Prüfbericht-Nr.: *Test report no.:*	**IN225B6J 001** **ULR-TC568822300000087F**	**Auftrags-Nr.:** *Order no.*:	146709884 0010	Seite 1 von 70 *Page 1 of 70*
Kunden-Referenz-Nr.: *Client reference no.:*	2042855	**Auftragsdatum:** *Order date:*	2022.07.26	
Auftraggeber: *Client:*	Relayer Inc. South Wacker Avenue 311, Suite 4950,Chicago, Illinois,United States,60606			
Prüfgegenstand: *Test item:*	Ethernet Gateway 4			
Bezeichnung *Identification*	RYG2-9-EGW-CCE-UNLK	**Serien -Nr.:** *Serial no.:* Engineering Sample		
Auftrags-Inhalt: *Order content*:	Testing and issue of Test Report with Grant Certificate			
Prüfgrundlage: *Test specification:*	FCC Part 15 Subpart C 15.247,15.205, 15.207 & 15.209			
Wareneingangsdatum: *Date of sample receipt:*	2022.07.26			
Prüfmuster-Nr.: *Test sample no:*	A003323724-001			
Prüfzeitraum: *Testing period:*	2022-08-23 - 2022-09-08			
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, Banglore-560100, India FCC Test Site Registration No: 496599 IC Test Site Registration No: 3466E-1			
Prüfergebnis*: *Test result*:*	Pass			

geprüft von: *tested by:*		**genehmigt von:** *authorized by:*	
Datum: *Date:* 2022-09-09		**Ausstellatum:** *Issue date:* 2022-10-08	
Stellung / *Position:*	**Yogesh V** Engineer	**Stellung** / *Position:*	**Madhu K.N** Senior Engineer
Sonstiges / *Other:*	FCC ID: 2A8J7-DSGTPA-1W		
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*

TEST SUMMARY

Test Item	FCC	Result
Maximum conducted (Peak) output power	15.247 (b)(2)	Pass
Occupied bandwidth and 20dB Bandwidth	15.247 (a) (i)	Pass
Number of Hopping channels	15.247 (a) (i)	Pass
Carrier Frequency Separation	15.247 (a) (1)	Pass
Time of Occupancy (Dwell Time)	15.247 (a) (i)	Pass
Emissions in non-restricted frequency bands	15.247 (d)	Pass
Spurious Radiated Emissions and Restricted Bands of Operation	FCC 15.209 / FCC 15.205	Pass
Conducted Spurious Emission on AC Power lines	FCC 15.207	Pass

Product Category: Electronics Testing
Test Discipline: EMC Test Facility

REVISION HISTORY OF THIS REPORT

Report Number	Version	Description	Issue date
ULR-TC568822300000087F	01	Initial issue of report	2022-10-08

Table of Contents

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) 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	Frankonia	LAX-10	LAX-10-800	-	31-01-2023	Yearly	Radiated Spurious Emission
Baloon and Biconical Antenna	Schwarzbeck Mess-Elektronik	VHBB-9124 / BBA-9106	1028	-	03-02-2023	Yearly	
Log - Periodical Antenna	Schwarzbeck Mess-Elektronik	VUSLP 9111B	9111B-111	-	04-02-2023	Yearly	
Horn Antenna	Schwarzbeck	HAX-18	HAX18-802	-	20-05-2023	Yearly	
Semi Anechoic Chamber	Frankonia	-	-	-	-	-	
Fully Anechoic Chamber	Albatross	-	-	-	-	-	
EMI Receiver	Rohde & Schwarz	ESW 44	101732	4.73.SP5	04-08-2023	Yearly	
EMI Receiver	Rohde & Schwarz	ESW44	101773	1.72SP1	12-02-2023	Yearly	
Signal Analyser	Rohde & Schwarz	FSV7	101644	FW 3.40	25-01-2023	Yearly	Antenna-Port Conducted test
Spectrum Analyzer	Agilent	E4407B	US41192772	A.14.06	15-12-2022	Yearly	
Signal Analyser	Anritsu	MS2830A	6261983953	-	14-09-2022	Yearly	
EMI Receiver	Rohde & Schwarz	ESR7	101133	3.48 SP3	22-07-2023	Yearly	Conducted AC Power line Test
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100811	-	12-07-2023	Yearly	
LISN	Rohde & Schwarz	ENV216	100022	-	07-10-2022	Yearly	

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

This product will be used inside connectivity kit and communicate with senor module.

3.2 Ratings and System Details of Equipment under Test

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

Protocol	LoRa
Operating Frequency Range	902.2MHz to 927.8MHz
No. of Channels	513
Channel Spacing	50kHz
Tx Transmitting Power	30dBm
Maximum Measured Power	29.04dBm@902.2MHz
Modulation	GFSK+DSS
Data Rate	10-400 kb/sec
Number of antennas	1
Antenna Gain & Antenna Type	Max 2.46dBi - Dipole Antenna
	Max 3.2dBi – Dipole Antenna
Antenna Part No & Antenna Model	(TLS.90.205111) & Shockwave 868/915MHz Permanent Mount External Antenna
	(TLS.01.305111) & Shockwave 600MHz-6000MHz Permanent Mount External Antenna with 0.3mtr CFD-200 SMA(M)
Supply Voltage to Product	Ethernet Gateway: 5VDC through AC-DC Adapter
	DC Injector: 9VDC through AC-DC Adapter
Environmental conditions	-40°C to +85°C
	-40°C to +85°C
EUT Dimension(W x L x H)	75X100X30mm

***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	±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: RYG2-9-EGW-CCE-UNLK

Hardware Version Identification Number HVIN: RYG2-9-EGW-CCE-UNLK

Firmware Version: 1.0.8.5

Firmware Version identification Number FVIN: NA

4.3 Special Accessories and Auxiliary Equipment

Product Name	Technical Specification
Power Amplifier	SmartAmp 900MHz 1 Watt Operating range :902-928MHz Power Consumption: Tx = 1.2A, Rx = 130 mA @ 9VDC
DC Injection	9VDC Max 5A
Low Pass Filter	50Ω SMA 7th Order Part No: CLPFL-1200 Low Pass Range DC to 1200MHz

4.4 Countermeasures to achieve EMC Compliance

- None

4.5 List of frequencies

Frequency Band (GHz)	Channel No.	Frequency (MHz)
Sub-GHz (902.2 MHz – 927.8 MHz)	**Low**	**902.2**
	:	:
	Mid	**915**
	:	:
	High	**927.8**

Table 5: List of SubGHz Center frequencies

Channel used for SubGHz testing

Channel Low : 902.2MHz

Channel Mid : 915MHz

Channel High : 927.8MHz

Note:

1. TUV Sample Identification number : A003323724-001 Radiated & Conducted test Sample

5 Operational Description

ALTA Ethernet Gateway 4 allows your Monnit Wireless Sensors to communicate with the iMonnit® Online Wireless Sensor Monitoring and Notification System without the need for a PC. Gateway with SmartAMP provided insure connectivity enhance RF power with larger range.

6 Block Diagram

Not Applicable

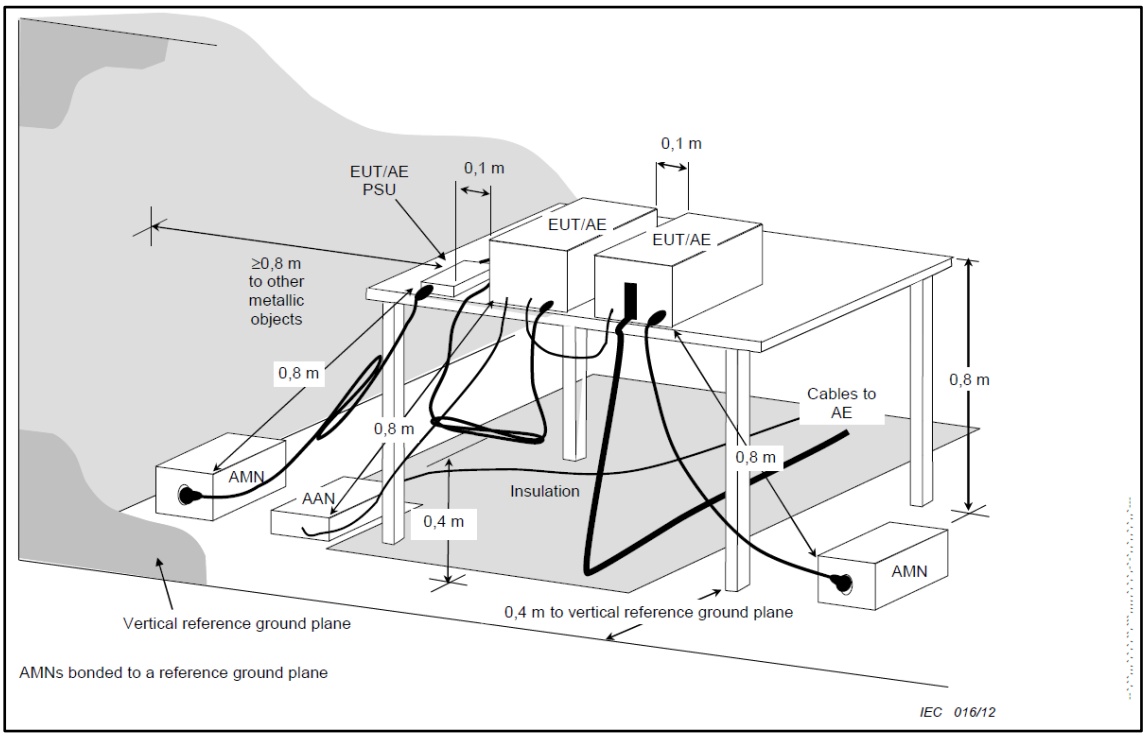
7 TEST METHODOLOGY

7.1 Conducted Spurious Emission Test on AC Power lines

Measured levels of ac power-line conducted emission across the 50Ω LISN port (to which the EUT is connected). All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer.

The device is placed on the test table, raised 80cm above the reference ground plane. The vertical conducting plane is located 40cm to the rear of the device. AC Conducted emission measurement is made over frequency range from 150kHz to 30MHz, this measurement was performed with EUT powered by 2 methods and both method are tested individually, one with an AC adaptor with 110V AC 60Hz supply and second with Wireless charger with supply 110V AC 60Hz.

7.1.1 Test Setup Configuration



7.2 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

7.2.1 Test Setup Configuration

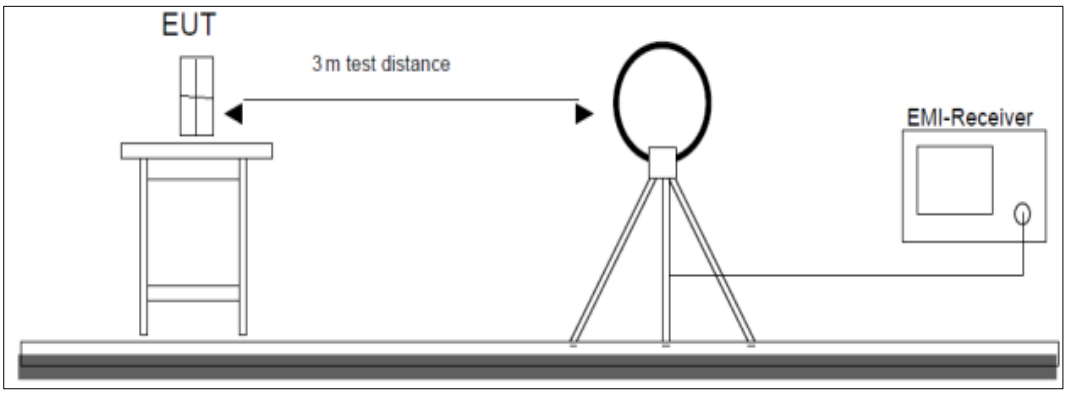


Figure 1: Frequency Range 9 kHz- 30 MHz

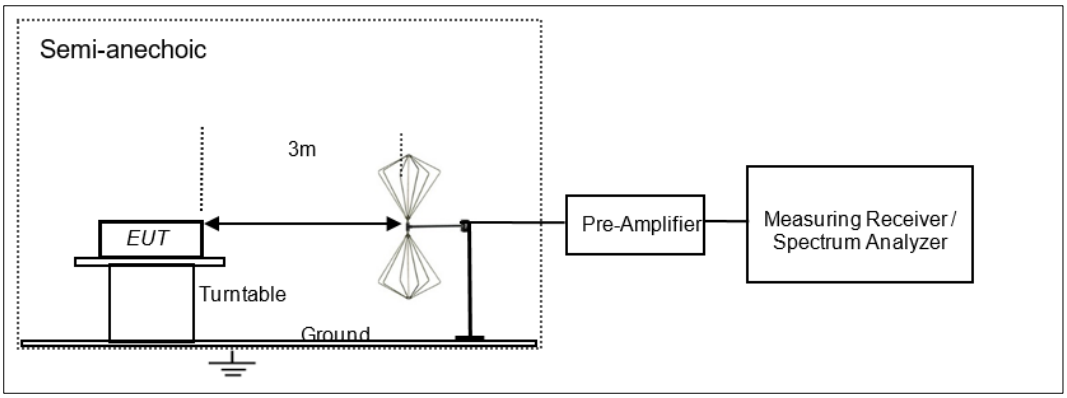


Figure 2: Frequency Range 30 MHz – 200 MHz

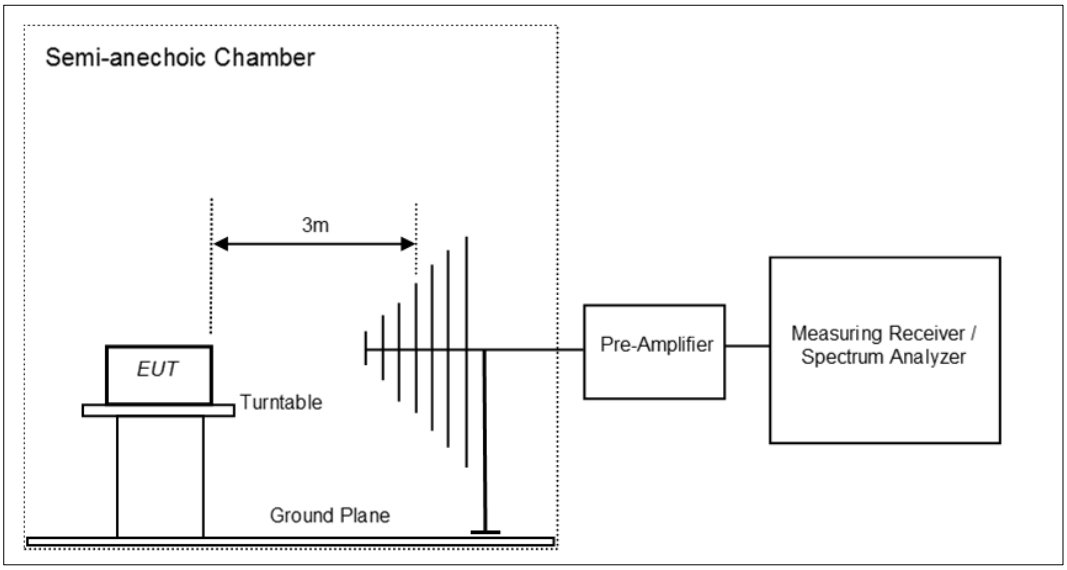


Figure 3: Frequency Range 200 MHz - 1GHz

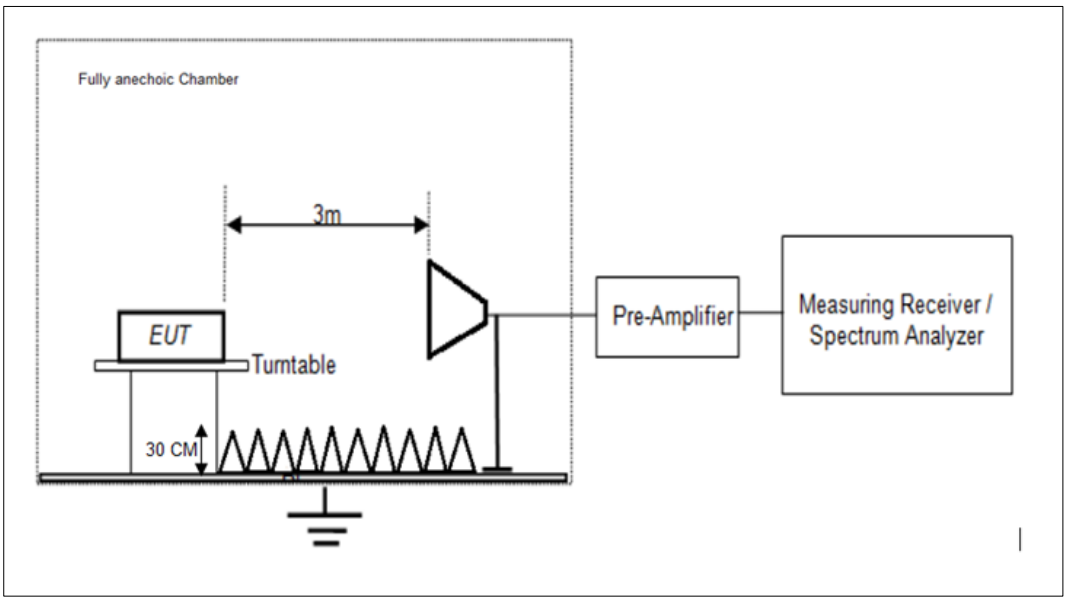


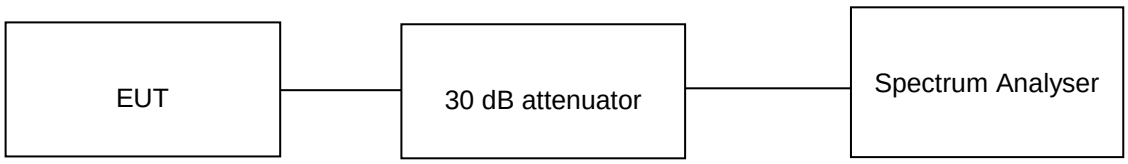
Figure 4: Frequency Range above 1 GHz

8 TEST RESULTS

8.1 Maximum Peak Conducted Output Power

Result ***Pass***

Test Specification	FCC part 15 Subpart C 15.247 (b)(2)
Test Method	Subclause 7.8.5 of ANSI C63.10
Measurement Bandwidth	30kHz
Detector	Peak
Port of testing	Antenna port
Requirement	Power ≤ 1 W (30 dBm)



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °C Voltage = 5VDC through AC-DC Adapter Relative humidity: 65%

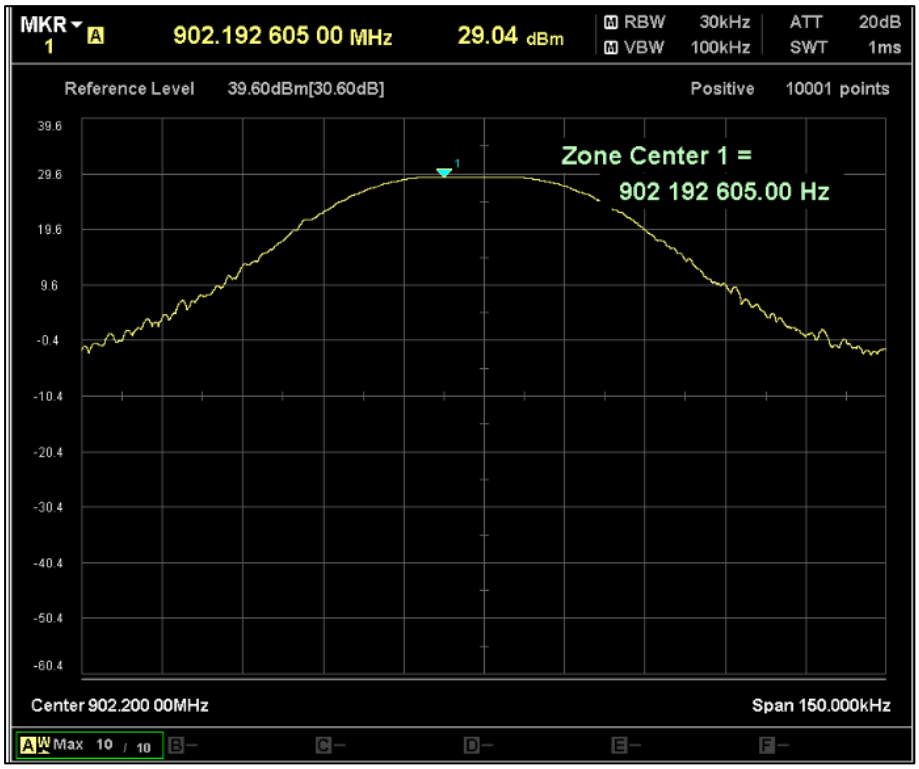
KDB Guidelines applied:

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

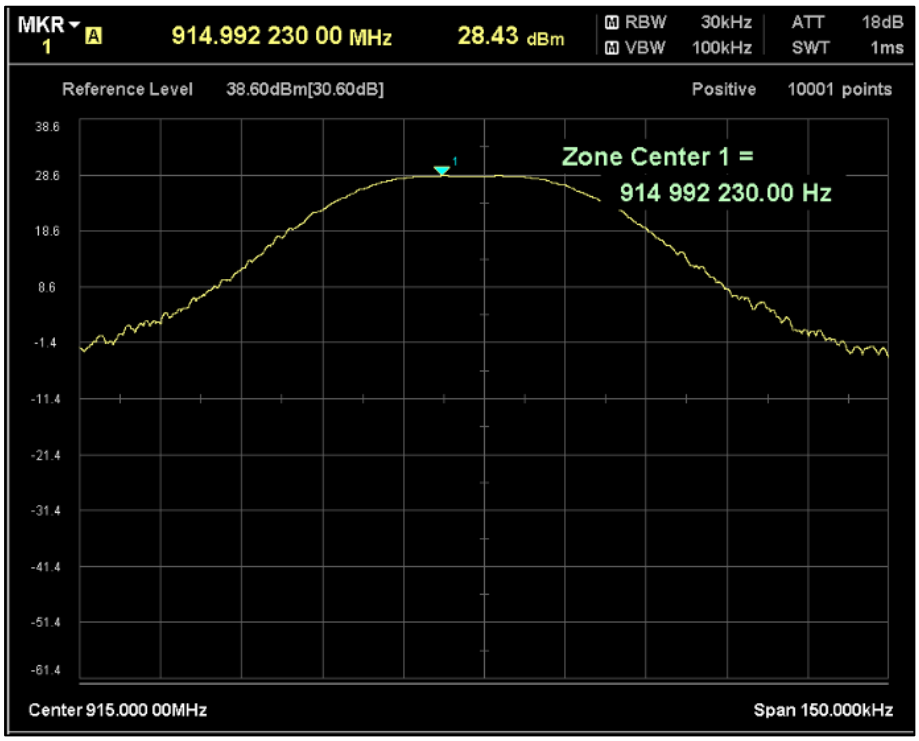
Test results:

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 (30dB) + Cable loss (0.6dB)
3. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 3.2 dBi & 2.46dBi

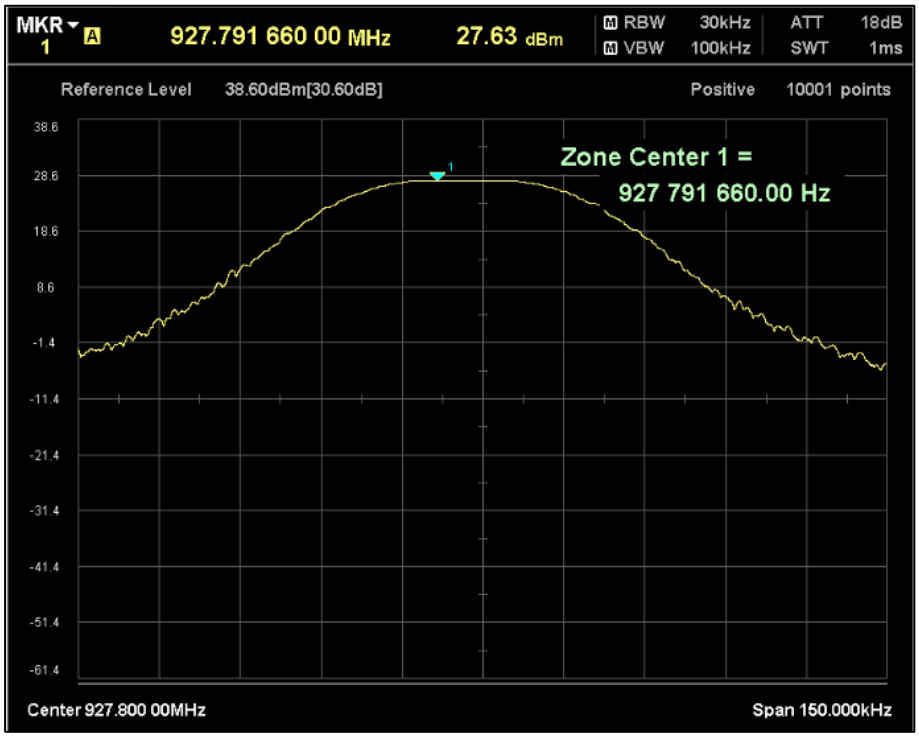
Data rate	Channel Frequency (MHz)	Measured Power (dBm)	Power Limit (dBm)
10Kbps	902.2	29.04	30.00
	915.0	28.43	30.00
	927.8	27.63	30.00



Channel Frequency: 902.2MHz



Channel Frequency: 915MHz



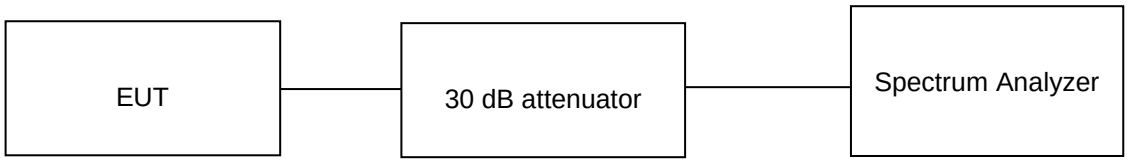
Channel Frequency: 927.8MHz

8.2 Occupied bandwidth & 20dB Bandwidth

Result ***Pass***

Test Specification	FCC part 15 Subpart C 15.247 (a) (1) (i)
Test Method	Subclause 7.8.7 of ANSI C63.10
Measurement Bandwidth	3 kHz
Detector	Peak
Port of testing	Antenna port
Requirement	The minimum 20 dB bandwidth of the hopping channel is 250 kHz use at least 50 hopping frequencies.

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °C Voltage = 5VDC Through AC-DC Adapter Relative humidity: 65%

KDB Guidelines applied:

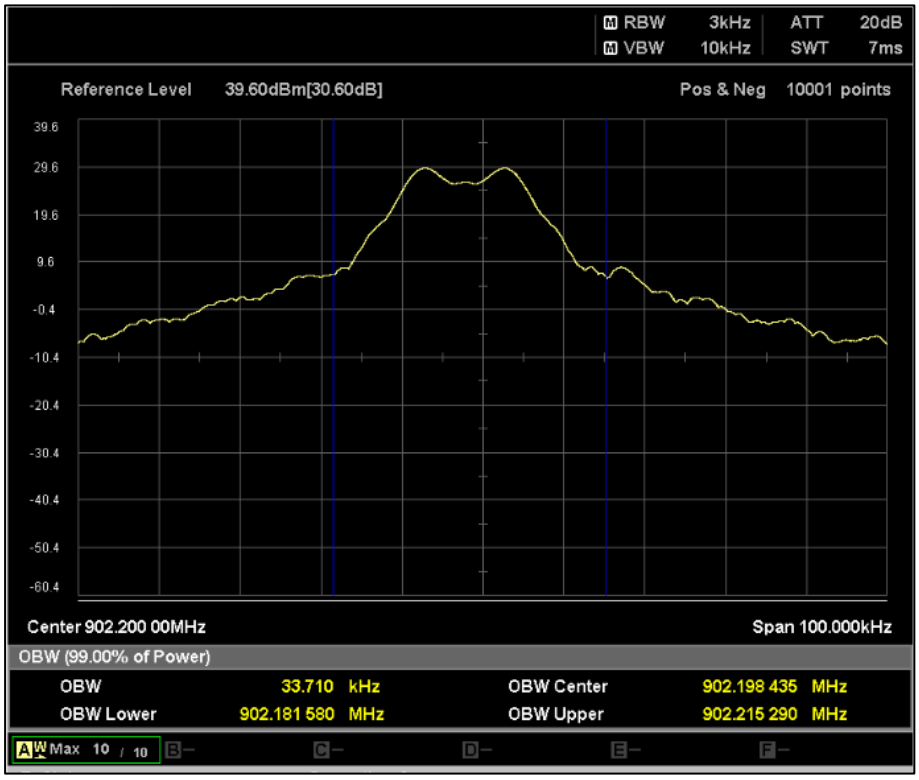
Measurements were made as per section 9(b) in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Test results:

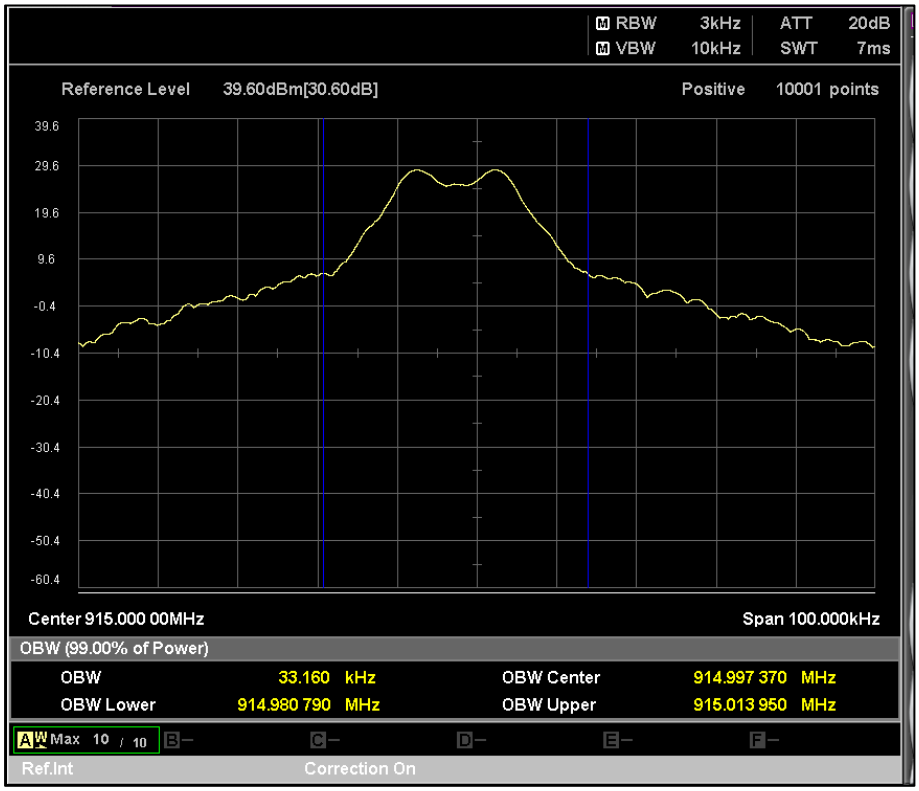
Note:
1. All the losses are included during measurement and final values are mentioned in the test report.
2. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 3.2 dBi & 2.46dBi

Channel Frequency (MHz)	20 dB Bandwidth (KHz)	99% OBW (KHz)
902.2	27.74	33.71
915	28.33	35.88
927.8	28.48	36.12

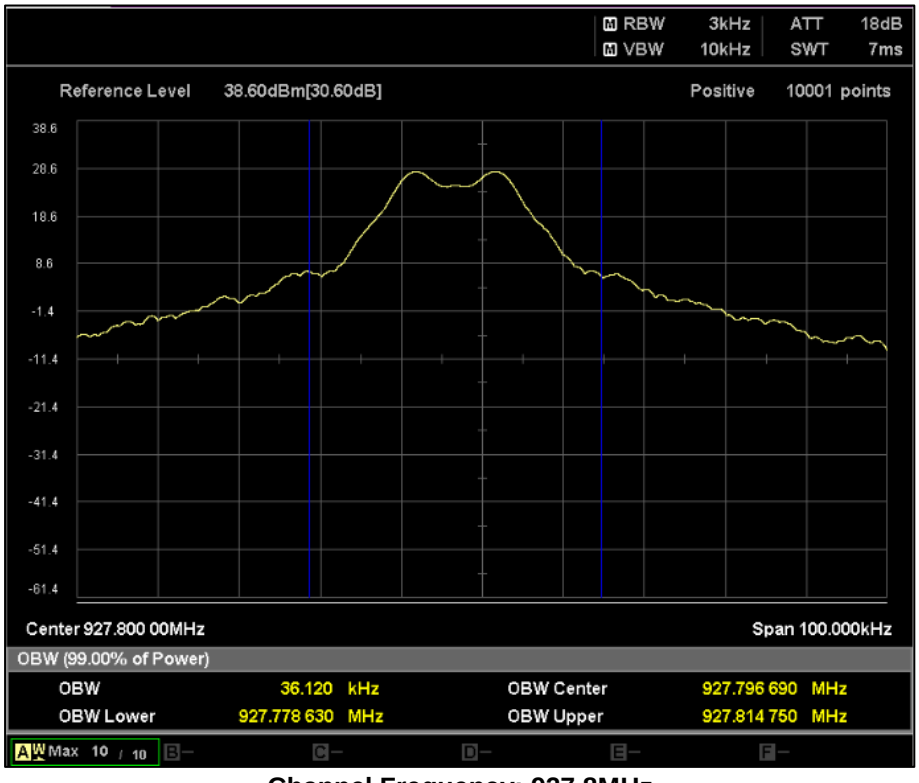
99% Occupied bandwidth



Channel Frequency: 902.2MHz

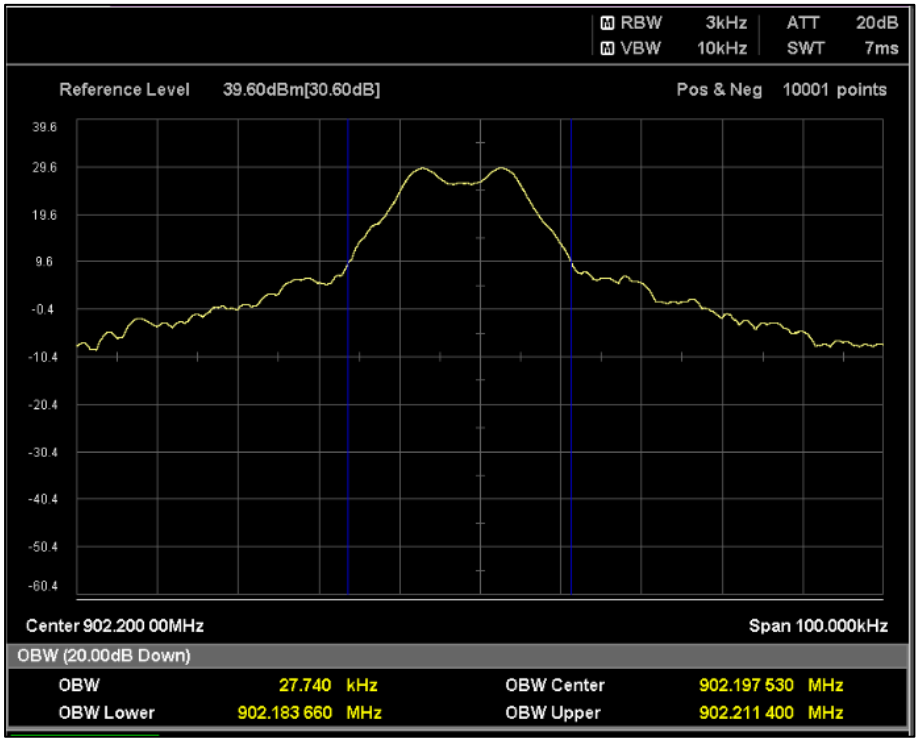


Channel Frequency: 915MHz

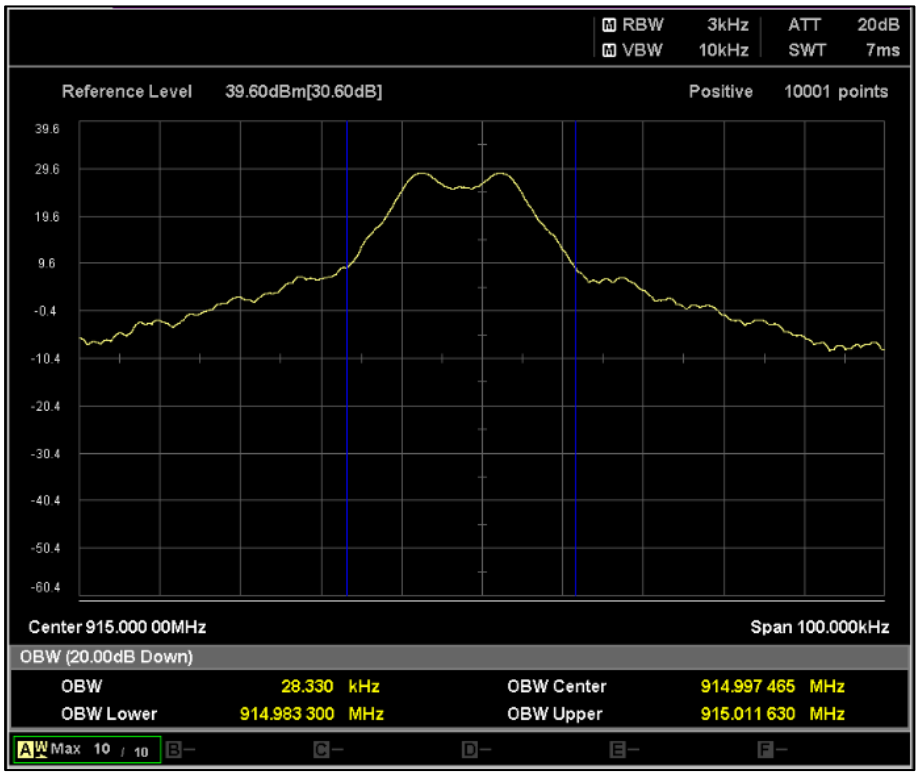


Channel Frequency: 927.8MHz

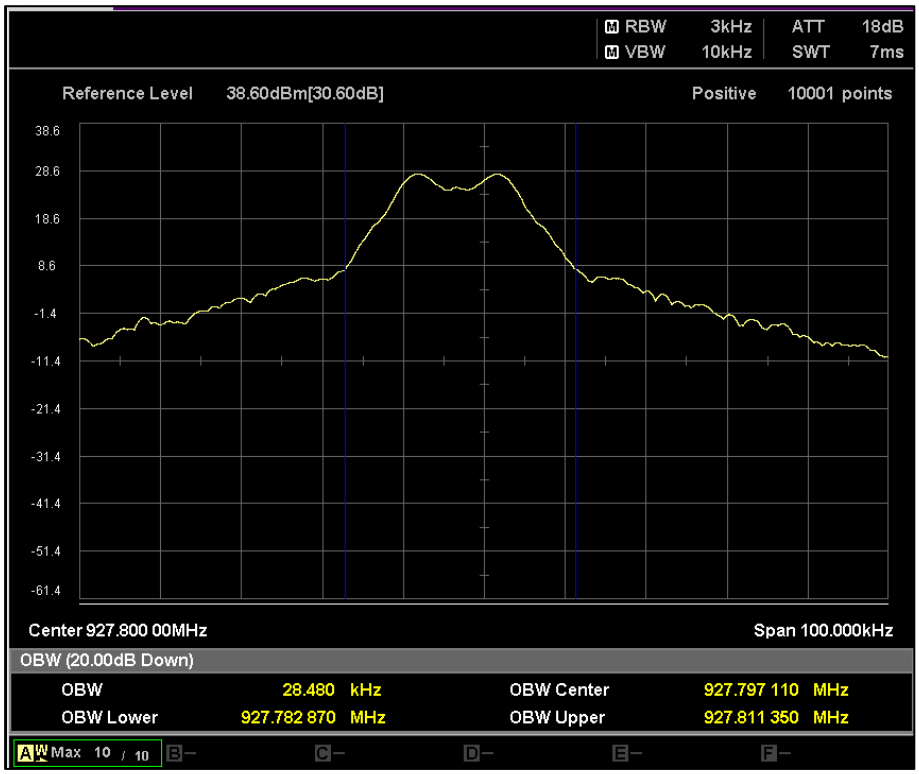
20dB Bandwidth



Channel Frequency: 902.2MHz



Channel Frequency: 915MHz



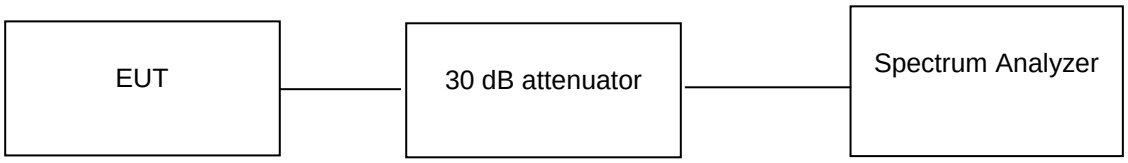
Channel Frequency: 927.8MHz

8.3 Number of Hopping Channels

Result ***Pass***

Test Specification	FCC Part 15 Subpart C Section 15.247 (a) (1) (i)
Test Method	Subclause 7.8.3 of ANSI C63.10
Measurement Bandwidth	10 kHz*
Detector	Peak
Port of testing	Antenna port
Requirement	Frequency hopping systems operating in the band 902.2-928 MHz shall use at least 50 hopping channels if the minimum 20 dB bandwidth is less than 250 kHz.

Test Method:



***Note:** RBW setting of 10 kHz is used because setting of 8.4 kHz (30% of 20 dB bandwidth) bandwidth in the Spectrum Analyser is not supported

Test Condition

Normal Test Condition:

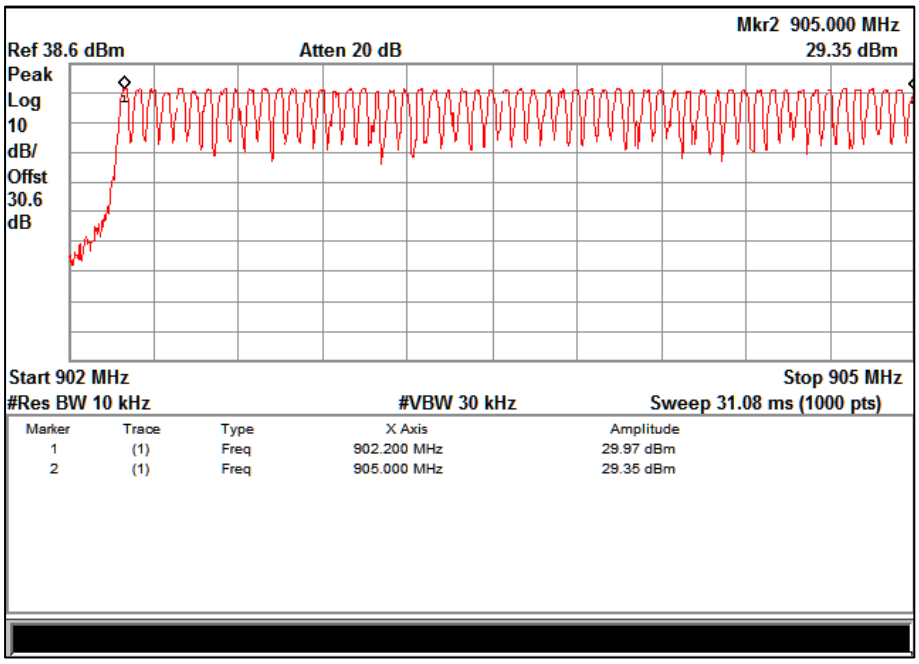
Temperature (Norm) = + 22.1 °C Voltage = 5VDC Through AC-DC Adapter Relative humidity: 65%

KDB Guidelines applied:

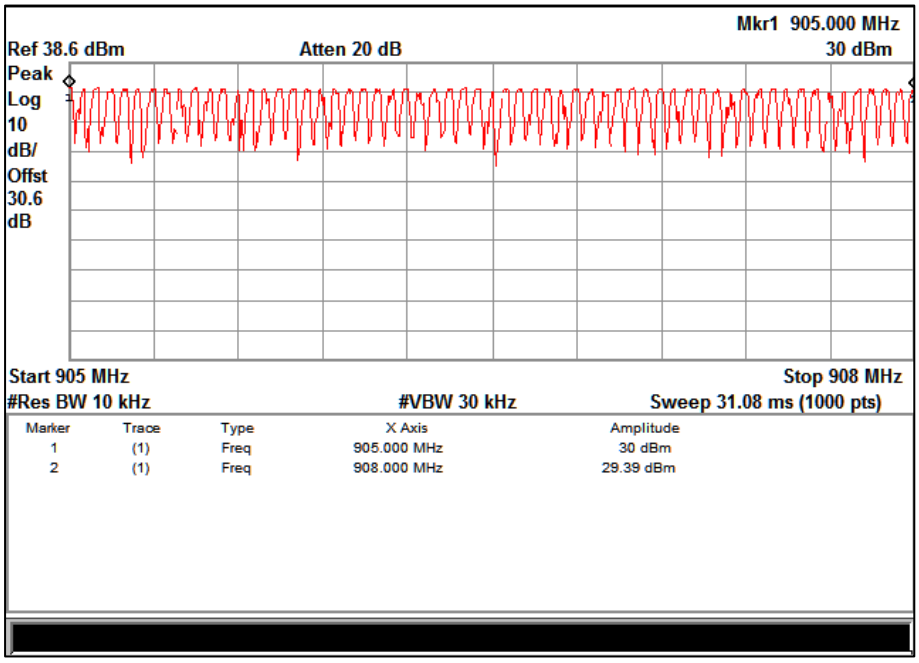
Measurements were made as per section 9(b) in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Test results:

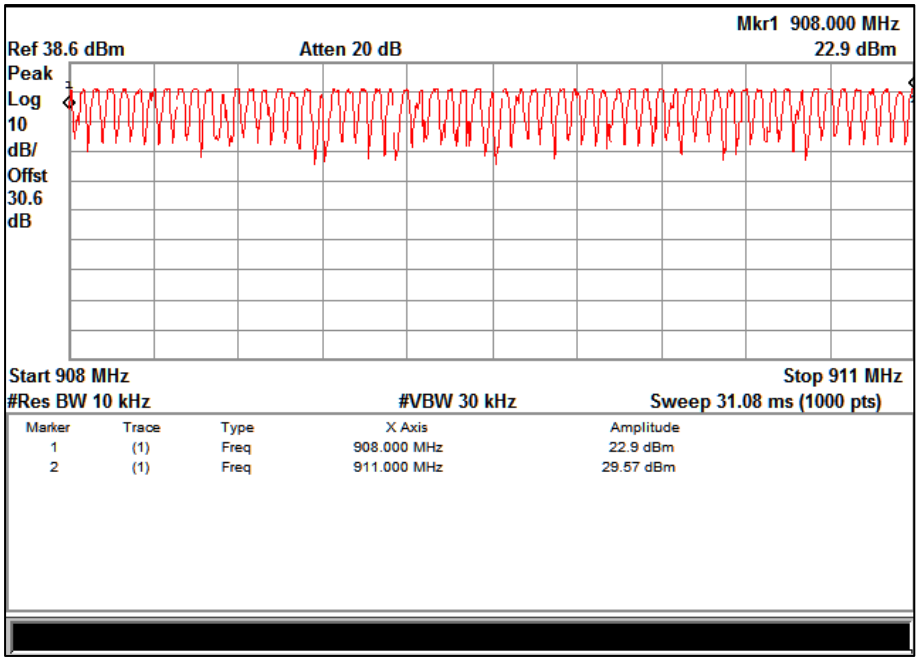
Note:
1. All the losses are included during measurement and final values are mentioned in the test report.



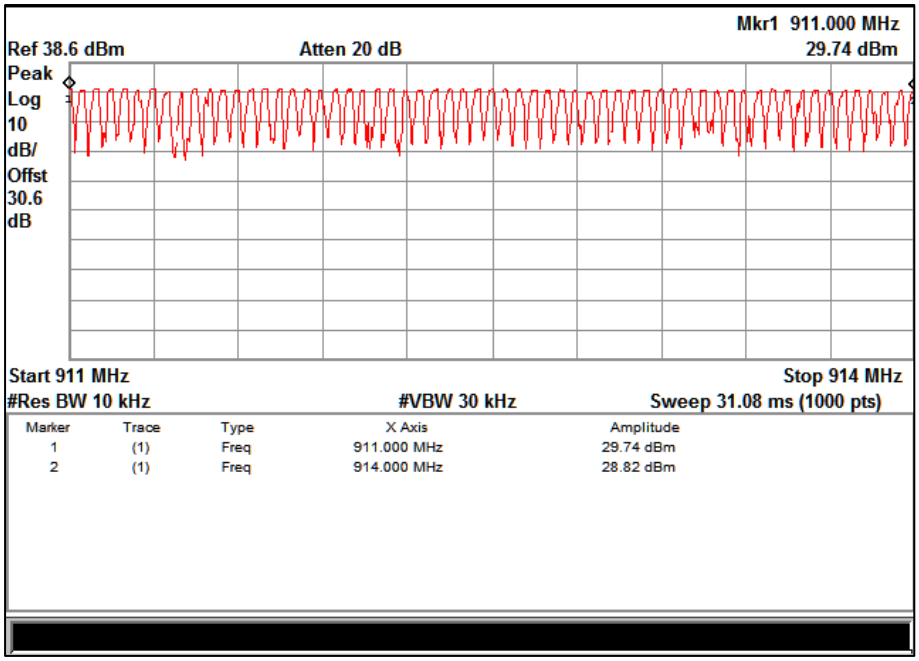
Number of Hopping Frequencies(902MHz – 905MHz)



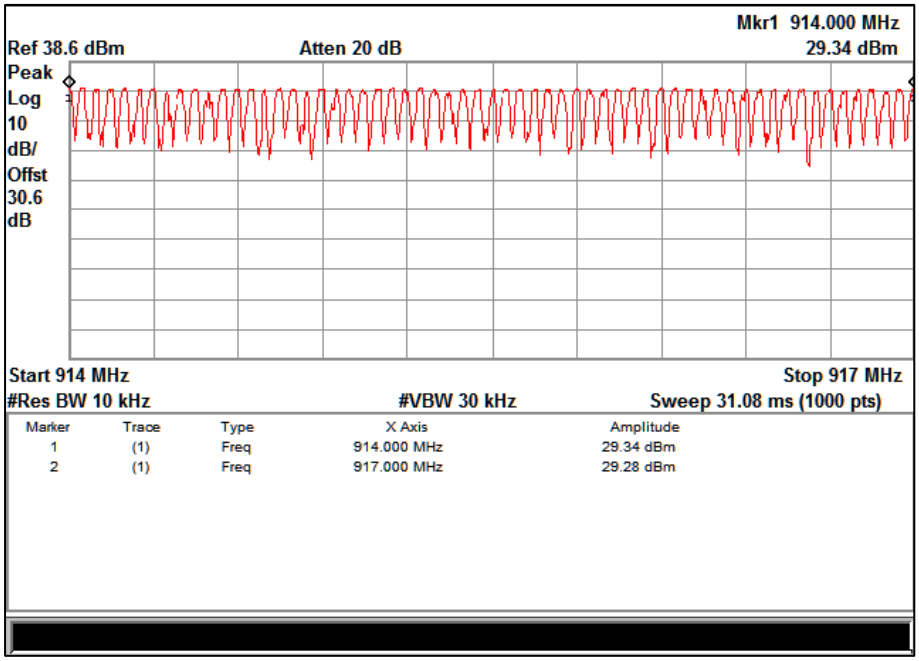
Number of Hopping Frequencies(905MHz – 908MHz)



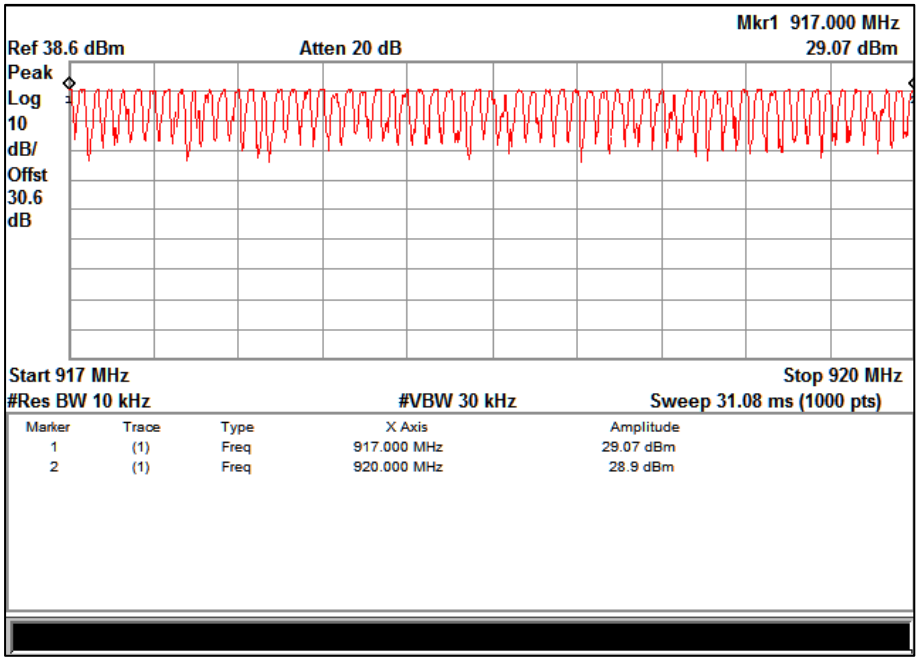
Number of Hopping Frequencies(908MHz – 911MHz)



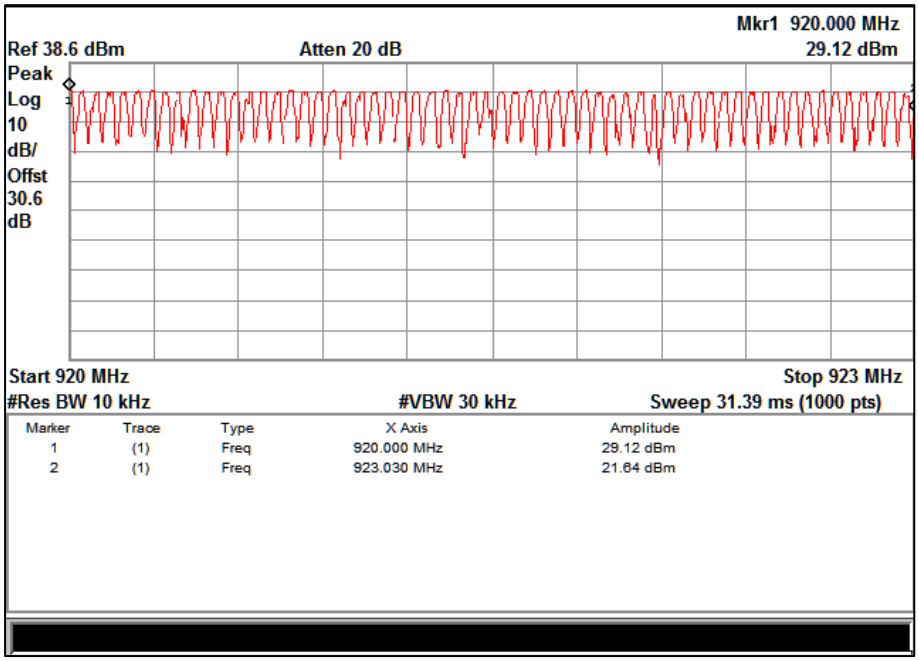
Number of Hopping Frequencies(911MHz – 914MHz)



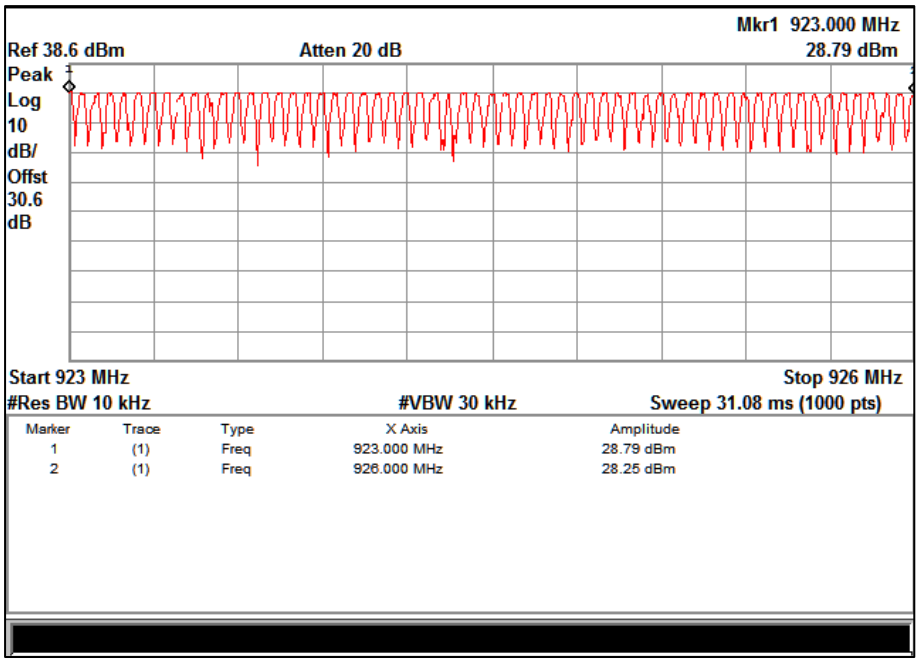
Number of Hopping Frequencies(914MHz – 917MHz)



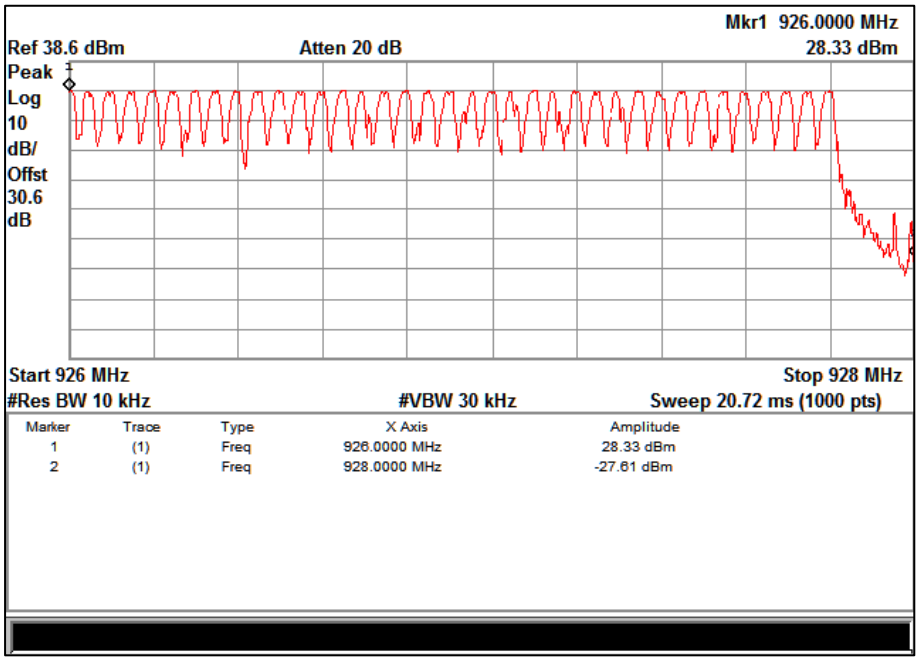
Number of Hopping Frequencies(917MHz – 920MHz)



Number of Hopping Frequencies(920MHz – 923MHz)



Number of Hopping Frequencies(923MHz – 926MHz)



Number of Hopping Frequencies(926MHz – 928MHz)

Start hopping Frequency Observed 902.2 MHz
Stop hopping Frequency Observed 927.8 MHz

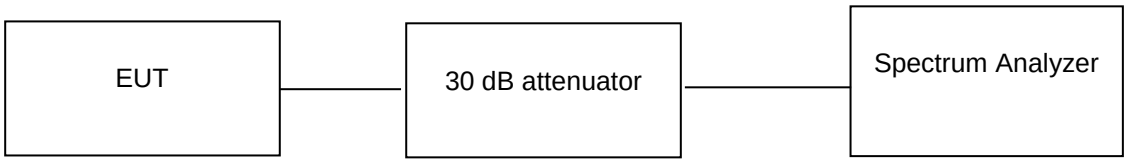
Total Number of Hopping Channels Observed = 498

8.4 Carrier Frequency Separation

Result ***Pass***

Test Specification	FCC Part 15 Subpart C Section 15.247 (a) (1)
Test Method	Clause 7.8.2 of ANSI C63.10
Measurement Bandwidth	10kHz
Detector	Peak
Port of testing	Antenna port
Requirement	Frequency hopping systems shall have hopping channel carrier frequency separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

Test Method:



Test Condition

Normal Test Condition:

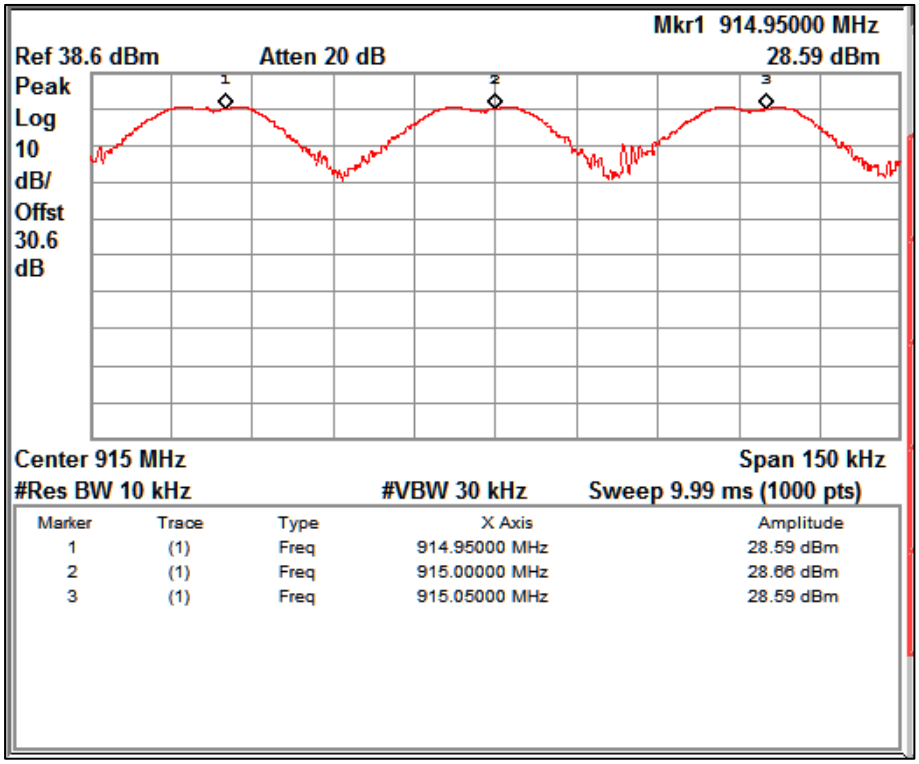
Temperature (Norm) = + 22.1 °C Voltage = 5VDC through AC-DC Adapter Relative humidity: 65%

KDB Guidelines applied:

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

Test results:

Note:
1. All the losses are included during measurement and final values are mentioned in the test report.



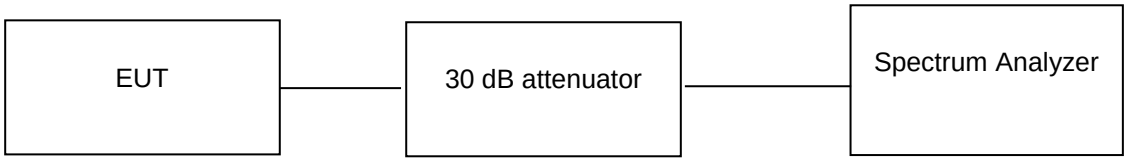
Frequency (MHz)	Channel spacing Observed (KHz)
914.95	50.00
915.00	50.00
915.05	50.00

8.5 Time of Occupancy (Dwell Time)

Result ***Pass***

Test Specification	FCC Part 15 Subpart C Section 15.247 (a) (1) (i)
Test Method	Clause 7.8.4 of ANSI C63.10
Measurement Bandwidth	10 kHz
Detector	Peak
Port of testing	Antenna port
Requirement	If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

Test Method:



Test Condition

Normal Test Condition:

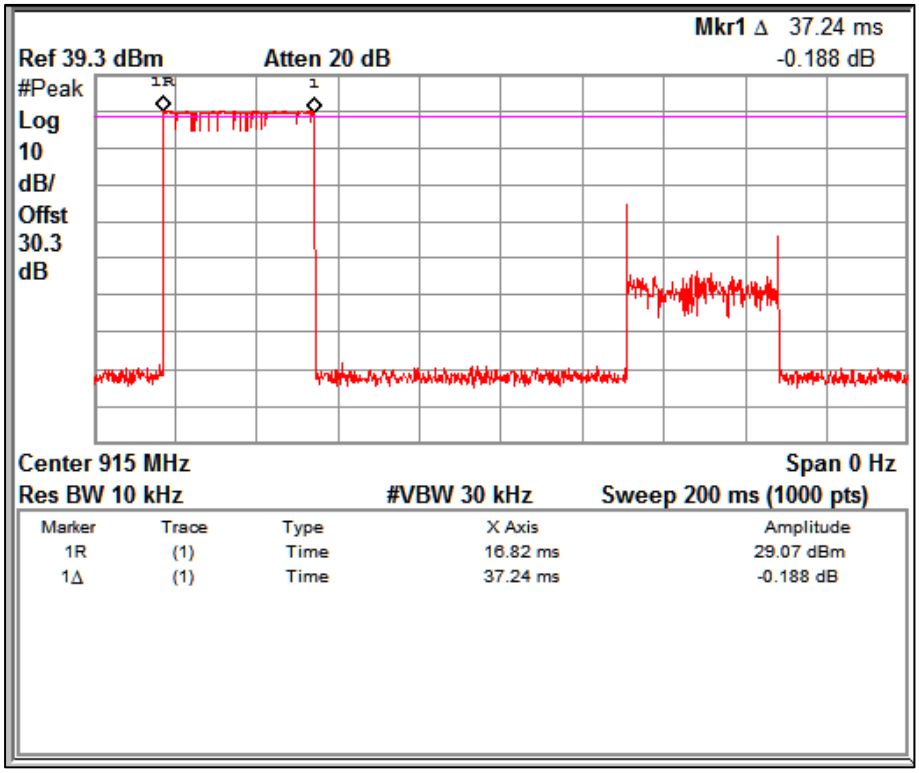
Temperature (Norm) = + 22.1 °C Voltage = 5VDC through AC-DC Adapter Relative humidity: 65%

KDB Guidelines applied:

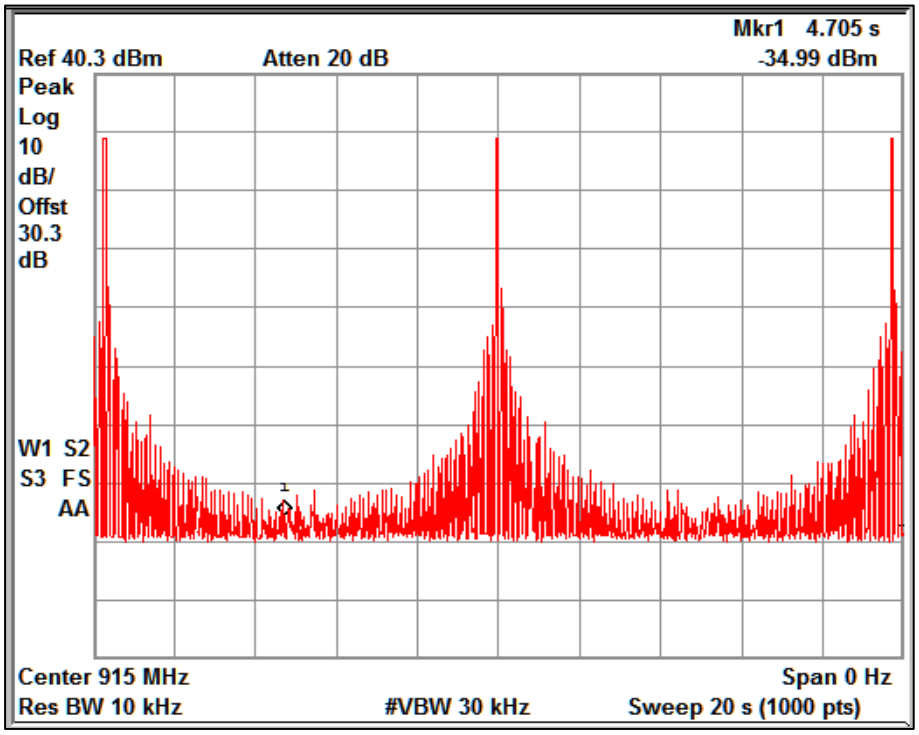
Measurements were made as per section 9(b) in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Test results:

Note:
1. All the losses are included during measurement and final values are mentioned in the test report.



Dwell Time



Number of Bins

Dwell Time = 37.24ms
Total bins in 20 Sec =03
Max. Allowed time = 0.4s

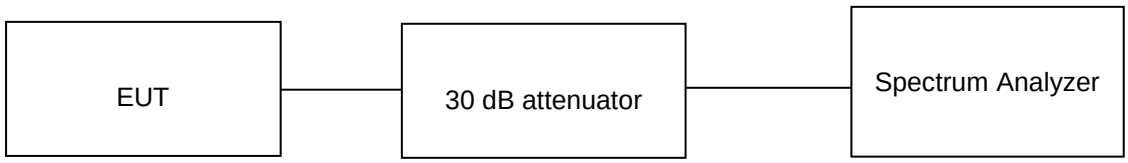
Total time occupancy in 20s = 37.24 * 03 = 111.72ms (which is less than 400ms)

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

Result ***Pass***

Test Specification	FCC part 15 Subpart C 15.247 (d)
Test Method	Subclause 7.8.8 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) = + 22.1 °C Voltage = 5VDC through AC-DC Adapter Relative humidity: 65%

KDB Guidelines applied:

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

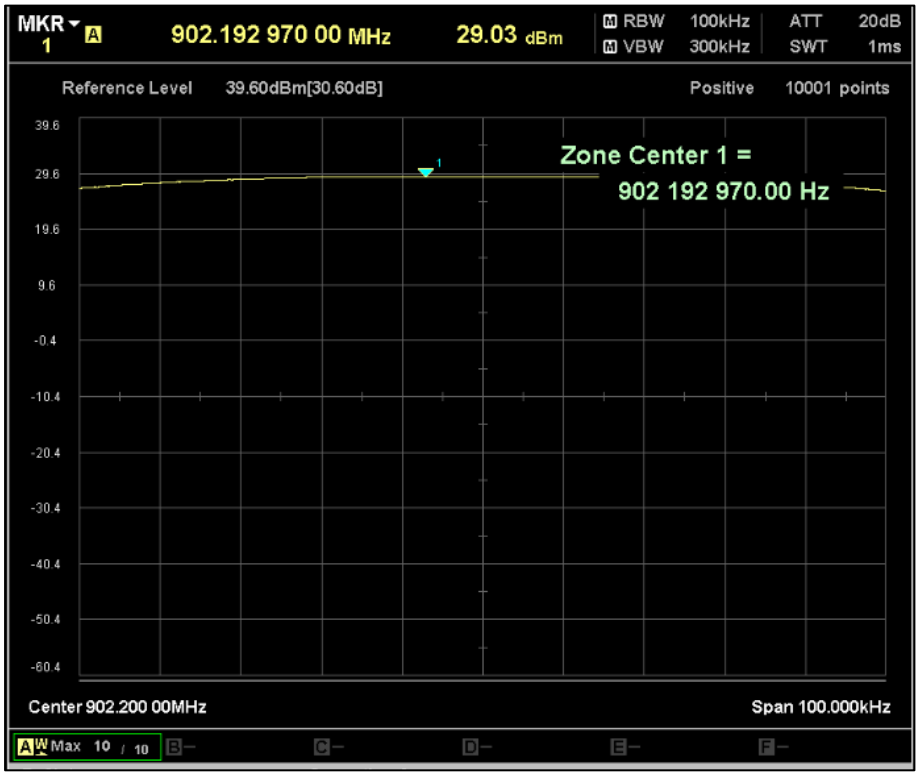
Test results:

Note:

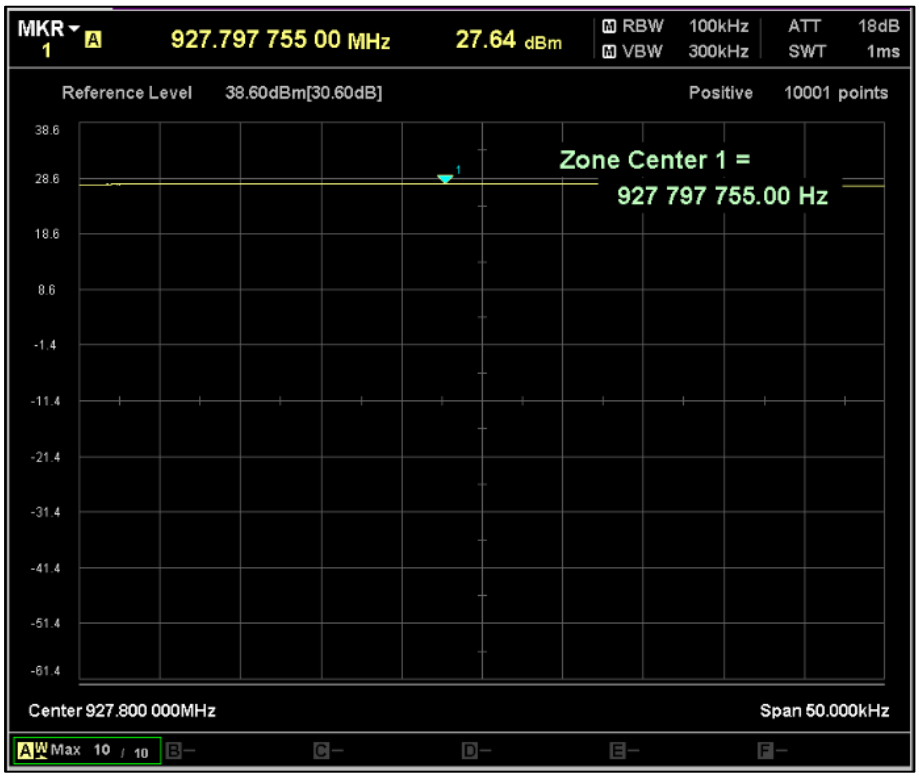
1. All the losses are included during measurement and final values are mentioned in the test report
2. Final Value (dBm) = Measured Value (dBm) + Attenuator factor (30dB) + Cable loss (0.6dB)

8.6.1 Band edge and reference plots

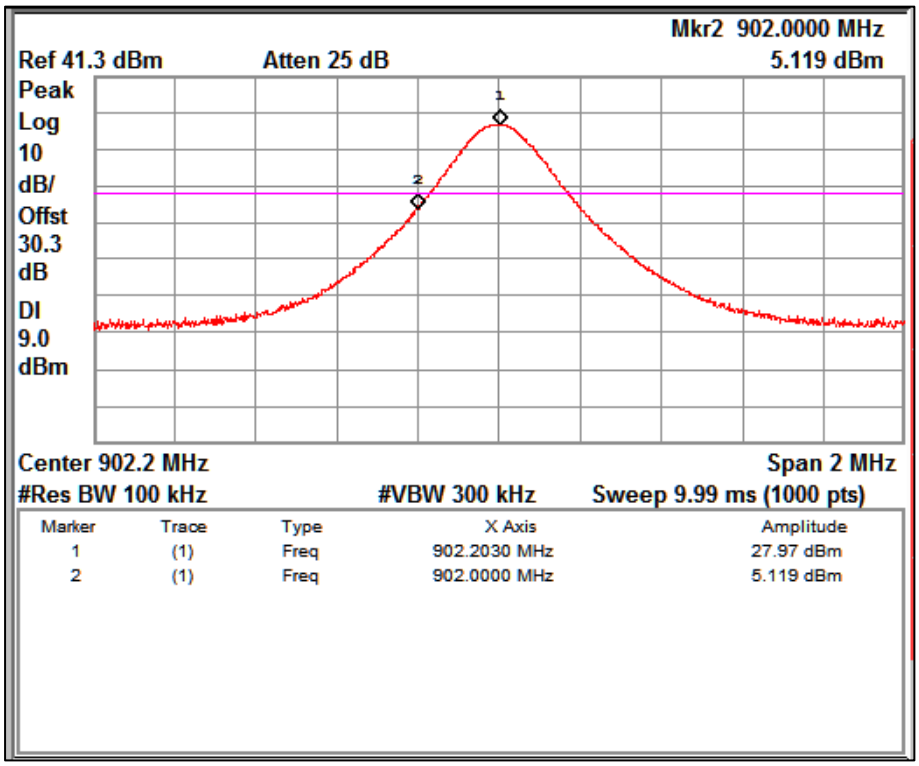
Data Rate (kbps)	Channel Frequency (MHz)	Band edge Frequency MHz	Value at Band edge (A) (dBm)	Reference Value (B) (dBm)	A-B (dBc)	Minimum Limit (dBc)
10	902.2	902	7.46	29.03	-21.57	-20
10	927.8	928	6.16	27.64	-21.48	-20



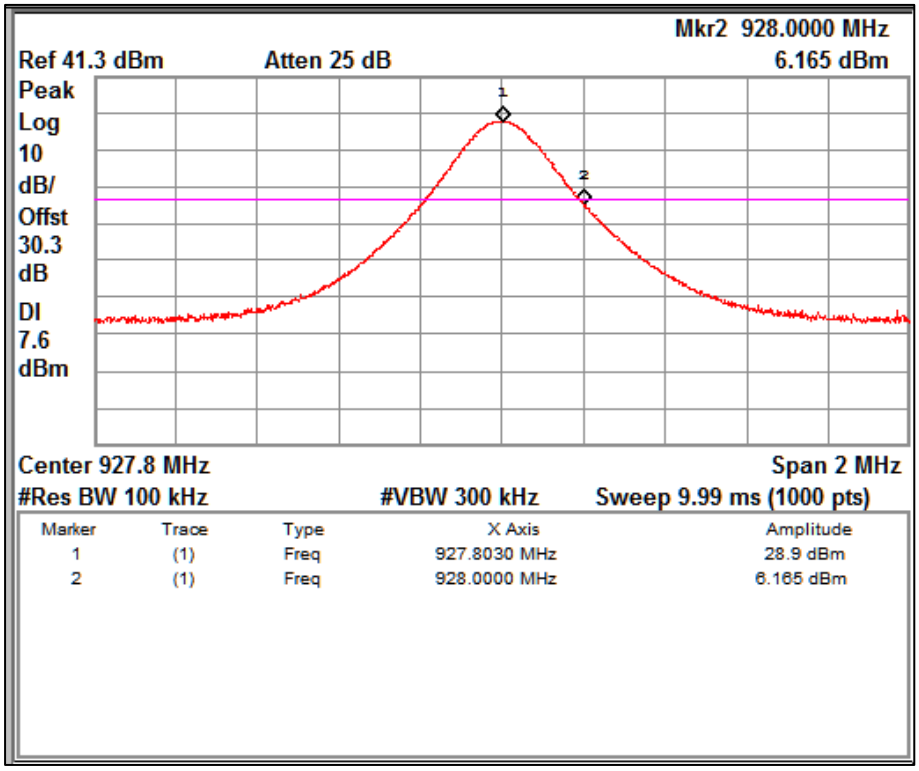
Reference plot for 902.2MHz



Reference plot for 927.8 MHz

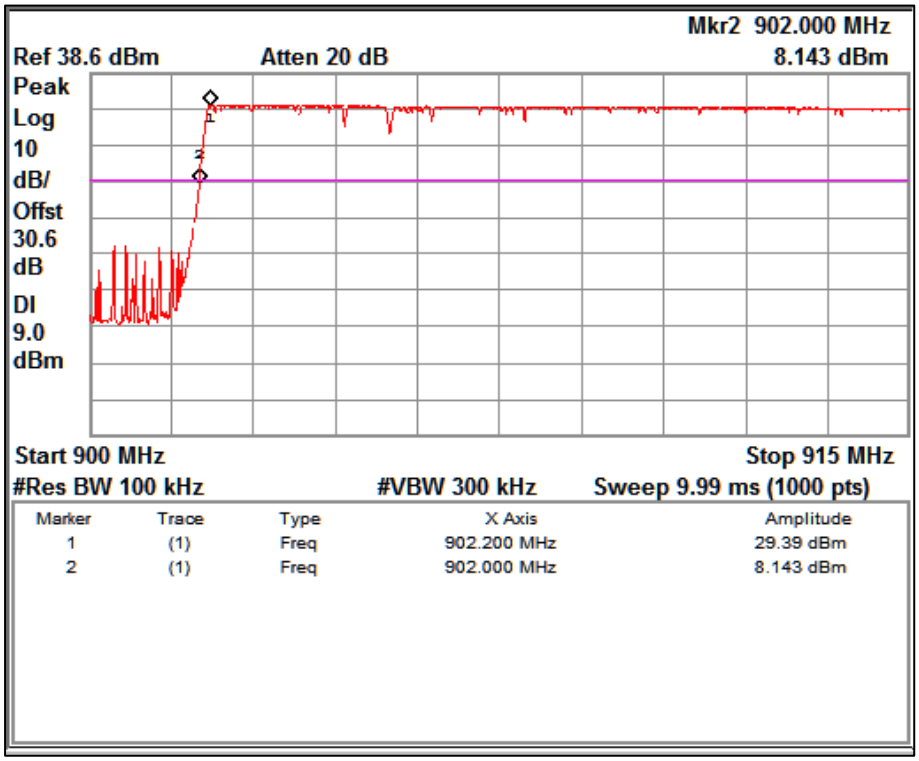


Band edge Channel Frequency 902.2MHz

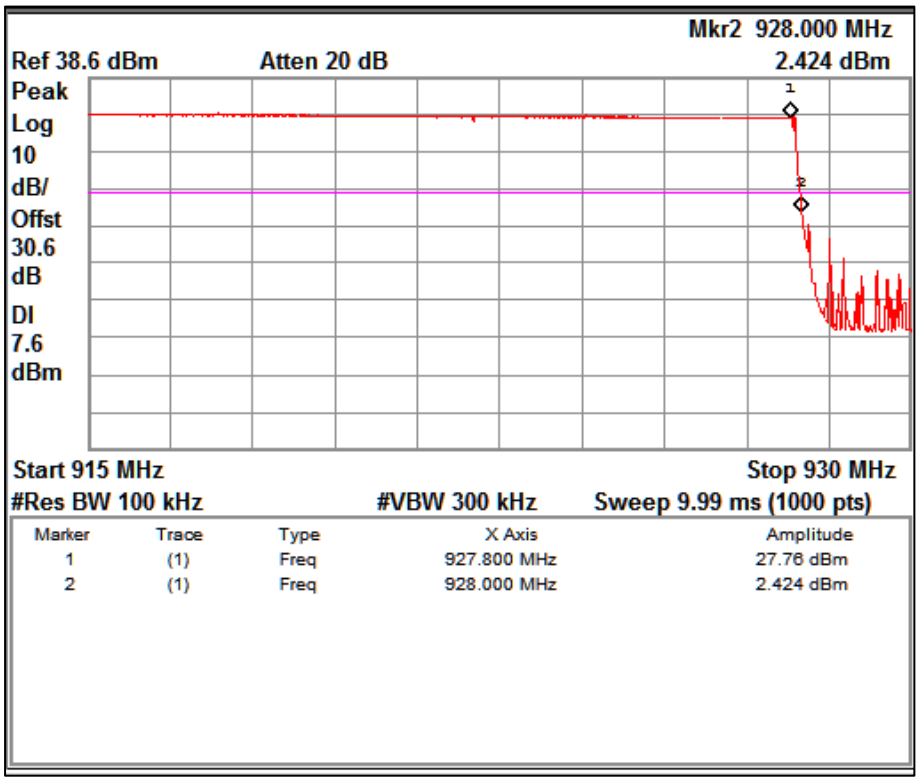


Band edge Channel Frequency 927.8MHz

Device in Hopping Mode:

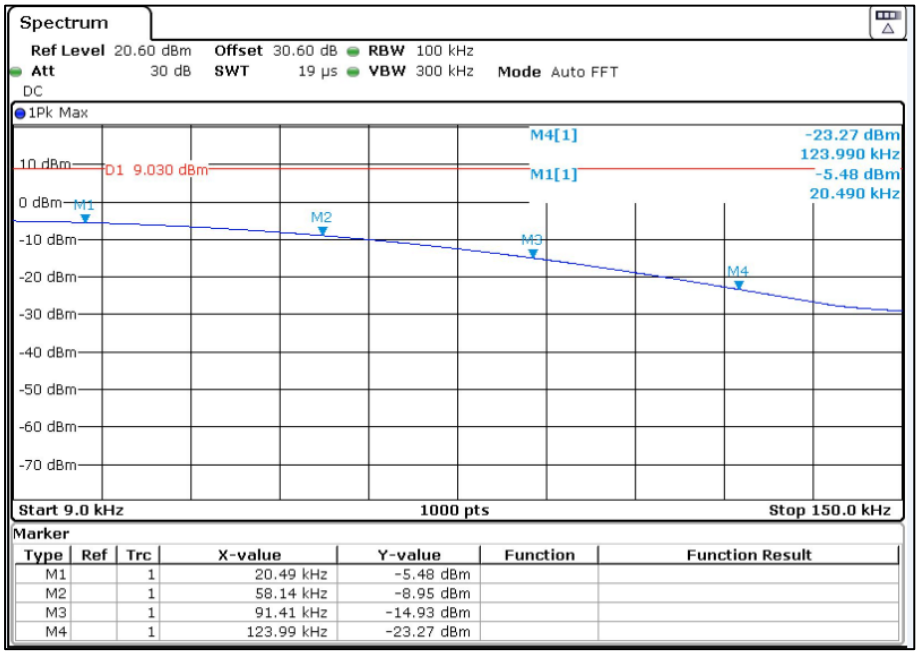


Hopping Frequency low Band edge

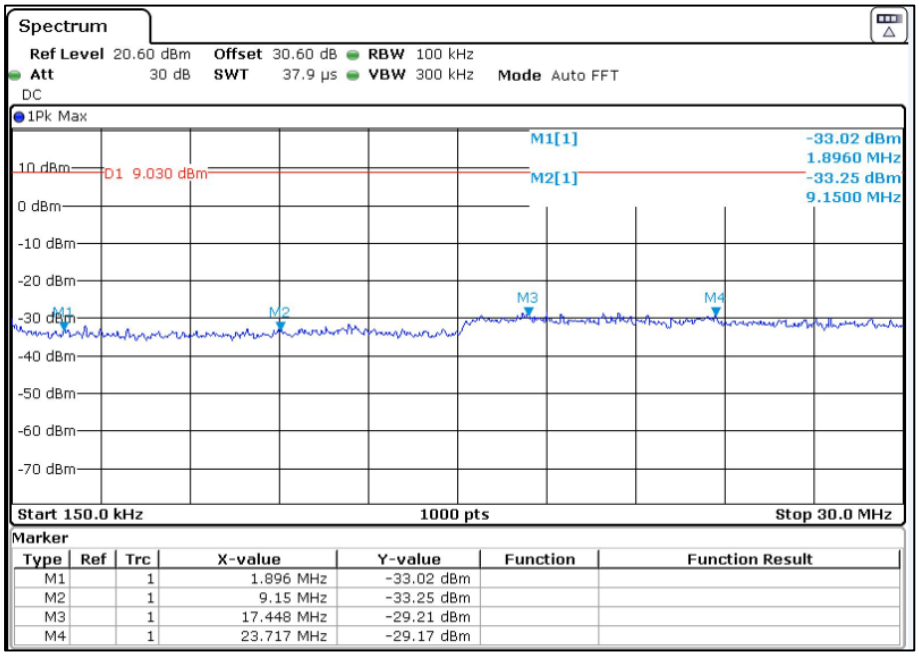


Hopping Frequency High Band edge

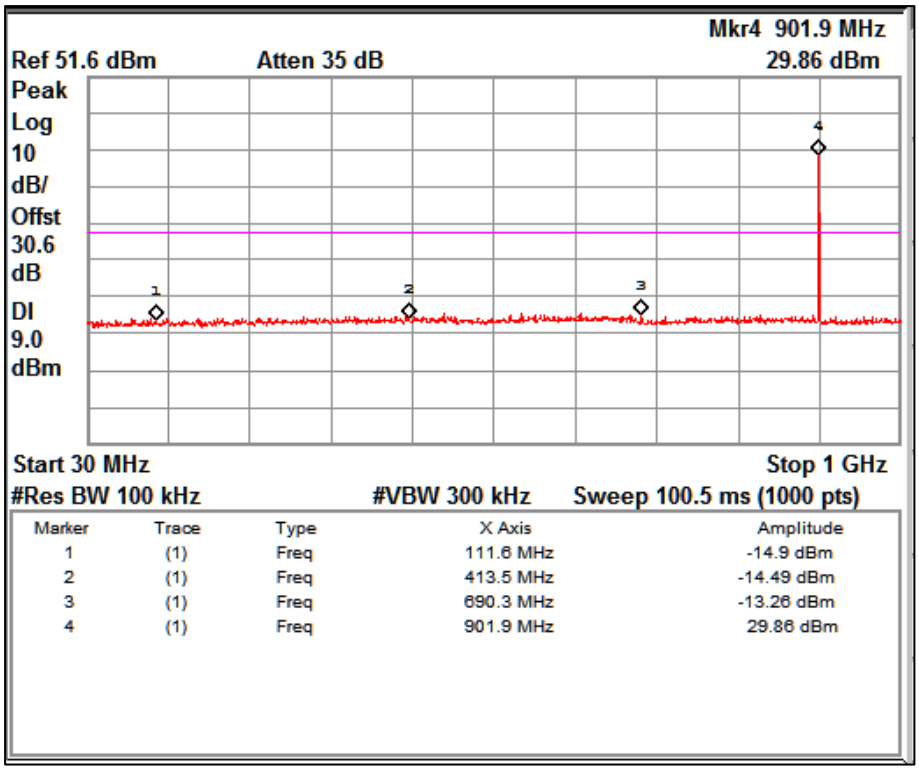
8.6.2 Out-Of-Band Emissions



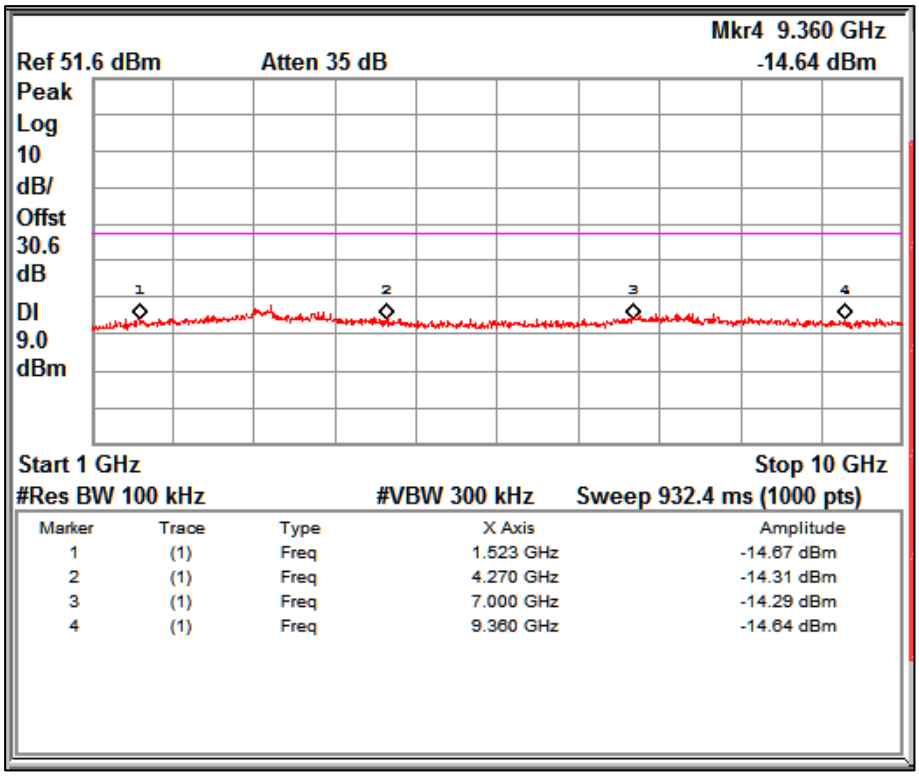
Channel Frequency 902.2MHz **Frequency Range 9KHz – 150KHz**



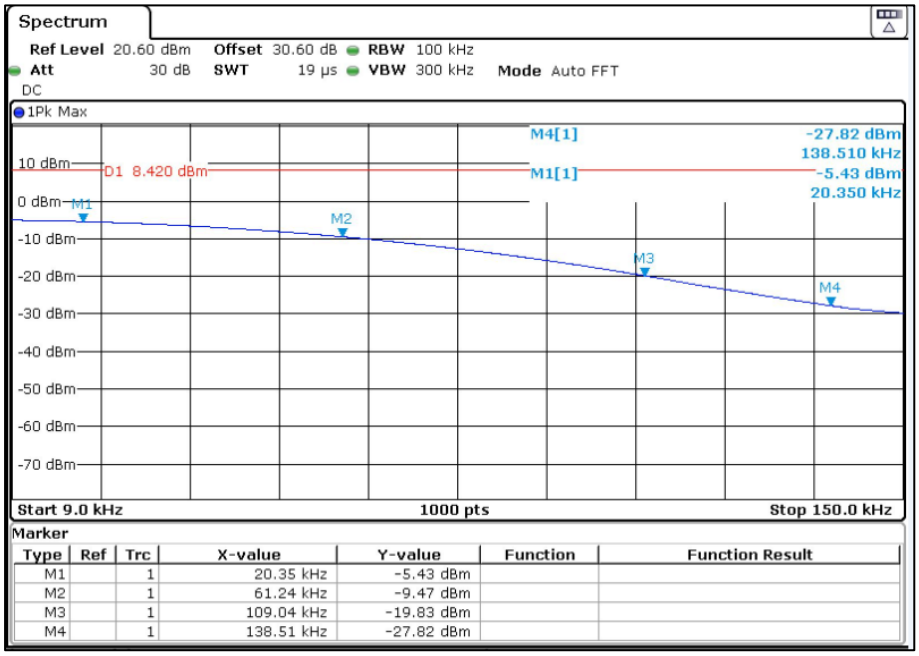
Channel Frequency 902.2MHz **Frequency Range 150KHz – 30MHz**



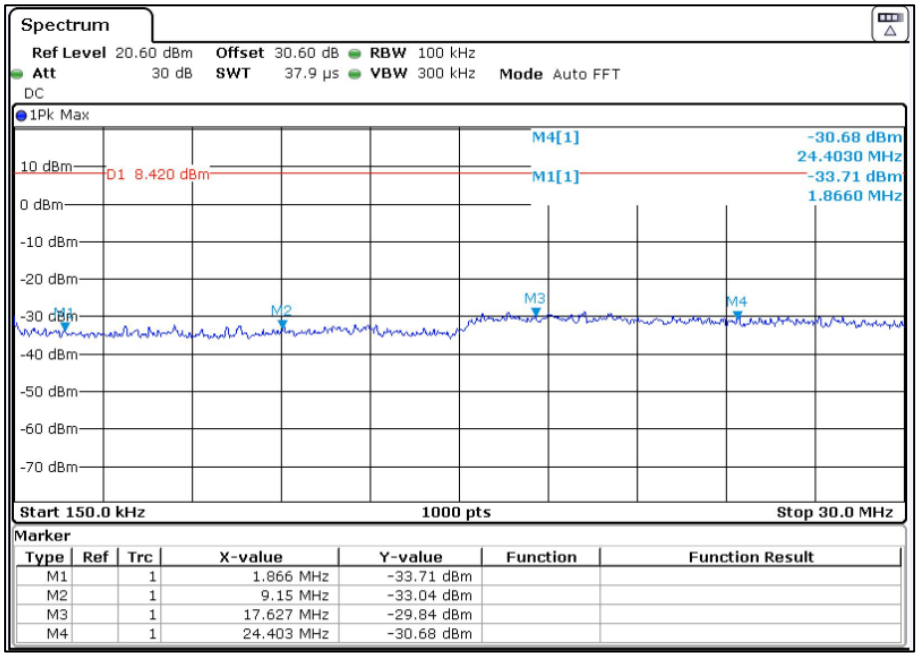
Channel Frequency 902.2MHz **Frequency Range 30MHz – 1GHz**



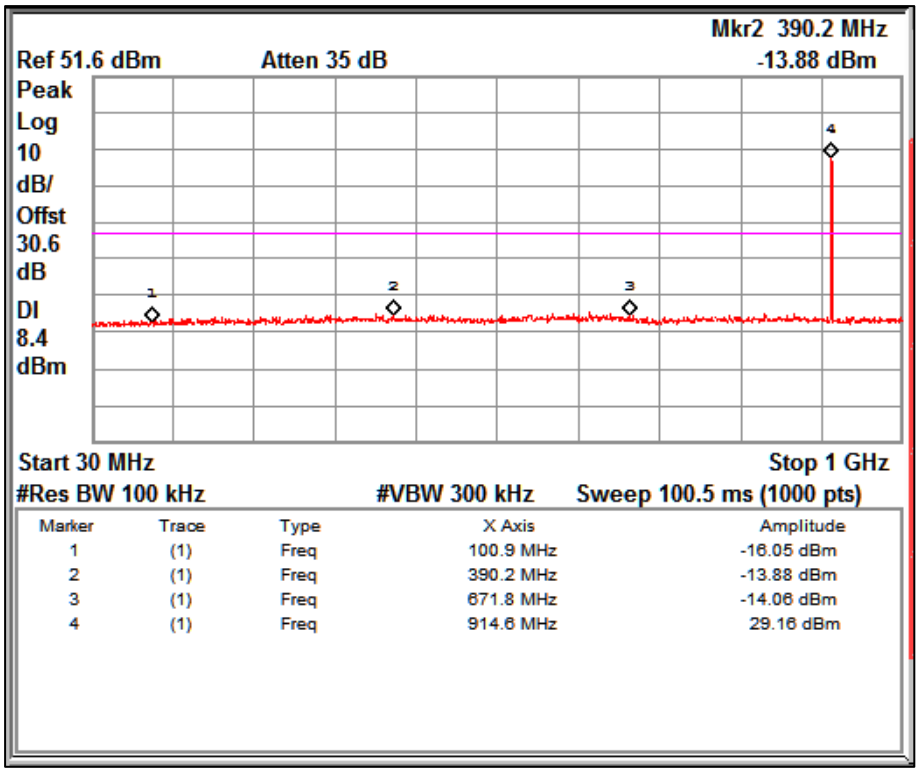
Channel Frequency 902.2MHz **Frequency Range 1GHz – 10GHz**



Channel Frequency 915MHz **Frequency Range 9KHz – 150KHz**

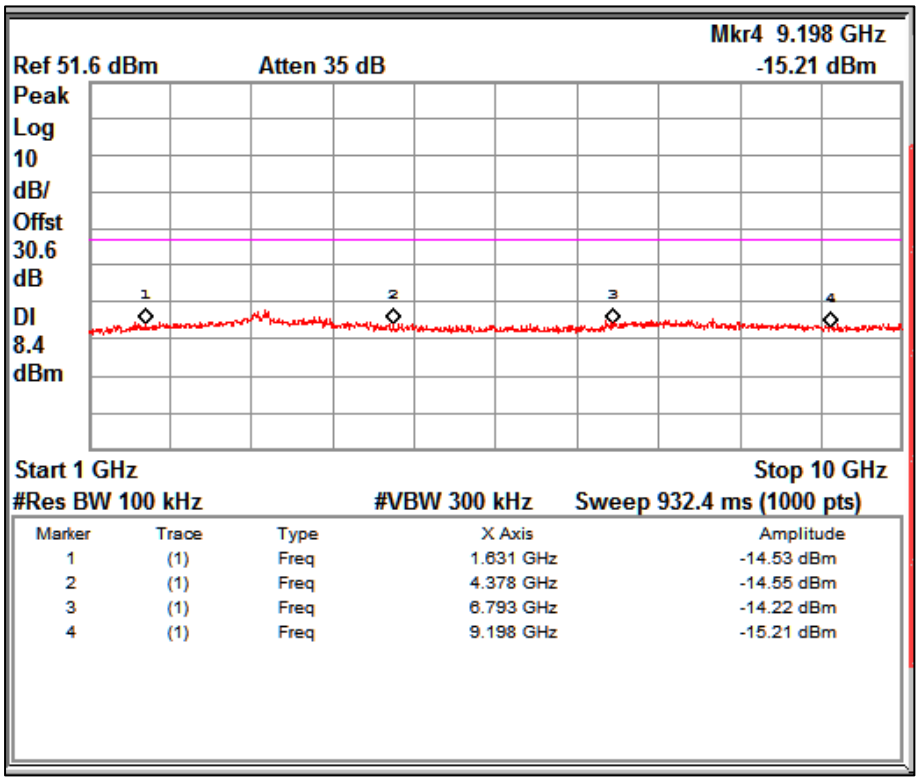


Channel Frequency 915MHz **Frequency Range 150KHz – 30MHz**



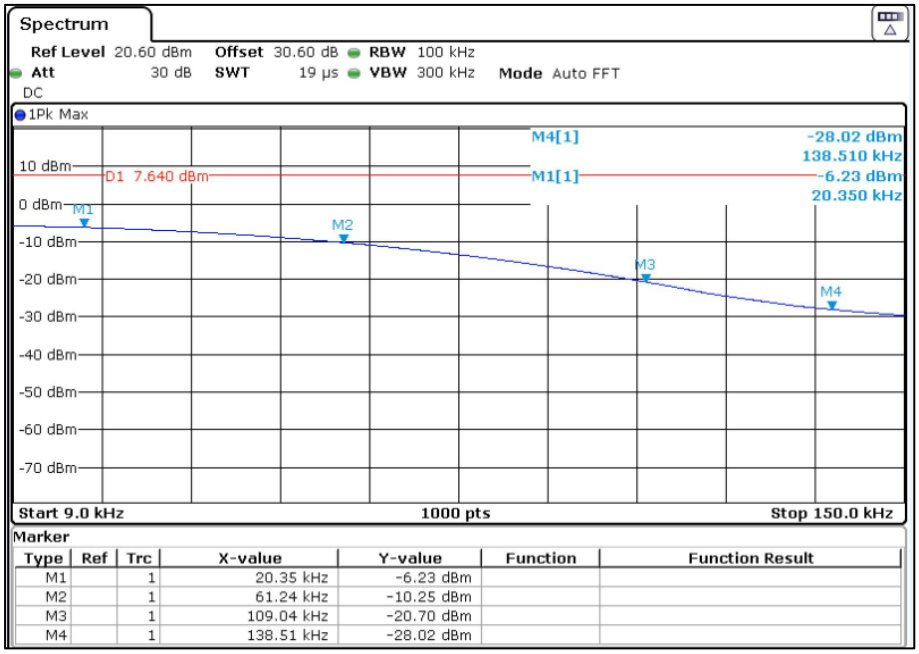
Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	100.9 MHz	-16.05 dBm
2	(1)	Freq	390.2 MHz	-13.88 dBm
3	(1)	Freq	671.8 MHz	-14.06 dBm
4	(1)	Freq	914.6 MHz	29.16 dBm

Channel Frequency 915MHz **Frequency Range 30MHz – 1GHz**

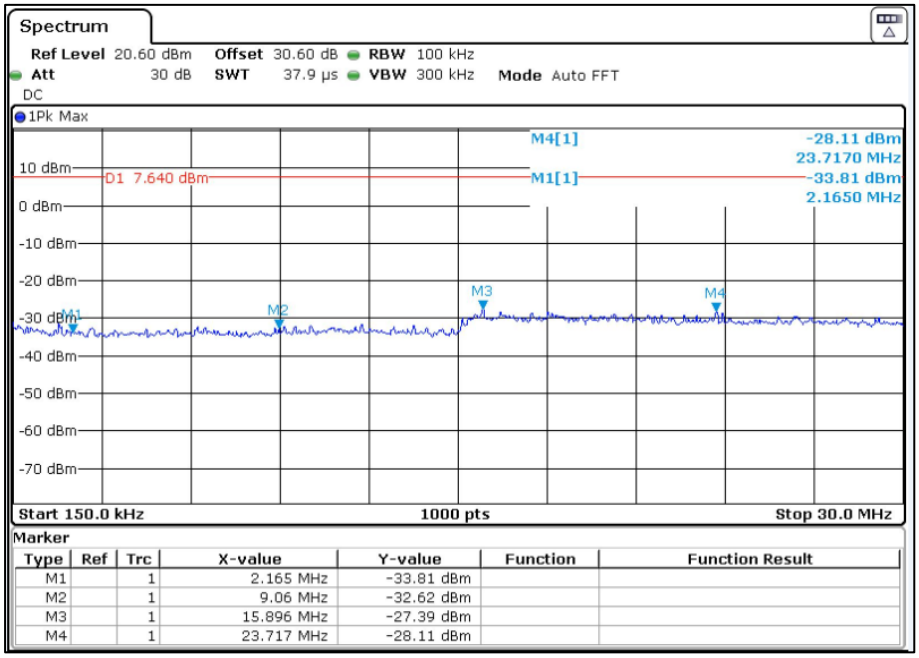


Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	1.631 GHz	-14.53 dBm
2	(1)	Freq	4.378 GHz	-14.55 dBm
3	(1)	Freq	6.793 GHz	-14.22 dBm
4	(1)	Freq	9.198 GHz	-15.21 dBm

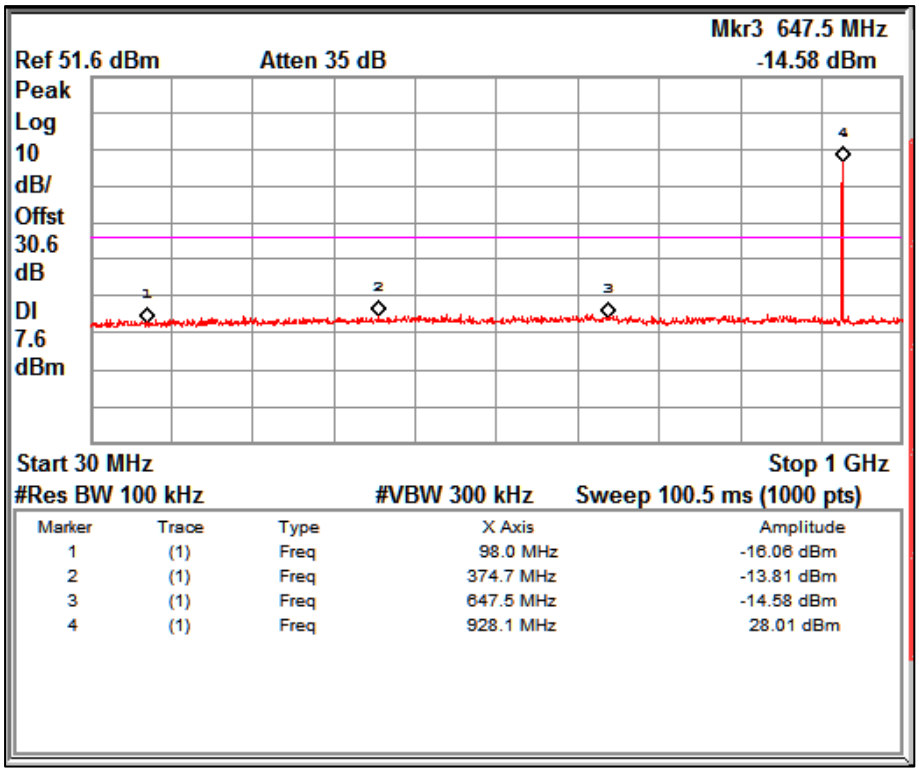
Channel Frequency 915MHz **Frequency Range 1GHz – 10GHz**



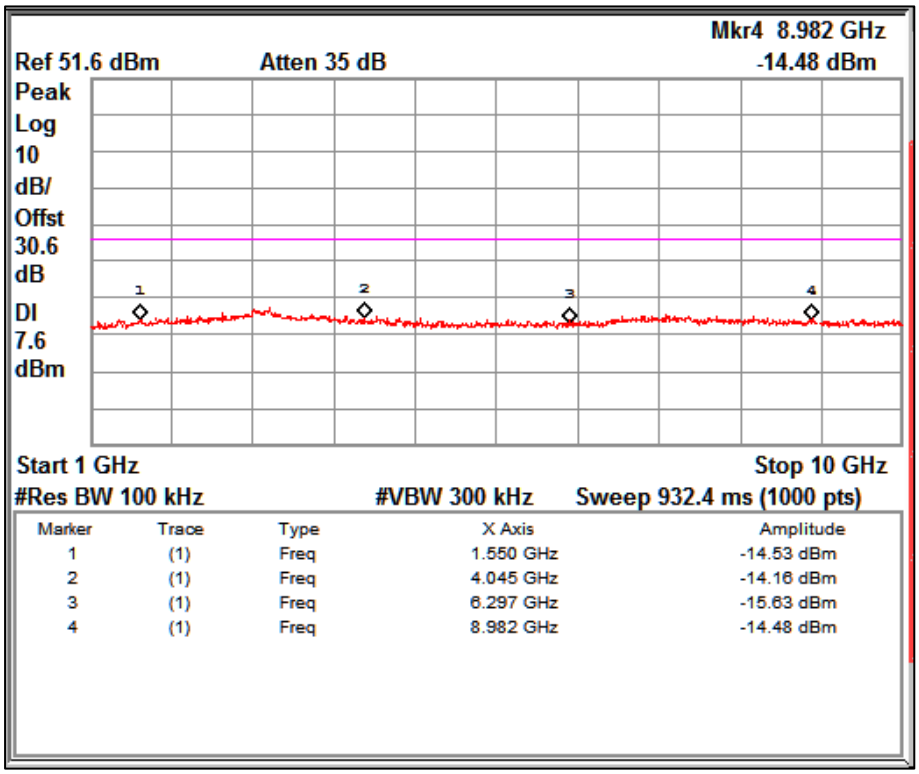
Channel Frequency 927.8MHz **Frequency Range 9KHz – 150KHz**



Channel Frequency 927.8MHz **Frequency Range 150KHz – 30MHz**



Channel Frequency 927.8MHz **Frequency Range 30MHz – 1GHz**



Channel Frequency 927.8MHz **Frequency Range 1GHz – 10GHz**

8.7 Spurious Radiated Emissions & Restricted Bands of Operation

Result ***Pass***

Test Specification	FCC part 15 Subpart C 15.247 (d) / (15.209 & 15.205)
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) = + 19.5 °C Voltage = 5VDC through AC-DC Adapter Relative humidity: 63%

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

Antenna -1: 2.46 dBi for more Please refer clause 3.2 Ratings and System Details of Equipment under Test

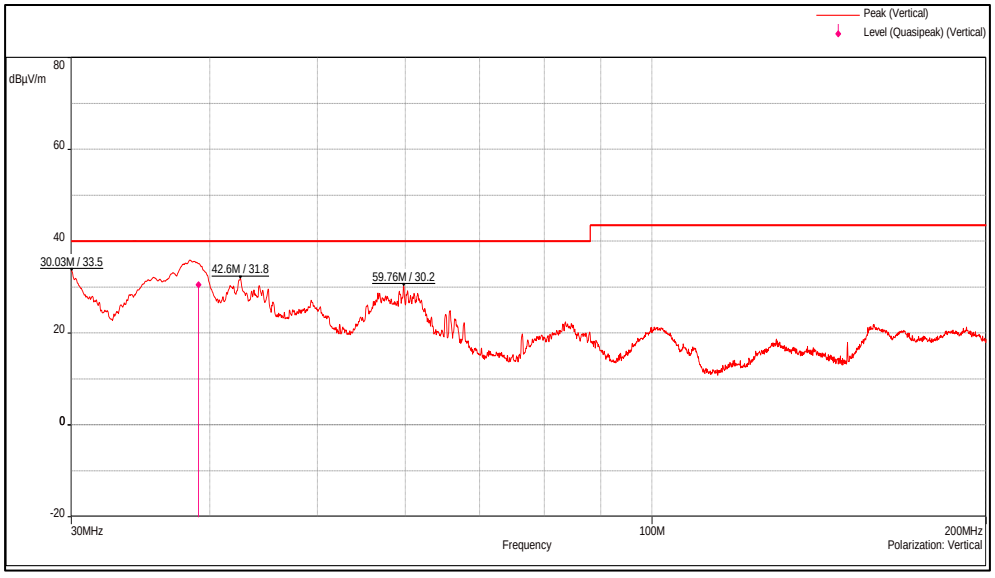
Test results for frequency range 9kHz – 30MHz

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

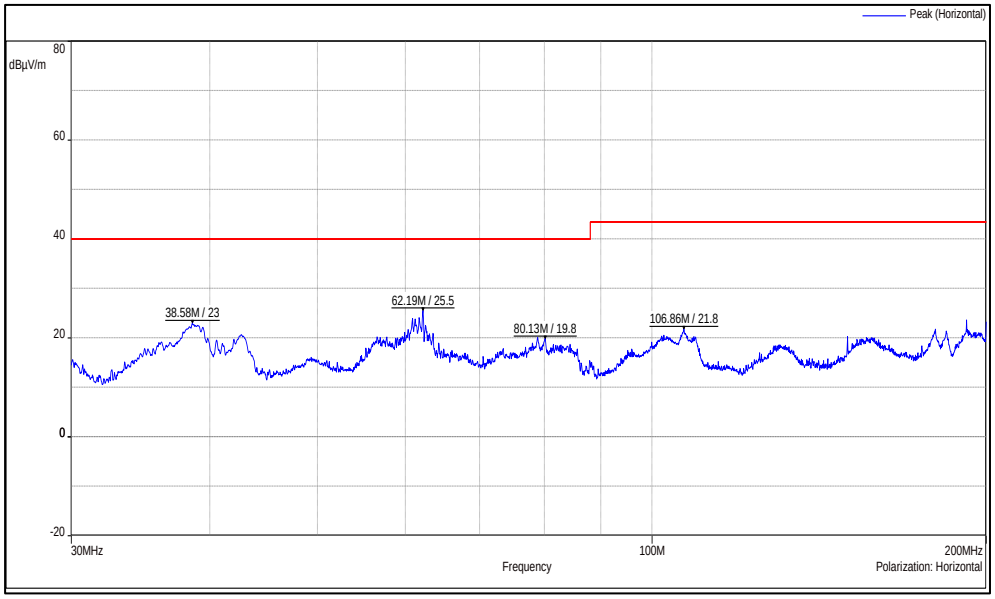
Table 7: Test results for frequency range 30MHz – 200MHz

Polarization	Measured Frequency (MHz)	Measured Spurious emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	30.03(Pk)	33.50	40.00	-6.5
	39.06(Qp)	30.50	40.00	-9.5
	42.60(Pk)	31.80	40.00	-8.2
	59.76(Pk)	30.20	40.00	-9.8
Horizontal	38.58(Pk)	23.00	40.00	-17.00
	62.19(Pk)	25.50	40.00	-14.50
	80.13(Pk)	19.80	40.00	-20.20
	106.86(Pk)	21.80	43.50	-21.70

Test Graphs:



Frequency range: 30MHz-200MHz **Polarization: Vertical**

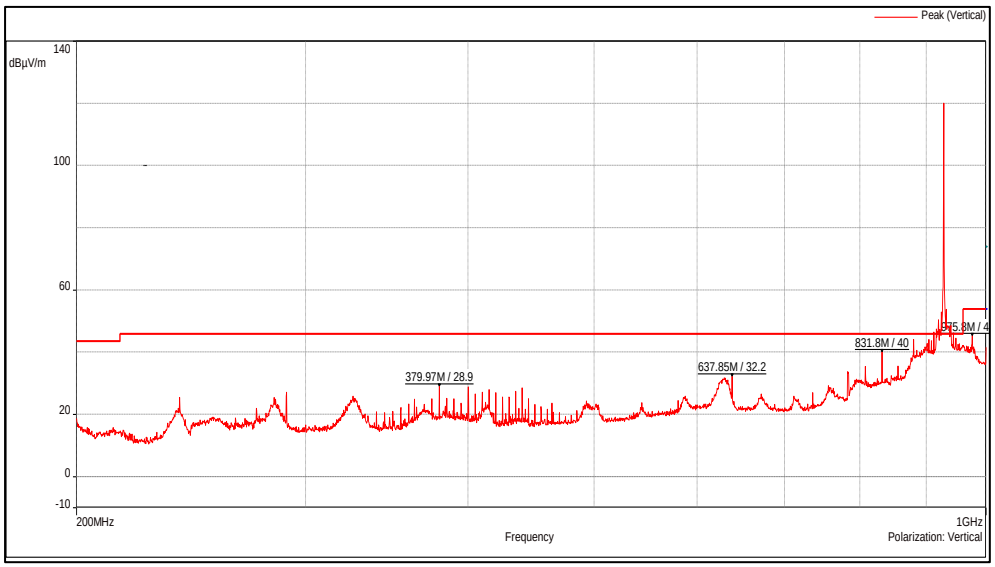


Frequency range: 30MHz-200MHz **Polarization: Horizontal**

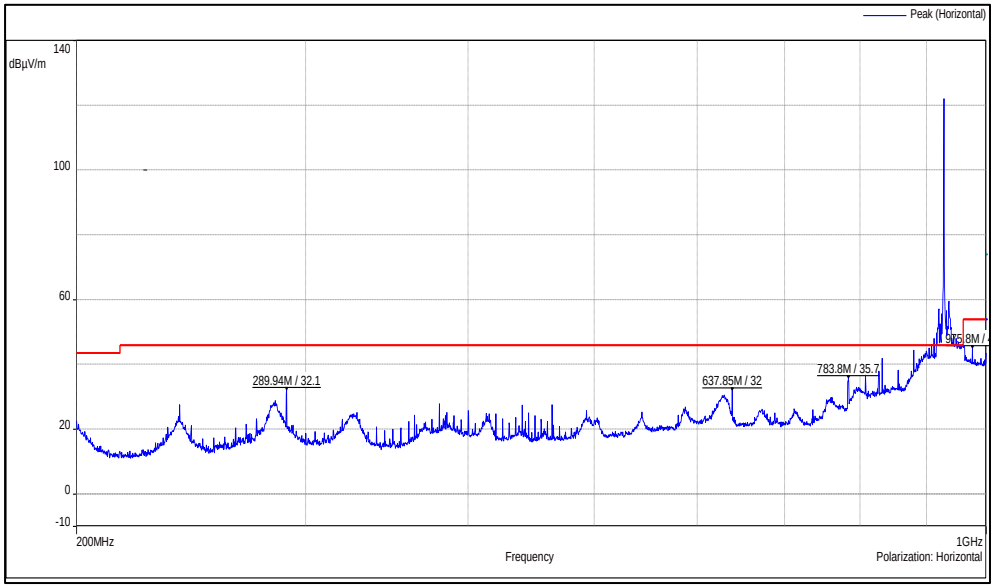
Table 8: Test results for frequency range 200MHz – 1GHz

Polarization	Measured Frequency (MHz)	Measured Spurious emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	379.97	28.90	43.50	-14.6
	637.85	32.20	43.50	-11.3
	831.806	30.7	46.00	-15.3
	879.8	40.87	46.00	-5.13
	903.776	41.09	46.00	-4.91
	947.792	40.65	46.00	-5.35
Horizontal	289.94	32.10	43.50	-11.4
	637.85	32.00	43.50	-11.5
	831.8	41.12	46.00	-4.88
	879.788	38.61	46.00	-7.39
	903.8	40.61	46.00	-5.39
	961.52	29.09	54.00	-24.91

Test Graphs:



Frequency range: 200MHz-1GHz **Polarization: Vertical**



Frequency range: 200MHz-1GHz **Polarization: Horizontal**

***Note:** Testing performed all the three channels for reporting purpose mentioned only single channel

Table 9: Test results for frequency range 1GHz – 10GHz

Channel frequency (MHz)	Antenna Polarization	Measured Frequency (MHz)	Measured Spurious emission (dBµV/m)	Duty Cycle Correction Factor (dB)	Final Spurious emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
902.2	Vertical	1804.50(Pk)	67.57	-	67.57	74.00	-6.43
		1804.50(Av)	67.37	23.34	44.03	54.00	-9.97
		2706.6(Pk)	57.49	-	57.49	74.00	-16.51
		2706.6(Av)	56.74	23.34	33.40	54.00	-20.6
		3608.8(Pk)	48.33	-	48.33	74.00	-25.67
		3608.8(Av)	45.77	23.34	22.43	54.00	-31.57
		4511.00(Pk)	46.96	-	46.96	74.00	-27.04
		4511.00(Av)	42.81	23.34	19.47	54.00	-34.53
	Horizontal	1804.50(Pk)	72.23	-	72.23	74.00	-1.77
		1804.50(Av)	72.09	23.34	48.75	54.00	-5.25
		2706.6(Pk)	63.42	-	63.42	74.00	-10.58
		2706.6(Av)	63.01	23.34	39.67	54.00	-14.33
		3608.8(Pk)	48.34	-	48.34	74.00	-25.66
		3608.8(Av)	45.64	23.34	22.30	54.00	-31.7
		4511.00(Pk)	47.35	-	47.35	74.00	-26.65
		4511.00(Av)	42.87	23.34	19.53	54.00	-34.47
915	Vertical	1830.00(Pk)	57.96	-	57.96	74.00	-16.04
		1830.00(Av)	57.48	23.34	34.14	54.00	-19.86
		2745.00(Pk)	61.87	-	61.87	74.00	-12.13
		2745.00(Av)	61.50	23.34	38.16	54.00	-15.84
		3660.00(Pk)	48.28	-	48.28	74.00	-25.72
		3660.00(Av)	45.53	23.34	22.19	54.00	-31.81
		4575.00(Pk)	49.63	-	49.63	74.00	-24.37
		4575.00(Av)	46.86	23.34	23.52	54.00	-30.48
	Horizontal	1830.00(Pk)	61.30	-	61.30	74.00	-12.7
		1830.00(Av)	61.02	23.34	37.68	54.00	-16.32
		2745.00(Pk)	62.74	-	62.74	74.00	-11.26
		2745.00(Av)	62.35	23.34	39.01	54.00	-14.99
		3660.00(Pk)	52.36	-	52.36	74.00	-21.64
		3660.00(Av)	50.72	23.34	27.38	54.00	-26.62
		4575.00(Pk)	50.21	-	50.21	74.00	-23.79
		4575.00(Av)	47.73	23.34	24.39	54.00	-29.61

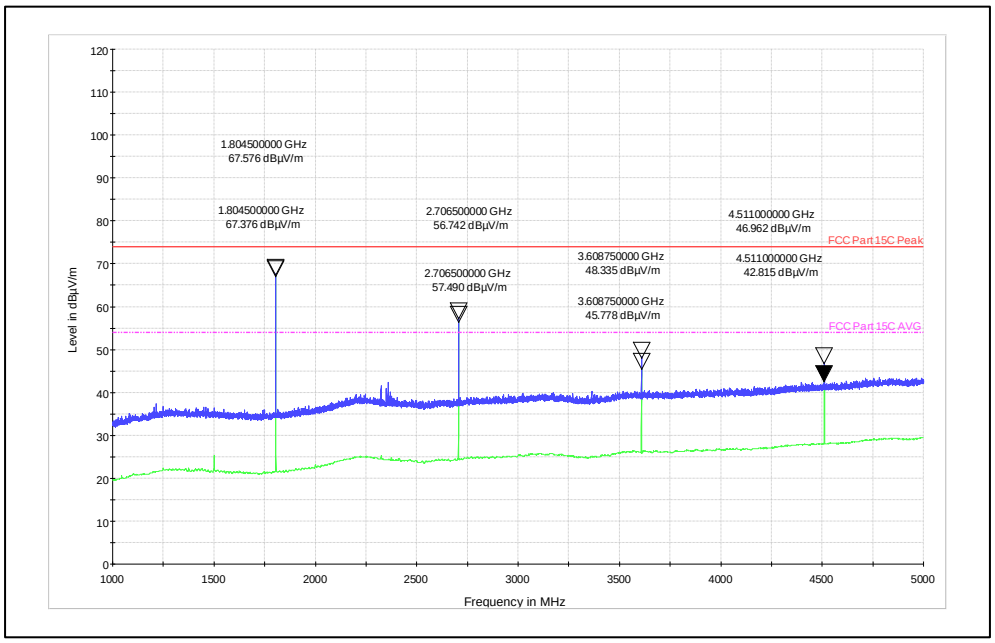
Channel frequency (MHz)	Antenna Polarization	Measured Frequency (MHz)	Measured Spurious emission (dBµV/m)	Duty Cycle Correction Factor (dB)	Final Spurious emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
927.8	Vertical	1855.50(Pk)	61.50	-	61.50	74.00	-12.5
		1855.50(Av)	61.16	23.34	37.82	54.00	-16.18
		2783.50(Pk)	59.27	-	59.27	74.00	-14.73
		2783.50(Av)	58.64	23.34	35.30	54.00	-18.7
		3711.25(Pk)	45.60	-	45.60	74.00	-28.4
		3711.25(Av)	42.16	23.34	18.82	54.00	-35.18
		4639.00(Pk)	47.07	-	47.07	74.00	-26.93
		4639.00(Av)	42.55	23.34	19.21	54.00	-34.79
	Horizontal	1855.50(Pk)	65.38	-	65.38	74.00	-8.62
		1855.50(Av)	65.12	23.34	41.78	54.00	-12.22
		2783.50(Pk)	60.44	-	60.44	74.00	-13.56
		2783.50(Av)	59.89	23.34	36.55	54.00	-17.45
		3711.25(Pk)	47.59	-	47.59	74.00	-26.41
		3711.25(Av)	45.05	23.34	21.71	54.00	-32.29
		4639.00(Pk)	45.50	-	45.50	74.00	-28.5
		4639.00(Av)	40.27	23.34	40.27	54.00	-13.73

Note: Duty Cycle Correction Factor: 20*log (1/x)

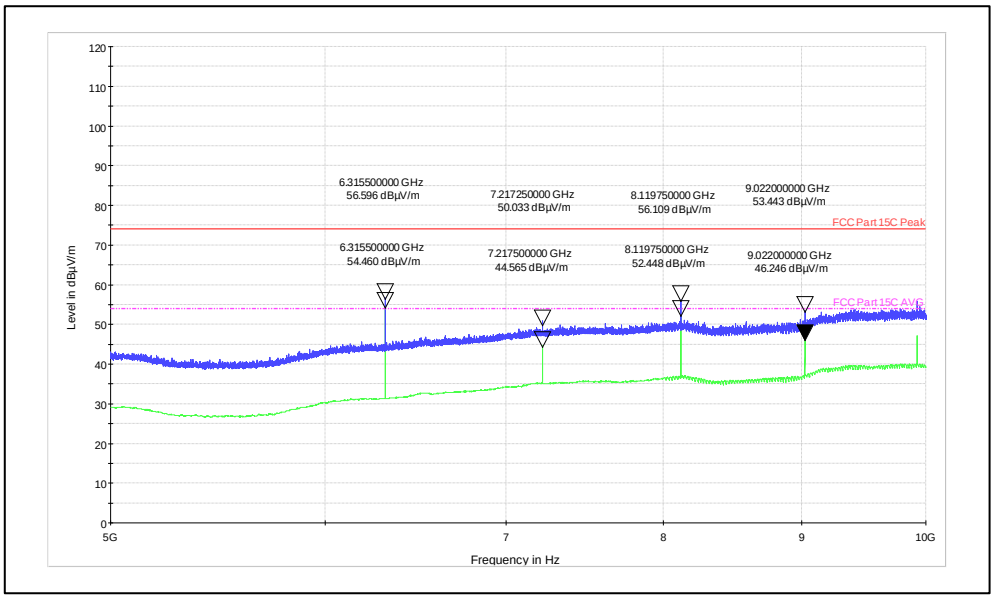
Where X→ Duty Cycle

Test Graphs:

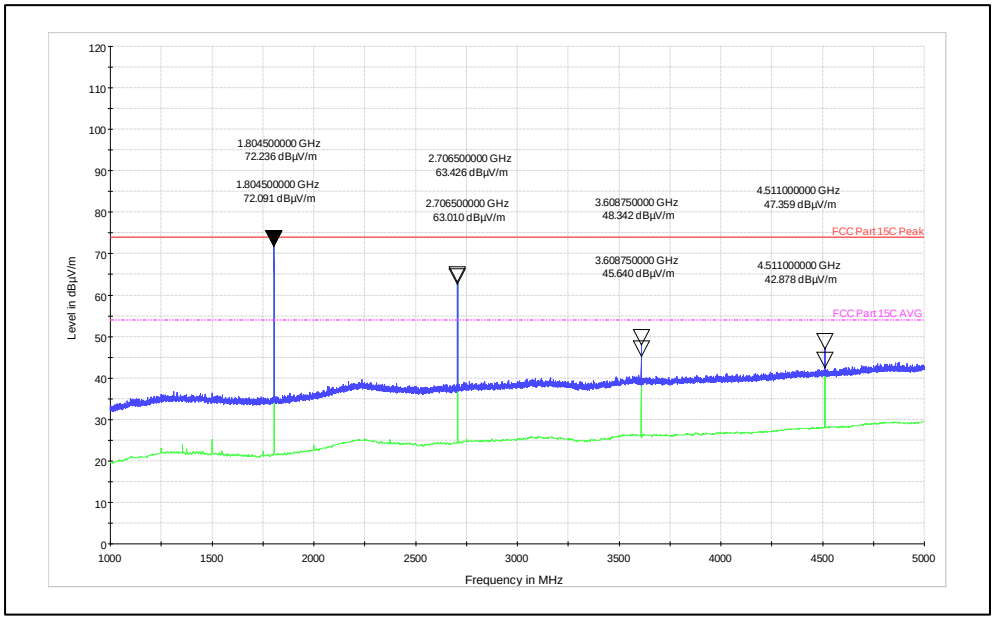
Channel Frequency: 902.2MHz



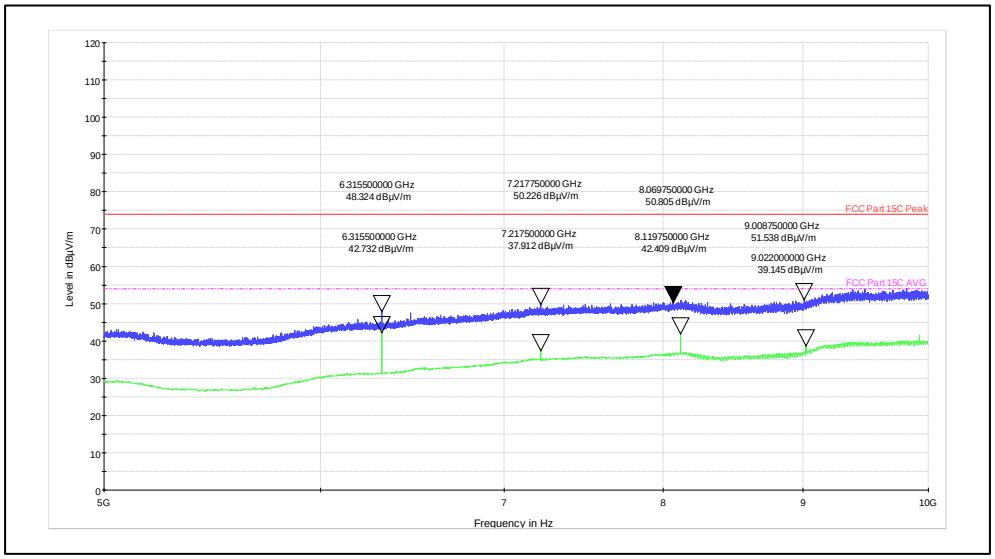
Frequency range: 1GHz to 5GHz **Polarization: Vertical**



Frequency range: 5GHz to 10GHz **Polarization:Vertical**

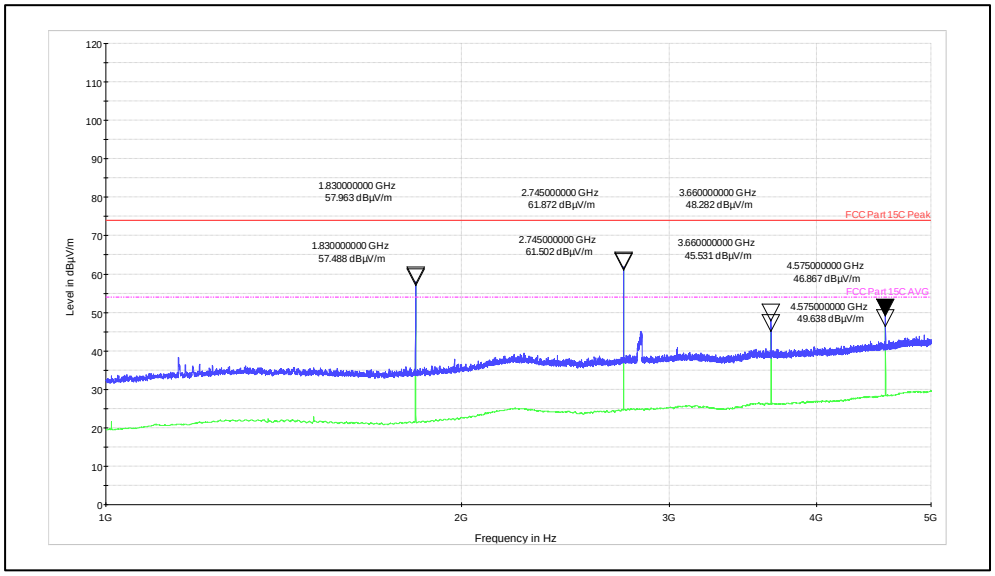


Frequency range: 1GHz to 5GHz **Polarization: Horizontal**

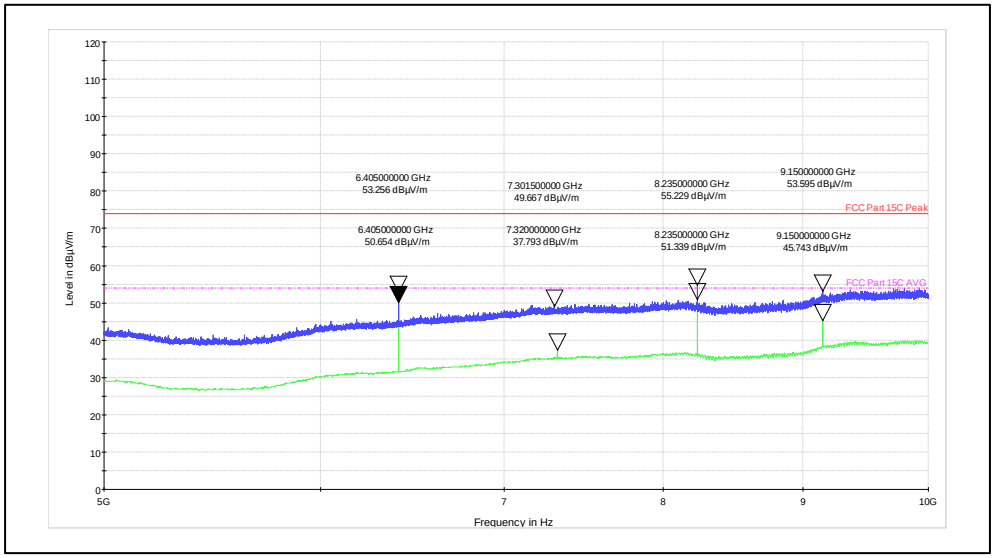


Frequency range: 5GHz to 10GHz **Polarization: Horizontal**

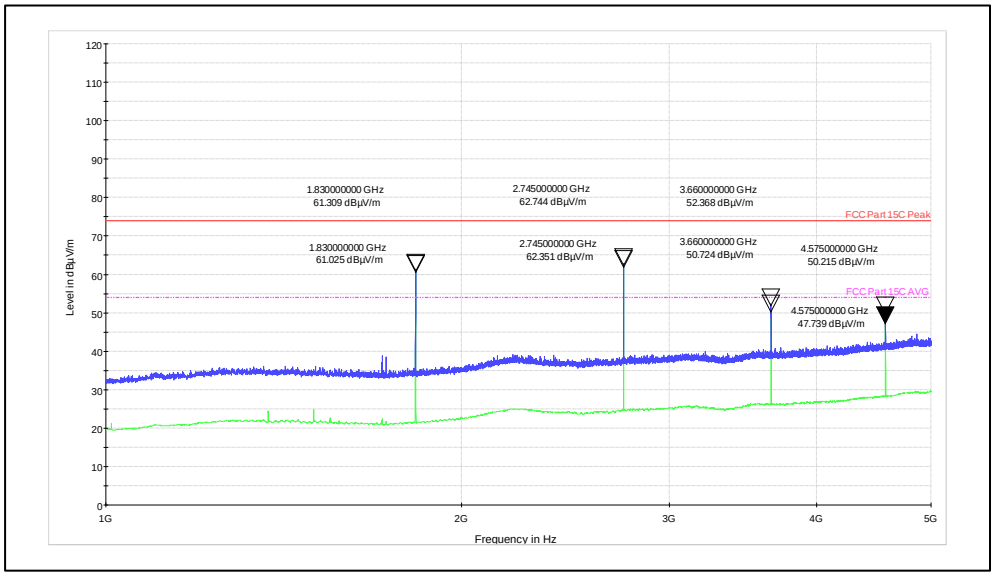
Channel Frequency: 915MHz



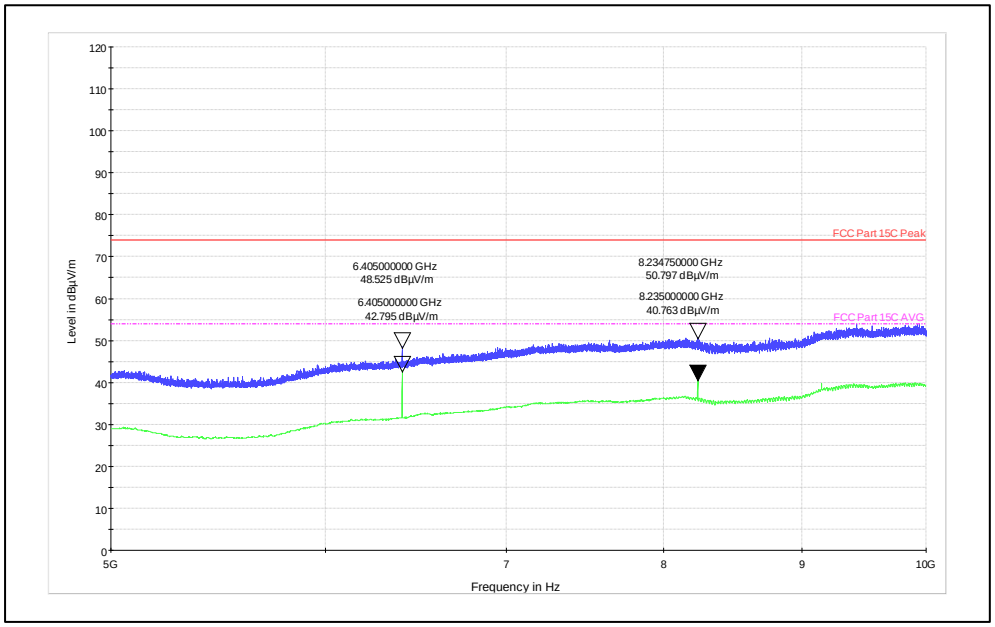
Frequency range: 1GHz to 5GHz **Polarization: Vertical**



Frequency range: 5GHz to 10GHz **Polarization: Vertical**

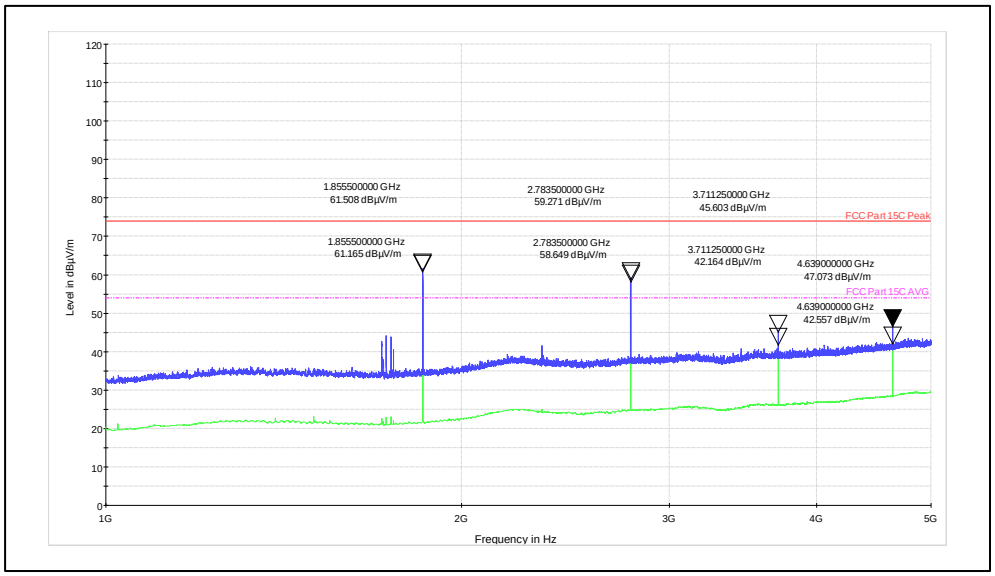


Frequency range: 1GHz to 5GHz **Polarization: Horizontal**

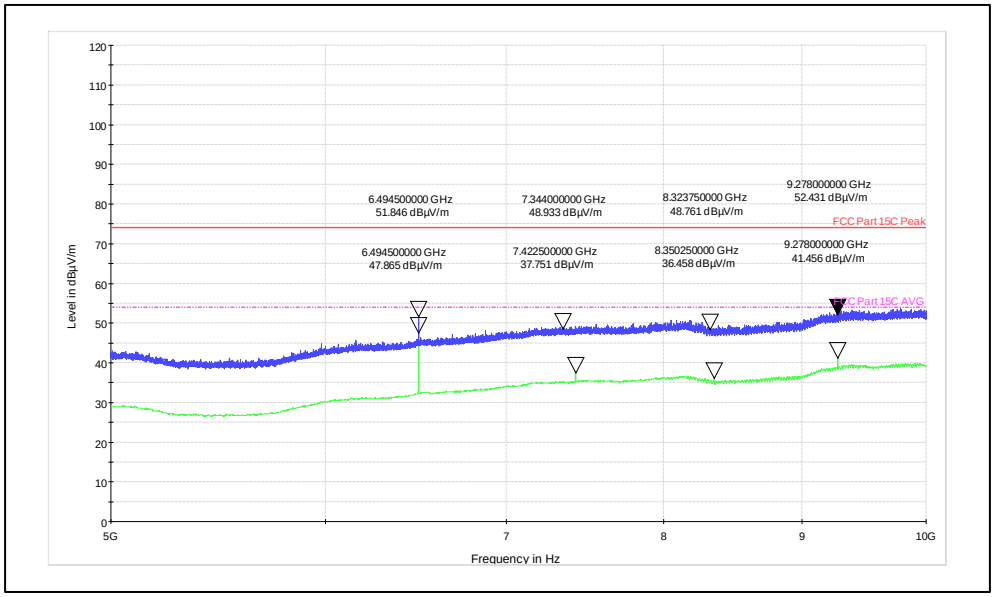


Frequency range: 5GHz to 10GHz **Polarization: Horizontal**

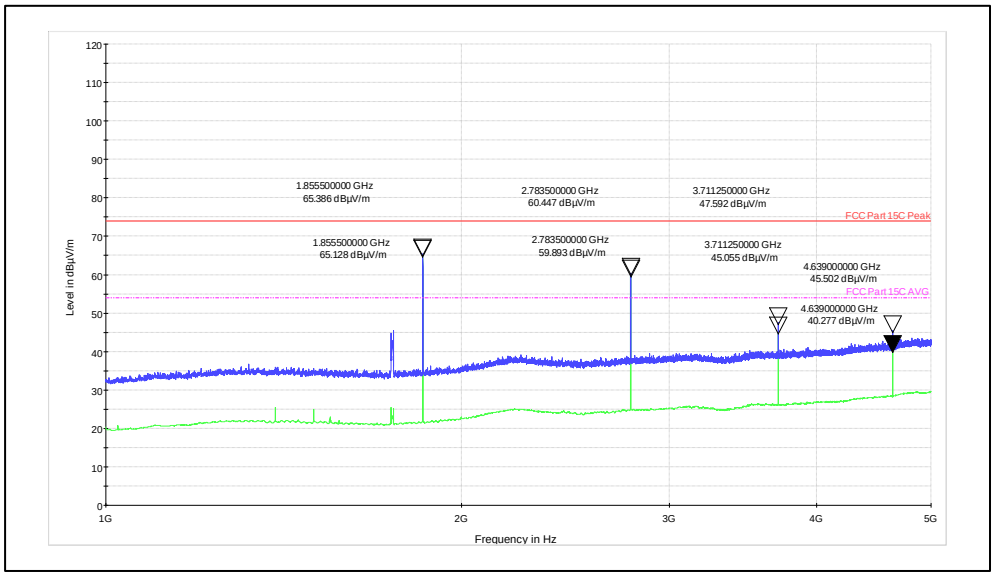
Channel Frequency: 927.8MHz



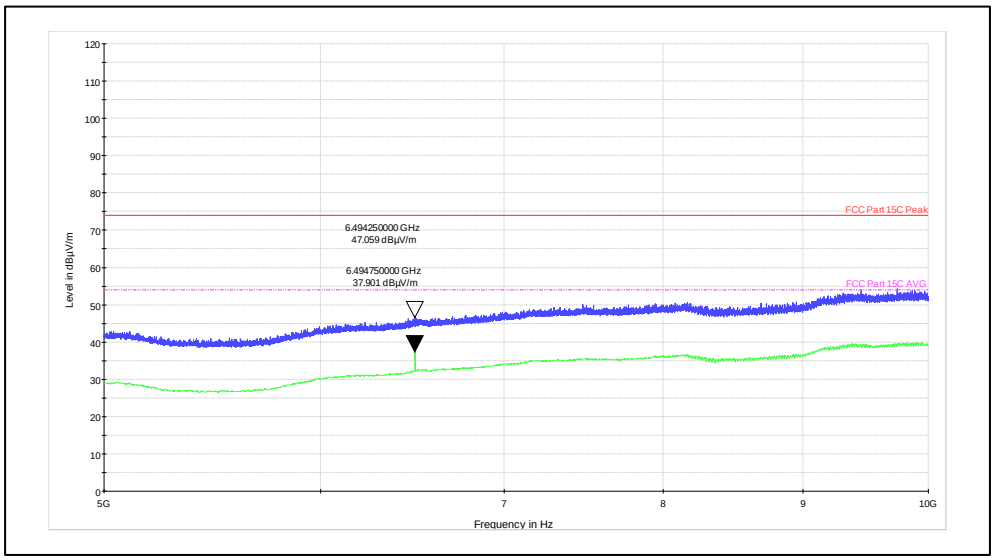
Frequency range: 1GHz to 5GHz **Polarization: Vertical**



Frequency range: 5GHz to 10GHz **Polarization: Vertical**



Frequency range: 1GHz to 5GHz **Polarization: Horizontal**



Frequency range: 5GHz to 10GHz **Polarization: Horizontal**

Antenna-2: 3.20dBi for more please refer clause 3.2 Ratings and System Details of Equipment under Test

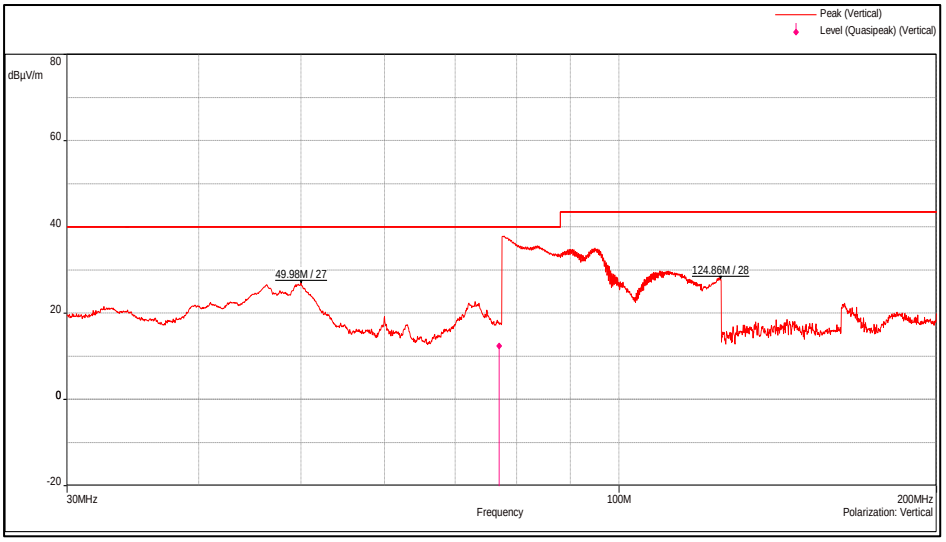
Test results for frequency range 9kHz – 30MHz

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

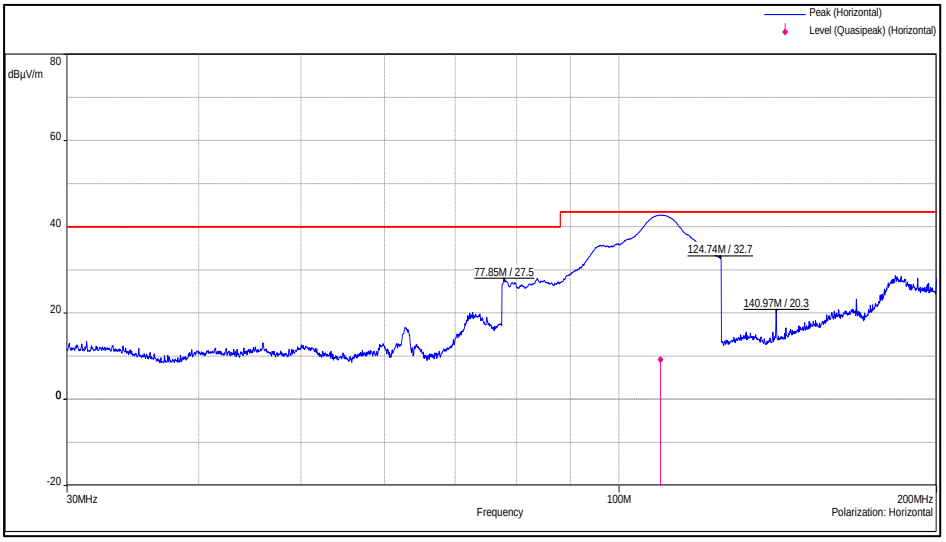
Table 10: Test results for frequency range 30MHz – 200MHz

Polarization	Measured Frequency (MHz)	Measured Spurious emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	49.98	27.00	40.00	-13.00
	76.99	12.36	40.00	-27.64
	124.86	28.00	43.50	-15.50
Horizontal	77.85	27.50	40.00	-12.50
	109.51	9.23	43.50	-34.27
	124.74	32.70	43.50	-10.80
	140.97	20.30	43.50	-23.20

Test Plots:



Frequency range: 30MHz-200MHz **Polarization: Vertical**

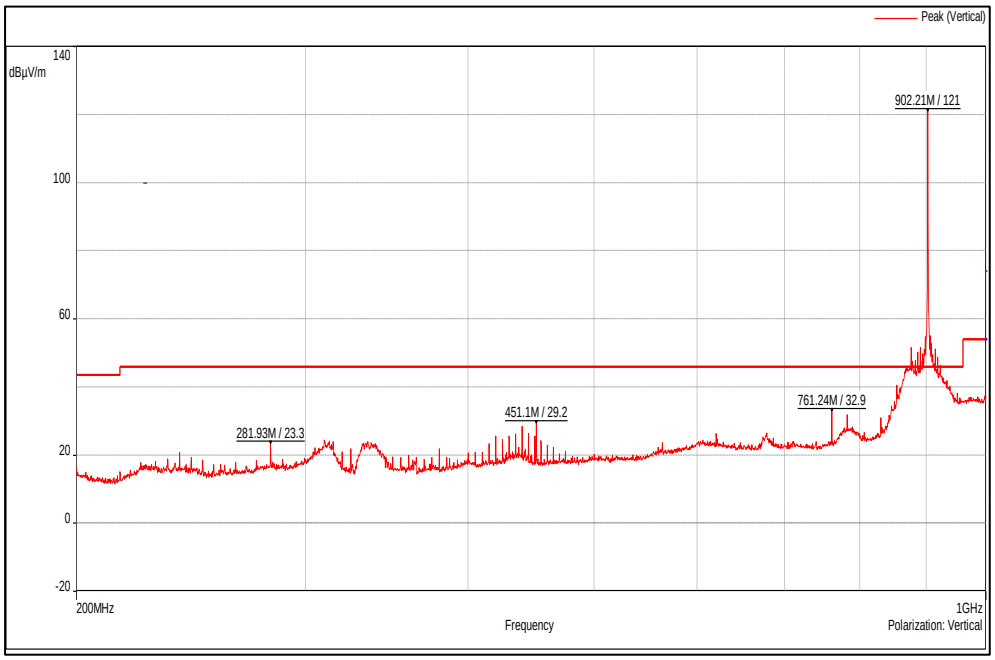


Frequency range: 30MHz-200MHz **Polarization: Horizontal**

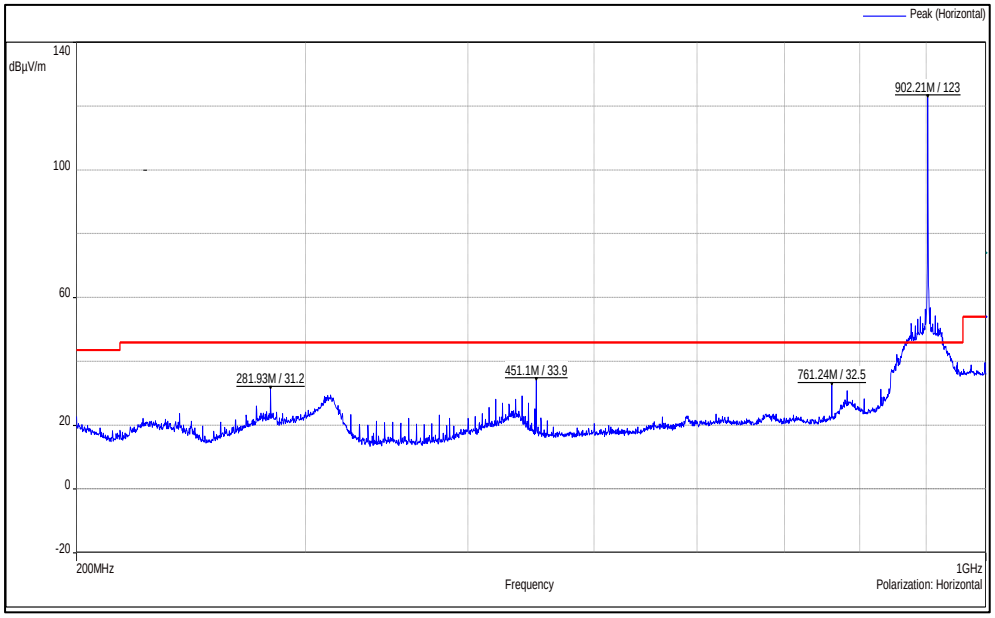
Table 11: Test results for frequency range 200MHz – 1GHz

Polarization	Measured Frequency (MHz)	Measured Spurious emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	281.93	23.30	46.00	-22.7
	451.10	29.20	46.00	-16.8
	761.24	32.90	46.00	-13.1
Horizontal	281.93	31.20	46.00	-14.8
	451.10	33.90	46.00	-12.1
	761.24	32.50	46.00	-13.5

Test Plots:



Frequency range: 200MHz-1GHz **Polarization: Vertical**



Frequency range: 200MHz-1GHz **Polarization: Horizontal**

Table 12: Test results for frequency range 1GHz – 10GHz

Channel frequency (MHz)	Antenna Polarization	Measured Frequency (MHz)	Measured Spurious emission (dBµV/m)	Duty Cycle Correction Factor (dB)	Final Spurious emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
902.2	Vertical	1804.50(Pk)	51.45	-	51.45	74.00	-22.55
		1804.50(Av)	50.29	23.34	26.95	54.00	-27.05
		2706.6(Pk)	56.31	-	56.31	74.00	-17.69
		2706.6(Av)	55.22	23.34	31.88	54.00	-22.12
		3608.8(Pk)	52.57	-	52.57	74.00	-21.43
		3608.8(Av)	51.14	23.34	27.80	54.00	-26.2
		4511.00(Pk)	45.86	-	45.86	74.00	-28.14
		4511.00(Av)	42.17	23.34	18.83	54.00	-35.17
	Horizontal	1804.50(Pk)	62.36	-	62.36	74.00	-11.64
		1804.50(Av)	62.02	23.34	38.68	54.00	-15.32
		2706.6(Pk)	61.63	-	61.63	74.00	-12.37
		2706.6(Av)	61.13	23.34	37.79	54.00	-16.21
		3608.8(Pk)	55.67	-	55.67	74.00	-18.33
		3608.8(Av)	54.57	23.34	31.23	54.00	-22.77
		4511.00(Pk)	47.26	-	47.26	74.00	-26.74
		4511.00(Av)	43.01	23.34	19.67	54.00	-34.33
915	Vertical	1830.00(Pk)	50.88	-	50.88	74.00	-23.12
		1830.00(Av)	49.70	23.34	26.36	54.00	-27.64
		2745.00(Pk)	63.15	-	63.15	74.00	-10.85
		2745.00(Av)	62.78	23.34	39.44	54.00	-14.56
		3660.00(Pk)	65.60	-	65.60	74.00	-8.4
		3660.00(Av)	65.30	23.34	41.96	54.00	-12.04
		4575.00(Pk)	52.39	-	52.39	74.00	-21.61
		4575.00(Av)	50.17	23.34	26.83	54.00	-27.17
	Horizontal	1830.00(Pk)	56.26	-	56.26	74.00	-17.74
		1830.00(Av)	55.61	23.34	32.27	54.00	-21.73
		2745.00(Pk)	63.58	-	63.58	74.00	-10.42
		2745.00(Av)	63.18	23.34	39.84	54.00	-14.16
		3660.00(Pk)	69.10	-	69.10	74.00	-4.9
		3660.00(Av)	68.88	23.34	45.54	54.00	-8.46
		4575.00(Pk)	51.48	-	51.48	74.00	-22.52
		4575.00(Av)	49.38	23.34	26.04	54.00	-27.96

Channel frequency (MHz)	Antenna Polarization	Measured Frequency (MHz)	Measured Spurious emission (dBµV/m)	Duty Cycle Correction Factor (dB)	Final Spurious emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
927.8	Vertical	1855.50(Pk)	55.78	-	55.58	74.00	-18.42
		1855.50(Av)	55.13	23.34	31.79	54.00	-22.21
		2783.50(Pk)	55.75	-	55.75	74.00	-18.25
		2783.50(Av)	54.90	23.34	31.56	54.00	-22.44
		3711.25(Pk)	50.74	-	50.74	74.00	-23.26
		3711.25(Av)	48.96	23.34	26.62	54.00	-27.38
		4639.00(Pk)	48.23	-	48.23	74.00	-25.77
		4639.00(Av)	44.65	23.34	21.31	54.00	-32.69
	Horizontal	1855.50(Pk)	65.35	-	65.35	74.00	-8.65
		1855.50(Av)	65.09	23.34	41.75	54.00	-12.25
		2783.50(Pk)	63.56	-	63.56	74.00	-10.44
		2783.50(Av)	63.09	23.34	39.75	54.00	-14.25
		3711.25(Pk)	52.10	-	52.10	74.00	-21.9
		3711.25(Av)	50.48	23.34	27.14	54.00	-26.86
		4639.00(Pk)	46.04	-	46.04	74.00	-27.96
		4639.00(Av)	40.45	23.34	17.11	54.00	-36.89

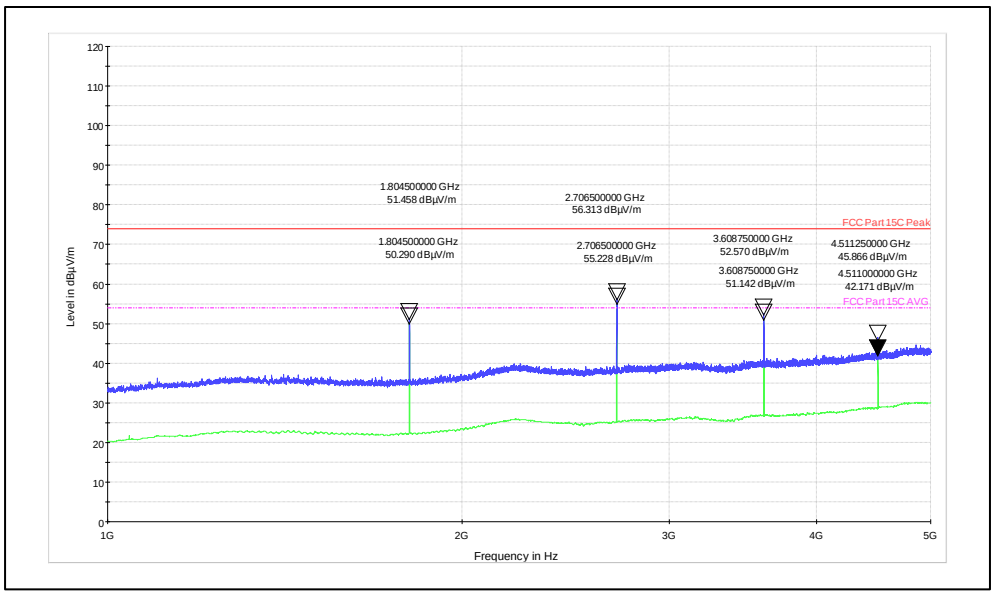
Note:

Duty Cycle Correction Factor: 20*log (1/x)

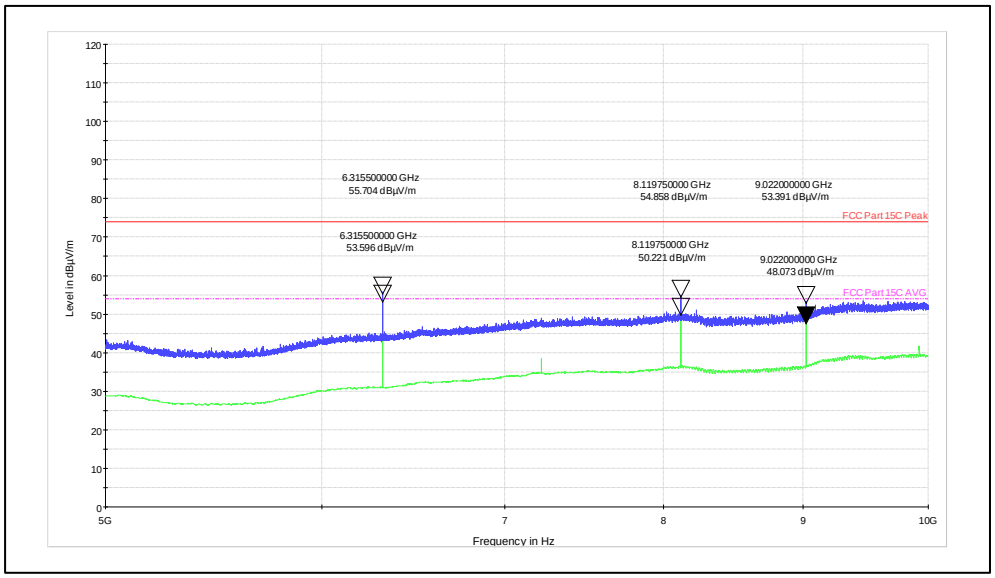
Where X → Duty Cycle

Test Plots:

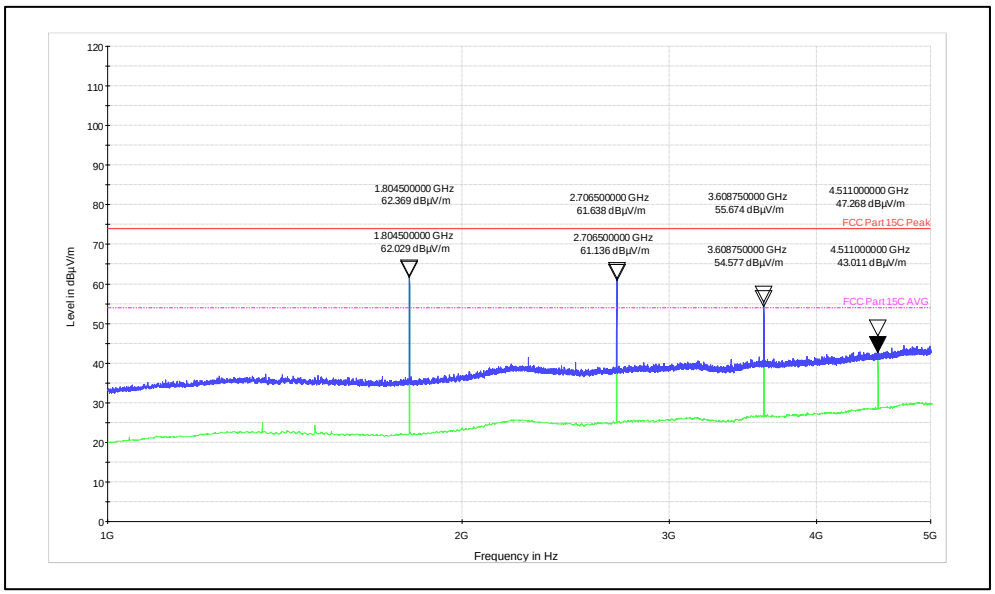
Channel Frequency: 902.2MHz



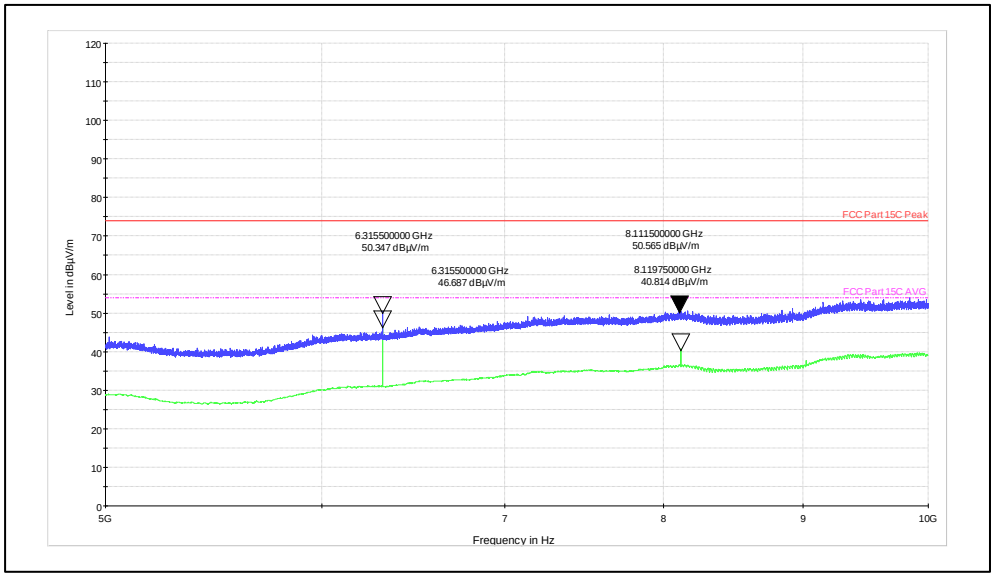
Frequency range: 1GHz to 5GHz **Polarization: Vertical**



Frequency range: 5GHz to 10GHz **Polarization: Vertical**

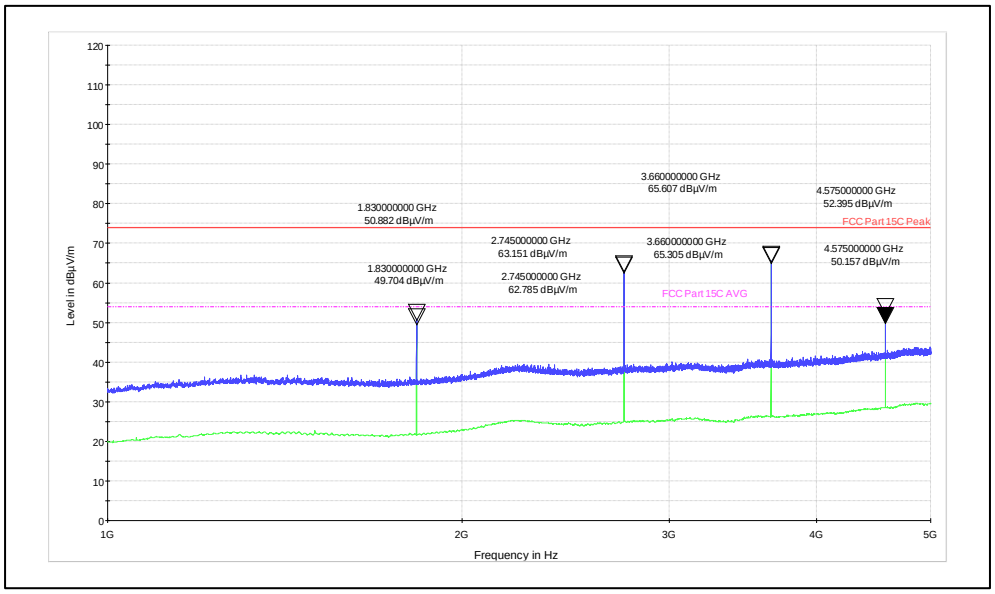


Frequency range: 1GHz to 5GHz **Polarization: Horizontal**

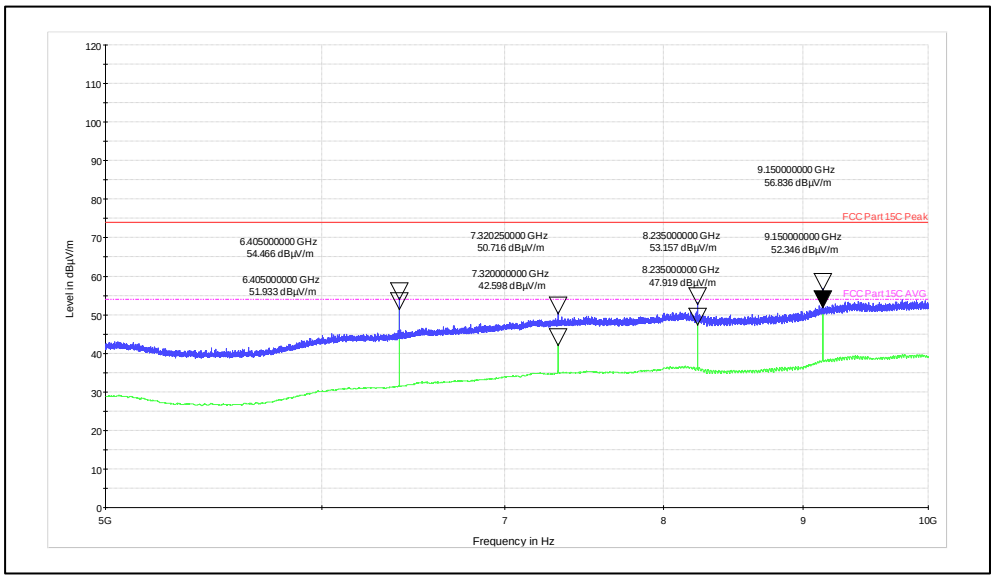


Frequency range: 5GHz to 10GHz **Polarization: Horizontal**

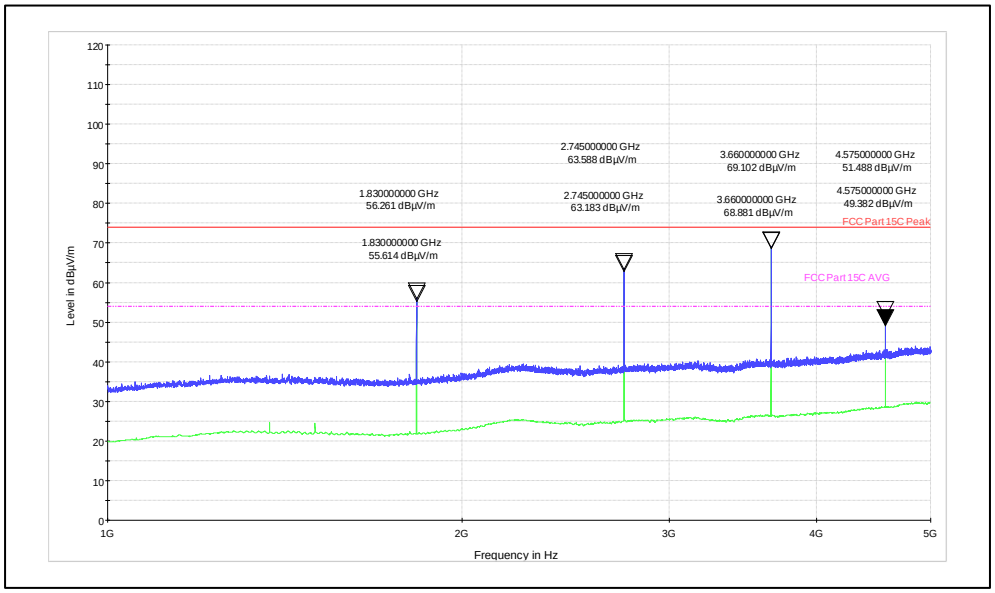
Channel Frequency: 915MHz



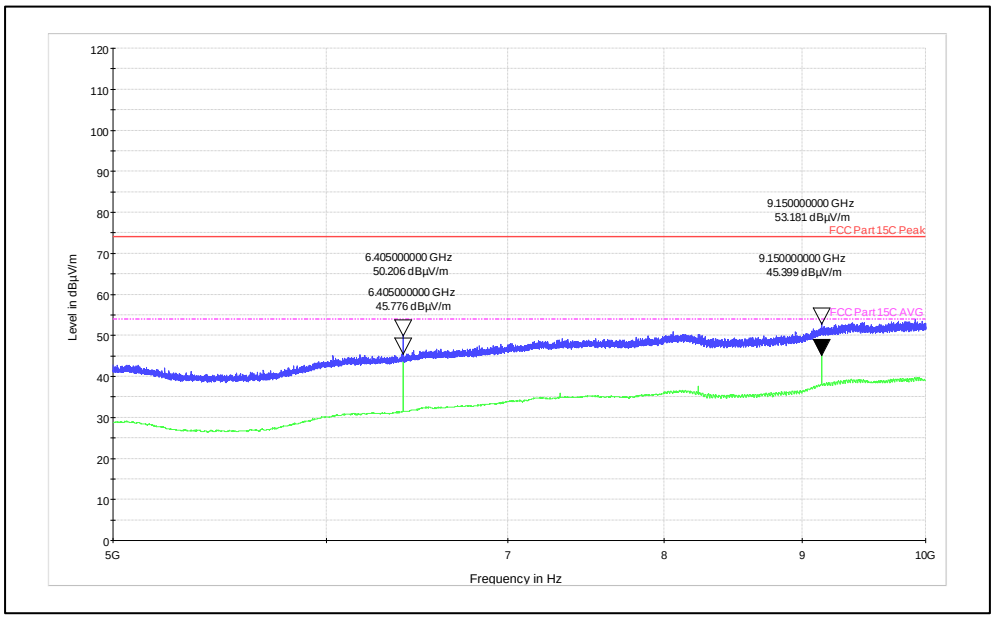
Frequency range: 1GHz to 5GHz **Polarization: Vertical**



Frequency range: 5GHz to 10GHz **Polarization: Vertical**

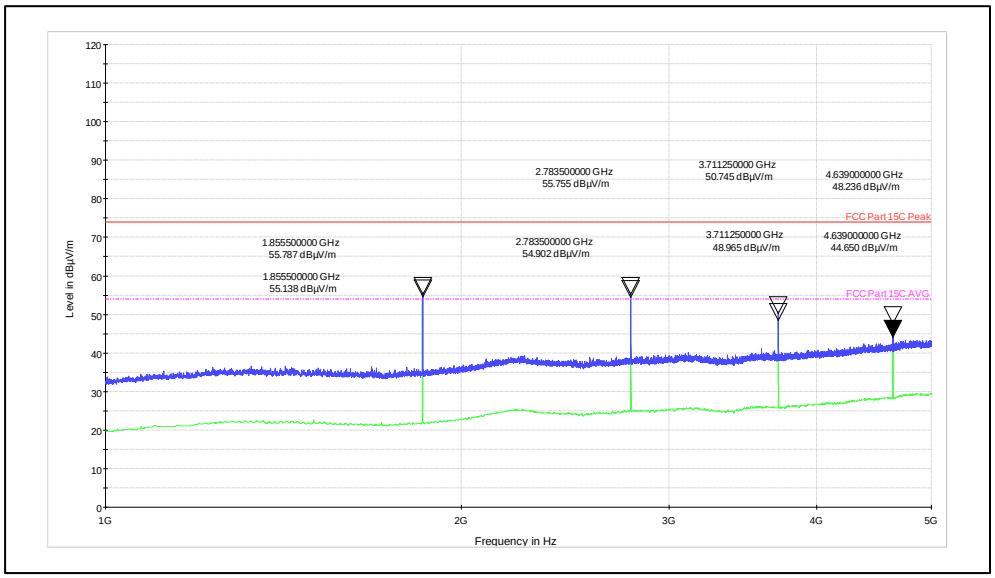


Frequency range: 1GHz to 5GHz **Polarization: Horizontal**

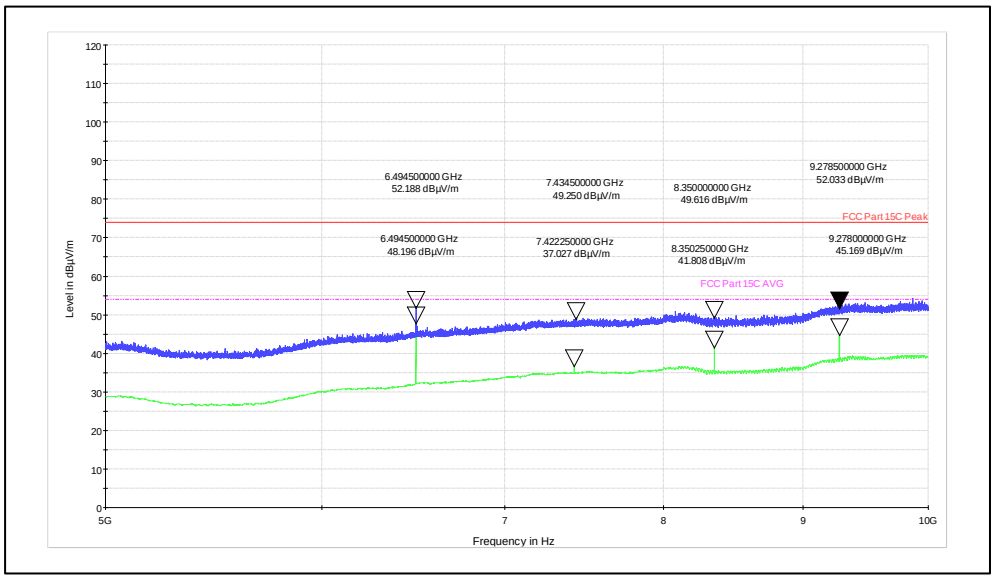


Frequency range: 5GHz to 10GHz **Polarization: Vertical**

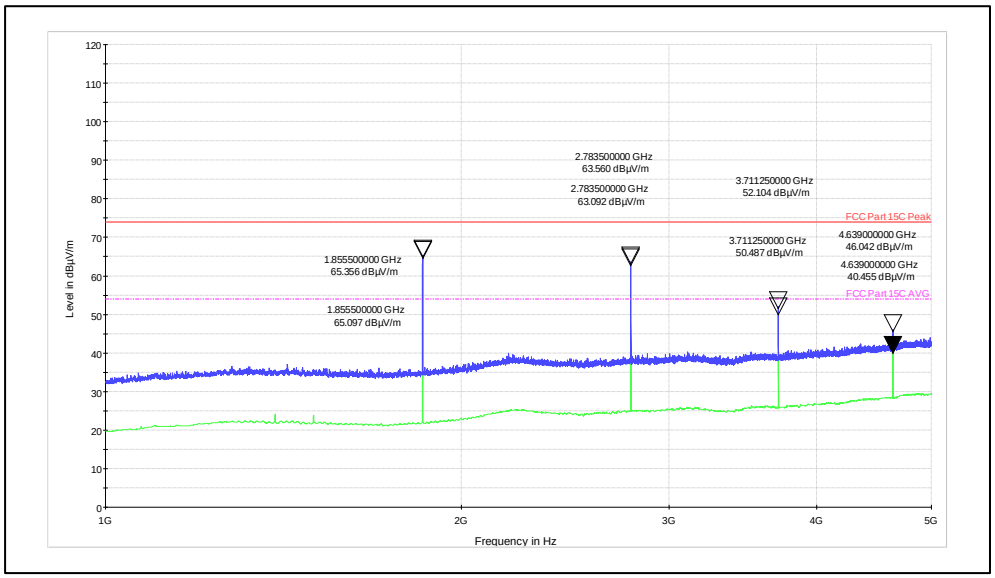
Channel Frequency: 927.8MHz



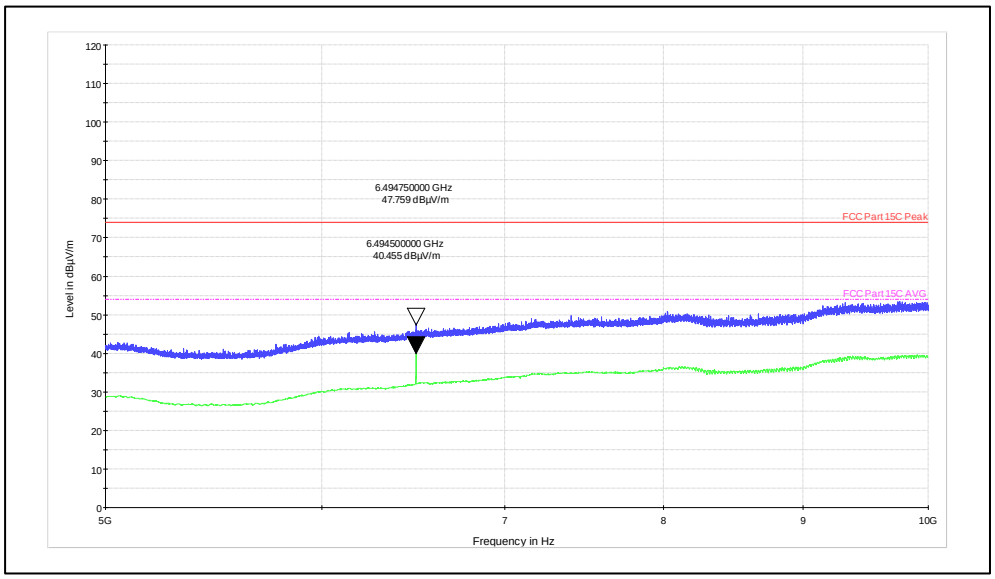
Frequency range: 1GHz to 5GHz **Polarization: Vertical**



Frequency range: 5GHz to 10GHz **Polarization: Vertical**



Frequency range: 1GHz to 5GHz **Polarization: Horizontal**



Frequency range: 5GHz to 10GHz **Polarization: Horizontal**

8.8 Conducted spurious emission Test on AC Power lines

Result ***Pass***

Test Specification	:	FCC Part 15 Section 15.207
Test Method	:	ANSI C 63.10-2013
Testing Location	:	Screened room
Measurement Bandwidth	:	9kHz
Frequency Range	:	150kHz – 30MHz
Supply Voltage	:	110VAC,60Hz
Test Method	:	Refer TEST METHODOLOGY

Table 13: Limits for Conducted AC powerline emission

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

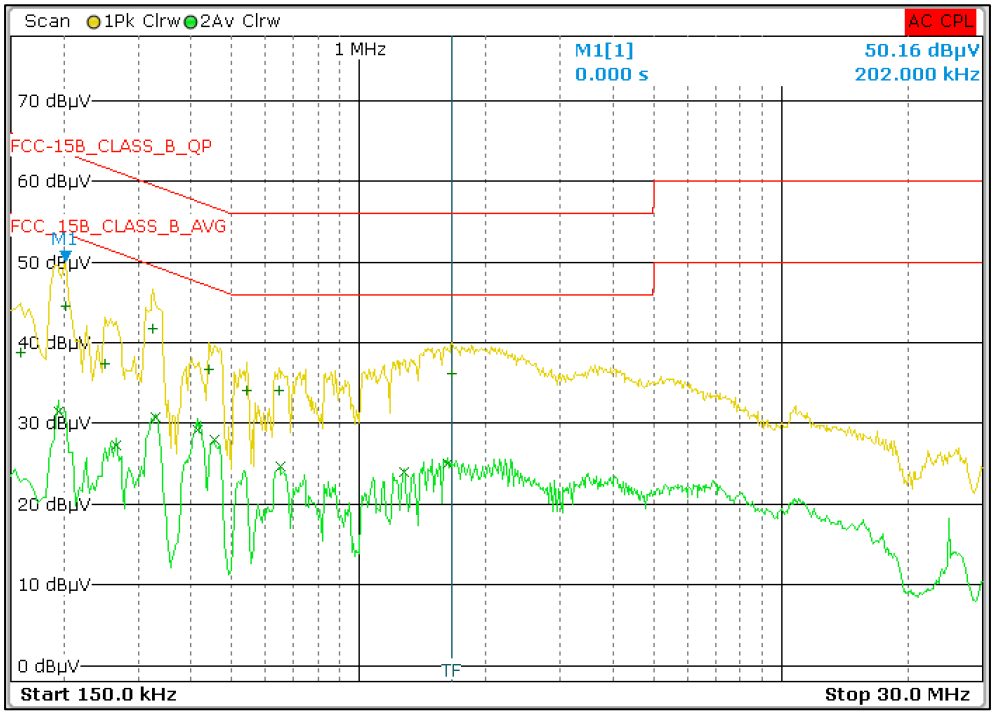
* Decreases with the logarithm of the frequency

Test Conditions:

Temperature (Norm) = +24 °C Voltage =110VAC,60Hz through AC/DC Adapter Relative humidity: 64%

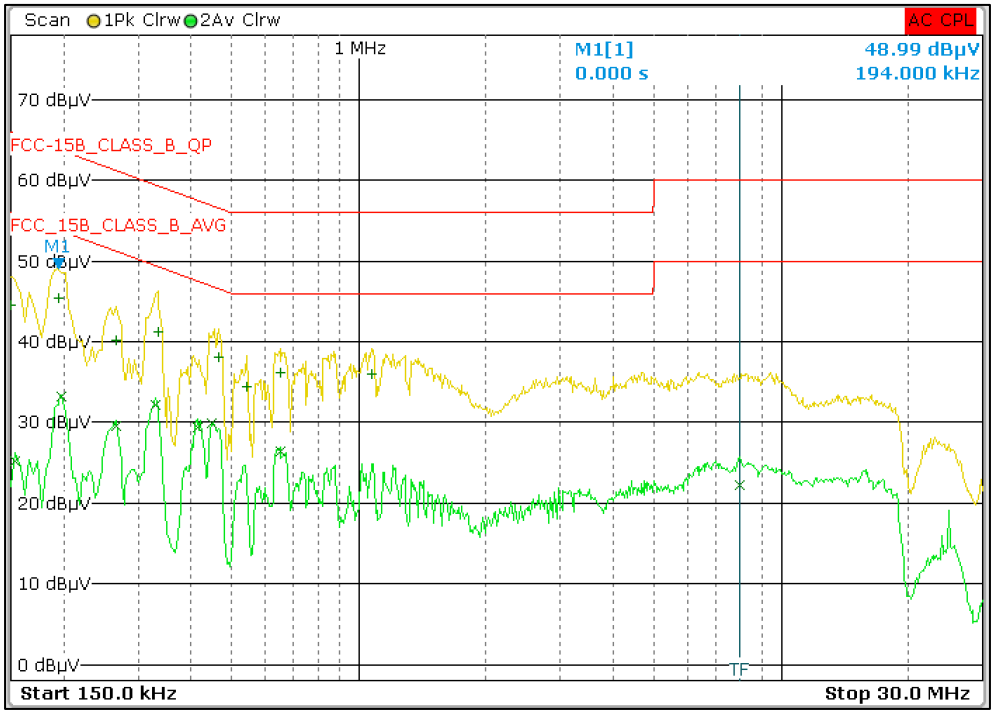
Test Results:

Operating Condition: Line-110VAC 60Hz



Trace	Frequency	Level (dBµV)	Phase	Detector	Delta Limit/dB
1	326.000000000 kHz	41.82		Quasi Peak	-17.73
2	414.000000000 kHz	29.19		Average	-18.38
2	330.000000000 kHz	30.72		Average	-18.73
2	454.000000000 kHz	27.97		Average	-18.83
1	202.000000000 kHz	44.54		Quasi Peak	-18.99
1	1.666000000 MHz	36.12		Quasi Peak	-19.88
1	442.000000000 kHz	36.63		Quasi Peak	-20.39
2	1.618000000 MHz	25.00		Average	-21.00
2	650.000000000 kHz	24.58		Average	-21.42
1	646.000000000 kHz	34.12		Quasi Peak	-21.88
1	542.000000000 kHz	34.11		Quasi Peak	-21.89
2	1.278000000 MHz	24.00		Average	-22.00
2	194.000000000 kHz	31.49		Average	-22.37
2	266.000000000 kHz	27.25		Average	-23.99
1	250.000000000 kHz	37.38		Quasi Peak	-24.38
1	158.000000000 kHz	38.71		Quasi Peak	-26.86

Operating Condition: Neutral-110VAC 60Hz



Trace	Frequency	Level (dBµV)	Phase	Detector	Delta Limit/dB
2	450.000000000 kHz	29.87		Average	-17.01
2	330.000000000 kHz	32.15		Average	-17.30
2	414.000000000 kHz	29.40		Average	-18.17
1	334.000000000 kHz	41.14		Quasi Peak	-18.21
1	194.000000000 kHz	45.45		Quasi Peak	-18.41
1	466.000000000 kHz	38.14		Quasi Peak	-18.44
2	650.000000000 kHz	26.40		Average	-19.60
1	650.000000000 kHz	36.14		Quasi Peak	-19.86
1	1.074000000 MHz	36.03		Quasi Peak	-19.97
2	198.000000000 kHz	33.24		Average	-20.45
1	266.000000000 kHz	40.16		Quasi Peak	-21.08
1	150.000000000 kHz	44.45		Quasi Peak	-21.55
1	542.000000000 kHz	34.45		Quasi Peak	-21.55
2	266.000000000 kHz	29.56		Average	-21.68
2	7.998000000 MHz	22.21		Average	-27.79
2	154.000000000 kHz	25.15		Average	-30.63

9 LIST OF TABLES

10 List of Figures

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