

RADIO TEST REPORT

REPORT NUMBER: M2004026-9

**TEST STANDARD: FCC PART 15 SUBPART C
SECTION 15.247
ISED RSS-247 SECTION 5.0**

CLIENT: RUBICON GLOBAL PTY. LTD.

DEVICE: FERIT NODE – LORA

MODEL: 81170

FCC ID: 2AWYU-81170

DATE OF ISSUE: 17 AUGUST 2020

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Equipment Under Test (EUT): FERIT NODE – LORA

REVISION TABLE

Version	Sec/Para Changed	Change Made	Date
1		Initial issue of document	17/08/2020

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RADIO TEST REPORT

CERTIFICATE OF COMPLIANCE

Device: FERIT NODE – LORA
Model: 81170
Variant Model: FERIT NODE – P400 (Model: 81338)
Manufacturer: Rubicon Global Pty. Ltd.

Radio Module: Bluetooth Low Energy (Nrf52840)
FCC ID: 2AWYU-81170

Tested for: Rubicon Global Pty. Ltd.
Address: 1 Cato Street, Hawthorn East, 3123
Phone Number: +61 3 9832 3031
Contact: Paul Spooner
Email: paul.spooner@rubiconwater.com

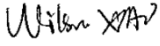
Standard: FCC Part 15, Subpart C, Section 15.247 Operation within the bands
902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

ISED RSS-247, Issue 2, Section 5 Standard specifications for
frequency hopping systems and digital transmission systems
operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-
5850 MHz

Result: The FERIT NODE – LORA complied with the applicable requirements
above standards. Refer to Report M2004026-9 for full details.

Test Date(s): 9 -15 and 18 June, 2020

Issue Date: 17 August 2020

Test Engineer(s): 
Wilson Xiao

Attestation: *I hereby certify that the device(s) described herein were tested as
described in this report and that the data included is that which was
obtained during such testing.*

Authorised Signatory: 
Shabbir Ahmed
Lead Engineer - RF & Wireless

Issued by: EMC Technologies Pty. Ltd.,
176 Harrick Road, Keilor Park, VIC, 3042, Australia.
Phone: +61 3 9365 1000

E-mail: emc-general@emctech.com.au

Web: www.emctech.com.au



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RADIO REPORT FOR CERTIFICATION

1 TEST SUMMARY

Section	Description	FCC	ISED	Result(s)
6.1	Antenna Requirement	§15.203	§RSS-Gen 6.8	Complied
6.2	Restricted Bands of Operation	§15.205	§RSS-Gen 8.10	Complied
6.3	Conducted Limits	§15.207	§RSS-Gen 8.8	Not Applicable
6.4	Radiated emission limits; general requirements	§15.209	§RSS-Gen 8.9	Complied
6.5	6 dB Bandwidth	§15.247(a)(2)	§RSS-247 5.2(a)	Complied
6.6	Peak Output Power	§15.247(b)(3)	§RSS-247 5.4(d)	Complied
6.7	Out-of-Band/Spurious Emissions	§15.247(d)	§RSS-247 5.5	Complied
6.8	Band-Edge Emission Measurements	§15.247(d)	§RSS-247 5.5	Complied
6.9	Power spectral density	§15.247(e)	§RSS-247 5.2(b)	Complied
6.10	Maximum Permissible Exposure	§15.247(i)	§RSS-102	Complied
6.11	Occupied Bandwidth – 99% power	§15.215	§RSS-Gen 6.7	Complied

2 TEST FACILITY

2.1 General

EMC Technologies Pty Ltd is accredited by the FCC as a test laboratory able to perform compliance testing for the public. EMC Technologies Pty Ltd has also been designated as a Conformity Assessment Body (CAB) by Australian Communications and Media Authority (ACMA) under the APECTEL MRA and is designated to perform compliance testing on equipment subject to Declaration of Conformity (DoC) and Certification under Parts 15 and 18 of the FCC Commission's rules – **Registration Number 494713 & Designation number AU0001.**

EMC Technologies Pty Ltd is also an ISED Canada recognized testing laboratory – **ISED company number: 3569B and CAB identifier number: AU0001.**

2.2 Test Laboratory/Accreditations

NATA is the Australian National laboratory accreditation body and has accredited EMC Technologies to operate to the IEC/ISO17025 requirements. A major requirement for accreditation is the assessment of the company and its personnel as being technically competent in testing to the standards. This requires fully documented test procedures, continued calibration of all equipment to the National Standard at the National Measurements Institute (NMI) and an internal quality system similar to ISO 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A²LA).

All testing in this report has been conducted in accordance with EMC Technologies' scope of NATA accreditation to ISO 17025 for both testing and calibration and ISO 17020 for Inspection – **Accreditation Number 5292.**

The current full scope of accreditation can be found on the NATA website: www.nata.com.au

3 TEST EQUIPMENT CALIBRATION

Measurement instrumentation and transducers were calibrated in accordance with the applicable standards by an independent NATA registered laboratory such as Keysight Technologies (Australia) Pty Ltd or the National Measurement Institute (NMI) or in-house. All equipment calibration is traceable to Australian national standards at the National Measurements Institute.

Equipment Type	Make/Model/Serial Number	Last Cal. dd/mm/yyyy	Due Date dd/mm/yyyy	Cal. Interval
Chamber	Frankonia SAC-3-2 (R-144)	17/07/2017	17/07/2020	3 Year ^{*1}
EMI Receiver	R&S ESU40 Sn: 100392 (R-140)	28/04/2020	28/04/2021	1 Year ^{*2}
Antennas	EMCO 6502 Active Loop Antenna Sn: 9311-2801 (A-231)	16/11/2018	16/11/2020	2 Year ^{*2}
	SUNOL JB1 Sn: A061917 (A-425)	04/09/2019	04/09/2021	2 Year ^{*2}
	EMCO 3115 Horn Antenna Sn: 8908-3282 (A-004)	16/01/2019	16/01/2022	3 Year ^{*1}
	ETS-Lindgren 3160-09 Horn Antenna Sn: 66032 (A-307)	12/06/2018	12/06/2021	3 Year ^{*2}
Cables ^{*3}	Huber & Suhner Sucoflex 104A Sn: 503055 (C-457)	04/06/2020	04/06/2021	1 Year ^{*1}
	Huber & Suhner Sucoflex 104A Sn: 800448 (C-520)	04/06/2020	04/06/2021	1 Year ^{*1}
	Huber & Suhner Sucoflex 102 DC - 40 GHz Sucoflex 102 Sn: 27319/2 (C-273)	09/07/2019	09/07/2020	1 Year ^{*1}

Note *1. Internal NATA calibration.

Note *2. External NATA / A2LA calibration.

Note *3. Cables are verified before measurements are taken.

4 MEASUREMENT UNCERTAINTY

EMC Technologies has evaluated the equipment and the methods used to perform the emissions testing. The estimated measurement uncertainties for emissions tests shown within this report are as follows:

Radiated Emissions:	9 kHz to 30 MHz	±4.1 dB
	30 MHz to 300 MHz	±5.1 dB
	300 MHz to 1000 MHz	±4.7 dB
	1 GHz to 18 GHz	±4.6 dB
	18 GHz to 40 GHz	±4.6 dB
Peak Output Power:		±1.5 dB

The above expanded uncertainties are based on standard uncertainties multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Application of measurement uncertainty for this report:

The referenced uncertainty standard specifies that determination of compliance shall be based on measurements without taking into account measurement instrumentation uncertainty. However, the measurement uncertainty shall appear in the test report.

5 Device Details

(Information supplied by the Client)

FERIT NODE – LORA is Telemetry node that can burst sensor data over a LoRa network
Multiple IO and comms (RS485/I2C)

FERIT NODE – P400 Telemetry node that can burst sensor data over a 900MHz network
Multiple IO and comms (RS485/I2C)

5.1 EUT (Transmitter) Details

Radio:	Bluetooth Low Energy (Nrf52840)
Manufacturer:	Nordic Semiconductor
Frequency band:	2400 - 2483.5 MHz
Number of Channels:	40
Operating Frequency:	2402 MHz to 2480 MHz Low: 2402 MHz, Mid: 2440 MHz, High: 2480 MHz
Nominal Bandwidth:	2 MHz (<i>declared by client</i>)
Modulation:	GFSK
Antenna:	PCB 2.4 GHz Inverted F Antenna
Antenna Peak Gain:	3 dBi

5.2 EUT (Host) Details

Test Sample:	FERIT NODE – LORA (VAR1)
Model:	81170
Variant Model:	FERIT NODE – P400 (Model: 81338) (VAR2)
Supply Rating:	3.3 V DC, 1.5A
Manufacturer:	Rubicon Global Pty. Ltd.

5.3 Test Configuration

Testing was performed with the Bluetooth transceiver set to transmit continuously (100% Duty cycle) at Low Channel (2402 MHz), Mid Channel (2440 MHz) and High Channel (2480 MHz).

The following commands were used to set up the transceiver via Putty:

“ bt cancel ”

“ bt start_channel 2 ” / “ bt start_channel 40 ” / “ bt start_channel 80 ”

“ bt output_power neg4dBm ”

“ bt start_tx_modulated_carrier ”

5.4 Modifications

No modifications were required to achieve compliance.

5.5 Deviations from the Standard

Note any deviations to the standard



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6 RESULTS

6.1 §15.203/ RSS-Gen 6.8 Antenna Requirement

The Bluetooth transceiver incorporates an integral PCB antenna that cannot be replaced by another type.

Antenna Type: PCB 2.4GHz Inverted F Antenna

Antenna gain: 3 dBi

Connector: Not Applicable

6.2 §15.205/ RSS-Gen 8.10/ RSS-247 3.3 Restricted Bands of Operation

The provisions of the §15.205/ RSS-Gen 8.10/ RSS-247 3.3 restricted bands of operation and §15.209 radiated emissions limits have been met, refer to section 6.7

6.3 §15.207/ RSS-Gen 8.8 Conducted Limits

The device is battery DC powered and does not connect directly or indirectly to the AC mains network. Test was not applicable.

6.4 §15.209/ RSS-Gen 8.9 Radiated emission limits; general requirements

The provisions of the §15.205/ RSS-Gen 8.10/ RSS-247 3.3 restricted bands of operation and §15.209/ RSS-Gen 8.9 radiated emissions limits have been met, refer to section 6.7

6.5 §15.247(a)(2)/ RSS-247 5.2(a) 6 dB bandwidth

6.5.1 Test Procedure

The tests were performed in accordance with ANSI C63.10: 2013 Clause 11.8 DTS bandwidth. The 6 dB bandwidth was measured while the device was transmitting with typical modulation applied. The resolution bandwidth of 100 kHz and the video bandwidth of 300 kHz were utilised when measuring the bandwidth.

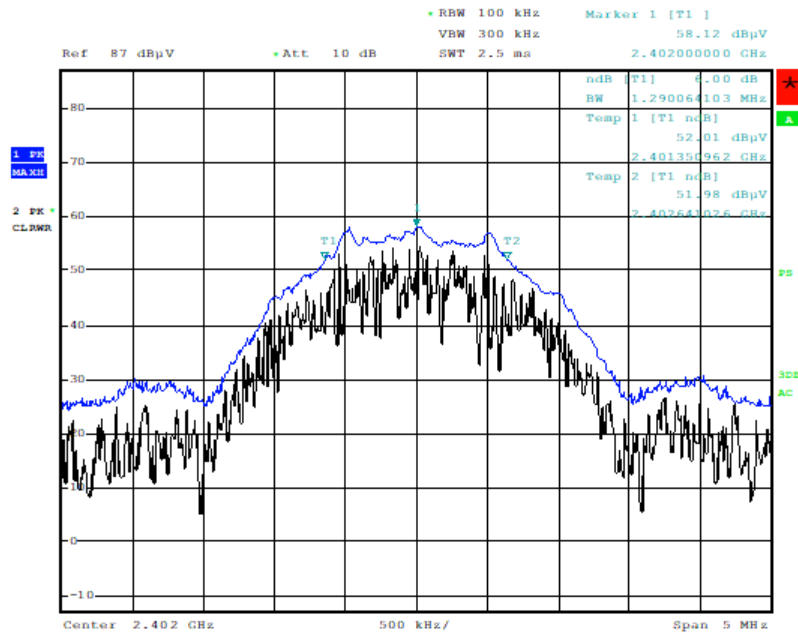
6.5.2 Limits

In the band 2400-2483.5MHz, the minimum 6 dB bandwidth is to be at least 500 kHz.

6.5.3 Results

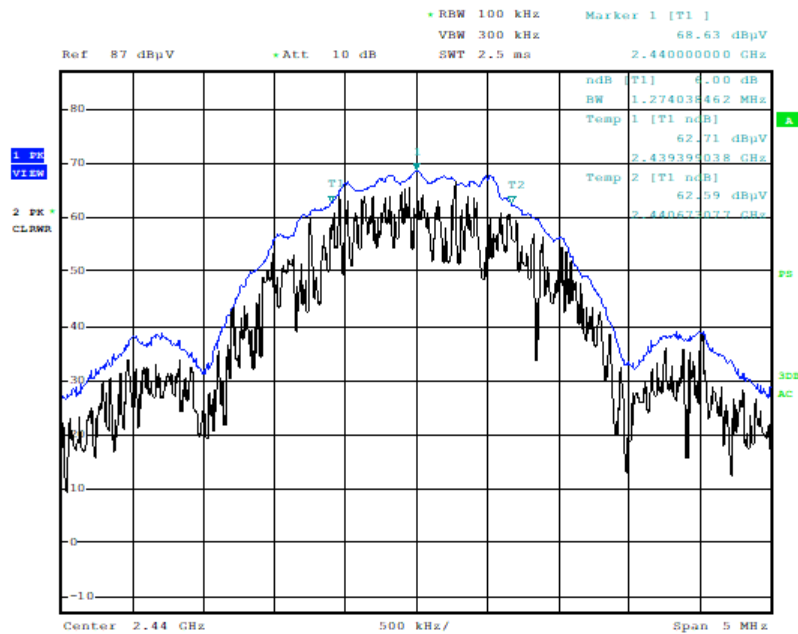
Table 6-1: 6dB Bandwidth

Freq. [MHz]	6 dB Bandwidth [kHz]	Limit [kHz]
2402	1290	≥ 500
2440	1274	≥ 500
2480	1250	≥ 500



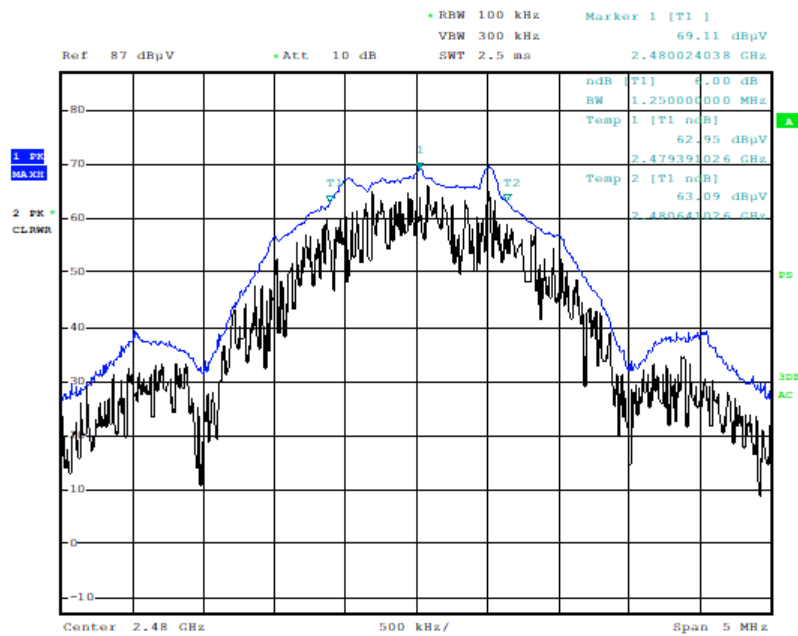
Date: 18. JUN.2020 13:57:30

Graph 6-1: 6 dB bandwidth, 2402 MHz



Date: 18. JUN.2020 14:00:11

Graph 6-2: 6 dB bandwidth, 2440 MHz



Date: 18. JUN. 2020 13:59:21

Graph 6-3: 6 dB bandwidth, 2480 MHz

6.6 §15.247(b)(3)/ RSS-247 5.4(d) Peak Output Power

6.6.1 Test Procedure

The field strength of the fundamental transmitted frequency was measured inside a semi-anechoic chamber compliant with ANSI C63.4: 2014 in accordance to ANSI C63.10: 2013 clause 11.9.1.1.

The EUT was positioned on a test turn-table and rotated through 360° to determine the highest emissions. The measurement antenna was also varied between 1 and 4 metres height. Different orientations of the EUT (x, y and z-axis) and measurement antenna polarisations (vertical and horizontal) were investigated to produce the highest emission EIRP. All measurements were made at a distance of 3 metres.

6.6.2 Limits

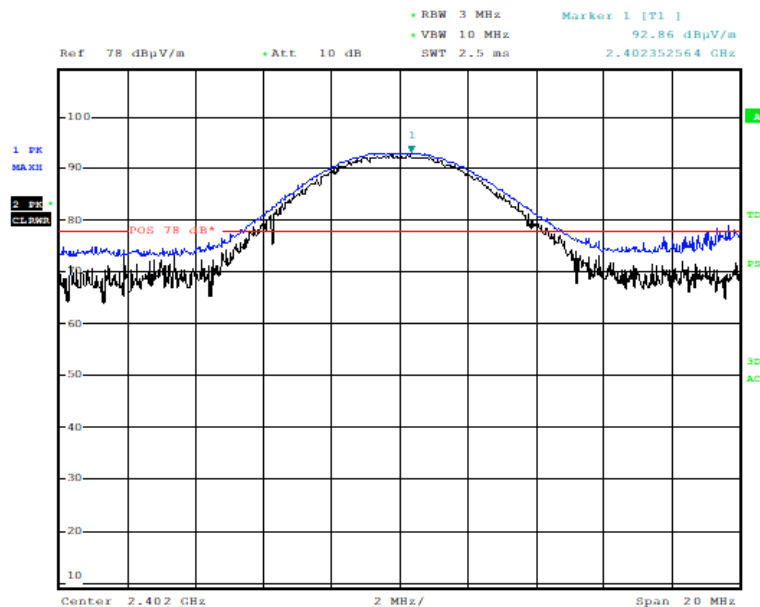
The maximum peak conducted output power at 2400-2483.5 MHz is 1 Watts or 30 dBm.

6.6.3 Results

Table 6-2: Maximum Peak Power

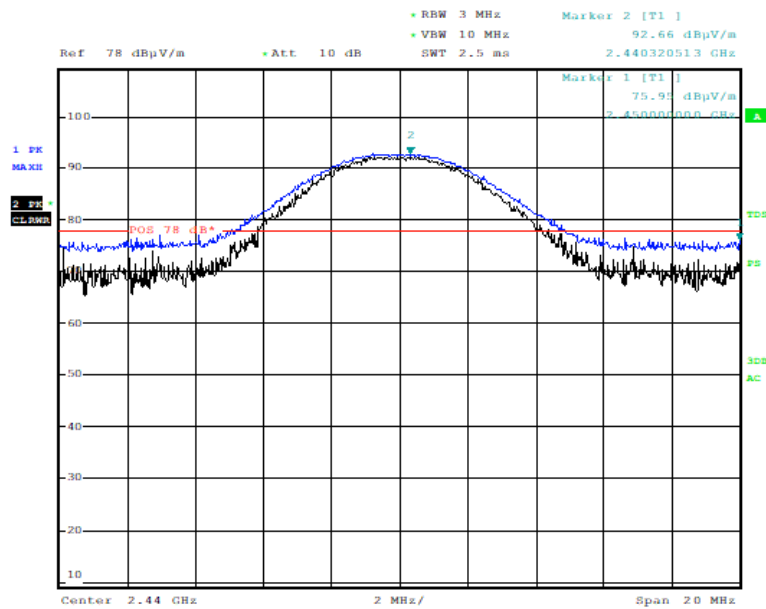
Freq. [MHz]	E-Field@ 3 m dBuV/m	EIRP (dBm)	Antenna Gain (dBi)	Equivalent Conducted Output Power (dBm)	Limit (dBm)	Results
2402	92.86	-2.37	3	-5.37	30	Complied
2440	92.66	-2.57	3	-5.57	30	Complied
2480	92.17	-3.06	3	-6.06	30	Complied

The measured radiated field strength is converted to equivalent conducted output power for checking compliance (KDB 558074 D01 Section 3).



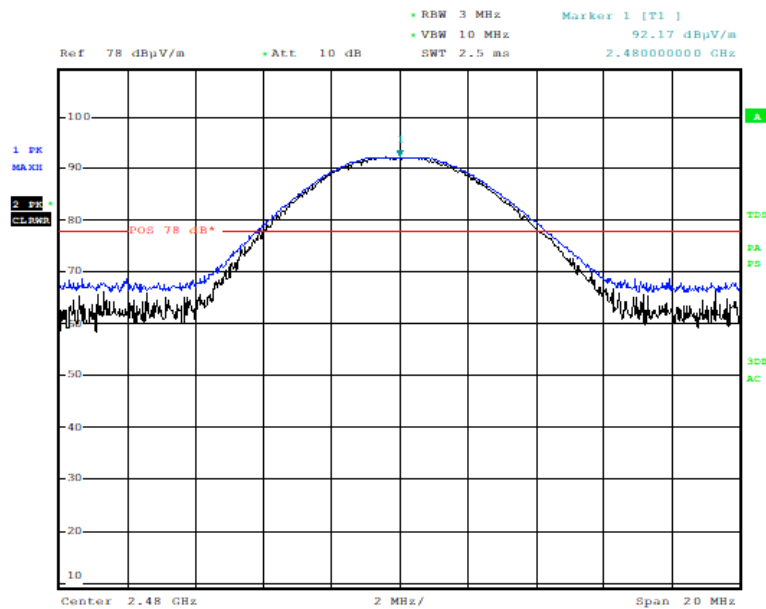
Date: 11. JUN. 2020 10:13:58

Graph 6-4: Max EIRP, 2402 MHz



Date: 11. JUN. 2020 10:10:04

Graph 6-5: Max EIRP, 2440 MHz



Date: 11. JUN. 2020 10:04:19

Graph 6-6: Max EIRP, 2480 MHz

6.7 §15.247(d)/ RSS-247 5.5 Out-of-Band/Spurious Emissions

6.7.1 Test procedure

Radiated out-of-band/spurious emissions measurements were performed in a semi-anechoic chamber compliant with ANSI C63.4: 2014.

The test frequency range was sub-divided into smaller bands with the defined resolution bandwidths to permit reliable display and identification of emissions.

Frequency range [MHz]	Measurement Bandwidth [kHz]	Measurement Distance [m]	Antenna
0.009 to 0.150	0.2	3	0.6 metre loop antenna
0.150 to 30	9	3	
30 to 1000	120	3	
1000 to 18 000	1000	3	Biconilog hybrid
18 000 to 40 000	1000	1	Standard gain or broadband horn

EUT was set at a height of 0.8 m for measurements below 1000 MHz and set at a height of 1.5 m for measurements above 1000 MHz.

The sample was slowly rotated with the spectrum analyser set to Max-Hold. This was performed for at least two antenna heights. When an emission was located, it was positively identified and its maximum level found by rotating the automated turntable and by varying the antenna height. For below 1000 MHz the emissions were measured with a Quasi-Peak detector, and for above 1000 MHz the emissions were measured with Peak and Average detectors.

EUT was investigated on all three axes (x, y, and z). Measurements on the worst axis are presented below.

The measurement data for each frequency range was corrected for cable losses, antenna factors and preamplifier gain. This process was performed for both horizontal and vertical polarisations of the measurement antenna.

6.7.2 Evaluation of field strength

Field strengths were calculated automatically by the software using pre-stored calibration data. The method of calculation is shown below:

$$E = V + AF - G + L$$

Where: E = Radiated Field Strength in dBμV/m.

V = EMI Receiver Voltage in dBμV/m.

AF = Antenna Factor in dB (stored as a data array).

G = Preamplifier Gain in dB (stored as a data array).

L = Cable loss in dB (stored as a data array of Insertion Loss versus frequency).

6.7.3 Limits

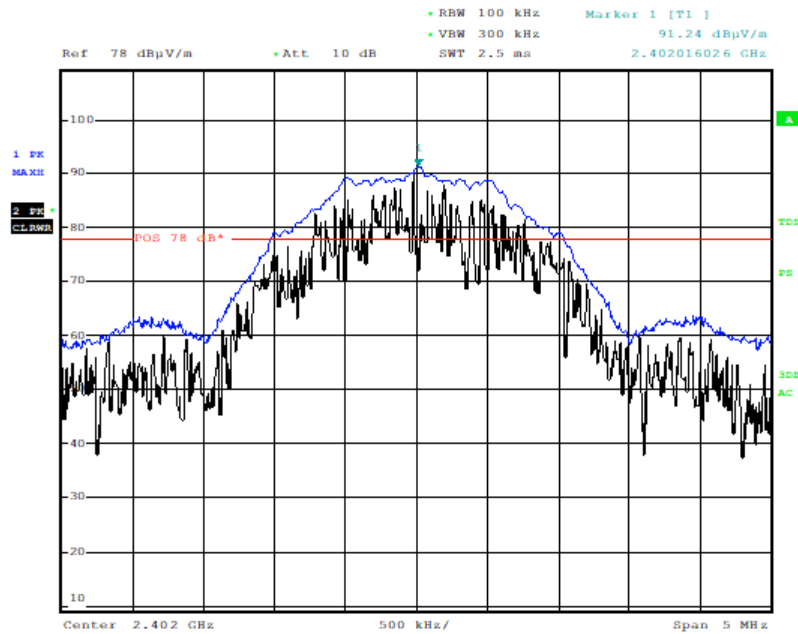
The limit applied is in accordance with the out-of-band/spurious emissions limit defined in §15.247(d).

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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.

The in-band peak PSD in 100 kHz bandwidth were measured on all channels according to ANSI C63.10-2013 clause 11.11.2. The maximum PSD level was used to establish the limit for nonrestricted frequency bands. However, the general limits of §15.209 apply for the restricted bands of operation defined in §15.205.

Table 6-3: 100 kHz reference level measurement

Freq. (MHz)	Peak at 3 m (dBμV/m)	Limit at 3m (dBμV/m)
2402	91.24	71.24

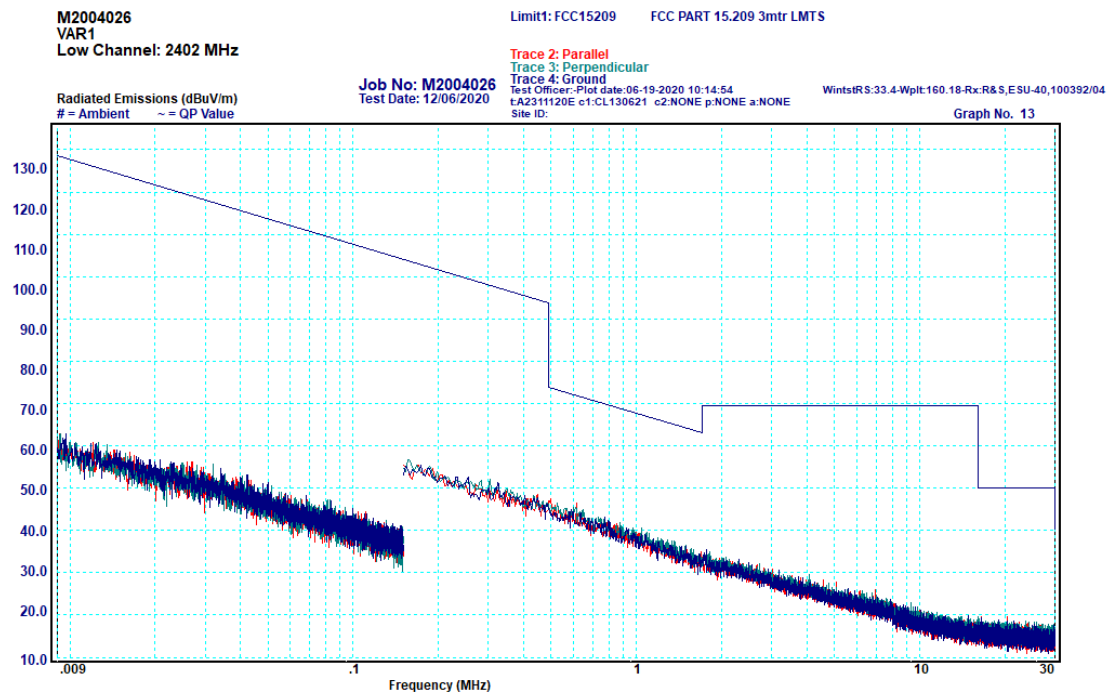


Date: 11 JUN 2020 10:15:35

Graph 6-7: 100 kHz bandwidth reference level

6.7.4 Transmitter Spurious Emissions: 9 kHz to 30 MHz

All emissions measured in the frequency band 9kHz - 30MHz complied with the requirements of the standard.



Graph 6-8: Transmitter Spurious Emissions, 9kHz – 30 MHz, 2402 MHz

No peaks were measured within 10 dB of the limit.



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M2004026
VAR1
Mid Channel: 2440 MHz

Limit1: FCC15209 FCC PART 15.209 3mtr LMTS

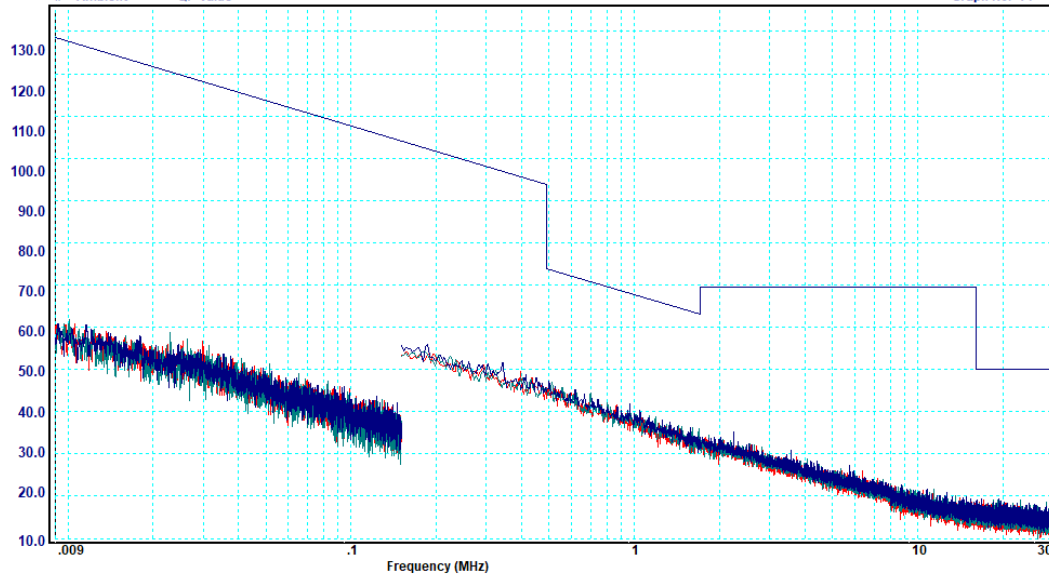
Trace 2: Parallel
Trace 3: Perpendicular
Trace 4: Ground
Test Officer: Plot date: 06-19-2020 10:16:35
tA2311120E c1:CL130621 c2:NONE p:NONE a:NONE
Site ID:

WintstRS:33.4-Wplt:160.18-Rx:R&S,ESU-40,100392/04

Radiated Emissions (dBuV/m)
= Ambient ~ = QP Value

Job No: M2004026
Test Date: 12/06/2020

Graph No. 14



Graph 6-9: Transmitter Spurious Emissions, 9kHz – 30 MHz, 2440 MHz

No peaks were measured within 10 dB of the limit.

M2004026
VAR1
High Channel: 2480 MHz

Limit1: FCC15209 FCC PART 15.209 3mtr LMTS

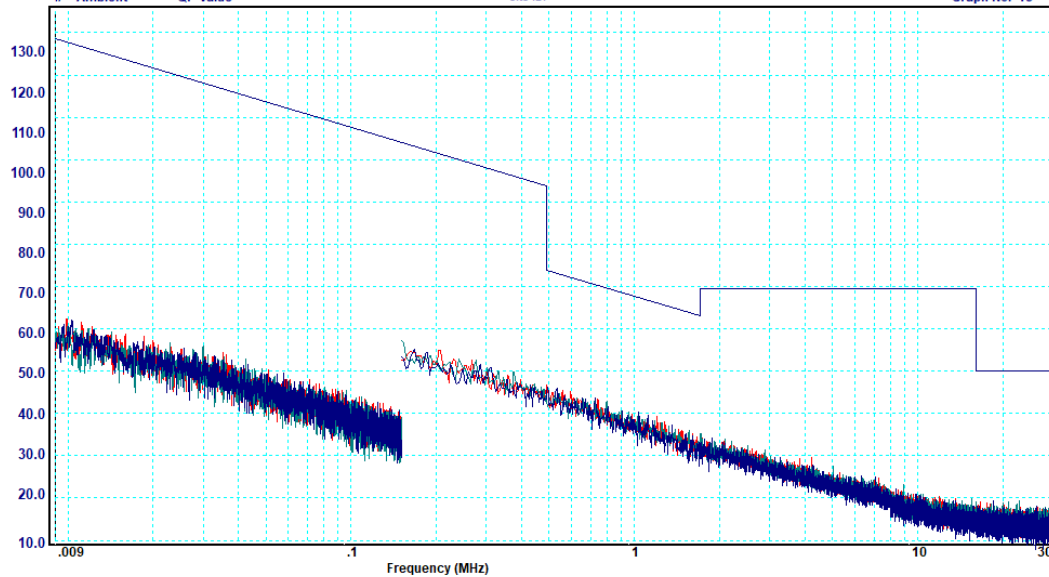
Trace 2: Parallel
Trace 3: Perpendicular
Trace 4: Ground
Test Officer: Plot date: 06-19-2020 10:18:10
tA2311120E c1:CL130621 c2:NONE p:NONE a:NONE
Site ID:

WintstRS:33.4-Wplt:160.18-Rx:R&S,ESU-40,100392/04

Radiated Emissions (dBuV/m)
= Ambient ~ = QP Value

Job No: M2004026
Test Date: 12/06/2020

Graph No. 15



Graph 6-10: Transmitter Spurious Emissions, 9kHz – 30 MHz, 2480 MHz

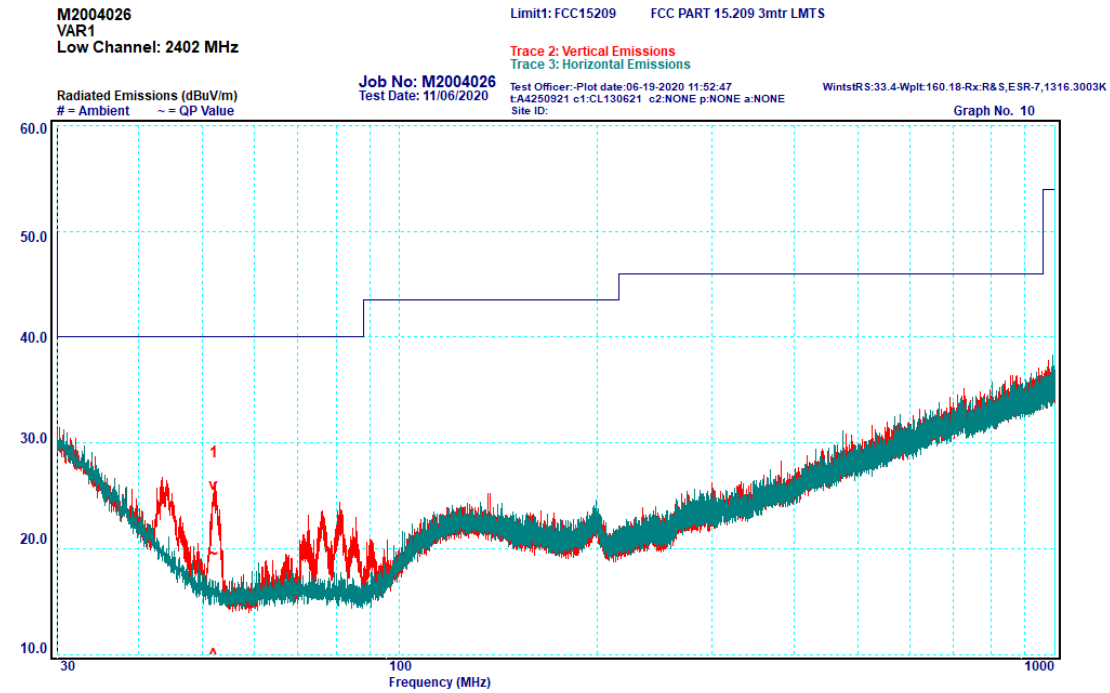
No peaks were measured within 10 dB of the limit.



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6.7.5 Transmitter Spurious Emissions: 30 - 1000 MHz

All emissions measured in the frequency band 30 – 1000 MHz complied with the requirements of the standard.



Graph 6-11: Transmitter Spurious Emissions, 30 – 1000 MHz, Low Channel 2402 MHz

Table 6-4: Transmitter Spurious Emissions, 30 – 1000 MHz, Low Channel 2402 MHz

Peak	Frequency [MHz]	Polarisation	Quasi Peak		
			Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]
1	52.08	Vertical	19.5	40.0	-20.5

M2004026
VAR1
Mid Channel: 2440 MHz

Limit1: FCC15209 FCC PART 15.209 3mtr LMTS

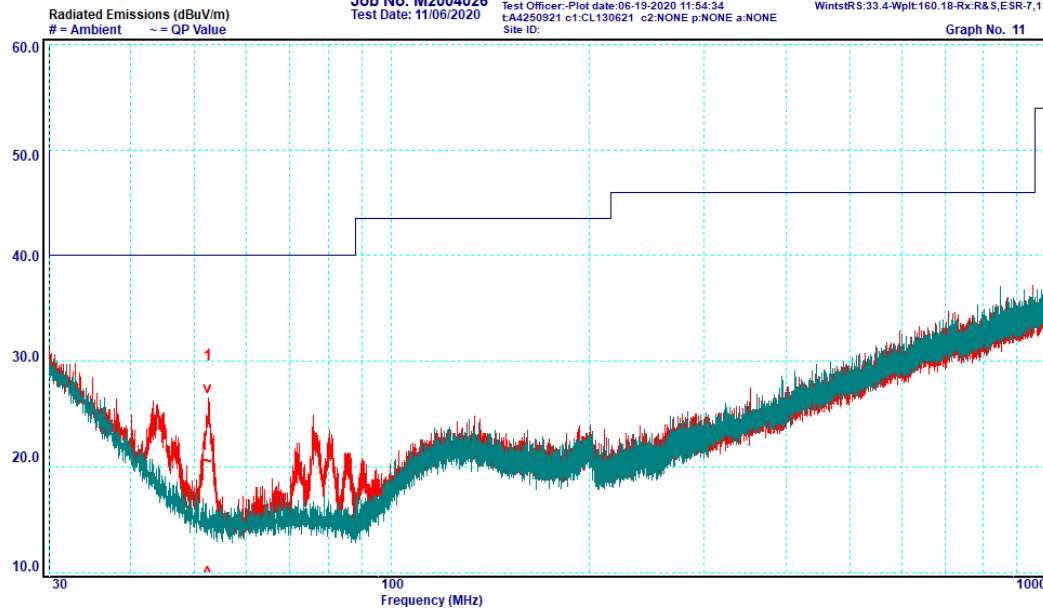
Trace 2: Vertical Emissions
Trace 3: Horizontal Emissions

Job No: M2004026
Test Date: 11/06/2020

Test Officer: Plot date: 06-19-2020 11:54:34
tA4250921 c1:CL130621 c2:NONE p:NONE a:NONE
Site ID:

WintSR S:33.4 Wpl:160.18-Rx:R&S,ESR-7,1316.3003K

Graph No. 11



Graph 6-12: Transmitter Spurious Emissions, 30 – 1000 MHz, Mid Channel 2440 MHz

Table 6-5: Transmitter Spurious Emissions, 30 – 1000 MHz, Mid Channel 2440 MHz

Peak	Frequency [MHz]	Polarisation	Quasi Peak		
			Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]
1	52.49	Vertical	20.5	40.0	-19.5

M2004026
VAR1
High Channel: 2480MHz

Limit1: FCC15209 FCC PART 15.209 3mtr LMTS

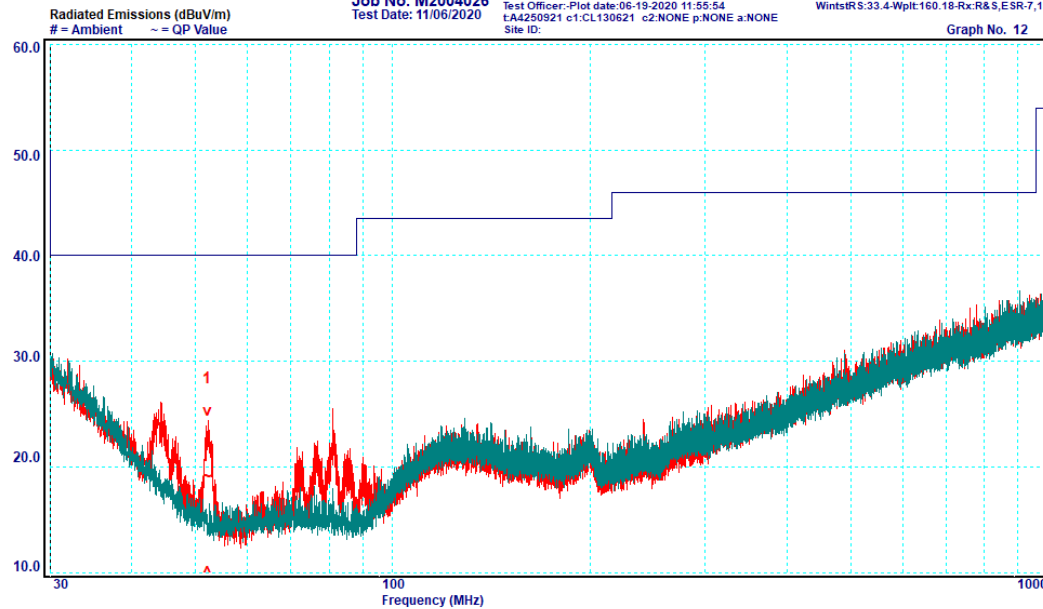
Trace 2: Vertical Emissions
Trace 3: Horizontal Emissions

Job No: M2004026
Test Date: 11/06/2020

Test Officer: Plot date: 06-19-2020 11:55:54
t: A4250921 c1: CL130621 c2: NONE p: NONE a: NONE
Site ID:

WintSR S: 33.4 Wpl: 160.18-Rx: R&S, ESR-7, 1316.3003K

Graph No. 12



Graph 6-13: Transmitter Spurious Emissions, 30 – 1000 MHz, High Channel 2480 MHz

Table 6-6: Transmitter Spurious Emissions, 30 – 1000 MHz, High Channel 2480 MHz

Peak	Frequency [MHz]	Polarisation	Quasi Peak		
			Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]
1	52.21	Vertical	19.1	40.0	-20.9

6.7.6 Transmitter Spurious Emissions: 1 - 18 GHz

All emissions measured in the frequency band 1 – 18 GHz complied with the requirements of the standard.

Peak Measurement:

M2004026

VAR1

Low Channel: 2402 MHz PK

Limit1: FCC15205PK FCC PART 15.205, 1-18GHz@3mtr, 18-40GHz@1mtr

Trace 2: Vertical Emissions

Trace 3: Horizontal Emissions

Job No: M2004026

Test Date: 11/06/2020

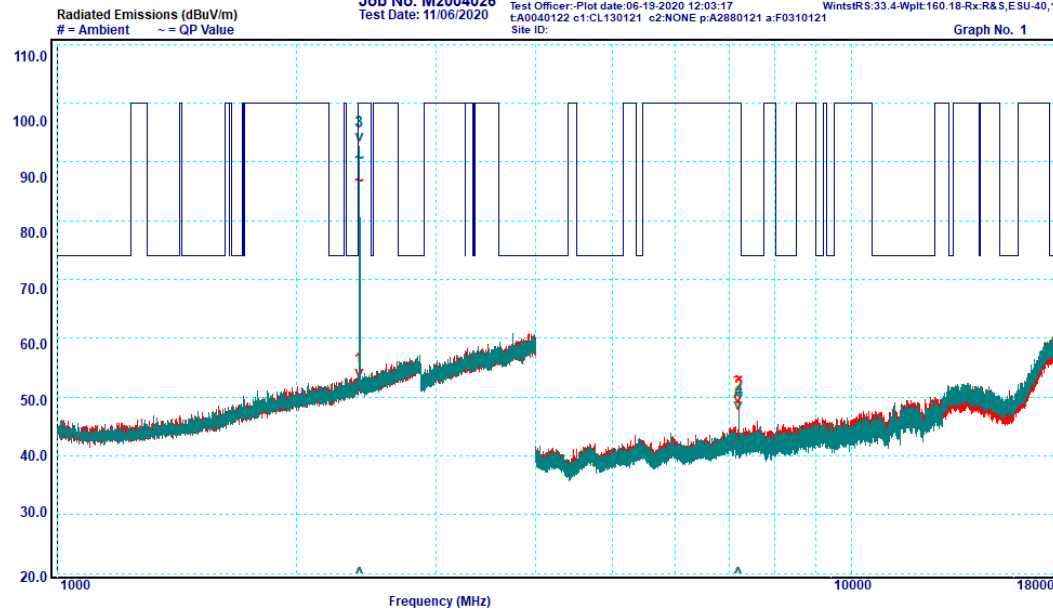
Test Officer: Plot date: 06-19-2020 12:03:17

EA0040122 c1:CL130121 c2:NONE p:A2680121 a:F0310121

Site ID:

WintstRS:33.4-Wp1t:160.18-Rx:R&S,ESU-40,100392/04

Graph No. 1



Graph 6-14: Transmitter Spurious Emissions, 1 – 18 GHz, Low Channel 2402 MHz, Peak

Table 6-7: Transmitter Spurious Emissions, 1 – 18 GHz, Low Channel 2402 MHz, Peak

Peak	Frequency [MHz]	Polarisation	Peak		
			Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]
1*	2402	Vertical	N/A	N/A	N/A
2	7204.62	Vertical	53.2	71.24	-18.04
3*	2402.02	Horizontal	N/A	N/A	N/A
4	7206	Horizontal	50.1	71.24	-21.14

*Peaks 1 and 3 are the fundamental transmissions and are not subject to the spurious emissions limit of the standard

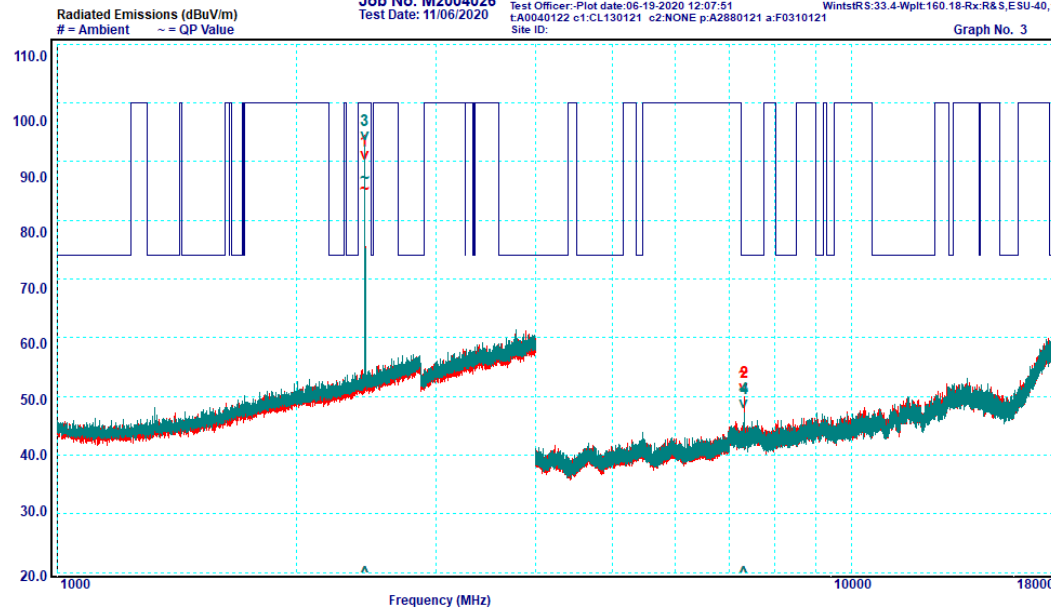
M2004026
VAR1
Mid Channel: 2440MHz PK

Limit1: FCC15205PK FCC PART 15.205, 1-18GHz@3mtr, 18-40GHz@1mtr

Trace 2: Vertical Emissions
Trace 3: Horizontal Emissions

Job No: M2004026
Test Date: 11/06/2020

Test Officer: Plot date: 06-19-2020 12:07:51 WinstRS: 33.4 Wpl: 160.18-Rx: R&S, ESU-40, 100392/04
t: A0040122 c1: CL130121 c2: NONE p: A2880121 a: F0310121
Site ID: Graph No. 3



Graph 6-15: Transmitter Spurious Emissions, 1 – 18 GHz, Mid Channel 2440 MHz, Peak

Table 6-8: Transmitter Spurious Emissions, 1 – 18 GHz, Mid Channel 2440 MHz, Peak

Peak	Frequency [MHz]	Polarisation	Peak		
			Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
1*	2440.03	Vertical	N/A	N/A	N/A
2	7318.71	Vertical	54	74	-20
3*	2440.02	Horizontal	N/A	N/A	N/A
4	7318.82	Horizontal	51	74	-23

*Peaks 1 and 3 are the fundamental transmissions and are not subject to the spurious emissions limit of the standard

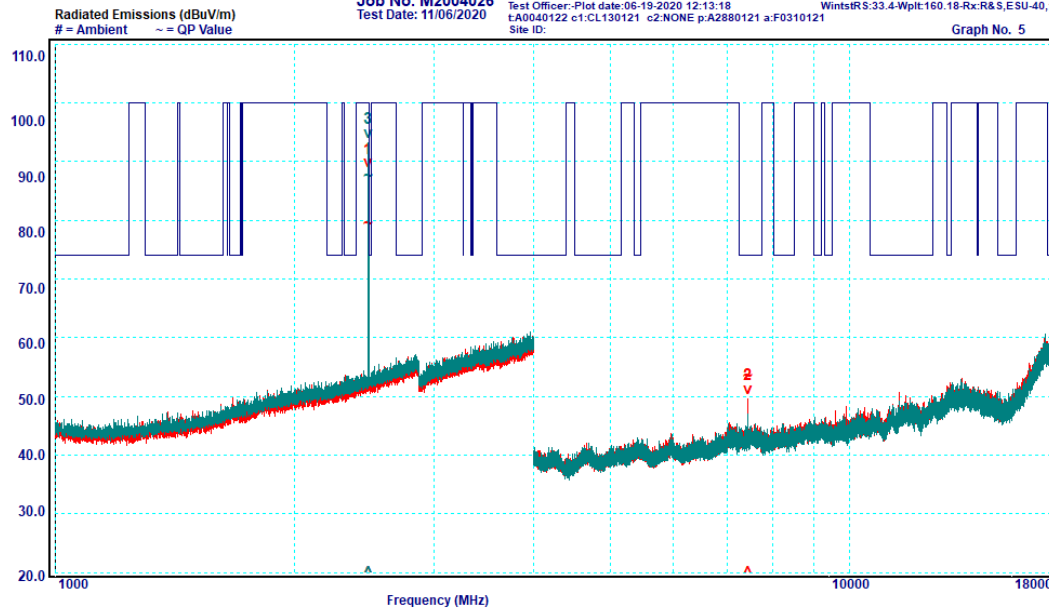
M2004026
VAR1
High Channel: 2480MHz PK

Limit1: FCC15205PK FCC PART 15.205, 1-18GHz@3mtr, 18-40GHz@1mtr

Trace 2: Vertical Emissions
Trace 3: Horizontal Emissions

Job No: M2004026
Test Date: 11/06/2020

Test Officer: Plot date: 06-19-2020 12:13:18 WintSR S:33.4 Wpl:160.18-Rx:R&S,ESU-40,100392/04
t:A0040122 c1:CL130121 c2:NONE p:A2880121 a:F0310121
Site ID: Graph No. 5



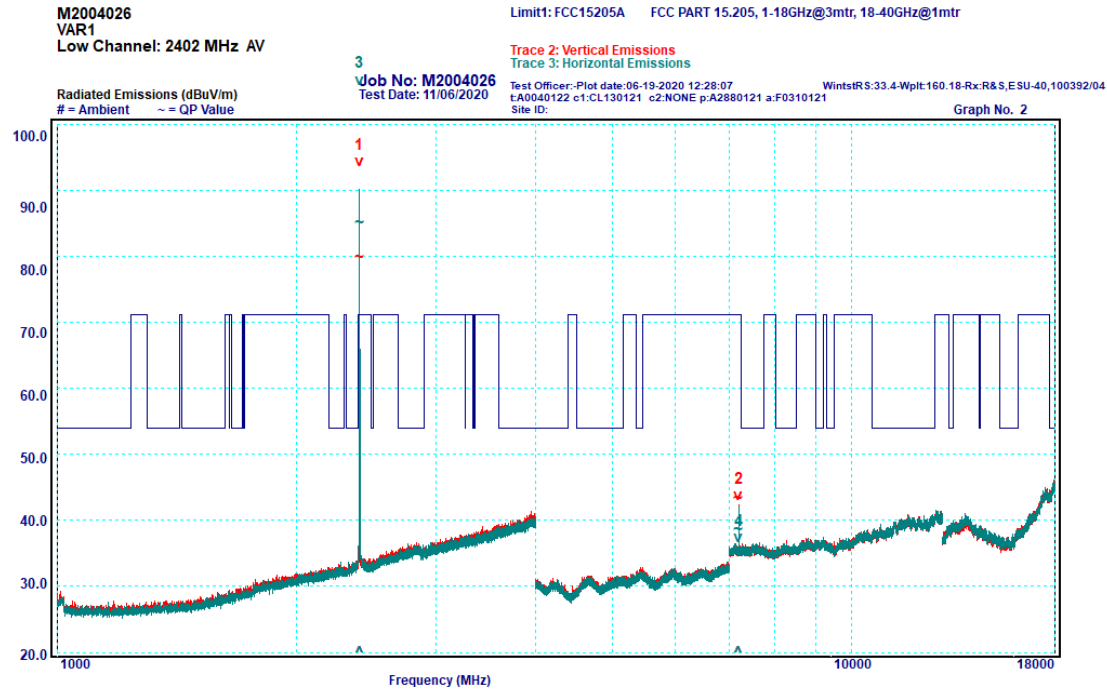
Graph 6-16: Transmitter Spurious Emissions, 1 – 18 GHz, High Channel 2480 MHz, Peak

Table 6-9: Transmitter Spurious Emissions, 1 – 18 GHz, High Channel 2480 MHz, Peak

Peak	Frequency [MHz]	Polarisation	Peak		
			Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
1*	2480.02	Vertical	N/A	N/A	N/A
2	7438.72	Vertical	53.4	74	-20.6
3*	2480.02	Horizontal	N/A	N/A	N/A

*Peaks 1 and 3 are the fundamental transmissions and are not subject to the spurious emissions limit of the standard

Average Measurement:



Graph 6-17: Transmitter Spurious Emissions, 1 – 18 GHz, 2402 MHz, Average

Table 6-10: Transmitter Spurious Emissions, 1 – 18 GHz, 2402 MHz, Average

Peak	Frequency [MHz]	Polarisation	Peak		
			Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]
1*	2402.02	Vertical	N/A	N/A	N/A
2	7204.93	Vertical	43.4	71.2	-27.8
3*	2402.03	Horizontal	N/A	N/A	N/A
4	7206	Horizontal	38.6	71.2	-32.6

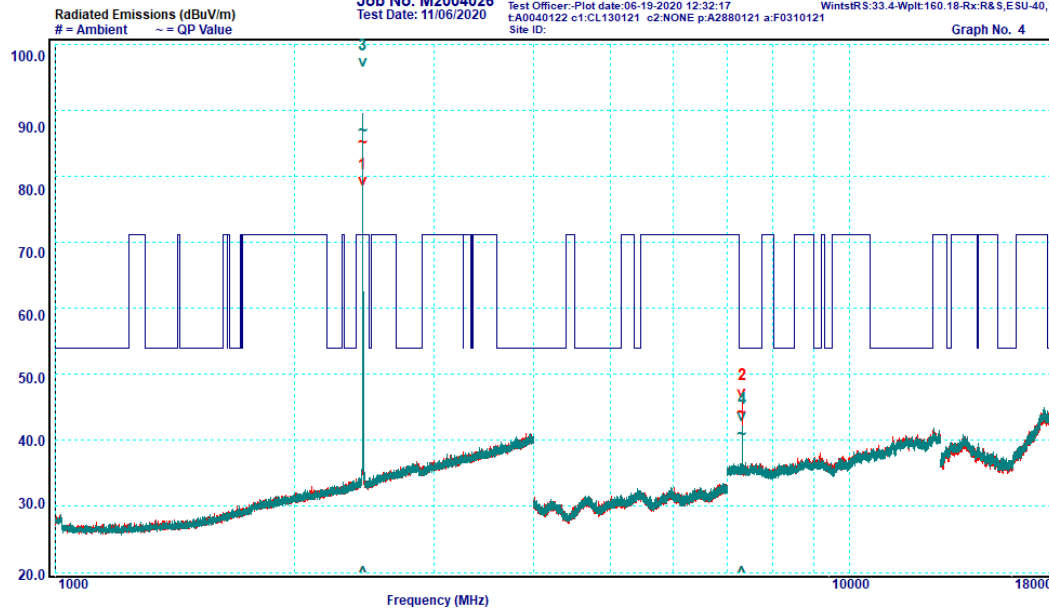
*Peaks 1 and 3 are the fundamental transmissions and are not subject to the spurious emissions limit of the standard

M2004026
VAR1
Mid Channel: 2440MHz AV

Limit1: FCC15205A FCC PART 15.205, 1-18GHz@3mtr, 18-40GHz@1mtr

Trace 2: Vertical Emissions
Trace 3: Horizontal Emissions

Job No: M2004026
Test Date: 11/06/2020
Test Officer: Plot date: 06-19-2020 12:32:17
WintSR S: 33.4 Wpl: 160.18 Rx: R&S, ESU-40, 100392/04
LA0040122 c1: CL130121 c2: NONE p: A2880121 a: F0310121
Site ID: Graph No. 4



Graph 6-18: Transmitter Spurious Emissions, 1 – 18 GHz, 2440 MHz, Average

Table 6-11: Transmitter Spurious Emissions, 1 – 18 GHz, 2440 MHz, Average

Peak	Frequency [MHz]	Polarisation	Peak		
			Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
1*	2440.03	Vertical	N/A	N/A	N/A
2	7318.92	Vertical	44.2	54	-9.8
3*	2440.1	Horizontal	N/A	N/A	N/A
4	7318.97	Horizontal	40.9	54	-13.1

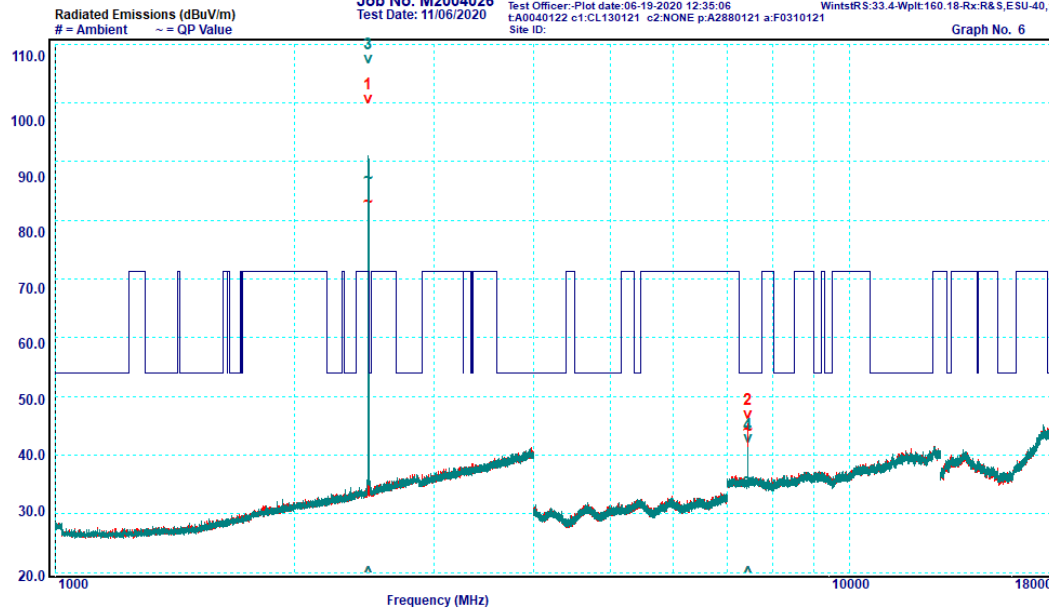
*Peaks 1 and 3 are the fundamental transmissions and are not subject to the spurious emissions limit of the standard

M2004026
VAR1
High Channel: 2480MHz AV

Limit1: FCC15205A FCC PART 15.205, 1-18GHz@3mtr, 18-40GHz@1mtr

Trace 2: Vertical Emissions
Trace 3: Horizontal Emissions

Job No: M2004026
Test Date: 11/06/2020
Test Officer: Plot date: 06-19-2020 12:35:06
WintRS: 33.4 Wpl: 160.18 Rx: R&S, ESU-40, 100392/04
t: A0040122 c1: CL130121 c2: NONE p: A2880121 a: F0310121
Site ID: Graph No. 6



Graph 6-19: Transmitter Spurious Emissions, 1 – 18 GHz, 2480 MHz, Average

Table 6-12: Transmitter Spurious Emissions, 1 – 18 GHz, 2480 MHz, Average

Peak	Frequency [MHz]	Polarisation	Peak		
			Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
1*	2479.98	Vertical	N/A	N/A	N/A
2	7438.73	Vertical	44.3	54	-9.7
3*	2479.98	Horizontal	N/A	N/A	N/A
4	7439.54	Horizontal	36	54	-18

*Peaks 1 and 3 are the fundamental transmissions and are not subject to the spurious emissions limit of the standard

6.7.7 Transmitter Spurious Emissions: 18 – 26 GHz

All emissions measured in the frequency band 18 – 26 GHz complied with the requirements of the standard.

Peak Measurement:

M2004026

VAR1

Low Channel: 2402 MHz PK

Limit1: FCC15205Pk FCC PART 15.205, 1-18GHz@3mtr, 18-40GHz@1mtr

Trace 2: Vertical Emissions

Trace 3: Horizontal Emissions

Job No: M2004026

Test Date: 15/06/2020

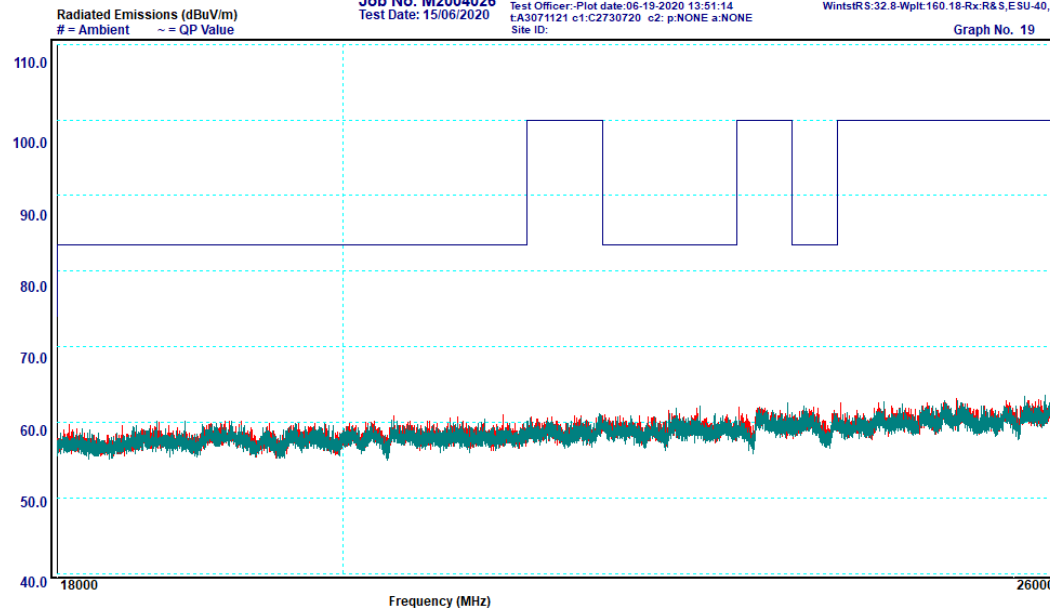
Test Officer: Plot date: 06-19-2020 13:51:14

tA3071121 c1:C2730720 c2: p:NONE a:NONE

Site ID:

WintstRS:32.8-Wpllt:160.18-Rx:R&S,ESU-40,100392/04

Graph No. 19



Graph 6-20: Transmitter Spurious Emissions, 18 – 26 GHz, 2402 MHz, Peak

No peaks were measured within 10 dB of the limit.

M2004026

VAR1

Mid Channel: 2442 MHz PK

Limit1: FCC15205Pk FCC PART 15.205, 1-18GHz@3mtr, 18-40GHz@1mtr

Trace 2: Vertical Emissions

Trace 3: Horizontal Emissions

Job No: M2004026

Test Date: 15/06/2020

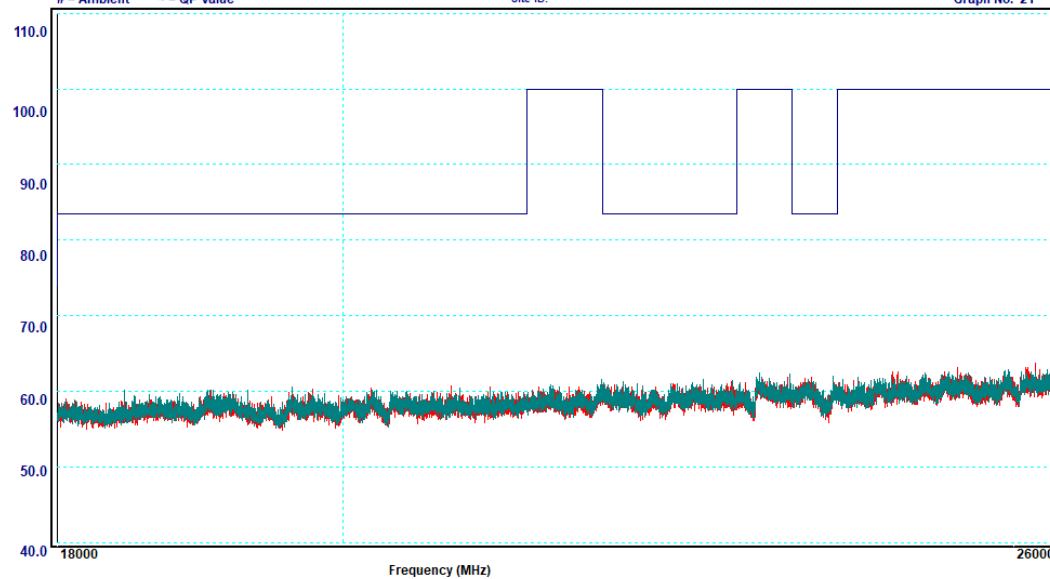
Test Officer: Plot date: 06-19-2020 13:52:12

tA3071121 c1:C2730720 c2: p:NONE a:NONE

Site ID:

WintstRS:32.8-Wpllt:160.18-Rx:R&S,ESU-40,100392/04

Graph No. 21



Graph 6-21: Transmitter Spurious Emissions, 18 – 26 GHz, 2442 MHz, Peak

No peaks were measured within 10 dB of the limit.

M2004026
VAR1
High Channel: 2480 MHz PK

Limit1: FCC15205PK FCC PART 15.205, 1-18GHz@3mtr, 18-40GHz@1mtr

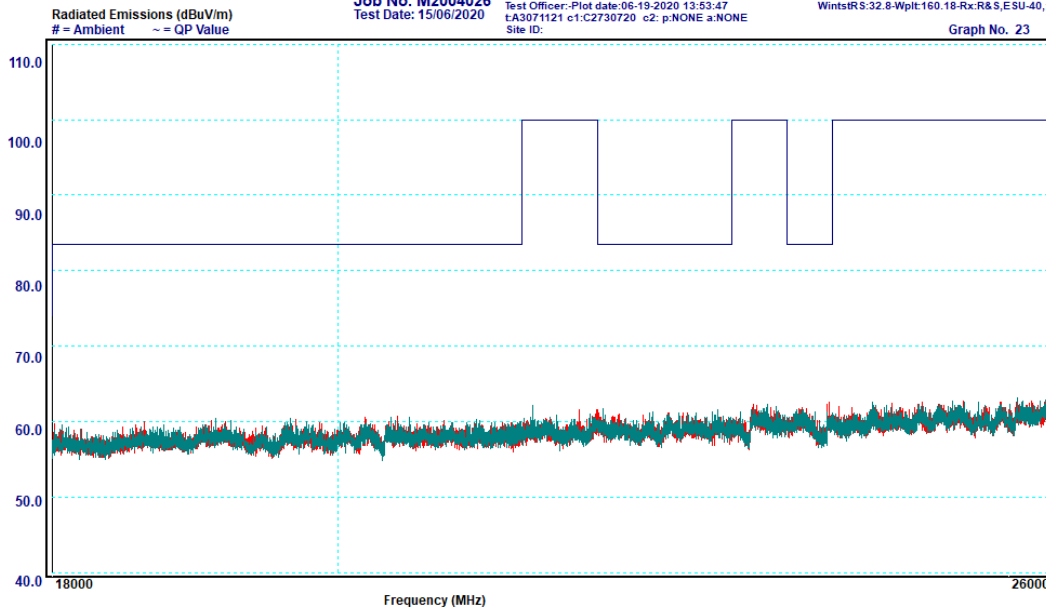
Trace 2: Vertical Emissions
Trace 3: Horizontal Emissions

Job No: M2004026
Test Date: 15/06/2020

Test Officer: Plot date: 06-19-2020 13:53:47
t: A3071121 c1: C2730720 c2: p: NONE a: NONE
Site ID:

WintstRS: 32.8-Wpl: 160.18-Rx: R&S, ESU-40, 100392/04

Graph No. 23



Graph 6-22: Transmitter Spurious Emissions, 18 – 26 GHz, 2480 MHz, Peak

No peaks were measured within 10 dB of the limit.

Average Measurement:

M2004026
VAR1
Low Channel: 2402 MHz AV

Limit1: FCC15205A FCC PART 15.205, 1-18GHz@3mtr, 18-40GHz@1mtr

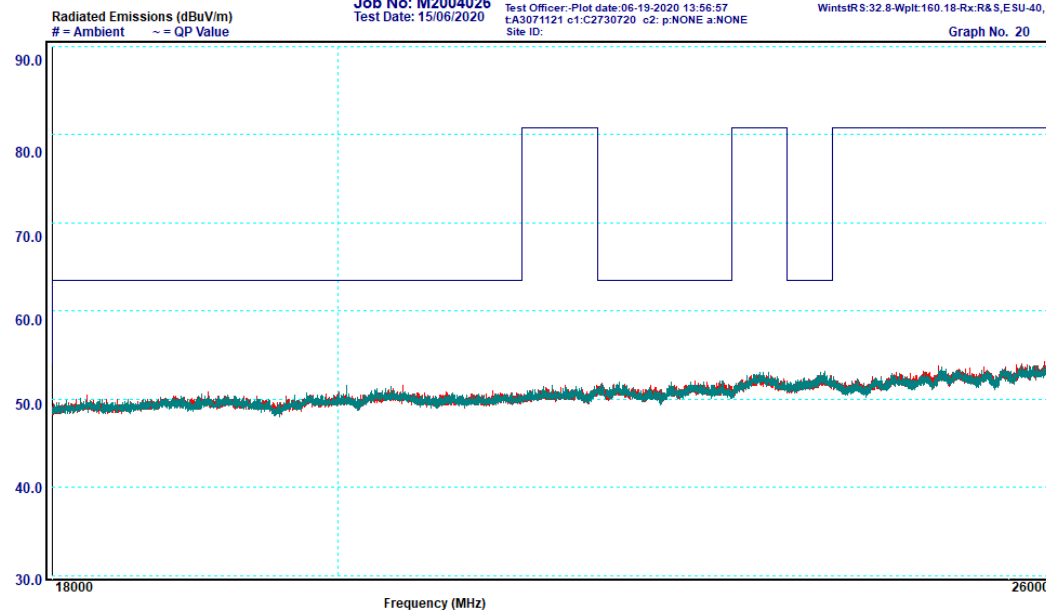
Trace 2: Vertical Emissions
Trace 3: Horizontal Emissions

Job No: M2004026
Test Date: 15/06/2020

Test Officer: Plot date: 06-19-2020 13:56:57
t: A3071121 c1: C2730720 c2: p: NONE a: NONE
Site ID:

WintstRS: 32.8-Wpl: 160.18-Rx: R&S, ESU-40, 100392/04

Graph No. 20



Graph 6-23: Transmitter Spurious Emissions, 18 – 26 GHz, 2402 MHz, Average

No peaks were measured within 10 dB of the limit.



Accreditation No. 5292

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M2004026
VAR1
Mid Channel: 2440 MHz AV

Limit1: FCC15205A FCC PART 15.205, 1-18GHz@3mtr, 18-40GHz@1mtr

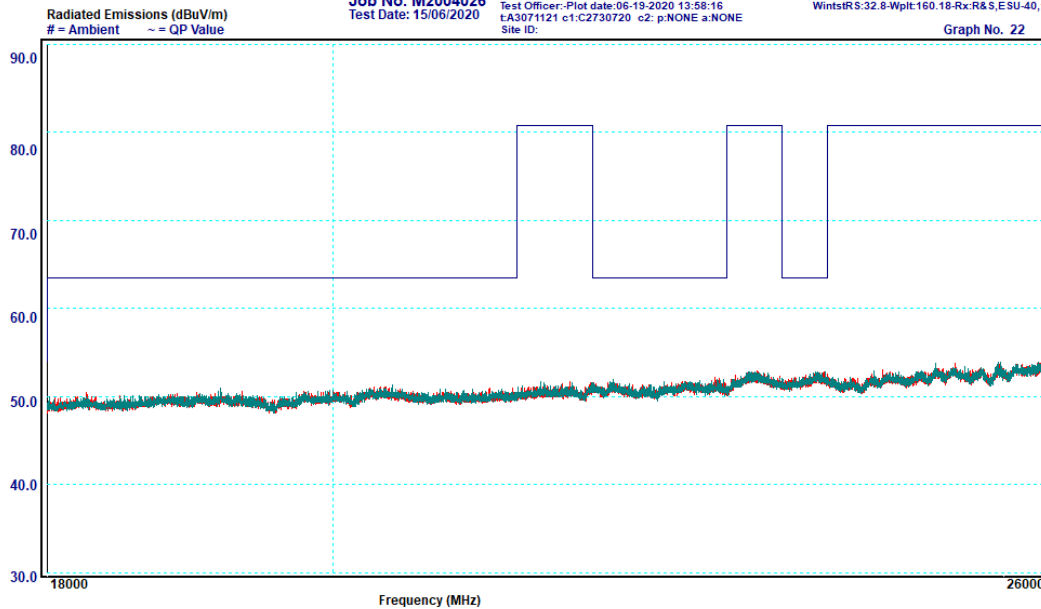
Trace 2: Vertical Emissions
Trace 3: Horizontal Emissions

Job No: M2004026
Test Date: 15/06/2020

Test Officer: Plot date: 06-19-2020 13:58:16
tA3071121 c1: C2730720 c2: p: NONE a: NONE
Site ID:

WintstRS: 32.8-Wplt: 160.18-Rx: R&S, ESU-40, 100392/04

Graph No. 22



Graph 6-24: Transmitter Spurious Emissions, 18 – 26 GHz, 2440 MHz, Average

No peaks were measured within 10 dB of the limit.

M2004026
VAR1
High Channel: 2480 MHz AV

Limit1: FCC15205A FCC PART 15.205, 1-18GHz@3mtr, 18-40GHz@1mtr

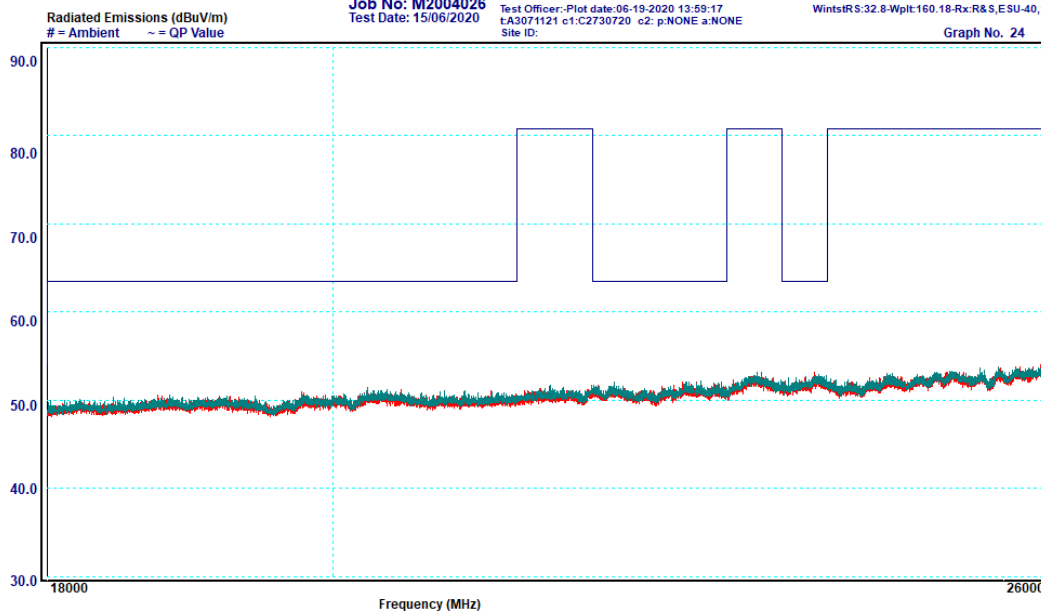
Trace 2: Vertical Emissions
Trace 3: Horizontal Emissions

Job No: M2004026
Test Date: 15/06/2020

Test Officer: Plot date: 06-19-2020 13:59:17
tA3071121 c1: C2730720 c2: p: NONE a: NONE
Site ID:

WintstRS: 32.8-Wplt: 160.18-Rx: R&S, ESU-40, 100392/04

Graph No. 24



Graph 6-25: Transmitter Spurious Emissions, 18 – 26 GHz, 2480 MHz, Average

No peaks were measured within 10 dB of the limit.

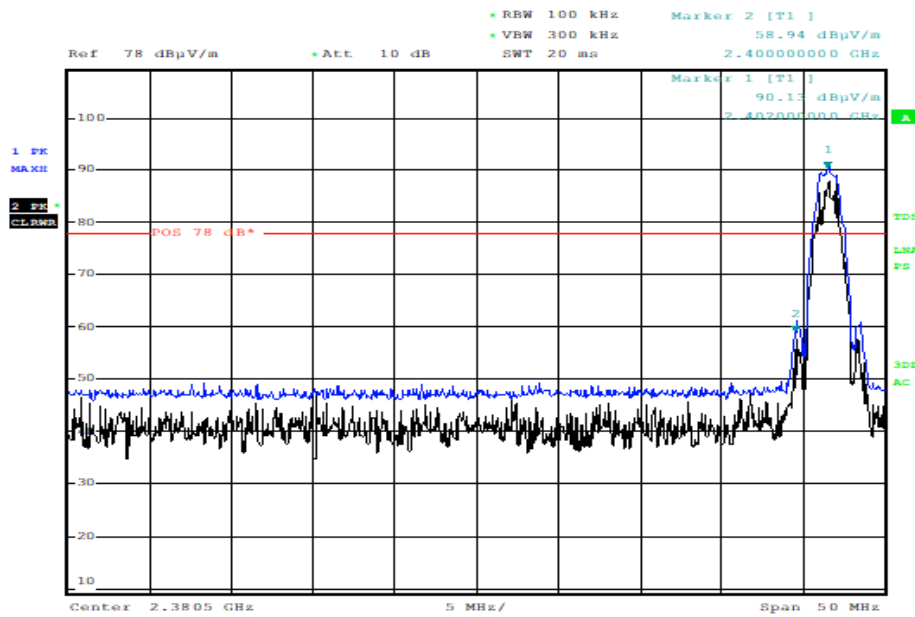


Accreditation No. 5292

This document shall not be reproduced except in full.

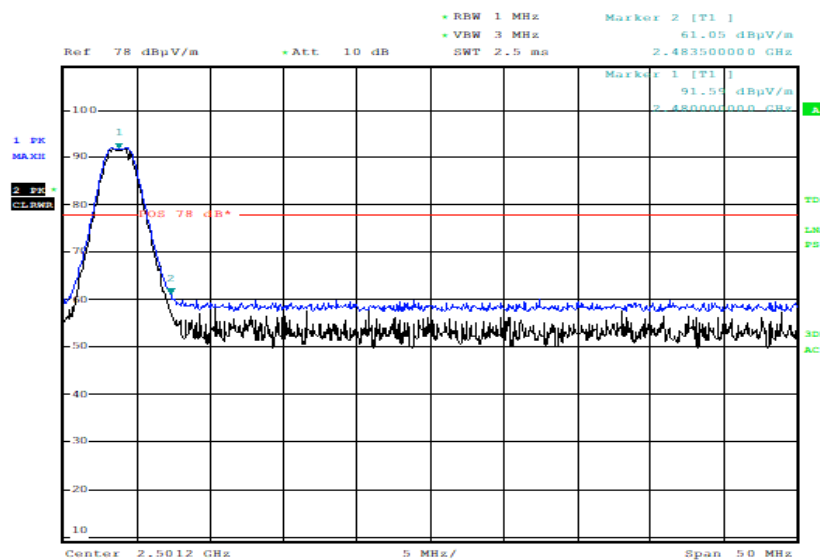
6.8 §15.247(d)/ §RSS-247 5.5 Band Edge Emission Measurements

Band-edge measurements were done using radiated in accordance to ANSI C63.10 clause 11.13.1 referring to clause 6.10.4 and 6.10.5. All emissions measured near the lower and higher band edge complied with the requirements of §15.247/ RSS-247 5.0.



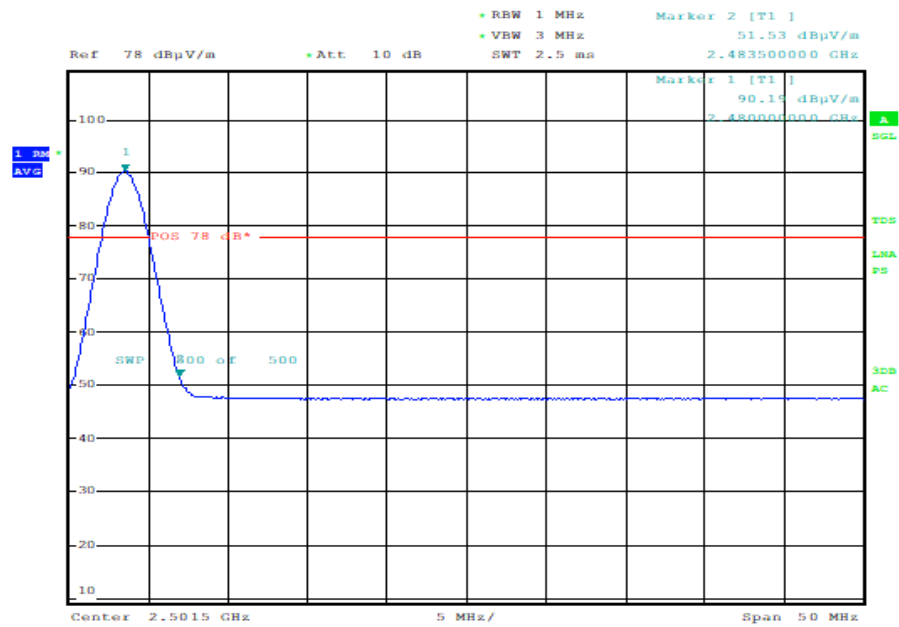
Date: 11.JUN.2020 10:17:26

Graph 6-26: Lower Band edge, Peak



Date: 11.JUN.2020 10:05:48

Graph 6-27: Upper Band edge, Peak



Date: 11.JUN.2020 10:25:20

Graph 6-28: Upper Band edge, Average

Table 6-13: Band edge Measurement

Measurement Type	Freq [MHz]	Measurement [dBuV/m]	Limit [dBuV/m]	Result
Peak	2400	58.94	71.24	Complied
Peak	2483.5	61.05	74.0	Complied
Average	2483.5	51.53	54.0	Complied

6.9 §15.247(e)/ RSS-247 5.2(b) Power Spectral Density

6.9.1 Test procedure

The tests were performed in accordance with ANSI C63.10: 2013 Clause 11.10 Maximum power spectral density level in the fundamental emissions.

Power spectral density measurements were made at 3 metres. The measurement resolution bandwidth was 3 kHz. The orientation of the EUT and the measurement antenna height and polarisation that produced the highest EIRP was used.

Power spectral density measurements were done at radiated method. The measurement resolution bandwidth was 3 kHz.

6.9.2 Limits

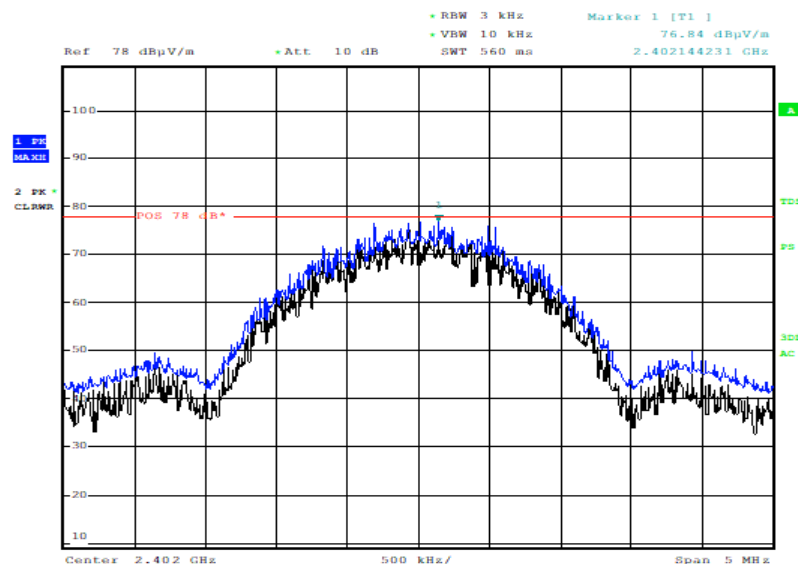
The maximum peak conducted power spectral density (PSD) is 8 dBm per 3 kHz.

6.9.3 Results

The measured radiated field strength is converted to equivalent conducted output power spectral density for checking compliance (KDB 558074 D01 Section 3).

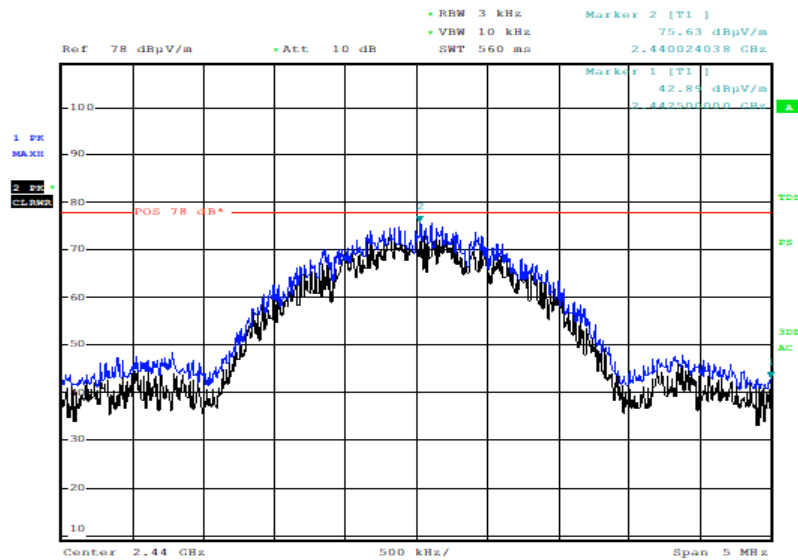
Table 6-14: Power spectral density

Freq. [MHz]	E-Field@ 3 m		Antenna Gain (dBi)	Equivalent Conducted Output PSD (dBm)	Limit (dBm)	Results
	dBuV/m	dBm				
2402	76.84	-18.39	3	-21.39	8	Complied
2440	75.63	-19.60	3	-22.60	8	Complied
2480	76.19	-19.04	3	-22.04	8	Complied



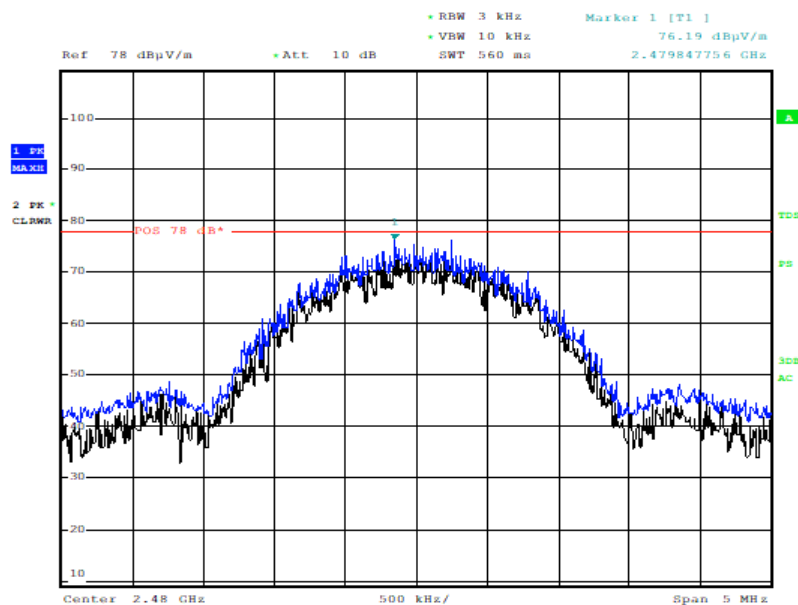
Date: 11 JUN 2020 10:31:35

Graph 6-29: Radiated Power Spectral Density, 2402 MHz



Date: 11. JUN. 2020 10:11:10

Graph 6-30: Radiated Power Spectral Density, 2440 MHz



Date: 11. JUN. 2020 10:29:55

Graph 6-31: Radiated Power Spectral Density, 2480 MHz

6.10 §15.247(i)/ §RSS-Gen 3.4/§RSS-102 Maximum Permissible Exposure

The EUT complied with the applicable maximum permissible exposure levels. Refer to EMC Technologies report M2004026-3 and M2004026-4.

6.11 §15.215/ §RSS-Gen 6.7 Occupied Bandwidth – 99% power

6.11.1 Test procedure

The bandwidth containing 99% power of the transmitted signal was measured using the procedure from ANSI C63.10 section 6.9.

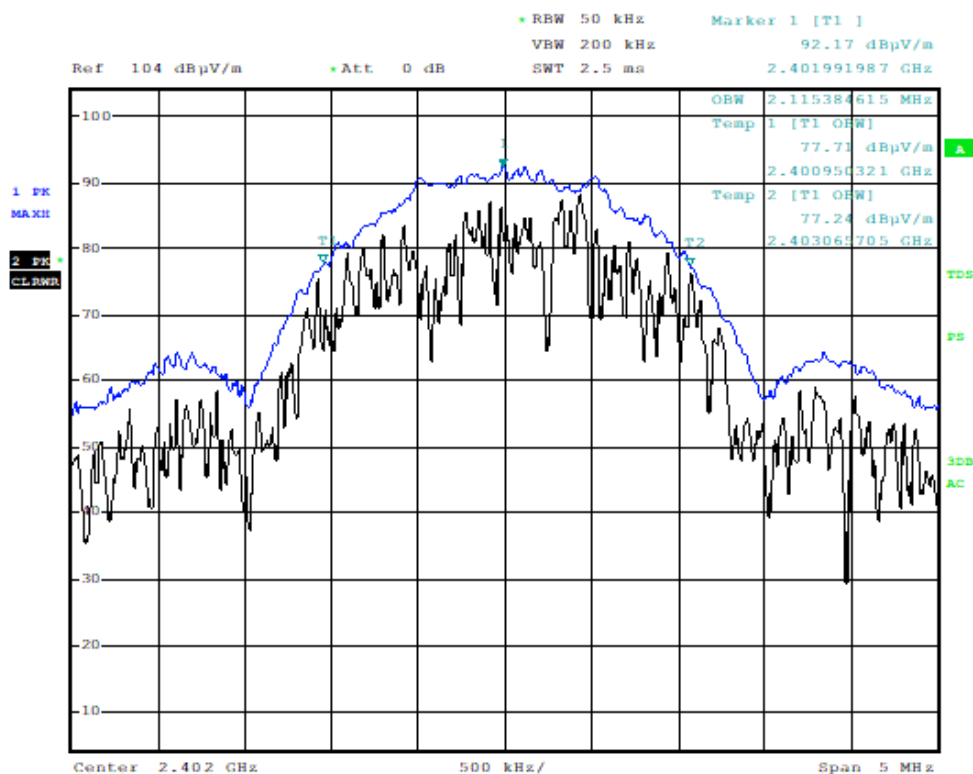
6.11.2 Limits

The 99% power should be contained within the frequency band 2400 – 2483.5 MHz.

6.11.3 Results

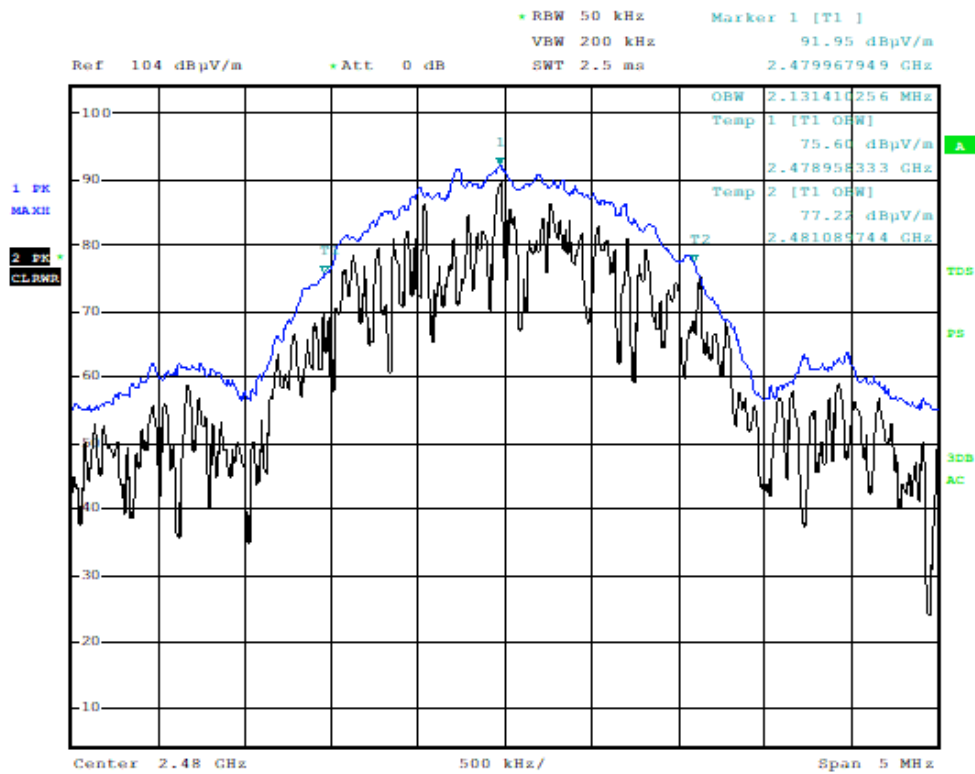
Table 6-15: Occupied Bandwidth

Freq. [MHz]	99% Bandwidth [MHz]	Low Frequency [MHz]	High Frequency [MHz]	Result
2402	2.115	2400.95	2403.06	Complied
2480	2.131	2478.95	2481.08	Complied



Date: 10 JUN 2020 13:46:37

Graph 6-32: Occupied bandwidth, 2402 MHz



Date: 10. JUN. 2020 14:06:44

Graph 6-33: Occupied bandwidth, 2480 MHz

END OF REPORT