

TECHNICAL REPORT FOR TYPE ACCEPTANCE

MODEL : SC-980

FCC ID : O78SC980

EMI TEST REPORT

Date of test : Aug 3, 2009

**UL Japan, Inc.
Shonan EMC LAB.**

**1-22-3 Megumigaoka, Hiratsuka-shi,
Kanagawa-ken, 259-1220 JAPAN**

TECHNICAL DATA – SC- 980 Narrow band

A. RF POWER OUTPUT

1. Power measured using test set-up Figure 1.
 Primary power 13.6 VDC at battery input connector.
2. Power Data for 450.1MHz to 511.9875MHz @ 45W is presented in Paragraph 1.
3. Power Data for 450.1MHz to 511.9875MHz @ 10W is presented in Paragraph 2.

B. FREQUENCY STABILITY

1. a. Frequency stability with varying temperature. See Figure 1 for test set-up.
 b. Data is presented on Paragraph 3 for Standard Primary Input Voltage of 13.6 VDC maintained throughout entire test.
2. a. Frequency stability with Primary Input Voltage. See Figure 1 for test set-up.
 b. Data is presented on Paragraph 4 for Standard Temperature of 25 degrees Celsius maintained throughout entire test.

C. OCCUPIED BANDWIDTH

1. a. A spectrum analyzer was used to determine the occupied bandwidth.
 See Figure 1 for test set-up.
- b. Data is presented on Paragraph 5 to Paragraph 8 for Standard primary Input Voltage of 13.6 VDC maintained throughout entire test. The carrier and all detectable sidebands were displayed on the spectrum analyzer and pertinent data concerning amplitude and frequency were read from the screen.
- c. un modulated : Data measured at 481.1MHz. (see Paragraph 5)
- d. Input to transmitter audio circuits: 2500Hz sine wave at a level 16dB greater than that necessary to produce 50% modulation. Data measured at 481.1MHz and is typical of all frequencies. (see Paragraph 6)
- e. Input to transmitter audio circuits: 2500Hz sine wave at a level 16dB greater than that necessary to produce 50% modulation with CTCSS(250.3Hz).
 Data measured at 481.1MHz and is typical of all frequencies.
 (see Paragraph 7)
- f. Input to transmitter audio circuits: 2500Hz sine wave at a level 16dB greater than that necessary to produce 50% modulation with DCS(023).
 Data measured at 481.1MHz and is typical of all frequencies.
 (see Paragraph 8)

D. MODULATION CHARACTERISTICS

1. Modulation Deviation

- a. Measured using test set-up, see Figure 1.
- b. Primary Input Voltage of 13.6 VDC at battery input connector.
- c. Data (Positive peak) is presented in Paragraph 9
- d. Data (Negative peak) is presented in Paragraph 10.
- e. Data (Positive peak) with CTCSS (250.3Hz) is presented in Paragraph 11.
- f. Data (Negative peak) with CTCSS (250.3Hz) is presented in Paragraph 12.
- g. Data (Positive peak) with DCS (023) is presented in Paragraph 13.
- h. Data (Negative peak) with DCS (023) is presented in Paragraph 14.

2. Transmitter Audio Frequency Response

- a. Measured using test set-up, see Figure 1.
- b. Primary Input Voltage of 13.6 VDC at battery input connector.
Ref = 1 kHz tone response at +-1.5 kHz deviation. Curve was taken maintaining constant +- 1.5 kHz deviation.
- c. Data is presented in Paragraph 15.

3. Low-Pass Filter Response

- a. Measured using test set-up, see Figure 1.
- b. Primary Input Voltage of 13.6 VDC at battery input connector.
Input 1 kHz tone at a level 20dB greater than that required for 3 kHz deviation
The response at 1 kHz tone = 0dB. Curve was taken maintaining constant input at modulation sensitivity. Output of low-pass filter was monitored using Audio Analyzer
- c. Data is presented in Paragraph 16.

E. CONDUCTED SPURIOUS EMISSION

1. Conducted spurious data was measured at 25 degrees Celsius, 13.6 VDC applied at battery input connector external power input and using external antenna jack.
See Figure 1 for test set-up.
2. Data for 450.1MHz @ 45W is presented in Paragraph 17.
3. Data for 481.1MHz @ 45W is presented in Paragraph 18.
4. Data for 511.9875MHz @ 45W is presented in Paragraph 19.
5. Data for 450.1MHz @ 10W is presented in Paragraph 20.
6. Data for 481.1MHz @ 10W is presented in Paragraph 21.

7. Data for 511.9875.MHz @ 10W is presented in Paragraph 22.
8. Data for 481.1MHz @ Receiver is presented in Paragraph 23.

F. TRANSIENT BEHAVIOR

- a. Measured using test set-up, see Figure 1.
- b. Primary Input Voltage of 13.6 VDC at battery input connector.
- c. Data is presented in Paragraph 24.

G. RADIATED SPURIOUS EMISSION

1. Radiated spurious data was measured at 20 degrees Celsius, 13.6 VDC applied at battery input and using external antenna jack into a 50 ohm non-radiating load.
The substitution method found in TIA/EIA 603 procedure.
2. Data for 450.1MHz @ 45W is presented in Paragraph 25.
3. Data for 481.1MHz @ 45W is presented in Paragraph 26.
4. Data for 511.9875MHz @ 45W is presented in Paragraph 27.

H. RADIATED SPURIOUS EMISSION (Receiver)

1. Data for 450.1MHz to 511.9875MHz @ Receiver is presented in Sheet 1.

(EMI TEST REPORT)

I. PARAGRAPHS

1. RF Power Output, 45W
2. RF Power Output, 10W
3. Frequency Stability vs. Temperature
4. Frequency Stability vs. Voltage
5. Occupied Bandwidth, un modulated
6. Occupied Bandwidth, 2500Hz Sine Wave
7. Occupied Bandwidth, 2500Hz Sine Wave with CTCSS (250.3Hz)
8. Occupied Bandwidth, 2500Hz Sine Wave with DCS (023)
9. Deviation vs. Audio input Level - Positive peak
10. Deviation vs. Audio input Level - Negative peak
11. Deviation vs. Audio input Level with CTCSS (250.3Hz) - Positive peak
12. Deviation vs. Audio input Level with CTCSS (250.3Hz) - Negative peak
13. Deviation vs. Audio input Level with DCS (023) - Positive peak
14. Deviation vs. Audio input Level with DCS (023) -Negative peak
15. Transmitter Audio Frequency Response
16. Audio Low-Pass Filter Response
17. Conducted Spurious Emissions, 450.1MHz @ 45W
18. Conducted Spurious Emissions, 481.1MHz @ 45W
19. Conducted Spurious Emissions, 511.9875MHz @ 45W
20. Conducted Spurious Emissions, 450.1MHz @ 10W
21. Conducted Spurious Emissions, 481.1MHz @ 10W
22. Conducted Spurious Emissions, 511.9875MHz @ 10W
23. Conducted Spurious Emissions, Receiver
24. Transient Behavior

Sheet 1. Radiated Spurious Emissions, Receiver

I. FIGURE

1. Test Set-up

TECHNICAL DATA

Model Name		: SC-980	
Sample Number		: Sample2	
Specification is Referenced		: EIA/TIA-603C	
Emission Type		: 11K0F3E	
Channel Spacing		: 12.5	(kHz)
Description		: Mobile	
Mode		: FM	
Frequency Range	TX	: 450.000 - 512.000	(MHz)
	RX	: 450.000 - 512.000	(MHz)
Test Voltage	Normal	: 13.6	(V)
	Extreme	: 10.88	(13.6-20%) (V)
		: 16.32	(13.6+20%) (V)
Temperature	Normal	: 25	(°C)
	Extreme	: -30 - +60	(°C)
Test Frequency	TX	: 450.100	(MHz)
	RX	: 450.100	(MHz)
	TX	: 481.100	(MHz)
	RX	: 481.100	(MHz)
	TX	: 511.9875	(MHz)
	RX	: 511.9875	(MHz)
1st IF	RX	: -58.05	(MHz)
2nd IF	RX	: -450	(kHz)
Microphone Impedance		: 600	(Ω)
Speaker Impedance		: 4	(Ω)
Rated RF Power	HIGH	: 45	(W)
	LOW	: 10	(W)
Test Operator		: K.Atсутa	
Test Date	Start	: 2009/6/26	
	Finish	: 2009/6/29	

Carrier Frequency Stability - Temperature Variation

SAMPLE1

481.100

Temperature[°C]	Measured	Frequency error[Hz]	ppm	Upper Limit	Lower Limit
-30	481.099904	-96	-0.21	2.50	-2.50
-20	481.099850	-150	-0.32	2.50	-2.50
-10	481.099820	-180	-0.39	2.50	-2.50
0	481.099800	-200	-0.43	2.50	-2.50
10	481.099878	-122	-0.26	2.50	-2.50
25	481.099965	-35	-0.08	2.50	-2.50
40	481.100100	100	0.22	2.50	-2.50
50	481.100295	295	0.63	2.50	-2.50
60	481.100442	442	0.95	2.50	-2.50

Audio Frequency Response

Frequency[Hz]	Measured SAMPLE1	Upper Limit	Lower Limit
100			
250	-14.40		
300	-11.90	-9.46	-17.89
400	-8.80	-6.96	-12.90
500	-6.50	-5.02	-9.02
700	-3.28	-2.10	-6.10
1000	0.00	1.00	-3.00
1500	3.40	4.52	0.52
2000	5.90	7.02	3.02
2500	7.42	8.96	4.96
3000	7.82	10.54	4.96
4000			

Audio LPF Response

AF[kHz]	Measured SAMPLE1	Limit
1000	0.00	0.00
1500	-0.57	0.00
2000	-1.08	0.00
2500	-1.84	0.00
3000	-3.31	0.00
4000	-9.74	-7.50
5000	-18.54	-13.31
7000	-43.06	-22.08
10000	-47.60	-31.37
15000	-47.70	-41.94
20000		-50.00
100000		-50.00

Modulation Limiting

Carrier

SAMPLE1

INPUT		f=300Hz		f=1000Hz		f=3000Hz		Limit
V[mV]	[dB]	Positive Peak	Negative Peak	Positive Peak	Negative Peak	Positive Peak	Negative Peak	
1.5	-20	0.09	0.09	0.19	0.18	0.31	0.31	2.5
4.7	-10	0.16	0.17	0.47	0.47	0.85	0.85	2.5
7.5	-6	0.23	0.23	0.73	0.72	1.30	1.29	2.5
10.6	-3	0.31	0.31	1.01	1.00	1.46	1.44	2.5
15.0	0	0.41	0.41	1.41	1.40	1.52	1.51	2.5
21.2	3	0.56	0.56	1.87	1.76	1.55	1.54	2.5
29.9	6	0.78	0.78	1.93	1.84	1.57	1.56	2.5
47.4	10	1.21	1.20	1.99	1.93	1.58	1.56	2.5
75.2	14	1.77	1.66	2.05	1.98	1.58	1.56	2.5
94.6	16	1.80	1.71	2.14	1.95	1.57	1.56	2.5
150.0	20	1.84	1.77	2.11	2.00	1.58	1.56	2.5
474.3	30	1.96	1.76	2.05	2.09	1.58	1.58	2.5

Modulation Limiting

with CTCSS 250.3Hz

SAMPLE1

INPUT		f=300Hz		f=1000Hz		f=3000Hz		Limit
V[mV]	[dB]	Positive Peak	Negative Peak	Positive Peak	Negative Peak	Positive Peak	Negative Peak	
1.5	-20	0.40	0.39	0.46	0.46	0.58	0.58	2.5
4.7	-10	0.46	0.46	0.71	0.71	1.07	1.06	2.5
7.5	-6	0.52	0.52	0.94	0.93	1.47	1.46	2.5
10.6	-3	0.59	0.58	1.19	1.18	1.61	1.59	2.5
15.0	0	0.68	0.68	1.55	1.54	1.67	1.65	2.5
21.2	3	0.82	0.81	1.95	1.86	1.69	1.67	2.5
29.9	6	1.00	0.99	2.00	1.93	1.71	1.69	2.5
47.4	10	1.39	1.37	2.06	2.01	1.71	1.70	2.5
75.2	14	1.89	1.77	2.12	2.05	1.71	1.70	2.5
94.6	16	1.91	1.82	2.20	2.02	1.71	1.70	2.5
150.0	20	1.95	1.88	2.17	2.06	1.71	1.70	2.5
474.3	30	2.06	1.86	2.11	2.15	1.71	1.71	2.5

Modulation Limiting

with DCS 023

SAMPLE1

INPUT		f=300Hz		f=1000Hz		f=3000Hz		Limit
V[mV]	[dB]	Positive Peak	Negative Peak	Positive Peak	Negative Peak	Positive Peak	Negative Peak	
1.5	-20	0.65	0.65	0.75	0.75	0.85	0.86	2.5
4.7	-10	0.70	0.69	0.99	1.00	1.30	1.32	2.5
7.5	-6	0.75	0.76	1.20	1.21	1.69	1.70	2.5
10.6	-3	0.81	0.82	1.43	1.44	1.82	1.82	2.5
15.0	0	0.90	0.91	1.77	1.78	1.88	1.88	2.5
21.2	3	1.02	1.04	2.18	2.12	1.88	1.90	2.5
29.9	6	1.22	1.20	2.25	2.20	1.92	1.91	2.5
47.4	10	1.60	1.61	2.26	2.25	1.91	1.93	2.5
75.2	14	2.11	2.00	2.32	2.28	1.91	1.93	2.5
94.6	16	2.14	2.05	2.40	2.24	1.91	1.93	2.5
150.0	20	2.17	2.11	2.36	2.28	1.91	1.93	2.5
474.3	30	2.30	2.08	2.32	2.37	1.92	1.93	2.5

Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]

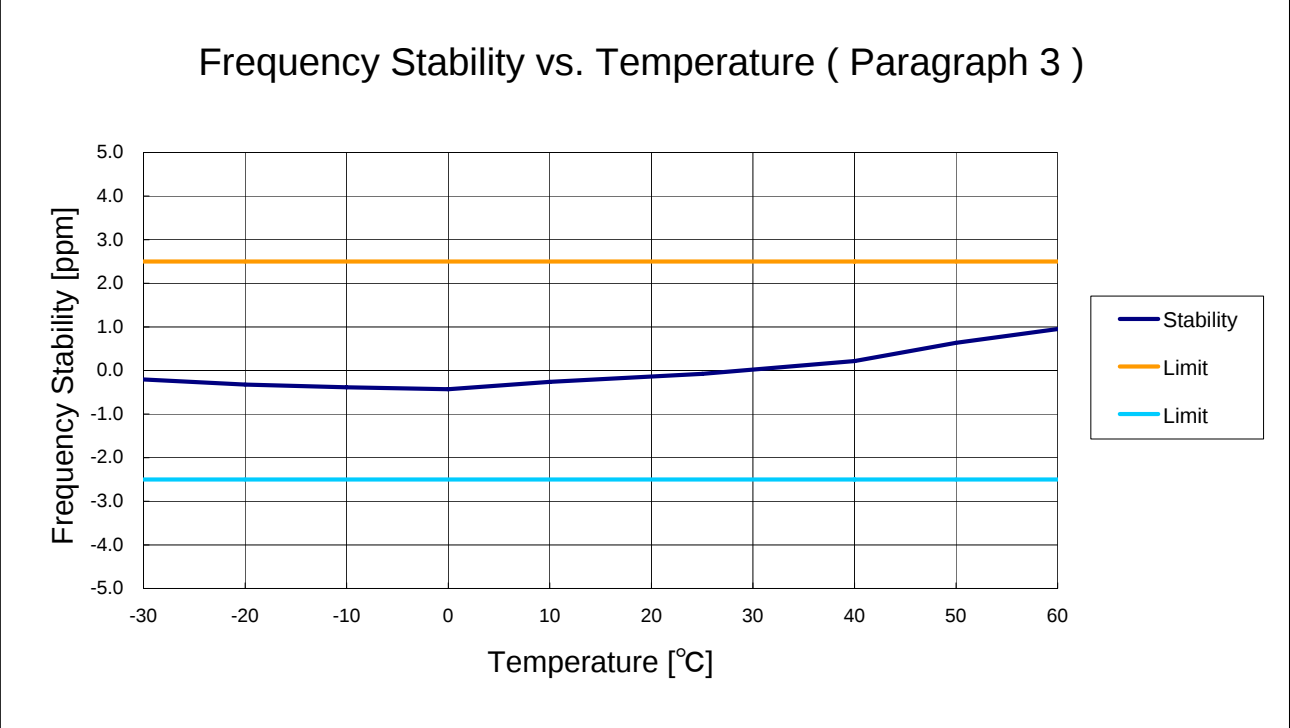
1. RF Power Output @45W (Paragraph 1)

Carrier Frequency [MHz]	RF Power Output [W]	Final D.C. Input Current [A]	D.C. Input Voltage [V]	D.C. Input Power [W]
450.100	44.50	8.52	13.60	115.87
481.100	44.30	8.58	13.60	116.69
511.9875	44.50	12.40	13.60	168.64

2. RF Power Output @10W (Paragraph 2)

Carrier Frequency [MHz]	RF Power Output [W]	Final D.C. Input Current [A]	D.C. Input Voltage [V]	D.C. Input Power [W]
450.100	11.00	3.66	13.60	49.78
481.100	9.11	3.51	13.60	47.74
511.9875	9.82	4.86	13.60	66.10

3.Frequency Stability vs. Temperature (Paragraph 3) : 481.100MHz

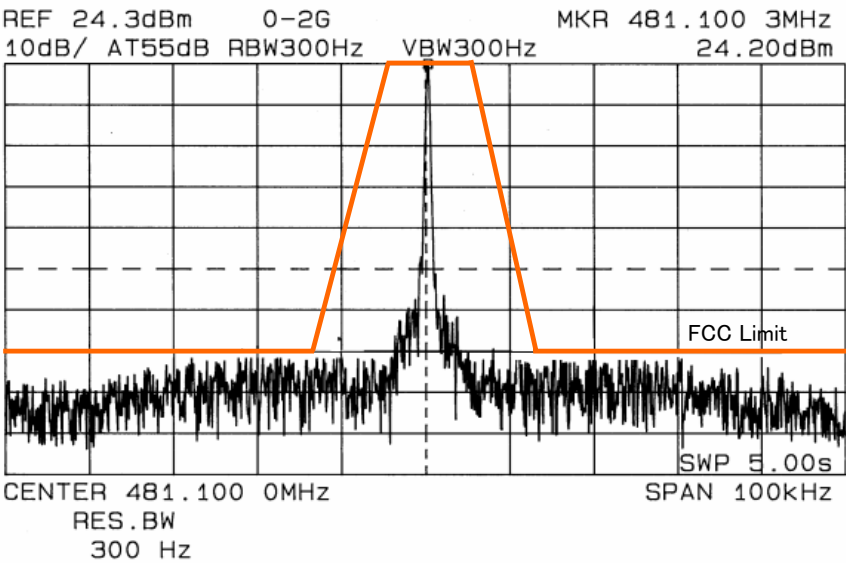


4. Frequency Stability vs. Voltage (Paragraph 4)

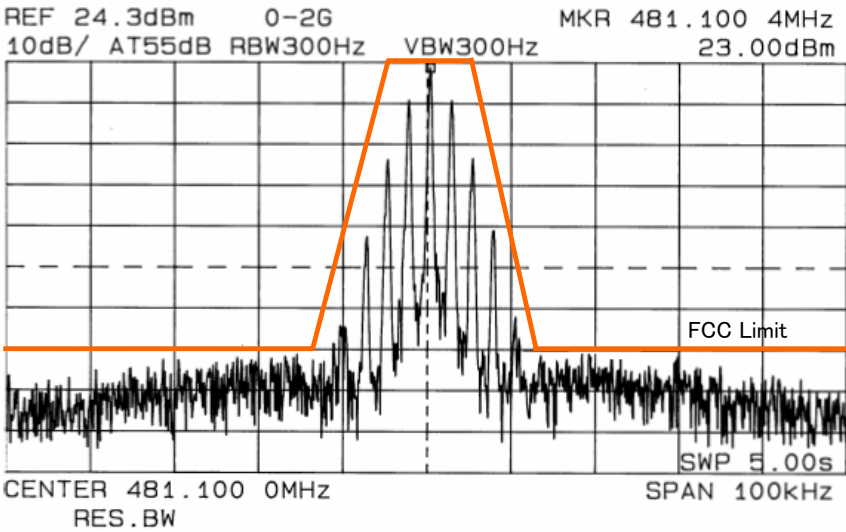
Carrier Frequency [MHz]	STV [%]	Voltage [V]	Change in Frequency		
			[MHz]	[Hz]	[ppm]
481.100	100	13.60	481.100030	30	0.06
	80	10.88	481.100030	30	0.06
	120	16.32	481.100030	30	0.06

Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]
Frequency 481.100[MHz]

5. Occupied Bandwidth unmodulated (Paragraph 5)



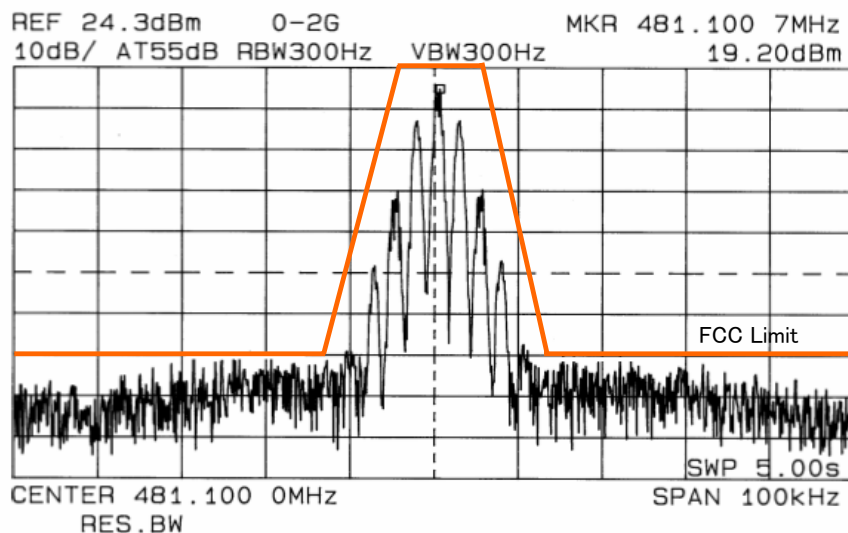
6. Occupied Bandwidth 2500Hz Sine Wave (Paragraph 6)



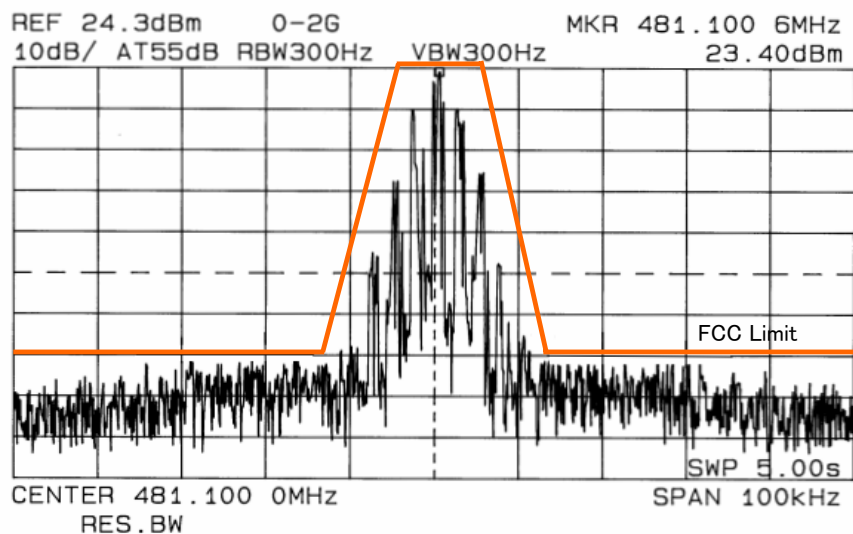
Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]
Frequency 481.100[MHz]

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7. Occupied Bandwidth 2500Hz Sine Wave with CTCSS(250.3Hz) (Paragraph 7)



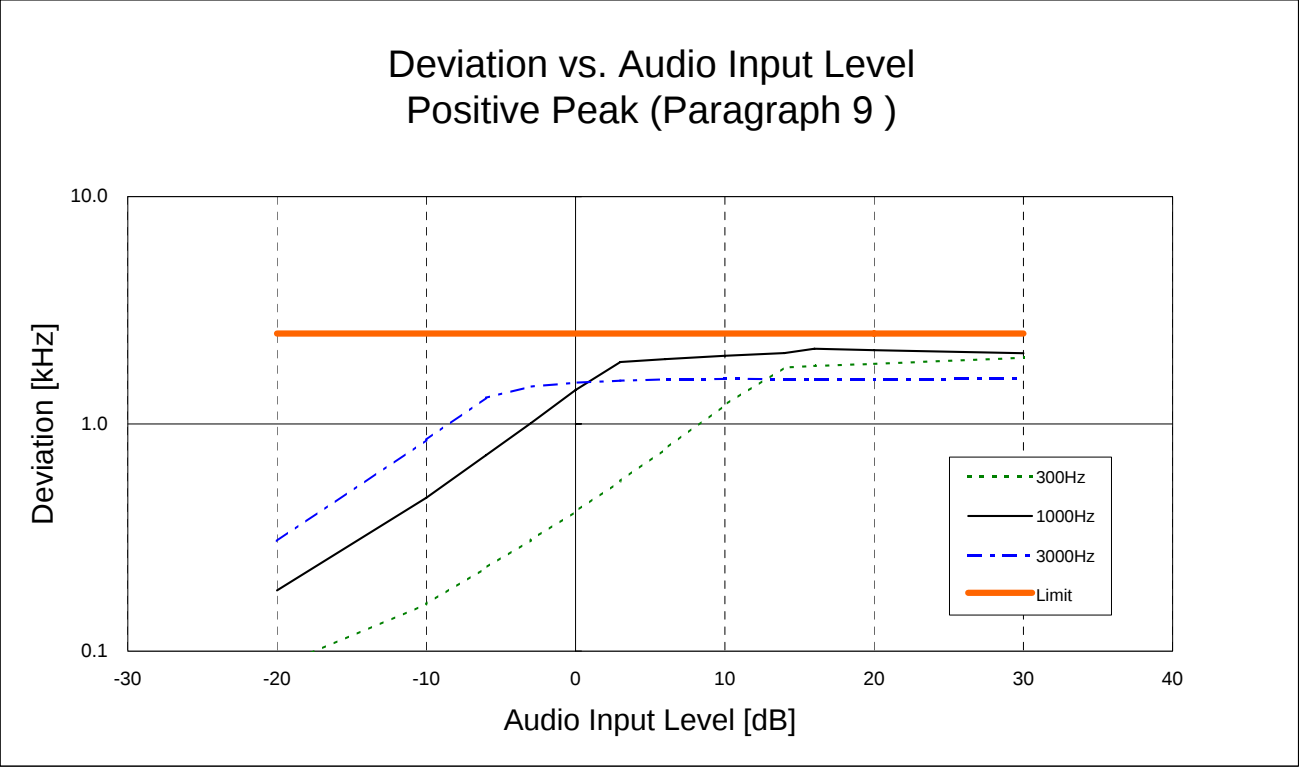
8. Occupied Bandwidth 2500Hz Sine Wave with DCS(023) (Paragraph 8)



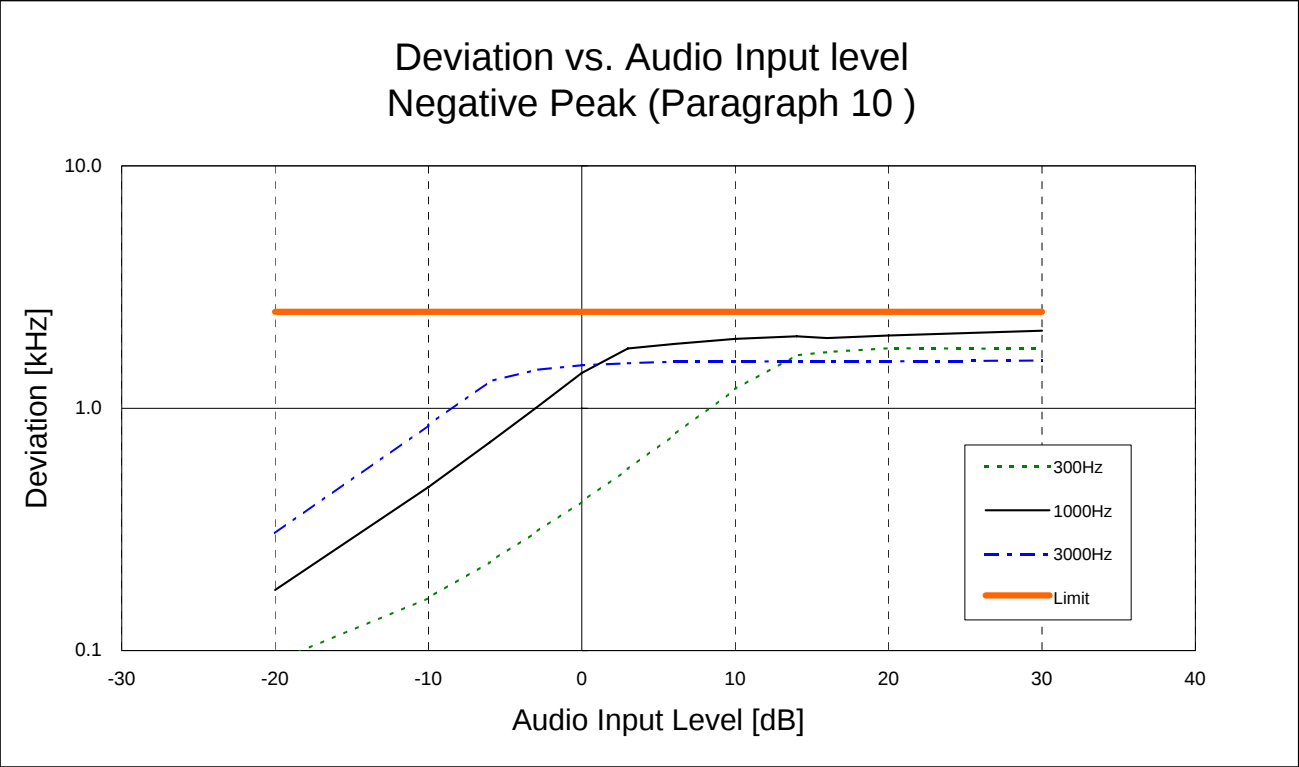
Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]
Frequency 481.100[MHz]

0dB =15.0[mV]

9.Deviation vs. Audio Input Level (Paragraph 9)



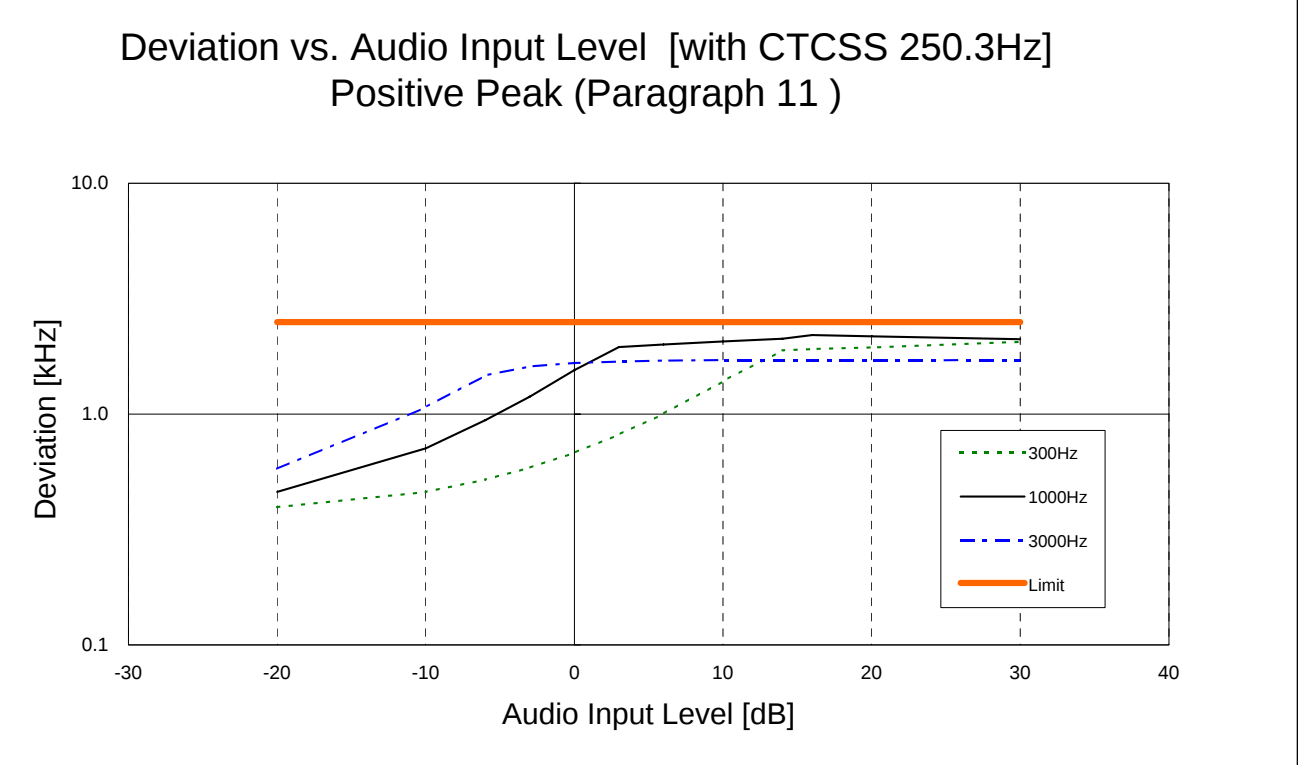
10.Deviation vs. Audio Input Level (Paragraph 10)



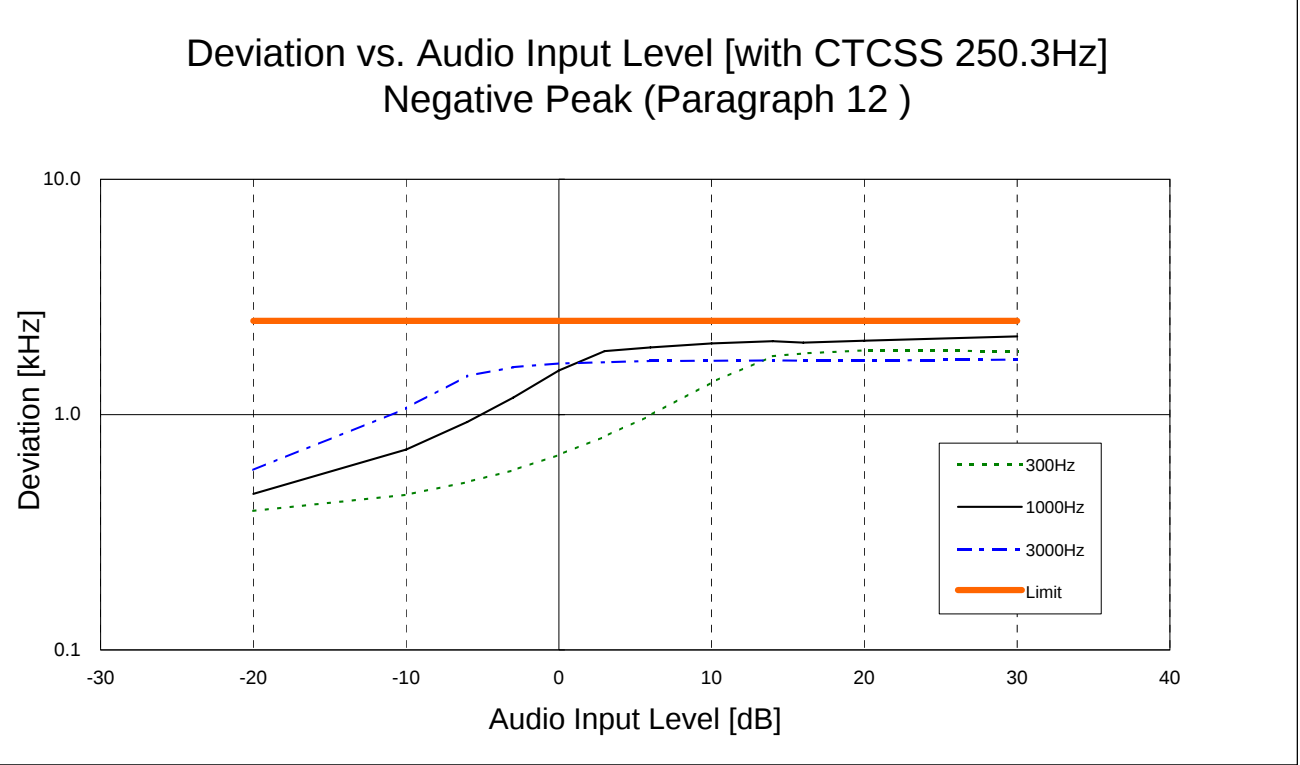
Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]
Frequency 481.100[MHz]

0dB =15.0[mV]

11.Deviation vs. Audio Input Level (Paragraph 11)



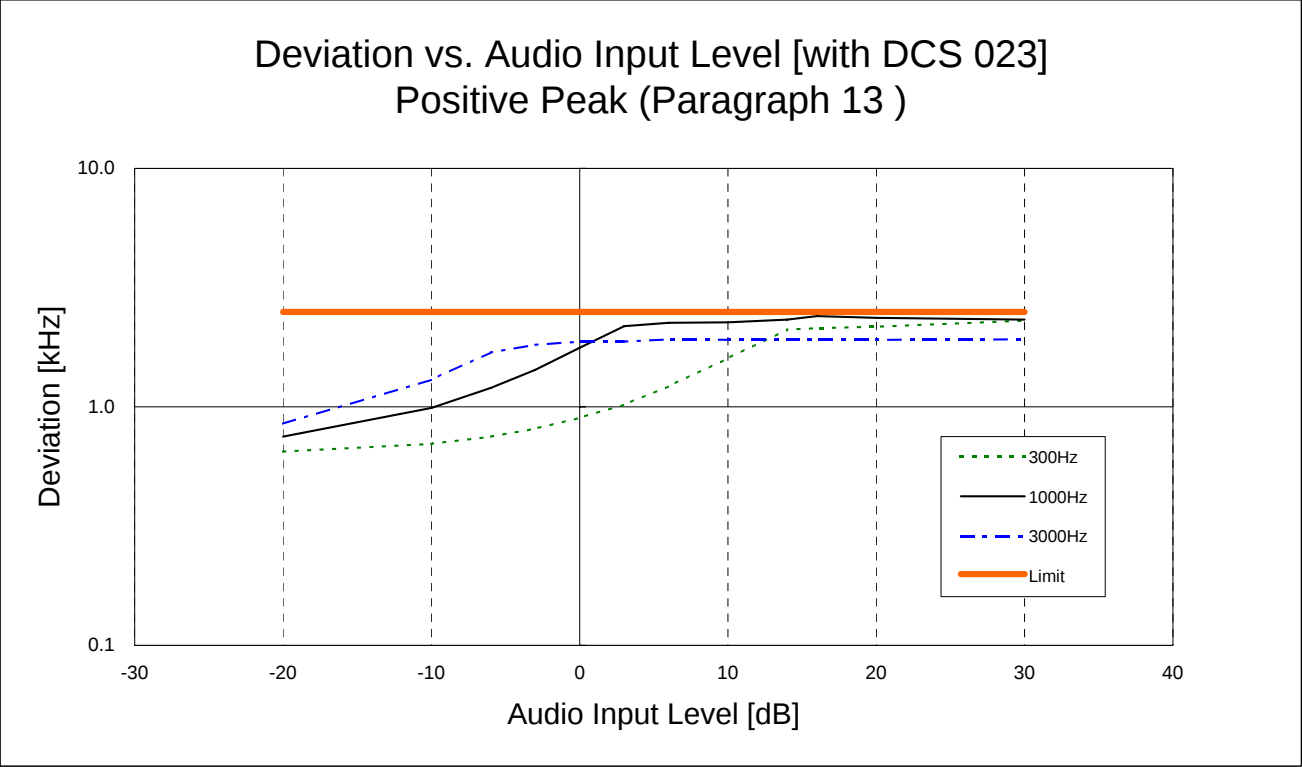
12.Deviation vs. Audio Input Level (Paragraph 12)



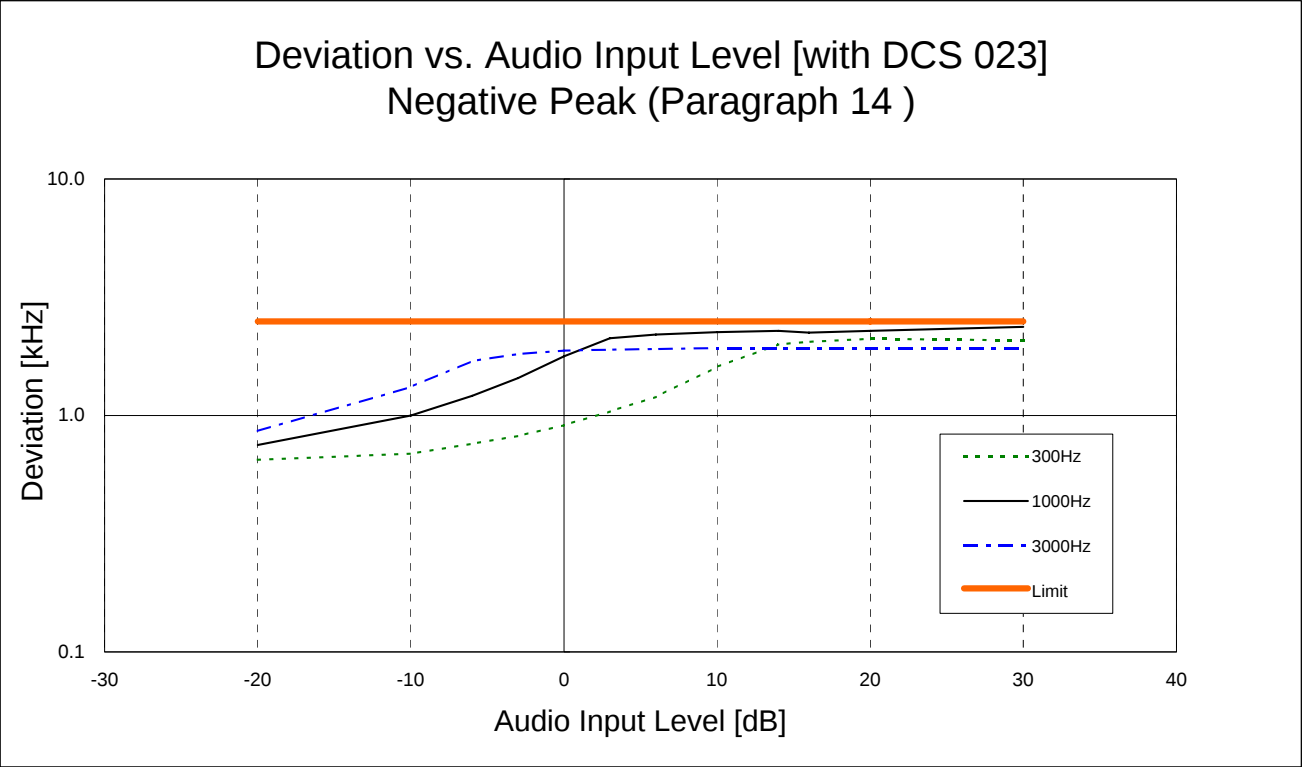
Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]
Frequency 481.100[MHz]

0dB =15.0[mV]

13.Deviation vs. Audio Input Level (Paragraph 13)

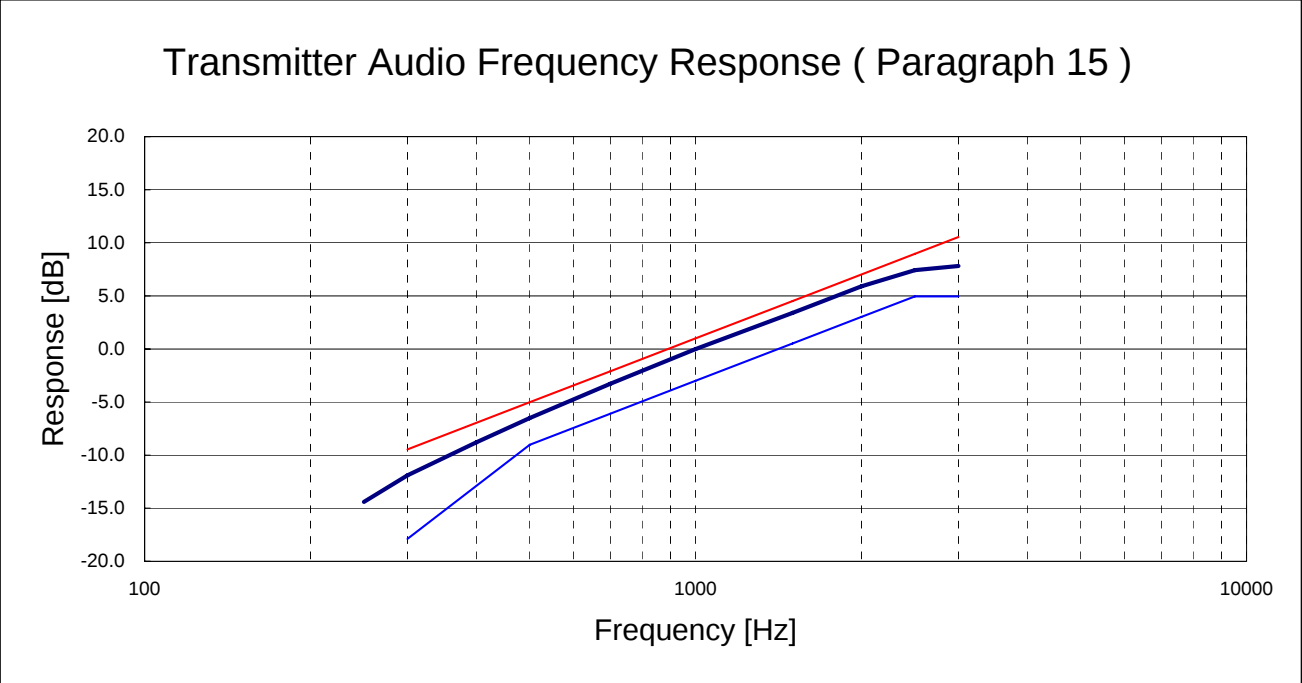


14.Deviation vs. Audio Input Level (Paragraph 14)

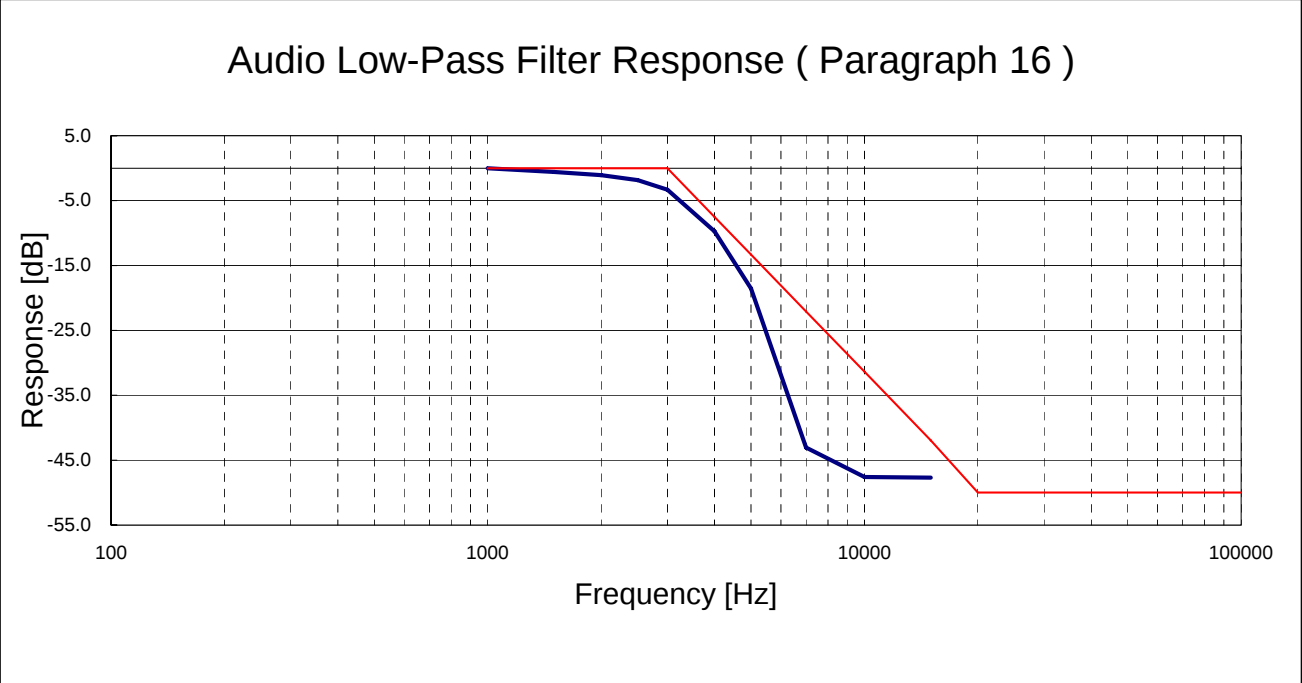


Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]
Frequency 481.100[MHz]

15. Transmitter Audio Frequency Response (Paragraph 15)



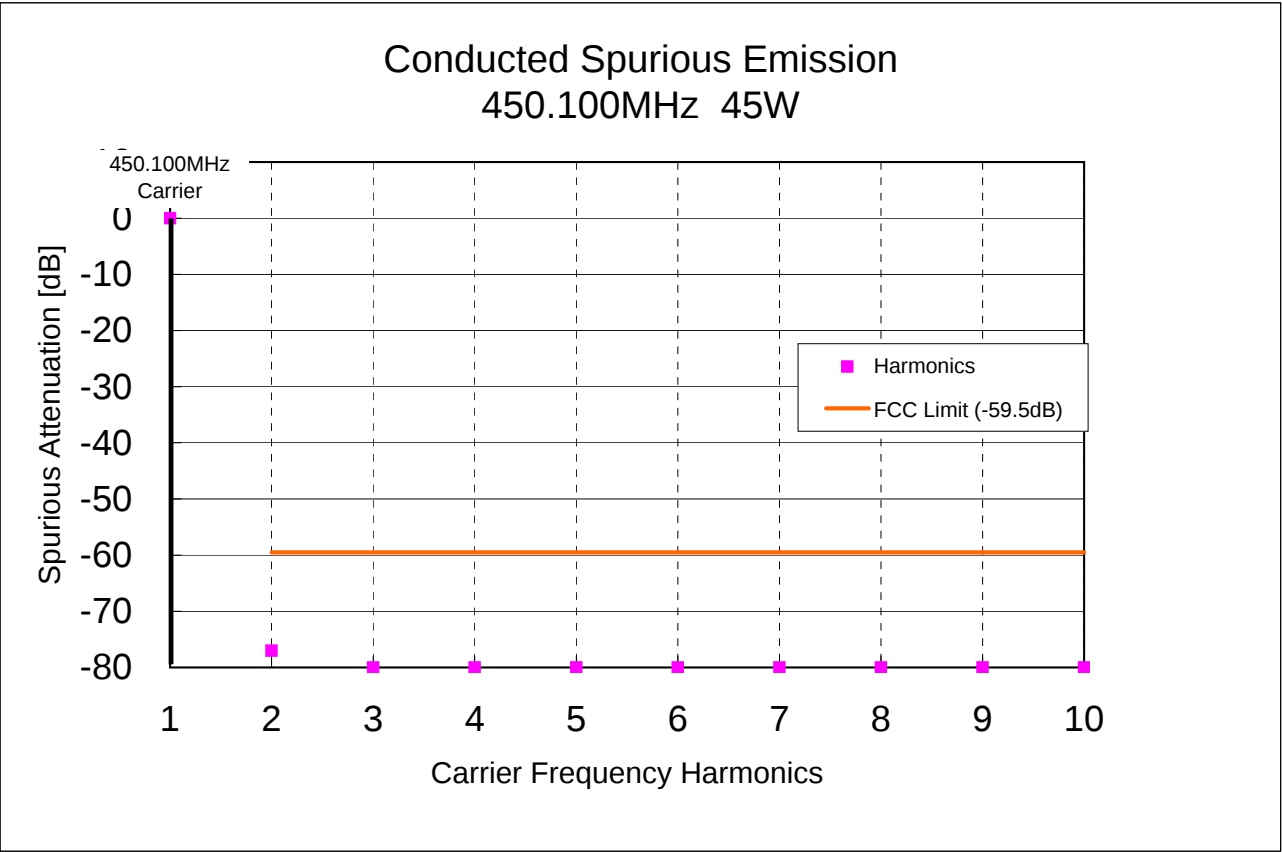
16. Audio Low-Pass Filter Response (Paragraph 16)



Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]

17. Conducted Spurious Emission, 450.100MHz@45 (PARAGRAPH 17)

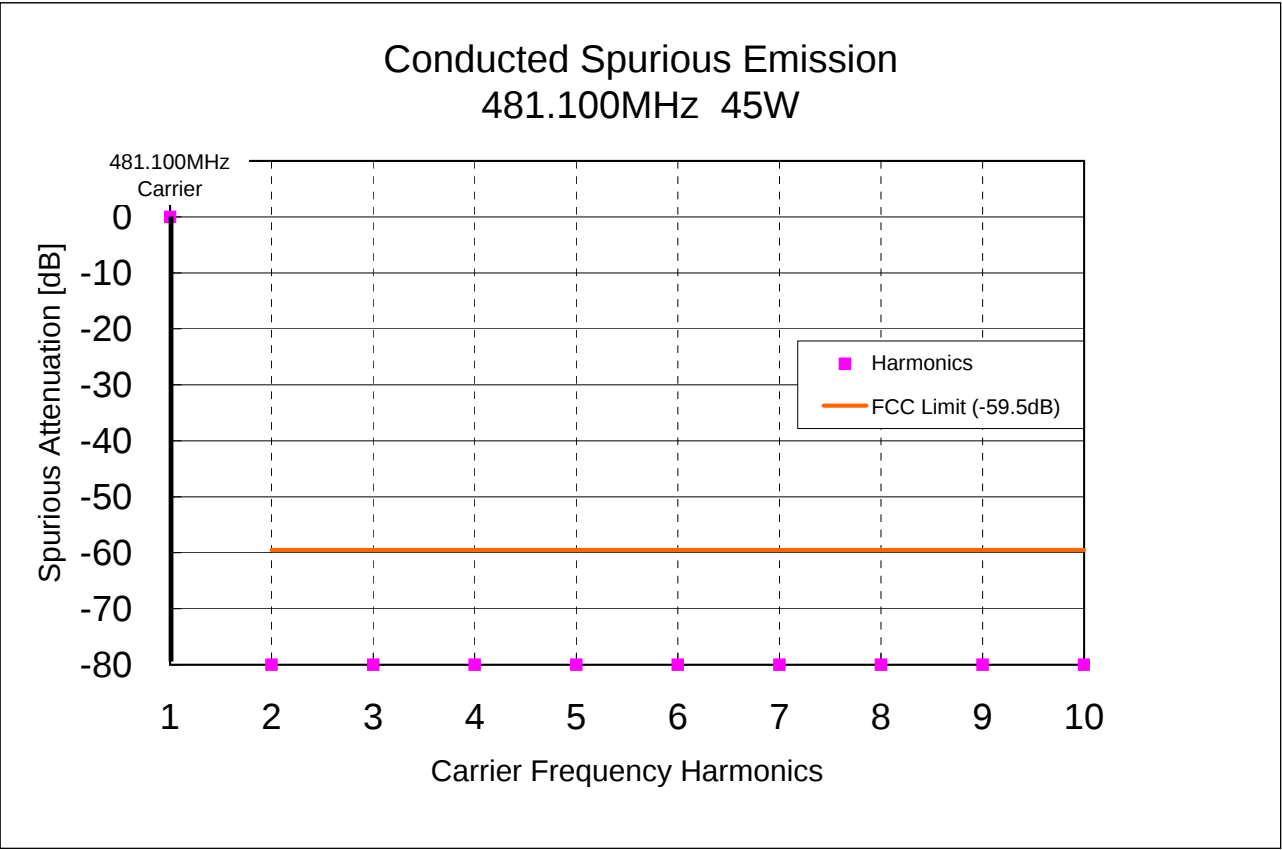
Harmonics	Emission Frequency [MHz]	Spurious Attenuation [dB]	FCC Limit
1	450.100(Carrier)	0.0	
2	900.200	-77.0	-59.5
3	1200.300	-80.0	-59.5
4	1800.400	-80.0	-59.5
5	2250.500	-80.0	-59.5
6	2700.600	-80.0	-59.5
7	3150.700	-80.0	-59.5
8	3600.800	-80.0	-59.5
9	4050.900	-80.0	-59.5
10	4501.000	-80.0	-59.5



Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]

18. Conducted Spurious Emission, 481.100MHz@45 (PARAGRAPH 18)

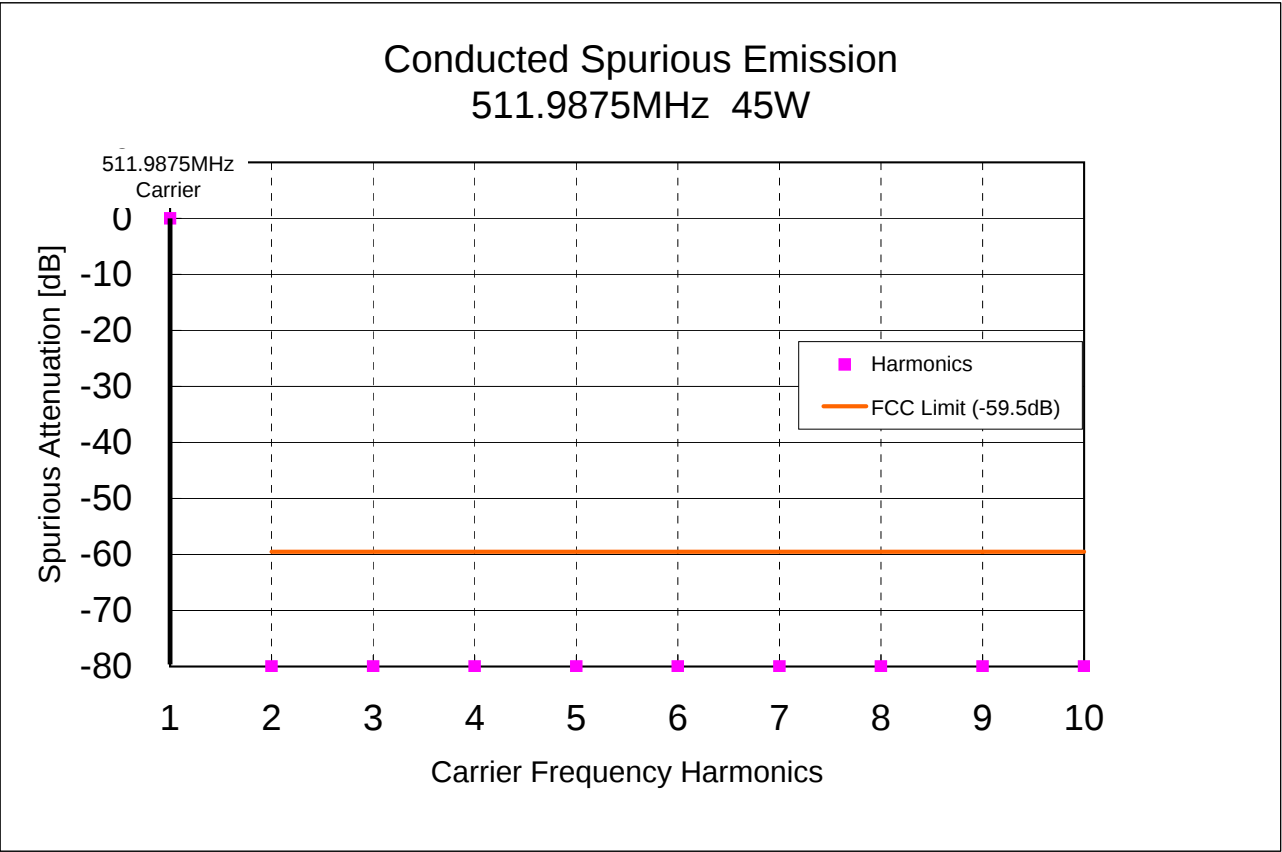
Harmonics	Emission Frequency [MHz]	Spurious Attenuation [dB]	FCC Limit
1	481.100(Carrier)	0.0	
2	962.200	-80.0	-59.5
3	1443.300	-80.0	-59.5
4	1924.400	-80.0	-59.5
5	2405.500	-80.0	-59.5
6	2886.600	-80.0	-59.5
7	3367.700	-80.0	-59.5
8	3848.800	-80.0	-59.5
9	4329.900	-80.0	-59.5
10	4811.000	-80.0	-59.5



Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]

19. Conducted Spurious Emission, 511.9875MHz@45W (PARAGRAPH 19)

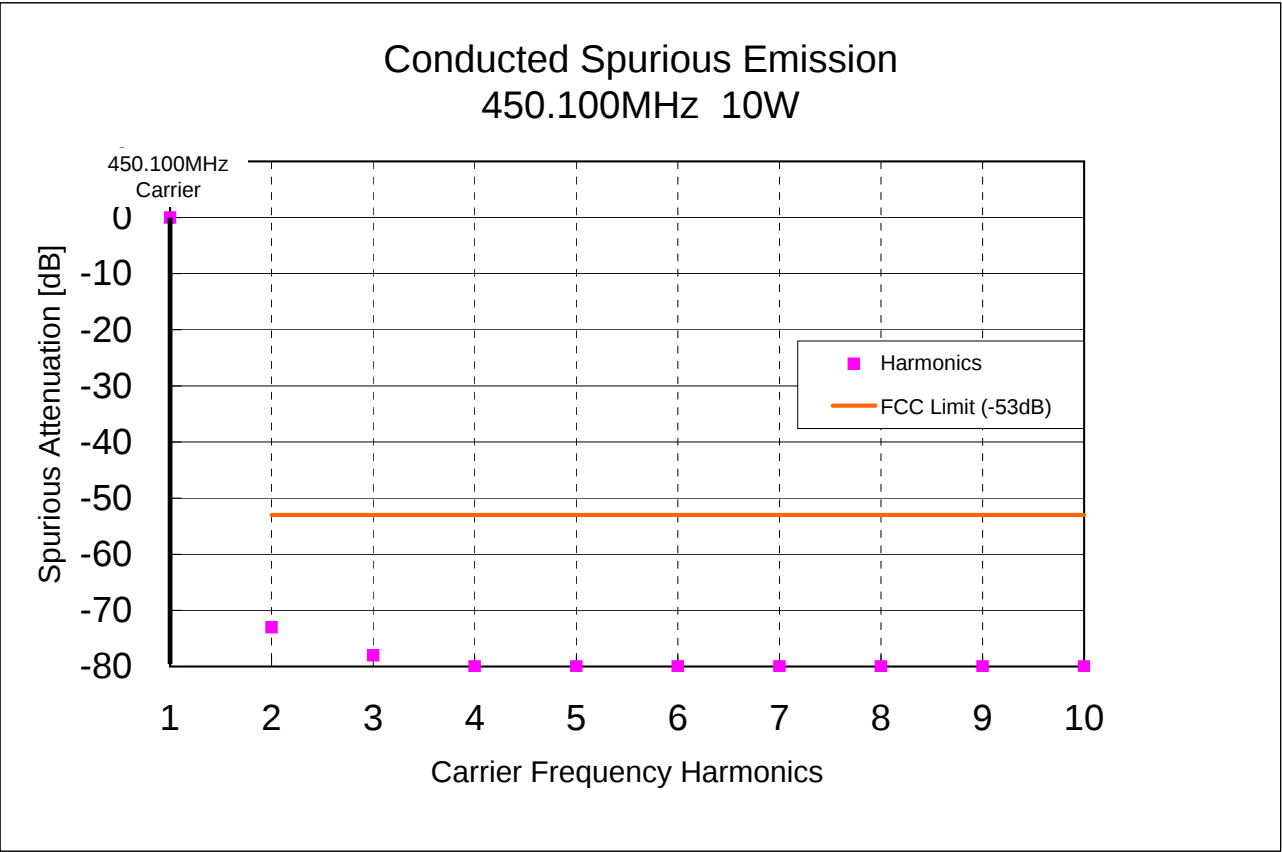
Harmonics	Emission Frequency [MHz]	Spurious Attenuation [dB]	FCC Limit
1	511.9875(Carrier)	0.0	
2	1023.975	-80.0	-59.5
3	1535.963	-80.0	-59.5
4	2047.950	-80.0	-59.5
5	2559.938	-80.0	-59.5
6	3071.925	-80.0	-59.5
7	3583.913	-80.0	-59.5
8	4095.900	-80.0	-59.5
9	4607.888	-80.0	-59.5
10	5119.875	-80.0	-59.5



Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]

20.Conducted Spurious Emission, 450.100MHz@10W (PARAGRAPH 20)

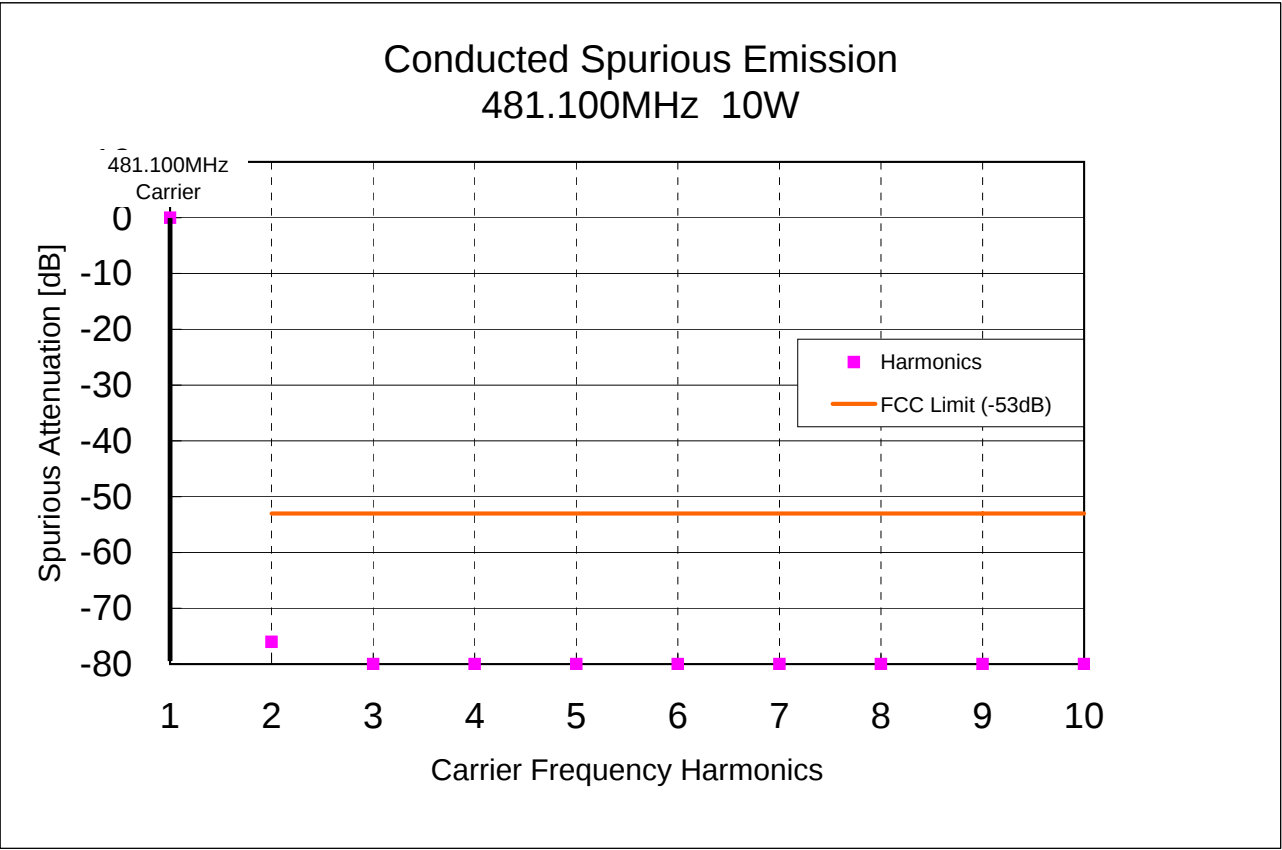
Harmonics	Emission Frequency [MHz]	Spurious Attenuation [dB]	FCC Limit
1	450.100(Carrier)	0.0	
2	900.200	-73.0	-53.0
3	1350.300	-78.0	-53.0
4	1800.400	-80.0	-53.0
5	2250.500	-80.0	-53.0
6	2700.600	-80.0	-53.0
7	3150.700	-80.0	-53.0
8	3600.800	-80.0	-53.0
9	4050.900	-80.0	-53.0
10	4501.000	-80.0	-53.0



Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]

21. Conducted Spurious Emission, 481.100MHz@10W (PARAGRAPH 21)

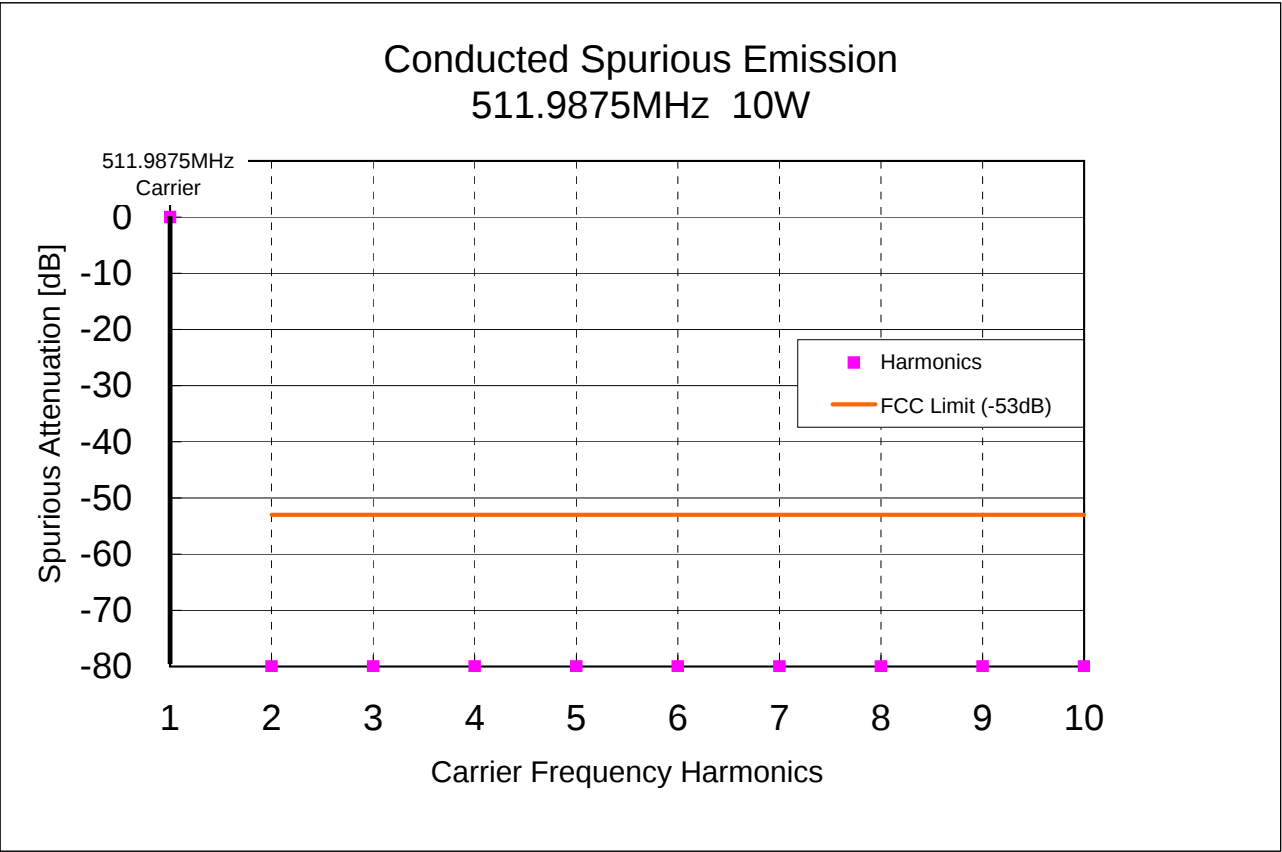
Harmonics	Emission Frequency [MHz]	Spurious Attenuation [dB]	FCC Limit
1	481.100(Carrier)	0.0	
2	962.200	-76.0	-53.0
3	1443.300	-80.0	-53.0
4	1924.400	-80.0	-53.0
5	2405.500	-80.0	-53.0
6	2886.600	-80.0	-53.0
7	3367.700	-80.0	-53.0
8	3848.800	-80.0	-53.0
9	4329.900	-80.0	-53.0
10	4811.000	-80.0	-53.0



Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]

22.Conducted Spurious Emission, 511.9875MHz@10W (PARAGRAPH 22.)

Harmonics	Emission Frequency [MHz]	Spurious Attenuation [dB]	FCC Limit
1	511.9875(Carrier)	0.0	
2	1023.975	-80.0	-53.0
3	1535.963	-80.0	-53.0
4	2047.950	-80.0	-53.0
5	2559.938	-80.0	-53.0
6	3071.925	-80.0	-53.0
7	3583.913	-80.0	-53.0
8	4095.900	-80.0	-53.0
9	4607.888	-80.0	-53.0
10	5119.875	-80.0	-53.0



Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]
Frequency 481.1[MHz]

23. Conducted Spurious Emission @ Receiver (Paragraph 23)

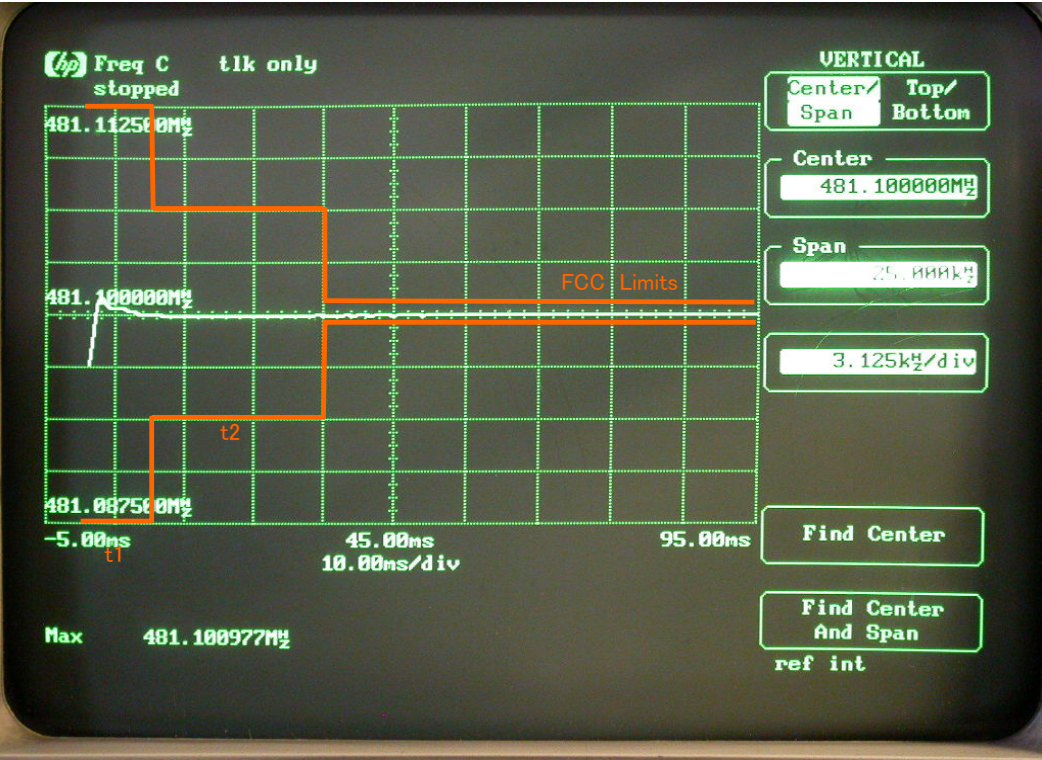
Frequency Tuned [MHz]	Frequency Emission [MHz]	Level [dBm]
481.100	423.050	-71.3
481.100	846.100	---
481.100	1269.150	---
481.100	1692.200	---
481.100	2115.250	---
481.100	2538.300	---
481.100	2961.350	-79.5
481.100	3384.400	---
481.100	3807.450	---
481.100	4230.500	---

* Less than -85dBm

Model Name SC-980
FCC ID O78SC980
Serial Number SAMPLE2
Emission Type 11K0F3E
Channel Spacing 12.5[kHz]
Frequency 481.1[MHz]

24.Transient Behavior (Paragraph 24)

Switch on condition



Switch off condition

