TEST REPORT

Test Report No. : UL-RPT-RP11179027JD04A_V2

Manufacturer	:	3D Sound Labs
Model No.	:	3DSLM01
FCC ID	:	2AEBV-3DSLM01
Technology	:	*Bluetooth* – Low Energy
Test Standard(s)	:	FCC Parts 15.207 & 15.247

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2. The results in this report apply only to the sample(s) tested.
3. The test results in this report are traceable to the national or international standards.
4. Version 2.0 Supersedes all previous versions

Date of Issue: 29 July 2016

Checked by:

Steven White
Service Lead, Radio Laboratory

Company Signatory:

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Senior Engineer, Radio Laboratory
UL VS LTD

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This laboratory is accredited by UKAS. The tests reported herein have been performed in accordance with its terms of accreditation.

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1. Customer Information

Company Name:	3D Sound Labs
Address:	130 Rue de Lourmel Paris 75015 France

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Section 15.247
Specification Reference:	47CFR15.207
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Sections 15.207 and 15.209
Site Registration:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	02 June 2016 to 14 July 2016

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.207	Transmitter AC Conducted Emissions	✓
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	✓
Part 15.247€	Transmitter Power Spectral Density	Note 1
Part 15.247(b)(3)	Transmitter Maximum Peak Output Power	✓

Key to Results

✓ = Complied ✗ = Did not comply

Note(s):

1. In accordance with FCC KDB 558074 Section 10.1, PSD is not required if the maximum conducted output power is less than the PSD limit of 8 dBm / 3 kHz. The PSD level is therefore deemed to be equal to the measured total output power.

2.3. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	KDB 558074 D01 DTS Meas Guidance v03r05 April 8, 2016
Title:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	3D Sound Labs
Model Name or Number:	3DSLM01
Test Sample Serial Number:	#1
Hardware Version:	3.6
Software Version:	4
FCC ID:	2AEBV-3DSLM01

3.2. Description of EUT

The equipment under test was a Motion sensing module for head-tracking

3.3. Modifications Incorporated in the EUT

The sample was fitted with a temporary antenna connector to enable conducted antenna port testing. The sample was flashed with custom firmware to enable continuous transmit mode at maximum output power. No other modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	*Bluetooth* Low Energy (Digital Transmission System)		
Type of Unit:	Transceiver		
Channel Spacing:	2 MHz		
Modulation:	GFSK		
Data Rate:	1 Mbps		
Power Supply Requirement(s):	Nominal	3.7 VDC (Internal Battery Power Operation) 5.0 VDC (USB – charging only)	
Maximum Conducted Output Power:	4.2 dBm		
Antenna Gain:	1.7 dBi		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	**Channel ID**	**RF Channel**	**Channel Frequency (MHz)**
	Bottom	0	2402
	Middle	19	2440
	Top	39	2480

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Laptop Computer
Brand Name:	Dell
Model Name or Number:	Latitude E5410
Serial Number:	DQC78L1 (*UL Computer Name: GBITL018*)

Description:	USB to UART adapter
Brand Name:	Silicon Labs
Model Name or Number:	CP210x
Serial Number:	Not Stated

Description:	USB to UK Travel Adapter
Brand Name:	Motorola
Model Name or Number:	0C40500K0301
Serial Number:	10284.C6.0821306.22N1

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

- Transmitting at maximum power in *Bluetooth* LE mode with modulation, maximum possible data length available (37 byte payload length) and Pseudorandom Bit Sequence 9.

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- The EUT was controlled with a test laptop and a third party test software application 'nRFgo Studio v1.21.1.3' using commands supplied by the customer. Channels, packet lengths and other settings were then set using this software application as required.
- During transmit tests; the device was powered via its internal battery.
- AC conducted tests were performed with the EUT charging from a representative USB Charger.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6. Measurement Uncertainty* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Matthew Galbraith	**Test Date:**	14 July 2016
Test Sample Serial Number:	#1		

FCC Reference:	Part 15.207
Test Method Used:	ANSI C63.10 Section 6.2

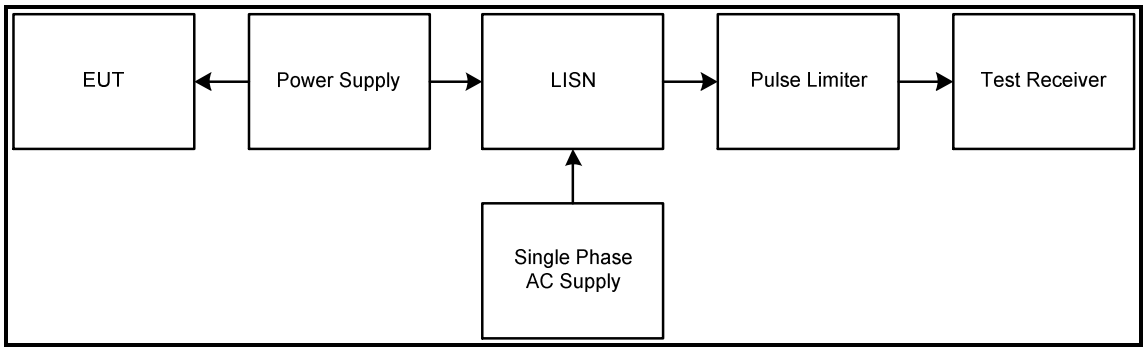
Environmental Conditions:

Temperature (℃):	24
Relative Humidity (%):	37

Note(s):

1. The EUT was plugged into a USB charger, via a representative cable, the AC charger was connected to 120 VAC 60 Hz single phase supply via a LISN.
2. A pulse limiter was fitted between the LISN and the test receiver.
3. Pre-scans were performed and markers placed on the highest live and neutral measured levels.
4. Final measurements were performed on the marker frequencies and the results entered in the tables below.

Test setup:



Transmitter AC Conducted Spurious Emissions (continued)

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.334	Live	33.0	59.3	26.3	Complied
3.570	Live	36.5	56.0	19.5	Complied
3.853	Live	43.4	56.0	12.6	Complied
5.158	Live	36.7	60.0	23.3	Complied
10.032	Live	37.5	60.0	22.5	Complied
11.116	Live	38.6	60.0	21.4	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.199	Live	18.2	53.6	35.4	Complied
0.393	Live	18.1	48.0	29.9	Complied
1.927	Live	14.5	46.0	31.5	Complied
3.858	Live	25.1	46.0	20.9	Complied
11.287	Live	21.9	50.0	28.1	Complied
25.057	Live	15.7	50.0	34.3	Complied

Transmitter AC Conducted Spurious Emissions (continued)

Results: Neutral / Quasi Peak

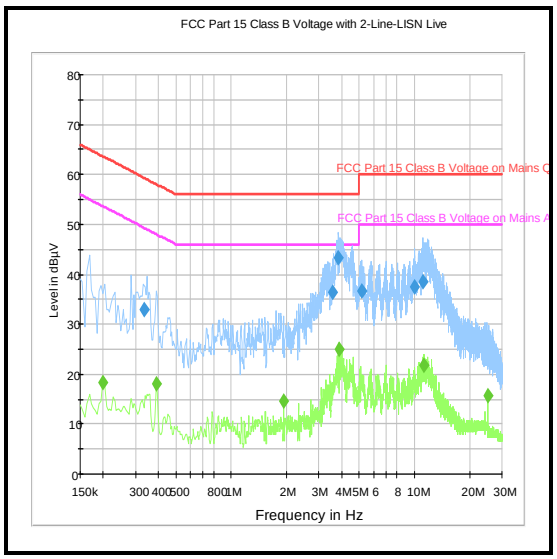
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.163	Neutral	32.0	65.3	33.3	Complied
0.334	Neutral	31.7	59.3	27.6	Complied
3.345	Neutral	33.4	56.0	22.6	Complied
3.916	Neutral	35.5	56.0	20.5	Complied
10.032	Neutral	33.8	60.0	26.2	Complied
11.841	Neutral	35.5	60.0	24.5	Complied

Results: Neutral / Average

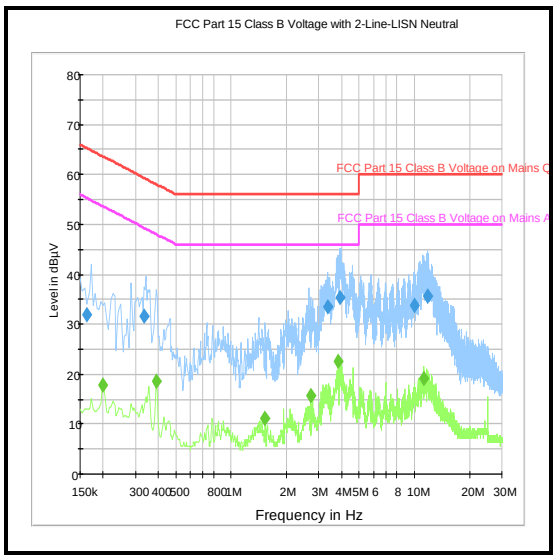
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.199	Neutral	17.8	53.6	35.8	Complied
0.393	Neutral	18.6	48.0	29.4	Complied
1.531	Neutral	11.1	46.0	34.9	Complied
2.715	Neutral	15.8	46.0	30.2	Complied
3.853	Neutral	22.5	46.0	23.5	Complied
11.260	Neutral	19.1	50.0	30.9	Complied

Transmitter AC Conducted Spurious Emissions (continued)

Results: 120 VAC 60 Hz



Live



Neutral

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.2.2. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	02 June 2016
Test Sample Serial Number:	#1		

FCC Reference:	Part 15.247(a)(2)
Test Method Used:	FCC KDB 558074 Section 8.1 Option 2

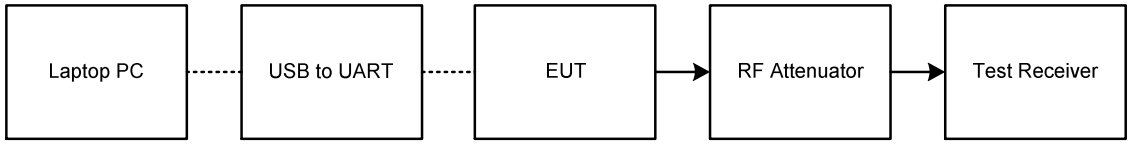
Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	41

Note(s):

1. 6 dB DTS bandwidth tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.1 Option 2 measurement procedure. The spectrum analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The DTS bandwidth was measured at 6 dB down from the peak of the signal.
2. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

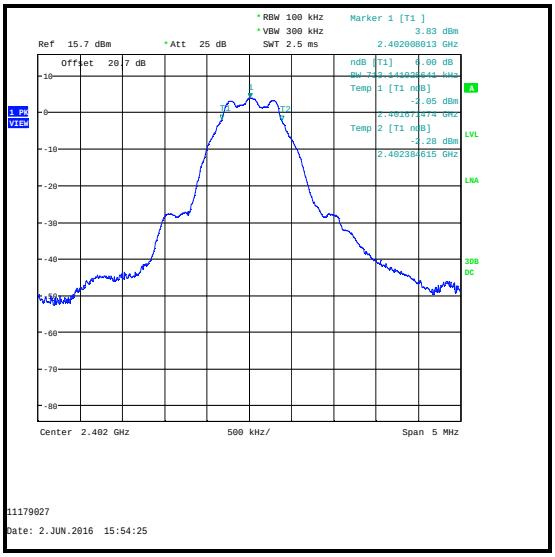
Test setup:



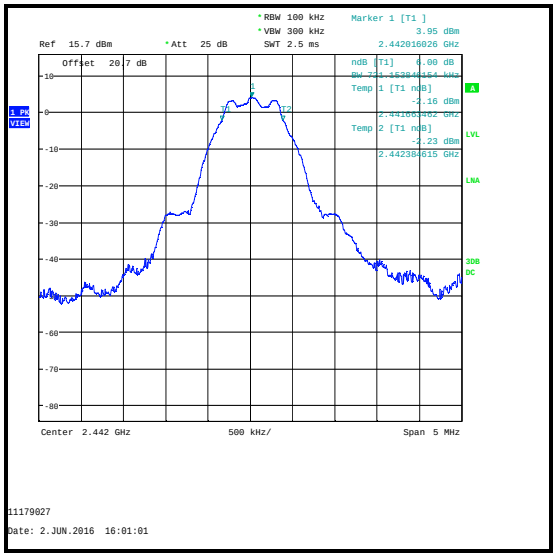
Transmitter Minimum 6 dB Bandwidth (continued)

Results:

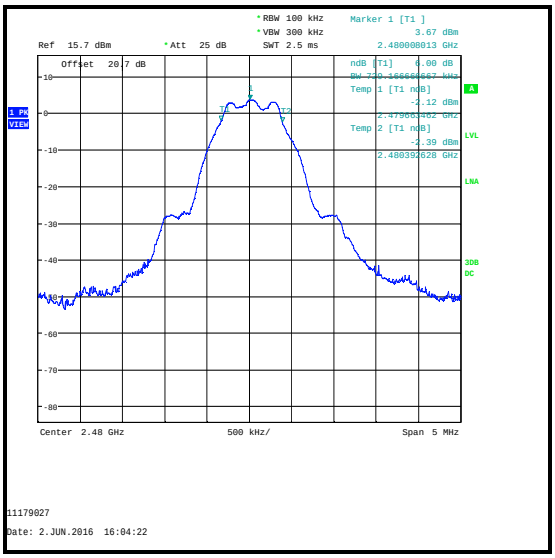
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	713.141	≥500	213.141	Complied
Middle	721.154	≥500	221.154	Complied
Top	729.167	≥500	229.167	Complied



Bottom Channel



Middle Channel



Top Channel

Transmitter Minimum 6 dB Bandwidth (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	02 Apr 2017	12
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	17 Feb 2017	12
G0628	Vector Signal Generator	Rohde & Schwarz	SMBV100A	261847	25 Jan 2017	12

5.2.3. Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	02 June 2016
Test Sample Serial Number:	#1		

FCC Reference:	Part 15.247(b)(3)
Test Method Used:	FCC KDB 558074 Section 9.1.1

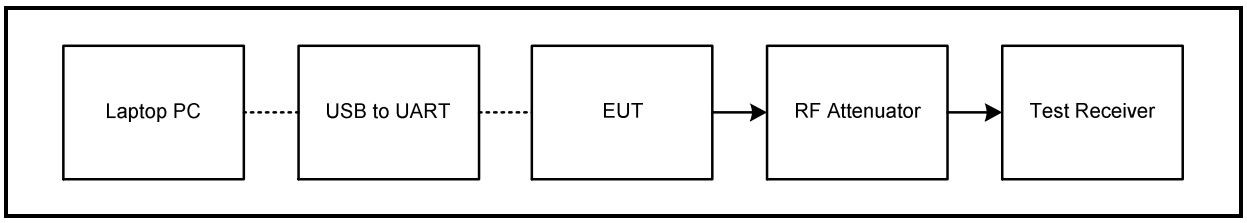
Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	41

Note(s):

1. Conducted power tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 9.1.1 with the RBW > *DTS bandwidth* procedure. A resolution bandwidth of 1 MHz was used and the video bandwidth was set to 3 MHz.
2. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.
3. The conducted power was added to the declared antenna gain to obtain the EIRP.

Test setup:



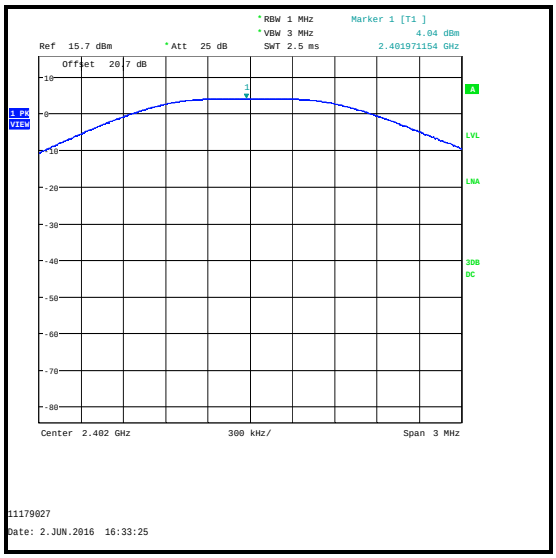
Transmitter Maximum Peak Output Power (continued)

Results:

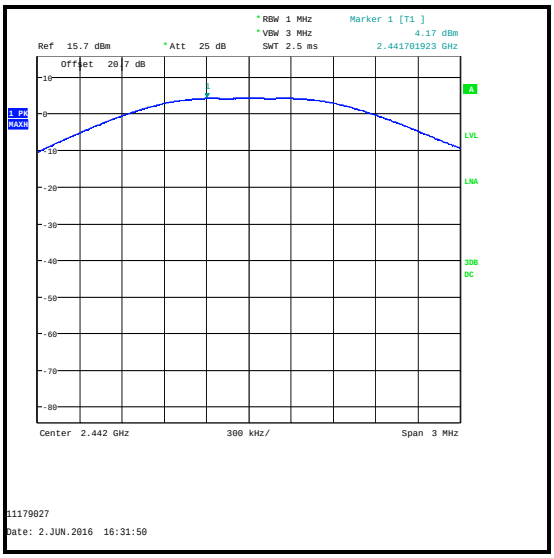
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	4.0	30.0	26.0	Complied
Middle	4.2	30.0	25.8	Complied
Top	3.9	30.0	26.1	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	4.0	1.7	5.7	36.0	30.3	Complied
Middle	4.2	1.7	5.9	36.0	30.1	Complied
Top	3.8	1.7	5.5	36.0	30.5	Complied

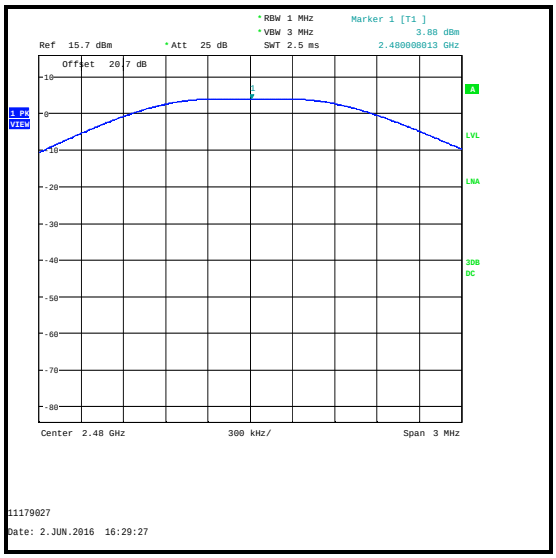
Transmitter Maximum Peak Output Power (continued)



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	02 Apr 2017	12
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	17 Feb 2017	12
G0628	Vector Signal Generator	Rohde & Schwarz	SMBV100A	261847	25 Jan 2017	12

5.2.4. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value measured (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±4.69 dB
Conducted Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Spectral Power Density	2.4 GHz to 2.4835 GHz	95%	±2.94 dB
Minimum 6 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±3.92%

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

6. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version
2.0	-	-	Amended Front Page

--- END OF REPORT ---