 30 MHz
- 100 kHz for measurements from 30 MHz to 1000 MHz
- 1 MHz for measurements above 1000 MHz

Post detector video filters, if used, shall be wide enough not to affect the peak detector reading. Alternatively, field strength meters and spectrum analysers without weighting circuits may be employed, provided measurements are made on the peak basis and recorded as observed.

OET MP-5
Section 2.2.6 Antenna-to-test unit distance

Measurements shall be made at the distance at which the limits are specified, to extent possible. […] The Commission as an alternative shall accept measurements at a closer fixed distance, provided l/d is used as an attenuation law factor (where d is the distance measured in appropriate units). […] When measurements were carried out at other distances, an extrapolation factor of 20 dB/decade was used.

Test charateristics

In order to find emissions caused by the EUT, a preliminary measurement inside a fully anechoic chamber was carried out. A final measurement on the required test site was carried out on these frequencies.

Preliminary measurement:

Frequency range	Receiver bandwidth	Test distance	Test site	Antenna height
9 kHz to 150 kHz	200 Hz	3 m	Fully anechoic chamber	1 m
150 kHz to 30 MHz	9 kHz	3 m	Fully anechoic chamber	1 m
30 MHz to 1 GHz	100 kHz	3 m	Fully anechoic chamber	1 m

Final measurement:

Frequency range	Receiver bandwidth	Test distance	Test site	Antenna height
9 kHz to 150 kHz	200 Hz	3 m	Outdoor test site	Arround 2 m
150 kHz to 30 MHz	9 kHz	3 and 30 m	Outdoor test site	Arround 2 m
30 MHz to 1 GHz	100 kHz	10 m	Open area test site	1 m to 4 m

1.1.1 Test results (radiated emissions)

Ambient temperature	15 °C	Relative humidity	72 %

Position of EUT: The EUT was set-up on a non-conducting support of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cable of the EUT runs vertically to the false floor. For further information of the EUT set-up refer to the pictures in annex A of this test report.

Test record: During the test, the EUT transmits continuously. All results are shown in the following.

Calculation of the filed strength limit:

With a rated output power of 12.5 W the the field strength limit according to CFR47 §18.305 is 15 µV/m at 300 m distance.

Field strength calculation:

All measurements were made with closer measurement distances than 300 m. Therefore the measured field strength was corrected by a distance correction factor was follows:

$F_{SL} = F_{ST} + DC$

Where
F_{SL} = Field strength in dBµV/m;
F_{ST} = Field strength at measurement distance in dBµV/m
DC = Distance correction factor in dB, which is calculated with
DC = 20 log (test distance in m / specified distance in m)
= -40 dB (3 m);
= -29.5 dB (10 m)
= -20 dB (30 m)

So the result was calculated as following:

Result [dBµV/m] = reading [dBµV] + cable loss [dB] + antenna factor [dB/m] + DC [dB]

During the measurement the EUT was supplied by 24 DC.

Wanted signal field strength (measuring distance 30 m)								
Frequency kHz	Receiver bandwidth / Dectector	Readings dBµV	Antenna factor dB/m	Cable loss dB	DC dB	Result dBµV/m	Limit dBµV/m	Margin dB
196.2 *	9 kHz / Average	19.0	20 (incl. cable loss)	-	-20	19.0	23.5	4.5
Measurement uncertainty				+2.2 dB / -3.6 dB				

The following emissions below 30 MHz were measured with a 3 m distance, because they are too low to be detected at wider distances:

Spurious emissions below 30 MHz (measuring distance 3 m)								
Frequency kHz	Receiver bandwidth / Dectector	Readings dBµV	Antenna factor dB/m	Cable loss dB	DC dB	Result dBµV/m	Limit dBµV/m	Margin dB
588.4	9 kHz / Average	21.4	20 (incl. cable loss)	-	-40.0	1.4	23.5	22.1
980.8	9 kHz / Average	13.2	20 (incl. cable loss)	-	-40.0	-6.8	23.5	30.3
1373.4	9 kHz / Average	8.1	20 (incl. cable loss)	-	-40.0	-11.9	23.5	35.4
Measurement uncertainty				+2.2 dB / -3.6 dB				

Spurious emissions above 30 MHz (measuring distance 10 m)								
Frequency MHz	Receiver bandwidth / Dectector	Readings dBµV	Antenna factor dB/m	Cable loss dB	DC dB	Result dBµV/m	Limit dBµV/m	Margin dB
52.580	100 kHz / Average	13.5	7.9	0.8	-29.5	-7.3	23.5	30.8
90.257	100 kHz / Average	8.2	9.9	1.1	-29.5	-10.3	23.5	33.8
127.925	100kHz / Average	-0.2	12.3	1.3	-29.5	-16.1	23.5	39.6
197.022	100 kHz / Average	19.2	8.9	1.5	-29.5	0.1	23.5	23.4
253.494	100 kHz / Average	6.9	12.4	1.8	-29.5	-8.4	23.5	31.9
312.375	100 kHz / Average	-4.8	13.0	1.9	-29.5	-19.4	23.5	42.9
Measurement uncertainty				+2.2 dB / -3.6 dB				

Test: Passed

Test equipment used (refer clause 6):

14 – 21, 29, 31 – 36, 54, 142

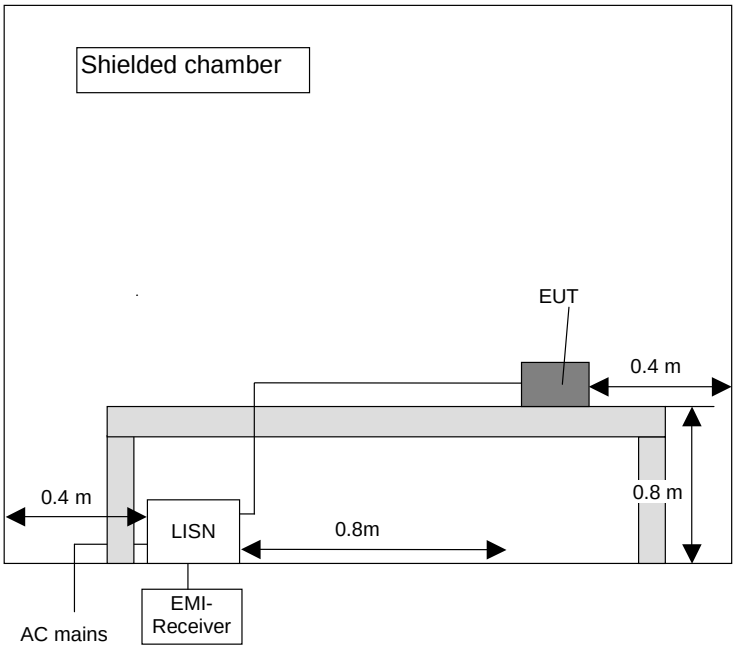
5.2 Conducted emissions on power supply lines (150 kHz to 30 MHz)

1.1.2 Method of measurement

This test will be carried out in a shielded chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm above the ground plane. Floor-standing devices will be placed directly on the ground plane. The set-up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

The frequency range 150 kHz to 30 MHz will be measured with an EMI Receiver set to MAX Hold mode with peak and average detector and a resolution bandwidth of 9 kHz. A scan will be carried out on the phase (or plus pole in case of DC powered devices) of the AC mains network. If levels detected 10 dB below the appropriable limit, this emission will be measured with the average and quasi-peak detector on all lines.

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz



1.1.3 Test results (conducted emissions on power supply lines)

Ambient temperature	21 °C	Relative humidity	52 %

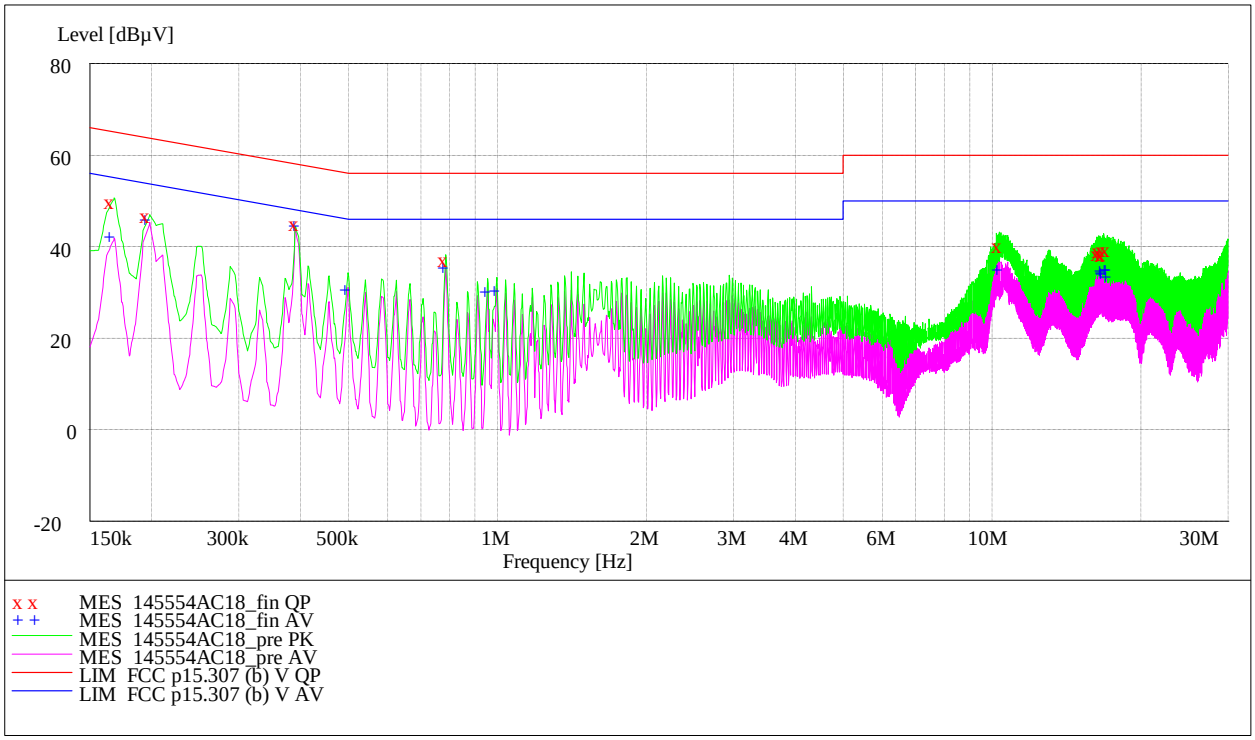
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.

Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: The EUT was supplied with 24 V DC by an AC/DC adaptor type Mini PS-100-240AC/24DC/1.3 from Phoenix Contact, which was connected to an AC mains network with 120 VAC / 60 Hz.

The curves in the diagram only represent for each frequency point the maximum measured value of all preliminary measurements, which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by an “x” and the average measured points by a “+”.



Data record name: 145554AC18

Result measured with the quasi-peak detector (marked by an x):

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.166200	50.5	1.3	65.1	14.7	N	GND
0.195900	47.3	1.0	63.8	16.5	N	GND
0.392100	45.6	0.9	58.0	12.4	N	GND
0.784500	37.8	0.8	56.0	18.2	N	GND
10.355100	40.7	1.4	60.0	19.3	L1	GND
16.403100	39.1	2.0	60.0	20.9	N	FLO
16.526400	39.7	2.0	60.0	20.3	N	FLO
16.692900	38.8	2.0	60.0	21.2	N	FLO
16.734300	38.9	2.0	60.0	21.1	N	FLO
16.774800	40.0	2.0	60.0	20.0	N	FLO
17.106000	39.9	2.0	60.0	20.1	N	FLO
Measurement uncertainty			+6.7 dB / -6.0 dB			

Result measured with the average detector (marked by a +):

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.166200	42.7	1.3	55.1	12.4	N	GND
0.195900	46.5	1.0	53.8	7.3	N	GND
0.392100	45.2	0.9	48.0	2.8	N	GND
0.497400	31.1	0.8	46.0	14.9	N	GND
0.784500	36.0	0.8	46.0	10.0	N	GND
0.953700	30.7	0.8	46.0	15.3	N	FLO
0.995100	30.9	0.7	46.0	15.1	N	GND
10.355100	35.6	1.4	50.0	14.4	L1	GND
16.650600	35.2	2.0	50.0	14.8	N	FLO
16.692000	34.8	2.0	50.0	15.2	N	FLO
16.733400	34.6	2.0	50.0	15.4	N	FLO
17.063700	35.5	2.0	50.0	14.5	N	FLO
17.105100	35.5	2.0	50.0	14.5	N	FLO
17.147400	34.0	2.0	50.0	16.0	N	FLO
Measurement uncertainty			+6.7 dB / -6.0 dB			

Test: Passed

Test equipment used (refer clause 6):

1 - 4, 20

6 Test equipment and ancillaries used for tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
1	Shielded chamber M4	-	Siemens AG	B83117-S1-X158	480088	Weekly verification (system cal.)	
2	EMI Receiver	ESIB 26	Rohde & Schwarz	1088.7490	481182	03/21/2014	03/2016
3	LISN	NSLK8128	Schwarzbeck	8128161	480138	12/20/2013	12/2014
4	High pass filter	HR 0.13-5ENN	FSY Microwave Inc.	DC 0109 SN 002	480340	Weekly verification (system cal.)	
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
15	EMI Receiver	ESIB 26	Rohde & Schwarz	1088.7490	481182	03/21/2014	03/2016
16	Controller	HD100	Deisel	100/670	480139	-	-
17	Turntable	DS420HE	Deisel	420/620/80	480087	-	-
18	Antenna support	AS615P	Deisel	615/310	480086	-	-
19	Antenna	CBL6111 D	Chase	22921	480674	08/29/2014	08/2017
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	-
21	Outdoor test site	-	Phoenix Test-Lab	-	480293	-	-
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	02/26/2014	02/2016
32	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
33	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
34	Antenna support	AS615P	Deisel	615/310	480187	-	-
35	Antenna	CBL6112 B	Chase	2688	480328	04/14/2014	04/2017
36	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	02/18/2014	02/2016
54	Measuring receiver	ESPC	Rohde & Schwarz	843756/006	480150	02/24/2014	02/2016
142	RF-cable No. 36	Sucoflex 106B	Huber + Suhner	-	480865	Weekly verification (system cal.)	

7 Report history

Report Number	Date	Comment
F145554E3	26 November 2014	Document created
-	-	-
-	-	-

8 List of annexes

Annex A	TEST SETUP PHOTOGRAPHS	8 pages

145554_1.JPG: RXM030S012PNP8A and TXM030S012PNP8A, test set-up fully anechoic chamber
145554_2.JPG: RXM030S012PNP8A and TXM030S012PNP8A, test set-up fully anechoic chamber
145554_3.JPG: RXM030S012PNP8A and TXM030S012PNP8A, test set-up fully anechoic chamber
145554_4.JPG: RXM030S012PNP8A and TXM030S012PNP8A, test set-up fully anechoic chamber
145554_10.JPG: RXM030S012PNP8A and TXM030S012PNP8A, test set-up outdoor test site (3 m)
145554_14.JPG: RXM030S012PNP8A and TXM030S012PNP8A, test set-up outdoor test site (30 m)
145554_8.JPG: RXM030S012PNP8A and TXM030S012PNP8A, test set-up open area test site
145554_15.JPG: RXM030S012PNP8A and TXM030S012PNP8A, test set-up shielded chamber

Annex B	EXTERNAL PHOTOGRAPHS	3 pages

145554_o.JPG: TXM030S012PNP8A, front view
145554_p.JPG: TXM030S012PNP8A, side view
145554_r.JPG: TXM030S012PNP8A, rear view

Annex C	INTERNAL PHOTOGRAPHS	4 pages

145554_j.JPG: TXM030S012PNP8A, internal view
145554_l.JPG: TXM030S012PNP8A, PCB, top view
145554_n.JPG: TXM030S012PNP8A, PCB, bottom view
145554_i.JPG: TXM030S012PNP8A, antenna view