

Prüfbericht-Nr.: Test report no.:	ULR-TC568821300000006F	Auftrags-Nr.: Order no.:	166501087 0010	Seite 1 von 21 Page 1 of 21
Kunden-Referenz-Nr.: Client reference no.:	NA	Auftragsdatum: Order date:	2020-11-23	
Auftraggeber: Client:	EMS Technologies Canada Ltd. 400 Maple Grove Rd Ottawa ON K2V 188 CANADA			
Prüfgegenstand: Test item:	SAT-IDP-BC SAT-IDP-SC			
Bezeichnung: Identification.:	SAT-IDP	Serien -Nr.: Serial no.:	EMC-Rev4-002	
Auftrags-Inhalt: Order content:	Testing and issue of FCC and IC grant certificate			
Prüfgrundlage: Test specification:	FCC Part 15 Subpart C 15.247, 15.207 RSS 247 Issue 2 and RSS Gen Issue 5			
Wareneingangsdatum: Date of sample receipt:	2021-01-22			
Prüfmuster-Nr.: Test sample no.:	A002986226-001 A002986226-002			
Prüfzeitraum: Testing period:	2021-01-23 - 2021-01-29			
Ort der Prüfung: Place of testing:	Wireless laboratory, Bangalore			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (India) Pvt. Ltd. 27/B, 2nd cross road, Electronic city Phase1, Bangalore-560100, India FCC Test Site Registration No.: 496599 ISED Test site registration No.: 3466E-1			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:	genehmigt von: authorized by:			
Datum: Date: 2021-01-29		Ausstellatum: Issue date: 2021-03-15		
Stellung / Position:	Srinivasa B R Engineer	Stellung / Position:	Mahammadgouse Kaladagi Assistant Manager	
Sonstiges / Other:	FCC ID : K6KSATIDP IC : 1275B-SATIDP HVIN:Rev 4 PMN:SAT-IDP-BC/SAT-IDP-SC			
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:	Prüfmuster vollständig und unbeschädigt Test item complete and undamaged			
* 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
* 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 = mangelhaft N/T = nicht getestet 5 = poor N/T = not tested				
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. 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.				

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TEST SUMMARY

Test Item	Applicable Standard		Result
	FCC	ISED	
Maximum conducted (average) output power	FCC 15.247(b)(3)	RSS 247 Issue 2, Section 5.4 (d)	*N/T
Maximum Power Spectral Density	FCC 15.247(e)	RSS 247 Issue 2, Section 5.2 (b)	*N/T
DTS Bandwidth	FCC 15.247(a)(2)	RSS 247 Issue 2, Section 5.2 (a)	*N/T
Emissions in non-restricted frequency bands	FCC 15.247(d)	RSS 247 Issue 2, Section 5.5	*N/T
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 Emissions on a.c Power Lines	FCC 15.207	RSS-Gen Issue 5, Section 8.8	**N/A

Product Category: Electronics Testing
Test Discipline: EMC Test Facility

Note:

1. **N/A: Not Applicable.
Product is exclusively Battery operated, hence CE test on AC power line is not applicable
2. *N/T: Not tested-
This Product uses FCC & IC Certified BLE module with FCC ID: QOQ11;
IC ID: 5123A-11, please refer the module test report for Antenna port measurement test case.

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REVISION HISTORY OF THIS REPORT

Report Number	Version	Description	Issue date
ULR-TC568821300000006F	01	Initial issue of report	2021-02-26
ULR-TC568821300000006F	02	Updated as per Reviwer comments	2021-03-15

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1 GENERAL REMARKS

1.1 Attachments

There are no attachments are integral part of this test report.

1. TEST SETUP PHOTOS
- 2: EUT EXTERNAL PHOTOS
- 3: EUT INTERNAL PHOTOS
- 4: FCC & IC LABEL AND LABEL LOCATION
- 5: BLOCK DIAGRAM
- 6: SPECIFICATION OF EUT
- 7: SCHEMATIC DIAGRAM
- 8: BILL OF MATERIAL
- 9: USER MANUAL
- 10: MAXIMUM PERMISSIBLE EXPOSURE INFORMATION

2 TEST SITES

2.1 Testing Facilities

TÜV Rheinland (India) Pvt.Ltd.,
27/B, 2nd Cross,
Electronic city Phase 1
Bangalore – 560100
India

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
Active loop antenna	Schwarzbeck	FMZB 1519 B	1519B-00111	-	31.06.2021	Yearly	Radiated Spurious Emission
Biconical Antenna	Schwarzbeck	VHBB91 24+BBA 9106	9124-1208+910 6-0525	-	16.06.2021	Yearly	
Baloon and Biconical Antenna	Schwarzbeck mess-elektronik	VHBB-9124 / BBA-9106	01028	-	16.06.2021	Yearly	
Log - Periodical Antenna	Schwarzbeck	VUSLP 9118 A	VULP911 8A-0733	-	17.06.2021	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA 9170-0904	-	29.06.2021	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-1944	-	30.06.2021	Yearly	
Semi Anechoic Chamber	Frankonia	-	-	-	-	-	
Fully Anechoic Chamber	Albatross	-	-	-	-	-	
EMI Receiver	Rohde & Schwarz	ESU 40	100288	-	09.06.2021	Yearly	Antenna-Port Conducted test
Spectrum Analyser	Agilent Technologies	E4407B	US41192 772	A.14.06	10.08.2021	Yearly	
Thermal Chamber	Votsch	VT4002	58566101 750010		16.10.2021	Yearly	
Signal Analyzer	Rohde & Schwarz	FSV7	101644		15.01.2022	Yearly	

Table 2: Instrument application Software versions

SL. No.	Test Type	Application software	Version
1	Radiated spurious emission measurement in SAC	EMC 32	10.60.00
2	Radiated spurious emission measurement in FAC	EMC 32	10.60.00

3 GENERAL PRODUCT INFORMATION

3.1 Product Function and Intended Use

The SAT-IDP is a compact, single unit, low data rate satellite terminal, designed to operate over the INMARSAT satellites using the INMARSAT Data Pro (IDP) protocols. With an integral GPS receiver, the SAT-IDP provides low cost satellite communications for applications such as asset tracking, telematics and SCADA exception reporting. Mounting is via 3x M4 (No. 8) bolts or central M25 thread on base.

Model Types:

The SAT-IDP Model Types consist of the standard model (SAT-IDP-BC) (as shown in **Figure 1**) and the variant (SAT-IDP-SC) as shown in **Figure 2**. All units are functionally identical and only differ in that they offer various cable exit and termination options, which may then be used with optional extension cables.



Figure1: SAT-IDP-BC



Figure2: SAT-IDP-SC

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3.2 Ratings and System Details of Equipment under Test

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

EUT name	SAT-IDP	
Protocol	Inmarsat Data Pro (IDP)	BLE
Operating Frequency Range	<u>Radio Receiver Band:</u> 1518 MHz to 1610MHz; <u>Inmarsat:</u> 1525-1559 MHz <u>Extended receive band:</u> (Outside USA region): 1518-1525 MHz <u>GPS band:</u> 1559 MHz to 1610MHz <u>Radio Transmit Band:</u> 1626.5-1660.5 MHz, <u>Extended Inmarsat Transmit Band:</u> (outside USA region) 1668-1675 MHz	2402MHz to 2480MHz
No. of Channels	Not applicable	40
Channel Spacing	5kHz	2MHz
Maximum Measured Power	32.085 dBm at 1626.501MHz	10.12 dBm (as Per BLE module grant)
Modulation	OQPSK	GFSK (DSSS)
Number of antennas	1	1
Antenna Gain	6dBi	1 dBi
Antenna Type	Integrated Planar	PCB Chip Antenna
Supply Voltage to Product	9.6V to 32V DC Supply	
Environmental conditions	Temperature -40°C to +70°C	
	Humidity ≤ 95% @ +40°C, non-condensing	
EUT Dimension	118 mm x 108 mm x 37 mm (LxWxH)	

***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 Simultaneous operation

Combination	BLE And MSS (Mobile-Satellite Service) / 1.5/1.6 GHz MSS bands
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Note: Simultaneous Operation was performed with the above mentioned combination and worst case test results are mentionrd in this report.

3.4 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	$\pm 5 \%$

Note: The Listed Measurement Uncertainties are the worst-case uncertainty, for the respective test cases. Above Table is for reporting purpose only and not used in determining Final Pass/Fail verdict.

4 TEST SET-UP AND OPERATION MODE

4.1 Principle of Configuration Selection

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

4.2 Test Operation and Test Software

Hardware Version(HVIN) : Rev 4

Software Version(FVIN): 01.02.003.2021

4.3 Special Accessories and Auxiliary Equipment

SL No	Accessory Name	Make	Model
1	IDP Terminal Test Equipment (Test Equipment)	SPCI	PLTM-02
2	Load Board	Honeywell (Customer Make)	Not Applicable
3	Multi Channel GPS Simulator	Spirent	4500
4	Antenna's	Laird	OD24M-5
5	DC power source	TENMA	72-6610

Table 5: List of Accessories Used

4.4 Countermeasures to achieve EMC Compliance

None

4.5 List of BLE frequencies

Frequency Band (GHz)	Channel No.	Frequency (MHz)
2400MHz-2483.5MHz	Low	2402
	:	:
	Mid	2440
	:	:
	High	2480

Table 6: List of 2.4GHz Center frequencies

Channel used for testing

Channel low : **2402MHz**

Channel mid : **2440MHz**

Channel High : **2480MHz**

Note:

TUV Sample Identification number : A002986226-001 – Radiated test Sample
: A002986226-002 – Conducted test Sample

5 TEST METHODOLOGY

5.1 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

5.1.1 Test Setup Configuration

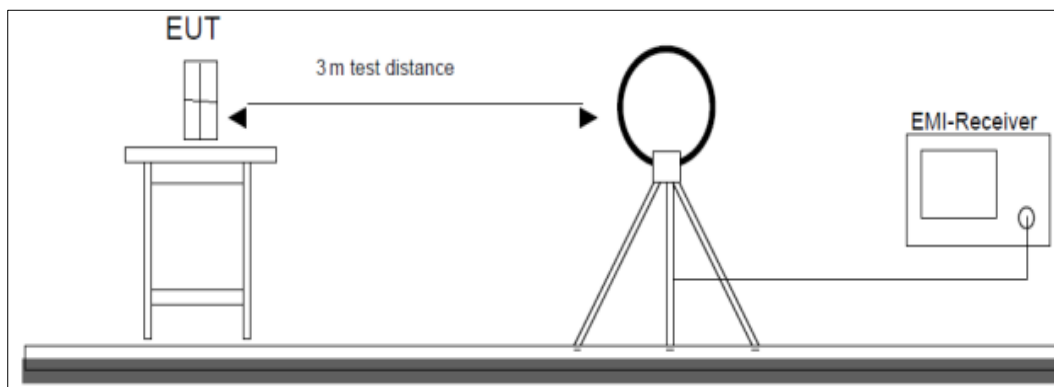


Figure 1: Frequency Range 9 kHz- 30 MHz

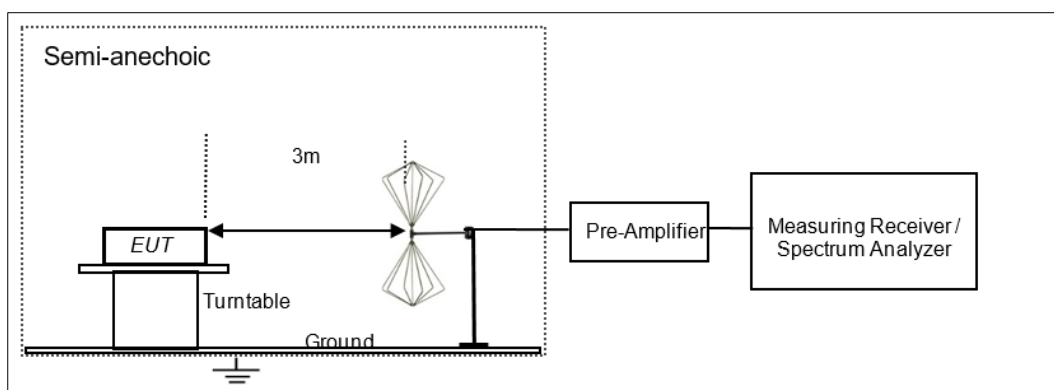


Figure 2: Frequency Range 30 MHz – 200 MHz

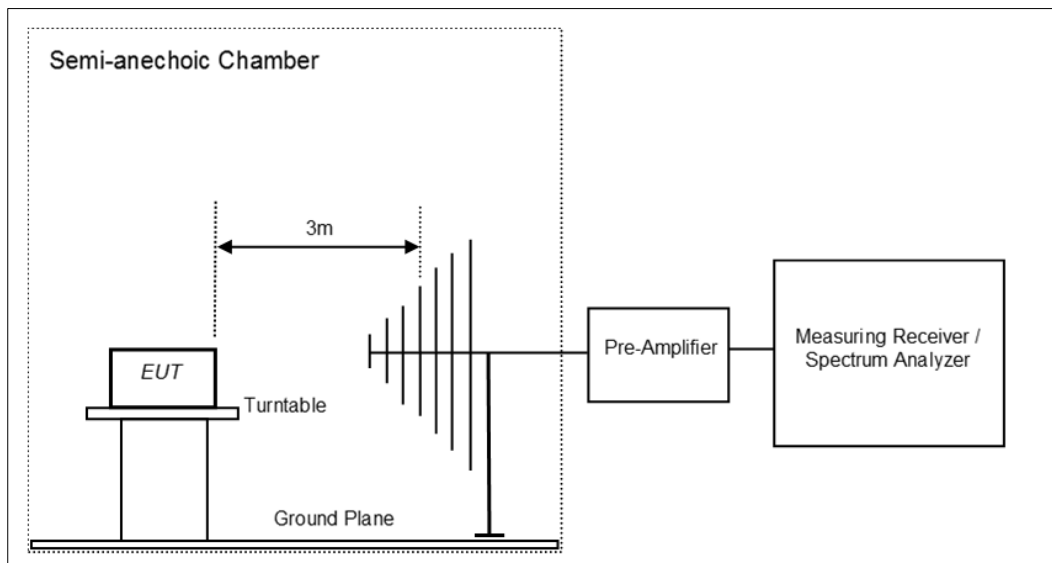


Figure 3: Frequency Range 200 MHz - 1GHz

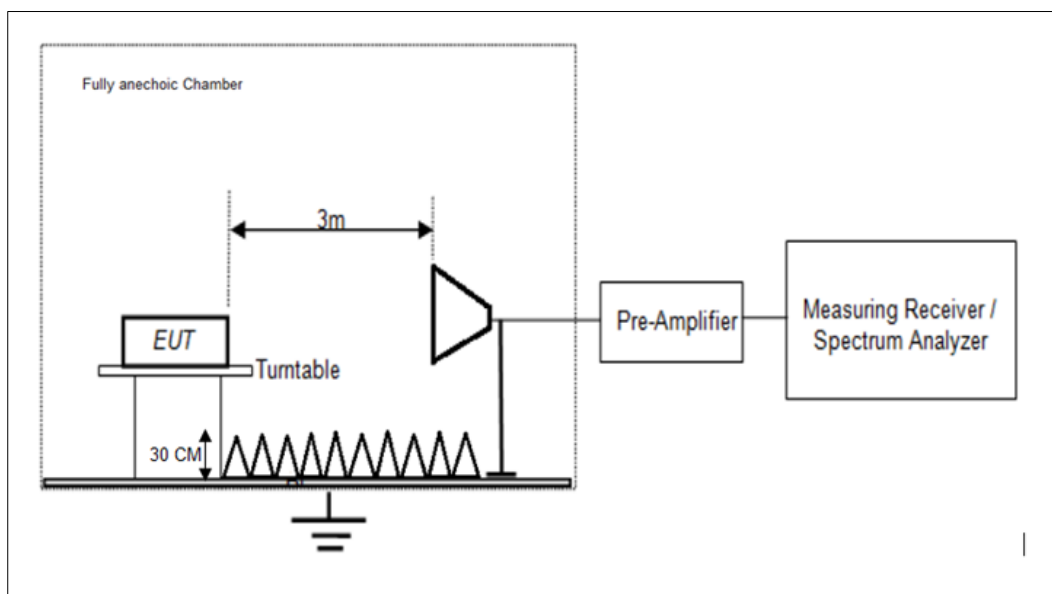


Figure 4: Frequency Range above 1 GHz

6 TEST RESULTS

6.1 Spurious Radiated Emissions & Restricted Bands of Operation

Result	Pass
Test Specification	FCC part 15 Subpart C 15.247 (d) / (15.209 & 15.205)/ IC RSS-GEN, Section 8.9 and 8.10
Test Method	ANSI C63.10-2013
Measurement Location	Semi Anechoic Chamber 30MHz - 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 7: 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) = + 23.5 °C

Voltage = 12V DC Battery operated

Relative humidity: 63%

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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

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 8: Test results for frequency range 30MHz – 1GHz

Polarization	Frequency (MHz)	Measured value (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Vertical	35.950	22.792	40.000	-17.208
	74.989	25.786	40.000	-14.214
	93.325	27.592	43.500	-15.908
	235.419	21.209	46.000	-24.791
	537.638	20.300	46.000	-25.700
	954.654	26.210	46.000	-19.790
Horizontal	44.450	19.961	40.000	-20.039
	74.989	20.441	40.000	-19.559
	181.542	20.681	43.000	-22.319
	230.038	20.374	46.000	-25.626
	443.735	19.163	46.000	-26.837
	922.502	26.317	46.000	-19.683

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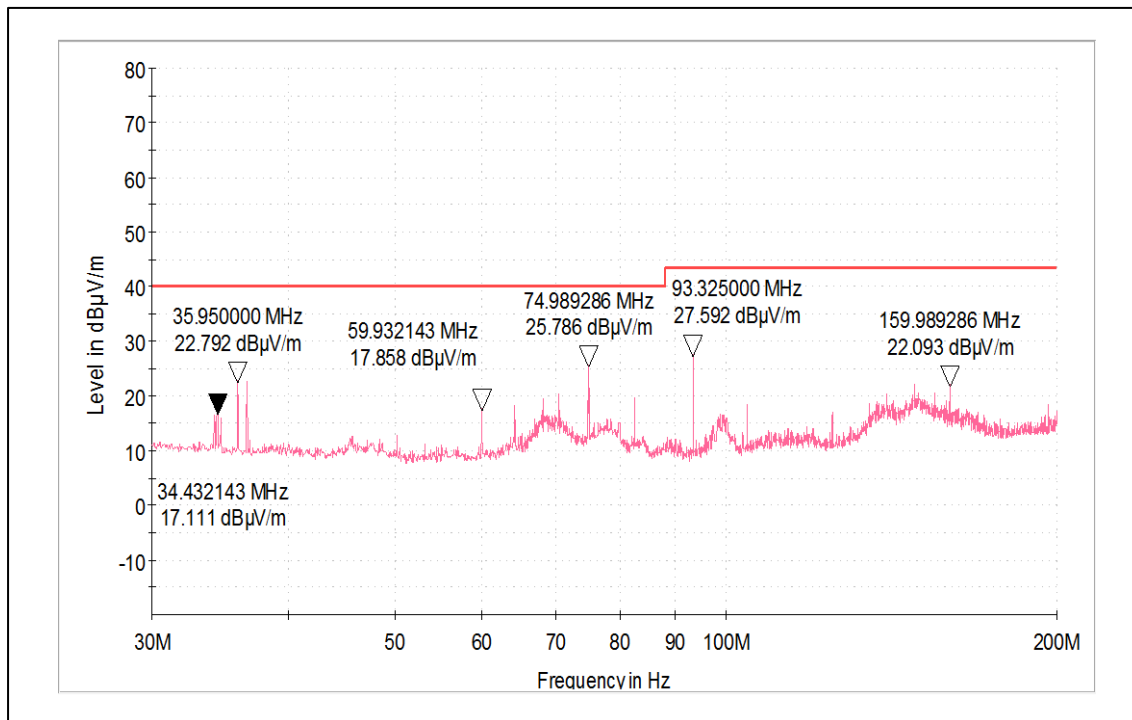
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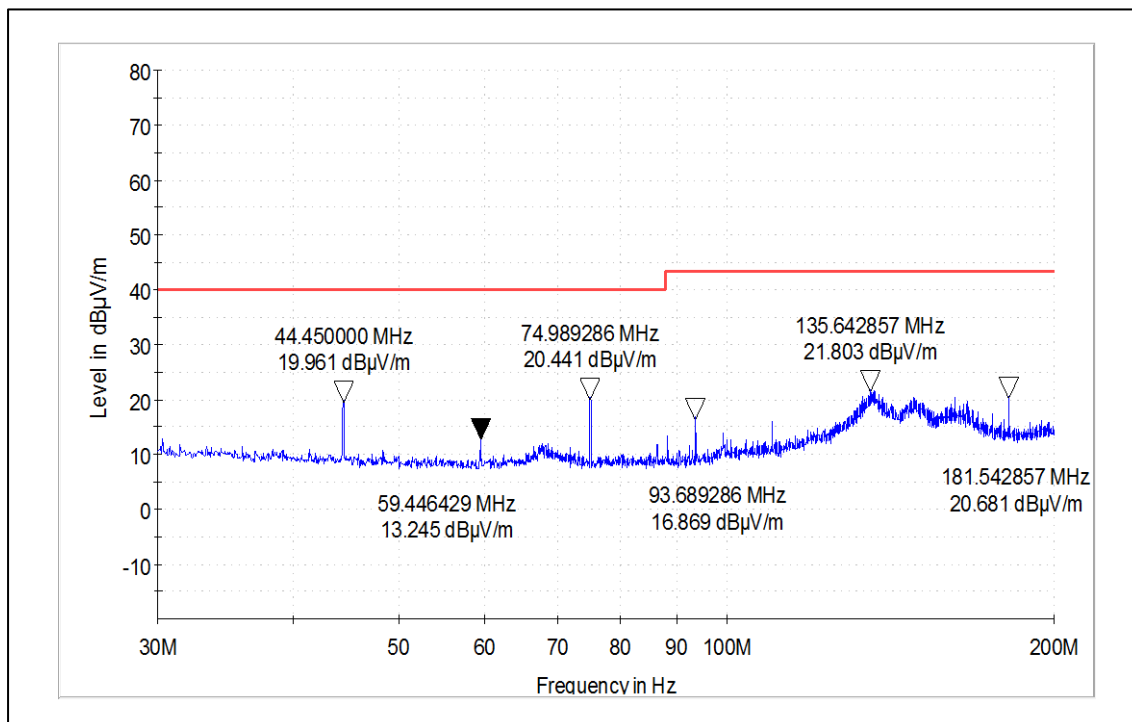
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Test Plots:



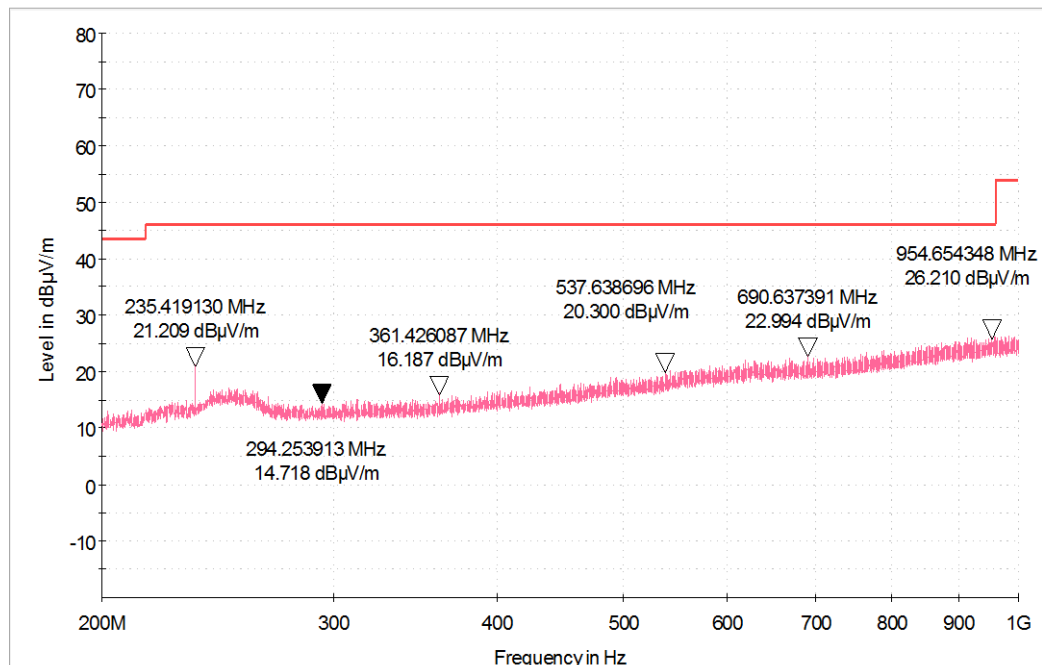
Frequency: 30MHz – 200MHz

Polarization: Vertical



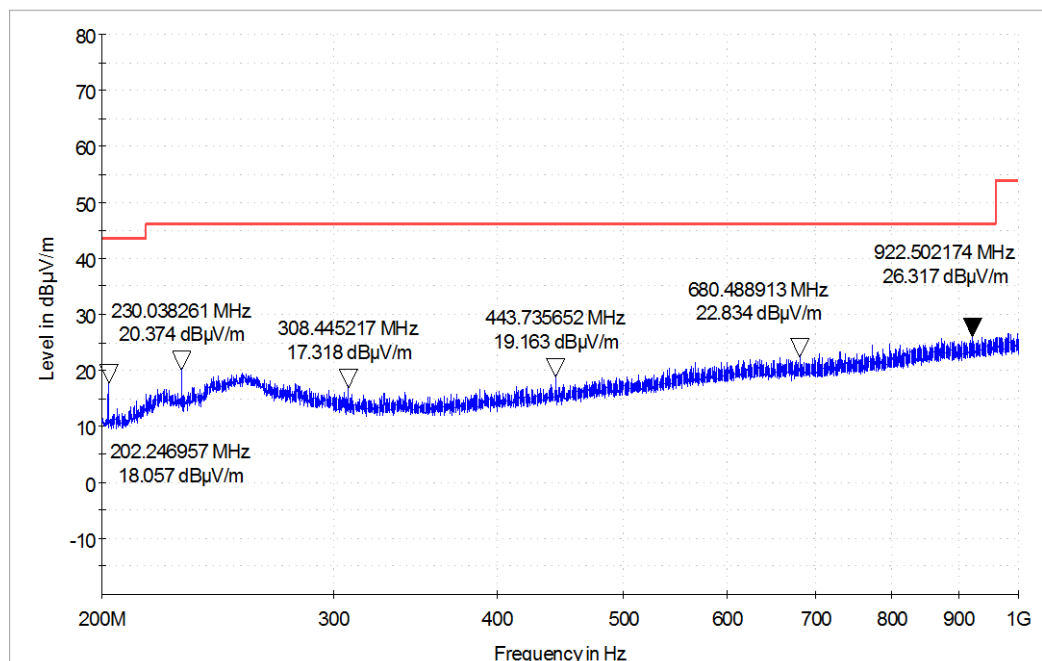
Frequency: 30MHz – 200MHz

Polarization: Horizontal



Frequency: 200MHz – 1GHz

Polarization: Vertical



Frequency: 200MHz – 1GHz

Polarization: Horizontal

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Table 9: Test results for the frequencies above 1GHz:

Frequency (MHz)	Antenna Polarization	Measured Frequency (MHz)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2402	Vertical	2390(Pk)	43.852	74	-30.148
		2390(Av)	25.166	54	-28.834
		2402(Pk)	97.353	-	-
		2402(Av)	96.228	-	-
		4804(Pk)	47.884	74	-26.116
		4804(Av)	39.458	54	-14.542
		7206(Pk)	No Harmonic Found		
		7206(Av)			
	Horizontal	2390(Pk)	41.097	74	-32.903
		2390(Av)	23.753	54	-30.247
		2402(Pk)	93.591	-	-
		2402(Av)	92.478	-	-
		4804(Pk)	45.288	74	-28.712
		4804(Av)	33.504	54	-20.496
		7206(Pk)	No Harmonic Found		
		7206(Av)			
2440	Vertical	2440(Pk)	92.623	-	-
		2440(Av)	93.704	-	-
		4880(Pk)	46.332	74	-27.668
		4880(Av)	36.131	54	-17.869
		7320(Pk)	No Harmonic Found		
		7320(Av)			
	Horizontal	2440(Pk)	92.720	-	-
		2440(Av)	91.613	-	-
		4880(Pk)	43.472	74	-30.528
		4880(Av)	32.378	54	-21.622
		7320(Pk)	No Harmonic Found		
		7320(Av)			

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2480	Vertical	2483.5(Pk)	41.917	74	-32.083
		2483.5(Av)	29.976	54	-24.024
		2480(Pk)	91.646	-	-
		2480(Av)	90.530	-	-
		4960(Pk)	41.926	74	-32.074
		4960(Av)	32.175	54	-21.825
		7440(Pk)	No Harmonic Found		
		7440(Av)			
	Horizontal	2483.5(Pk)	41.436	74	-32.564
		2483.5(Av)	29.191	54	-24.809
		2480(Pk)	90.706	-	-
		2480(Av)	89.591	-	-
		4960(Pk)	40.740	74	-33.26
		4960(Av)	30.247	54	-23.753
		7440(Pk)	No Harmonic Found		
		7440(Av)			

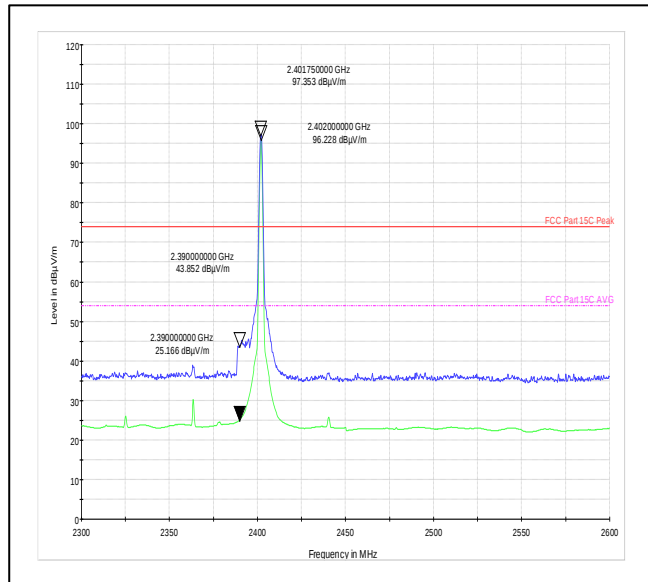
Table 10: Test Results of Simultaneous operation

Measured Frequency (MHz)	Antenna Polarization	Measured Transmitter spurious emissions level (dBμV/m)	Limit (dBm)	Margin (dB)
3321.002	Vertical	47.829 (Pk)	74	-26.17
	Horizontal	39.106 (Pk)	74	-34.89
4981.503	Vertical	55.756 (Pk)	74	-18.24
	Horizontal	47.745 (Pk)	74	-26.25
6642.004	Vertical	No Harmonic found		
	Horizontal			

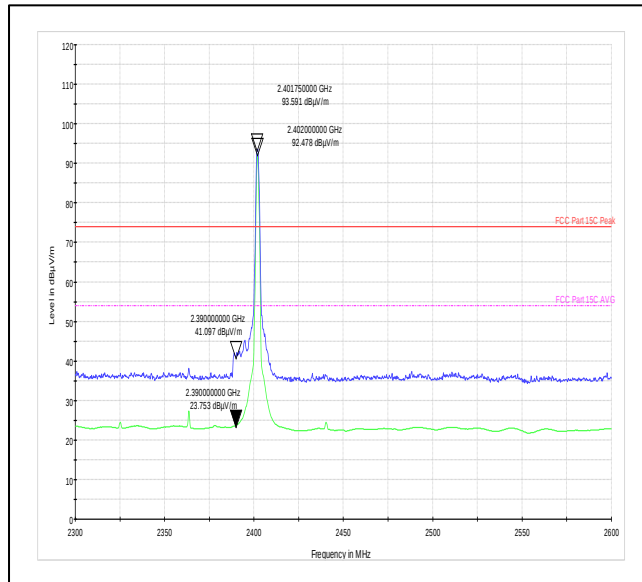
PK: Measured emission w.r.t Peak detector

Worst Case Plots:

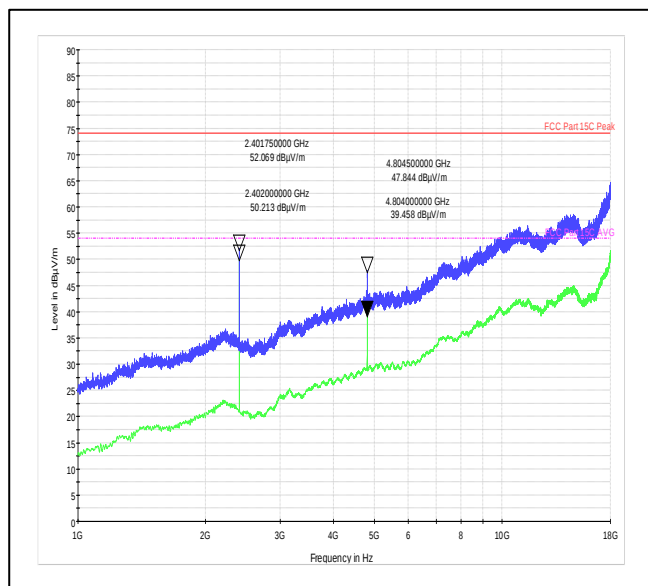
Channel frequency:2402MHz



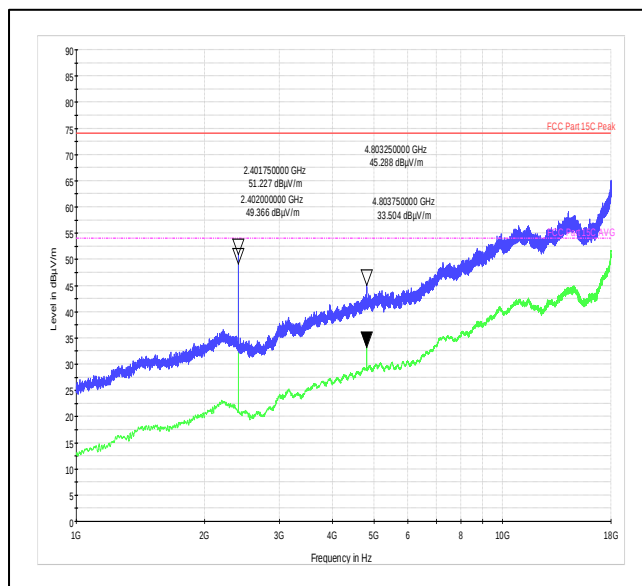
Polarization:Vertical



Polarization:Horizontal



Polarization:Vertical



Polarization:Horizontal

Test results for frequency range 18GHz- 26GHz

No emissions found in frequency range 18 GHz to 26 GHz, hence not reported

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*****End of test Report*****