FCC Test Report

FCC ID	:	**2AMUGTBSP100**
Equipment	:	**LoRaWAN Sensor**
Model No.	:	**TBMS100, TBDW100, TBHH100, TBHV100** **(refer to item 1.1.1 for more details)**
Brand Name	:	**Tabs**
Applicant	:	**TrackNet, Inc**
Address	:	**900 LAFAYETTE ST #329, SANTA CLARA, California, United States, 95050**
Standard	:	**47 CFR FCC Part 15.247**
Received Date	:	**Sep. 04, 2017**
Tested Date	:	**Sep. 12 ~ Nov. 01, 2017**

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:

Along Chen / Assistant Manager

Approved by:

Gary Chang / Manager

Testing Laboratory 2732

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Release Record

Report No.	Version	Description	Issued Date
FR790401-1	Rev. 01	Initial issue	Nov. 21, 2017

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	Note	N/A
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 9149.00MHz 47.05 (Margin -6.95dB) - AV	Pass
15.247(d)	Band Edge	Meet the requirement of limit	Pass
15.247(b)(2)(3)	Conducted Output Power	Power [dBm]: 19.20	Pass
15.247(a)(1)(i)	Number of Hopping Channels	Meet the requirement of limit	Pass
15.247(a)(1)	Hopping Channel Separation	Meet the requirement of limit	Pass
15.247(f)	Dwell Time	Meet the requirement of limit	Pass
15.247(f)	Power spectral density	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass
Note: The EUT consumes power from battery, so the test is not required.			

1 General Description

1.1 Information

1.1.1 Product Details

The following models are provided to this EUT.

Brand Name	Model Name	Product Name	Description
Tabs	TBMS100	Motion Sensor	With Sensor Board: PIR - Occupency Sensor (U816)
	TBDW100	Door and Window Sensor	With Sensor Board: Door / Window sensor (U705)
	TBHH100	Healthy Home Sensor	With Sensor Board: TH sensor without U817
	TBHV100	Healthy Home Sensor VOC	With Sensor Board: TH + VOC (U817 parts) sensor

1.1.2 Specification of the Equipment under Test (EUT)

RF General Information					
Frequency Range (MHz)	Ch. Freq. (MHz)	Channel Number	Data Rate (bit/sec)	Spread Factor	Channel Bandwidth (kHz)
902 ~ 928	902.3 ~ 914.9	1-64 [64]	980 ~ 5470	10 ~ 7	125
Note 1: RF output power specifies that Maximum Conducted (Average) Output Power. Note 2: The device uses CSS modulation. Note 3: The device supports hybrid mode.					

1.1.3 Antenna Details

Ant. No.	Type	Connector	Gain (dBi)	Remark
1	Monopole	NA	-1.7	---

1.1.4 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	3.6Vdc from battery

1.1.5 Accessories

Accessories		
No.	**Equipment**	**Description**
1	RAMWAY Battery	Model: ER14250 Rating: 3.6Vdc
2	FANSO Battery	Model: ER14250H Rating: 3.6Vdc
3	Magnet	Only for Door and Window Sensor (model: TBDW100)

1.1.6 Channel List

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	902.3	17	905.5	33	908.7	49	911.9
2	902.5	18	905.7	34	908.9	50	912.1
3	902.7	19	905.9	35	909.1	51	912.3
4	902.9	20	906.1	36	909.3	52	912.5
5	903.1	21	906.3	37	909.5	53	912.7
6	903.3	22	906.5	38	909.7	54	912.9
7	903.5	23	906.7	39	909.9	55	913.1
8	903.7	24	906.9	40	910.1	56	913.3
9	903.9	25	907.1	41	910.3	57	913.5
10	904.1	26	907.3	42	910.5	58	913.7
11	904.3	27	907.5	43	910.7	59	913.9
12	904.5	28	907.7	44	910.9	60	914.1
13	904.7	29	907.9	45	911.1	61	914.3
14	904.9	30	908.1	46	911.3	62	914.5
15	905.1	31	908.3	47	911.5	63	914.7
16	905.3	32	908.5	48	911.7	64	914.9

1.1.7 Test Tool and Duty Cycle

Test Tool	Python, version: 3.5.2

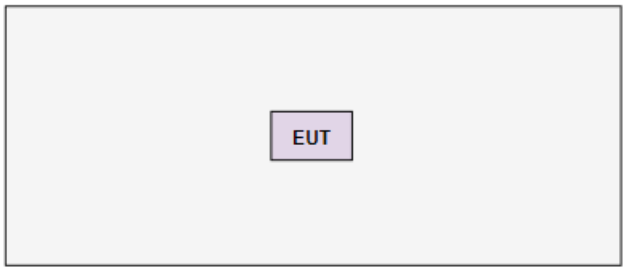
1.1.8 Power Setting

Modulation Mode	Test Frequency (MHz)		
	902.3	**908.5**	**914.9**
CSS	20	20	20

1.2 Local Support Equipment List

Support Equipment List					
No.	**Equipment**	**Brand**	**Model**	**FCC ID**	**Signal cable / Length (m)**
1	Notebook	DELL	Latitude E6430	DoC	---

1.3 Test Setup Chart

Test Setup Diagram


Note: The support notebook is disconnected from EUT and removed from test table after sending command from notebook to control EUT to transmit continuously.

1.4 The Equipment List

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Tested Date	Sep. 12 ~ Sep. 13, 2017				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101498	Nov. 25, 2016	Nov. 24, 2017
Receiver	R&S	ESR3	101658	Nov. 24, 2016	Nov. 23, 2017
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 25, 2017	Jul. 24, 2018
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 21, 2016	Dec. 20, 2017
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Oct. 25, 2016	Oct. 24, 2017
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 10, 2016	Nov. 09, 2017
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Dec. 09, 2016	Dec. 08, 2017
Preamplifier	EMC	EMC02325	980225	Jul. 28, 2017	Jul. 27, 2018
Preamplifier	Agilent	83017A	MY53270014	Aug. 21, 2017	Aug. 20, 2018
Preamplifier	EMC	EMC184045B	980192	Aug. 22, 2017	Aug. 21, 2018
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Dec. 09, 2016	Dec. 08, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Dec. 09, 2016	Dec. 08, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16139/4	Dec. 09, 2016	Dec. 08, 2017
LF cable 1M	EMC	EMCCFD400-NM-NM-1000	16052	Dec. 09, 2016	Dec. 08, 2017
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Dec. 09, 2016	Dec. 08, 2017
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Dec. 09, 2016	Dec. 08, 2017
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Tested Date	Oct. 26 ~ Nov. 01, 2017				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	ROHDE&SCHWARZ	FSV40	101486	Nov. 15, 2016	Nov. 14, 2017
TEMP&HUMIDITY CHAMBER	GIANT FORCE	GCT-225-40-SP-SD	MAF1212-002	Nov. 21, 2016	Nov. 20, 2017
Power Sensor	Agilent	U2021XA	MY53480019	Feb. 06, 2017	Feb. 05, 2018
DC POWER SOURCE	GW INSTEK	GPC-6030D	EM892433	Oct. 26, 2017	Oct. 25, 2018
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Measurement Software	Agilent	EN RF test	1.1501125	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

1.5 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.247
ANSI C63.10-2013
FCC KDB 558074 D01 DTS Meas Guidance v04
FCC KDB 453039

1.6 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Measurement Uncertainty	
Parameters	**Uncertainty**
Bandwidth	±34.134 Hz
Conducted power	±0.808 dB
Power density	±0.463 dB
Conducted emission	±2.670 dB
AC conducted emission	±2.90 dB
Radiated emission ≤ 1GHz	±3.66 dB
Radiated emission > 1GHz	±5.63 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
Radiated Emissions	03CH01-WS	25°C / 63%	Vincent Yeh
RF Conducted	TH01-WS	22°C / 65%	Felix Sung

- FCC Designation No.: TW2732
- FCC site registration No.: 181692
- IC site registration No.: 10807A-1

2.2 The Worst Test Modes and Channel Details

Test item	Test Frequency (MHz)	Channel Bandwidth (kHz)	Modulation / SF	Test Configuration
Conducted Emissions Radiated Emissions > 1GHz Conducted Output Power Hopping Channel Separation 20dB and Occupied bandwidth Power Spectral Density	902.3 / 908.5 / 914.9	125	CSS / 8	1
Radiated Emissions ≤ 1GHz	902.3 / 908.5 / 914.9	125	CSS / 8	1, 2, 3, 4
Number of Hopping Channels	902.3 ~ 914.9	125	CSS / 8	1
Dwell Time	902.3	125	CSS: 10 / 9 / 8 / 7	1

NOTE:

1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **X-plane** result was found as the worst case and was shown in this report.
2. Test configurations for radiated emission below 1GHz test are listed as follows:
   1) Test configuration 1: model TBMS100
   2) Test configuration 2: model TBDW100
   3) Test configuration 3: model TBHH100
   4) Test configuration 4: model TBHV100

3 Transmitter Test Results

3.1 Unwanted Emissions into Restricted Frequency Bands

3.1.1 Limit of Unwanted Emissions into Restricted Frequency Bands

Restricted Band Emissions Limit			
Frequency Range (MHz)	**Field Strength (uV/m)**	**Field Strength (dBuV/m)**	**Measure Distance (m)**
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:
Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit
Note 2:
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

3.1.2 Test Procedures

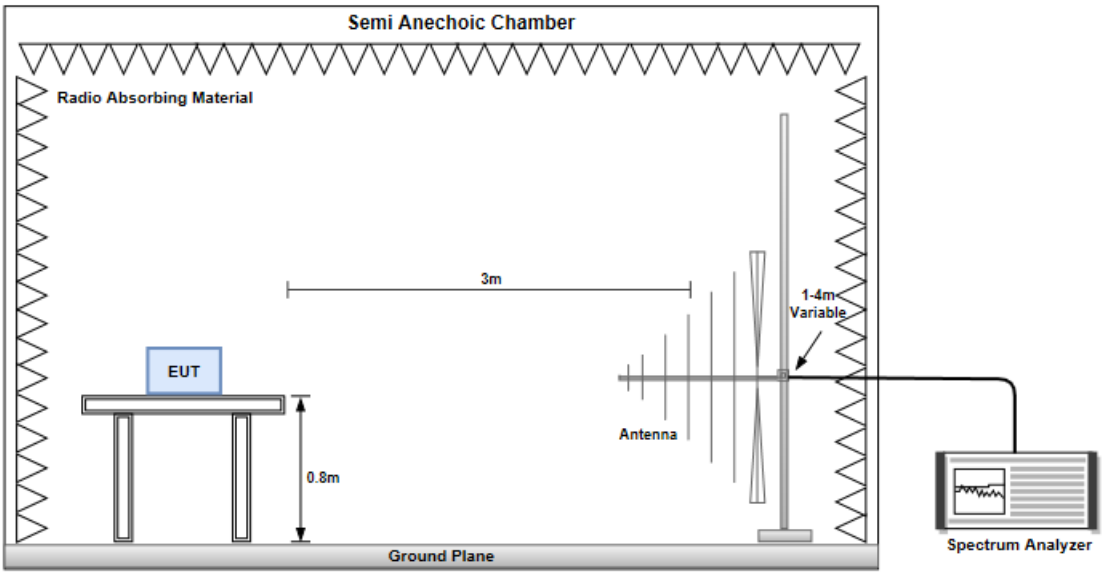
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

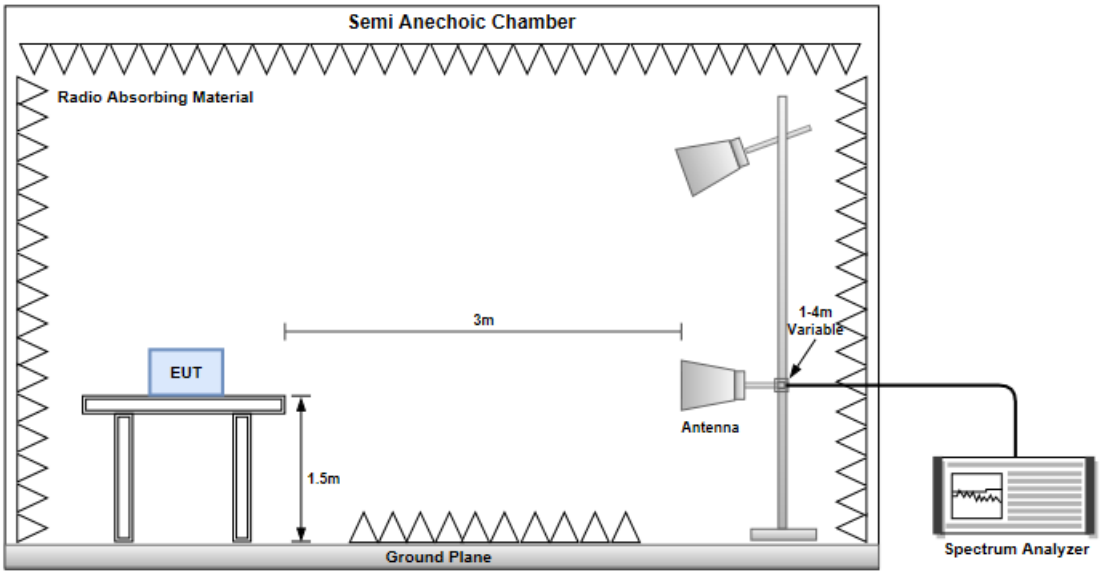
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

3.1.3 Test Setup

Radiated Emissions below 1 GHz



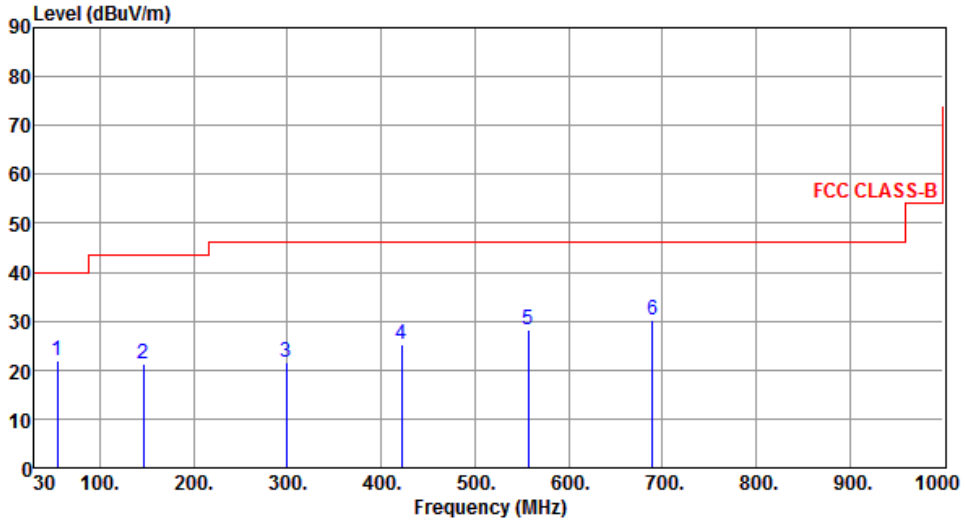
Radiated Emissions above 1 GHz



Test configuration 1: model TBMS100

3.1.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

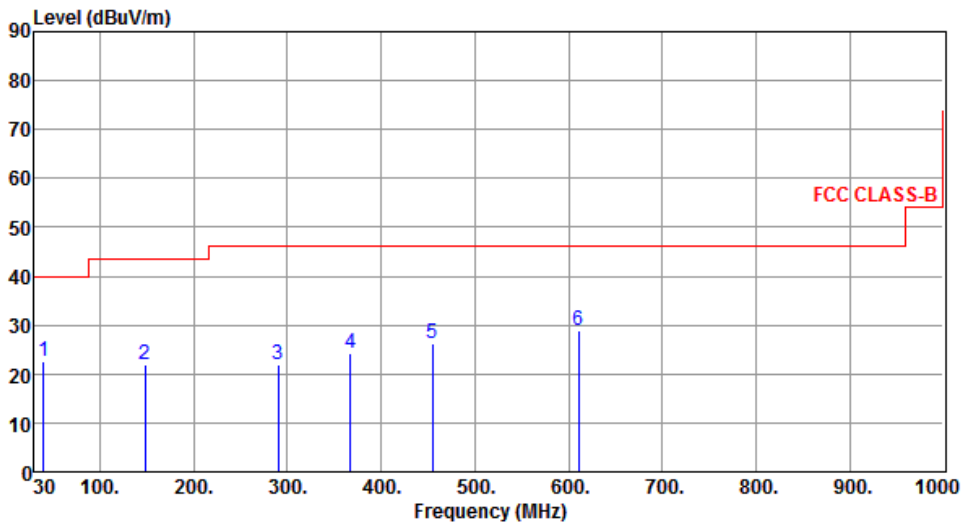
Modulation / SF	CSS / 10	**Test Freq. (MHz)**	902.3
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	54.25	21.87	40.00	-18.13	29.92	-8.05	Peak	---	---
2	146.40	21.29	43.50	-22.21	29.75	-8.46	Peak	---	---
3	298.69	21.59	46.00	-24.41	29.29	-7.70	Peak	---	---
4	421.88	25.36	46.00	-20.64	29.80	-4.44	Peak	---	---
5	556.71	28.13	46.00	-17.87	29.76	-1.63	Peak	---	---
6	689.60	30.07	46.00	-15.93	29.61	0.46	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

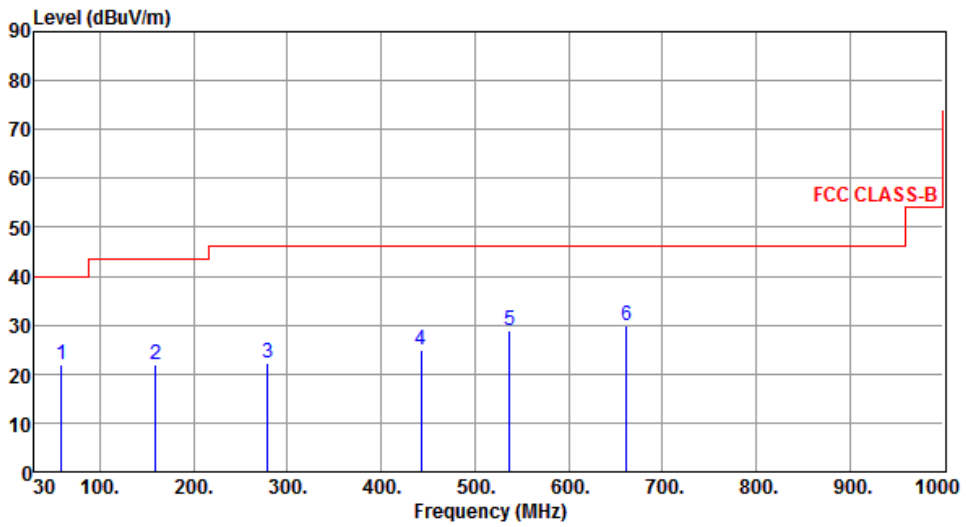
Modulation / SF	CSS / 10	Test Freq. (MHz)	902.3
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	39.70	22.68	40.00	-17.32	30.87	-8.19	Peak	---	---
2	148.34	21.96	43.50	-21.54	30.36	-8.40	Peak	---	---
3	289.96	21.91	46.00	-24.09	29.79	-7.88	Peak	---	---
4	367.56	24.27	46.00	-21.73	30.16	-5.89	Peak	---	---
5	454.86	26.36	46.00	-19.64	30.05	-3.69	Peak	---	---
6	611.03	28.92	46.00	-17.08	29.51	-0.59	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

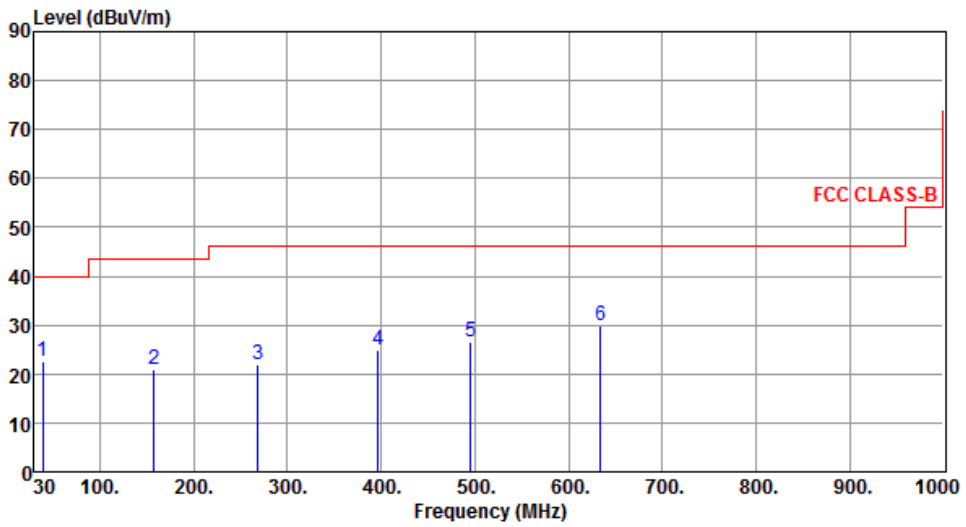
Modulation / SF	CSS / 10	Test Freq. (MHz)	908.5
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	59.10	21.77	40.00	-18.23	30.20	-8.43	Peak	---	---
2	159.01	21.87	43.50	-21.63	30.11	-8.24	Peak	---	---
3	279.29	22.26	46.00	-23.74	30.40	-8.14	Peak	---	---
4	442.25	25.06	46.00	-20.94	29.03	-3.97	Peak	---	---
5	537.31	28.73	46.00	-17.27	30.76	-2.03	Peak	---	---
6	661.47	29.79	46.00	-16.21	29.77	0.02	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

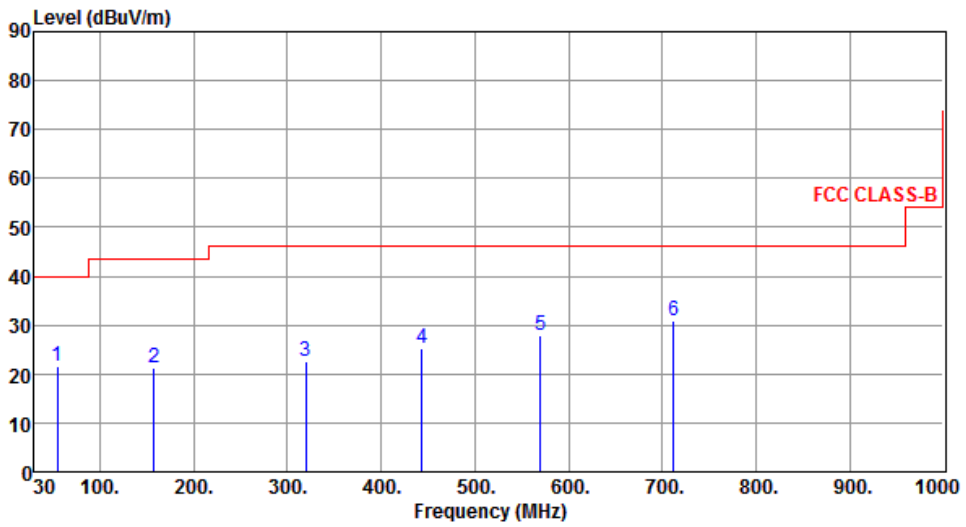
Modulation / SF	CSS / 10	Test Freq. (MHz)	908.5
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	38.73	22.47	40.00	-17.53	30.74	-8.27	Peak	---	---
2	158.04	21.00	43.50	-22.50	29.24	-8.24	Peak	---	---
3	268.62	21.88	46.00	-24.12	30.48	-8.60	Peak	---	---
4	396.66	24.91	46.00	-21.09	29.96	-5.05	Peak	---	---
5	495.60	26.68	46.00	-19.32	29.60	-2.92	Peak	---	---
6	634.31	29.90	46.00	-16.10	30.24	-0.34	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

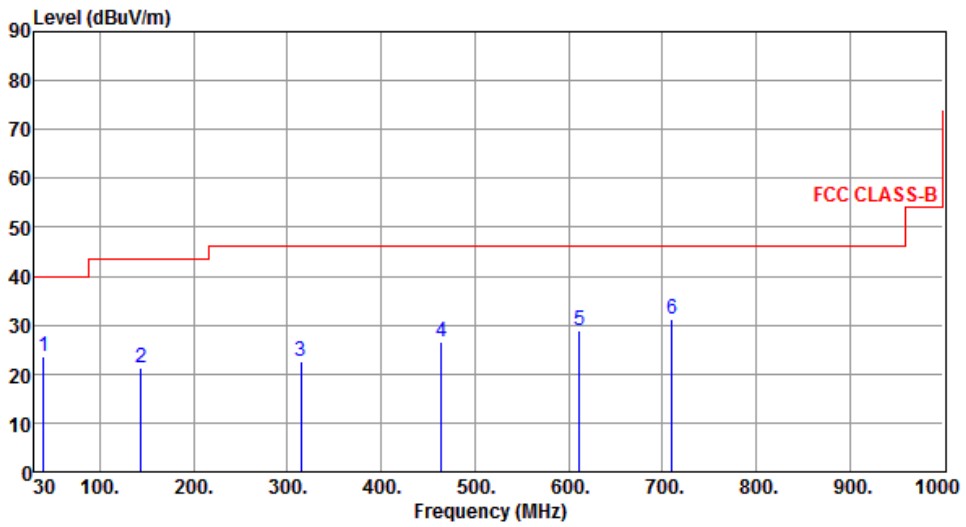
Modulation / SF	CSS / 10	Test Freq. (MHz)	914.9
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	54.25	21.65	40.00	-18.35	29.70	-8.05	Peak	---	---
2	158.04	21.22	43.50	-22.28	29.46	-8.24	Peak	---	---
3	320.03	22.43	46.00	-23.57	29.60	-7.17	Peak	---	---
4	443.22	25.12	46.00	-20.88	29.07	-3.95	Peak	---	---
5	570.29	27.83	46.00	-18.17	29.17	-1.34	Peak	---	---
6	711.91	30.91	46.00	-15.09	30.01	0.90	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Modulation / SF	CSS / 10	Test Freq. (MHz)	914.9
Polarization	Vertical		

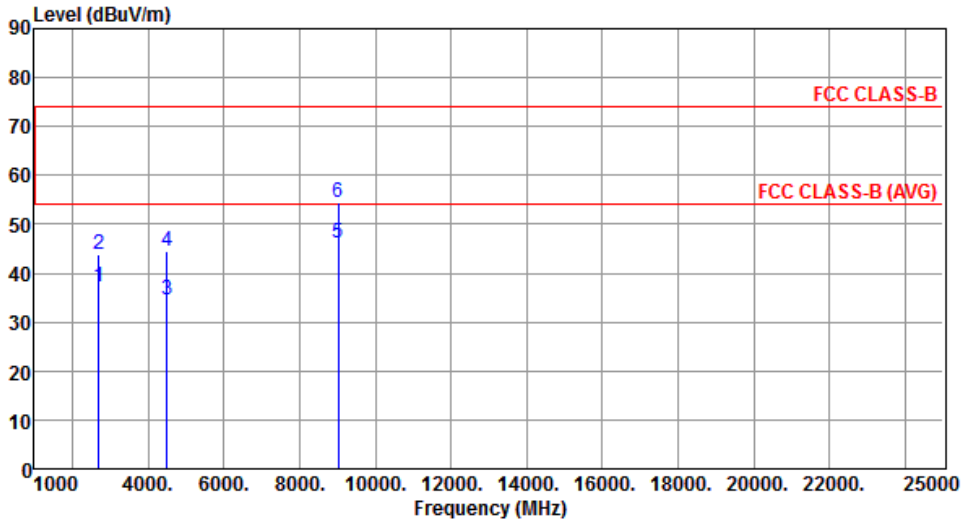


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	39.70	23.73	40.00	-16.27	31.92	-8.19	Peak	---	---
2	143.49	21.29	43.50	-22.21	29.85	-8.56	Peak	---	---
3	314.21	22.67	46.00	-23.33	29.98	-7.31	Peak	---	---
4	464.56	26.43	46.00	-19.57	29.94	-3.51	Peak	---	---
5	612.00	28.90	46.00	-17.10	29.48	-0.58	Peak	---	---
6	709.97	31.32	46.00	-14.68	30.47	0.85	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

3.1.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

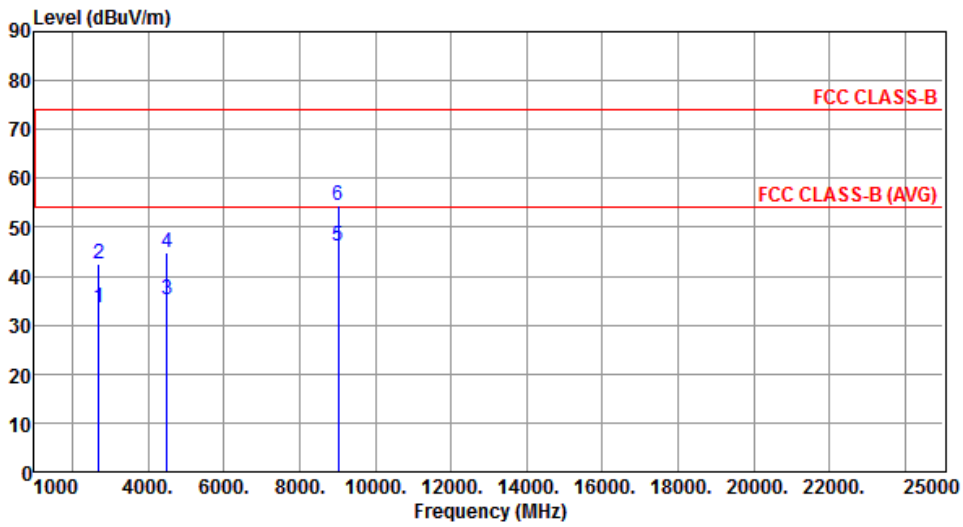
Modulation / SF	CSS / 10	Test Freq. (MHz)	902.3
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2706.90	37.10	54.00	-16.90	39.13	-2.03	Average	191	333
2	2706.90	43.90	74.00	-30.10	45.93	-2.03	Peak	191	333
3	4511.50	34.54	54.00	-19.46	31.56	2.98	Average	195	31
4	4511.50	44.56	74.00	-29.44	41.58	2.98	Peak	195	31
5	9023.00	46.03	54.00	-7.97	34.92	11.11	Average	155	88
6	9023.00	54.56	74.00	-19.44	43.45	11.11	Peak	155	88

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

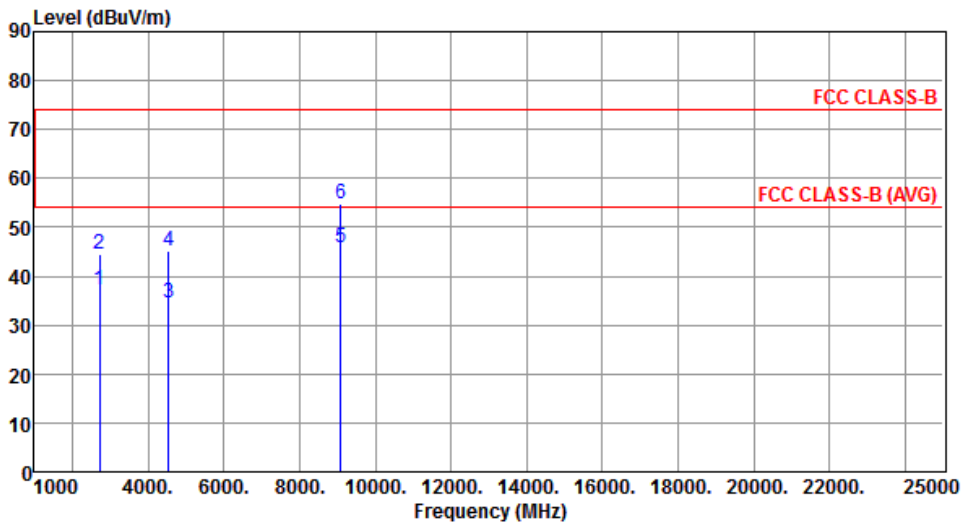
Modulation / SF	CSS / 10	Test Freq. (MHz)	902.3
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2706.90	33.43	54.00	-20.57	35.46	-2.03	Average	109	311
2	2706.90	42.57	74.00	-31.43	44.60	-2.03	Peak	109	311
3	4511.50	35.15	54.00	-18.85	32.17	2.98	Average	205	16
4	4511.50	44.84	74.00	-29.16	41.86	2.98	Peak	205	16
5	9023.00	46.20	54.00	-7.80	35.09	11.11	Average	298	154
6	9023.00	54.59	74.00	-19.41	43.48	11.11	Peak	298	154

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

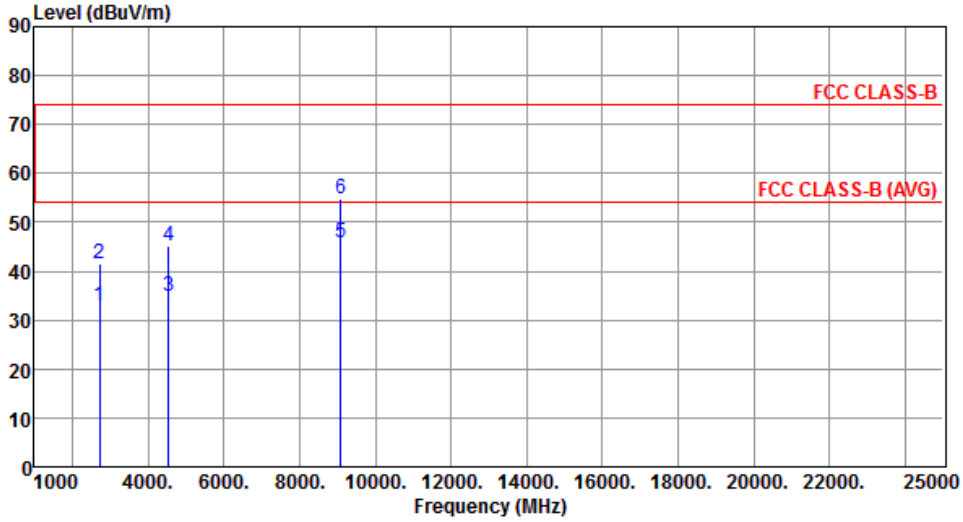
Modulation / SF	CSS / 10	Test Freq. (MHz)	908.5
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2725.50	37.11	54.00	-16.89	39.09	-1.98	Average	260	346
2	2725.50	44.45	74.00	-29.55	46.43	-1.98	Peak	260	346
3	4542.50	34.58	54.00	-19.42	31.52	3.06	Average	179	26
4	4542.50	45.09	74.00	-28.91	42.03	3.06	Peak	179	26
5	9085.00	45.91	54.00	-8.09	34.59	11.32	Average	166	16
6	9085.00	54.83	74.00	-19.17	43.51	11.32	Peak	166	16

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

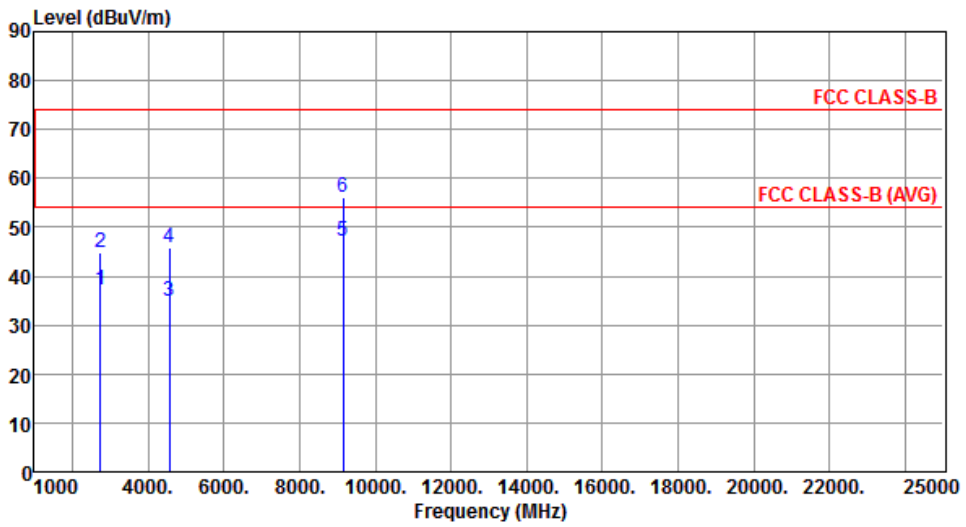
Modulation / SF	CSS / 10	Test Freq. (MHz)	908.5
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2725.50	32.78	54.00	-21.22	34.76	-1.98	Average	100	6
2	2725.50	41.68	74.00	-32.32	43.66	-1.98	Peak	100	6
3	4542.50	34.79	54.00	-19.21	31.73	3.06	Average	181	28
4	4542.50	45.32	74.00	-28.68	42.26	3.06	Peak	181	28
5	9085.00	45.76	54.00	-8.24	34.44	11.32	Average	292	154
6	9085.00	54.64	74.00	-19.36	43.32	11.32	Peak	292	154

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

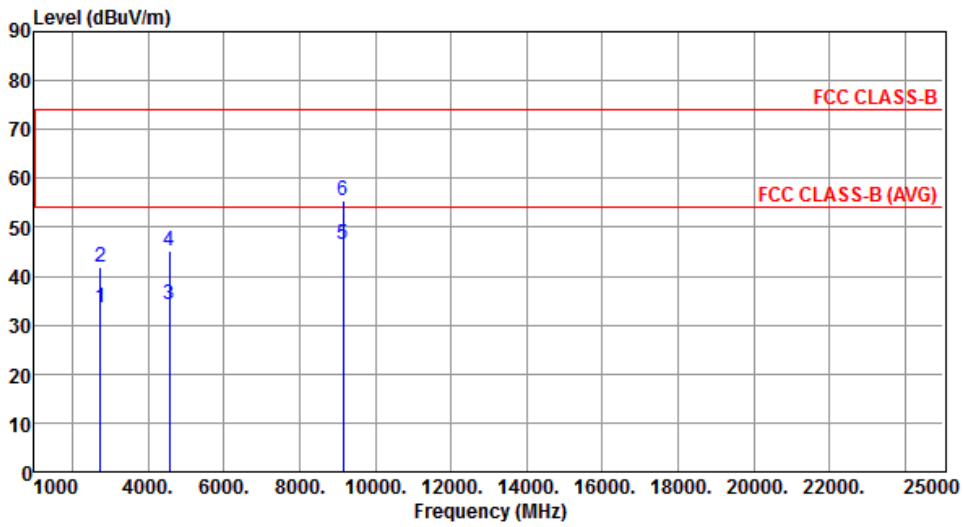
Modulation / SF	CSS / 10	Test Freq. (MHz)	914.9
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2744.70	37.16	54.00	-16.84	39.07	-1.91	Average	249	358
2	2744.70	44.69	74.00	-29.31	46.60	-1.91	Peak	249	358
3	4574.50	34.91	54.00	-19.09	31.78	3.13	Average	150	37
4	4574.50	45.80	74.00	-28.20	42.67	3.13	Peak	150	37
5	9149.00	47.05	54.00	-6.95	35.53	11.52	Average	163	89
6	9149.00	56.26	74.00	-17.74	44.74	11.52	Peak	163	89

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation / SF	CSS / 10	Test Freq. (MHz)	914.9
Polarization	Vertical		



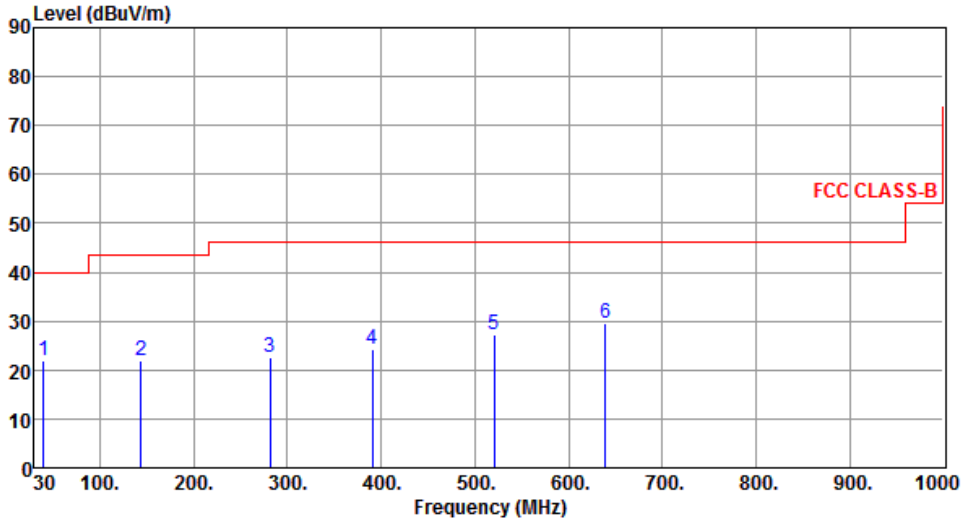
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2744.70	33.67	54.00	-20.33	35.58	-1.91	Average	264	131
2	2744.70	41.87	74.00	-32.13	43.78	-1.91	Peak	264	131
3	4574.50	34.28	54.00	-19.72	31.15	3.13	Average	199	11
4	4574.50	45.07	74.00	-28.93	41.94	3.13	Peak	199	11
5	9149.00	46.58	54.00	-7.42	35.06	11.52	Average	286	160
6	9149.00	55.40	74.00	-18.60	43.88	11.52	Peak	286	160

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Test configuration 2: model TBDW100

3.1.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)

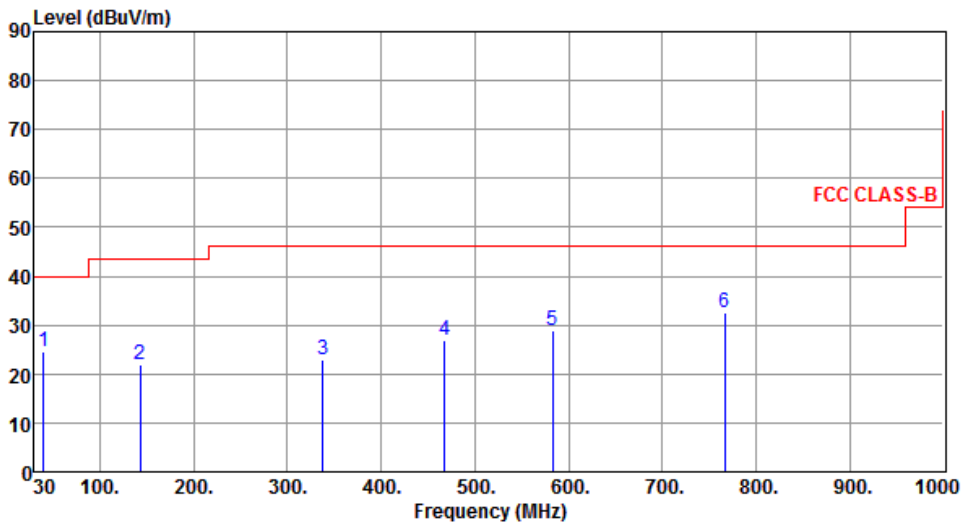
Modulation / SF	CSS / 10	**Test Freq. (MHz)**	902.3
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	39.70	21.78	40.00	-18.22	29.97	-8.19	Peak	---	---
2	143.49	21.83	43.50	-21.67	30.39	-8.56	Peak	---	---
3	281.23	22.62	46.00	-23.38	30.71	-8.09	Peak	---	---
4	390.84	24.36	46.00	-21.64	29.58	-5.22	Peak	---	---
5	520.82	27.29	46.00	-18.71	29.68	-2.39	Peak	---	---
6	639.16	29.71	46.00	-16.29	30.00	-0.29	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

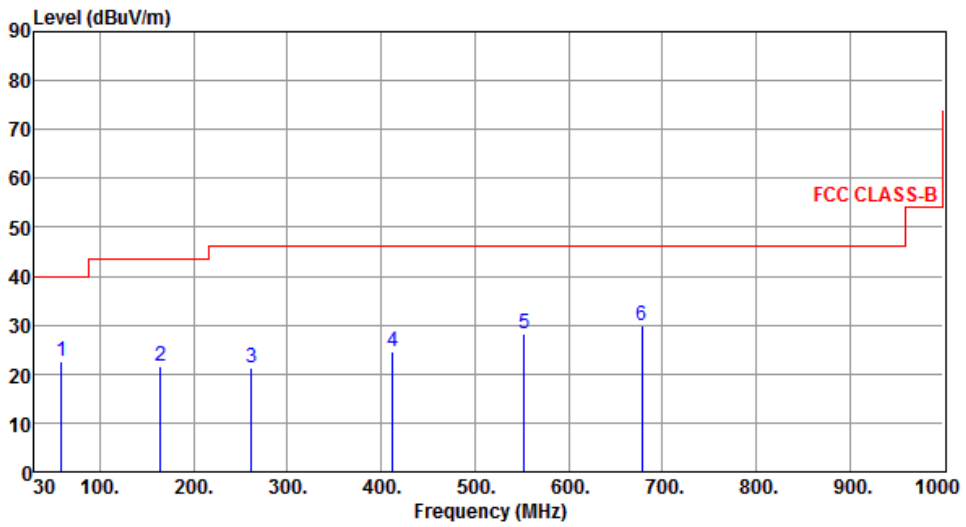
Modulation / SF	CSS / 10	Test Freq. (MHz)	902.3
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	39.70	24.63	40.00	-15.37	32.82	-8.19	Peak	---	---
2	142.52	21.95	43.50	-21.55	30.53	-8.58	Peak	---	---
3	337.49	23.04	46.00	-22.96	29.77	-6.73	Peak	---	---
4	467.47	26.78	46.00	-19.22	30.24	-3.46	Peak	---	---
5	582.90	28.80	46.00	-17.20	29.88	-1.08	Peak	---	---
6	766.23	32.50	46.00	-13.50	30.58	1.92	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

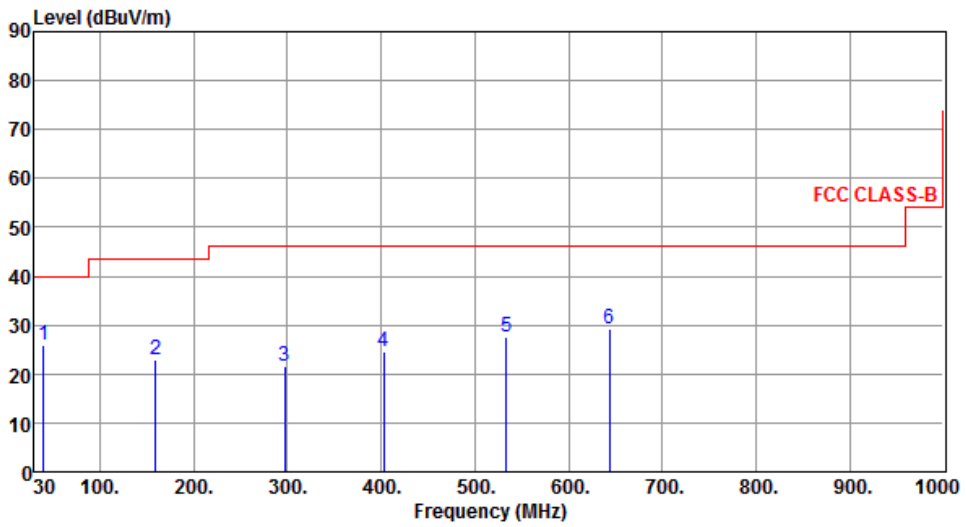
Modulation / SF	CSS / 10	Test Freq. (MHz)	908.5
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	59.10	22.45	40.00	-17.55	30.88	-8.43	Peak	---	---
2	164.83	21.62	43.50	-21.88	30.03	-8.41	Peak	---	---
3	261.83	21.41	46.00	-24.59	30.36	-8.95	Peak	---	---
4	412.18	24.48	46.00	-21.52	29.15	-4.67	Peak	---	---
5	552.83	28.23	46.00	-17.77	29.93	-1.70	Peak	---	---
6	677.96	29.73	46.00	-16.27	29.45	0.28	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

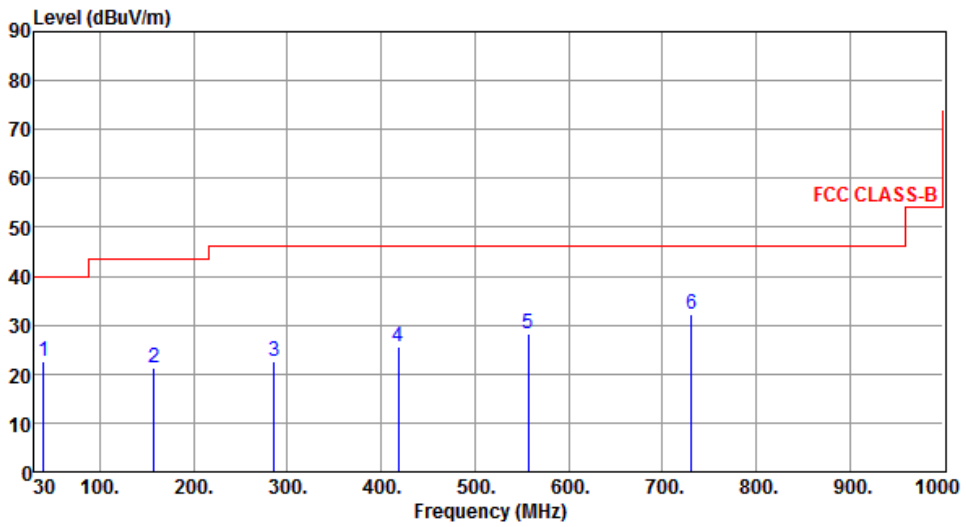
Modulation / SF	CSS / 10	Test Freq. (MHz)	908.5
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	39.70	25.95	40.00	-14.05	34.14	-8.19	Peak	---	---
2	159.01	23.03	43.50	-20.47	31.27	-8.24	Peak	---	---
3	296.75	21.67	46.00	-24.33	29.42	-7.75	Peak	---	---
4	402.48	24.50	46.00	-21.50	29.39	-4.89	Peak	---	---
5	533.43	27.48	46.00	-18.52	29.60	-2.12	Peak	---	---
6	644.01	29.26	46.00	-16.74	29.49	-0.23	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

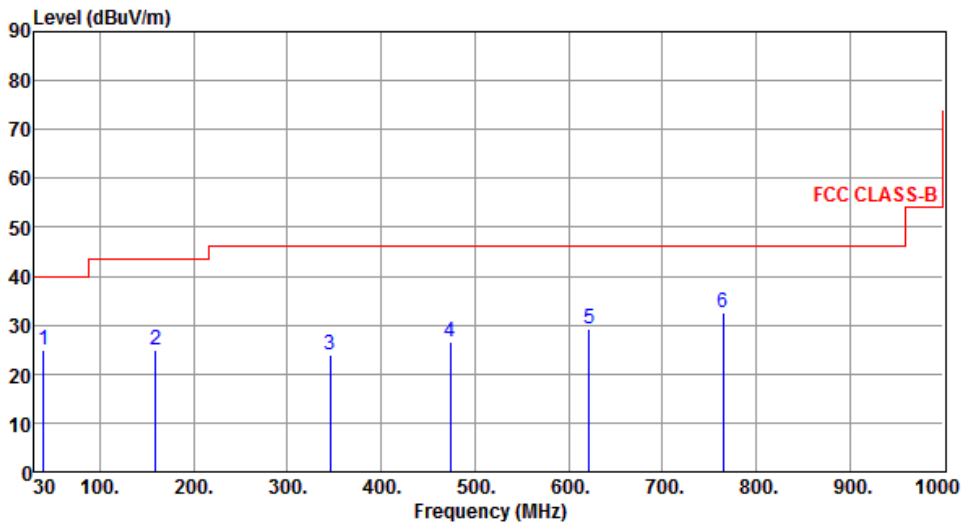
Modulation / SF	CSS / 10	Test Freq. (MHz)	914.9
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	39.70	22.60	40.00	-17.40	30.79	-8.19	Peak	---	---
2	158.04	21.21	43.50	-22.29	29.45	-8.24	Peak	---	---
3	286.08	22.57	46.00	-23.43	30.54	-7.97	Peak	---	---
4	418.00	25.67	46.00	-20.33	30.20	-4.53	Peak	---	---
5	556.71	28.13	46.00	-17.87	29.76	-1.63	Peak	---	---
6	731.31	32.35	46.00	-13.65	31.01	1.34	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Modulation / SF	CSS / 10	Test Freq. (MHz)	914.9
Polarization	Vertical		



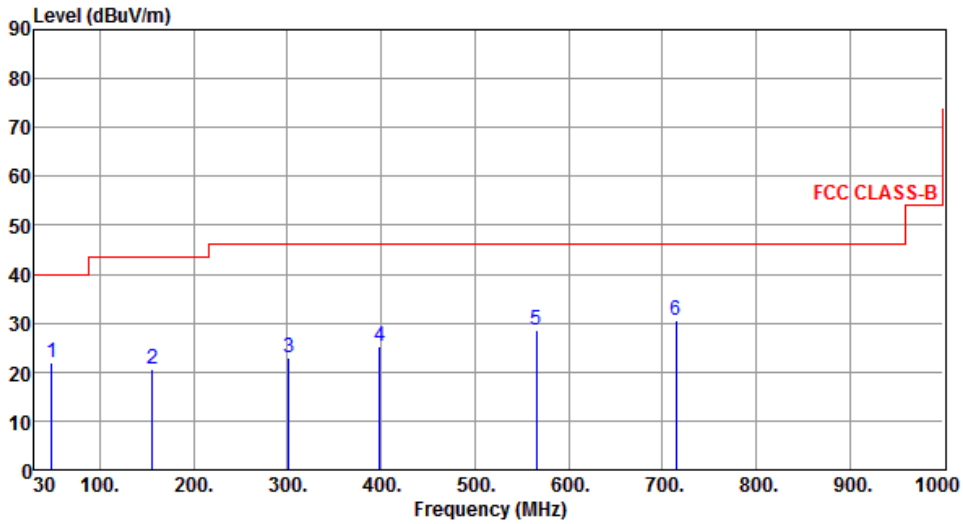
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	39.70	24.84	40.00	-15.16	33.03	-8.19	Peak	---	---
2	159.01	24.96	43.50	-18.54	33.20	-8.24	Peak	---	---
3	345.25	23.91	46.00	-22.09	30.43	-6.52	Peak	---	---
4	474.26	26.69	46.00	-19.31	30.01	-3.32	Peak	---	---
5	621.70	29.15	46.00	-16.85	29.62	-0.47	Peak	---	---
6	765.26	32.50	46.00	-13.50	30.59	1.91	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Test configuration 3: model TBHH100

3.1.7 Transmitter Radiated Unwanted Emissions (Below 1GHz)

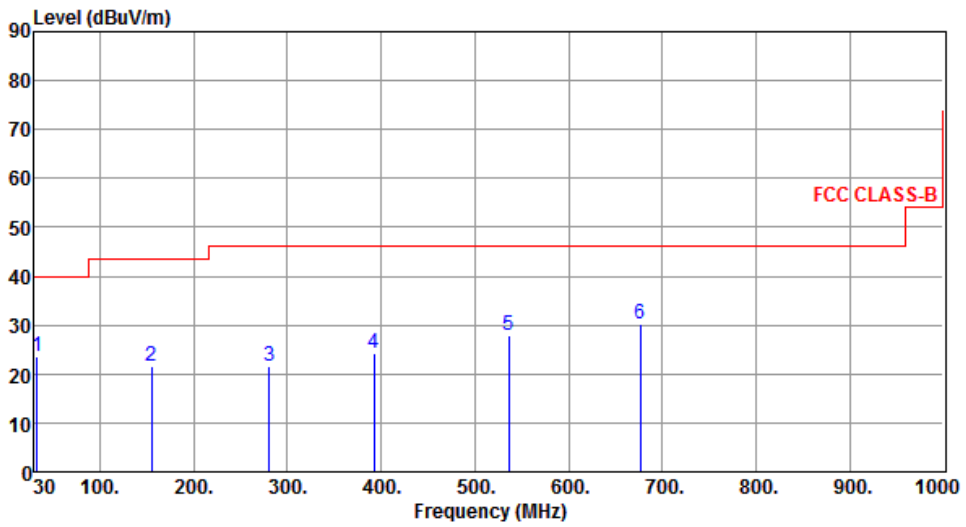
Modulation / SF	CSS / 10	**Test Freq. (MHz)**	902.3
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	48.43	22.03	40.00	-17.97	29.79	-7.76	Peak	---	---
2	156.10	20.75	43.50	-22.75	29.02	-8.27	Peak	---	---
3	301.60	22.89	46.00	-23.11	30.52	-7.63	Peak	---	---
4	398.60	25.16	46.00	-20.84	30.15	-4.99	Peak	---	---
5	565.44	28.57	46.00	-17.43	30.01	-1.44	Peak	---	---
6	714.82	30.51	46.00	-15.49	29.54	0.97	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

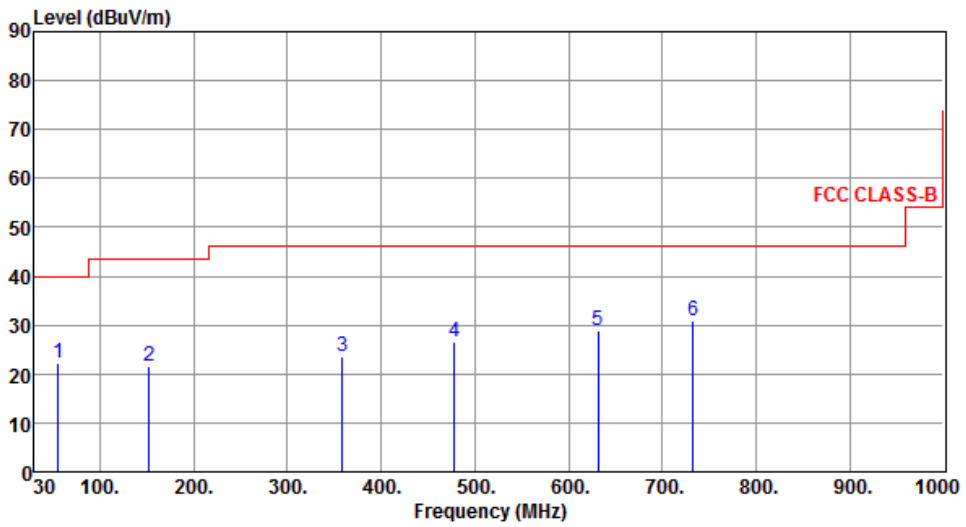
Modulation / SF	CSS / 10	Test Freq. (MHz)	902.3
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	32.91	23.66	40.00	-16.34	32.31	-8.65	Peak	---	---
2	155.13	21.46	43.50	-22.04	29.74	-8.28	Peak	---	---
3	280.26	21.73	46.00	-24.27	29.83	-8.10	Peak	---	---
4	392.78	24.35	46.00	-21.65	29.51	-5.16	Peak	---	---
5	536.34	27.81	46.00	-18.19	29.86	-2.05	Peak	---	---
6	676.99	30.18	46.00	-15.82	29.92	0.26	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

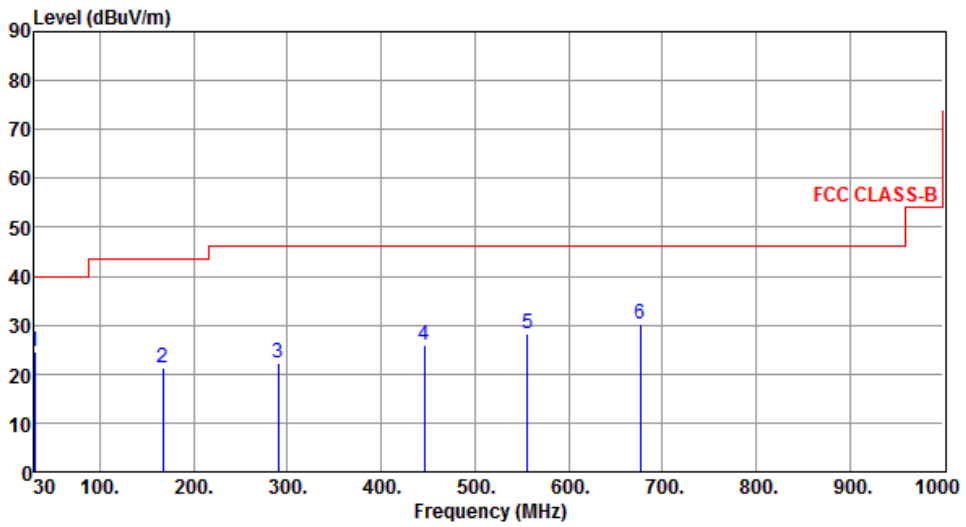
Modulation / SF	CSS / 10	Test Freq. (MHz)	908.5
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	55.22	22.16	40.00	-17.84	30.29	-8.13	Peak	---	---
2	152.22	21.55	43.50	-21.95	29.87	-8.32	Peak	---	---
3	358.83	23.57	46.00	-22.43	29.72	-6.15	Peak	---	---
4	478.14	26.65	46.00	-19.35	29.90	-3.25	Peak	---	---
5	631.40	28.91	46.00	-17.09	29.29	-0.38	Peak	---	---
6	733.25	31.02	46.00	-14.98	29.64	1.38	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

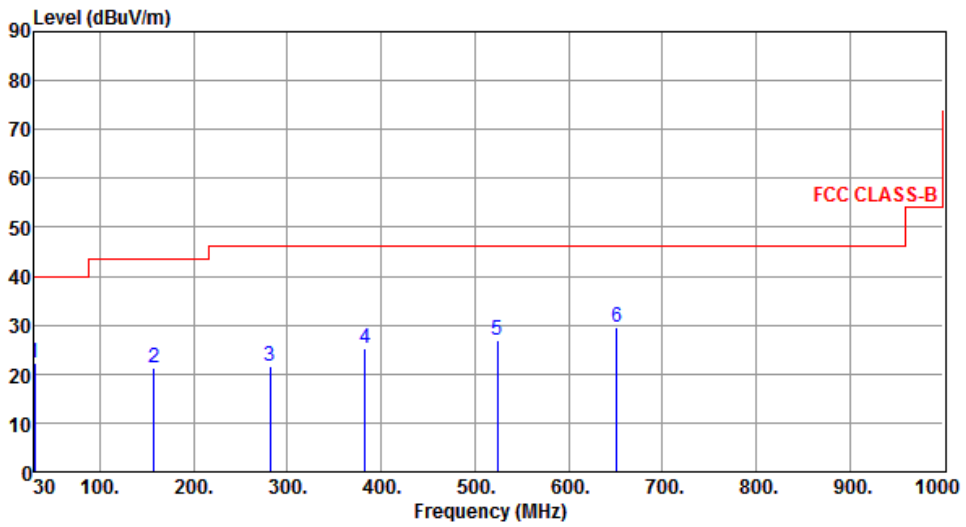
Modulation / SF	CSS / 10	Test Freq. (MHz)	908.5
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	30.00	24.48	40.00	-15.52	33.31	-8.83	Peak	---	---
2	166.77	21.38	43.50	-22.12	29.86	-8.48	Peak	---	---
3	289.96	22.34	46.00	-23.66	30.22	-7.88	Peak	---	---
4	446.13	26.01	46.00	-19.99	29.89	-3.88	Peak	---	---
5	555.74	28.31	46.00	-17.69	29.96	-1.65	Peak	---	---
6	676.99	30.29	46.00	-15.71	30.03	0.26	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

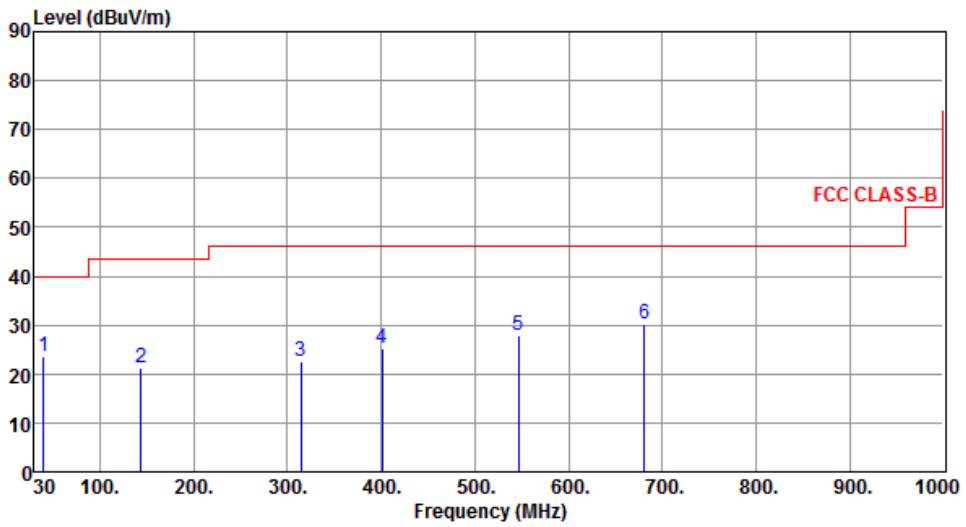
Modulation / SF	CSS / 10	Test Freq. (MHz)	914.9
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	30.00	22.18	40.00	-17.82	31.01	-8.83	Peak	---	---
2	158.04	21.22	43.50	-22.28	29.46	-8.24	Peak	---	---
3	281.23	21.44	46.00	-24.56	29.53	-8.09	Peak	---	---
4	383.08	25.30	46.00	-20.70	30.74	-5.44	Peak	---	---
5	523.73	26.92	46.00	-19.08	29.26	-2.34	Peak	---	---
6	651.77	29.63	46.00	-16.37	29.77	-0.14	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Modulation / SF	CSS / 10	Test Freq. (MHz)	914.9
Polarization	Vertical		



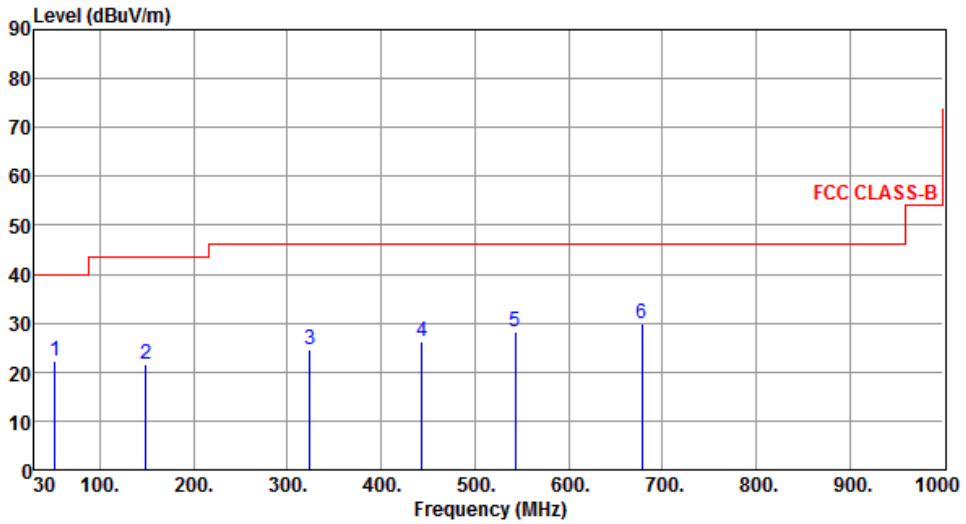
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	39.70	23.73	40.00	-16.27	31.92	-8.19	Peak	---	---
2	143.49	21.29	43.50	-22.21	29.85	-8.56	Peak	---	---
3	314.21	22.67	46.00	-23.33	29.98	-7.31	Peak	---	---
4	401.51	25.24	46.00	-20.76	30.16	-4.92	Peak	---	---
5	547.01	27.96	46.00	-18.04	29.78	-1.82	Peak	---	---
6	680.87	30.36	46.00	-15.64	30.04	0.32	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Test configuration 4: model TBHV100

3.1.8 Transmitter Radiated Unwanted Emissions (Below 1GHz)

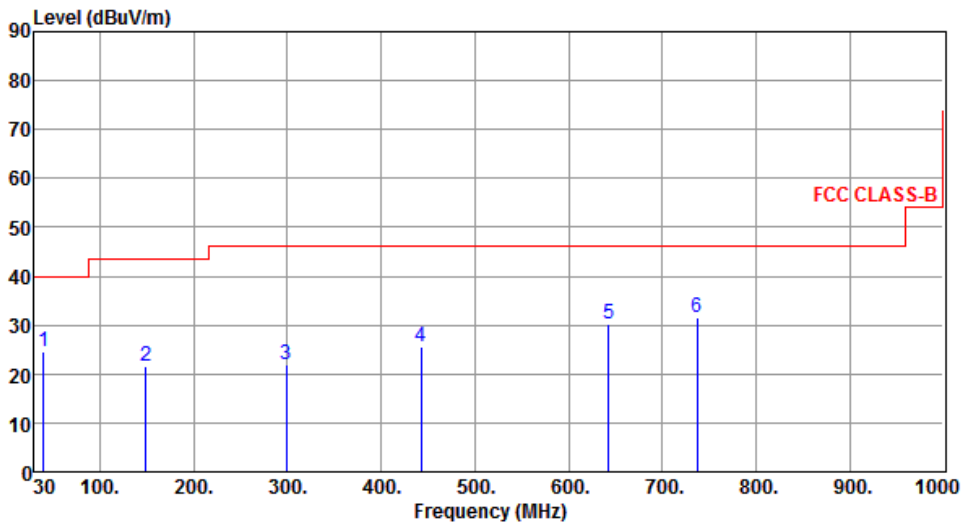
Modulation / SF	CSS / 10	**Test Freq. (MHz)**	902.3
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	52.31	22.15	40.00	-17.85	30.04	-7.89	Peak	---	---
2	149.31	21.49	43.50	-22.01	29.86	-8.37	Peak	---	---
3	323.91	24.48	46.00	-21.52	31.54	-7.06	Peak	---	---
4	443.22	26.39	46.00	-19.61	30.34	-3.95	Peak	---	---
5	543.13	28.21	46.00	-17.79	30.12	-1.91	Peak	---	---
6	677.96	29.87	46.00	-16.13	29.59	0.28	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

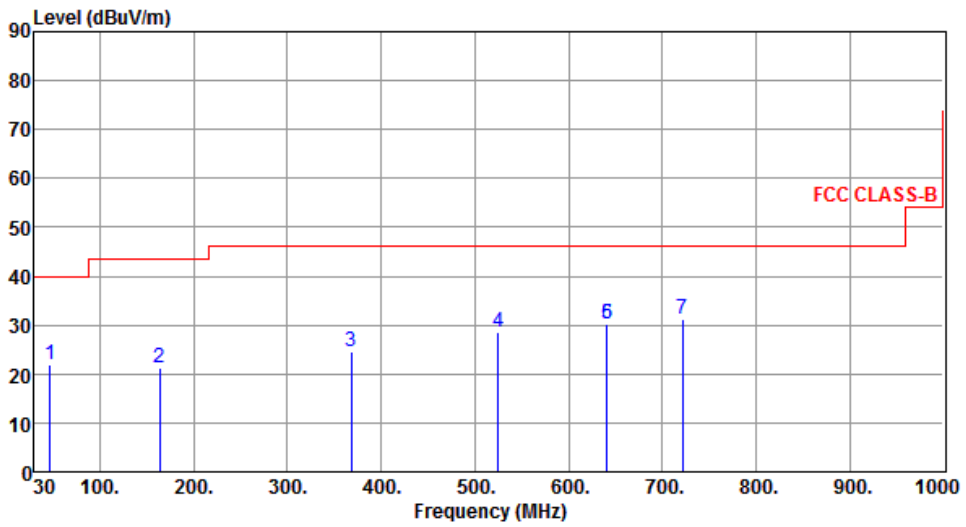
Modulation / SF	CSS / 10	Test Freq. (MHz)	902.3
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	39.70	24.73	40.00	-15.27	32.92	-8.19	Peak	---	---
2	149.31	21.55	43.50	-21.95	29.92	-8.37	Peak	---	---
3	298.69	22.01	46.00	-23.99	29.71	-7.70	Peak	---	---
4	442.25	25.42	46.00	-20.58	29.39	-3.97	Peak	---	---
5	643.04	30.09	46.00	-15.91	30.33	-0.24	Peak	---	---
6	737.13	31.66	46.00	-14.34	30.19	1.47	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

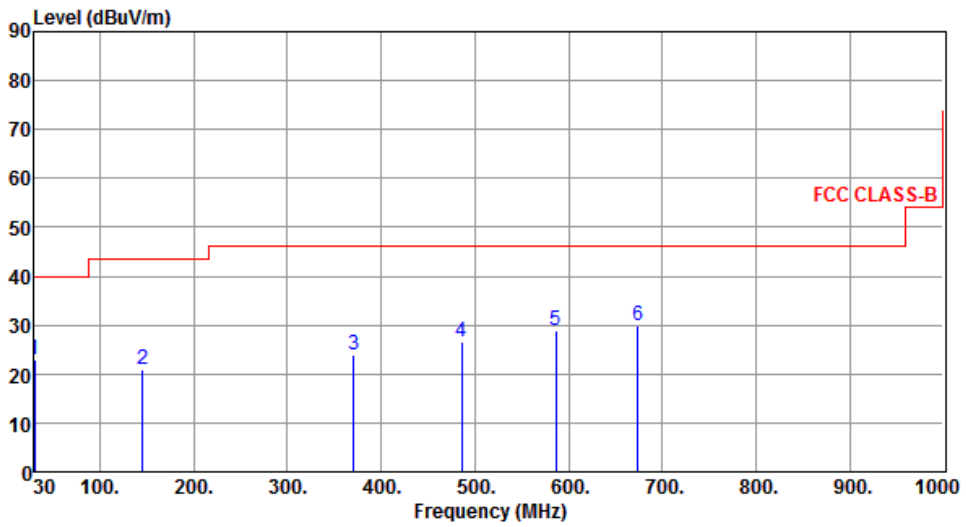
Modulation / SF	CSS / 10	Test Freq. (MHz)	908.5
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	46.49	21.86	40.00	-18.14	29.65	-7.79	Peak	---	---
2	163.86	21.23	43.50	-22.27	29.60	-8.37	Peak	---	---
3	368.53	24.72	46.00	-21.28	30.58	-5.86	Peak	---	---
4	524.70	28.44	46.00	-17.56	30.76	-2.32	Peak	---	---
5	641.10	30.12	46.00	-15.88	30.38	-0.26	Peak	---	---
6	641.10	30.12	46.00	-15.88	30.38	-0.26	Peak	---	---
7	721.61	31.15	46.00	-14.85	30.03	1.12	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

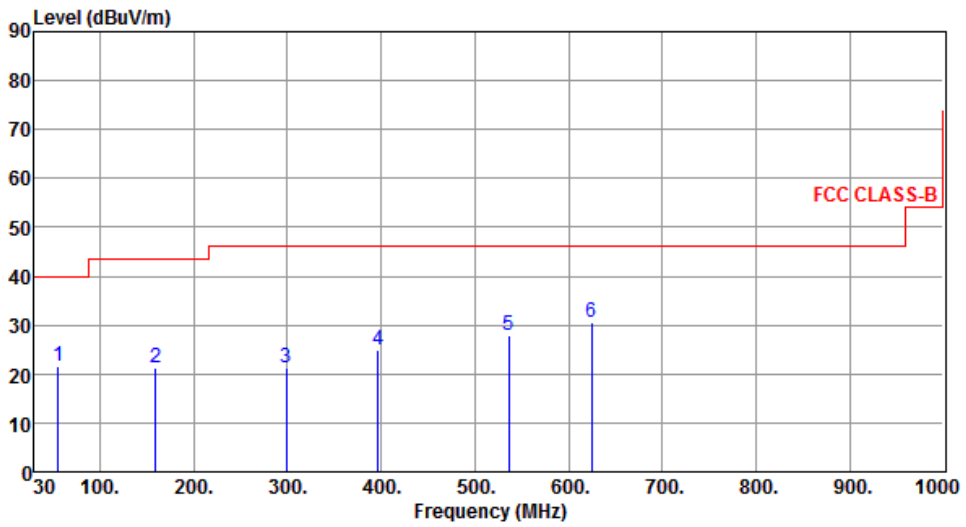
Modulation / SF	CSS / 10	Test Freq. (MHz)	908.5
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	30.00	22.93	40.00	-17.07	31.76	-8.83	Peak	---	---
2	145.43	20.92	43.50	-22.58	29.42	-8.50	Peak	---	---
3	370.47	23.94	46.00	-22.06	29.75	-5.81	Peak	---	---
4	485.90	26.72	46.00	-19.28	29.83	-3.11	Peak	---	---
5	586.78	28.75	46.00	-17.25	29.75	-1.00	Peak	---	---
6	674.08	29.74	46.00	-16.26	29.51	0.23	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

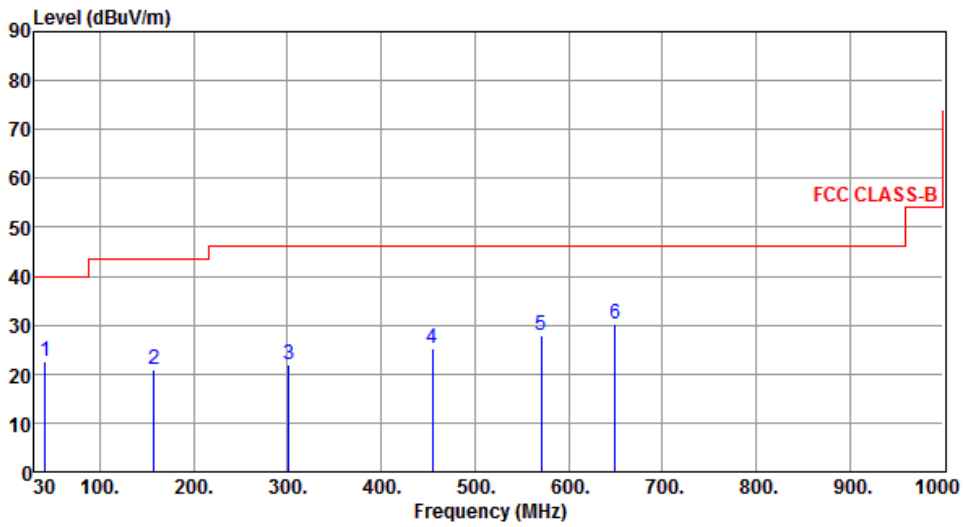
Modulation / SF	CSS / 10	Test Freq. (MHz)	914.9
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	55.22	21.57	40.00	-18.43	29.70	-8.13	Peak	---	---
2	159.01	21.19	43.50	-22.31	29.43	-8.24	Peak	---	---
3	298.69	21.25	46.00	-24.75	28.95	-7.70	Peak	---	---
4	396.66	24.84	46.00	-21.16	29.89	-5.05	Peak	---	---
5	536.34	27.83	46.00	-18.17	29.88	-2.05	Peak	---	---
6	624.61	30.48	46.00	-15.52	30.92	-0.44	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Modulation / SF	CSS / 10	Test Freq. (MHz)	914.9
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	41.64	22.67	40.00	-17.33	30.73	-8.06	Peak	---	---
2	158.04	21.07	43.50	-22.43	29.31	-8.24	Peak	---	---
3	301.60	22.04	46.00	-23.96	29.67	-7.63	Peak	---	---
4	454.86	25.34	46.00	-20.66	29.03	-3.69	Peak	---	---
5	571.26	27.76	46.00	-18.24	29.08	-1.32	Peak	---	---
6	649.83	30.16	46.00	-15.84	30.32	-0.16	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

3.2 Unwanted Emissions into Non-Restricted Frequency Bands

3.2.1 Limit of Unwanted Emissions into Non-Restricted Frequency Bands

The peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz.

3.2.2 Test Procedures

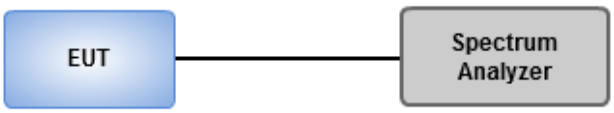
Reference Level Measurement

1. Set the RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Set Sweep time = auto couple, Trace mode = max hold.
3. Allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

Unwanted Emissions Level Measurement

1. Set RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Trace Mode = max hold, Sweep = auto couple.
3. Allow the trace to stabilize.
4. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

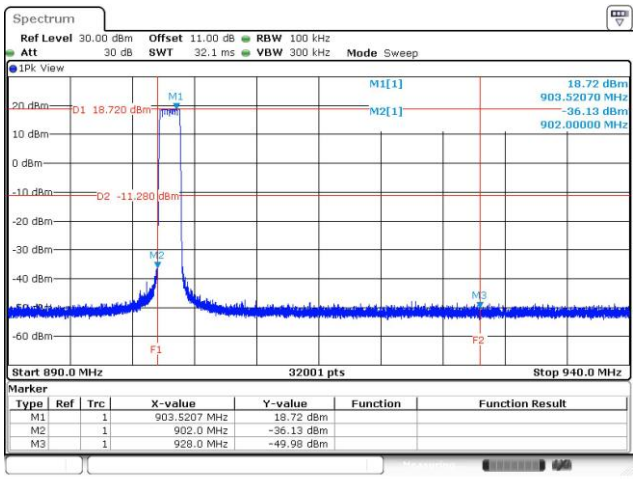
3.2.3 Test Setup

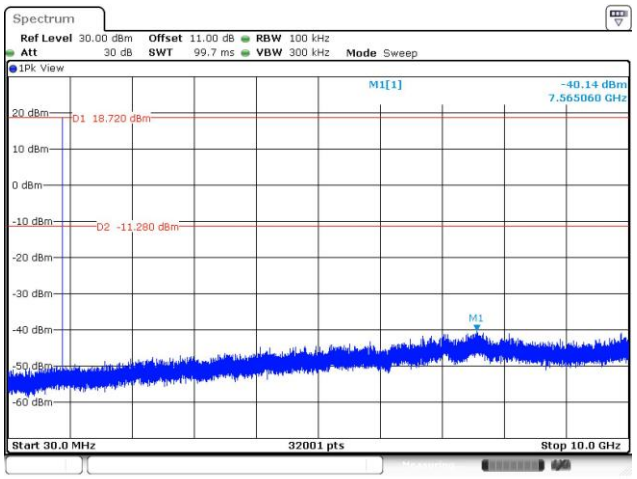


3.2.4 Unwanted Emissions into Non-Restricted Frequency Bands

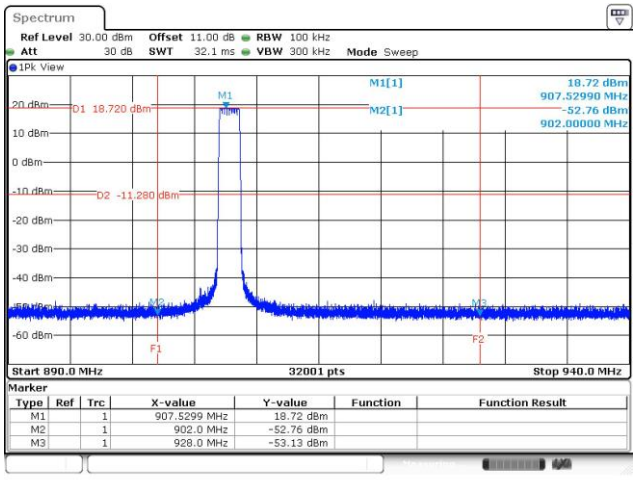
Hopping on

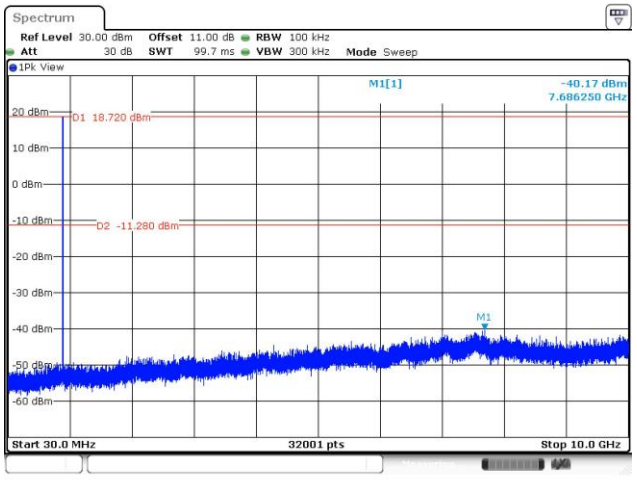
TX Frequency 902.3~903.7-1MHz / 30MHz~10GHz (down 30dBc)



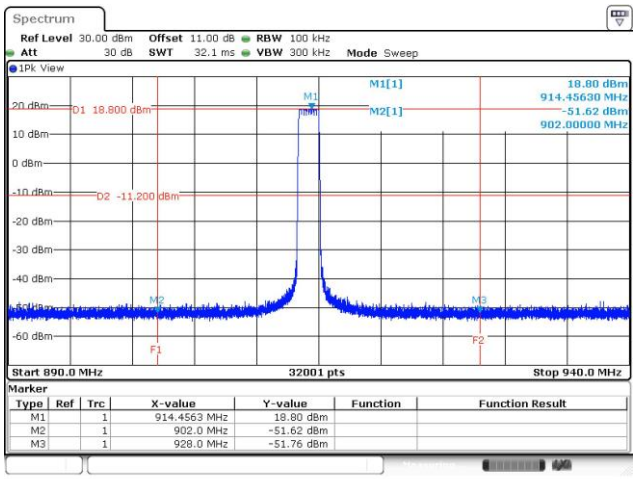


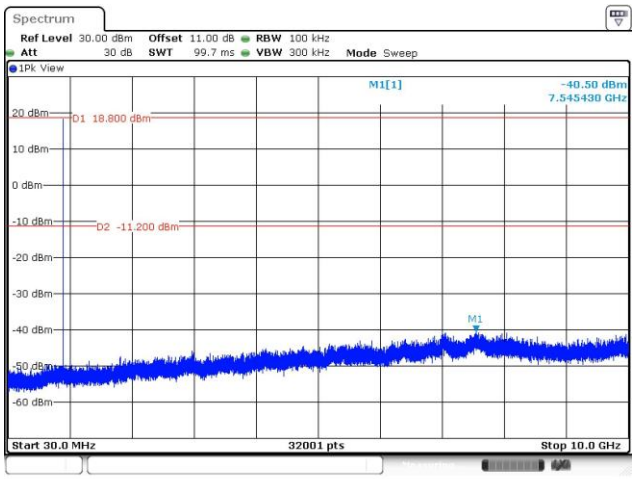
TX Frequency 907.1~908.5MHz / 30MHz~10GHz (down 30dBc)





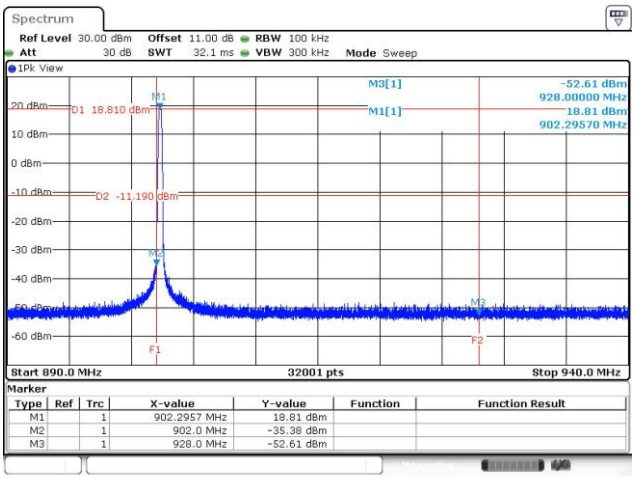
TX Frequency 913.5~914.9MHz / 30MHz~10GHz (down 30dBc)

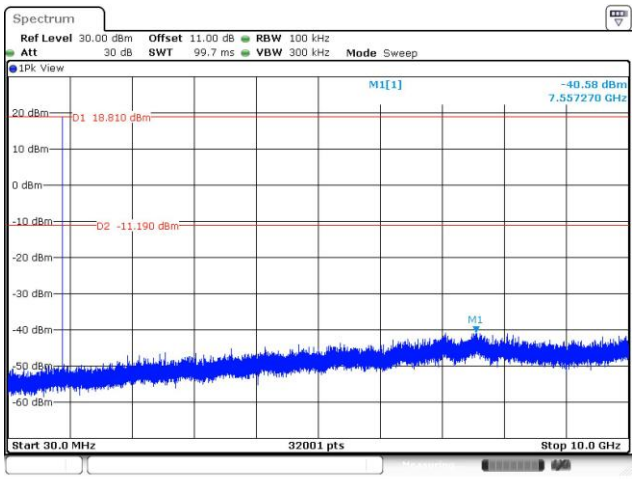




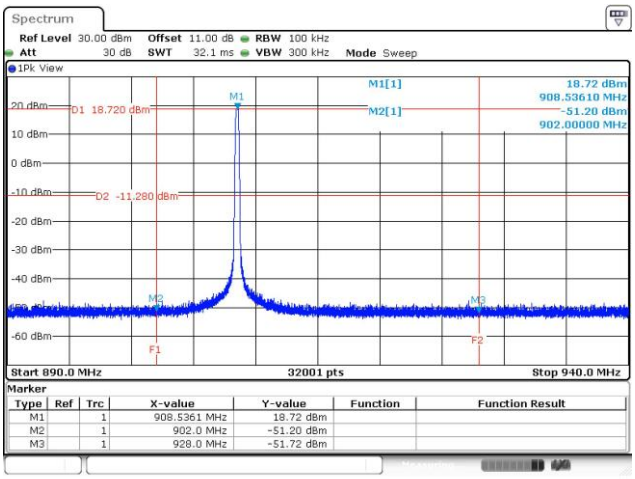
Hopping off

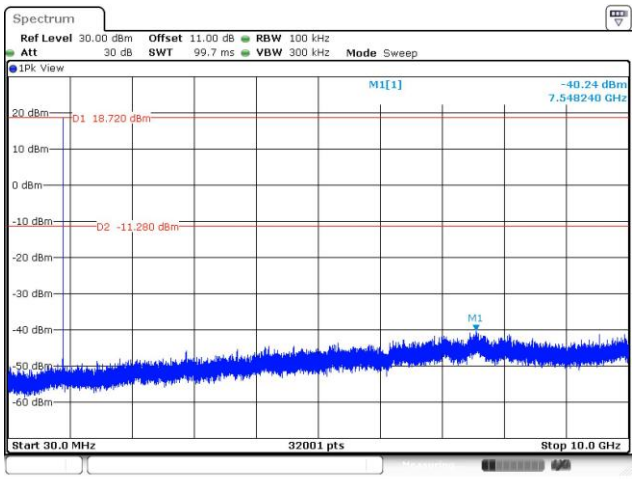
TX Frequency 902.3MHz / 30MHz~10GHz (down 30dBc)



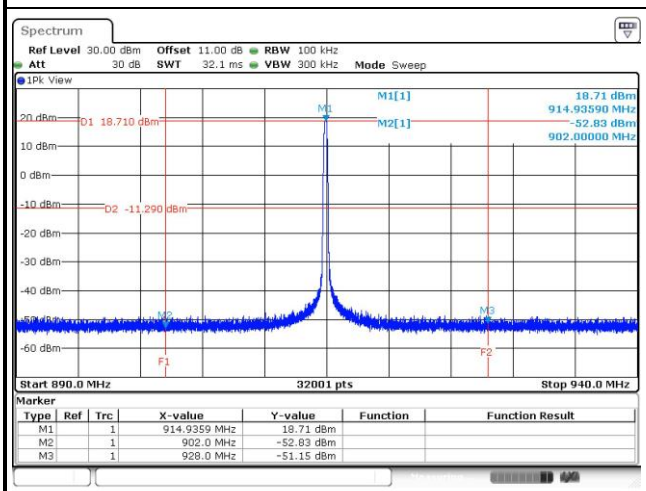


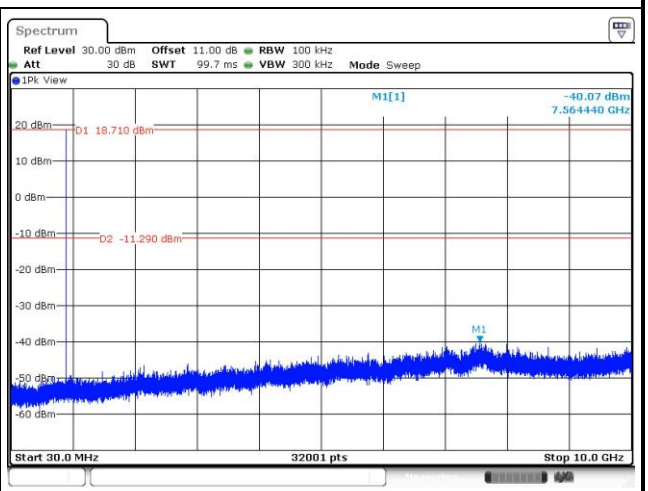
TX Frequency 908.5MHz / 30MHz~10GHz (down 30dBc)





TX Frequency 914.9MHz / 30MHz~10GHz (down 30dBc)





3.3 Conducted Output Power

3.3.1 Limit of Conducted Output Power

☒ 1 Watt, systems employing at least 50 hopping channels;

☐ 0.25 Watt, for systems employing less than 50 hopping channels, but at least 25 hopping channels,

3.3.2 Test Procedures

1. A wideband power meter is used for power measurement. Bandwidth of power senor and meter is 50MHz
2. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power

3.3.3 Test Setup

3.3.4 Test Result of Conducted Output Power

Modulation / SF	Freq. (MHz)	Output Power (mW)	Output Power (dBm)	Limit (W)
CSS / 10	902.3	82.99	19.19	1
CSS / 10	908.5	83.18	19.20	1
CSS / 10	914.9	82.99	19.19	1

3.4 Number of Hopping Frequency

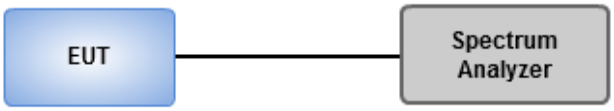
3.4.1 Limit of Number of Hopping Frequency

Number of Hopping Frequencies Limit for Frequency Hopping Systems		
☒	902-928 MHz Band:	
	☐	N ≥ 50, 20 dB bandwidth of the hopping channel is less than 250 kHz
	☐	N ≥ 25, 20 dB bandwidth of the hopping channel is 250 kHz or greater
	☒	Hybrid mode, No minimum number of hopping channels associated with hybrid system.
N: Number of Hopping Frequencies		

3.4.2 Test Procedures

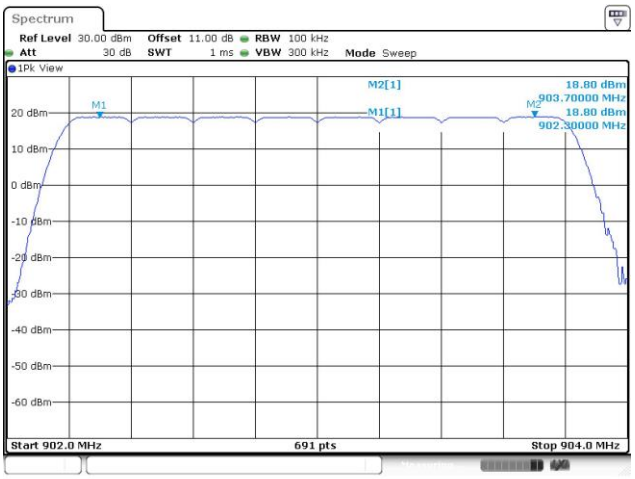
1. Set RBW = 100kHz, VBW = 300kHz, Sweep time = Auto, Detector = Peak Trace max hold.
2 Allow trace to stabilize.

3.4.3 Test Setup

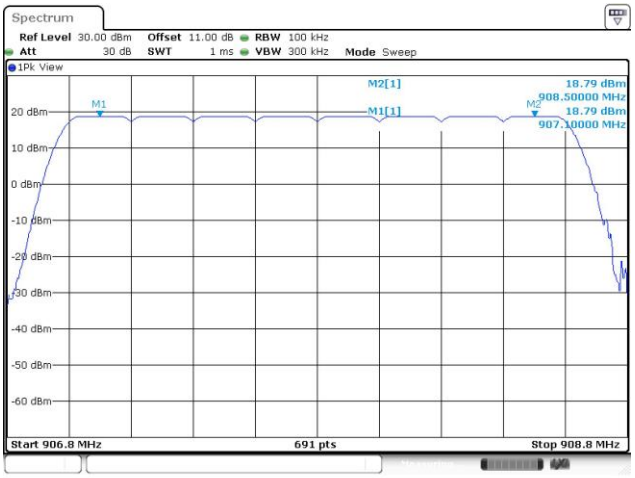


3.4.4 Test Result of Number of Hopping Frequency

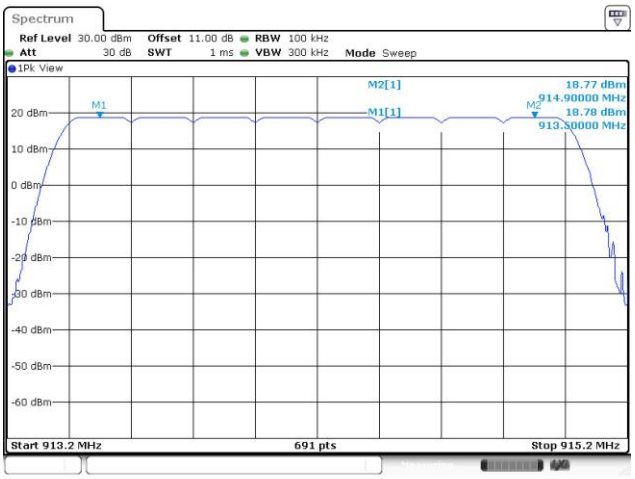
TX Frequency 902.3~903.7-1MHz



TX Frequency 907.1~908.5MHz



TX Frequency 913.5~914.9MHz



3.5 20dB and Occupied Bandwidth

3.5.1 Test Procedures

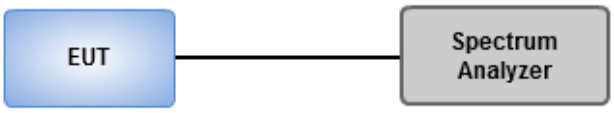
20dB Bandwidth

1. Set RBW=3kHz, VBW=10kHz, Sweep time=Auto, Detector=Peak Trace max hold.
2 Allow trace to stabilize.
3 Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

Occupied Bandwidth

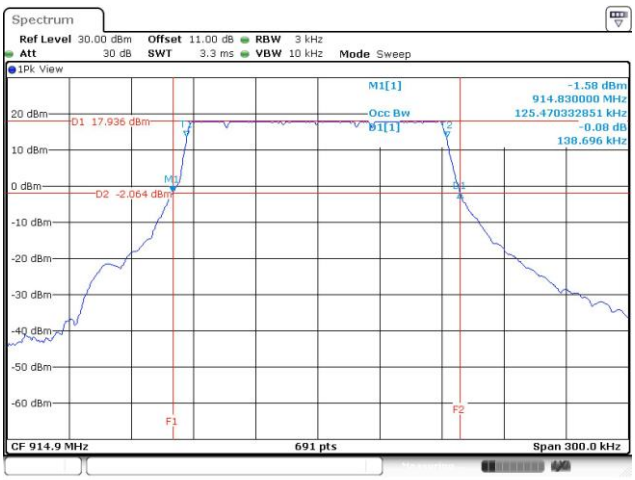
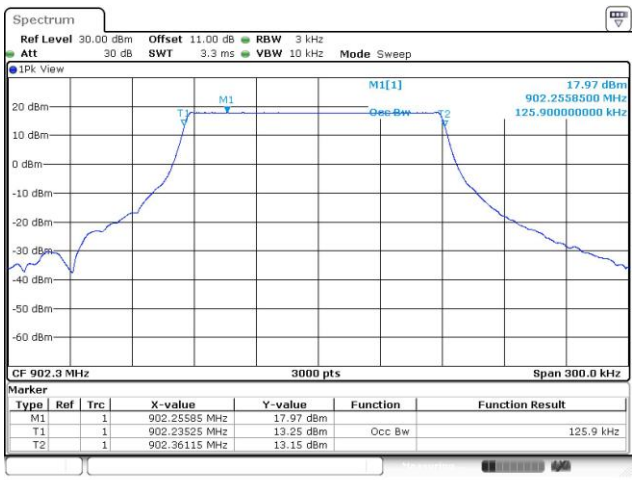
1. Set RBW=3kHz, VBW=10kHz,Sweep time = Auto, Detector=Sample, Trace max hold
2 Allow trace to stabilize
3. Use Occupied bandwidth function of spectrum analyzer to measuring 99% occupied bandwidth

3.5.2 Test Setup



3.5.3 Test result of 20dB and Occupied Bandwidth

Modulation / SF	Freq. (MHz)	20dB Bandwidth (kHz)	Occupied Bandwidth (kHz)
CSS / 10	902.3	137.83	125.90
CSS / 10	908.5	138.26	125.60
CSS / 10	914.9	138.70	125.50

Worst Plot of 20dB Bandwidth	Worst Plot of Occupied Bandwidth
	

3.6 Channel Separation

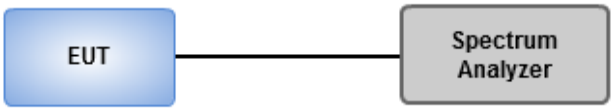
3.6.1 Limit of Channel Separation

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

3.6.2 Test Procedures

1. Set RBW=10kHz, VBW=30kHz, Sweep time=Auto, Detector=Peak Trace max hold.
2 Allow trace to stabilize.
3 Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The EUT shall show compliance with the appropriate regulatory limit

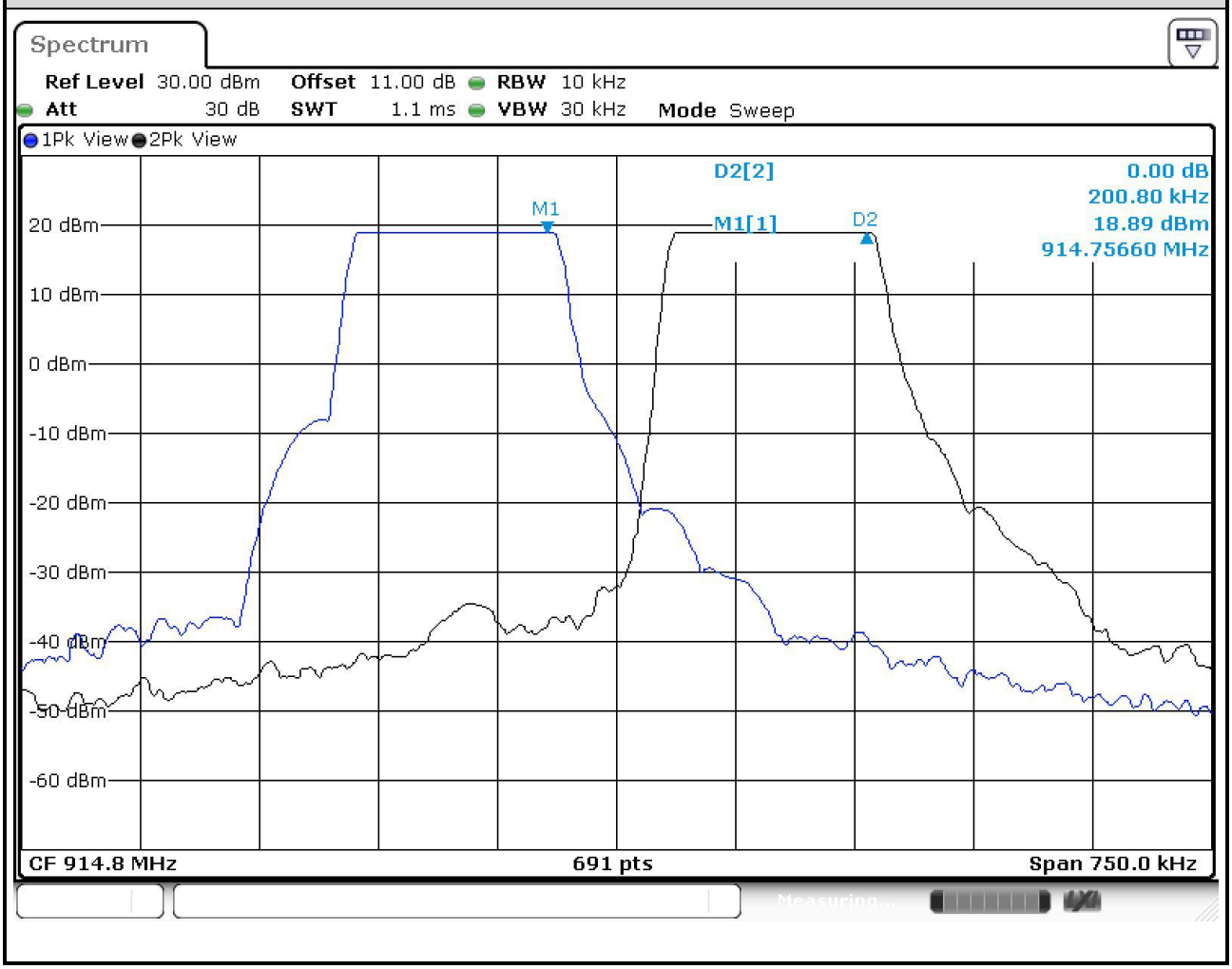
3.6.3 Test Setup



3.6.4 Test result of Channel Separation

Modulation / SF	Freq. (MHz)	Adjacent Channel Separation (kHz)	20dB Bandwidth (kHz)	Pass/Fail
CSS / 10	902.3	200.08	137.83	Pass
CSS / 10	908.5	200.08	138.26	Pass
CSS / 10	914.9	200.08	138.70	Pass

Worst Plot



3.7 Number of Dwell Time

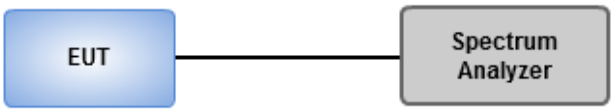
3.7.1 Limit of Dwell time

Time of Occupancy (Dwell Time) Limit for Frequency Hopping Systems	
☒	902-928 MHz Band:
	☐ ≤ 0.4 second within a 20 second period, 20 dB bandwidth of the hopping channel is less than 250 kHz
	☐ ≤ 0.4 second within a 10 second period, 20 dB bandwidth of the hopping channel is 250 kHz or greater
	☒ Hybrid mode ,an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4

3.7.2 Test Procedures

1. Set RBW=100kHz, VBW=300kHz, Sweep time=6.4s / 500ms, Detector=Peak, Span=0Hz, Trace max hold.
2. Measure and record the burst on time.

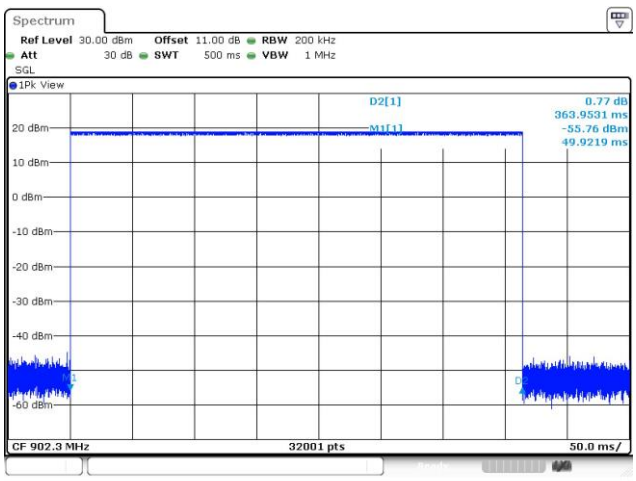
3.7.3 Test Setup

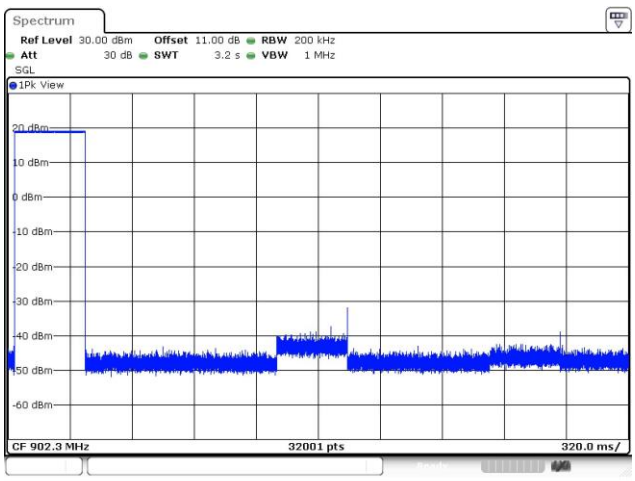


3.7.4 Test Result of Dwell Time

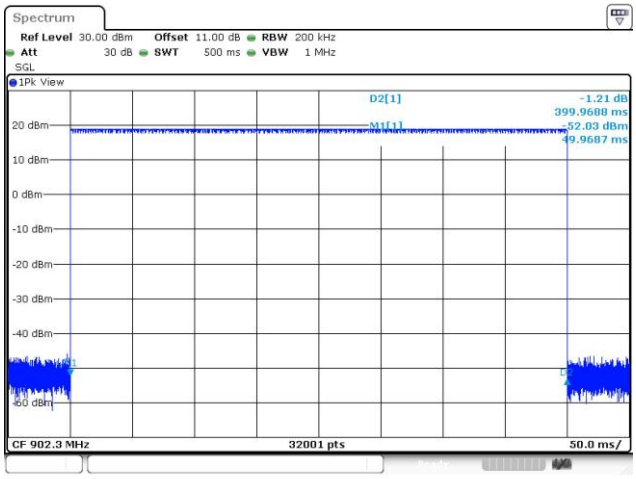
Modulation / SF	Freq. (MHz)	Length of Transmission Time (sec)	Number of Transmission in a 3.2 s (8 Hopping*0.4s)	Result (s)	Limit (s)
CSS / 7	902.3	0.363953	1	0.36395	0.4
CSS / 8	902.3	0.399969	1	0.39997	0.4
CSS / 9	902.3	0.390234	1	0.39023	0.4
CSS / 10	902.3	0.370859	1	0.37086	0.4

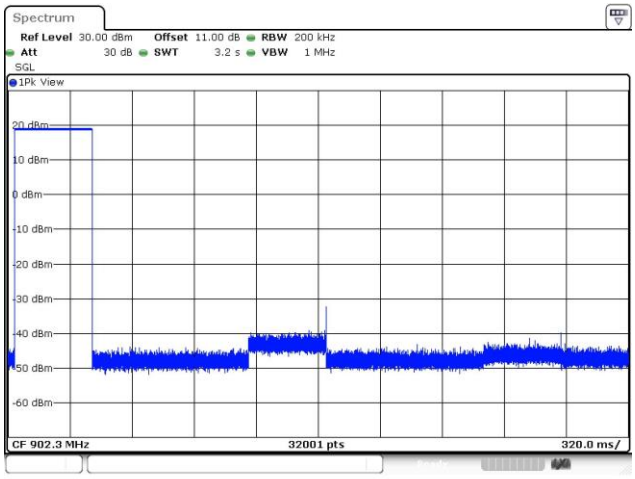
SF 7



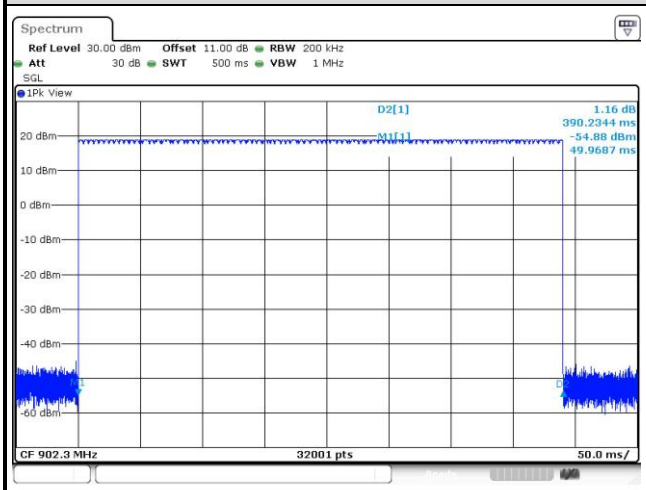


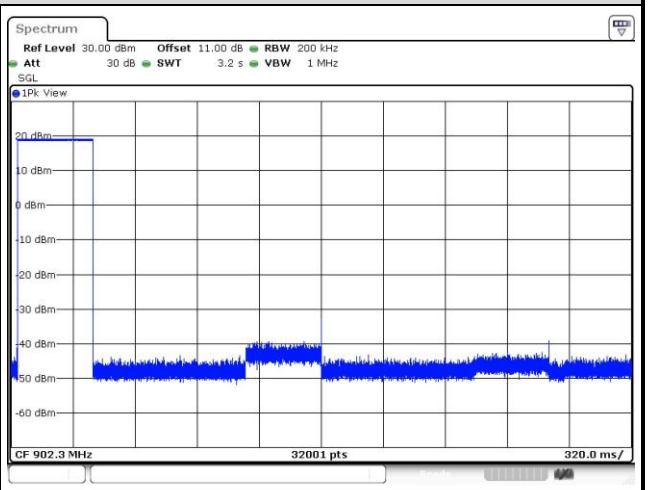
SF 8



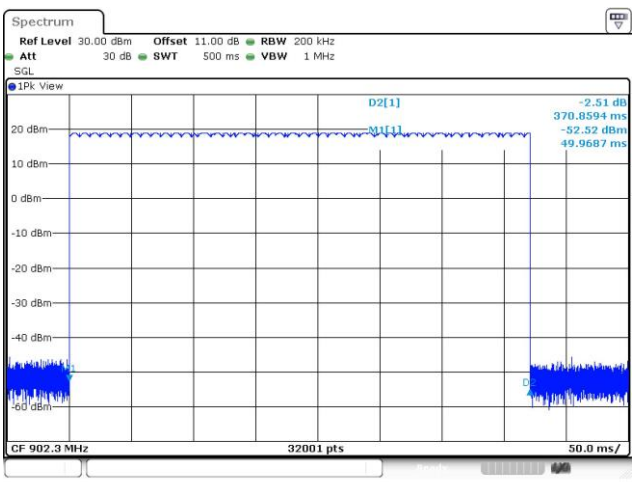


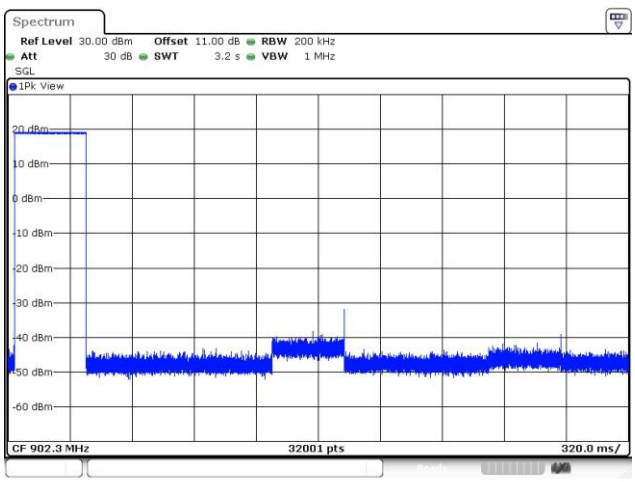
SF 9


Spectrum
Ref Level 30.00 dBm Offset 11.00 dB RBW 200 kHz
Att 30 dB SWT 500 ms VBW 1 MHz
SGL
1Pk View
D2[1] 1.16 dB
390.2344 ms
M1[1] -54.88 dBm
49.9687 ms
CF 902.3 MHz 32001 pts 50.0 ms/


Spectrum
Ref Level 30.00 dBm Offset 11.00 dB RBW 200 kHz
Att 30 dB SWT 3.2 s VBW 1 MHz
SGL
1Pk View
CF 902.3 MHz 32001 pts 320.0 ms/

SF 10


Spectrum
Ref Level 30.00 dBm Offset 11.00 dB RBW 200 kHz
Att 30 dB SWT 500 ms VBW 1 MHz
SGL
1Pk View
D2[1] -2.51 dB
370.8594 ms
M1[1] -52.52 dBm
49.9687 ms
CF 902.3 MHz 32001 pts 50.0 ms/


Spectrum
Ref Level 30.00 dBm Offset 11.00 dB RBW 200 kHz
Att 30 dB SWT 3.2 s VBW 1 MHz
SGL
1Pk View
CF 902.3 MHz 32001 pts 320.0 ms/

3.8 Power Spectral Density

3.8.1 Limit of Power Spectral Density

Power spectral density shall not be greater than 8 dBm in any 3 kHz band. This item is for Hybrid mode.

3.8.2 Test Procedures

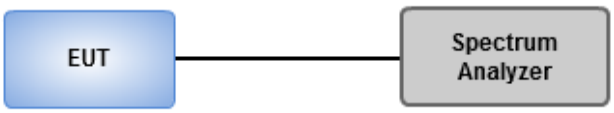
☐ Maximum peak conducted output power was used to demonstrate compliance to the fundamental output power limit.

1. Set the RBW = 3kHz, VBW = 10kHz.
2. Detector = Peak, Sweep time = auto couple.
3. Trace mode = max hold, allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

☒ Maximum (average) conducted output power was used to demonstrate compliance to the fundamental output power limit.

1. Set the RBW = 3kHz, VBW = 10 kHz.
2. Detector = RMS, Sweep time = auto couple.
3. Employ trace averaging (RMS) mode over a minimum of 100 traces
4. Use the peak marker function to determine the maximum amplitude level.

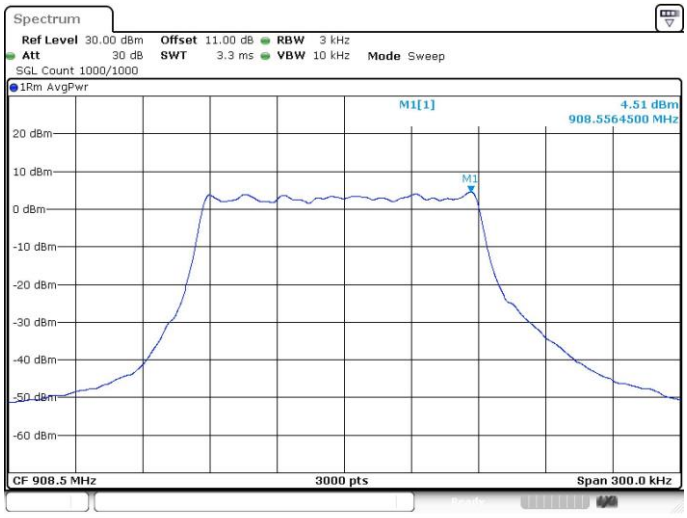
3.8.3 Test Setup



3.8.4 Test Result of Power Spectral Density

Modulation / SF	Freq. (MHz)	Total Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
CSS / 10	902.3	3.84	8.00
CSS / 10	908.5	4.51	8.00
CSS / 10	914.9	4.35	8.00

Worst Plot



4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website http://www.icertifi.com.tw.

Linkou	**Kwei Shan**	**Kwei Shan Site II**
Tel: 886-2-2601-1640	Tel: 886-3-271-8666	Tel: 886-3-271-8640
No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C.	No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.	No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information.

Tel: 886-3-271-8666
Fax: 886-3-318-0155
Email: ICC_Service@icertifi.com.tw

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