

Prüfbericht-Nr.: <i>Test report no.:</i>	IN25OQ01 001	Auftrags-Nr.: <i>Order no.:</i>	147121871 010	Seite 1 von 28 Page 1 of 28
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	2115186	Auftragsdatum: <i>Order date:</i>	2025-10-28	
Auftraggeber: <i>Client:</i>	Minda Corporation Limited D-6-11, Sector-59 Noida; Uttar Pradesh; India; 201301			
Prüfgegenstand: <i>Test item:</i>	KEY FOB			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	ER-365001F			
Auftrags-Inhalt: <i>Order content:</i>	Testing and issue of Test Report with Grant Certificate			
Prüfgrundlage: <i>Test specification:</i>	FCC Part15 SubpartC 15.231; 15.205; 15.209 RSS 210 Issue 11; RSS GEN Issue 5			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2025-11-10			
Prüfmuster-Nr.: <i>Test sample no.:</i>	A004134958-001 A004134958-002			
Prüfzeitraum: <i>Testing period:</i>	2025-11-13 - 2025-11-27			
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, Electronic City Phase1 Bangalore -560 100, India			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>	genehmigt von: <i>authorized by:</i>			
Datum: <i>Date:</i> 2026-03-04				
Stellung / Position:	M.V.Naveen Kumar Senior Engineer	Stellung / Position:	Vinay N Manager	
Sonstiges / <i>Other:</i>	FCC ID: 2A29L-365001F IC: 23641-365001F HVIN: ER-365001F			
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: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
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- | | |
|---|--|
| 1 | <p>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.</p> <p>Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.</p> <p><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></p> |
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| 3 | <p>Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben.</p> <p>Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.</p> <p><i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i></p> <p><i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i></p> |

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4	Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2023, 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. Zu weiteren Informationen bezüglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019. <i>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2023, 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. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.</i>
5	Other <i>Sonstiges</i> Test sample(s), as well sample information, description, product details and intended usage was provided by customer. The Laboratory is not be responsible for the information/data provided by the customer which can affect the validity of results.
6	Test sample obtaining <i>Prüfmusterbereitstellung</i> ☒ Sending by customer ☐ Sampling by TÜV Rheinland Group ☐ Others:
7	Additional Information FCC Test site registration number: 570793 ISED Test site registration number: 27711

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TEST SUMMARY

Test Item	FCC	ISED	Result
Field Strength of Emissions from Intentional Radiator & Restricted band of Operation	15.231(b)	RSS 210 Section A.1.3 (b) RSS-Gen, Sections 8.10	Pass
Duty Cycle Determination	15.231(b)(2)	RSS 210 Section A.1.2 (a) (b)	Pass
Field Strength of Spurious emission	15.231(b)(3)	RSS 210 Section A.1.5 (d) RSS-Gen, Sections 8.9	Pass
Bandwidth of emission	15.231(c)	RSS 210 Section A.1.4	Pass

Note:

1. The System has 2 separate units namely as Supervisory Control Unit (SCU) and Key Fob. SCU part has 125 KHz LF Transmitter and 315MHz RF Receiver and Key Fob part has 315MHz RF Transmitter and 125 KHz Receiver.
2. This Test report covers the KEYFOB section 315MHz Transmitters test cases

Product Category: Electronics Testing

Test Discipline: EMC Test Facility

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REVISION HISTORY OF THIS REPORT

Report Number	Version	Description	Issue date
IN25OQ01 001	01	Testing & Issue of Test Report	2026-03-04

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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

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2 TEST SITES

2.1 Testing Facilities

1. TÜV Rheinland (India) Pvt.Ltd.,
27/B, 2nd Cross,
ElectronicCityPhase1
Bangalore – 560 100,
India
2. TUV Rheinland (India) Pvt.Ltd.,
108, Beside ISBR Business School,
Electronic city Phase I
Bangalore - 560 100,
India

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	103384	3.20SP2	24.06.2026	Yearly	Radiated Spurious Emission
EMI Receiver	Rohde & Schwarz	ESW 44	101773	1.72.SP2	26.01.2026	Yearly	
Active loop antenna	Frankonia	LAX-10	LAX-10-800	-	16.04.2026	Yearly	
Balun & Biconical Antenna	Schwarzbeck mess-elektronik	BBA 9106+VH BB 9124	9124-1117	-	27.05.2026	Yearly	
Log-Periodic Antenna	Schwarzbeck mess-elektronik	VUSLP 9111B	9111B-324	-	26.05.2026	Yearly	
Horn Antenna	Schwarzbeck mess-elektronik	BBHA 9120D	9120D-1944	-	11.11.2026	Yearly	
Semi Anechoic Chamber	Frankonia	-	-	-	-	-	
3mtr Fully Anechoic Chamber	Albatross	-	-	-	-	-	
Signal Analyser	Rohde & Schwarz	FSV7	1321.3008 K07/10164 4	-	18.02.2026	Yearly	Conducted Test Parameters
10 dB RF Attenuator (DUT-1)	Rohde & Schwarz	-	-	-	10.10.2026	Yearly	

Table 2: Instrument application Software versions

SL. No.	Test Type	Application software	Version
1	Radiated spurious emission measurement in 10mtr SAC	BAT EMC	3.20.0.17
2	Radiated spurious emission measurement in 3mtr FAC	EMC 32	10.60.20

3 GENERAL PRODUCT INFORMATION

3.1 Product Function and Intended Use

Smart Control Unit Features

- Operates All the Four Turn Indicators and Indication Sign on Instrument Cluster
- Retracts solenoid to allow the lock bar to operate (If authentication is successful)
- Operates the seat Actuator (if authentication successful)
- Operates Fuel Tank Actuator (if authentication successful)
- Communicates with Engine ECU (If authentication is successful)
- Transmits LF signals (125 KHz) to wake up and request authenticate the key FOB
- Receives & demodulates the UHF signals (315MHz) to authenticate the key FOB.

FOB Assembly Features

- Switching ON/OFF Smart communication feature using a switch
- Finder / Seat Open /Ft open operation using a switch
- Senses LF Signal (125KHz)
- Transmits RF Signal (315MHz)
- Measures the strength of the LF signal

3.2 Ratings and System Details of Equipment under Test

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

Protocol		SRD (Short Range Device)
Operating Frequency Range		315MHz (Single Frequency)
No of Channels		1
Modulation		FSK
Data Rate		2Kbps
Number of antennas		1
Antenna Gain & Antenna Type		-20dBi & PCB Antenna
Supply Voltage to Product		3 VDC (Through Battery (CR2032))
Environmental conditions	Operating Condition	-20°C to +60°C
	Storage Condition	-30°C to +85°C
EUT Dimension(L x W x H) in mm		L(77) x B(35) x H(10) in mm

***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
RF output power, conducted	± 0.67 dB
Power Spectral Density, conducted	± 0.85 dB
Unwanted Emissions, conducted	± 2.58 dB
All emissions, radiated	± 3.67 dB

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4 TEST SET-UP AND OPERATION MODE

4.1 Principle of Configuration Selection

Transmission was enabled with highest possible duty cycle transmission.

4.2 Test Operation and Test Software

Hardware Version Identification Number (HVIN):	ER-365001F
Test Firmware:	SMIT_VAS_064_21_Piaggio_MP3_Keyless_FOB_315_V0.1_HomoLog_Hex
Software Name:	SMIT_VAS_030_20_Smart_Key_System_FOB_V0.2
Hardware Name & Version	SMIT_VAS_045_21_F_1.0

4.3 Special Accessories and Auxiliary Equipment

- None

4.4 Simultaneous Transmission

- None

4.5 Countermeasures to achieve EMC Compliance

- None

4.6 TUV Sample Identification

A004134958-001 → Conducted Test Sample

A004134958-002 → Radiated Test Sample

5 Operational Description

This product is applicable for the LOCK / UNLOCKS operation of the handle lock when authorized user (with key FOB) within distance of 1.5meter distance. Authorized users can open the fuel cap and seat from vehicle within distance of 1.5-meter distance. In addition, it has a vehicle locator finder, seat, FT open function from the FOB when authorized user (with key FOB) within distance of 50 meters from the vehicle. Vehicle finder indication takes place over the flasher. ECU is communicating with Engine ECU over the CAN for the status of authentication & DTC.LED and IMMO LED are provided on dashboard for the indication of authentication status. The developed system is suitable for two wheelers for the smart key system.

6 TEST METHODOLOGY

6.1 Radiated Emission Test

The radiated emission measurement was performed according to the procedures in ANSI C63.10-2020. 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 Balloon 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

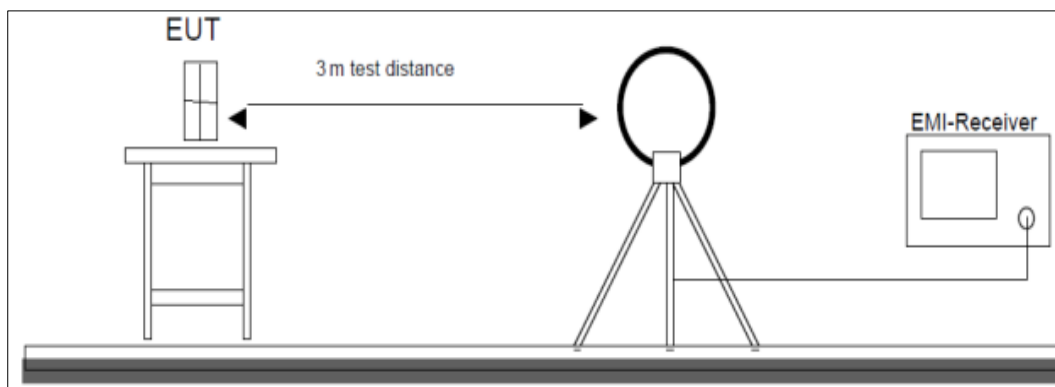


Figure 1: Frequency Range 9 kHz- 30 MHz

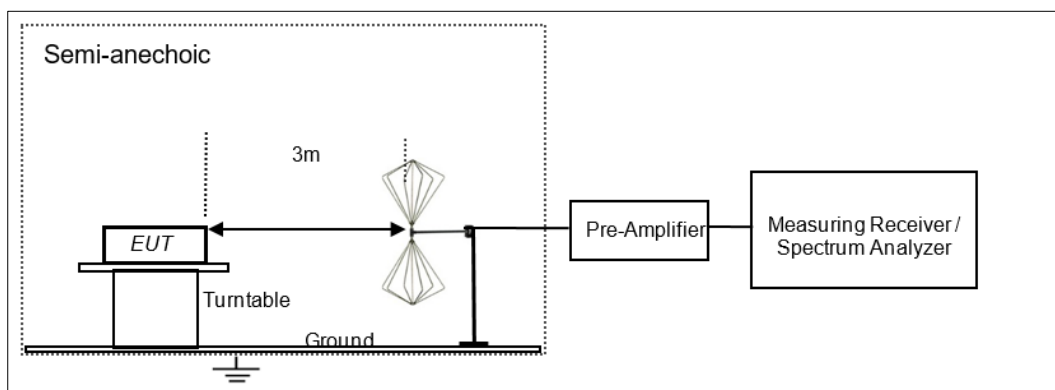


Figure 2: Frequency Range 30 MHz – 200 MHz

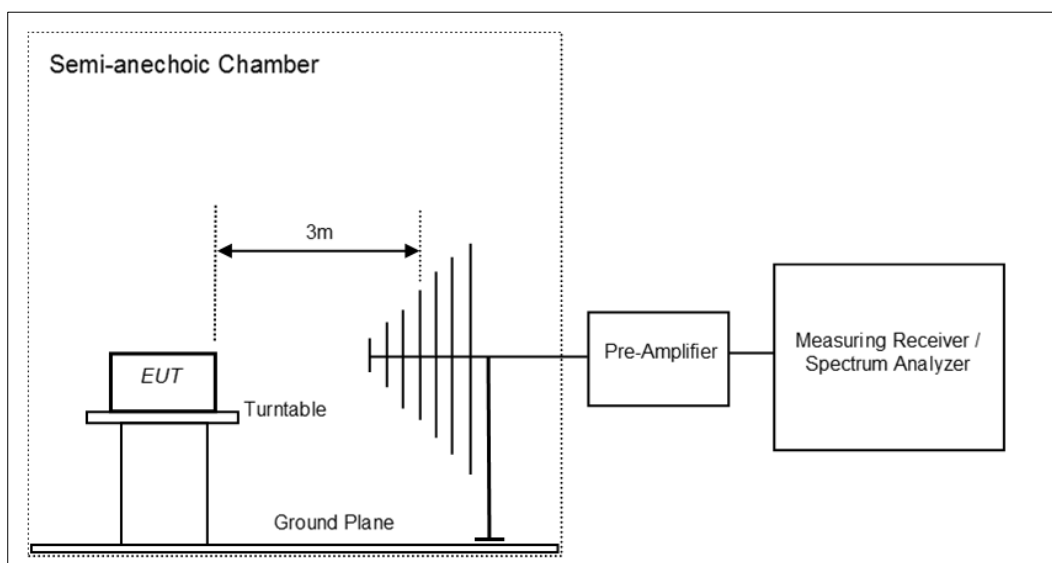


Figure 3: Frequency Range 200 MHz - 1GHz

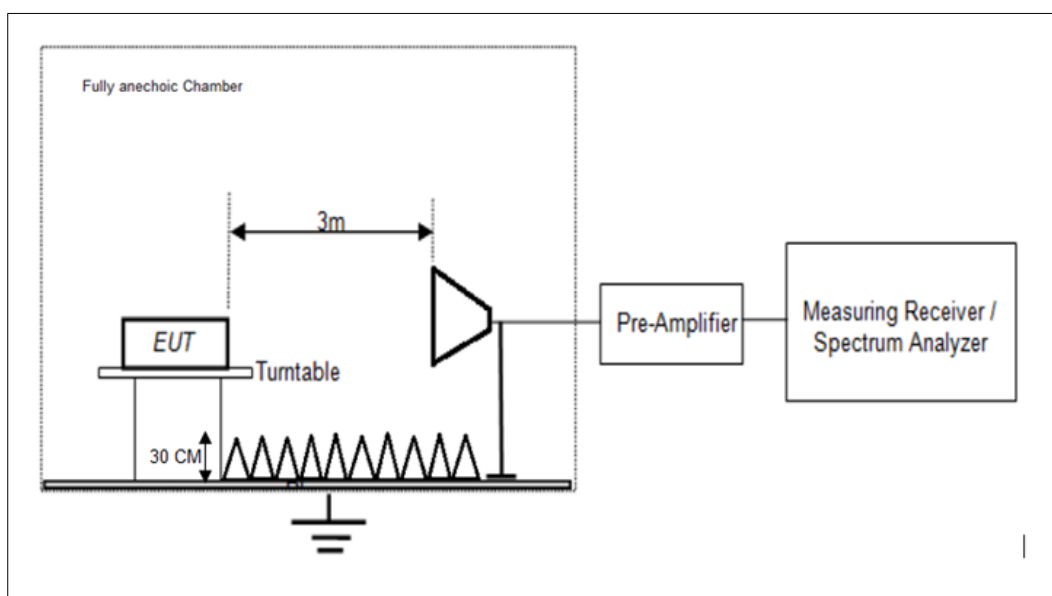


Figure 4: Frequency Range above 1 GHz

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7 TEST RESULTS

7.1 Field Strength of Emissions from Intentional Radiator & Restricted Band of Operation

Result

Pass

Test Specification	FCC part 15 Subpart C 15.231(b), 15.205(a) RSS 210 Issue 11 Section A.1.3, RSS-Gen, Section 8.10
Test Method	ANSI C63.10-2020 ANSI C63.10:2020+Cor. 1:2023+ C63.10a:2024.
Measurement Location	Semi Anechoic Chamber 30MHz - 1 GHz
Measurement Bandwidth	100 kHz for frequency range < 1GHz
Measuring Distance	3 m
Requirement	As per the limits mentioned in the below table
Test setup	Refer TEST METHODOLOGY

Table 5: Transmitter Field strength Limits

Fundamental Frequency (MHz)	Field strength of Fundamental $\mu\text{V/m}$ @3mtr	Field strength of spurious emissions $\mu\text{V/m}$ @3mtr
260-470MHz	3750 to 12500**	375 to 1250**

Note: ** Linear interpolations

For 260MHz to 470MHz: FS ($\mu\text{V/m}$) = (41.67 * F) -7083

The fundamental & harmonic emission limits for a device operating at 315MHz listed in below

Fundamental Frequency (MHz)	Field strength of Fundamental $\mu\text{V/m}$ @3mtr	Field strength of Fundamental dB $\mu\text{V/m}$ @3mtr
315MHz	6043.05	75.62

Results:

The fundamental & Harmonics field strength didn't exceed the limits specified in Table 2 at a distance of 3mtr taken with an average detector

Conversion Formula: $20 \cdot \log(\mu\text{V/m})$

Test Conditions:

Temperature (Norm) = + 24 °C

Voltage = 3 VDC (Through Battery (CR2032))

Relative humidity = 62 %

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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 Intentional Radiator as per 15.231(b)

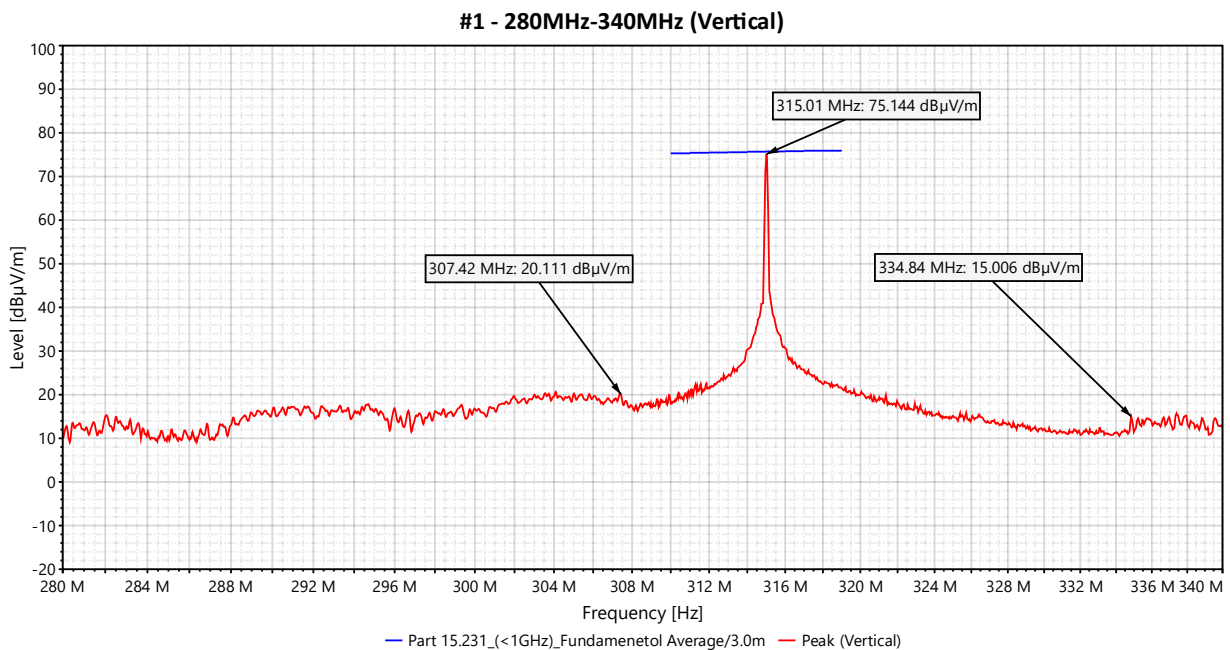
Polarization	Measured Frequency (MHz)	Measured Intentional Radiator of Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Vertical	315.01(Pk)	75.14	75.62	-0.48
Horizontal	315.01(Pk)	71.18	75.62	-4.44

Test Results for Restricted bands of Operation as per 15.205

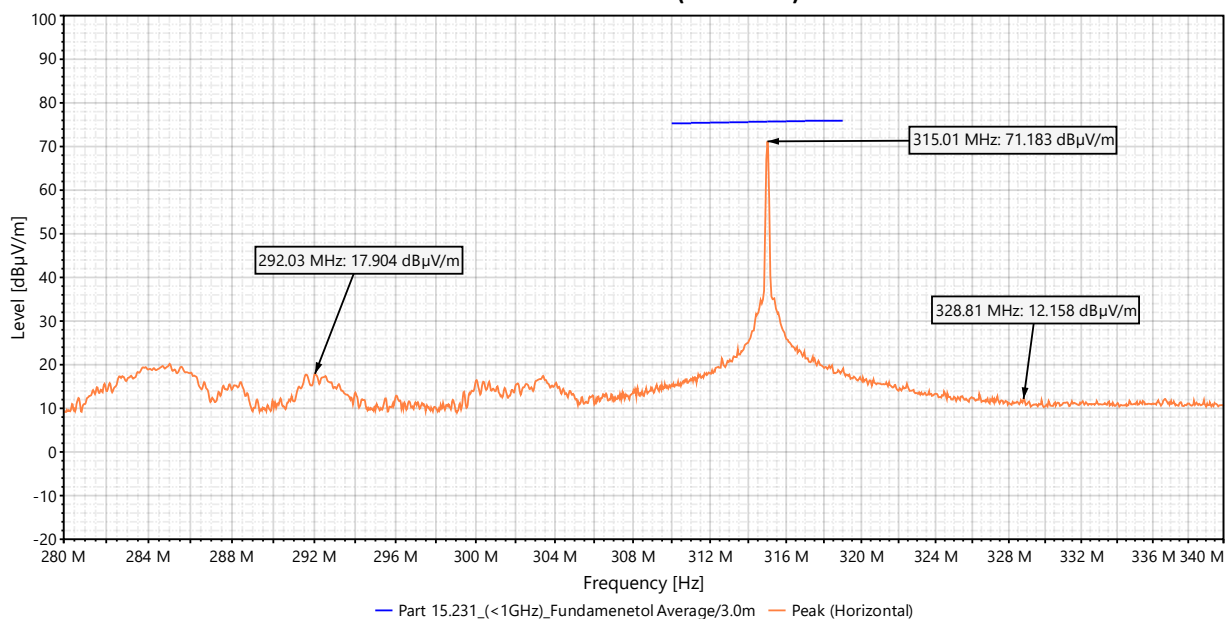
Polarization	Measured frequency (MHz)	Mesaured Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Vertical	307.42(Pk)	20.11	55.19	-35.08
	334.84(Pk)	15.00	56.75	-41.75
Horizontal	292.03(Pk)	17.90	54.11	-36.21
	328.81(Pk)	12.15	56.43	-44.28

Note: Limits considered as per 15.231

Test Plots



#2 - 280MHz-340MHz (Horizontal)



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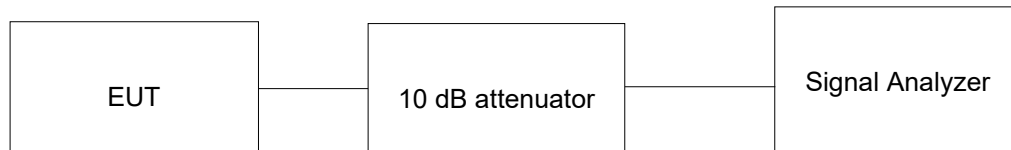
7.2 DUTY CYCLE DETERMINATION

Result

Pass

Test Specification	FCC part 15 Subpart C 15.231(a)(1) RSS-210 Issue 11 Section A.1.2 (a) (b)
Test Method	ANSI C63.10-2020 ANSI C63.10:2020+Cor. 1:2023+ C63.10a:2024.
Requirement	A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released

Test Method



Test Conditions:

Temperature (Norm) = + 24 °C

Voltage = 3 VDC (Through Battery (CR2032))

Relative humidity = 62 %

Results:

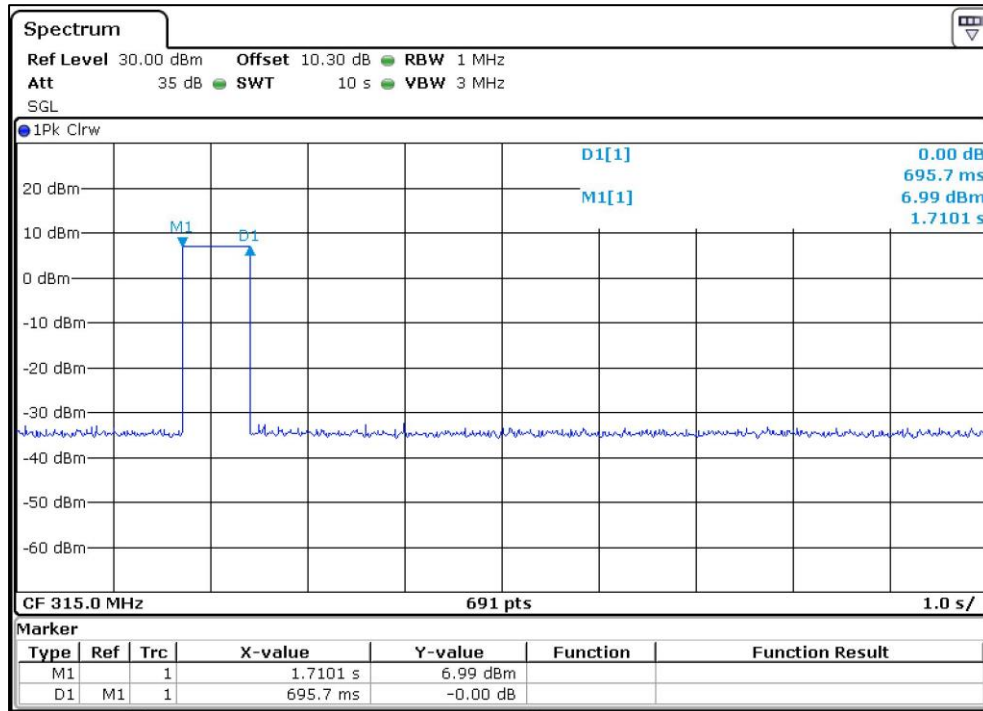
Transmitting Frequency (MHz)	Transmitting time (sec)	Limit (sec)	Remarks
315 MHz	0.695	5	Pass

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Test Plots:



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7.3 FIELD STRENGTH OF SPURIOUS EMISSION

Result

Pass

Test Specification	FCC part 15 Subpart C 15.231(b), 15.209(a) RSS 210 Issue 11 A.1.5, RSS-Gen, Sections 8.9
Test Method	ANSI C63.10-2020 ANSI C63.10:2020+Cor. 1:2023+ C63.10a:2024.
Measurement Location	Semi Anechoic Chamber 30MHz - 1 GHz Full Anechoic Chamber 1GHz – 4GHz
Measurement Bandwidth	100 kHz for frequency range < 1GHz 1 MHz for frequency range > 1GHz
Measuring Distance	3 m
Requirement	As per the limits mentioned in the below table
Test setup	Refer TEST METHODOLOGY

The Harmonic emission limits as per 15.231

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750	125 to 375
174-260	3750	375
260-470	3750 to 12500	375 to 1250
Above 470	12500	1250

The Harmonic emission limits for rest of the frequencies as per 15.209

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*
30-40.66	100	40.0	3
40.70-88	100	40.0	3
88-130	150	43.5	3

Note:

The Harmonics field strength didn't exceed the limits specified in Table 2 at 3mtr distance taken with an average detector

Conversion Formula: $20 \cdot \log (\mu V/m)$

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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

Frequency range of 30MHz – 200MHz:

Antenna Polarization	Measured Frequency (MHz)	Measured Spurious Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Vertical	46.95(Pk)	22.50	40.00	-17.50
	73.35(Pk)	19.47	40.00	-20.53
	98.25(Pk)	17.48	43.50	-26.02
	169.14(Pk)	27.20	43.50	-16.30
Horizontal	35.76(Pk)	15.55	40.00	-24.45
	53.49(Pk)	17.99	40.00	-22.01
	98.40(Pk)	18.47	43.50	-25.03
	155.64(Pk)	27.10	43.50	-16.40

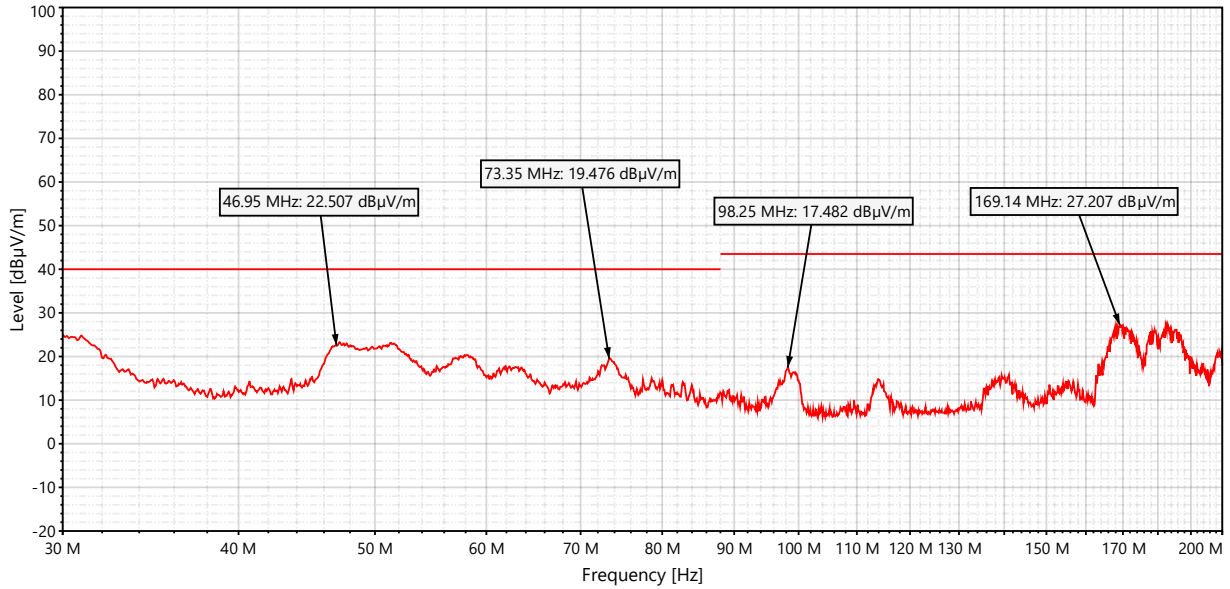
Frequency range of 200MHz to 1GHz:

Antenna Polarization	Measured Frequency (MHz)	Measured Spurious Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Vertical	314.99(Av)	47.97	*	-
	630.02(Av)	58.32	61.93	-3.61
	945.02(Av)	30.46	61.93	-31.47
	960.02(Av)	40.77	61.93	-21.16
Horizontal	314.99(Av)	44.05	*	-
	630.02(Av)	47.25	61.93	-14.68
	945.02(Av)	20.81	61.93	-41.12

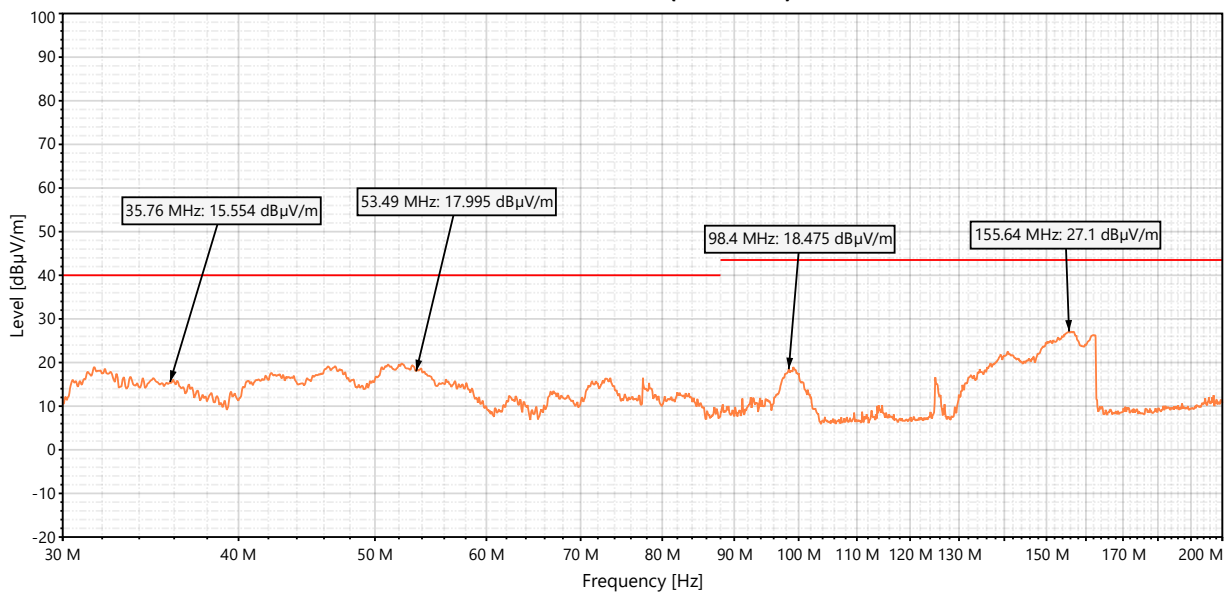
Note: -* → indicates the Nominal frequency (315MHz)

Test Plots:

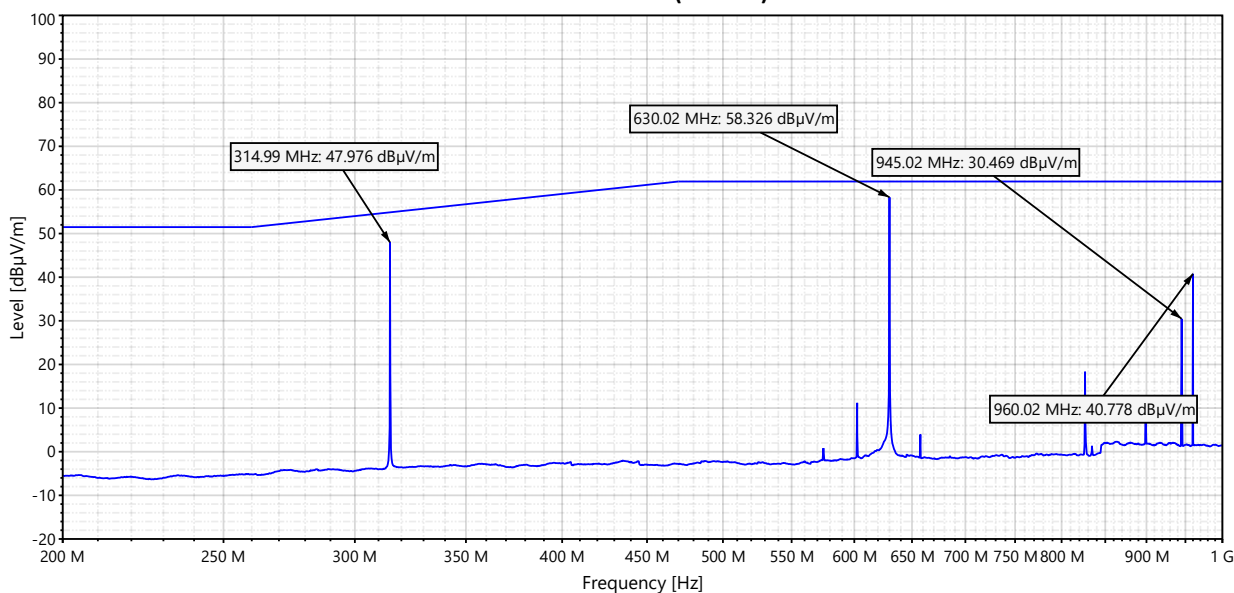
#1 - 30MHz-200MHz (Vertical)



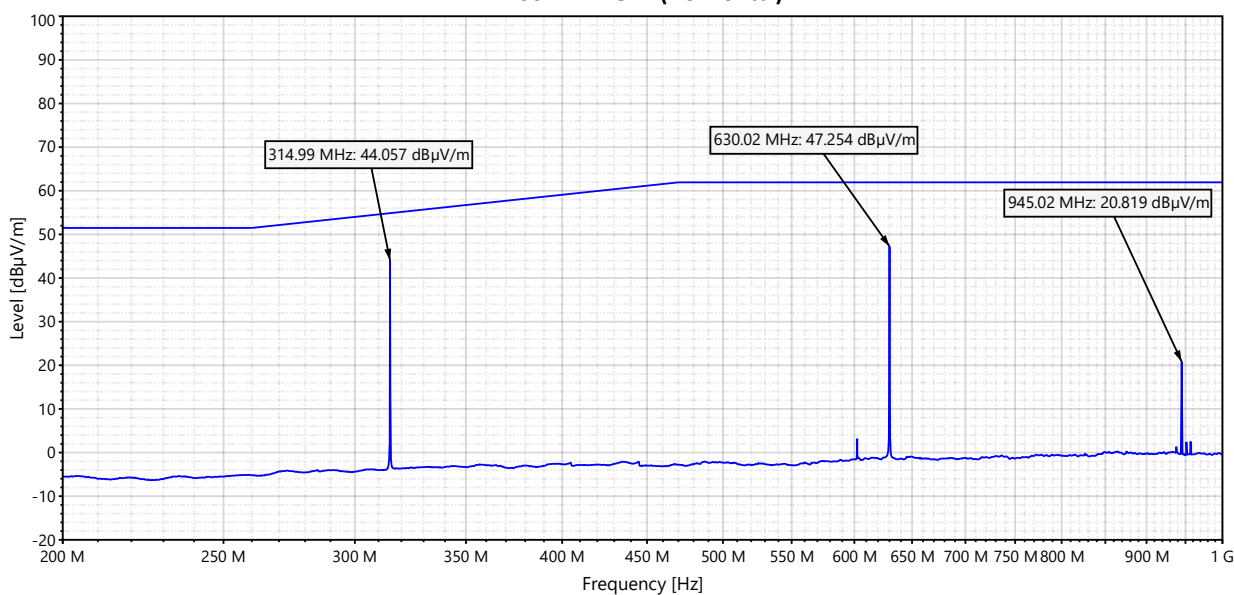
#2 - 30MHz-200MHz (Horizontal)



#1 - 200MHz-1GHz (Vertical)



#2 - 200MHz-1GHz (Horizontal)



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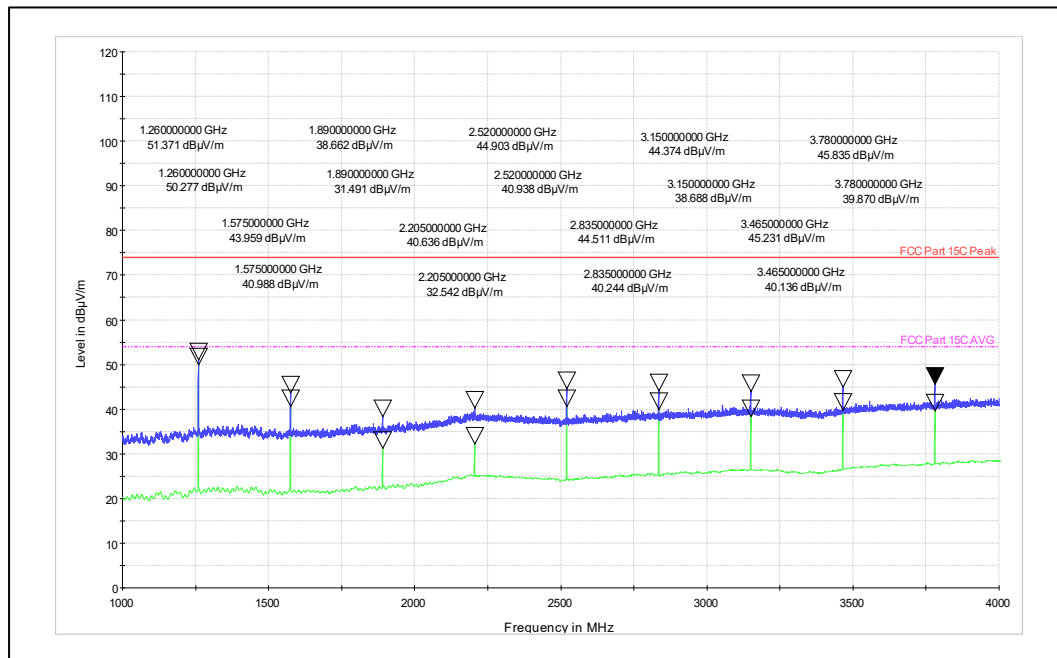
Frequency range of 1GHz to 4GHz:

Antenna Polarization	Measured Frequency (MHz)	Measured Emission value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	1260(Pk)	51.37	74.00	-22.63
	1260(Av)	50.27	54.00	-3.73
	1575(Pk)	43.95	74.00	-30.05
	1575(Av)	40.98	54.00	-13.02
	1890(Pk)	38.66	74.00	-35.34
	1890(Av)	31.49	54.00	-22.51
Horizontal	1260(Pk)	36.72	74.00	-37.28
	1260(Av)	26.33	54.00	-27.67
	1575(Pk)	36.67	74.00	-37.33
	1575(Av)	28.27	54.00	-25.73
	1890(Pk)	35.93	74.00	-38.07
	1890(Av)	24.78	54.00	-29.22

Note: Measurements have taken up to 10th harmonics of a Nominal frequency (315MHz).

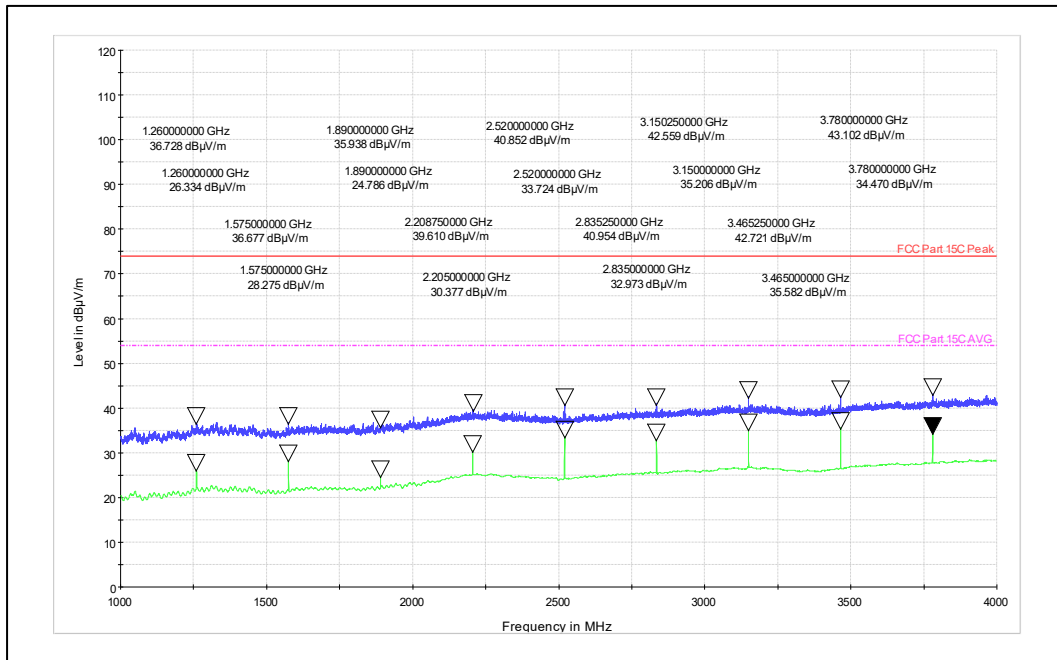
Test Plots:

Channel Frequency: 315MHz



Frequency Range: 1GHz-4GHz

Antenna Polarization: Vertical Polarization



Frequency Range: 1GHz-4GHz

Antenna Polarization: Horizontal Polarization

Prüfbericht - Nr.:
Test Report No.:

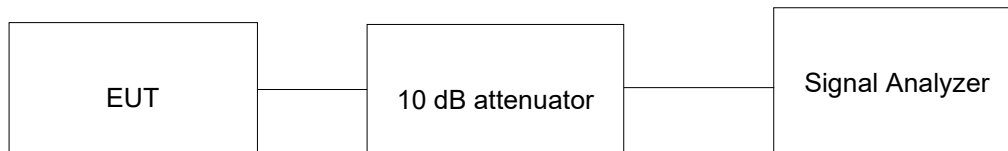
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7.4 20dB BANDWIDTH

Test Specification	FCC part 15 Subpart C 15.231(C) RSS-210 Issue 11 Section A.1.4
Test Method	ANSI C63.10:2020 ANSI C63.10:2020+Cor. 1:2023+ C63.10a:2024.
Requirement	The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Method



Test Conditions:

Temperature (Norm) = + 23.2 °C

Voltage = 3 VDC (Through Battery (CR2032))

Relative humidity = 62 %

Results:

Channel Frequency (MHz)	99% Measured Bandwidth (MHz)	20dB Bandwidth (MHz)	Limit (MHz)
315	0.033	0.039	0.787

Prüfbericht - Nr.:

Test Report No.:

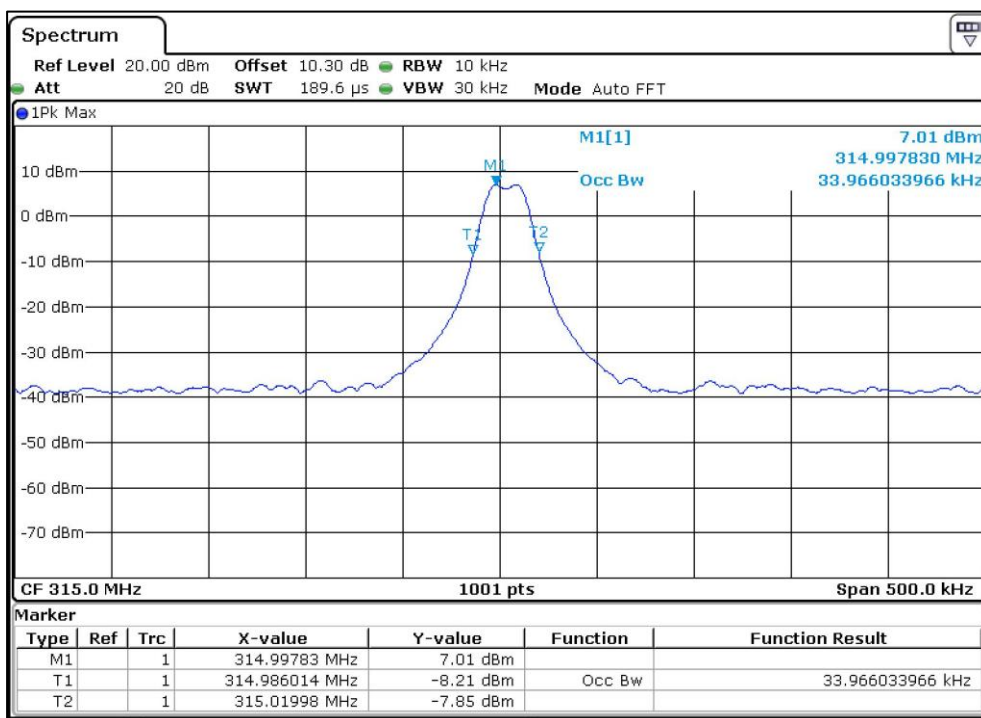
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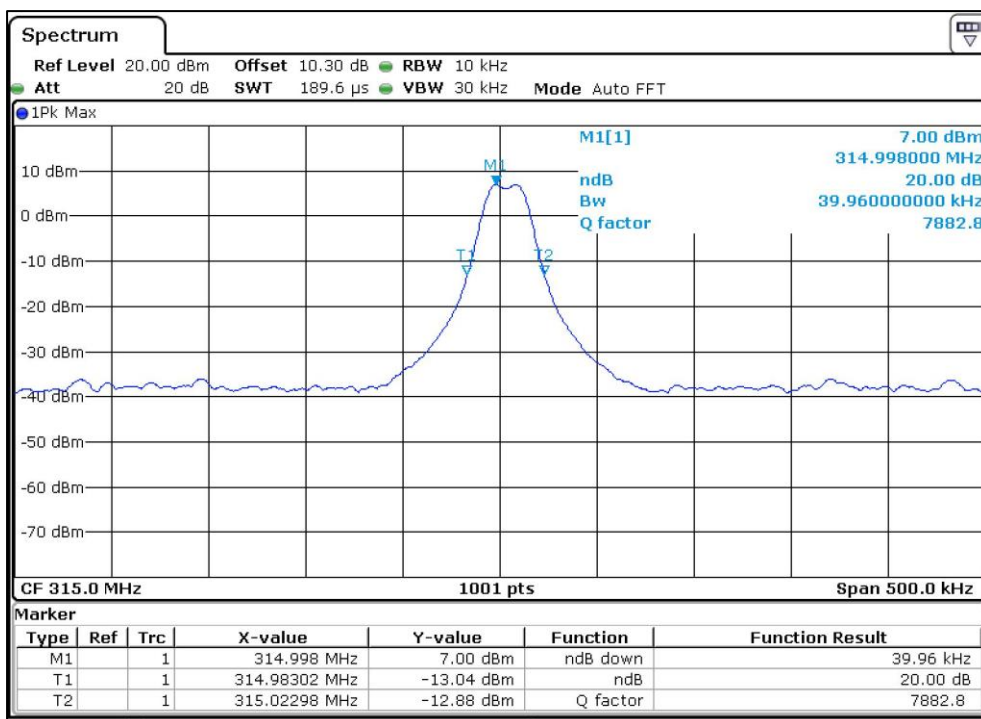
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Test Plots:

99% Bandwidth:



20dB Bandwidth:



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*****End of test report*****