



EMI - TEST REPORT

- FCC Part 15.249, RSS210 -

Model Name : Me1550 (internal development name), RONDO 3
(market name), product codes: Me1550, Me1551,
Me1552, Me1553

Product Description : Single Unit Audio Processor for cochlear implant
system including a 2.4 GHz transceiver with integral
antenna

Applicant : MED-EL Elektromedizinische Geraete GmbH
Address : Fuerstenweg 77a
6020 INNSBRUCK, AUSTRIA

Manufacturer : MED-EL Elektromedizinische Geraete GmbH
Address : Fuerstenweg 77a
6020 INNSBRUCK, AUSTRIA

<p>Test Result according to the standards listed in clause 1 test standards:</p>	<p>POSITIVE</p>
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<p>Test Report No. : T45644-00-07SK</p>	<p>10. March 2020 <hr/> Date of issue</p>
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Deutsche
 Akkreditierungsstelle
 D-PL-12030-01-01
 D-PL-12030-01-02

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.



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ATTACHMENTS A, B as separate supplements



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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September, 2018)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (September, 2018)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.249	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz

ANSI C63.10: 2013 Testing Unlicensed Wireless Devices

ETSI TR 100 028 V1.3.1: 2001-03 Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the Measurement of Mobile Radio Equipment Characteristics—Part 1 and Part 2

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2 EQUIPMENT UNDER TEST

2.1 Information provided by the Client

Please note, we do not take any responsibility for information provided by the client or his representative which may have an influence on the validity of the test results.

2.2 Sampling

The customer is responsible for the choice of sample. Sample configuration, start-up and operation is carried out by the customer or according his/her instructions.

2.3 Photo documentation of the EUT – Detailed photos see Attachment A

2.4 Equipment category

2.4 GHz proprietary

2.5 Short description of the equipment under test (EUT)

The EUT is a single unit audio processor with a proprietary 2.4 GHz transceiver and an inductive link at 11.6 MHz. The Me1550 (internal development name) is a medical device similar to a hearing aid but is worn off the ear at a position slightly above and behind the ear. It converts acoustic signals and drives an implanted MED-EL cochlear implant which - based on the information from the audio processor - directly stimulates the acoustic nerve in the inner ear to evoke auditory sensations. The 2.4 GHz transceiver can receive commands from an external device and can transmit acknowledge messages to the latter.

Number of tested samples:	2
Serial number:	122 (radiated sample), 152 (conducted sample)
Firmware version:	1.0.1
Type:	Me1550

EUT configuration:

(The CDF filled by the applicant can be viewed at the test laboratory.)

2.6 Variants of the EUT

According to the manufacturer the sub variants Me1550, Me1551, Me1552, and Me1553 do not differ in hardware and/or firmware, they just differ in product code which are only introduced for marketing and sales purposes.

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2.7 Operation frequency and channel plan

The operating frequency is 2400 MHz to 2483.5 MHz.

Channel plan:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480
20	2442		

Note: the marked frequencies are determined for final testing.

2.8 Transmit operating modes

The EUT uses GFSK and provides following data rate:

2 Mbps (Mbps = Megabits per second)

The EUT was operated during the measurements under following conditions:

continuous TX

2.9 Antenna

The following antennas shall be used with the EUT:

Number	Characteristic	Model number	Plug	Frequency range (GHz)	Gain (dBi)
1	Monopole antenna	Taoglas FXP75.24.0033B.ku	-	2.4 - 2.5	2.5

2.10 Power supply system utilised

Power supply voltage, V_{nom} : 3.8 VDC (Li-Ion battery)
 alternative Power supply : 120 VAC, 60 Hz, 5.0 VDC (charging via cable)

2.11 Peripheral devices and interface cables

The following peripheral devices and interface cables are connected during the measurements:



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- Charging cable Model : #8, SN021915, MED-EL
- Switching Power Adaptor Model : UES06WNCPU-050100SPA, Ansmann AG

2.12 Determination of worst case conditions for final measurement

Measurements have been made in all three orthogonal axes and the settings of the EUT were changed to locate at which position and at what setting of the EUT produce the maximum of the emissions. For the further measurement the EUT is set in X position with the following settings:

The EUT uses GFSK and provides following data rate:
 2 Mbps (Mbps = Megabits per second)

The EUT was operated during the measurements under following conditions:

Standard	Available channels	Tested channels	Power setting	Modulation	Data rate
2.4 GHz proprietary	1 to 39	1, 20, 39	4 dBm	GFSK	2 Mbps

2.12.1 Test jig

No special test jig was used for testing.

2.12.2 Test software

The EUT provides a special test software which allows a TX continuous mode at a selected frequency.

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3 TEST RESULT SUMMARY

Operating in the 2400 MHz – 2483.5 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.35(c)	RSS-Gen, 8.2	Pulsed operation	passed
15.203	RSS-Gen, 6.8	Antenna requirement	passed
15.204	RSS-Gen, 8.3	External radio frequency power amplifiers	not applicable
15.205(a)	RSS-Gen, 8.10	Emissions in restricted bands	passed
15.207(a)	RSS-Gen, 8.8	AC power line conducted emissions	passed
15.215(c)	-	EBW	passed
-	RSS-Gen, 6.6	OBW	passed
15.249(a)	RSS-210, B10(a)	Field strength of fundamental	passed
15.249(d)	RSS-210, B10(b)	Out-of-band emission, radiated	passed
-	RSS-Gen, 8.11	Transmitter frequency stability	not applicable

The mentioned RSS Rule Parts in the above table are related to:
 RSS-Gen, Issue 5, March 2019, Amendment 1
 RSS-210, Issue 10, December 2019

3.1 Final assessment

The equipment under test fulfills the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 07 January 2020

Testing concluded on : 04 February 2020

Checked by:

Tested by:

 Klaus Gegenfurtner
 Teamleader Radio

 Sabine Kugler
 Radio Team



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4 TEST ENVIRONMENT

4.1 Address of the test laboratory

CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor $k = 2$. The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 / 2011 + A1 / 2014 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Measurement Type	Range	Confidence Level	Calculated Uncertainty
AC power line conducted emissions	0.15 MHz to 30 MHz	95%	± 3.29 dB
EBW and OBW	2400 MHz to 30000 MHz	95%	$\pm 2.5 \times 10^{-7}$
Output power ERP, radiated	1000 MHz to 7000 MHz	95%	± 2.71 dB
Field strength of the fundamental	1000 MHz to 7000 MHz	95%	± 2.71 dB
Power spectral density	2400 MHz to 3000 MHz	95%	± 0.62 dB
Spurious Emissions, conducted	9 kHz to 10000 MHz	95%	± 2.15 dB
Spurious Emissions, conducted	10000 MHz to 40000 MHz	95%	± 3.47 dB
Spurious Emissions, radiated	9 kHz to 30 MHz	95%	± 3.53 dB
Spurious Emissions, radiated	30 MHz to 1000 MHz	95%	± 4.44 dB
Spurious Emissions, radiated	1000 MHz to 30000 MHz	95%	± 2.34 dB
Spurious Emissions, radiated	30000 MHz to 40000 MHz	95%	± 5.13 dB



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4.1 Conformity Decision Rule

The conformity decision rule is based on the ILAC G8 published at the time of reporting.

4.2 Measurement protocol for FCC and ISED

4.2.1 General information

CSA Group Bayern GmbH is recognized as wireless testing laboratory under the CAB identifier:

FCC: DE 0011
ISED: DE0009

4.2.2 General Standard information

The test methods used comply with ANSI C63.10 - "Testing Unlicensed Wireless Devices".

4.2.2.1 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.2.2.2 Radiated emission (electrical field 30 MHz - 1 GHz)

Spurious emissions from the EUT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarised antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is established in accordance with ANSI C63.10. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion so that they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area. The antenna is positioned 3, 10 or 30 metres horizontally from the EUT and is repeated vertically. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 metres and the EUT is rotated 360 degrees. The final level in dBµV/m is calculated by taking the reading from the EMI receiver (Level dBµV) and adding the correction factors and cable loss factor (dB). The FCC or CISPR limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

The resolution bandwidth setting:
 30 MHz – 1000 MHz: RBW: 120 kHz

Example:

Frequency	Level	+	Factor	=	Level	-	CISPR Limit	=
Delta								
(MHz)	(dBµV)		(dB)		(dBµV/m)		(dBµV/m)	(dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	= -2.4

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4.2.2.3 Radiated emission (electrical field 1 GHz - 40 GHz)

Radiated emissions from the EUT are measured in the frequency range 1 GHz up to the maximum frequency as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table, 1.5 metre above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is following set out in ANSI C63.10. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to max peak detector function and a resolution 1 MHz and video bandwidth 3 MHz for peak measurement. The conditions determined as worst case will then be used for the final measurements. When the EUT is larger than the beam width of the measuring antenna it will be moved over the surface for the four sides of the equipment. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty and are calculated at the specified test distance.

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5 TEST CONDITIONS AND RESULTS

5.1 AC power line conducted emissions

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up

For detailed photos of the test set-up see Attachment B.

5.1.3 Applicable standard

According to FCC Part 15, Section 15.207(a):

Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the given limits.

5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.10 described under item 4.4.3. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin -1.0 dB at 11.481 MHz

Limit according to FCC Part 15, Section 15.207(a):

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

The requirements are **FULFILLED**.

Remarks: For detailed test result please refer to following test protocols.

Inductive link works at 11.6 MHz, no RX mode possible.

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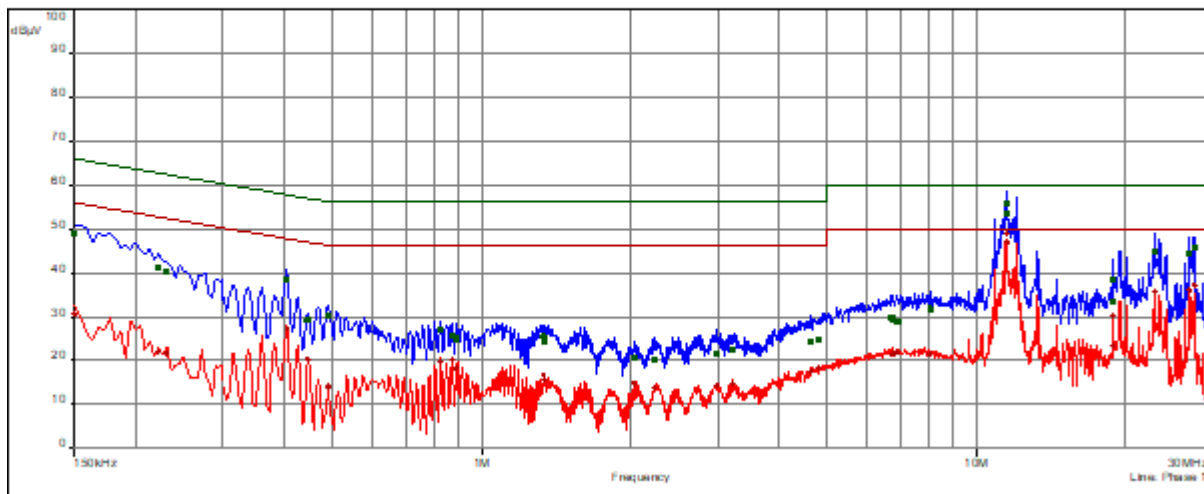
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5.1.6 Test protocol

Test point: L1
 Operation mode: TX continuous
 Remarks: None

Result: passed

- FCC/FCC Part 15C (15.207) B - Average/
- FCC/FCC Part 15C (15.207) B - Q/Peak/
- Max. Peak (Phase 1)
- Max. CSRR AVG (Phase 1)
- Quad/Peak (Phase 1)
- CSRR AV (Phase 1)



FCC/FCC Part 15C (15.207) B

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(μV)	dB	dB	dB(μV)	dB	dB		dB
0.150	1	48.8	-17.2	66.0	30.6	-25.4	56.0	Phase 1	10.1
0.222	1	41.4	-21.4	62.7	22.0	-30.7	52.7	Phase 1	10.1
0.231	1	40.2	-22.2	62.4	21.6	-30.8	52.4	Phase 1	10.1
0.404	2	38.4	-19.4	57.8	27.2	-20.6	47.8	Phase 1	10.2
0.444	2	29.3	-27.7	57.0	20.3	-26.7	47.0	Phase 1	10.2
0.489	2	30.3	-25.9	56.2	14.0	-32.2	46.2	Phase 1	10.2
0.825	3	27.0	-29.0	56.0	19.7	-26.3	46.0	Phase 1	10.2
0.870	3	25.8	-30.2	56.0	20.2	-25.9	46.0	Phase 1	10.2
0.888	3	25.0	-31.0	56.0	18.3	-27.8	46.0	Phase 1	10.2
1.335	4	25.4	-30.6	56.0	16.9	-29.1	46.0	Phase 1	10.3
1.340	4	24.1	-31.9	56.0	15.8	-30.3	46.0	Phase 1	10.3
2.033	4	20.6	-35.4	56.0	14.8	-31.2	46.0	Phase 1	10.3
2.235	4	20.4	-35.6	56.0	13.9	-32.1	46.0	Phase 1	10.3
2.990	5	21.5	-34.6	56.0	14.4	-31.6	46.0	Phase 1	10.4
3.215	5	22.5	-33.6	56.0	14.8	-31.2	46.0	Phase 1	10.4
4.637	5	24.4	-31.6	56.0	17.5	-28.5	46.0	Phase 1	10.4
4.799	5	24.8	-31.2	56.0	18.3	-27.7	46.0	Phase 1	10.4
6.749	6	29.8	-30.2	60.0	21.4	-28.6	50.0	Phase 1	10.6
6.780	6	29.3	-30.7	60.0	21.5	-28.5	50.0	Phase 1	10.6
6.933	6	29.0	-31.0	60.0	22.0	-28.0	50.0	Phase 1	10.6
8.063	6	31.8	-28.2	60.0	21.4	-28.6	50.0	Phase 1	10.7
11.481	7	55.9	-4.1	60.0	49.0	-1.0	50.0	Phase 1	10.9
11.540	7	53.5	-6.5	60.0	46.9	-3.1	50.0	Phase 1	10.9
18.870	7	33.5	-26.5	60.0	23.3	-26.7	50.0	Phase 1	11.4
18.879	7	38.6	-21.4	60.0	30.2	-19.8	50.0	Phase 1	11.4
22.967	8	44.8	-15.2	60.0	35.7	-14.3	50.0	Phase 1	11.6
22.971	8	45.0	-15.0	60.0	35.7	-14.3	50.0	Phase 1	11.6
26.967	8	44.4	-15.6	60.0	36.2	-13.9	50.0	Phase 1	11.7
27.570	8	45.9	-14.1	60.0	37.2	-12.8	50.0	Phase 1	11.7



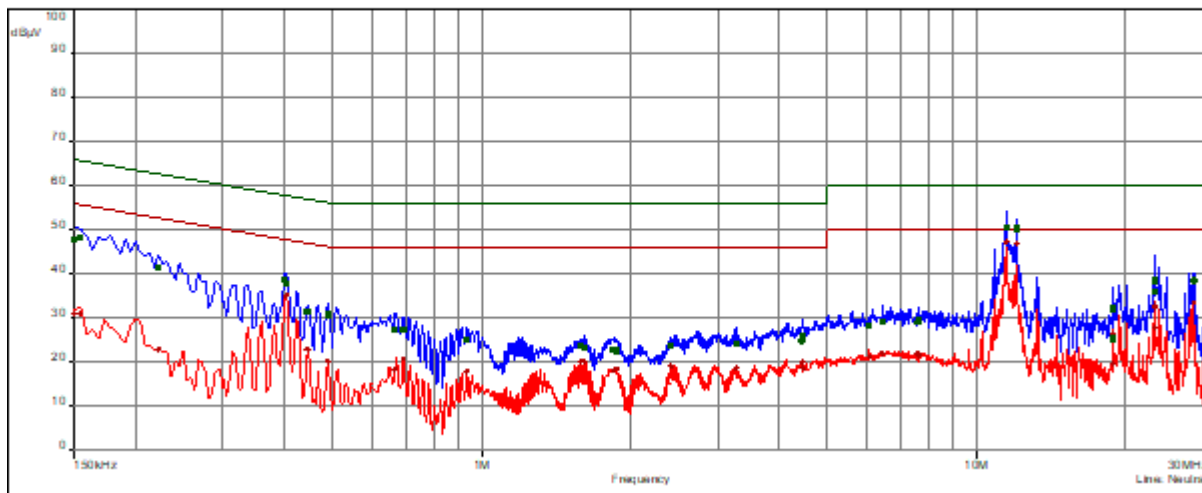
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Test point: N
 Operation mode: TX continuous
 Remarks: None

Result: passed

- FCC/CC Part 15C (15.207) B - Average/
- FCC/CC Part 15C (15.207) B - Q/Peak/
- Max/Peak (Neutral)
- Max. CISPR AVG (Neutral)
- QuasiPeak (Fmax) (Neutral)
- CISPR AV (Fmax) (Neutral)



FCC/CC Part 15C (15.207) B

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(μV)	dB	dB	dB(μV)	dB	dB		dB
0.150	9	48.0	-18.0	66.0	31.0	-25.0	56.0	Neutral	10.1
0.155	9	48.3	-17.5	65.8	31.0	-24.7	55.8	Neutral	10.1
0.222	9	41.3	-21.4	62.7	23.0	-29.7	52.7	Neutral	10.1
0.399	10	38.6	-19.3	57.9	34.8	-13.0	47.9	Neutral	10.2
0.404	10	37.8	-20.0	57.8	35.3	-12.4	47.8	Neutral	10.2
0.444	10	31.4	-25.6	57.0	22.8	-24.2	47.0	Neutral	10.2
0.489	10	30.7	-25.5	56.2	20.2	-26.0	46.2	Neutral	10.2
0.668	11	27.4	-28.6	56.0	18.3	-27.7	46.0	Neutral	10.2
0.695	11	27.4	-28.6	56.0	20.7	-25.3	46.0	Neutral	10.2
0.933	11	25.0	-31.0	56.0	17.9	-28.1	46.0	Neutral	10.2
1.583	12	23.8	-32.2	56.0	20.2	-25.8	46.0	Neutral	10.3
1.605	12	23.4	-32.6	56.0	20.1	-25.9	46.0	Neutral	10.3
1.848	12	22.8	-33.2	56.0	18.2	-27.8	46.0	Neutral	10.3
1.875	12	22.6	-33.4	56.0	18.5	-27.5	46.0	Neutral	10.3
2.409	13	23.9	-32.1	56.0	19.0	-27.0	46.0	Neutral	10.3
3.273	13	24.3	-31.7	56.0	18.5	-27.5	46.0	Neutral	10.4
4.434	13	24.9	-31.1	56.0	20.0	-26.0	46.0	Neutral	10.4
4.452	13	25.8	-30.2	56.0	18.5	-27.5	46.0	Neutral	10.4
6.078	14	28.3	-31.7	60.0	21.3	-28.7	50.0	Neutral	10.5
6.456	14	29.2	-30.8	60.0	22.1	-27.9	50.0	Neutral	10.5
7.617	14	29.0	-31.0	60.0	21.9	-28.1	50.0	Neutral	10.6
7.640	14	29.6	-30.4	60.0	21.5	-28.5	50.0	Neutral	10.6
11.481	15	50.7	-9.3	60.0	47.2	-2.8	50.0	Neutral	10.8
12.084	15	50.3	-9.7	60.0	46.8	-3.2	50.0	Neutral	10.8
18.875	15	32.1	-27.9	60.0	26.5	-23.5	50.0	Neutral	11.2
18.888	15	25.4	-34.6	60.0	19.6	-30.4	50.0	Neutral	11.2
22.953	16	35.9	-24.1	60.0	27.7	-22.3	50.0	Neutral	11.3
22.967	16	38.5	-21.5	60.0	32.6	-17.4	50.0	Neutral	11.3
27.561	16	38.5	-21.5	60.0	33.5	-16.5	50.0	Neutral	11.2

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5.2 Field strength of fundamental

For test instruments and accessories used see section 6 Part **CPR 3**.

5.2.1 Description of the test location

Test location: Anechoic chamber 1
Test distance: 3 m

5.2.2 Photo documentation of the test set-up

For detailed photos of the test set-up see Attachment B.

5.2.3 Applicable standard

According to FCC Part 15C, Section 15.249(a):

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the effective limits.

5.2.4 Description of Measurement

The radiated emission of the fundamental wave from the EUT is measured using a spectrum analyser and appropriate linear polarized antennas. The setup of the EUT and the measurement procedure is in accordance to ANSI C63.10, Item 6.5. The EUT is measured in TX continuous mode unmodulated under normal conditions.

Analyser settings:

Peak measurement: RBW: 3 MHz VBW: 10 MHz Detector: Max peak

5.2.5 Test result

Frequency (MHz)	Level PK dB(μ V/m)	Limit PK dB(μ V/m)	Margin PK (dB)	Polarisation	Orientation EUT	Limit AV dB(μ V/m)
2404	89.8	114.0	-24.2	H	X	94.0
2442	87.6	114.0	-26.4	V	Y	94.0
2480	85.6	114.0	-28.4	V	Z	94.0

Note: Average measurement not conducted because measured peak fieldstrength below average limit.



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Average-Limit according to FCC Part 15C, Section 15.249(a):

Frequency (MHz)	Field strength of fundamental	
	(mV/m)	dB(μ V/m)
902 - 928	50	94
2400 - 2483.5	50	94
5725-5875	50	94
24000 - 24250	250	108

Peak-Limit according to FCC Part 15C, Section 15.249(e):

However the peak fieldstrength shall not exceed the maximum permitted average limit by more than 20 dB.

The requirements are **FULFILLED**.Remarks: None

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.



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5.3 Out-of-band emission, radiated

For test instruments and accessories used see section 6 Part **SER1**, **SER 2**, **SER 3**.

5.3.1 Description of the test location

Test location: OATS 1
 Test location: Anechoic chamber 1
 Test distance: 3 m

5.3.2 Photo documentation of the test set-up

For detailed photos of the test set-up see Attachment B.

5.3.3 Applicable standard

According to FCC Part 15C, Section 15.249 (d):

Emission radiated outside of the specified frequency bands, except harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated limit in FCC Part 15C, Section 15.209, whichever is the lesser attenuation.

5.3.4 Description of Measurement

The radiated emissions from the EUT are measured in the frequency range of 9 kHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. The setup of the EUT and the measurement procedure is in accordance to ANSI C63.10, Item 6.3. In the frequency range above 1 GHz a spectrum analyser is used with appropriate linear polarized antennas. If the emission level in peak mode complies with the average limit testing is stopped and peak values will be reported, otherwise, the emission is measured in average mode again and reported. The EUT is measured in TX continuous mode unmodulated under normal conditions.

Instrument settings:

9 kHz – 150 kHz RBW: 200 Hz
 150 kHz - 30 MHz RBW: 9 kHz
 30 MHz – 1000 MHz: RBW: 120 kHz
 1000 MHz – 25 GHz RBW: 1 MHz

5.3.5 Test result f < 30 MHz

Frequency (MHz)	Reading PK dB(μA/m)	Reading PK dB(μV/m)	D factor dB(μV/m)	Level PK dB(μV/m)	Limit AV dB(μV/m)	Delta (dB)
0.47	-18.9	32.1	-80.0	-47.9	14.2	-62.1
11.62	2.9	53.9	-40.0	13.9	29.5	-15.6
23.24	-3.2	47.8	-40.0	7.8	29.5	-21.7

Note: The measurement results from distance 3 m are extrapolated (D factor) to the specified distance.



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5.3.6 Test result 30 MHz < f < 1 GHz

2404 MHz

Frequency (MHz)	Reading Vert. (dB μ V)	Reading Hor. (dB μ V)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dB μ V/m)	Level Hor. (dB μ V/m)	Limit (dB μ V/m)	Dlimit (dB)
77.43	1.7	4.0	11.0	11.4	12.7	15.4	40.0	-24.6
83.94	2.3	10.2	10.4	10.2	12.7	20.4	40.0	-19.6
119.53	3.0	1.7	13.6	13.1	16.6	14.8	43.5	-26.9
262.47	-1.9	1.6	15.3	15.3	13.4	16.9	46.0	-29.1
457.17	-3.5	-3.3	20.8	21.1	17.3	17.8	46.0	-28.2
765.90	-3.0	-3.0	26.5	27.1	23.5	24.1	46.0	-21.9

2442 MHz

Frequency (MHz)	Reading Vert. (dB μ V)	Reading Hor. (dB μ V)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dB μ V/m)	Level Hor. (dB μ V/m)	Limit (dB μ V/m)	Dlimit (dB)
77.43	1.1	3.9	11.0	11.4	12.1	15.3	40.0	-24.7
83.94	4.9	10.9	10.4	10.2	15.3	21.1	40.0	-18.9
119.53	3.1	1.6	13.6	13.1	16.7	14.7	43.5	-26.8
262.47	-2.2	1.4	15.3	15.3	13.1	16.7	46.0	-29.3
457.17	-3.3	-3.3	20.8	21.1	17.5	17.8	46.0	-28.2
765.90	-3.0	-2.9	26.5	27.1	23.5	24.2	46.0	-21.8

2480 MHz

Frequency (MHz)	Reading Vert. (dB μ V)	Reading Hor. (dB μ V)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dB μ V/m)	Level Hor. (dB μ V/m)	Limit (dB μ V/m)	Dlimit (dB)
77.43	1.2	3.7	11.0	11.4	12.2	15.1	40.0	-24.9
83.94	4.6	10.3	10.4	10.2	15.0	20.5	40.0	-19.5
119.53	3.0	1.7	13.6	13.1	16.6	14.8	43.5	-26.9
262.47	-1.7	1.4	15.3	15.3	13.6	16.7	46.0	-29.3
457.17	-3.4	-3.3	20.8	21.1	17.4	17.8	46.0	-28.2
765.90	-3.1	-3.0	26.5	27.1	23.4	24.1	46.0	-21.9

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

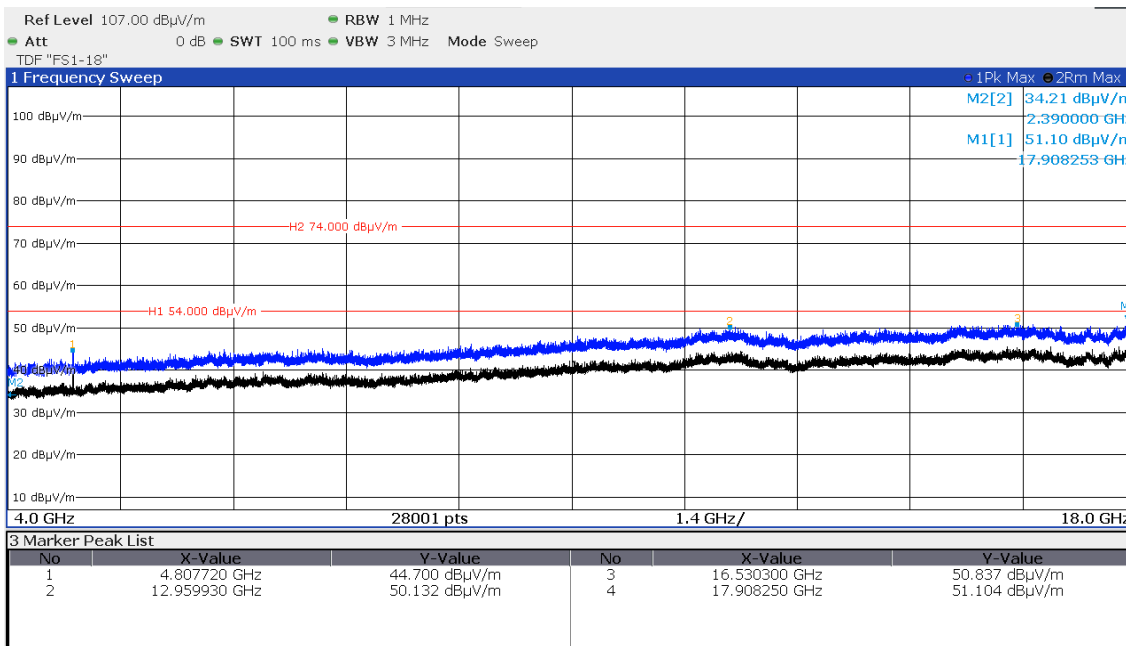
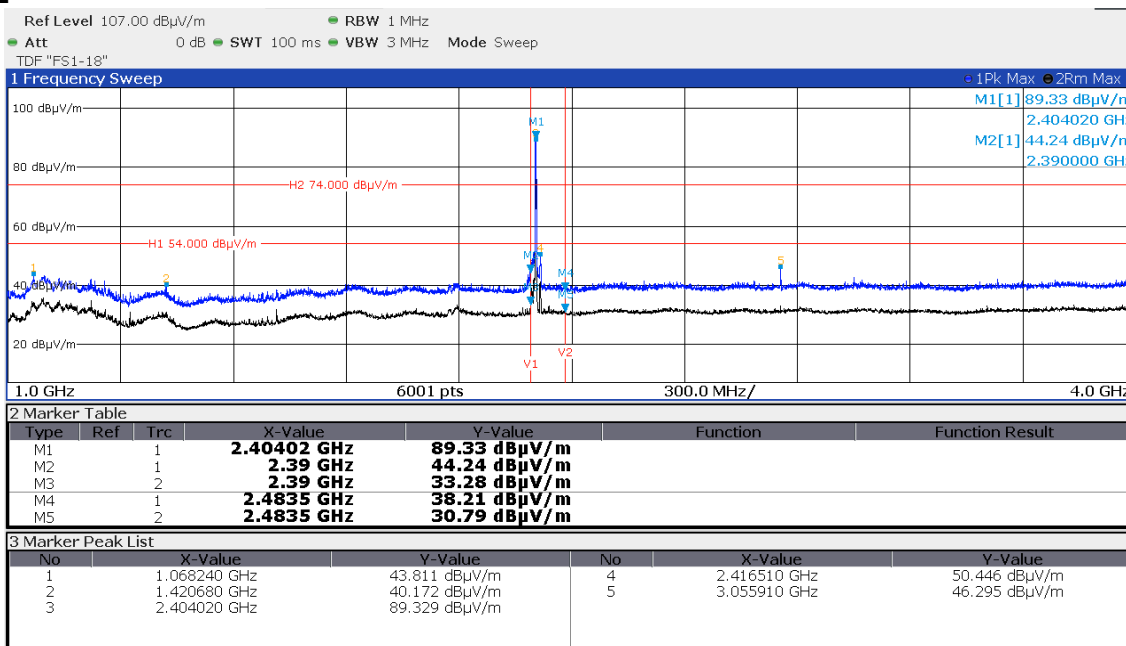


FCC ID: VNP-Me1550

IC: 11986A-Me1550

5.3.7 Test result f > 1 GHz

2404 MHz

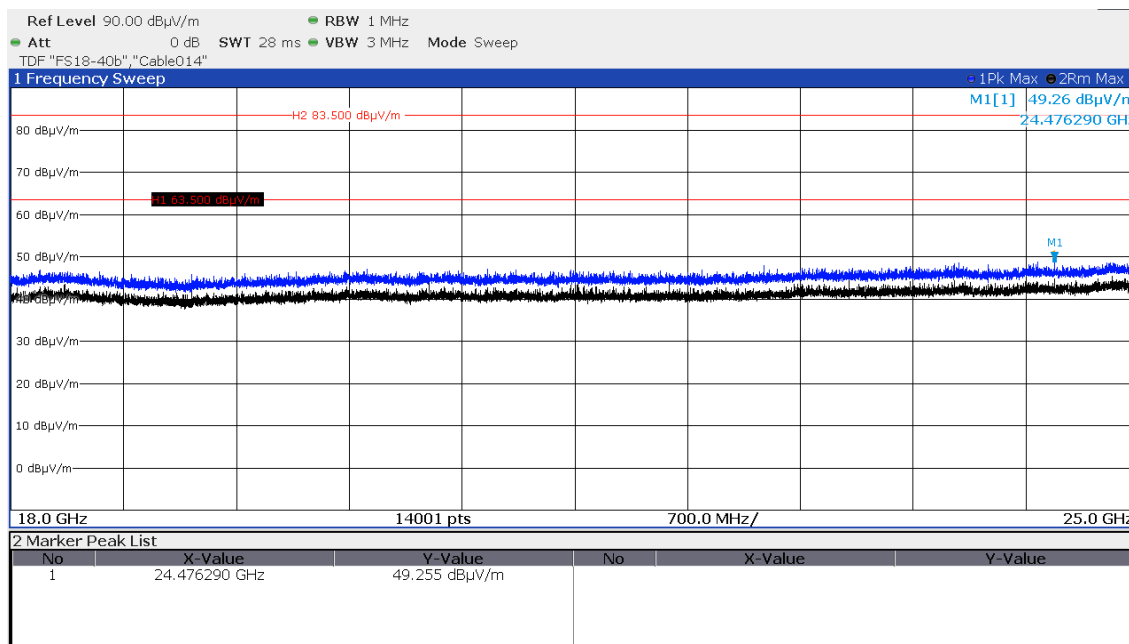


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.



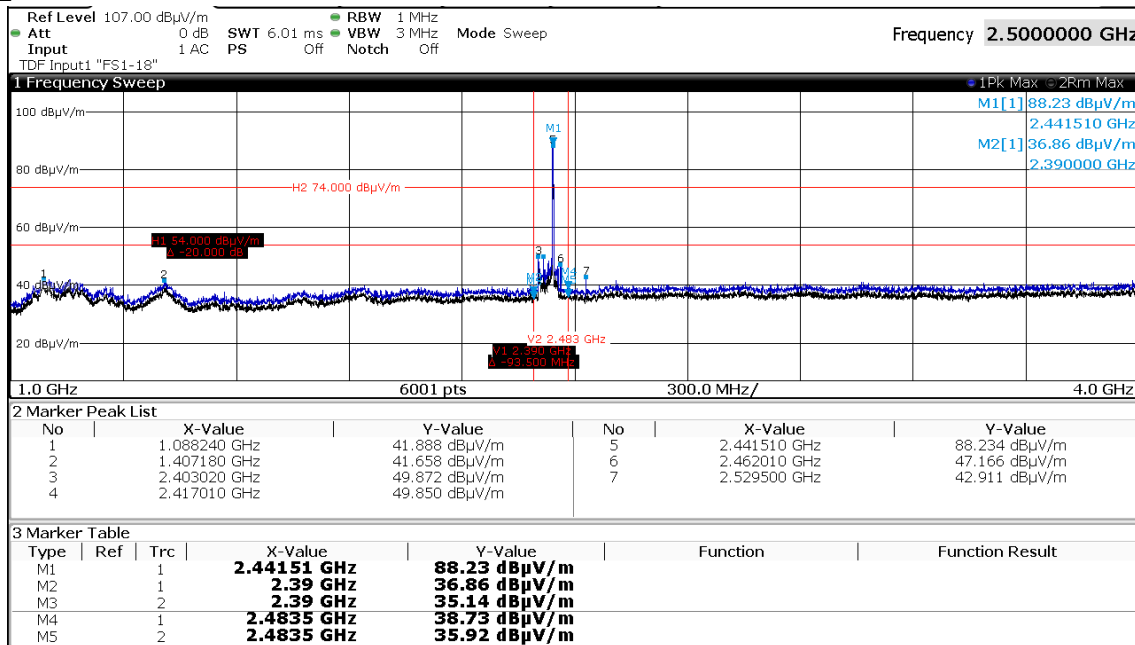
FCC ID: VNP-Me1550

IC: 11986A-Me1550



Note: The measurement distance for 18 - 25 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

2442 MHz

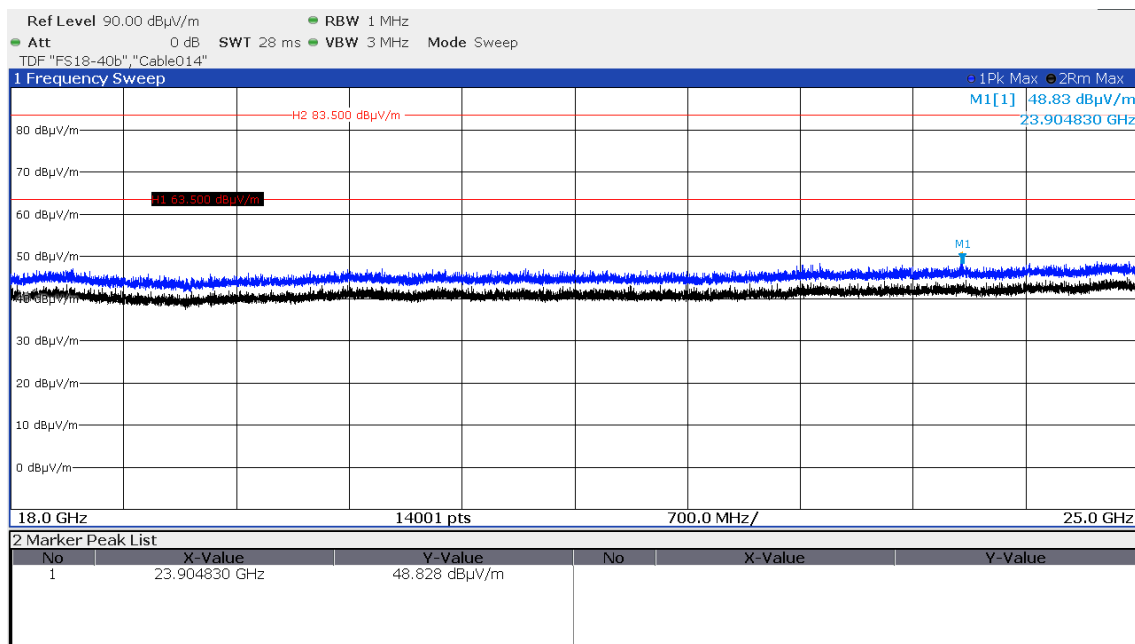
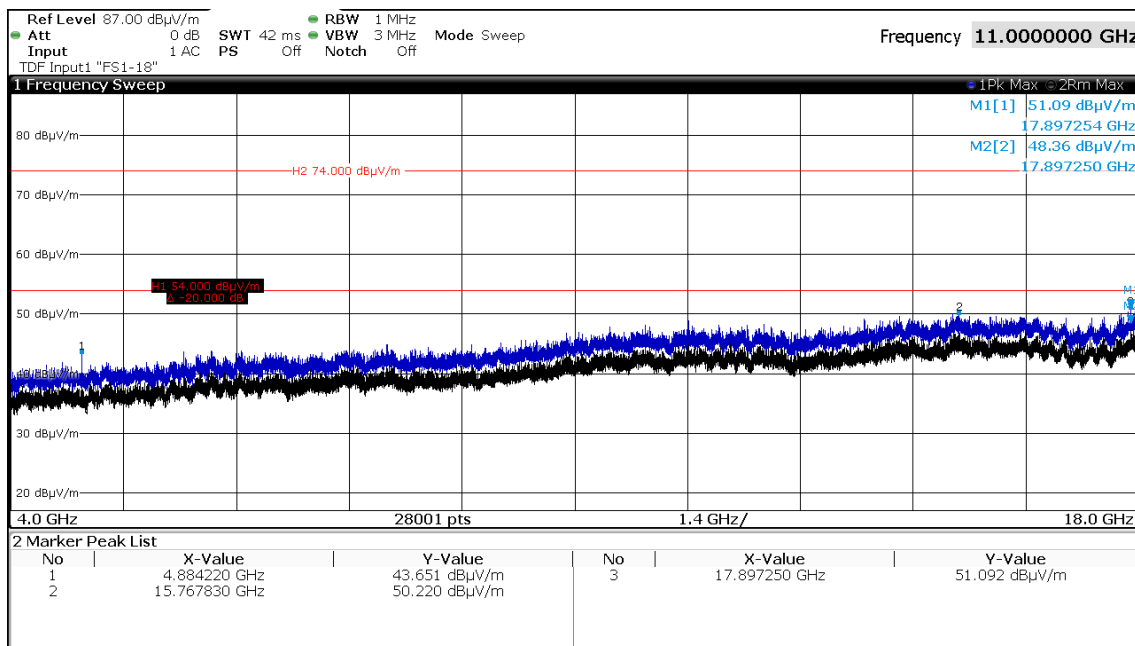


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.



FCC ID: VNP-Me1550

IC: 11986A-Me1550



Note: The measurement distance for 18 - 25 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

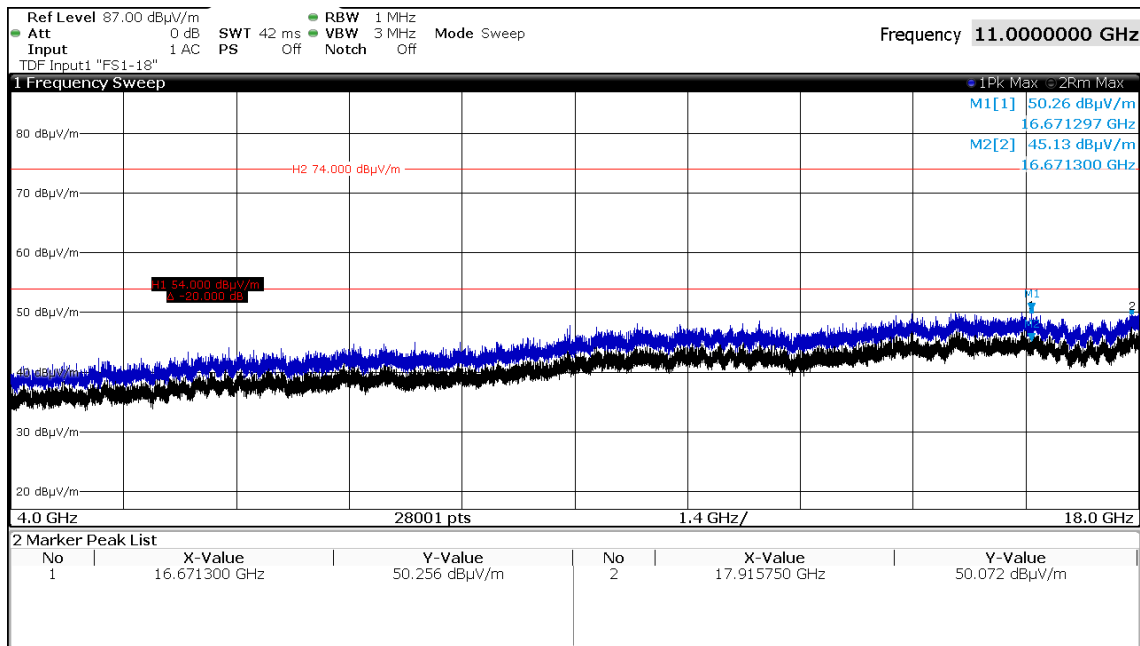
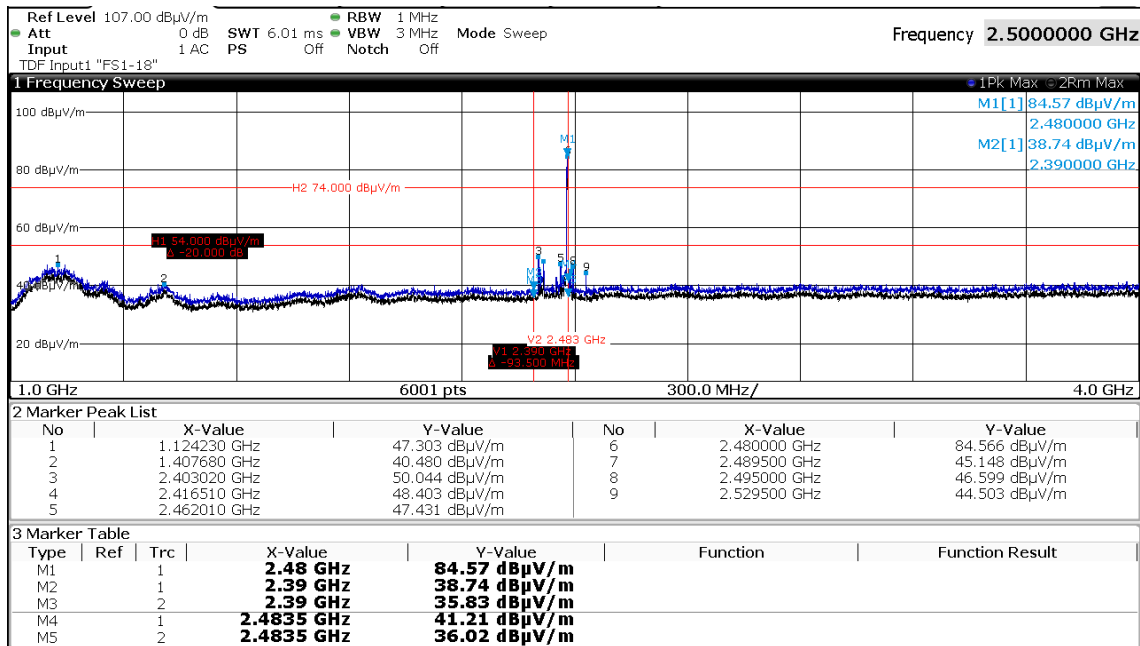
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.



FCC ID: VNP-Me1550

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2480 MHz

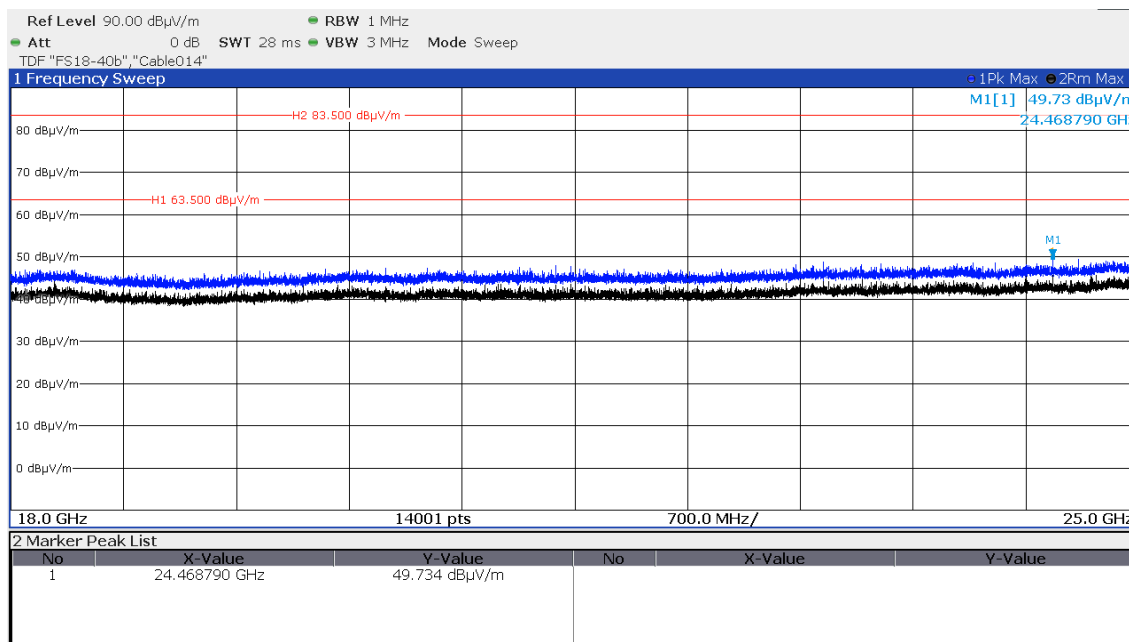


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.



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IC: 11986A-Me1550



Note: The measurement distance for 18 - 25 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

Limit according to FCC Part 15C, Section 15.209:

Frequency (MHz)	15.209 Limits (µV/m)	Measurement distance (m)
0.009 - -0.49	2400/f(kHz)	300
0.49 – 1.705	24000/f(kHz)	30
1.705 – 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Average limit according to FCC Part 15C, Section 15.249(a):

Fundamental frequency (MHz)	Field strength of harmonics	
	(µV/m)	dB(µV/m)
902 - 928	500	54
2400 - 2483.5	500	54
5725 - 5875	500	54
24000 - 24250	2500	68

The requirements are **FULFILLED**.

Remarks: The measurement was performed up to the 10th harmonic (25 GHz).

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.



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5.4 EBW and OBW

For test instruments and accessories used see section 6 Part MB.

5.4.1 Description of the test location

Test location: Anechoic chamber 1

5.4.2 Photo documentation of the test set-up

For detailed photos of the test set-up see Attachment B.

5.4.3 Applicable standard

According to FCC Part 15, Section 15.215(c):

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in Section 15.217 through Section 15.257, must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated.

5.4.4 Description of Measurement

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio of -20 dB (99%). The x-dB-down (OBW) function of the analyser is used. The measurement is performed with normal modulation in TX continuous mode.

Spectrum analyser settings:

RBW: 30 kHz, VBW: 100 kHz, Span: 5 MHz, Trace mode: max. hold, Detector: max. peak;

5.4.5 Test result

Centre <i>f</i> (MHz)	20dB bandwidth <i>f</i> ₁	20dB bandwidth <i>f</i> ₂	Measured EBW (MHz)
2404.075745	2403.23408	2404.91741	1.683330
2441.985750	2441.29657	2442.67493	1.378360
2479.985000	2479.29207	2480.67793	1.385860

Centre <i>f</i> (MHz)	99% bandwidth <i>f</i> ₁	99% bandwidth <i>f</i> ₂	Measured OBW (MHz)
2404.000809	2403.15446	2404.84716	1.692698
2441.997613	2441.15065	2442.84458	1.693925
2479.994050	2479.15166	2480.83644	1.684774

Operating frequency band (MHz)	20 dB Bandwidth (MHz)
<i>f</i> _{low} > 2400	<i>f</i> _{low} = 2403.23408
<i>f</i> _{high} < 2483.5	<i>f</i> _{high} = 2480.67793
Operating Band occupancy	77.44

Operating Band occupancy percentage	92.75 %
Operating channel occupancy percentage	84.17 %

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.



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Limit according to FCC Part 15C, Section 15.215(c):

If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Due to the channelizing of the operating band into 16 channels with channel bandwidth of 5 MHz the limit central 80% of the permitted band cannot be applied. Therefore the stability of the EUT will be shown staying within the central 80% of the operating channel.

The requirements are **FULFILLED**.

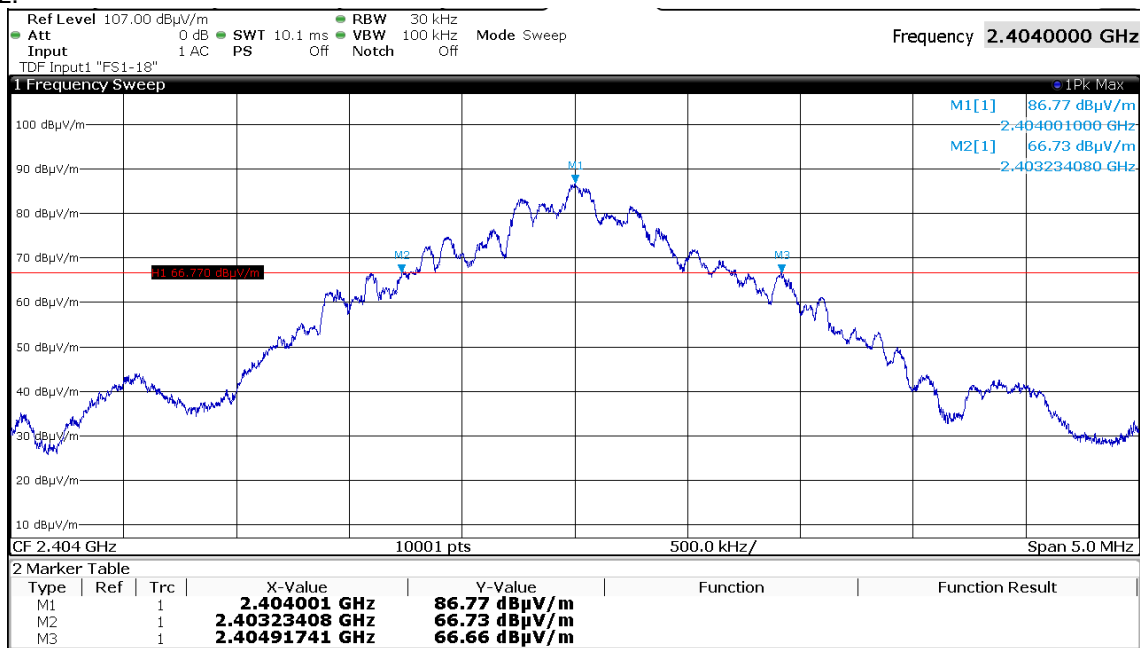
Remarks: For detailed test result please refer to following test protocols.

The OBW99 is measured for RSS only.

5.4.6 Test protocols

20 dB bandwidth

2404 MHz:



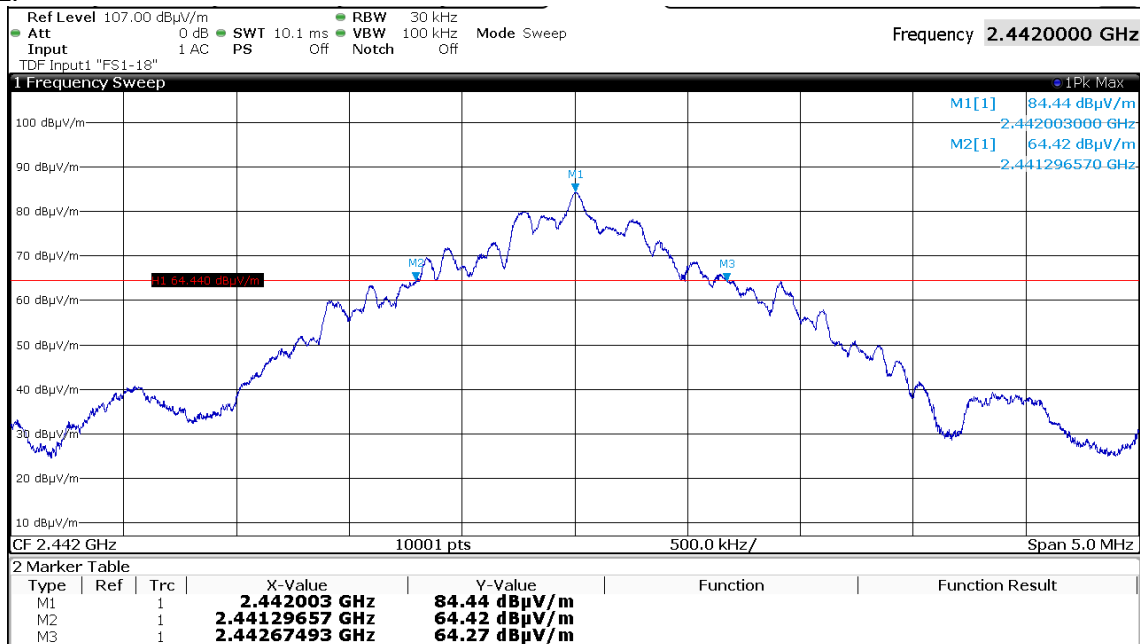
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.



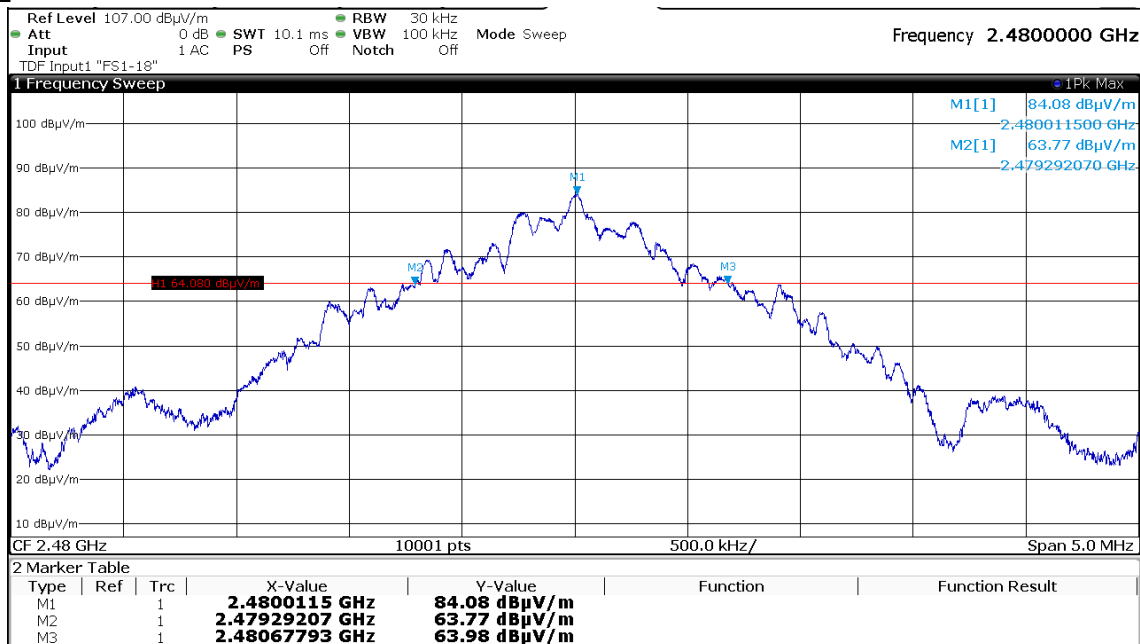
FCC ID: VNP-Me1550

IC: 11986A-Me1550

2442 MHz:



2480 MHz



The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

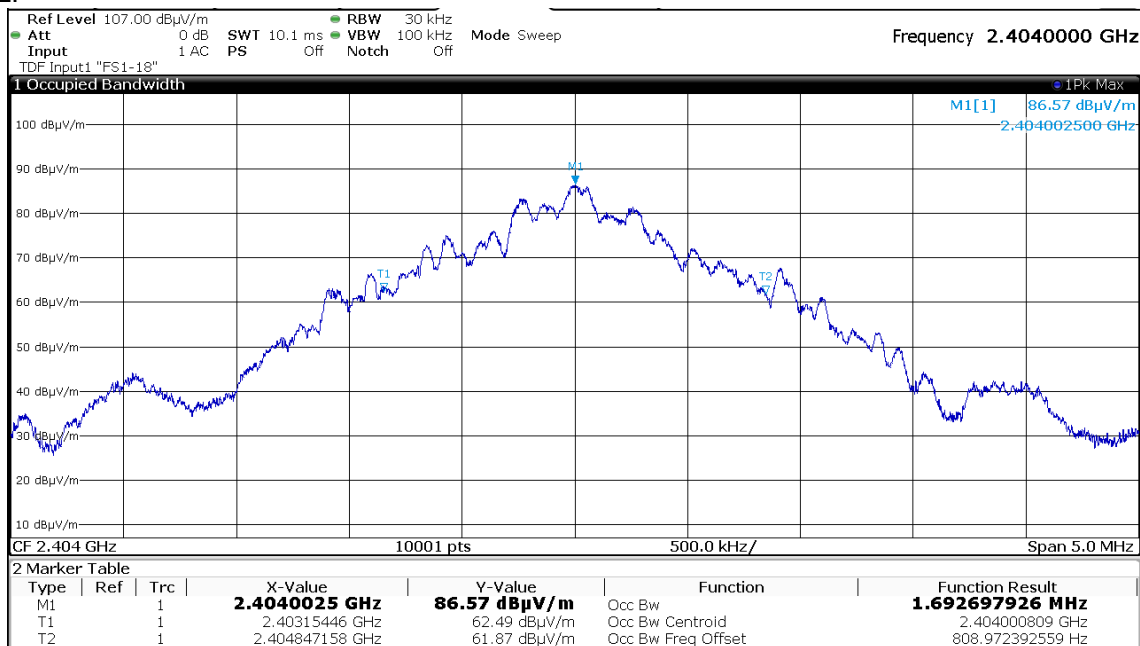


FCC ID: VNP-Me1550

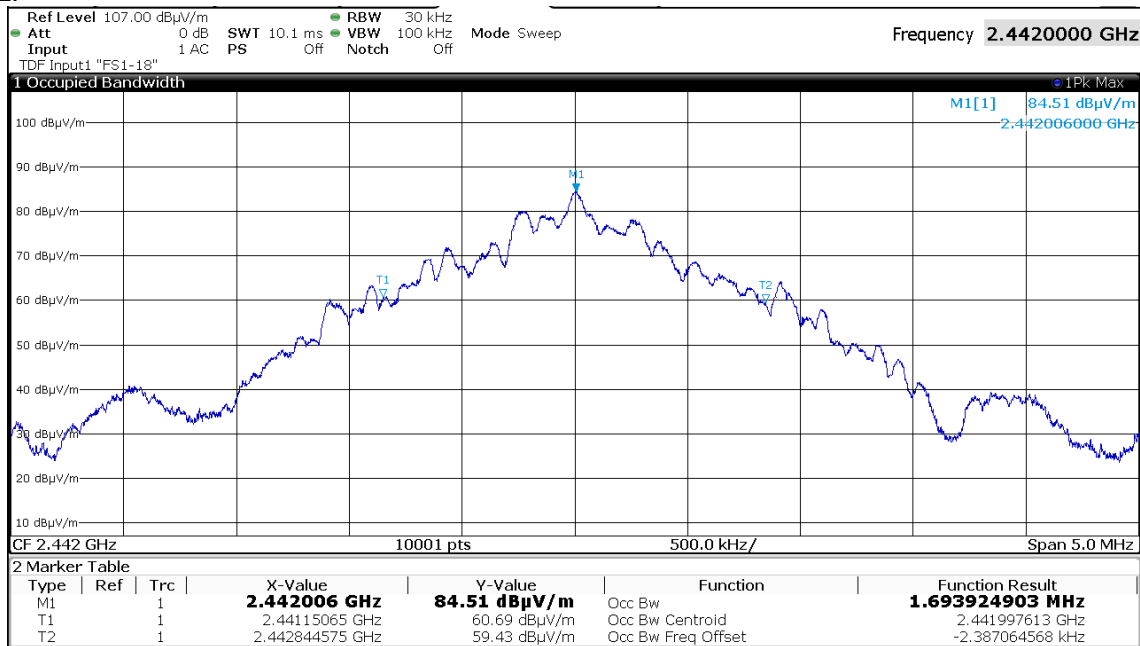
IC: 11986A-Me1550

OBW 99%

2404 MHz:



2442 MHz:



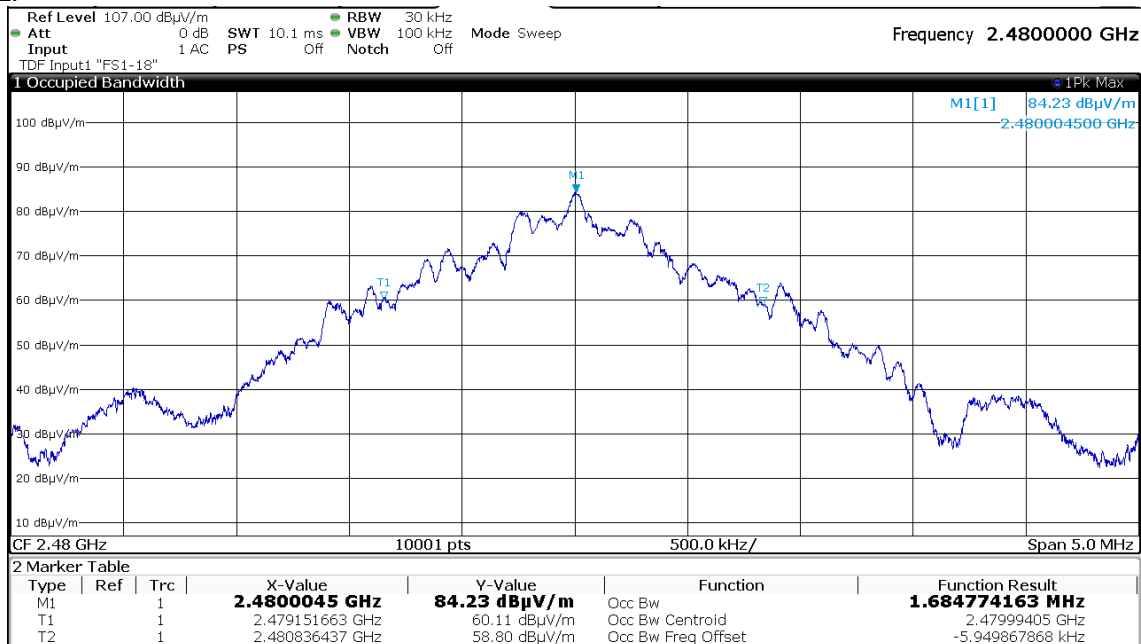
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.



FCC ID: VNP-Me1550

IC: 11986A-Me1550

2480 MHz:



The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.



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IC: 11986A-Me1550

5.5 Correction for pulse operation (duty cycle)

For test instruments and accessories used see section 6 Part DC.

5.5.1 Description of the test location

Test location: Shielded Room S6

5.5.2 Photo documentation of the test set-up

For detailed photos of the test set-up see Attachment B.

5.5.3 Applicable standard

According to FCC Part 15A, Section 15.35(c):

When the radiated emission limits are expressed in terms of average value and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete puls train, including blanking intervals, as long as the pulse train does not exceed 0.1s. In cases where the puls train exceeds 0.1s, the measured field strength shall be determined from the average absolute voltage during a 0.1s interval during which the field strength is at its maximum. The exact method of calculating the average field strength shall be submitted.

5.5.4 Description of Measurement

The duty cycle factor (dB) is calculated applying the following formula:

$$K_E = 20 \log (T_{on} / T_{conn})$$

K_E : pulse operation correction factor
 T_{on} on air duration
 T_{conn} connection interval duration

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

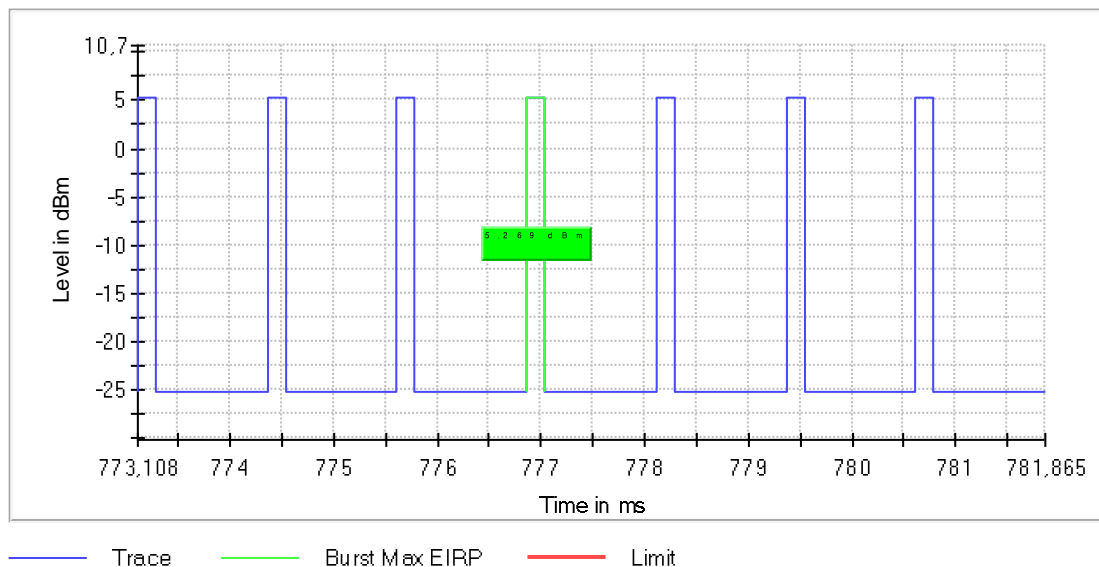


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5.5.5 Test result

$$K_E = 20 \log (0.17 * 80 / 100) = -17.3 \text{ dB}$$



Remarks: The minimum connection interval $T_{\text{conn}} = 1.25 \text{ ms}$ was multiplied by 80 to get an observation period of 100 ms. Therefore the on air duration T_{on} was multiplied by 80.

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.



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IC: 11986A-Me1550

5.6 Antenna application

5.6.1 Applicable standard

According to FCC Part 15C, Section 15.203(a):

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section.

5.6.2 Result

The EUT uses an integrated antenna. No other antenna than that furnished by the responsible party or external power amplifier can be applied by a customer.

The antenna of the EUT meets the requirement of FCC Part 15C, Section 15.203 and 15.204.

The requirements are **FULFILLED**.

Remarks: None

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.



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IC: 11986A-Me1550

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	BAT-EMC 3.18.0.26	01-02/68-13-001				
	ESCI	02-02/03-15-001	02/07/2020	02/07/2019		
	ESH 2 - Z 5	02-02/20-05-004	31/10/2021	31/10/2019	30/04/2020	31/10/2019
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2	02-02/50-05-155	13/11/2022	13/11/2019	13/05/2020	13/11/2019
CPR 3	FSW43	02-02/11-15-001	08/04/2020	08/04/2019		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	3117	02-02/24-05-009	06/06/2020	06/06/2019		
	18N-20	02-02/50-17-003				
	NMS111-GL200SC01-NMS11	02-02/50-17-012				
	BAM 4.5-P	02-02/50-17-024				
	NCD	02-02/50-17-025				
	KK-SF106-2X11N-6,5M	02-02/50-18-016				
DC	FSW43	02-02/11-15-001	08/04/2020	08/04/2019		
	OSP-B157W8 with OSP120	02-02/30-13-002	18/09/2020	18/09/2019		
	OSP-B157WX with OSP120	02-02/30-18-007	23/08/2020	23/08/2019		
	minibend KR-16	02-02/50-16-013				
	Semflex K-400-K	02-02/50-19-013				
	SMB-K27 PULSETRAIN	02-02/68-19-001				
MB	FSW43	02-02/11-15-001	08/04/2020	08/04/2019		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	3117	02-02/24-05-009	06/06/2020	06/06/2019		
	18N-20	02-02/50-17-003				
	NMS111-GL200SC01-NMS11	02-02/50-17-012				
	BAM 4.5-P	02-02/50-17-024				
	NCD	02-02/50-17-025				
	KK-SF106-2X11N-6,5M	02-02/50-18-016				
SER 1	ESCI	02-02/03-05-005	04/12/2020	04/12/2019		
	HFH 2 - Z 2	02-02/24-15-001	28/03/2020	28/03/2019		
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
SER 2	ESVS 30	02-02/03-05-006	19/08/2020	19/08/2019		
	VULB 9168	02-02/24-05-005	19/07/2020	19/07/2019		
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
SER 3	FSP 40	02-02/11-11-001	07/10/2020	07/10/2019		
	FSW43	02-02/11-15-001	08/04/2020	08/04/2019		
	JS4-18004000-30-5A	02-02/17-05-017				
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	3117	02-02/24-05-009	06/06/2020	06/06/2019		
	BBHA 9170	02-02/24-05-014	12/06/2021	12/06/2018	14/01/2021	14/01/2020
	KMS102-0.2 m	02-02/50-11-020				
	18N-20	02-02/50-17-003				
	NMS111-GL200SC01-NMS11	02-02/50-17-012				

**FCC ID: VNP-Me1550****IC: 11986A-Me1550**

BAM 4.5-P	02-02/50-17-024
NCD	02-02/50-17-025
KK-SF106-2X11N-6,5M	02-02/50-18-016

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.