

Prüfbericht-Nr.: <i>Test report no.:</i>	IN24ZOTO 001	Auftrags-Nr.: <i>Order no.:</i>	146879464 010	Seite 1 von 36 Page 1 of 36
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	2566340	Auftragsdatum: <i>Order date:</i>	2024-02-06	
Auftraggeber: <i>Client:</i>	75F Inc. , 1650 W, 82nd St, #200, Bloomington, Minnesota, USA - 55431			
Prüfgegenstand: <i>Test item:</i>	Hyper Split			
Bezeichnung <i>Identification</i>	7X-HS-K9X-X	Serien -Nr.: <i>Serial no.:</i>	Engineering Sample	
Auftrags-Inhalt: <i>Order content:</i>	Testing and issue of Test Report			
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15 Subpart C 15.247,15.205, 15.207 & 15.209			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2024-06-04			
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003735739-001 A003735739-002			
Prüfzeitraum: <i>Testing period:</i>	2024-06-04 - 2024-07-04			
Ort der Prüfung: <i>Place of testing:</i>	Wireless laboratory, Bangalore			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (India) Pvt. Ltd. 27/B,2nd cross road, Electronic city Phase1, Bangalore-560100, India FCC Test Site Registration No: 496599 IC Test Site Registration No: 27711			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>	genehmigt von: <i>authorized by:</i>			
Datum: <i>Date:</i> 2024-10-01	Ausstellatum: <i>Issue date:</i> 2024-10-04			
Stellung / Position:	Likhithesh M D Senior Engineer	Stellung / Position:	Madhu K N Asst. Manager	
Sonstiges / Other:	FCC ID: 2AVZO-101057 IC: 25972-101057 HVIN: 101057HSL			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
* Legende: 1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar	5 = mangelhaft N/T = nicht getestet
* Legend: 1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable	5 = poor N/T = not
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

Prüfbericht - Nr.:

Test Report No.:

IN24ZOTO 001

Seite 2 von 36

Page 2 of 36

1	Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden. <i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i>
2	Wie vertraglich vereinbart, wurde dieses Dokument nur digital unterzeichnet. Der TÜV Rheinland hat nicht überprüft, welche rechtlichen oder sonstigen diesbezüglichen Anforderungen für dieses Dokument gelten. Diese Überprüfung liegt in der Verantwortung des Benutzers dieses Dokuments. Auf Verlangen des Kunden kann der TÜV Rheinland die Gültigkeit der digitalen Signatur durch ein gesondertes Dokument bestätigen. Diese Anfrage ist an unseren Vertrieb zu richten. Eine Umweltgebühr für einen solchen zusätzlichen Service wird erhoben. <i>As contractually agreed, this document has been signed digitally only. TUV Rheinland has not verified and unable to verify which legal or other pertaining requirements are applicable for this document. Such verification is within the responsibility of the user of this document. Upon request by its client, TUV Rheinland can confirm the validity of the digital signature by a separate document. Such request shall be addressed to our Sales department. An environmental fee for such additional service will be charged.</i>
3	Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt. <i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i> <i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i>
4	Die Entscheidungsregel für Konformitätserklärungen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. <i>The decision rule for statements of conformity in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report.</i>

Prüfbericht - Nr.:
Test Report No.:

IN24ZOTO 001

Seite 3 von 36
Page 3 of 36

TEST SUMMARY

Test Item	FCC	ISED	Result
Maximum conducted output power	FCC 15.247(b)(3)	RSS 247 Issue 3, Section 5.4 (d)	Pass
Maximum Power Spectral Density	FCC 15.247(e)	RSS 247 Issue 3, Section 5.2 (b)	Pass
Occupied bandwidth and 6dB Bandwidth	15.247 (a) (2)	RSS 247 Issue 3, Section 5.2 (a)	Pass
Emissions in non-restricted frequency bands	15.247 (d)	RSS 247 Issue 3, Section 5.5	Pass
Spurious Radiated Emissions and Restricted Bands of Operation	FCC 15.209 / FCC 15.205	RSS-Gen Issue 5, Section 8.9 /8.10	Pass
Conducted Spurious Emission on AC Power lines	FCC 15.207	RSS-Gen Issue 5, Section 8.8	Pass

Product Category: Electronics Testing
Test Discipline: EMC Test Facility

Prüfbericht - Nr.:

Test Report No.:

IN24ZOTO 001

Seite 4 von 36

Page 4 of 36

REVISION HISTORY OF THIS REPORT

Report Number	Version	Description	Issue date
IN24ZOTO 001	01	Initial issue of report	2024-10-04

Table of Contents

1	GENERAL REMARKS	6
1.1	Attachments	6
2	TEST SITES	7
2.1	Testing Facilities.....	7
2.2	List of Test and Measurement Instruments.....	7
3	GENERAL PRODUCT INFORMATION.....	8
3.1	Product Function and Intended Use.....	8
3.2	Ratings and System Details of Equipment under Test	8
3.3	Measurement Uncertainty:	9
4	TEST SET-UP AND OPERATION MODE.....	10
4.1	Principle of Configuration Selection	10
4.2	Test Operation and Test Software	10
4.3	Special Accessories and Auxiliary Equipment	10
4.4	Countermeasures to achieve EMC Compliance	10
4.5	Simultaneous Transmission	10
4.6	List of frequencies	10
5	OPERATIONAL DESCRIPTION.....	11
6	TEST METHODOLOGY	12
6.1	Radiated Emission Test	12
6.1.1	Test Setup Configuration	12
7	TEST RESULTS	14
7.1	Maximum Peak Conducted Output Power	14
7.2	Occupied bandwidth.....	16
7.3	Power Spectral Density	19
7.4	Emissions in non-restricted frequency bands and Conducted Spurious Emission.....	21
7.4.1	Band edge and reference plots.	22
7.4.2	Out-Of-Band Emissions.....	24
7.5	Spurious Radiated Emissions & Restricted Bands of Operation	25
8	LIST OF TABLES.....	36
9	LIST OF FIGURES	36

Prüfbericht - Nr.:

Test Report No.:

IN24ZOTO 001

Seite 6 von 36

Page 6 of 36

1 GENERAL REMARKS

1.1 Attachments

All attachments are part of this test report and are issued in separate document.

1. TEST SETUP PHOTOS
2. EUT EXTERNAL PHOTOS
3. EUT INTERNAL PHOTOS
4. FCC LABEL AND LABEL LOCATION
5. BLOCK DIAGRAM
6. SPECIFICATION OF EUT
7. SCHEMATIC DIAGRAMS
8. BILL OF MATERIAL
9. USER MANUAL
10. Maximum Permissible Exposure Information

Prüfbericht - Nr.:
Test Report No.:

IN24ZOTO 001

Seite 7 von 36
Page 7 of 36

2 TEST SITES

2.1 Testing Facilities

- | | |
|---|--|
| <p>1. TÜV Rheinland (India) Pvt.Ltd.,
27/B, 2nd Cross,
ElectronicCityPhase1
Bangalore – 560 100,
India
Radiated Measurement site type:
Fully anechoic chamber (used for above 1 GHz
measurements)</p> | <p>2. TUV Rheinland (India) Pvt.Ltd.,
108, Beside ISBR Business School,
Electronic city Phase I
Bangalore - 560 100.
India
Radiated Measurement site type:
Semi anechoic chamber (used for below 1 GHz
measurements)</p> |
|---|--|

2.2 List of Test and Measurement Instruments

Table 1: List of test and measurement instruments

Equipment	Manufacturer	Model Name	Serial Number	Firmware Versions	Calibration Due Date	Periodicity	Test Facility
EMI Receiver	Rohde & Schwarz	ESW 44	101773	4.73 SP5	26.01.2025	Yearly	Radiated Spurious Emission
Active loop antenna	Frankonia	LAX-10	LAX-10-800	-	23-03-2025	Yearly	
Balun & Biconical Antenna	Schwarzbeck mess-elektronik	VHBB-9124 / BBA-9106	01028	-	08.02.2025	Yearly	
Log-Periodic Antenna	Schwarzbeck mess-elektronik	VUSLP-9111B	9111B-111	-	08.02.2025	Yearly	
Active loop antenna	Frankonia	LAX-10	LAX-10-800	-	23-03-2025	Yearly	
Fully Anechoic Chamber	Albatross	-	-	-	-	-	
Spectrum Analyzer	Agilent	E4407B	US41192772	A.14.06	01.04.2025	Yearly	Antenna – Port Conducted Test

Table 2: Instrument application Software versions

SL. No.	Test Type	Application software	Version
1	Radiated spurious emission measurement in FAC	EMC 32	10.60.20
2	Radiated spurious emission measurement in 10mtr SAC	BAT EMC	3.20.0.17

3 GENERAL PRODUCT INFORMATION

3.1 Product Function and Intended Use

HyperStat Split has 2 parts, HyperLite and Connect module. HyperLite is installed inside a zone. This monitors Air quality (with up to 8 onboard sensors) and it is equipped with a 2.8" TFT screen paired with mechanical buttons and a touch slider for taking user inputs and displaying zone data. The Connect Module is installed inside the RTU/FCU and do stage or modulated controls and can accept up to 8 Universal analog inputs.

3.2 Ratings and System Details of Equipment under Test

Table 3: Ratings and System Details as declared by Client*

Protocol	BLE (Bluetooth Low Energy)
Operating Frequency Range	2400MHz to 2483.5MHz
Channel Spacing	2MHz
Tx Transmitting Power	6 dBm
Maximum measured e.i.r.p (dBm)	1.81 dBm @ 2440MHz for Hyperlite
Modulation	GFSK
Data Rate	1Mbps
Number of antennas	1
Antenna Gain & Antenna Type	-1.0 dBi
Antenna Part Number	2450AT42E010B
Supply Voltage to Product	24VDC / VAC Nominal
Environmental conditions	-17°C to +50°C
EUT Dimension (W * H)	105mm x 140mm

***Disclaimer:** The information/data is supplied by the client and the same is considered to arrive at the final value. Any changes made apart from the specified specification, can directly impact on the tests results. Refer the products user manual for more details.

3.3 Measurement Uncertainty:

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k = 2$

Table 4: Measurement Uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	$\pm 5 \%$
RF output power, conducted	$\pm 1.5 \text{ dB}$
Power Spectral Density, conducted	$\pm 3 \text{ dB}$
Unwanted Emissions, conducted	$\pm 3 \text{ dB}$
All emissions, radiated	$\pm 6 \text{ dB}$
Temperature	$\pm 3 \text{ }^{\circ}\text{C}$
Supply Voltages	$\pm 3 \%$
Time	$\pm 5 \%$

4 TEST SET-UP AND OPERATION MODE

4.1 Principle of Configuration Selection

Transmission was enabled with highest possible duty cycle on low, mid, and high channels.

4.2 Test Operation and Test Software

Hardware Version Identification Number(HVIN): 101057HSL
Software version : 4.105
Software Name: TeraTerm
Hardware Name: HyperLite
Hardware revision: 101057 rev 1.1

4.3 Special Accessories and Auxiliary Equipment

- None

4.4 Countermeasures to achieve EMC Compliance

- None

4.5 Simultaneous Transmission

This product does not support Simultaneous operation.

4.6 List of frequencies

Frequency Band (GHz)	Channel No.	Frequency (MHz)
BLE (2400 MHz – 2480 MHz)	Low	2402
	:	:
	Mid	2440
	:	:
	High	2480

Table 5: List of BLE Center frequencies

Channel used for BLE testing.

Channel Low: 2402MHz

Channel Mid: 2440MHz

Channel High: 2480MHz

Note:

TUV Sample Identification Number:

A003735739-001	Radiated Sample
A003735739-002	Conducted Sample

5 OPERATIONAL DESCRIPTION

HyperStat Lite is powered using the 75F *PoR* (Power over RS485) bus from the Connect Module which supplies 24V DC as well as RS485 communication signal to enable to and for data transfer in a half-duplex manner. HyperStat Lite features up to 8 onboard sensors (temperature, humidity, CO2, PIR, Sound, illuminance, and an optional PM2.5/PM10) along with the capacity to expand the portfolio by having a Sensor bus to connect further 75F OWI-supported sensors. HyperStat lite Features connectivity options like LW mesh for connecting with 75F CCU as well as BLE 5.0

6 TEST METHODOLOGY

6.1 Radiated Emission Test

The radiated emission measurement was performed according to the procedures in ANSI C63.10-2013. The equipment under test (EUT) was placed at the middle of the 80 cm high turntable for below 1 GHz & 1.5 m height for above 1 GHz measurement, and the EUT is 3 meters far from the measuring antenna. The turntable was rotated 360° for obtaining the maximum emission. The height of the measuring antennas was scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained. The measurement above 1000 MHz was performed by horn antenna, The measurement below 30 MHz was performed by loop antenna, Measurement from 30 MHz to 200 MHz was performed by Baloon and Biconical Antenna, and measurement from 200 MHz to 1 GHz was performed by Log-Periodic Antenna.

The EUT was rotated around the X-, Y-, and Z-Axis and the results from worst case axis are recorded.

6.1.1 Test Setup Configuration

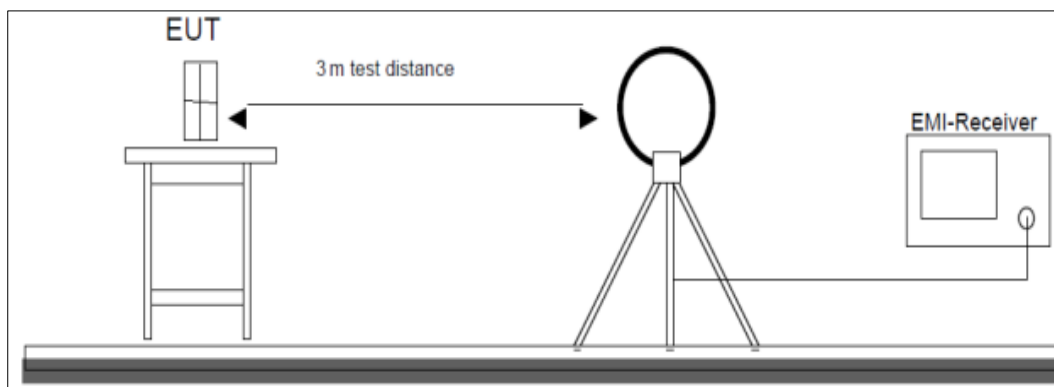


Figure 1: Frequency Range 9 kHz- 30 MHz

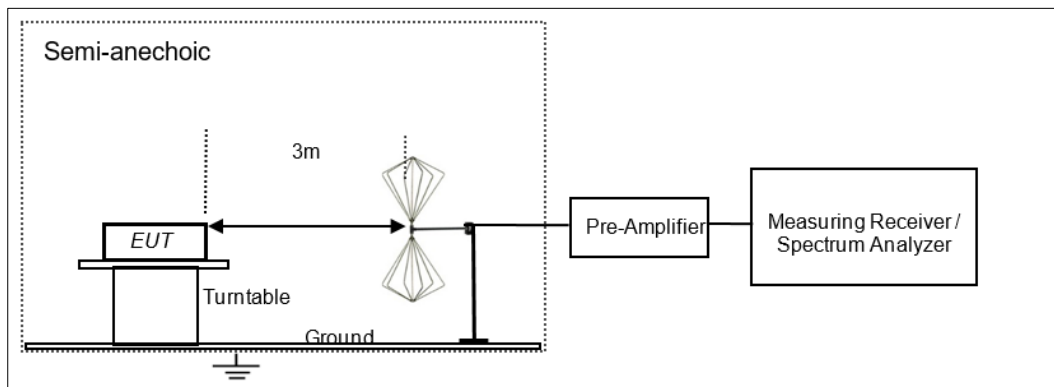


Figure 2: Frequency Range 30 MHz – 200 MHz

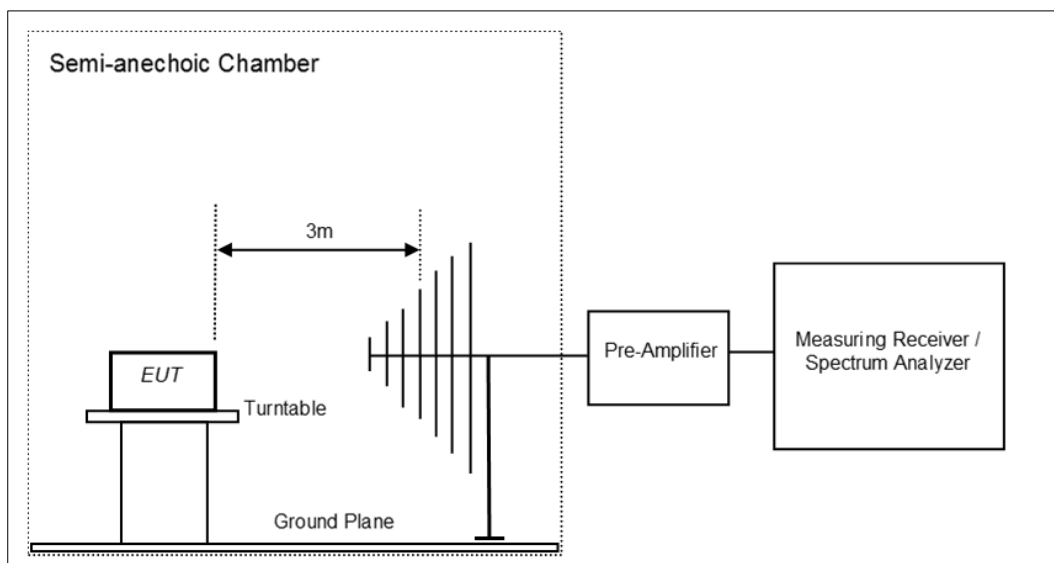


Figure 3: Frequency Range 200 MHz - 1GHz

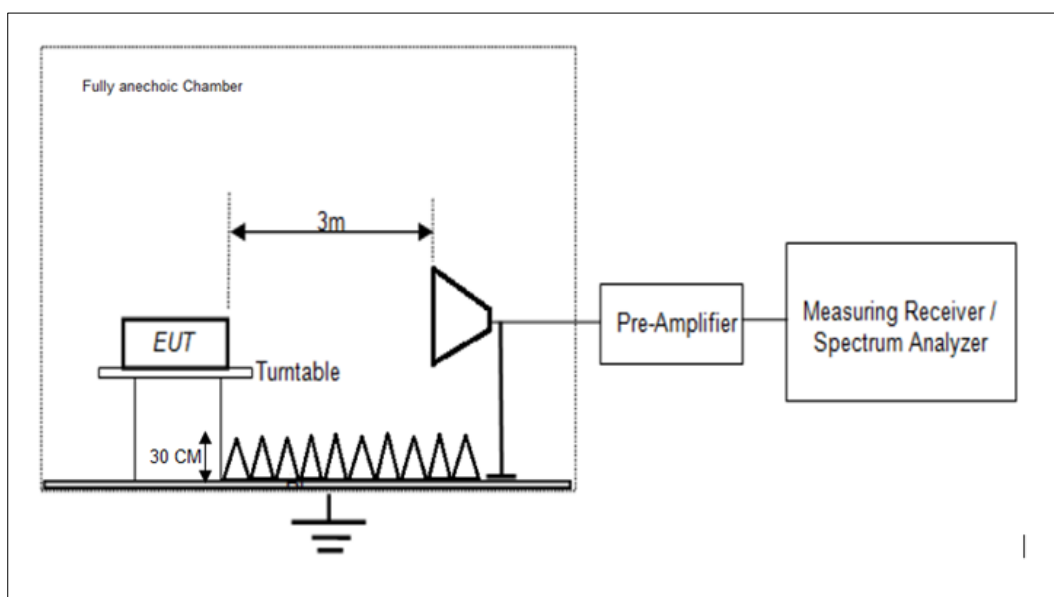


Figure 4: Frequency Range above 1 GHz

Prüfbericht - Nr.:
Test Report No.:

IN24ZOTO 001

Seite 14 von 36
Page 14 of 36

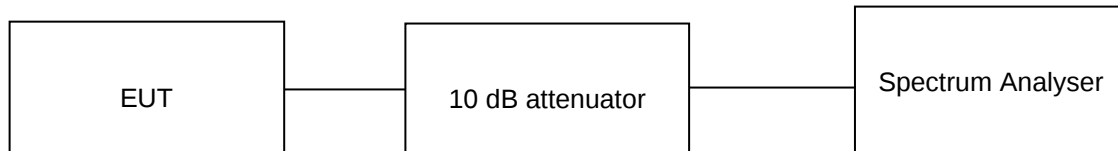
7 TEST RESULTS

7.1 Maximum Peak Conducted Output Power

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (b)(3) RSS-247 issue 3, section 5.4 (d)
Test Method	Subclause 11.9.1.1 of ANSI C63.10
Measurement Bandwidth	1MHz
Detector	Peak
Port of testing	Antenna port
Requirement	Power $\leq$ 1 W (30 dBm)



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.3 °C Voltage = 24 VDC through DC supply Relative humidity: 58%

KDB Guidelines applied:

Measurements were made as per section 9(b) in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Prüfbericht - Nr.:
Test Report No.:

IN24ZOTO 001

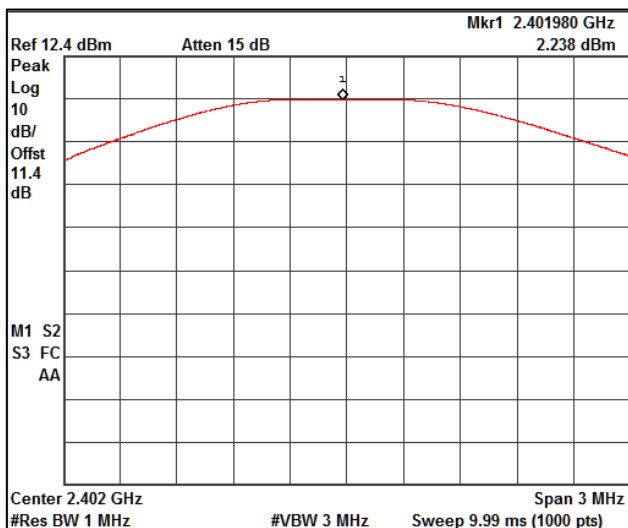
Seite 15 von 36
Page 15 of 36

Test results:

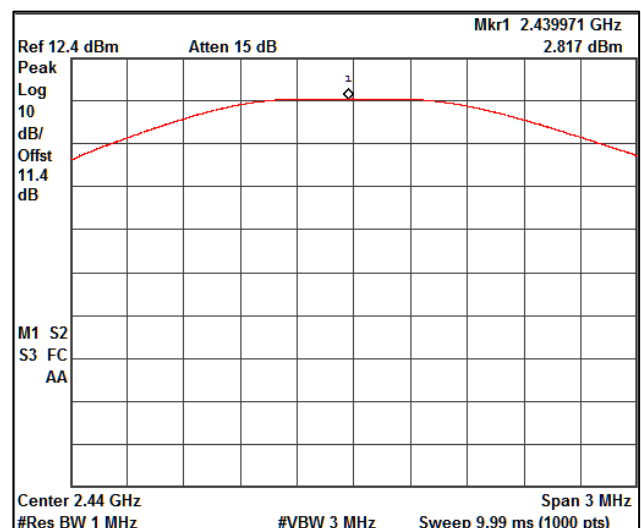
Note:

1. All the losses are included during measurement and final values are mentioned in the test report
2. Total Peak Output power (dBm) = Measured Peak power (dBm) + Attenuator factor (10dB) + Cable loss (1.4dB)
3. This product does not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is -1.0 dBi.

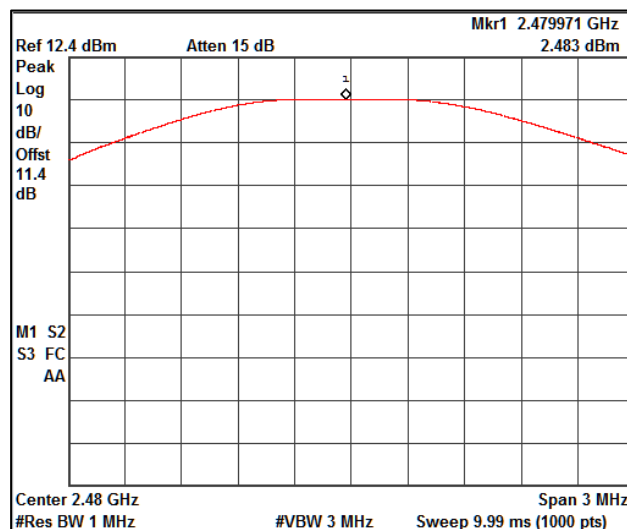
Channel Frequency (MHz)	Measured Power (dBm)	Antenna Gain (dBi)	Maximum (e.i.r.p)	Power Limit (dBm)
2402	2.23	-1.0	1.23	30
2440	2.81	-1.0	1.81	30
2480	2.48	-1.0	1.48	30



Channel Frequency: 2402MHz



Channel Frequency: 2440MHz



Channel Frequency: 2480MHz

Prüfbericht - Nr.:
Test Report No.:

IN24ZOTO 001

Seite 16 von 36
Page 16 of 36

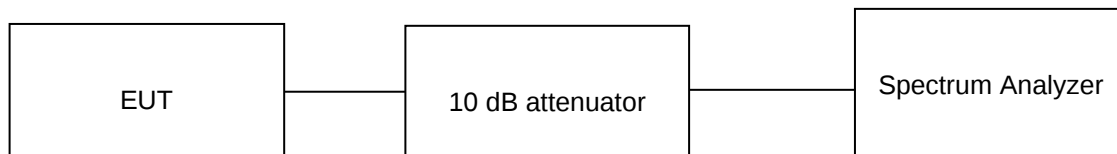
7.2 Occupied bandwidth

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (a) (2) / RSS 247 Issue 3, Section 5.2 (a)
Test Method	Subclause 6.9.3 & 11.8.1 of ANSI C63.10
Measurement Bandwidth	100kHz for x dB bandwidth 1 to 5% of OCB for 99% bandwidth
Detector	Peak
Port of testing	Antenna port
Requirement	Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.3 °C Voltage = 24 VDC through DC supply Relative humidity: 58%

KDB Guidelines applied:

Measurements were made as per section 8.2 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Prüfbericht - Nr.:
Test Report No.:

IN24ZOTO 001

Seite 17 von 36
Page 17 of 36

Test results:

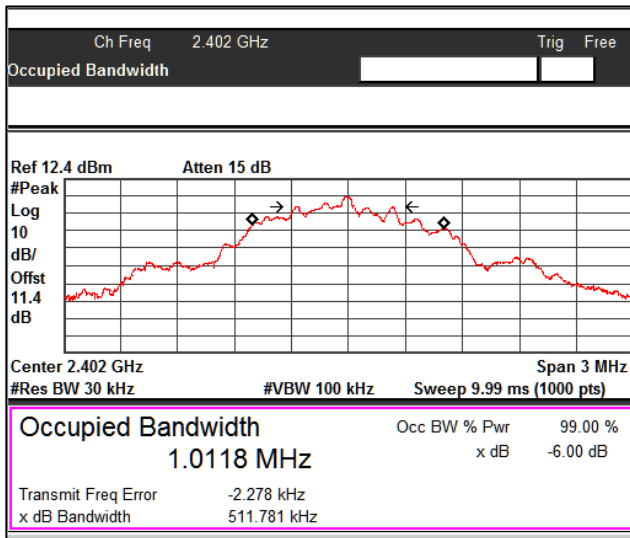
Note:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. This product does not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is -1.0 dBi.

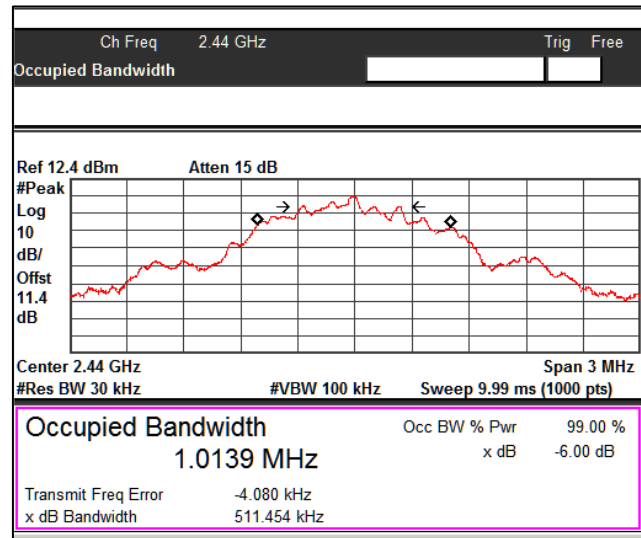
Hyper Lite:

Channel Frequency (MHz)	6 dB Bandwidth (MHz)	99% OBW (MHz)	Minimum 6dB Limit (kHz)
2402	0.627	1.011	≥500
2440	0.626	1.013	
2480	0.631	1.015	

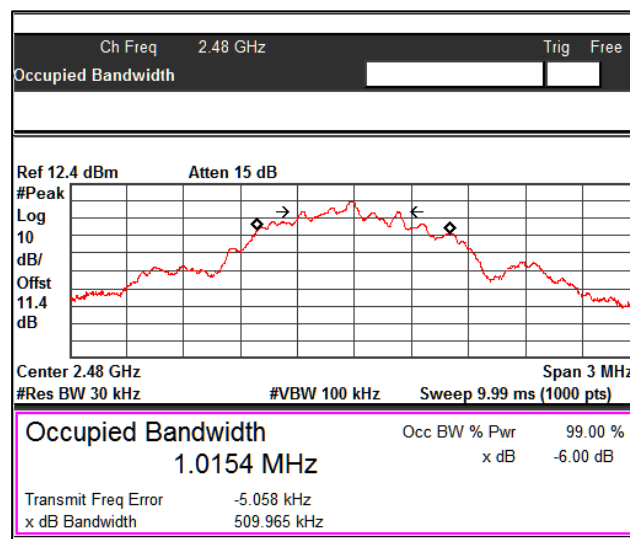
99% Bandwidth:



Channel Frequency: 2402MHz



Channel Frequency: 2440MHz



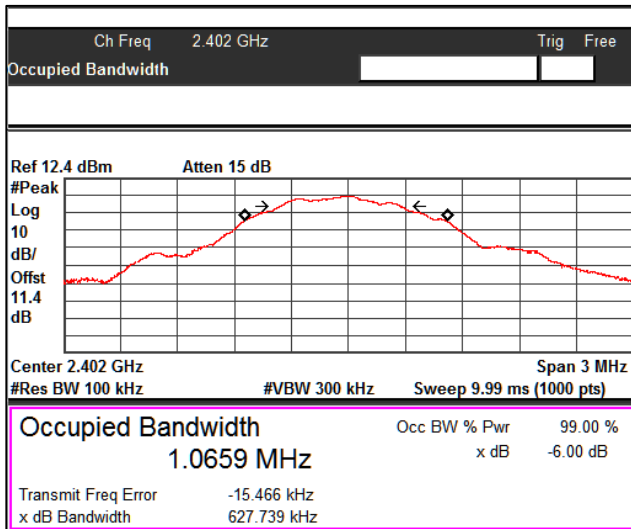
Channel Frequency: 2480MHz

Prüfbericht - Nr.:
Test Report No.:

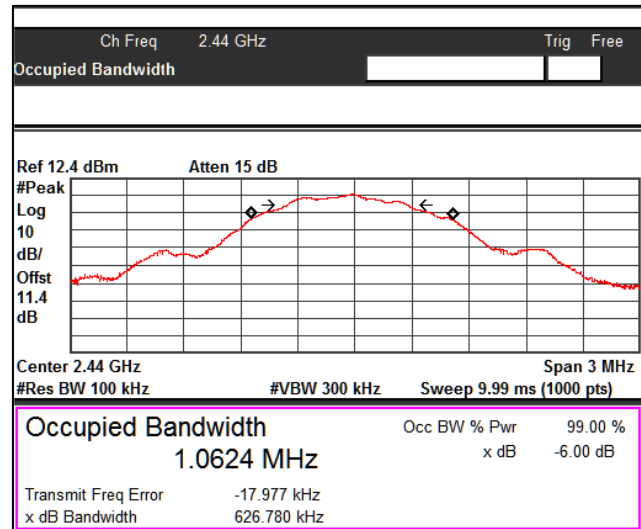
IN24ZOTO 001

Seite 18 von 36
Page 18 of 36

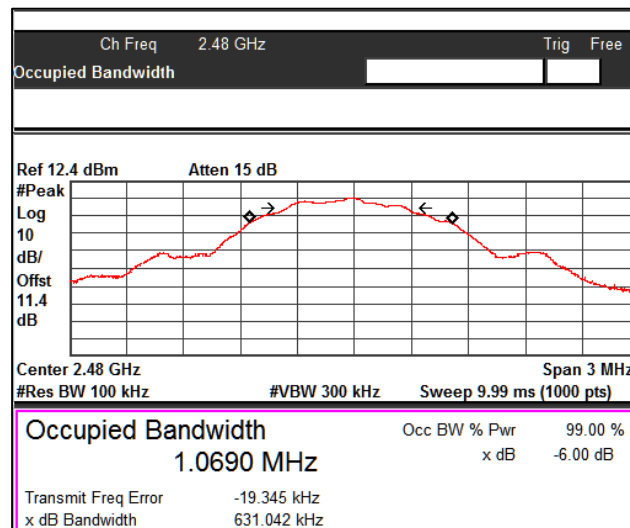
DTS Bandwidth(6dB):



Channel Frequency: 2402MHz



Channel Frequency: 2440MHz



Channel Frequency: 2480MHz

Prüfbericht - Nr.:
Test Report No.:

IN24ZOTO 001

Seite 19 von 36
Page 19 of 36

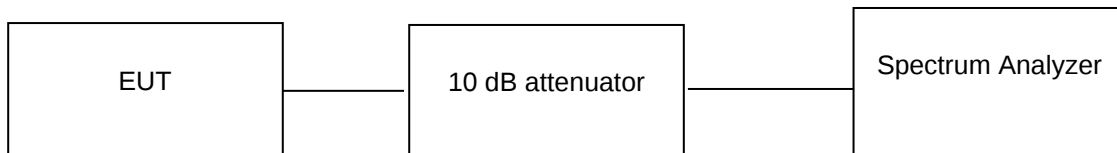
7.3 Power Spectral Density

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (e) / RSS 247 Issue 3, Section 5.2 (b)
Test Method	Subclause 11.10.2 of ANSI C63.10
Measurement Bandwidth	100 kHz
Detector	Peak
Port of testing	Antenna port
Requirement	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.3 °C Voltage = 24 VDC through DC supply Relative humidity: 58%

KDB Guidelines applied:

Measurements were made as per section 8.4 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Prüfbericht - Nr.:
Test Report No.:

IN24ZOTO 001

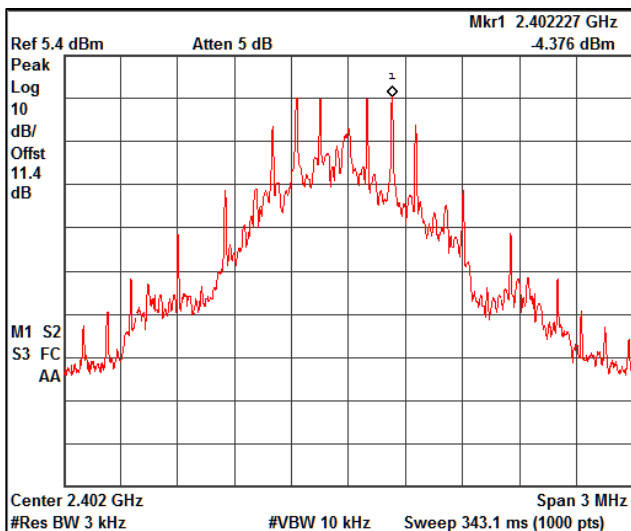
Seite 20 von 36
Page 20 of 36

Test results:

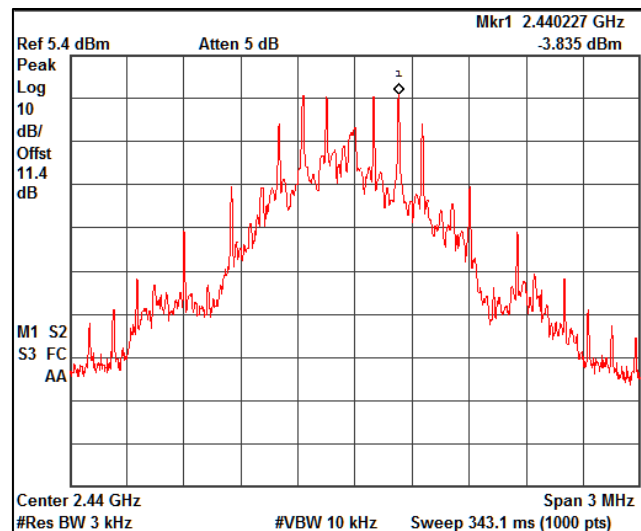
Note:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. This product does not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is -1.0 dBi.

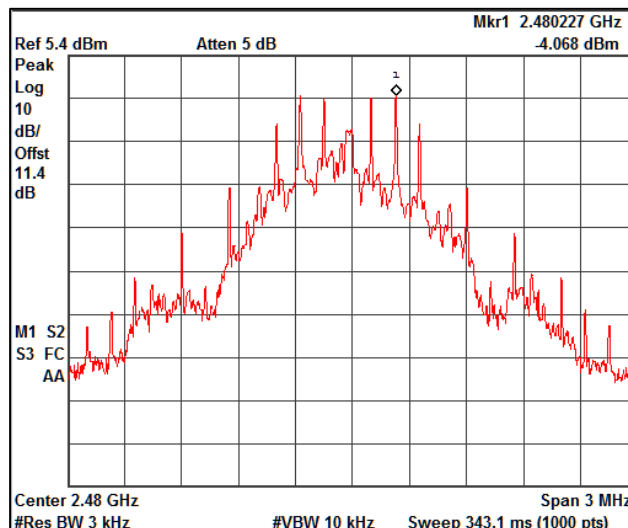
Channel Frequency (MHz)	Measured Power spectral density (dBm/3kHz)	Limit (dBm)
2402	-4.37	8.00
2440	-3.83	8.00
2480	-4.06	8.00



Channel Frequency: 2402MHz



Channel Frequency: 2440MHz



Channel Frequency: 2480MHz

Prüfbericht - Nr.:
Test Report No.:

IN24ZOTO 001

Seite 21 von 36
Page 21 of 36

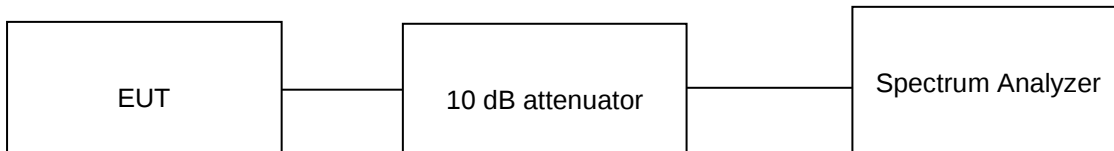
7.4 Emissions in non-restricted frequency bands and Conducted Spurious Emission

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (d) / RSS 247 Issue 3, Section 5.5
Test Method	Subclause 11.11.3 of ANSI C63.10
Measurement Bandwidth	100 kHz
Detector	Peak
Port of testing	Antenna port
Requirement	In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.3 °C Voltage = 24 VDC through DC supply Relative humidity: 58%

KDB Guidelines applied:

Measurements were made as per section 8.5 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Prüfbericht - Nr.:

Test Report No.:

IN24ZOTO 001

Seite 22 von 36

Page 22 of 36

Test results:

Note:

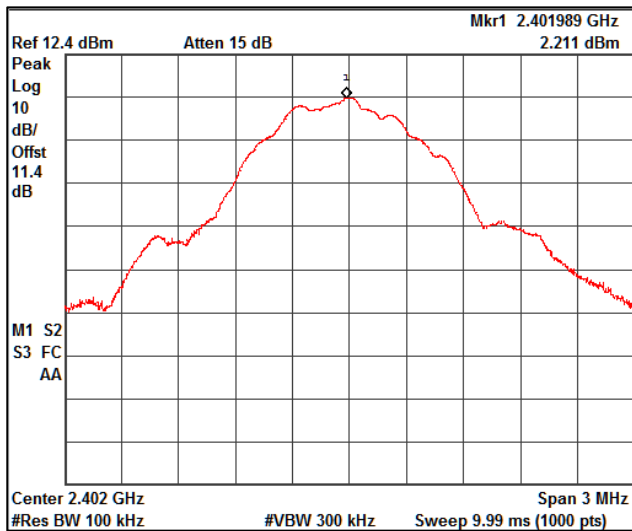
1. All the losses are included during measurement and final values are mentioned in the test report.
2. This product does not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is -1.0 dBi.

7.4.1 Band edge and reference plots.

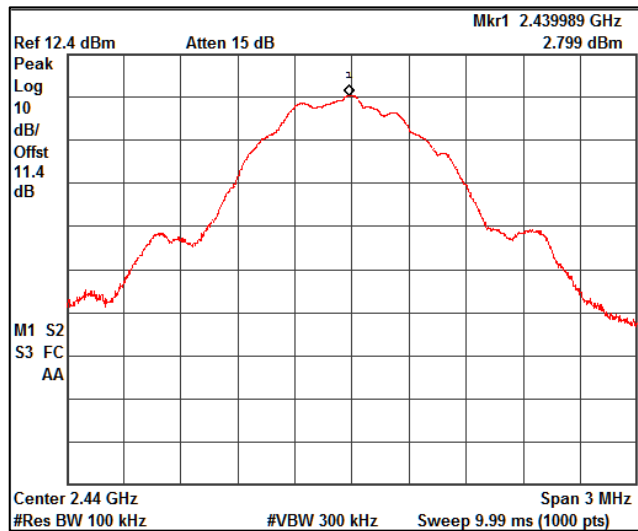
Hyper Lite:

Channel Frequency (MHz)	Band edge frequency (MHz)	Value at band edge (A) (dBm)	Reference value (B) (dBm)	A-B (dBc)	Minimum Limit (dBc)
2402.00	2400.00	-52.68	2.21	-54.89	-20
2480.00	2483.50	-55.10	2.42	-57.52	-20

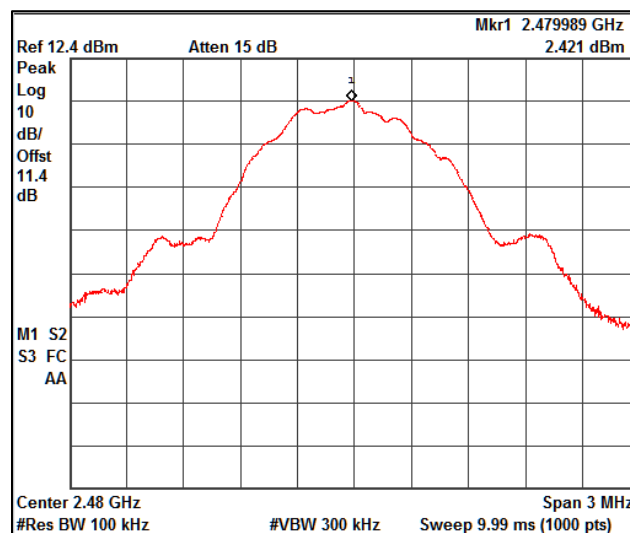
Reference Plots:



Channel Frequency: 2402MHz



Channel Frequency: 2440MHz

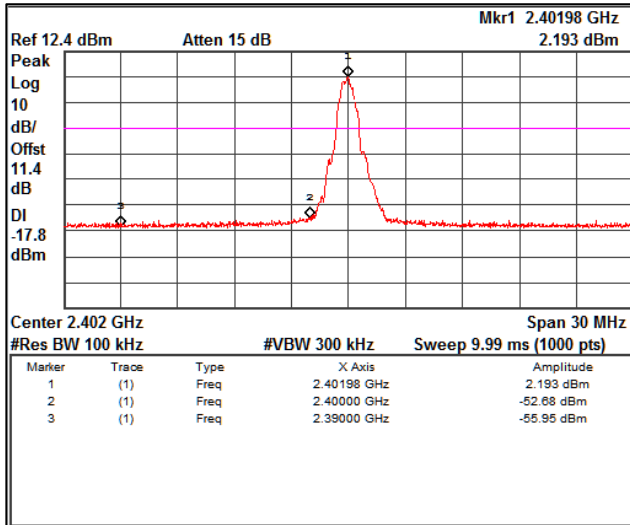


Channel Frequency: 2480MHz

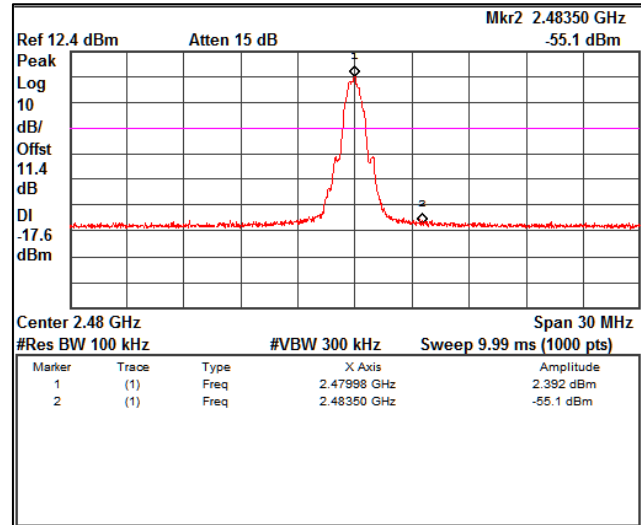
Prüfbericht - Nr.:
Test Report No.:

IN24ZOTO 001

Seite 23 von 36
Page 23 of 36

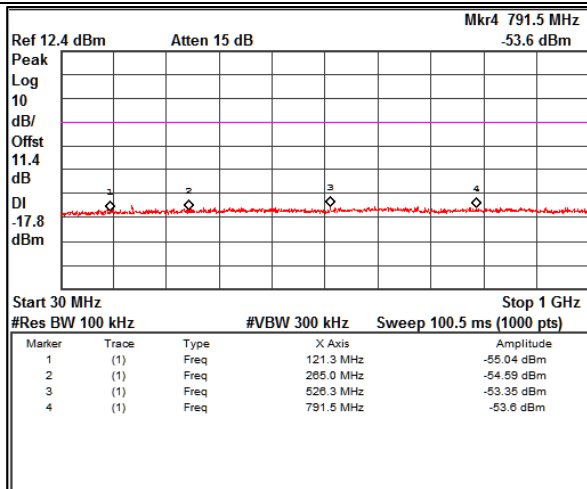


Band edge Channel Frequency 2402MHz

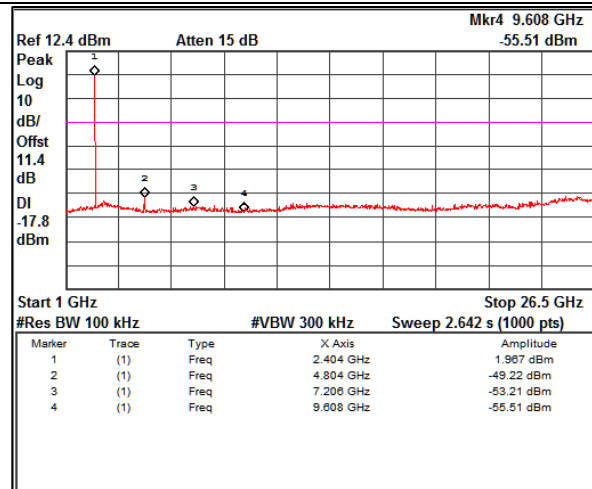


Band edge Channel Frequency 2480MHz

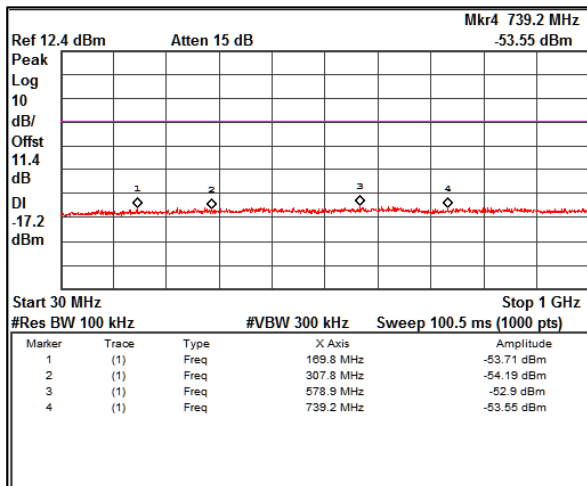
7.4.2 Out-Of-Band Emissions



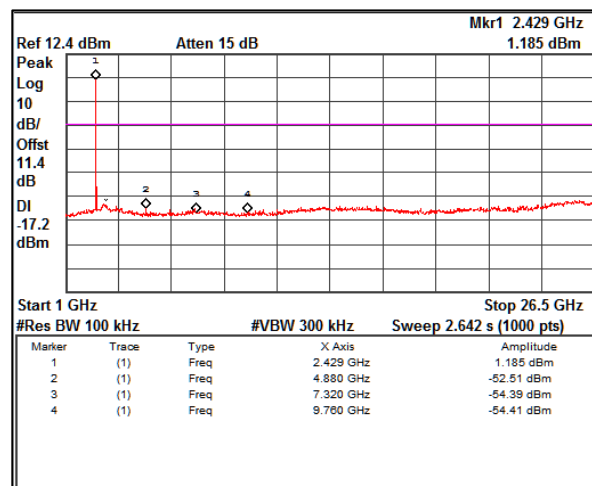
**Channel Frequency 2402MHz
Frequency Range 30MHz – 1GHz**



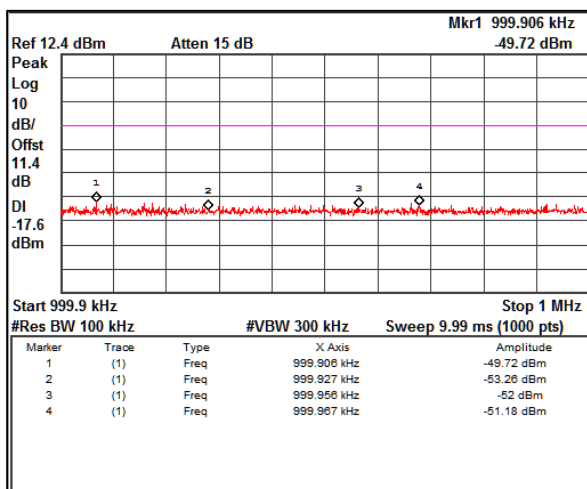
**Channel Frequency 2402MHz
Frequency Range 1GHz – 26.5GHz**



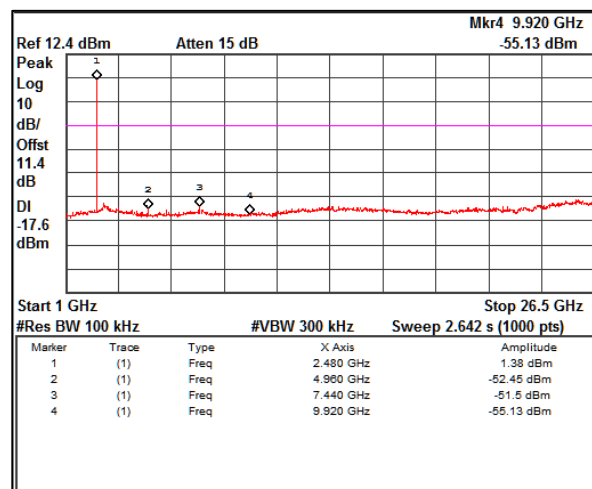
**Channel Frequency 2440MHz
Frequency Range 30MHz – 1GHz**



**Channel Frequency 2440MHz
Frequency Range 1GHz – 26.5GHz**



**Channel Frequency 2480MHz
Frequency Range 30MHz – 1GHz**



**Channel Frequency 2402MHz
Frequency Range 1GHz – 26.5GHz**

Prüfbericht - Nr.:
Test Report No.:

IN24ZOTO 001

Seite 25 von 36
Page 25 of 36

7.5 Spurious Radiated Emissions & Restricted Bands of Operation

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (d) / (15.209 & 15.205) RSS-GEN issue 5 clause 8.9, 8.10
Test Method	ANSI C63.10
Measurement Location	Semi Anechoic Chamber 9kHz - 1 GHz Fully Anechoic Chamber 1 GHz - 40GHz
Measurement Bandwidth	100 kHz for frequency range < 1GHz 1 MHz for Frequency range >1GHz
Detector	Refer remarks below
Measuring Distance	3 m
Requirement	As per the limits mentioned in the below table
Test setup	Refer TEST METHODOLOGY

Table 6: Transmitter limits for Radiated emission

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Distance of Measurement (m)
0.009 – 0.490	2400/F(kHz)	48.50 – 13.80	300*
0.490 – 1.705	24000/F(kHz)	33.80 – 23.00	30*
1.705 -30	30	29.54	30*
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Remark: * The limit shows in the table above of frequency range 0.009 – 0.490, 0.490 – 1.705 MHz and 1.705-30MHz is at 300 meter, 30 meter and 30 meter range respectively, which corresponds to 128.51 – 93.80, 73.80 – 62.96 and 69.54 dBμV/m at 3m range by extrapolation calculation and the measurement of loop antenna.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

Test Conditions:

Temperature (Norm) = + 22.3 °C Voltage = 24 VDC through DC supply Relative humidity: 58%

Prüfbericht - Nr.:

Test Report No.:

IN24ZOTO 001

Seite 26 von 36

Page 26 of 36

Test results:

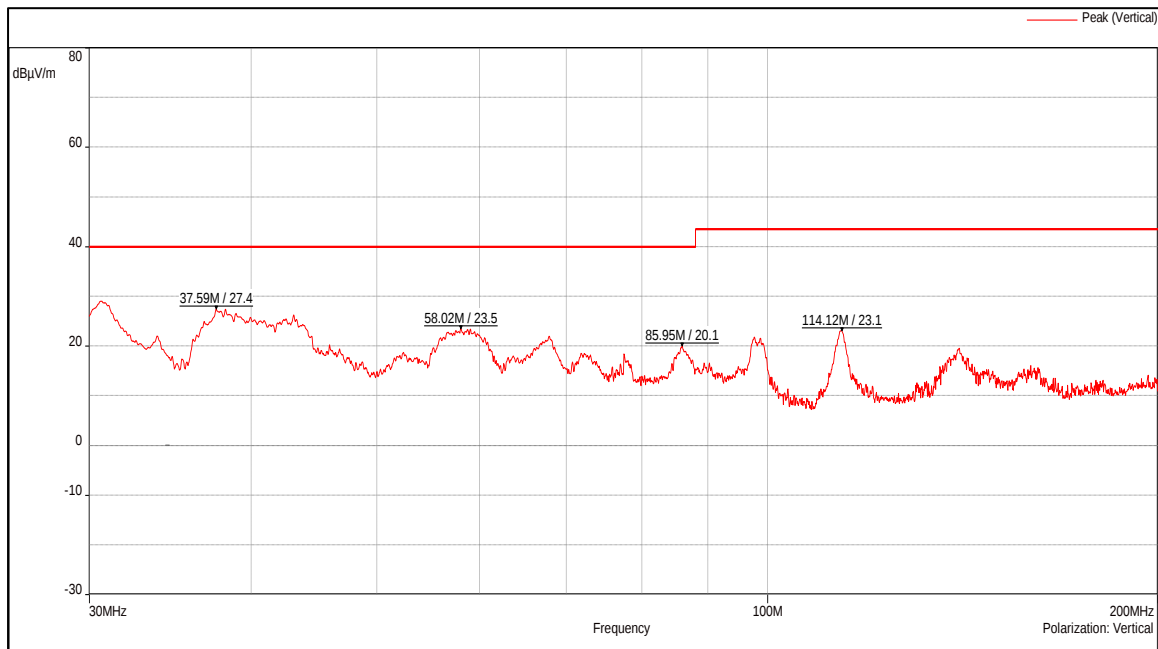
Note: All the losses are included during measurement and final values are mentioned in the test report. Refer TEST METHODOLOGY for more details.

Test results for frequency range 9kHz – 30MHz

No emissions found in frequency range 9 kHz to 30 MHz, and measured levels are below 20dB from the limit line, hence not reported.

Table 7: Test results for frequency range 30MHz – 200MHz

Antenna Polarization	Measured Frequency (MHz)	Measured Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Vertical	37.59	27.40	40.00	-12.60
	58.02	23.50	40.00	-16.50
	85.95	20.10	40.00	-19.90
	114.12	23.10	43.50	-20.40
Horizontal	51.60	19.40	40.00	-20.60
	75.18	18.30	40.00	-21.70
	97.59	16.30	43.50	-27.20
	135.48	15.30	43.50	-28.20



Channel Frequency 30MHz – 200MHz

Polarization Vertical

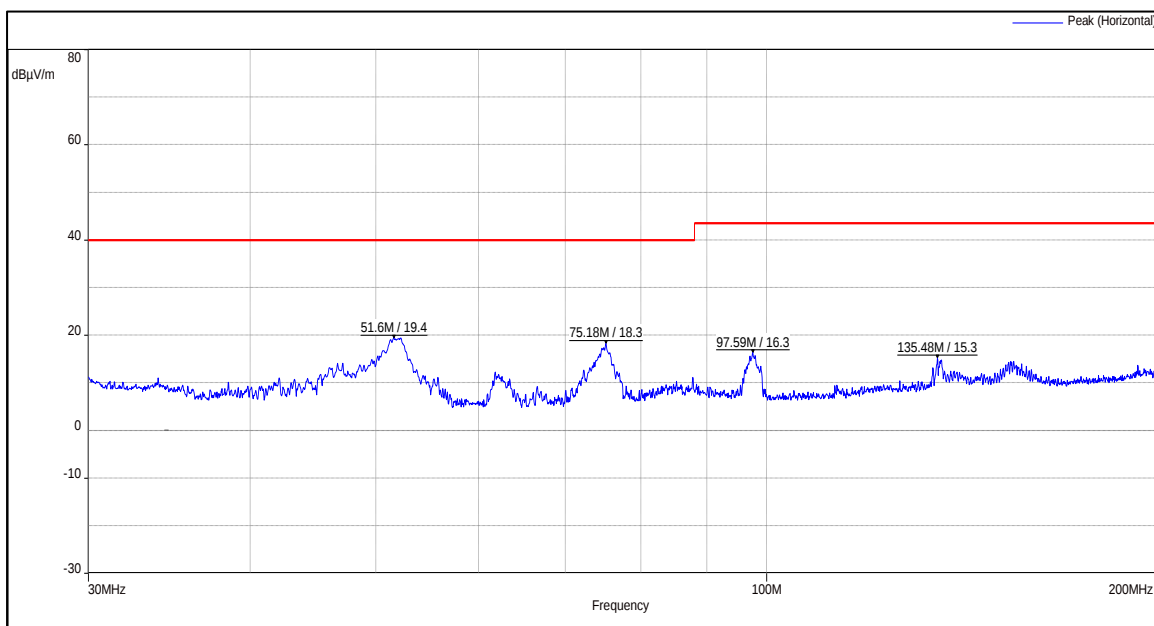
Prüfbericht - Nr.:

Test Report No.:

IN24ZOTO 001

Seite 27 von 36

Page 27 of 36



Channel Frequency 30MHz – 200MHz

Polarization Horizontal

Prüfbericht - Nr.:
Test Report No.:

IN24ZOTO 001

Seite 28 von 36
Page 28 of 36

Table 8: Test results for the frequencies above 1GHz:

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	2402(Pk)	Vertical	67.91	-	-
	2402(Av)		63.13	-	-
	2390(Pk)		37.75	74.00*	-36.25
	2390(Av)		24.27	54.00*	-29.73
	4804(Pk)		53.24	74.00	-20.76
	4804(Av)		44.99	54.00	-9.01
	7206(Pk)		52.37	74.00	-21.63
	7206(Av)		40.64	54.00	-13.36
	2402(Pk)	Horizontal	72.52	-	-
	2402(Av)		67.87	-	-
	2390(Pk)		37.43	74.00*	-36.57
	2390(Av)		24.26	54.00*	-29.74
	4804(Pk)		45.17	74.00	-28.83
	4804(Av)		35.03	54.00	-18.97
	7206(Pk)		50.56	74.00	-23.44
	7206(Av)		36.52	54.00	-17.48
2440	2440(Pk)	Vertical	68.88	-	-
	2440(Av)		64.13	-	-
	4880(Pk)		51.54	74.00	-22.46
	4880(Av)		42.70	54.00	-11.30
	7320(Pk)		51.91	74.00	-22.09
	7320(Av)		39.97	54.00	-14.03
	2440(Pk)	Horizontal	75.15	-	-
	2440(Av)		70.46	-	-
	4880(Pk)		44.57	74.00	-29.43
	4880(Av)		33.72	54.00	-20.28
	7320(Pk)		49.10	74.00	-24.90
	7320(Av)		35.62	54.00	-18.38
2480	2480(Pk)	Vertical	67.18	-	-
	2480(Av)		62.39	-	-
	2483.5(Pk)		36.90	74.00*	-37.10
	2483.5(Av)		26.46	54.00*	-27.54
	4960(Pk)		54.65	74.00	-19.35
	4960(Av)		46.32	54.00	-7.68
	7440(Pk)		50.55	74.00	-23.45
	7440(Av)		37.93	54.00	-16.07
	2480(Pk)	Horizontal	74.18	-	-
	2480(Av)		69.47	-	-
	2483.5(Pk)		36.54	74.00*	-37.46
	2483.5(Av)		23.51	54.00*	-30.49
	4960(Pk)		47.33	74.00	-26.67
	4960(Av)		36.58	54.00	-17.42
	7440(Pk)		48.40	74.00	-25.60
	7440(Av)		35.59	54.00	-18.41

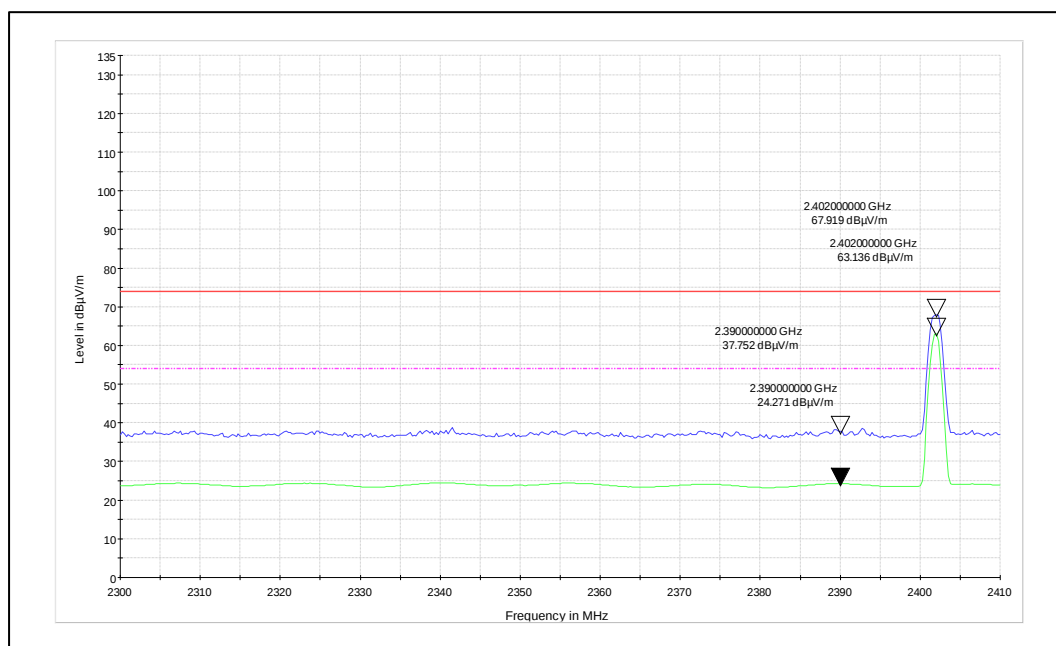
→ Fundamental Frequency

*→ Restricted Band edges

Pk: Peak Detector.

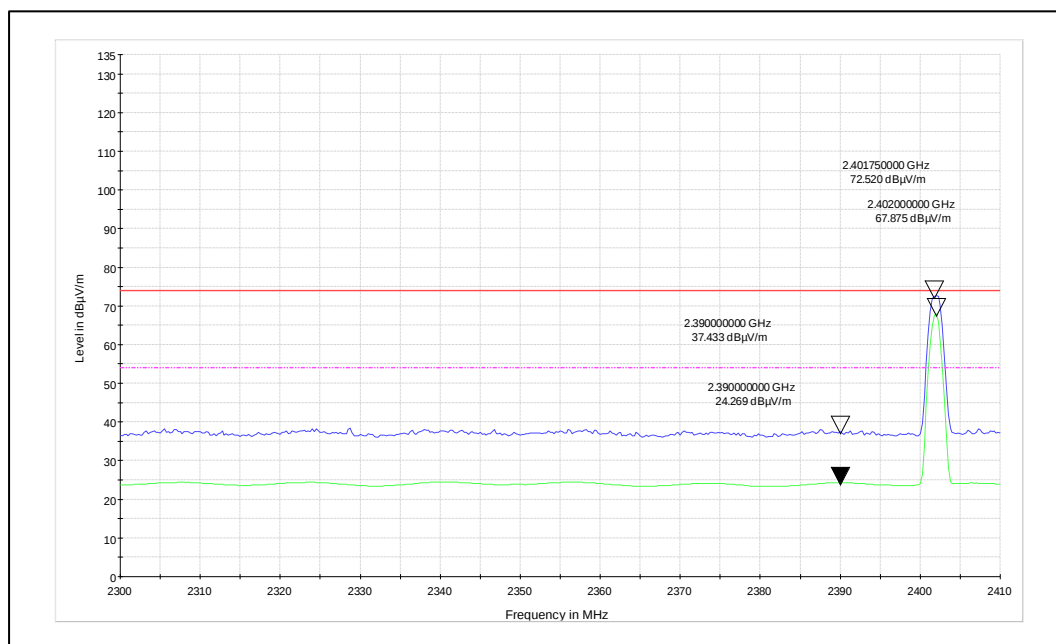
Av: Average Detect

Channel Frequency 2402MHz



Channel Frequency: 2402MHz

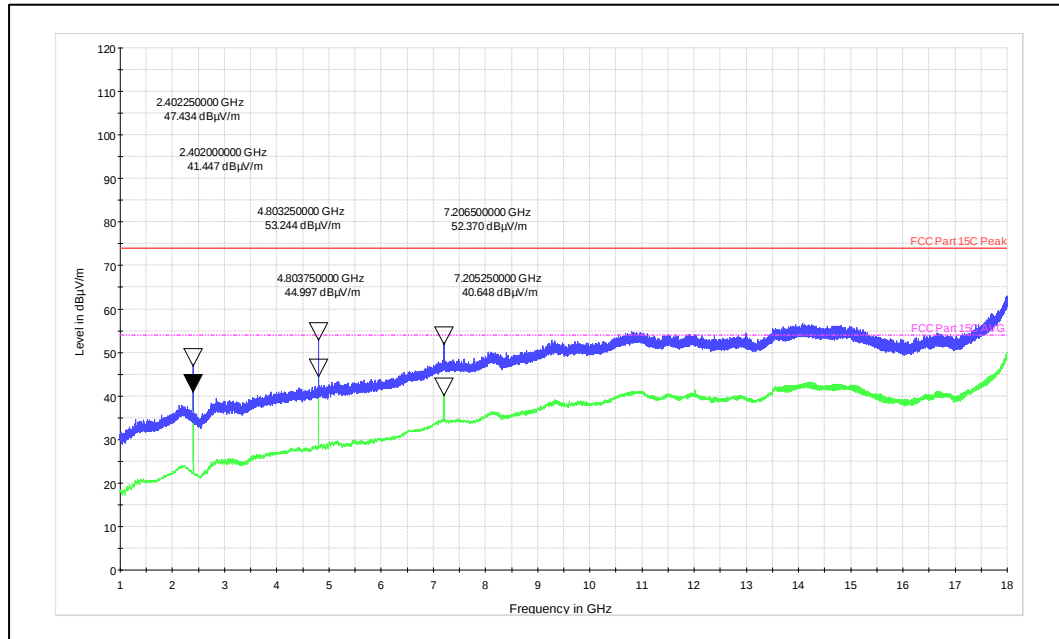
Polarization: Vertical



Channel Frequency: 2402MHz

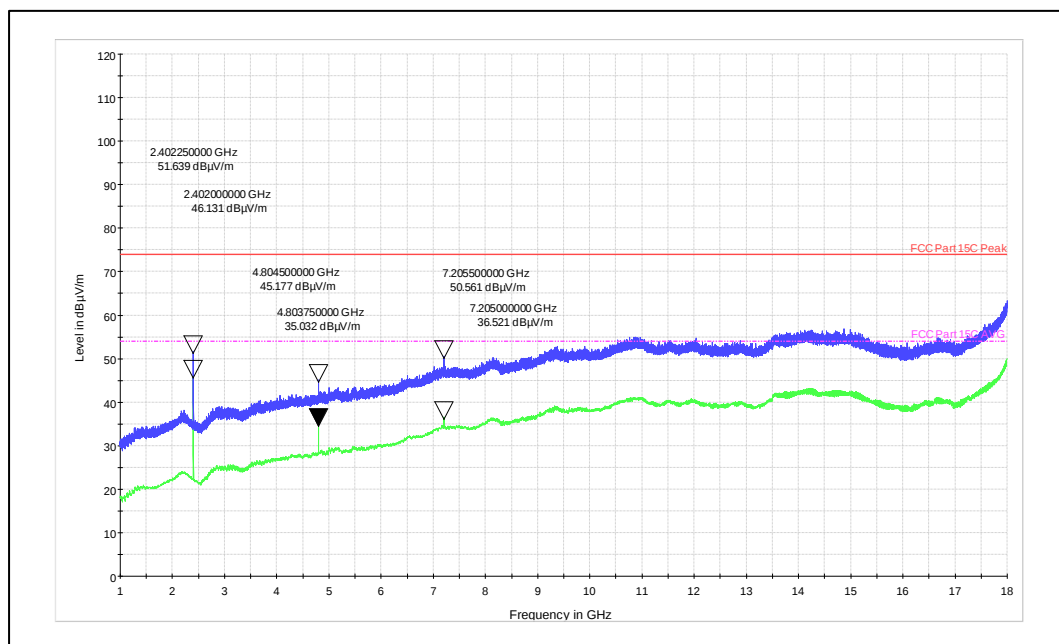
Polarization: Horizontal

Channel Frequency 2402MHz



Frequency Range: 1GHz – 18GHz

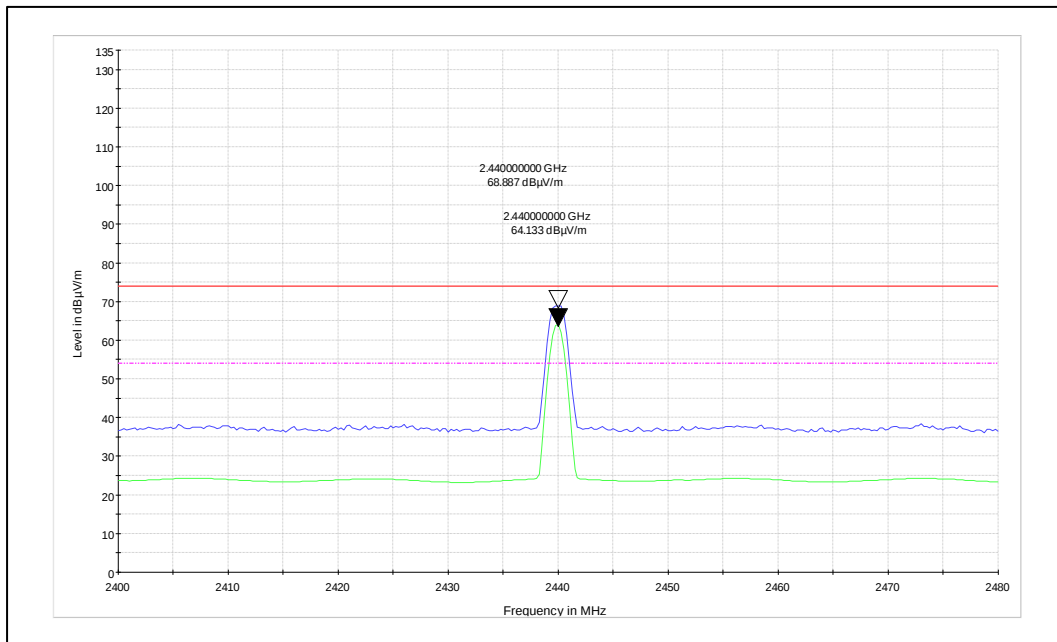
Polarization: Vertical



Frequency Range: 1GHz – 18GHz

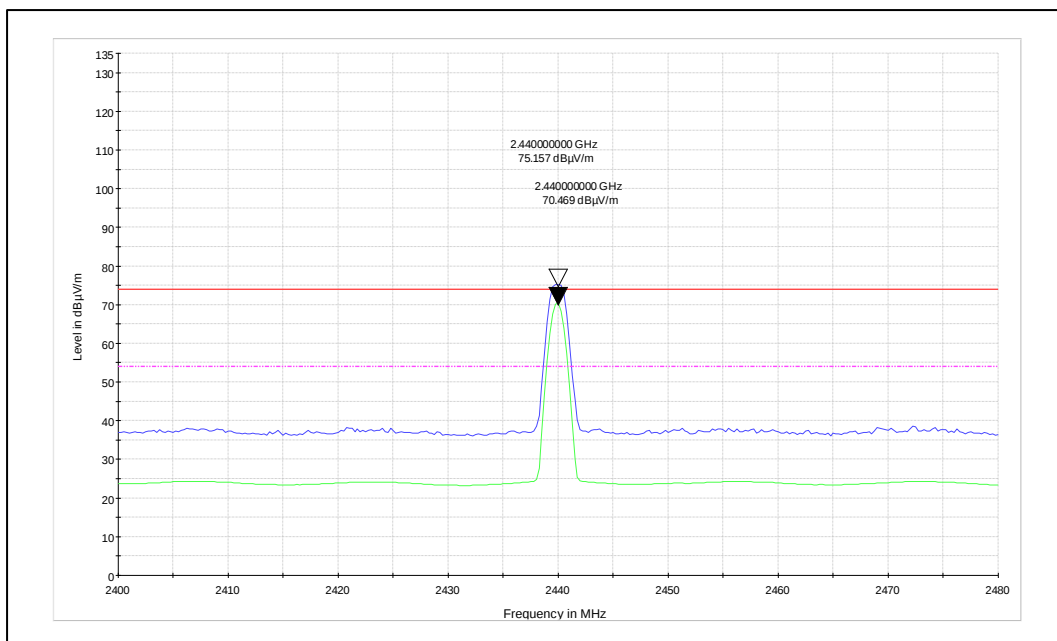
Polarization: Horizontal

Channel Frequency 2440MHz



Channel Frequency: 2440MHz

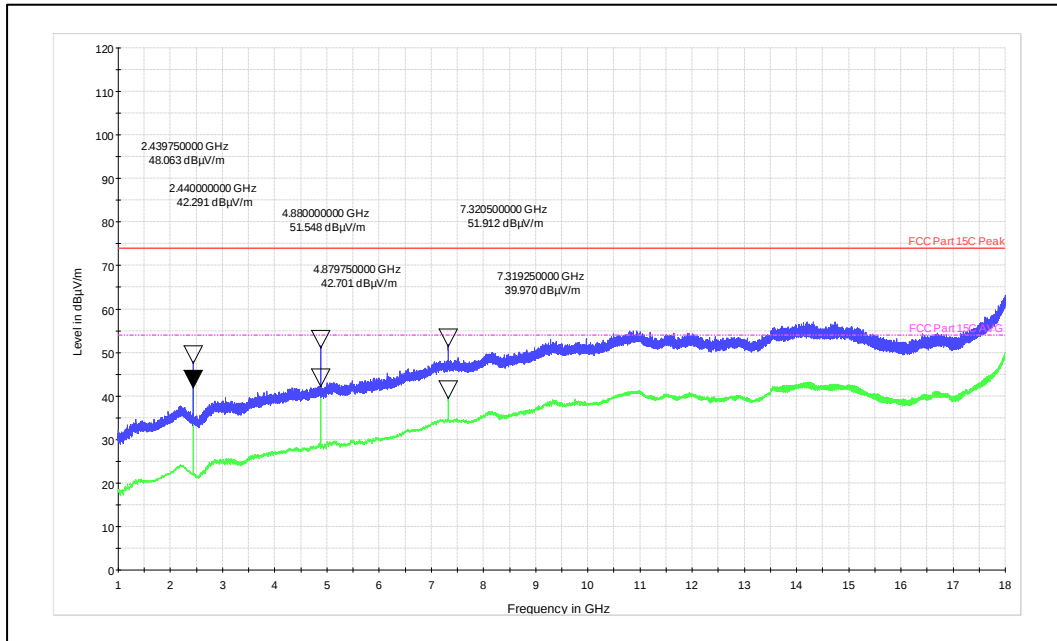
Polarization: Vertical



Channel Frequency: 2440MHz

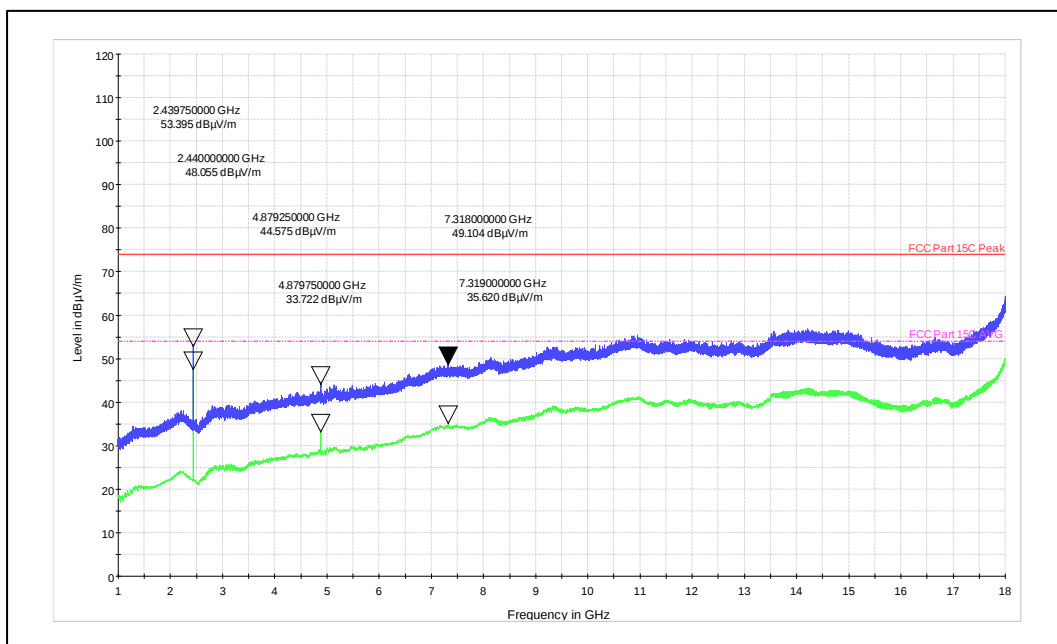
Polarization: Horizontal

Channel Frequency 2440MHz



Frequency Range: 1GHz – 18GHz

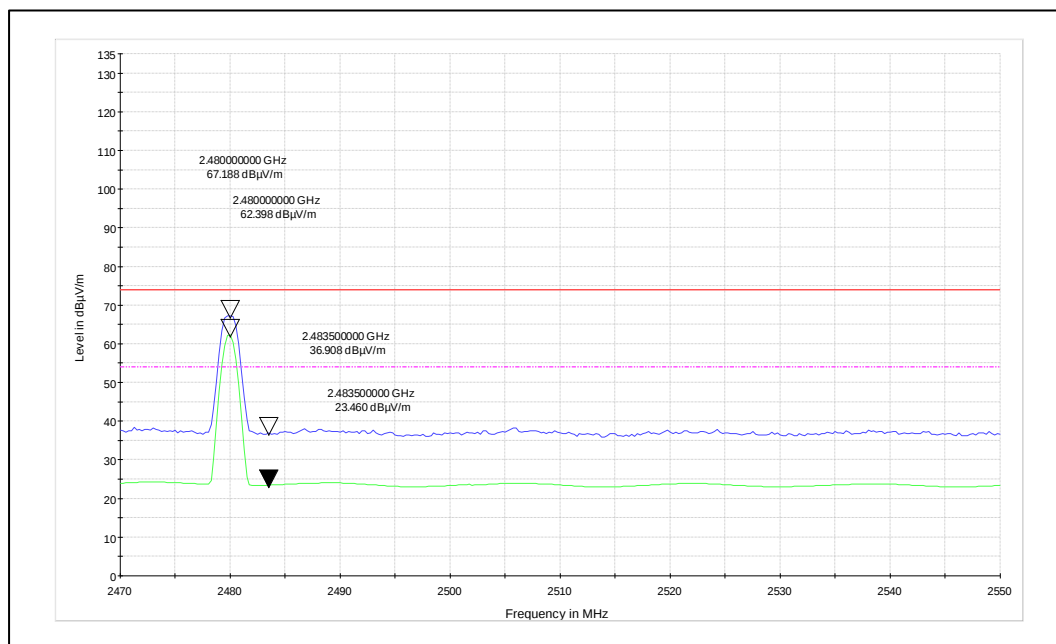
Polarization: Vertical



Frequency Range: 1GHz – 18GHz

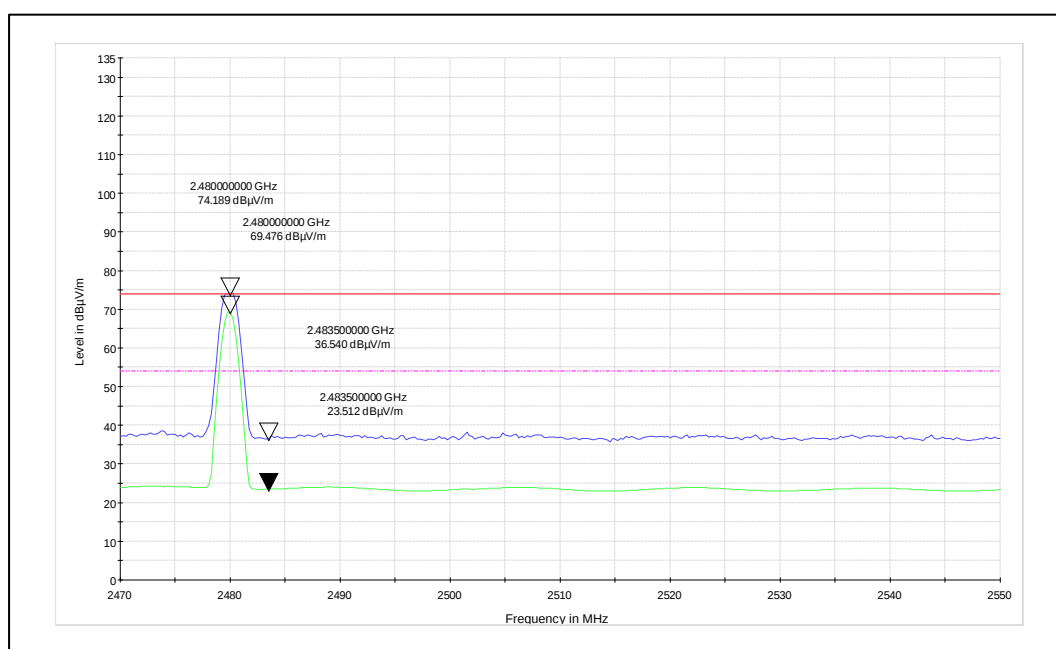
Polarization: Horizontal

Channel Frequency 2480MHz



Channel Frequency: 2480MHz

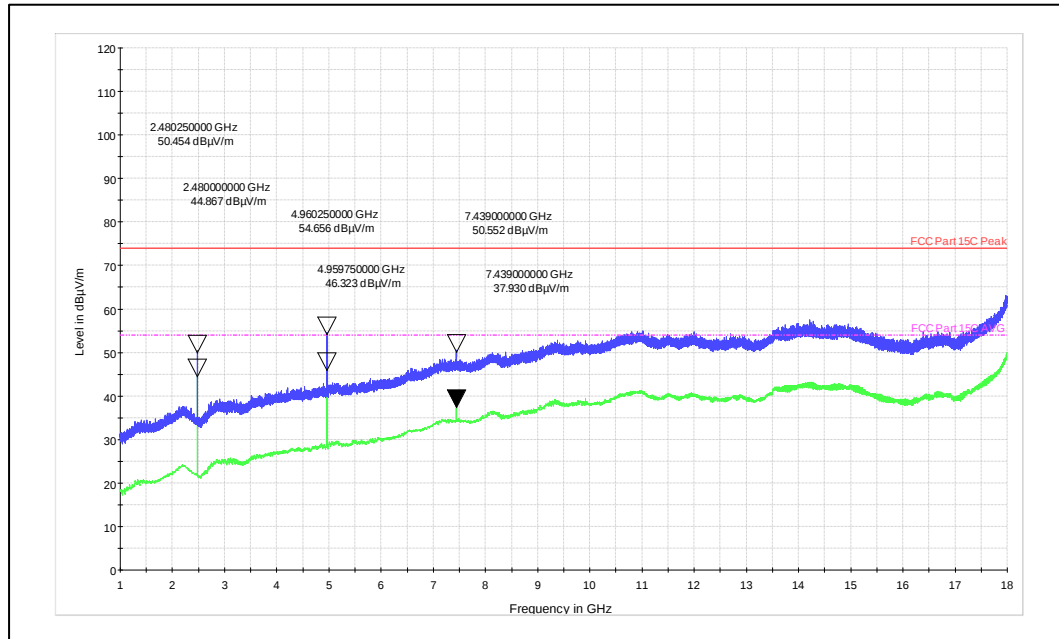
Polarization: Vertical



Channel Frequency: 2480MHz

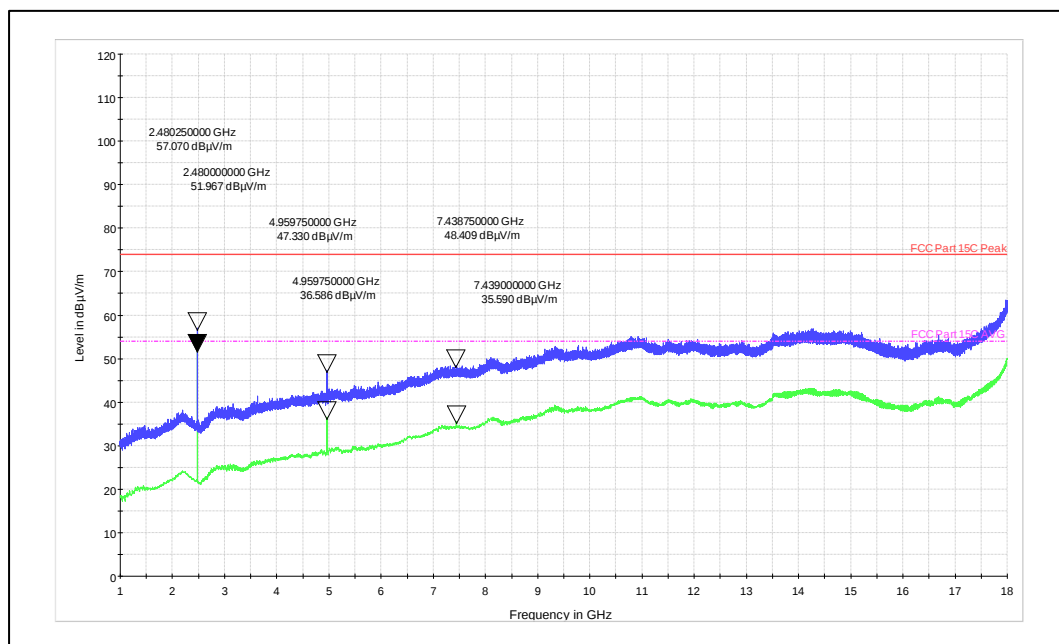
Polarization: Horizontal

Channel Frequency 2480MHz



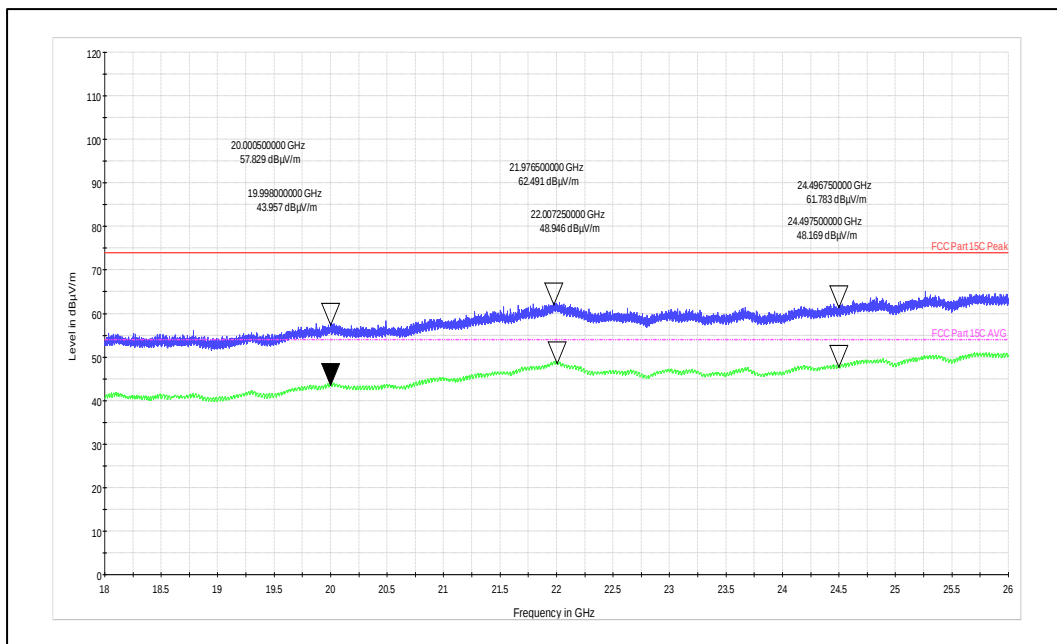
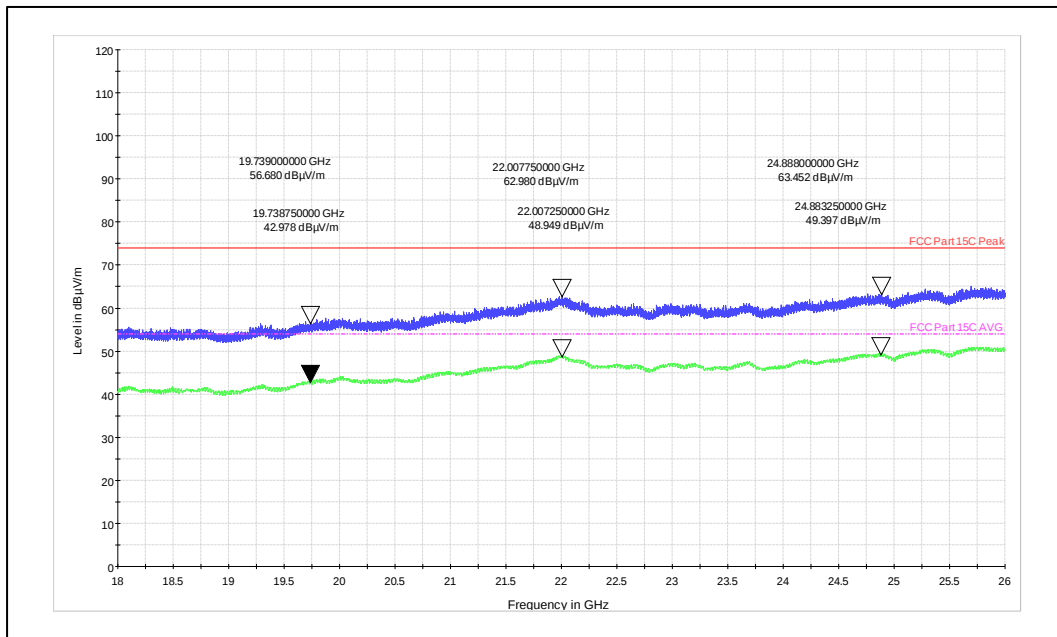
Frequency Range: 1GHz – 18GHz

Polarization: Vertical



Frequency Range: 1GHz – 18GHz

Polarization: Horizontal



8 LIST OF TABLES

Table 1: List of test and measurement instruments	7
Table 2: Instrument application Software versions	7
Table 3: Ratings and System Details as declared by Client*	8
Table 4: Measurement Uncertainty	9
Table 5: List of BLE Center frequencies	10
Table 6: Transmitter limits for Radiated emission	25
Table 7: Test results for frequency range 30MHz – 200MHz	26
Table 8: Test results for the frequencies above 1GHz:	28

9 LIST OF FIGURES

Figure 1: Frequency Range 9 kHz- 30 MHz	11
Figure 2: Frequency Range 30 MHz – 200 MHz	11
Figure 3: Frequency Range 200 MHz - 1GHz	12
Figure 4: Frequency Range above 1 GHz	12