Radio Test Report

Manufacturer: Renishaw Plc
Model: RMM-QE

In accordance with ARIB STD-T66 and MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19)

Prepared for: Renishaw Plc
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COMMERCIAL-IN-CONFIDENCE

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EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with ARIB STD-T66 and MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19): 3.7 (2014-10) for the tests detailed in section 1.3.

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
01	First version	07-Jan-2026
02	Added reference to Radio Equipment Regulations to brief summary of results table	10-Apr-2026

Table 1

1.2 Introduction

Applicant	Renishaw Plc
Manufacturer	Renishaw Plc
Model Number(s)	RMM-QE
Serial Number(s)	ANT154, AK0X92 and ANT149
Hardware Version(s)	Production
Software Version(s)	Production
Number of Samples Tested	3
Test Specification/Issue/Date	ARIB STD-T66 and MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19): 3.7 (2014-10)
Order Number	PU03736938
Date	11-August-2025
Date of Receipt of EUT	07-October-2025
Start of Test	27-October-2025
Finish of Test	20-November-2025
Name of Engineer(s)	Joshua Peploe-Williams and Thomas Biddlecombe
Related Document(s)	Radio Equipment Regulations, Article 24 Radio Equipment Regulations, Article 14 Radio Equipment Regulations, Article 5 Table 1 Radio Equipment Regulations, Article 7, Table 3 Radio Equipment Regulations, Article 6, Table 2 Radio Equipment Regulations, Article 49-20 Radio Equipment Regulations, Article 9-4

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with ARIB STD-T66 and MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19) is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configurations and Mode: 2.4 GHz Transceiver 1 & Transceiver 2 - FHSS				
2.1	3.2 (2)	Antenna Power	Pass	Radio Equipment Regulations, Article 14
2.2	3.2 (4)	Frequency Deviation	Pass	Radio Equipment Regulations, Article 5 Table 1
2.4	3.2 (7)	Allowable Value for Occupied Bandwidth	Pass	Radio Equipment Regulations, Article 6, Table 2
2.5	3.2 (8)	Spread Bandwidth	Pass	Radio Equipment Regulations, Article 49-20
2.6	3.2 (9)	Process Gain	Pass	Radio Equipment Regulations, Article 49-20
2.7	3.2 (11)	Dwell Time	Pass	Radio Equipment Regulations, Article 49-20
2.8	3.3 (1)	Limit on Secondary Radiation	Pass	Radio Equipment Regulations, Article 24
2.9	3.6 (2)	Antenna Gain	Pass	Radio Equipment Regulations, Article 49-20
2.3	3.2 (6)	Permissible Value of Spurious or Unnecessary Radiation Intensity	Pass	Radio Equipment Regulations, Article 7, Table 3

Configurations and Mode: 2.4GHz Transceiver 1 & Transceiver 2 – DTS				
2.1	3.2 (2)	Antenna Power	Pass	Radio Equipment Regulations, Article 14
2.2	3.2 (4)	Frequency Deviation	Pass	Radio Equipment Regulations, Article 5 Table 1
2.3	3.2 (6)	Permissible Value of Spurious or Unnecessary Radiation Intensity	Pass	Radio Equipment Regulations, Article 7, Table 3
2.4	3.2 (7)	Allowable Value for Occupied Bandwidth	Pass	Radio Equipment Regulations, Article 6, Table 2
2.5	3.2 (8)	Spread Bandwidth	Pass	Radio Equipment Regulations, Article 49-20
2.8	3.3 (1)	Limit on Secondary Radiation	Pass	Radio Equipment Regulations, Article 24
2.9	3.6 (2)	Antenna Gain	Pass	Radio Equipment Regulations, Article 49-20
Configurations and Mode: 2.4GHz Transceiver 1 & Transceiver 2-				
2.10	Article 2, Item (19) Notice 88, Appendix 43	Voltage Variations	Pass	Article 2, Item (19) Notice 88, Appendix 43
2.11	3.4 (1)	Interference Protection Function	Pass	Radio Equipment Regulations, Article 9-4

Table 2

1.4 Customer Supplied Form

Equipment Description

Technical Description: *(Please provide a brief description of the intended use of the equipment)*	The Renishaw RMM-QE (model RMM-QE) – Radio Machine Module is designed to work with the Universal Sensor Interface (USI) and is designed to support Renishaw probes that require rich data processing. The RMM-QE is compatible with all QE series radio probes but provides enhanced data connectivity with advanced 'analogue' probe types.
Manufacturer:	Renishaw
Model:	RMM-QE
Part Number:	A-7262-0001
Hardware Version:	Production
Software Version:	Production

The type of Wideband Data Transmission Equipment

FHSS ☒	non-FHSS ☐

In case of FHSS

In case of non-Adaptive FHSS equipment:	
The number of Hopping Frequencies:	39
In case of Adaptive FHSS equipment:	
The maximum number of Hopping Frequencies:	39
The minimum number of Hopping Frequencies:	39
The (average) dwell Time:	0.5ms

Adaptive/non-adaptive Equipment

Non-adaptive Equipment	☒
Adaptive Equipment without the possibility to switch to a non-adaptive mode	☐
Adaptive Equipment which can also operate in a non-adaptive mode	☐

In case of Adaptive Equipment

The maximum Channel Occupancy Time implemented by the equipment:	0.5	ms
The equipment has implemented an LBT mechanism		☐
In case of non-FHSS equipment:		
The equipment is Frame Based equipment		☒
The equipment is Load Based equipment		☐
The equipment can switch dynamically between Frame Based and Load Based equipment		☐
The CCA time implemented by the equipment:		µs
The equipment has implemented a DAA mechanism		☐
The equipment can operate in more than one adaptive mode		☐

In case of Non-adaptive Equipment

The maximum RF Output Power (e.i.r.p.)	+8.43	dBm
The maximum (corresponding) Duty Cycle	18	%
Equipment with dynamic behaviour, that behaviour is described here. *(e.g. the different combinations of duty cycle and corresponding power levels to be declared)*		

The worst case operational mode for each of the following tests

RF Output Power	+4dBm
Power Spectral Density	
Duty cycle, Tx-Sequence, Tx-gap	
Accumulated Transmit Time, Frequency Occupation & Hopping Sequence (only for FHSS equipment)	
Hopping Frequency Separation (only for FHSS equipment)	
Medium Utilisation:	
Adaptivity & Receiver Blocking:	
Nominal Channel Bandwidth	2MHz
Transmitter unwanted emissions in the OOB domain	
Transmitter unwanted emissions in the spurious domain	
Receiver spurious emissions	

The different transmit operating modes *(tick all that apply)*

Operating mode 1: Single Antenna Equipment	☒
Equipment with only one antenna Note: The RMM-QE contains two antennas – one for each transceiver.	☒
Equipment with two diversity antennas but only one antenna active at any moment in time	☐
Smart Antenna Systems with two or more antennas but operating in a (legacy) mode where only one antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)	☐
Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming	☐
Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)	☐
High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1	☐
High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2	☐
Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming	☐
Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)	☐
High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1	☐
High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2	☐
NOTE: Add more lines if more channel bandwidths are supported.	

In case of Smart Antenna Systems

The number of Receive chains:		
The number of Transmit chains:		
symmetrical power distribution	☐	
asymmetrical power distribution	☐	
In case of beam forming, the maximum (additional) beam forming gain:		dB
NOTE: The additional beam forming gain does not include the basic gain of a single antenna.		

Operating Frequency Range(s) of the Equipment

Operating Frequency Range 1:	2404	MHz to	2480	MHz
Operating Frequency Range 2:	2402	MHz to	2480	MHz
NOTE: Add more lines if more Frequency Ranges are supported.				

Nominal Channel Bandwidth

Nominal Channel Bandwidth 1:	2	MHz
NOTE: Add more lines if more channel bandwidths are supported.		

Type of Equipment (stand-alone, combined, plug-in radio device, etc.)

Stand-alone:			☒
Combined Equipment:			☐
Plug-in radio device:			☐
Other:	☐	Please specify:	

The normal and extreme operating conditions that apply to the equipment

Normal operating conditions (if applicable):					
Operating temperature:				20	°C
Other (please specify if applicable):					°C
Extreme operating conditions:					
Operating temperature:	Minimum	5	°C to Maximum	55	°C
Other (please specify if applicable):	Minimum		°C to Maximum		°C
Details provided are for the:					
stand-alone equipment					☐
combined equipment					☐
test jig					☐

The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels

Antenna Type:			
Integral Antenna (information to be provided in case of conducted measurements)			☐
Antenna Gain:		+4.43	dBi
If applicable, additional beamforming gain (excluding basic antenna gain):			dB
Temporary RF connector provided			☐
No temporary RF connector provided			☐
Integral Antenna (information to be provided in case of conducted measurements)			☒
Dedicated Antennas (equipment with antenna connector)			☐
Single power level with corresponding antenna(s)			☐
Multiple power settings and corresponding antenna(s)			☐
Number of different Power Levels:			
Power Level 1		+4	dBm
NOTES: Add more lines in case the equipment has more power levels. These power levels are conducted power levels (at antenna connector).			
For each of the power levels, provide the intended antenna assemblies, their corresponding gains (G) and the resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable			
Power Level 1		+4	dBm
Number of antenna assemblies provided for this power level:			
Assembly #	Gain (dBi)	e.i.r.p (dBm)	Part number or model number
1	+4.43	+8.43	Integral
2			
3			
Power Level 2			dBm
Number of antenna assemblies provided for this power level:			
Assembly #	Gain (dBi)	e.i.r.p (dBm)	Part number or model number
1			
2			
3			
Power Level 3			dBm
Number of antenna assemblies provided for this power level:			
Assembly #	Gain (dBi)	e.i.r.p (dBm)	Part number or model number
1			
2			
3			
NOTE 3: Add more rows in case more antenna assemblies are supported for this power level.			

The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined equipment or test jig in case of plug-in devices

Details provided are for the:				
stand-alone equipment				☒
combined equipment				☐
test jig				☐
Supply Voltage				
AC mains	☐	AC voltage:		V
DC	☒	DC voltage:	14.0	V
In case of DC, indicate the type of power source				
Internal Power Supply				☐
External Power Supply or AC/DC adapter Power is supplied by the connected USI.				☒
Battery				☐
Other:	☐	Please specify:		

Describe the test modes available which can facilitate testing

Radio Test Modes: Carrier bottom, middle and top channels. Modulated bottom, middle and top channels. Rx bottom, middle and top channels. FHSS modulated transmission. PER Rx bottom, middle and top channels. PER Tx bottom, middle and top channels. Please see accompanying support documentation.

The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3] IEEE 802.15.4™, proprietary, etc.)

Proprietary – “Renishaw QE”. Bluetooth (not currently implemented).

If applicable, the statistical analysis referred in clause 5.4.1 q)

N/A

If applicable, the statistical analysis referred in clause 5.4.1 r)

N/A

Geo-location capability supported by the equipment

Yes	☐
The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user.	☐
No	☒

Configuration for testing (see clause 5.3.2.3 of ETSI EN 300 328 V2.2.2)

From all combinations of conducted power settings and intended antenna assembly(ies) specified in clause 5.4.1 m), specify the combination resulting in the highest e.i.r.p. for the radio equipment.

Unless otherwise specified in ETSI EN 300 328, this power setting is to be used for testing against the requirements of ETSI EN 300 328. In case there is more than one such conducted power setting resulting in the same (highest) e.i.r.p. level, the highest power setting is to be used for testing. See also ETSI EN 300 328, clause 5.3.2.3.

Highest overall e.i.r.p. value:			+8.43	dBm
Corresponding Antenna assembly gain:	+4.43	dBi	Antenna Assembly #:	
Corresponding conducted power setting: (also the power level to be used for testing)	4	dBm	Listed as Power Setting #:	1

Modulation

ITU Class(es) of emission:	1M71FXD			
Can the transmitter operate unmodulated?	Yes	☒	No	☐

Duty Cycle

The transmitter is intended for:	
Continuous duty	☐
Intermittent duty	☒
Continuous operation possible for testing purposes	☒

About the UUT

The equipment submitted are representative production models	☒
If not, the equipment submitted are pre-production models?	☐
If pre-production equipment are submitted, the final production equipment will be identical in all respects with the equipment tested	☐
If not, supply full details:	

Additional items and/or supporting equipment provided

Spare batteries (e.g. for portable equipment)	☐
Battery charging device	☐
External Power Supply or AC/DC adapter	☐
Test Jig or interface box USI Development Board	☒
RF test fixture (for equipment with integrated antennas)	☐
Combined equipment	☐
Manufacturer:	☐
Model:	☐
Model Name:	☐
User Manual	☒
Technical documentation (Handbook and circuit diagrams)	☒

Cable Loss

Adapter Cable Loss (Conducted sample)	1	dB

I hereby declare that the information supplied is correct and complete.

Name: John Styles
Position held: Electronics Design Manager
Date: 09/10/2025

1.5 Product Information

1.5.1 Technical Description

The Renishaw RMM-QE (model RMM-QE) – Radio Machine Module is designed to work with the Universal Sensor Interface (USI) and is designed to support Renishaw probes that require rich data processing. The RMM-QE is compatible with all QE series radio probes but provides enhanced data connectivity with advanced 'analogue' probe types.

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.

The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
RMM-QE, Model: , Serial Number: ANT149			
0	As supplied by the customer	Not Applicable	Not Applicable
RMM-QE, Model: , Serial Number: ANT154			
0	As supplied by the customer	Not Applicable	Not Applicable
Populated RMM-QE PCB, Model: , Serial Number: AK0X92			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.8 Test Location

TÜV SÜD conducted the following tests at our Octagon House Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configurations and Mode: 2.4GHz Transceiver 1 & Transceiver 2 - FHSS		
Antenna Power	Thomas Biddlecombe	UKAS
Frequency Deviation	Thomas Biddlecombe	UKAS
Allowable Value for Occupied Bandwidth	Thomas Biddlecombe	UKAS
Spread Bandwidth	Thomas Biddlecombe	UKAS
Process Gain	Thomas Biddlecombe	UKAS
Dwell Time	Thomas Biddlecombe	UKAS
Limit on Secondary Radiation	Joshua Peploe-Williams	UKAS
Antenna Gain	Thomas Biddlecombe	UKAS
Permissible Value of Spurious or Unnecessary Radiation Intensity	Joshua Peploe-Williams	UKAS
Configurations and Mode: 2.4GHz Transceiver 1 & Transceiver 2 - DTS		
Antenna Power	Thomas Biddlecombe	UKAS
Frequency Deviation	Thomas Biddlecombe	UKAS
Permissible Value of Spurious or Unnecessary Radiation Intensity	Joshua Peploe-Williams	UKAS
Allowable Value for Occupied Bandwidth	Thomas Biddlecombe	UKAS
Spread Bandwidth	Thomas Biddlecombe	UKAS
Limit on Secondary Radiation	Joshua Peploe-Williams	UKAS
Antenna Gain	Thomas Biddlecombe	UKAS
Configurations and Mode: 2.4GHz Transceiver 1 & Transceiver 2 -		
Voltage Variations	Joshua Peploe-Williams	UKAS
Interference Protection Function	Thomas Biddlecombe	UKAS

Table 4

Laboratory Address: TÜV SÜD, Octagon House,
Concorde Way, Fareham, Hampshire,
PO15 5RL, United Kingdom

2 Test Details

2.1 Antenna Power

2.1.1 Specification Reference

ARIB STD-T66 and MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19), Clause 3.2 (2)

2.1.2 Equipment Under Test and Modification State

RMM-QE, S/N: ANT149 - Modification State 0

2.1.3 Date of Test

19-November-2025

2.1.4 Test Method

The Power Spectral Density was measured using a spectrum analyser which was tuned to the test frequency with the relevant RBW to match the limit. The max hold function on the analyser was used to obtain output power and assessed against the power limit.

A power meter was used to obtain the total conducted output power and a percentage deviation from the measured power to the declared power was calculated and assessed against the tolerance limits.

The EUT was powered by 14 VDC via DC PSU.

2.1.5 Environmental Conditions

Ambient Temperature	21.2 °C
Relative Humidity	29.0 %

2.1.6 Test Results

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	-
Limit Clause(s):	3.2(2)(a) 3.2(3)	Test Method(s):	Refer to Test Method
Additional Reference(s):	-		
Note(s):	3.6		

DUT Configuration			
Mode:	2 MB/s FHSS	Duty Cycle (%):	19.5
Antenna Configuration:	SISO	DCCF (dB):	7.09
Active Port(s):	A (Modem A)	Peak Antenna Gain (dBi):	4.43

Test Frequency (MHz)	Conducted Output Power (mW/MHz)					Limit (mW/MHz)
	A	B	C	D	∑	
2442	2.12	-	-	-	-	3.00

Table 5 - Output Power Results

Test Frequency (MHz)	Conducted Output Power (mW)					Declared (mW)	Tolerance (%)	Limit (%)
	A	B	C	D	∑			
Hopping	2.53	-	-	-	-	2.50	1.23	-80 ≤ n ≤ +20

Table 6 - Output Power Tolerance Results

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	-
Limit Clause(s):	3.2(2)(a) 3.2(3)	Test Method(s):	Refer to Test Method
Additional Reference(s):	-		
Note(s):	3.6		

DUT Configuration			
Mode:	2 MB/s FHSS	Duty Cycle (%):	19.6
Antenna Configuration:	SISO	DCCF (dB):	7.08
Active Port(s):	B (Modem B)	Peak Antenna Gain (dBi):	4.43

Test Frequency (MHz)	Conducted Output Power (mW/MHz)					Limit (mW/MHz)
	A	B	C	D	∑	
2442	-	1.84	-	-	-	3.00

Table 7 - Output Power Results

Test Frequency (MHz)	Conducted Output Power (mW)					Declared (mW)	Tolerance (%)	Limit (%)
	A	B	C	D	∑			
Hopping	-	2.10	-	-	-	2.50	-16.17	-80 ≤ n ≤ +20

Table 8 - Output Power Tolerance Results

ARIB STD T-66, Limit Clause 3.2

Clause	Requirement
3.2(2)(a)	3 mW/MHz

Table 9 - Antenna Power Limit

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	-
Limit Clause(s):	3.2(2)(a) 3.2(3)	Test Method(s):	Refer to Test Method
Additional Reference(s):	-		
Note(s):	3.6		

DUT Configuration			
Mode:	2 MB/s DTS	Duty Cycle (%):	19.5
Antenna Configuration:	SISO	DCCF (dB):	7.09
Active Port(s):	A (Modem A)	Peak Antenna Gain (dBi):	4.43

Test Frequency (MHz)	Conducted Output Power (mW/MHz)					Limit (mW/MHz)
	A	B	C	D	∑	
2402	2.05	-	-	-	-	3.00
2442	2.12	-	-	-	-	3.00
2480	2.21	-	-	-	-	3.00

Table 10 - Output Power Results

Test Frequency (MHz)	Conducted Output Power (mW)					Declared (mW)	Tolerance (%)	Limit (%)
	A	B	C	D	∑			
2402	2.18	-	-	-	-	2.50	-12.69	-80 ≤ n ≤ +20
2442	2.27	-	-	-	-	2.50	-9.31	-80 ≤ n ≤ +20
2480	2.38	-	-	-	-	2.50	-4.76	-80 ≤ n ≤ +20

Table 11 - Output Power Tolerance Results

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	-
Limit Clause(s):	3.2(2)(a) 3.2(3)	Test Method(s):	Refer to Test Method
Additional Reference(s):	-		
Note(s):	3.6		

DUT Configuration			
Mode:	2 MB/s DTS	Duty Cycle (%):	19.6
Antenna Configuration:	SISO	DCCF (dB):	7.08
Active Port(s):	B (Modem B)	Peak Antenna Gain (dBi):	4.43

Test Frequency (MHz)	Conducted Output Power (mW/MHz)					Limit (mW/MHz)
	A	B	C	D	∑	
2402	-	1.80	-	-	-	3.00
2442	-	1.84	-	-	-	3.00
2480	-	1.87	-	-	-	3.00

Table 12 - Output Power Results

Test Frequency (MHz)	Conducted Output Power (mW)					Declared (mW)	Tolerance (%)	Limit (%)
	A	B	C	D	∑			
2402	-	1.91	-	-	-	2.50	-23.58	-80 ≤ n ≤ +20
2442	-	1.96	-	-	-	2.50	-21.40	-80 ≤ n ≤ +20
2480	-	2.02	-	-	-	2.50	-19.27	-80 ≤ n ≤ +20

Table 13 - Output Power Tolerance Results

ARIB STD T-66, Limit Clause 3.2

Clause	Requirement
3.2(2)(a)	3 mW/MHz

Table 14 - Antenna Power Limit

2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Hygrometer	Rotronic	I-1000	2891	12	02-Dec-2025
GPSDR Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	18-Mar-2026
Digital Multi-meter	Iso-tech	IDM93N	4435	12	06-Mar-2026
MXA Signal Analyser	Keysight Technologies	N9020B	5528	24	10-Sep-2027
USB Power Sensor	Boonton	RTP5008	5833	12	29-Aug-2026
USB Power Sensor	Boonton	RTP5008	5834	12	29-Aug-2026
Modular Power System Mainframe	Keysight Technologies	N6701C	5835	-	TU
DC Power Module 60V 20A 300W	Keysight Technologies	N6754A	5836	-	O/P Mon
Signal Conditioning Unit	TUV SUD	SPECTRUM_SCU001	6350	12	02-Sep-2026
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6638	12	29-Aug-2026
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6639	12	29-Aug-2026

Table 15

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

2.2 Frequency Deviation

2.2.1 Specification Reference

ARIB STD-T66 and MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19), Clause 3.2 (4)

2.2.2 Equipment Under Test and Modification State

RMM-QE, S/N: ANT149 - Modification State 0

2.2.3 Date of Test

19-November-2025

2.2.4 Test Method

The frequency of the spectrum was measured using a spectrum analyser by finding the centre point of the 10 dB bandwidth. The deviation of the measured value from the assigned frequency was calculated in ppm.

The EUT was powered by 14 VDC via DC PSU.

2.2.5 Environmental Conditions

Ambient Temperature	21.2 °C
Relative Humidity	29.0 %

2.2.6 Test Results

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	3.2 (4)	Test Method(s):	Refer to test method
Additional Reference(s):	-		

DUT Configuration			
Mode:	2 MB/s DTS	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Modem A)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	Frequency Error (ppm)				Limit (ppm)
	A	B	C	D	
2402	+25.616	-	-	-	±50.0
2442	+25.369	-	-	-	±50.0
2480	+25.657	-	-	-	±50.0

Table 16 - Frequency Tolerance Results

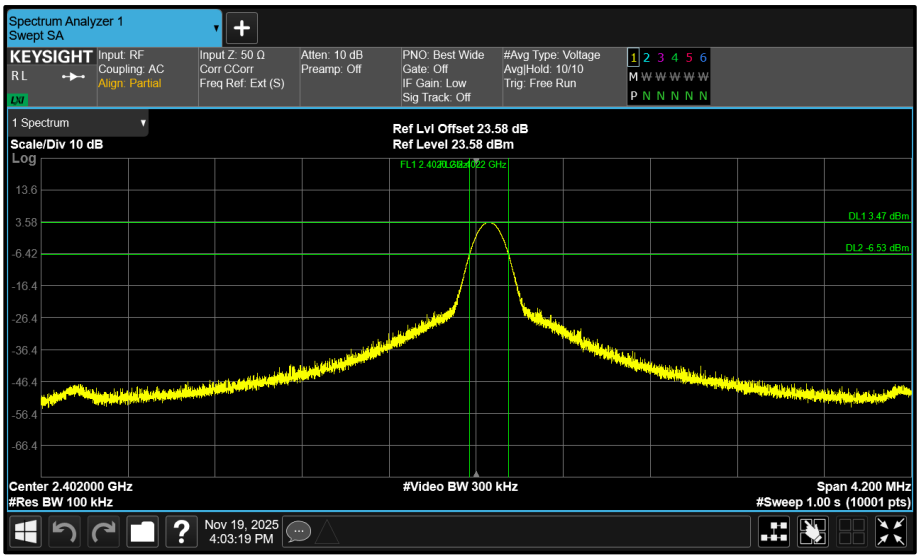


Figure 1 - 2402 MHz Frequency Tolerance

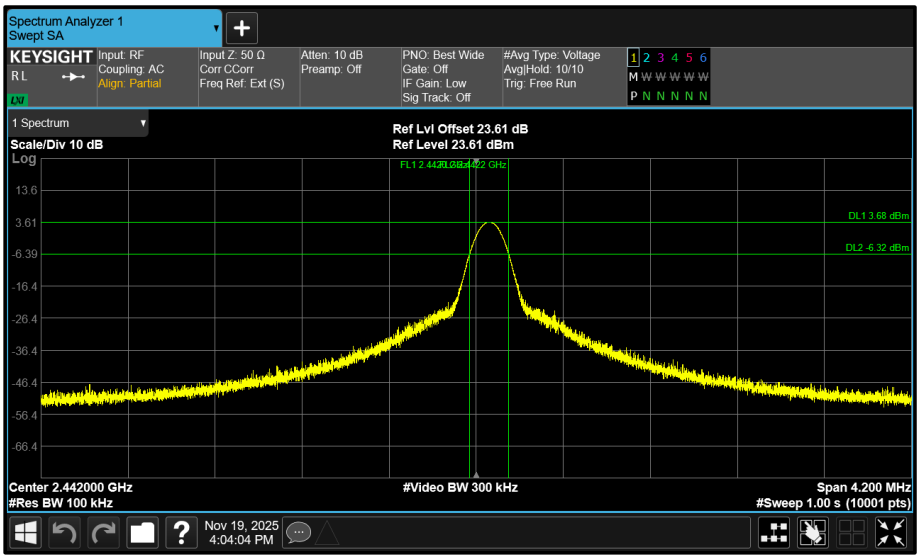


Figure 2 - 2442 MHz Frequency Tolerance

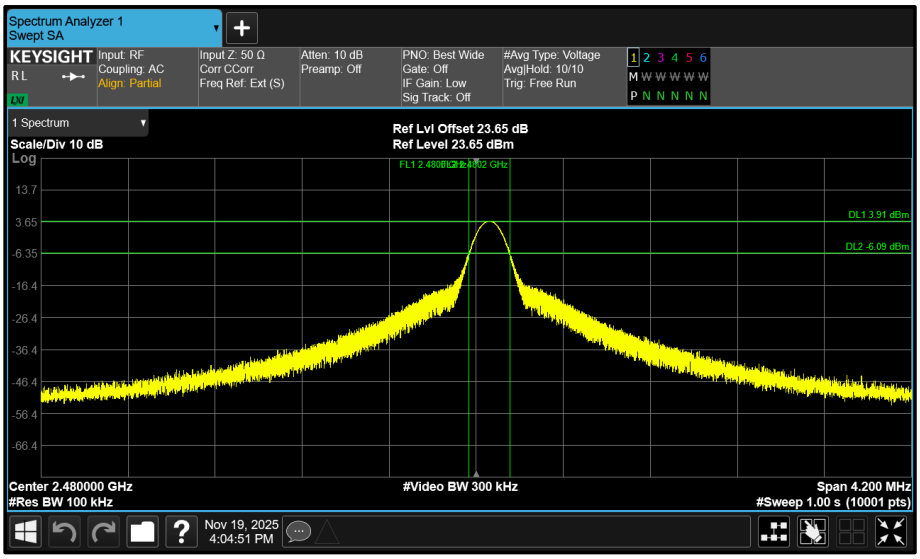


Figure 3 - 2480 MHz Frequency Tolerance

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	3.2 (4)	Test Method(s):	Refer to test method
Additional Reference(s):	-		

DUT Configuration			
Mode:	2 MB/s DTS	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	B (Modem B)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	Frequency Error (ppm)				Limit (ppm)
	A	B	C	D	
2402	-	+24.217	-	-	±50.0
2442	-	+24.165	-	-	±50.0
2480	-	+24.302	-	-	±50.0

Table 17 - Frequency Tolerance Results

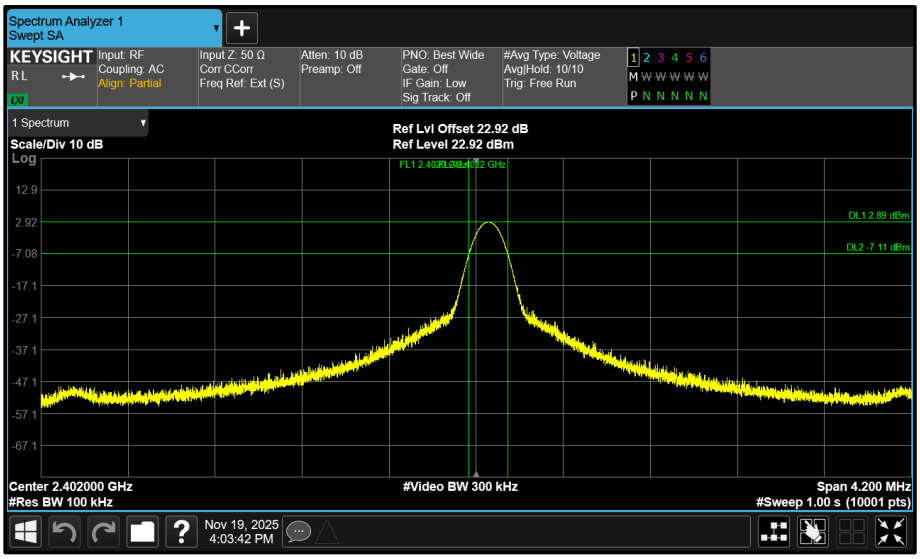


Figure 4 - 2402 MHz Frequency Tolerance

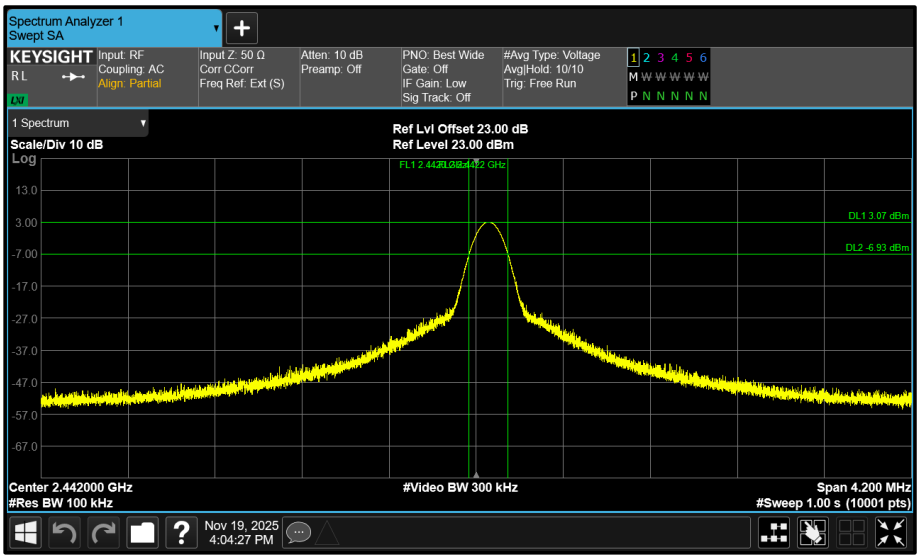


Figure 5 - 2442 MHz Frequency Tolerance

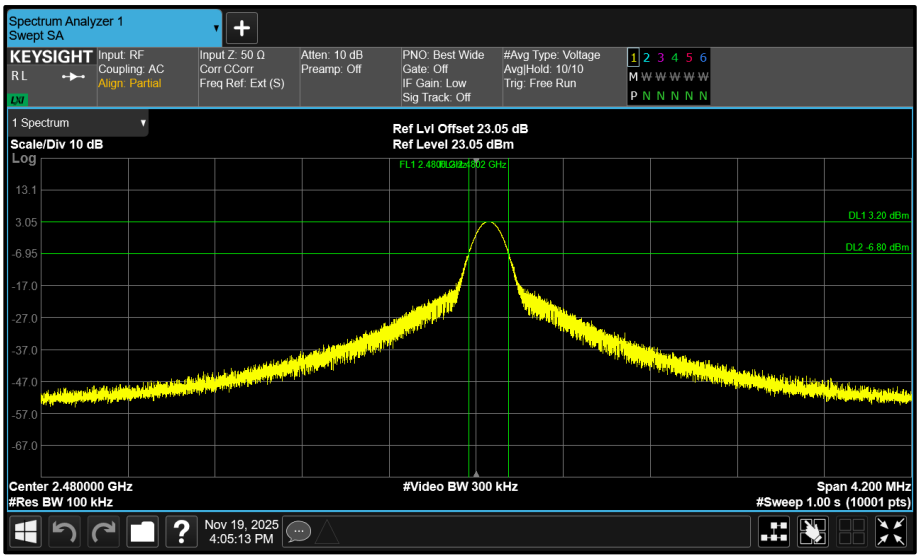


Figure 6 - 2480 MHz Frequency Tolerance

ARIB STD T-66, Limit Clause 3.2 (4)

± 50 x 10^{-6}.

2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Hygrometer	Rotronic	I-1000	2891	12	02-Dec-2025
GPSDR Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	18-Mar-2026
Digital Multi-meter	Iso-tech	IDM93N	4435	12	06-Mar-2026
MXA Signal Analyser	Keysight Technologies	N9020B	5528	24	10-Sep-2027
Modular Power System Mainframe	Keysight Technologies	N6701C	5835	-	TU
DC Power Module 60V 20A 300W	Keysight Technologies	N6754A	5836	-	O/P Mon
Signal Conditioning Unit	TUV SUD	SPECTRUM_SCU001	6350	12	02-Sep-2026
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6638	12	29-Aug-2026
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6639	12	29-Aug-2026

Table 18

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

2.3 Permissible Value of Spurious or Unnecessary Radiation Intensity

2.3.1 Specification Reference

ARIB STD-T66 and MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19), Clause 3.2 (6)

2.3.2 Equipment Under Test and Modification State

RMM-QE, S/N: ANT154 - Modification State 0

2.3.3 Date of Test

27-October-2025 to 29-October-2025

2.3.4 Test Method

This test was performed in accordance with ARIB STD-T66 Clause 3.2 (6).
The EUT was connected via a 1m cable and 20 dB of attenuation.
A preliminary sweep was performed using EmX and for results within 10 dB a final measurement was performed.
A measurement bandwidth of 100 kHz was used for below 1 GHz and 1 MHz was used for above 1 GHz.
The EUT was battery powered using a 14 VDC power supply.

2.3.5 Environmental Conditions

Ambient Temperature	19.9 - 20.3 °C
Relative Humidity	38.0 - 55.9 %

2.3.6 Test Results

2.4 GHz Transceiver 2

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
*				

Table 19 - 802.15.4_TX, FHSS, 30 MHz to 13 GHz

*No emissions found within 6 dB of the limit.

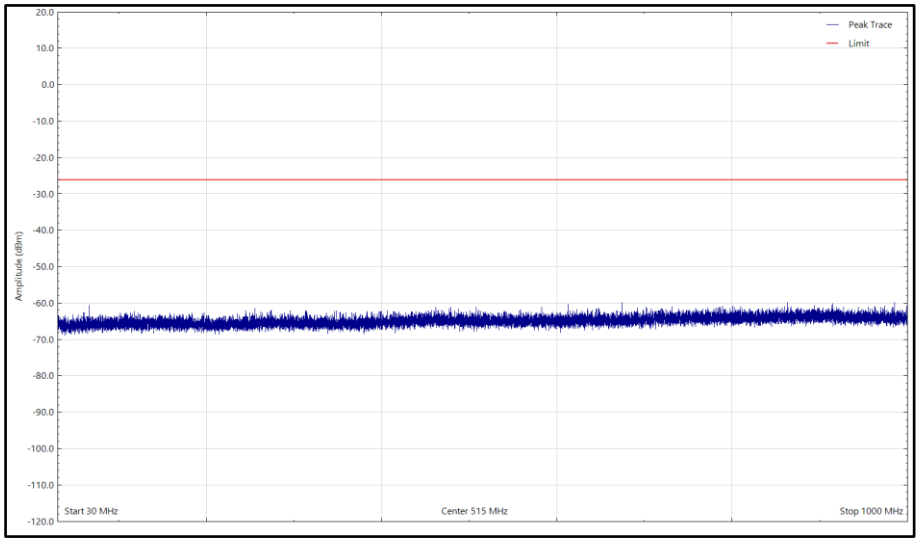


Figure 7 - 802.15.4_TX, FHSS, 30 MHz to 1 GHz, (Peak)

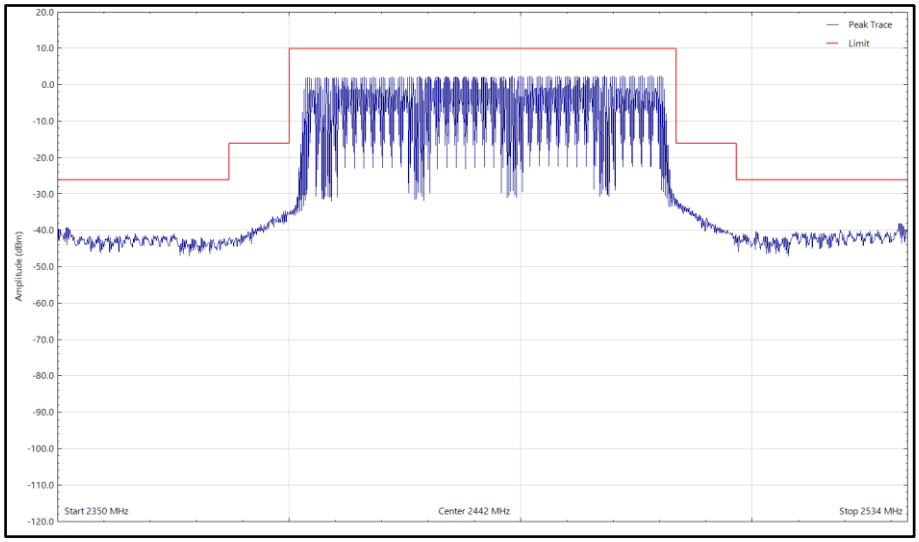


Figure 8 - 802.15.4_TX, FHSS, 2.350 GHz to 2.534 GHz, (Peak)

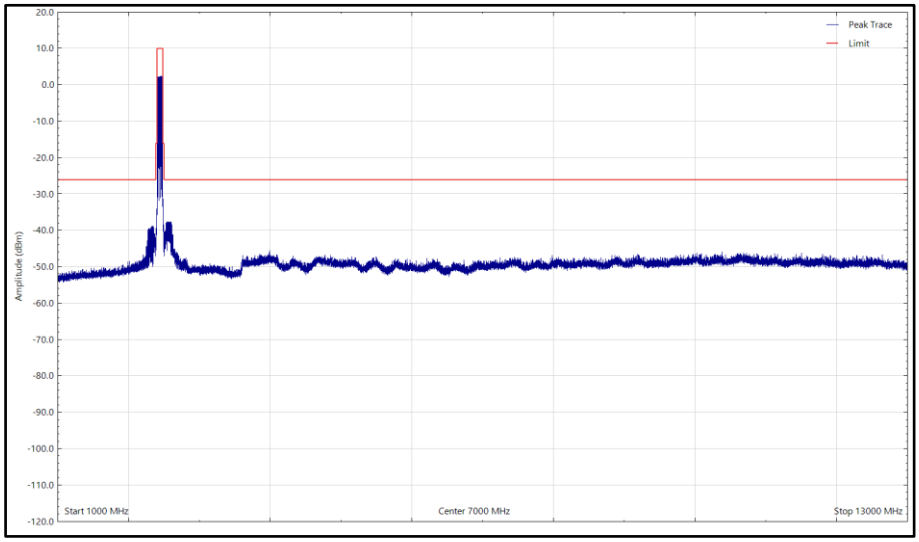


Figure 9 - 802.15.4_TX, FHSS, 1 GHz to 13 GHz, (Peak)

2.4GHz Transceiver 1

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 20 - 802.15.4_TX, FHSS, 30 MHz to 13 GHz

*No emissions found within 6 dB of the limit.

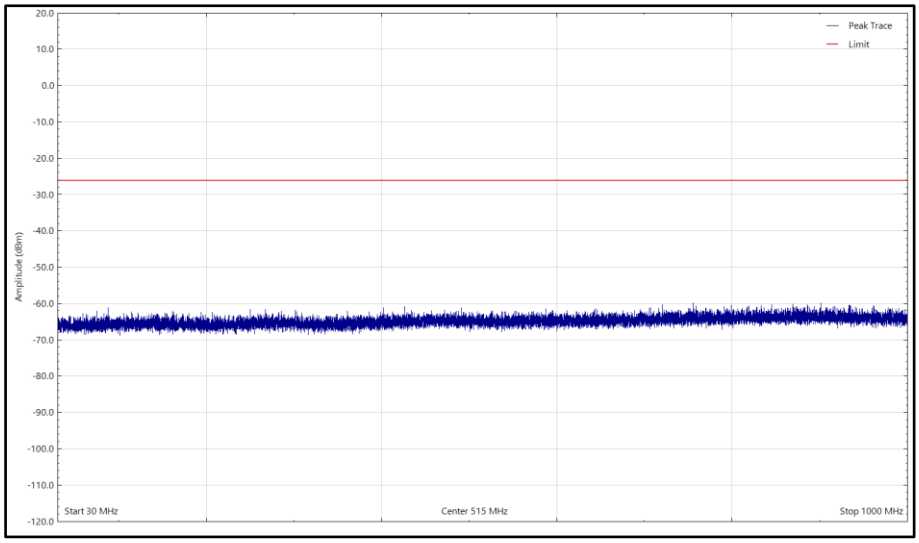


Figure 10 - 802.15.4_TX, FHSS, 30 MHz to 1 GHz, (Peak)

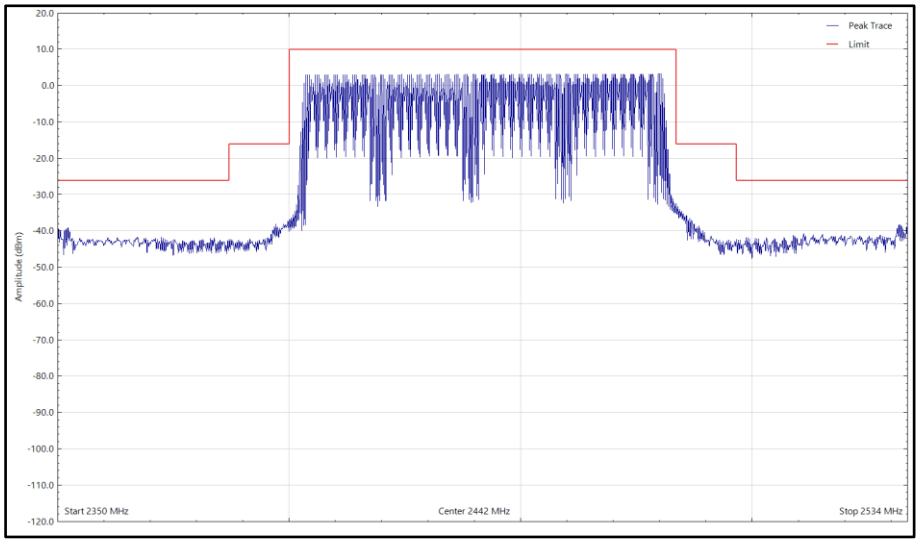


Figure 11 - 802.15.4_TX, FHSS, 2.350 GHz to 2.534 GHz, (Peak)

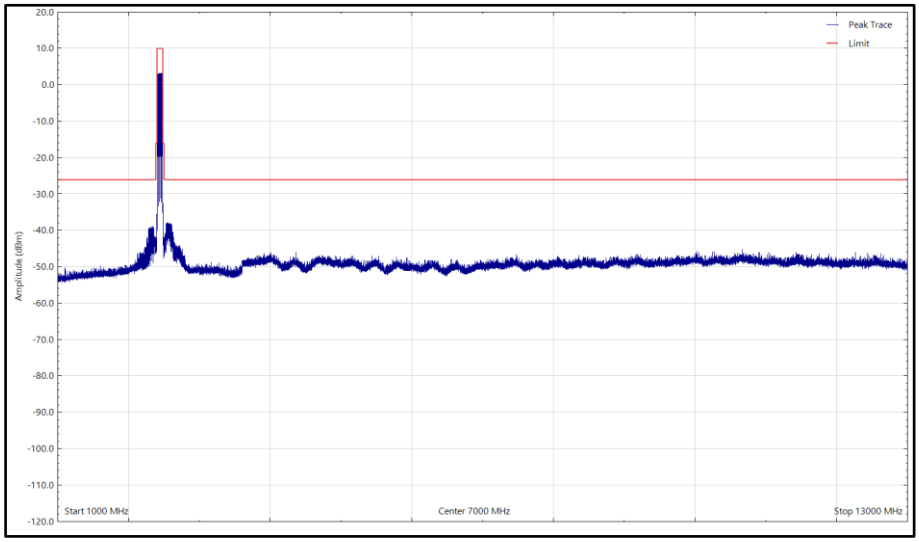


Figure 12 - 802.15.4_TX, FHSS, 1 GHz to 13 GHz, (Peak)

2.4GHz Transceiver 1

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
2399.961	-24.60	-16.00	-8.60	Peak

Table 21 - 802.15.4_TX, 2402 MHz, 30 MHz to 13 GHz

No other emissions found within 6 dB of the limit.

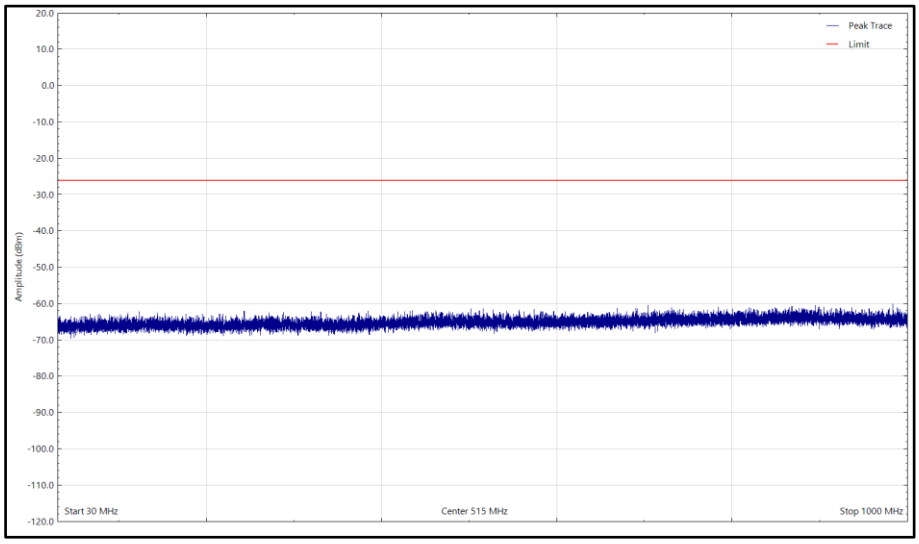


Figure 13 - 802.15.4_TX, 2402 MHz, 30 MHz to 1 GHz, (Peak)

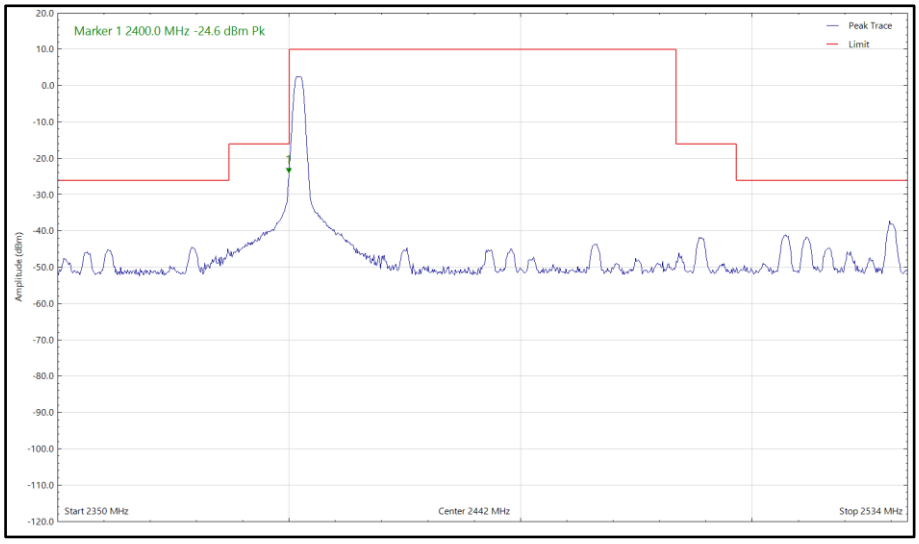


Figure 14 - 802.15.4_TX, 2402 MHz, 2.350 GHz to 2.534 GHz, (Peak)

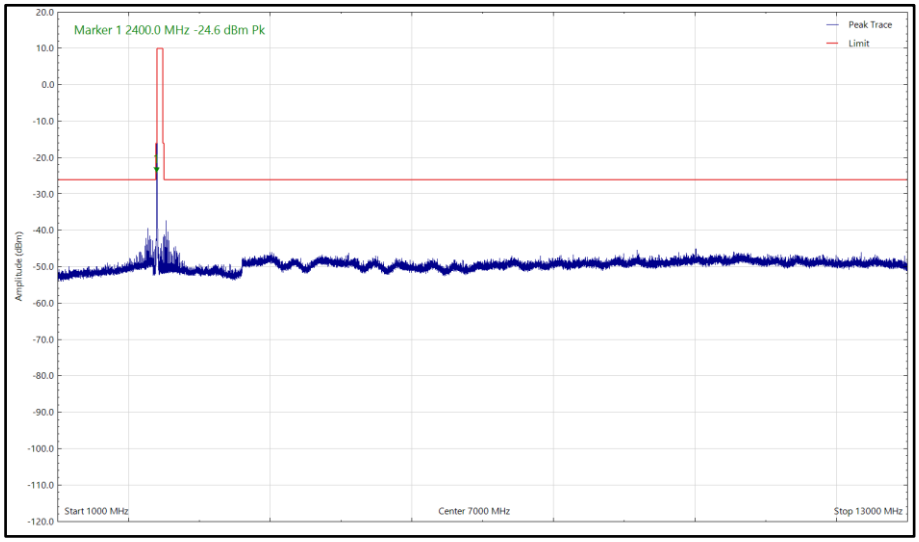


Figure 15 - 802.15.4_TX, 2402 MHz, 1 GHz to 13 GHz, (Peak)

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
*				

Table 22 - 802.15.4_TX, 2442 MHz, 30 MHz to 13 GHz

*No emissions found within 6 dB of the limit.

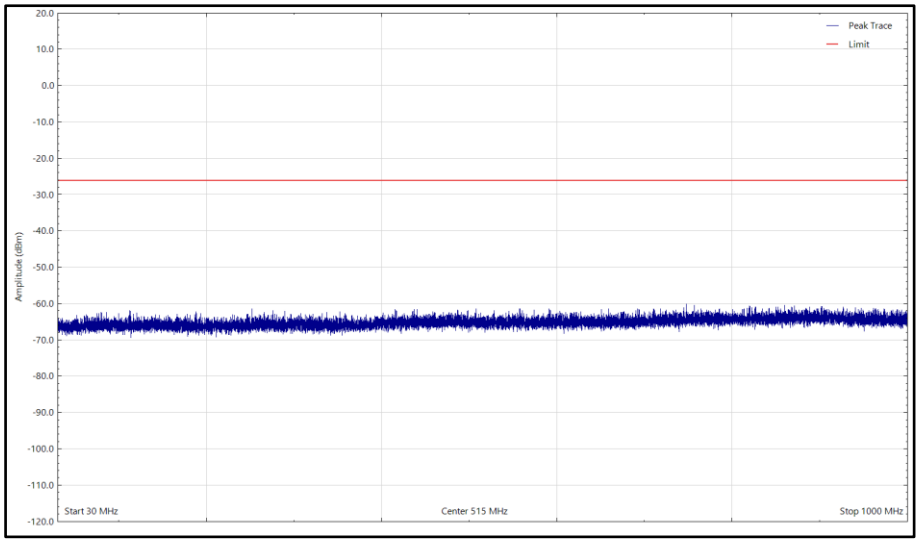


Figure 16 - 802.15.4_TX, 2442 MHz, 30 MHz to 1 GHz, (Peak)

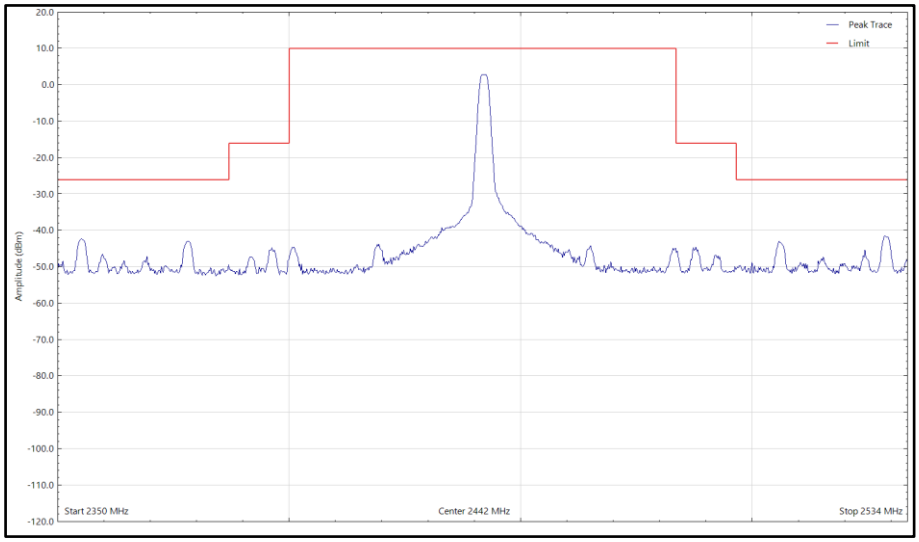


Figure 17 - 802.15.4_TX, 2442 MHz, 2.350 GHz to 2.534 GHz, (Peak)

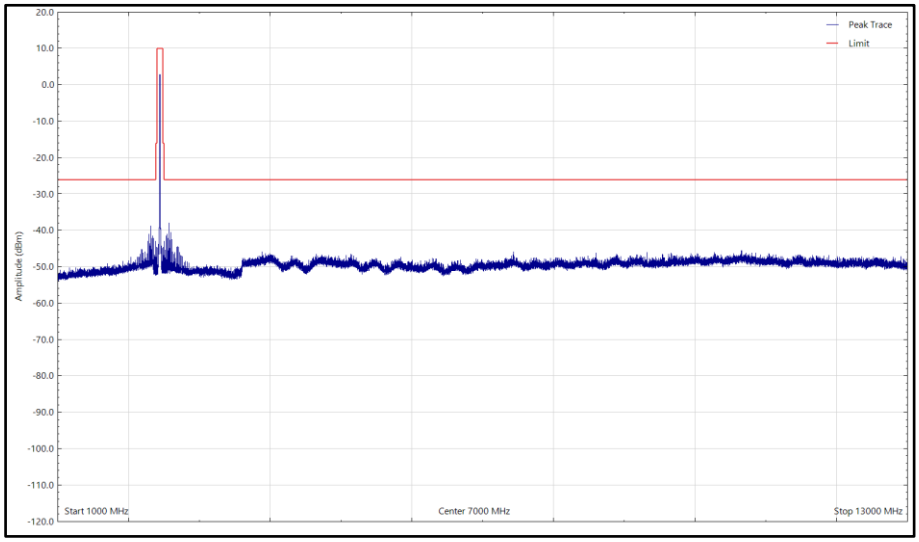


Figure 18 - 802.15.4_TX, 2442 MHz, 1 GHz to 13 GHz, (Peak)

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
*				

Table 23 - 802.15.4_TX, 2480 MHz, 30 MHz to 13 GHz

*No emissions found within 6 dB of the limit.

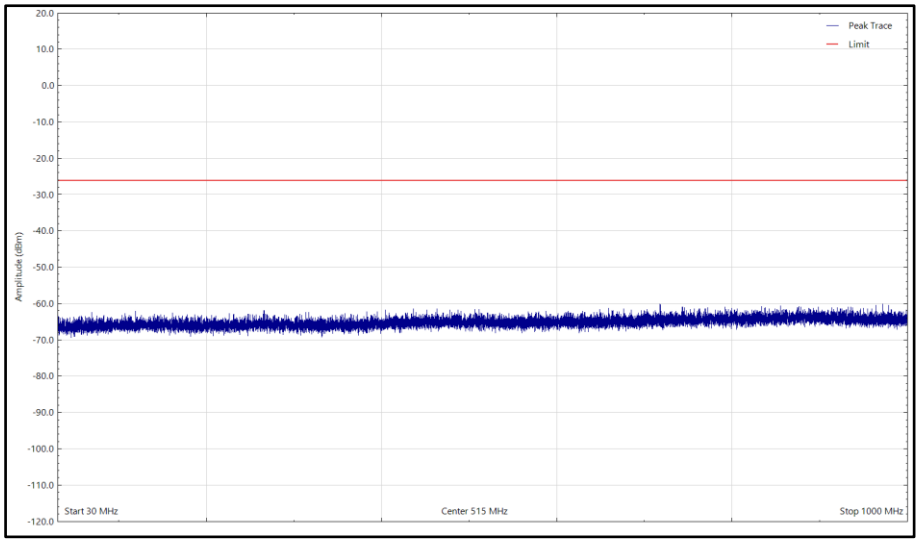


Figure 19 - 802.15.4_TX, 2480 MHz, 30 MHz to 1 GHz, (Peak)

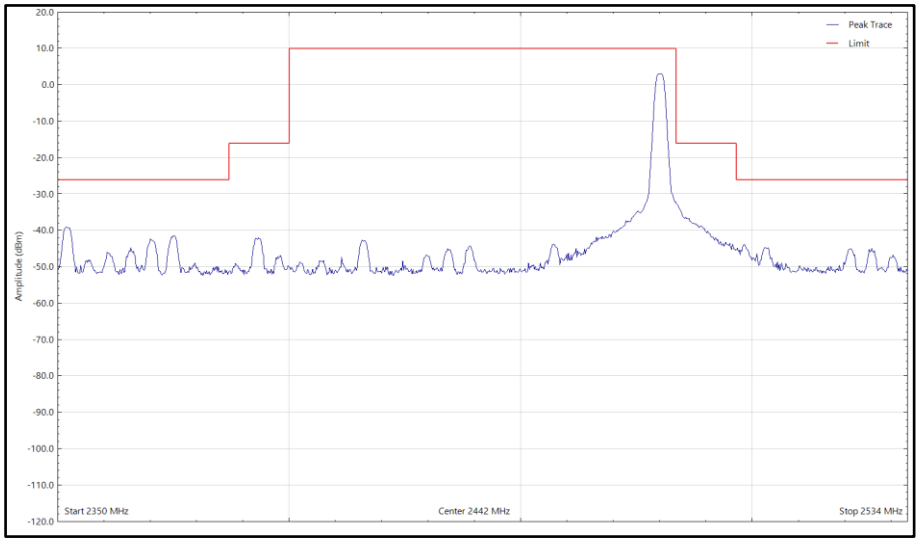


Figure 20 - 802.15.4_TX, 2480 MHz, 2.350 GHz to 2.534 GHz, (Peak)

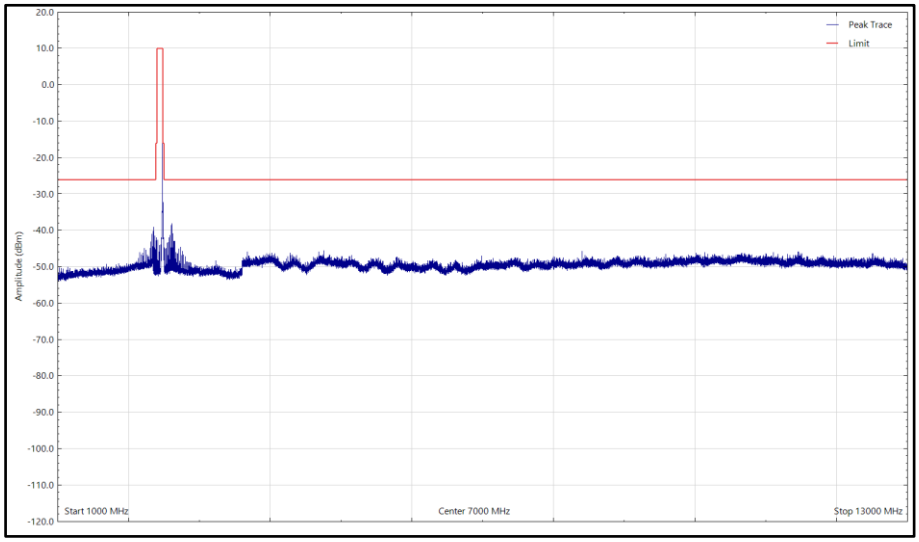


Figure 21 - 802.15.4_TX, 2480 MHz, 1 GHz to 13 GHz, (Peak)

2.4 GHz Transceiver 2

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
2399.961	-25.52	-16.00	-9.52	Peak

Table 24 - 802.15.4_TX, 2402 MHz, 30 MHz to 13 GHz

No other emissions found within 6 dB of the limit.

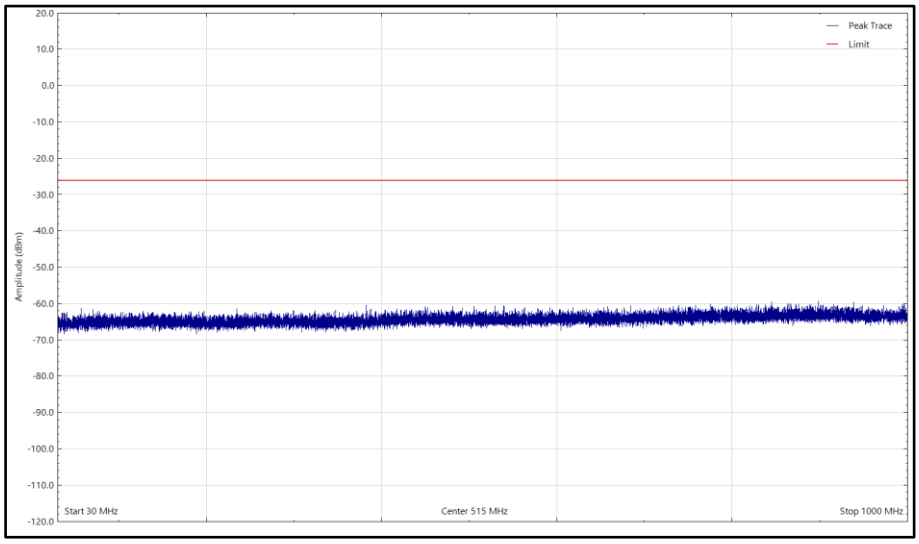


Figure 22 - 802.15.4_TX, 2402 MHz, 30 MHz to 1 GHz, (Peak)

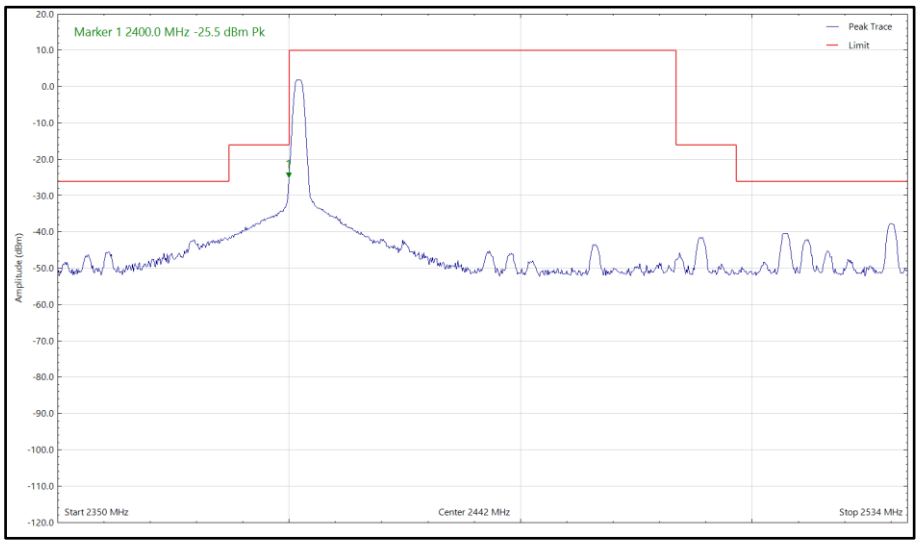


Figure 23 - 802.15.4_TX, 2402 MHz, 2.350 GHz to 2.534 GHz, (Peak)

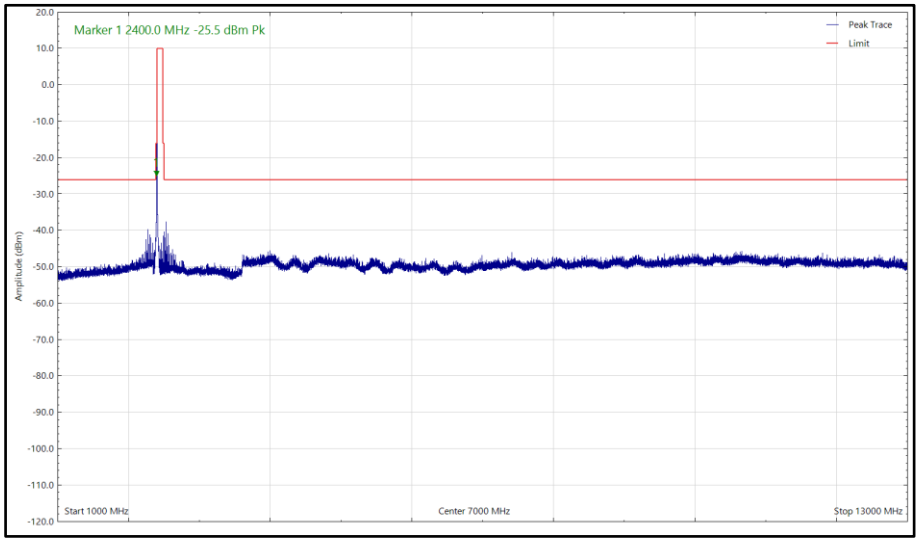


Figure 24 - 802.15.4_TX, 2402 MHz, 1 GHz to 13 GHz, (Peak)

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
*				

Table 25 - 802.15.4_TX, 2442 MHz, 30 MHz to 13 GHz

*No emissions found within 6 dB of the limit.

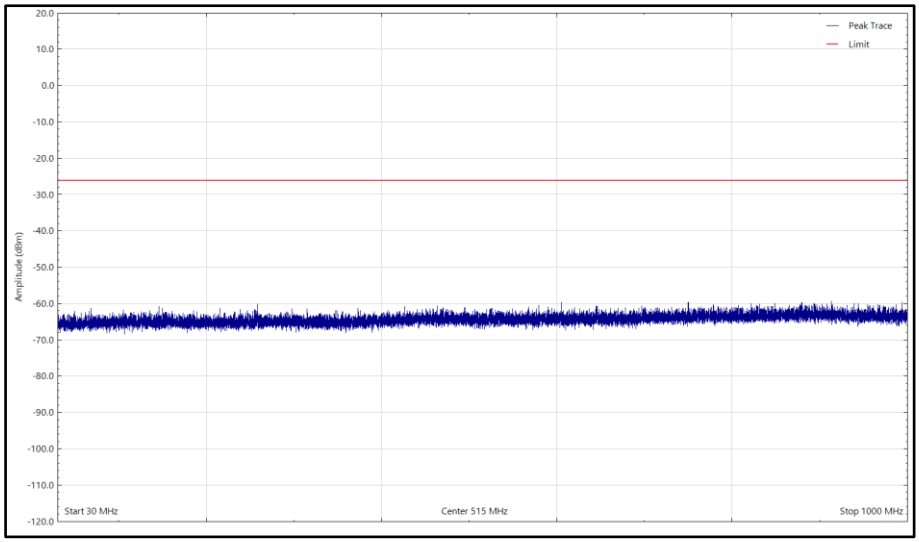


Figure 25 - 802.15.4_TX, 2442 MHz, 30 MHz to 1 GHz, (Peak)

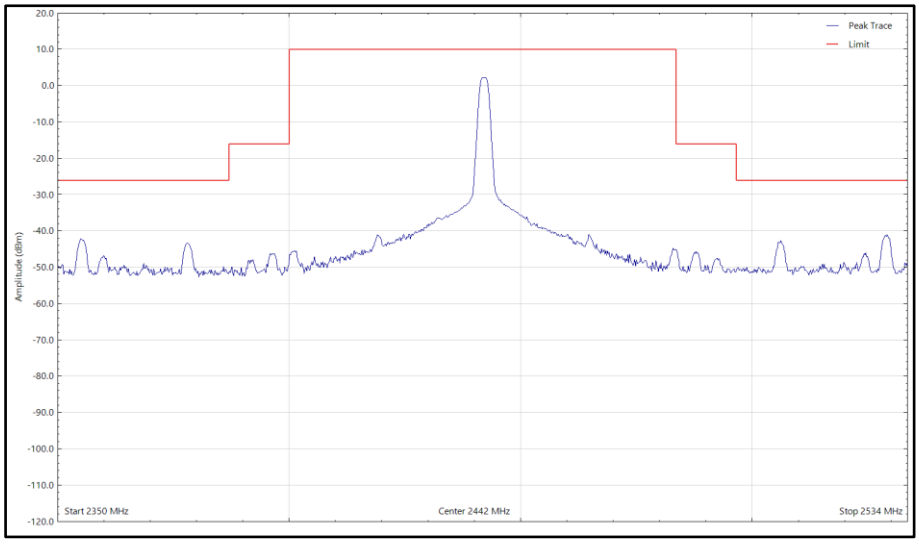


Figure 26 - 802.15.4_TX, 2442 MHz, 2.350 GHz to 2.534 GHz, (Peak)

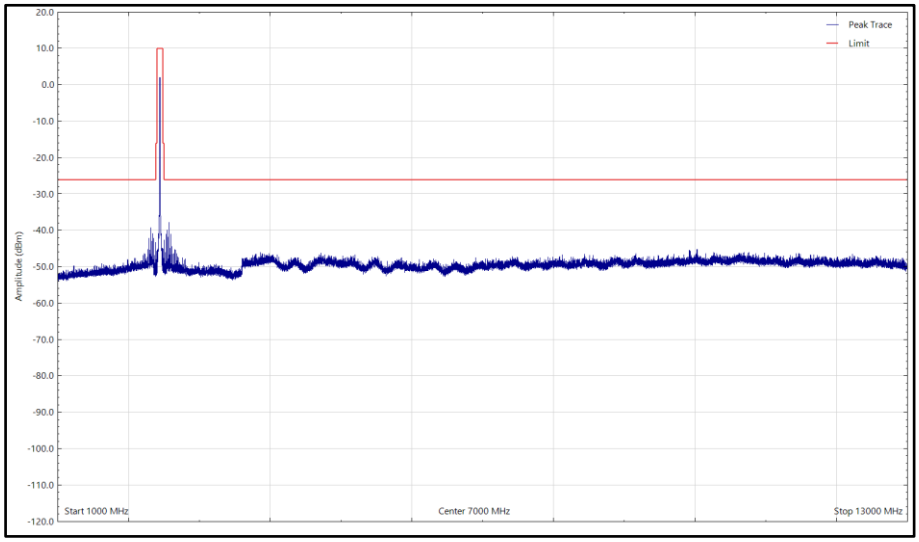


Figure 27 - 802.15.4_TX, 2442 MHz, 1 GHz to 13 GHz, (Peak)

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
*				

Table 26 - 802.15.4_TX, 2480 MHz, 30 MHz to 13 GHz

*No emissions found within 6 dB of the limit.

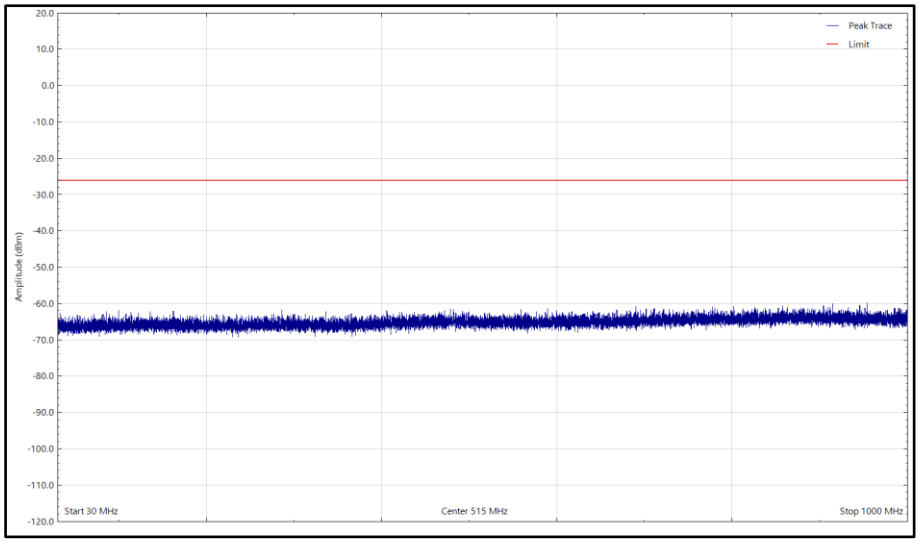


Figure 28 - 802.15.4_TX, 2480 MHz, 30 MHz to 1 GHz, (Peak)

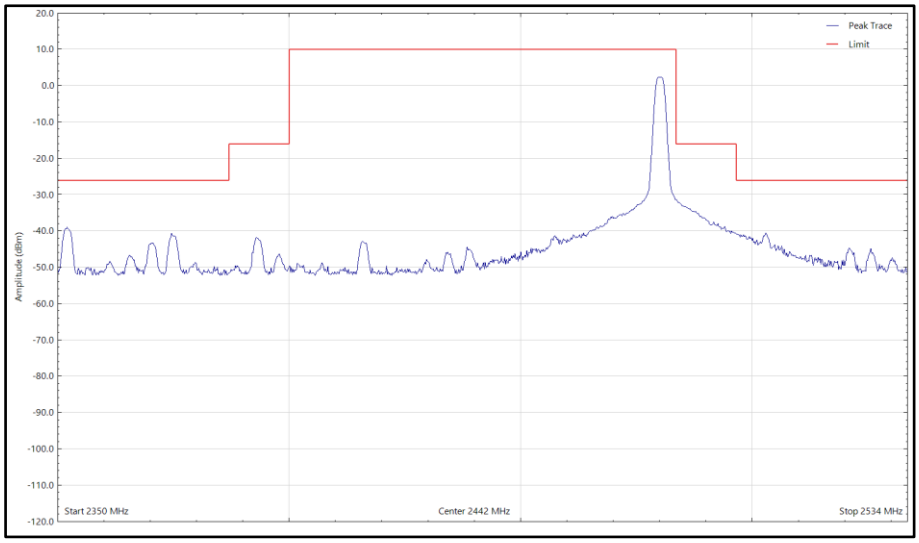


Figure 29 - 802.15.4_TX, 2480 MHz, 2.350 GHz to 2.354 GHz, (Peak)

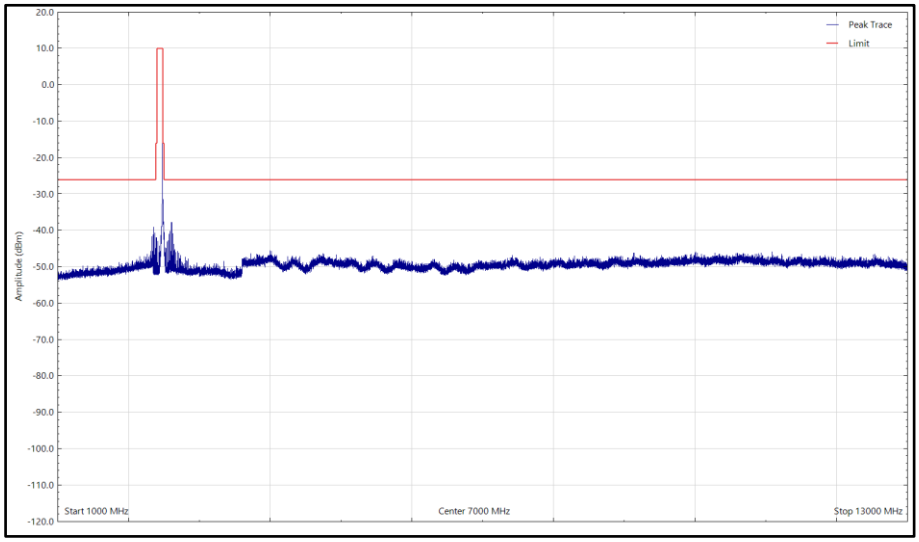


Figure 30 - 802.15.4_TX, 2480 MHz, 1 GHz to 13 GHz, (Peak)

ARIB STD-T66, Limit Clause 3.2 (6)

Frequency Range	Limit
2387 MHz to 2400 MHz and 2483.5 MHz to 2496.5 MHz	25 µW or -16 dBm
<2387 MHz and >2496.5 MHz	2.5 µW or -26 dBm

2.3.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Hygrometer	Rotronic	I-1000	2891	12	02-Dec-2025
GPSDR Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	18-Mar-2026
Digital Multi-meter	Iso-tech	IDM93N	4435	12	06-Mar-2026
Emissions Software	TUV SUD	EmX V3.5.5	5125	-	Software
Attenuator 5W 20dB DC-18GHz	Aaren	AT40A-4041-D18-20	5497	12	23-Apr-2026
3 GHz High pass Filter	Wainwright	WHKX12-2580-3000-18000-80SS	5547	12	30-May-2026
1m Coaxial Cable Assy	Junkosha	MWX221-01000AMSAMS/A	6381	12	30-Jul-2026
MXA Signal Analyser	Keysight Technologies	N9020B	6876	24	31-Aug-2026

Table 27

2.4 Allowable Value for Occupied Bandwidth

2.4.1 Specification Reference

ARIB STD-T66, Clause 3.2 (7)
MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19)

2.4.2 Equipment Under Test and Modification State

S/N: ANT149 - Modification State 0

2.4.3 Date of Test

19-November-2025

2.4.4 Test Method

The spectrum analyser was tuned to the test frequency with a span to incorporate the entire bandwidth of the modulated signal. Allowing for the trace to stabilize, the bandwidth whereby 99% power of the power resides was recorded.

The EUT was powered by 14 VDC via DC PSU.

2.4.5 Environmental Conditions

Ambient Temperature	21.2 °C
Relative Humidity	29.0 %

2.4.6 Test Results

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	-
Limit Clause(s):	3.2(7)	Test Method(s):	Refer to Test Method
Additional Reference(s):	-		

DUT Configuration			
Mode:	2 MB/s FHSS	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Modem A)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	99% Bandwidth (MHz)					Limit (MHz)
	A	B	C	D	Maximum	
2402-2480	80.037	-	-	-	80.037	≤83.5

Table 28 - 99% Bandwidth Results

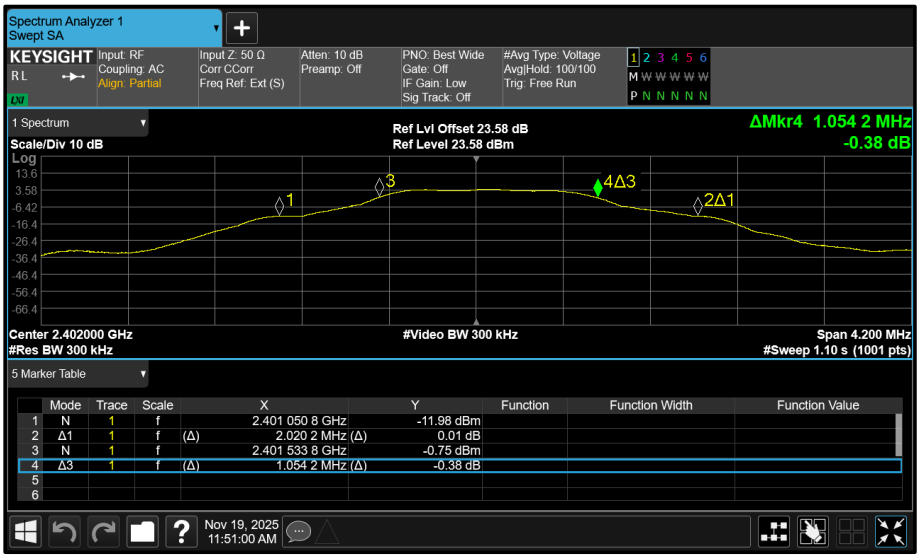


Figure 31 - 2402 MHz Occupied Bandwidth

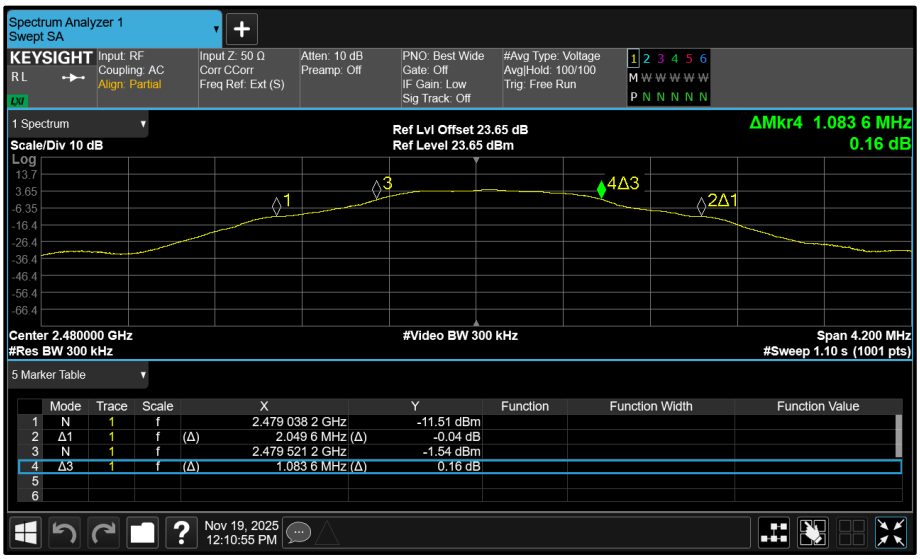


Figure 32 - 2480 MHz Occupied Bandwidth

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	-
Limit Clause(s):	3.2(7)	Test Method(s):	Refer to Test Method
Additional Reference(s):	-		

DUT Configuration			
Mode:	2 MB/s FHSS	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	B (Modem B)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	99% Bandwidth (MHz)					Limit (MHz)
	A	B	C	D	Maximum	
2402-2480	-	80.033	-	-	80.033	≤83.5

Table 29 - 99% Bandwidth Results

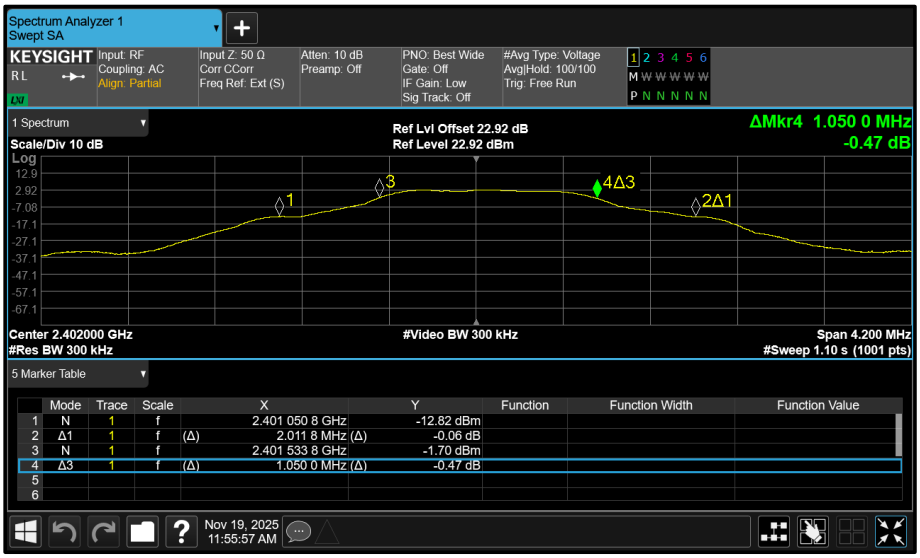


Figure 33 - 2402 MHz Occupied Bandwidth

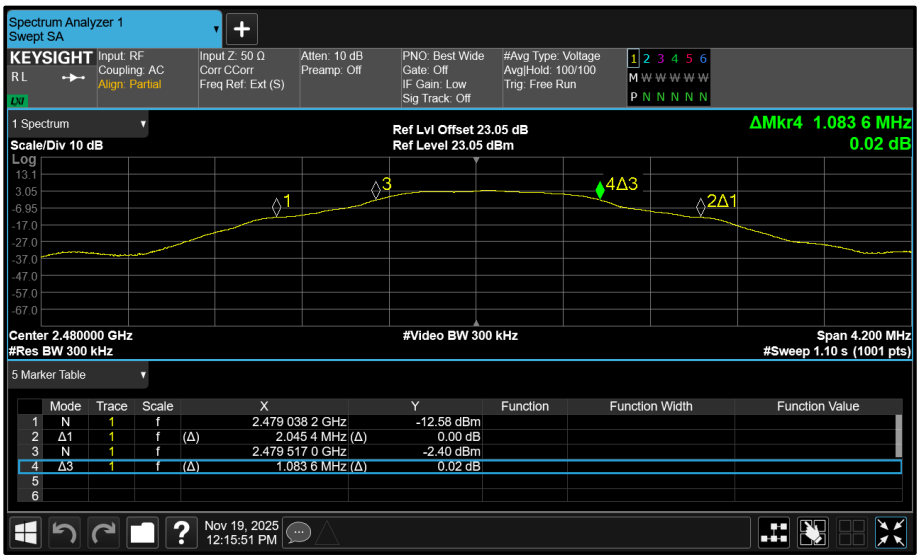


Figure 34 - 2480 MHz Occupied Bandwidth

2.4GHz Transceiver 1 - DTS

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	-
Limit Clause(s):	3.2(7)	Test Method(s):	Refer to Test Method
Additional Reference(s):	-		

DUT Configuration			
Mode:	2 MB/s DTS	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Modem A)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	99% Bandwidth (MHz)					Limit (MHz)
	A	B	C	D	Maximum	
2402	2.020	-	-	-	2.020	≤26.0
2442	2.024	-	-	-	2.024	≤26.0
2480	2.050	-	-	-	2.050	≤26.0

Table 30 - 99% Bandwidth Results

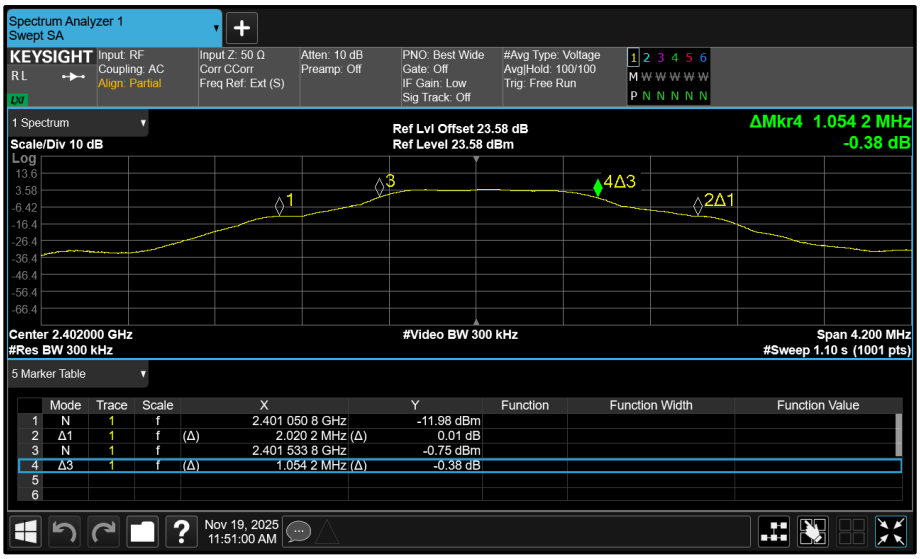


Figure 35 - 2402 MHz Occupied Bandwidth

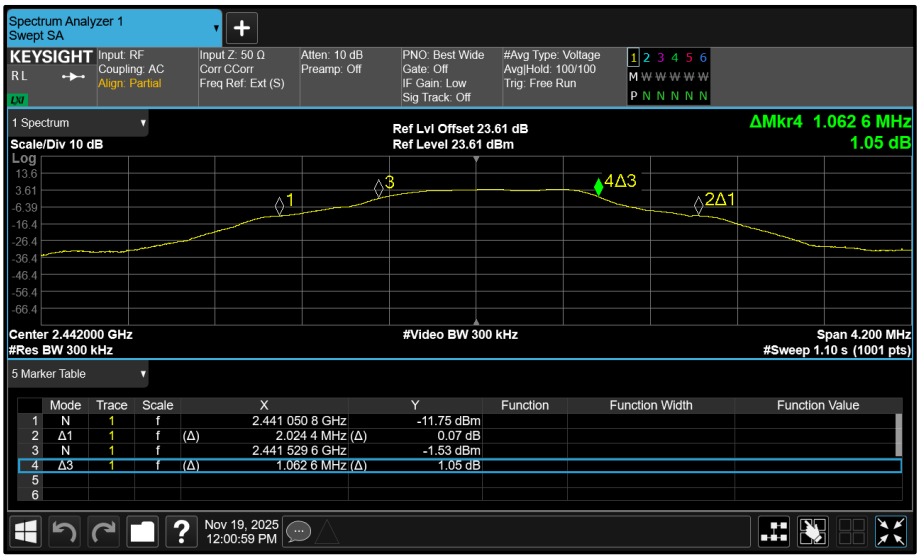


Figure 36 - 2442 MHz Occupied Bandwidth

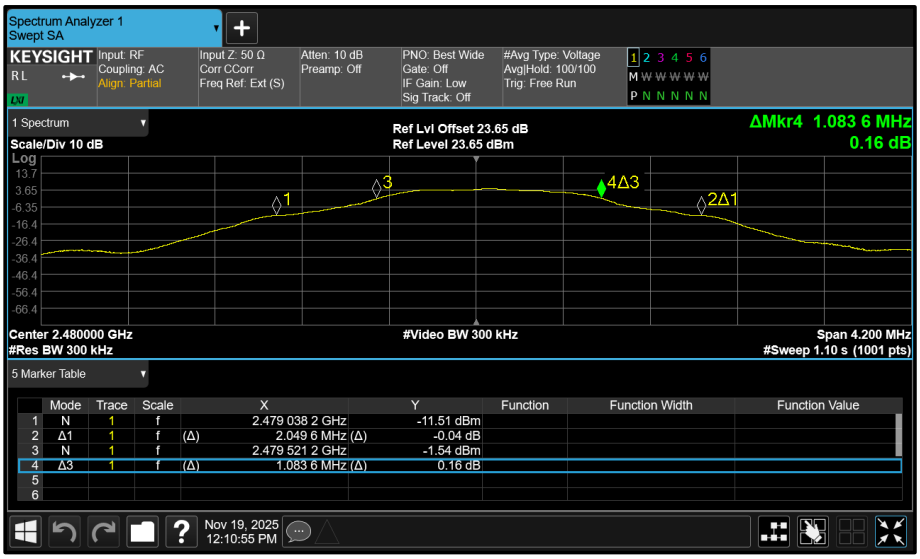


Figure 37 - 2480 MHz Occupied Bandwidth

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	-
Limit Clause(s):	3.2(7)	Test Method(s):	Refer to Test Method
Additional Reference(s):	-		

DUT Configuration			
Mode:	2 MB/s DTS	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	B (Modem B)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	99% Bandwidth (MHz)					Limit (MHz)
	A	B	C	D	Maximum	
2402	-	2.012	-	-	2.012	≤26.0
2442	-	2.020	-	-	2.020	≤26.0
2480	-	2.045	-	-	2.045	≤26.0

Table 31 - 99% Bandwidth Results

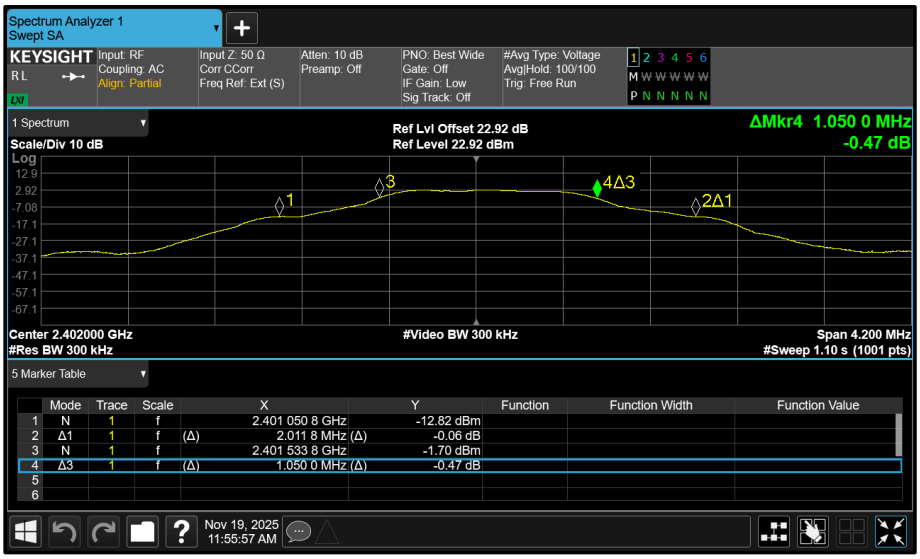


Figure 38 - 2402 MHz Occupied Bandwidth

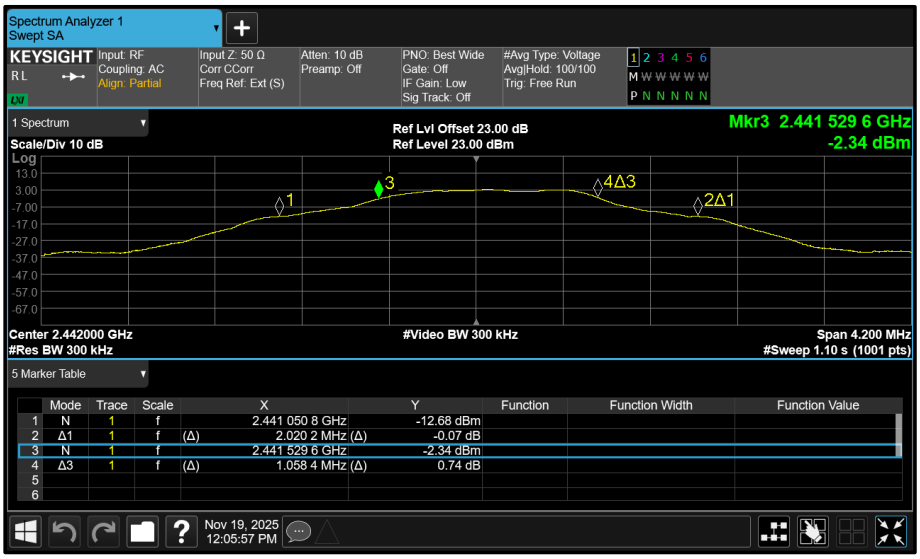


Figure 39 - 2442 MHz Occupied Bandwidth

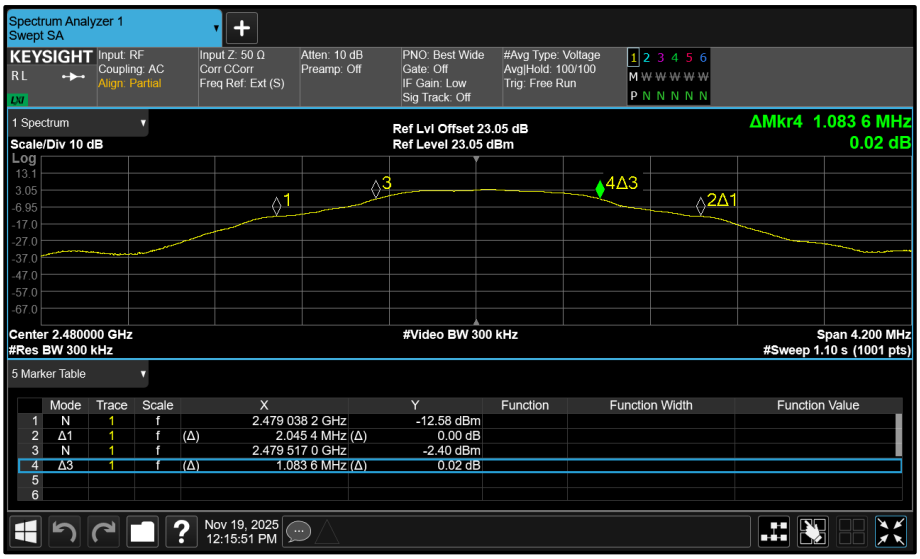


Figure 40 - 2480 MHz Occupied Bandwidth

ARIB STD T-66, Limit Clause 3.2 (7)

Permissible value of occupied frequency bandwidth for transmission devices using a FH system, a DS-FH hybrid system, or a FH-OFDM hybrid system is at most 83.5MHz; for transmission devices using an OFDM system is at most 38MHz; and for transmission devices using any other system the necessary frequency bandwidth is at most 26MHz.

2.4.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Hygrometer	Rotronic	I-1000	2891	12	02-Dec-2025
GPSDR Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	18-Mar-2026
Digital Multi-meter	Iso-tech	IDM93N	4435	12	06-Mar-2026
MXA Signal Analyser	Keysight Technologies	N9020B	5528	24	10-Sep-2027
Modular Power System Mainframe	Keysight Technologies	N6701C	5835	-	TU
DC Power Module 60V 20A 300W	Keysight Technologies	N6754A	5836	-	O/P Mon
Signal Conditioning Unit	TUV SUD	SPECTRUM_SCU001	6350	12	02-Sep-2026
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6638	12	29-Aug-2026
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6639	12	29-Aug-2026

Table 32

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

2.5 Spread Bandwidth

2.5.1 Specification Reference

ARIB STD-T66, Clause 3.2 (8)
MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19)

2.5.2 Equipment Under Test and Modification State

RMM-QE, S/N: ANT149 - Modification State 0

2.5.3 Date of Test

19-November-2025

2.5.4 Test Method

The spectrum analyser was tuned to the test frequency with a span to incorporate the entire bandwidth of the modulated signal. Allowing for the trace to stabilize, the bandwidth whereby 90% power of the power resides was recorded.

The EUT was powered by 14 VDC via DC PSU.

2.5.5 Environmental Conditions

Ambient Temperature	21.2 °C
Relative Humidity	29.0 %

2.5.6 Test Results

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	-
Limit Clause(s):	3.2(8)	Test Method(s):	Refer to Test Method
Additional Reference(s):	-		

DUT Configuration			
Mode:	2 MB/s DTS	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Modem A)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	90% Bandwidth (MHz)					Limit (MHz)
	A	B	C	D	Maximum	
2402	1.054	-	-	-	1.054	≥0.5
2442	1.063	-	-	-	1.063	≥0.5
2480	1.084	-	-	-	1.084	≥0.5

Table 33 - 90% Bandwidth Results

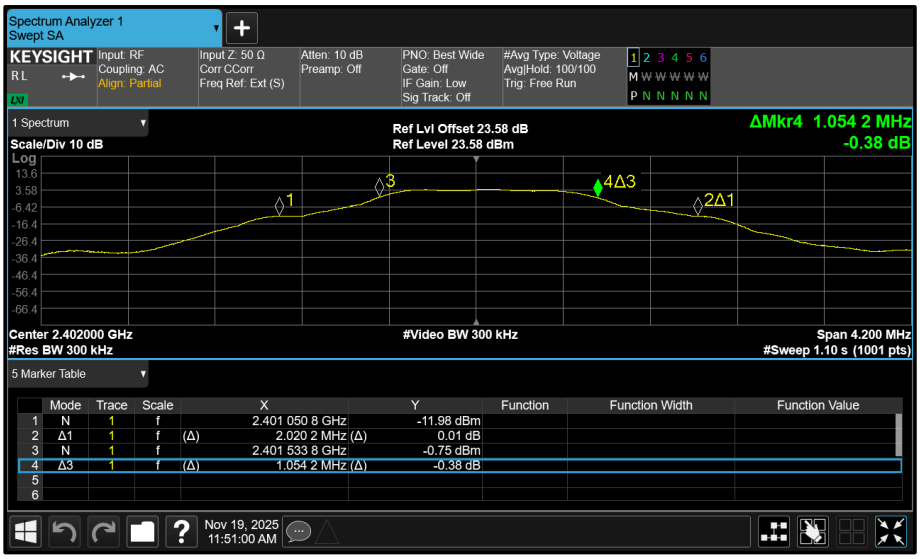


Figure 41 - 2402 MHz Spread Bandwidth

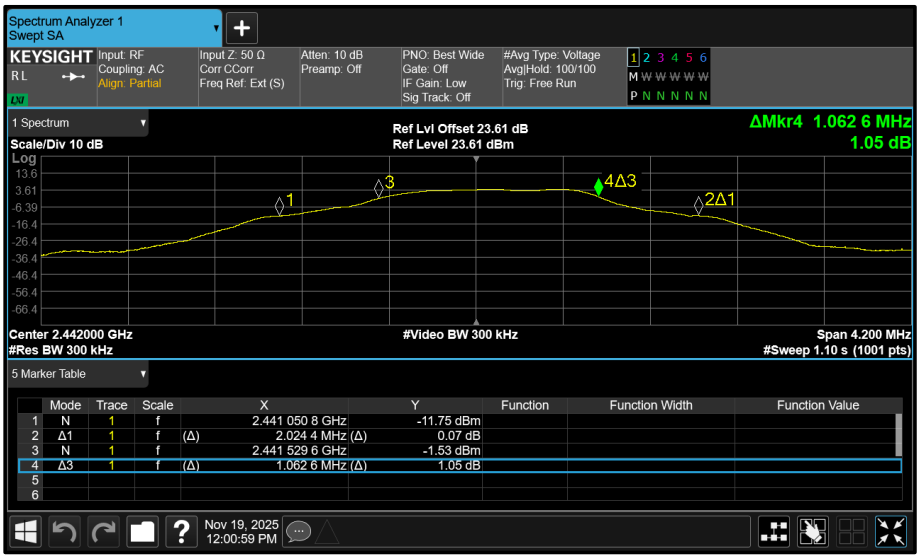


Figure 42 - 2442 MHz Spread Bandwidth

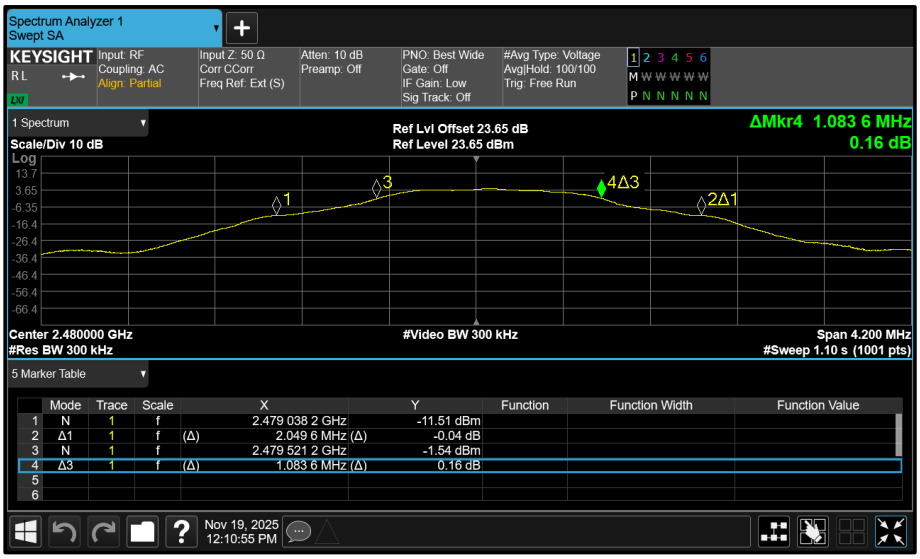


Figure 43 - 2480 MHz Spread Bandwidth

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	-
Limit Clause(s):	3.2(7)	Test Method(s):	Refer to Test Method
Additional Reference(s):	-		

DUT Configuration			
Mode:	2 MB/s DTS	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	B (Modem B)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	90% Bandwidth (MHz)					Limit (MHz)
	A	B	C	D	Maximum	
2402	-	1.050	-	-	1.050	≥0.5
2442	-	1.058	-	-	1.058	≥0.5
2480	-	1.084	-	-	1.084	≥0.5

Table 34 - 90% Bandwidth Results

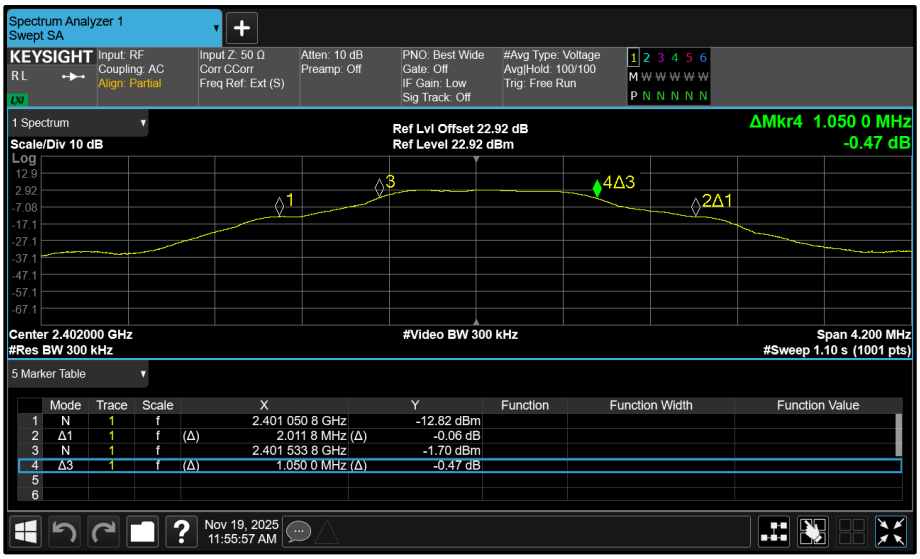


Figure 44 - 2402 MHz Spread Bandwidth

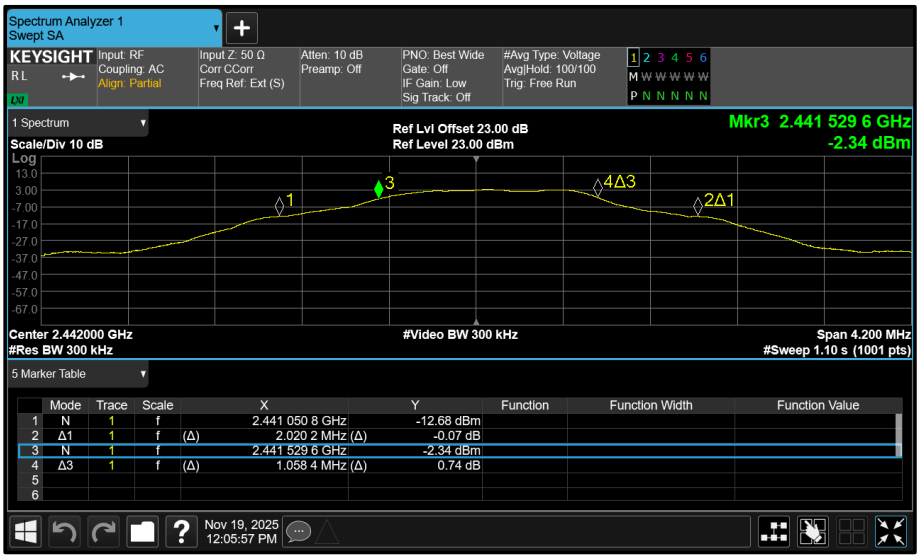


Figure 45 - 2442 MHz Spread Bandwidth

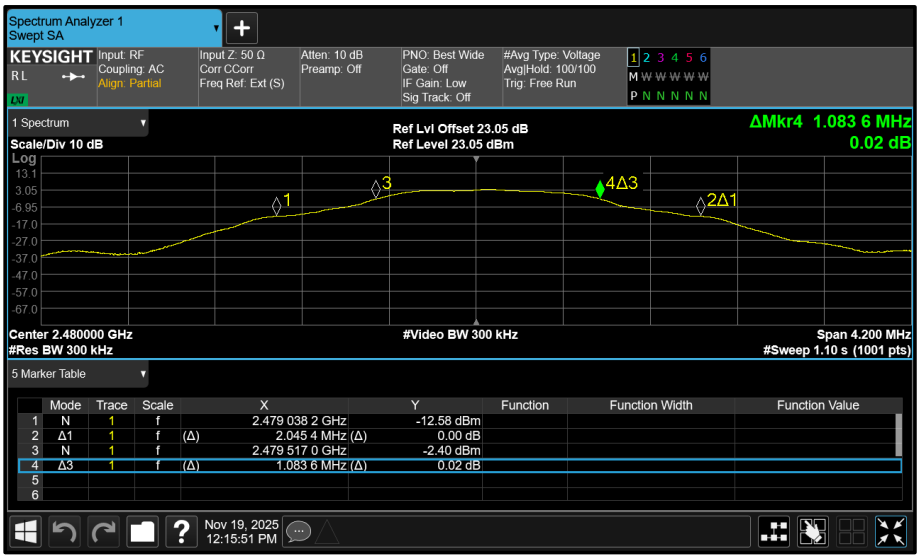


Figure 46 - 2480 MHz Spread Bandwidth

ARIB STD T-66, Limit Clause 3.2 (8)

For spread spectrum systems, the spread bandwidth must be at least 500kHz.

2.5.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Hygrometer	Rotronic	I-1000	2891	12	02-Dec-2025
GPSDR Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	18-Mar-2026
Digital Multi-meter	Iso-tech	IDM93N	4435	12	06-Mar-2026
MXA Signal Analyser	Keysight Technologies	N9020B	5528	24	10-Sep-2027
Modular Power System Mainframe	Keysight Technologies	N6701C	5835	-	TU
DC Power Module 60V 20A 300W	Keysight Technologies	N6754A	5836	-	O/P Mon
Signal Conditioning Unit	TUV SUD	SPECTRUM_SCU001	6350	12	02-Sep-2026
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6638	12	29-Aug-2026
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6639	12	29-Aug-2026

Table 35

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

2.6 Process Gain

2.6.1 Specification Reference

ARIB STD-T66, Clause 3.2 (9)
MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19)

2.6.2 Equipment Under Test and Modification State

RMM-QE, S/N: ANT149 - Modification State 0

2.6.3 Date of Test

19-November-2025

2.6.4 Test Method

The process gain was calculated via the following method:

(Spread Bandwidth MHz * Minimum number of hopping channels) / Data rate Mb/s

The minimum number of hopping channels was confirmed to be 39 by the customer.

2.6.5 Environmental Conditions

Ambient Temperature	21.2 °C
Relative Humidity	29.0 %

2.6.6 Test Results

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	-
Limit Clause(s):	3.2(9)	Test Method(s):	Refer to Test Method
Additional Reference(s):	-		

DUT Configuration			
Mode:	2 Mb/s FHSS	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Modem A)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	90% Spread Bandwidth (MHz)	Spread Factor	
		Minimum	Limit
2402	1.054	20.553	≥5.0
2442	1.063	20.729	≥5.0
2480	1.084	21.138	≥5.0

Table 36 - Process Gain

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	-
Limit Clause(s):	3.2(9)	Test Method(s):	Refer to Test Method
Additional Reference(s):	-		

DUT Configuration			
Mode:	2 Mb/s FHSS	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	B (Modem B)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	90% Spread Bandwidth (MHz)	Spread Factor	
		Minimum	Limit
2402	1.050	20.475	≥5.0
2442	1.058	20.631	≥5.0
2480	1.084	21.138	≥5.0

Table 37 - Process Gain

ARIB STD T-66, Limit Clause 3.2 (9)

For spread spectrum systems, the process gain must be at least 5.

2.7 Dwell Time

2.7.1 Specification Reference

ARIB STD-T66, Clause 3.2 (11)
MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19)

2.7.2 Equipment Under Test and Modification State

RMM-QE, S/N: ANT149 - Modification State 0

2.7.3 Date of Test

18-November-2025

2.7.4 Test Method

The spectrum analyser was tuned to the test frequency with a zero Hz span and a low enough RBW to avoid picking up transmissions on other channels. The trace was swept for long enough to conclude the hopping channel does not exceed the limits.

The EUT was powered by 14 VDC via DC PSU.

2.7.5 Environmental Conditions

Ambient Temperature	21.3 °C
Relative Humidity	25.4 %

2.7.6 Test Results

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	-
Limit Clause(s):	3.2(11)	Test Method(s):	Refer to Test Method
Additional Reference(s):	-		

DUT Configuration			
Mode:	2 MB/s FHSS	Duty Cycle (%):	19.6
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Modem A) | B (Modem B)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	Time of Occupancy			Limit (ms)
	Dwell Time (ms)	Number of Transmissions	Time of Occupancy (ms)	
2404 (Modem A)	0.102	800	81.5	400.0
2404 (Modem B)	0.102	800	81.7	400.0

Table 38 - Time of Occupancy Results

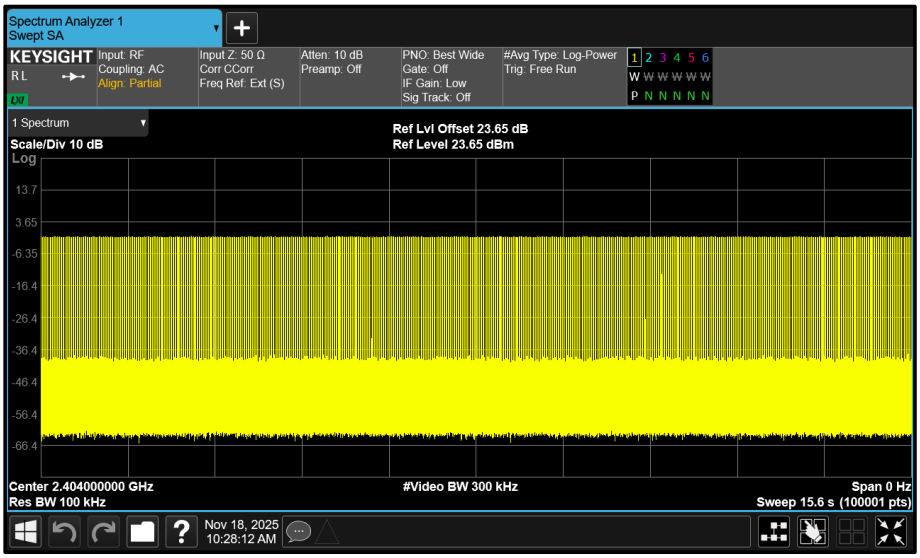


Figure 47 - Modem A - 2404 MHz Accumulated Transmit Time

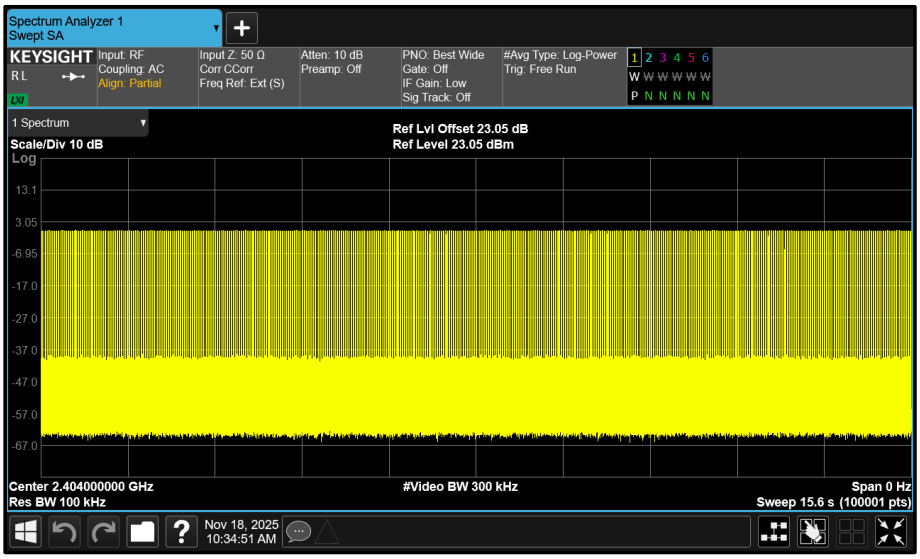


Figure 48 - Modem B - 2404 MHz Accumulated Transmit Time

ARIB STD T66, Limit Clause 3.2 (11)

For transmission devices that use a FH system, the frequency dwell time should be at most 0.4 seconds, except transmission devices for radio controllers used with outdoor model airplanes, for which the dwell time should be at most 0.05 seconds. For transmission devices that use a DS system or DS hybrid system that does not involve an OFDM system, the total frequency dwell time for an arbitrary frequency, within a time of 0.4 seconds multiplied by the process gain, should be at most 0.4 seconds.

2.7.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Hygrometer	Rotronic	I-1000	2891	12	02-Dec-2025
GPSDR Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	18-Mar-2026
Digital Multi-meter	Iso-tech	IDM93N	4435	12	06-Mar-2026
MXA Signal Analyser	Keysight Technologies	N9020B	5528	24	10-Sep-2027
Modular Power System Mainframe	Keysight Technologies	N6701C	5835	-	TU
DC Power Module 60V 20A 300W	Keysight Technologies	N6754A	5836	-	O/P Mon
Signal Conditioning Unit	TUV SUD	SPECTRUM_SCU001	6350	12	02-Sep-2026
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6638	12	29-Aug-2026
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6639	12	29-Aug-2026

Table 39

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

2.8 Limit on Secondary Radiation

2.8.1 Specification Reference

ARIB STD-T66, Clause 3.3 (1)
MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19)

2.8.2 Equipment Under Test and Modification State

RMM-QE, S/N: ANT154 - Modification State 0

2.8.3 Date of Test

27-October-2025 to 29-October-2025

2.8.4 Test Method

This test was performed in accordance with ARIB STD-T66 Clause 3.3 (1).
The EUT was connected via a 1m cable and 20 dB of attenuation.
A preliminary sweep was performed using EmX and for results within 10 dB a final measurement was performed.
A measurement bandwidth of 100 kHz was used for below 1 GHz and 1 MHz was used for above 1 GHz.
The EUT was powered using a 14 VDC power supply.

2.8.5 Environmental Conditions

Ambient Temperature	19.9 - 20.3 °C
Relative Humidity	38.0 - 55.9 %

2.8.6 Test Results

2.4 GHz Transceiver 1, FHSS

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
*				

Table 40 - 802.15.4_RX, FHSS, 30 MHz to 13 GHz

*No emissions found within 6 dB of the limit.

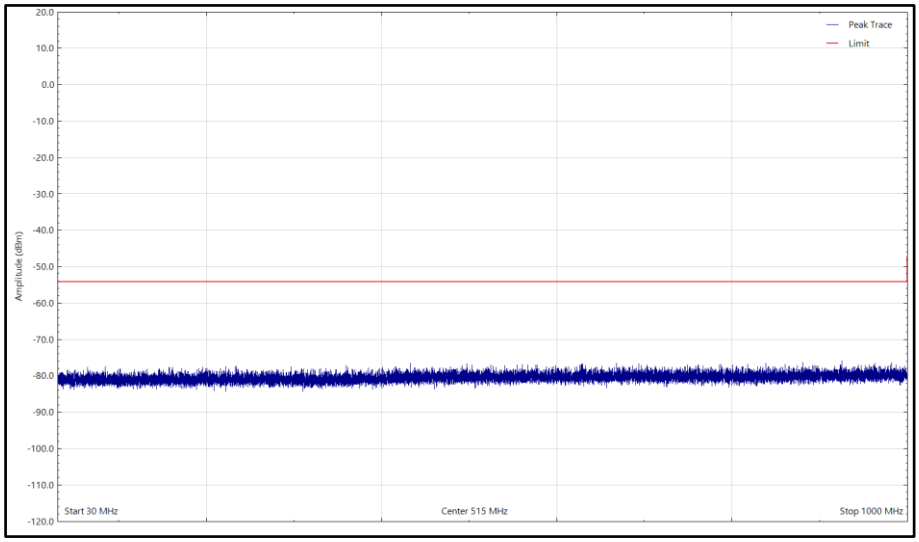


Figure 49 - 802.15.4_RX, FHSS, 30 MHz to 1 GHz, (Peak)

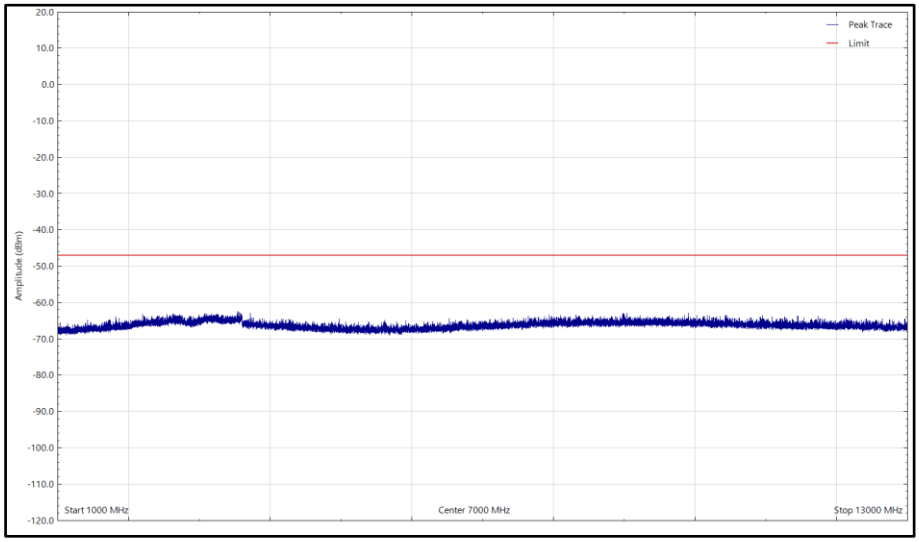


Figure 50 - 802.15.4_RX, FHSS, 1 GHz to 13 GHz, (Peak)

2.4GHz Transceiver 2, FHSS

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
*				

Table 41 - 802.15.4_RX, FHSS, 30 MHz to 13 GHz

*No emissions found within 6 dB of the limit.

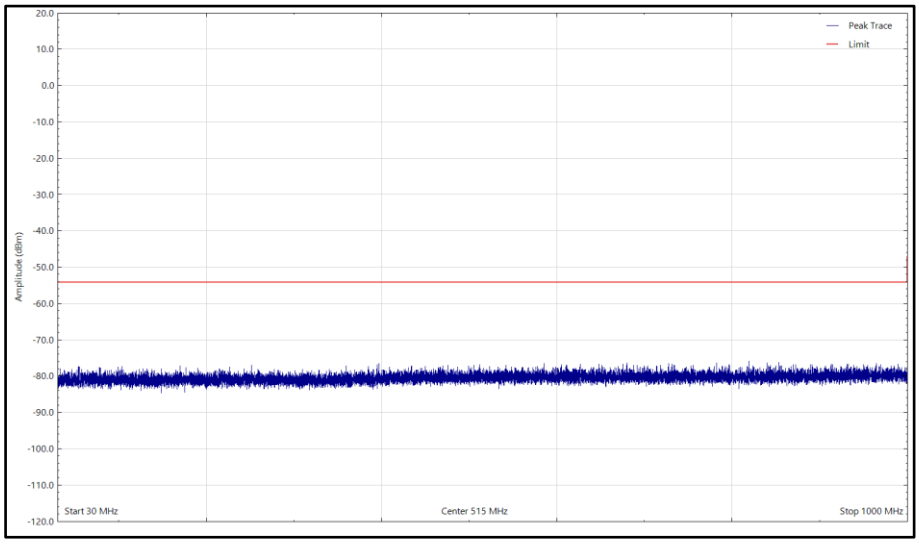


Figure 51 - 802.15.4_RX, FHSS, 30 MHz to 1 GHz, (Peak)

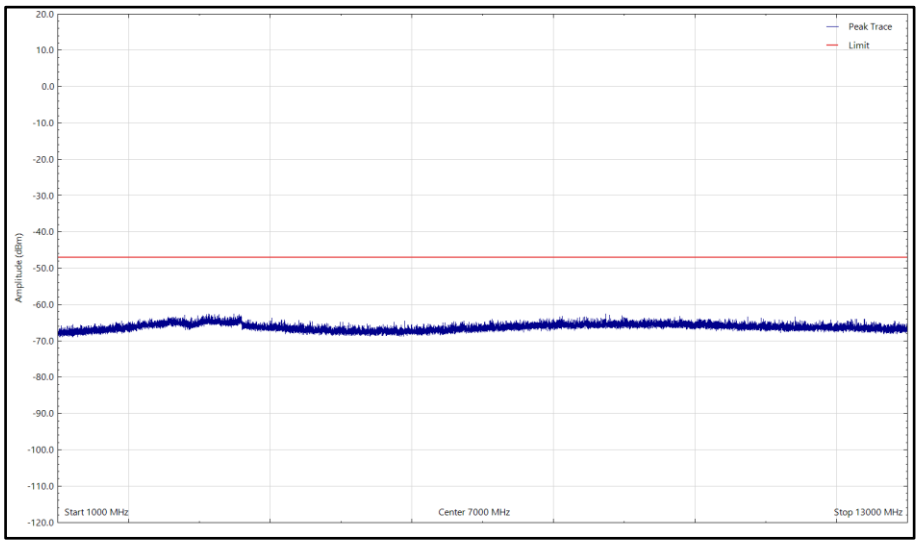


Figure 52 - 802.15.4_RX, FHSS, 1 GHz to 13 GHz, (Peak)

2.4GHz Transceiver 1, DTS

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
*				

Table 42 - 802.15.4_RX, 2402 MHz, 30 MHz to 13 GHz

*No emissions found within 6 dB of the limit.

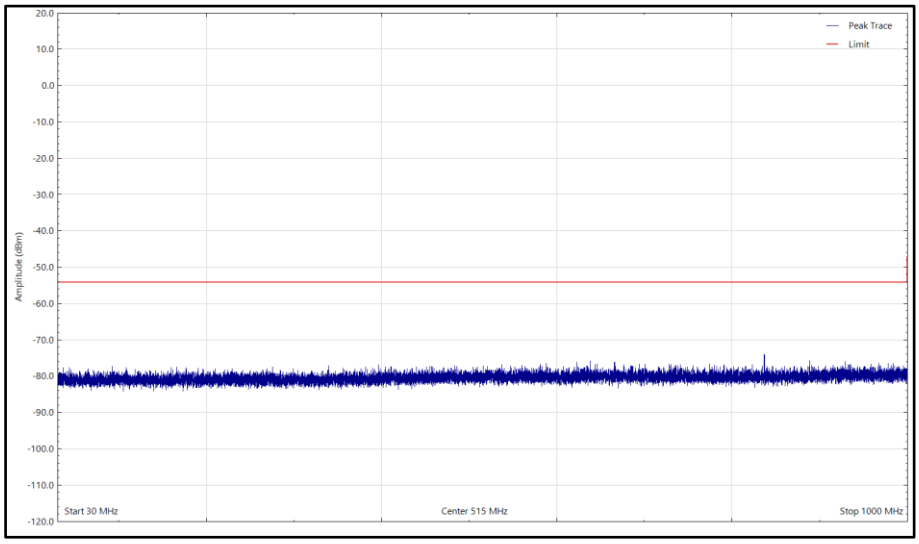


Figure 53 - 802.15.4_RX, 2402 MHz, 30 MHz to 1 GHz, (Peak)

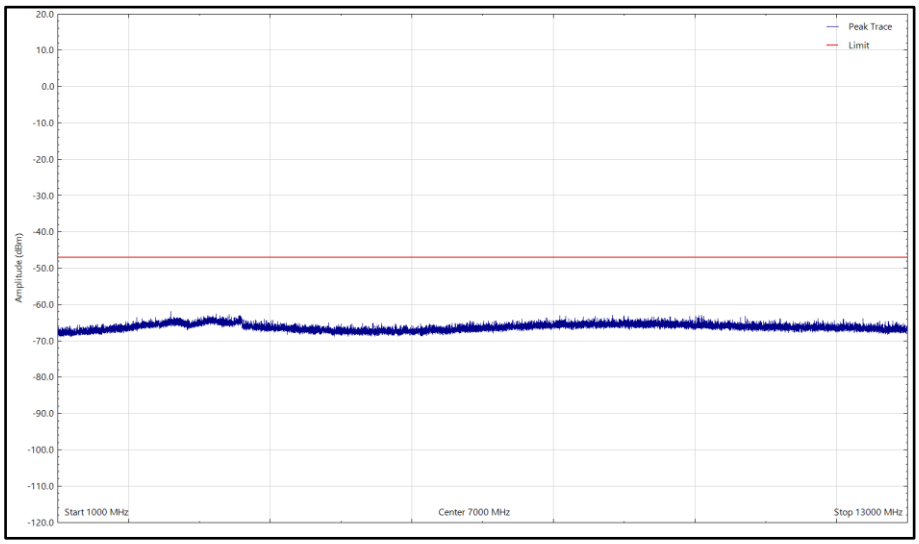


Figure 54 - 802.15.4_RX, 2402 MHz, 1 GHz to 13 GHz, (Peak)

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
*				

Table 43 - 802.15.4_RX, 2442 MHz, 30 MHz to 13 GHz

*No emissions found within 6 dB of the limit.

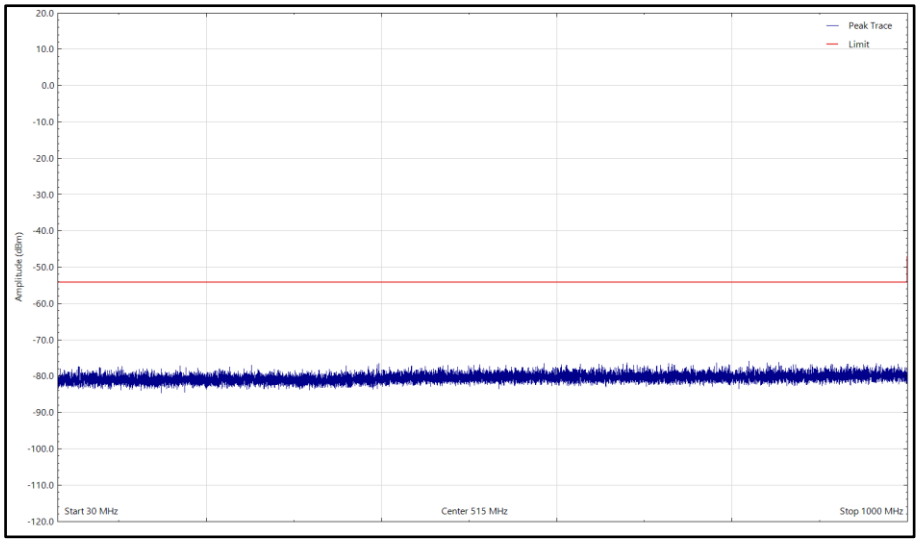


Figure 55 - 802.15.4_RX, 2442 MHz, 30 MHz to 1 GHz, (Peak)

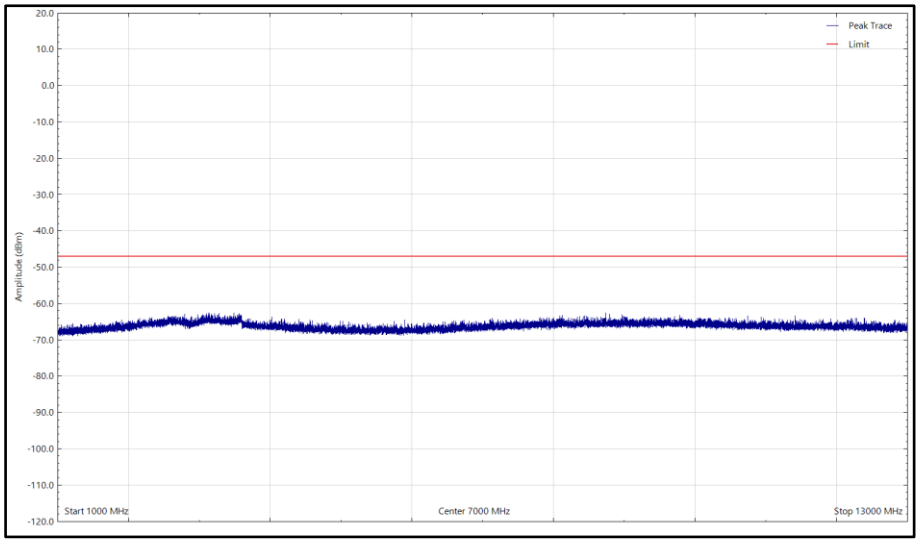


Figure 56 - 802.15.4_RX, 2442 MHz, 1 GHz to 13 GHz, (Peak)

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
*				

Table 44 - 802.15.4_RX, 2480 MHz, 30 MHz to 13 GHz

*No emissions found within 6 dB of the limit.

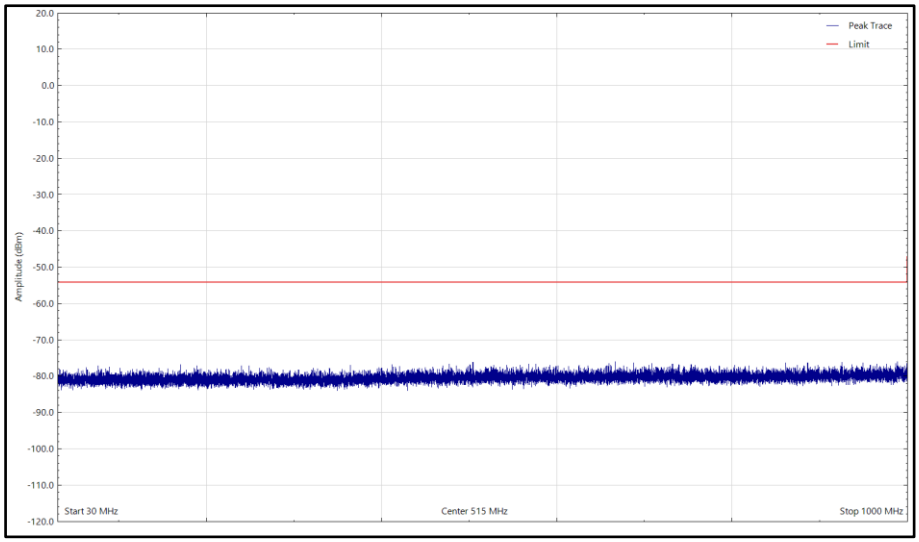


Figure 57 - 802.15.4_RX, 2480 MHz, 30 MHz to 1 GHz, (Peak)

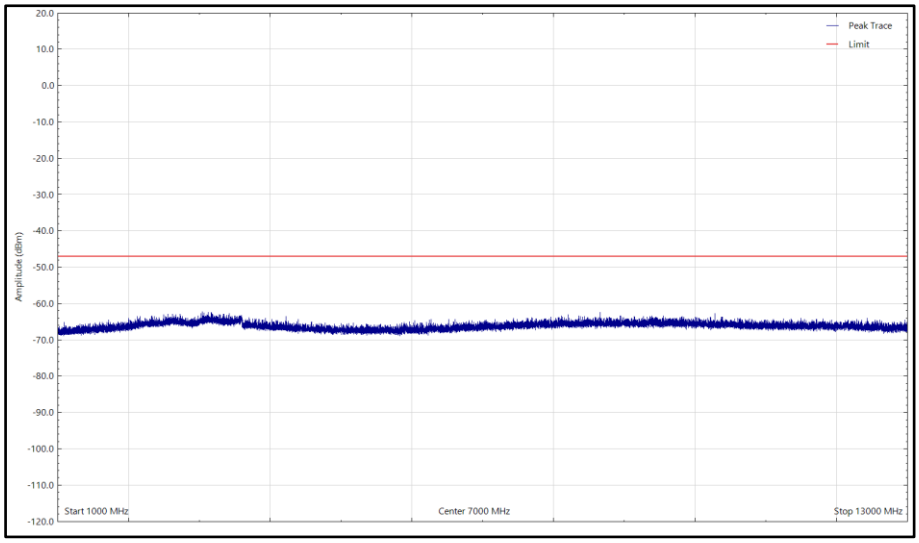


Figure 58 - 802.15.4_RX, 2480 MHz, 1 GHz to 13 GHz, (Peak)

2.4 GHz Transceiver 2, DTS

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
*				

Table 45 - 802.15.4_RX, 2402 MHz, 30 MHz to 13 GHz

*No emissions found within 6 dB of the limit.

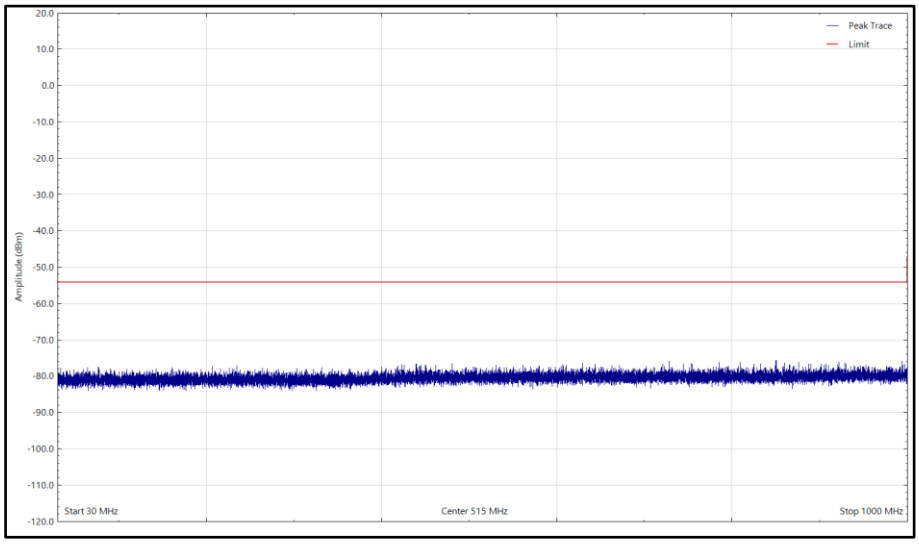


Figure 59 - 802.15.4_RX, 2402 MHz, 30 MHz to 1 GHz, (Peak)

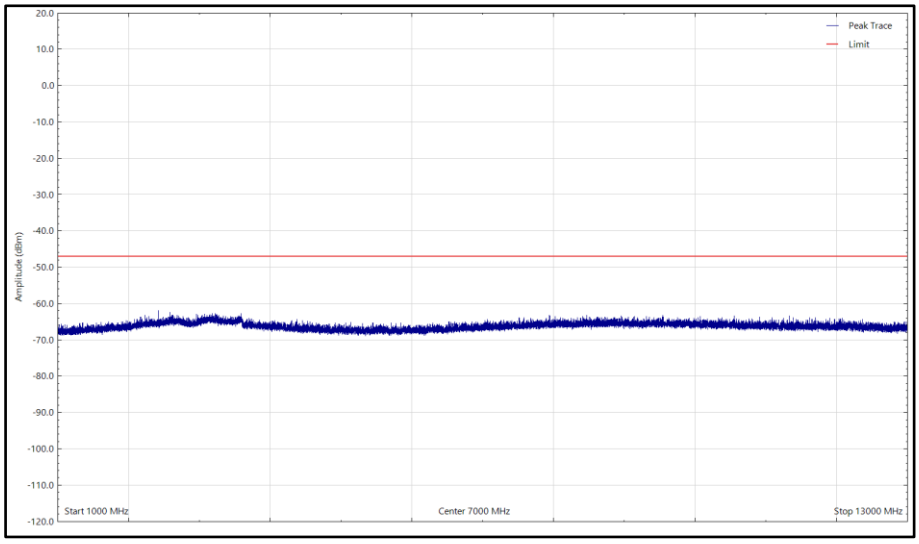


Figure 60 - 802.15.4_RX, 2402 MHz, 1 GHz to 13 GHz, (Peak)

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
*				

Table 46 - 802.15.4_RX, 2442 MHz, 30 MHz to 13 GHz

*No emissions found within 6 dB of the limit.

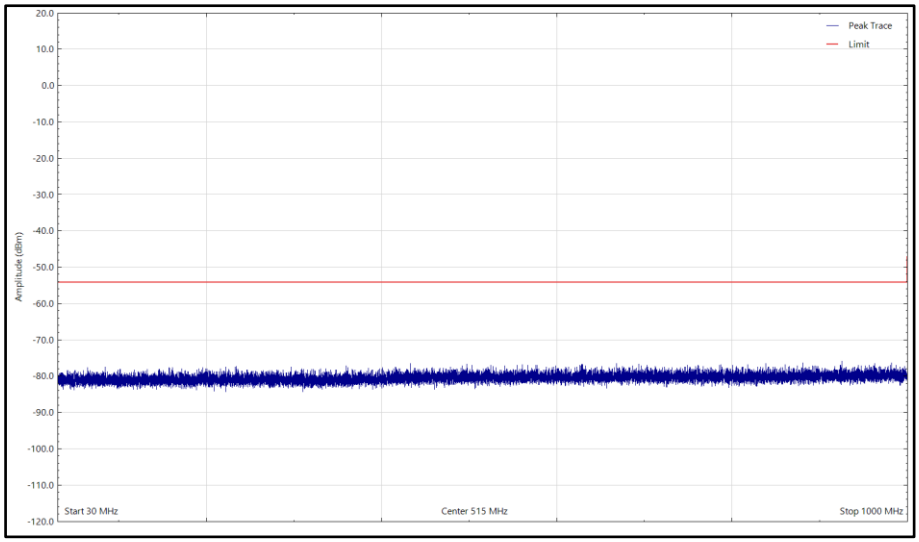


Figure 61 - 802.15.4_RX, 2442 MHz, 30 MHz to 1 GHz, (Peak)

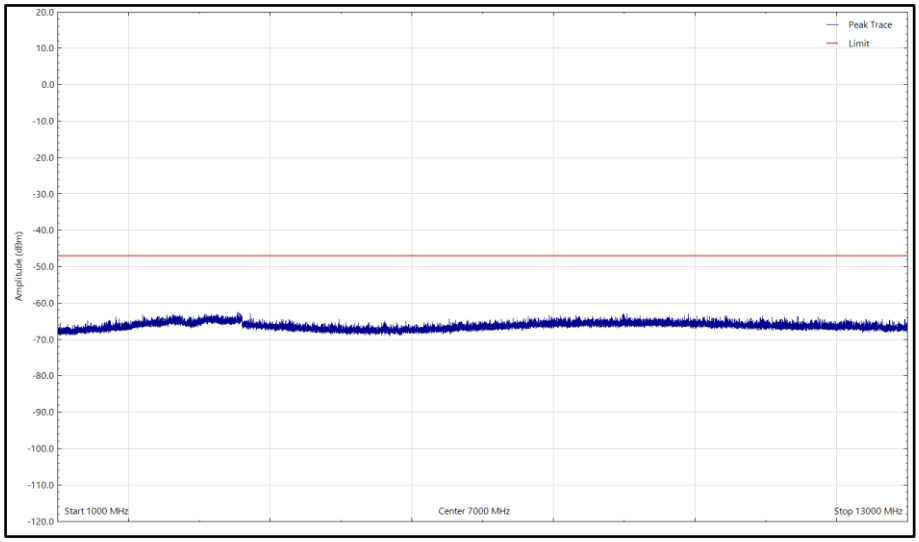


Figure 62 - 802.15.4_RX, 2442 MHz, 1 GHz to 13 GHz, (Peak)

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
*				

Table 47 - 802.15.4_RX, 2480 MHz, 30 MHz to 13 GHz

*No emissions found within 6 dB of the limit.

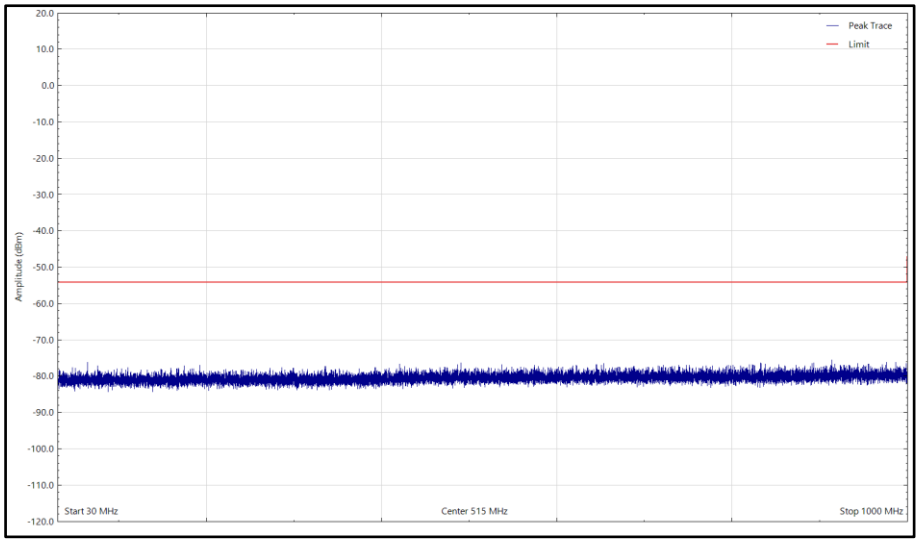


Figure 63 - 802.15.4_RX, 2480 MHz, 30 MHz to 1 GHz, (Peak)

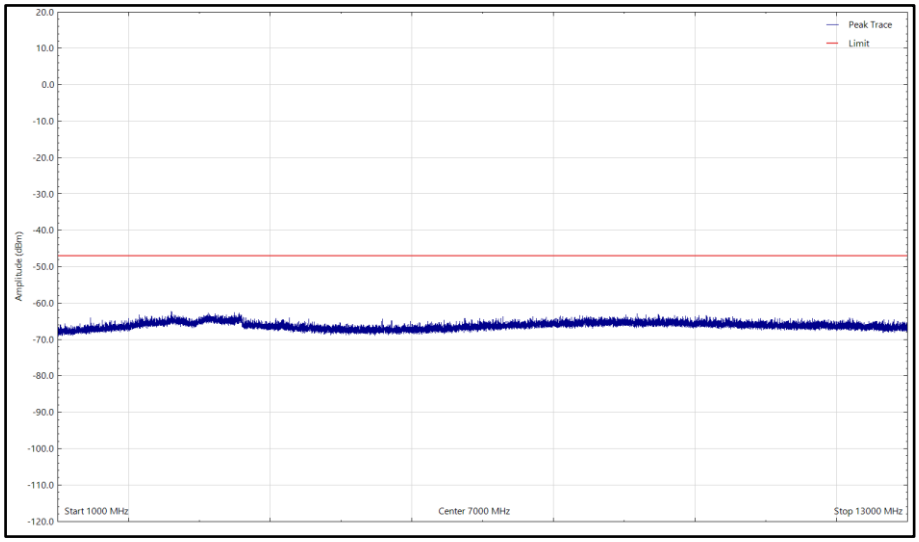


Figure 64 - 802.15.4_RX, 2480 MHz, 1 GHz to 13 GHz, (Peak)

ARIB STD-T66, Limit Clause 3.3 (1)

The limit at which secondary radiation will not hinder the function of other radio equipment is, if a fictional antenna circuit with the same electrical constant as the receiving antenna were to be used in calculations, at most 4nW if using a frequency below 1GHz and at most 20nW if using a frequency above or equal to 1GHz.

2.8.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Hygrometer	Rotronic	I-1000	2891	12	02-Dec-2025
Power Supply	Farnell	LT30/2	3422		TU
GPSDR Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	18-Mar-2026
Digital Multi-meter	Iso-tech	IDM93N	4435	12	06-Mar-2026
Emissions Software	TUV SUD	EmX V3.5.5	5125	-	Software
Attenuator 5W 20dB DC-18GHz	Aaren	AT40A-4041-D18-20	5497	12	23-Apr-2026
1m Coaxial Cable Assy	Junkosha	MWX221-01000AMSAMS/A	6381	12	30-Jul-2026
MXA Signal Analyser	Keysight Technologies	N9020B	6876	24	31-Aug-2026

Table 48

TU - Traceability Unscheduled

2.9 Antenna Gain

2.9.1 Specification Reference

ARIB STD-T66, Clause 3.6 (2)
MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19)

2.9.2 Equipment Under Test and Modification State

S/N: ANT149 - Modification State 0

2.9.3 Date of Test

19-November-2025

2.9.4 Test Method

The following information was provided by the manufacturer. (See Annex A for Details).

The maximum half power beamwidth was calculated by determining the EIRP relative to an antenna with a transmitting power of 12.14 dBm/MHz (16.37 mW/MHz).

A = EIRP (mW/MHz) / 16.37

Maximum Half-Power Beamwidth = 360 degrees / A.

2.9.5 Environmental Conditions

Ambient Temperature	21.2 °C
Relative Humidity	29.0 %

2.9.6 Test Results

Parameter	Results
Frequency Range (MHz)	2404-2480
Antenna Gain (dBi)	4.43
Half-Power Beamwidth	360 degrees
EIRP (mW/MHz)	6.13
A	0.374
Calculated Maximum Half-Power Beamwidth	360 degrees

Table 49

ARIB STD-T66, Limit Clause 3.6 (2)

The absolute gain of transmitting antennas must be at most 12.14 dB.

2.10 Voltage Variations

2.10.1 Specification Reference

ARIB STD-T66 and MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19), Clause Article 2, Item (19) Notice 88, Appendix 43

2.10.2 Equipment Under Test and Modification State

RMM-QE, S/N: AK0X92 - Modification State 0

2.10.3 Date of Test

28-October-2025

2.10.4 Test Method

The input voltage was set to ±10% of the nominal voltage specified by the manufacturer. Using a DVM the input voltage to the RF circuit was measured.

2.10.5 Environmental Conditions

Ambient Temperature	20.1 °C
Relative Humidity	42.3 %

2.10.6 Test Results

2.4GHz Transceiver 1 -

Input Supply Voltage	Measured Voltage at RF Circuitry
12.6	3.04
14	3.04
15.4	3.04

Table 50 - Voltage Variation Results

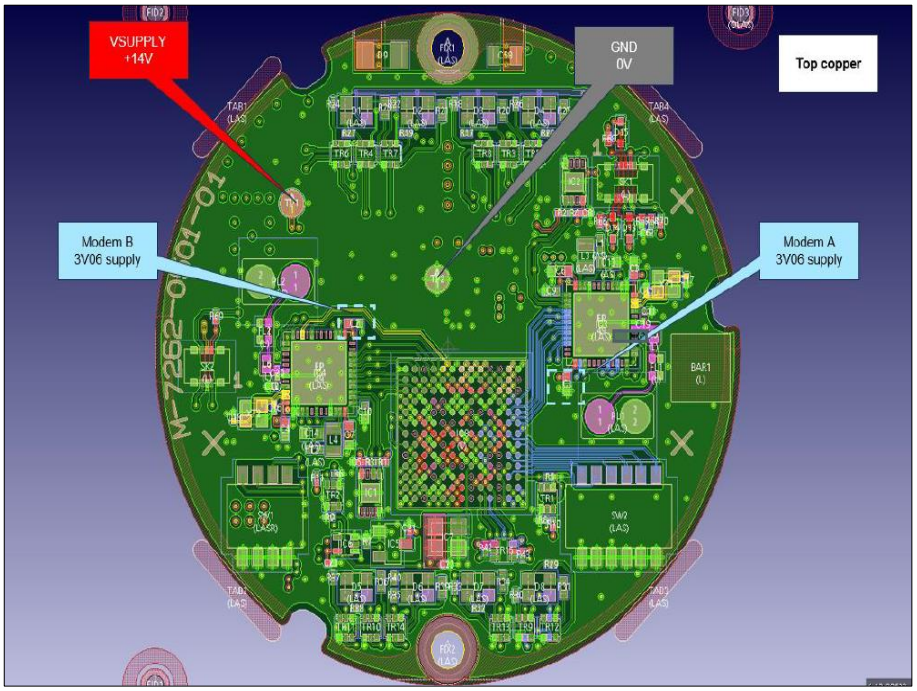


Figure 65 - Top Side Component Placement

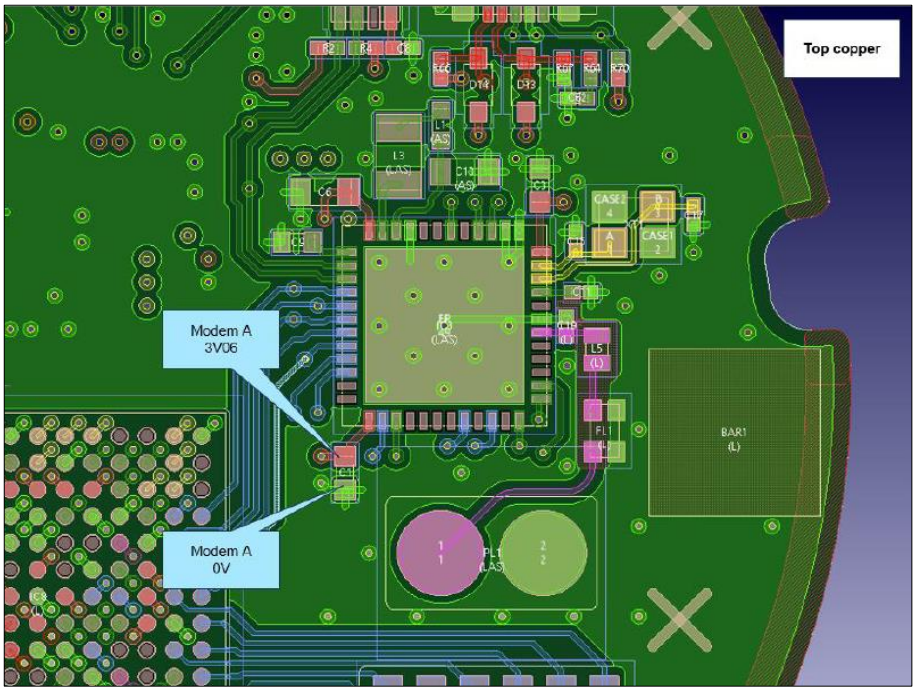


Figure 66 - Image showing the test point at which the voltage was measured to the RF Circuitry

The input voltage to the receiver RF circuit varied less than ±1% as the input voltage from the external power supply to the receiver was varied ±10% therefore tests are performed only at the manufacturer's nominal voltage.

2.4GHz Transceiver 2 -

Input Supply Voltage	Measured Voltage at RF Circuitry
12.6	3.04
14	3.04
15.4	3.04

Table 51 - Voltage Variation Results

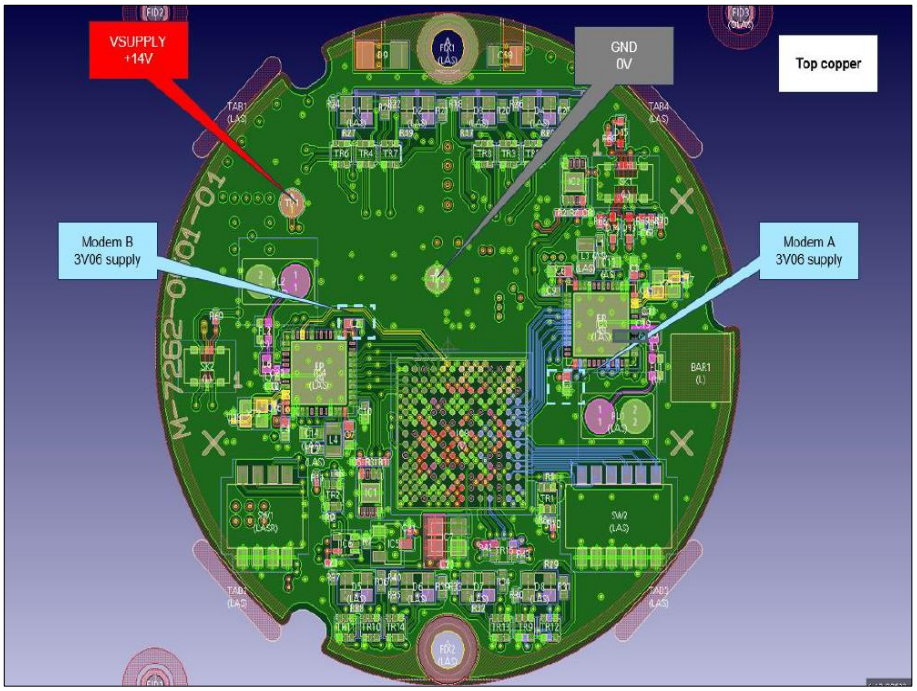


Figure 67 - Top Side Component Placement

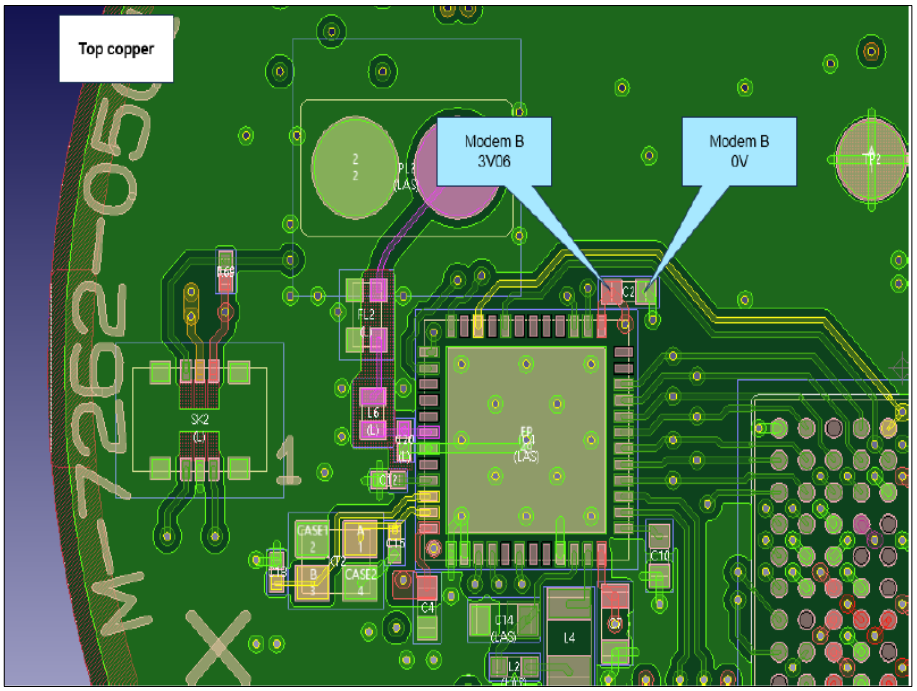


Figure 68 - Image showing the test point at which the voltage was measured to the RF Circuitry

The input voltage to the receiver RF circuit varied less than ±1% as the input voltage from the external power supply to the receiver was varied ±10% therefore tests are performed only at the manufacturer's nominal voltage.

2.10.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Hygrometer	Rotronic	I-1000	2891	12	02-Dec-2025
Digital Multi-meter	Iso-tech	IDM93N	4435	12	06-Mar-2026
Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon

Table 52

O/P Mon – Output monitored using calibrated equipment.

2.11 Interference Protection Function

2.11.1 Specification Reference

ARIB STD-T66, Clause 3.4 (1)
MIC No. 88 Annex 43 (Article 2 Paragraph 1 Item 19)

2.11.2 Equipment Under Test and Modification State

RMM-QE, S/N: ANT149 - Modification State 0

2.11.3 Date of Test

20-November-2025

2.11.4 Test Method

This test was performed in accordance with Notification 88, Annex 45, clause 9.

The device under test was connected to a signal analyser and using a digital demodulation measurement application the demod bits were shown on screen which were used to determine the transmitted identification code.

2.11.5 Environmental Conditions

Ambient Temperature	21.0 °C
Relative Humidity	22.1 %

2.11.6 Test Results

2.4GHz Transceiver 1 -

Result: After a header of 01010101 01010101 the EUT transmitted the binary code 00110110 11001111 00011000 00110000 which in hex is 36 CF 18 30.

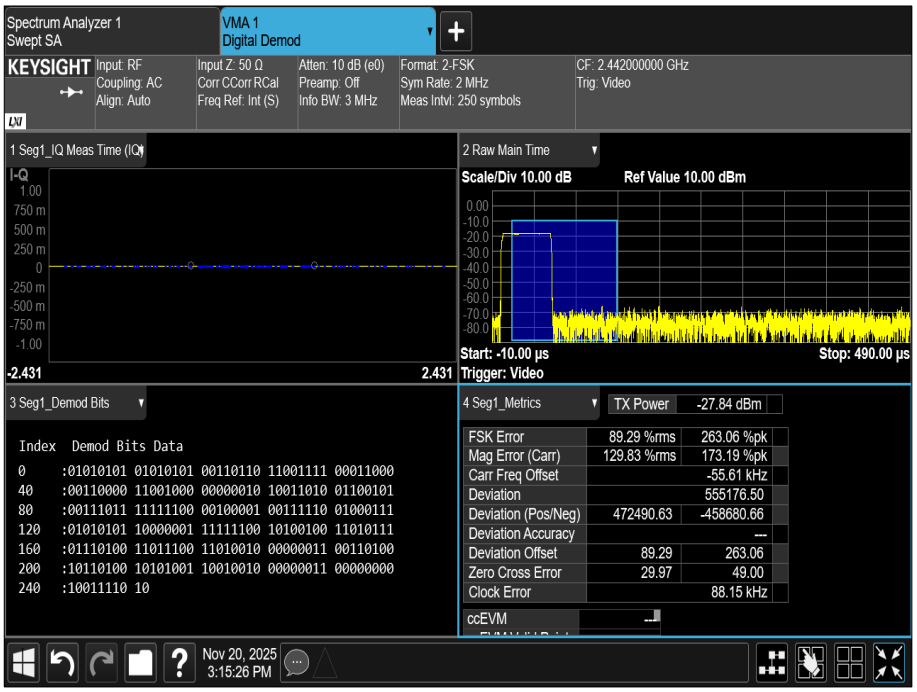


Figure 69 - Evidence

Radio Equipment Regulations Article 9-4, paragraph 1, item 8

Client devices should send an identification code to the master device to identify itself as a valid/authorized client.

2.11.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Hygrometer	Rotronic	I-1000	2891	12	02-Dec-2025
Digital Multi-meter	Iso-tech	IDM93N	4435	12	06-Mar-2026
Attenuator 5W 20dB DC-18GHz	Aaren	AT40A-4041-D18-20	5497	12	23-Apr-2026
Modular Power System Mainframe	Keysight Technologies	N6701C	5835	-	TU
DC Power Module 60V 20A 300W	Keysight Technologies	N6754A	5836	-	O/P Mon
MXA Signal Analyser	Keysight Technologies	N9020B	6418	24	15-Oct-2027
Directional Coupler 0.5-18 GHz	RF-Lambda	RFDC5M18G20	6913	-	O/P Mon
1m SMA Cable	Junkosha	MWX221-01000AMSAMS/B	6921	12	08-Dec-2025

Table 53

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

3 Photographs

3.1 Equipment Under Test (EUT)



Figure 70 - EUT Front



Figure 71 - EUT Back

4 Test Equipment Information

4.1 Customer Support Equipment

The following customer supplied test equipment was used during testing covered by this document.

Item	Serial Number	Test Section	Description
RMP-400S	5RMY93	2.7	Used as a companion device to send packets for Interference Protection Function
USI Dev Board	37	2.7	Used to control the RMM-QE for Interference Protection Function
Laptop	CND2272R4Z	2.7	Used Renishaw's proprietary software to control the RMM-QE and USI Dev Board

5 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Antenna Power	± 0.64 dB
Frequency Deviation	± 25.32 kHz
Permissible Value of Spurious or Unnecessary Radiation Intensity	± 3.454 dB
Allowable Value for Occupied Bandwidth	± 42.21 kHz
Spread Bandwidth	± 42.21 kHz
Process Gain	-
Dwell Time	0.3 %
Limit on Secondary Radiation	±3.45 dB
Antenna Gain	-
Voltage Variations	
Interference Protection Function	-

Table 54

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2021, Clause 4.4.3 (Procedure 2). The measurement results are directly compared with the test limit to determine conformance with the requirements of the standard.

Risk: The uncertainty of measurement about the measured result is negligible with regard to the final pass/fail decision. The measurement result can be directly compared with the test limit to determine conformance with the requirement (compare IEC Guide 115). The level of risk to falsely accept and falsely reject items is further described in ILAC-G8.