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Test Report

Report Number: F151497E8

Applicant:

Dräger Safety AG & Co. KGaA

Manufacturer:

Dräger Safety AG & Co. KGaA

Equipment under Test (EUT):

FPS COM 7000

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

References

[1] **ANSI C63.10: 2013** American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

[2] **FCC CFR 47 Part 15** Radio Frequency Devices

[2] **RSS-247 Issue 1 (May 2015)** Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

[3] **RSS-Gen Issue 4 (November 2014)** General Requirements for Compliance of Radio Apparatus

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.

Test engineer:	Thomas KÜHN		12/17/2015
	Name	Signature	Date
Authorized reviewer:	Bernd STEINER		12/17/2015
	Name	Signature	Date

This test report is only valid in its original form.

The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT NUMBER.

This test report is valid in hardcopy form as well as in electronic form.

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1 Identification

1.1 Applicant

Name:	Dräger Safety AG & Co. KGaA
Address:	Revalstr. 1 23560 Lübeck
Country:	Germany
Name for contact purposes:	Mr. Sebastian KLEINER
Phone:	+49 451 – 882 – 19 51
Fax:	+49 451 – 882 – 20 80
eMail Address:	Sebastian.Kleiner@draeger.com
Applicant represented during the test by the following person:	-

1.2 Manufacturer

Name:	Dräger Safety AG & Co. KGaA
Address:	Revalstr. 1 23560 Lübeck
Country:	Germany
Name for contact purposes:	Mr. Sebastian KLEINER
Phone:	+49 451 – 882 – 19 51
Fax:	+49 451 – 882 – 20 80
eMail Address:	Sebastian.Kleiner@draeger.com
Manufacturer represented during the test by the following person:	-

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 and Industry Canada Test site registration IC3469A-1.

1.4 EUT (Equipment Under Test)

Test object: *	Cordless audio device for respirator masks
Model name / HVIN: *	FPS COM 7000
FCC ID:*	X6O-FPSCOM7000
IC: *	5895F-FPSCOM7000
Serial number: *	ARHE-0002
PCB identifier: *	Right main: 8325042-04, Left Main: 8325132-03, Tactical Radio: 8325102-04, UI PTT: 8325172-03, UI ON OFF: 8325182-03, UI CH: 8325192-03, Main2ACC: 8325162-02
Hardware version: *	Right main: 8325041-05,8325043-02 Left Main: 8325131-04, 8325133-02, Tactical Radio: 8325103-03, 8325101-04, UI PTT: 8325171-04, UI ON OFF: 8325181-03, UI CH: 8325191-03, Main2ACC: 8325161-02
Software version / FVIN: *	R61407-00 (DSP 2.2), R61409-00 (µC1.19), R61514-00 (TR1.10)
Lowest internal frequency	12 MHz

1.5 Technical data of equipment

Channel 1	RX:	903.500 MHz	TX:	903.500 MHz
Channel 41	RX:	915.150 MHz	TX:	915.150 MHz
Channel 81	RX:	926.800 MHz	TX:	926.800 MHz

Rated RF output power: *	10 dBm (e.r.p.)					
Number of channels	81					
Channel spacing	291,25 kHz					
Antenna type: *	Internal only					
Antenna gain: *	0 dBi					
Antenna connector: *	None (internal antenna only)					
Adaptive frequency agility: *	No					
Modulation: *	4GFSK / FHSS					
Supply Voltage: *	U_{nom}=	3.0 V DC	U_{min}=	2.3 V DC	U_{max}=	3.3 V DC
Type of power supply: *	Two batteries AA size					
Temperature range: *	-35 °C to +60 °C (operating temperature range)					
Ancillary used for test:	-					

* declared by the applicant.

The following external I/O cables were used:

Identification	Connector		Length *
	EUT	Ancillary	
None	None	-	-
-	-	-	-

*: Length during the test if no other specified.

1.6 Dates

Date of receipt of test sample:	08/25/2015
Start of test:	08/26/2015
End of test:	09/08/2015

2 Operational states

The EUT is a cordless audio device used in combination with a respirator masks. All tests were carried out with an unmodified EUT.

The EUT is a composite device, which contains two radio units:
- The left hand unit is a transceiver unit and
- the right hand unit is a receiver unit.

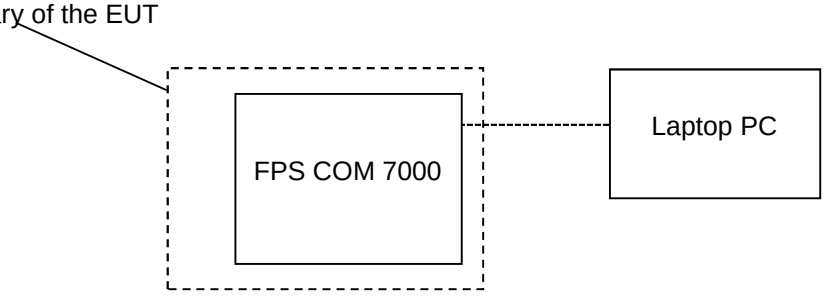
Object of this test report is the transceiver (left hand) unit of the EUT. The results of the radiated emission measurement of the receiver (right hand) unit are documented under the PHOENIX-Testlab GmbH test report reference F151497E9.

The operation mode could be chosen with the help of a laptop computer with a test-software, communicates with the EUT via a program interface, connected to the system connector of the EUT. This connection was not maintained during the tests, the program interface was removed.

The following test modes were adjusted during the tests:

Test items	Operation	Operation mode
20 dB bandwidth	Transmit with normal modulation on channel 1, 41 or 81	1, 2, 3
Carrier frequency separation	Transmit with normal modulation on channel 1, 41 or 81	1, 2, 3
Number of hopping channels	Transmit with normal modulation, hopping on all channels	4
Dwell time	Transmit with normal modulation on channel 1, 41 or 81	4
Maximum peak output power	Transmit with normal modulation on channel 1, 41 or 81	1, 2, 3
Radiated emissions (transmitter)	Transmit with normal modulation on channel 1, 41 or 81	1, 2, 3
Radiated emissions (receiver)	Receive on channel 1, 41 or 81	5, 6, 7

Physical boundary of the EUT



3 Additional information

Because the EUT has no antenna connector and also no internal rf connector, the output power of the EUT was measured as e.r.p. value instead of the measuring the conducted peak output power. Measurements of the 20 dB bandwidth (clause 5.1), carrier frequency separation (clause 5.2), the number of hopping channels (clause 5.3) and dwell time (clause 5.4) were carried out on with the help of a test fixture.

During the tests the EUT was not labelled as required by FCC / IC.

Because the antenna of the EUT is glued, some internal photographs were supplied by the applicant or made from PCBs supplied by the applicant in order to keep the tested sample operational.

4 Overview

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS 247, Issue 1 [3] or RSS-Gen, Issue 4 [4]	Status	Refer page
20 dB bandwidth	General	15.247 (a) (1) (i)	5.1 (1) [3]	Passed	8 et seq.
Carrier frequency separation	General	15.247 (a) (1) (i)	5.1 (3) [3]	Passed	11 et seq.
Number of hopping channels	902.0 – 928.0	15.247 (a) (1) (i)	5.1 (3) [3]	Passed	14 et seq.
Dwell time	902.0 – 928.0	15.247 (a) (1) (i)	5.1 (3) [3]	Passed	16 et seq.
Maximum peak output power	902.0 – 928.0	15.247 (b) (2)	5.4 (1) [3]	Passed	19 et seq.
Radiated emissions (transmitter)	0.009 - 10,000	15.247 (d) 15.205 (a) 15.209 (a)	5.5 [3] 8.9 [4]	Passed	21 et seq.
Radiated emissions (receiver)	30.0 – 5,000	15.109 (a)	7.1.2 [4]	Not applicable *	
Conducted emissions on supply line	0.15 - 30	15.207 (a)	8.8 [4]	Not applicable **	
Antenna requirement	-	15.203 [2]	-	Passed ***	

*: Not applicable, because of a collocated permanently operating transmitter.
**: Not applicable, because the EUT is intended to be used with batteries and has no charging possibilities.
***: Integrated antenna only, requirement fulfilled.

5 Test results

5.1 20 dB bandwidth

5.1.1 Method of measurement (20 dB bandwidth)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on and the hopping function has to be disenabled, the transmitter shall work with its maximum data rate.

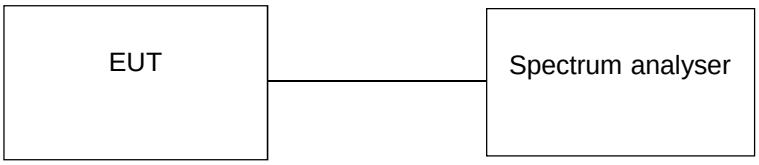
The following spectrum analyser settings according to [1] shall be used:

- Span: App. 2 to 5 times the 20 dB bandwidth, centred on the actual hopping channel.
- Resolution bandwidth: 1 % to 5 % of the 20 dB bandwidth.
- Video bandwidth: three times the resolution bandwidth.
- Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set on the signal peak. The first display line has to be set on this value. The second display line has to be set 20 dB below the first line (or the peak marker). The frequency lines shall be set on the intersection points between the second display line and the measured curve.

The measurement will be performed at the upper, the lower end and the middle of the assigned frequency band.

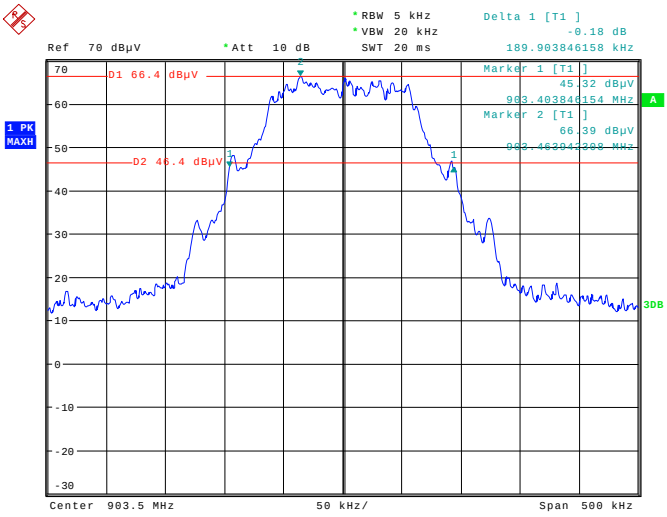
Test set-up:



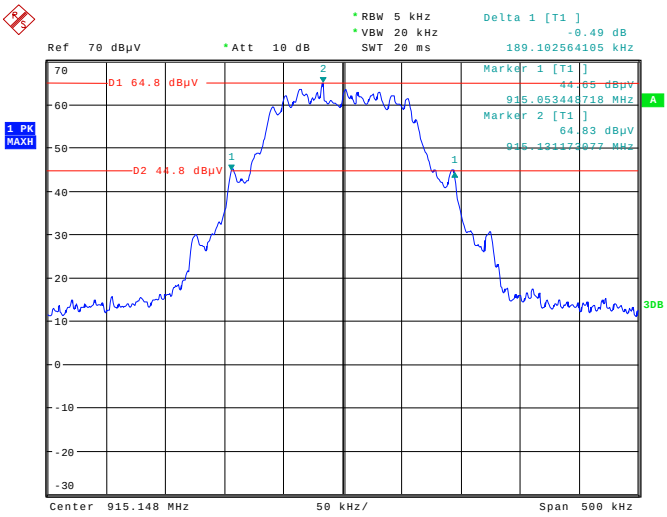
5.1.2 Test results (20 dB bandwidth)

Ambient temperature	22 °C		Relative humidity	67 %

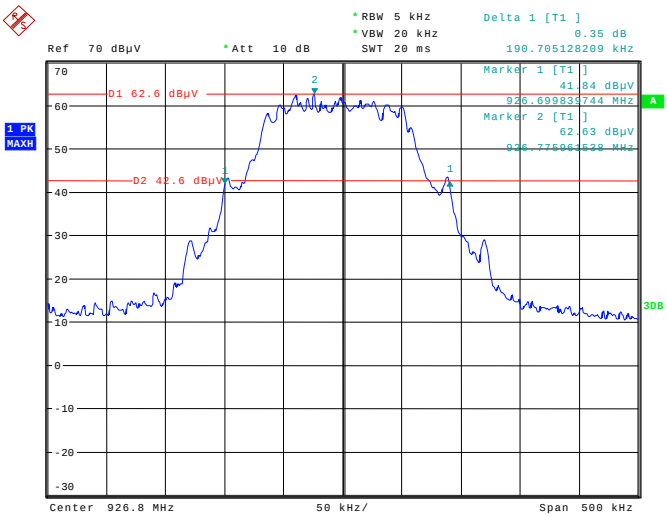
151497_223.wmf: 20 dB bandwidth at the lower end of the assigned frequency band:



151497_224.wmf: 20 dB bandwidth at the middle of the assigned frequency band:



151497_225.wmf: 20 dB bandwidth at the upper end of the assigned frequency band:



Channel number	Channel frequency [MHz]	20 dB bandwidth [kHz]
1	903.5000	189.904 kHz
41	915.150	189.103 kHz
81	926.800	190.705 kHz
Measurement uncertainty		+0.66 dB / -0.72 dB

Test equipment used (see chapter 6):

26, 30

5.2 Carrier frequency separation

5.2.1 Method of measurement (carrier frequency separation)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on and the hopping function has to be enabled.

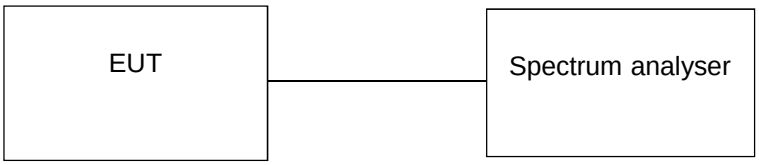
The following spectrum analyser settings according to [1] shall be used:

- Span: Wide enough to capture the peaks of two adjacent channels.
- Resolution bandwidth: Start with the Resolution bandwidth set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
- Video bandwidth ≥ Resolution bandwidth.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.

After trace stabilisation the marker and the delta marker function will be used to determine the separation between the peaks of two adjacent channel signals.

The measurement will be performed at the upper, the lower end and the middle of the assigned frequency band.

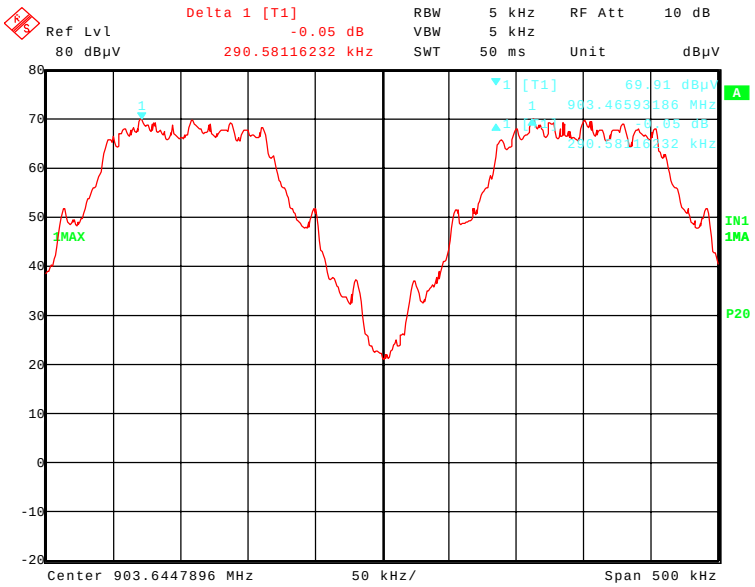
Test set-up:



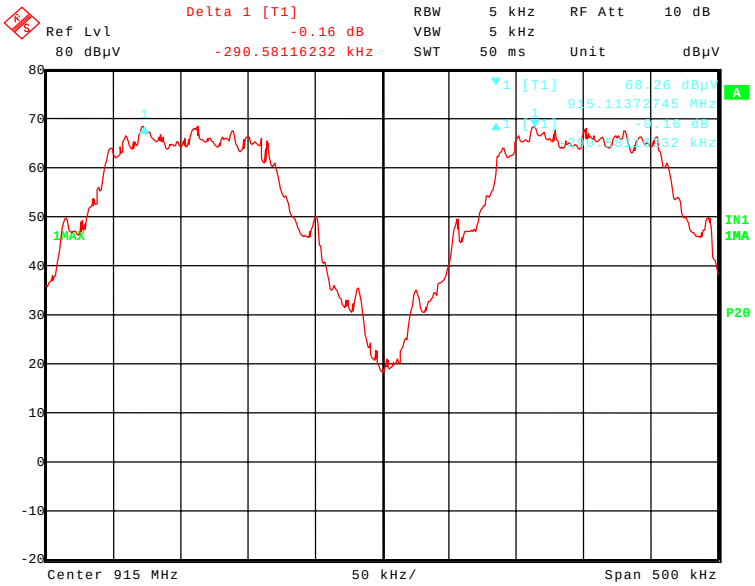
5.2.2 Test results (carrier frequency separation)

Ambient temperature	22 °C		Relative humidity	67 %

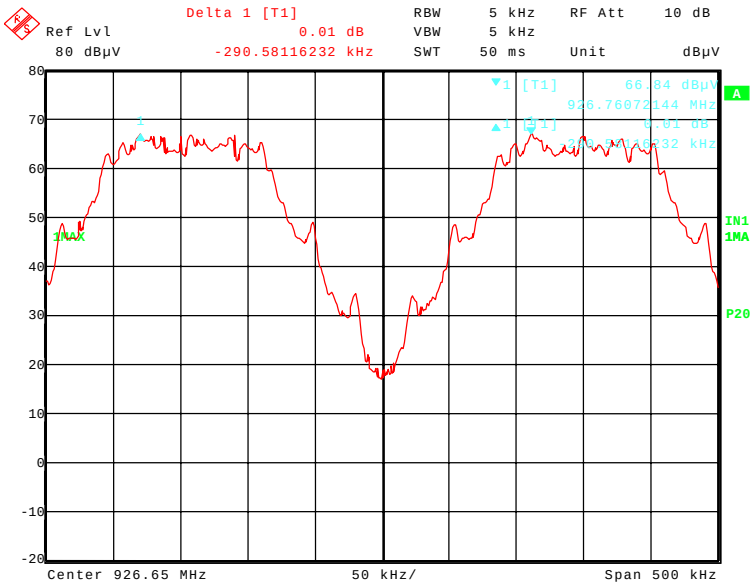
151497_226.wmf: Channel separation at the lower end of the assigned frequency band:



151497_227.wmf: Channel separation at the middle of the assigned frequency band:



151497_228.wmf: Channel separation at the upper end of the assigned frequency band:



Channel number	Channel frequency [MHz]	Channel separation [kHz]	Minimum limit [kHz]
1	903.500	290.581	189.904 kHz (the 20 dB bandwidth)
41	915.150	290.581	189.103 kHz (the 20 dB bandwidth)
81	926.800	290.581	190.705 kHz (the 20 dB bandwidth)
Measurement uncertainty			$<10^{-7}$

Test: Passed

Test equipment used (see chapter 6):

26, 30

5.3 Number of hopping frequencies

5.3.1 Method of measurement (number of hopping frequencies)

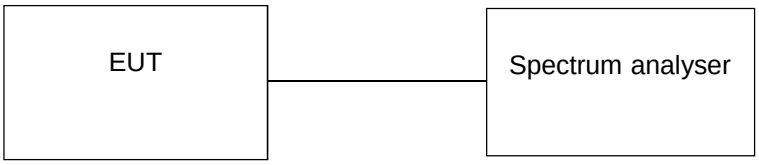
The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on and the hopping function has to be enabled.

The following spectrum analyser settings according to [1] shall be used:

- Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- Resolution bandwidth: To identify clearly the individual channels, set the Resolution bandwidth to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- Video bandwidth: ≥ the resolution bandwidth.
- Sweep: Auto.
- Detector function: Peak.
- Trace mode: Max hold.

After trace stabilisation the number of hopping channels could be counted. It might be possible to divide the span into some sub ranges in order to clearly show all hopping frequencies.

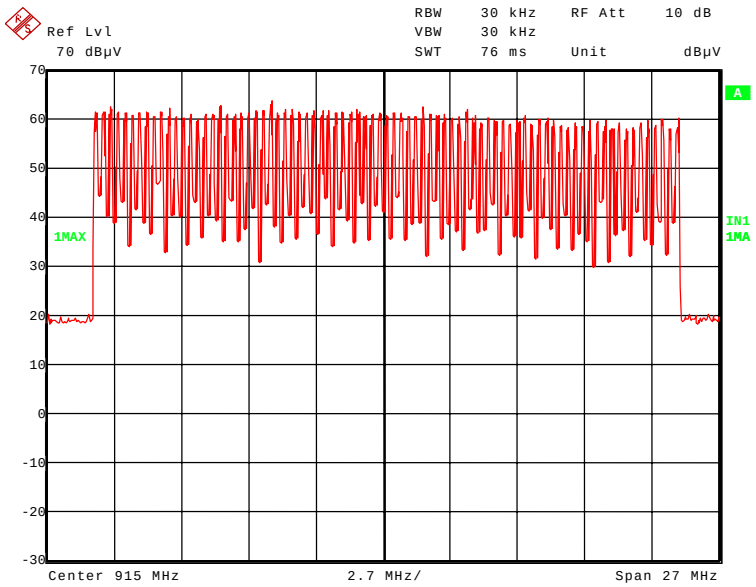
Test set-up:



5.3.2 Test results (number of hopping frequencies)

Ambient temperature	22 °C	Relative humidity	67 %

151497_231.wmf: Number of hopping channels:



Remark: The resolution bandwidth was set to a value < the 20 dB bandwidth in order to achieve a clear separation of the signal peaks

Number of hopping channels	Limit
Operation mode 4	
81	At least 50

Test: Passed

Test equipment used (see chapter 6):

26, 30

5.4 Dwell time

5.4.1 Method of measurement (dwell time)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on and the hopping function has to be enabled.

The following spectrum analyser settings according to [1] shall be used:

- Span: Zero, centred on a hopping channel.
- Resolution bandwidth shall be ≤ channel spacing and where possible Resolution bandwidth should be set >> 1 / *T*, where *T* is the expected dwell time per channel.
- Video bandwidth: ≥ the resolution bandwidth.
- Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
- Detector function: peak.
- Trace mode: Max hold.

The marker and delta marker function of the spectrum analyser will be used to determine the dwell time.

The measurement will be performed at the middle of the assigned frequency band.

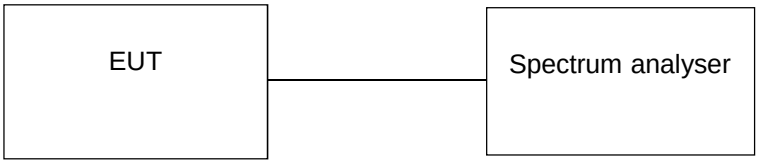
Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.

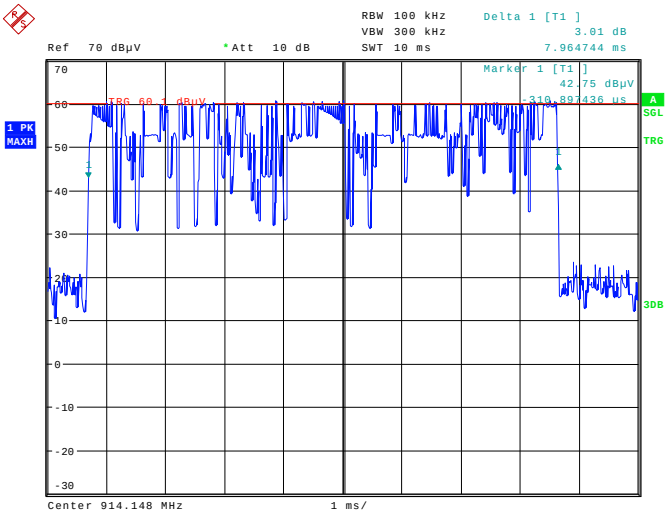
Test set-up:



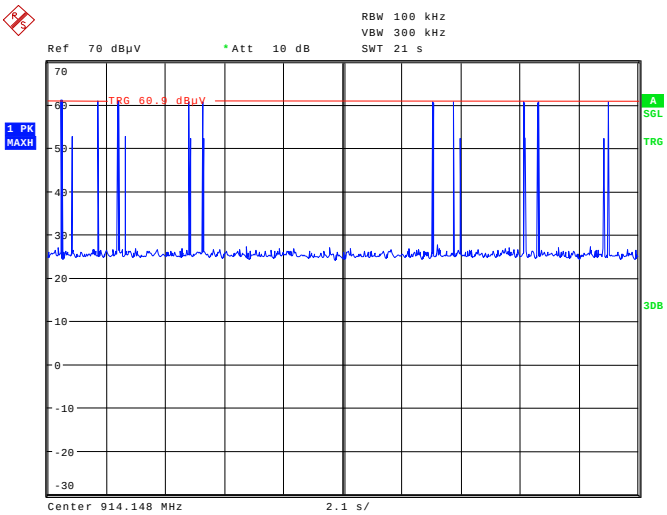
5.4.2 Test results (dwell time)

Ambient temperature	22 °C	Relative humidity	67 %

151497_239.wmf: Dwell time at the middle of the assigned frequency band (single hop):



151497_240.wmf: Dwell time at the middle of the assigned frequency band (required period):



Channel number	Channel frequency [MHz]	t_{pulse} [ms]	Number of pulses	Dwell time [ms]	Limit [ms]
41	915.150	7.965	10	79.650	400.000
Measurement uncertainty				$<10^{-7}$	

Test: Passed

Test equipment used (see chapter 6):

26, 30

5.5 Maximum peak output power

5.5.1 Method of measurement (maximum peak output power)

Because the EUT has no antenna connector, which presents the power delivered to the antenna, the peak value of the field strength was measured. The method of measurement is described under clause 5.6.1 of this test report with the exception that a peak detector was used. According to [1] with this the field strength value the radiated power of the EUT was calculated. After subtraction of the antenna gain, which was declared by the manufacturer the maximum peak output power was calculated. The used formulas are listed below.

5.5.2 Test results (maximum peak output power)

Ambient temperature	21 °C	Relative humidity	57 %

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

Cable guide: For detail information of test set-up and 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: During all measurements the EUT was supplied with 3.0 V DC by the internal batteries.

Test results: The test results were calculated with the following formula:

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

Radiated field strength at 3 m OATS (peak)									
Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
903.500	110.5	Carrier	-	84.6	22.5	3.4	100.0	270.0	Vert.
915.150	111.0	Carrier	-	84.7	22.9	3.4	104.0	226.0	Vert.
926.800	109.8	Carrier	-	83.0	23.4	3.4	100.0	224.0	Vert.
Measurement uncertainty				+2.2 dB / -3.6 dB					

The maximum radiated peak output power was calculated with the following formular:

Calculated maximum radiated peak output power [W] = (field strength [V/m] * measuring distance [m])^2 / 30

This maximum radiated peak output power was converted in dBm and the antenna gain was subtracted to get the maximum conducted peak output power value.

Frequency MHz	Field strength dBµV/m	 V/m	Radiated peak power W	 dBm	Antenna gain dBi	Conducted peak output power dBm	Limit dBm
903.500	110.5	0.335	0.034	15.3	0	15.3	30.0
915.150	111.0	0.355	0.038	15.8	0	15.8	30.0
926.800	109.8	0.309	0.029	14.6	0	14.6	30.0

Test: Passed

Test equipment used (see chapter 6):

14 - 20

5.6 Radiated emissions

5.6.1 Method of measurement (radiated emissions)

The radiated emission measurement is subdivided into five stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 9 kHz to 1 GHz.
- A final measurement carried out on an outdoor test side without reflecting ground plane and a fixed antenna height in the frequency range 9 kHz to 30 MHz.
- A final measurement carried out on an open area test side with reflecting ground plane and various antenna height in the frequency range 30 MHz to 1 GHz.
- A preliminary measurement carried out in a fully anechoic chamber with a variable antenna distance and height in the frequency range 1 GHz to 25 / 40 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 40 GHz.

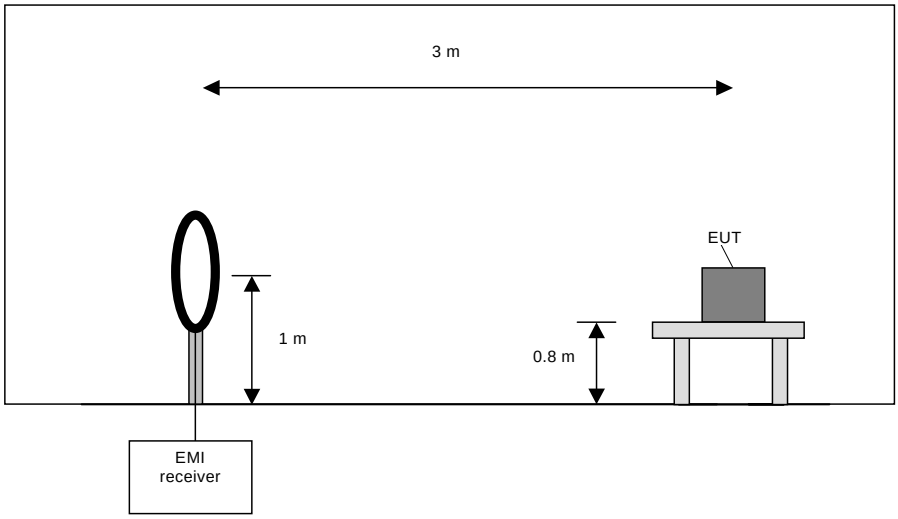
Preliminary measurement (9 kHz to 30 MHz):

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. Table-top 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. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to [1].

The frequency range 9 kHz to 30 MHz will be monitored with a spectrum analyser while the system and its cables will be manipulated to find out the configuration with the maximum emission levels if applicable. The EMI Receiver will be set to MAX Hold mode. The EUT and the measuring antenna will be rotated around their vertical axis to found the maximum emissions.

The resolution bandwidth of the spectrum analyser will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	10 kHz



Preliminary measurement procedure:

Prescans were performed in the frequency range 9 kHz to 150 kHz and 150 kHz to 30 MHz.

The following procedure will be used:

1) Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2) Manipulate the system cables within the range to produce the maximum level of emission.
3) Rotate the EUT by 360 ° to maximize the detected signals.
4) Make a hardcopy of the spectrum.
5) Measure the frequencies of highest detected emission with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6) Repeat steps 1) to 5) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).
7) Rotate the measuring antenna and repeat steps 1) to 5).

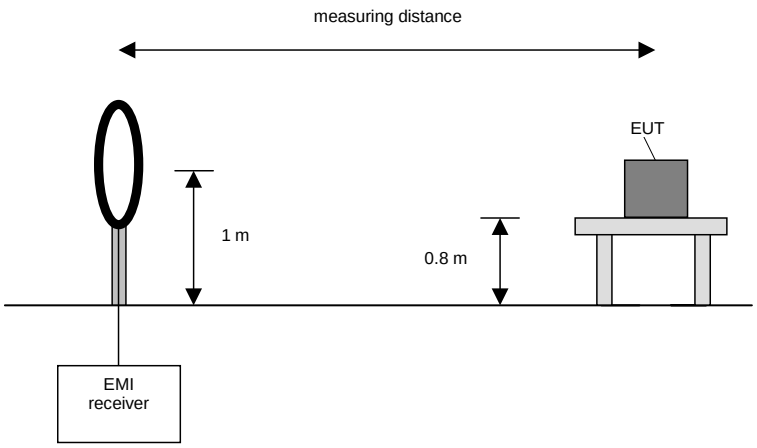
Final measurement (9 kHz to 30 MHz):

In the second stage a final measurement will be performed on an open area test site with no conducting ground plane in a measuring distances of 3 m, 10 m and 30 m. In the case where larger measuring distances are required the results will be extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with a EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 kHz to 490 kHz where an average detector will be used according Section 15.209 (d) [2].

On the frequencies, which were detected during the preliminary measurements, the final measurement will be performed while rotating the EUT and the measuring antenna in the range of 0 ° to 360 ° around their vertical axis until the maximum value is found.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz



Final measurement procedure:

The following procedure will be used:

1) Monitor the frequency range with the measuring antenna at vertical orientation parallel to the EUT at an azimuth of 0 °.
2) Rotate the EUT by 360 ° to maximize the detected signals and note the azimuth and orientation.
3) Rotate the measuring antenna to find the maximum and note the value.
4) Rotate the measuring antenna and repeat steps 1) to 3) until the maximum value is found.
5) Repeat steps 1) to 4) with the other orthogonal axes of the EUT (if the EUT is a module and might be used in a handheld equipment application).

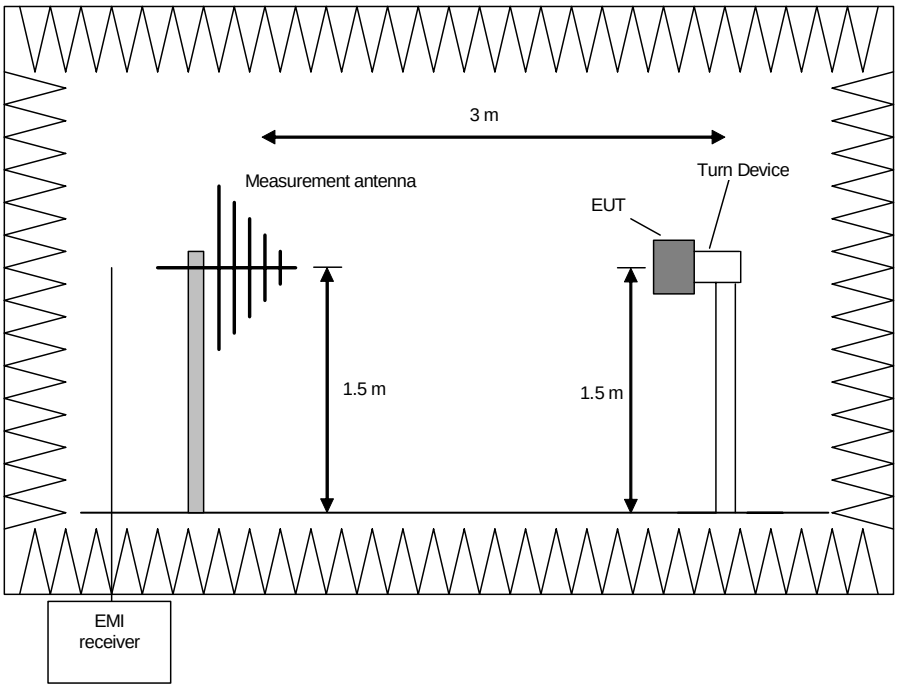
Preliminary measurement (30 MHz to 1 GHz)

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Table top devices will set up on a non-conducting turn device on the height of 1.5 m. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to [1].

The frequency range 30 MHz to 1 GHz will be measured with an EMI Receiver set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °. This measurement is repeated after raising the EUT in 30 ° steps according 6.6.5.4 in [1].

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 230 MHz	100 kHz
230 MHz to 1 GHz	100 kHz



Procedure preliminary measurement:

Prescans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz.
The following procedure will be used:

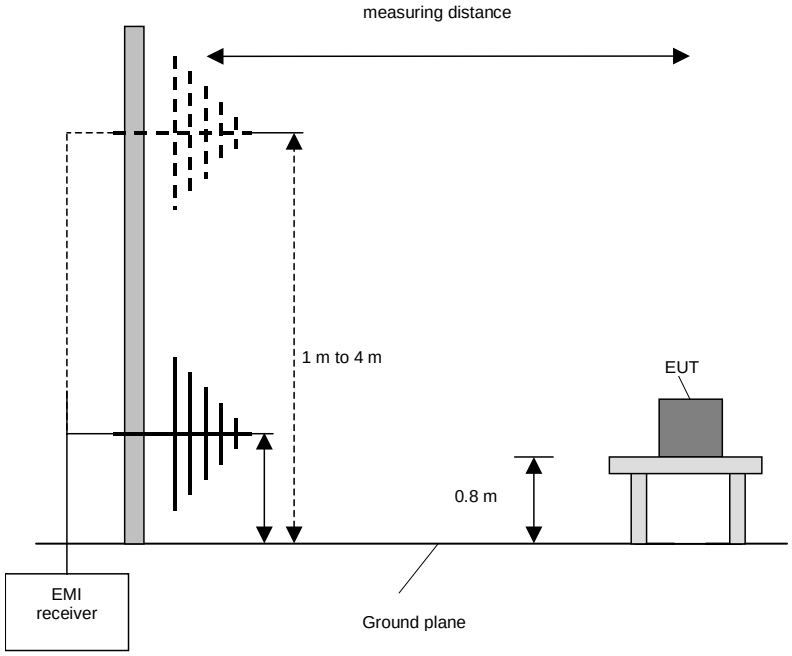
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Repeat 1) to 3) with the vertical polarisation of the measuring antenna.
5. Make a hardcopy of the spectrum.
6. Repeat 1) to 5) with the EUT raised by an angle of 30 ° (60 °, 90 °, 120 ° and 150 °) according to 6.6.5.4 in [1].
7. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.

Final measurement (30 MHz to 1 GHz)

A final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement. During this test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure final measurement:

The following procedure will be used:

1) Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of 23 °.
2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
3) Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° is reached.
4) Repeat 1) to 3) for the other orthogonal antenna polarization.
5) Move the antenna and the turntable to the position where the maximum value is detected.
6) Measure while moving the antenna slowly +/- 1 m.
7) Set the antenna to the position where the maximum value is found.
8) Measure while moving the turntable +/- 45 °.
9) Set the turntable to the azimuth where the maximum value is found.
10) Measure with Final detector (QP and AV) and note the value.
11) Repeat 5) to 10) for each frequency.
12) Repeat 1) to 11) for each orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).

Preliminary and final measurement (1 GHz to 40 GHz)

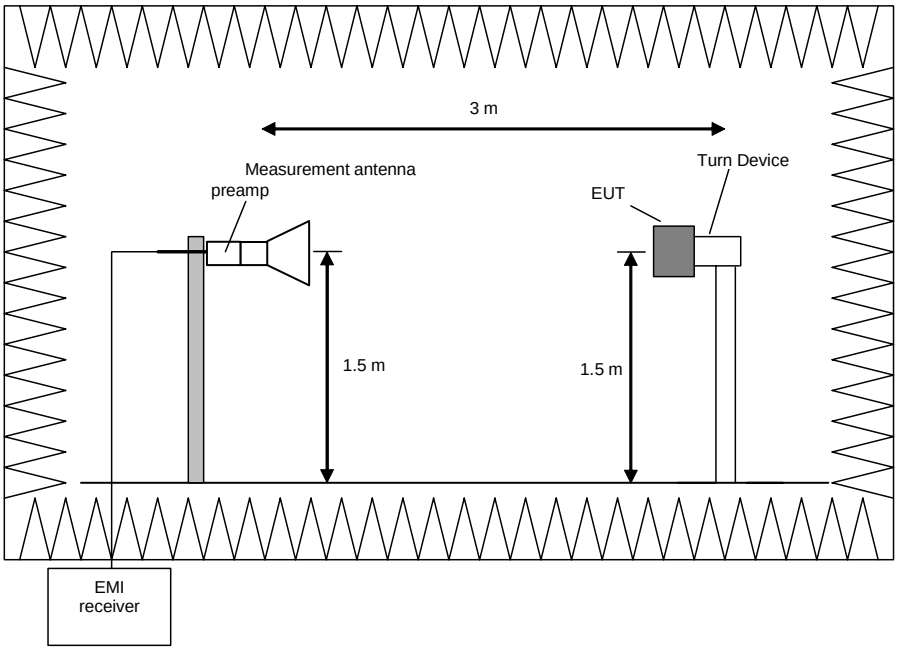
This measurement will be performed in a fully anechoic chamber. Table top devices will set up on a non-conducting turn device on the height of 1.5 m. The set-up of the Equipment under test will be in accordance to [1].

Preliminary measurement (1 GHz to 40 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The spectrum analyser set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °. This measurement is repeated after raising the EUT in 30 ° steps according 6.6.5.4 in [1].

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	100 kHz
4 GHz to 12 GHz	100 kHz
12 GHz to 18 GHz	100 kHz
18 GHz to 25 / 26.5 GHz	100 kHz
26.5 GHz to 40 GHz	100 kHz



Procedure preliminary measurement:

Prescans were performed in the frequency range 1 to 40 GHz.
The following procedure will be used:

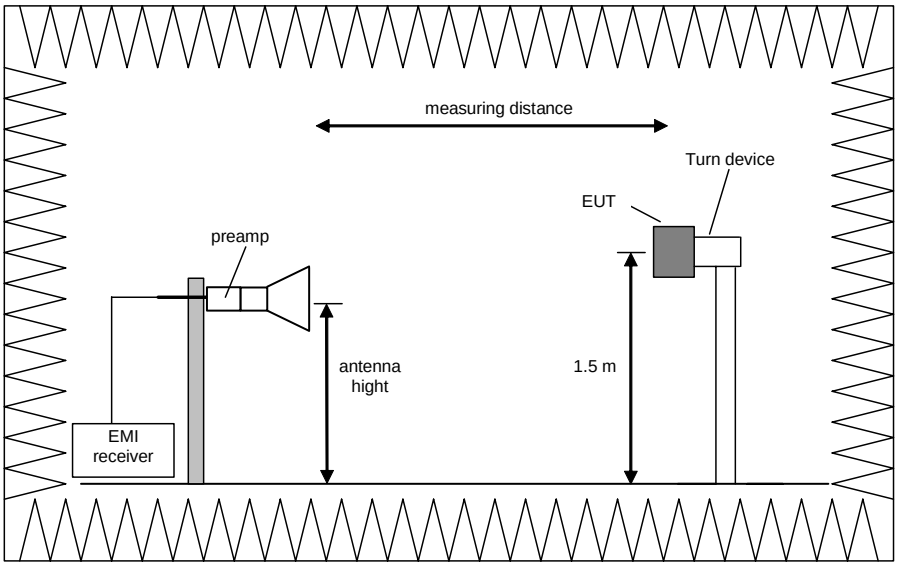
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Rotate the EUT by 360° to maximize the detected signals.
3. Repeat 1) to 2) with the vertical polarisation of the measuring antenna.
4. Make a hardcopy of the spectrum.
5. Repeat 1) to 4) with the EUT raised by an angle of 30° (60°, 90°, 120° and 150°) according to 6.6.5.4 in [1].
6. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
7. The measurement antenna polarisation, with the according EUT position (Turntable and Turn device) which produces the highest emission for each frequency will be used for the final measurement. The six closest values to the applicable limit will be used for the final measurement.

Final measurement (1 GHz to 40 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. The measurement will be performed by rotating the turntable through 0 to 360° in the worst-case EUT orientation which was obtained during the preliminary measurements.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	1 MHz
4 GHz to 12 GHz	1 MHz
12 GHz to 18 GHz	1 MHz
18 GHz to 25 / 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz



Procedure of measurement:

The measurements were performed in the frequency ranges 1 GHz to 4 GHz, 4 GHz to 12 GHz, 12 GHz to 18 GHz, 18 GHz to 25 /26.5 GHz and 26.5 GHz to 40 GHz.
The following procedure will be used:

1) Set the turntable and the turn device to obtain the worst-case emission for the first frequency identified in the preliminary measurements.
2) Set the measurement antenna polarisation to the orientation with the highest emission for the first frequency identified in the preliminary measurements.
3) Set the spectrum analyser to EMI mode with peak and average detector activated.
4) Rotate the turntable from 0° to 360° to find the EUT angle that produces the highest emissions.
5) Note the highest displayed peak and average values
6) Repeat the steps 1) to 5) for each frequency detected during the preliminary measurements.

5.6.2 Test results (radiated emissions)

5.6.2.1 Preliminary radiated emission measurement (10 MHz to 10 GHz)

Ambient temperature	22 °C	Relative humidity	54 %

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

Cable guide: For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following.

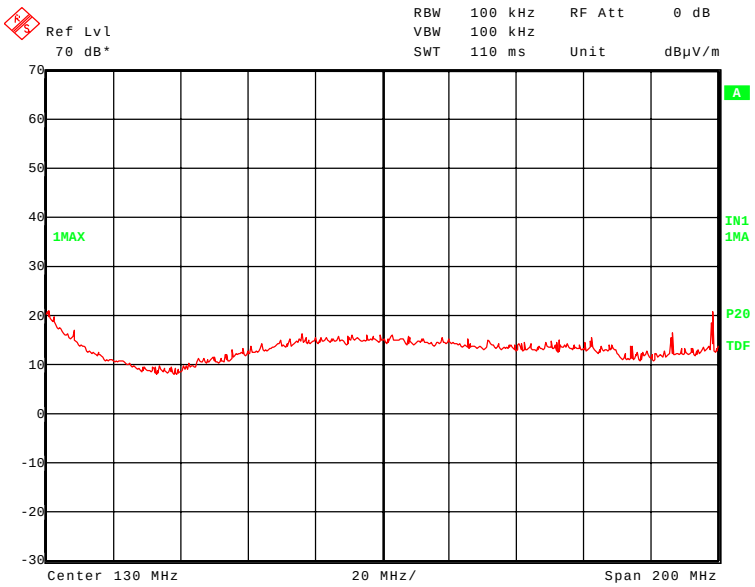
Supply voltage: During all measurements the EUT was supplied by new internal batteries.

Frequency range: The preliminary measurement was carried out in the frequency range 10 MHz to 10 GHz according to [2].

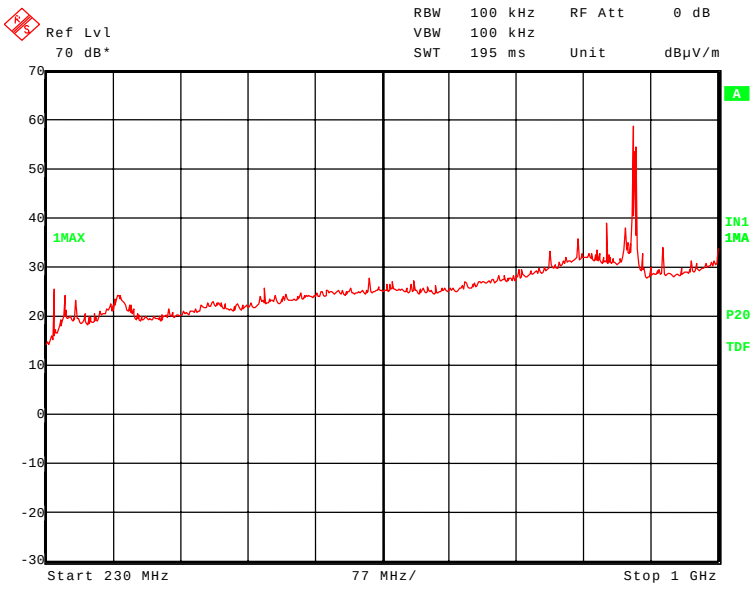
Remark: As pre-tests have shown, the emissions in the frequency range 10 MHz to 30 MHz are not depending on the transmitter operation mode. Therefore the emissions in this frequency range were measured only with the transmitter operates in operation mode 2.

Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

151497_201.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 1):



151497_202.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 1, carrier notched):



The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

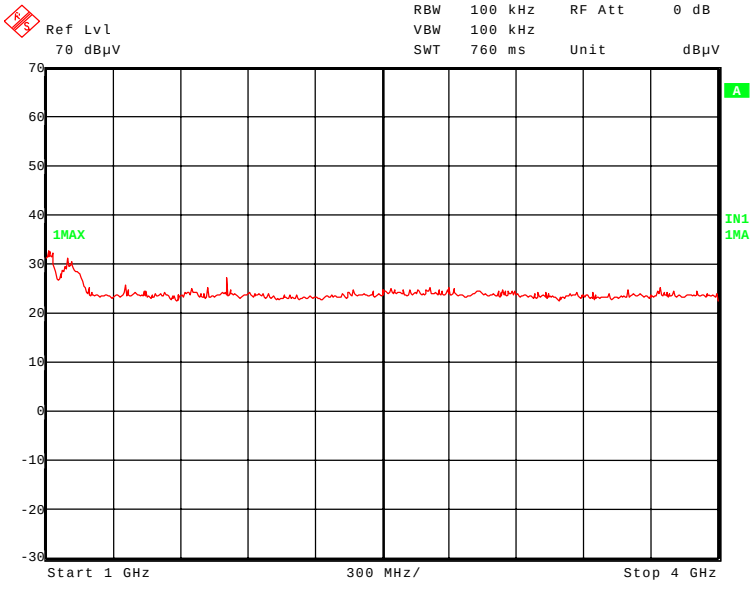
- 216.000 MHz, 228.000 MHz, 600.000 MHz, 871.394 MHz, 903.500 MHz and 935.605 MHz.

The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

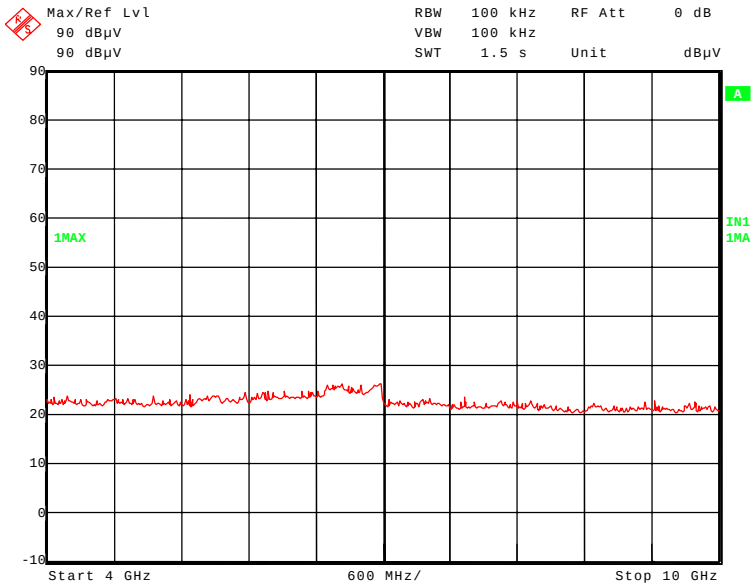
- 240.000 MHz, 252.000 MHz and 264.000 MHz.

These frequencies have to be measured on the open area test site. The result is presented in the following.

151497_207.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 1):



151497_212.wmf: Spurious emissions from 4 GHz to 10 GHz (operation mode 1):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 1015.179 MHz, 1096.098 MHz and 1352.358 MHz.

The following frequency was found outside the restricted bands during the preliminary radiated emission test:

- 1807.000 MHz.

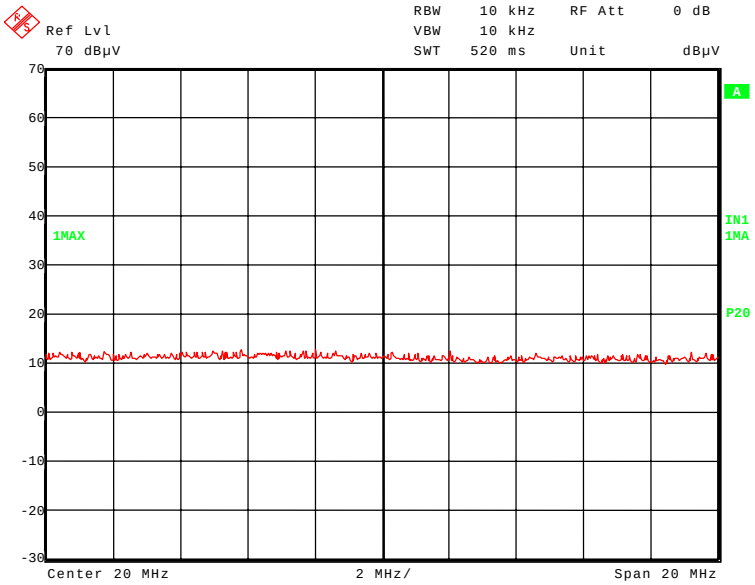
These frequencies have to be measured in a final measurement. The results were presented in the following.

Test equipment used (see chapter 6):

29, 31 – 37, 43 – 45, 49, 55, 73, 75, 83

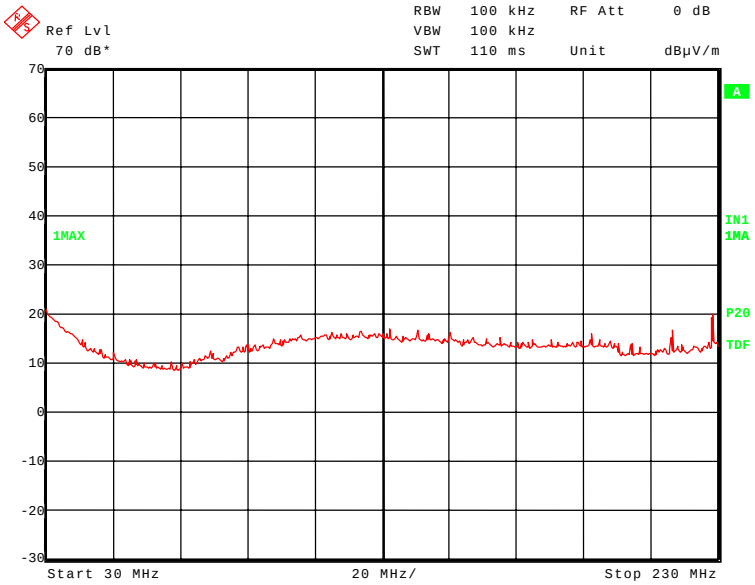
Transmitter operates on the middle of the assigned frequency band (operation mode 2)

151497_222.wmf: Spurious emissions from 10 MHz to 30 MHz (operation mode 2):

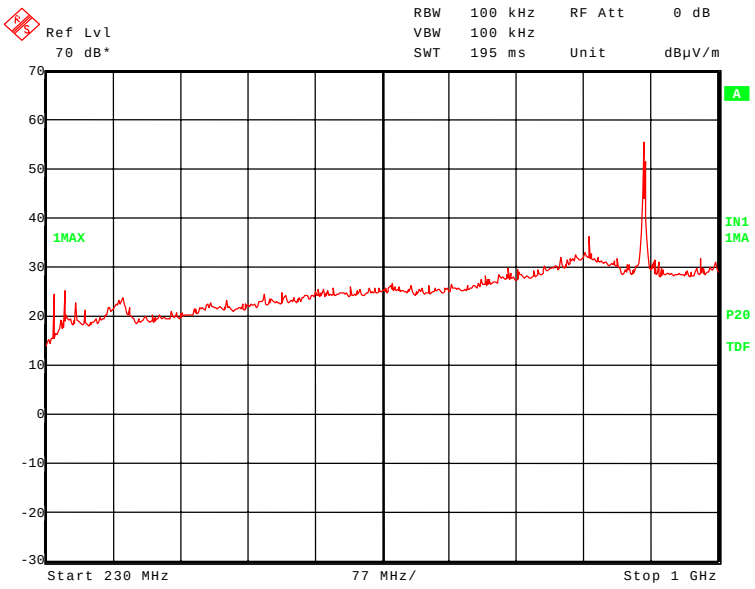


No significant frequencies above the noise floor of the system (max. 33 dBµV/m (measured with peak detector) at 3 m distance) were found during the preliminary radiated emission test, so no final measurements will be carried out on the outdoor test site.

151497_203.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 2):



151497_204.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 2, carrier notched):



The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

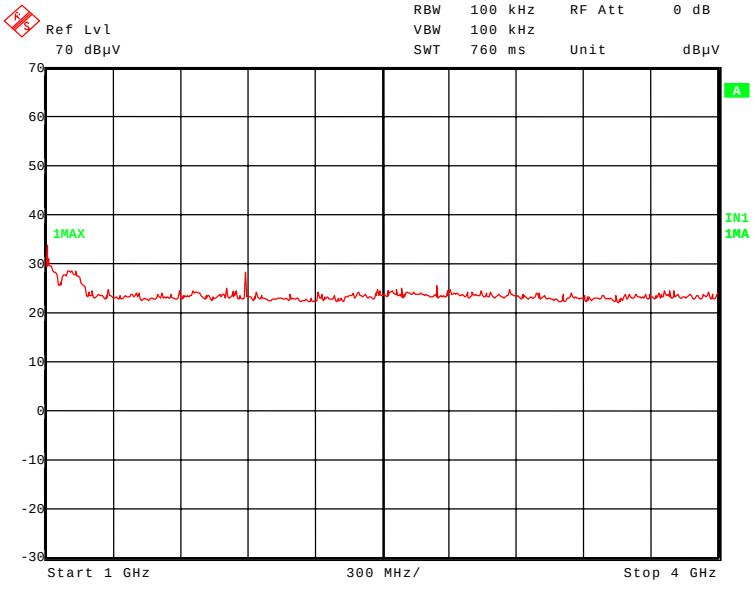
- 216.000 MHz, 228.000 MHz, 318.172 MHz, 852.000 MHz and 915.150 MHz.

The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

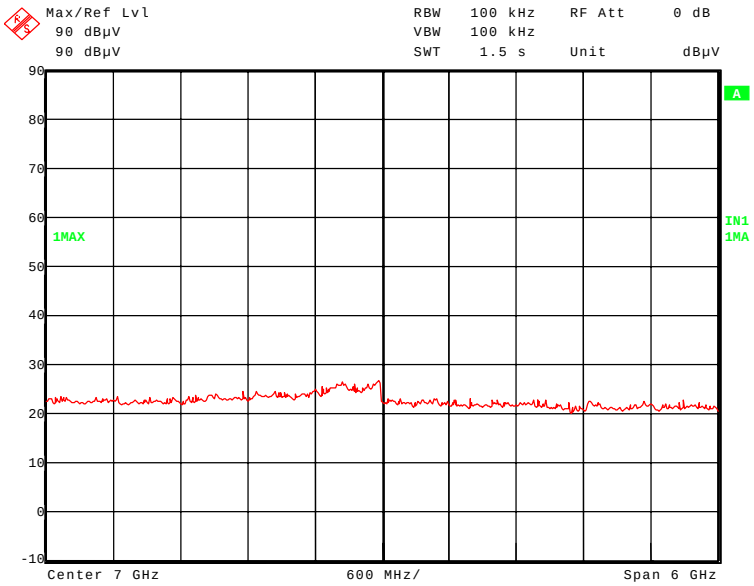
- 240.000 MHz, 252.000 MHz, 264.000 MHz and 979.312 MHz.

These frequencies have to be measured on the open area test site. The result is presented in the following.

151497_208.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 2):



151497_211.wmf: Spurious emissions from 4 GHz to 10 GHz (operation mode 2):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 1011.455 MHz, 1096.098 MHz and 2745.450 MHz.

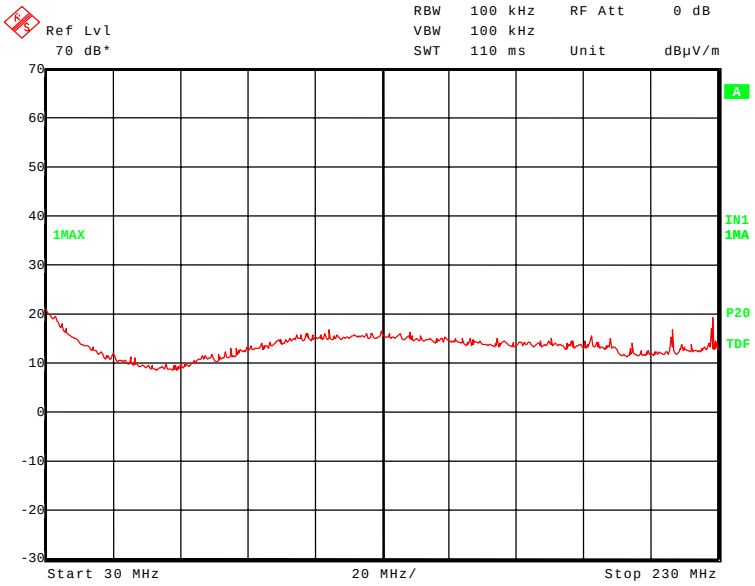
The following frequency was found outside the restricted bands during the preliminary radiated emission test:

- 1830.300 MHz.

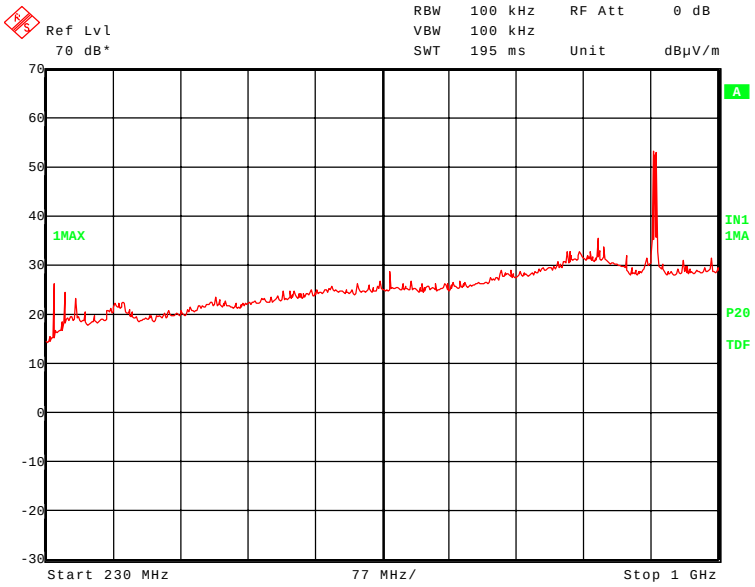
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates on the upper end of the assigned frequency (operation mode 3)

151497_205.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 3):



151497_206.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 3, carrier notched):



The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

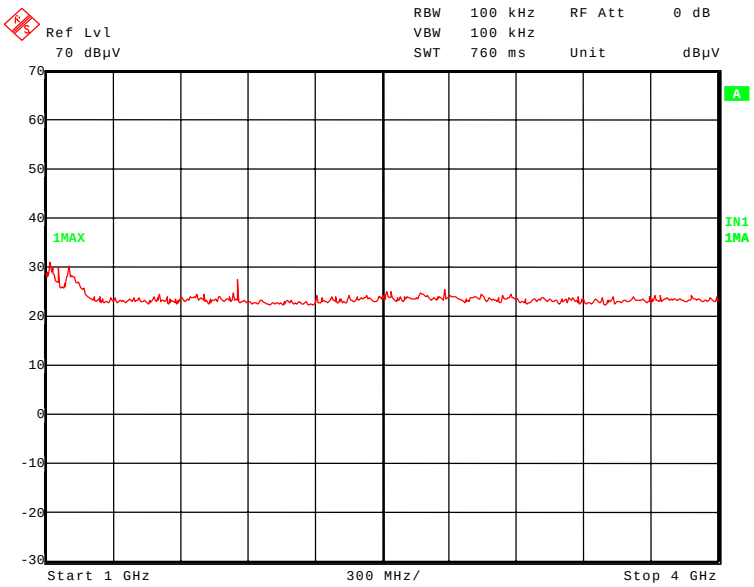
- 216.000 MHz, 228.000 MHz 624.000 MHz, 862.740 MHz and 926.800 MHz.

The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

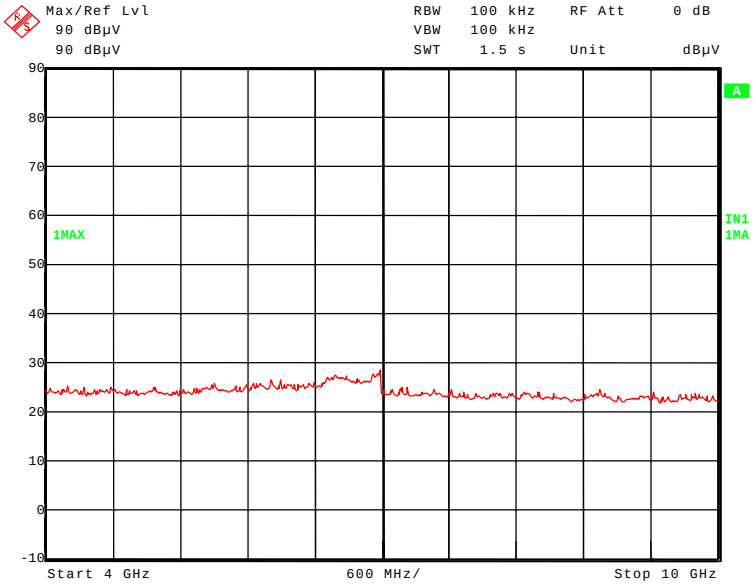
- 240.000 MHz, 252.000 MHz, 264.000 MHz and 991.096 MHz.

These frequencies have to be measured on the open area test site. The result is presented in the following.

151497_209.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 3):



151497_210.wmf: Spurious emissions from 4 GHz to 10 GHz (operation mode 3):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 1011.455 MHz, 1096.098 MHz and 2780.400 MHz.

The following frequency was found outside the restricted bands during the preliminary radiated emission test:

- 1853.600 MHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

5.6.2.2 Final radiated emission measurement (10 MHz to 30 MHz)

No significant frequencies above the noise floor of the system (max. 33 dBµV/m (measured with peak detector) at 3 m distance) were found during the preliminary radiated emission test, so no final measurements were carried out on the outdoor test site.

5.6.2.3 Final radiated emission measurement (30 MHz to 1 GHz)

Ambient temperature	21 °C	Relative humidity	57 %

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

Cable guide: For detail information of test set-up and 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: During all measurements the EUT was supplied by new internal batteries.

Test results: The test results were calculated with the following formula:

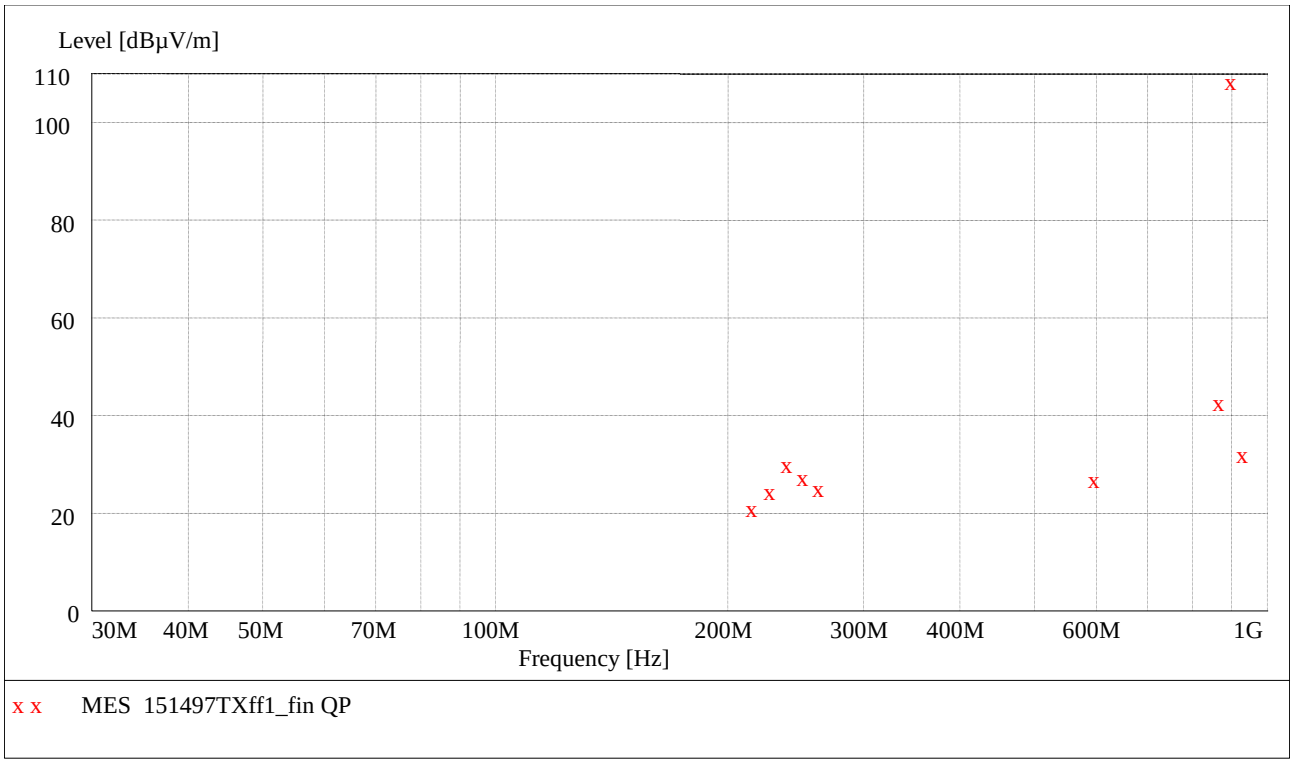
Result [dBµV/m] = reading [dBµV] + cable loss [dB] + antenna factor [dB/m]

The measured points and the limit line in the following diagrams refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with an x are the measured results of the standard final measurement on the open area test site.

The results of the standard subsequent measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

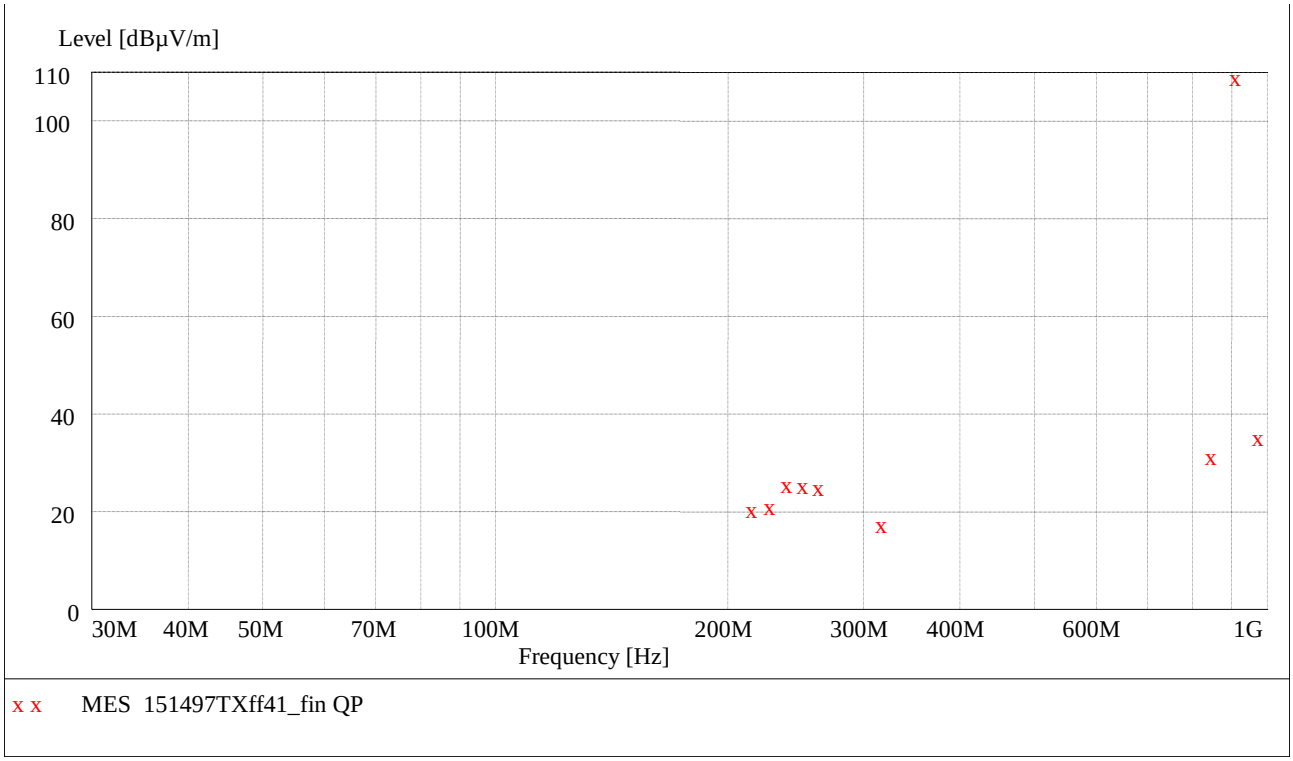
The measurement time with the quasi-peak measuring detector is 1 second.

Transmitter operates on the lower end of the assigned frequency (operation mode 1)



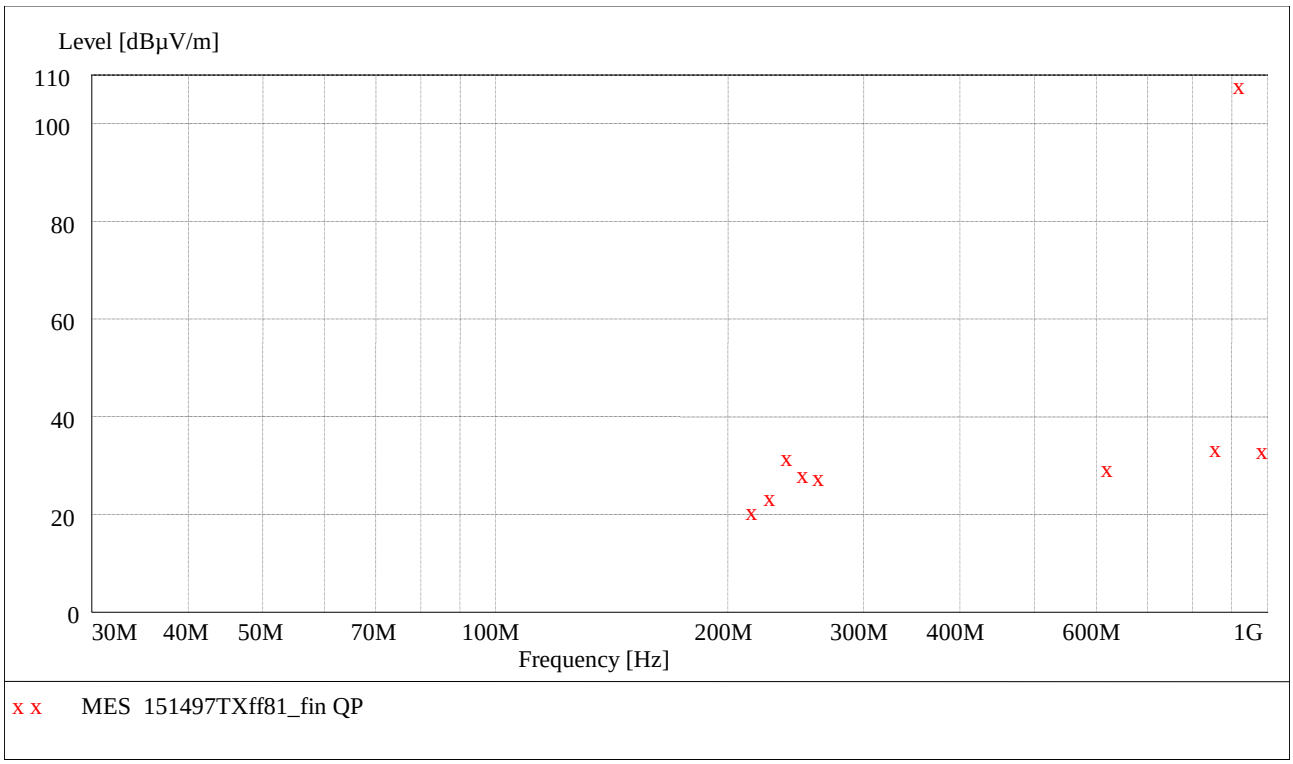
Data record name: 151497TXff1

Transmitter operates on the middle of the assigned frequency (operation mode 2)



Data record name: 151497TXff41

Transmitter operates on the upper end of the assigned frequency (operation mode 3)



Data record name: 151497TXff81

Result measured with the quasi-peak detector:
(These values were marked in the diagrams by an x)

Transmitter operates on the lower end of the assigned frequency band (operation mode 1)									
Spurious emissions outside restricted bands									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dBµV/m	dBµV/m	dB	dBµV	dB/m	dB	cm	deg	
216.000	21.5	89.0	67.5	10.4	9.5	1.6	132	225	Hor.
228.000	25.2	89.0	63.8	13.4	10.2	1.6	131	225	Hor.
600.000	27.5	89.0	61.5	5.5	19.2	2.8	185	45	Vert.
871.394	43.30	89.0	45.7	17.8	22.1	3.4	108.0	270.0	Vert.
903.500	109.00	Carrier	-	83.1	22.5	3.4	100.0	270.0	Vert.
935.605	32.60	89.0	56.4	5.5	23.7	3.4	137.0	3.0	Hor.
Spurious emissions inside restricted bands									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dBµV/m	dBµV/m	dB	dBµV	dB/m	dB	cm	deg	
240.000	30.5	46.0	15.5	17.6	11.2	1.7	119	225	Hor.
252.000	27.8	46.0	18.2	13.7	12.3	1.8	121	225	Hor.
264.000	25.7	46.0	20.3	11.6	12.3	1.8	100	225	Hor.
Transmitter operates on the middle of the assigned frequency band (operation mode 2)									
Spurious emissions outside restricted bands									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dBµV/m	dBµV/m	dB	dBµV	dB/m	dB	cm	deg	
216.000	21.0	89.5	68.5	9.9	9.5	1.6	143	1	Hor.
228.000	21.7	89.5	67.8	9.9	10.2	1.6	150	1	Hor.
318.172	18.0	89.5	71.5	2.8	13.3	1.9	113	136	Hor.
852.000	31.8	89.5	57.7	6.0	22.5	3.3	144.0	91.0	Hor.
915.150	109.5	Carrier	-	83.2	22.9	3.4	104.0	226.0	Vert.
Spurious emissions inside restricted bands									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dBµV/m	dBµV/m	dB	dBµV	dB/m	dB	cm	deg	
240.000	26.1	46.0	19.9	13.2	11.2	1.7	150	1	Hor.
252.000	26.0	46.0	20.0	11.9	12.3	1.8	150	45	Hor.
264.000	25.6	46.0	20.4	11.5	12.3	1.8	150	45	Hor.
979.312	35.7	54.0	18.3	8.4	23.8	3.5	100.0	181.0	Vert.

Transmitter operates on the upper end of the assigned frequency band (operation mode 3)									
Spurious emissions outside restricted bands									
Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
216.000	21.2	88.3	67.1	10.1	9.5	1.6	136	26	Hor.
228.000	24.2	88.3	64.1	12.4	10.2	1.6	124	12	Hor.
624.000	30.1	88.3	58.2	7.6	19.7	2.8	128	83	Hor.
862.740	34.1	88.3	54.2	8.5	22.2	3.4	113.0	236.0	Vert.
926.800	108.3	Carrier	-	81.5	23.4	3.4	100.0	224.0	Vert.
Spurious emissions inside restricted bands									
Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
240.000	32.3	46.0	13.7	19.4	11.2	1.7	124	14	Hor.
252.000	28.7	46.0	17.3	14.6	12.3	1.8	100	14	Hor.
264.000	28.0	46.0	18.0	13.9	12.3	1.8	102	12	Hor.
991.096	33.7	54.0	20.3	6.4	23.7	3.6	100.0	185.0	Vert
Measurement uncertainty				+2.2 dB / -3.6 dB					

Test: Passed

Test equipment used (see chapter 6):

14 – 20

5.6.2.4 Final radiated emission measurement (1 GHz to 10 GHz)

Ambient temperature	22 °C	Relative humidity	54 %

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

Cable guide: For detail information of test set-up and 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: During all measurements the EUT was supplied by new internal batteries.

Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

Result measured with the peak detector:

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1015.179	41.1	74.0	32.9	43.0	22.3	26.0	1.8	150	Hor.	Yes
1096.098	38.8	74.0	35.2	40.0	22.8	26.0	1.9	150	Vert.	Yes
1352.358	32.3	74.0	41.7	31.2	24.9	25.9	2.1	150	Vert.	Yes
1807.000	38.3	89.0	50.7	34.6	27.1	25.9	2.5	150	Vert.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Result measured with the average detector:

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1015.179	20.8	54.0	33.2	22.7	22.3	26.0	1.8	150	Hor.	Yes
1096.098	20.5	54.0	33.5	21.7	22.8	26.0	1.9	150	Vert.	Yes
1352.358	19.5	54.0	34.5	18.4	24.9	25.9	2.1	150	Vert.	Yes
1807.000	24.1	89.0	64.9	20.4	27.1	25.9	2.5	150	Vert.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Transmitter operates at the middle of the assigned frequency band (operation mode 2)

Result measured with the peak detector:

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1011.455	38.2	74.0	35.8	40.1	22.3	26.0	1.8	150	Hor.	Yes
1096.098	39.3	74.0	34.7	40.5	22.8	26.0	1.9	150	Vert.	Yes
1830.300	38.4	89.5	51.1	34.6	27.2	26.0	2.7	150	Vert.	No
2745.450	43.3	74.0	30.7	33.7	31.9	25.6	3.3	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Result measured with the average detector:

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1011.455	20.2	54.0	33.8	22.1	22.3	26.0	1.8	150	Hor.	Yes
1096.098	20.0	54.0	34.0	21.2	22.8	26.0	1.9	150	Vert.	Yes
1830.300	24.0	89.5	65.5	20.2	27.2	26.0	2.7	150	Vert.	No
2745.450	28.9	54.0	25.1	19.3	31.9	25.6	3.3	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Transmitter operates at the upper end of the assigned frequency band (operation mode 3)

Result measured with the peak detector:

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1011.455	38.0	74.0	36.0	39.9	22.3	26.0	1.8	150	Hor.	Yes
1096.098	37.0	74.0	37.0	38.2	22.8	26.0	1.9	150	Vert.	Yes
1853.600	39.2	88.3	49.1	35.1	27.2	25.7	2.6	150	Hor.	No
2780.400	42.7	74.0	31.3	33.7	31.7	26.1	3.4	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Result measured with the average detector:

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1011.455	19.6	54.0	34.4	21.5	22.3	26.0	1.8	150	Hor.	Yes
1096.098	23.3	54.0	30.7	24.5	22.8	26.0	1.9	150	Vert.	Yes
1853.600	24.3	88.3	64.0	20.2	27.2	25.7	2.6	150	Hor.	No
2780.400	26.9	54.0	27.1	17.9	31.7	26.1	3.4	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

Test equipment used (see chapter 6):

29, 31 – 34, 36, 37, 44, 45, 49, 73, 75

6 Test equipment and ancillaries used for tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
15	Measuring receiver	ESIB7	Rohde & Schwarz	100304	480521	03/06/2015	03/2017
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	25761	480894	09/18/2014	09/2017
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	-
26	Test fixture	-	Phoenix Test-Lab	-	410160	Weekly verification (system cal.)	
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
30	Spectrum analyser	FSU	Rohde & Schwarz	200125	480956	03/09/2015	03/2016
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	03/02/2015	03/2016
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	Antenna	HL50	Rohde & Schwarz	100438	481170	08/27/2014	08/2017
37	Positioner	TDF1.5-10kg	Maturo	-	482034	-	-
43	RF-cable No. 36	Sucoflex 106B	Suhner	0587/6B	480865	Weekly verification (system cal.)	
44	RF-cable No. 3	Sucoflex 106B	Suhner	0563/6B	480670	Weekly verification (system cal.)	
45	RF-cable No. 40	Sucoflex 106B	Suhner	0708/6B	481330	Weekly verification (system cal.)	
49	Preamplifier	JS3-00101200-23-5A	Miteq	681851	480337	Six month verification (system cal.)	
55	Loop antenna	HFH2-Z2	Rohde & Schwarz	100417	481912	09/15/2015	09/2016
73	High Pass Filter	WHJS1000C 11/60EF	Wainwright Instruments GmbH	1	480413	Weekly verification (system cal.)	
75	High Pass Filter	WHKX4.0/18 G-8SS	Wainwright Instruments GmbH	1	480587	Weekly verification (system cal.)	
83	Tuneable Notch Filter	WRCA800/900-0.2/40-6EEK	Wainwright Instruments GmbH	15	480414	Weekly verification (system cal.)	

7 Report history

Report Number	Date	Comment
F151497E8	12/17/2015	Document created

8 List of annexes

Annex A Test set-up photographs 6 pages

151497_n_a.JPG: FPS COM 7000, test setup fully anechoic chamber
151497_n_i.JPG: FPS COM 7000, test setup fully anechoic chamber
151497_n_f.JPG: FPS COM 7000, test set-up fully anechoic chamber
151497_n_b.JPG: FPS COM 7000, test set-up fully anechoic chamber
151497_n_e.JPG: FPS COM 7000, test set-up fully anechoic chamber
151497_n_j.JPG: FPS COM 7000, test set-up open area test site

Annex B External photographs 7 pages

151497_n_25.JPG: FPS COM 7000, 3-D-view
151497_n_18.JPG: FPS COM 7000, top view
151497_n_23.JPG: FPS COM 7000, front/bottom view
151497_n_24.JPG: FPS COM 7000, left hand view
151497_n_22.JPG: FPS COM 7000, rear view battery / connector cover opened
151497_n_20.JPG: FPS COM 7000, type plate view
151497_n_16.JPG: FPS COM 7000, connector view

Annex C Internal photographs 7 pages

151497_n_15.JPG: FPS COM 7000, internal view
151497_n_1.JPG: FPS COM 7000, PCB1, top view
151497_n_2.JPG: FPS COM 7000, PCB1, bottom view
151497_n_6.JPG: FPS COM 7000, PCB1, top view, shielding removed
151497_n_5.JPG: FPS COM 7000, PCB1, bottom view, shielding removed
151497_n_10.JPG: FPS COM 7000, additional PCBs, top view
151497_n_11.JPG: FPS COM 7000, additional PCBs, bottom view