FCC PART 15.247

TEST REPORT

For

Mianyang Ruitai Intelligent Technology Co., Ltd.

L3 Enterprise Accelerator B, Jiusheng Road Scientific Innovation District,
Mianyang City Sichuan, China

FCC ID: 2AZVARTECR3800-F

Report Type:	**Equipment Name:**
Original Report	UHF RFID READER

Report Number:	RSC210510001-0B
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Mianyang Ruitai Intelligent Technology Co., Ltd.
Product	UHF RFID READER
Tested Model	RTEC R3800-F
FCC ID	2AZVARTECR3800-F
Frequency Range*	902.75MHz-927.25MHz
RF Output Power	21.14dBm
Modulation Type*	GFSK
Antenna Gain*	4 dBi
Voltage Range	DC 12-24V from adapter
Measure approximately	156 mm (L) x 130 mm (W) x 39 mm (H)
Sample serial number	210510001/01 (assigned by the BACL, Chengdu)
Sample/EUT Status	The test sample was in good condition and received: 2021-05-10

Note: Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

Note*: The device has 16 antennas that can't transmit simultaneously for 900MHz RFID function. The 16 antenna ports are fully identical based on the declaration of manufacturer, we have verified each port, the worst case emission was recorded at antenna port 2#, and the data following was presented for antenna 2#.

Objective

This report is prepared on behalf of **Mianyang Ruitai Intelligent Technology Co., Ltd.** in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules.

The tests were performed in order to determine EUT compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

No Related Submittals.

Measurement Uncertainty

Item			Uncertainty
Power line conducted emission			2.48 dB
Radiated Emission(Field Strength)	30MHz-200MHz	H	4.31 dB
		V	4.57 dB
	200MHz-1GHz	H	4.68 dB
		V	5.78 dB
	1GHz-6GHz		4.56 dB
	6GHz-18GHz		4.57 dB
RF output power, conducted			±0.61dB
Occupied Bandwidth			±5%
Humidity			±5%
Temperature			±1℃
Voltage(AC,<10kHz)			±1%
Time			±1%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the corresponding inclusion factor K when the inclusion probability is about 95%.

Test Methodology

All measurements contained in this report were conducted with:

ANSI C63.10-2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Chengdu) to collect test data is located No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, China.

Bay Area Compliance Laboratories Corp. (Chengdu) lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4324.01) and the FCC designation No. CN1186 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration*

The system was configured for testing in engineering mode.

Channel List					
Channel	Frequency(MHz)	Channel	Frequency(MHz)	Channel	Frequency(MHz)
0	902.75	17	911.25	34	919.75
1	903.25	18	911.75	35	920.25
2	903.75	19	912.25	36	920.75
3	904.25	20	912.75	37	921.25
4	904.75	21	913.25	38	921.75
5	905.25	22	913.75	39	922.25
6	905.75	23	914.25	40	922.75
7	906.25	24	914.75	41	923.25
8	906.75	25	915.25	42	923.75
9	907.25	26	915.75	43	924.25
10	907.75	27	916.25	44	924.75
11	908.25	28	916.75	45	925.25
12	908.75	29	917.25	46	925.75
13	909.25	30	917.75	47	926.25
14	909.75	31	918.25	48	926.75
15	910.25	32	918.75	49	927.25
16	910.75	33	919.25	/	/

EUT were tested with Channel 0, 24 and 49.

EUT Exercise Software*

The setting by the software built-in the device as following table:

Software and version		DemoY	
Mode	Channel	Frequency (MHz)	Power Level
RFID	Low	902.75	18
	Middle	914.75	18
	High	927.25	18

Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

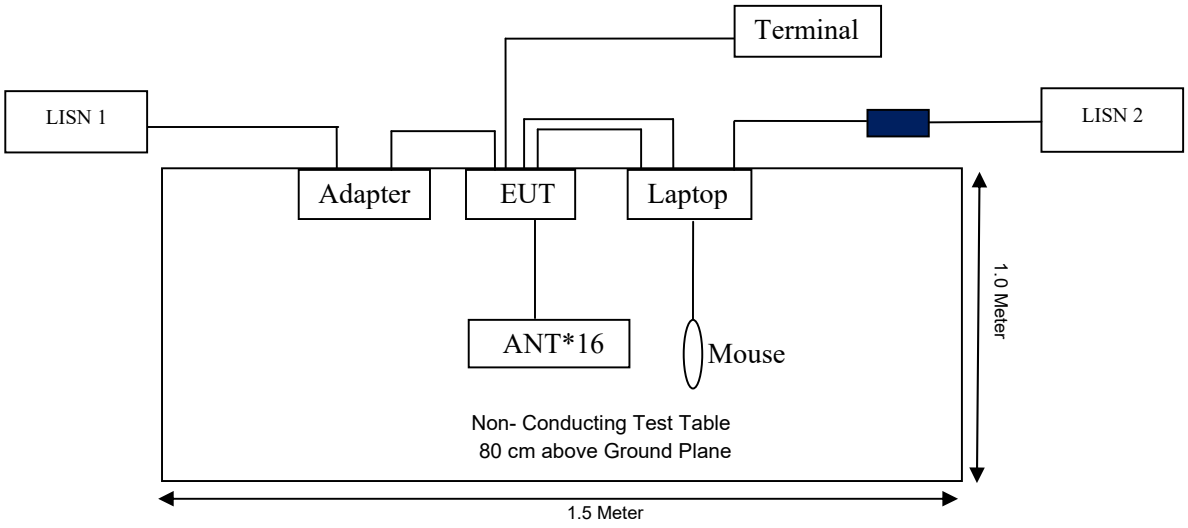
Manufacturer	Description	Model	Serial Number
DELL	Laptop	C640	5P804A00
DELL	AC ADAPTER	ADP-90FB REV.B	Unknown
LOGITECH	Mouse	M-U0026	Unknown

External I/O Cable

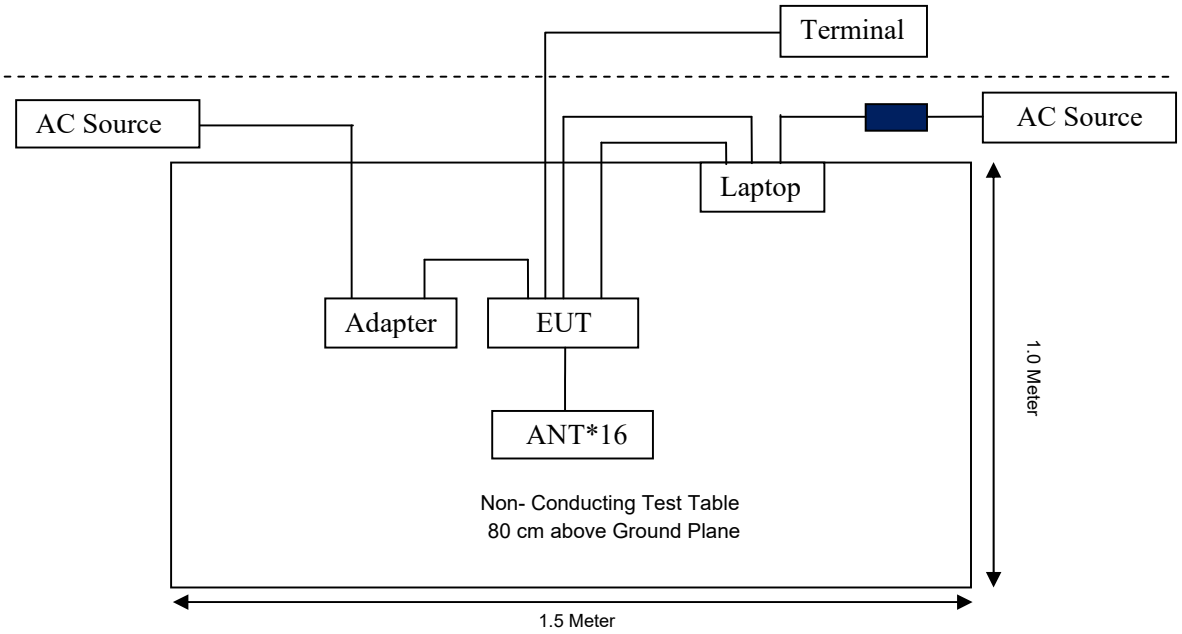
Cable Description	Length (m)	From	To
Unshielded RS232 Serial Port Line	1.0	EUT	Laptop
Unshielded RJ45 Cable	1.0	EUT	Laptop
Unshielded 485 Signal Cable	5.0	EUT	Terminal
Unshielded DC Cable	0.9	EUT	Adapter
Unshielded AC Cable	1.5	Adapter	LISN 1
Shielded RF Coaxial Cable	2.0	EUT	Antenna*16
Unshielded Mouse USB Cable	1.5	Mouse	Laptop
Unshielded AC Cable	1.5	AC ADAPTER	LISN 2

Block Diagram of Test Setup

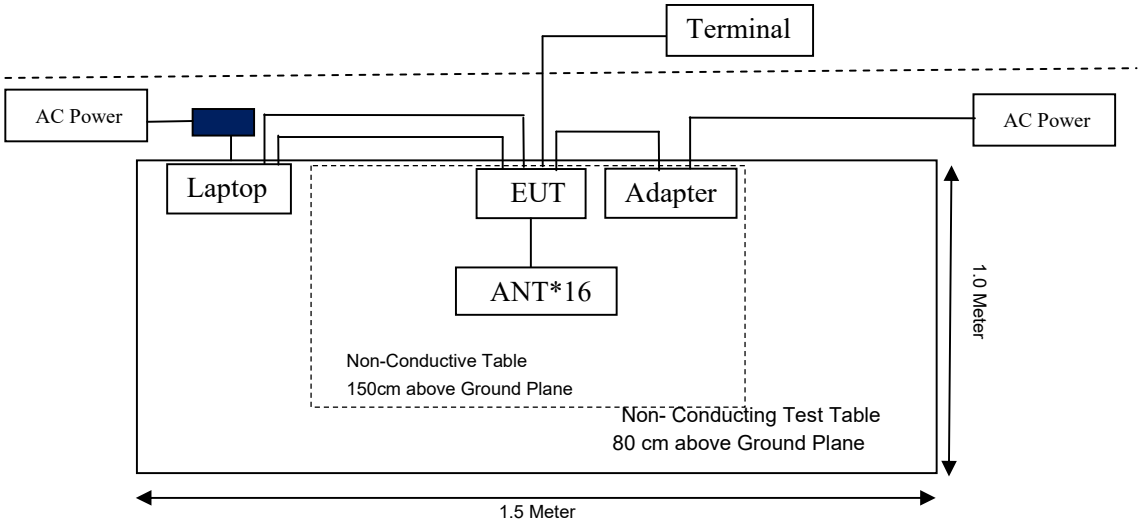
Conducted Emission:



Radiated Emissions(Below 1GHz):



Radiated Emissions(Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 & §1.1310 & §2.1091	MaximuM Permissible exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247(a)(1)(i)	20 dB Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(i)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(i)	Quantity of hopping channel Test	Compliance
§15.247(b)(2)	Peak Output Power Measurement	Compliance
§15.247(d)	Band Edges	Compliance

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

TEST EQUIPMENTS LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emission					
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2021-04-12	2022-04-11
ROHDE&SCHWARZ	L.I.S.N.	ENV216	3560.6550.16	2021-01-13	2022-01-12
ROHDE&SCHWARZ	L.I.S.N.	3810/2BR	9509-1102	2021-01-13	2022-01-12
HP	RF Limiter	11947A	3107A01270	2020-08-13	2021-08-12
Unknown	Conducted Cable	L-E-003	000003	2020-08-04	2021-08-03
Rohde & Schwarz	EMC32	EMC32	V 8.52.0	NCR	NCR
Radiated Emission					
EMCT	Semi-Anechoic Chamber	966	001	2020-07-24	2025-07-23
SONOMA INSTRUMENT	Pre-Amplifier	310 N	186684	2020-08-10	2021-08-09
SUNOL SCIENCES	Broadband Antenna	JB3	A121808	2019-12-10	2022-12-09
Rohde & Schwarz	EMI Test Receiver	ESR3	102456	2021-04-12	2022-04-11
INMET	Attenuator	18N-6dB	000186	2019-12-10	2022-12-09
Unknown	RF Cable (Below 1GHz)	L-E-005	000005	2020-09-04	2021-09-03
Unknown	RF Cable (Below 1GHz)	T-E128	000128	2020-10-16	2021-10-15
UTIFLEX	RF Cable (Below 1GHz)	T-E237	233522-001	2020-07-17	2021-07-16
Rohde & Schwarz	Spectrum Analyzer	FSU26	200835	2021-04-12	2022-04-11
EMCO	Horn Antenna	3115	2192	2019-09-25	2021-09-24
Mini-circuits	Pre-Amplifier	ZVA-183-S+	771001215	2020-09-20	2021-09-19
MICRO-TRONICS	900 MHz Notch Filter	BRM50706	G031	2021-05-19	2022-05-18
SUHNER+HUBER	RF Cable (Above 1GHz)	SUCOFLEX 126E	501524/126EA	2021-01-25	2022-01-24
IW-MICROWAVE	RF Cable (Above 1GHz)	SPS-2301	111503	2020-08-31	2021-08-30
Rohde & Schwarz	EMC32	EMC32	V9.10.00	NCR	NCR
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSU26	100113	2021-04-12	2022-04-11
Agilent	USB power sensor	U2021XA	MY53320008	2021-01-13	2022-01-12
Mini-Circuits	6dB Attenuator	BW-S6W5+	00433	2020-09-10	2021-09-09
FLORIDA RF LABS	RF Coaxial Cable	SMA-SMA	2Y194	Each Time	

FCC §15.247 & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f²)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Per 447498 D01 General RF Exposure Guidance v06**,** simultaneous transmission MPE test exclusion applies when the sum of the MPE for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0.

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = PG/4\pi R^2$$

Where:
S = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
RFID	902.75-927.25	4.0	2.51	21.5	141.254	20	0.071	0.602

Result: The device meets FCC MPE at ≥20cm.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Antenna Connector Construction*

The EUT has 16 External antennas, fulfill the requirement of this section. Please refer to the EUT photos.

Antenna	Manufacturer	Model Number	Antenna Gain (Max)	Antenna Connector	Impedance
RFID	RTEC	RTEC ANT-CR	4dBi	SMA-K	50 Ω

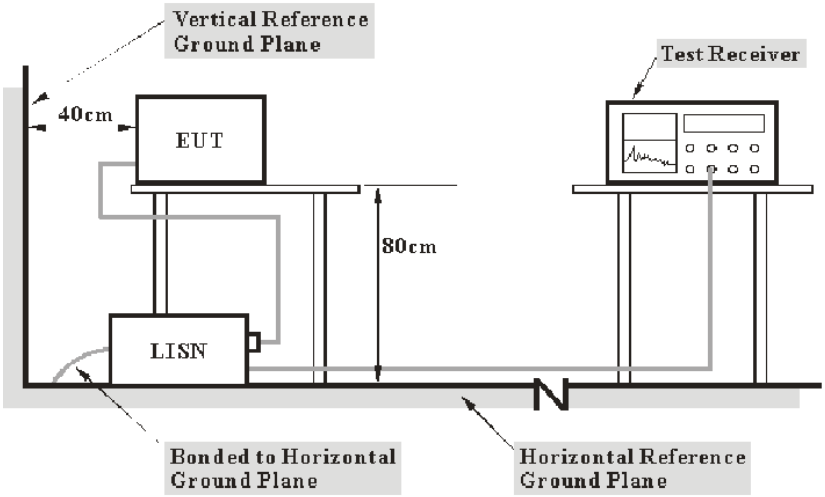
Result: Compliance

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

EUT Setup



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

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	RBW
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$

Herein,
V_C: corrected voltage amplitude
V_R: reading voltage amplitude
A_c: attenuation caused by cable loss
VDF: voltage division factor of AMN or ISN

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Data

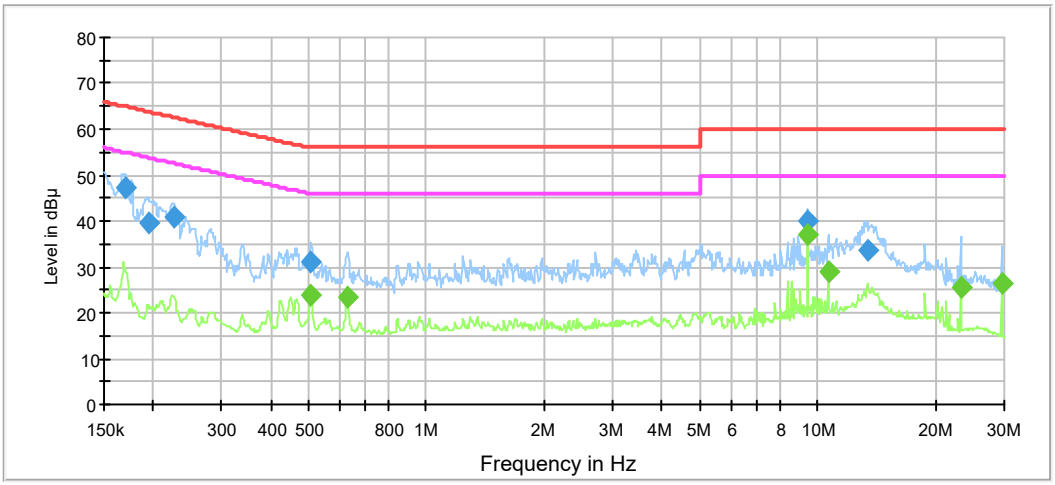
Environmental Conditions

Temperature:	19 °C
Relative Humidity:	52 %
ATM Pressure:	95.9 kPa

The testing was performed by Even Wu on 2021-06-02.

Test Mode: Transmitting

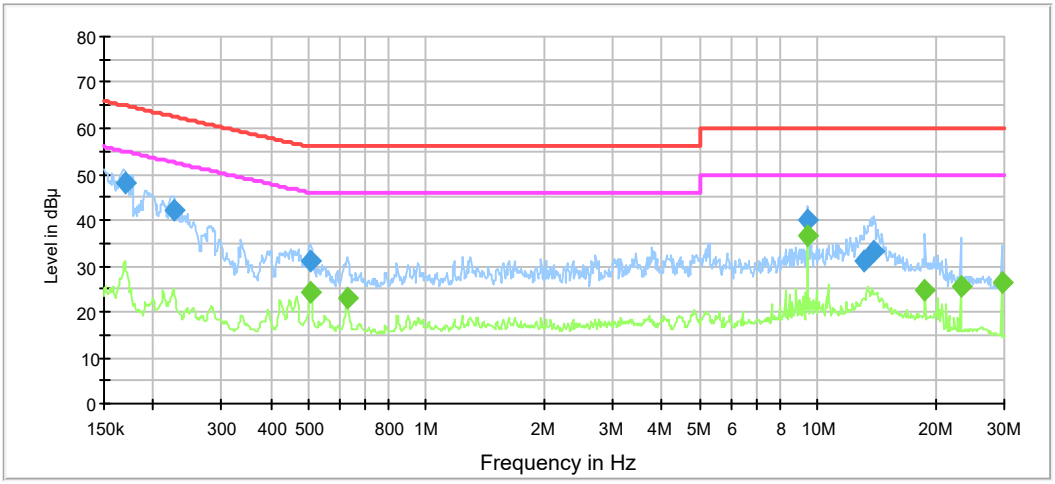
AC120V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.170769	47.3	1000.0	9.000	L1	19.5	17.7	64.9
0.194414	39.8	1000.0	9.000	L1	19.5	24.1	63.8
0.226921	40.7	1000.0	9.000	L1	19.6	21.8	62.6
0.506536	31.0	1000.0	9.000	L1	19.6	25.0	56.0
9.417222	39.9	1000.0	9.000	L1	19.6	20.1	60.0
13.418785	33.6	1000.0	9.000	L1	19.6	26.4	60.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.506536	23.7	1000.0	9.000	L1	19.6	22.3	46.0
0.627699	23.5	1000.0	9.000	L1	19.6	22.5	46.0
9.417222	37.0	1000.0	9.000	L1	19.6	13.0	50.0
10.667787	28.8	1000.0	9.000	L1	19.6	21.2	50.0
23.226297	25.7	1000.0	9.000	L1	19.7	24.3	50.0
29.508759	26.3	1000.0	9.000	L1	19.8	23.7	50.0

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.169919	48.3	1000.0	9.000	N	19.5	16.7	65.0
0.225792	42.0	1000.0	9.000	N	19.6	20.6	62.6
0.504016	31.0	1000.0	9.000	N	19.6	25.0	56.0
9.417222	39.8	1000.0	9.000	N	19.6	20.2	60.0
13.153731	31.2	1000.0	9.000	N	19.6	28.8	60.0
13.965024	33.0	1000.0	9.000	N	19.6	27.0	60.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.506536	24.2	1000.0	9.000	N	19.6	21.8	46.0
0.627699	23.1	1000.0	9.000	N	19.6	22.9	46.0
9.417222	36.8	1000.0	9.000	N	19.6	13.2	50.0
18.836725	24.7	1000.0	9.000	N	19.6	25.3	50.0
23.226297	25.6	1000.0	9.000	N	19.7	24.4	50.0
29.508759	26.3	1000.0	9.000	N	19.8	23.7	50.0

Note:
1) Corrected Amplitude = Reading + Correction Factor
2) Correction Factor =LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter
3) Margin = Limit – Corrected Amplitude

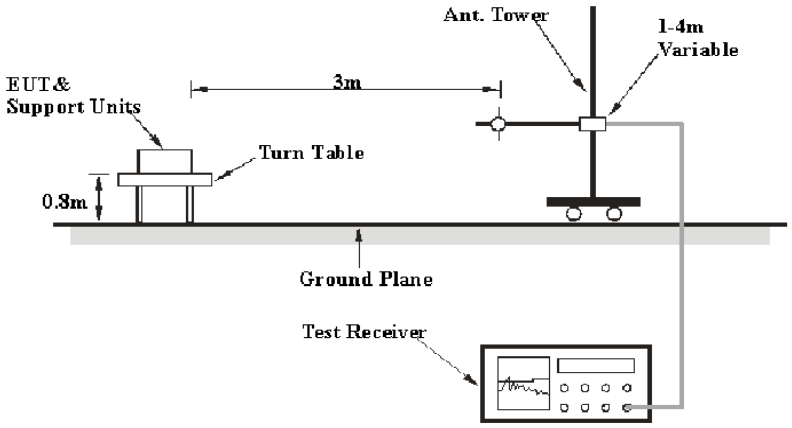
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

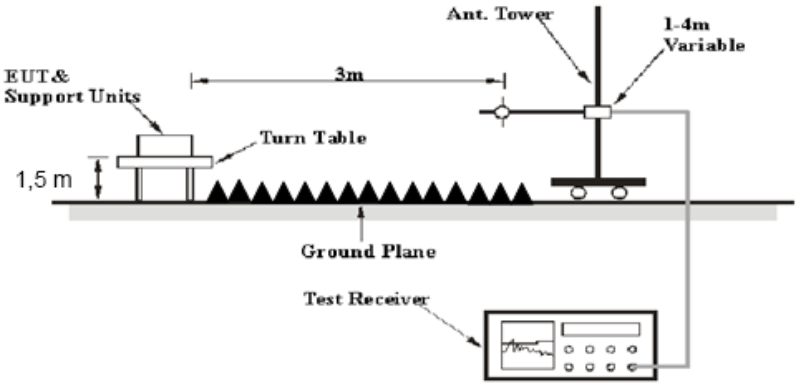
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 10 GHz.

During the radiated emission test, the EMI test receiver setup was set with the following configurations:

Frequency Range	RBW	Video B/W	Detector
30 MHz–1000 MHz	120 kHz	300 kHz	QP
Above 1GHz	1MHz	3 MHz	PK
	1MHz	3 MHz	AV

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz - 1 GHz, peak and average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Data

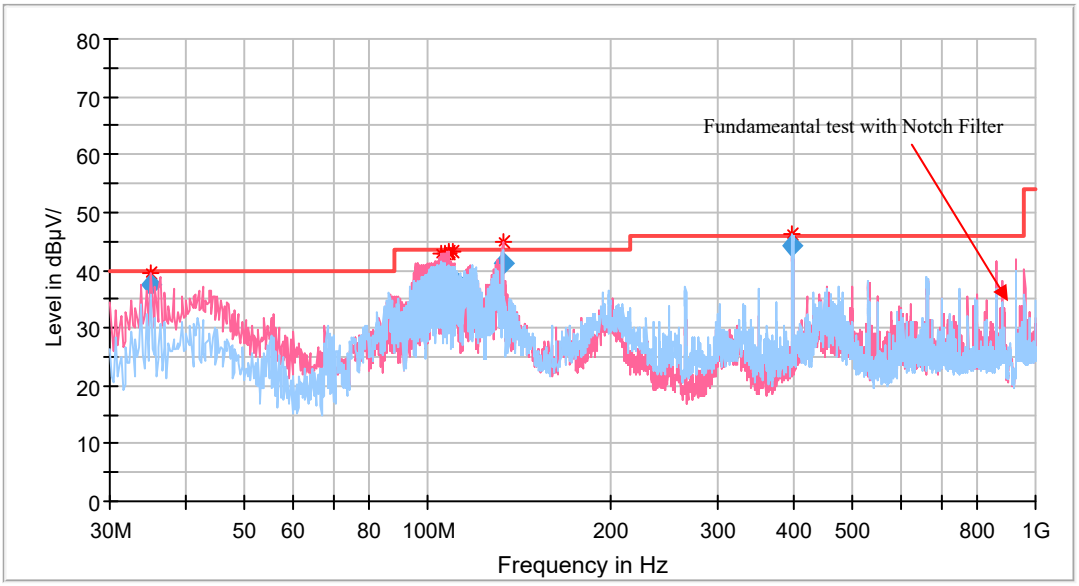
Environmental Conditions

Temperature:	19 °C
Relative Humidity:	52 %
ATM Pressure:	95.9 kPa

The testing was performed by Even Wu on 2021-06-01.

Test Mode: Transmitting

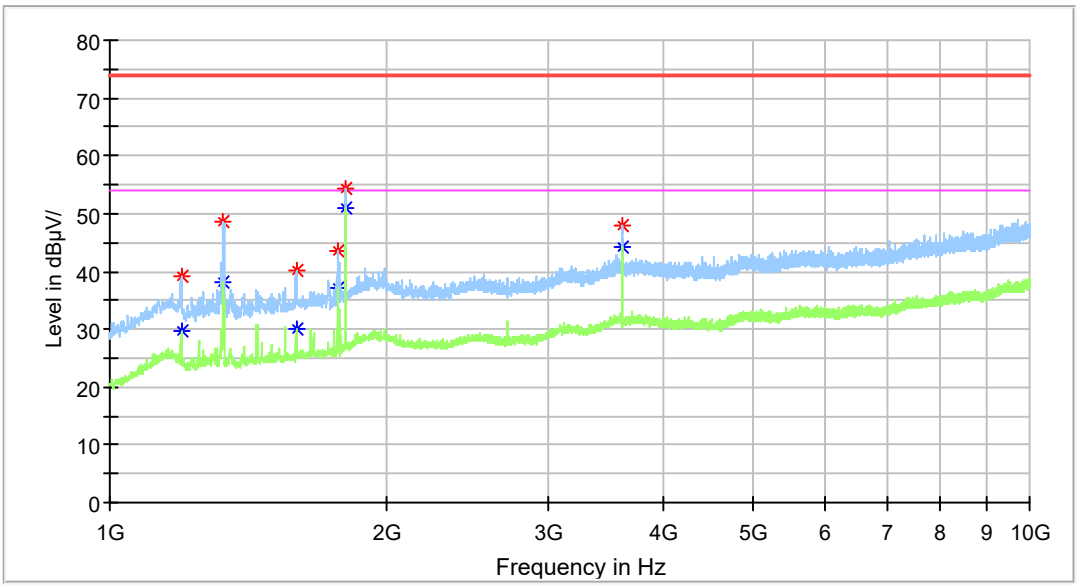
30 MHz to 1 GHz_Middle Channel(worst case)



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
35.150500	37.37	40.00	2.63	1000.0	120.000	104.0	V	45.0	-7.9
105.500125	37.23	43.50	6.27	1000.0	120.000	124.0	V	237.0	-13.8
106.723750	37.88	43.50	5.62	1000.0	120.000	104.0	V	240.0	-13.6
108.633000	38.63	43.50	4.87	1000.0	120.000	109.0	V	246.0	-13.3
108.641125	38.87	43.50	4.63	1000.0	120.000	105.0	V	239.0	-13.3
109.906125	38.36	43.50	5.14	1000.0	120.000	115.0	V	234.0	-13.1
133.044625	41.29	43.50	2.21	1000.0	120.000	104.0	V	176.0	-11.5
398.849125	44.38	46.00	1.62	1000.0	120.000	104.0	H	66.0	-9.0

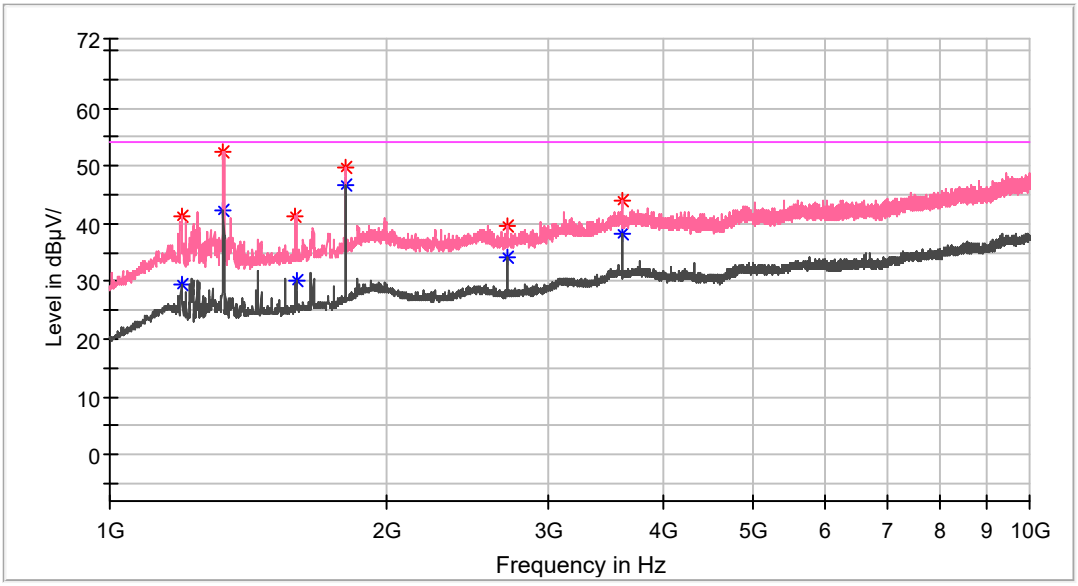
Above 1 GHz:

Low Channel_Horizontal



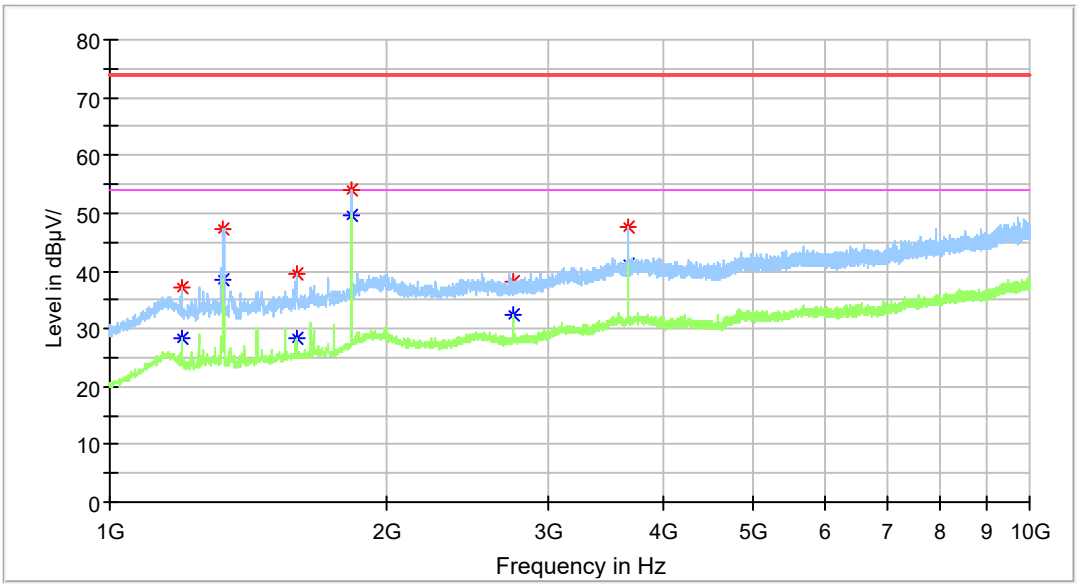
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1195.300000	---	29.64	54.00	24.36	100.0	H	324.0	0.4
1195.300000	39.21	---	74.00	34.79	100.0	H	324.0	0.4
1328.500000	---	38.01	54.00	15.99	150.0	H	219.0	0.9
1329.400000	48.74	---	74.00	25.26	150.0	H	219.0	0.9
1594.000000	---	29.95	54.00	24.05	100.0	H	225.0	2.3
1594.000000	40.28	---	74.00	33.72	100.0	H	225.0	2.3
1766.800000	43.56	---	74.00	30.44	150.0	H	240.0	3.9
1766.800000	---	37.21	54.00	16.79	150.0	H	240.0	3.9
1805.500000	54.35	---	74.00	19.65	200.0	H	102.0	4.3
1805.500000	---	51.08	54.00	2.92	200.0	H	102.0	4.3
3610.900000	47.91	---	74.00	26.09	150.0	H	173.0	9.8
3610.900000	---	44.13	54.00	9.87	150.0	H	173.0	9.8

Low Channel_Vertical



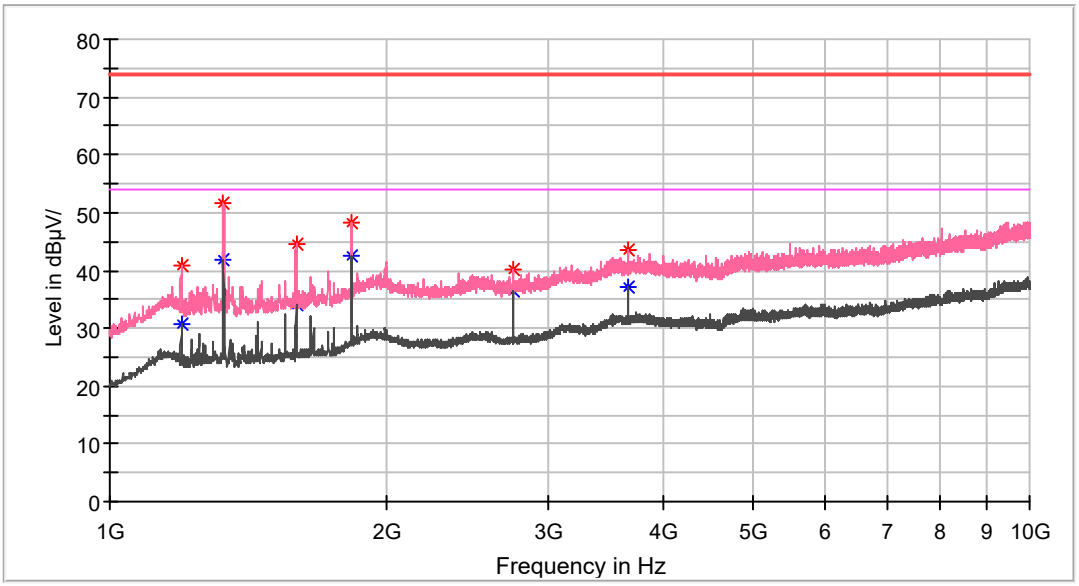
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1195.300000	---	29.41	54.00	24.59	100.0	V	338.0	0.4
1198.900000	41.31	---	74.00	32.69	100.0	V	338.0	0.4
1328.500000	---	42.37	54.00	11.63	150.0	V	16.0	0.9
1328.500000	52.55	---	74.00	21.45	100.0	V	16.0	0.9
1591.300000	41.36	---	74.00	32.64	100.0	V	280.0	2.3
1595.800000	---	30.05	54.00	23.95	100.0	V	280.0	2.4
1805.500000	---	46.54	54.00	7.46	200.0	V	350.0	4.3
1805.500000	49.84	---	74.00	24.16	200.0	V	350.0	4.3
2708.200000	39.71	---	74.00	34.29	150.0	V	340.0	6.3
2708.200000	---	34.27	54.00	19.73	150.0	V	340.0	6.3
3610.900000	43.84	---	74.00	30.16	100.0	V	171.0	9.8
3610.900000	---	38.14	54.00	15.86	200.0	V	171.0	9.8

Middle Channel_Horizontal



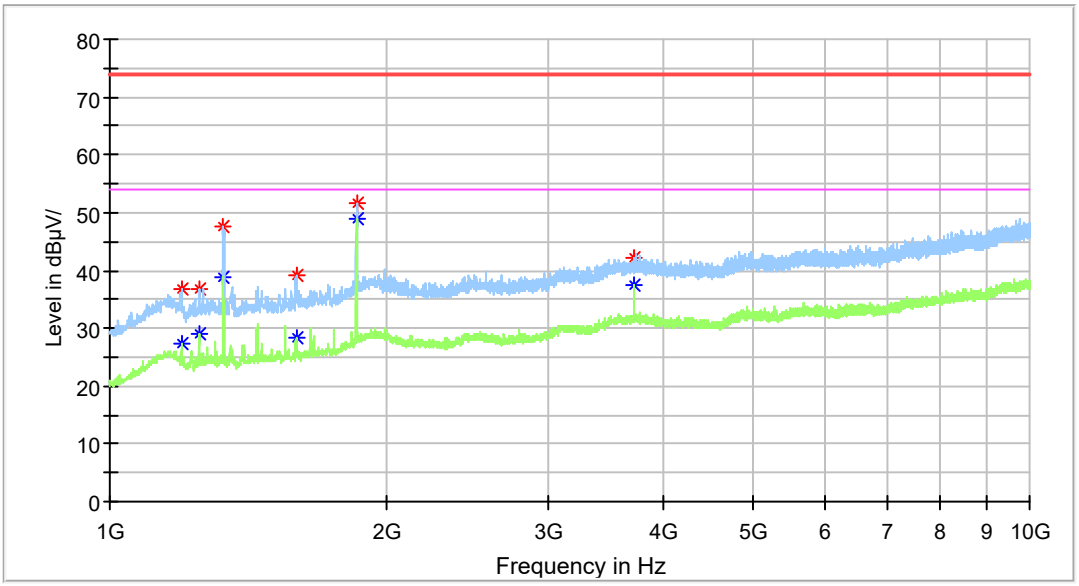
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1198.000000	37.01	---	74.00	36.99	100.0	H	225.0	0.4
1199.800000	---	28.46	54.00	25.54	200.0	H	225.0	0.4
1327.600000	47.39	---	74.00	26.61	150.0	H	223.0	0.9
1328.500000	---	38.46	54.00	15.54	150.0	H	223.0	0.9
1594.900000	39.38	---	74.00	34.62	100.0	H	236.0	2.4
1595.800000	---	28.51	54.00	25.49	200.0	H	236.0	2.4
1828.900000	---	49.47	54.00	4.53	200.0	H	244.0	4.5
1828.900000	54.08	---	74.00	19.92	150.0	H	244.0	4.5
2744.200000	---	32.38	54.00	21.62	150.0	H	223.0	6.4
2744.200000	38.19	---	74.00	35.81	200.0	H	223.0	6.4
3658.600000	47.46	---	74.00	26.54	200.0	H	182.0	10.0
3658.600000	---	41.25	54.00	12.75	200.0	H	182.0	10.0

Middle Channel_Vertical



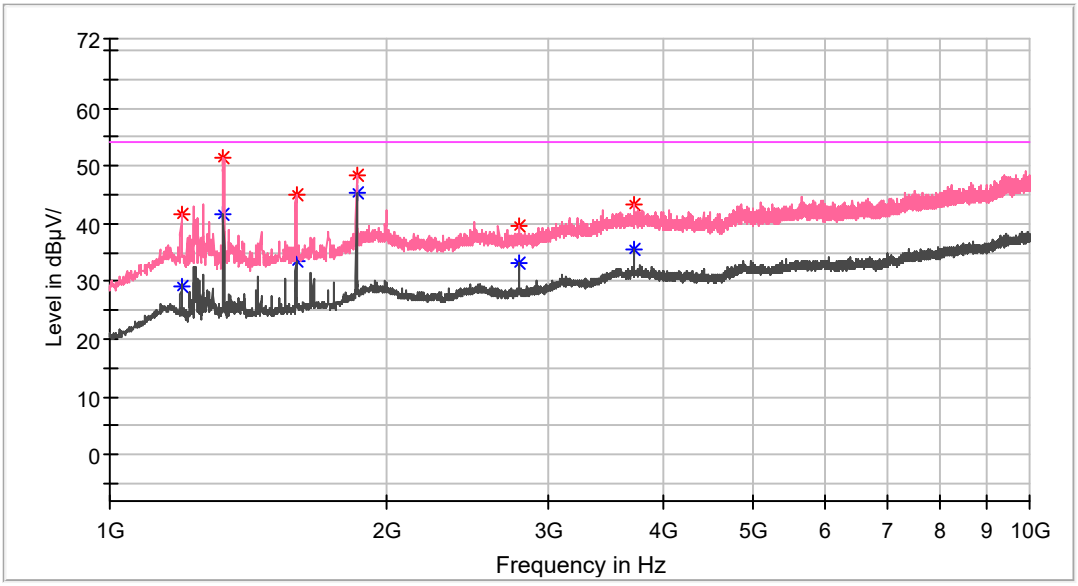
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1198.000000	---	30.66	54.00	23.34	200.0	V	279.0	0.4
1198.000000	40.69	---	74.00	33.31	200.0	V	279.0	0.4
1328.500000	---	41.92	54.00	12.08	150.0	V	0.0	0.9
1329.400000	51.48	---	74.00	22.52	100.0	V	9.0	0.9
1594.000000	---	33.98	54.00	20.02	100.0	V	275.0	2.3
1594.900000	44.63	---	74.00	29.37	100.0	V	275.0	2.4
1828.900000	---	42.68	54.00	11.32	200.0	V	10.0	4.5
1828.900000	48.31	---	74.00	25.69	200.0	V	10.0	4.5
2744.200000	40.10	---	74.00	33.90	150.0	V	5.0	6.4
2744.200000	---	36.36	54.00	17.64	150.0	V	5.0	6.4
3658.600000	---	37.11	54.00	16.89	100.0	V	165.0	10.0
3658.600000	43.47	---	74.00	30.53	150.0	V	165.0	10.0

High Channel_Horizontal



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1196.200000	36.84	---	74.00	37.16	150.0	H	144.0	0.4
1199.800000	---	27.38	54.00	26.62	150.0	H	123.0	0.4
1250.200000	---	29.10	54.00	24.90	100.0	H	282.0	0.6
1250.200000	36.88	---	74.00	37.12	150.0	H	282.0	0.6
1327.600000	47.64	---	74.00	26.36	150.0	H	218.0	0.9
1328.500000	---	38.65	54.00	15.35	150.0	H	218.0	0.9
1594.000000	---	28.23	54.00	25.77	200.0	H	306.0	2.3
1594.000000	39.06	---	74.00	34.94	200.0	H	306.0	2.3
1854.100000	51.50	---	74.00	22.50	150.0	H	240.0	4.7
1854.100000	---	48.91	54.00	5.09	150.0	H	240.0	4.7
3709.000000	42.25	---	74.00	31.75	200.0	H	179.0	10.1
3709.000000	---	37.35	54.00	16.65	200.0	H	179.0	10.1

High Channel_Vertical

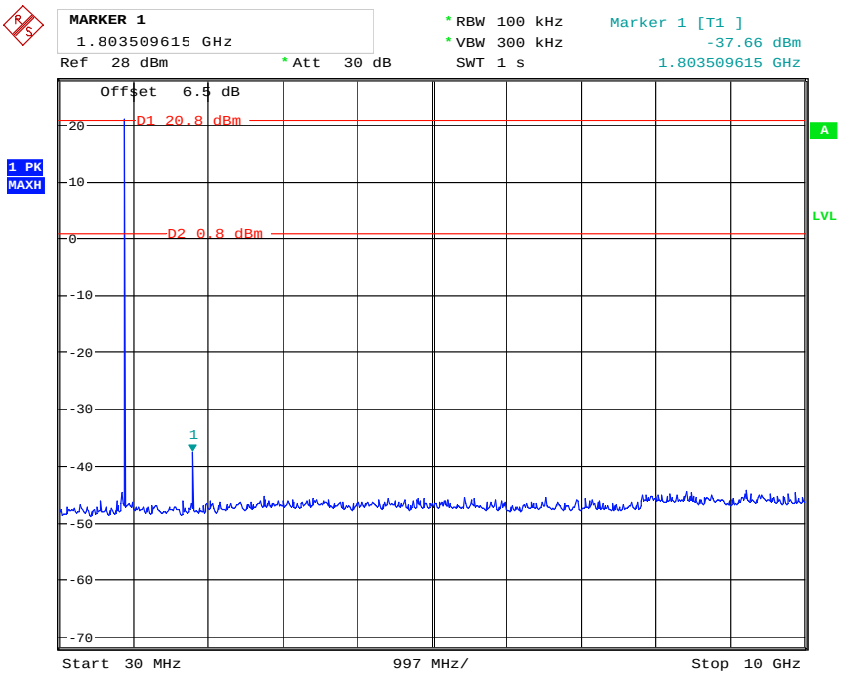


Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1196.200000	---	29.23	54.00	24.77	150.0	V	339.0	0.4
1196.200000	41.56	---	74.00	32.44	150.0	V	339.0	0.4
1328.500000	---	41.58	54.00	12.42	100.0	V	22.0	0.9
1329.400000	51.56	---	74.00	22.44	100.0	V	33.0	0.9
1594.000000	---	33.64	54.00	20.36	100.0	V	278.0	2.3
1594.000000	44.88	---	74.00	29.12	100.0	V	278.0	2.3
1854.100000	48.49	---	74.00	25.51	100.0	V	0.0	4.7
1854.100000	---	45.29	54.00	8.71	100.0	V	0.0	4.7
2781.100000	39.73	---	74.00	34.27	150.0	V	36.0	6.5
2782.000000	---	33.18	54.00	20.82	150.0	V	36.0	6.5
3709.000000	---	35.55	54.00	18.45	150.0	V	182.0	10.1
3709.000000	43.41	---	74.00	30.59	100.0	V	182.0	10.1

Note:
Corrected Amplitude = Corrected Factor + Reading
Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor
Margin = Limit- Corr. Amplitude

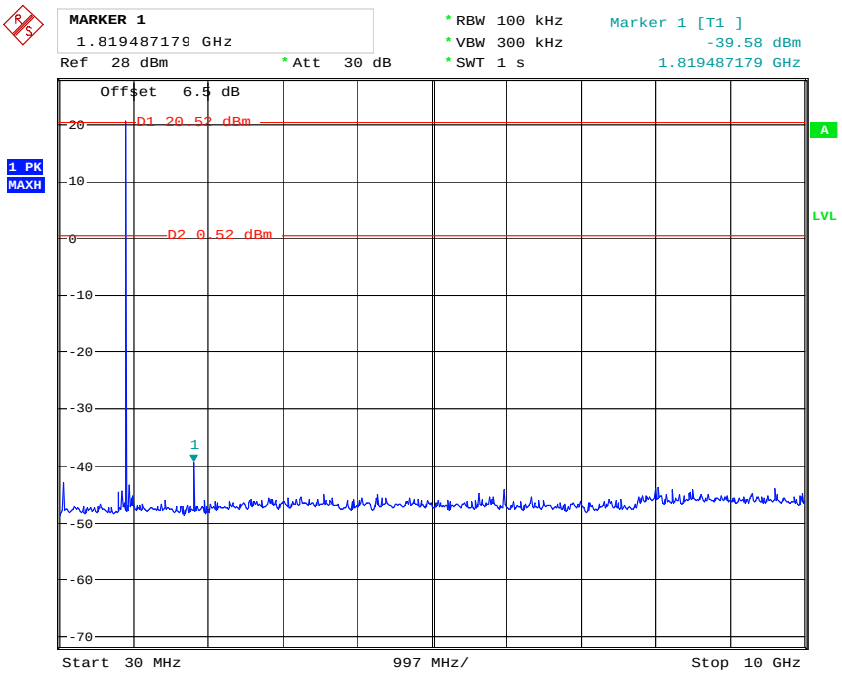
Conducted Spurious Emission At Antenna Port:

Low Channel



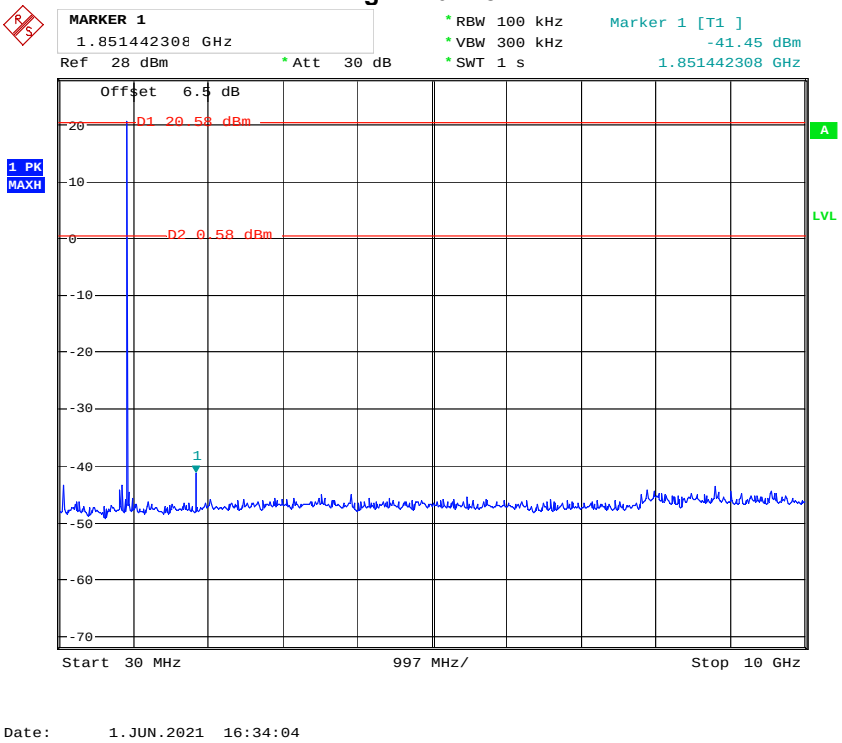
Date: 1.JUN.2021 10:30:48

Middle Channel



Date: 1.JUN.2021 16:36:33

High Channel



Band Edge Emissions

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBμV	PK/QP/AV	H/V	dB(1/m)	dB	dB	dBμV/m	dBμV/m	dB
frequency:902.75 MHz									
902	8.89	QP	V	28.02	2.69	0.00	39.60	46.00	6.40
902	8.83	QP	H	28.02	2.69	0.00	39.54	46.00	6.46
frequency:927.25 MHz									
928	8.95	QP	H	28.22	2.55	0.00	39.72	46.00	6.28
928	9.45	QP	V	28.22	2.55	0.00	40.22	46.00	5.78

Note:
Corrected Amplitude = Corrected Factor + Reading
Corrected Factor=Antenna factor (RX) + Cable Loss
Margin = Limit- Corr. Amplitude

FCC §15.247(A) (1) - CHANNEL SEPARATION TEST

Applicable Standard

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.

Test Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 100 kHz, maxhold the channel.
2. Set the adjacent channel of the EUT maxhold another trace.
3. Measure the channel separation.

Test Data

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	53 %
ATM Pressure:	95.9 kPa

The testing was performed by Even Wu on 2021-06-01.

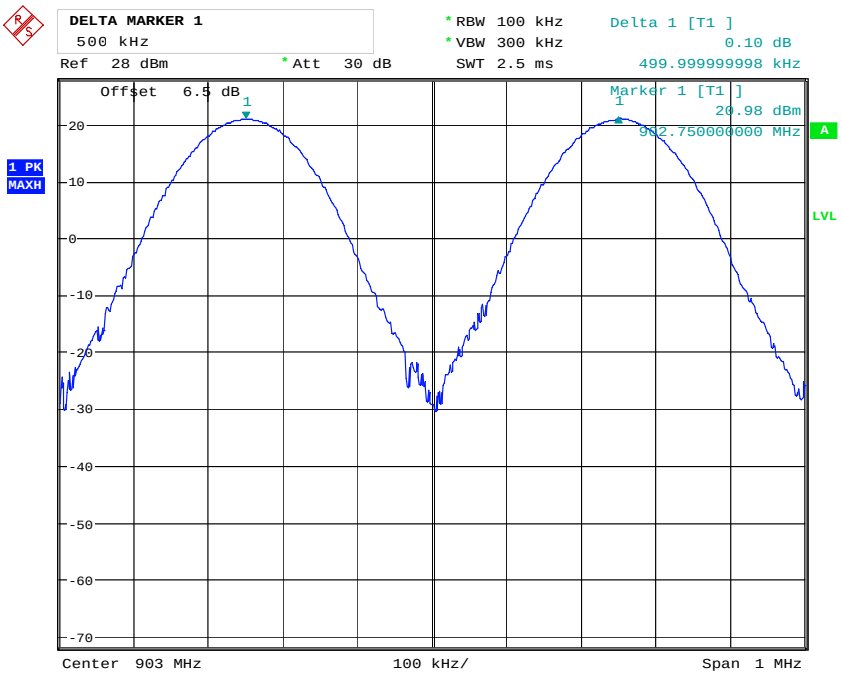
Test Result: Compliance.

Please refer to following tables and plots.

Test Mode: Transmitting

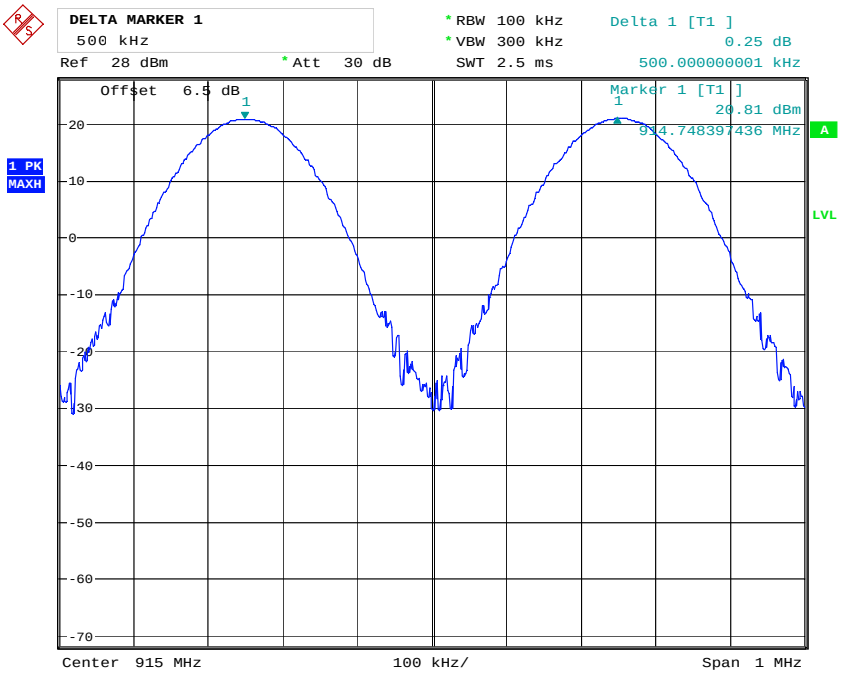
Mode	Channel	Frequency(MHz)	Channel Separation (kHz)	Limit (kHz)
RFID	Low	902.75	500	43.91
	Adjacent	903.25		
	Middle	914.75	500	44.23
	Adjacent	915.25		
	Adjacent	926.75	500	44.23
	High	927.25		

SP_Low Channel



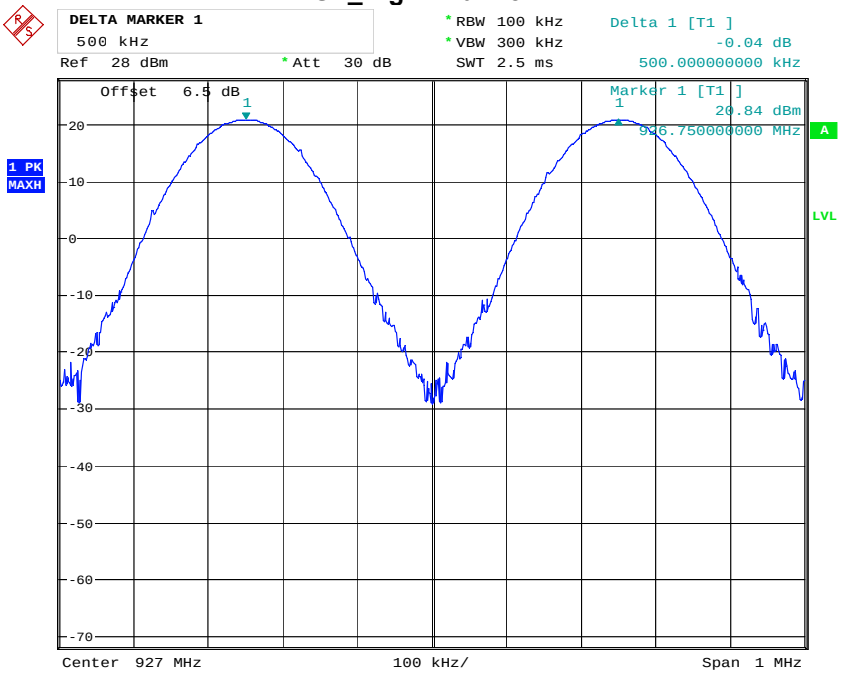
Date: 1.JUN.2021 13:41:17

SP_Middle Channel



Date: 1.JUN.2021 14:14:40

SP_High Channel



Date: 1.JUN.2021 14:21:11

FCC §15.247(a)(1) – 20 dB BANDWIDTH

Applicable Standard

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Data

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	53 %
ATM Pressure:	95.9 kPa

The testing was performed by Even Wu on 2021-06-01.

Test Result: Compliance.

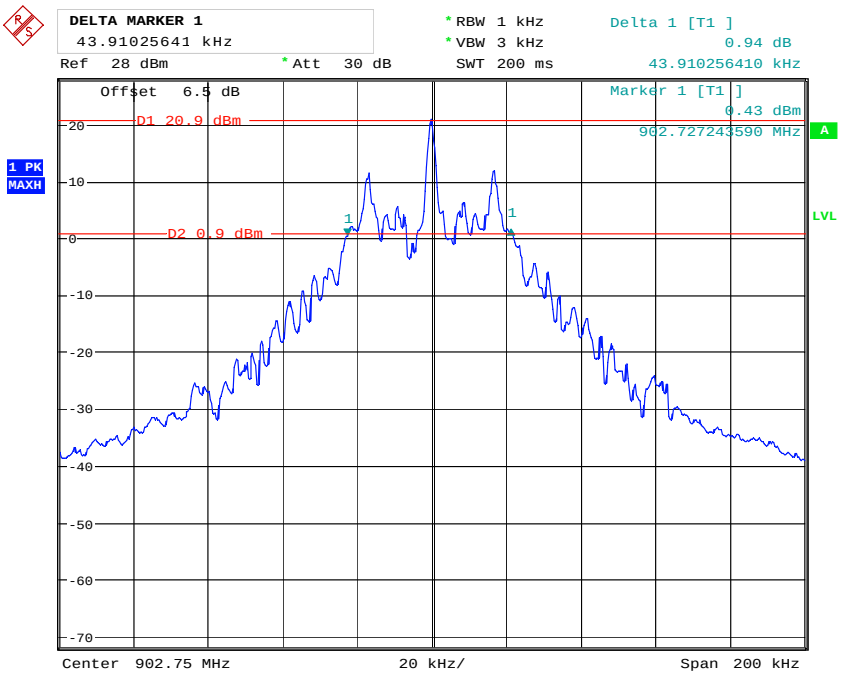
Please refer to following tables and plots

Test Mode: Transmitting

20 dB Bandwidth:

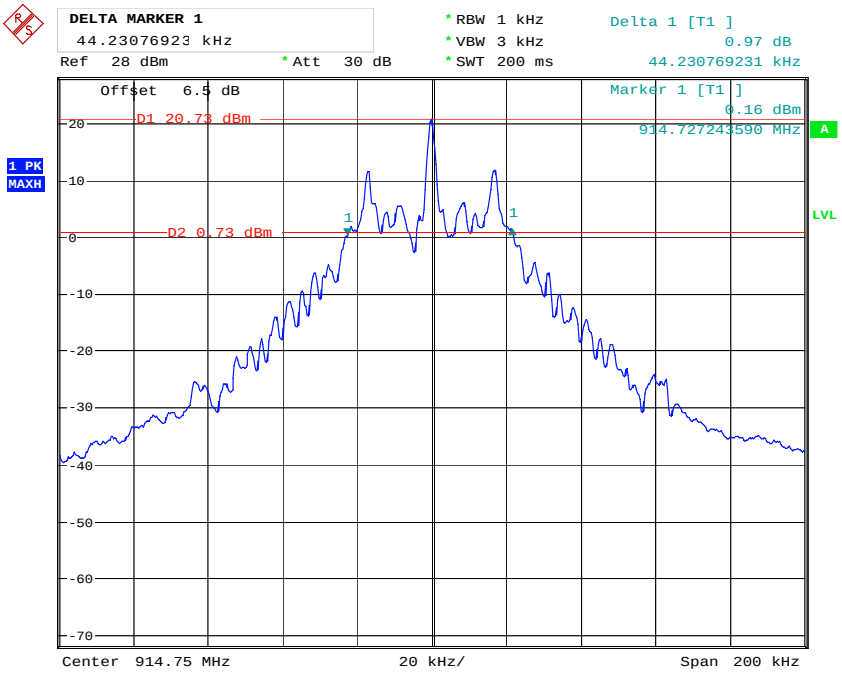
Mode	Channel	Frequency(MHz)	20 dB BW(kHz)	Limit (kHz)
RFID	Low	902.75	43.91	250
	Middle	914.75	44.23	250
	High	927.25	44.23	250

Low Channel



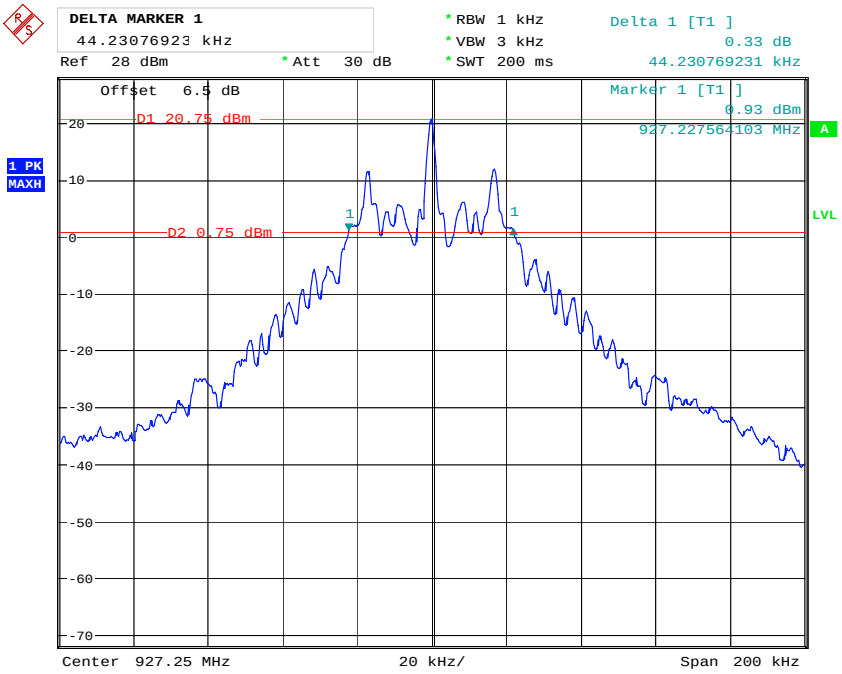
Date: 1.JUN.2021 10:27:07

Middle Channel



Date: 1.JUN.2021 15:52:06

High Channel



Date: 1.JUN.2021 15:35:23

FCC §15.247(a)(1)(i) - QUANTITY OF HOPPING CHANNEL TEST

Applicable Standard

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

Test Data

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	53 %
ATM Pressure:	95.9 kPa

The testing was performed by Even Wu on 2021-06-01.

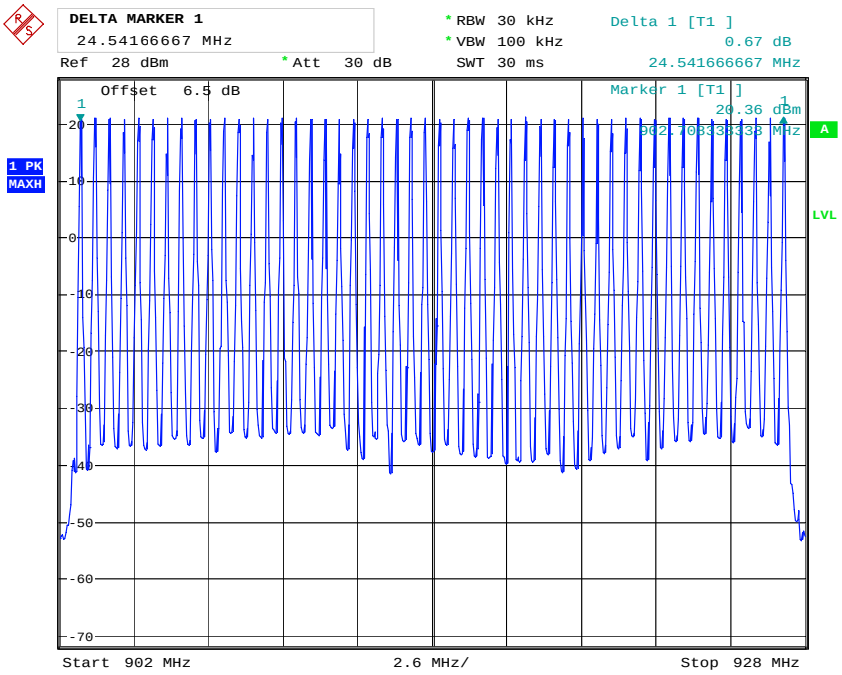
Test Result: Compliance.

Please refer to following tables and plots.

Test Mode: Transmitting

Mode	Frequency Range (MHz)	Hopping Channel Number	Limit
RFID	902.75-927.25	50	50

Number of Hopping Channels



Date: 1.JUN.2021 11:49:02

FCC §15.247(a)(1)(i) - TIME OF OCCUPANCY (DWELL TIME)

Applicable Standard

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Test Procedure

1. The EUT was worked in channel hopping.
2. Set the RBW to: 100 kHz.
3. Set the VBW ⩾ 3×RBW.
4. Set the span to 0Hz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Recorded the time of single pulses

Test Data

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	53 %
ATM Pressure:	95.9 kPa

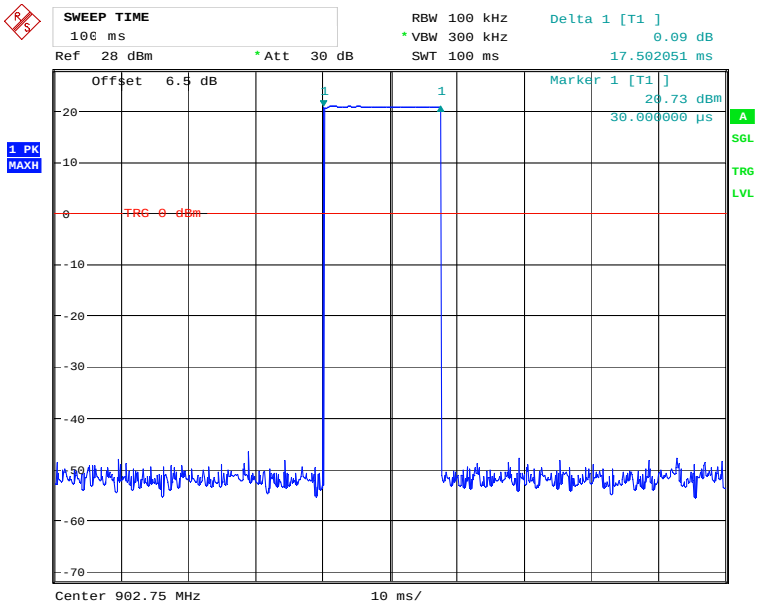
The testing was performed by Even Wu on 2021-06-01.

Test Result: Compliance. Please refer to following tables and plots

Test Mode: Transmitting

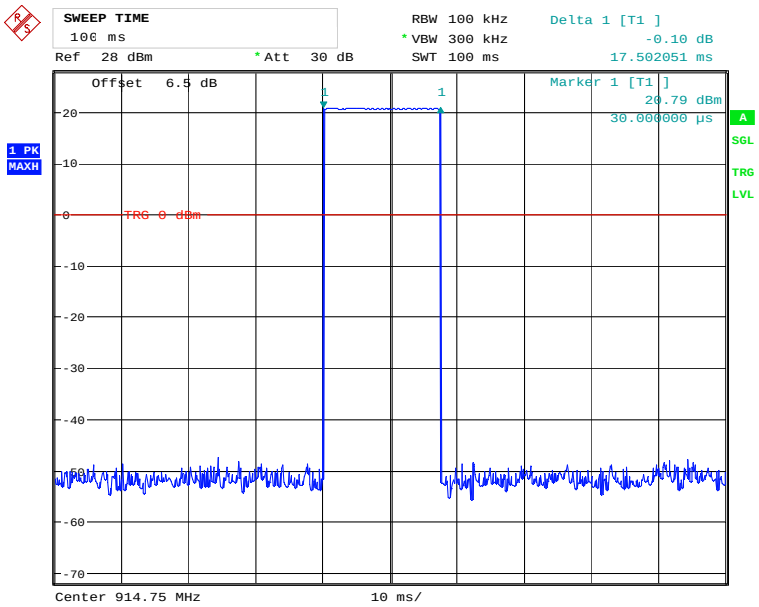
Mode	Channel	Frequency (MHz)	Pulse Width (ms)	Hopping Number within 20 second period	Dwell time(s)	Limit (s)
RFID	Low	902.75	17.50	16	0.280	0.4
	Middle	914.75	17.50	16	0.280	0.4
	High	927.25	17.50	16	0.280	0.4

Pulse Width _Low Channel



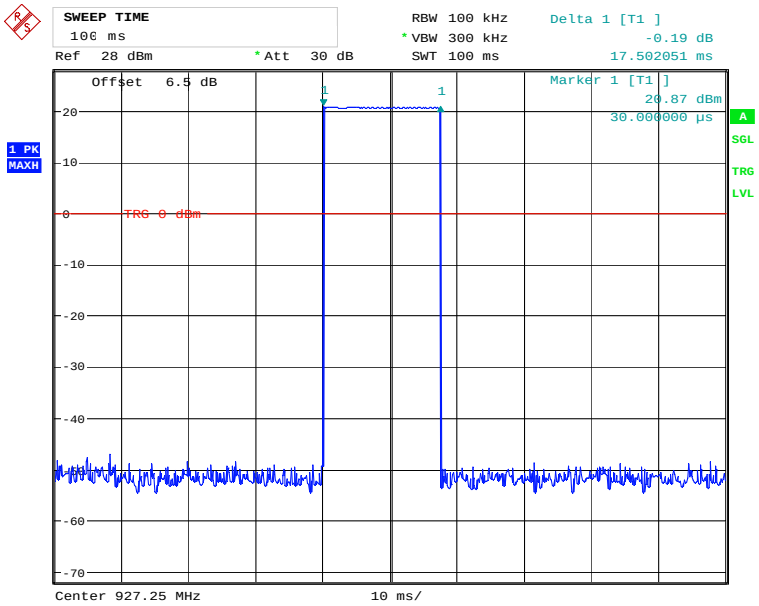
Date: 1.JUN.2021 11:08:39

Pulse Width _Middle Channel



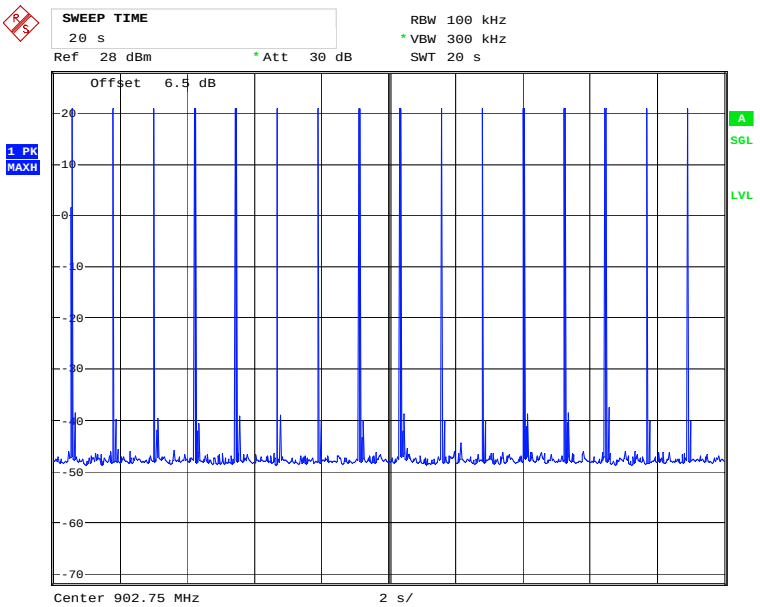
Date: 1.JUN.2021 11:07:47

Pulse Width _High Channel



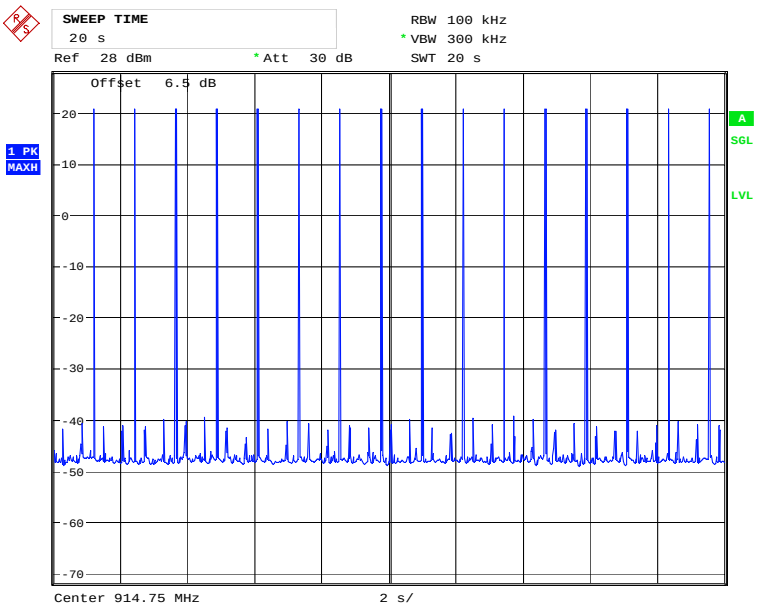
Date: 1.JUN.2021 11:06:30

Number of Pulse in 20S Period _Low Channel



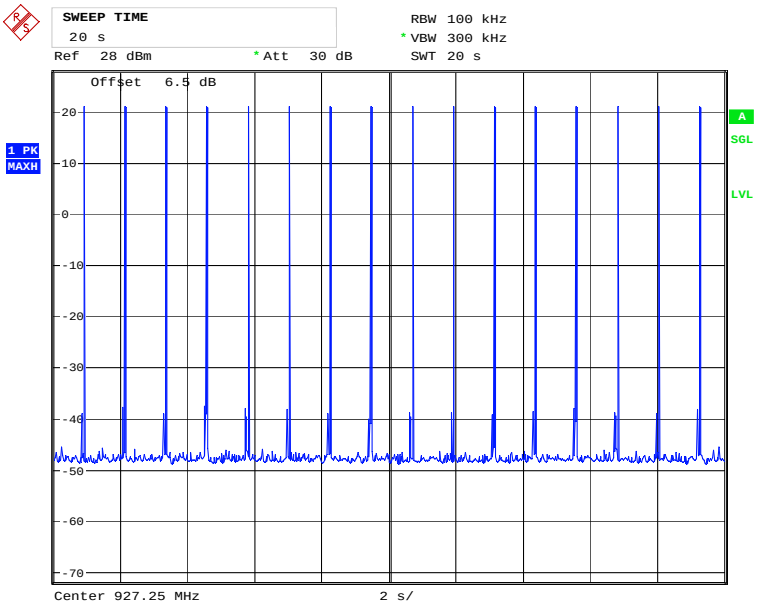
Date: 1.JUN.2021 10:58:35

Number of Pulse in 20S Period _Middle Channel



Date: 1.JUN.2021 10:59:58

Number of Pulse in 20S Period_High Channel



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FCC §15.247(b) (2) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.

Test Data

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	53 %
ATM Pressure:	95.9 kPa

The testing was performed by Even Wu on 2021-06-01.

Test Result: Compliance. Please refer to following tables.

Test Mode: Transmitting

Antenna port	Maximum Peak Conducted Output Power			
	Low channel 902.75 MHz	Middle channel 914.75 MHz	High Channel 927.25 MHz	Limit
	dBm	dBm	dBm	dBm
1	20.57	20.57	20.90	30
2	20.96	21.14	20.86	30
3	20.89	21.00	20.93	30
4	20.54	20.68	21.00	30
5	20.81	20.89	20.93	30
6	20.67	20.76	20.82	30
7	20.70	20.81	20.86	30
8	20.74	20.87	20.94	30
9	20.77	20.83	20.94	30
10	20.67	20.82	20.81	30
11	20.72	20.81	20.96	30
12	20.81	20.88	20.87	30
13	20.65	20.71	20.97	30
14	20.79	21.03	20.84	30
15	20.75	20.71	21.13	30
16	20.80	20.70	20.94	30

Note: The data above was tested in conducted mode.

FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW=100 kHz; VBW=300 kHz.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Data

Environmental Conditions

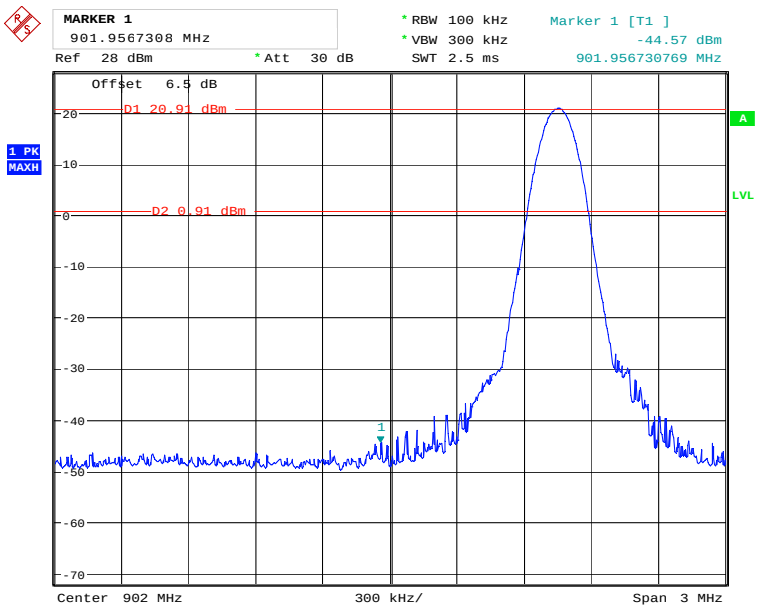
Temperature:	20 °C
Relative Humidity:	53 %
ATM Pressure:	95.9 kPa

The testing was performed by Even Wu on 2021-06-01.

Test Result: Compliance. Please refer to the below plots:

Single:

Band Edge, Left Side



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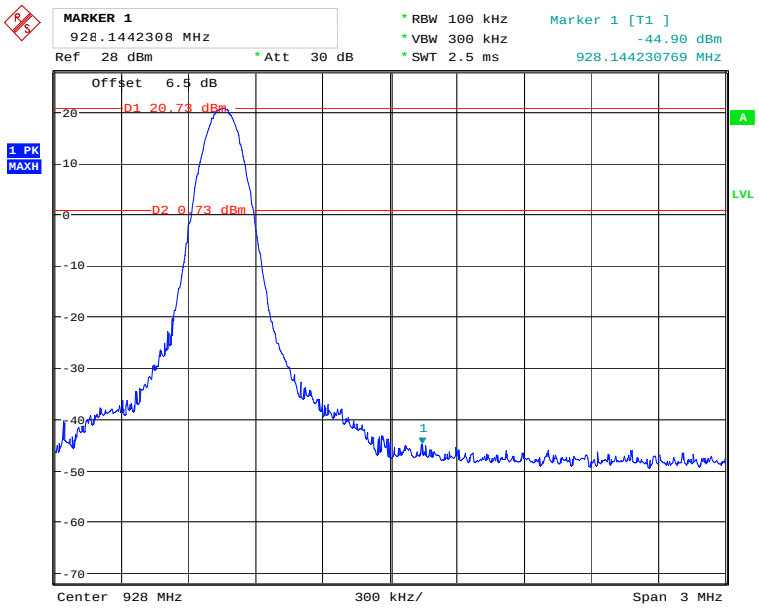
Band Edge, Right Side



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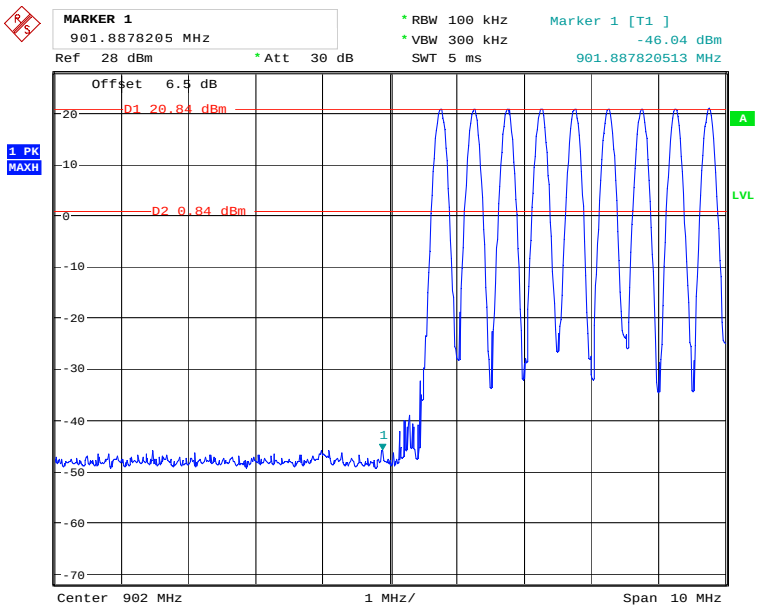
Hopping:

Band Edge, Left Side



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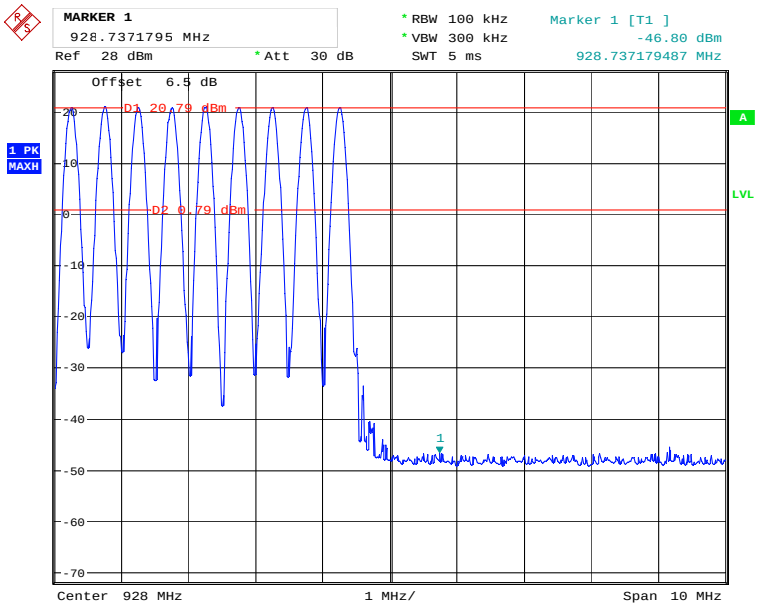
Band Edge, Right Side



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END OF REPORT