

Tx Radiated Emissions - Continued

Open Area Test Site Results:

12.5 kHz Channel Spacing

495.1 MHz @ 50 W

Emission Mask D

Harmonics Emission Frequency (MHz)	Level (dBm)	Level (dBc)
990.2	-35.80	-82.80
1485.3	-69.93	-116.93
1980.4	-59.37	-106.37
2475.5	-63.81	-110.81
2970.6	-65.91	-112.91
3465.7	-53.15	-100.15
Measurement Uncertainty	± 4.6 dB	

Sample Calculation:

	Measurement					Result
	Reference	Substitution				
Emission Frequency (MHz)	Reference Level (dBm)	Sig-gen Level	Cable and Attenuator Gain	Antenna Gain (dBd)	Path and Boresight corrections	dBm
990.2	-68.94	-18.56	-17.40	-0.35	0.50	-35.80
		A	B	C	D	E

$$\text{Result (E)} = A+B+C+D$$

Photo: OATS Setup



TRANSIENT FREQUENCY BEHAVIOR

SPECIFICATION: FCC 47 CFR 90.214

GUIDE: TIA-102.CAAA-C 2.2.18

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. Measurements and plots were made following the TIA procedure.

MEASUREMENT RESULTS:

See the tables and plots on the following pages for 12.5 kHz channel spacing.

LIMIT CLAUSES: FCC 47 CFR 90.214

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 495.1 MHz 50 W 12.5 kHz Channel Spacing

495.1 MHz @ 50 W Tx

TRANSIENT RESPONSE PERIOD	CARRIER PEAK VARIATION FROM NORMAL	
	Key ON (kHz)	Key OFF (kHz)
t1	-0.5	N/A
t2	-0.7	N/A
t3	N/A	0.5

Confirm that during periods t1 and t3 the frequency difference does not exceed the value of one channel separation.	YES	NO
	✓	☐
Confirm that during the period t2 the frequency difference does not exceed half a channel separation.	YES	NO
	✓	☐
Confirm that during the period t2 to t3 the frequency difference does not exceed the frequency error limit.	YES	NO
	✓	☐

Measurement Uncertainty: Frequency ± 130 Hz; Time $\pm 0.2\%$

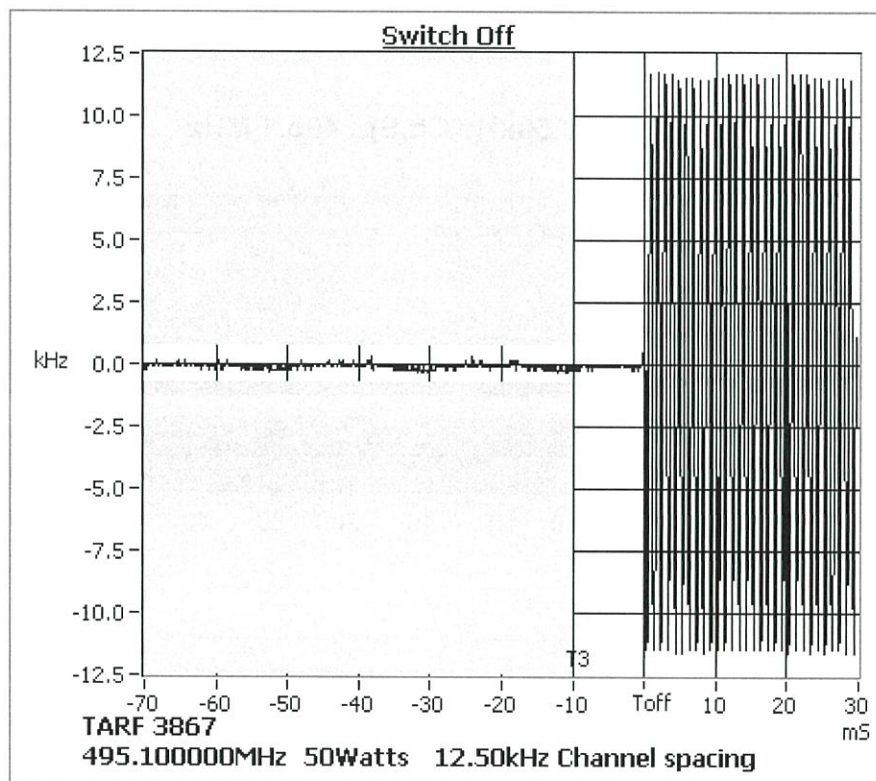
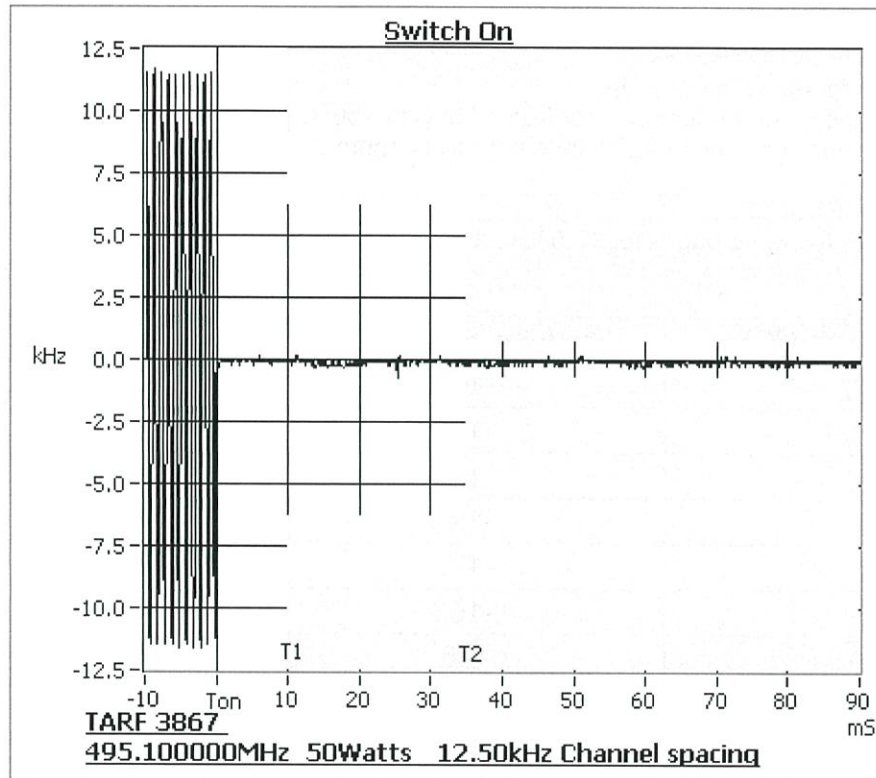
LIMIT: FCC 47 CFR 90.214

TRANSIENT PERIODS	FREQUENCY RANGE	
	150 MHz – 174 MHz	421 MHz – 512 MHz
t1 (ms)	5 ms	10 ms
t2 (ms)	20 ms	25 ms
t3 (ms)	5 ms	10 ms

Transient Frequency Behaviour

SPECIFICATION: FCC 47 CFR 90.214

Tx FREQUENCY: 495.1 MHz 50 W 12.5 kHz Channel Spacing



TRANSMITTER FREQUENCY STABILITY - TEMPERATURE

SPECIFICATION: FCC 47 CFR 2.1055 (a) (1)

GUIDE: TIA-102.CAAA-C 2.2.2

MEASUREMENT PROCEDURE:

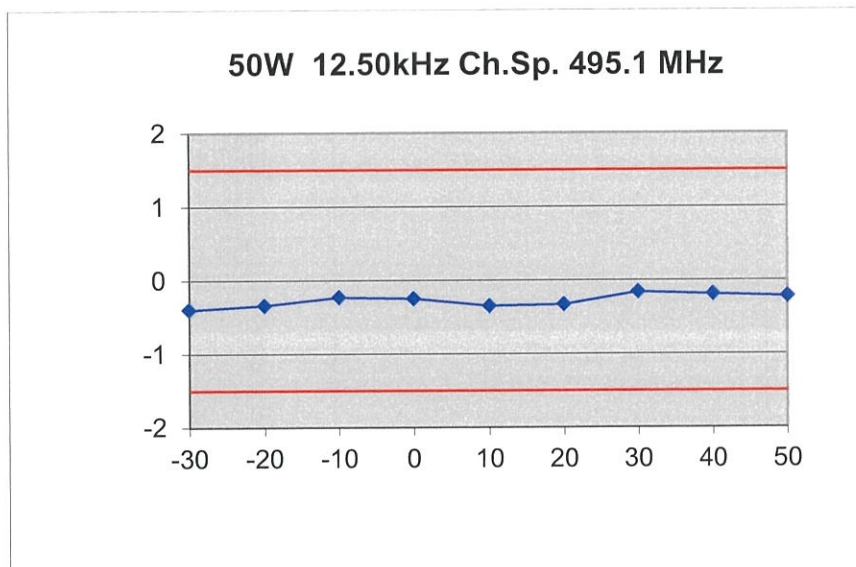
1. Refer Annex A for equipment set up.
2. The EUT was tested for frequency error from -30° C to +50° C in 10° C increments
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:

See the plots on the following pages for 12.5 kHz & 25.0 kHz channel spacings.

495.1 MHz

Temperature (°C)	Frequency Error (Hz)	Error (ppm)
-30	-199	-0.4
-20	-170	-0.34
-10	-112	-0.23
0	-123	-0.25
10	-172	-0.35
20	-163	-0.33
30	-78	-0.16
40	-95	-0.19
50	-110	-0.22
Measurement Uncertainty	$\pm 7 \times 10^{-8}$	



LIMIT: FCC 47 CFR 90.213

Channel Spacing (kHz)	Frequency Error (ppm)
12.5	1.5

TRANSMITTER FREQUENCY STABILITY - VOLTAGE

SPECIFICATION: FCC 47 CFR 2.1055 (d) (1)

GUIDE: TIA-102.CAAA-C 2.2.2

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The EUT was tested for frequency error at an input voltage to the radio of 85% to 115%.
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:

Voltage	FREQUENCY ERROR (ppm) for 12.5 kHz
	495.1 MHz
120 V _{DC}	-0.16
138 V _{DC}	-0.16
102 V _{DC}	-0.17
Measurement Uncertainty	$\pm 7 \times 10^{-8}$

LIMIT CLAUSES: FCC 47 CFR 90.213

Channel Spacing (kHz)	Frequency Error (ppm)
12.5	1.5

TEST EQUIPMENT LIST

Equipment Type	Information	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
AC Voltmeter		Tait		1		7-Mar-18
Antenna	Reference Dipoles	Emco	3121C DB1	9510-1164	E3559	14-Apr-19
Antenna	18GHz DRG	Emco	DRG3115	9512-4638	E3560	15-May-20
Antenna	18GHz DRG	Emco	DRG3115	2084	E3076	
Antenna	Log Periodic	Schwarzbeck	VUSLP	9111-219	E4617	
Antenna	Reverb - 1-18GHz DRG	Schwarzbeck	BBHA 9120 D	9120D-885	E4857	
Antenna	Reverb - 1-18GHz DRG	Schwarzbeck	BBHA 9120 D	9120D-884	E4858	
Audio Analyser	TREVA1	Hewlett Packard	HP8903A	2437A04625	E4986	28-Sep-18
Coax Cable	2m Black	Suhner	RG214HF/Nm/Nm/2000	TeltestBlack2	E4623	1-Dec-17
Coax Cable	2m Black	Suhner	RG214HF/Nm/Nm/2000	TeltestBlack3	E4624	28-Nov-17
Coax Cable	3m Blue	Suhner	Sucoflex 104A	44611/4A	E4620	5-Dec-17
Coax Cable	OATS Turntable Cable 1	Intelcom	RG214	OATS1	E4621	8-Dec-17
Coax Cable	OATS Tower Cable	Intelcom	RG214	OATS2	E4622	8-Dec-17
Coax Cable	Reverb - 4.5m Multiflex 141	TeltestBlue6	MF 141	TeltestBlue6	E4843	6-Dec-17
Coax Cable	Reverb - 2m Multiflex 141	TeltestBlue5	MF 141	TeltestBlue5	E4844	6-Dec-17
Coax Cable	Reverb - 2m Multiflex 141	TeltestBlue4	MF 141	TeltestBlue4	E4845	6-Dec-17
Coax Cable	Reverb - 1m Multiflex 141	TeltestBlue2	MF 141	TeltestBlue2	E4847	6-Dec-17
Coax Cable	Reverb - 1m Multiflex 141	TeltestBlue1	MF 141	TeltestBlue1	E4848	6-Dec-17
Coax Cable	2.5m Blue	Suhner	Sucoflex 104A	33449/4PEA	E4997	28-Nov-17
Coax Cable	OATS Turntable Cable 2	Intelcom	RG215	OATS3	E4995	2-Dec-17
Coax Cable	2m Black	Suhner	RG214HF/Nm/Nm/2000	TeltestBlack7	E5004	6-Dec-17
Environ. Chamber	Upright	Contherm	5400 RHSLT.M	1416	E4051	1-Aug-18
Modulation Analyser	TREVA1	Hewlett Packard	HP8901B (Opt 002)	2441A00393	E3073	3-Oct-18
Multimeter		Fluke	77	35069359	E3237	26-Sep-18
OATS	Antenna Tower	Electrometrics	EM-4720-2	112	E4447	
OATS	Controller	Electrometrics	EM-4700	119	E4445	
OATS	Turntable	Electrometrics	EM-4704A	105	E4446	
OATS	FCC Listing Registration			837095		8-May-19
Oscilloscope	100MHz Digital	Tektronics	TDS340	B013611	E3585	28-Sep-19
Power Meter	TREVA1 Power Head for HP8901	Hewlett Packard	HP11722A	3111A05573	E7054	30-Sep-18
Power Supply	AC Variac	Yamabishi	S-260-5	TX-533	E1737	
RF Amplifier	+21.7 dB 1GHz	Tait	ZFL-1000LN	E3660	E3360	22-Feb-18
RF Amplifier	Pre-amplifier	Agilent	87405C	MY47010688	E4941	9-Oct-18
RF Attenuator	30dB 350W	Weinschel	67-30-33	BR0531	E4280	28-Nov-17
RF Attenuator	TREVA1 3dB	Weinschel	Model 1	BL9958	E4081	30-Nov-17
RF Attenuator	TREVA 1 20dB 150W	Weinschel	40-20-23	MF817	E4082	28-Nov-17
RF Chamber	S-LINE TEM CELL	Rohde & Schwarz	1089.9296.02	338232/003	E3636	30-Nov-17
RF Chamber	Reverb - Stirrer controller for reverb chamber	Teseq	Stirrer Controller	29765.1	E4854	

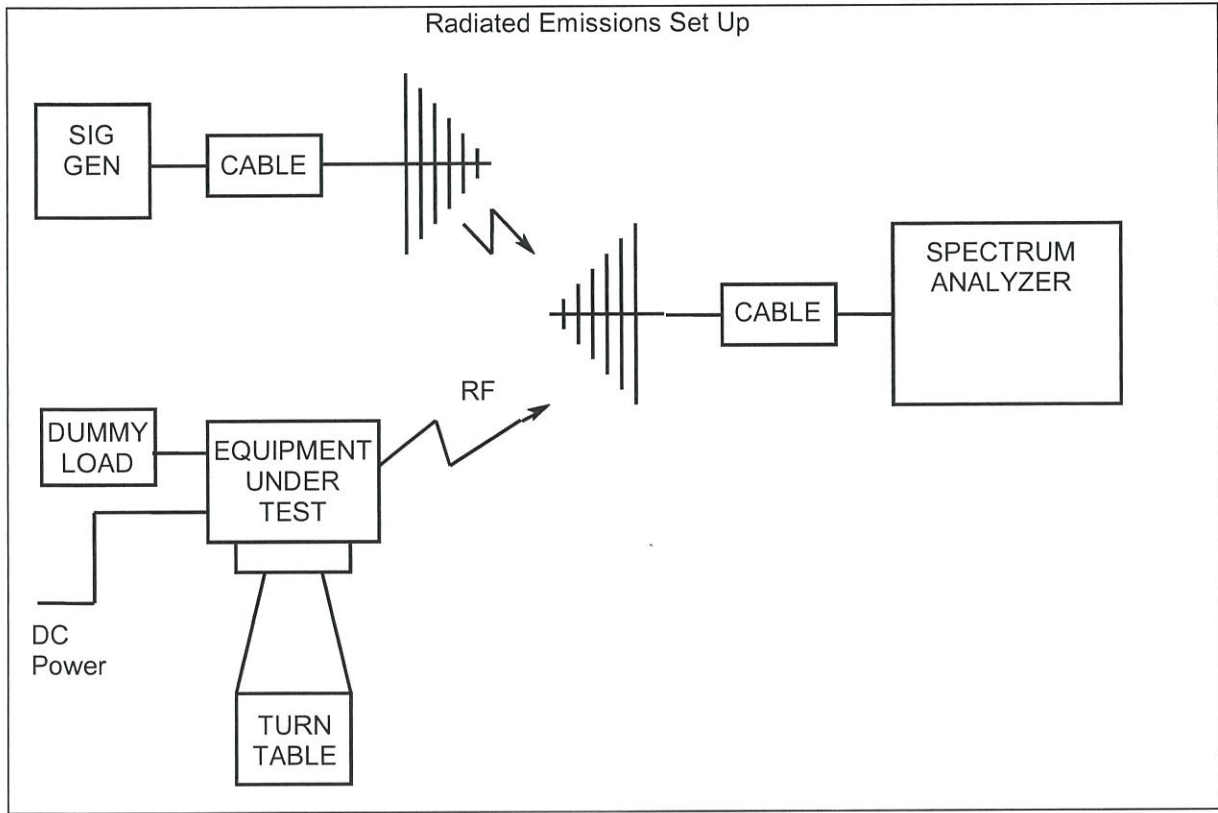
TELTEST Laboratories
Tait Ltd
Report Number 3867

Equipment Type	Information	Manufacturer	Model No	Serial No#	Tait ID	Cal Due
RF Chamber	Reverb - 0.5 - 18GHz Reverberation Chamber	Teseq	RVC XS	29765	E4855	
RF Combiner	TREVA1	Minicircuits	ZFSC-4-1	-	E4083	
RF Load	150W	Bird	8166	524	E3625	29-Nov-17
Signal Generator	Analog 4GHz	Agilent	E4422B	GB40050320	E3788	28-Sep-18
Signal Generator	TREVA1 Analog 3.2GHz	Agilent	E8663D	MY50420224	E4908	20-Oct-18
Signal Generator	Digital 4GHz	Agilent	E4437B	US39260389	E4764	30-Sep-19
Spectrum Analyser	26.5GHz	Agilent	PXA N9030A	MY49432161	E4907	18-Oct-18
Spectrum Analyser	13.2GHz	Hewlett Packard	HP8562E	3821A00779	E3715	2-Oct-18
Spectrum Analyser	13.2GHz	Agilent	E4445A	MY42510072	E4139	15-Oct-18
Temp & Humidity datalogger		Hobo	U21-011	10134275	E4980	4-Dec-17
Testware	Base Station Network Audio Generator		August 2015	-	-	
Testware	Conducted Emissions		16/12/2015	-	-	
Testware	Frequency Vs Temperature		May 2016	-	-	
Testware	Reverb Emissions		28 May 2015	-	-	
Testware	Sideband Spectrum		August 2015	-	-	
Testware	S-Line Radiated Emissions		May 2016	-	-	
Testware	TREVA		December 2015	-	-	

NOTE: All testing was performed between 18 → 25 October 2017

Items without calibration dates are calibrated immediately before use, or set using calibrated instruments.

ANNEX A – TEST SETUP DETAILS



All other testing is performed using the Teltest Radio **EVA**luation system (TREVA), which is configured as shown below. The Spectrum Analyser is connected to the EUT via the attenuator network for Conducted Emissions testing, and Occupied Bandwidth.

