EST Technology

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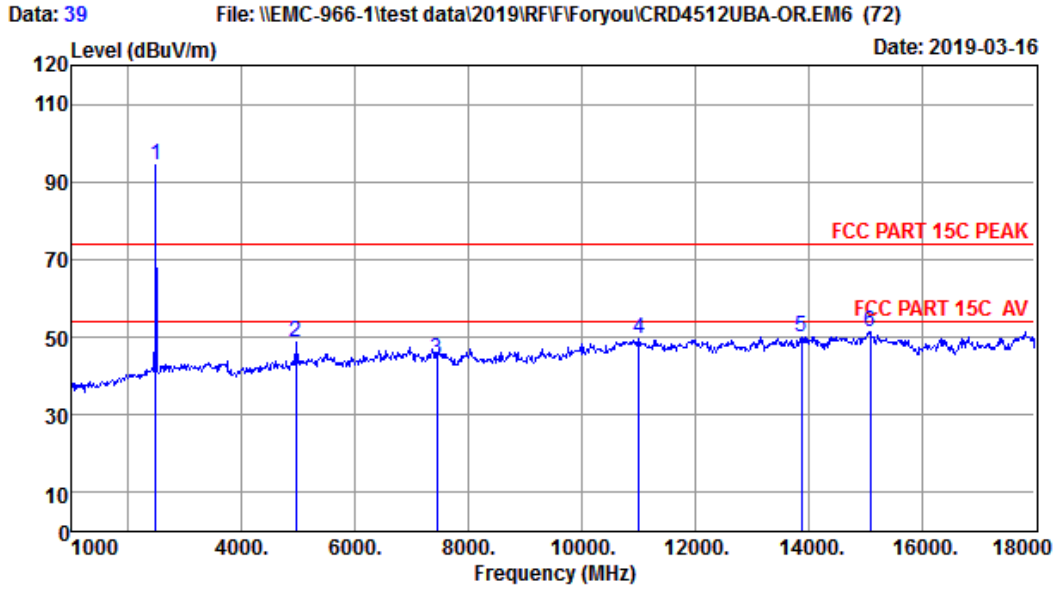

Site no. : 1# 966 Chamber Data no. : 39
Dis. / Ant. : 3m 9120D 1-18G Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : Seven
EUT : CAR RADIO
Power : DC 12V
M/N : CRD4512UBA-OR
Test Mode : GFSK TX 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.38	4.03	33.56	96.33	94.18	74.00	-20.18	Peak
2	4960.00	31.68	6.10	33.40	44.34	48.72	74.00	25.28	Peak
3	7440.00	36.34	7.66	31.10	31.43	44.33	74.00	29.67	Peak
4	11013.00	39.99	10.15	31.44	30.75	49.45	74.00	24.55	Peak
5	13886.00	40.90	11.78	30.91	28.21	49.98	74.00	24.02	Peak
6	15093.00	40.71	12.18	31.10	29.48	51.27	74.00	22.73	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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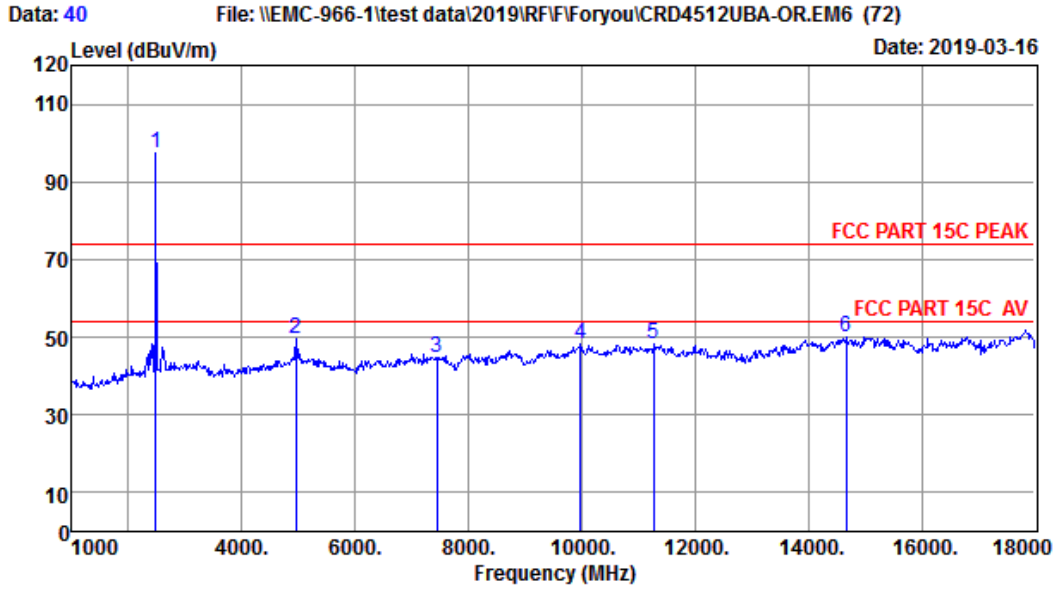


Site no. : 1# 966 Chamber Data no. : 40
Dis. / Ant. : 3m 9120D 1-18G Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : Seven
EUT : CAR RADIO
Power : DC 12V
M/N : CRD4512UBA-OR
Test Mode : GFSK TX 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.38	4.03	33.56	99.68	97.53	74.00	-23.53	Peak
2	4960.00	31.68	6.10	33.40	45.27	49.65	74.00	24.35	Peak
3	7440.00	36.34	7.66	31.10	31.93	44.83	74.00	29.17	Peak
4	9976.00	38.47	9.36	32.85	33.40	48.38	74.00	25.62	Peak
5	11268.00	39.81	10.01	30.67	28.94	48.09	74.00	25.91	Peak
6	14668.00	41.03	12.17	31.32	28.08	49.96	74.00	24.04	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

18000MHz – 25000MHz

Pass

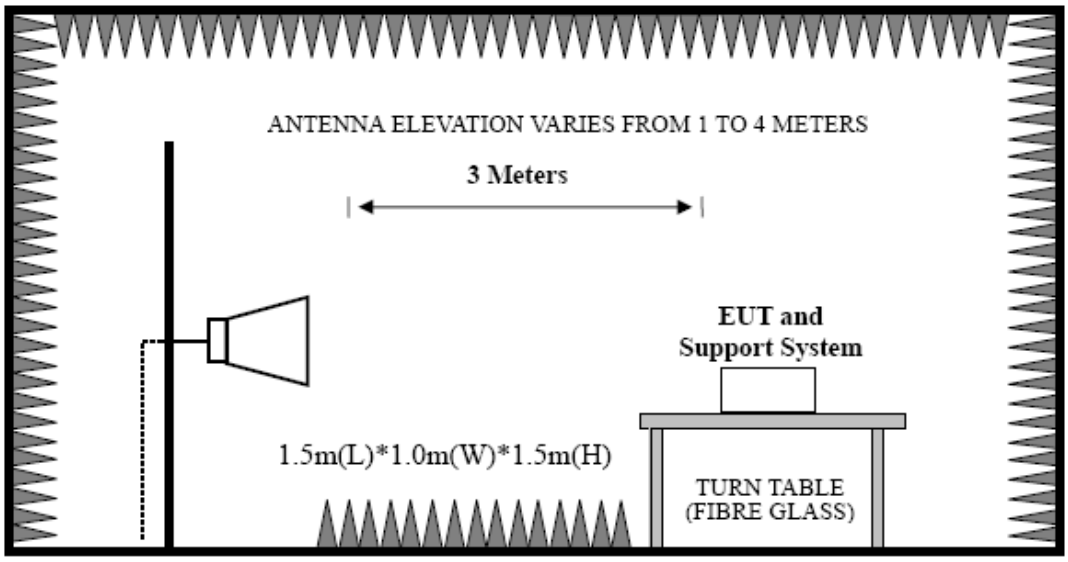
Note: The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

9. BAND EDGE COMPLIANCE

9.1. Limit

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

9.2. Block Diagram of Test setup



9.3. Test Procedure

EUT was placed on a turn table, which is 1.5 m high above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. Power on the EUT and let it working in test mode, then test it. EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.

Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of emissions
Peak : RBW = 1MHz, VBW = 1MHz, Detector=PEAK detector, Sweep time = auto.
AV : RBW = 1MHz, VBW = 10Hz, Detector=PEAK detector, Sweep time = auto.

9.4. Test Result

Pass (The testing data was attached in the next pages,only worse case is reported.)

Note: 1、For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.

2、The frequency 2402MHz and 2480MHz is fundamental frequency which no limit, the limit on plots is automatically generated by the software, it's not fundamental limit, we can't remove it.

9.5. Test Data

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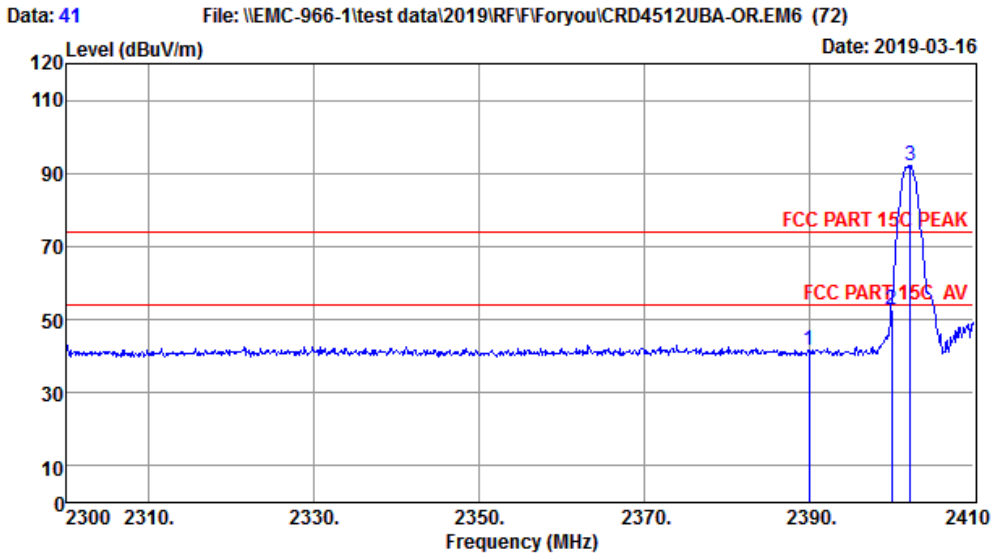

Site no. : 1# 966 Chamber Data no. : 41
Dis. / Ant. : 3m 9120D 1-18G Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : Seven
EUT : CAR RADIO
Power : DC 12V
M/N : CRD4512UBA-OR
Test Mode : GFSK TX 2402Mhz(No Hopping)

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.26	4.00	33.24	43.53	41.55	74.00	32.45	Peak
2	2400.00	27.26	4.03	33.23	54.71	52.77	74.00	21.23	Peak
3	2402.30	27.26	4.03	33.23	94.05	92.11	74.00	-18.11	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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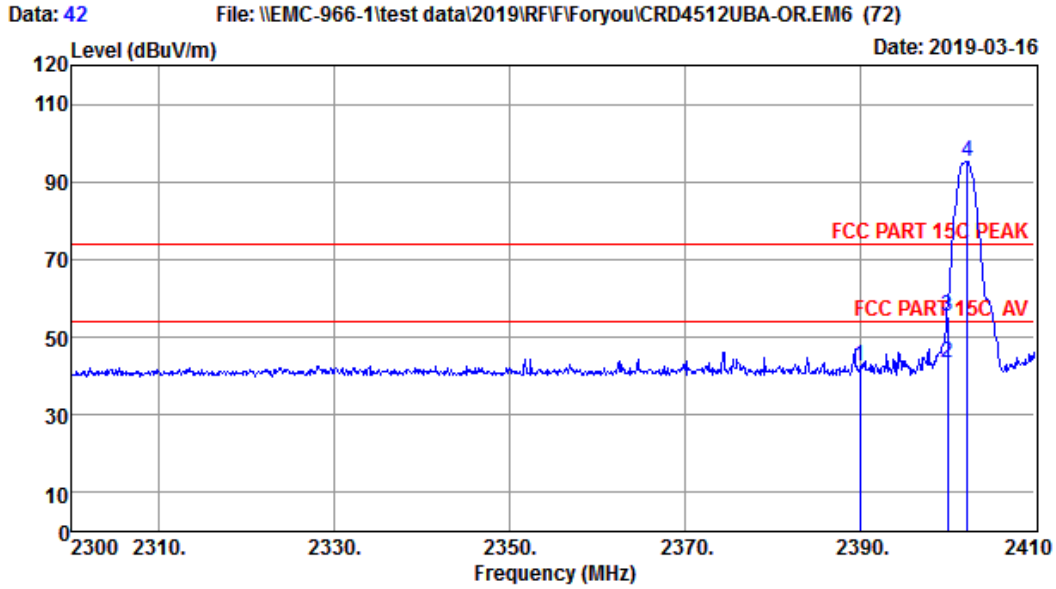

Site no. : 1# 966 Chamber Data no. : 42
Dis. / Ant. : 3m 9120D 1-18G Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : Seven
EUT : CAR RADIO
Power : DC 12V
M/N : CRD4512UBA-OR
Test Mode : GFSK TX 2402Mhz(No Hopping)

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.26	4.00	33.24	44.38	42.40	74.00	31.60	Peak
2	2400.00	27.26	4.03	33.23	45.26	43.32	54.00	10.68	Average
3	2400.00	27.26	4.03	33.23	57.21	55.27	74.00	18.73	Peak
4	2402.30	27.26	4.03	33.23	97.19	95.25	74.00	-21.25	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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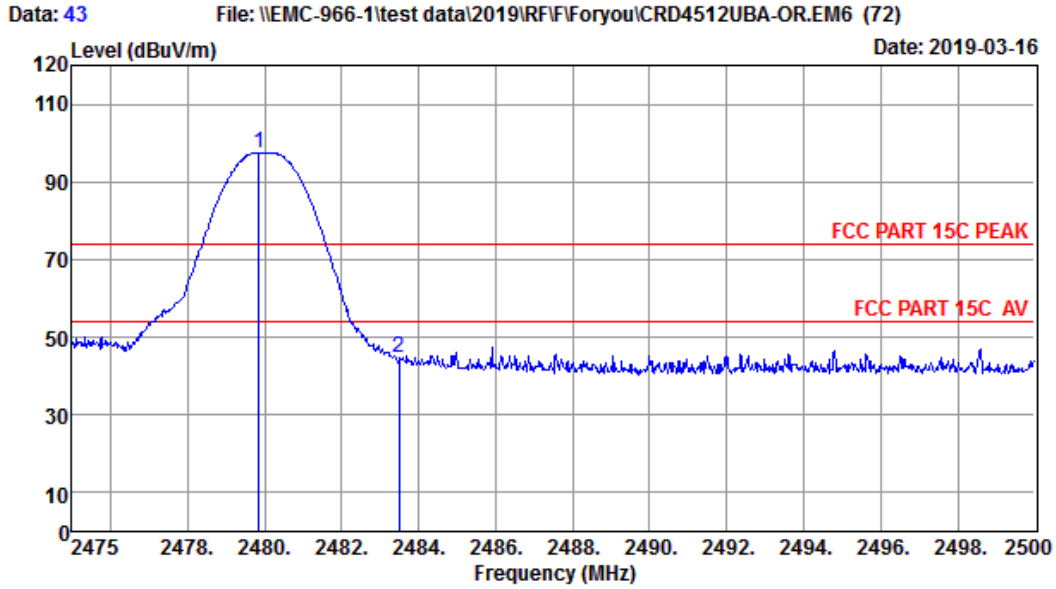

Site no. : 1# 966 Chamber Data no. : 43
Dis. / Ant. : 3m 9120D 1-18G Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : Seven
EUT : CAR RADIO
Power : DC 12V
M/N : CRD4512UBA-OR
Test Mode : GFSK TX 2480MHz(No Hopping)

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.85	27.38	4.03	33.56	99.79	97.64	74.00	-23.64	Peak
2	2483.50	27.38	4.03	33.56	46.72	44.57	74.00	29.43	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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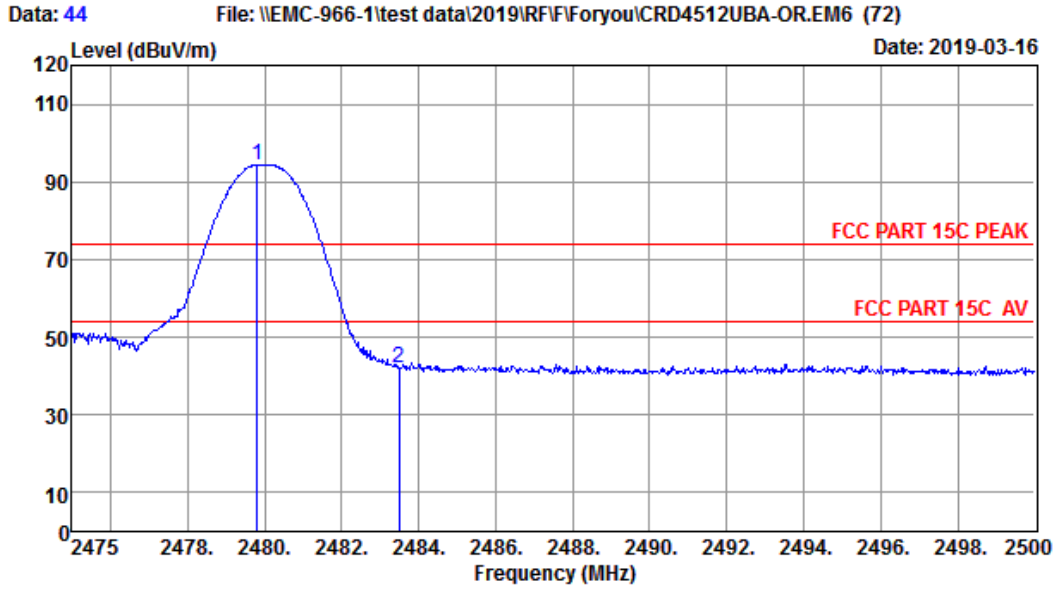

Site no. : 1# 966 Chamber Data no. : 44
Dis. / Ant. : 3m 9120D 1-18G Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : Seven
EUT : CAR RADIO
Power : DC 12V
M/N : CRD4512UBA-OR
Test Mode : GFSK TX 2480MHz(No Hopping)

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.80	27.38	4.03	33.56	96.56	94.41	74.00	-20.41	Peak
2	2483.50	27.38	4.03	33.56	44.27	42.12	74.00	31.88	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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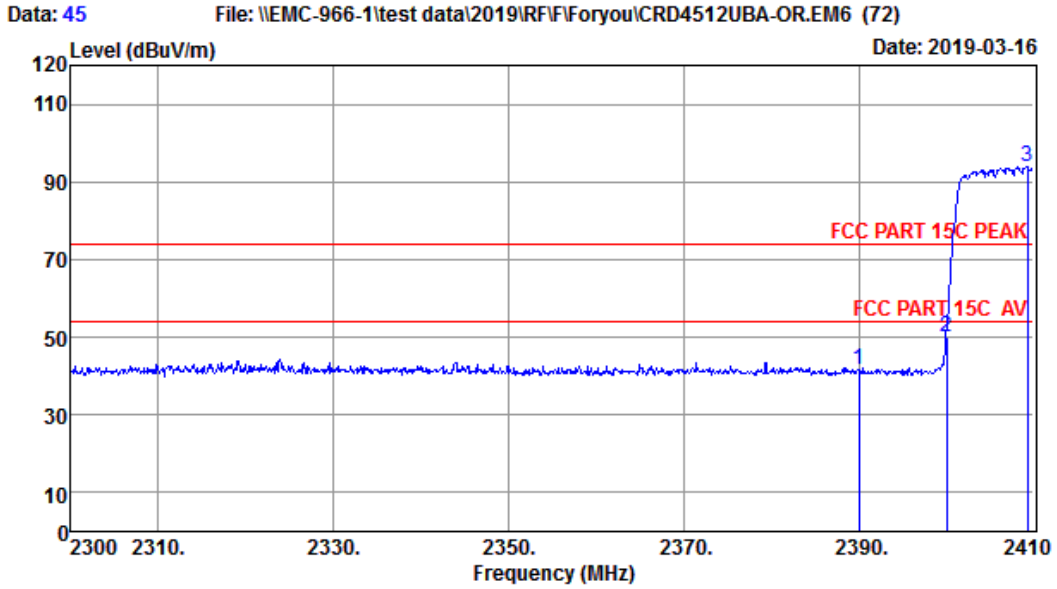

Site no. : 1# 966 Chamber Data no. : 45
Dis. / Ant. : 3m 9120D 1-18G Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : Seven
EUT : CAR RADIO
Power : DC 12V
M/N : CRD4512UBA-OR
Test Mode : GFSK TX 2402MHz(Hopping On)

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.26	4.00	33.24	43.46	41.48	74.00	32.52	Peak
2	2400.00	27.26	4.03	33.23	51.88	49.94	74.00	24.06	Peak
3	2409.23	27.28	4.03	33.23	95.72	93.80	74.00	-19.80	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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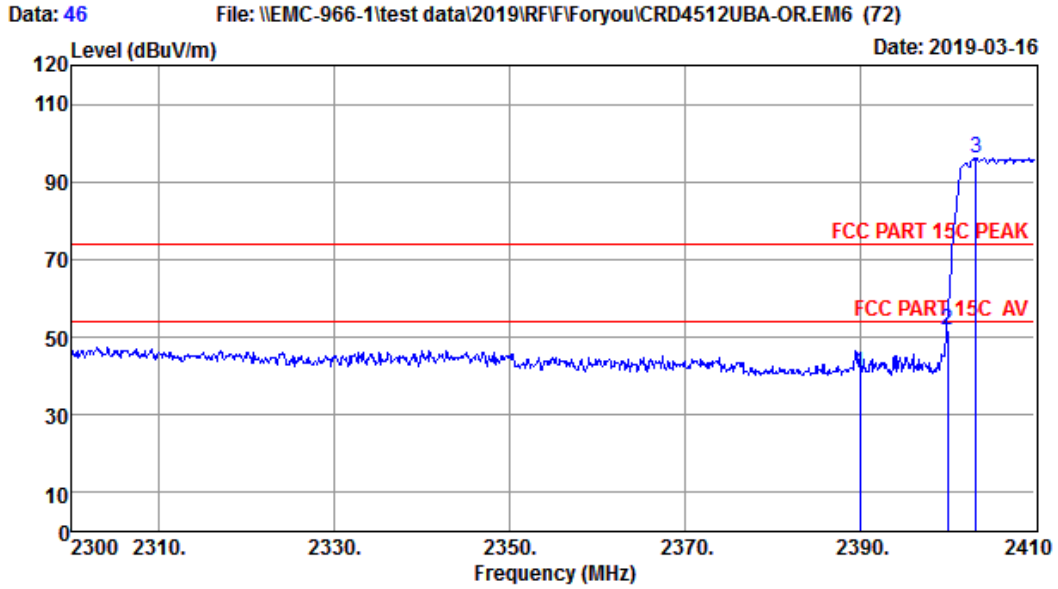

Site no. : 1# 966 Chamber Data no. : 46
Dis. / Ant. : 3m 9120D 1-18G Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : Seven
EUT : CAR RADIO
Power : DC 12V
M/N : CRD4512UBA-OR
Test Mode : GFSK TX 2402MHz(Hopping On)

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.26	4.00	33.24	42.64	40.66	74.00	33.34	Peak
2	2400.00	27.26	4.03	33.23	53.75	51.81	74.00	22.19	Peak
3	2403.29	27.28	4.03	33.23	97.98	96.06	74.00	-22.06	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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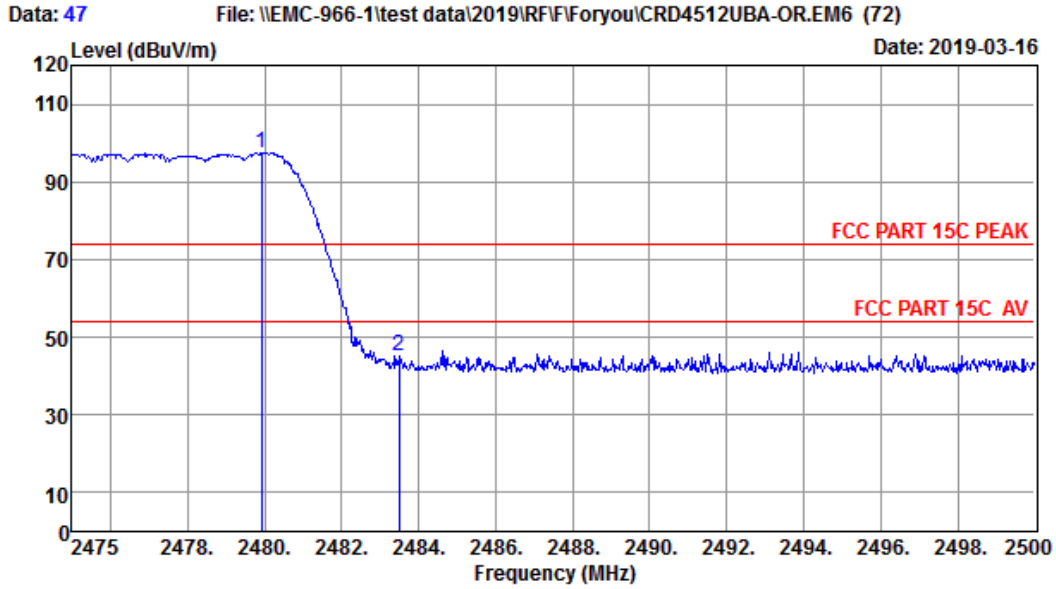

Site no. : 1# 966 Chamber Data no. : 47
Dis. / Ant. : 3m 9120D 1-18G Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : Seven
EUT : CAR RADIO
Power : DC 12V
M/N : CRD4512UBA-OR
Test Mode : GFSK TX 2480MHz(Hopping On)

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.93	27.38	4.03	33.56	99.61	97.46	74.00	-23.46	Peak
2	2483.50	27.38	4.03	33.56	47.34	45.19	74.00	28.81	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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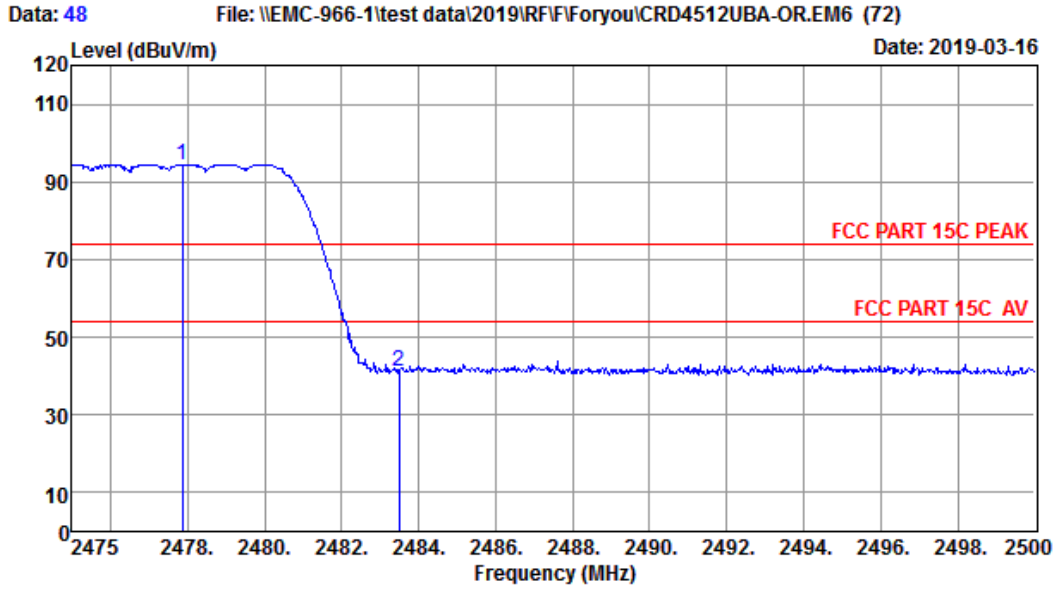


Site no. : 1# 966 Chamber Data no. : 48
Dis. / Ant. : 3m 9120D 1-18G Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : Seven
EUT : CAR RADIO
Power : DC 12V
M/N : CRD4512UBA-OR
Test Mode : GFSK TX 2480MHz(Hopping On)

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2477.88	27.38	4.03	33.56	96.64	94.49	74.00	-20.49	Peak
2	2483.50	27.38	4.03	33.56	43.35	41.20	74.00	32.80	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

10. CONDUCTED SPURIOUS EMISSION Band Edges Test

10.1. Limit

In any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

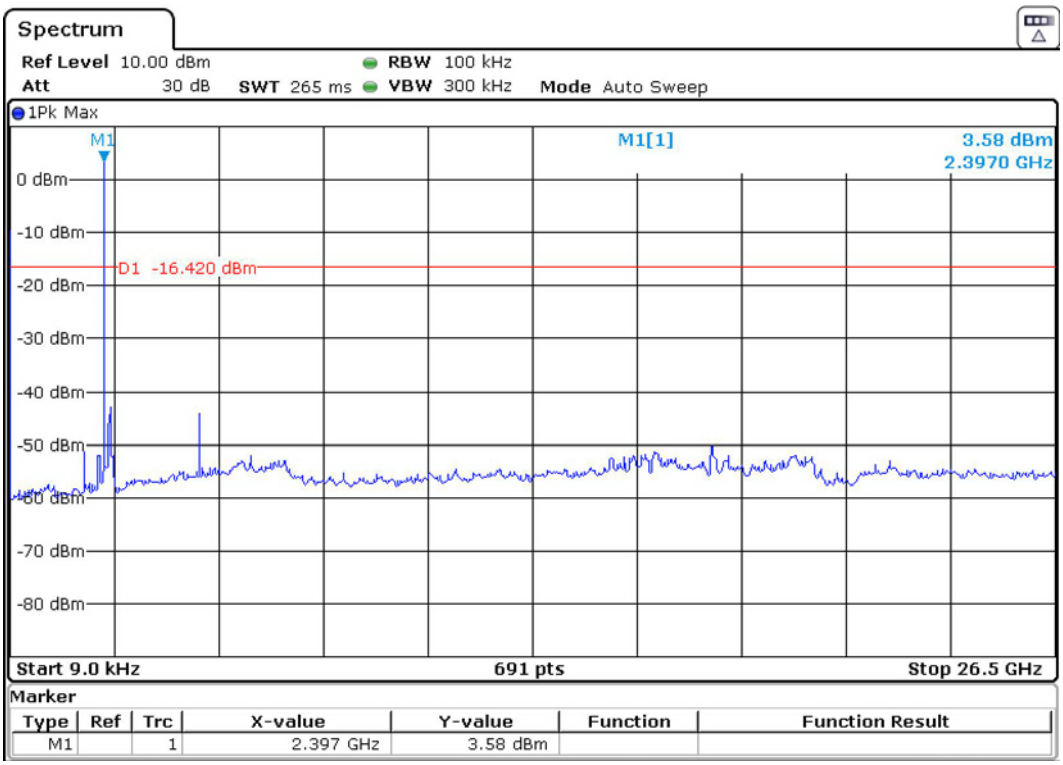
10.2. Test Procedure

The transmitter output was connected to a spectrum analyzer, The resolution bandwidth is set to 100 kHz, The video bandwidth is set to 300 kHz for frequency range from 30MHz to 1000 MHz; The resolution bandwidth is set to 1 MHz, The video bandwidth is set to 3 MHz for frequency range from 1000MHz to 25000 MHz.

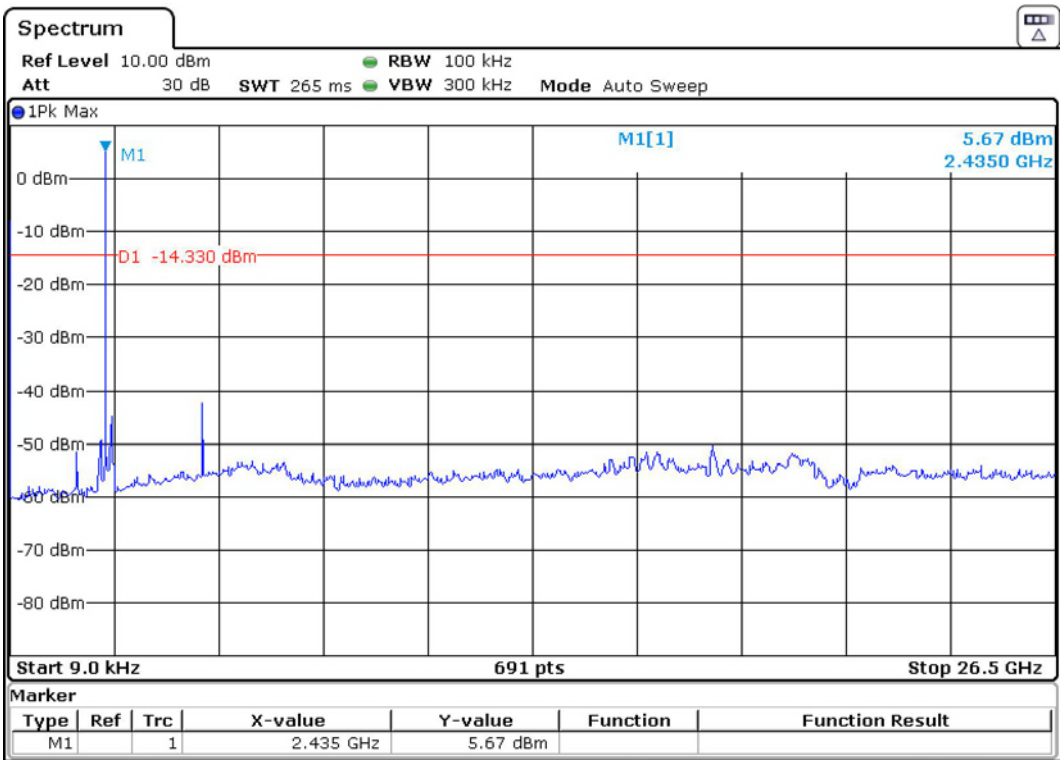
10.3. Test Result

PASS (The testing data was attached in the next pages,only worse case is reported.)

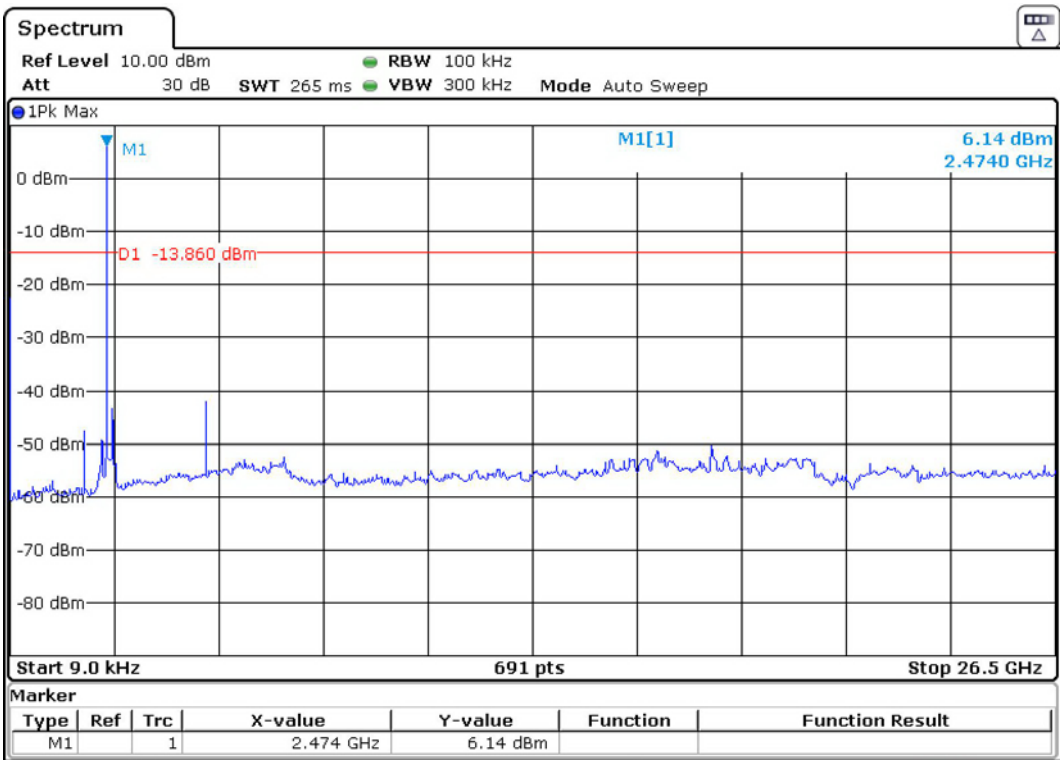
GFSK-2402MHz



GFSK-2441MHz

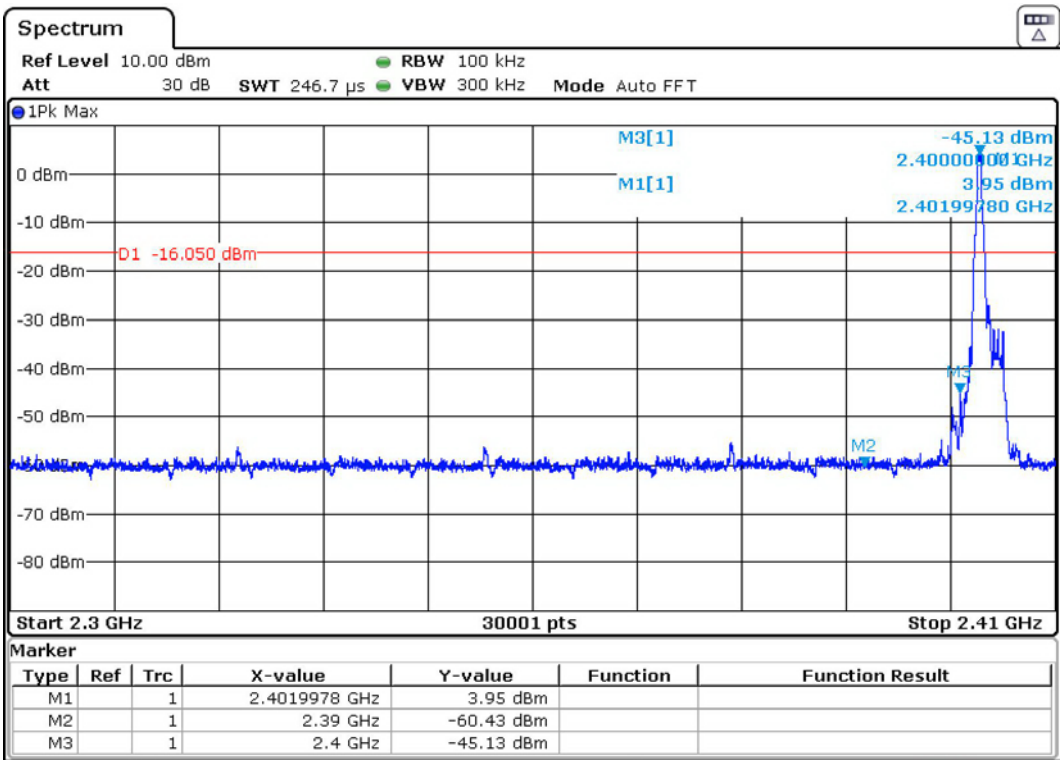


GFSK-2480MHz



BAND EDGES

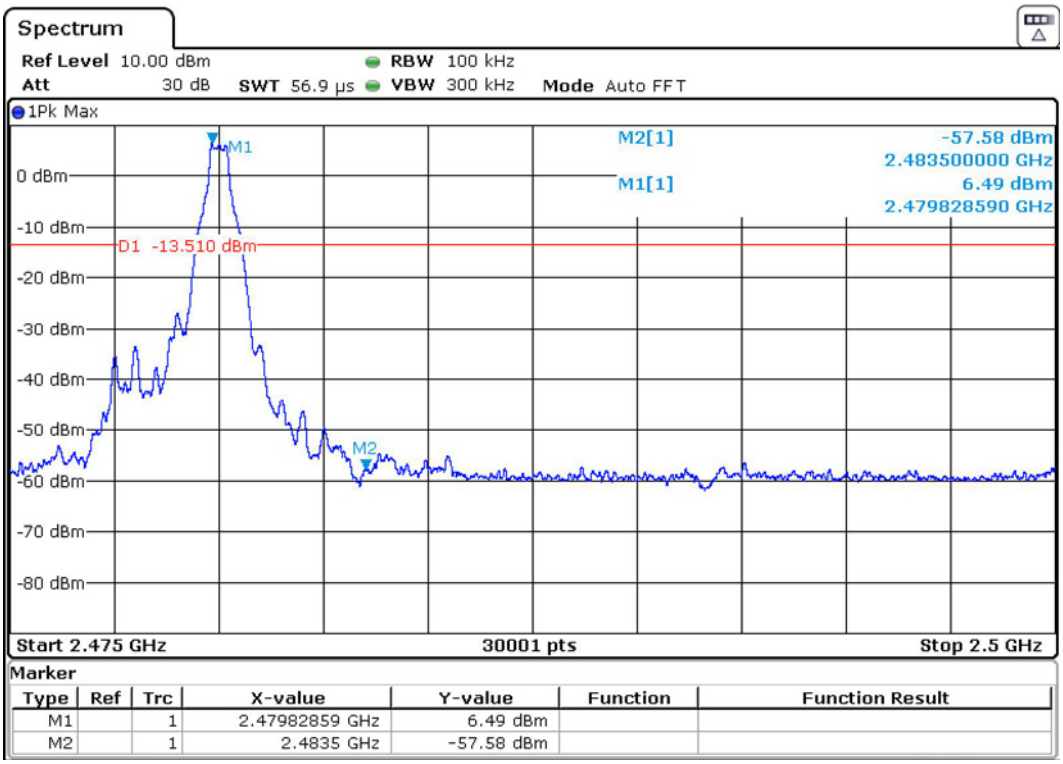
NO HOPPING GFSK 2402MHZ



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4019978 GHz	3.95 dBm		
M2		1	2.39 GHz	-60.43 dBm		
M3		1	2.4 GHz	-45.13 dBm		

NO HOPPING GFSK 2480MHZ

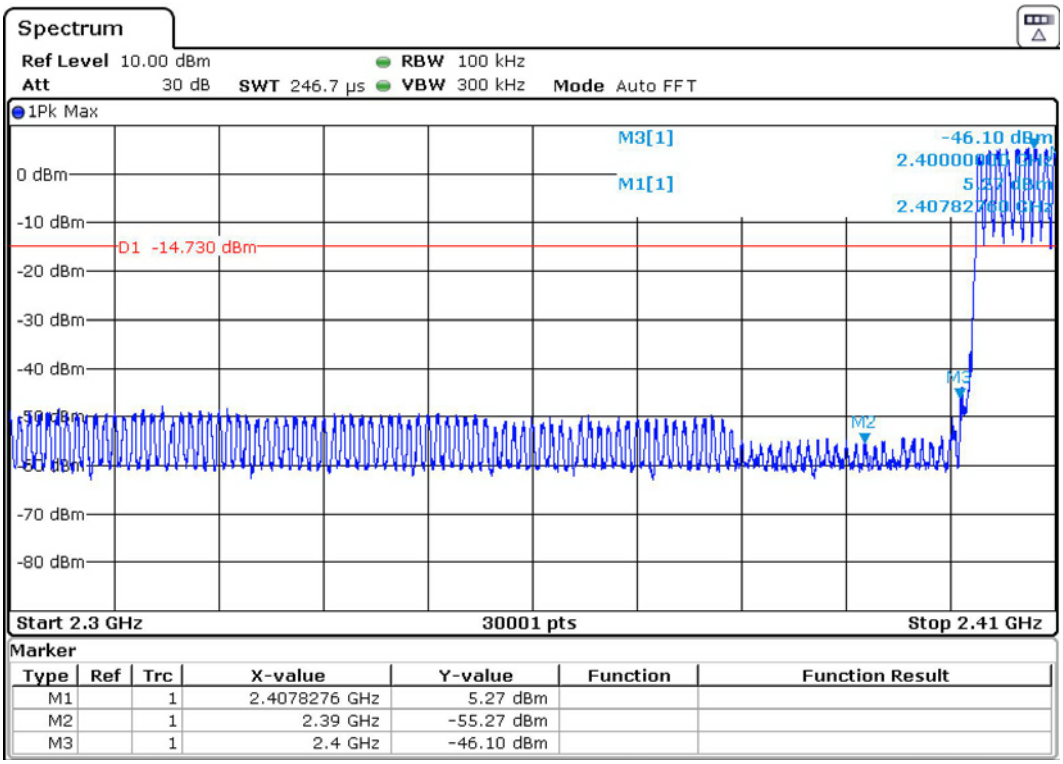


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47982859 GHz	6.49 dBm		
M2		1	2.4835 GHz	-57.58 dBm		

BAND EDGES

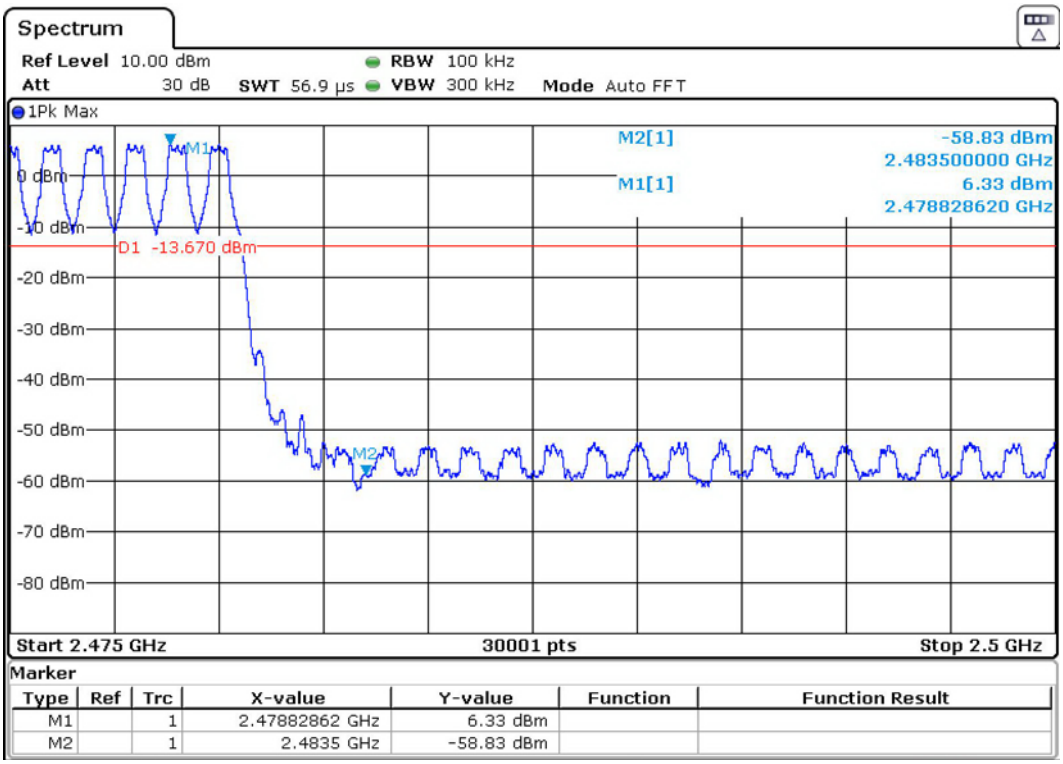
HOPPING ON GFSK 2402MHZ



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4078276 GHz	5.27 dBm		
M2		1	2.39 GHz	-55.27 dBm		
M3		1	2.4 GHz	-46.10 dBm		

HOPPING ON GFSK 2480MHZ



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47882862 GHz	6.33 dBm		
M2		1	2.4835 GHz	-58.83 dBm		

11. POWER LINE CONDUCTED EMISSIONS

11.1. Limit

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

11.2. Test Procedure

The EUT was placed on a non-metallic table, 80cm above the ground plane. The EUT Power connected to the power mains through a line impedance stabilization network (L.I.S.N. 1#). This provides a 50 ohm coupling impedance for the EUT (Please refer the block diagram of the test setup and photographs). The AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.10: 2013 on Conducted Emission Test.

The bandwidth of test receiver (R & S ESHS30) is set at 10kHz.

The frequency range from 150kHz to 30MHz is checked.

11.3. Test Result

N/A.

12. ANTENNA REQUIREMENTS

12.1. Limit

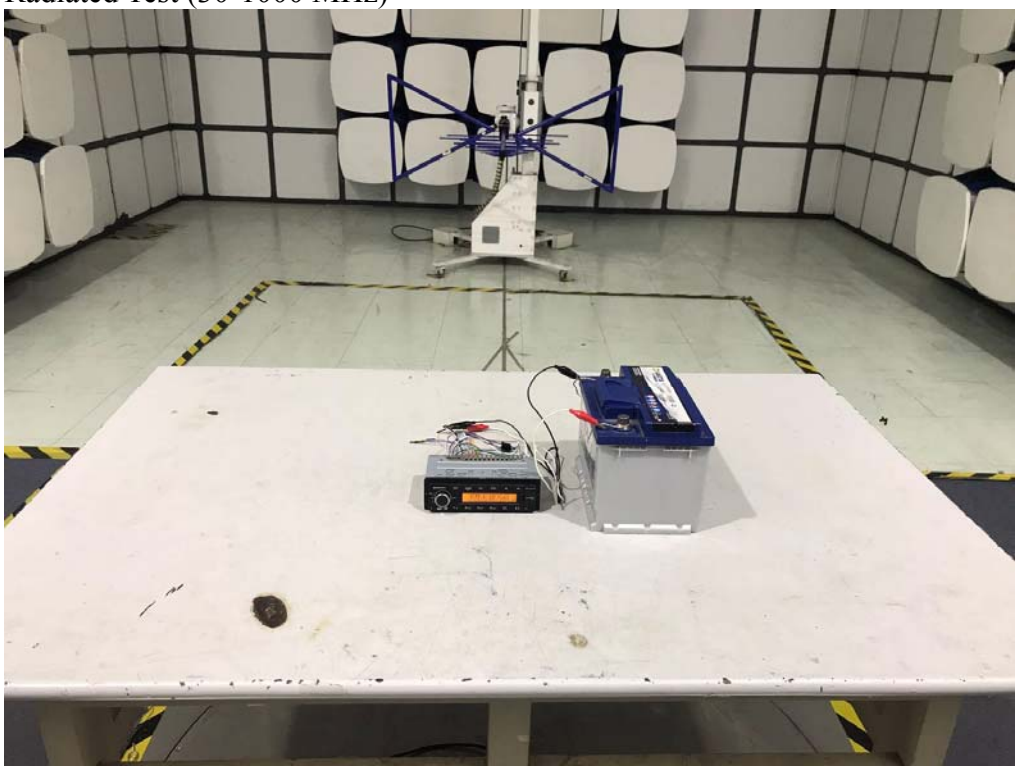
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

12.2. Result

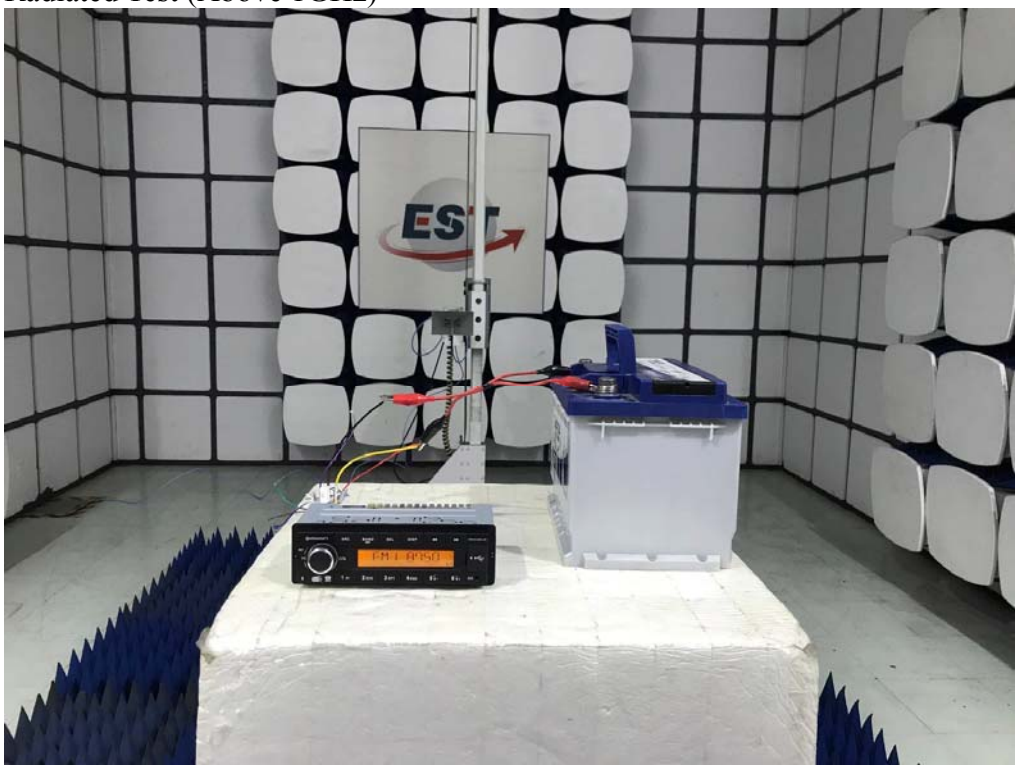
The antennas used for this product are Internal antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 0 dBi.

13. TEST SETUP PHOTO

Radiated Test (30-1000 MHz)



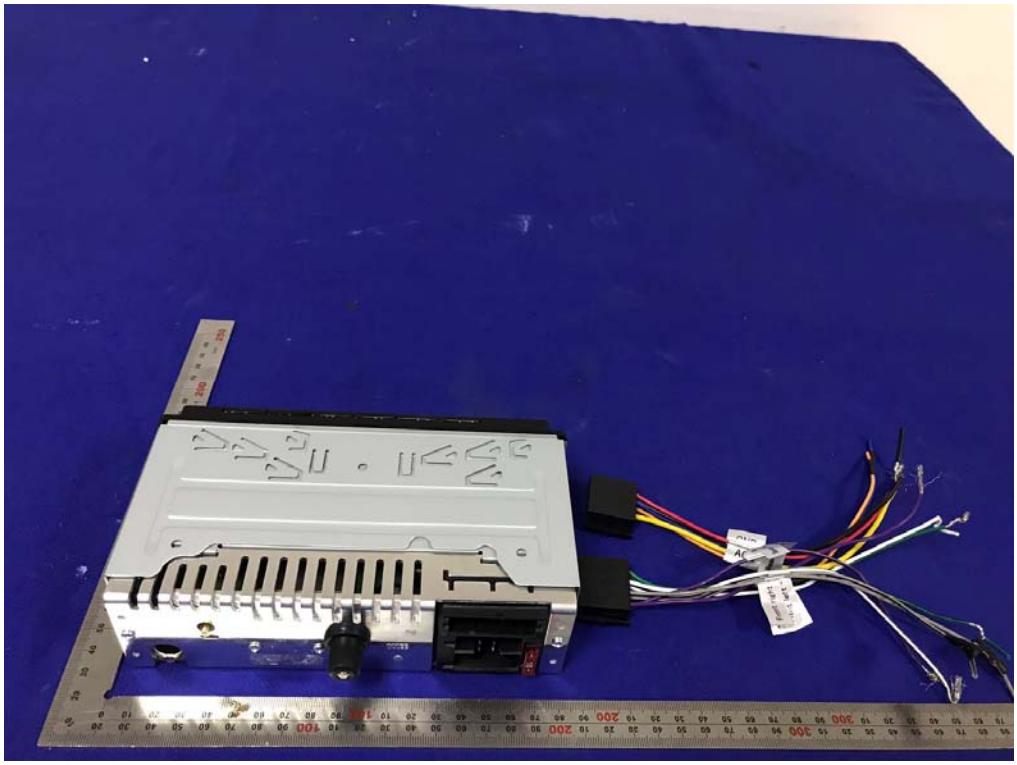
Radiated Test (Above 1GHz)



14. PHOTO EUT

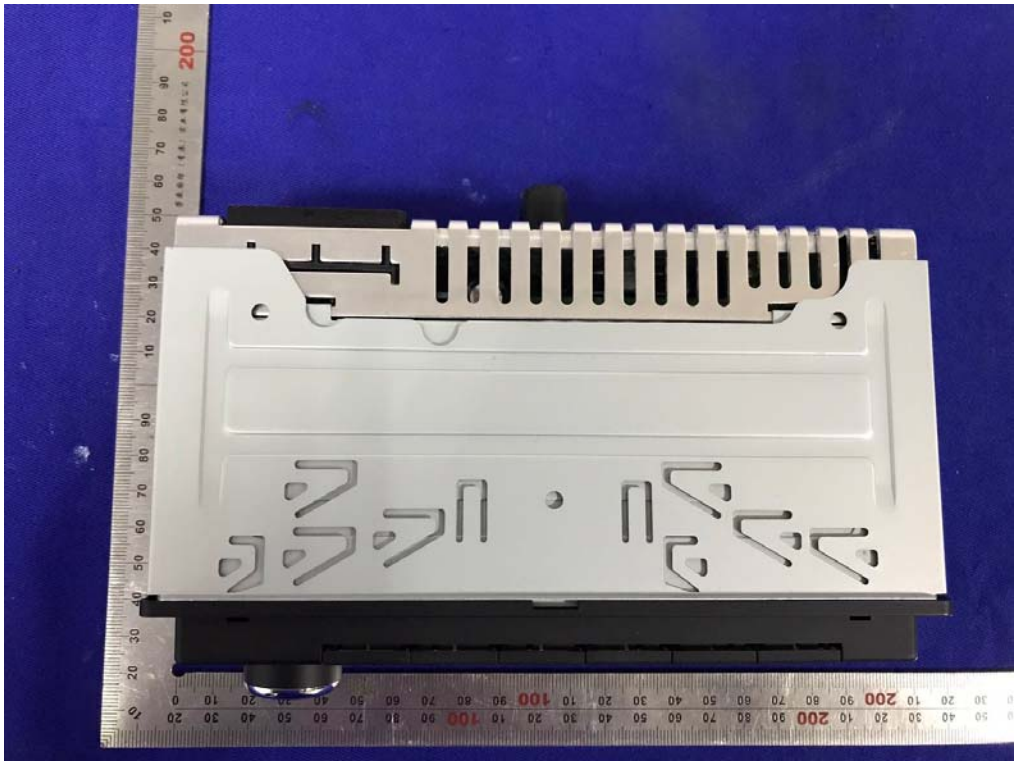
External Photos

M/N: CRD4512UBA-OR



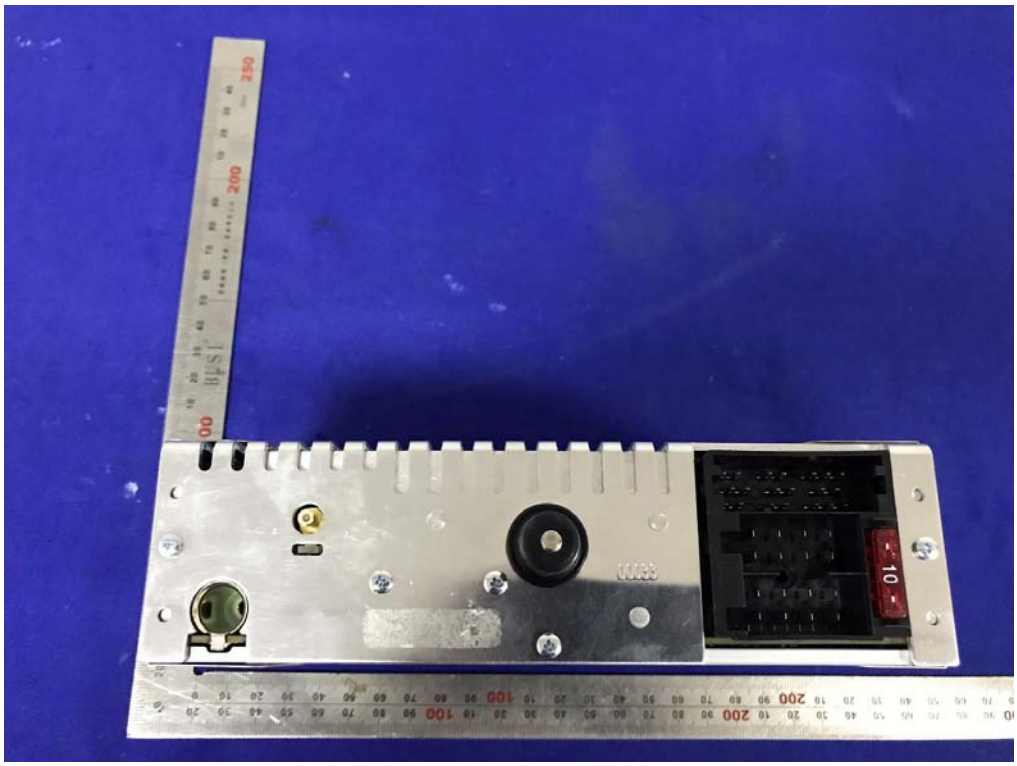
External Photos

M/N: CRD4512UBA-OR



External Photos

M/N: CRD4512UBA-OR



External Photos

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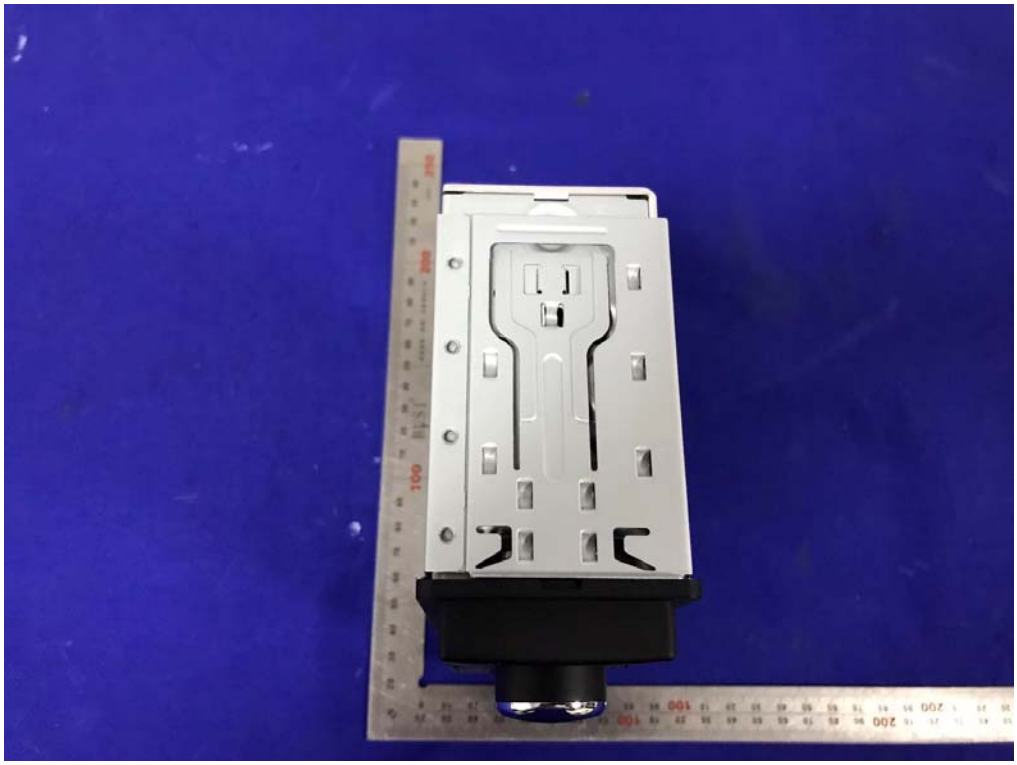

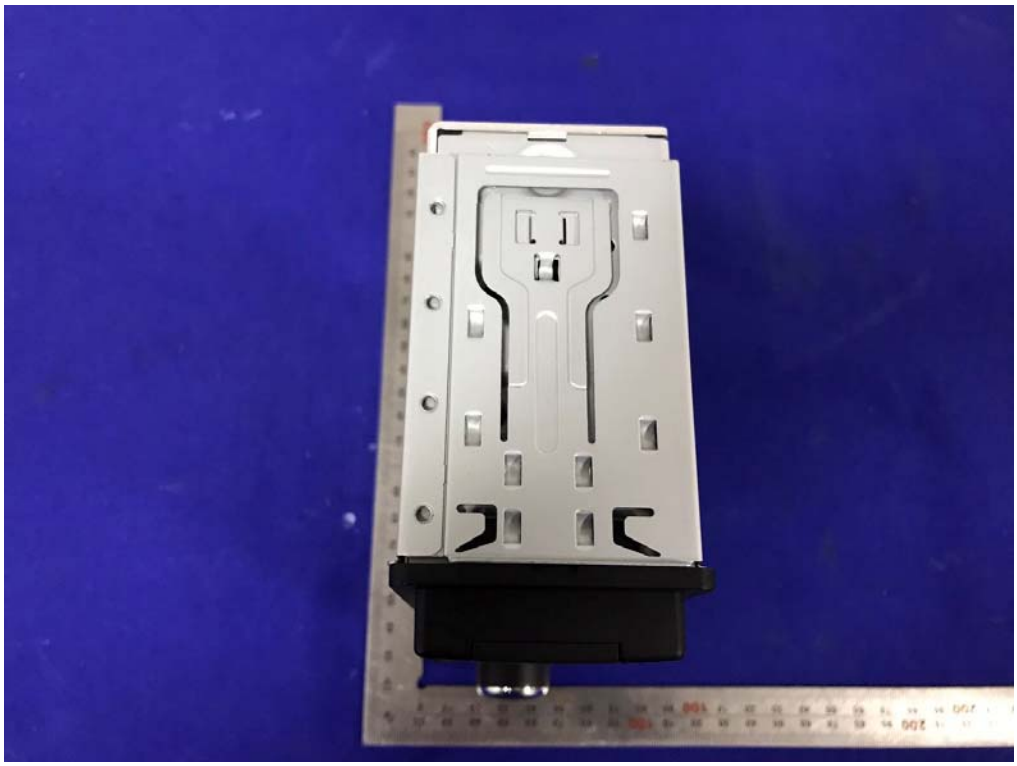

Internal Photos

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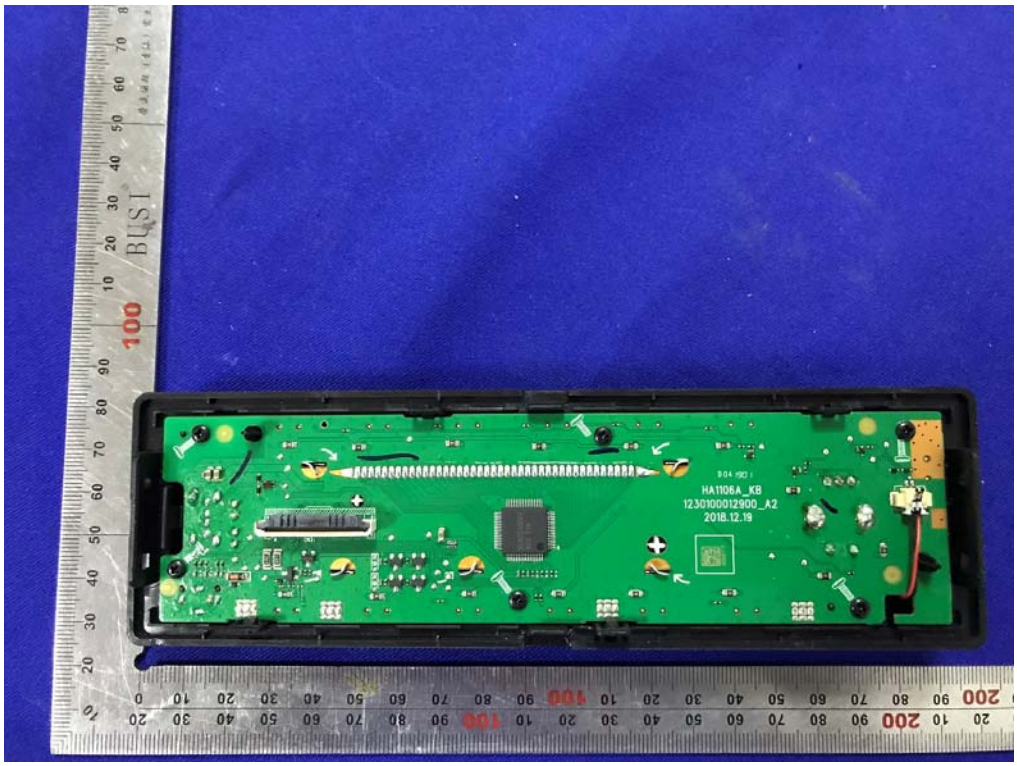
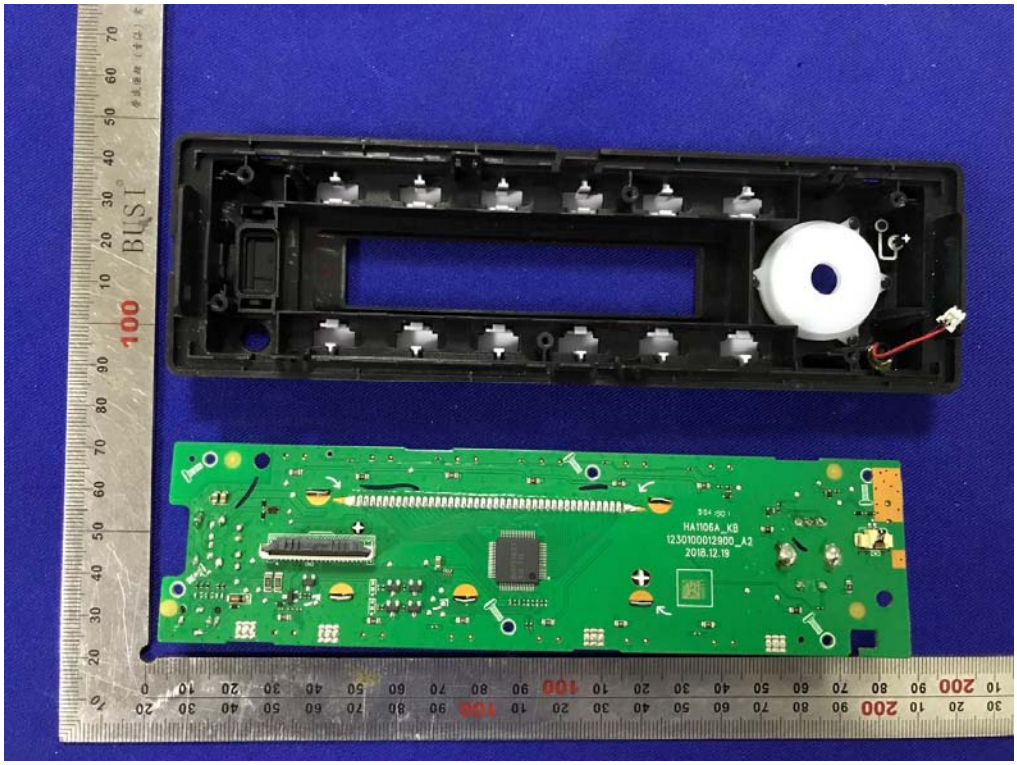
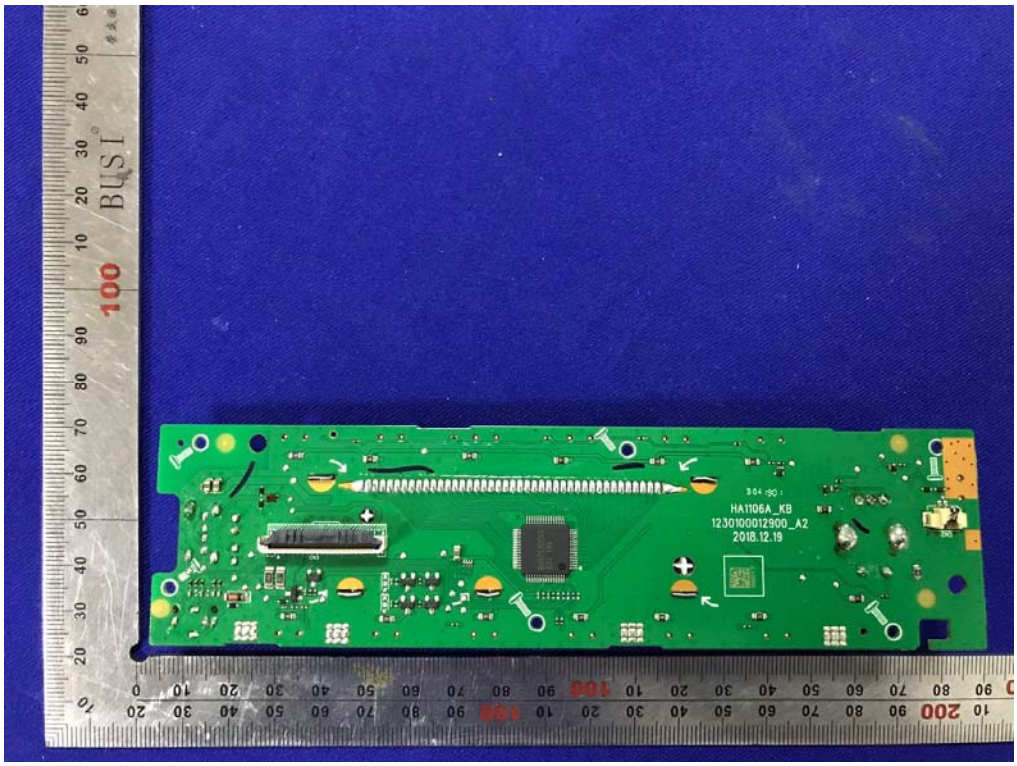


Internal Photos

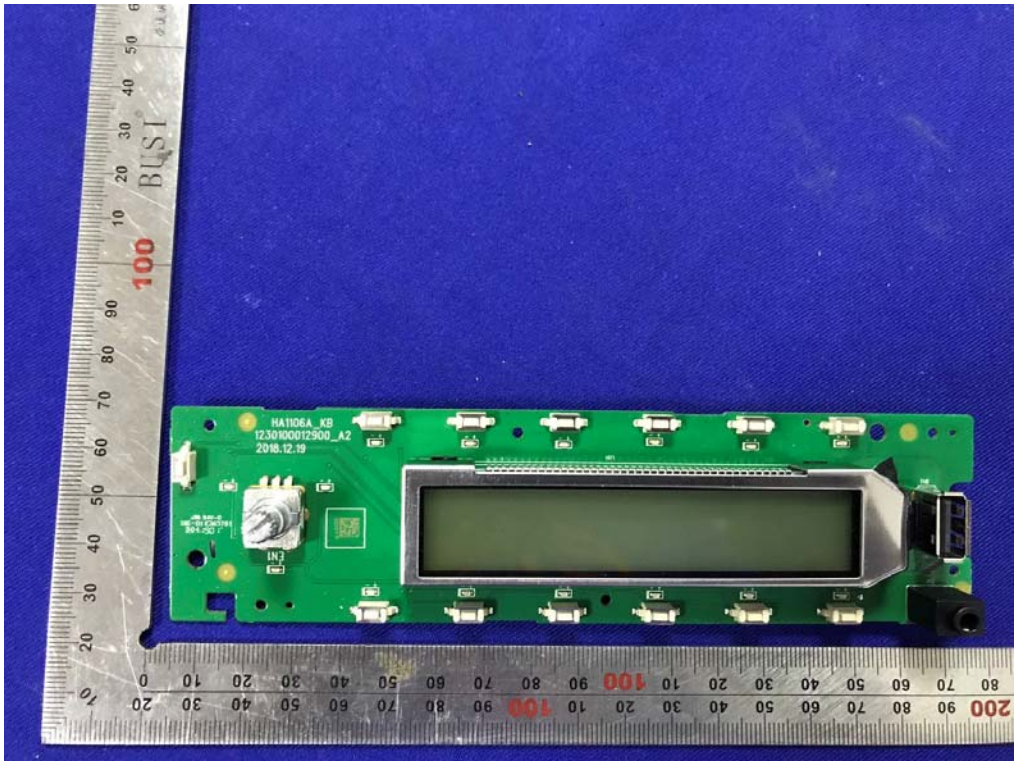
M/N: CRD4512UBA-OR

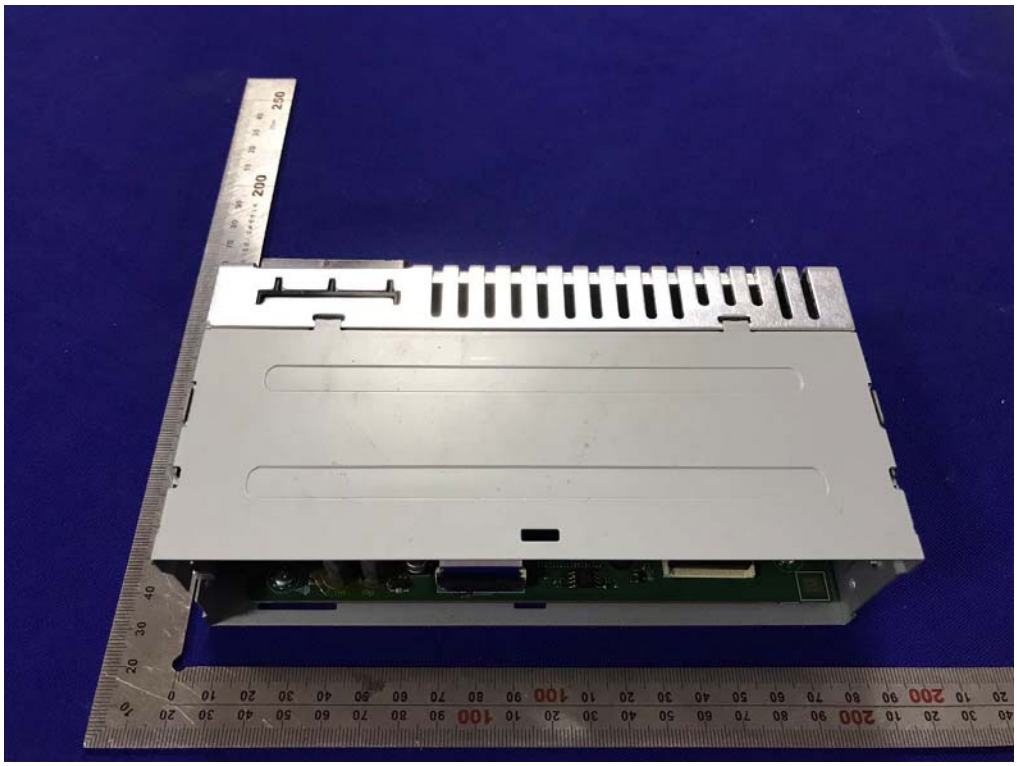




Internal Photos

M/N: CRD4512UBA-OR





Internal Photos

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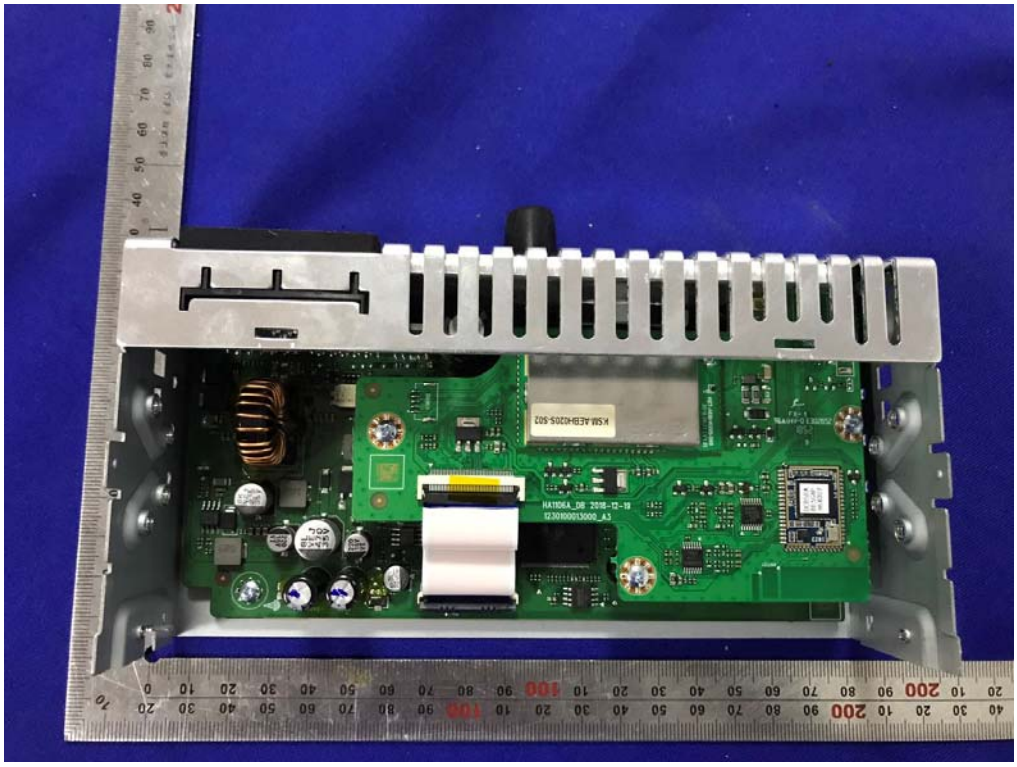

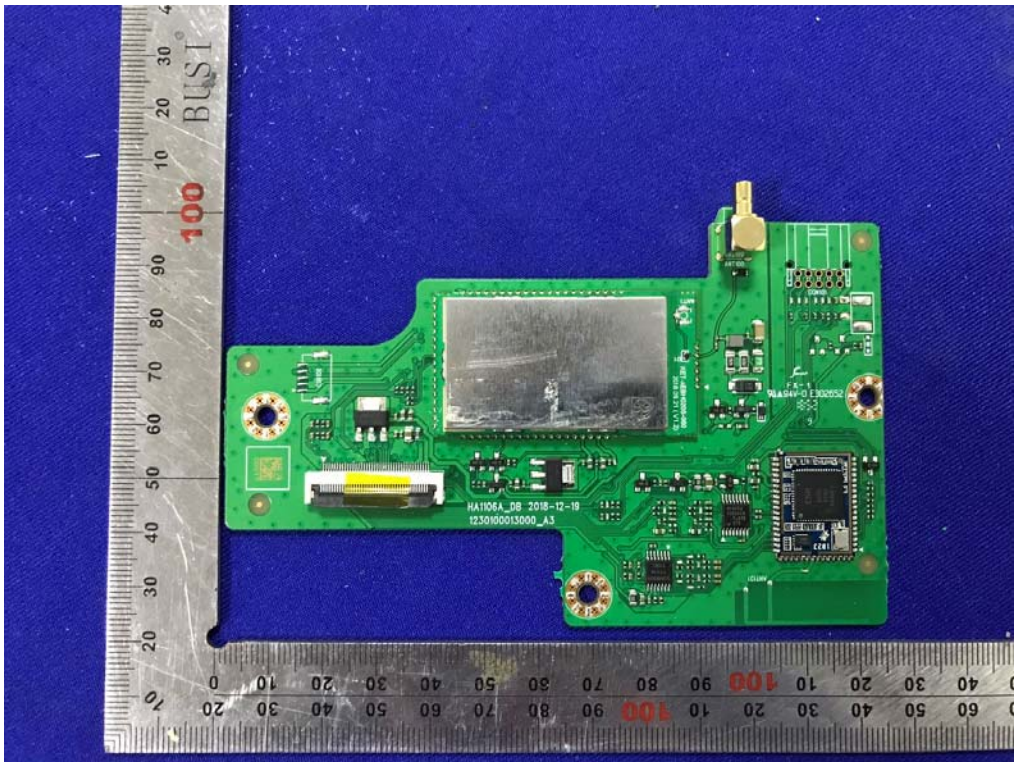

Internal Photos

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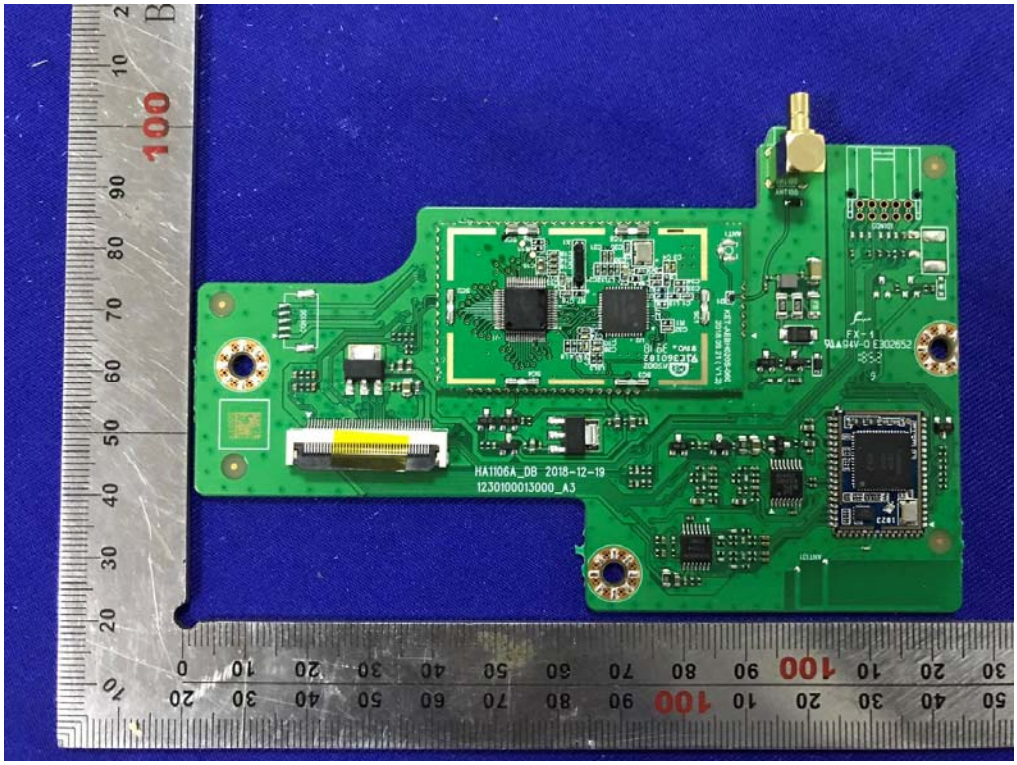

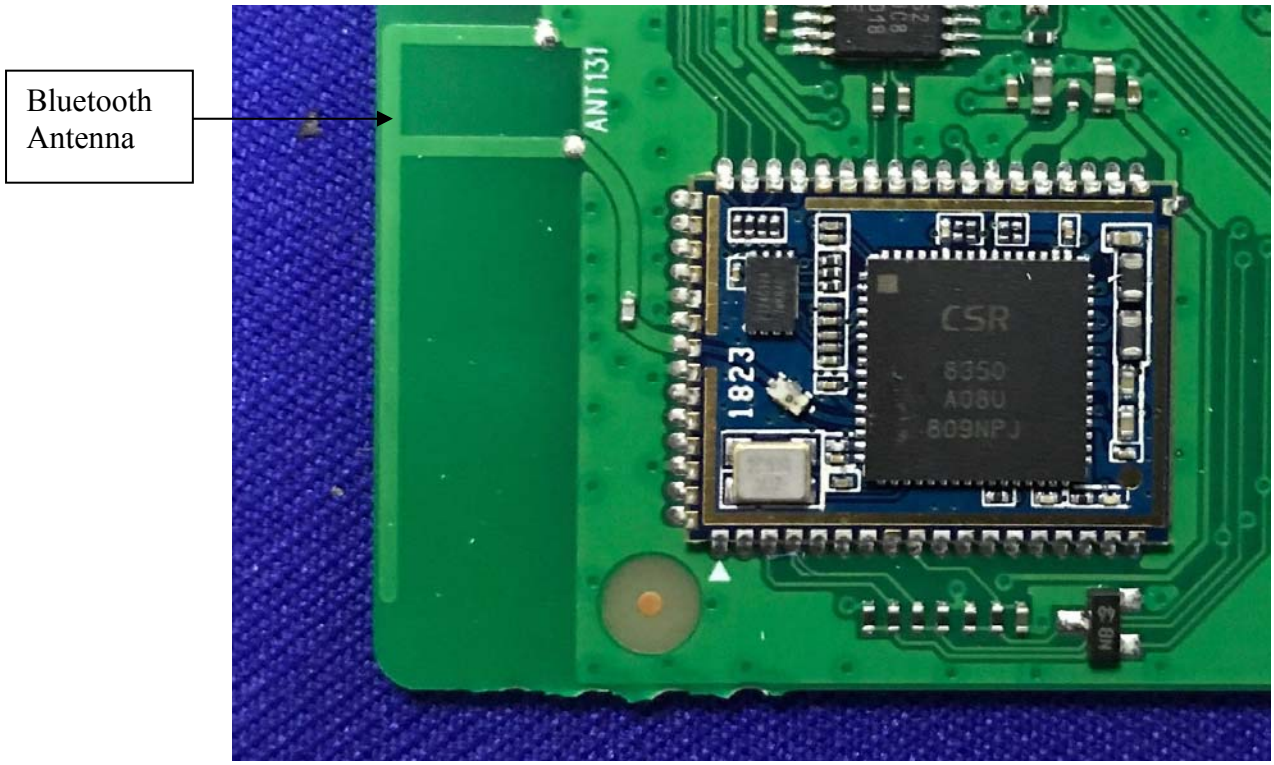

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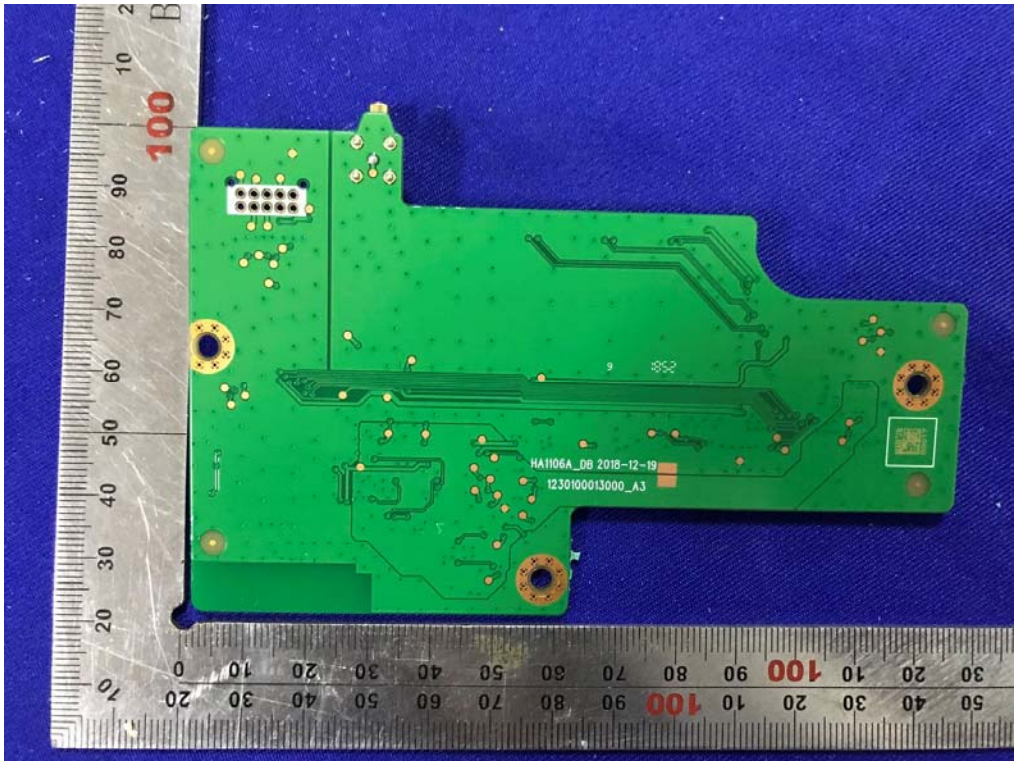

Internal Photos

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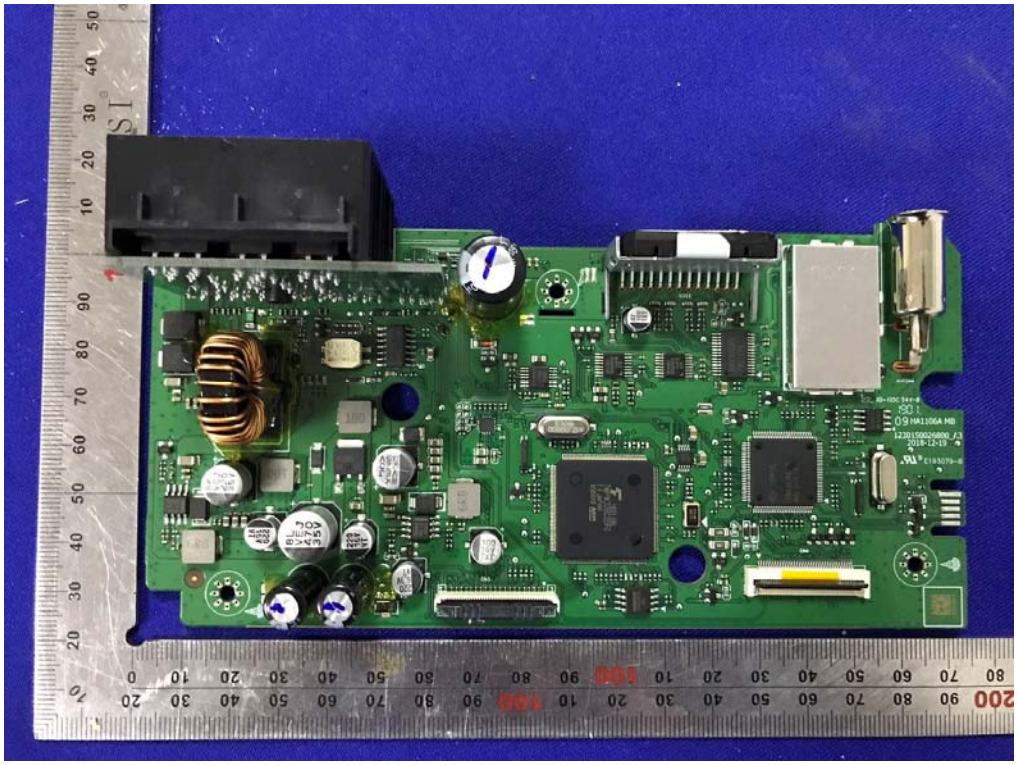

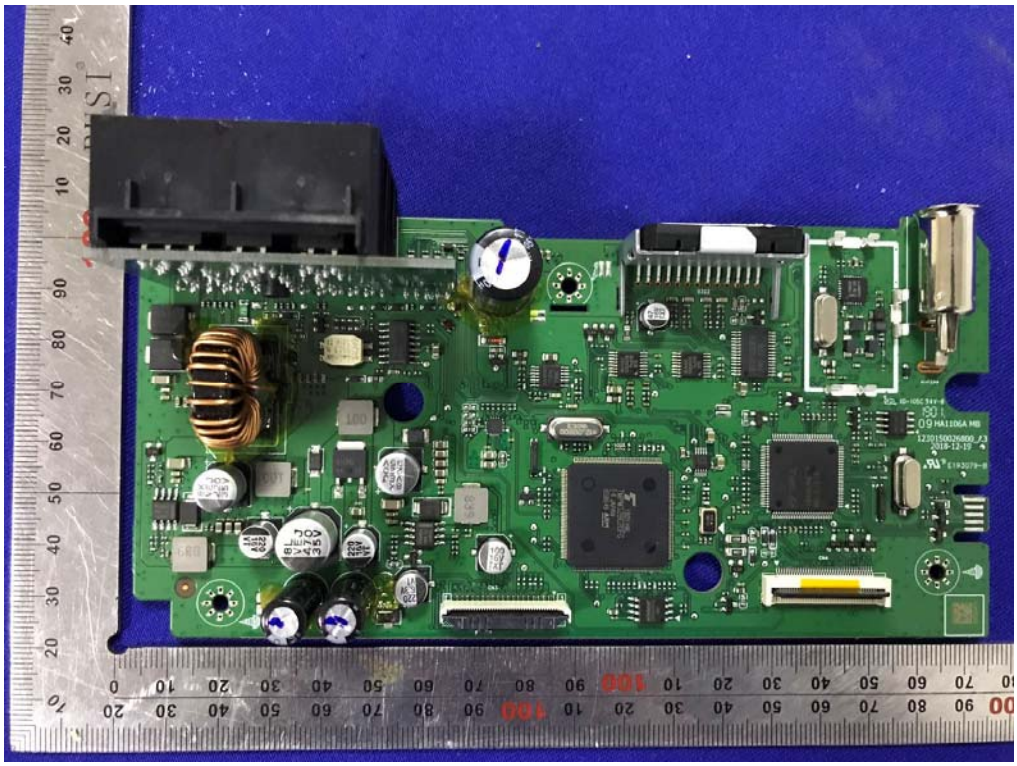

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