

Test report

Number:	T251-0890/18	Project file:	C20172948
		Date:	2019-07-12
		Pages:	61

Product: Radio communication PCB board

Type reference: TWR-POS-CLRC663

Ratings: 5V; 440 mA
Operating clock frequency: 13,56 MHz
Protection class: III

Trademark: NXP

Applicant: NXP Semiconductors
2 Esplanade Anton Philips, Campus Effiscience, Colombelles,
BP2000, FR-14906 Caen Cedex 9, France

Manufacturer: SOMINEX
Campus Effiscience - Innovaparc - 2 rue Jean Perrin,
FR-14460 Colombelles, France

Place of manufacture: SOMINEX
Campus Effiscience - Innovaparc - 2 rue Jean Perrin,
FR-14460 Colombelles, France

Summary of testing

Testing method: FCC 47 CFR Part 15, Subpart C

Testing location: SIQ Ljubljana, Mašera-Spasićeva ulica 10, SI-1000 Ljubljana, Slovenia

Remarks: Date of receipt of test items: 2018-01-16
Number of items tested: 1
Date of performance of tests: 2018-01-15 - 2018-02-26
The test results presented in this report relate only to the items tested.
The product complies with the requirements of the testing methods.
/

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Approved by: Marjan Mak

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1 GENERAL

History sheet			
Date	Report No.	Change	Revision
2019-03-01	T251-0890/18	Initial Test Report issued.	--

Environmental conditions:

Ambient temperature: 15°C to 35°C

Relative humidity: 30% to 60%

Atmospheric pressure: 860 mbar to 1060 mbar

1.1 Equipment under test

Radio communication PCB board

Type: **TWR-POS-CLRC663**

FCC ID: **OWRCLEV6630T**

Tested SIQ sample number:

TWR-POS-CLRC663: S20180276

TWR-POS-K81: S20180287

TWR-ELEV SECONDARY: S20170278

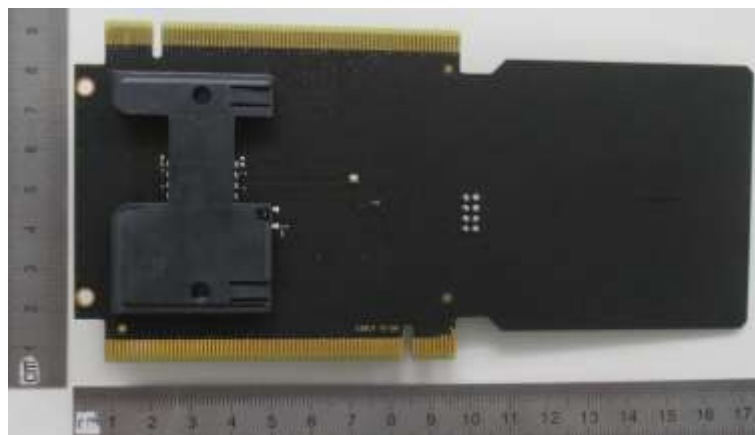
Note: TWR-POS-K81 connected to HP EliteBook 8560p (Radiated emission below 30 MHz) and to HP ProBook 650 for all other measurements.

TWR-POS-CLRC663 is the card interface board. It reads contact and contactless payment cards. This board embeds NXP's CLRC663 (contactless frontend) and TDA8035 (contact frontend). The jumpers on the TWR-POS-CLRC663 are used to connect the board to different CPU modules.

TWR-POS-CLRC663 is part of system SLN-POS-RDR Point of Sale (POS) Reader Solution which enables you to quickly add a PCI- and EMVCo-compliant PIN entry device (PED), NFC reader, chip card reader and magnetic stripe reader (MSR) to any design to enable credit card payment



Picture of EUT



Picture of EUT



Supply voltage of transmitter	5 Vdc
Operating frequency	13,56 MHz
Antenna type	PCB 63x63 mm
Modulation type:	Amplitude AM
Hardware version:	TWR-POS-CLRC663
Software version:	K81_POSCR_CARDTEK_v310_RC663

1.2 Antenna requirements (§15.203)

Requirement

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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Conclusion:

PASS; EUT has internal PCB antenna.

1.3 ANSI C63.4 Subpart selection

Subpart C: Intentional Radiators

1.4 Class statement requirements

- The Class B statement offers several suggestions for minimizing interference to radio or TV receivers, including reorienting the receiving antenna and moving the Class B device farther away from the receiver.

1.5 Occupied bandwidth measurement

Fundamental frequency	Minimum resolution bandwidth
9 kHz to 30 MHz	1 kHz
30 to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

1.6 Quasi-peak detector

Frequency range	Bandwidth (-6dB)
10 Hz to 20 kHz	Full range (wideband)
10 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
30 MHz to 1 GHz	120 kHz

1.7 Peak, rms, and average detectors

Frequency range	Bandwidth (-6dB)
10 Hz to 20 kHz	10, 100, 1000 Hz
10 kHz to 150 kHz	1 and 10 kHz
150 kHz to 30 MHz	1 and 10 kHz
30 MHz to 1 GHz	10 and 100 kHz
1 GHz to 40 GHz	0.1, 1.0 and 10 MHz

2 LIMITS

2.1 Subpart C: Intentional Radiators

2.1.1 Section 15.207, Conducted emission limits:

Frequency Range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.5	66 – 56*	56 – 46*
0.5 to 5.0	56	46
5.0 to 30.0	60	50

* Decreases with the logarithm of the frequency.

The shown limits in table shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

- For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.
- For all other carrier current systems: 1000 µV within the frequency band 535-1705 kHz, as measured using a 50 µH/50 ohms LISN.
- Carrier current systems operating below 30 MHz are also subject to the radiated emission limits as appropriate.

2.1.2 Section 15.209, Radiated emission limits:

Limits:

Frequency Range (MHz)	Limits (dBµV/m)	Test distance (m)	Frequency low end limit (dBµV/m)	Frequency high end limit (dBµV/m)
0.009 to 0.490	$20 \cdot \log(2400/F(\text{kHz}))$	300	48.51937	13.8003
0.490 to 1.705	$20 \cdot \log(24000/F(\text{kHz}))$	30	33.8003	22.96974
1.705 to 30.0	30	30	29.54243	29.54243
30 to 88	40**	3	40	40
88 to 216	43.5**	3	43.52183	43.52183
216 to 960	46**	3	46.0206	46.0206
Above 960	54	3	53.9794	53.9794

** Except as provided in paragraph below, fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz.

Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

Additional provisions to the general radiated emission limitations – Section 15.215: In no case shall the level of the unwanted emissions from an intentional radiator operating under these additional provisions exceed the field strength of the fundamental emission as per clause 15.209.

Intentional radiators operating under the alternative provisions to the general emission limits must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

3 ALL TEST EQUIPMENT AND THEIR DESCRIPTION

3.1 General information

Description	Model No.	SIQ No.	Last calibration	Calibrated until	Calibration period	Used
Rohde-Schwarz, RFI receiver	ESU8	105187	2017-11	2019-11	24 months	X
Rohde-Schwarz, RFI receiver	ESU26	100428	2018-02	2020-02	24 months	X
Rohde & Schwarz, Artificial main network	ESH2-Z5	106899	2017-05	2019-05	24 months	
Rohde & Schwarz, Artificial main network	ENV216	109818	2017-09	2019-09	24 months	X
Comtest Engineering, Semi Anechoic Chamber SAC 1	SAC 3m	NPS001	2017-05	2019-05	24 months	X
Comtest Engineering, Semi Anechoic Chamber SAC 2	SAC 3m	NPS003	2017-05	2019-05	24 months	
Rohde & Schwarz, Horn Antenna	HF907 (SN 102508)	102508	2018-05	2020-05	24 months	
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 100842)	100842	2017-07	2019-07	24 months	X
Rohde & Schwarz, Horn Antenna	HF907 (SN 102494)	102494	2018-05	2020-05	24 months	
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 100843)	100843	2017-07	2019-07	24 months	
Maturo, Turn table (2 m diameter)	TT 2.0 SI	/	N/A	N/A	N/A	X
Maturo, Bore-sight antenna mast	BAM-4.0-P	/	N/A	N/A	N/A	X
Maturo, Multi-channel positioning equipment	Maturo NCD	/	N/A	N/A	N/A	X
Schwarzbeck, Biconical antenna	VHBB9124 (SN 9124-317)	105112	2016-11	2018-11	24 months	X
Schwarzbeck, Active Loop Antenna	FMZB 1519 B	/	2016-08	2018-08	24 months	X
Fluke, Digital Multimeter	179	108102	2016-11	2018-11	12 months	X
Kambič, Temperature chamber	I-190 CK	107298	N/A	N/A	/	X

3.2 Other instrument information and auxiliary equipment

Description	Model No.	Bandwidth	Detector functions	Antenna factors	Cable loss	Range
Rohde-Schwarz, AMN	ENV216	/	/	/	/	9 kHz – 30 MHz
Rohde & Schwarz, Artificial main network	ESH 2-Z5	/	/	/	/	9 kHz – 30 MHz
Rohde-Schwarz, RFI receiver	ESU8	200Hz, 9kHz, 120kHz, 1MHz	Peak, Q-peak, Average	/	/	20 Hz – 8 GHz
Rohde-Schwarz, RFI receiver	ESU26	200Hz, 9kHz, 120kHz, 1MHz	Peak, Q-peak, Average	/	/	20 Hz – 26.5 GHz
Hewlett Packard, RF Spectrum Analyzer	8593E	200Hz, 9kHz, 120kHz, 1MHz	Peak, Q-peak, Average	/	/	9 kHz – 26.5 GHz
Comtest Engineering, Semi Anechoic Chamber SAC 1	SAC 3m	/	/	/	/	30 MHz – 18 GHz
Comtest Engineering, Semi Anechoic Chamber SAC 2	SAC 3m	/	/	/	/	30 MHz – 18 GHz
Rohde & Schwarz, Horn Antenna	HF907 (SN 102508)	/	/	See section 3.2.2	/	0.8 GHz – 18 GHz
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 100842)	/	/	See section 3.2.2	/	30 MHz – 6 GHz
Rohde & Schwarz, Horn Antenna	HF907 (SN 102494)	/	/	See section 3.2.2	/	0.8 GHz – 18 GHz
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 100843)	/	/	See section 3.2.2	/	30 MHz – 6 GHz
Schwarzbeck, Biconical antenna	VHBB9124 (SN 9124-317)	/	/	See section 3.2.2	/	30 MHz – 300 MHz
Schwarzbeck, Active Loop Antenna	FMZB 1519 B	/	/	See section 3.2.2	/	9 kHz – 30 MHz

3.2.1 Cable loss and attenuation of radiated emission

3.2.1.1 Conducted emission cable (SIQ-K024)

Point	Frequency (9kHz-30MHz)	Cable length (meters)	Loss (dB)
1	190 kHz	1	0,4
2	530 kHz	1	0,26
3	2,53 MHz	1	0,16
4	5,19 MHz	1	0,07
5	11,05 MHz	1	0,03
6	22,01 MHz	1	0,06
7	24,03 MHz	1	0,04

3.2.1.2 Radiated emission attenuation

Point	Frequency (30 MHz – 26,5 GHz)	Attenuation (dB)
1	30 MHz	0,501
2	150 MHz	1,174
3	400 MHz	2,034
4	800 MHz	2,995
5	1 GHz	3,416
6	1,363	1,666667
7	2,686	3,58333
8	5,332	5,25
9	7,978	6,25
10	10,624	7,5
11	13,27	8,333333
12	15,916	9,166666
13	18,562	9,833333
14	21,208	10,66667
15	23,854	11,5
16	26,5	12,16667

3.2.2 Antenna factors

3.2.2.1 Antenna VHBB9124

Frequency (MHz)	Antenna factor VHBB9124 (SN 9124-317)
20	15,3
21	15,1
22	14,8
23	14,5
24	14,3
25	14,1
26	13,8
27	13,6
28	13,3
29	13,1
30	12,6
31	12,4
32	12,2
33	12,0
34	11,8
35	11,7
36	11,4
37	11,3
38	11,1
39	11,0
40	10,8
41	10,7
42	10,5
43	10,3
44	10,2
45	10,1
46	9,9
47	9,9
48	9,7
49	9,7
50	9,5
51	9,5
52	9,3
53	9,3
54	9,2
55	9,1
56	9,0
57	9,0
58	9,0
59	9,0
60	9,0
61	9,0
62	8,9
63	8,9
64	8,8
65	8,8
66	8,8
67	8,9
68	8,9

69	8,9
70	8,9
71	8,9
72	8,9
73	8,9
74	8,9
75	8,9
76	8,9
77	8,9
78	8,9
79	9,0
80	9,0
81	9,0
82	9,1
83	9,0
84	9,0
85	9,0
86	9,1
87	9,1
88	9,2
89	9,2
90	9,3
91	9,3
92	9,3
93	9,3
94	9,3
95	9,3
96	9,4
97	9,4
98	9,5
99	9,5
100	9,6
102	9,7
104	9,7
106	9,9
108	10,0
110	10,2
112	10,2
114	10,3
116	10,4
118	10,5
120	10,5
122	10,7
124	10,7
126	10,8
128	10,9
130	11,0
132	11,1
134	11,2
136	11,4
138	11,5
140	11,6
142	11,8
144	11,8
146	12,0
148	11,9
150	12,0

152	12,1
154	12,4
156	12,6
158	12,8
160	12,9
162	12,9
164	13,0
166	13,0
168	12,8
170	12,8
172	12,9
174	13,0
176	13,2
178	13,3
180	13,4
182	13,5
184	13,5
186	13,5
188	13,6
190	13,7
192	13,8
194	13,8
196	13,9
198	14,0
200	14,1
202	14,2
204	14,3
206	14,4
208	14,3
210	14,4
212	14,7
214	14,6
216	14,5
218	14,5
220	14,6
222	14,4
224	14,6
226	14,8
228	14,9
230	15,0
232	15,0
234	15,0
236	15,0
238	15,2
240	15,3
242	15,3
244	15,4
246	15,3
248	15,2
250	15,2
252	15,2
254	15,4
256	15,4
258	15,5
260	15,6
262	15,7
264	15,7

266	15,8
268	15,9
270	15,9
272	16,0
274	16,0
276	16,2
278	16,2
280	16,4
282	16,7
284	16,8
286	17,0
288	16,9
290	16,9
292	17,2
294	17,4
296	17,6
298	17,9
300	18,2

3.2.2.2 Antenna FMZB 1519 B

Frequency (MHz)	Antenna factor (dB)
0,009	-30,60
0,010	-30,80
0,020	-31,80
0,030	-32,00
0,040	-32,10
0,050	-32,20
0,060	-32,20
0,070	-32,20
0,080	-32,20
0,090	-32,30
0,100	-32,30
0,150	-32,30
0,200	-32,40
0,300	-32,40
0,400	-32,40
0,500	-32,40
0,600	-32,40
0,700	-32,50
0,800	-32,50
0,900	-32,50
1,000	-32,50
2,000	-32,50
3,000	-32,50
4,000	-32,50
5,000	-32,50
6,000	-32,50
7,000	-32,50
8,000	-32,50
9,000	-32,50
10,000	-32,50
11,000	-32,50
12,000	-32,50
13,000	-32,50
14,000	-32,40
15,000	-32,40
16,000	-32,40
17,000	-32,40
18,000	-32,30
19,000	-32,30
20,000	-32,20
21,000	-32,10
22,000	-32,10
23,000	-32,00
24,000	-31,90
25,000	-31,80
26,000	-31,70
27,000	-31,60
28,000	-31,50
29,000	-31,40
30,000	-31,30

3.2.2.3 Antenna HL562E

Frequency (MHz)	Antenna factor HL562E (SN 100842)	Antenna factor HL562E (SN 100843)
30	18.12	18.17
32	17.08	17.07
34	16.01	16
36	14.91	14.94
38	13.76	13.75
40	12.64	12.61
42	11.43	11.4
44	10.17	10.15
46	8.86	8.81
48	7.42	7.44
50	6.01	5.96
52	4.59	4.56
54	3.38	3.37
56	2.84	2.85
58	3.06	3.14
60	3.78	3.76
62	4.44	4.4
64	5.36	5.32
66	6.19	6.18
68	6.96	6.92
70	7.56	7.52
72	8.04	8.01
74	8.38	8.35
76	8.67	8.64
78	8.88	8.85
80	9.04	9.03
82	9.14	9.09
84	9.2	9.14
86	9.22	9.16
88	9.22	9.17
90	9.21	9.17
92	9.22	9.15
94	9.22	9.16
96	9.21	9.16
98	9.22	9.17
100	9.33	9.05
105	9.38	9.39
110	9.67	9.74
115	9.55	10.33
120	10.51	9.88
125	10.15	9.87
130	9.23	9.13
135	8.79	8.71
140	8.4	8.4
145	7.93	7.82
150	7.74	7.75
155	7.68	7.76
160	7.86	7.78
165	8.47	8.33
170	9.83	9.66
175	10.29	10.3
180	7.86	7.93



185	7.19	7.27
190	7.54	7.21
195	7.32	7.2
200	7.56	7.49
205	7.56	7.68
210	7.71	7.95
215	8.68	8.29
220	8.43	8.49
225	8.51	8.62
230	8.85	8.82
235	9.1	9.05
240	9.31	9.29
245	9.33	9.33
250	9.5	9.45
255	9.71	9.64
260	9.86	9.81
265	9.95	9.9
270	10	10.02
275	10.15	10.15
280	10.37	10.36
285	10.58	10.61
290	10.76	10.8
295	10.84	10.9
300	10.83	11.12
305	11.38	11.37
310	11.36	11.32
315	11.53	11.48
320	11.7	11.67
325	11.84	11.81
330	11.98	11.94
335	12.32	12.13
340	12.19	12.22
345	12.29	12.35
350	12.43	12.47
355	12.59	12.61
360	12.72	12.73
365	12.83	12.81
370	12.99	12.99
375	13.08	13.1
380	13.12	13.11
385	13.21	13.2
390	13.38	13.33
395	13.54	13.5
400	13.65	13.63
405	13.74	13.73
410	13.84	13.83
415	14.14	13.96
420	14.1	14
425	14.13	14.08
430	14.24	14.2
435	14.4	14.4
440	14.55	14.49
445	14.7	14.65
450	14.82	14.79
455	14.89	14.91
460	14.9	15.09
465	15.16	15.19

470	15.24	15.22
475	15.31	15.25
480	15.38	15.32
485	15.48	15.43
490	15.58	15.52
495	15.66	15.6
500	15.72	15.7
505	15.74	15.75
510	15.83	15.82
515	16.05	15.92
520	15.95	15.93
525	15.97	15.97
530	16.05	16.01
535	16.09	16.07
540	16.16	16.15
545	16.21	16.21
550	16.29	16.3
555	16.38	16.41
560	16.51	16.53
565	16.67	16.68
570	16.78	16.85
575	16.87	17.02
580	17.03	17.11
585	17.06	17.08
590	17.1	17.09
595	17.15	17.13
600	17.22	17.18
605	17.28	17.25
610	17.35	17.33
615	17.42	17.37
620	17.41	17.42
625	17.48	17.48
630	17.56	17.55
635	17.67	17.65
640	17.8	17.79
645	17.94	17.95
650	18.08	18.13
655	18.16	18.12
660	18.18	18.03
665	18.12	17.99
670	18.13	18.01
675	18.19	18.09
680	18.26	18.24
685	18.42	18.41
690	18.56	18.56
695	18.62	18.61
700	18.67	18.67
705	18.7	18.74
710	18.74	18.79
715	18.81	18.86
720	18.89	18.95
725	19.09	19.09
730	19.22	19.26
735	19.17	19.23
740	19.19	19.14
745	19.14	19.1
750	19.13	19.09



755	19.17	19.1
760	19.19	19.15
765	19.24	19.21
770	19.34	19.29
775	19.37	19.36
780	19.36	19.36
785	19.43	19.41
790	19.51	19.48
795	19.59	19.56
800	19.7	19.66
805	19.83	19.79
810	19.98	19.95
815	20.07	20.04
820	20.1	19.96
825	20.11	19.92
830	20.09	19.94
835	20.09	19.96
840	20.14	20.05
845	20.19	20.11
850	20.27	20.2
855	20.36	20.29
860	20.42	20.37
865	20.46	20.44
870	20.5	20.51
875	20.52	20.55
880	20.59	20.61
885	20.7	20.69
890	20.82	20.77
895	20.89	20.83
900	20.88	20.92
905	20.83	21.08
910	20.93	21.21
915	21.19	21.17
920	21.22	21.1
925	21.09	21.03
930	20.98	21
935	20.95	21
940	20.96	21.01
945	21	21.04
950	21.05	21.06
955	21.09	21.07
960	21.15	21.13
965	21.23	21.2
970	21.27	21.26
975	21.31	21.3
980	21.36	21.37
985	21.43	21.44
990	21.52	21.53
995	21.63	21.64
1000	21.73	21.73

3.2.2.4 Antenna HF907

Frequency (GHz)	Antenna factor HF907 (SN 102508)	Antenna factor HF907 (SN 102494)
1	24.36	24.36
1.01	24.34	24.38
1.02	24.53	24.55
1.03	24.6	24.63
1.04	24.46	24.51
1.05	24.35	24.41
1.06	24.48	24.49
1.07	24.51	24.56
1.08	24.32	24.37
1.09	24.26	24.29
1.1	24.33	24.35
1.11	24.38	24.44
1.12	24.23	24.25
1.13	24.18	24.19
1.14	24.23	24.24
1.15	24.35	24.38
1.16	24.3	24.3
1.17	24.23	24.26
1.18	24.37	24.4
1.19	24.56	24.57
1.2	24.52	24.55
1.21	24.39	24.42
1.22	24.51	24.52
1.23	24.66	24.7
1.24	24.64	24.68
1.25	24.51	24.54
1.26	24.53	24.55
1.27	24.69	24.72
1.28	24.65	24.65
1.29	24.46	24.47
1.3	24.48	24.52
1.31	24.66	24.68
1.32	24.64	24.65
1.33	24.49	24.5
1.34	24.53	24.53
1.35	24.75	24.75
1.36	24.73	24.76
1.37	24.62	24.65
1.38	24.74	24.76
1.39	24.96	24.99
1.4	25.02	25.05
1.41	24.94	24.95
1.42	25.02	25.03
1.43	25.31	25.37
1.44	25.39	25.43
1.45	25.27	25.29
1.46	25.37	25.42
1.47	25.7	25.7
1.48	25.77	25.76
1.49	25.66	25.67
1.5	25.76	25.77



1.51	26.04	26.03
1.52	26.12	26.12
1.53	26.01	26.03
1.54	26.06	26.03
1.55	26.29	26.29
1.56	26.35	26.36
1.57	26.25	26.25
1.58	26.27	26.27
1.59	26.41	26.45
1.6	26.51	26.5
1.61	26.37	26.36
1.62	26.33	26.33
1.63	26.48	26.52
1.64	26.58	26.57
1.65	26.42	26.44
1.66	26.35	26.37
1.67	26.51	26.53
1.68	26.64	26.59
1.69	26.46	26.47
1.7	26.36	26.34
1.71	26.52	26.5
1.72	26.7	26.7
1.73	26.54	26.53
1.74	26.4	26.38
1.75	26.62	26.64
1.76	26.85	26.83
1.77	26.72	26.73
1.78	26.59	26.57
1.79	26.75	26.8
1.8	27.08	27.07
1.81	26.92	26.92
1.82	26.77	26.76
1.83	27	27
1.84	27.26	27.23
1.85	27.09	27.06
1.86	26.92	26.88
1.87	27.17	27.14
1.88	27.4	27.35
1.89	27.27	27.22
1.9	27.14	27.12
1.91	27.43	27.38
1.92	27.72	27.71
1.93	27.59	27.56
1.94	27.55	27.52
1.95	27.9	27.9
1.96	28.25	28.24
1.97	28.13	28.1
1.98	28.06	28.04
1.99	28.43	28.44
2	28.67	28.63
2.01	28.5	28.45
2.02	28.37	28.39
2.03	28.67	28.63
2.04	28.76	28.76
2.05	28.48	28.46
2.06	28.37	28.36
2.07	28.49	28.48

2.08	28.52	28.51
2.09	28.31	28.29
2.1	28.16	28.14
2.11	28.24	28.23
2.12	28.28	28.27
2.13	28.15	28.13
2.14	28.01	28
2.15	28.1	28.09
2.16	28.22	28.21
2.17	28.14	28.1
2.18	28.02	28
2.19	28.11	28.08
2.2	28.29	28.28
2.21	28.24	28.21
2.22	28.11	28.08
2.23	28.21	28.18
2.24	28.37	28.36
2.25	28.31	28.28
2.26	28.16	28.13
2.27	28.21	28.19
2.28	28.4	28.38
2.29	28.37	28.35
2.3	28.21	28.19
2.31	28.28	28.25
2.32	28.46	28.43
2.33	28.47	28.44
2.34	28.35	28.33
2.35	28.41	28.38
2.36	28.56	28.54
2.37	28.62	28.59
2.38	28.54	28.49
2.39	28.56	28.55
2.4	28.73	28.71
2.41	28.77	28.74
2.42	28.72	28.69
2.43	28.74	28.72
2.44	28.86	28.85
2.45	28.9	28.89
2.46	28.86	28.84
2.47	28.89	28.88
2.48	29.02	29.01
2.49	29.08	29.07
2.5	29.05	29.03
2.51	29.1	29.09
2.52	29.3	29.29
2.53	29.39	29.39
2.54	29.38	29.35
2.55	29.39	29.38
2.56	29.58	29.57
2.57	29.74	29.73
2.58	29.65	29.62
2.59	29.54	29.52
2.6	29.71	29.68
2.61	29.9	29.87
2.62	29.71	29.68
2.63	29.53	29.5
2.64	29.67	29.65



2.65	29.87	29.84
2.66	29.72	29.66
2.67	29.5	29.48
2.68	29.6	29.58
2.69	29.82	29.79
2.7	29.71	29.69
2.71	29.51	29.48
2.72	29.59	29.55
2.73	29.77	29.76
2.74	29.72	29.68
2.75	29.56	29.51
2.76	29.59	29.56
2.77	29.74	29.71
2.78	29.69	29.63
2.79	29.53	29.48
2.8	29.54	29.51
2.81	29.65	29.61
2.82	29.6	29.55
2.83	29.44	29.42
2.84	29.49	29.47
2.85	29.63	29.6
2.86	29.6	29.56
2.87	29.49	29.47
2.88	29.59	29.57
2.89	29.79	29.78
2.9	29.79	29.77
2.91	29.73	29.71
2.92	29.88	29.86
2.93	30.1	30.09
2.94	30.16	30.14
2.95	30.08	30.06
2.96	30.23	30.21
2.97	30.54	30.52
2.98	30.57	30.55
2.99	30.46	30.43
3	30.58	30.56
3.05	31.17	31.18
3.1	31.68	31.64
3.15	31.58	31.55
3.2	31.75	31.72
3.25	31.89	31.85
3.3	31.71	31.68
3.35	31.64	31.6
3.4	31.7	31.67
3.45	31.84	31.83
3.5	31.95	31.91
3.55	32.01	31.96
3.6	32.09	32.07
3.65	32.32	32.29
3.7	32.52	32.48
3.75	32.62	32.57
3.8	32.85	32.8
3.85	32.93	32.89
3.9	32.94	32.91
3.95	33.02	32.98
4	32.97	32.91
4.05	33.07	33.01

4.1	33.21	33.17
4.15	33.33	33.31
4.2	33.48	33.43
4.25	33.71	33.66
4.3	33.87	33.83
4.35	34.02	33.99
4.4	33.83	33.82
4.45	33.57	33.53
4.5	33.61	33.58
4.55	33.61	33.59
4.6	33.51	33.49
4.65	33.44	33.39
4.7	33.6	33.58
4.75	33.93	33.92
4.8	34.06	34.05
4.85	34.13	34.13
4.9	34.27	34.25
4.95	34.38	34.36
5	34.38	34.34
5.05	34.19	34.17
5.1	33.99	33.97
5.15	33.93	33.93
5.2	33.97	33.96
5.25	33.92	33.91
5.3	33.93	33.93
5.35	34.17	34.18
5.4	34.37	34.38
5.45	34.43	34.44
5.5	34.38	34.38
5.55	34.42	34.42
5.6	34.45	34.45
5.65	34.28	34.28
5.7	34.05	34.04
5.75	34.04	34.05
5.8	34.2	34.2
5.85	34.31	34.31
5.9	34.35	34.35
5.95	34.47	34.49
6	34.69	34.7
6.05	34.87	34.86
6.1	34.82	34.82
6.15	34.75	34.75
6.2	34.78	34.79
6.25	34.77	34.79
6.3	34.68	34.69
6.35	34.66	34.68
6.4	34.84	34.87
6.45	35.03	35.07
6.5	35.13	35.14
6.55	35.13	35.13
6.6	35.26	35.26
6.65	35.36	35.36
6.7	35.29	35.29
6.75	35.17	35.16
6.8	35.16	35.15
6.85	35.26	35.28
6.9	35.37	35.38



6.95	35.35	35.36
7	35.44	35.45
7.05	35.59	35.61
7.1	35.74	35.76
7.15	35.73	35.74
7.2	35.61	35.63
7.25	35.65	35.66
7.3	35.65	35.67
7.35	35.64	35.64
7.4	35.63	35.64
7.45	35.71	35.74
7.5	35.89	35.9
7.55	35.99	36.01
7.6	36.09	36.1
7.65	36.18	36.21
7.7	36.23	36.25
7.75	36.26	36.29
7.8	36.21	36.22
7.85	36.2	36.2
7.9	36.14	36.16
7.95	36.16	36.17
8	36.14	36.15
8.05	36.19	36.19
8.1	36.3	36.32
8.15	36.46	36.47
8.2	36.5	36.5
8.25	36.51	36.53
8.3	36.51	36.5
8.35	36.48	36.48
8.4	36.46	36.45
8.45	36.4	36.39
8.5	36.41	36.4
8.55	36.45	36.45
8.6	36.56	36.58
8.65	36.7	36.71
8.7	36.71	36.7
8.75	36.79	36.83
8.8	36.85	36.88
8.85	36.88	36.85
8.9	36.79	36.75
8.95	36.79	36.81
9	36.87	36.84
9.05	36.82	36.75
9.1	36.85	36.81
9.15	36.9	36.88
9.2	36.89	36.9
9.25	36.92	36.91
9.3	36.97	36.97
9.35	37.07	37.07
9.4	37.11	37.11
9.45	37.14	37.16
9.5	37.2	37.19
9.55	37.1	37.08
9.6	37.06	37.03
9.65	37.04	37.05
9.7	36.96	36.97
9.75	36.93	36.93

9.8	37	37
9.85	37.15	37.16
9.9	37.23	37.24
9.95	37.25	37.22
10	37.31	37.3
10.05	37.31	37.3
10.1	37.23	37.2
10.15	37.15	37.13
10.2	37.11	37.13
10.25	37.11	37.15
10.3	37.11	37.13
10.35	37.15	37.19
10.4	37.21	37.24
10.45	37.25	37.27
10.5	37.27	37.28
10.55	37.24	37.24
10.6	37.18	37.18
10.65	37.17	37.19
10.7	37.19	37.19
10.75	37.16	37.17
10.8	37.16	37.18
10.85	37.26	37.26
10.9	37.32	37.32
10.95	37.33	37.32
11	37.36	37.35
11.05	37.34	37.33
11.1	37.34	37.36
11.15	37.35	37.34
11.2	37.34	37.33
11.25	37.29	37.29
11.3	37.28	37.29
11.35	37.34	37.31
11.4	37.31	37.3
11.45	37.32	37.33
11.5	37.38	37.39
11.55	37.41	37.42
11.6	37.44	37.43
11.65	37.44	37.42
11.7	37.43	37.42
11.75	37.48	37.48
11.8	37.39	37.38
11.85	37.4	37.38
11.9	37.45	37.39
11.95	37.45	37.43
12	37.48	37.47
12.05	37.51	37.5
12.1	37.54	37.51
12.15	37.58	37.58
12.2	37.59	37.6
12.25	37.62	37.6
12.3	37.62	37.6
12.35	37.61	37.62
12.4	37.61	37.65
12.45	37.65	37.63
12.5	37.67	37.66
12.55	37.71	37.71
12.6	37.8	37.76



12.65	37.86	37.82
12.7	37.89	37.86
12.75	37.92	37.9
12.8	38	37.98
12.85	38.05	38.02
12.9	38.06	38.02
12.95	38.09	38.05
13	38.14	38.1
13.05	38.21	38.19
13.1	38.29	38.24
13.15	38.36	38.35
13.2	38.44	38.47
13.25	38.57	38.55
13.3	38.63	38.59
13.35	38.68	38.67
13.4	38.77	38.73
13.45	38.84	38.77
13.5	38.9	38.8
13.55	38.92	38.88
13.6	39.03	39
13.65	39.15	39.11
13.7	39.3	39.23
13.75	39.42	39.33
13.8	39.53	39.49
13.85	39.66	39.59
13.9	39.74	39.65
13.95	39.81	39.7
14	39.89	39.83
14.05	39.96	39.92
14.1	40.02	39.96
14.15	40.08	40.04
14.2	40.16	40.11
14.25	40.25	40.18
14.3	40.33	40.27
14.35	40.37	40.28
14.4	40.44	40.32
14.45	40.5	40.4
14.5	40.62	40.56
14.55	40.7	40.61
14.6	40.77	40.64
14.65	40.83	40.71
14.7	40.86	40.77
14.75	40.83	40.72
14.8	40.79	40.65
14.85	40.76	40.65
14.9	40.84	40.76
14.95	40.87	40.77
15	40.89	40.79
15.05	40.95	40.85
15.1	41.03	40.94
15.15	41.08	40.96
15.2	41.02	40.93
15.25	40.99	40.88
15.3	41.01	40.91
15.35	41.04	40.88
15.4	41.08	40.92
15.45	41.12	40.96

15.5	41.15	40.97
15.55	41.18	41
15.6	41.14	41.01
15.65	41.05	40.99
15.7	40.99	40.95
15.75	40.99	40.92
15.8	41.03	41
15.85	41.14	41.11
15.9	41.18	41.15
15.95	41.27	41.22
16	41.34	41.33
16.05	41.4	41.36
16.1	41.39	41.34
16.15	41.33	41.32
16.2	41.31	41.31
16.25	41.4	41.37
16.3	41.47	41.43
16.35	41.53	41.52
16.4	41.66	41.66
16.45	41.77	41.75
16.5	41.82	41.77
16.55	41.84	41.87
16.6	41.83	41.95
16.65	41.85	41.94
16.7	41.91	42
16.75	42.09	42.2
16.8	42.23	42.35
16.85	42.36	42.39
16.9	42.5	42.49
16.95	42.61	42.59
17	42.63	42.6
17.05	42.63	42.57
17.1	42.64	42.54
17.15	42.76	42.58
17.2	42.82	42.63
17.25	42.86	42.75
17.3	43.02	42.9
17.35	43.15	42.98
17.4	43.28	43.1
17.45	43.3	43.17
17.5	43.32	43.16
17.55	43.37	43.19
17.6	43.39	43.23
17.65	43.5	43.35
17.7	43.52	43.41
17.75	43.62	43.49
17.8	43.74	43.6
17.85	43.89	43.69
17.9	43.92	43.81
17.95	44.02	43.89
18	44.18	43.98

4 TEST SUMMARY

STANDARDS (details on first page)	Tested		Sample	
	yes	no	pass	not pass
47 CFR Part 15, Subpart C ANSI C63.10-2013;	☒	☐	☒	☐

Test	47 CFR Part 15 section	Section within the report	Conclusion
Conducted emission	15.207	7.1	PASS
Radiated emission	15.209	7.2	PASS
Bandwidth of the emission	15.215	7.3	PASS
Spectrum mask	15.225	7.4	PASS
Frequency tolerance of the carrier signal	15.225	7.5	PASS

4.1 Operating voltages/frequencies used for testing

Section	Test	Operating conditions
7.1	Conducted emission	120 V; 60 Hz, 5 VDC (via USB)
7.2	Radiated emission	5 VDC (via USB)
7.3.	Bandwidth of the emission	5 VDC (via USB)
7.4	Spectrum mask	5 VDC (via USB)
7.5	Frequency tolerance of the carrier signal	5 VDC (via USB)

5 CONVERSION FACTORS AND ALL OTHER FORMULAS

Unit	Conversion unit	Formula of conversion
dB μ V	dB μ V/m	dB μ V/m = dB μ V + AF
μ V/m	dB μ V/m	dB μ V/m = 20log(X(μ V/m)/1 μ V)

Test distance stated in standard	Test distance of measurement	Conversion factor
3 m	3 m	/
10/30/300 m	3 m	20dB/decade (over 30 MHz)
		40dB/decade (under 30 MHz)

Below 30 MHz:

$$1 \text{ db/decade} = \log(10)/\log(2) = 3.321926095$$

Conversion dB/decade :

$$= 3.32 \times 12 \text{ dB/Octave}$$

$$= 39,8631 \text{ dB/decade} \sim 40 \text{ dB/decade}$$

Above 30 MHz:

$$1 \text{ db/decade} = \log(10)/\log(2) = 3.321926095$$

Conversion dB/decade :

$$= 3.32 \times 6 \text{ dB/Octave}$$

$$= 19.9316 \text{ dB/decade} \sim 20 \text{ dB/decade}$$

*Conversion formula: Below 30 MHz: 40*log(D1/d1)

Above 30 MHz: 20*log(D2/d1)

Where d1 is 3 m

D1 can be 30 or 300 m

D2 is 10 m distance

6 EMISSION TESTS

6.1 Restricted bands of operation (§15.205 of FCC 47 CRF 15)

6.1.1 Requirement

Except as shown in paragraph (d) of §15.205 only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
¹ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(²)
13.36-13.41			

¹Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

²Above 38.6

6.1.2 Test results

See Radiated emission results under 6.3 Radiated emission and 6.5 Spectrum mask.

6.2 Conducted emission measurement (§15.207 of FCC 47 CRF 15)

6.2.1 Requirement

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.5	66 – 56*	56 – 46*
0.5 to 5.0	56	46
5.0 to 30.0	60	50

* Decreases with the logarithm of the frequency.

The shown limits in table shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

- For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.
- For all other carrier current systems: 1000 μV within the frequency band 535-1705 kHz, as measured using a 50 μH/50 ohms LISN.
- Carrier current systems operating below 30 MHz are also subject to the radiated emission limits as appropriate.

6.2.2 Test procedure

- As per clause 6.2 from ANSI C63.10-2013.
- The EUT is placed on a non-conductive 0.8 meters high table, 0.4 meters from the vertical conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). LISN 50 Ohm measuring port is terminated by a measuring instrument having 50 Ohm input impedance.
- Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.
- AC power lines of EUT are checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz is searched using PEAK, QUASI-PEAK and AVERAGE function of the receiver to determine compliance with Section 15.207 limits outside the transmitter's fundamental emission band. Bandwidth is set to 9 kHz.

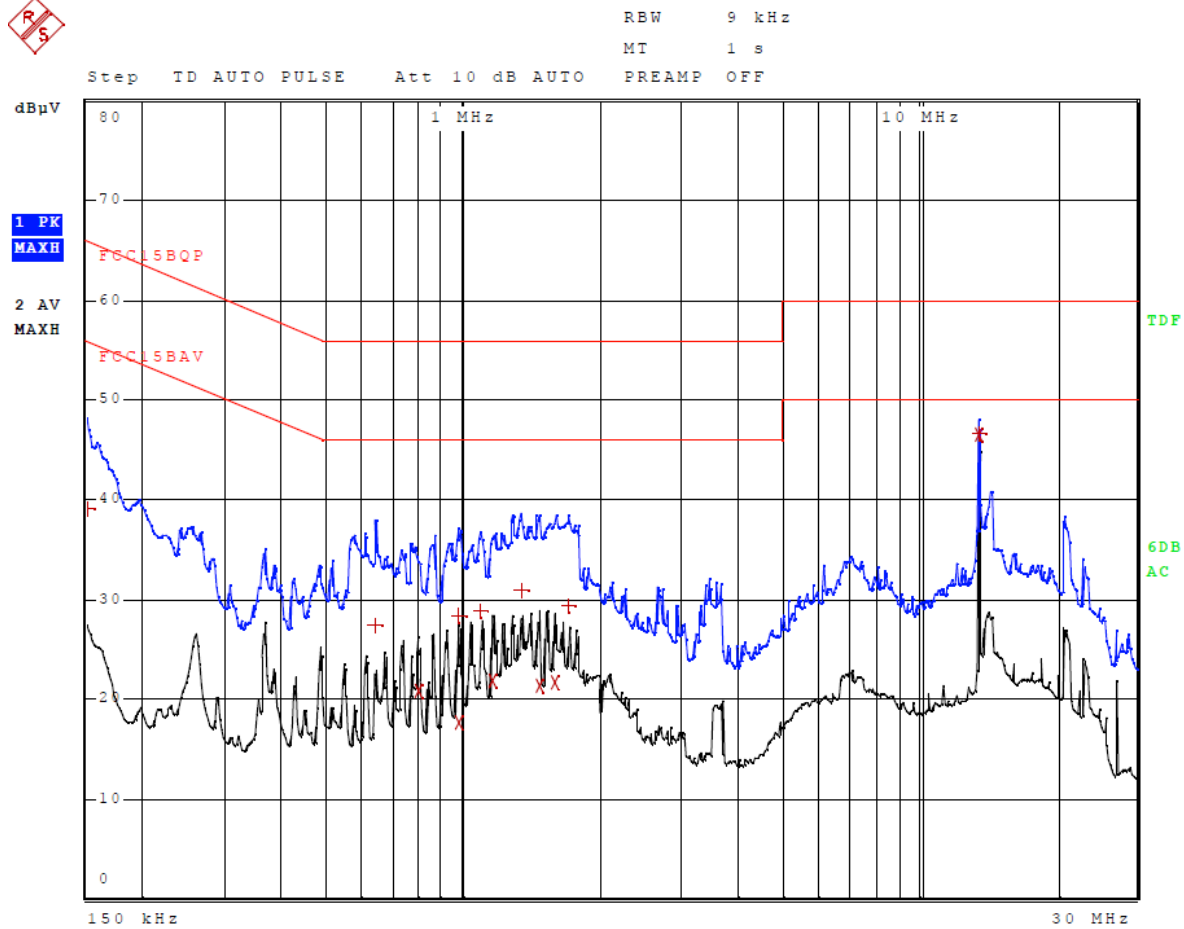
6.2.3 Test results

Device passed the requirements stated

Measurement with a dummy load in lieu of the antenna:

S20172948

Meas Type	CONDUCTED EMISSION
Equipment under Test	TWR-POS-CLR663
Manufacturer	NXP GmbH
OP Condition	Uin: 120 V, 60 Hz; WAITING FOR A TAG
Operator	Andrej Skof
Test Spec	
PHASE	



S20172948

Meas Type CONDUCTED EMISSION
Equipment under Test TWR-POS-CLR663
Manufacturer NXP GmbH
OP Condition Uin: 120 V, 60 Hz; WAITING FOR A TAG
Operator Andrej Skof
Test Spec
 PHASE

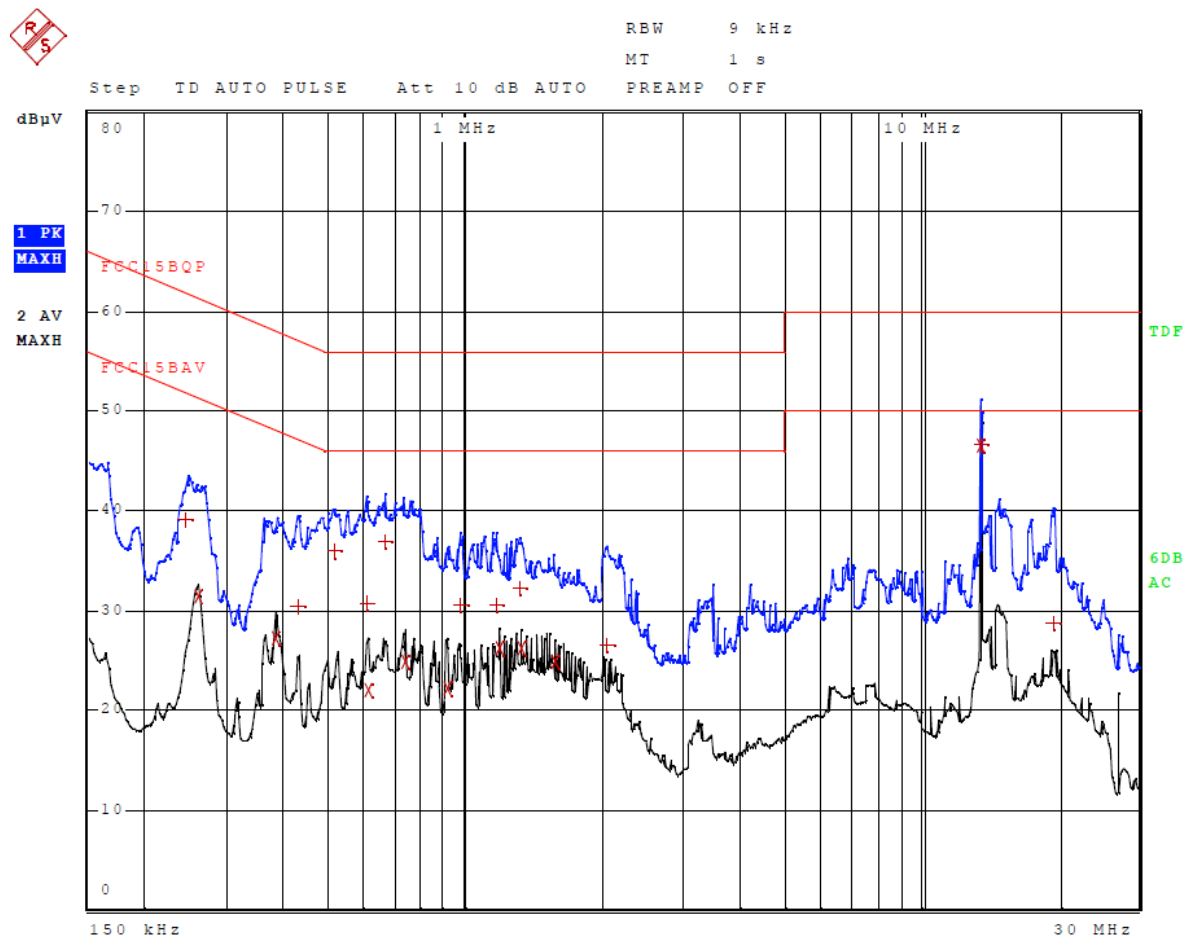
Final Measurement

Meas Time: 1 s
Margin: 20 dB
Subranges: 13

Trace	Frequency	Level (dBμV)	Detector	Delta Limit/dB
2	13.560000000 MHz	46.43	CISPR Averag	-3.57
1	13.560000000 MHz	46.63	Quasi Peak	-13.37
2	1.162500000 MHz	21.83	CISPR Averag	-24.17
2	1.590000000 MHz	21.61	CISPR Averag	-24.39
2	1.468500000 MHz	21.18	CISPR Averag	-24.82
1	1.340250000 MHz	30.90	Quasi Peak	-25.10
2	795.750000000 kHz	20.79	CISPR Averag	-25.21
1	1.700250000 MHz	29.38	Quasi Peak	-26.62
1	150.000000000 kHz	39.00	Quasi Peak	-27.00
1	1.088250000 MHz	28.82	Quasi Peak	-27.18
1	975.750000000 kHz	28.31	Quasi Peak	-27.69
2	980.250000000 kHz	17.61	CISPR Averag	-28.39
1	640.500000000 kHz	27.25	Quasi Peak	-28.75

S20172948

Meas Type CONDUCTED EMISSION
Equipment under Test TWR-POS-CLR663
Manufacturer NXP GmbH
OP Condition Uin: 120 V, 60 Hz; WAITING FOR A TAG
Operator Andrej Skof
Test Spec
NEUTRAL



S20172948

Meas Type CONDUCTED EMISSION
Equipment under Test TWR-POS-CLR663
Manufacturer NXP GmbH
OP Condition Uin: 120 V, 60 Hz; WAITING FOR A TAG
Operator Andrej Skof
Test Spec
 NEUTRAL

Final Measurement

Meas Time: 1 s
Margin: 20 dB
Subranges: 20

Trace	Frequency	Level (dBμV)	Detector	Delta Limit/dB
2	13.560000000 MHz	46.46	CISPR Averag	-3.54
1	13.560000000 MHz	46.65	Quasi Peak	-13.35
1	665.250000000 kHz	36.95	Quasi Peak	-19.05
2	1.187250000 MHz	26.16	CISPR Averag	-19.84
2	1.326750000 MHz	26.05	CISPR Averag	-19.95
1	514.500000000 kHz	35.89	Quasi Peak	-20.11
2	258.000000000 kHz	31.31	CISPR Averag	-20.19
2	384.000000000 kHz	27.14	CISPR Averag	-21.05
2	735.000000000 kHz	24.87	CISPR Averag	-21.13
2	1.572000000 MHz	24.82	CISPR Averag	-21.18
1	244.500000000 kHz	38.99	Quasi Peak	-22.95
1	1.313250000 MHz	32.14	Quasi Peak	-23.86
2	910.500000000 kHz	22.04	CISPR Averag	-23.96
2	611.250000000 kHz	22.02	CISPR Averag	-23.98
1	609.000000000 kHz	30.61	Quasi Peak	-25.39
1	1.164750000 MHz	30.44	Quasi Peak	-25.56
1	978.000000000 kHz	30.43	Quasi Peak	-25.57
1	429.000000000 kHz	30.34	Quasi Peak	-26.93
1	2.053500000 MHz	26.42	Quasi Peak	-29.58
1	19.443750000 MHz	28.66	Quasi Peak	-31.34

S20172948

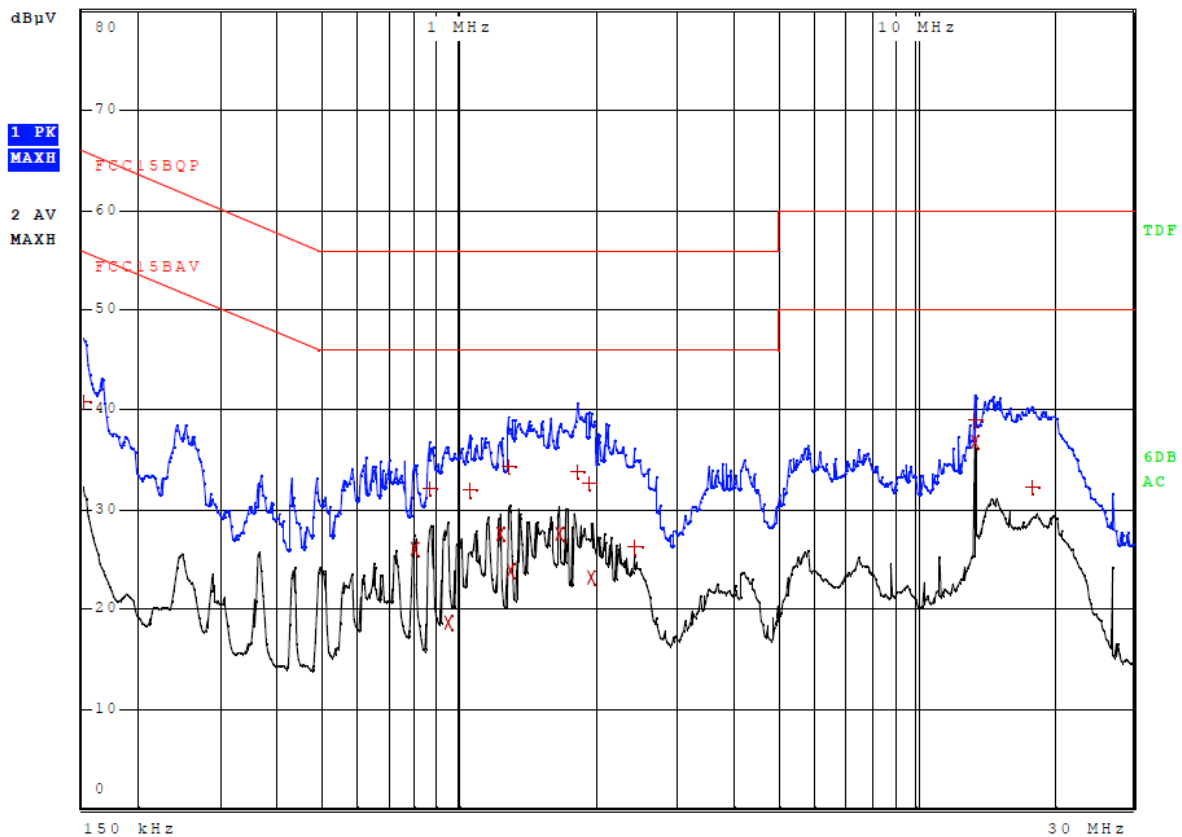
Meas Type CONDUCTED EMISSION
Equipment under Test TWR-POS-CLR663
Manufacturer NXP GmbH
OP Condition Uin: 120 V, 60 Hz; READING A TAG
Operator Andrej Skof
Test Spec
PHASE



RBW 9 kHz

MT 1 s

Step TD AUTO PULSE Att 10 dB AUTO PREAMP OFF



S20172948

Meas Type CONDUCTED EMISSION
Equipment under Test TWR-POS-CLR663
Manufacturer NXP GmbH
OP Condition Uin: 120 V, 60 Hz; READING A TAG
Operator Andrej Skof
Test Spec
 PHASE

Final Measurement

Meas Time: 1 s
Margin: 20 dB
Subranges: 16

Trace	Frequency	Level (dBμV)	Detector	Delta Limit/dB
2	13.560000000 MHz	36.70	CISPR Averag	-13.30
2	1.225500000 MHz	27.45	CISPR Averag	-18.55
2	1.657500000 MHz	27.41	CISPR Averag	-18.59
2	798.000000000 kHz	26.01	CISPR Averag	-19.99
1	13.560000000 MHz	38.91	Quasi Peak	-21.09
1	1.279500000 MHz	34.26	Quasi Peak	-21.74
2	1.295250000 MHz	23.76	CISPR Averag	-22.24
1	1.815000000 MHz	33.67	Quasi Peak	-22.33
2	1.954500000 MHz	23.16	CISPR Averag	-22.84
1	1.936500000 MHz	32.54	Quasi Peak	-23.46
1	863.250000000 kHz	32.04	Quasi Peak	-23.96
1	1.059000000 MHz	31.77	Quasi Peak	-24.23
1	150.000000000 kHz	40.80	Quasi Peak	-25.20
2	944.250000000 kHz	18.56	CISPR Averag	-27.44
1	18.071250000 MHz	32.25	Quasi Peak	-27.75
1	2.436000000 MHz	26.17	Quasi Peak	-29.83

S20172948

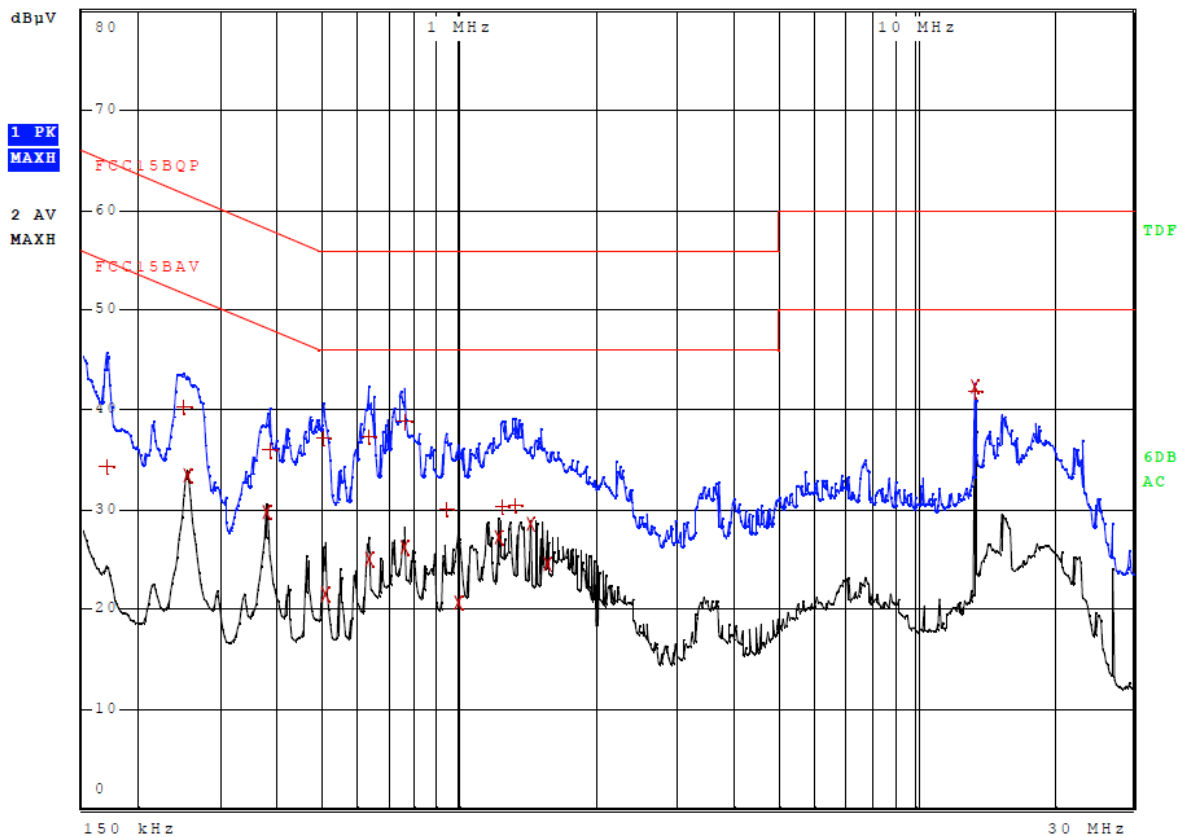
Meas Type CONDUCTED EMISSION
Equipment under Test TWR-POS-CLR663
Manufacturer NXP GmbH
OP Condition Uin: 120 V, 60 Hz; READING A TAG
Operator Andrej Skof
Test Spec
NEUTRAL



RBW 9 kHz

MT 1 s

Step TD AUTO PULSE Att 10 dB AUTO PREAMP OFF



S20172948

Meas Type CONDUCTED EMISSION
Equipment under Test TWR-POS-CLR663
Manufacturer NXP GmbH
OP Condition Uin: 120 V, 60 Hz; READING A TAG
Operator Andrej Skof
Test Spec
 NEUTRAL

Final Measurement

Meas Time: 1 s
Margin: 20 dB
Subranges: 20

Trace	Frequency	Level (dBμV)	Detector	Delta Limit/dB
2	13.560000000 MHz	42.29	CISPR Averag	-7.71
1	755.250000000 kHz	38.78	Quasi Peak	-17.22
2	1.432500000 MHz	28.53	CISPR Averag	-17.47
1	13.560000000 MHz	41.73	Quasi Peak	-18.27
2	251.250000000 kHz	33.43	CISPR Averag	-18.28
2	377.250000000 kHz	29.68	CISPR Averag	-18.66
1	631.500000000 kHz	37.28	Quasi Peak	-18.72
2	1.223250000 MHz	27.19	CISPR Averag	-18.81
1	503.250000000 kHz	37.07	Quasi Peak	-18.93
2	757.500000000 kHz	26.17	CISPR Averag	-19.83
2	631.500000000 kHz	24.95	CISPR Averag	-21.05
1	246.750000000 kHz	40.32	Quasi Peak	-21.55
2	1.560750000 MHz	24.37	CISPR Averag	-21.63
1	381.750000000 kHz	35.91	Quasi Peak	-22.33
2	505.500000000 kHz	21.35	CISPR Averag	-24.65
2	996.000000000 kHz	20.60	CISPR Averag	-25.40
1	1.324500000 MHz	30.38	Quasi Peak	-25.62
1	1.236750000 MHz	30.10	Quasi Peak	-25.90
1	935.250000000 kHz	29.98	Quasi Peak	-26.02
1	168.000000000 kHz	34.22	Quasi Peak	-30.84

6.3 Radiated emission measurement (§15.209 of FCC 47 CRF 15)

6.3.1 Requirement

Frequency Range (MHz)	Limits (dBµV/m)	Test distance (m)	Frequency low end limit (dBµV/m)	Frequency high end limit (dBµV/m)
0.009 to 0.490	$20 \cdot \log(2400/F(\text{kHz}))$	300	48.51937	13.8003
0.490 to 1.705	$20 \cdot \log(24000/F(\text{kHz}))$	30	33.8003	22.96974
1.705 to 30.0	30	30	29.54243	29.54243
30 to 88	40**	3	40	40
88 to 216	43.5**	3	43.52183	43.52183
216 to 960	46**	3	46.0206	46.0206
Above 960	54	3	53.9794	53.9794

** Except as provided in paragraph below, fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz.

Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications

6.3.2 Test procedure

Measurements from 9 kHz to 30 MHz

1. As per clause 6.4 from ANSI C63.10-2013
2. Radiated emission in the frequency range 9 kHz to 30 MHz are measured Active loop Antenna.
3. First preliminary measurements were performed in Semi-anechoic chamber at a distance of 3 m using active loop antenna.
4. The EUT was placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table and antenna was rotated 360 degrees to determine the position of the highest radiation.
5. Final measurements were done at a distance of 10 m at Open Area Test Site due to low emissions measured during preliminary measurements acc. to the clauses from Part 15, Sections 15.31(d) and 15.31(f)(2). Test results were extrapolated by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

Measurements from 30 MHz to 1 GHz

6. As per clause 6.5 from ANSI C63.10-2013
7. The EUT was placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
8. The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of variable-height antenna tower.
9. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
10. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
11. The test-receiver system was set to PEAK and QUAS-PEAK Detect Function and Specified Bandwidth with Maximum Hold Mode.
12. The highest points would be re-tested one by one using the quasi-peak method.

Measurements from 1 GHz to 18 GHz

13. As per clause 6.6 from ANSI C63.10-2013
14. The EUT was placed on the top of a rotating table 1.5 meters above the ground in an Anechoic Chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
15. The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of variable-height antenna tower.
16. The antenna is a horn antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
17. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
18. The test-receiver system was set to AVERAGE Detect Function and Specified Bandwidth with Maximum Hold Mode.
19. The highest points would be re-tested one by one using the AVERAGE detector.

6.3.3 Test results

Device passed the requirements stated

Preliminary measurements at 3 m:

Radiated emission

EUT Information

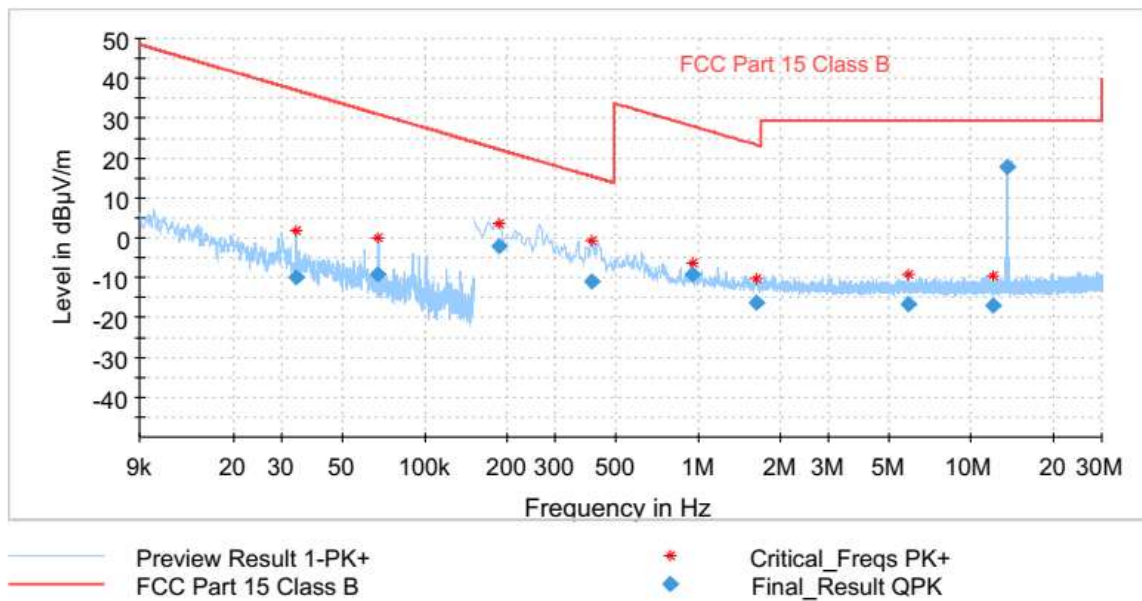
EUT

TWR-POS-CLR663

Operating condition:

Waiting a tag

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
0.033750	-10.00	37.03	47.04	H	320.0	-21
0.067450	-9.36	31.02	40.38	H	320.0	-21
0.186000	-2.20	22.21	24.41	H	320.0	-21
0.406500	-10.83	15.42	26.25	H	320.0	-21
0.946500	-9.31	28.08	37.39	H	320.0	-21
1.632750	-16.44	23.35	39.79	H	320.0	-21
5.896500	-16.77	29.52	46.30	H	320.0	-21
11.967000	-16.89	29.51	46.40	H	320.0	-21
13.560000	17.81	29.51	11.70	H	320.0	-21

EUT Information

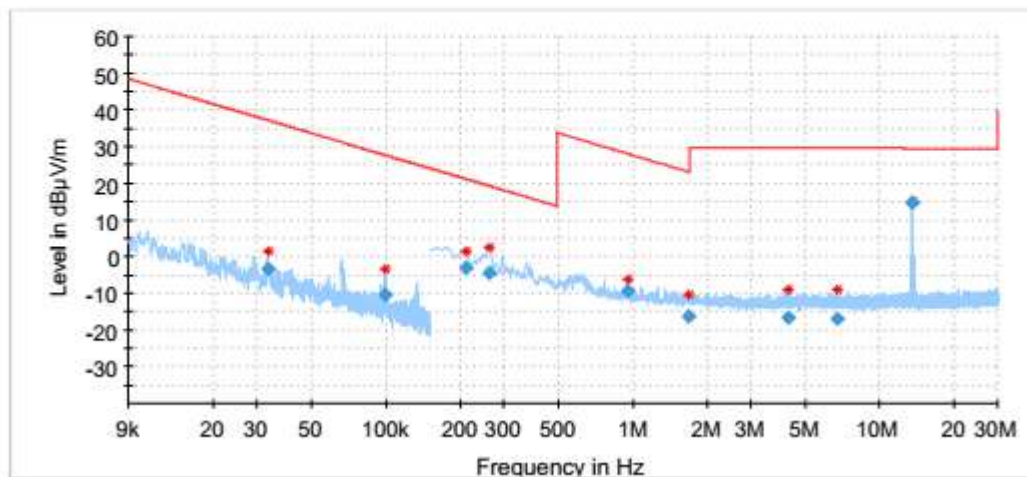
EUT

Operating condition:

TWR-POS-CLR663

Reading a tag

Full Spectrum



Comment

Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
0.033200	-3.39	37.18	40.57	H	320.0	-21
0.099550	-10.51	27.64	38.15	H	320.0	-21
0.210750	-3.02	21.13	24.15	H	320.0	-21
0.260250	-4.62	19.30	23.91	H	320.0	-21
0.946500	-9.17	28.08	37.25	H	320.0	-21
1.668750	-16.44	23.16	39.60	H	320.0	-21
4.224750	-16.76	29.53	46.29	H	320.0	-21
6.695250	-16.97	29.52	46.49	H	320.0	-21
13.560000	14.77	29.51	14.74	H	320.0	-21

Final measurement at 10 m on OATS

Results with measuring distance of 10 m				
Mode	Frequency (MHz)	Measured value (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Reading	13.56	47.29	103.00	55.71
Waiting	13.56	48.94	103.00	54.06

Calculated value from 10 m to 30 m						
Mode	Frequency (MHz)	Measured value at 10 m (dB μ V/m)	Correction factor from 10 m to 30 m (dB)	Calculated value at 30 m (dB μ V/m)	Limit at 30 m (dB μ V/m)	Margin (dB)
Reading	13.56	47.29	19	28.29	84.00	55.71
Waiting	13.56	48.94	19	29.94	84.00	54.06

NOTE: Antenna factor and cable loss are included in measurement correction.

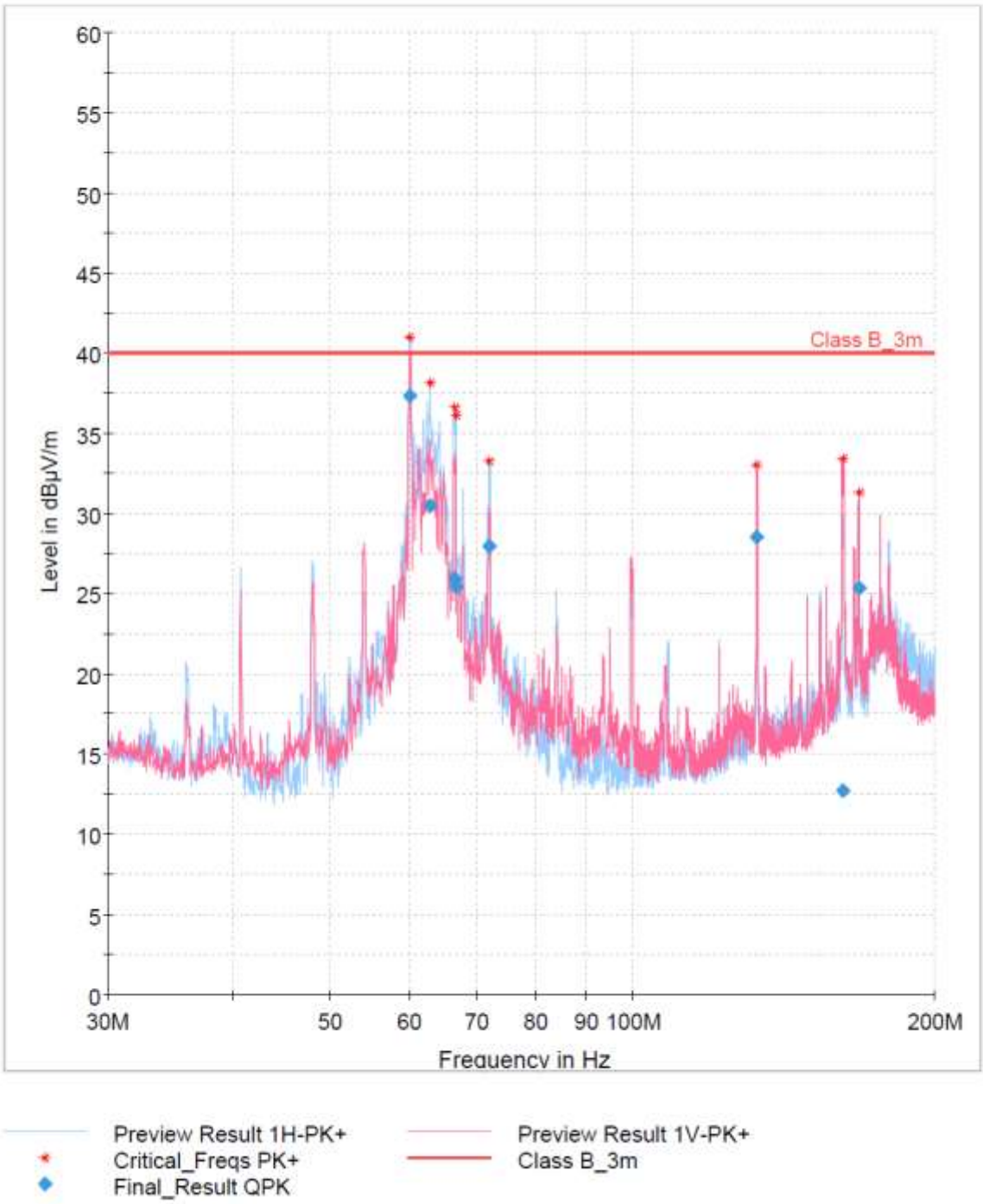
Final measurements from 30 MHz to 1 GHz

1 / 2

EUT Information

Model: TWR-POS-CLR663
 OP Condition: Waiting a Tag

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
60.030000	37.30	40.00	2.70	350.0	H	0.0
62.850000	30.45	40.00	9.55	350.0	H	355.0
66.420000	25.96	40.00	14.04	341.0	H	183.0
66.630000	25.46	40.00	14.54	350.0	H	161.0
72.000000	27.93	40.00	12.07	250.0	H	155.0
132.810000	28.53	40.00	11.47	105.0	V	166.0
162.240000	12.73	40.00	27.27	100.0	V	16.0
168.000000	25.33	40.00	14.67	100.0	V	100.0

EUT Information

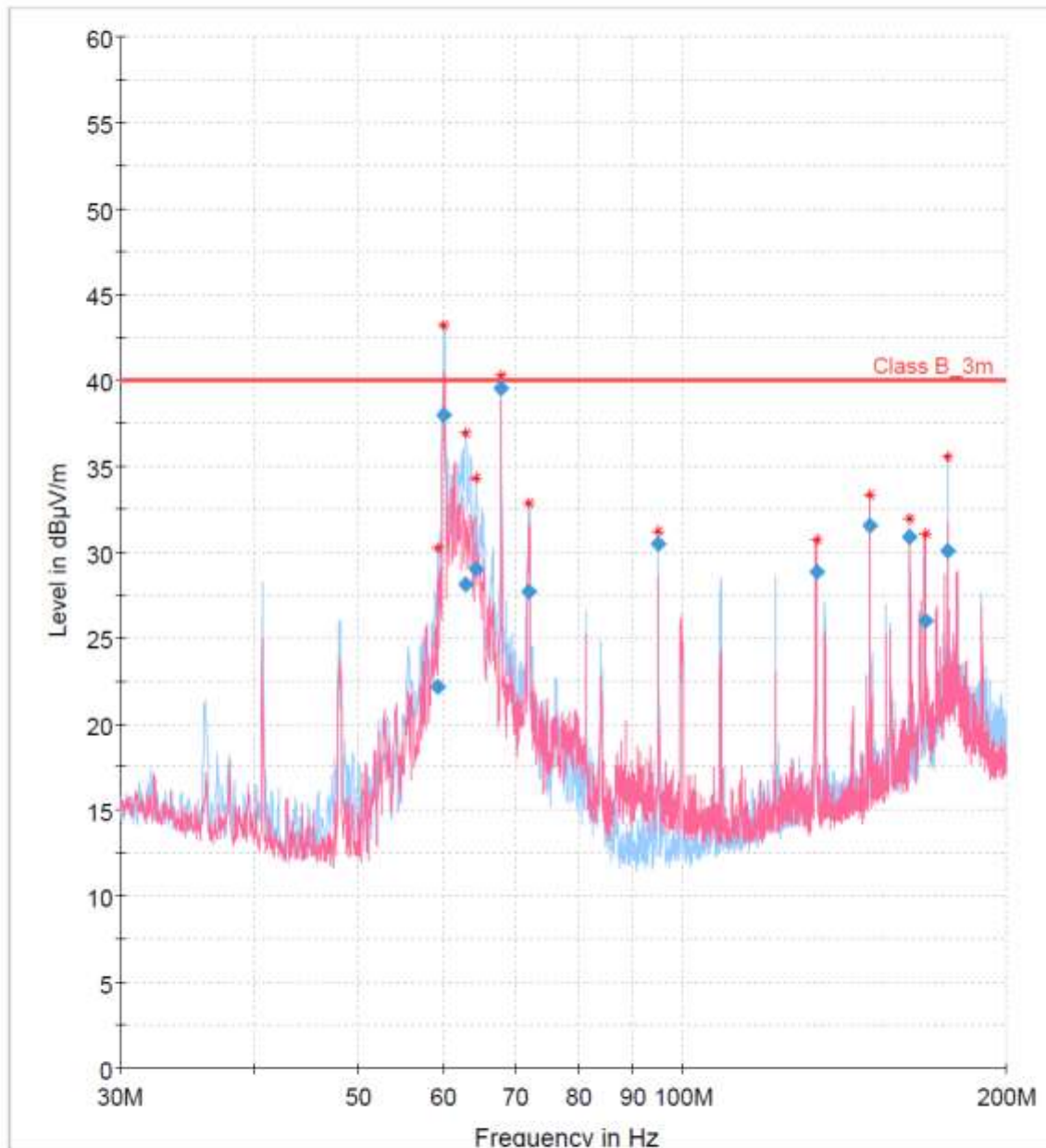
Model:

TWR-POS-CLR663

OP Condition:

Reading a Tag

Full Spectrum



Final Result

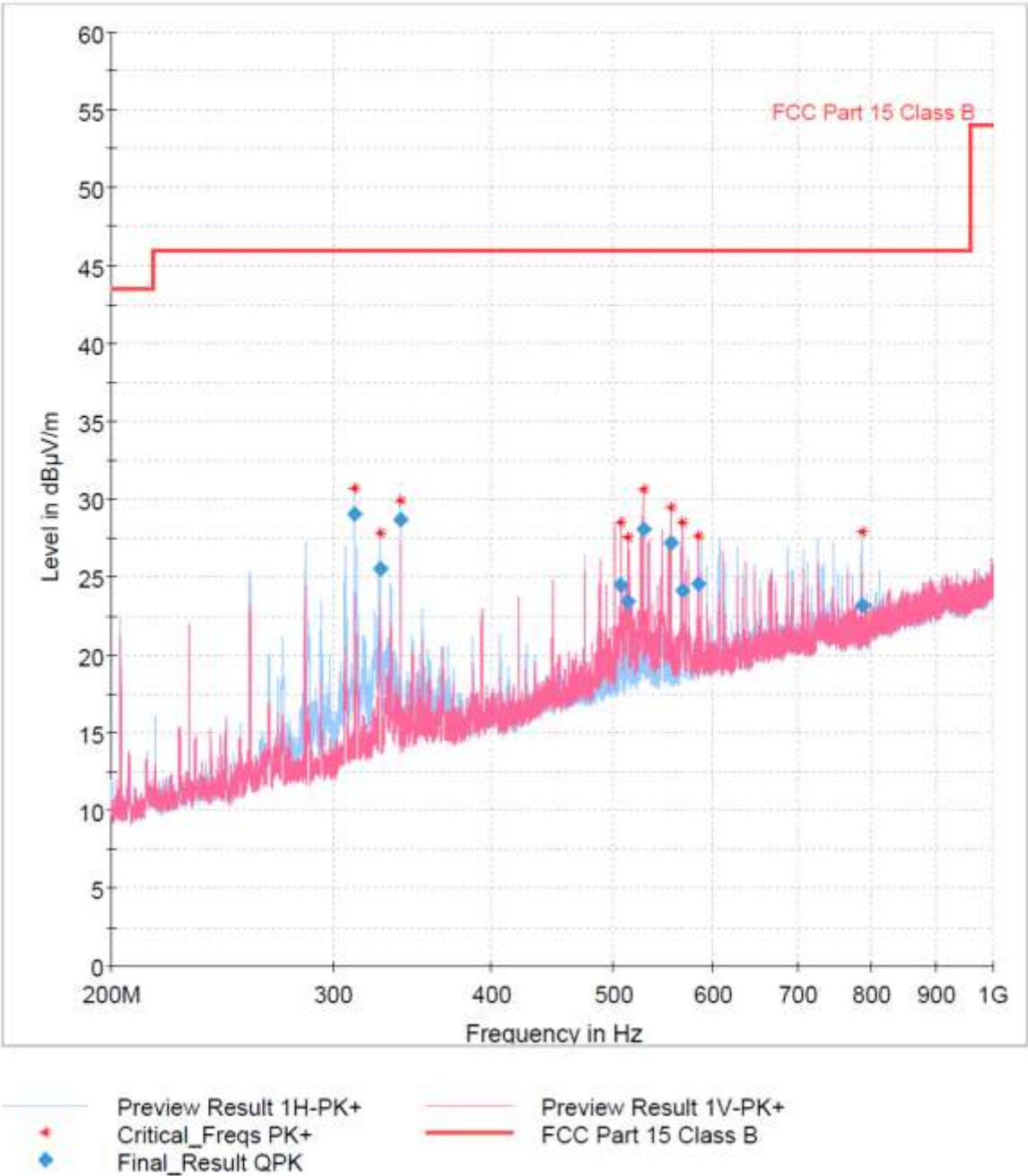
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
59.250000	22.17	40.00	17.83	348.0	H	0.0
60.000000	38.01	40.00	1.99	350.0	H	183.0
62.850000	28.12	40.00	11.88	350.0	H	354.0
64.260000	29.00	40.00	11.00	350.0	H	183.0
67.800000	39.50	40.00	0.50	325.0	H	6.0
71.970000	27.71	40.00	12.29	266.0	H	183.0
94.920000	30.53	40.00	9.47	196.0	H	359.0
133.260000	28.83	40.00	11.17	104.0	V	166.0
149.160000	31.51	40.00	8.49	109.0	V	176.0
162.720000	30.89	40.00	9.11	112.0	H	160.0
168.000000	25.97	40.00	14.03	100.0	V	103.0
176.280000	30.07	40.00	9.93	174.0	H	285.0

Radiated emission

EUT Information

EUT TWR-POS-CLR663
 Operating condition: Waiting for a tag

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
311.880000	29.00	46.00	17.00	103.0	H	268.0
339.000000	28.68	46.00	17.32	103.0	H	273.0
528.840000	28.05	46.00	17.95	100.0	V	322.0
555.960000	27.19	46.00	18.81	100.0	V	322.0
326.640000	25.50	46.00	20.50	100.0	H	109.0
583.080000	24.57	46.00	21.43	100.0	V	0.0
506.610000	24.47	46.00	21.53	104.0	V	322.0
566.760000	24.16	46.00	21.84	106.0	H	273.0
513.090000	23.45	46.00	22.55	100.0	V	322.0
786.480000	23.19	46.00	22.81	100.0	H	171.0

Radiated emission

EUT Information

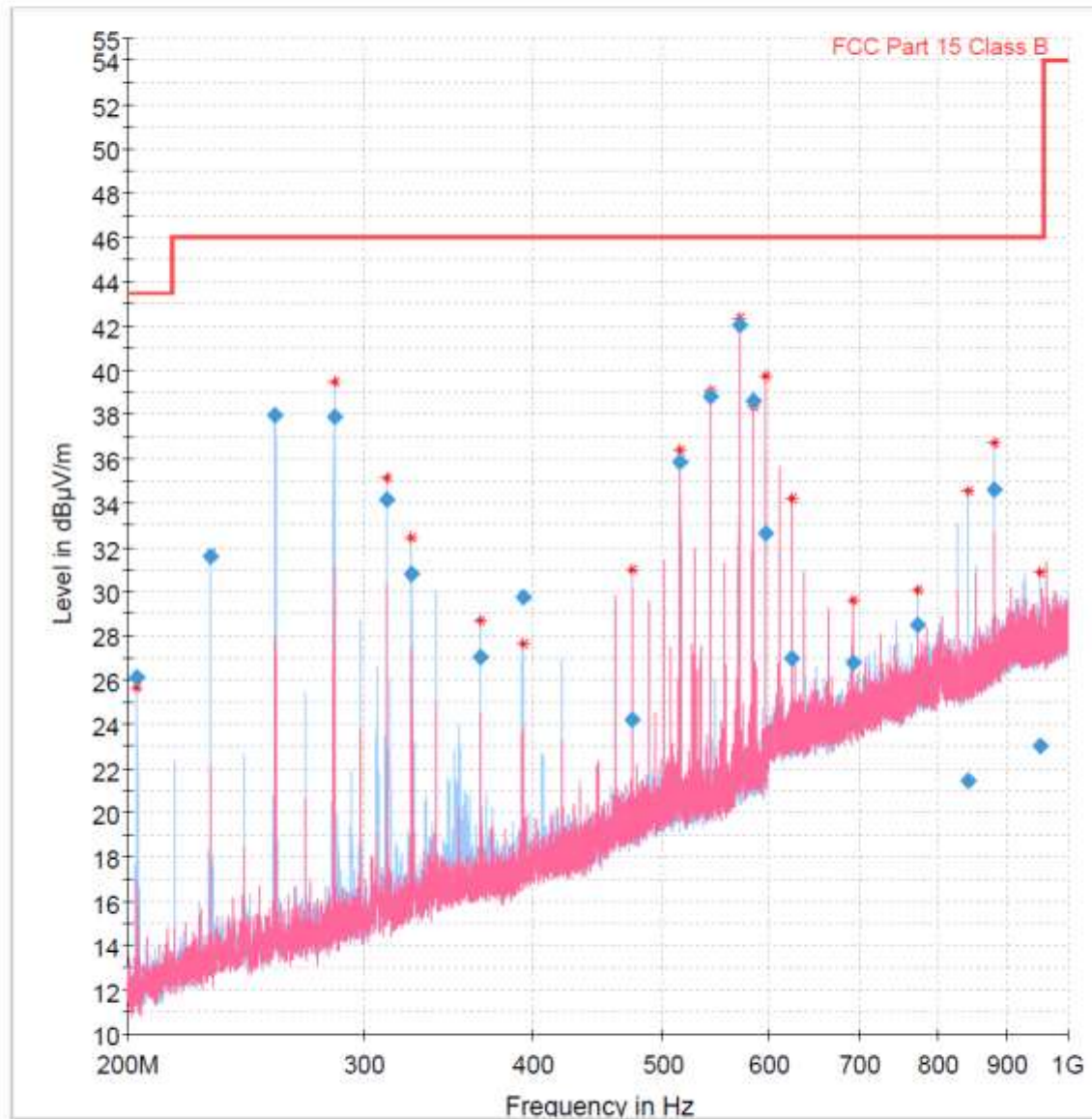
Model:

TWR-POS-CLR663

OP Condition

Reading a Tag

Full Spectrum



◆ Preview Result 1H-PK+
★ Critical_Freqs PK+
◆ Final_Result QPK

— Preview Result 1V-PK+
— FCC Part 15 Class B

EMI Auto Test(1)

2 / 2

Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
569.520000	42.02	46.00	3.98	100.0	V	343.0
542.400000	38.81	46.00	7.19	103.0	V	5.0
583.080000	38.61	46.00	7.39	100.0	V	5.0
257.640000	37.95	46.00	8.05	100.0	H	167.0
284.760000	37.92	46.00	8.08	103.0	H	198.0
515.280000	35.88	46.00	10.12	100.0	V	36.0
881.400000	34.59	46.00	11.41	143.0	H	104.0
311.880000	34.12	46.00	11.88	100.0	H	198.0
596.640000	32.64	46.00	13.36	100.0	V	312.0
230.520000	31.55	46.00	14.45	104.0	H	135.0
325.440000	30.82	46.00	15.18	100.0	H	198.0
393.240000	29.72	46.00	16.28	100.0	H	198.0
203.400000	26.10	43.50	17.40	150.0	H	130.0
772.920000	28.46	46.00	17.54	100.0	H	135.0
366.120000	27.01	46.00	18.99	100.0	H	198.0
623.760000	26.99	46.00	19.01	150.0	V	0.0
691.560000	26.78	46.00	19.22	100.0	V	312.0
474.600000	24.22	46.00	21.78	250.0	H	98.0
952.950000	23.03	46.00	22.97	104.0	H	167.0
843.360000	21.45	46.00	24.55	193.0	H	130.0

6.4 Bandwidth of the emission (§15.215)

6.4.1 Requirements

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §15.217 through 15.257 and in subpart E of FCC Part 15, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

6.4.2 Test procedure

1. As per Clause 6.9.2 from ANSI C63.10-2013
2. The EUT is placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table is rotated 360 degrees to determine the position of the highest radiation.
3. The EUT is set 3 m away from the interference-receiving antenna.
4. Resolution bandwidth is set to a value greater than 5% of the allowed bandwidth.

6.4.3 Test results

Device passed the requirements stated

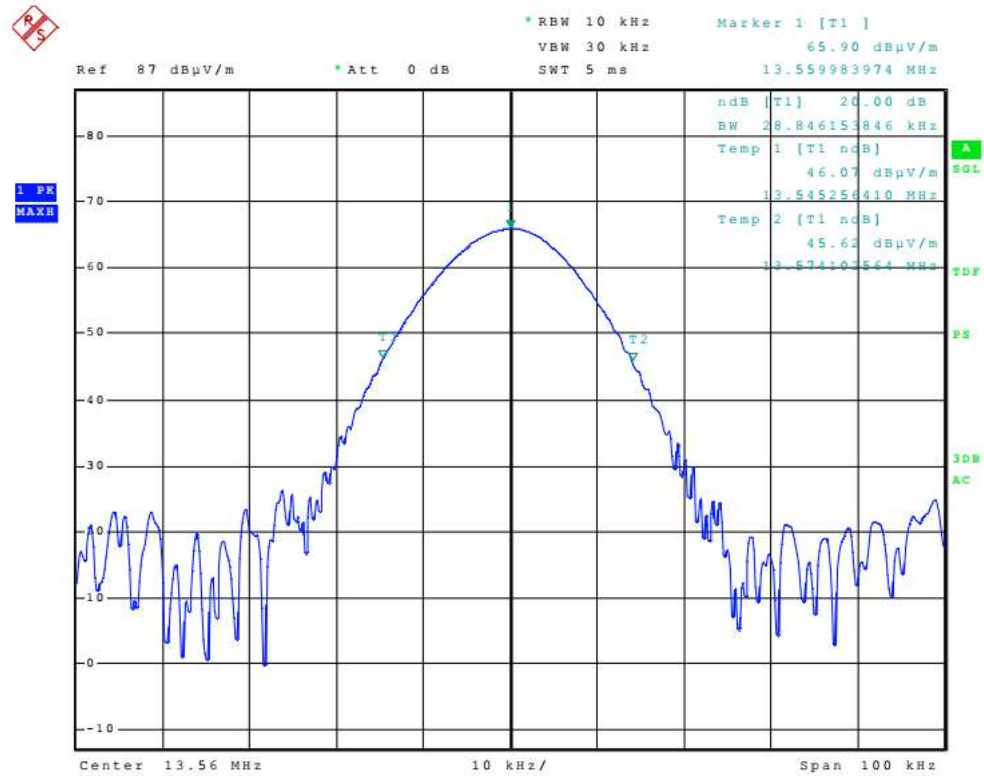
Meas Type OCCUPIED BANDWIDTH

Equipment under Test TWR-POS-CLR663

OP Condition Waiting for a Tag

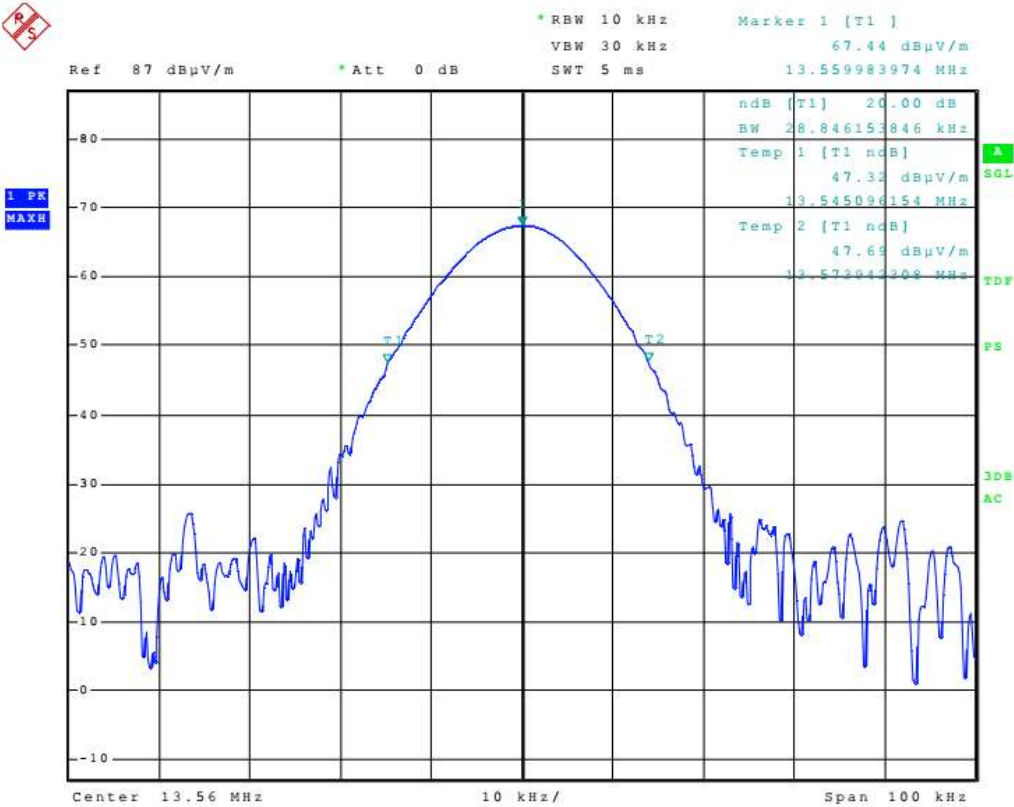
Test Spec

Antenna: 5 deg, Sample: 320 deg





Meas Type OCCUPIED BANDWIDTH
Equipment under Test TWR-POS-CLR663
OP Condition Reading a Tag
Test Spec
Antenna: 5 deg, Sample: 320 deg





Frequency (MHz)	Permitted frequency band (MHz)	20 dB bandwidth (kHz)	PASS/FAIL
13.56	13.110 – 14.010	28.84	PASS

6.5 Spectrum mask (§15.225 (a)-(d) of FCC 47 CRF 15)

6.5.1 Requirements

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters. Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters. Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters. The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

6.5.2 Test procedure

1. As per clause 6.4 from ANSI C63.10-2013
2. The EUT was placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
3. The EUT was set 3 m away from the interference-receiving antenna.
4. Frequencies with maximum emission were retested on OATS.
5. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.

6.5.3 Test results

Device passed the requirements stated

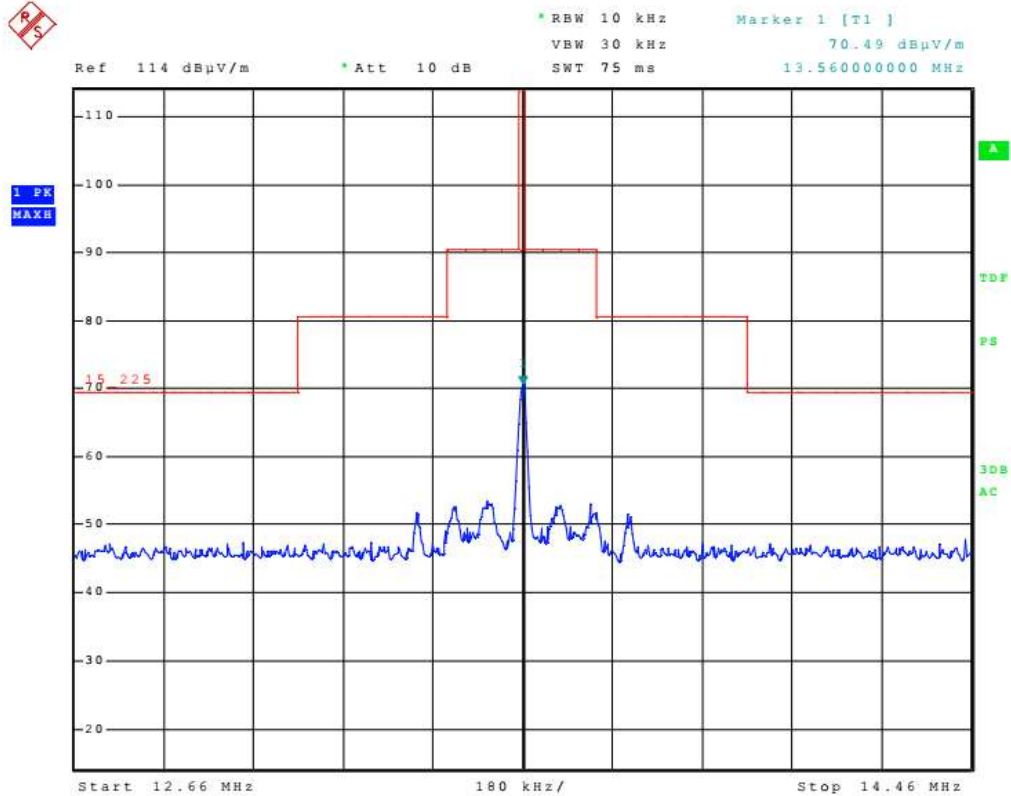
Meas Type SPECTRUM MASK
 Equipment under Test TWR-POS-CLR663
 OP Condition Waiting a tag

Test Spec

Antenna: 5 deg, Sample: 320 deg

Sweep Settings Screen A

Center Frequency	13.560000 MHz	Ref Level	114.000 dBμV/m
Frequency Offset	0.000000 Hz	Ref Level Offset	0.000 dB
Span	1.800000 MHz	Ref Position	100.000 %
Start Frequency	12.660000 MHz	Level Range	100.000 dB
Stop Frequency	14.460000 MHz	RF Att	10.000 dB
RBW	10.000000 kHz		
VBW	30.000000 kHz	X-Axis	LIN
Sweep Time	75.00 ms	Y-Axis	LOG



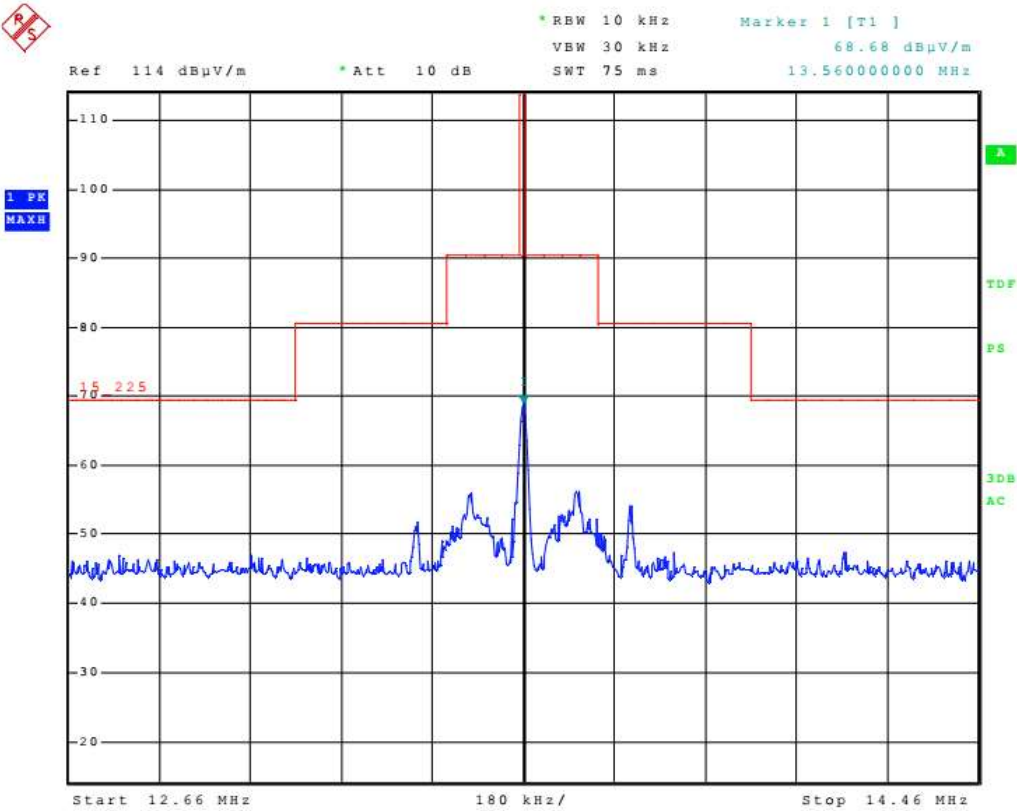


Meas Type SPECTRUM MASK
Equipment under Test TWR-POS-CLR663
OP Condition Reading a tag

Test Spec
Antenna: 5 deg, Sample: 320 deg

Sweep Settings Screen A

Center Frequency	13.560000 MHz	Ref Level	114.000 dBμV/m
Frequency Offset	0.000000 Hz	Ref Level Offset	0.000 dB
Span	1.800000 MHz	Ref Position	100.000 %
Start Frequency	12.660000 MHz	Level Range	100.000 dB
Stop Frequency	14.460000 MHz	RF Att	10.000 dB
RBW	10.000000 kHz		
VBW	30.000000 kHz	X-Axis	LIN
Sweep Time	75.00 ms	Y-Axis	LOG





6.6 Frequency tolerance of the carrier signal (§15.225 (e))

6.6.1 Requirement

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

6.6.2 Test procedure

1. As per clause 6.8 from ANSI C63.10-2013.
2. The frequency tolerance of the carrier signal is measured over a temperature variation of -20 °C to $+50$ °C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 °C.
3. If the EUT provides an antenna connector the spectrum analyzer is connected to this port. In cases where the EUT does not provide an antenna connector a test fixture is used.
4. The peak detector of the spectrum analyzer is selected and the resolution bandwidth as well as the video bandwidth is set to values appropriate to the shape of the spectrum of the EUT.
5. While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized.

6.6.3 Test results

Device passed the requirements stated

TWR-POS-CLR663		FREQUENCY STABILITY				
Temperature	Supply voltage (V)	Minutes after switch on	Measured Frequency (MHz)	Allowed tolerance (kHz)	Measured tolerance	RESULT
50	5,00	0	13,559927000	Fref±1.356 kHz	-0,076	PASS
	5,00	2	13,559924000	Fref±1.356 kHz	-0,079	PASS
	5,00	5	13,559923000	Fref±1.356 kHz	-0,080	PASS
	5,00	10	13,559923000	Fref±1.356 kHz	-0,080	PASS
40	5,00	0	13,559970500	Fref±1.356 kHz	-0,033	PASS
	5,00	2	13,559970500	Fref±1.356 kHz	-0,033	PASS
	5,00	5	13,559940500	Fref±1.356 kHz	-0,063	PASS
	5,00	10	13,559940500	Fref±1.356 kHz	-0,063	PASS
30	5,00	0	13,559986500	Fref±1.356 kHz	-0,017	PASS
	5,00	2	13,559972500	Fref±1.356 kHz	-0,031	PASS
	5,00	5	13,559970500	Fref±1.356 kHz	-0,033	PASS
	5,00	10	13,559970500	Fref±1.356 kHz	-0,033	PASS
20	4,25	0	13,559970500	Fref±1.356 kHz	-0,033	PASS
	4,25	2	13,560010400	Fref±1.356 kHz	0,007	PASS
	4,25	5	13,560009400	Fref±1.356 kHz	0,006	PASS
	4,25	10	13,560009400	Fref±1.356 kHz	0,006	PASS
20	5,00	0	13,560017400	Fref±1.356 kHz	0,014	PASS
	5,00	2	13,560005400	Fref±1.356 kHz	0,002	PASS
	5,00	5	13,560004400	Fref±1.356 kHz	0,001	PASS
	5,00	10	13,560003400	Fref	0,000	PASS
20	5,75	0	13,560018400	Fref±1.356 kHz	0,015	PASS
	5,75	2	13,560001400	Fref±1.356 kHz	-0,002	PASS
	5,75	5	13,559999400	Fref±1.356 kHz	-0,004	PASS
	5,75	10	13,559998400	Fref±1.356 kHz	-0,005	PASS
10	5,00	0	13,560045900	Fref±1.356 kHz	0,043	PASS
	5,00	2	13,560037900	Fref±1.356 kHz	0,034	PASS
	5,00	5	13,560036900	Fref±1.356 kHz	0,034	PASS
	5,00	10	13,560035900	Fref±1.356 kHz	0,033	PASS
0	5,00	0	13,560055900	Fref±1.356 kHz	0,053	PASS
	5,00	2	13,560054900	Fref±1.356 kHz	0,052	PASS
	5,00	5	13,560054900	Fref±1.356 kHz	0,052	PASS
	5,00	10	13,560054900	Fref±1.356 kHz	0,052	PASS
-10	5,00	0	13,560040000	Fref±1.356 kHz	0,037	PASS
	5,00	2	13,560050000	Fref±1.356 kHz	0,047	PASS
	5,00	5	13,560051000	Fref±1.356 kHz	0,048	PASS
	5,00	10	13,560051000	Fref±1.356 kHz	0,048	PASS
-20	5,00	0	N/A*	Fref±1.356 kHz		N/A
	5,00	2	N/A*	Fref±1.356 kHz		N/A
	5,00	5	N/A*	Fref±1.356 kHz		N/A
	5,00	10	N/A*	Fref±1.356 kHz		N/A

*Note: Device does not start after it is power up.