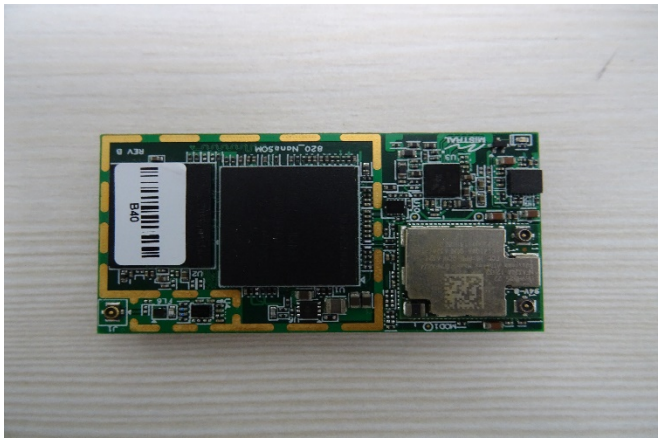
Prüfbericht-Nr.: *Test report no.:*	**ULR-TC568820300000038F**	**Auftrags-Nr.:** *Order no.:*	**166203252 0030**	Seite 1 von 25 *Page 1 of 25*
Kunden-Referenz-Nr.: *Client reference no.:*	NA	**Auftragsdatum:** *Order date:*	2019-11-26	
Auftraggeber: *Client:*	Mistral Solutions Private Limited 60 Adarsh Regent, 100 feet ring road Domlur Extension, Bangalore-560071,India			
Prüfgegenstand: *Test item:*	SD820 Nano SOM with 2x2 802.11 a/b/g/n/ac WIFI+ Bluetooth Module			
Bezeichnung / Serien -Nr.: *Identification / Serial no.:*	SD820 Nano SOM Rev B			
Auftrags-Inhalt: *Order content*:	Testing & issue of test report			
Prüfgrundlage: *Test specification:*	FCC Part 15 Subpart C 15.247, 15.207, ANSI C63.10-2013 RSS 247 Issue 2 and RSS Gen Issue 5			
Wareneingangsdatum: *Date of sample receipt:*	2020-03-10			
Prüfmuster-Nr.: *Test sample no:*	A001073243-001 A001073243-002			
Prüfzeitraum: *Testing period:*	2020-08-24 - 2020-08-28			
Ort der Prüfung: *Place of testing:*	Wireless laboratory, Bangalore			
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland (India) Pvt.Ltd., 27/B, 2nd Cross, ElectronicCityPhase1 Bangalore – 560 100, India			
Prüfergebnis*: *Test result*:*	Pass			



geprüft von:
tested by:

Datum:
Date: 2020-11-28

Stellung / *Position:* **Madhu Karadekere Nagaraju**
Engineer

genehmigt von:
authorized by:

Ausstellatum:
Issue date: 2020-11-28

Stellung / *Position:* **Mahammadgouse Kaladagi**
Assistant Manager

Sonstiges / *Other:* **ULR – TC5688-20300000038F**
FCC ID: 2AVEC-QCNFA324
IC ID: 26058-QCNFA324

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	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
** Legend:*	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*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.
V05

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	NA

Product Category: Electronics Testing
Test Discipline: EMC Test Facility

NA: Not Applicable

*N/T: Not tested – These test cases are not tested, the product uses certified RF module **QCNFA324** from **Qualcomm Atheros, Inc.**, with **FCC ID: PPD-QCNFA324 & IC ID: 4104A-QCNFA324.**

REVISION HISTORY OF THIS REPORT

Report Number	Version	Description	Issue date
ULR-TC568820300000038F	01	Initial issue of report	07.10.2020
ULR-TC568820300000038F	02	Reviewer comments updated	28.11.2020

Table of Contents

1 GENERAL REMARKS 5
1.1 Attachments 5
2 TEST SITES 6
2.1 Testing Facilities 6
2.2 List of Test and Measurement Instruments 6
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 11
4.7 Report references 12
5 Operational Description 13
6 Block Diagram 13
7 TEST METHODOLOGY 14
7.1 Radiated Emission Test 14
7.1.1 Test Setup Configuration 14
8 TEST RESULTS FOR BT-EDR 16
8.1 Spurious Radiated Emissions & Restricted Bands of Operation 16
9 LIST OF TABLES 25
10 List of Figures 25

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

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) Private Limited
   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	ESU 40	100288	4.43 SP3	09.06.2021	Yearly	Radiated Spurious Emission
Active loop antenna	Schwarzbeck	FMZB 1519 B	1519B-00111	-	31.01.2021	Yearly	
Biconical Antenna	Schwarzbeck	VHBB9124+BBA 9106	9124-1208+9106-0525	-	17.02.2021	Yearly	
Baloon and Biconical Antenna	Schwarzbeck mess-elektronik	VHBB-9124 / BBA-9106	01028	-	02.09.2021	Yearly	
Log - Periodical Antenna	Schwarzbeck	VULP 9118 A	VULP9118A-0733	-	13.02.2021	Yearly	
Log Periodic Antenna	Schwarzbeck Mess-Elektronik	VULP 9111B	9111B-324	-	12.12.2020	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA 9170-0904	-	29.01.2021	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-1944	-	30.01.2021	Yearly	
Semi Anechoic Chamber	Frankonia	-	-	-	-	-	
Fully Anechoic Chamber	Albatross	-	-	-	-	-	
EMI Receiver	Rohde & Schwarz	ESW 44	101732	-	10.12.2020	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 820 Nano SOM from Mistral is an easy to use, ultra-compact, light-weight System on Module providing very high processing power. The SOM is based on Qualcomm Snapdragon 820 and is ideal for advanced, next-gen embedded applications. With a PCB size of just 51mm x 26mm, this is one of the smallest Snapdragon based SOMs available in the market currently. Equipped with powerful specifications and features, the 820 Nano SOM is ideal for designs requiring 4K Ultra HD HEVC (H.265) video and graphics processing, wireless connectivity, low power consumption and advanced processing power. The feature-rich 820 Nano SOM supports latest features like Type-C functionality, 4K Encode/Decode and integrated 9-axis MEMS on a very small footprint, making it ideal for several powerful applications. The 820 Nano SOM is ideal for designing products like wearable computers, camera solutions, media gateways, Infotainment, drones, assistive devices and other smart gadgets requiring small package and high processing power.

3.2 Ratings and System Details of Equipment under Test

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

Radio Protocol	Bluetooth-EDR
Operating Frequency Range	2402MHz to 2480MHz
No. of Channels	79 (Refer Table 6)
Channel Spacing	1MHz
Maximum Measured Power (e.i.r.p)	11.79 dBm(1Mbps 2440MHz)
Modulation	FHSS, GFSK & 8DPSK
Number of antennas	1
Antenna Gain	Peak gain(2.0dBi) Average gain(-0.5dBi)
Antenna Type & Part No	SMD Type, SR42W001
Supply Voltage to Product	4.2V DC Supply
Environmental conditions	0°C to +70°C Relative Humidity <95%
EUT Dimension	51 x 26 x 1.63 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.

Note: Product SD820 Nano SOM- Wi-Fi Module has multiple protocols. All the supported wireless protocols and their respective test results are issued in separate test reports, refer clause 4.7 Report references

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	±5 %
RF output power, conducted	±1.5 dB
Power Spectral Density, conducted	±3 dB
Unwanted Emissions, conducted	±3 dB
All emissions, radiated	±6 dB
Temperature	±3 ℃
Supply Voltages	±3 %
Time	±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: RevB
Hardware Version Identification Number(s) (HVIN): QCNFA324

Software Version: Andr_oreo_8.0
Firmware Version Identification Number(s) : eeprom_ar6320_3p0_NFA324i_5.bin

4.3 Special Accessories and Auxiliary Equipment

- Test laptop and USB cable

4.4 Countermeasures to achieve EMC Compliance

- None

4.5 Simultaneous Transmission

- Device support simultaneous transmission, measured levels under simultaneous Transmission are same as the stand- alone transmission hence not reported

4.6 List of frequencies

Frequency Band (MHz)	Channel No.	Channel Frequency (MHz)
2400 – 2483.5 BT(BDR+EDR)	**0**	**2402**
	1	2403
	2	2404
	3	2405
	:	:
	:	:
	:	:
	37	2439
	38	**2440**
	39	2441
	40	2442
	:	:
	:	:
	:	:
	74	2476
	75	2477
	:	:
	:	:
	78	**2480**

Table 5: List of Bluetooth center Frequencies

Channel used for Bluetooth testing

Channel low : 2402MHz

Channel mid : 2440MHz

Channel high : 2480MHz

Note:

TUV Sample Identification number : A001073243-002 – Radiated & SAR test Sample
A001073243-001 – Conducted test Sample

4.7 Report references

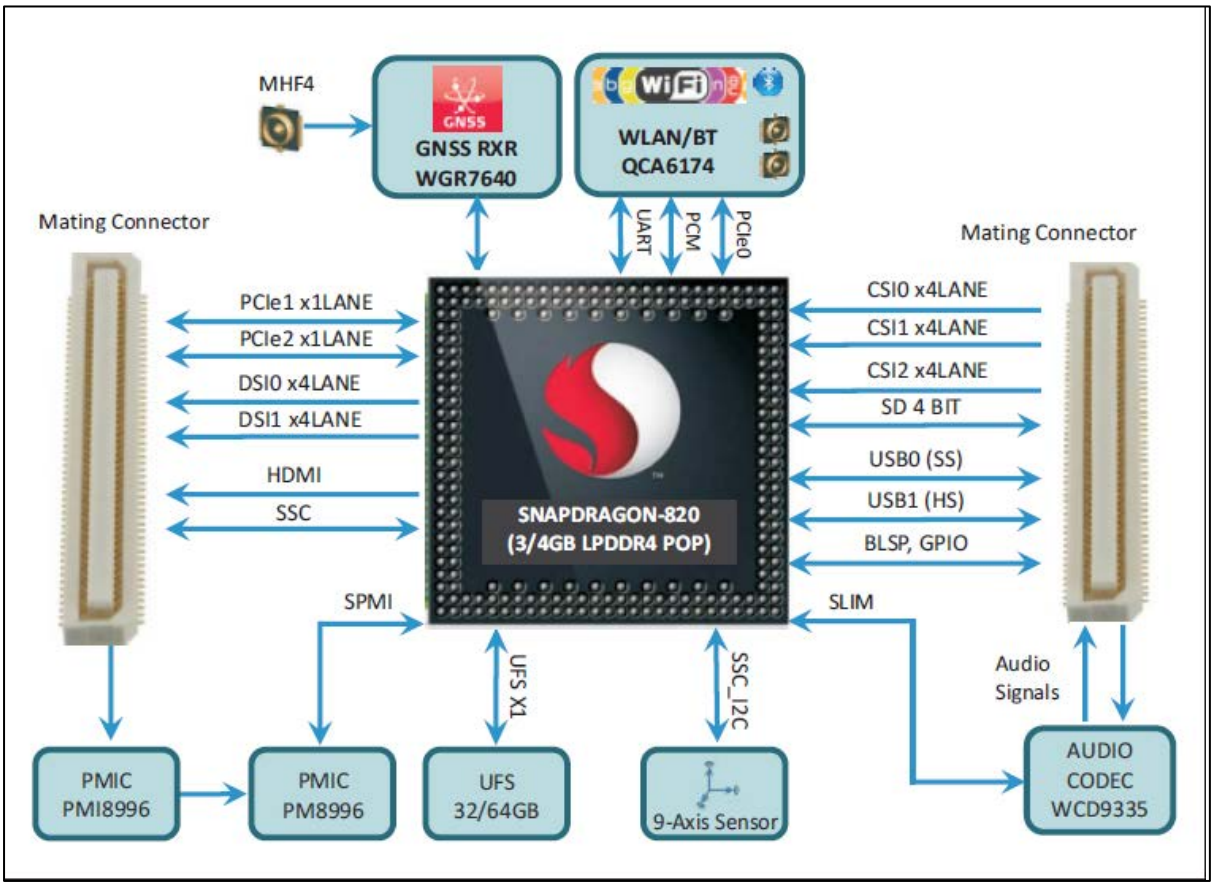
Note: Product SD820 Nano SOM- Wifi Module has multiple protocols. All the supported wireless protocols and their respective test results are issued in saparate test reports, following table lists the report numbers.

Radio Protocol	**Report Number**
RF test report for Wi-Fi (2.4GHz) & BLE (2.4GHz)	ULR-TC568820300000037F
RF test report for BT (2.4GHz) – (This report)	**ULR-TC568820300000038F**
RF test report for Wi-Fi (5GHz)	ULR-TC568820300000039F
SAR test report for Wi-Fi (2.4 & 5GHz)	ULR-TC568820300000040F

5 Operational Description

Based on a complete “System on Module” architecture, the 820 Nano SOM consists of ® ™ the 64-bit quad-core Qualcomm Kryo CPU, 2.2GHz capable of 4K Encode/Decode, 3/4GB LPDDR4, 32/64GB UFS and with major interfaces available via inter-board connectors. Application Development on the 820 Nano SOM is enabled with Android and Embedded Linux through a feature-rich carrier board that enables prototyping in record time. Optional Adaptor boards like LCD, Camera, Sensors and Battery Charger are also available for increased scope of development around the 820 Nano SOM.

6 Block Diagram



7 TEST METHODOLOGY

7.1 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 mesurement 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

7.1.1 Test Setup Configuration

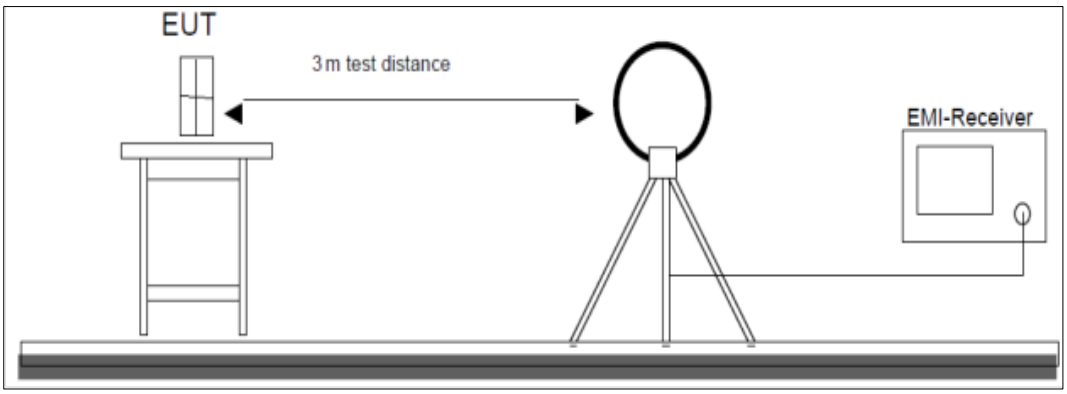


Figure 1: Frequency Range 9 kHz- 30 MHz

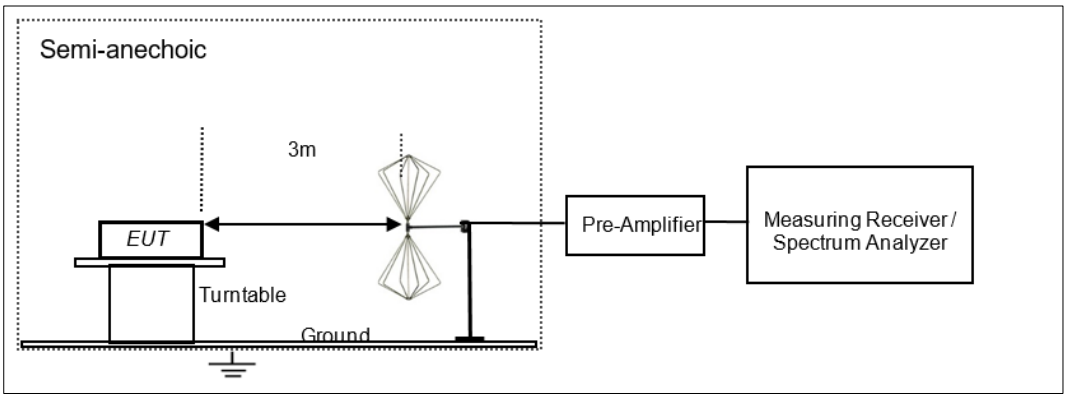


Figure 2: Frequency Range 30 MHz – 200 MHz

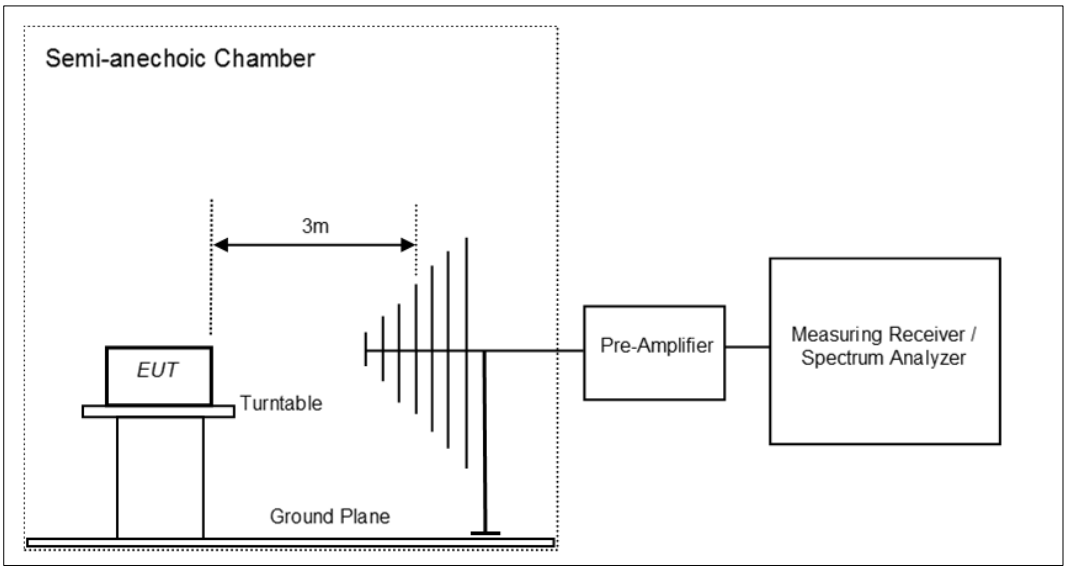


Figure 3: Frequency Range 200 MHz - 1GHz

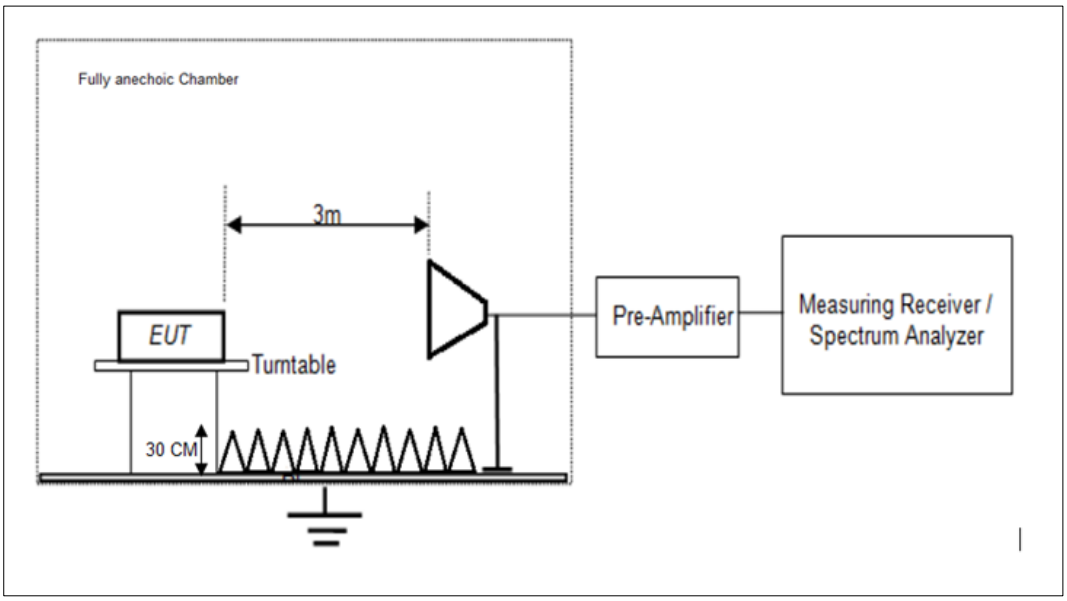


Figure 4: Frequency Range above 1 GHz

8 TEST RESULTS FOR BT-EDR

8.1 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
Measurement Location	Fully anechoic chamber
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	Reffer 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) = + 24.8 °C Voltage = 4.2VDC input Relative humidity = 74 %

Test results:

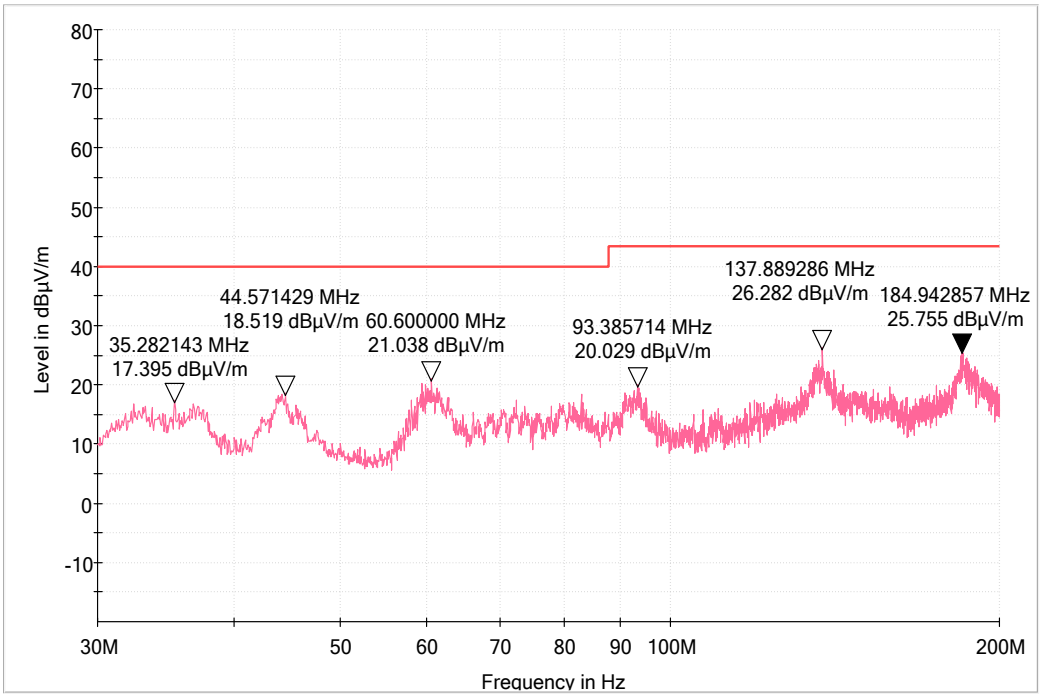
Note: All the losses are included during measurement and final values are mentioned in the test report. Refer TEST METHODOLOGY for more details

Test results for frequency range 9kHz – 30MHz

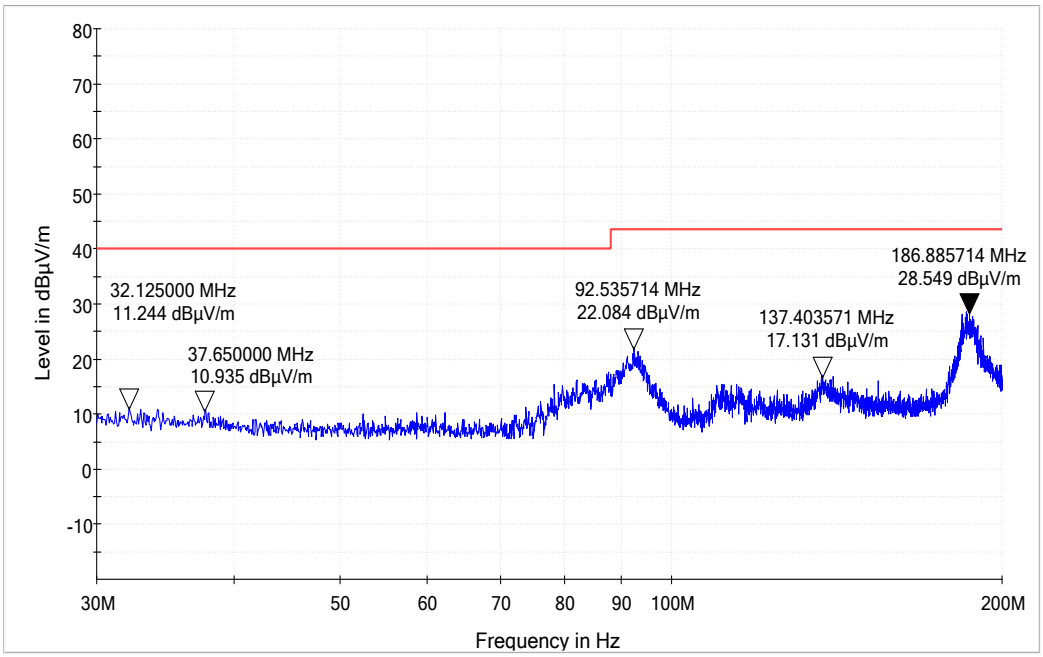
No emissions found in frequency range 9 kHz to 30 MHz, and measured levels are below 20dB from the limit line, henve not reported

Test results for frequency range 30MHz – 200MHz

Antenna Polarization	Frequency (MHz)	Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	35.28	17.39	40.00	-22.61
	44.57	18.51	40.00	-21.49
	93.38	20.02	43.50	-23.48
	184.94	25.75	43.50	-17.75
Horizontal	32.12	11.24	40.00	-28.76
	37.65	10.93	40.00	-29.07
	92.53	22.08	43.50	-21.42
	186.88	28.54	43.50	-14.96



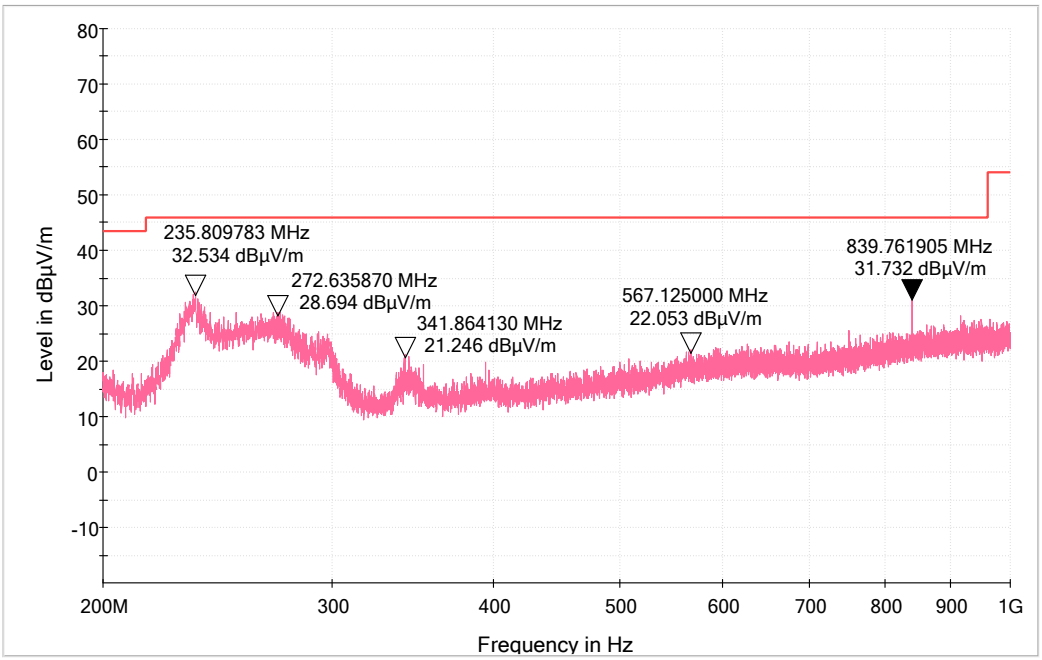
Channel Frequency 30MHz – 200MHz **Polarization Vertical**



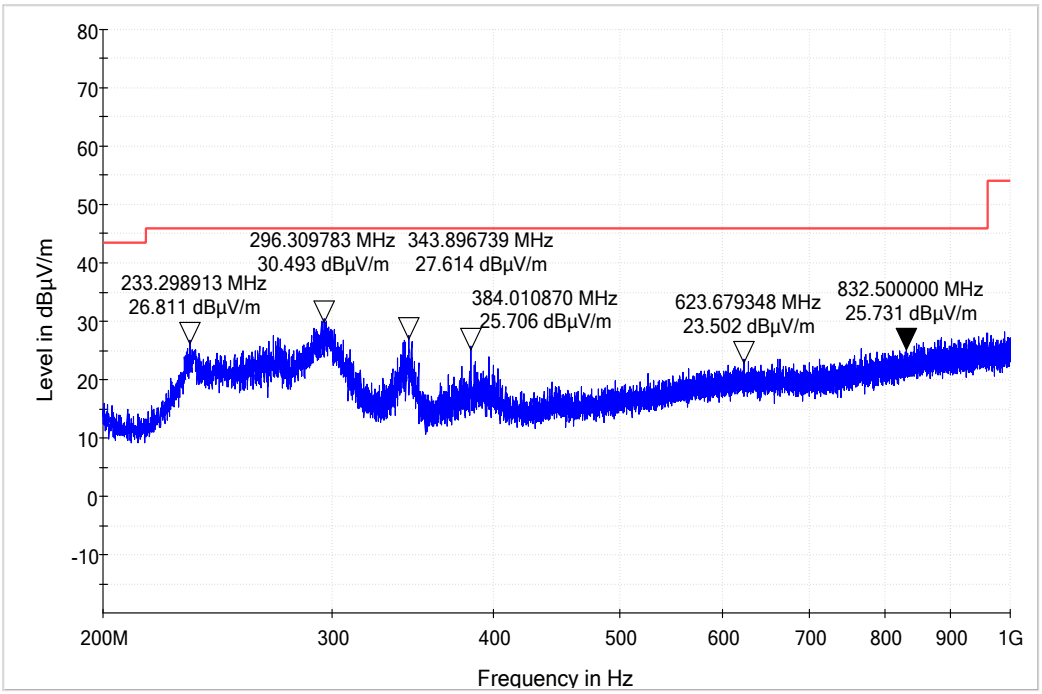
Channel Frequency 30MHz – 200MHz **Polarization Horizontal**

Test results for frequency range 200MHz – 1GHz

Antenna Polarization	Frequency (MHz)	Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	235.80	32.53	46.00	-13.47
	272.63	28.69	46.00	-17.31
	567.12	22.05	46.00	-23.95
	839.76	31.73	46.00	-14.27
Horizontal	233.29	26.81	46.00	-19.19
	384.01	25.70	46.00	-20.30
	623.67	23.50	46.00	-22.50
	832.50	25.73	46.00	-20.27



Channel Frequency 200MHz – 1GHz **Polarization Vertical**



Channel Frequency 200MHz – 1GHz **Polarization Horizontal**

Test results for the frequencies in the range 1 GHz to 26.5 GHz

Data Rate: 1Mbps

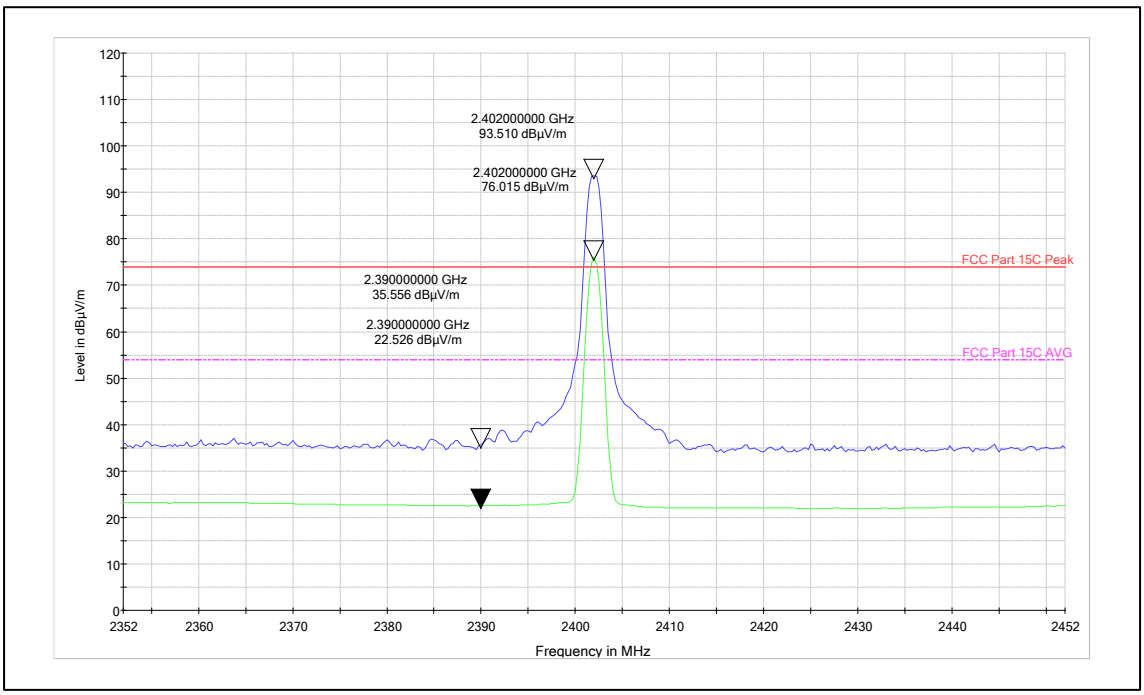
Channel Frequency(MHz)	Antenna Polarization	Measured Frequency (MHz)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	**V**	**2390(Pk)**	**35.55**	**74***	**-38.45**
		2390(Av)	**22.56**	**54***	**-31.44**
		2402(Pk)	**93.51**	**-**	**-**
		2402(Av)	**76.01**	**-**	**-**
		4804(Pk)	**45.48**	**74**	**-28.52**
		4804(Av)	**30.15**	**54**	**-23.85**
		7206(Pk)	**No Harmonics Found**		
		7206(Av)			
	H	**2390(Pk)**	**46.1**	**74***	**-27.90**
		2390(Av)	**25.36**	**54***	**-28.64**
		2402(Pk)	**104.88**	**-**	**-**
		2402(Av)	**87.42**	**-**	**-**
		4804(Pk)	**43.4**	**74**	**-30.60**
		4804(Av)	**29.59**	**54**	**-24.41**
		7206(Pk)	**No Harmonics Found**		
		7206(Av)			
2440	V	2440(Pk)	97.06	-	-
		2440(Av)	80.03	-	-
		4880(Pk)	44.68	74	-29.32
		4880(Av)	30.62	54	-23.38
		7320(Pk)	No Harmonics Found		
		7320(Av)			
	H	2440(Pk)	102.77	-	-
		2440(Av)	85.28	-	-
		4880(Pk)	43.54	74	-30.46
		4880(Av)	29.82	54	-24.18
		7320(Pk)	No Harmonics Found		
		7320(Av)			
2480	V	2480(Pk)	96.07	-	-
		2480(Av)	90.55	-	-
		2483.5(Pk)	48.62	74*	-25.38
		2483.5(Av)	26.29	54*	-27.71
		4960(Pk)	45.06	74	-28.94
		4960(Av)	35.85	54	-18.15
		7440(Pk)	No Harmonics Found		
		7440(Av)			
	H	2480(Pk)	102.27	-	-
		2480(Av)	96.72	-	-
		2483.5(Pk)	54.5	74*	-19.50
		2483.5(Av)	30.78	54*	-23.22
		4960(Pk)	43.85	74	-30.15
		4960(Av)	33.49	54	-20.51
		7440(Pk)	No Harmonics Found		
		7440(Av)			

*** : Indicate restricted band of operation §15.205**
Pk: Peak Detector; Av: Average Detector

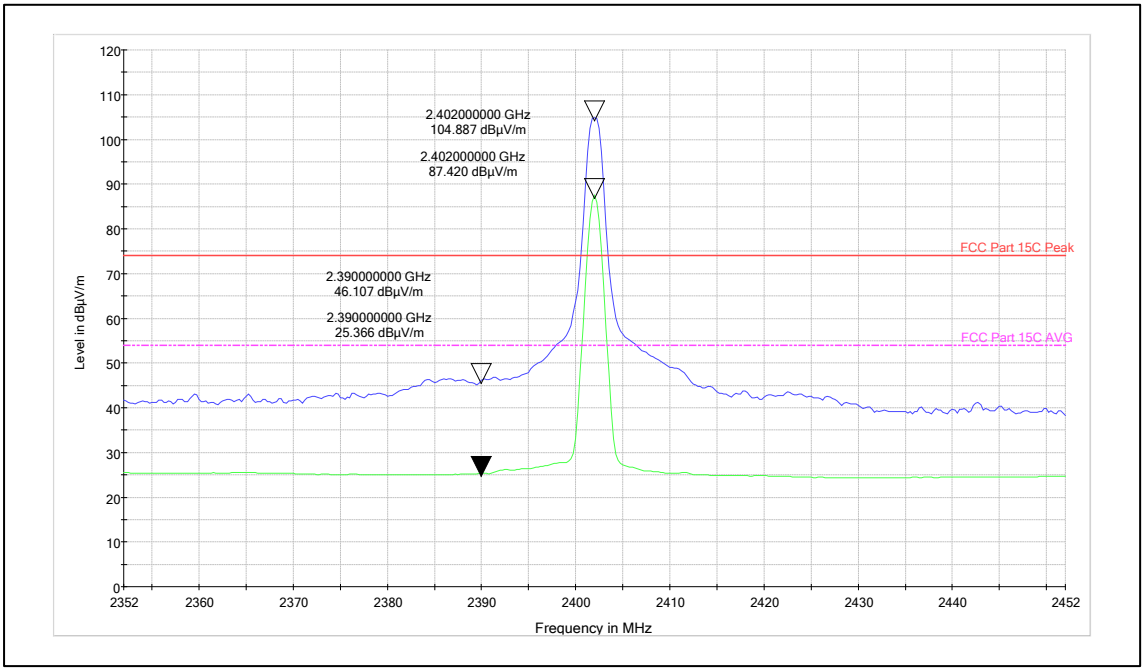
Worst case Plots

Data Rate: 1Mbps

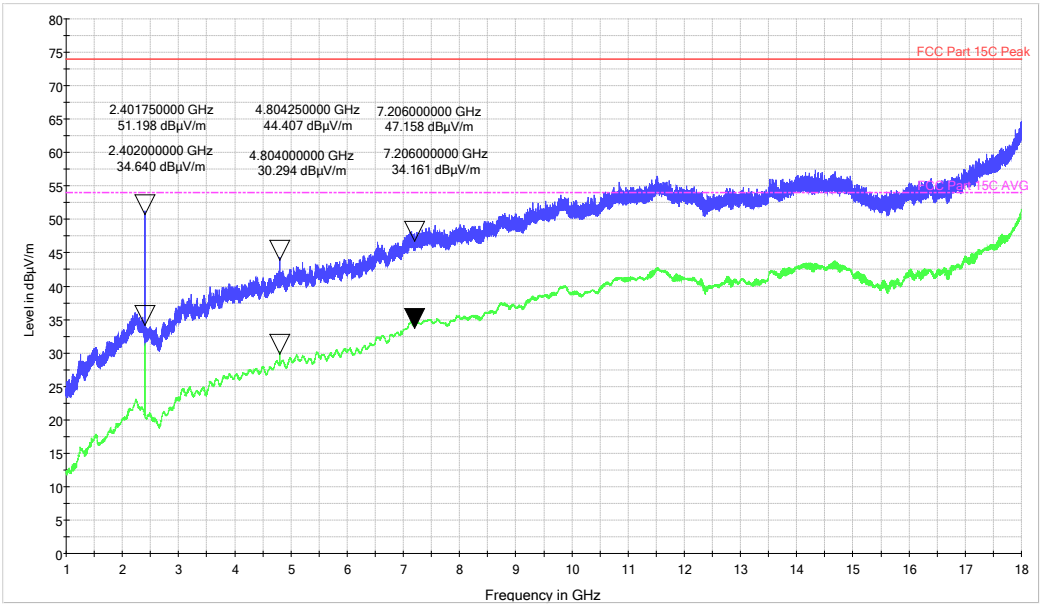
Channel Frequency 2402MHz



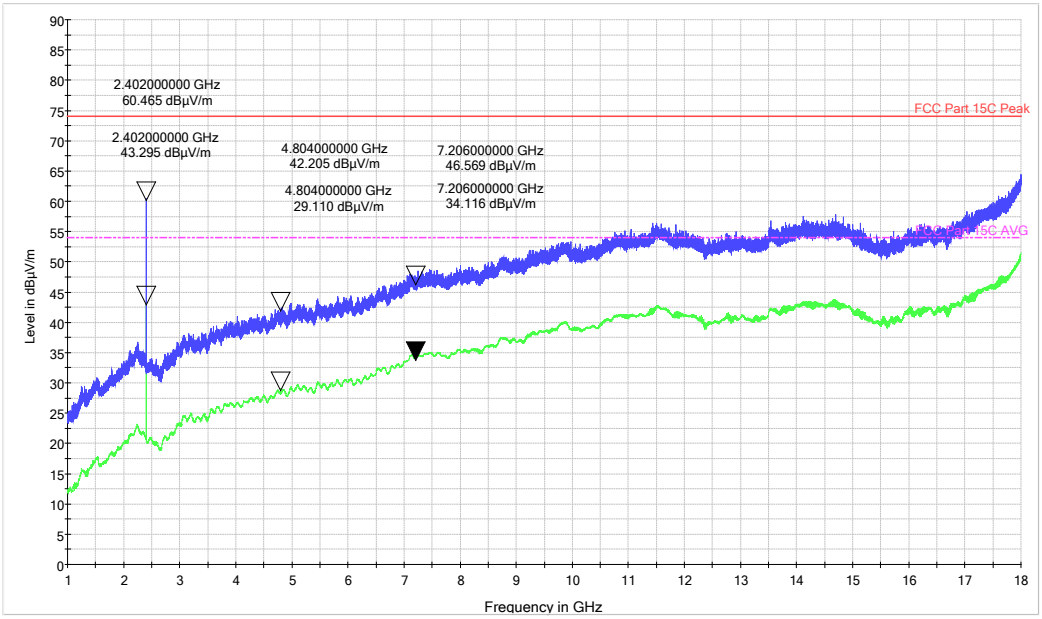
Channel Frequency: 2412MHz Polarization: Vertical



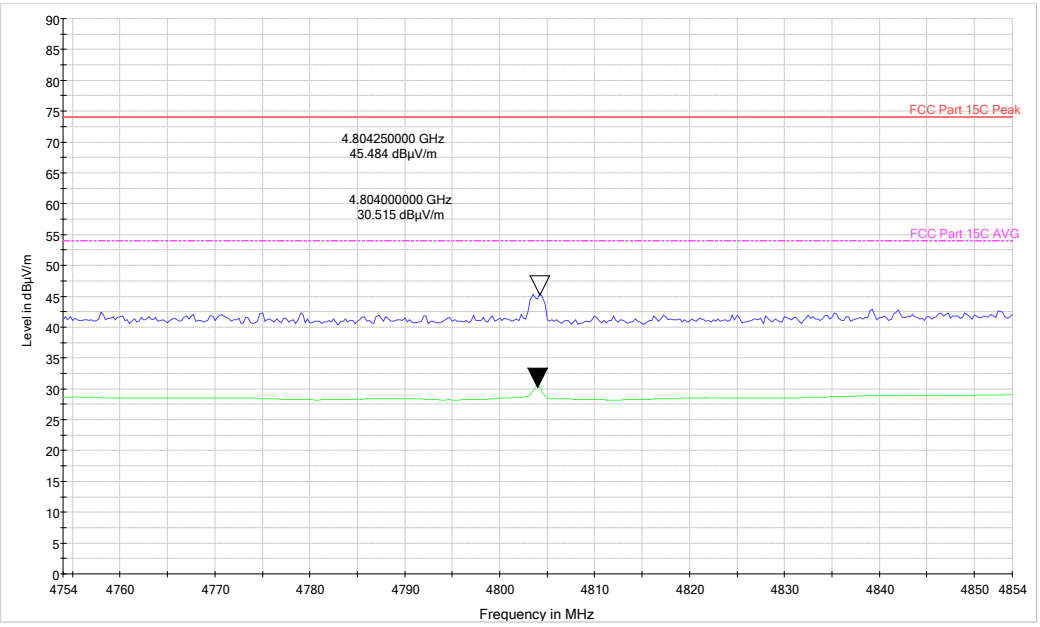
Channel Frequency: 2412MHz Polarization: Horizontal



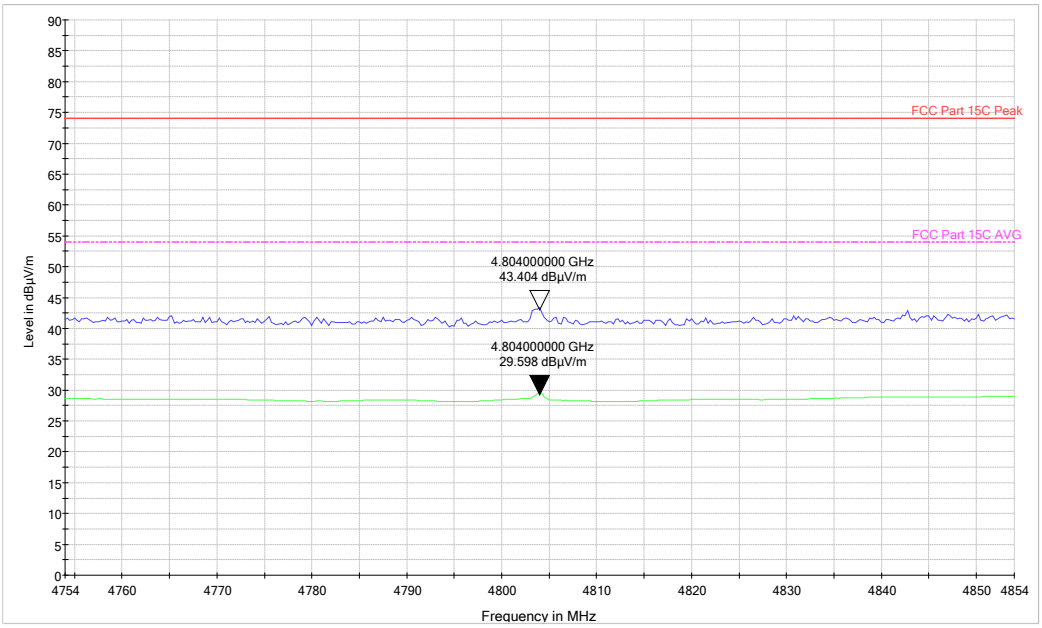
Channel Frequency: 1 - 18 GHz Polarization: Vertical



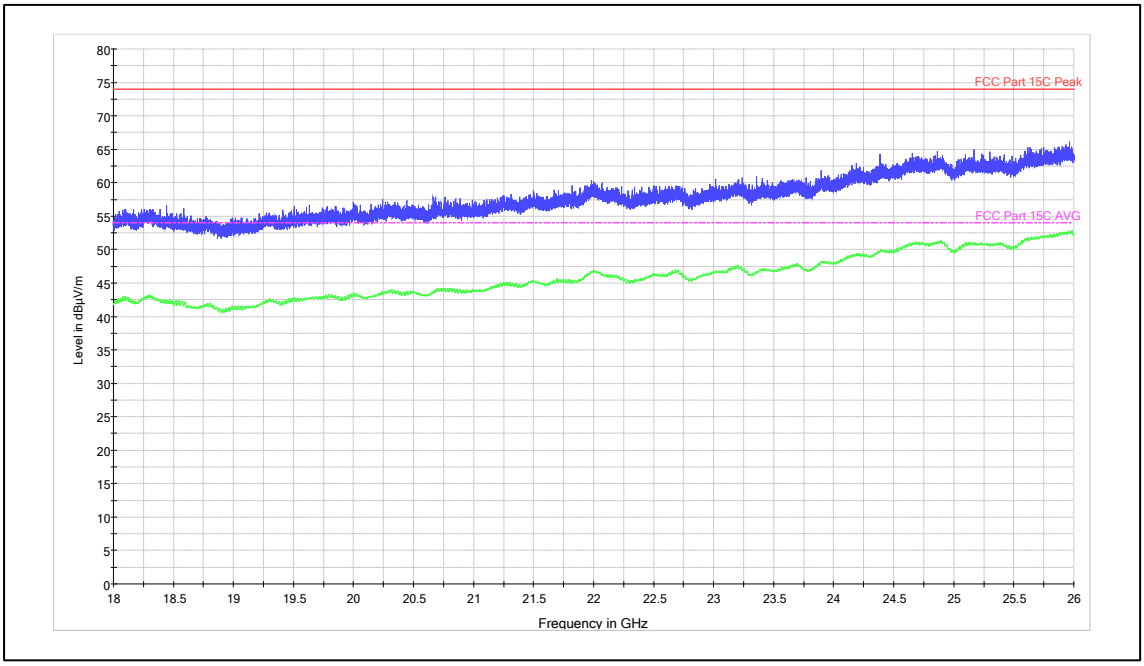
Channel Frequency: 1 - 18 GHz Polarization: Horizontal



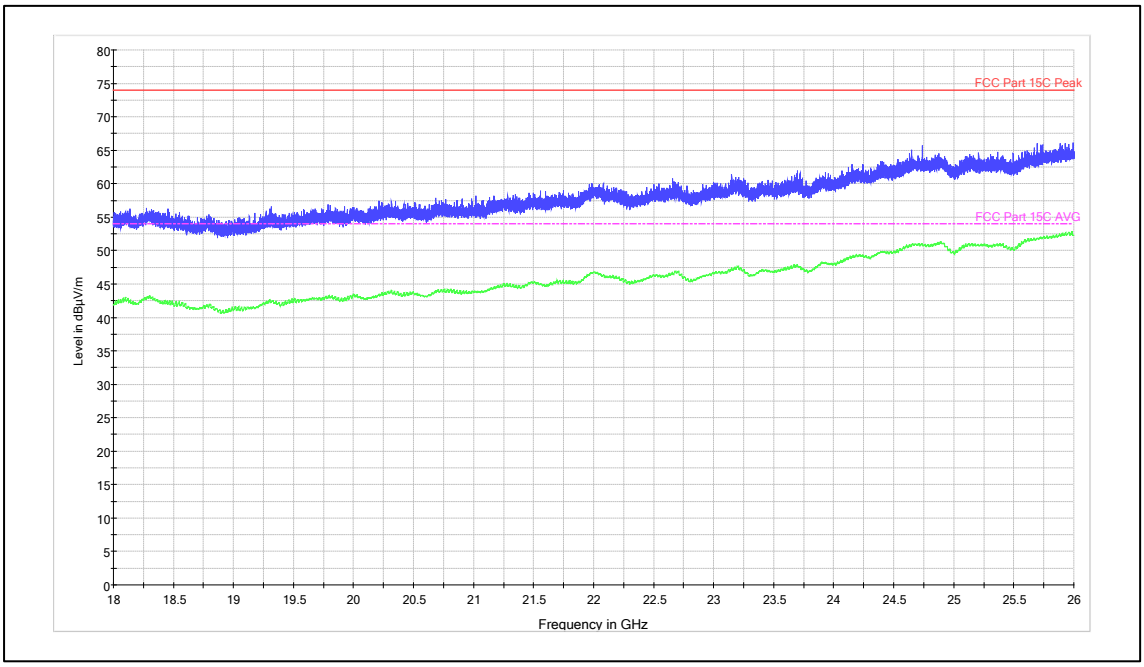
Channel Frequency: 2nd Harmonics Polarization: Vertical



Channel Frequency: 2nd Harmonics Polarization: Horizontal



Channel Frequency: 18 - 26 GHz Polarization: Vertical



Channel Frequency: 18 - 26 GHz Polarization: Horizontal

9 LIST OF TABLES

Table 1: List of test and measurement instruments 6
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 Bluetooth center Frequencies 11
Table 6: Transmitter limits for Radiated emission 16

10 List of Figures

Figure 1: Frequency Range 9 kHz- 30 MHz 14
Figure 2: Frequency Range 30 MHz – 200 MHz 14
Figure 3: Frequency Range 200 MHz - 1GHz 15
Figure 4: Frequency Range above 1 GHz 15

*****END OF TEST REPORT*****