

Report on the Radio Testing

For

Truma Limited

On

GB50 Caravan Mover 915

Report no. TRA-046413-47-01B

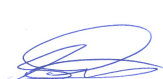
RF959 iss.1.0

Report Number: TRA-046413-47-01B
Issue: B

REPORT ON THE RADIO TESTING OF A
Truma Limited
GB50 Caravan Mover 915
WITH RESPECT TO SPECIFICATION
FCC 47CFR 15.249

TEST DATE: 2019-12-17

Tested by:



Steve Garwell
cn=Steve Garwell, o=Element Material
Technology, ou,
email=steve.garwell@element.com, c=GB
I am the author of this document
2020.04.01 16:59:18 +01'00'

Steven Garwell, Daniel
Moncayola
Radio Test Engineers

Approved by:



Digitally signed by John Charters
DN: cn=John Charters, o, ou=Element
Materials Technology Ltd.,
email=john.charters@element.com, c=GB
Reason: I am approving this document
Date: 2020.04.01 17:00:36 +01'00'

John Charters
Department Radio - Manager

Date:

2020-04-01

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

RF959 iss.1.0

1 Revision Record

<i>Issue Number</i>	<i>Issue Date</i>	<i>Revision History</i>
A	2019-12-17	Original
B	2020-04-01	Added FCC ID & Corrections to modulation type

2 Summary

TEST REPORT NUMBER:	TRA-046413-47-01B
WORKS ORDER NUMBER:	TRA-046413-05
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.
TEST SPECIFICATION:	47CFR15.249
EQUIPMENT UNDER TEST (EUT):	GB50 Caravan Mover 915
FCC IDENTIFIER:	2AVPBPFAM4
EUT SERIAL NUMBER:	CDFMC1119-0744
MANUFACTURER/AGENT:	Truma Limited
ADDRESS:	2000 Park Lane Dove Valley Park Derby DE65 5BG
CLIENT CONTACT:	Rob Earl ☎ +44 1283 587900 ✉ rearl@trumauk.com
ORDER NUMBER:	EVO/19/052
TEST DATE:	2019-12-17
TESTED BY:	Steven Garwell, Daniel Moncayola Element

2.1 Test Summary

<i>Test Method and Description</i>	<i>Requirement Clause 47CFR15</i>	<i>Applicable to this equipment</i>	<i>Result / Note</i>
Radiated spurious emissions	15.249(d)	☒	PASS
AC power line conducted emissions	15.207	☐	Note 1
Occupied bandwidth	15.215(c)	☒	PASS
Field strength of fundamental	15.249(a)	☒	PASS
Calculation of duty correction ¹	15.35(c)	☐	N/A

Notes:

Note 1: not applicable the device is battery operated.

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

3 Contents

1	Revision Record	3
2	Summary	4
2.1	Test Summary	5
3	Contents	6
4	Introduction	7
5	Test Specifications	8
5.1	Normative References	8
5.2	Deviations from Test Standards	8
6	Glossary of Terms	9
7	Equipment Under Test	10
7.1	EUT Identification	10
7.2	System Equipment	10
7.3	EUT Mode of Operation	10
7.3.1	Transmission	10
7.4	EUT Radio Parameters	10
7.4.1	General	10
7.5	EUT Description	11
8	Modifications	12
9	EUT Test Setup	12
9.1	Block Diagram	12
9.2	General Set-up Photograph	13
9.3	Measurement software	13
10	General Technical Parameters	14
10.1	Normal Conditions	14
11	Radiated emissions	15
11.1	Definitions	15
11.2	Test Parameters	15
11.3	Test Method	16
11.4	Test Equipment	17
11.5	Test Results	18
12	Occupied Bandwidth	19
12.1	Definition	19
12.2	Test Parameters	19
12.3	Test Method	20
12.4	Test Equipment	20
12.5	Test Results	21
13	Transmitter output power (fundamental radiated emission)	22
13.1	Definition	22
13.2	Test Parameters	22
13.3	Test Limit	22
13.4	Test Method	23
13.5	Test Equipment	23
13.6	Test Results	23
14	Measurement Uncertainty	24

4 Introduction

This report TRA-046413-47-01B presents the results of the Radio testing on a Truma Limited, GB50 Caravan Mover 915 to specification 47CFR15 Radio Frequency Devices: Category I Equipment.

The testing was carried out for Truma Limited 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
--------------------------	---	-------------------------------------	--

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.

IC Registration Number(s):

Element Hull	3483A
Element North West	3930B

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

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.

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
CISPR	Comité International Spécial des Perturbations Radioélectriques
CW	Continuous Wave
dB	decibel
dBm	dB relative to 1 milliwatt
DC	Direct Current
EIRP	Equivalent Isotropically Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
Hz	hertz
IC	Industry Canada (now ISED)
ISED	Innovation, Science and Economic Development Canada
ITU	International Telecommunication Union
m	metre
max	maximum
min	minimum
MRA	Mutual Recognition Agreement
N/A	Not Applicable
PCB	Printed Circuit Board
PDF	Portable Document Format
QP	Quasi-Peak
RF	Radio Frequency
RH	Relative Humidity
RMS	Root Mean Square
Rx	receiver
s	second
Tx	transmitter
UKAS	United Kingdom Accreditation Service
V	volt
W	watt
Ω	ohm

7 Equipment Under Test

7.1 EUT Identification

- Name: GB50 Caravan Mover 915
- Serial Number: CDFMC1119-0744
- Model Number: GB50 Caravan Mover 915
- Software Revision: 5.0
- Build Level / Revision Number: Issue 4

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 transmit tests was as follows:-

The EUT was transmitting a modulated carrier on the required test frequency.

7.4 EUT Radio Parameters

7.4.1 General

Frequency of operation:	916.6 MHz
Modulation type:	GFSK
Occupied channel bandwidth:	200 kHz
Declared output power:	< 0 dBm
Nominal Supply Voltage:	9 V dc

7.5 EUT Description

The EUT is a remote control device incorporating a 916 MHz short range device radio using a single antenna and single modulation scheme.

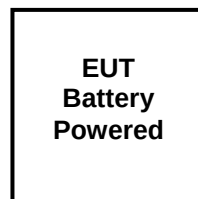
8 Modifications

No modifications were performed during this assessment.

9 EUT Test Setup

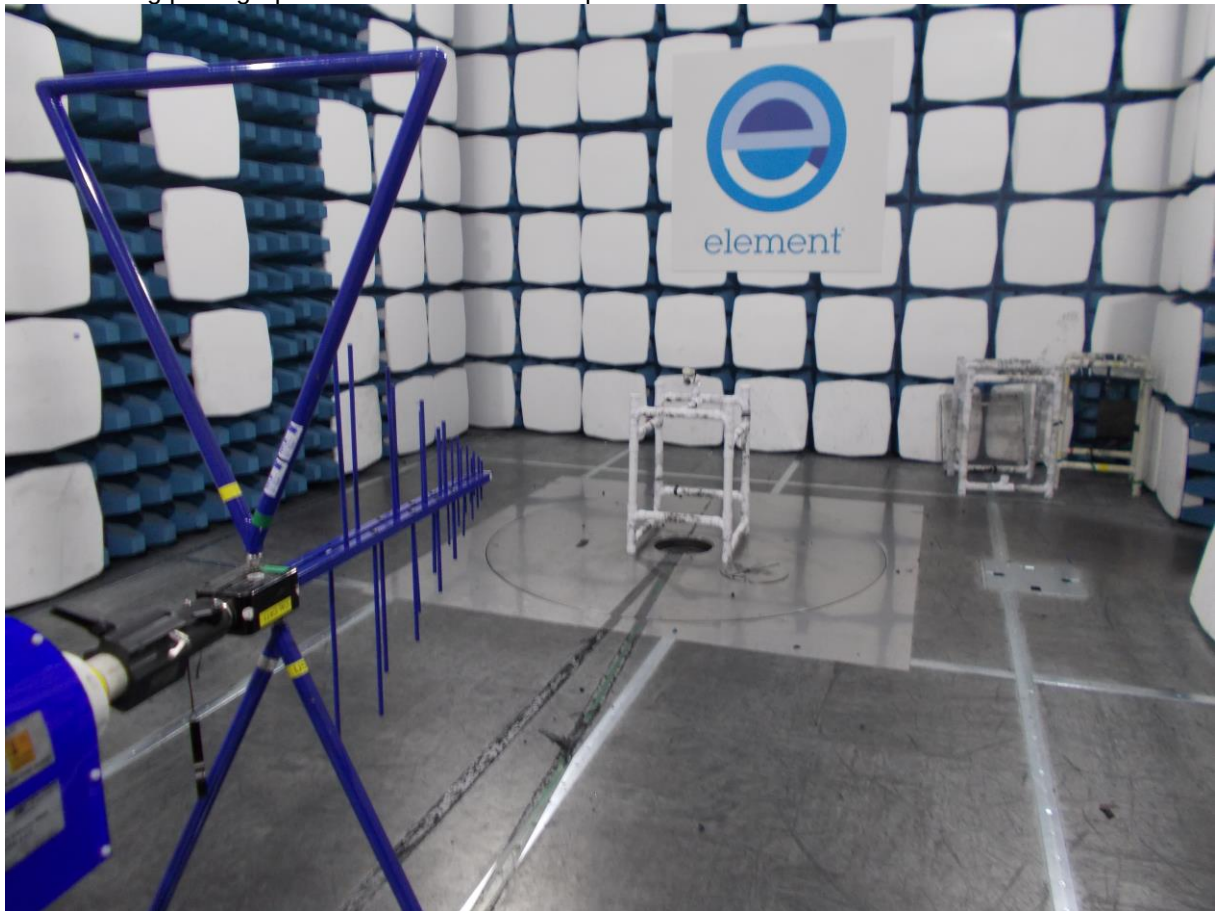
9.1 *Block Diagram*

The following diagram shows basic EUT interconnections with cable type and cable lengths identified:



9.2 General Set-up Photograph

The following photograph shows basic EUT set-up:



9.3 Measurement software

Where applicable, the following software was used to perform measurements contained within this report.

Element Emissions R5 (See Note)
Element Transmitter Bench Test (See Note)
ETS Lindgren EMPower V1.0.4.2
Note:

The version of the Element software used is recorded in the results sheets contained within this report.

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 9 V dc from alkaline batteries.

11 Radiated 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 3
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 and 6.6
EUT Frequency Measured:	916.6 MHz
EUT Channel Bandwidth:	200 kHz
Deviations From Standard:	None
Measurement BW:	30 MHz to 1 GHz: 120 kHz Above 1 GHz: 1 MHz
Measurement Detector:	Up to 1 GHz: quasi-peak Above 1 GHz: RMS average and Peak

Environmental Conditions (Normal Environment)

Temperature: 21 °C	+15 °C to +35 °C (as declared)
Humidity: 35 %RH	20%RH to 75%RH (as declared)
Supply: 9 V dc	

Test Limits

Emissions shall comply with the field strength limits shown in the Table 5. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 5 - General Field strength limits 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

nb. per FCC 47CFR15.35(b) / RSS-Gen 8.1, peak limit is 20 dB above average.

11.3 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 dB μ V/m at the regulatory distance, using:

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

$$\text{Factor} = CL + AF - PA$$

Where,

PR is the power recorded on the receiver / spectrum analyzer in dB μ V;

CL is the cable loss in dB;

AF is the test antenna factor in dB/m;

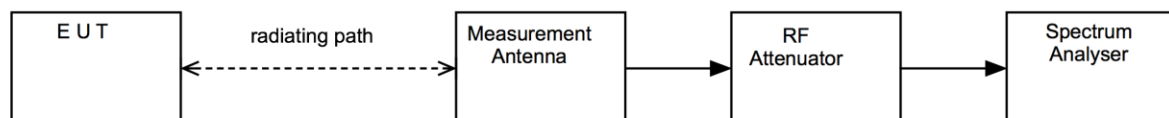
PA is the pre-amplifier gain in dB (where used);

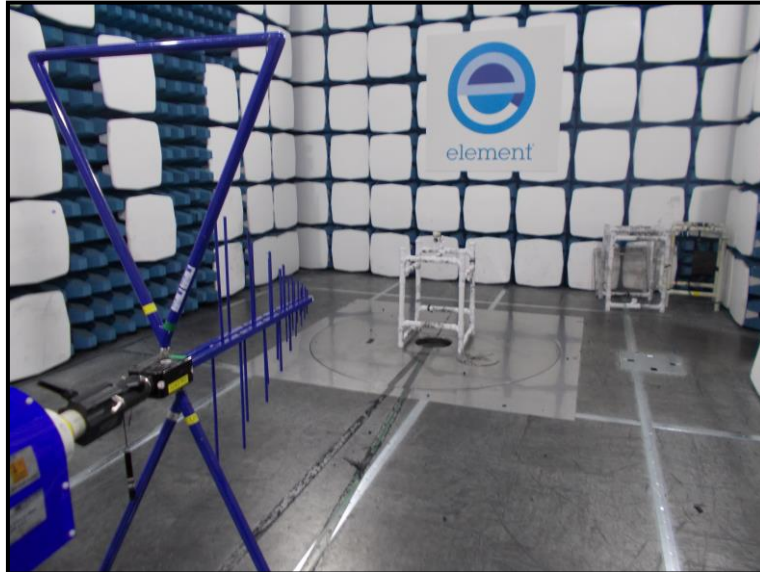
DC is the duty correction factor in dB (where used, e.g. harmonics of pulsed fundamental);

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

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

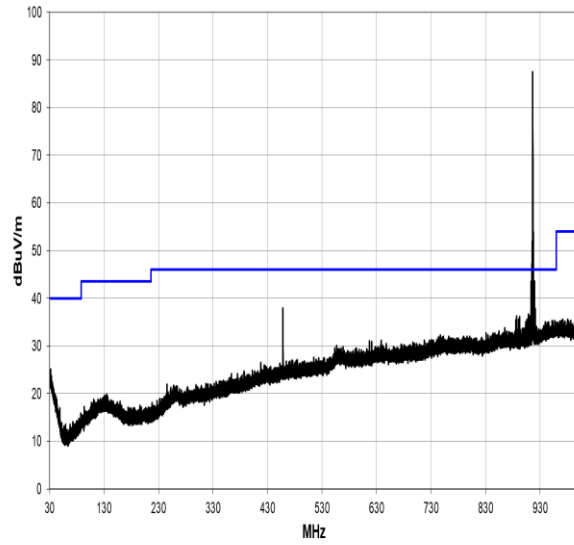
Figure i Test Setup



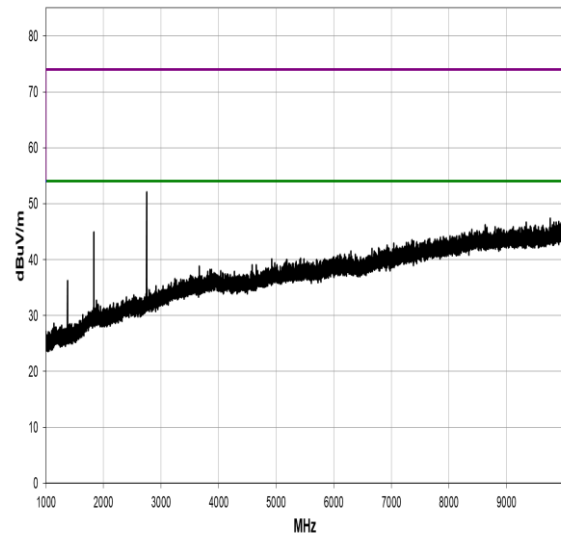
Test Setup Photograph:**11.4 Test Equipment**

<i>Equipment Description</i>	<i>Manufacturer</i>	<i>Equipment Type</i>	<i>Element No</i>	<i>Due For Calibration</i>
Spectrum Analyser	R&S	FSU46	REF910	2020-10-17
Bilog	Chase	CBL611/A	U573	2021-09-19
PreAmp	Watkins Johnson	6201-69	U372	2020-02-25
8449B	Agilent	Pre Amp	L572	2020-10-15
1-18GHz Horn	EMCO	3115	L139	2021-07-16

11.5 Test Results



30 MHz to 1 GHz



1 GHz to 10 GHz

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
458.348	38.6	-2.4	1.91	249.0	3.0	0.0	Horz	QP	0.0	36.2	46.0	-9.8
458.345	25.2	-2.4	1.0	100.1	3.0	0.0	Vert	QP	0.0	22.8	46.0	-23.2

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
2749.842	47.7	-2.8	2.03	37.0	3.0	0.0	Horz	AV	0.0	44.9	54.0	-9.1
2749.842	42.3	-2.8	2.26	162.0	3.0	0.0	Vert	AV	0.0	39.5	54.0	-14.5
2749.950	59.9	-2.8	2.03	37.0	3.0	0.0	Horz	PK	0.0	57.1	74.0	-16.9
1833.325	42.4	-5.7	2.32	223.0	3.0	0.0	Horz	AV	0.0	36.7	54.0	-17.3
1833.300	42.3	-5.7	2.67	89.9	3.0	0.0	Vert	AV	0.0	36.6	54.0	-17.4
2749.575	54.9	-2.8	2.26	162.0	3.0	0.0	Vert	PK	0.0	52.1	74.0	-21.9
1375.008	39.8	-9.3	1.04	296.9	3.0	0.0	Horz	AV	0.0	30.5	54.0	-23.5
1833.125	54.8	-5.7	2.32	223.0	3.0	0.0	Horz	PK	0.0	49.1	74.0	-24.9
1833.217	54.7	-5.7	2.67	89.9	3.0	0.0	Vert	PK	0.0	49.0	74.0	-25.0
1375.008	36.5	-9.3	3.95	6.0	3.0	0.0	Vert	AV	0.0	27.2	54.0	-26.8
1375.292	52.7	-9.3	1.04	296.9	3.0	0.0	Horz	PK	0.0	43.4	74.0	-30.6
1374.608	49.5	-9.3	3.95	6.0	3.0	0.0	Vert	PK	0.0	40.2	74.0	-33.8

12 Occupied Bandwidth

12.1 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.

20dB bandwidth

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal.

12.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Laboratory
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.9
EUT Frequency Measured:	916.6 MHz
EUT Channel Bandwidth:	200 kHz
EUT Test Modulation:	GFSK
Deviations From Standard:	None
Measurement BW:	3 kHz
(requirement: 1% to 5% OBW)	
Spectrum Analyzer Video BW:	10 kHz
(requirement at least 3x RBW)	
Measurement Span:	500 kHz
(requirement 2 to 5 times OBW)	
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

Temperature: 21 °C	+15 °C to +35 °C (as declared)
Humidity: 35 %RH	20%RH to 75%RH (as declared)
Supply: 9 V dc	

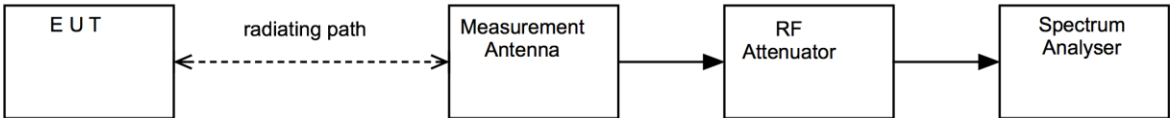
Federal Communications Commission:

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

12.3 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

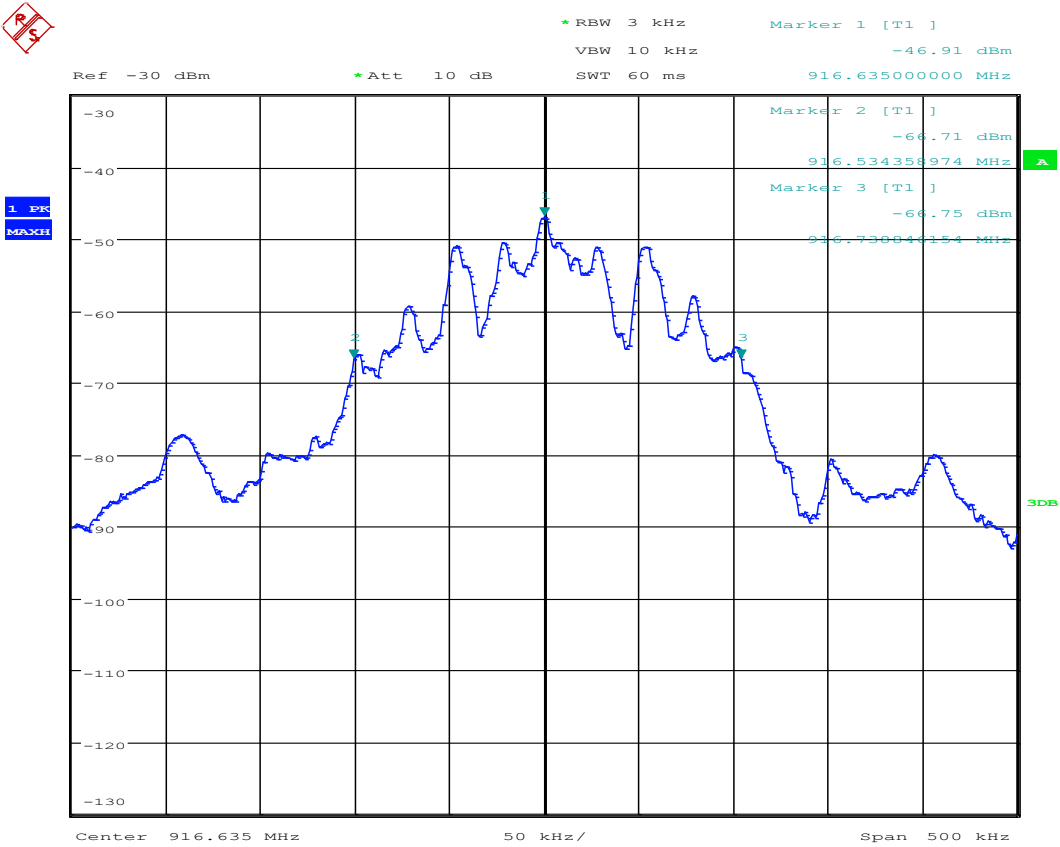


12.4 Test Equipment

<i>Equipment Description</i>	<i>Manufacturer</i>	<i>Equipment Type</i>	<i>Element No</i>	<i>Due For Calibration</i>
Spectrum Analyser	R&S	FSU46	REF910	2020-10-17

12.5 Test Results

20 dB Bandwidth			
Channel Frequency (MHz)	F_L (MHz)	F_H (MHz)	20 dB Bandwidth (kHz)
916.60 MHz	916.534359	916.738846	204.487000



Date: 18.DEC.2019 08:13:58

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 3
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 / 6.6
EUT Frequency Measured:	916.6 MHz
EUT Channel Bandwidths:	200 kHz
Deviations From Standard:	None
Measurement BW:	1 MHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	3 MHz
Measurement Detector:	Up to 1GHz: Quasi-peak Above 1GHz: Average RMS and Peak

Environmental Conditions (Normal Environment)

Temperature: 21 °C	+15 °C to +35 °C (as declared)
Humidity: 35 %RH	20%RH to 75%RH (as declared)

13.3 Test Limit

The field strength measured at 3 metres shall not exceed the limits in the following table:

Field Strength Limits for License-Exempt Transmitters for Any Application

<i>Fundamental frequency (MHz)</i>	<i>Field strength (mV/m at 3 m)</i>	<i>Detector</i>
902 to 928	50	Quasi-Peak
2400 to 2483.5	50	Average RMS
5725 to 5875	50	Average RMS

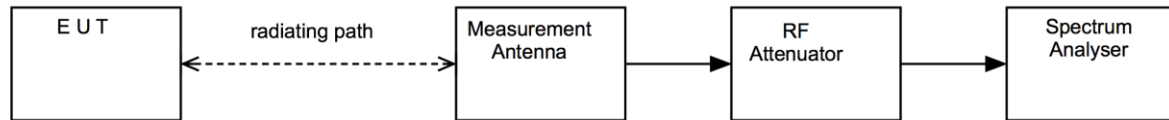
nb per FCC 47CFR15.249(e) / RSS-Gen 8.1, peak limit is 20 dB above average.

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.

Figure v Test Setup



13.5 Test Equipment

<i>Equipment Description</i>	<i>Manufacturer</i>	<i>Equipment Type</i>	<i>Element No</i>	<i>Due For Calibration</i>
Spectrum Analyser	R&S	FSU46	REF910	2020-10-17
Bilog	Chase	CBL611/A	U573	2021-09-19
PreAmp	Watkins Johnson	6201-69	U372	2020-02-25

13.6 Test Results

<i>Frequency 916.6 MHz:</i>					
<i>Channel Frequency (MHz)</i>	<i>Peak Field Strength (dBμV/m)</i>	<i>Distance (m)</i>	<i>Antenna Gain (dBi)</i>	<i>Max. Power (W)</i>	<i>Result</i>
916.6 MHz	87.7	3	N/A	0.000108	PASS

14 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 30MHz

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

[2] Spurious emissions

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

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

[3] AC power line conducted emissions

Uncertainty in test result = **3.4dB**

[4] Occupied bandwidth

Uncertainty in test result = **15.5%**

[5] Maximum frequency error

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

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