FCC Test Report

FCC ID	:	**MXF-WAPS232N**
Equipment	:	**RFID IOT Access Point**
Model No.	:	**WAPS-232N**
Brand Name	:	**Gemtek**
Applicant	:	**Gemtek Technology Co., Ltd.**
Address	:	**No.15-1 Zhoughua Rd, Hsinchu Industrial Park, Hukou, Hsinchu, Taiwan, R.O.C**
Standard	:	**47 CFR FCC Part 15.247**
Received Date	:	**Jun. 22, 2015**
Tested Date	:	**Nov. 26 ~ Dec. 02, 2015**

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.

Approved & Reviewed by:

Gary Chang / Manager

Testing Laboratory
2732

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Release Record

Report No.	Version	Description	Issued Date
FR562201-03-1	Rev. 01	Initial issue	Apr. 08, 2016

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.433MHz 34.40 (Margin -12.80dB) - AV	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 665.35MHz 44.63 (Margin -1.37dB) - PK	Pass
15.247(d)	Band Edge	Meet the requirement of limit	Pass
15.247(b)(2)(3)	Conducted Output Power	Power [dBm]: 23.27	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

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information						
Frequency Range (MHz)	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N_{TX})	Data Rate(bit/sec)	Spread Factor	Channel spacing (kHz)
902 ~ 928	902.3 ~ 924.375	1-90 [80]	1	977 ~ 5469	10 ~ 7	200 / 250
Note 1: RF output power specifies thatMaximum Conducted (Average) Output Power. Note 2: The device uses CSS modulation.						

1.1.2 Antenna Details

Ant. No.	Brand	Model	Type	Gain (dBi)	Connector	Remark
1	TSKY Co., Ltd.	A8-A003-00108	Dipole	-0.4	N -Type Male	---

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	55Vdc from POE

1.1.4 Accessories

Accessories		
No.	**Equipment**	**Description**
1	POE	Brand Name: Microsemi Model Name: PD-9001GR/AC Power Rating: I/P: 100-240Vac, 50-60Hz, 0.67A O/P: 55Vdc, 0.6A

1.1.5 Channel List

Channel spacing									
200 kHz								250 kHz	
Group 1		Group 2		Group 3		Group 4		Group 5	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	902.3	19	905.5	37	908.7	55	911.9	73	920.625
2	902.5	20	905.7	38	908.9	56	912.1	74	920.875
3	902.7	21	905.9	39	909.1	57	912.3	75	921.125
4	902.9	22	906.1	40	909.3	58	912.5	76	921.375
6	903.1	24	906.3	42	909.5	60	912.7	77	921.625
7	903.3	25	906.5	43	909.7	61	912.9	78	921.875
8	903.5	26	906.7	44	909.9	62	913.1	80	922.125
9	903.7	27	906.9	45	910.1	63	913.3	81	922.375
10	903.9	28	907.1	46	910.3	64	913.5	82	922.625
11	904.1	29	907.3	47	910.5	65	913.7	83	922.875
12	904.3	30	907.5	48	910.7	66	913.9	84	923.125
13	904.5	31	907.7	49	910.9	67	914.1	85	923.375
15	904.7	33	907.9	51	911.1	69	914.3	87	923.625
16	904.9	34	908.1	52	911.3	70	914.5	88	923.875
17	905.1	35	908.3	53	911.5	71	914.7	89	924.125
18	905.3	36	908.5	54	911.7	72	914.9	90	924.375

1.1.6 Test Tool and Duty Cycle

Test Tool	Putty, Ver. 0.60.0.0

1.1.7 Power Setting

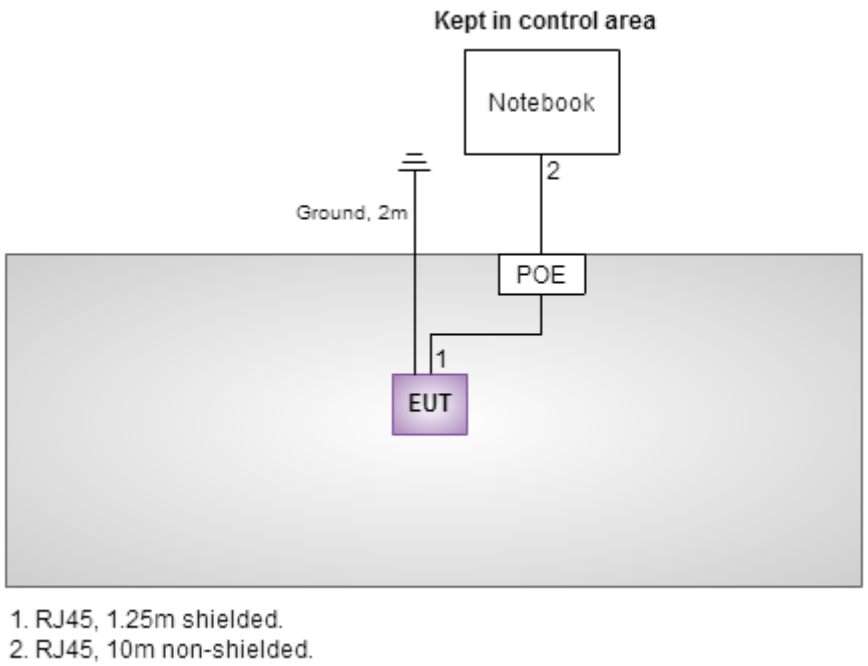
Modulation Mode	Test Frequency (MHz)		
	902.3	910.1	924.375
CSS	9	10	10

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	RJ45, 10m non-shielded.

1.3 Test Setup Chart

Test Setup Diagram



1. RJ45, 1.25m shielded.
2. RJ45, 10m non-shielded.

1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
EMC Receiver	R&S	ESCS 30	100169	Oct. 21, 2015	Oct. 20, 2016
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 13, 2015	Nov. 12, 2016
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Dec. 31, 2014	Dec. 30, 2015
Measurement Software	AUDIX	e3	6.120210k	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101498	Dec. 09, 2014	Dec. 08, 2015
Receiver	R&S	ESR3	101658	Nov. 04, 2015	Nov. 03, 2016
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Aug. 20, 2015	Aug. 19, 2016
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 11, 2014	Dec. 10, 2015
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 04, 2015	Nov. 03, 2016
Loop Antenna	R&S	HFH2-Z2	11900	Nov. 16, 2015	Nov. 15, 2016
Preamplifier	Burgeon	BPA-530	SN:100219	Sep. 10, 2015	Sep. 09, 2016
Preamplifier	Agilent	83017A	MY39501308	Oct. 02, 2015	Oct. 01, 2016
Preamplifier	EMC	EMC184045B	980192	Sep. 01, 2015	Aug. 31, 2016
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Dec. 15, 2014	Dec. 14, 2015
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Dec. 15, 2014	Dec. 14, 2015
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16139/4	Dec. 15, 2014	Dec. 14, 2015
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Dec. 15, 2014	Dec. 14, 2015
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Dec. 15, 2014	Dec. 14, 2015
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)				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101063	Feb. 03, 2015	Feb. 02, 2016
Power Meter	Anritsu	ML2495A	1241002	Sep. 21, 2015	Sep. 20, 2016
Power Sensor	Anritsu	MA2411B	1207366	Sep. 21, 2015	Sep. 20, 2016
Signal Generator	R&S	SMB100A	175727	Oct. 05, 2015	Oct. 04, 2016
Measurement Software	Sporton	Sporton_1	1.3.30	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
FCC Public notice DA 00-705
ANSI C63.10-2013

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	±3.72 dB
Radiated emission > 1GHz	±5.65 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	22°C / 49%	Peter Lin
Radiated Emissions	03CH01-WS	21-23°C / 61-65%	Aska Huang Warren Lee
RF Conducted	TH01-WS	22°C / 64%	Alex Huang

- 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)	Modulation / SF	Test Configuration
Conducted Emissions	902.3 / 910.1 / 924.375	CSS / 10	---
Radiated Emissions ≤ 1GHz	902.3 / 910.1 / 924.375	CSS / 10	---
Radiated Emissions > 1GHz Conducted Output Power	902.3 / 910.1 / 924.375	CSS / 10	---
Number of Hopping Channels	902.3 ~ 924.375	CSS / 10	---
Hopping Channel Separation	902.3 / 910.1 / 914.9 920.625 / 924.375	CSS / 10	---
Dwell Time	902.7 / 906.9 / 910.1 / 913.3 / 922.375	CSS: 10 / 9 / 8 / 7	---
Power spectral density	902.3 / 910.1 / 924.375	CSS / 10	---

3 Transmitter Test Results

3.1 Conducted Emissions

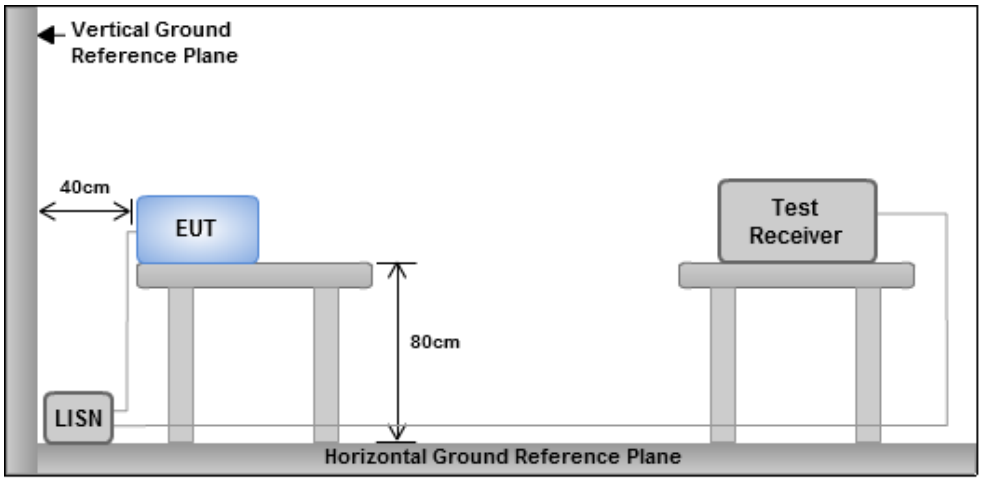
3.1.1 Limit of Conducted Emissions

Conducted Emissions Limit		
Frequency Emission (MHz)	**Quasi-Peak**	**Average**
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50
Note 1: * Decreases with the logarithm of the frequency.		

3.1.2 Test Procedures

1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50 Ω LISN port.
3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
4. This measurement was performed with AC 120V/60Hz

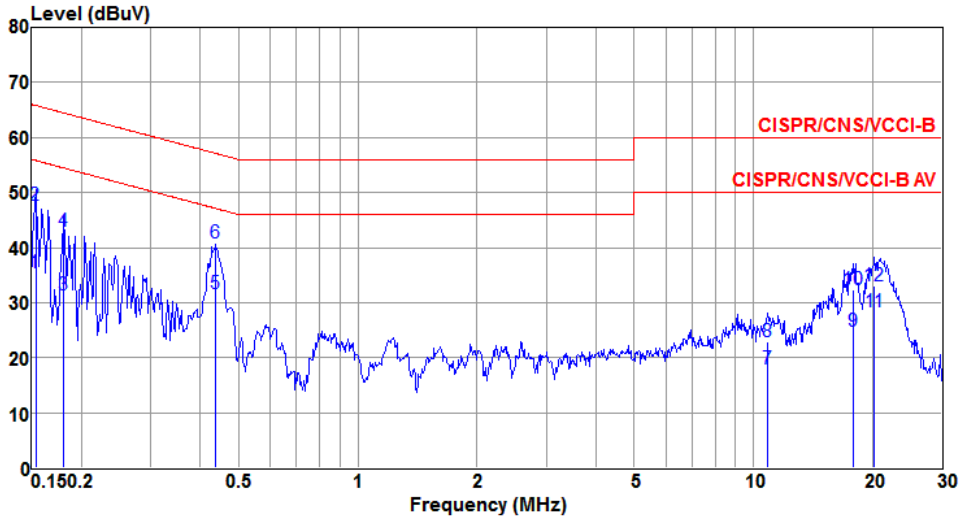
3.1.3 Test Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

3.1.4 Test Result of Conducted Emissions

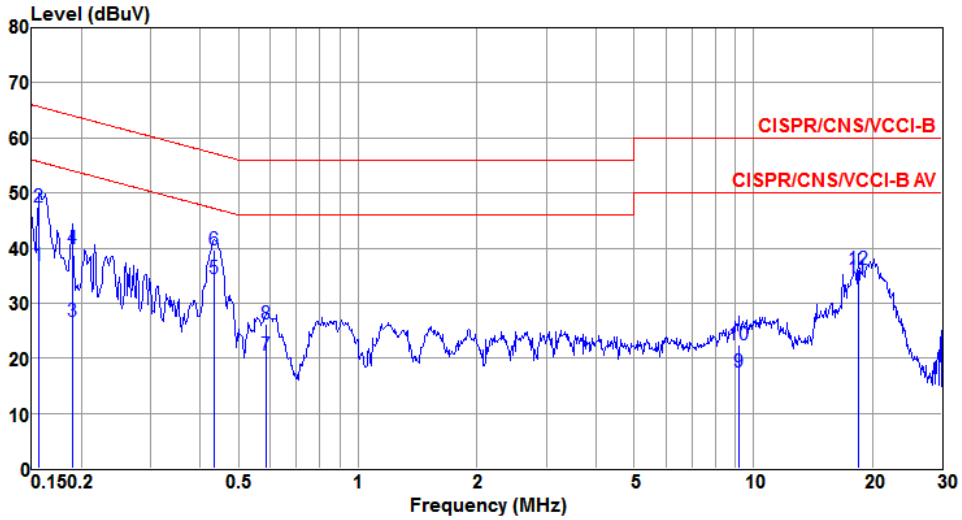
Modulation / SF	CSS / 10	Test Freq. (MHz)	902.3
Power Phase	Line		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.153	35.44	55.82	-20.38	35.31	0.11	0.02	Average
2	0.153	47.74	65.82	-18.08	47.61	0.11	0.02	QP
3	0.181	31.34	54.46	-23.12	31.21	0.11	0.02	Average
4	0.181	42.89	64.46	-21.57	42.76	0.11	0.02	QP
5@	0.437	31.58	47.11	-15.53	31.42	0.13	0.03	Average
6	0.437	40.81	57.11	-16.30	40.65	0.13	0.03	QP
7	10.847	18.03	50.00	-31.97	17.60	0.26	0.17	Average
8	10.847	23.00	60.00	-37.00	22.57	0.26	0.17	QP
9	17.944	24.72	50.00	-25.28	24.19	0.35	0.18	Average
10	17.944	32.42	60.00	-27.58	31.89	0.35	0.18	QP
11	20.270	28.24	50.00	-21.76	27.69	0.37	0.18	Average
12	20.270	32.97	60.00	-27.03	32.42	0.37	0.18	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

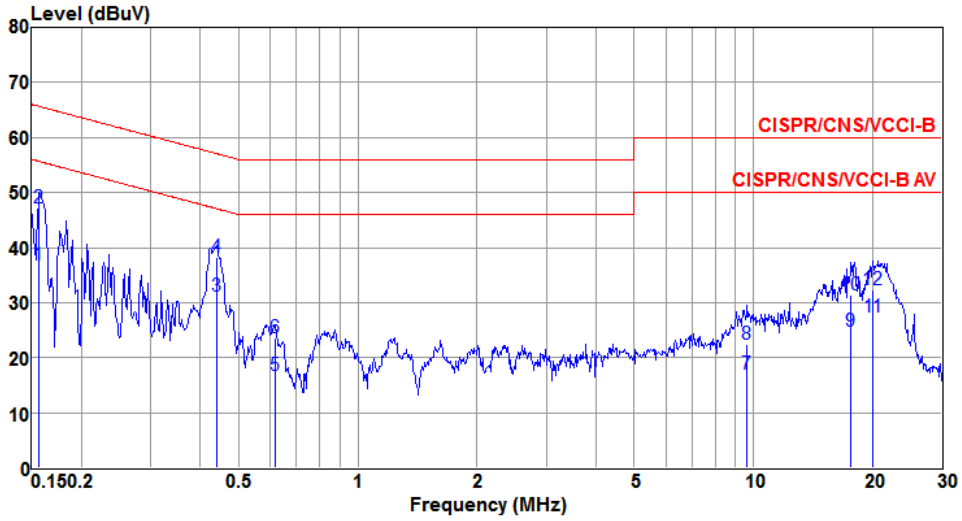
Modulation / SF	CSS / 10	Test Freq. (MHz)	902.3
Power Phase	Neutral		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.156	36.77	55.65	-18.88	36.62	0.13	0.02	Average
2	0.156	47.41	65.65	-18.24	47.26	0.13	0.02	QP
3	0.189	26.61	54.06	-27.45	26.48	0.11	0.02	Average
4	0.189	39.96	64.06	-24.10	39.83	0.11	0.02	QP
5@	0.433	34.40	47.20	-12.80	34.23	0.14	0.03	Average
6	0.433	39.77	57.20	-17.43	39.60	0.14	0.03	QP
7	0.589	20.56	46.00	-25.44	20.38	0.14	0.04	Average
8	0.589	26.16	56.00	-29.84	25.98	0.14	0.04	QP
9	9.204	17.37	50.00	-32.63	16.95	0.26	0.16	Average
10	9.204	22.53	60.00	-37.47	22.11	0.26	0.16	QP
11	18.432	34.52	50.00	-15.48	33.96	0.38	0.18	Average
12	18.432	36.01	60.00	-23.99	35.45	0.38	0.18	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

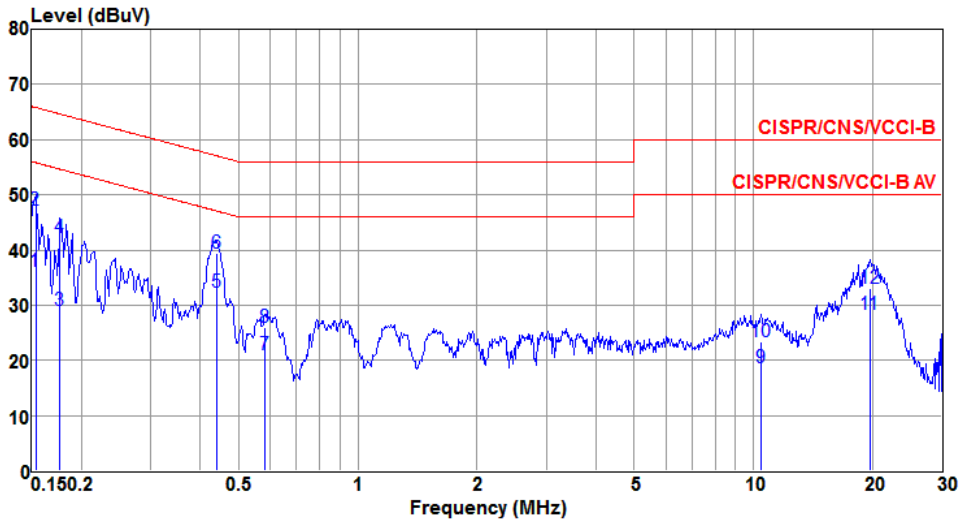
Modulation / SF	CSS / 10	Test Freq. (MHz)	910.1
Power Phase	Line		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.156	36.91	55.65	-18.74	36.78	0.11	0.02	Average
2	0.156	47.26	65.65	-18.39	47.13	0.11	0.02	QP
3@	0.440	31.09	47.07	-15.98	30.93	0.13	0.03	Average
4	0.440	38.14	57.07	-18.93	37.98	0.13	0.03	QP
5	0.617	16.69	46.00	-29.31	16.52	0.13	0.04	Average
6	0.617	23.53	56.00	-32.47	23.36	0.13	0.04	QP
7	9.654	16.99	50.00	-33.01	16.59	0.24	0.16	Average
8	9.654	22.35	60.00	-37.65	21.95	0.24	0.16	QP
9	17.661	24.75	50.00	-25.25	24.21	0.35	0.19	Average
10	17.661	31.29	60.00	-28.71	30.75	0.35	0.19	QP
11	20.056	27.49	50.00	-22.51	26.95	0.37	0.17	Average
12	20.056	32.37	60.00	-27.63	31.83	0.37	0.17	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

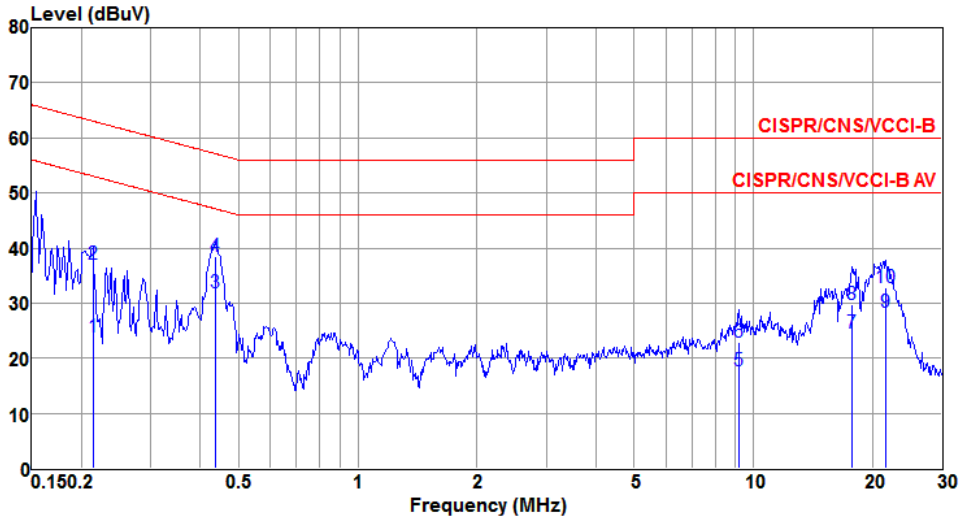
Modulation / SF	CSS / 10	Test Freq. (MHz)	910.1
Power Phase	Neutral		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.153	36.03	55.82	-19.79	35.88	0.13	0.02	Average
2	0.153	47.23	65.82	-18.59	47.08	0.13	0.02	QP
3	0.177	28.95	54.64	-25.69	28.82	0.11	0.02	Average
4	0.177	42.28	64.64	-22.36	42.15	0.11	0.02	QP
5@	0.440	32.32	47.07	-14.75	32.15	0.14	0.03	Average
6	0.440	39.35	57.07	-17.72	39.18	0.14	0.03	QP
7	0.582	20.95	46.00	-25.05	20.77	0.14	0.04	Average
8	0.582	26.08	56.00	-29.92	25.90	0.14	0.04	QP
9	10.452	18.60	50.00	-31.40	18.16	0.28	0.16	Average
10	10.452	23.35	60.00	-36.65	22.91	0.28	0.16	QP
11	19.740	28.32	50.00	-21.68	27.75	0.40	0.17	Average
12	19.740	33.02	60.00	-26.98	32.45	0.40	0.17	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

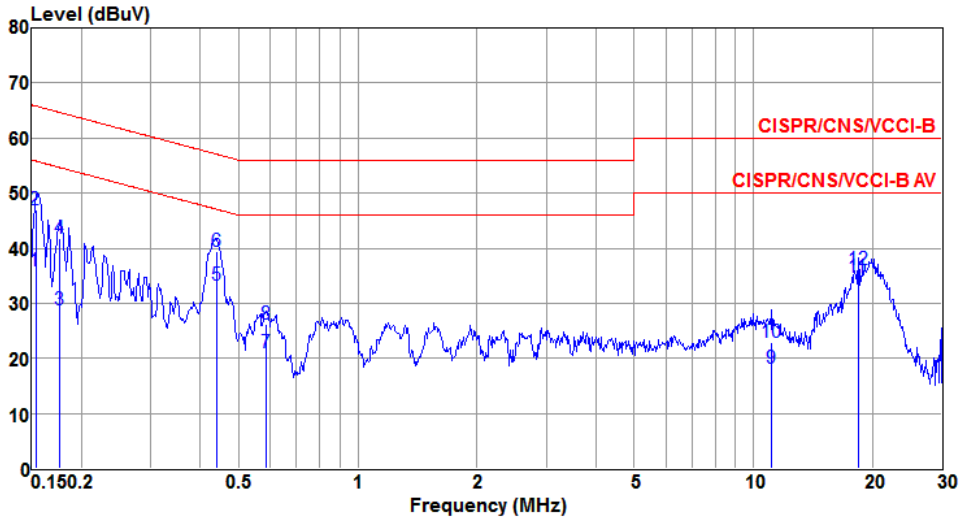
Modulation / SF	CSS / 10	Test Freq. (MHz)	924.375
Power Phase	Line		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.214	23.90	53.05	-29.15	23.77	0.11	0.02	Average
2	0.214	36.99	63.05	-26.06	36.86	0.11	0.02	QP
3@	0.437	31.95	47.11	-15.16	31.79	0.13	0.03	Average
4	0.437	38.43	57.11	-18.68	38.27	0.13	0.03	QP
5	9.204	17.60	50.00	-32.40	17.20	0.24	0.16	Average
6	9.204	22.98	60.00	-37.02	22.58	0.24	0.16	QP
7	17.755	24.52	50.00	-25.48	23.98	0.35	0.19	Average
8	17.755	29.83	60.00	-30.17	29.29	0.35	0.19	QP
9	21.600	28.22	50.00	-21.78	27.63	0.39	0.20	Average
10	21.600	32.73	60.00	-27.27	32.14	0.39	0.20	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

Modulation / SF	CSS / 10	Test Freq. (MHz)	924.375
Power Phase	Neutral		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.153	35.89	55.82	-19.93	35.74	0.13	0.02	Average
2	0.153	47.07	65.82	-18.75	46.92	0.13	0.02	QP
3	0.177	28.85	54.64	-25.79	28.72	0.11	0.02	Average
4	0.177	41.68	64.64	-22.96	41.55	0.11	0.02	QP
5@	0.440	33.32	47.07	-13.75	33.15	0.14	0.03	Average
6	0.440	39.51	57.07	-17.56	39.34	0.14	0.03	QP
7	0.585	21.08	46.00	-24.92	20.90	0.14	0.04	Average
8	0.585	26.28	56.00	-29.72	26.10	0.14	0.04	QP
9	11.139	18.12	50.00	-31.88	17.66	0.29	0.17	Average
10	11.139	22.80	60.00	-37.20	22.34	0.29	0.17	QP
11	18.432	34.69	50.00	-15.31	34.13	0.38	0.18	Average
12	18.432	36.15	60.00	-23.85	35.59	0.38	0.18	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

3.2 Unwanted Emissions into Restricted Frequency Bands

3.2.1 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.

3.2.2 Test Procedures

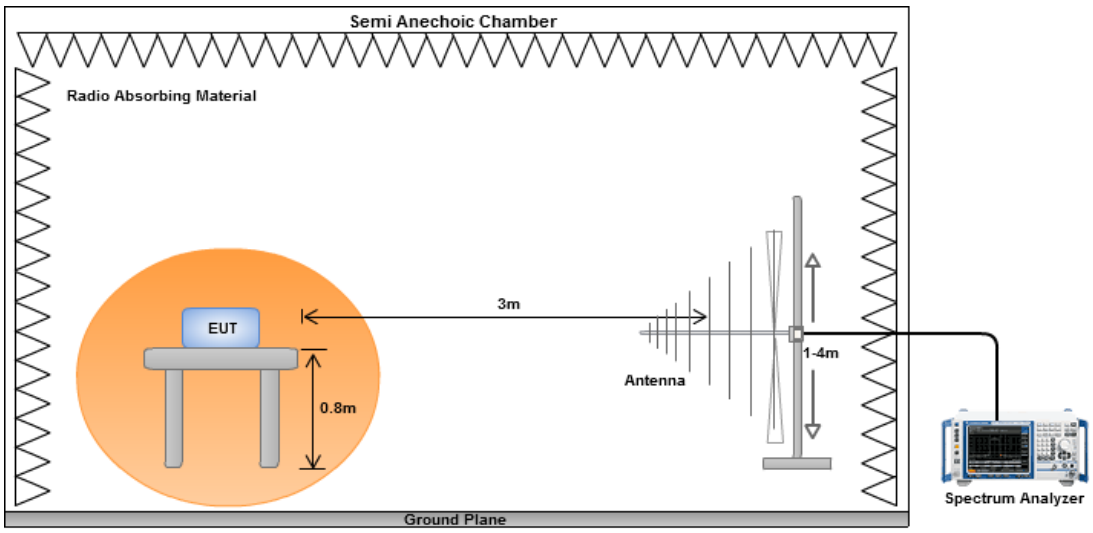
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission 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:

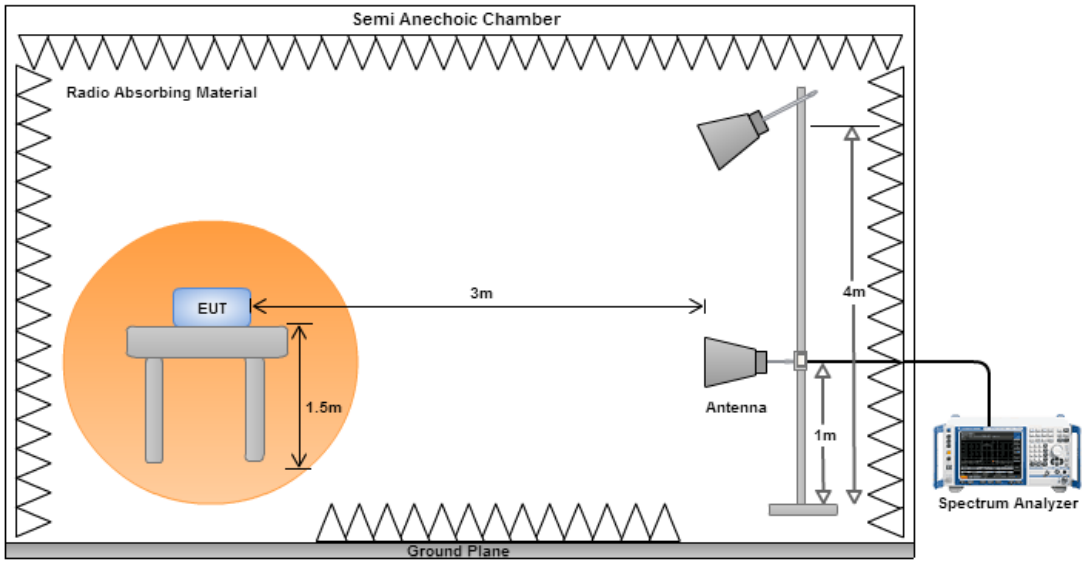
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.2.3 Test Setup

Radiated Emissions below 1 GHz

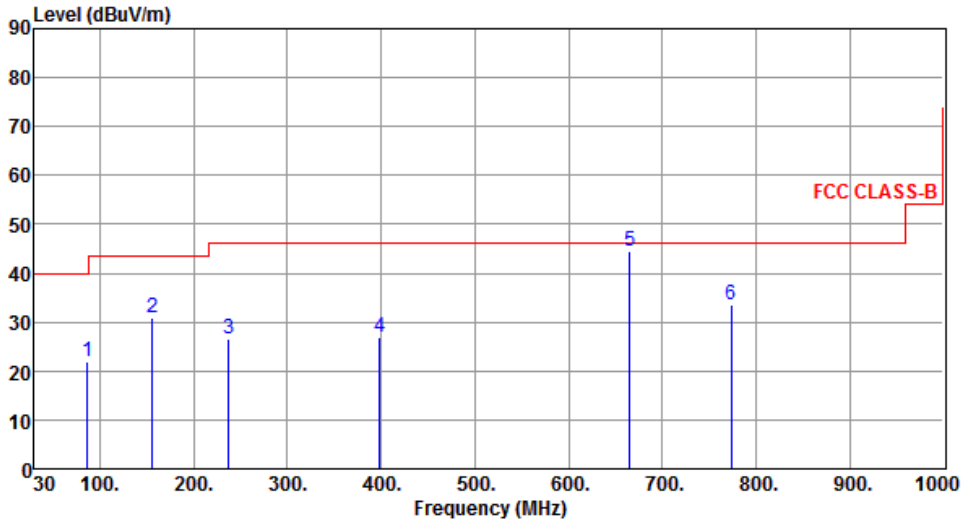


Radiated Emissions above 1 GHz



3.2.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

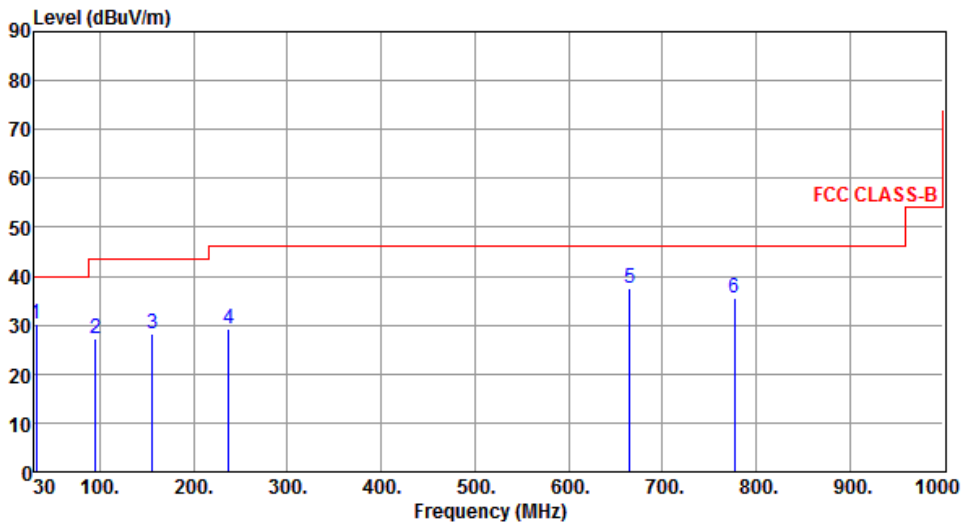
Modulation / SF	CSS / 10	Test Freq. (MHz)	902.3
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	86.26	21.84	40.00	-18.16	44.18	-22.34	Peak	---	---
2	156.10	30.79	43.50	-12.71	47.56	-16.77	Peak	---	---
3	237.58	26.50	46.00	-19.50	44.67	-18.17	Peak	---	---
4	398.60	26.83	46.00	-19.17	40.36	-13.53	Peak	---	---
5	665.35	44.63	46.00	-1.37	53.19	-8.56	Peak	---	---
6	773.99	33.48	46.00	-12.52	40.36	-6.88	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.

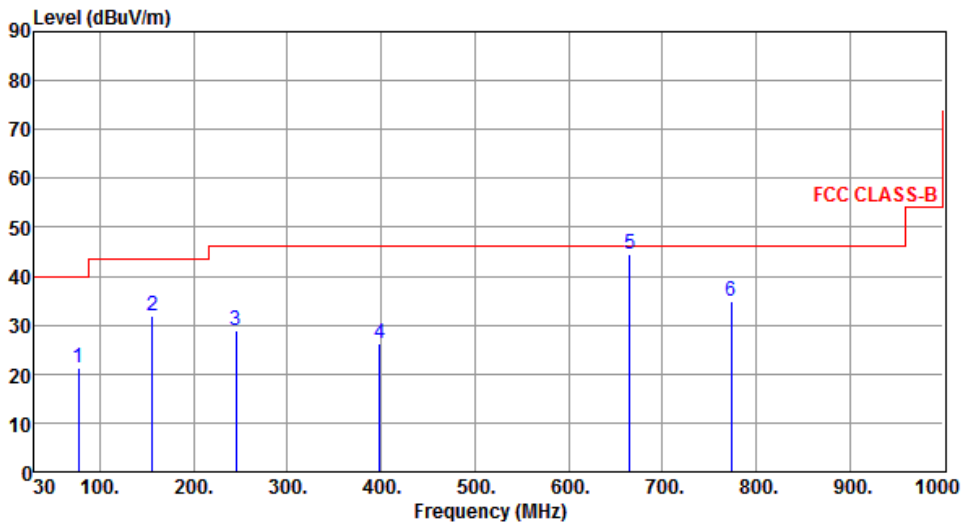
Modulation / SF	CSS / 10	Test Freq. (MHz)	902.3
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	31.94	30.11	40.00	-9.89	47.82	-17.71	Peak	---	---
2	94.99	27.18	43.50	-16.32	49.34	-22.16	Peak	---	---
3	156.10	28.35	43.50	-15.15	45.12	-16.77	Peak	---	---
4	237.58	29.27	46.00	-16.73	47.44	-18.17	Peak	---	---
5	665.35	37.68	46.00	-8.32	46.24	-8.56	Peak	---	---
6	776.90	35.51	46.00	-10.49	42.35	-6.84	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.

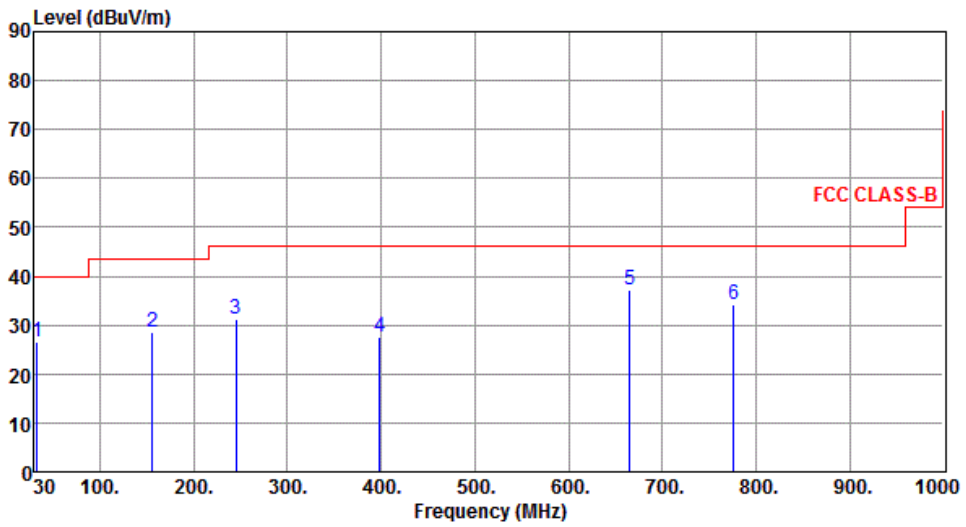
Modulation / SF	CSS / 10	Test Freq. (MHz)	910.1
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	77.53	21.09	40.00	-18.91	41.87	-20.78	Peak	---	---
2	156.10	31.86	43.50	-11.64	48.63	-16.77	Peak	---	---
3	245.34	28.94	46.00	-17.06	46.83	-17.89	Peak	---	---
4	398.60	26.34	46.00	-19.66	39.87	-13.53	Peak	---	---
5	665.35	44.35	46.00	-1.65	52.91	-8.56	Peak	---	---
6	773.99	34.74	46.00	-11.26	41.62	-6.88	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.

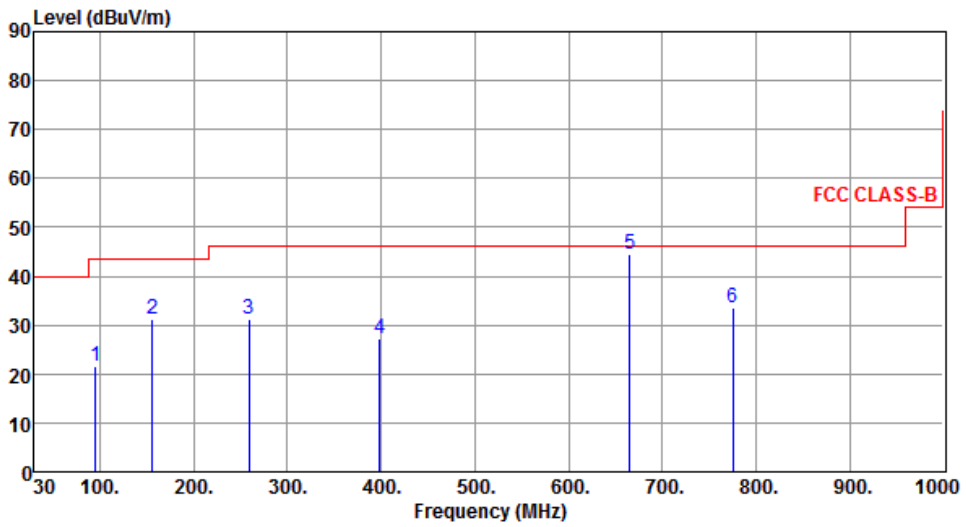
Modulation / SF	CSS / 10	Test Freq. (MHz)	910.1
Polarization	Vertical		



	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	26.73	40.00	-13.27	44.39	-17.66	Peak	---	---
2	156.10	28.46	43.50	-15.04	45.23	-16.77	Peak	---	---
3	245.34	31.37	46.00	-14.63	49.26	-17.89	Peak	---	---
4	398.60	27.50	46.00	-18.50	41.03	-13.53	Peak	---	---
5	665.35	37.11	46.00	-8.89	45.67	-8.56	Peak	---	---
6	775.93	34.36	46.00	-11.64	41.21	-6.85	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.

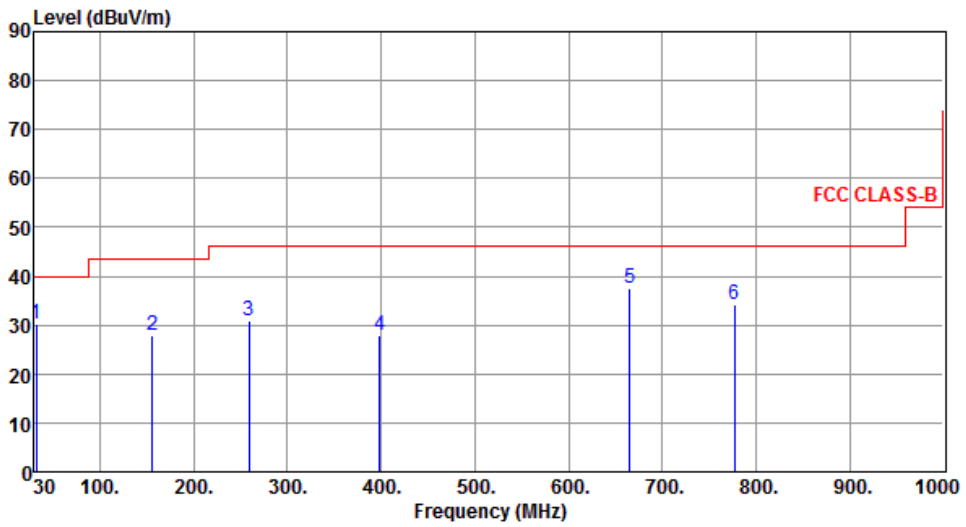
Modulation / SF	CSS / 10	Test Freq. (MHz)	924.375
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	94.99	21.50	43.50	-22.00	43.66	-22.16	Peak	---	---
2	156.10	31.27	43.50	-12.23	48.04	-16.77	Peak	---	---
3	258.92	31.22	46.00	-14.78	48.71	-17.49	Peak	---	---
4	398.60	27.11	46.00	-18.89	40.64	-13.53	Peak	---	---
5	665.35	44.46	46.00	-1.54	53.02	-8.56	Peak	---	---
6	774.96	33.67	46.00	-12.33	40.54	-6.87	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)	924.375
Polarization	Vertical		

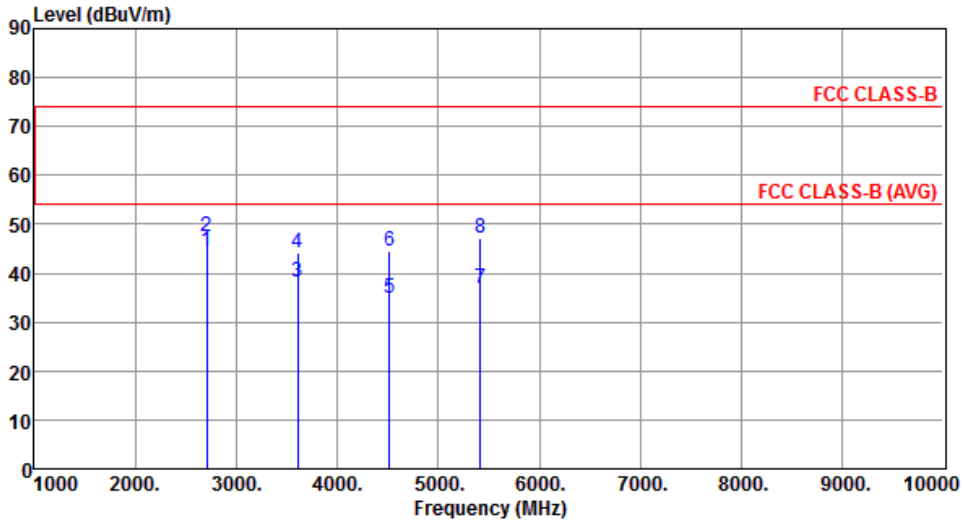


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	31.94	30.12	40.00	-9.88	47.83	-17.71	Peak	---	---
2	156.10	27.77	43.50	-15.73	44.54	-16.77	Peak	---	---
3	258.92	30.85	46.00	-15.15	48.34	-17.49	Peak	---	---
4	398.60	27.96	46.00	-18.04	41.49	-13.53	Peak	---	---
5	665.35	37.62	46.00	-8.38	46.18	-8.56	Peak	---	---
6	776.90	34.11	46.00	-11.89	40.95	-6.84	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.

3.2.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

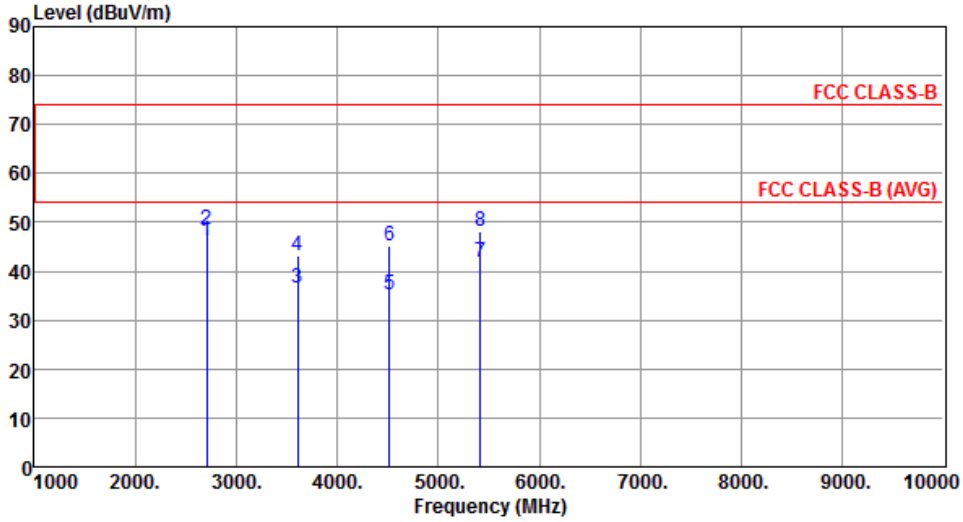
Modulation / SF	CSS / 10	Test Freq. (MHz)	902.3
Polarization	Horizontal		



	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	44.65	54.00	-9.35	46.53	-1.88	Average	155	139
2	2706.90	47.38	74.00	-26.62	49.26	-1.88	Peak	155	139
3	3609.20	38.19	54.00	-15.81	38.20	-0.01	Average	159	136
4	3609.20	44.29	74.00	-29.71	44.30	-0.01	Peak	159	136
5	4511.50	34.84	54.00	-19.16	31.21	3.63	Average	133	254
6	4511.50	44.65	74.00	-29.35	41.02	3.63	Peak	133	254
7	5413.80	36.73	54.00	-17.27	31.03	5.70	Average	103	146
8	5413.80	47.27	74.00	-26.73	41.57	5.70	Peak	103	146

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).

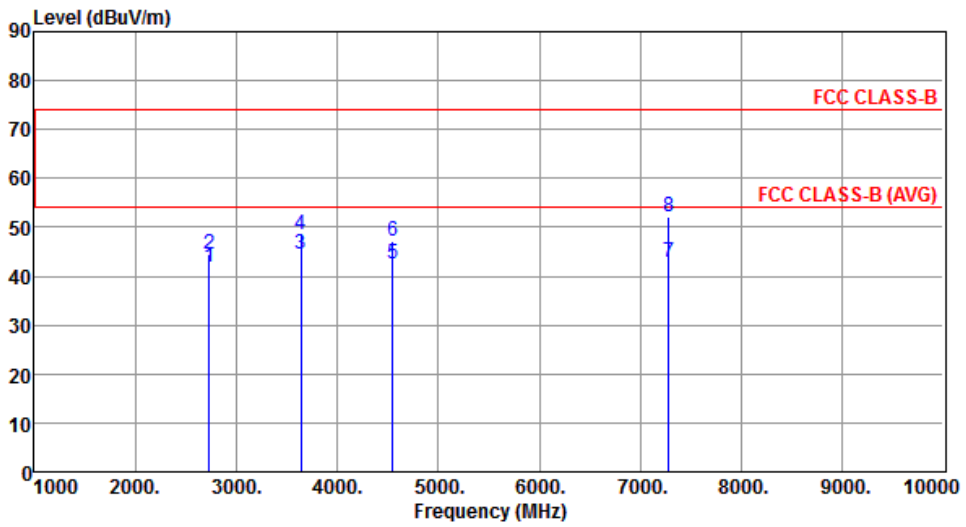
Modulation / SF	CSS / 10	Test Freq. (MHz)	902.3
Polarization	Vertical		



	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	46.24	54.00	-7.76	48.12	-1.88	Average	164	221
2	2706.90	48.45	74.00	-25.55	50.33	-1.88	Peak	164	221
3	3609.20	36.50	54.00	-17.50	36.51	-0.01	Average	249	156
4	3609.20	43.10	74.00	-30.90	43.11	-0.01	Peak	249	156
5	4511.50	35.26	54.00	-18.74	31.63	3.63	Average	283	189
6	4511.50	45.16	74.00	-28.84	41.53	3.63	Peak	283	189
7	5413.80	41.93	54.00	-12.07	36.23	5.70	Average	193	130
8	5413.80	48.24	74.00	-25.76	42.54	5.70	Peak	193	130

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).

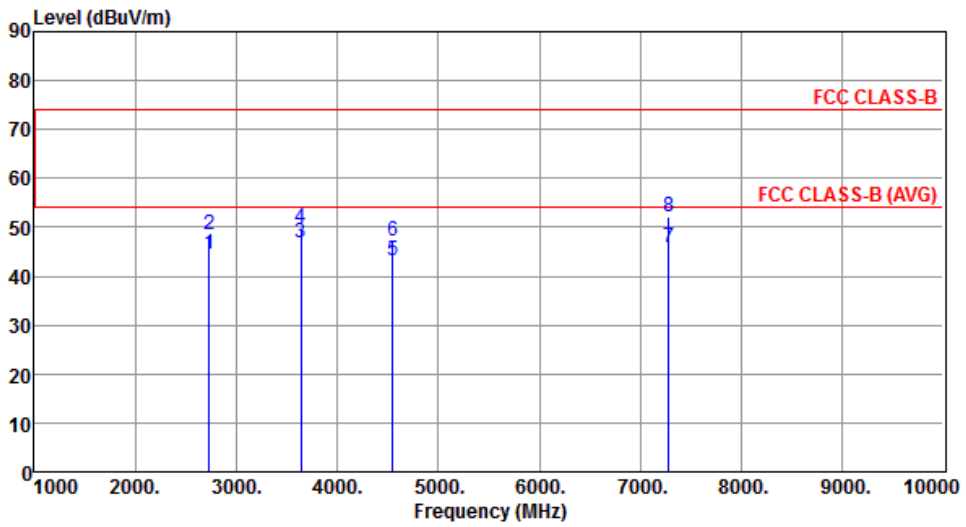
Modulation / SF	CSS / 10	Test Freq. (MHz)	910.1
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2730.30	41.85	54.00	-12.15	43.64	-1.79	Average	122	148
2	2730.30	44.41	74.00	-29.59	46.20	-1.79	Peak	122	148
3	3640.40	44.53	54.00	-9.47	44.35	0.18	Average	100	180
4	3640.40	48.41	74.00	-25.59	48.23	0.18	Peak	100	180
5	4550.50	42.49	54.00	-11.51	38.65	3.84	Average	201	142
6	4550.50	47.19	74.00	-26.81	43.35	3.84	Peak	201	142
7	7280.80	42.77	54.00	-11.23	33.35	9.42	Average	270	142
8	7280.80	51.98	74.00	-22.02	42.56	9.42	Peak	270	142

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).

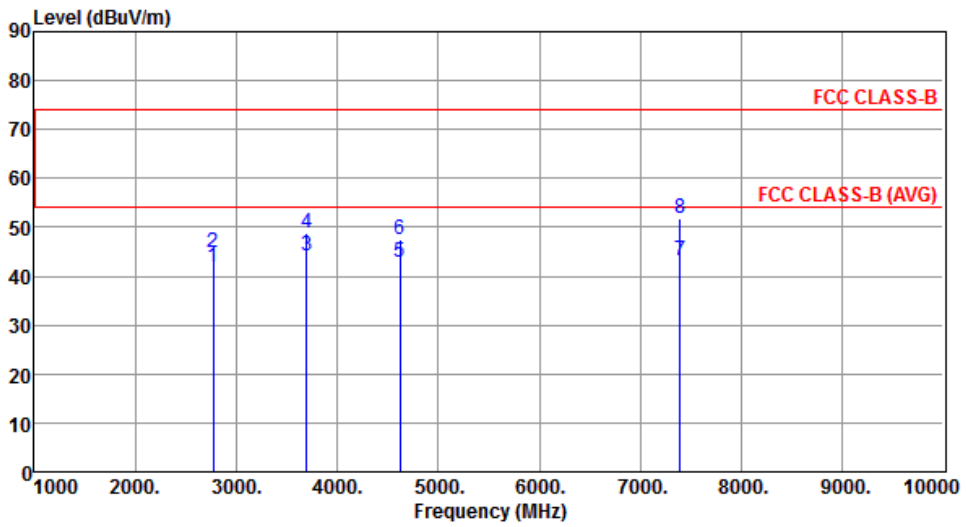
Modulation / SF	CSS / 10	Test Freq. (MHz)	910.1
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2730.30	44.51	54.00	-9.49	46.30	-1.79	Average	190	45
2	2730.30	48.53	74.00	-25.47	50.32	-1.79	Peak	190	45
3	3640.40	46.90	54.00	-7.10	46.72	0.18	Average	312	22
4	3640.40	49.83	74.00	-24.17	49.65	0.18	Peak	312	22
5	4550.50	43.19	54.00	-10.81	39.35	3.84	Average	100	162
6	4550.50	47.15	74.00	-26.85	43.31	3.84	Peak	100	162
7	7280.80	45.75	54.00	-8.25	36.33	9.42	Average	100	185
8	7280.80	52.07	74.00	-21.93	42.65	9.42	Peak	100	185

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).

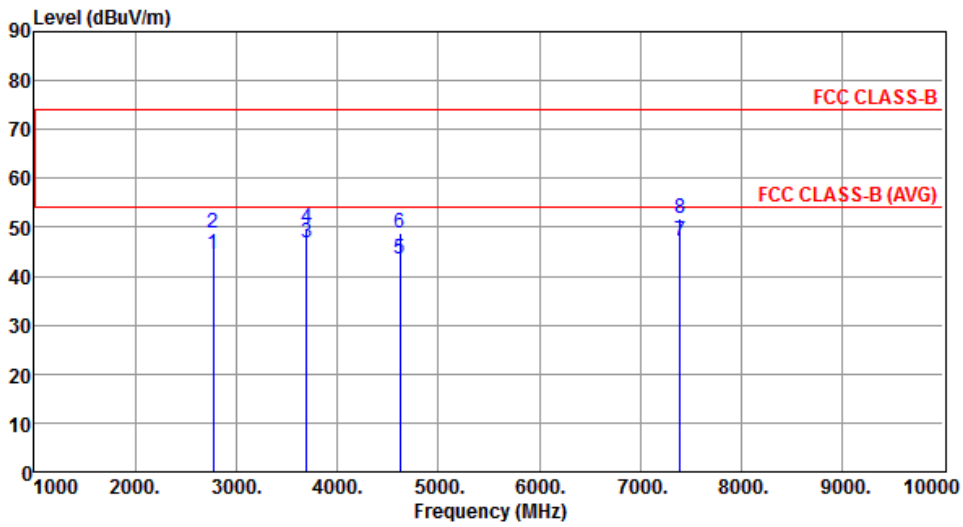
Modulation / SF	CSS / 10	Test Freq. (MHz)	924.375
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2773.13	41.68	54.00	-12.32	43.32	-1.64	Average	117	146
2	2773.13	44.94	74.00	-29.06	46.58	-1.64	Peak	117	146
3	3697.50	44.20	54.00	-9.80	43.65	0.55	Average	100	183
4	3697.50	48.76	74.00	-25.24	48.21	0.55	Peak	100	183
5	4621.88	42.74	54.00	-11.26	38.57	4.17	Average	206	136
6	4621.88	47.49	74.00	-26.51	43.32	4.17	Peak	206	136
7	7395.00	43.19	54.00	-10.81	33.56	9.63	Average	272	105
8	7395.00	51.91	74.00	-22.09	42.28	9.63	Peak	272	105

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)	924.375
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	2773.13	44.57	54.00	-9.43	46.21	-1.64	Average	195	21
2	2773.13	48.79	74.00	-25.21	50.43	-1.64	Peak	195	21
3	3697.50	46.90	54.00	-7.10	46.35	0.55	Average	325	3
4	3697.50	49.88	74.00	-24.12	49.33	0.55	Peak	325	3
5	4621.88	43.39	54.00	-10.61	39.22	4.17	Average	100	156
6	4621.88	48.71	74.00	-25.29	44.54	4.17	Peak	100	156
7	7395.00	47.28	54.00	-6.72	37.65	9.63	Average	100	178
8	7395.00	51.78	74.00	-22.22	42.15	9.63	Peak	100	178

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).

3.3 Unwanted Emissions into Non-Restricted Frequency Bands

3.3.1 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.

3.3.2 Test Procedures

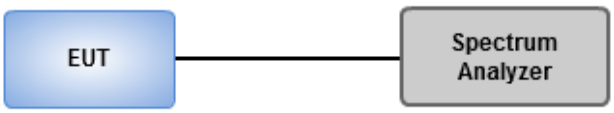
Reference Level Measurement

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

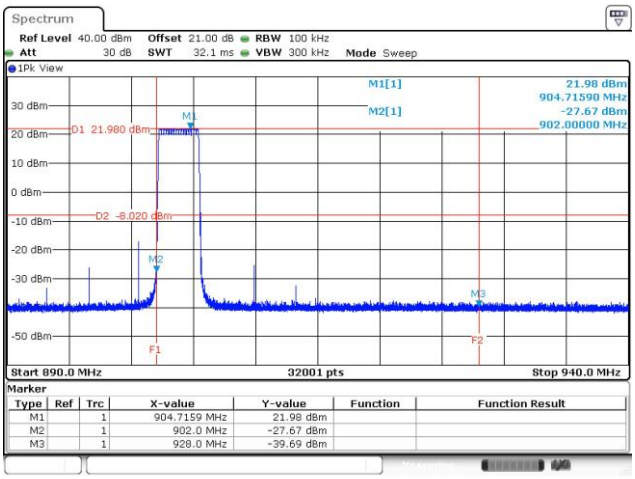
1. Set RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Trace Mode = max hold, Sweep = auto couple.
3. Allow the trace to stabilize.
4. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

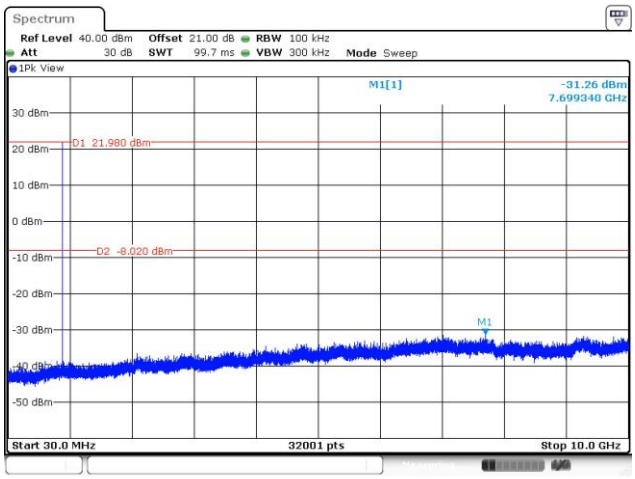
3.3.3 Test Setup

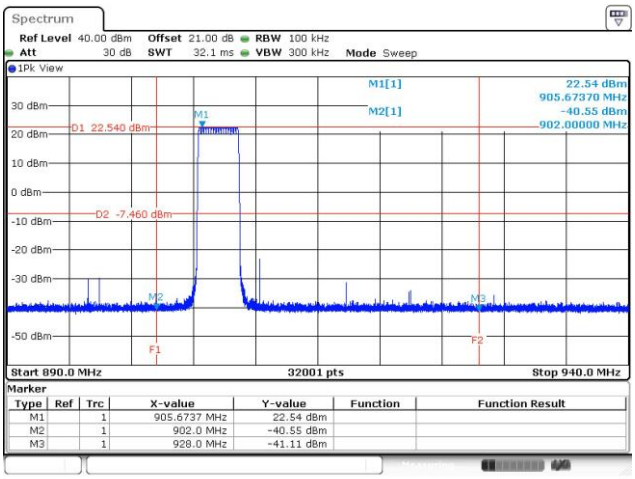


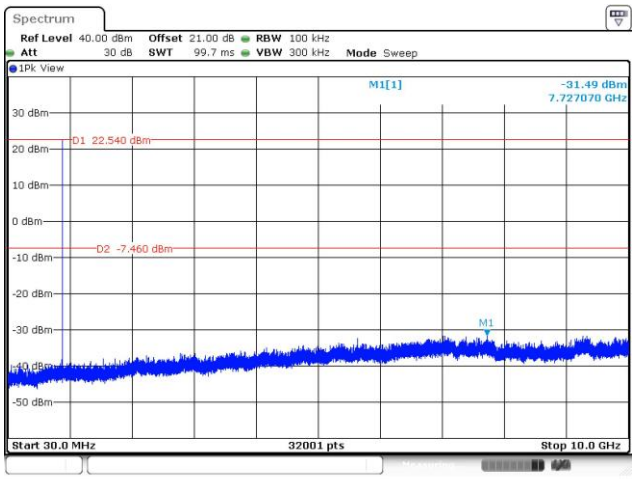
3.3.4 Unwanted Emissions into Non-Restricted Frequency Bands

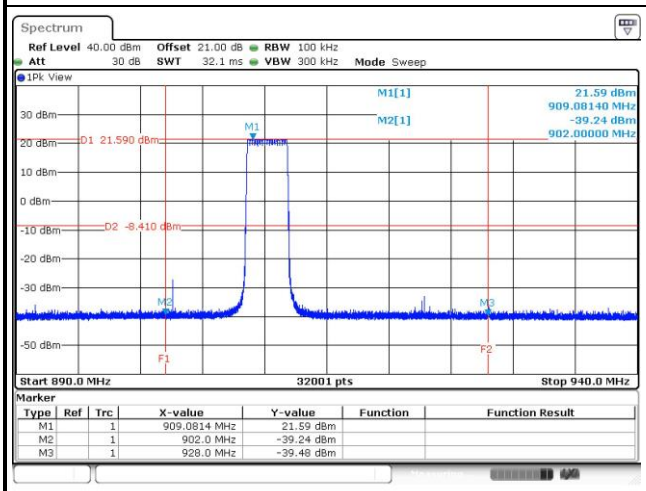
Hopping on (Group 1 / 2 / 3)	
30MHz~10GHz (down 30dBc)	

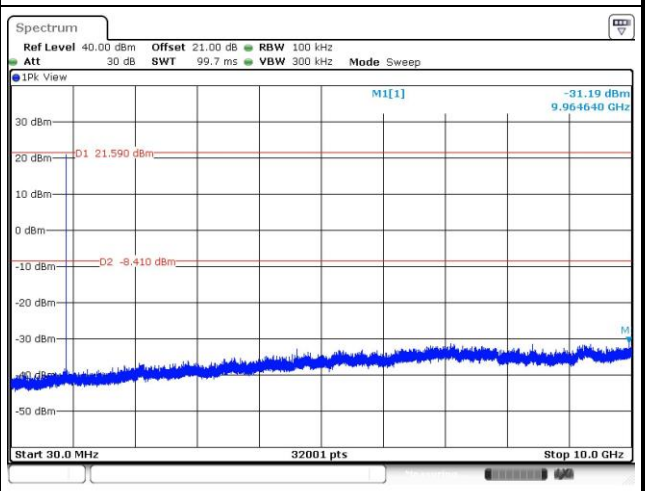






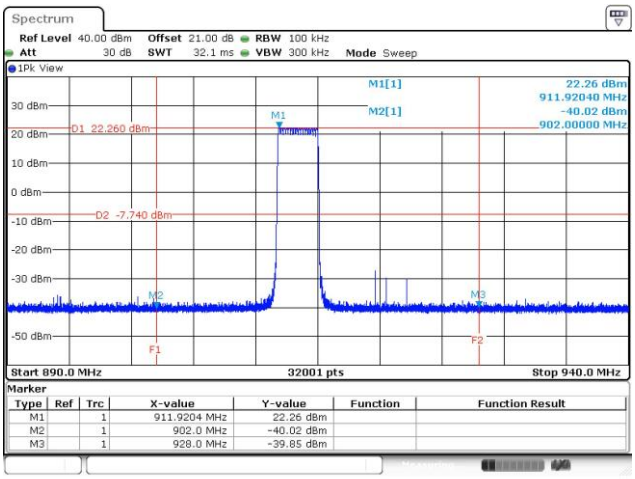


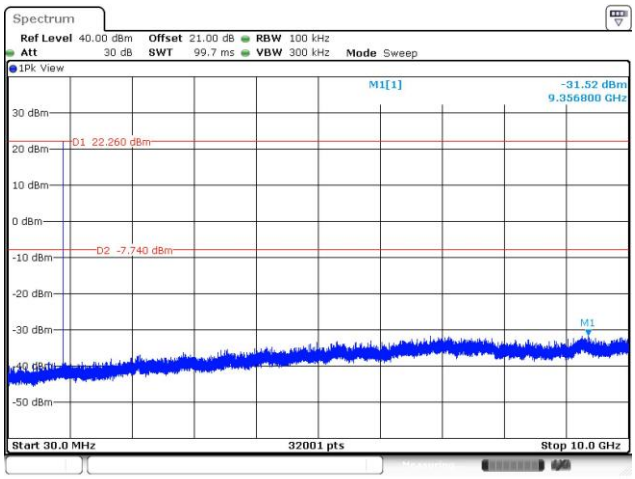


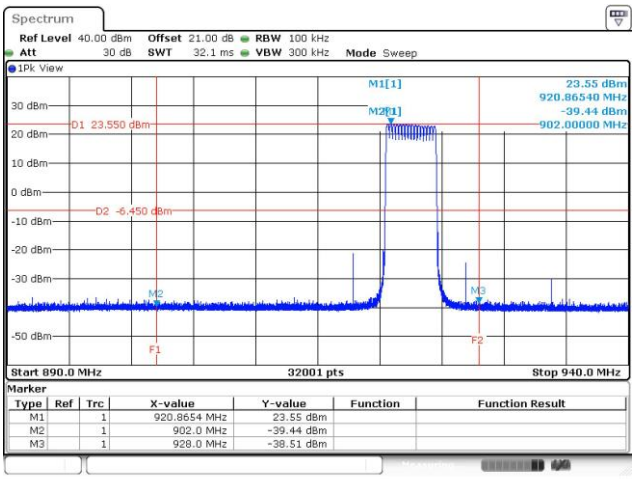


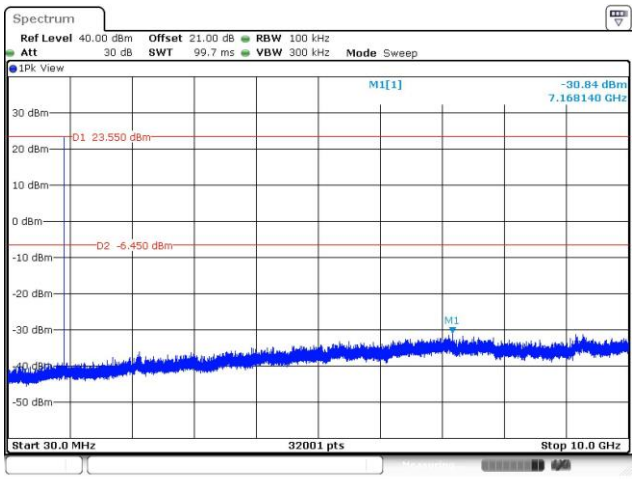
Hopping on (Group 4 / 5)

30MHz~10GHz (down 30dBc)









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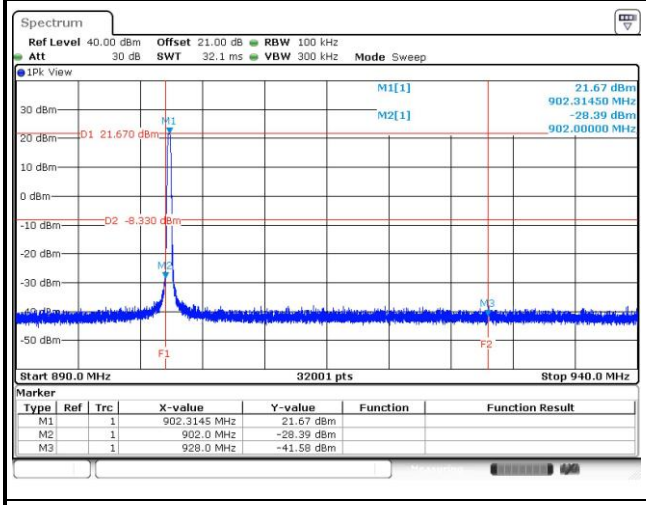
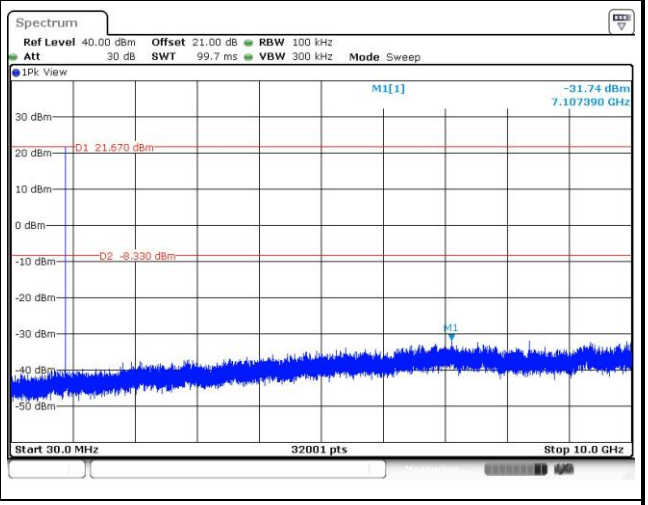
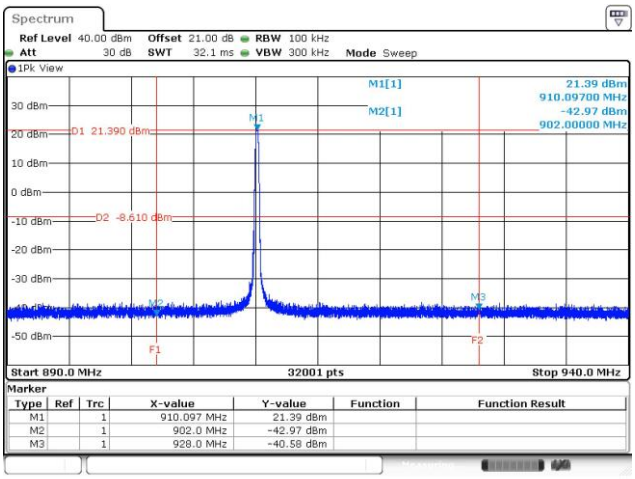
Hopping off (Low / Middle / High channel)

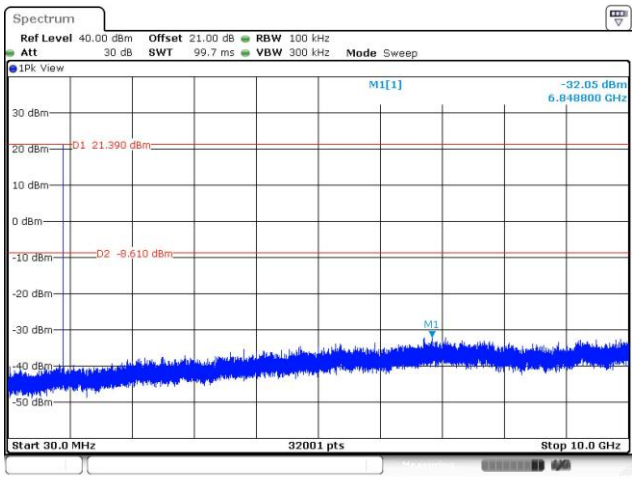
TX Freq 902.3MHz / 30MHz~10GHz (down 30dBc)



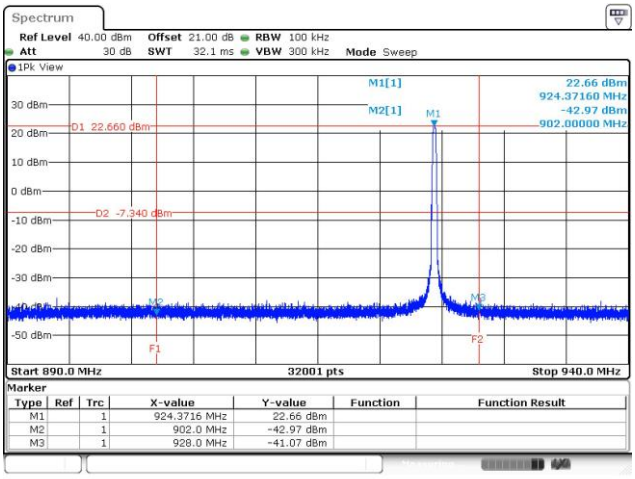


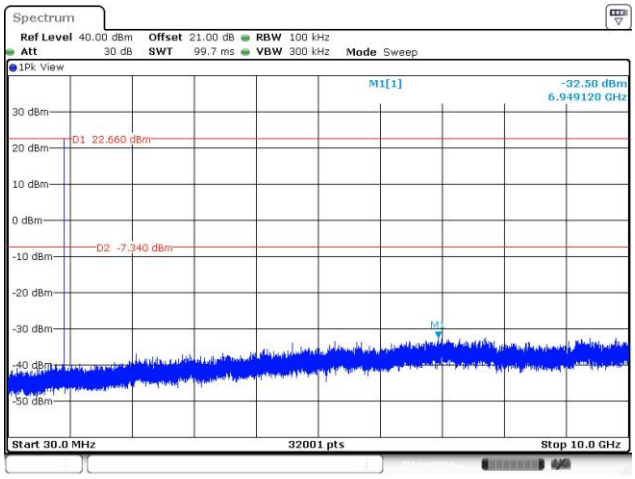
TX Freq 910.1MHz / 30MHz~10GHz (down 30dBc)





TX Freq 924.375MHz / 30MHz~10GHz (down 30dBc)





3.4 Conducted Output Power

3.4.1 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,

3.4.2 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

3.4.3 Test Setup

3.4.4 Test Result of Conducted Output Power

Modulation / SF	Freq. (MHz)	Output Power (mW)	Output Power (dBm)	Limit (W)
CSS / 10	902.3	166.72	22.22	1
CSS / 10	910.1	159.22	22.02	1
CSS / 10	924.375	212.32	**23.27**	1

3.5 Number of Hopping Frequency

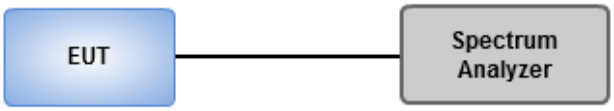
3.5.1 Limit of Number of Hopping Frequency

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		

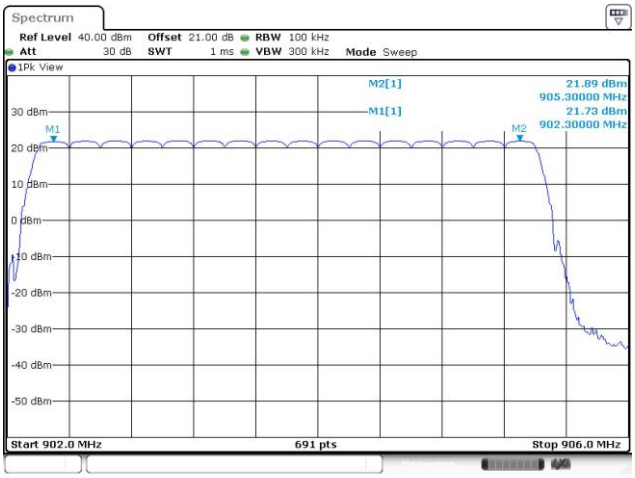
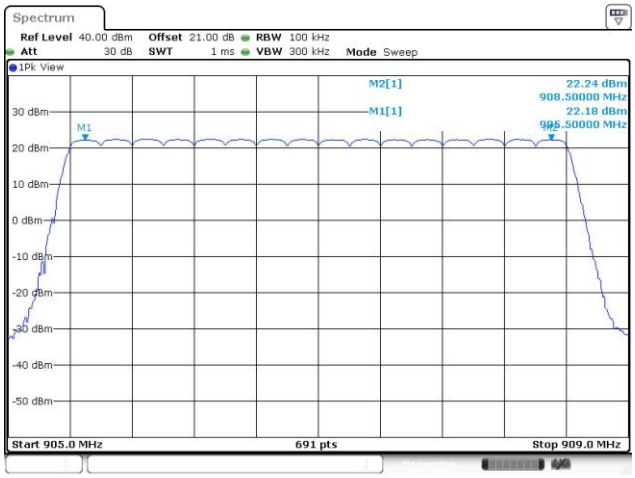
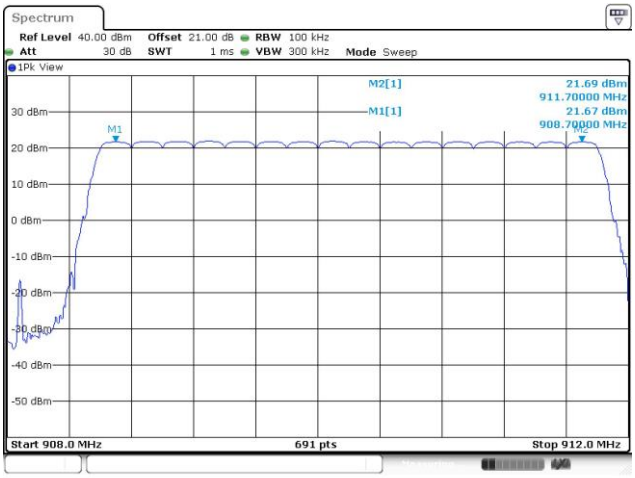
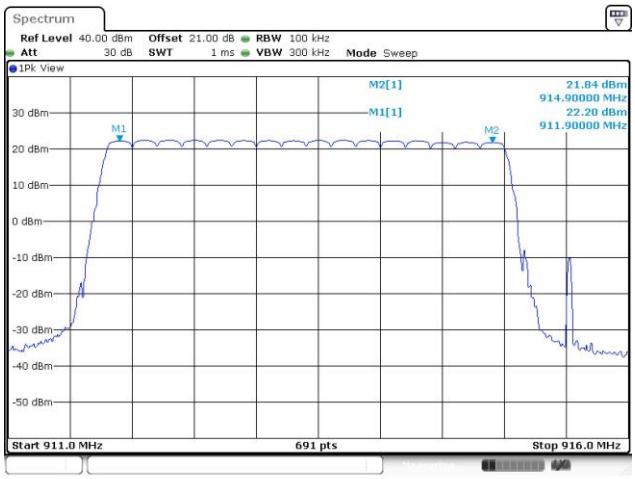
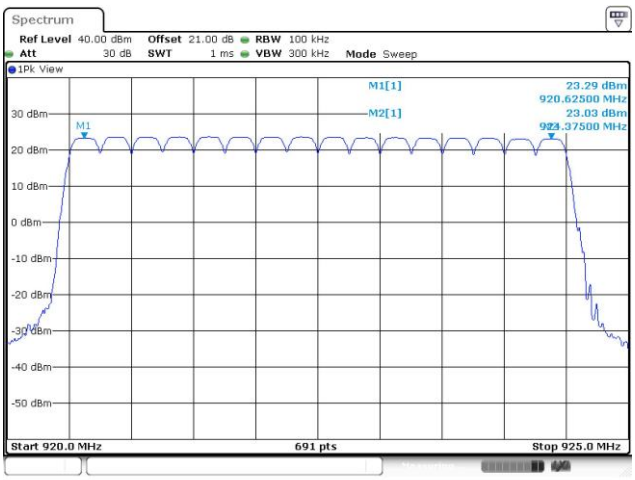
3.5.2 Test Procedures

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

3.5.3 Test Setup



3.5.4 Test Result of Number of Hopping Frequency

Group 1 / 3 / 5	Group 2 / 4
	
	
	

3.6 20dB and Occupied Bandwidth

3.6.1 Test Procedures

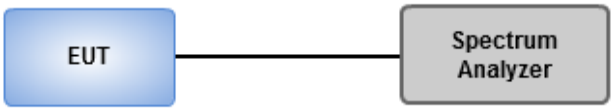
20dB Bandwidth

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

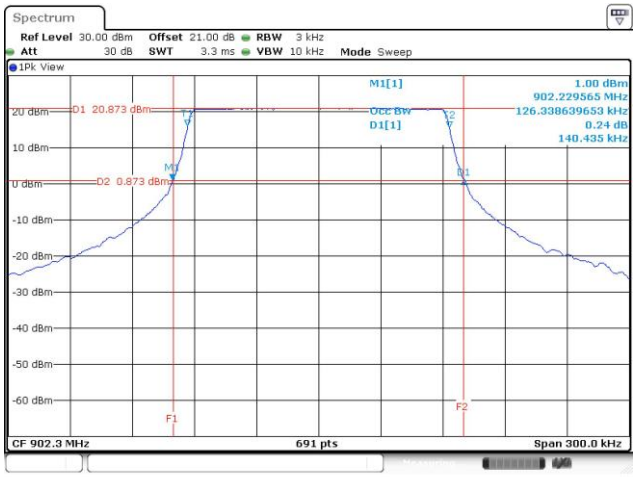
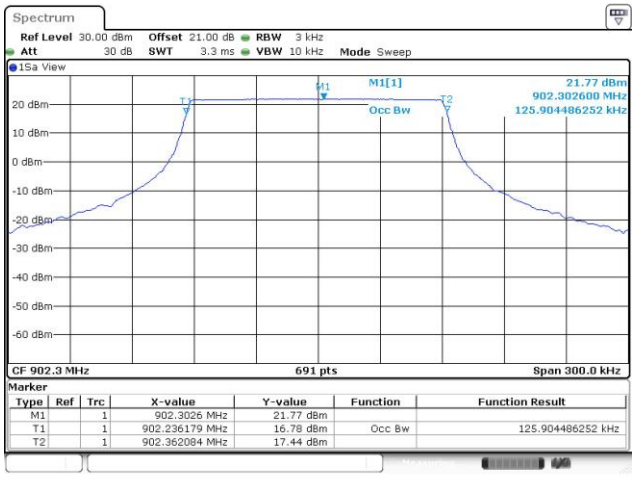
1. Set RBW=3kHz, VBW=10kHz,Sweep time = Auto, Detector=Sample, Trace max hold
2 Allow trace to stabilize
3. Use Occupied bandwidth function of spectrum analyzer to measuring 99% occupied bandwidth

3.6.2 Test Setup



3.6.3 Test result of 20dB and Occupied Bandwidth

Modulation / SF	Freq. (MHz)	20dB Bandwidth (MHz)	Occupied Bandwidth (MHz)
CSS / 10	902.3	0.140	0.126
CSS / 10	910.1	0.140	0.126
CSS / 10	914.9	0.140	0.126
CSS / 10	920.625	0.140	0.126
CSS / 10	924.375	0.140	0.126

Worst Plot of 20dB Bandwidth	Worst Plot of Occupied Bandwidth
	

3.7 Channel Separation

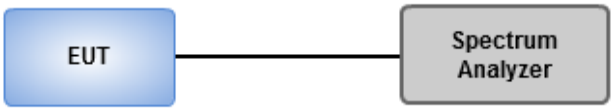
3.7.1 Limit of Channel Separation

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.

3.7.2 Test Procedures

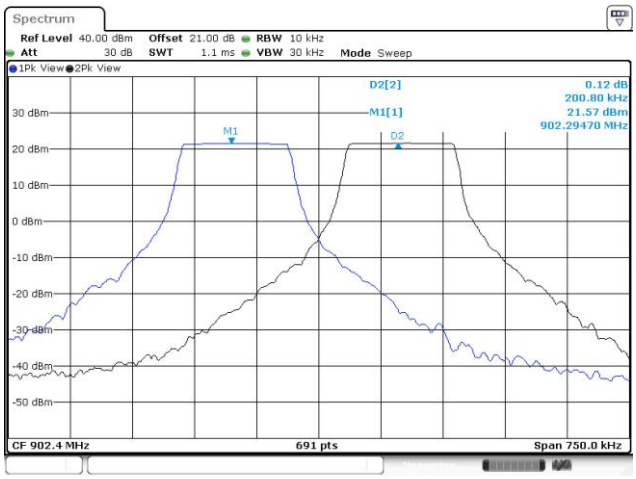
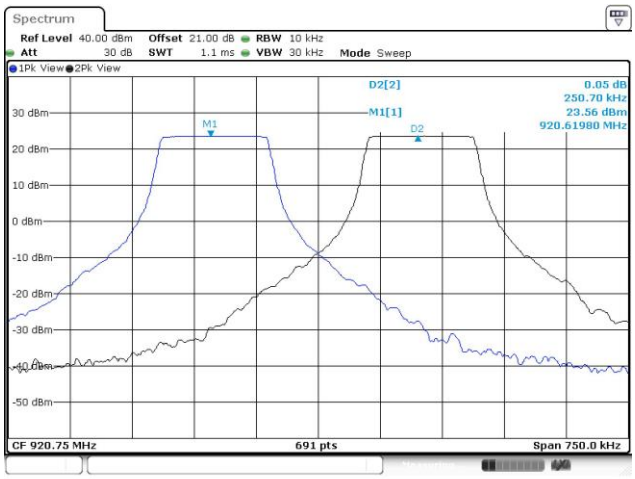
1. Set RBW=10kHz, VBW=30kHz, Sweep time=Auto, Detector=Peak Trace max hold.
2 Allow trace to stabilize.
3 Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The EUT shall show compliance with the appropriate regulatory limit

3.7.3 Test Setup



3.7.4 Test result of Channel Separation

Modulation / SF	Freq. (MHz)	Channel Separation (MHz)	20dB Bandwidth (MHz)	Pass/Fail
CSS / 10	902.3	0.20080	0.140	Pass
CSS / 10	910.1	0.20080	0.140	Pass
CSS / 10	914.9	0.20080	0.140	Pass
CSS / 10	920.625	0.25070	0.140	Pass
CSS / 10	924.375	0.25070	0.140	Pass

Worst Plot of 200 kHz channel spacing	Worst Plot of 250 kHz channel spacing
	

3.8 Number of Dwell Time

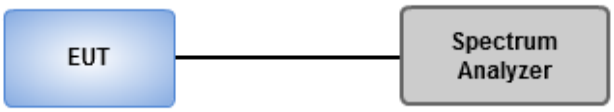
3.8.1 Limit of Dwell time

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

3.8.2 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.

3.8.3 Test Setup

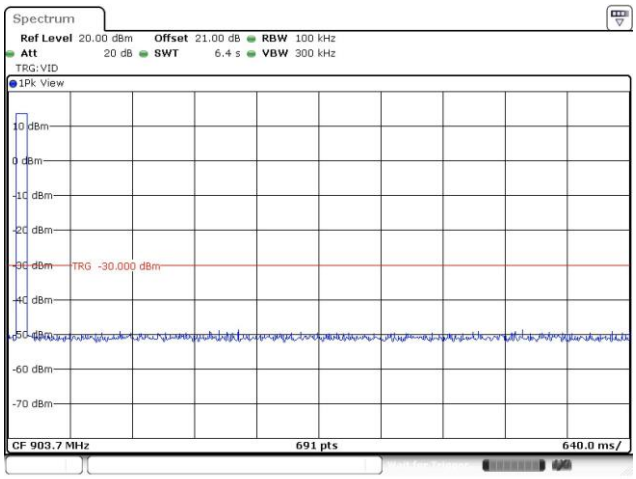


3.8.4 Test Result of Dwell Time

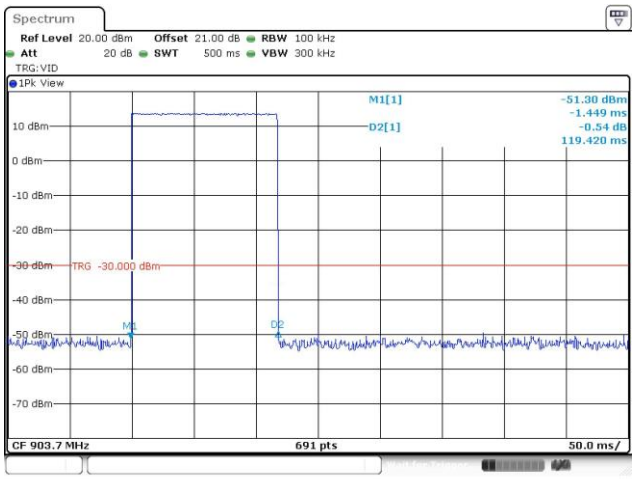
Modulation / SF	Freq. (MHz)	Length of Transmission Time (msec)	Number of Transmission in a 6.4 (16 Hopping*0.4)	Result (s)	Limit (s)
CSS / 7	903.7	0.11942	1	0.11942	0.4
CSS / 8	903.7	0.20768	1	0.20768	0.4
CSS / 9	903.7	0.37275	1	0.37275	0.4
CSS / 10	903.7	0.37290	1	0.37290	0.4
CSS / 10	906.9	0.37232	1	0.37232	0.4
CSS / 10	910.1	0.37319	1	0.37319	0.4
CSS / 10	913.3	0.37333	1	0.37333	0.4
CSS / 10	922.375	0.37275	1	0.37275	0.4

Frequency: 903.7 MHz

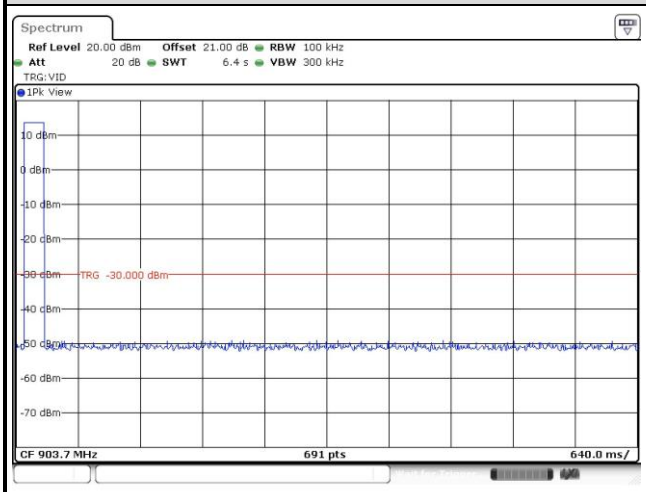
SF: 7



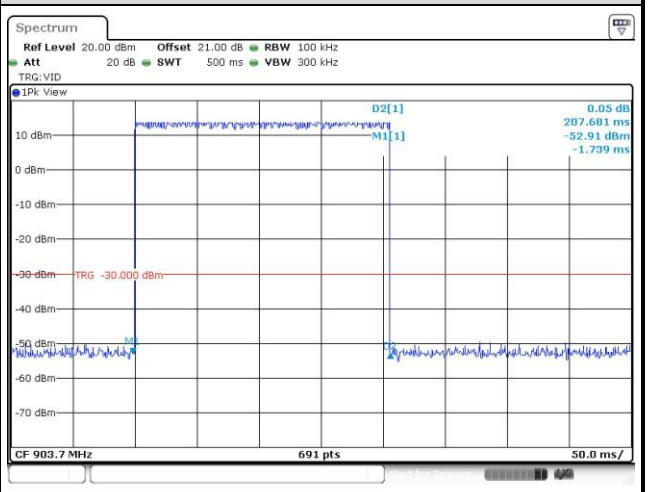
SF: 7

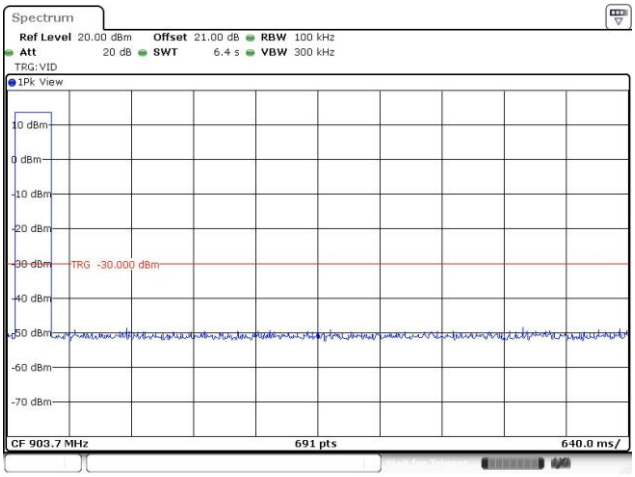
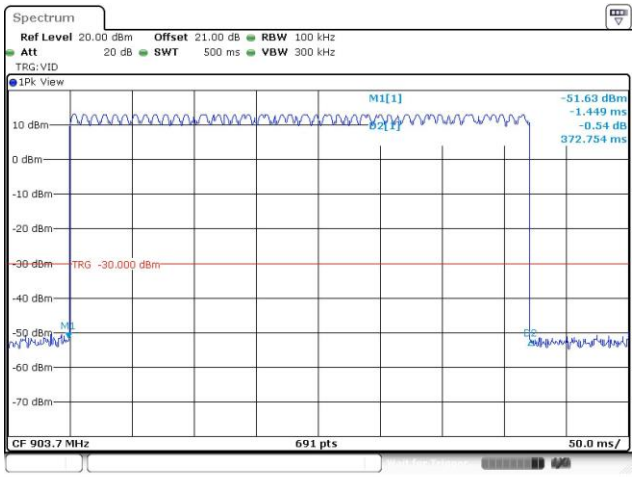
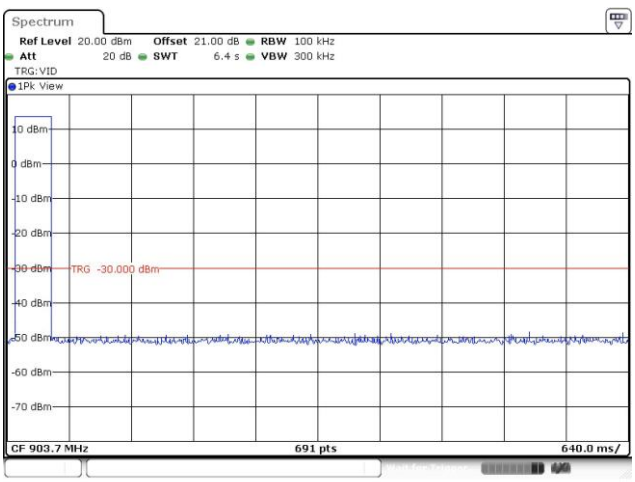
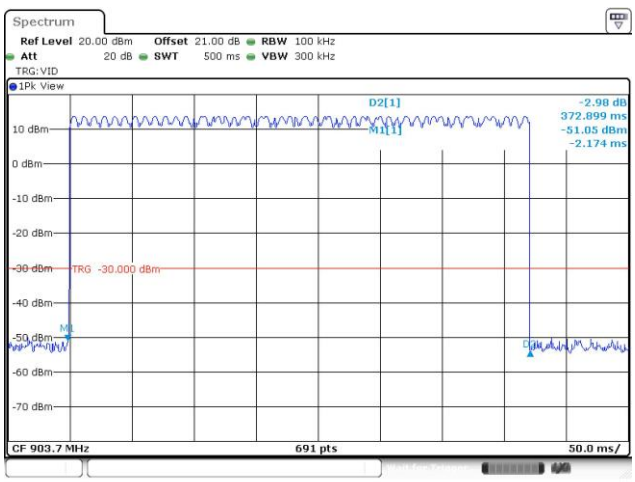


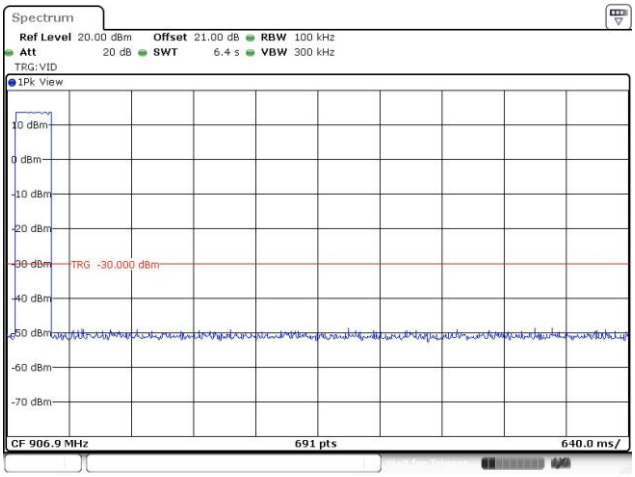
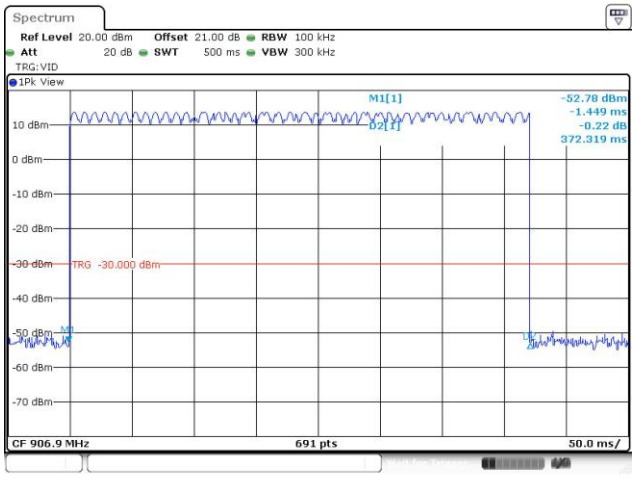
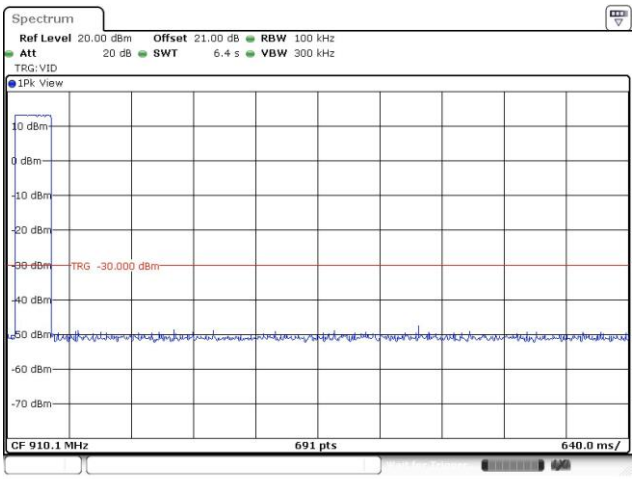
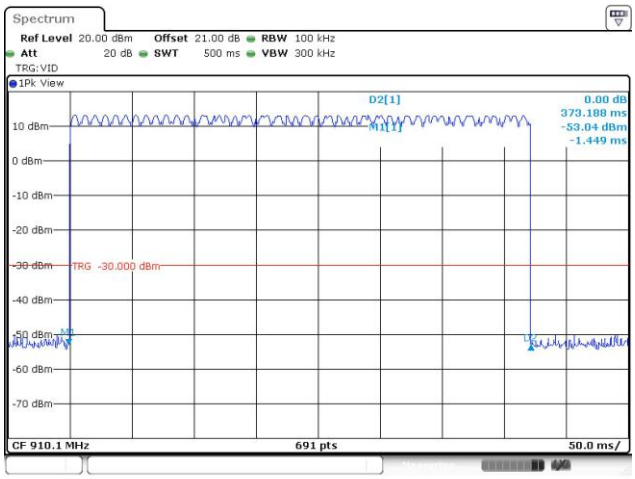
SF: 8

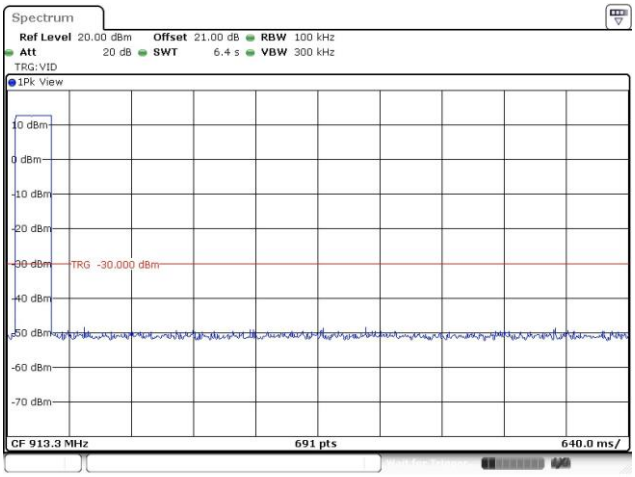
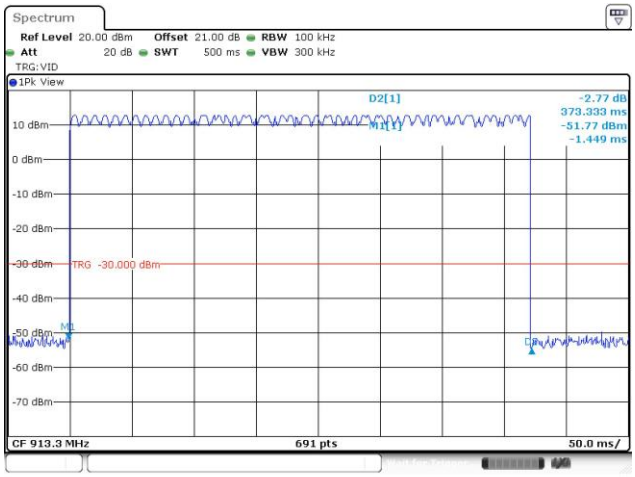
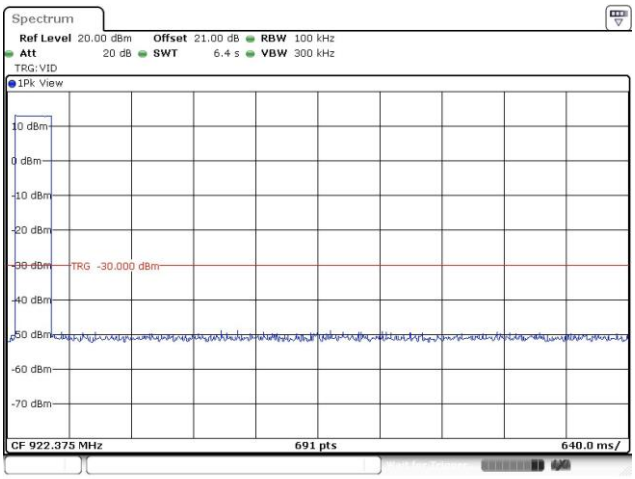
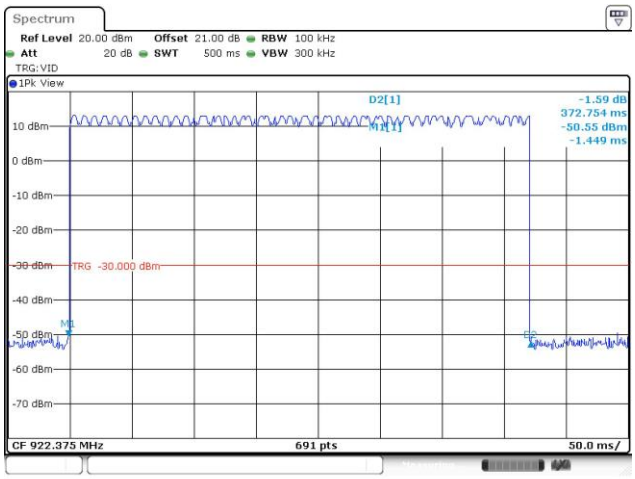


SF: 8



Frequency: 903.7 MHz	
SF: 9	**SF: 9**
	
SF: 10	**SF: 10**
	

Frequency: 906.9 MHz	
SF: 10	**SF: 10**
	
Frequency: 910.1 MHz	
SF: 10	**SF: 10**
	

Frequency: 913.3 MHz	
SF: 10	**SF: 10**
	
Frequency: 922.375 MHz	
SF: 10	**SF: 10**
	

3.9 Power Spectral Density

3.9.1 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.

3.9.2 Test Procedures

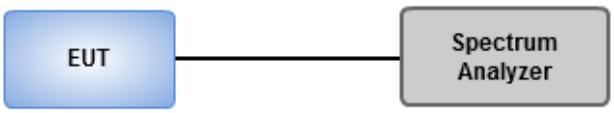
☐ Maximum peak conducted output power was used to demonstrate compliance to the fundamental output power limit.

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.

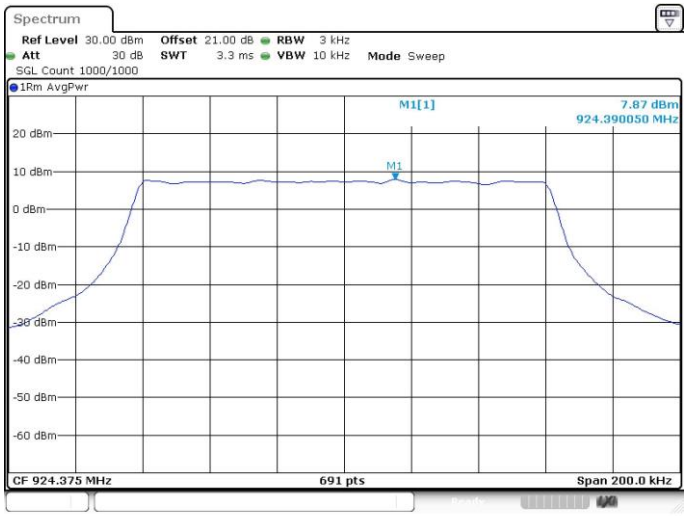
3.9.3 Test Setup



3.9.4 Test Result of Power Spectral Density

Modulation / SF	Freq. (MHz)	Total Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
CSS / 10	902.3	6.49	8.00
CSS / 10	910.1	6.80	8.00
CSS / 10	924.375	7.87	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, 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 Hsiang. 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 Hsiang, Tao Yuan Hsien 333, Taiwan, R.O.C.	No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan Hsiang, Tao Yuan Hsien 333, Taiwan, R.O.C.

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

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