

Report on the Radio Testing  
For  
MysteryVibe Ltd  
on  
Crescendo  
Report no. TRA-021996-47-02B  
8th August 2016

RF915 4.0

Report Number: TRA-021996-47-02B  
Issue: BV

REPORT ON THE RADIO TESTING OF A  
MysteryVibe Ltd  
Crescendo  
WITH RESPECT TO SPECIFICATION  
FCC 47CFR 15.247

TEST DATE: 31st May - 1st June 2016

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Date: 8th August 2016

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


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RF915 4.0

## 1 Revision Record

<i>Issue Number</i>	<i>Issue Date</i>	<i>Revision History</i>
A	8th August 2016	Original
B	8 <sup>th</sup> August 2016	Update to FCC and fix tables

## 2 Summary

TEST REPORT NUMBER:	TRA-021996-47-02B
WORKS ORDER NUMBER	TRA-021996-04
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(S):	47CFR15.247
EQUIPMENT UNDER TEST (EUT):	Crescendo
FCC IDENTIFIER:	2AHVA-6900
EUT SERIAL NUMBER:	Not Applicable
MANUFACTURER/AGENT:	MysteryVibe Ltd
ADDRESS:	68 Whalley Drive Bletchley Milton Keynes Buckinghamshire MK3 6HS United Kingdom
CLIENT CONTACT:	Soumyadip Rakshit   soumyadip@mysteryvibe.com
ORDER NUMBER:	Not Applicable
TEST DATE:	31st May - 1st June 2016
TESTED BY:	D Winstanley Element

## 2.1 Test Summary

Test Method and Description		Requirement Clause	Applicable to this equipment	Result / Note
		47CFR15		
Radiated spurious emissions (restricted bands of operation and cabinet radiation)		15.205	<input checked="" type="checkbox"/>	Pass
AC power line conducted emissions		15.207	<input type="checkbox"/>	N/A
Occupied bandwidth		15.247(a)(2)	<input checked="" type="checkbox"/>	Pass
Conducted carrier power	Peak	15.247(b)(3)	<input checked="" type="checkbox"/>	Pass
	Max.		<input type="checkbox"/>	
Conducted / radiated RF power out-of-band		15.247(d)	<input checked="" type="checkbox"/>	Pass
Power spectral density, conducted		15.247(e)	<input checked="" type="checkbox"/>	Pass
Calculation of duty correction		15.35(c)	<input type="checkbox"/>	N/A

### Notes:

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
7.3.2	Reception.....	10
7.4	EUT Radio Parameters .....	11
7.4.1	General .....	11
7.4.2	Antennas.....	11
7.4.3	Product specific declarations.....	11
7.5	EUT Description .....	11
8	Modifications .....	12
9	EUT Test Setup .....	13
9.1	Block Diagram.....	13
9.2	General Set-up Photograph .....	14
10	General Technical Parameters.....	15
10.1	Normal Conditions.....	15
10.2	Varying Test Conditions .....	15
11	Radiated emissions.....	16
11.1	Definitions .....	16
11.2	Test Parameters.....	16
11.3	Test Limit.....	16
11.4	Test Method .....	17
11.5	Test Set-up Photograph .....	18
11.6	Test Equipment.....	18
11.7	Test Results .....	19
12	Occupied Bandwidth .....	29
12.1	Definition .....	29
12.2	Test Parameters.....	29
12.3	Test Limit.....	29
12.4	Test Method .....	30
12.5	Test Equipment.....	30
12.6	Test Results .....	30
13	Maximum peak conducted output power.....	32
13.1	Definition .....	32
13.2	Test Parameters.....	32
13.3	Test Limit.....	32
13.4	Test Method .....	33
13.5	Test Equipment.....	33
13.6	Test Results .....	33
14	Out-of-band and conducted spurious emissions .....	34
14.1	Definition .....	34
14.2	Test Parameters.....	34
14.3	Test Limit.....	34
14.4	Test Method .....	35
14.5	Test Equipment.....	35
14.6	Test Results .....	36
15	Power spectral density.....	39
15.1	Definition .....	39
15.2	Test Parameters.....	39
15.3	Test Limit.....	39
15.4	Test Method .....	40
15.5	Test Equipment.....	40
15.6	Test Results .....	40
16	Measurement Uncertainty.....	41

## 4 Introduction

This report TRA-021996-47-02B presents the results of the Radio testing on a MysteryVibe Ltd, Crescendo to specification 47CFR15 Radio Frequency Devices.

The testing was carried out for MysteryVibe Ltd by Element, at the address(es) detailed below.

<input type="checkbox"/>	Element Hull Unit E South Orbital Trading Park Hedon Road Hull HU9 1NJ UK	<input checked="" type="checkbox"/>	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.

Throughout this report EUT denotes equipment under test.

FCC Site Listing:

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

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

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

## **7 Equipment Under Test**

### **7.1 EUT Identification**

- Name: Crescendo
- Serial Number: Not Applicable
- Model Number: 6900
- Software Revision: V3.2B
- 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 EUT was set to produce a modulated carrier on the required channel for test.  
The Test modes were integrated into the EUT

#### **7.3.2 Reception**

The EUT was set to in a permanent receive mode on the required channel for test.

## 7.4 EUT Radio Parameters

### 7.4.1 General

<b>Frequency of operation:</b>	2402 – 2480 MHz
<b>Modulation type(s):</b>	GFSK
<b>Occupied channel bandwidth(s):</b>	1 MHz
<b>Channel spacing:</b>	2 MHz
<b>Declared output power(s):</b>	<10 dBm
<b>Warning against use of alternative antennas in user manual (yes/no):</b>	Not Applicable
<b>Nominal Supply Voltage:</b>	3.3 Vdc

### 7.4.2 Antennas

<b>Type:</b>	<i>Inverted F Antenna PCB Trace</i>
<b>Frequency range:</b>	2.4 GHz
<b>Impedance:</b>	50 Ohms
<b>Gain:</b>	4.33 dBi
<b>Connector type:</b>	Integral

### 7.4.3 Product specific declarations

<b>Multiple antenna configuration(s), e.g. MIMO:</b>	Not Applicable
<b>Fixed pt-pt operations (yes/no):</b>	No
<b>Installation manual advice on pt-pt operational restrictions (yes/no):</b>	No
<b>Fixed pt-mpt operations (yes/no):</b>	No
<b>Simultaneous tx (yes/no):</b>	No

## 7.5 EUT Description

The EUT is novelty sex toy containing a Bluetooth low energy radio operating in the 2.4 GHz band

## **8 Modifications**

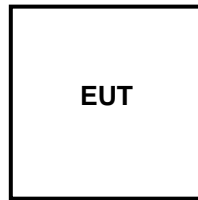
No modifications were performed during this assessment.

## 9 EUT Test Setup

### 9.1 *Block Diagram*

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

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 approx. 3.3 V dc from batteries.

### 10.2 Varying Test Conditions

There are no specific frequency stability requirements for the type of device. The results contained in this report demonstrate that the occupied bandwidth is contained within the authorised band and the manufacturer has declared sufficient frequency stability (refer to section 7.4).

Variation of supply voltage is required to ensure stability of the declared output power. During carrier power testing the following variations were made:

	<b>Category</b>	<b>Nominal</b>	<b>Variation</b>
<input type="checkbox"/>	Mains	110 V ac +/-2 %	85 % and 115 %
<input checked="" type="checkbox"/>	Battery	3.3 V dc	85 % and 115 %

## 11 Radiated emissions

### 11.1 Definitions

#### *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 (REF940)
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 and 6.6
EUT Channels / Frequencies Measured:	2402 / 2440 / 2480 MHz
EUT Channel Bandwidths:	2 MHz
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: 23 °C	+15 °C to +35 °C (as declared)
Humidity: 34 % RH	20 % RH to 75 % RH (as declared)
Supply: 3.3 V dc	3.3 V dc (as declared)

### 11.3 Test Limit

Unwanted emissions that fall within the restricted frequency bands shall comply with the limits specified:

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

<b>Frequency (MHz)</b>	<b>Field Strength (<math>\mu\text{V/m}</math> at 3 m)</b>
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 i, 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;

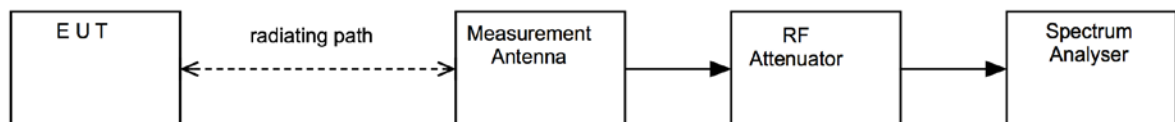
PA is the pre-amplifier gain in dB (where used);

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 different to limit distance);

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

**Figure i Test Setup**



### 11.5 Test Set-up Photograph

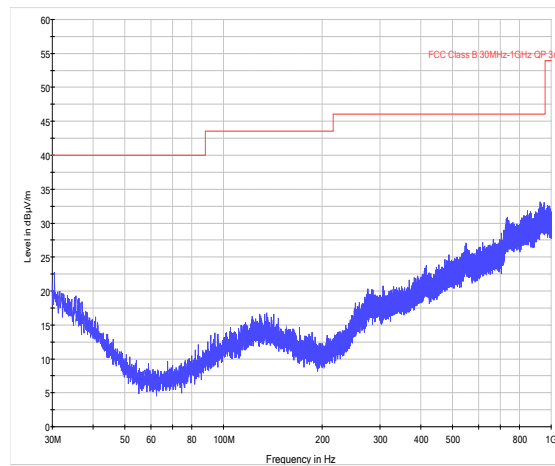


### 11.6 Test Equipment

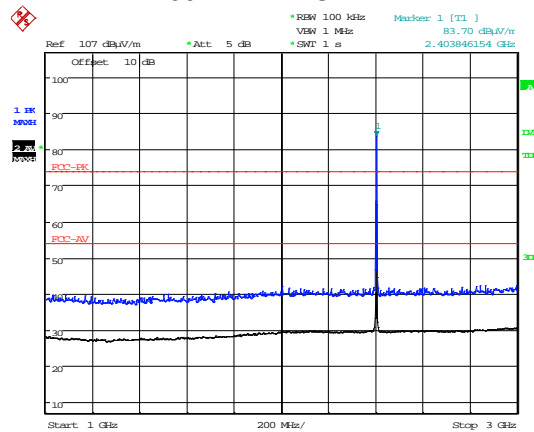
Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration	Calibration Period
ESVS10	R&S	Receiver	L317	11/03/2017	12
CBL611/A	Chase	Bilog	U191	26/02/2017	24
FSU26	R&S	Spectrum Analyser	REF909	26/04/2017	12
3115	EMCO	1-18GHz Horn	L139	25/09/2017	24
8449B	Agilent	Pre Amp	L572	16/02/2017	12
20240-20	Flann	Horn 18-26GHz (&U330)	L300	07/04/2018	24

## 11.7 Test Results

High Power; Channel: 2402 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)
Pk	4805.58	49.44	4.80	33.10	35.84	0.00	0.00	51.50	375.84	5012
Av	4805.58	40.64	4.80	33.10	35.84	0.00	0.00	42.70	136.46	500

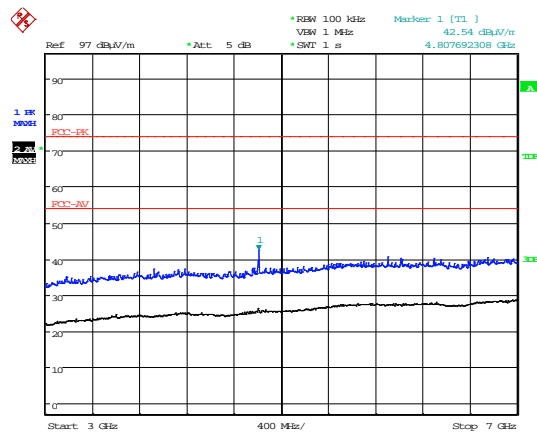


### 30 MHz – 1 GHz



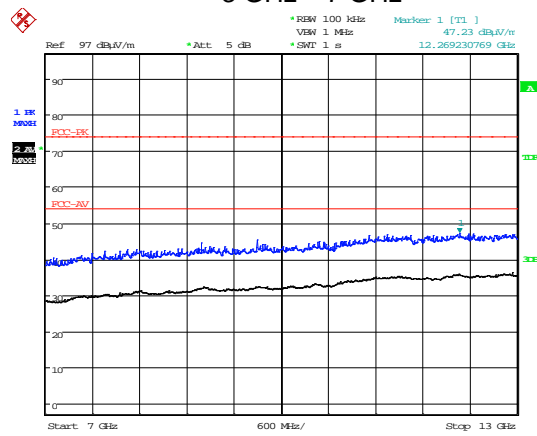
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### 1 GHz – 3 GHz



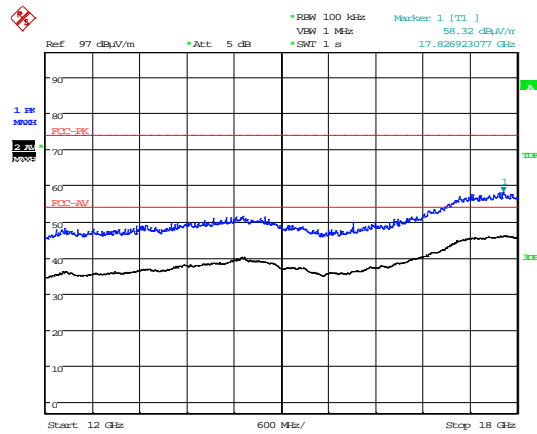
Date: 31.MAY.2016 20:02:46

## 3 GHz – 7 GHz



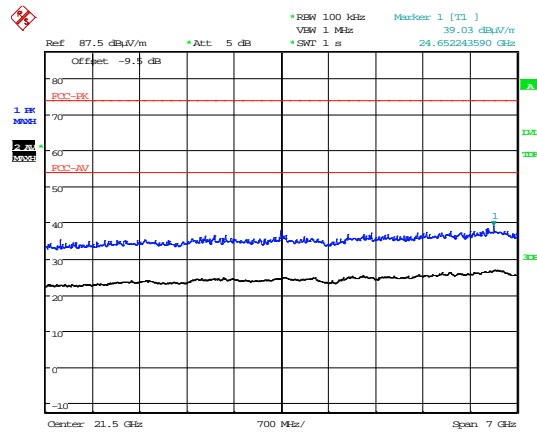
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## 7 GHz – 13 GHz



Date: 31.MAY.2016 17:39:19

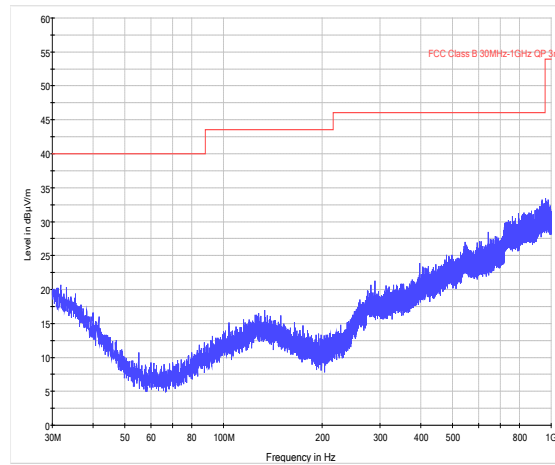
## 13 GHz – 18 GHz



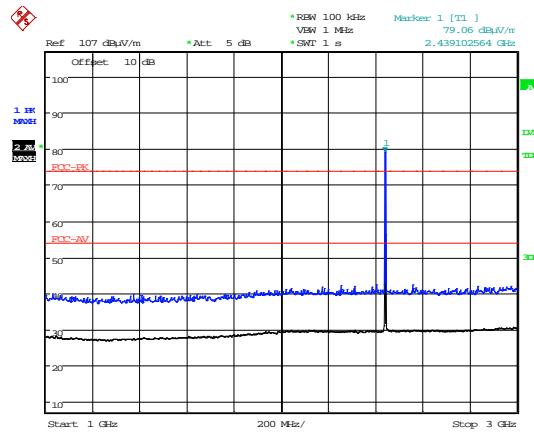
Date: 31.MAY.2016 21:37:35

## 18 GHz – 25 GHz

High Power; Channel: 2440 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)
Pk	4881.98	49.41	4.70	33.30	35.87	0.00	0.00	51.54	377.57	5012
Av	4881.98	40.86	4.70	33.30	35.87	0.00	0.00	42.99	141.09	500

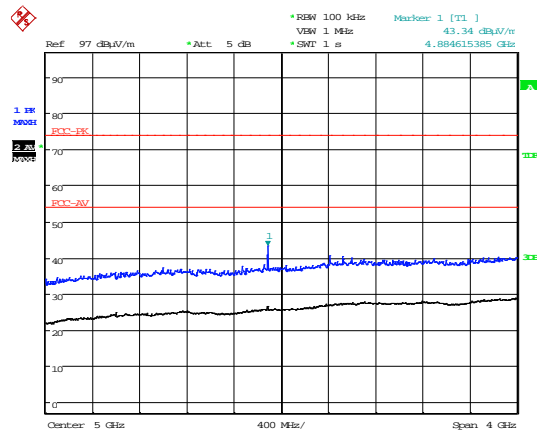


### 30 MHz – 1 GHz



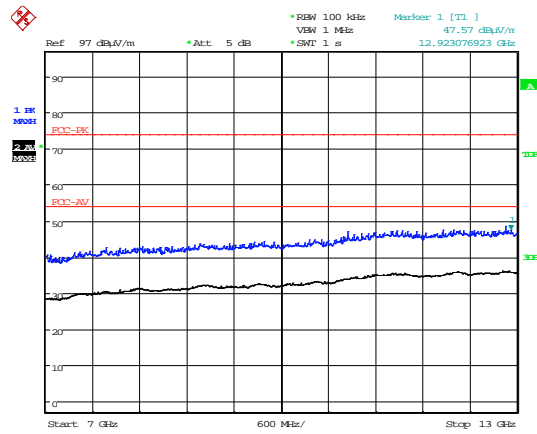
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### 1 GHz – 3 GHz



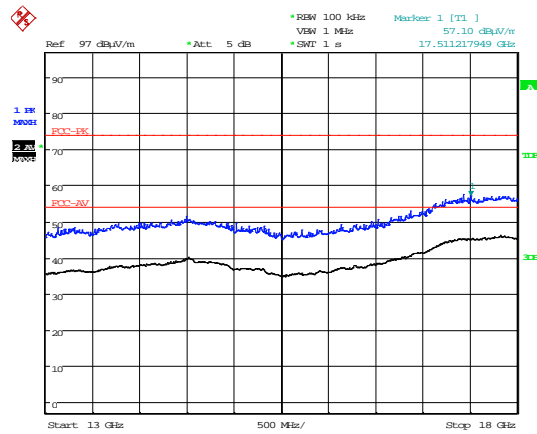
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## 3 GHz – 7 GHz



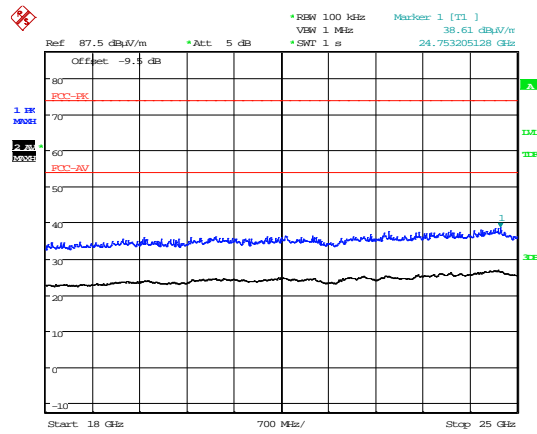
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## 7 GHz – 13 GHz



Date: 31.MAY.2016 18:33:41

## 13 GHz – 18 GHz

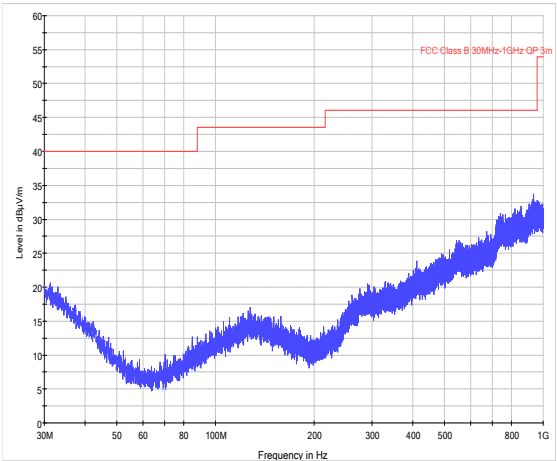


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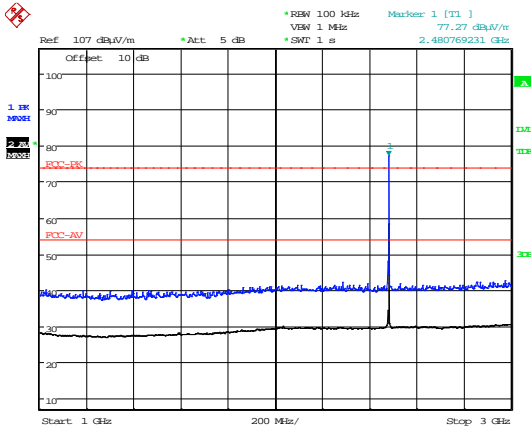
## 18 GHz – 25 GHz



High Power; Channel: high 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)
Pk	4957.92	49.04	4.60	33.50	35.90	0.00	0.00	51.24	364.75	5012
Av	4957.92	40.73	4.60	33.50	35.90	0.00	0.00	42.93	140.12	500

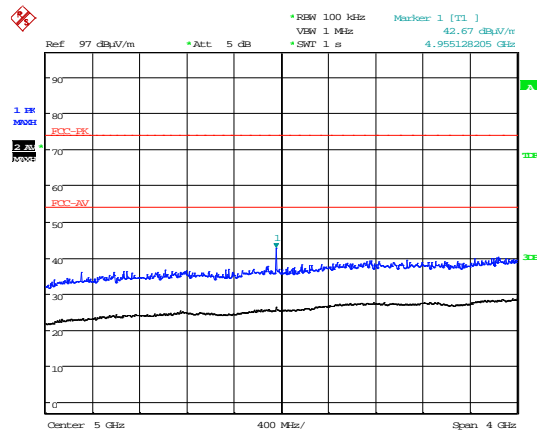


30 MHz – 1 GHz



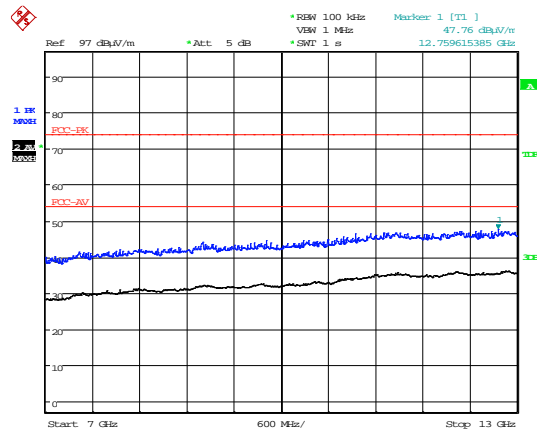
Date: 31.MAY.2016 20:16:44

1 GHz – 3 GHz



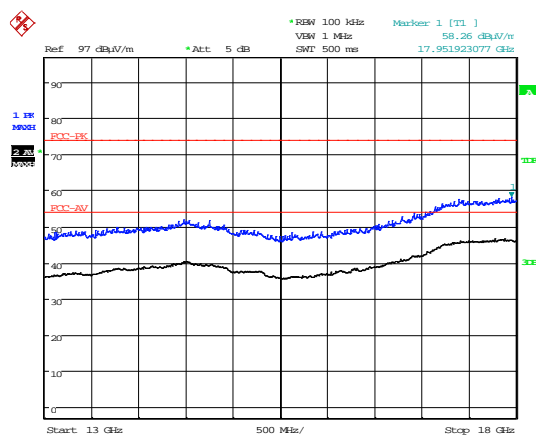
Date: 31.MAY.2016 19:03:23

## 3 GHz – 7 GHz



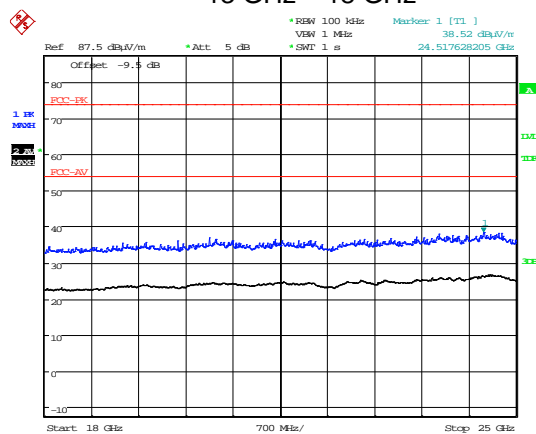
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## 7 GHz – 13 GHz



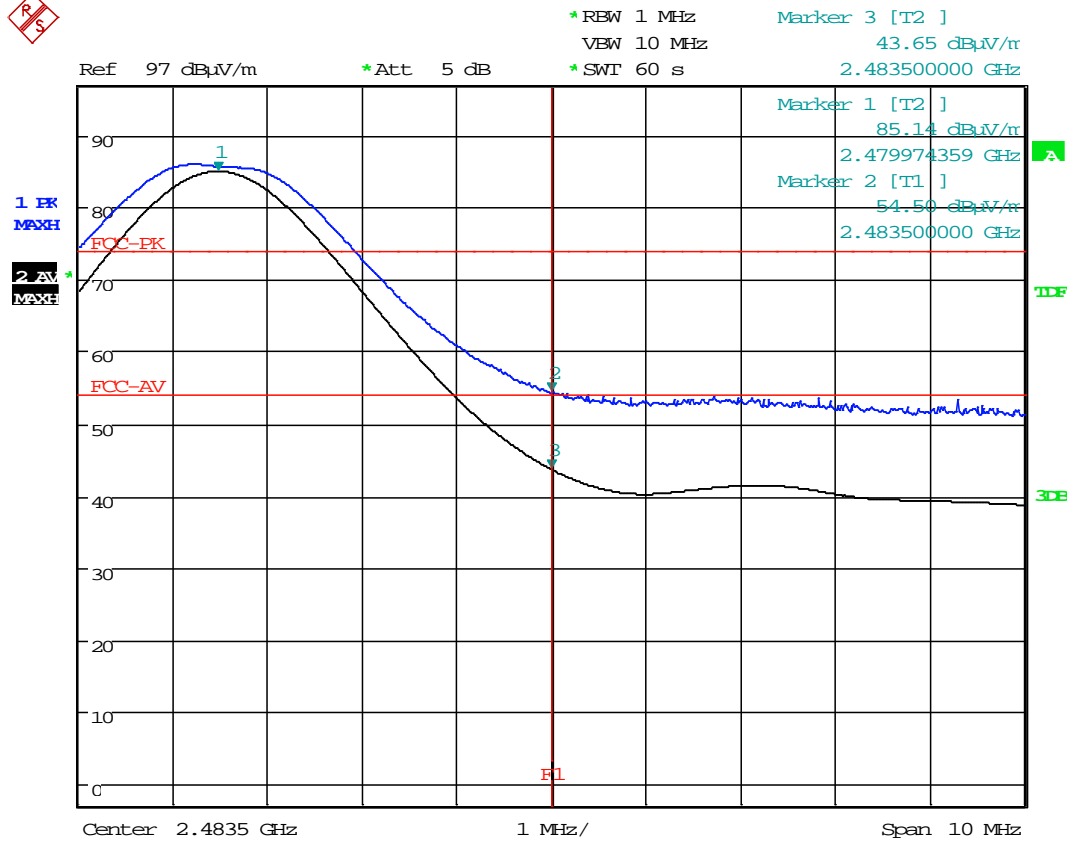
Date: 31.MAY.2016 19:11:10

## 13 GHz – 18 GHz



Date: 31.MAY.2016 21:47:56

## 18 GHz – 25 GHz



Date: 31.MAY.2016 19:53:43

## 12 Occupied Bandwidth

### 12.1 Definition

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 Lab
Test Standard and Clause:	FCC: ANSI C63.10-2013, Clause 11.8
EUT Channels / Frequencies Measured:	2402 MHz / 2440 MHz / 2480 MHz
EUT Channel Bandwidths:	2 MHz
EUT Test Modulations:	GFSK
Deviations From Standard:	None
Measurement BW:	100 kHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	300 kHz
Measurement Span: (requirement 2 to 5 times OBW)	5 MHz
Measurement Detector:	Peak

### Environmental Conditions (Normal Environment)

Temperature: 23 °C	+15 °C to +35 °C (as declared)
Humidity: 45 % RH	20 % RH to 75 % RH (as declared)
Supply: 3.3 V dc	3.3 V dc (as declared)

### 12.3 Test Limit

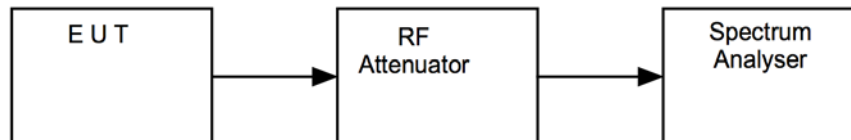
The minimum -6 dB bandwidth shall be at least 500 kHz.

## 12.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure iii, 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 iii Test Setup**

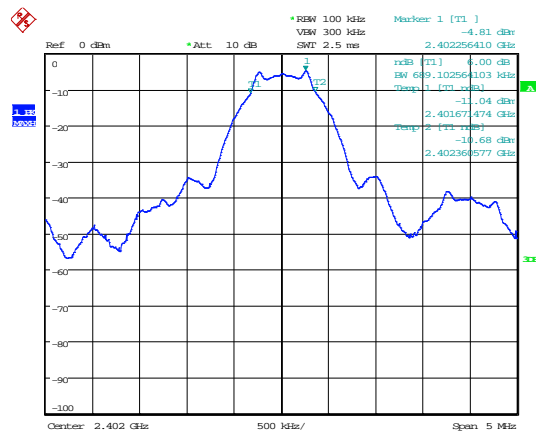


## 12.5 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration	Calibration Period
FSU26	R&S	Spectrum Analyser	REF909	26/04/2017	12

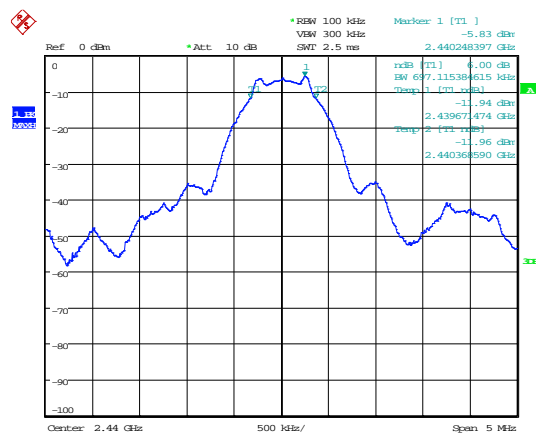
## 12.6 Test Results

Channel Frequency (MHz)	$F_L$ (MHz)	$F_H$ (MHz)	6dB Bandwidth (kHz)	Result
2402	2401.671474	2402.360577	689.103	PASS
2440	2439.671474	2440.36859	697.116	PASS
2480	2479.663462	2480.352564	689.102	PASS



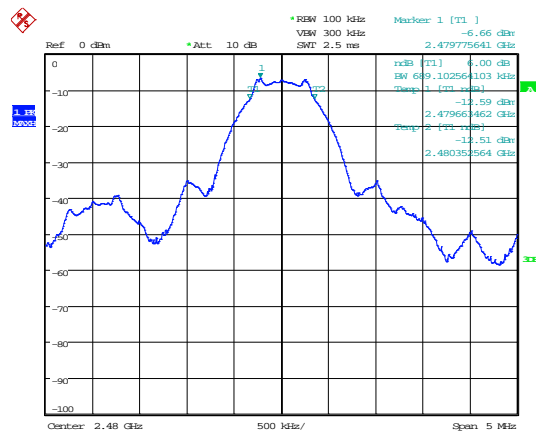
Date: 1.JUN.2016 11:08:42

## 2402 MHz



Date: 1.JUN.2016 11:09:38

## 2440 MHz



Date: 1.JUN.2016 11:10:50

## 2480 MHz

## 13 Maximum peak conducted output power

### 13.1 Definition

The maximum peak conducted output power is defined as the maximum power level measured with a peak detector using a filter with width and shape of which is sufficient to accept the signal bandwidth.

The maximum conducted output power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level.

### 13.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Lab
Test Standard and Clause:	ANSI C63.10-2013, Clause 11.9.1
EUT Channels / Frequencies Measured:	2402 MHz / 2440 MHz / 2480 MHz
EUT Channel Bandwidths:	2 MHz
Deviations From Standard:	None
Measurement BW:	2 MHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	10 MHz
Measurement Detector:	Peak
Voltage Extreme Environment Test Range:	Mains Power = 85 % and 115 % of Nominal (FCC only requirement); Battery Power = new battery.

### Environmental Conditions (Normal Environment)

Temperature: 23 °C	+15 °C to +35 °C (as declared)
Humidity: 45 % RH	20 % RH to 75 % RH (as declared)

### 13.3 Test Limit

For systems employing digital modulation techniques operating in the bands 902 to 928 MHz, 2400 to 2483.5 MHz and 5725 to 5850 MHz, the maximum peak conducted output power shall not exceed 1 W.

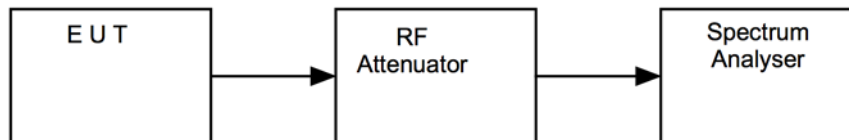


### 13.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure iv, 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 iv Test Setup**



### 13.5 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration	Calibration Period
FSU26	R&S	Spectrum Analyser	REF909	26/04/2017	12

### 13.6 Test Results

Channel Frequency (MHz)	Analyzer Level (dBm)	Cable loss (dB)	Power (mW)	Result
2402	-4.52	0.00	0.35	PASS
2440	-5.15	0.00	0.31	PASS
2480	-5.93	0.00	0.26	PASS

## 14 Out-of-band and conducted spurious emissions

### 14.1 Definition

#### *Out-of-band emission.*

Emission on a frequency or frequencies immediately outside the necessary bandwidth that results from the modulation process but excluding spurious emissions.

#### *Spurious emission.*

Emission on a frequency or frequencies that 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.

### 14.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Lab
Test Standard and Clause:	ANSI C63.10-2013, Clause 11.11
EUT Channels / Frequencies Measured:	2402 MHz / 2440 MHz / 2480 MHz
EUT Channel Bandwidths:	2 MHz
Deviations From Standard:	None
Measurement BW:	100 kHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	300 kHz
Measurement Detector:	Peak
Measurement Range:	30 MHz to 26.5 GHz

### Environmental Conditions (Normal Environment)

Temperature: 23 °C	+15 °C to +35 °C (as declared)
Humidity: 45 % RH	20 % RH to 75 % RH (as declared)
Supply: 3.3 V dc	3.3 V dc (as declared)

### 14.3 Test Limit

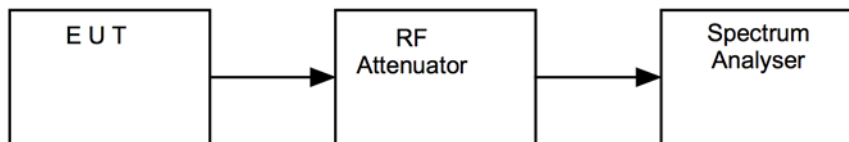
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in FCC 47CFR15.209(a) / RSS-Gen is not required.

#### 14.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure v, the emissions from the EUT were 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 v Test Setup**

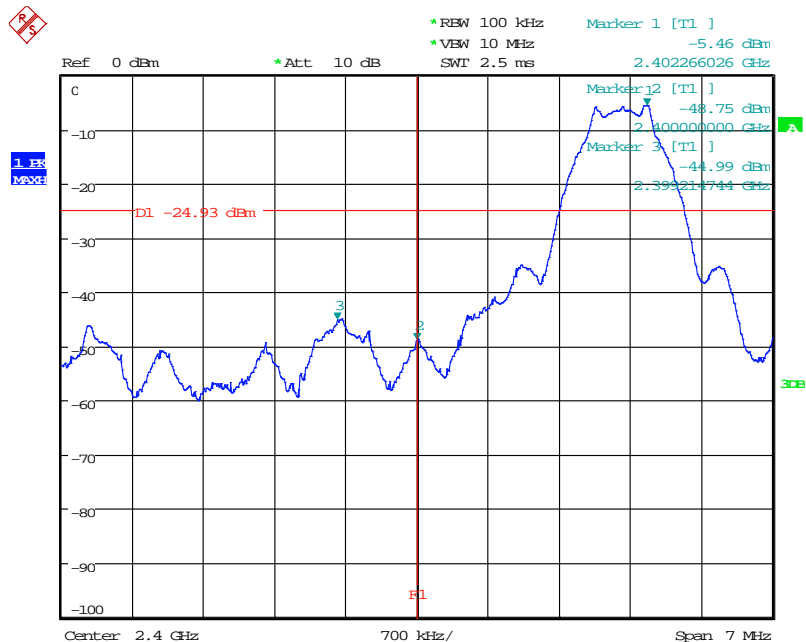
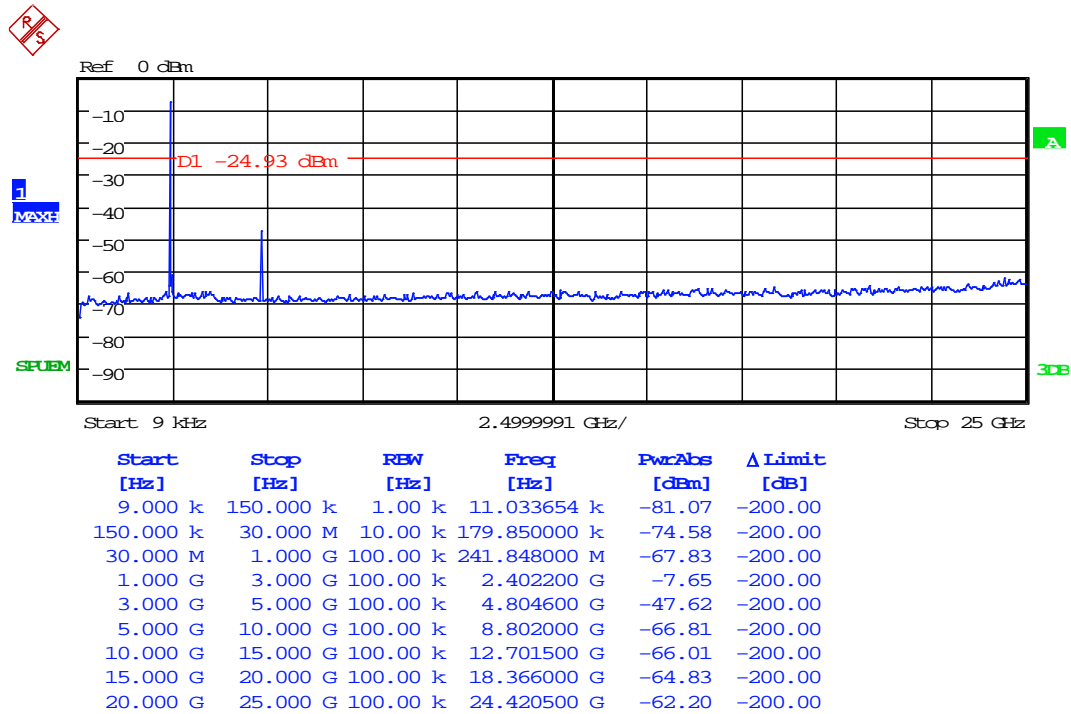


#### 14.5 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration	Calibration Period
FSU26	R&S	Spectrum Analyser	REF909	26/04/2017	12

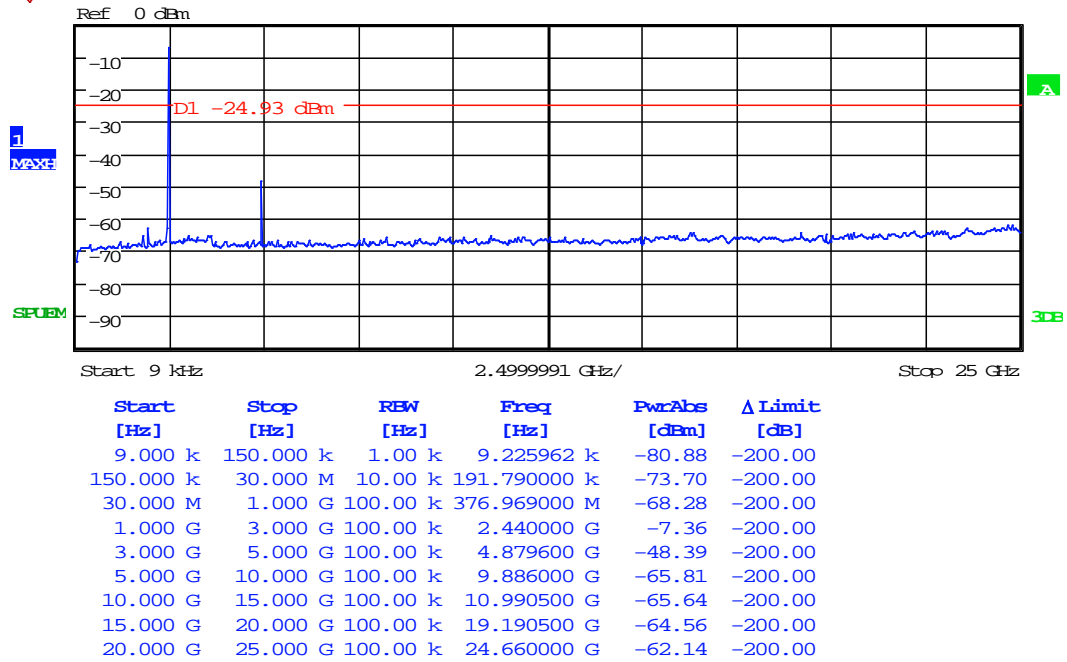
## 14.6 Test Results

2402 MHz						
Channel Frequency (MHz)	Emission Frequency (MHz)	Analyzer Level (dBm)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
No Significant Emissions						PASS

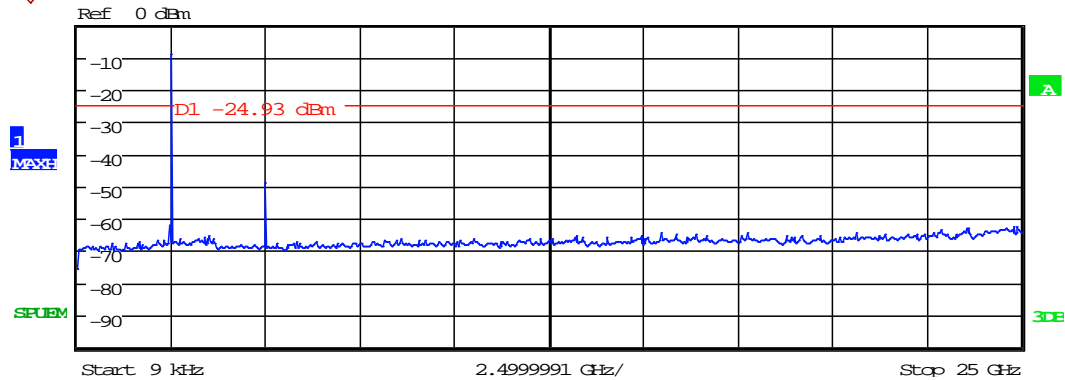


Date: 1.JUN.2016 11:20:03

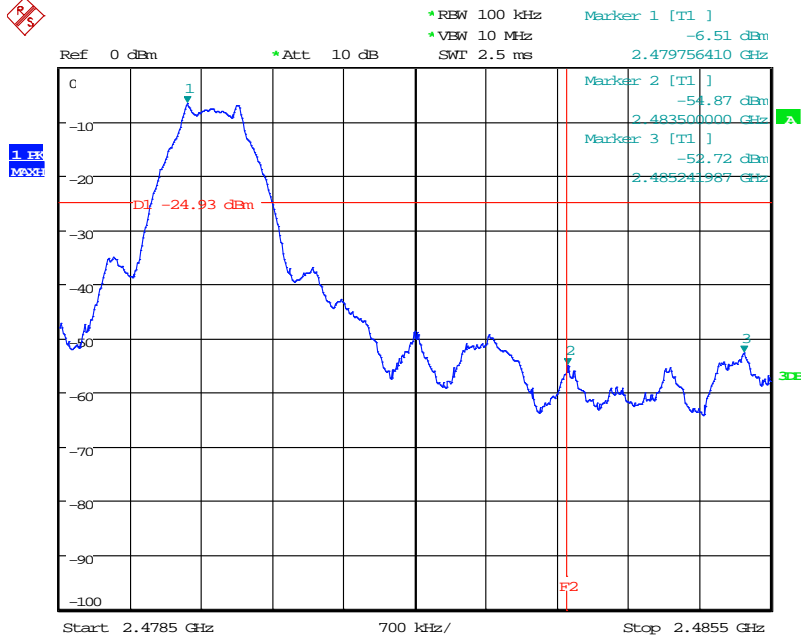
2440 MHz						
Channel Frequency (MHz)	Emission Frequency (MHz)	Analyzer Level (dBm)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
No Significant Emissions						PASS



2480 MHz						
Channel Frequency (MHz)	Emission Frequency (MHz)	Analyzer Level (dBm)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
No Significant Emissions						PASS



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
9.000 k	150.000 k	1.00 k	65.942308 k	-79.89	-200.00
150.000 k	30.000 M	10.00 k	239.550000 k	-76.05	-200.00
30.000 M	1.000 G	100.00 k	927.929000 M	-67.78	-200.00
1.000 G	3.000 G	100.00 k	2.480000 G	-9.00	-200.00
3.000 G	5.000 G	100.00 k	4.960600 G	-48.88	-200.00
5.000 G	10.000 G	100.00 k	8.555000 G	-66.37	-200.00
10.000 G	15.000 G	100.00 k	13.213000 G	-65.59	-200.00
15.000 G	20.000 G	100.00 k	17.760000 G	-64.46	-200.00
20.000 G	25.000 G	100.00 k	24.782000 G	-62.54	-200.00



Date: 1.JUN.2016 11:19:17

## 15 Power spectral density

### 15.1 Definition

The power per unit bandwidth.

### 15.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Lab
Test Standard and Clause:	ANSI C63.10-2013, Clause 11.10
EUT Channels / Frequencies Measured:	Low / Mid / High
EUT Channel Bandwidths:	2 MHz
Deviations From Standard:	None
Measurement BW:	100 kHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	10 MHz
Measurement Span: (requirement 1.5 times Channel BW)	1.1 MHz
Measurement Detector:	Peak

### Environmental Conditions (Normal Environment)

Temperature: 23 °C	+15 °C to +35 °C (as declared)
Humidity: 45 % RH	20 % RH to 75 % RH (as declared)
Supply: 3.3 V dc	3.3 V dc (as declared)

### 15.3 Test Limit

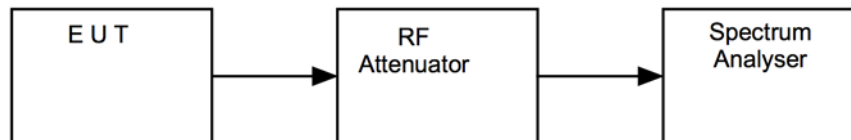
The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### 15.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure vi, the peak emission of the EUT was measured on a spectrum analyser, with path losses taken into account.

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 vi Test Setup**



### 15.5 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration	Calibration Period
FSU26	R&S	Spectrum Analyser	REF909	26/04/2017	12

### 15.6 Test Results

Channel Frequency (MHz)	Analyzer Level (dBm)	Cable loss (dB)	PSD (dBm)	Result
2402	-4.93	0.00	-4.93	PASS
2440	-5.65	0.00	-5.65	PASS
2480	-6.43	0.00	-6.43	PASS



## 16 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 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**

#### [2] AC power line conducted emissions

Uncertainty in test result = **3.4 dB**

#### [3] Occupied bandwidth

Uncertainty in test result = **15.5 %**

#### [4] Conducted carrier power

Uncertainty in test result (Power Meter) = **1.08 dB**

#### [5] Conducted / radiated RF power out-of-band

Uncertainty in test result – up to 8.1 GHz = **3.31 dB**

Uncertainty in test result – 8.1 GHz to 15.3 GHz = **4.43 dB**

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

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

#### [6] Power spectral density

Uncertainty in test result (Spectrum Analyser) = **2.48 dB**