

Report on the Radio Testing
For
Widex A/S
on
Evoke EC
Report no. TRA-040332-47-00A
14 June 2018

Report Number: TRA-040332-47-00A
Issue: A

REPORT ON THE RADIO TESTING OF A
Widex A/S
Evoke EC
WITH RESPECT TO SPECIFICATION
FCC 47CFR 15.209 & ISED RSS-210

TEST DATE: 2018-04-09

Tested by:

D Moncayola
Radio Test Engineer

Approved by:

J Charters
Department Manager Radio

Date: 14 June 2018

Disclaimers:

- [1] THIS DOCUMENT MAY BE REPRODUCED ONLY IN ITS ENTIRETY AND WITHOUT CHANGE
[2] THE RESULTS CONTAINED IN THIS DOCUMENT RELATE ONLY TO THE ITEM(S) TESTED

1 Revision Record

<i>Issue Number</i>	<i>Issue Date</i>	<i>Revision History</i>
A	14 June 2018	Original

2 Summary

TEST REPORT NUMBER: TRA-040332-47-00A

WORKS ORDER NUMBER: TRA-040332-01

PURPOSE OF TEST: USA: Testing of radio frequency equipment per the relevant authorization procedure of chapter 47 of CFR (code of federal regulations) Part 2, subpart J.

Canada: Testing of radio apparatus for TAC (technical acceptance certificate) per subsections 4(2) of the Radiocommunication Act and 21(1) of the Radiocommunication Regulations.

TEST SPECIFICATION(S): 47CFR15.209 & RSS-210

EQUIPMENT UNDER TEST (EUT): Evoke EC

FCC IDENTIFIER: TTY-ERE

ISED CERTIFICATION NUMBER: 5676B-ERE

EUT SERIAL NUMBER: 004520

MANUFACTURER/AGENT: Widex A/S

ADDRESS: Nymoellevej 6
3540 Lynge
Denmark

CLIENT CONTACT: Thorvaldur Oli Bodvarsson
☎ (+45) 44355801
✉ thbo@widex.com

ORDER NUMBER: 144331-01

TEST DATE: 2018-04-09

TESTED BY: D Moncayola
Element

2.1 Test Summary

Test Method and Description	Requirement Clause		Applicable to this equipment	Result / Note
	RSS	47CFR15		
Radiated spurious emissions	210, 4.3	15.209	☒	Pass
AC power line conducted emissions	Gen, 8.8	15.207	☐	Note 1
Occupied bandwidth	Gen, 6.6	15.209	☒	Note 2
Field strength of fundamental	210, 4.3	15.223	☒	Pass

Notes:

Note 1: No Applicable, fuel cell powered.

Note 2: Only 99 % bandwidth was measured

The results contained in this report relate only to the items tested, in the condition at time of test, and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. Any modifications made are identified in Section 8 of this report.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 5.2 of this test report (Deviations from Test Standards).

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4 Introduction

This report TRA-040332-47-00A presents the results of the Radio testing on a Widex A/S, Evoke EC to specification 47CFR15 Radio Frequency Devices and RSS-210 Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.

The testing was carried out for Widex A/S by Element, at the address detailed below.

☐	Element Hull Unit E South Orbital Trading Park Hedon Road Hull HU9 1NJ UK	☒	Element Skelmersdale Unit 1 Pendle Place Skelmersdale West Lancashire WN8 9PN UK
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This report details the configuration of the equipment, the test methods used and any relevant modifications where appropriate.

All test and measurement equipment under the control of the laboratory and requiring calibration is subject to an established programme and procedures to control and maintain measurement standards. The quality management system meets the principles of ISO 9001, and has quality control procedures for monitoring the validity of tests undertaken. Records and sufficient detail are retained to establish an audit trail of calibration records relating to its test results for a defined period. Under control of the established calibration programme, key quantities or values of the test & measurement instrumentation are within specification and comply with the relevant traceable internationally recognised and appropriate standard specifications, which are UKAS calibrated as such where these properties have a significant effect on results. Participation in inter-laboratory comparisons and proficiency testing ensures satisfactory correlation of results conform to Elements own procedures, as well as statistical techniques for analysis of test data providing the appropriate confidence in measurements.

FCC Site Listing:

Element is accredited for the above sites under the US-EU MRA, Designation number UK0009.

ISED Registration Number(s):

Element Skelmersdale	3930B
Element Hull	3483A

The test site requirements of ANSI C63.4-2014 are met up to 1 GHz.

The test site SVSWR requirements of CISPR 16-1-4:2010 are met over the frequency range 1 GHz to 18 GHz.

5 Test Specifications

5.1 Normative References

- FCC 47 CFR Ch. I – Part 15 – Radio Frequency Devices.
- ANSI C63.10-2013 – American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
- ANSI C63.4-2014 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- Industry Canada RSS-210, Issue 9, August 2016 – Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.
- Industry Canada RSS-Gen, Issue 4, November 2014 – General Requirements for Compliance of Radio Apparatus

5.2 Deviations from Test Standards

There were no deviations from the test standard.

6 Glossary of Terms

§	denotes a section reference from the standard, not this document
AC	Alternating Current
ANSI	American National Standards Institute
BW	bandwidth
C	Celsius
CFR	Code of Federal Regulations
CW	Continuous Wave
dB	decibel
dBm	dB relative to 1 milliwatt
DC	Direct Current
DSSS	Direct Sequence Spread Spectrum
EIRP	Equivalent Isotropically Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
Hz	hertz
IC	Industry Canada (nowISED)
ISED	Innovation, Science and Economic Development Canada
ITU	International Telecommunication Union
LBT	Listen Before Talk
m	metre
max	maximum
MIMO	Multiple Input and Multiple Output
min	minimum
MRA	Mutual Recognition Agreement
N/A	Not Applicable
PCB	Printed Circuit Board
PDF	Portable Document Format
Pt-mpt	Point-to-multipoint
Pt-pt	Point-to-point
RF	Radio Frequency
RH	Relative Humidity
RMS	Root Mean Square
Rx	receiver
s	second
SVSWR	Site Voltage Standing Wave Ratio
Tx	transmitter
UKAS	United Kingdom Accreditation Service
V	volt
W	watt
Ω	ohm

7 Equipment Under Test

7.1 EUT Identification

- Name: Evoke EC
- Serial Number: 004520
- Model Number: E-EC
- Software Revision: Production
- Build Level / Revision Number: Production

7.2 System Equipment

Equipment listed below forms part of the overall test setup and is required for equipment functionality and/or monitoring during testing. The compliance levels achieved in this report relate only to the EUT and not items given in the following list.

Not Applicable – No support/monitoring equipment required.

7.3 EUT Mode of Operation

7.3.1 Transmission

The mode of operation for tests was as follows:

The unit was transmitting permanently at full power modulated carrier at 10.6 MHz.

7.4 EUT Radio Parameters

7.4.1 General

Frequency of operation:	10.6 MHz
Modulation type(s):	FSK
Occupied channel bandwidth(s):	600 kHz
Channel spacing:	Not applicable, single channel
ITU emission designator(s):	600KF1XT
Nominal Supply Voltage:	1.2 Vdc

7.5 EUT Description

The EUT is a hearing aid with a very low power transceiver at 10.6 MHz.

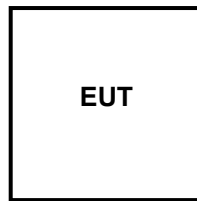
8 Modifications

No modifications were performed during this assessment.

9 EUT Test Setup

9.1 *Block Diagram*

The following diagram shows basic EUT interconnections:
EUT is a standalone battery powered device.



9.2 General Set-up Photograph

The following photograph shows basic EUT set-up:



10 General Technical Parameters

10.1 Normal Conditions

The E U T was tested under the normal environmental conditions of the test laboratory, except where otherwise stated. The normal power source applied was 1.2 V dc from the power cell.

11 Radiated spurious emissions

11.1 Definitions

Out-of-band emissions

Emissions on a frequency or frequencies immediately outside the necessary bandwidth which result from the modulation process, but exclude spurious emissions.

Spurious emissions

Emissions on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

Restricted bands

A frequency band in which intentional radiators are permitted to radiate only spurious emissions but not fundamental signals.

11.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Chamber
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5
EUT Frequency Measured:	10.6 MHz
EUT Channel Bandwidths:	600 kHz
Deviations From Standard:	None
Measurement BW:	30 MHz to 300 MHz: 120 kHz
Measurement Detector:	Quasi-peak

Environmental Conditions (Normal Environment)

Temperature: 22 °C	+15 °C to +35 °C (as declared)
Humidity: 40 % RH	20 % RH to 75 % RH (as declared)
Supply: 1.2 V dc	1.2 V dc (as declared)

11.3 Test Limit

Emissions from license-exempt transmitters shall comply with the field strength limits shown in the table below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

General Field Strength Limits for License-Exempt Transmitters at Frequencies above 30 MHz

<i>Frequency (MHz)</i>	<i>Field Strength (μV/m at 3 m)</i>
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

11.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure ii, the emissions from the EUT were measured on a spectrum analyzer / EMI receiver.

Radiated electromagnetic emissions from the EUT are checked first by preview scans. Preview scans for all spectrum and modulation characteristics are checked, using a peak detector and where applicable worst-case determined for function, operation, orientation, etc. for both vertical and horizontal polarisations. Pre-scan plots are shown with a peak detector and 100 kHz RBW.

If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.10 are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed, (see EUT setup photographs for more detail).

Emissions between 30 MHz and 1 GHz are measured using calibrated broadband antennas. Emissions above 1 GHz are characterized using standard gain horn antennas. Pre-amplifiers and filters are used where required. Care is taken to ensure that test receiver resolution bandwidth, video bandwidth and detector type(s) meet the regulatory requirements.

For both horizontal and vertical polarizations, the EUT is then rotated through 360 degrees in azimuth until the highest emission is detected. At the previously determined azimuth the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected, this maximum value is recorded.

Power values measured on the test receiver / analyzer are converted to field strength, FS, in dBμV/m at the regulatory distance, using:

$$FS = PR + CL + AF - PA + DC - CF$$

Where,

PR is the power recorded on the receiver / spectrum analyzer in dBμV;

CL is the cable loss in dB;

AF is the test antenna factor in dB/m;

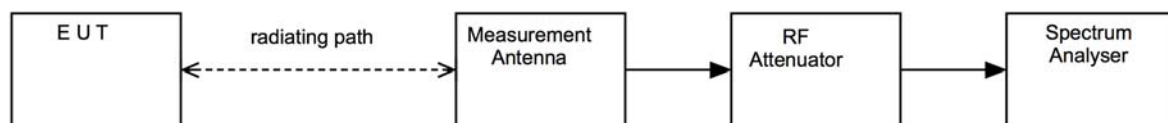
PA is the pre-amplifier gain in dB (where used);

DC is the duty correction factor in dB (where used, e.g. harmonics of pulsed fundamental);

CF is the distance factor in dB (where measurement distance is different to limit distance);

This field strength value is then compared with the regulatory limit.

Figure ii Test Setup



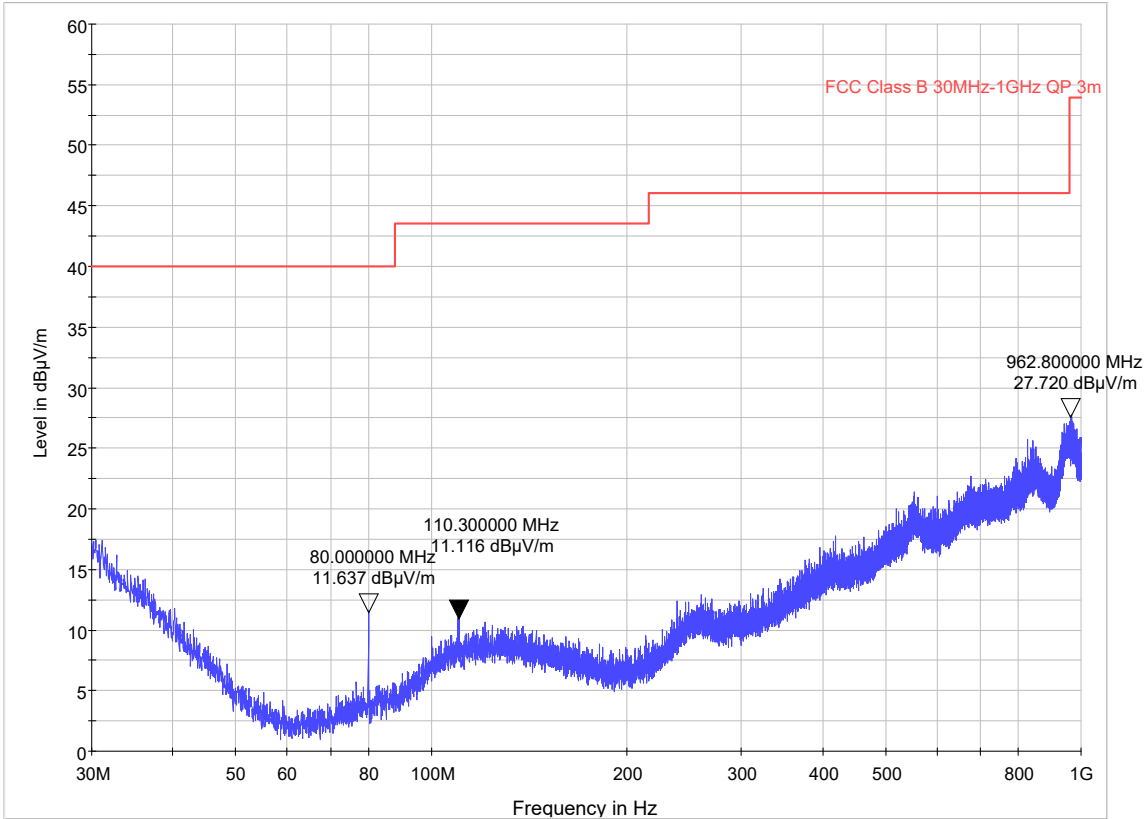
11.5 Test Set-up Photograph



11.6 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
CBL611/A	Chase	Bilog	U573	2019-08-02
ESVS10	R&S	Receiver	U004	2018-06-02
6201-69	Watkins Johnson	Pre Amp	U372	2019-02-21

11.7 Test Results



High Power; Frequency 10.6 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
No emissions within 20 dB to the limit										

12 Radiated spurious emissions, below 30 MHz

12.1 Definitions

Out-of-band emissions

Emissions on a frequency or frequencies immediately outside the necessary bandwidth which result from the modulation process, but exclude spurious emissions.

Spurious emissions

Emissions on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

Restricted bands

A frequency band in which intentional radiators are permitted to radiate only spurious emissions but not fundamental signals.

12.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Chamber
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.4
EUT Frequency Measured:	10.6 MHz
EUT Channel Bandwidths:	600 kHz
Deviations From Standard:	None
Measurement Distance and Site	1 m, Semi-anechoic chamber.
EUT Height:	1 m
Measurement Antenna and Height:	60 cm shielded loop; 1 m
Measurement BW:	9 kHz to 150 kHz: 200 Hz; 150 kHz to 30 MHz: 9 kHz
Measurement Detector:	9 kHz to 90 kHz and 110 kHz to 490 kHz: Average, RMS Other frequencies below 30 MHz: Quasi-peak.

Environmental Conditions (Normal Environment)

Temperature: 22 °C	+15 °C to +35 °C (as declared)
Humidity: 40 % RH	20 % RH to 75 % RH (as declared)
Supply: 1.2 V dc	1.2 V dc (as declared)

12.3 Test Limit

Emissions from license-exempt transmitters shall comply with the field strength limits shown in the table below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

General Field Strength Limits for License-Exempt Transmitters at Frequencies Below 30 MHz

<i>Frequency, f (kHz)</i>	<i>Field Strength</i>	<i>Measurement Distance (m)</i>
9 to 490	2,400 / 377.f (μA/m) 2,400 / f (μV/m)	300
490 to 1,750	24,000 / 377.f (μA/m) 24,000 / f (μV/m)	30
1,750 to 30,000	30 (μV/m)	30

12.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure i, the EUT fundamental frequency was maximised by rotating the EUT through 360°, in three orthogonal planes, and adjusting the measurement antenna azimuth.

Radiated electromagnetic emissions from the EUT are checked first by preview scans. Preview scans for all spectrum and modulation characteristics are checked, using a peak detector and where applicable worst-case determined for function, operation, orientation, etc. for both vertical and horizontal polarisations. Pre-scan plots are shown with a peak detector and 9 kHz RBW.

If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.10 are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed, (see EUT setup photographs for more detail).

Emissions between 9 kHz and 30 MHz are measured using a calibrated 60cm active loop antenna. Pre-amplifiers and filters are used where required. Care is taken to ensure that test receiver resolution bandwidth, video bandwidth and detector type(s) meet the regulatory requirements.

Power values measured on the test receiver / analyzer are converted to field strength, FS, in μV/m at the regulatory distance, using:

$$FS = 10^{(PR - CF) / 20}$$

Where,

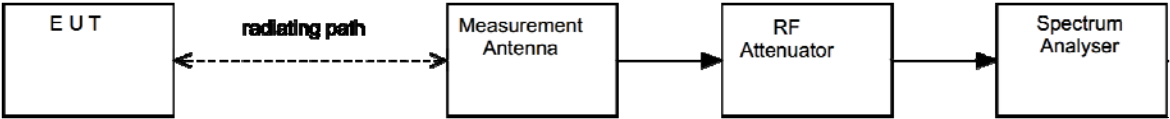
PR is the power recorded on the receiver / spectrum analyzer in dBμV and includes any cable loss, antenna factor and pre-amplifier gain;

CF is the distance extrapolation factor in dB (where measurement distance different to limit distance);

Per FCC 47CFR15.31(f)(2) / RSS-Gen 6.4, an extrapolation factor of 59.08 dB per decade was used for measurements at distances closer than specified.

This field strength value is then compared with the regulatory limit.

Figure i Test Setup



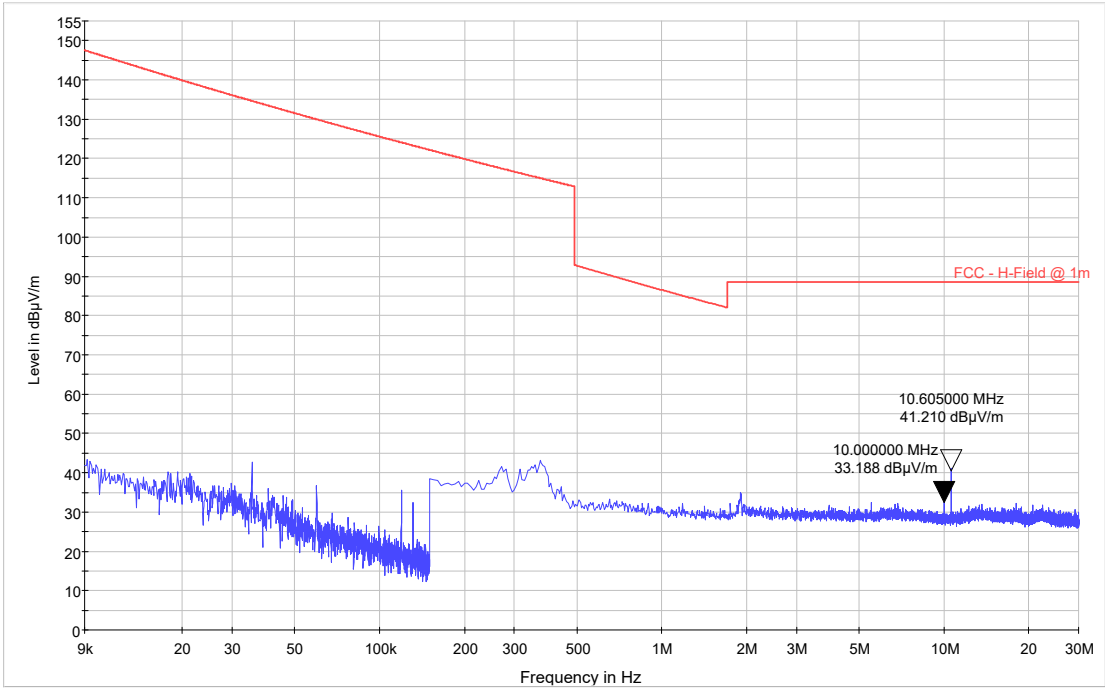
12.5 Test Set-up Photograph



12.6 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
hfh2	R&S	Loop Antenna	L007	2018-04-12
ESHS10	R&S	Receiver	U003	2018-08-29

12.7 Test Results



Modulation: FSK; Frequency: 10.6 MHz						
Emission Frequency (MHz)	Receiver Level (dBµV/m)	Measurement Distance (m)	Limit Distance (m)	Extrapolation Factor (dB)	Field Strength (µV/m)	Result
No emissions within 20 dB to the limit						PASS

13 Transmitter output power (fundamental radiated emission)

13.1 Definition

The RF power dissipated in the standard output termination when operating under the rated duty cycle selected by the applicant for approval.

13.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Chamber
Test Antenna:	Active 60cm loop
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.3 / 6.4
EUT Frequency Measured:	10.6 MHz
EUT Channel Bandwidths:	600 kHz
Deviations From Standard:	None
Measurement BW:	9 kHz
Measurement Detector:	Quasi-peak
Voltage Extreme Environment Test Range:	Fully charged power cell.

Environmental Conditions (Normal Environment)

Temperature: 22 °C	+15 °C to +35 °C (as declared)
Humidity: 40 % RH	20 % RH to 75 % RH (as declared)

13.3 Test Limit

The field strength measured at 30 m shall not exceed the limits in the following table:

General Field Strength Limits for License-Exempt Transmitters at Frequencies Below 30 MHz

<i>Frequency, f (kHz)</i>	<i>Field Strength</i>	<i>Measurement Distance (m)</i>
9 to 490	$2,400 / 377.f$ (μA/m) $2,400 / f$ (μV/m)	300
490 to 1,750	$24,000 / 377.f$ (μA/m) $24,000 / f$ (μV/m)	30
1,750 to 30,000	30 (μV/m)	30

13.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure v, the resolution bandwidth of the spectrum analyser was increased above the EUT occupied bandwidth and the peak emission data noted.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst-case configuration in each bandwidth.

Power values measured on the test receiver / analyzer are converted to field strength, FS, in $\mu\text{V/m}$ at the regulatory distance, using:

$$FS = 10^{(PR - CF) / 20}$$

Where,

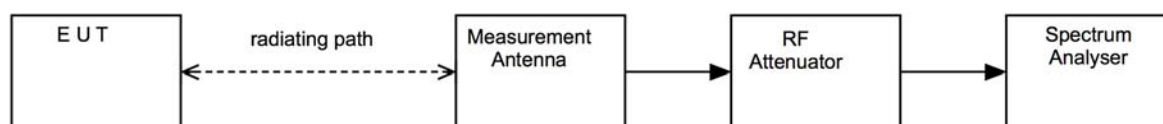
PR is the power recorded on the receiver / spectrum analyzer in $\text{dB}\mu\text{V}$ and includes any cable loss, antenna factor and pre-amplifier gain;

CF is the distance extrapolation factor in dB (where measurement distance different to limit distance);

Per FCC 47CFR15.31(f)(2) / RSS-Gen 6.4, an extrapolation factor of 59.08 dB per decade was used for measurements at distances closer than specified.

This field strength value is then compared with the regulatory limit.

Figure v Test Setup



13.5 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
hfh2	R&S	Loop Antenna	L007	2018-04-12
ESHS10	R&S	Receiver	U003	2018-08-29

13.6 Test Results

Modulation: FSK; High Power setting							
Channel Frequency (MHz)	Receiver Level (dB $\mu\text{V/m}$)	Measurement Distance (m)	Limit Distance (m)	Extrapolation Factor (dB)	Field Strength ($\mu\text{V/m}$)	Limit ($\mu\text{V/m}$)	Result
10.6	40.40	1	30	59.08	0.116	30	PASS

14 Occupied Bandwidth

14.1 Definition

Occupied bandwidth

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5 % of the emitted power. This is also known as the 99 % *emission bandwidth*. For transmitters in which there are multiple carriers, contiguous or non-contiguous in frequency, the occupied bandwidth is to be the sum of the occupied bandwidths of the individual carriers.

14.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Chamber
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.9
EUT Channels / Frequencies Measured:	10.6 MHz
EUT Channel Bandwidths:	600 kHz
EUT Test Modulations:	FSK
Deviations From Standard:	None
Measurement BW:	10 kHz
(requirement: 1% to 5% OBW)	
Spectrum Analyzer Video BW:	30 kHz
(requirement at least 3x RBW)	
Measurement Span:	2 MHz
(requirement 2 to 5 times OBW)	
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

Temperature: 22 °C	+15 °C to +35 °C (as declared)
Humidity: 40 % RH	20 % RH to 75 % RH (as declared)
Supply: 1.2 V dc	1.2 V dc (as declared)

14.3 Test Limit

Industry Canada:

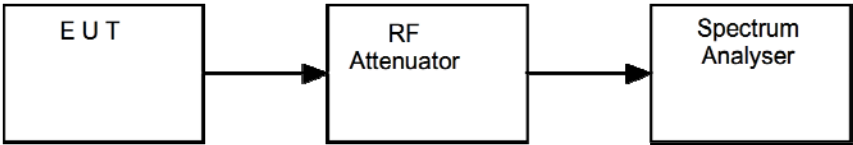
When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99 % emission bandwidth, as calculated or measured.

14.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure iv, the bandwidth of the EUT was measured on a spectrum analyser.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst-case configuration in each bandwidth.

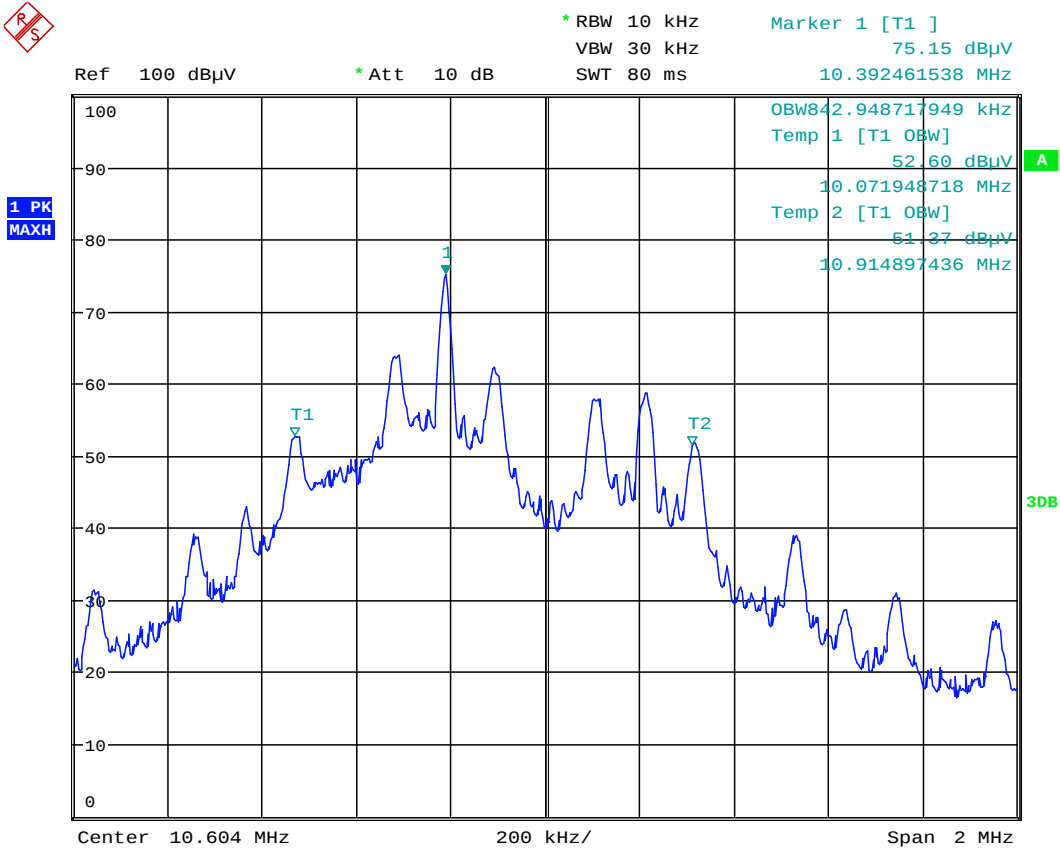
Figure iv Test Setup



14.5 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
FSU26	R&S	Spectrum Analyser	U405	2018-06-06

14.6 Test Results



15 Measurement Uncertainty

Calculated Measurement Uncertainties

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95 % confidence:

[1] Radiated emissions below 30 MHz

Uncertainty in test result (9 kHz to 30 MHz) = **2.3 dB**

[2] Spurious emissions

Uncertainty in test result (30 MHz to 1 GHz) = **4.6 dB**

Uncertainty in test result (1 GHz to 18 GHz) = **4.7 dB**

[3] AC power line conducted emissions

Uncertainty in test result = **3.4 dB**

[4] Occupied bandwidth

Uncertainty in test result = **15.5 %**

[5] Maximum frequency error

Uncertainty in test result (Power Meter) = **0.113 ppm**

Uncertainty in test result (Spectrum Analyser) = **0.265 ppm**