Radio Test Report

Domo Tactical Communications
NETnode Phase 4 1W OEM
D1707-OEM+AP001973

47 CFR Part 90I Effective Date 1st October 2018
↳ 47CFR part 2J 2018

Test Date: 22nd January 2020 to 23rd January 2020
Report Number: 01-11915-1-20 Issue 01

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Certificate of Test 11915-1

The equipment noted below has been fully tested by R.N. Electronics Limited and, where appropriate, conforms to the relevant subpart of FCC Part 90I. This is a certificate of test only and should not be confused with an equipment authorisation. Other standards may also apply.

Equipment:	NETnode Phase 4 1W OEM
Model Number:	D1707-OEM+AP001973
Unique Serial Number:	1RC1
Applicant:	Domo Tactical Communications Fusion 2, 1100 Parkway , Hampshire Whiteley, UK PO15 7AB
Proposed FCC ID	XRF-NETNodeP41W
Full measurement results are detailed in Report Number:	01-11915-1-20 Issue 01
Test Standards:	47 CFR Part 90I Effective Date 1st October 2018 ↳ 47CFR part 2J 2018

NOTE:
Certain tests were not performed based upon manufacturer's declarations. Certain other requirements are subject to manufacturer declaration only and have not been tested/verified. For details refer to section 3 of this report.

DEVIATIONS:
No deviations have been applied.

This certificate relates only to the unit tested as identified by a unique serial number and in the condition at the time it was tested. It does not relate to any other similar equipment and performance of the product before or after the test cannot be guaranteed. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of unit not meeting the intentions of the standard or the requirements of the Federal Regulations, particularly under different conditions to those during testing. Any compliance statements are made reliant on (a) the application of the product and use of the assigned band being acceptable to the FCC and (b) the modes of operation as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT. Statements of compliance, where measurements were made, do not include the measurement uncertainty. The measurement uncertainty, where stated, is the expanded uncertainty based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Date Of Test:	22nd January to 23rd January 2020
Test Engineer:	Charlie Blatt
Approved By: Radio Approvals Manager	Digitally signed by: Daniel Sims DN: CN = Daniel Sims C = GB O = RN Electronics Ltd Date: 2020.01.31 16:28:23 Z
Customer Representative:	

2360

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2 Equipment under test (EUT)

2.1 Equipment specification

Applicant	Domo Tactical Communications Fusion 2 1100 Parkway Hampshire Whiteley UK PO15 7AB	
Manufacturer of EUT	Domo Tactical Communications	
Full Name of EUT	NETnode Phase 4 1W OEM	
Model Number of EUT	D1707-OEM+AP001973	
Serial Number of EUT	1RC1	
Date Received	22nd January 2020	
Date of Test:	22nd January 2020 to 23rd January 2020	
Purpose of Test	To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.	
Date Report Issued	31st January 2020	
Main Function	Licensed non-broadcast transmitter.	
Information Specification	Height	190 mm
	Width	130 mm
	Depth	30 mm
	Weight	<1 kg
	Voltage	10.2 to 13.8 V DC
	Current	1 A

2.2 Configurations for testing

General Parameters	
EUT Normal use position	Fixed
Choice of model(s) for type tests	Production Sample
Antenna details	External
Antenna port	1 x N type (TX), 1x N-type RX
Baseband Data port (yes/no)?	No
Highest Signal generated in EUT	2479 MHz
Lowest Signal generated in EUT	Not specified
Hardware Version	SA4336 issue 1
Software Version	GUI 6.1.30 F-30
Firmware Version	6.0 R-1 Build 116 image 151
Type of Equipment	Licensed non-broadcast transmitter
Technology Type	COFDM
Geo-location (yes/no)	No
TX Parameters	
Alignment range – transmitter	2450 – 2483.5 MHz
EUT Declared Modulation Parameters	COFDM
EUT Declared Power level	+30 dBm (1 Watt)
EUT Declared Signal Bandwidths	6 MHz
EUT Declared Channel Spacing's	6 MHz
EUT Declared Duty Cycle	Up to 100%
Unmodulated carrier available?	No
Declared frequency stability	1 ppm
RX Parameters	
Alignment range – receiver	2450 – 2483.5 MHz
EUT Declared RX Signal Bandwidth	Not declared
Receiver Signal Level (RSL)	Not declared

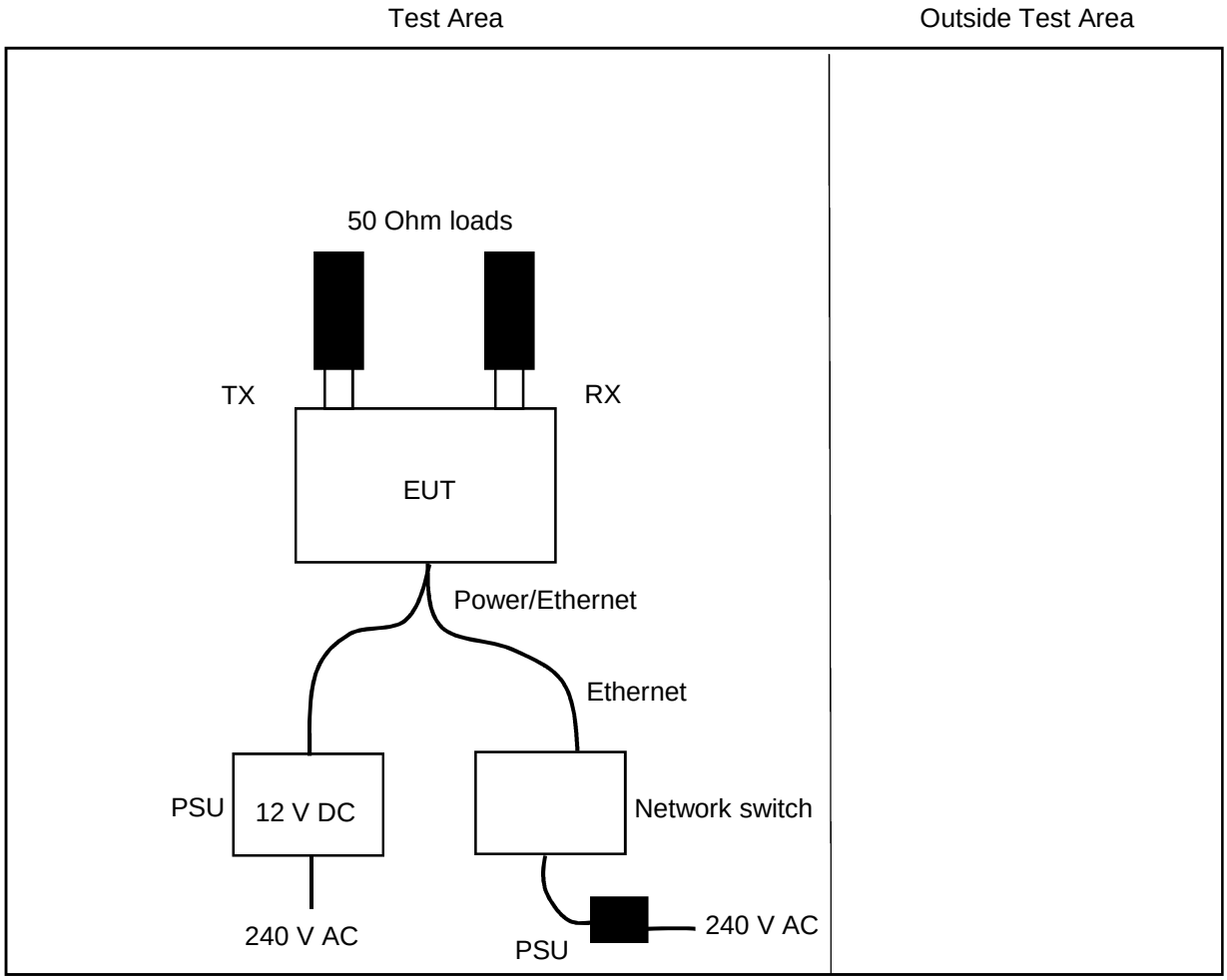
2.3 Functional description

Licensed non-broadcast transmitter operating under FCC part 90 in the 2450-2483.5 MHz band.

2.4 Modes of operation

Mode Reference	Description	Used for testing
TX1	2454 MHz 29 dBm COFDM modulation	Yes
TX2	2467 MHz 29 dBm COFDM modulation	Yes
TX3	2479 MHz 29 dBm COFDM modulation	Yes

2.5 Emissions configuration



The unit was powered from a 12 V DC bench supply. The network port was terminated via a 1.5m unscreened cable by a network switch. The unit was configured with engineering menus in software to allow permanent transmit modes of device on the top, middle and bottom channels as stated within section 2.4 of this report. The unit has a single modulation scheme and bandwidth. The transmit mode was 100% continuous with modulation and the power settings used for each channel were as stated below:-

Low Channel (2454 MHz) = +29 dBm
Mid Channel (2467 MHz) only = +29 dBm
High Channel (2479 MHz) = +29 dBm

2.5.1 Signal leads

Port Name	Cable Type	Connected
RX	N connector	Yes
TX	N connector	Yes
Power/Ethernet	Circular	Yes

3 Summary of test results

The NETnode Phase 4 1W OEM, D1707-OEM+AP001973 was tested for compliance to the following standard(s) :

47 CFR Part 90I Effective Date 1st October 2018
↳ 47CFR part 2J 2018

Any compliance statements are made reliant on (a) the application of the product and use of the assigned band being acceptable to the FCC and (b) the modes of operation as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of equipment not meeting the intentions of the standard or the essential requirements of the directive, particularly under different conditions to those during testing. Statements of compliance, where measurements were made, do not include the measurement uncertainty. The measurement uncertainty, where stated, is the expanded uncertainty based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Title	References	Results
Transmitter Tests		
1. Radiated emissions	FCC Part 90I Clause 90.210(b), 47CFR part 2J Clause 2.1053	PASSED[1]
2. Conducted emissions	FCC Part 90I Clause 90.210(b), 47CFR part 2J Clause 2.1051	PASSED[1]
3. Conducted power	FCC Part 90I Clause 90.205(o), FCC Part 90I Clause 2.1046	PASSED
4. Frequency stability	FCC Part 90I Clause 90.213(a), 47CFR part 2J Clause 2.1055	PASSED
5. Occupied bandwidth	FCC Part 90I Clause 90.209, 47CFR part 2J Clause 2.1049	PASSED
6. Emission mask	FCC Part 90I Clause 90.210(b)	PASSED
7. Modulation limiting	47CFR part 2J Clause 2.1047(b)	NOT APPLICABLE[2]
8. Modulation frequency response	47CFR part 2J Clause 2.1047(a)	NOT APPLICABLE[2]
9. Transient frequency behaviour	FCC Part 90I Clause 90.214	NOT APPLICABLE[3]
10. Adjacent channel power	FCC Part 90I Clause 90.221	NOT APPLICABLE[4]

[1] Spectrum investigated up to a frequency of 25 GHz based on 10 times the highest channel/ signal generated in equipment of 2479 MHz.
[2] EUT employs digital modulation.
[3] Transmitter does not operate in bands 150-174 MHz or 421-512 MHz.
[4] Transmitter does not operate in bands 450-470 MHz or 809-824 MHz or 854-869 MHz.

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4 Specifications

The tests were performed and operated in accordance with R.N. Electronics Ltd procedures and the relevant standards listed below.

4.1 Relevant standards

Ref.	Standard Number	Version	Description
4.1.1	FCC Part 90I	2018	Part 90 - Private Land Mobile Radio Services - Subpart I - General Technical standards
4.1.2	47CFR part 2J	2018	Part 2 – Frequency Allocations and radio treaty matters; General rules and regulations
4.1.3	ANSI C63.26	2015	American National Standard for Compliance testing of transmitters used in Licensed radio services

4.2 Deviations

No deviations were applied.

4.3 Tests at extremes of temperature & voltage

The following test conditions were used to simulate testing at nominal or extremes.

Temperature Test Conditions		Voltage Test Conditions	
T nominal	20 °C	V nominal	12V DC
T minimum	-30 °C	V minimum	10.2V DC
T maximum	50 °C	V maximum	13.8V DC

Extremes of temperature and voltage are based upon manufacturer's declaration.
The ambient test conditions of humidity and pressure in the laboratory were as specified in each specific test section within this report

4.4 Test fixtures

In order to measure RF parameters at temperature extremes, the EUT was tested in a temperature controlled chamber as follows:

The equipment external RF port was used for testing.

5 Tests, methods and results

5.1 Radiated emissions

5.1.1 Test methods

Test Requirements:	FCC Part 90I Clause 90.210(b) [Reference 4.1.1 of this report], 47CFR part 2J Clause 2.1053 [Reference 4.1.2 of this report]
Test Method:	ANSI C63.26 Clause 5.5 [Reference 4.1.3 of this report]
Limits:	FCC Part 90I Clause 90.210(b)(3) [Reference 4.1.1 of this report]

5.1.2 Configuration of EUT

The EUT was tested in an ALSE and ambient conditions were monitored. The separate transmit and receive ports were individually terminated with a 50 Ohm load. The unit was powered from 12 V DC. Three orthogonal planes were examined. All test modes specified in section 2.4 were tested and, therefore, the EUT was operated in TX1 to TX3 modes for this test.

5.1.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment noted in the 'Test Equipment' Section at Site M. Peak field strength from the EUT was maximised by rotating it 360 degrees. An RMS detector was used for final measurements.

30 MHz – 1 GHz.
The measuring antenna was scanned 1 - 4m in both Horizontal and Vertical polarisations. Substitution method was performed using tuned dipoles / a calibrated bi-conical antenna.

1 GHz – 25 GHz.
The measuring antenna was used in both Horizontal and Vertical polarisations. Substitution method was performed using standard gain horn antennas.

5.1.4 Test equipment

CAL07, E005, E136, E268, E411, E453, E454, E602, E624, E743, LPE364, TMS78, TMS814, TMS82

See Section 8 for more details

5.1.5 Test results

Temperature of test environment	16-19°C
Humidity of test environment	52-57%
Pressure of test environment	103-104kPa

Note: only emissions within 20dB of limits are reported.

Setup Table

Band	2450-2483.5 MHz
Power Level	29 dBm
Channel Spacing	6 MHz
Mod Scheme	COFDM
Low channel	2454 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
7362	-32.5	-19.5	Vertical	Upright

Setup Table

Band	2450-2483.5 MHz
Power Level	29 dBm
Channel Spacing	6 MHz
Mod Scheme	COFDM
Mid channel	2467 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
7401	-30.6	-17.6	Vertical	Upright

Setup Table

Band	2450-2483.5 MHz
Power Level	29 dBm
Channel Spacing	6 MHz
Mod Scheme	COFDM
High channel	2479 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
7437	-32.7	-19.7	Vertical	Upright

LIMITS:
Part 90.210(b)(3), -13 dBm

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows: 30MHz - 1000MHz ±6.1dB, 1 – 18 GHz ±3.5dB, 18 – 25 GHz ±3.9dB.

5.2 Conducted emissions

5.2.1 Test methods

Test Requirements:	FCC Part 90I Clause 90.210(b) [Reference 4.1.1 of this report], 47CFR part 2J Clause 2.1051 [Reference 4.1.2 of this report]
Test Method:	ANSI C63.26 Clause 5.7 [Reference 4.1.3 of this report]
Limits:	FCC Part 90I Clause 90.210(b)(3) [Reference 4.1.1 of this report]

5.2.2 Configuration of EUT

The EUT was operated on a test bench. Measurements were made at the 50 ohm coaxial transmit port. The EUT was operated in TX1 to TX3 modes for this test.

5.2.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment noted in the 'Test Equipment' Section at Site A. A complete scan of emissions from the lowest frequency generated/ used within the equipment up to 10 times the highest frequency generated/ used was made, to identify any signals within 20dB of the limits. Any identified spurious signals were measured in the required bandwidths.

5.2.4 Test equipment

E755, E866, E874

See Section 8 for more details

5.2.5 Test results

Temperature of test environment	21°C
Humidity of test environment	52%
Pressure of test environment	104kPa

Band	2450-2483.5 MHz
Power Level	29 dBm
Channel Spacing	6 MHz
Mod Scheme	COFDM
Low channel	2454 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
2447	-19.1	-6.1

Plots
11915-1 2454-low
11915-1 2454-high

Band	2450-2483.5 MHz
Power Level	29 dBm
Channel Spacing	6 MHz
Mod Scheme	COFDM
Mid channel	2467 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
No spurious emissions within 20 dB of limit		

Plots
11915-1 2467-low
11915-1 2467-high

Band	2450-2483.5 MHz
Power Level	29 dBm
Channel Spacing	6 MHz
Mod Scheme	COFDM
High channel	2479 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
2486.7	-21.3	-8.3

Plots
11915-1 2479-low
11915-1 2479-high

Any analyser plots can be found in Section 6 of this report.

LIMITS:
Part 90.210(b)(3), -13 dBm

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows: ± 2.8 dB up to 25 GHz.

5.3 Conducted power

5.3.1 Test methods

Test Requirements:	FCC Part 90I Clause 90.205(o) [Reference 4.1.1 of this report], FCC Part 90I Clause 2.1046 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.26 Clause 5.2 [Reference 4.1.3 of this report]
Limits:	FCC Part 90I Clause 90.205(o) [Reference 4.1.1 of this report]

5.3.2 Configuration of EUT

The EUT was measured on a bench using a spectrum analyser connected to the external RF port via attenuation. The EUT was operated in TX1 to TX3 modes for this test and highest power levels recorded.

5.3.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment listed in the 'Test Equipment' Section. The channel power function of the analyser was used with an RMS detector. Measurements were made on a test bench in site A.

5.3.4 Test equipment

E755, E866, E874

See Section 8 for more details

5.3.5 Test results

Temperature of test environment	21°C
Humidity of test environment	52%
Pressure of test environment	104kPa

Band	2450-2483.5 MHz
Power Level	29 dBm
Channel Spacing	6
Mod Scheme	COFDM
Low channel	2454 MHz
Mid channel	2467 MHz
High channel	2479 MHz

Test conditions			
	Low channel	Mid channel	High channel
Carrier Power (Watts)	0.85	0.86	0.83
Maximum TX Power observed (dBm)	29.29	29.36	29.19
Plot reference	11915-1 2454	11915-1 2467	11915-1 2479

Any analyser plots can be found in Section 6 of this report.

LIMITS:
Part 90.205(o), 5 W

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
<± 1.0 dB

5.4 Frequency stability

5.4.1 Test methods

Test Requirements:	FCC Part 90I Clause 90.213(a) [Reference 4.1.1 of this report], 47CFR part 2J Clause 2.1055 [Reference 4.1.2 of this report]
Test Method:	ANSI C63.26 Clause 5.6 [Reference 4.1.3 of this report]
Limits:	FCC Part 90I Clause 90.213(a) [Reference 4.1.1 of this report]

5.4.2 Configuration of EUT

The EUT was placed in a temperature controlled chamber and thermal balance was achieved before tests began. Measurements were made at the EUT 50 ohm TX port. The EUT was operated in **TX2** mode for this test.

5.4.3 Test procedure

Tests were made in accordance with the Test Method noted above, using the measuring equipment listed in the 'Test Equipment' Section. Temperature stability was achieved at each test level before taking measurements. No CW carrier was available for measurement since the EUT was digitally modulated, and therefore the mean frequency was calculated by measuring two points (at the same level) on the upper & lower sides of the modulation envelope using the Occupied Bandwidth function of the spectrum analyser. EUT supply was varied to 85 & 115% of nominal volts at nominal temperature.
Tests were performed using Test Site A.

5.4.4 Test equipment

E755, E866, E874, P270, TMS38, TMS57, TMS80

See Section 8 for more details

5.4.5 Test results

Temperature of test environment	21°C
Humidity of test environment	52%
Pressure of test environment	104kPa

Band	2450-2483.5 MHz
Power Level	29 dBm
Channel Spacing	6 MHz
Mod Scheme	COFDM
High channel	2479 MHz

Test conditions		Frequency Error (MHz) High channel
-30°C	Volts Nominal (12)	2478.998687
-20°C	Volts Nominal (12)	2478.998262
-10°C	Volts Nominal (12)	2479.000572
0°C	Volts Nominal (12)	2478.998326
10°C	Volts Nominal (12)	2478.994204
20°C	Volts Minimum (10.2)	2479.003315
	Volts Nominal (12)	2479.003864
	Volts Maximum (13.8)	2479.003824
30°C	Volts Nominal (12)	2478.994093
40°C	Volts Nominal (12)	2478.994683
50°C	Volts Nominal (12)	2478.994214
Max Frequency Error per chan (Hz)		+3864 / -5907
Max Frequency Error observed (ppm)		+1.56 / -2.38

Note: Refer to operational description provided with certification for justification on testing only a single channel within the EUT operational band.

LIMITS:
Part 90.213 Equipment operating above 2450 MHz, no limit is specified.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
<± 0.7 ppm

5.5 Occupied bandwidth

5.5.1 Test methods

Test Requirements:	FCC Part 90I Clause 90.209 [Reference 4.1.1 of this report], 47CFR part 2J Clause 2.1049(h) [Reference 4.1.2 of this report]
Test Method:	ANSI C63.26 Clause 5.4 [Reference 4.1.3 of this report]
Limits:	FCC Part 90I Clause 90.209 [Reference 4.1.1 of this report]

5.5.2 Configuration of EUT

The EUT was operated on a test bench. Measurements were made at the 50 ohm coaxial transmit port. The EUT was operated in TX1 to TX3 modes.

5.5.3 Test procedure

Tests were performed using Test Site A. Tests were made in accordance with the Test Method noted above using the measuring equipment noted in the 'Test Equipment' Section. A 91 kHz RBW, 3x VBW, auto sweep time and max hold settings were used for the 99% bandwidth measurement using the Occupied Bandwidth measurement function of the spectrum analyser.

5.5.4 Test equipment

E755, E866, E874

See Section 8 for more details

5.5.5 Test results

Temperature of test environment	21°C
Humidity of test environment	52%
Pressure of test environment	104kPa

Band	2450-2483.5 MHz
Power Level	29 dBm
Channel Spacing	6 MHz
Mod Scheme	COFDM
Low channel	2454 MHz
Mid channel	2467 MHz
High channel	2479 MHz

	Low channel	Mid channel	High channel
99 % Bandwidth (MHz) Nominal Temp & Volts	5.5566	5.5549	5.5483
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts	11915-1 2454	11915-1 2467	11915-1 2479

Any analyser plots can be found in Section 6 of this report.

LIMITS:
Part 90.209

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
<± 1.9 %

5.6 Emission mask

5.6.1 Test methods

Test Requirements: FCC Part 90I Clause 90.210(b) [Reference 4.1.1 of this report]
Test Method: ANSI C63.26 Clause 5.7 [Reference 4.1.3 of this report]
Limits: FCC Part 90I Clause 90.210(b) [Reference 4.1.1 of this report]

5.6.2 Configuration of EUT

The EUT was operated on a test bench. Measurements were made at the 50 ohm coaxial transmit port. The EUT was operated in TX1 to TX3 modes.

5.6.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment listed in the 'Test equipment used' Section. The analyser was tuned to the nominal centre frequency with span of 30MHz and RBW of 30kHz and allowed to sweep enough times to capture the entire power envelope. The frequencies at which the spurious emission limits were last exceeded were noted. Plots were taken referenced to the applicable spectrum mask. As the measurement bandwidth is less than the emission bandwidth, the mask is lowered by the ratio of the Occupied Bandwidth to measurement bandwidth

Highest occupied bandwidth = 5556.6 kHz

Measurement resolution bandwidth = 30 kHz

Ratio = 10*log(OBW/RBW)

= 22.68 dB.

Lowest transmit power = 29.2 dBm

Reference level for graph = 29.19 – 22.68 = 6.51 dBm.

Tests were performed is test site A.

5.6.4 Test equipment

E755, E866, E874

See Section 8 for more details

5.6.5 Test results

Temperature of test environment 21°C
Humidity of test environment 52%
Pressure of test environment 104kPa

Band	2450-2483.5 MHz
Power Level	29 dBm
Channel Spacing	6 MHz
Mod Scheme	COFDM
Low channel	2454 MHz
Mid channel	2467 MHz
High channel	2479 MHz

	Low channel	Mid channel	High channel
Nominal plot reference	11915-1 2454 mask	11915-1 2467 mask	11915-1 2479 mask

Any analyser plots can be found in Section 6 of this report.

LIMITS:

Part 90.210(b) & (n)
Under Part 90 section 210, the masks for equipment designated to operate in the 2.45 - 2.4835GHz band are not specified in the Applicable Emission Masks Chart.

Therefore, while the EUT has no provision to inject an audio sub carrier into the transmitted RF signal, mask applied is Mask B as noted for “All other bands”. Although Mask B generally pertains to equipment with an audio low pass filter, Mask C is completely inappropriate in that it does not allow for spread spectrum carriers within the designated bandwidth.

(b) Emission Mask B - For transmitters that are equipped with an audio low pass filter pursuant to 90.211(a), the power of any emission must be below the unmodulated carrier power (P) as follows:

1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows: ± 2.8 dB up to 26.5 GHz.

5.7 Modulation limiting

NOT APPLICABLE: EUT employs digital modulation.

5.8 Modulation frequency response

NOT APPLICABLE: EUT employs digital modulation.

5.9 Transient frequency behaviour

NOT APPLICABLE: Transmitter does not operate in bands 150-174 MHz or 421-512 MHz

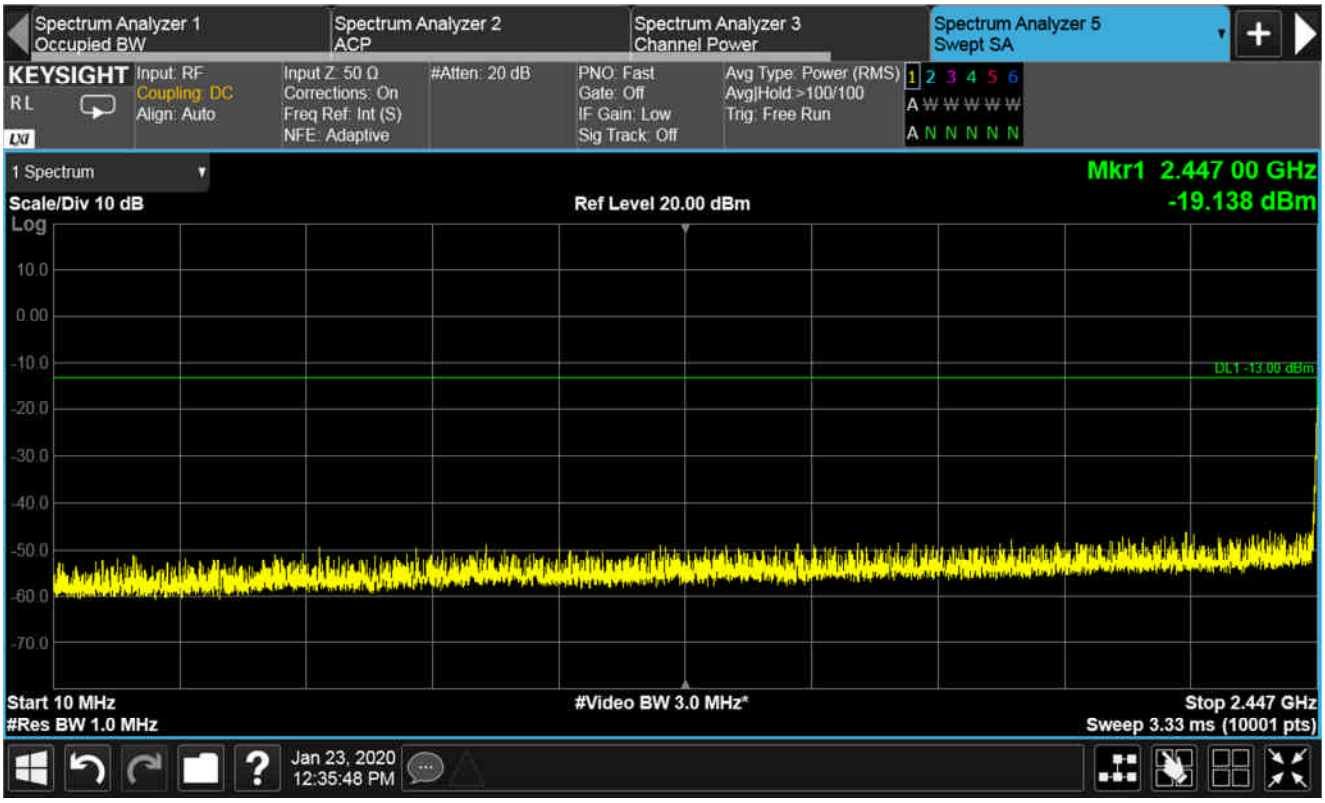
5.10 Adjacent channel power

NOT APPLICABLE: Transmitter does not operate in bands 450-470 MHz or 809-824 MHz or 854-869 MHz

6 Plots/Graphical results

6.1 Conducted emissions

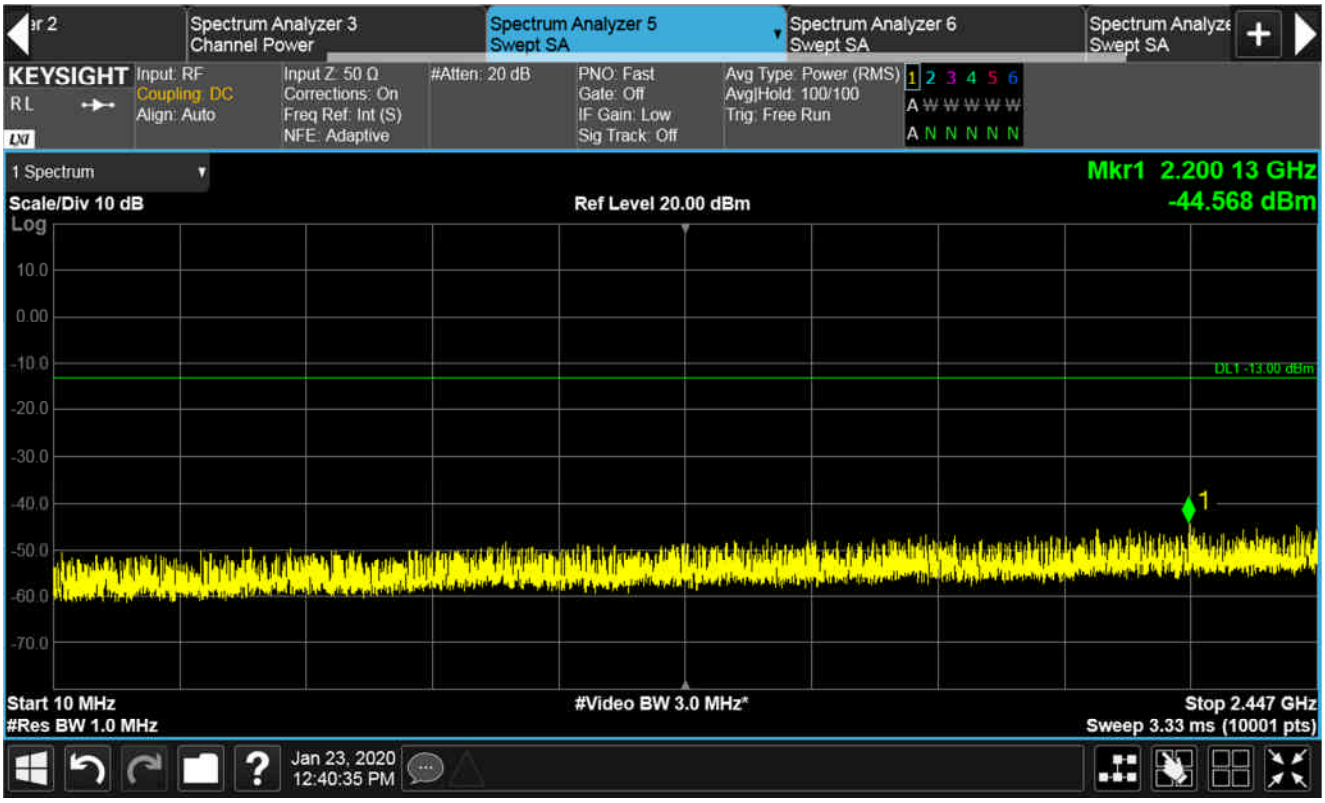
RF Parameters: Band 2450-2483.5 MHz, Power 29 dBm, Channel Spacing 6 MHz, Modulation COFDM



10 MHz to 2.447 MHz range.

2490 MHz to 25 GHz range.

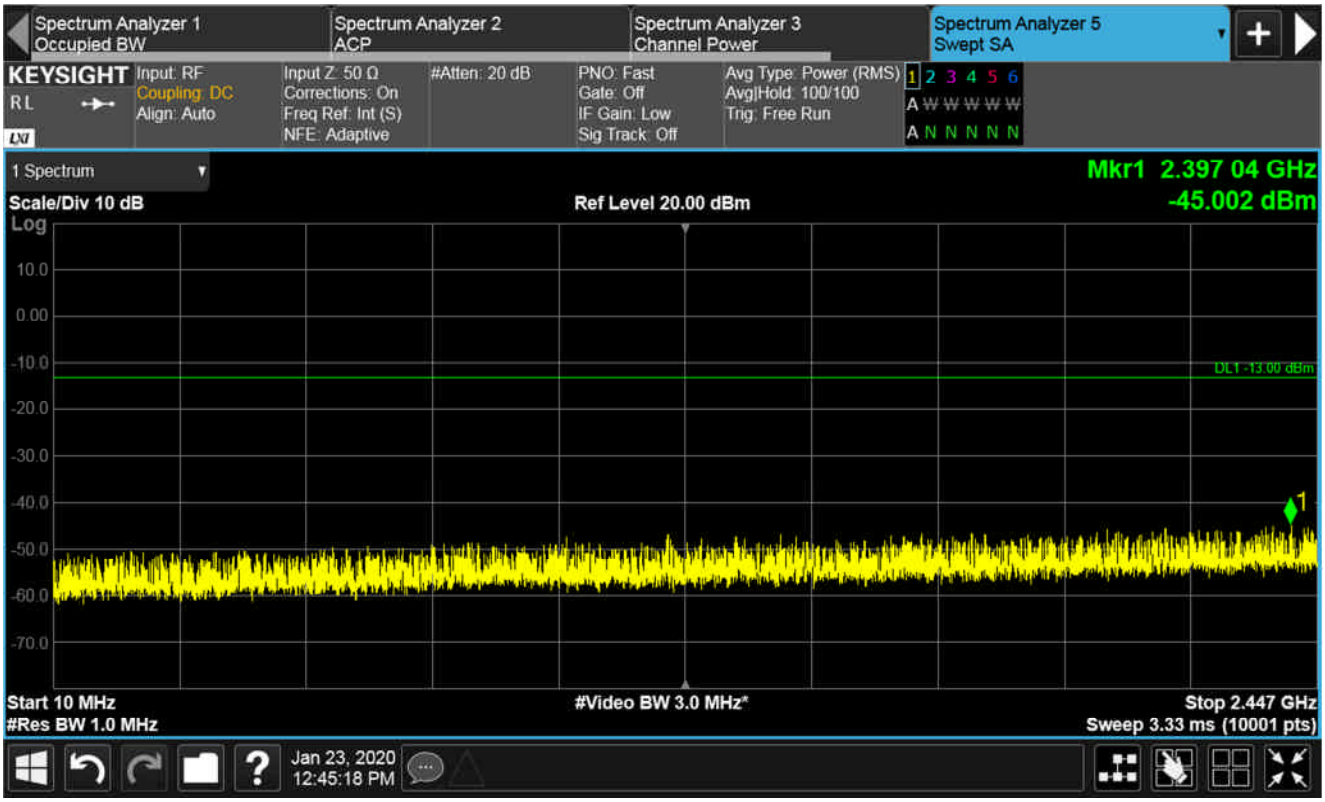
RF Parameters: Band 2450-2483.5 MHz, Power 29 dBm, Channel Spacing 6 MHz, Modulation COFDM



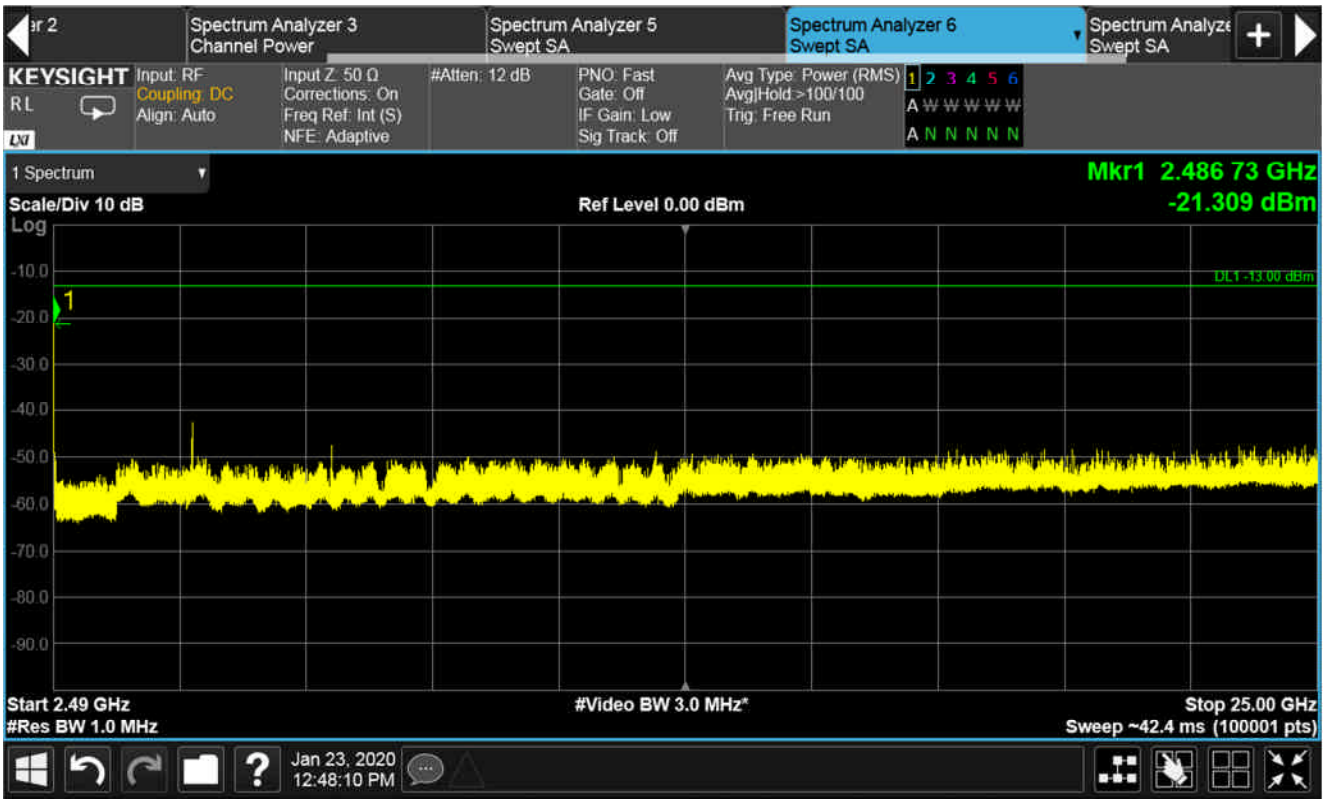
10 MHz to 2.447 MHz range.

2490 MHz to 25 GHz range.

RF Parameters: Band 2450-2483.5 MHz, Power 29 dBm, Channel Spacing 6 MHz, Modulation COFDM



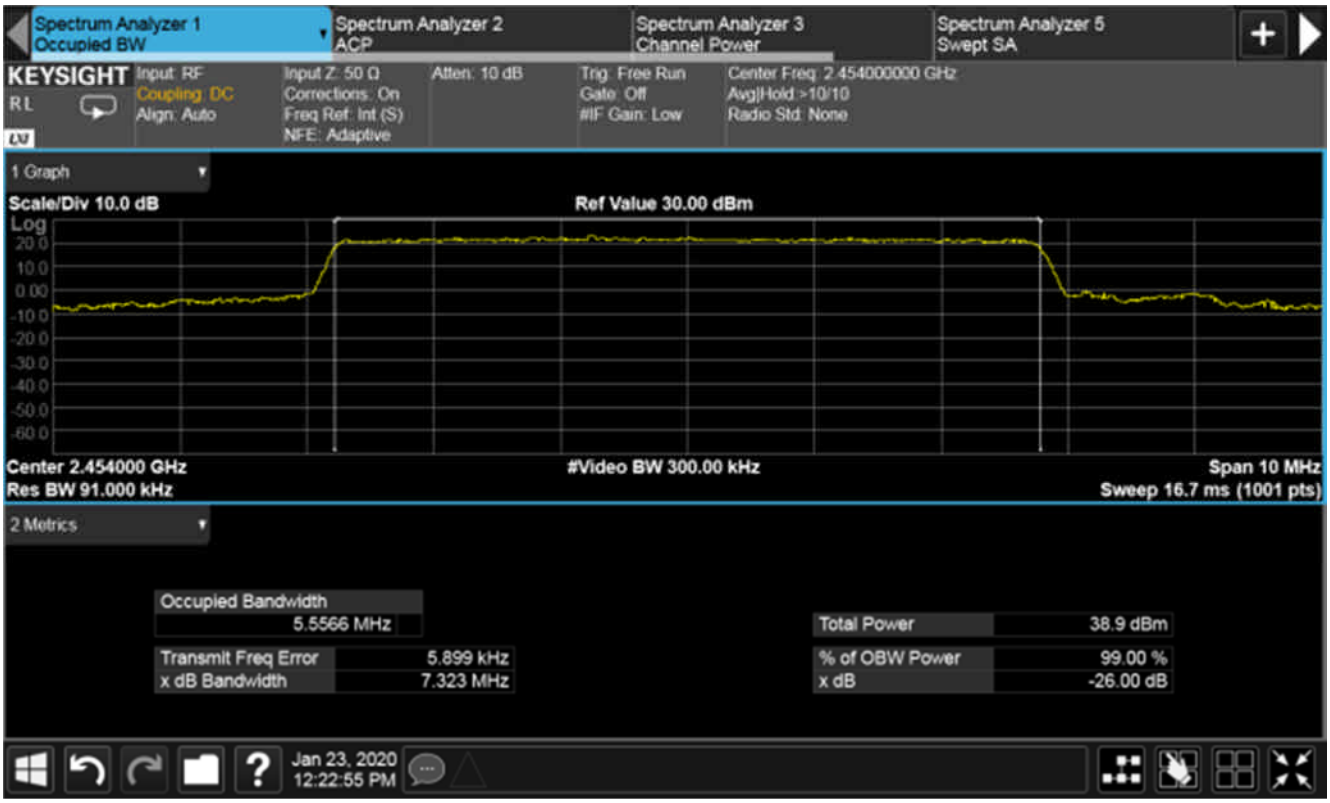
10 MHz to 2.447 MHz range.



2490 MHz to 25 GHz range.

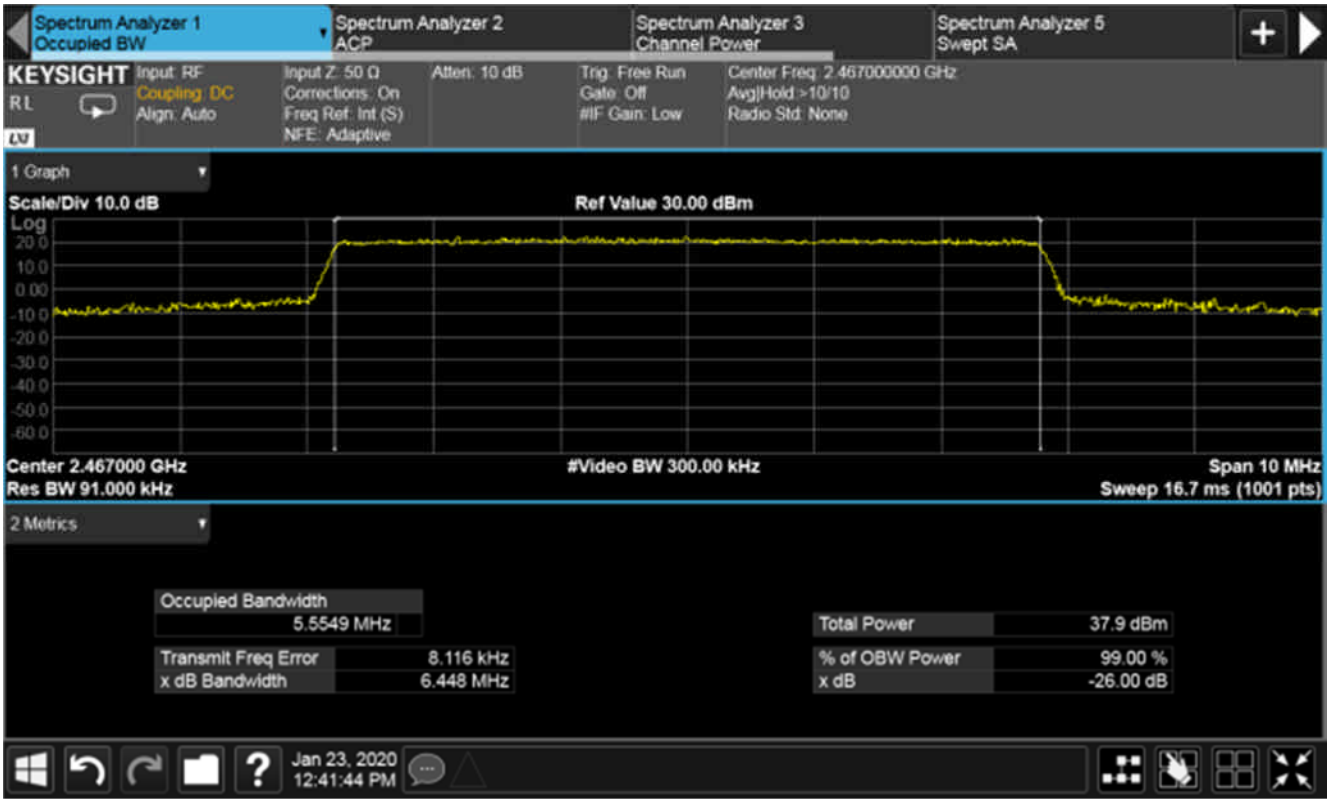
6.2 Occupied bandwidth

RF Parameters: Band 2450-2483.5 MHz, Power 29 dBm, Channel Spacing 6 MHz, Modulation COFDM, Channel 2454 MHz



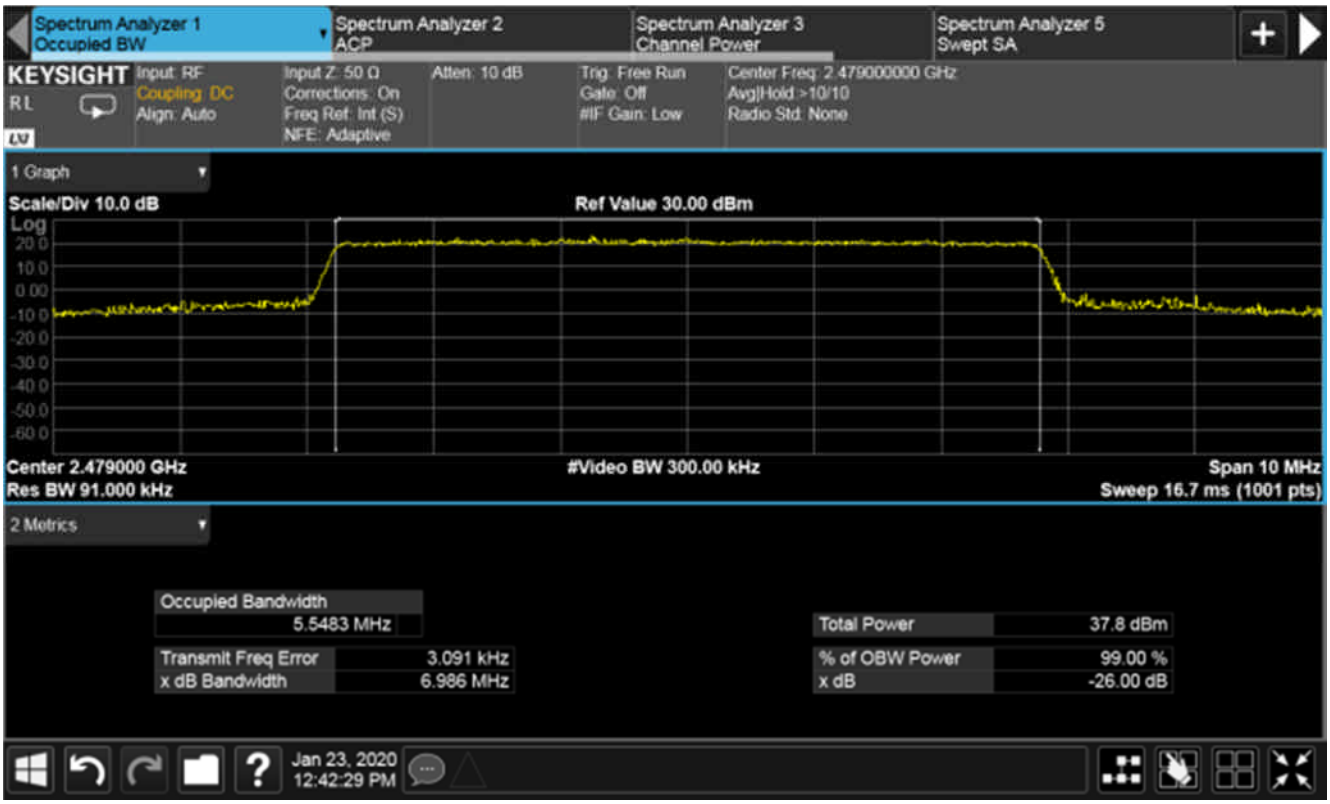
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

RF Parameters: Band 2450-2483.5 MHz, Power 29 dBm, Channel Spacing 6 MHz, Modulation COFDM, Channel 2467 MHz



Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

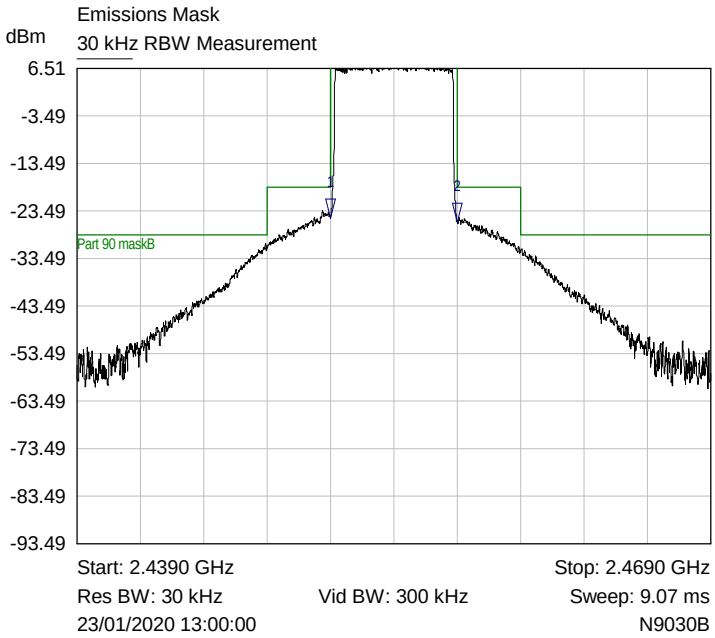
RF Parameters: Band 2450-2483.5 MHz, Power 29 dBm, Channel Spacing 6 MHz, Modulation COFDM, Channel 2479 MHz



Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

6.3 Emission mask

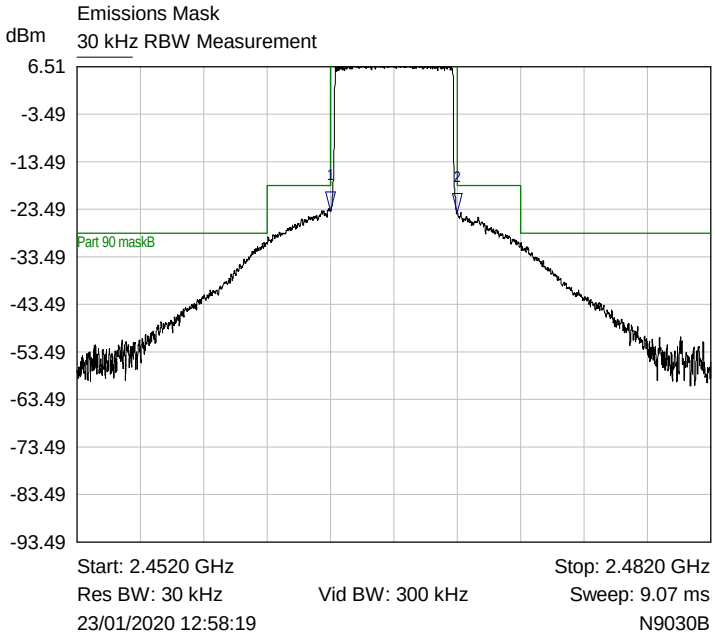
RF Parameters: Band 2450-2483.5 MHz, Power 29 dBm, Channel Spacing 6 MHz, Modulation COFDM, Channel 2454 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	30 kHz RBW Measurement	2.4510 GHz	-24.96 dBm	
2 ▽	30 kHz RBW Measurement	2.4570 GHz	-25.74 dBm	

Nominal Temperature, Nominal Voltage low channel mask

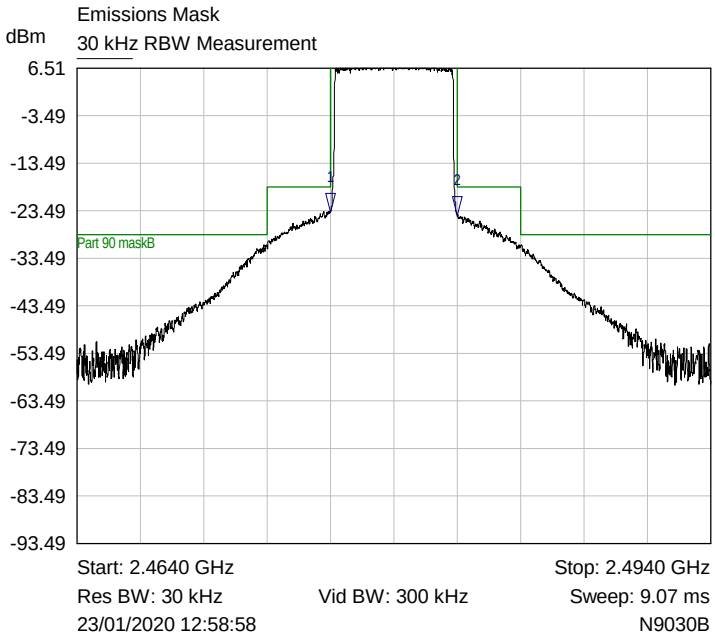
RF Parameters: Band 2450-2483.5 MHz, Power 29 dBm, Channel Spacing 6 MHz, Modulation COFDM, Channel 2467 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	30 kHz RBW Measurement	2.4640 GHz	-23.75 dBm	
2 ▽	30 kHz RBW Measurement	2.4700 GHz	-24.19 dBm	

Nominal Temperature, Nominal Voltage mid channel mask

RF Parameters: Band 2450-2483.5 MHz, Power 29 dBm, Channel Spacing 6 MHz, Modulation COFDM, Channel 2479 MHz

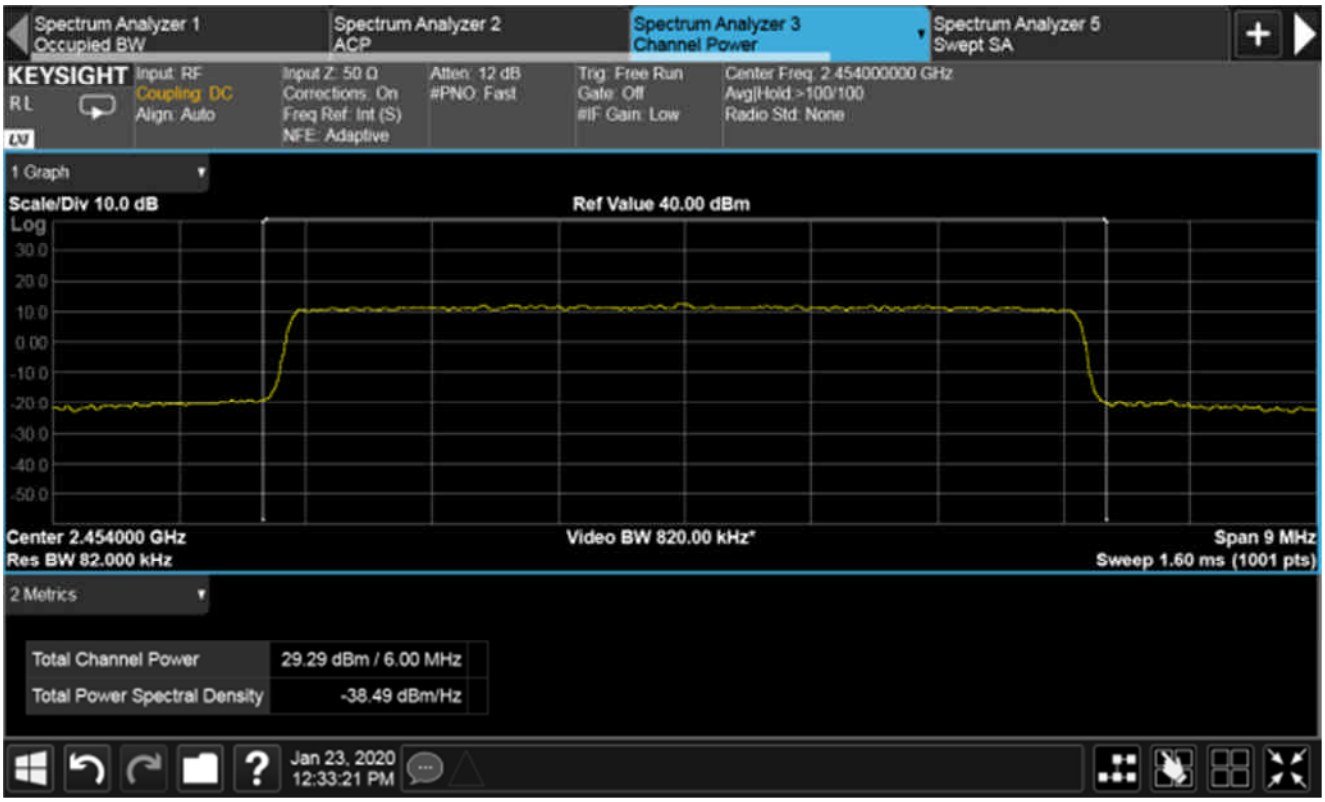


Mkr	Trace	X-Axis	Value	Notes
1 ▽	30 kHz RBW Measurement	2.4760 GHz	-23.76 dBm	
2 ▽	30 kHz RBW Measurement	2.4820 GHz	-24.57 dBm	

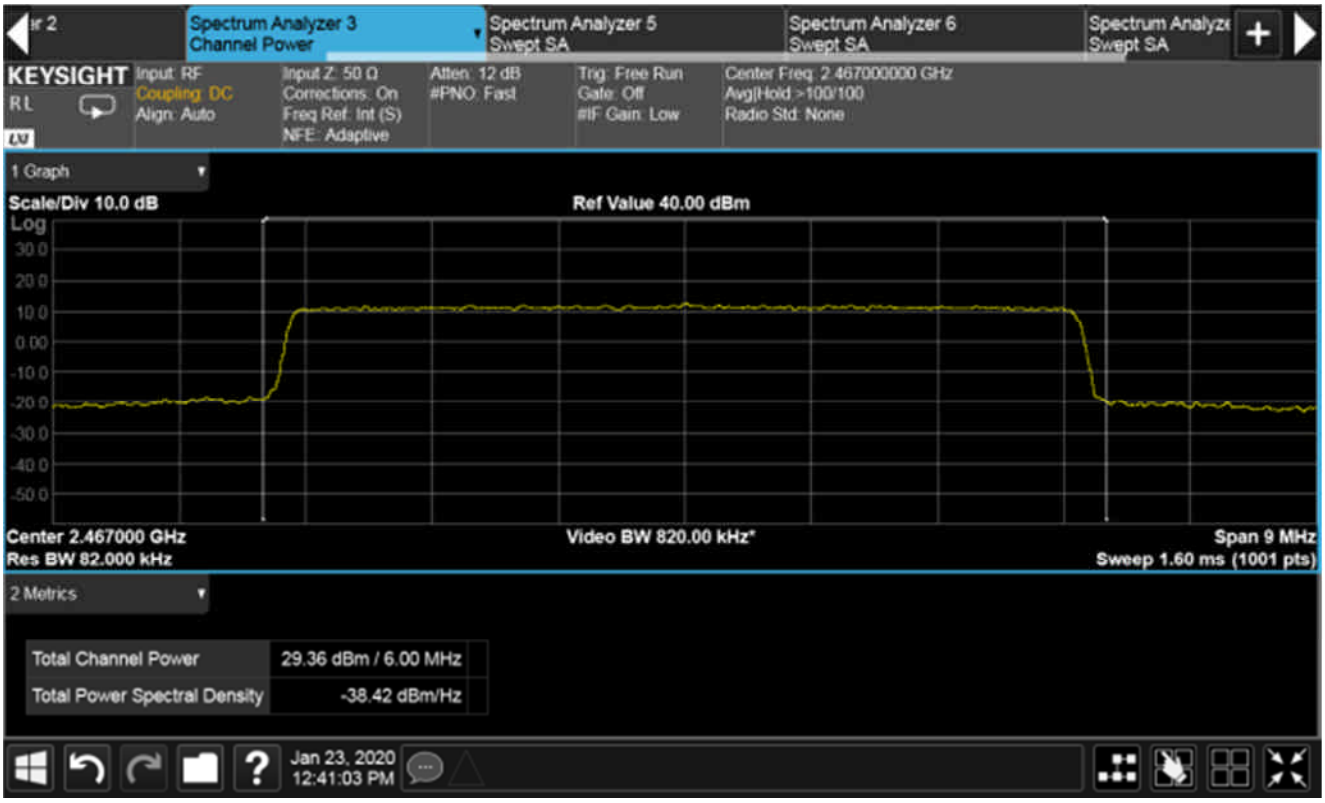
Nominal Temperature, Nominal Voltage high channel mask

6.4 Conducted Power

RF Parameters: Band 2450-2483.5 MHz, Power 29 dBm, Channel Spacing 6 MHz, Modulation COFDM, Channel 2454 MHz



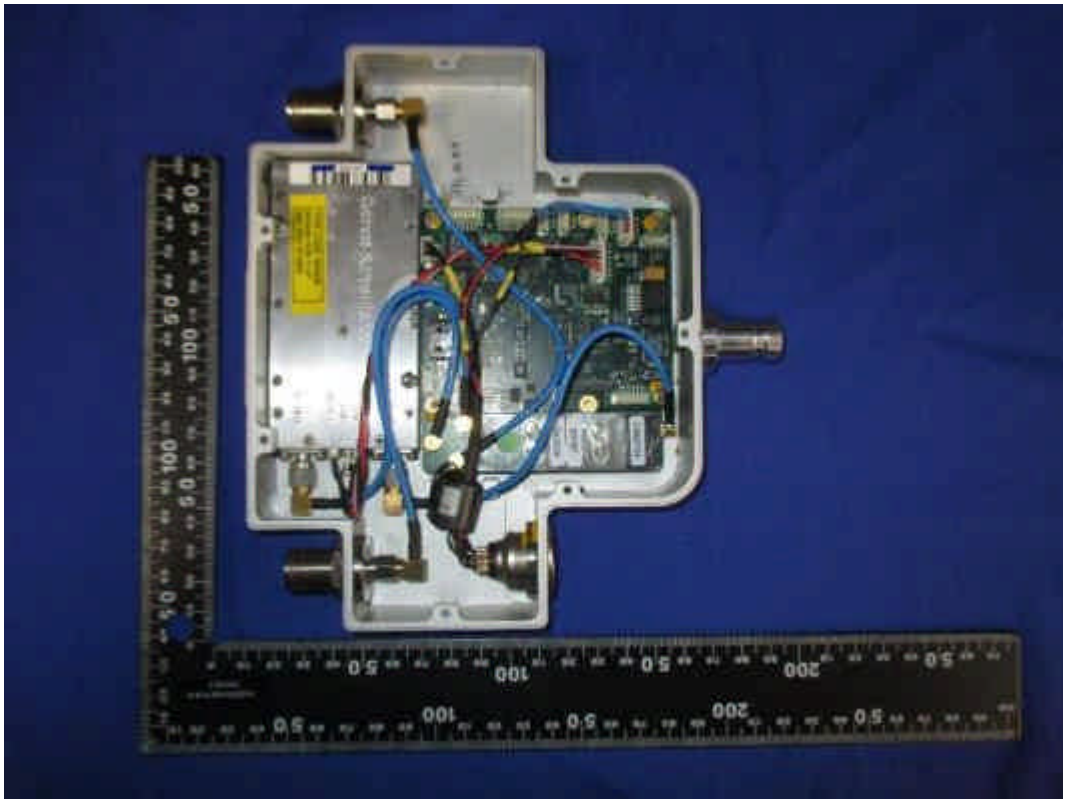
RF Parameters: Band 2450-2483.5 MHz, Power 29 dBm, Channel Spacing 6 MHz, Modulation COFDM, Channel 2467 MHz



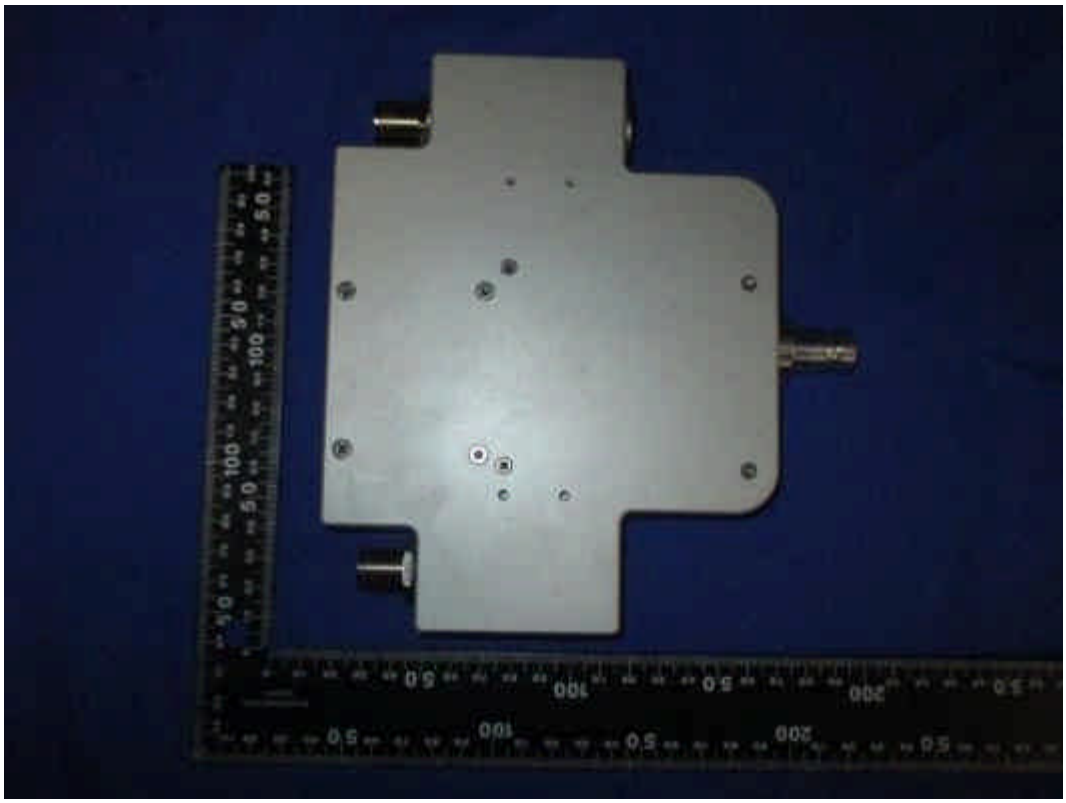
RF Parameters: Band 2450-2483.5 MHz, Power 29 dBm, Channel Spacing 6 MHz, Modulation COFDM, Channel 2479 MHz

7 Photographs

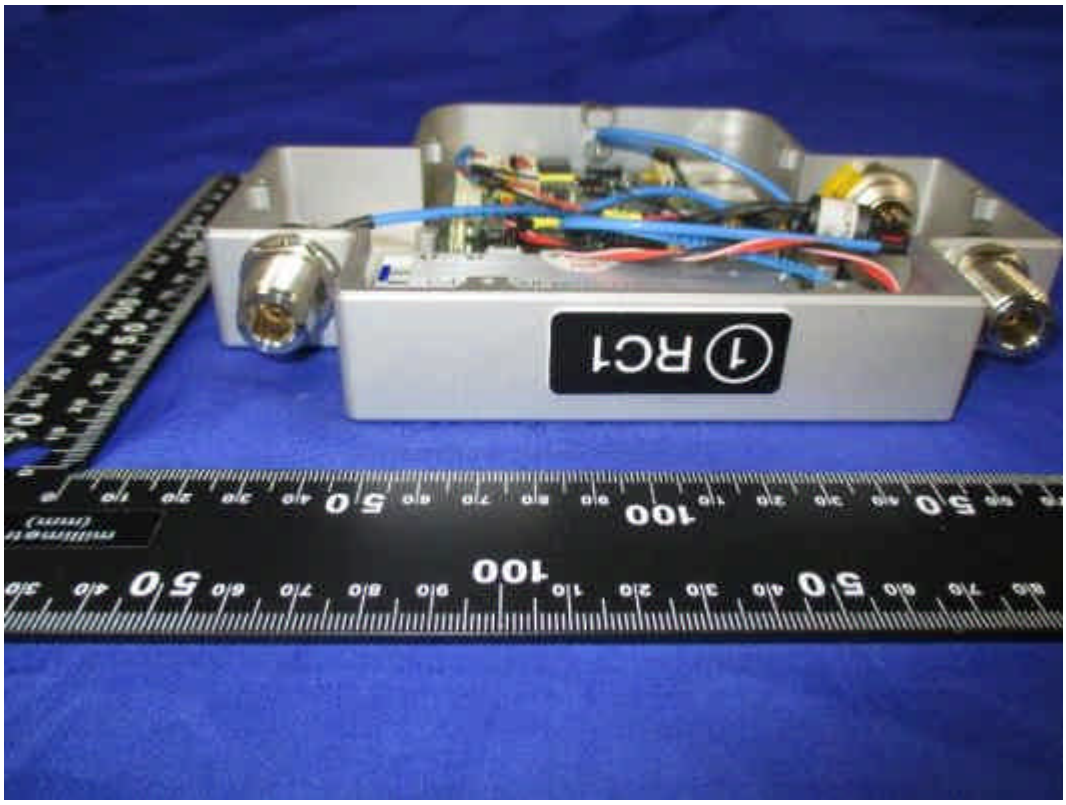
7.1 EUT Front View



7.2 EUT Reverse Angle



7.3 EUT Left side View



7.4 EUT Right side View

7.5 EUT Antenna Port

7.6 EUT Display & Controls

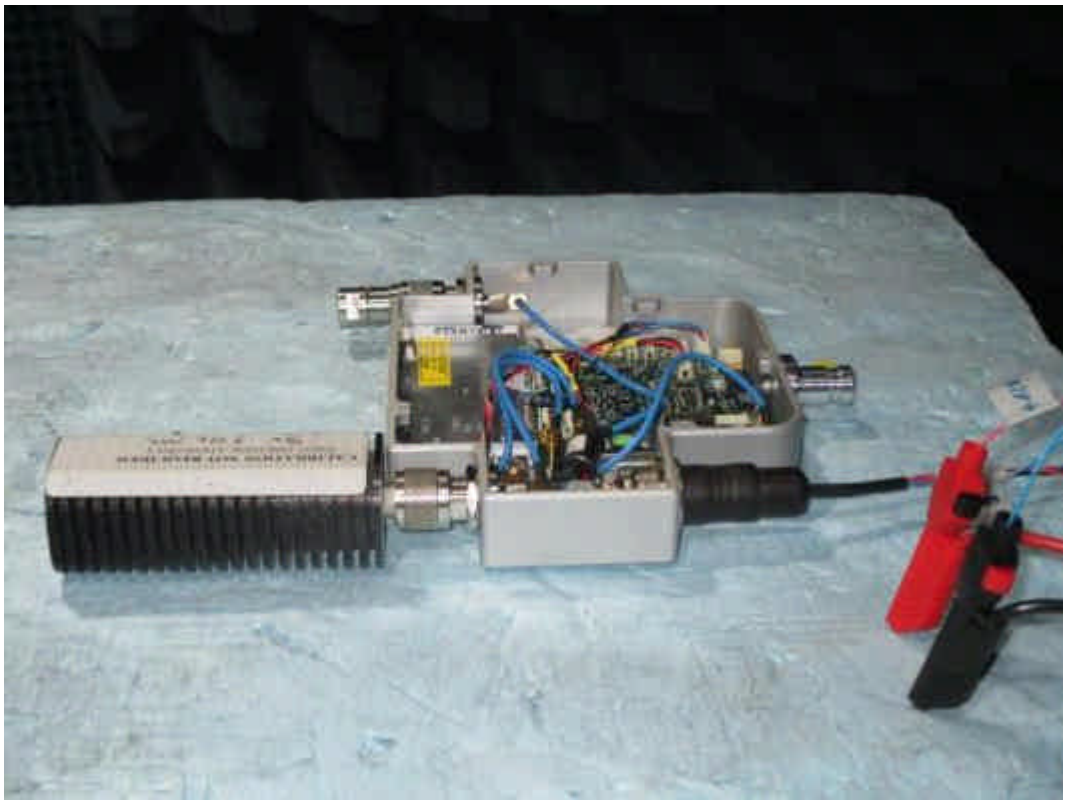
The unit does not have any displays or controls.

7.7 EUT Internal photos

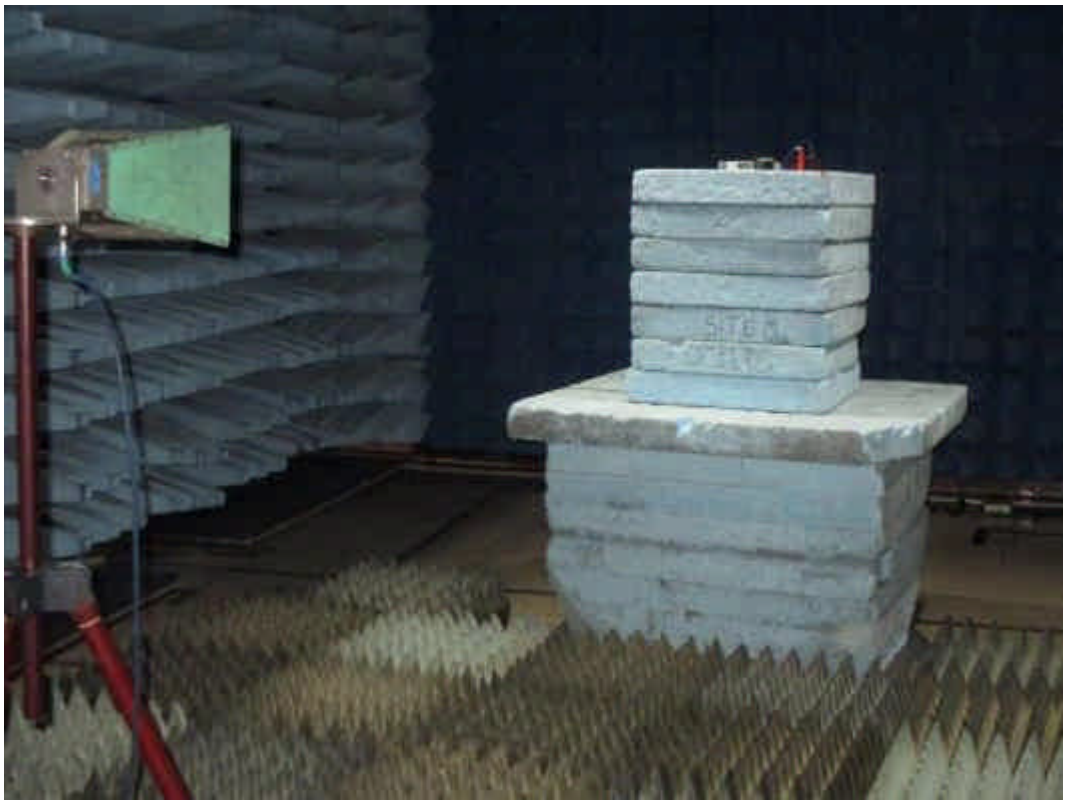
Photos not included at request of applicant.

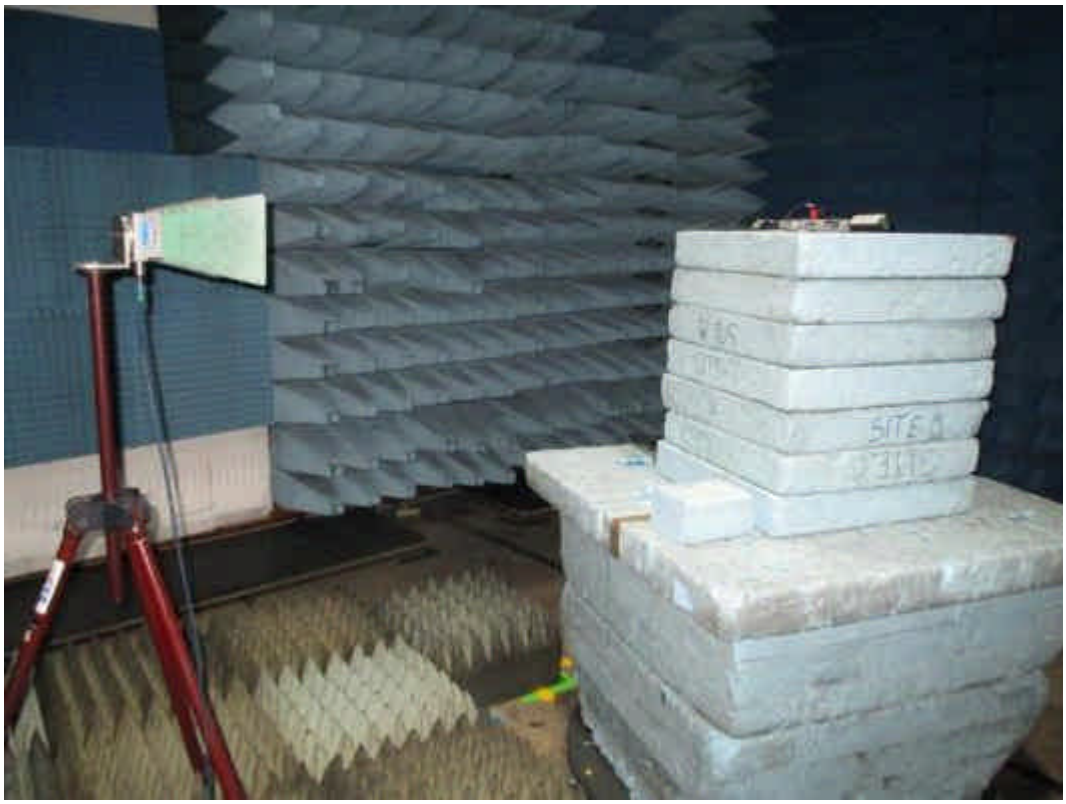
7.8 EUT ID Label

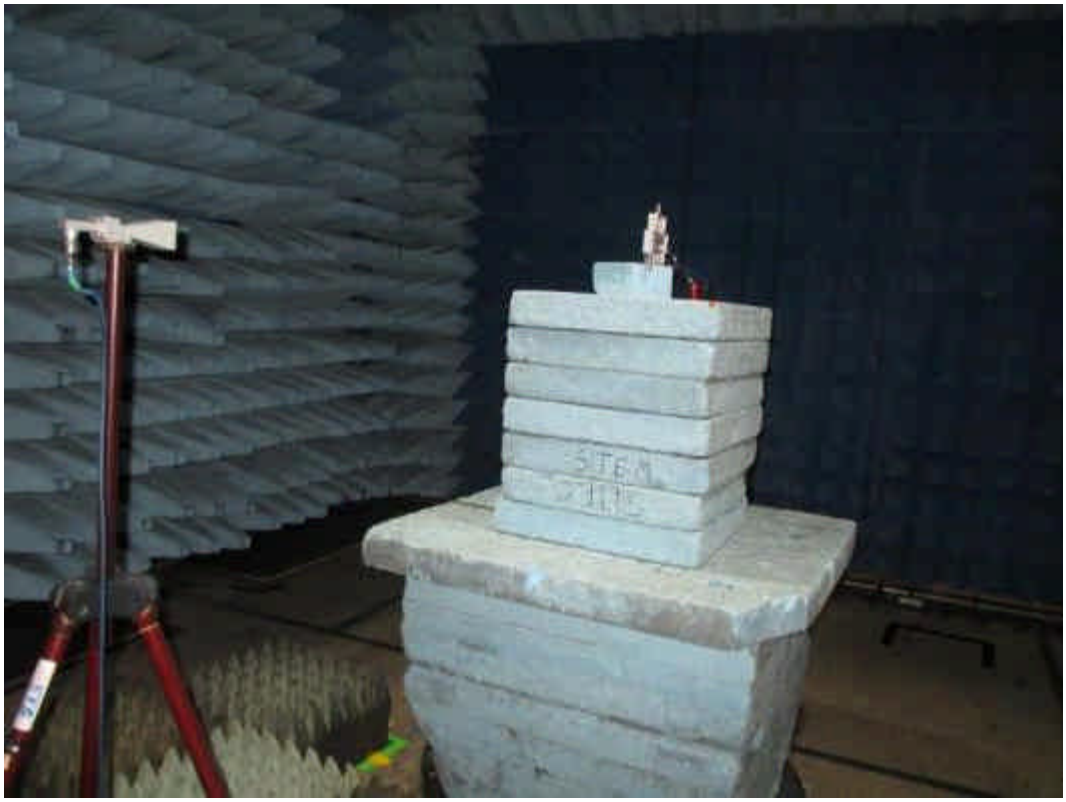
7.9 30-1000MHz Spurious emissions test set-up



7.10 Above 1GHz Spurious emissions test set-up







8 Test equipment calibration list

The following is a list of the test equipment used by R.N. Electronics Ltd to test the unit detailed within this report. In line with our procedures, the equipment was within calibration for the period during which testing was carried out.

RN No.	Model No.	Description	Manufacturer	Calibration date	Cal period
CAL07	MWX221	Cable N Type to SMA Blue 2m	Junflon	10-Jan-2020	6 months
E005	8447F	Pre-Amplifier 10MHz to 1000MHz	MCL Microwave+Mini-circuits	19-Jun-2019	12 months
E136	3105	Horn Antenna 1-12.5GHz	EMCO	27-Apr-2019	12 months
E268	BHA 9118	Horn Antenna 1-18GHz	Schaffner	27-Apr-2019	12 months
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	11-Jul-2019	12 months
E453	20240-20-AA	Horn Std Gain 17.6 - 26.7GHz	Flann (FMI)	26-Jul-2019	12 months
E454	18240-20	Horn Std Gain 11.9 - 18.0GHz	Flann (FMI)	24-Jul-2019	12 months
E602	MG3692A	Signal Generator 10MHz - 20GHz	Anritsu	04-Feb-2019	24 months
E624	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	10-Jan-2020	24 months
E743	2017 4/2dB	Attenuator 4/2dB 30-1000MHz	RN Electronics	11-Feb-2019	12 months
E755	N9030B	PXA 3Hz to 50GHz	Keysight Technologies	11-May-2019	12 months
E866	42N50A-30	Attenuator 18GHz 50W N-type	Anritsu	#30-Jan-2020	12 months
E874	M0del2-20	Attenuator N type 20dB 18GHz	Weinschel	06-Feb-2019	12 months
LPE364	CBL6112A	Antenna BiLog 30MHz - 2GHz	Chase Electronics Ltd	21-Mar-2018	24 months
P270	610-451	PSU 30V 2A	Thurlby	11-Apr-2019	12 months
TMS38	VMT04/140	Environmental Oven	Heraeus Votsch	N/A	N/A
TMS57	PM2534	Digital Multimeter	Philips	20-Mar-2019	24 months
TMS78	3160-08	Horn Std Gain 12.4-18 GHz	ETS Systems	24-Jul-2019	12 months
TMS80	206-3722	Digital Thermometer & K Probe	RS Components Ltd	20-Nov-2019	12 months
TMS814	MP627A	Antenna Doublet 200-1700 MHz	Anritsu	30-May-2019	12 months
TMS82	8449B	Pre-Amplifier 1GHz - 26.5GHz	Agilent Technologies	18-Dec-2019	12 months

Equipment was within calibration dates for tests and has been re-calibrated since date of tests.

9 Auxiliary and peripheral equipment

9 .1 Customer supplied equipment

No customer equipment was supplied.

9 .2 RN Electronics supplied equipment

RN No.	Model No.	Description	Manufacturer	Serial No
N484	GS605	5-Port Gigabit Ethernet Switch	Netgear	1FE1795S009BD
P270	610-451	PSU 30V 2A	Thurlby	35821
P281	L30-2	PSU 30V 2A	Farnell	3888

10 Condition of the equipment tested

In order for the EUT to produce the results shown within this report the following modifications, if any, were implemented.

10.1 Modifications before test

No modifications were made before test by RN Electronics Ltd.

10.2 Modifications during test

No modifications were made during test by RN Electronics Ltd.

11 Description of test sites

Site A Radio Laboratory and Anechoic Chamber

Site B Semi-Anechoic Chamber and Control Room
FCC Registration No. 293246
IC Registration No. 5612A-4

Site C Transient Laboratory

Site D Screened Room (Conducted Immunity)

Site E Screened Room (Control Room for Site D)

Site F Screened Room (Conducted Emissions)

Site G Screened Room (Control Room for Site H)

Site H 3m Semi-Anechoic Chamber (indoor OATS)
FCC Registration No. 293246
IC Registration No. 5612A-2

Site J Transient Laboratory

Site K Screened Room (Control Room for Site M)

Site M 3m Semi-Anechoic Chamber (indoor OATS)
FCC Registration No. 293246
IC Registration No. 5612A-3

Site N Radio Laboratory

Site Q Fully-Anechoic Chamber

Site OATS 3m and 10m Open Area Test Site
FCC Registration No. 293246
IC Registration No. 5612A-1

Site R Screened Room (Conducted Immunity)

Site S Safety Laboratory

Site T Transient Laboratory

12 Abbreviations and units

%	Percent
µA/m	microAmps per metre
µV	microVolts
µW	microWatts
AC	Alternating Current
ALSE	Absorber Lined Screened Enclosure
AM	Amplitude Modulation
Amb	Ambient
ATPC	Automatic Transmit Power Control
BER	Bit Error Rate
ºC	Degrees Celsius
C/I	Carrier / Interferer
CEPT	European Conference of Postal and Telecommunications Administrations
COFDM	Coherent OFDM
CS	Channel Spacing
CW	Continuous Wave
dB	deciBels
dBµA/m	deciBels relative to 1µA/m
dBµV	deciBels relative to 1µV
dBc	deciBels relative to Carrier
dBm	deciBels relative to 1mW
DC	Direct Current
DTA	Digital Transmission Analyser
EIRP	Equivalent Isotropic Radiated Power
ERP	Effective Radiated Power
EU	European Union
EUT	Equipment Under Test
FM	Frequency Modulation
FSK	Frequency Shift Keying
g	Grams
GHz	GigaHertz
Hz	Hertz
IF	Intermediate Frequency
kHz	kiloHertz
LBT	Listen Before Talk
LO	Local Oscillator
mA	milliAmps
max	maximum
kPa	Kilopascal
Mbit/s	MegaBits per second
MHz	MegaHertz
mic	Microphone
min	minimum
mm	milliMetres
ms	milliSeconds
mW	milliWatts
NA	Not Applicable
nom	Nominal
nW	nanoWatt
OATS	Open Area Test Site
OFDM	Orthogonal Frequency Division Multiplexing
ppm	Parts per million
PRBS	Pseudo Random Bit Sequence
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
R&TTE	Radio and Telecommunication Terminal Equipment
Ref	Reference
RF	Radio Frequency
RFC	Remote Frequency Control
RSL	Received Signal Level
RTP	Room Temperature and Pressure
RTPC	Remote Transmit Power Control
Rx	Receiver
s	Seconds
SINAD	Signal to Noise And Distortion
Tx	Transmitter
V	Volts