Sulis Consultants
CE Marking and Product Approvals

RF Test Report:

Salunda "Gateway" to 47CFR15.247

FCC ID: 2ALTW1702

SC_TR_253_B

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1 Revision History

Revision	Originator	Date	Comment
A	C Blackham	25 April 2017	1st issue
B	C Blackham	4 May 2017	Minor corrections

2 Purpose

This report details testing performed on the Salunda Gateway against FCC requirements.

3 Reference Documents

[1]	Title 47 CFR15	Federal Communications Commission Title 47 Code of Federal Regulations Part 15
[2]	ANSI C63.10-2013	IEEE American National Standard for Testing Unlicensed Wireless Devices Committee 63 standard 63-10. 27 June 2013.
[3]	KDB 558074 D01 DTS Meas Guidance v04[1]	Federal Communications Commission Office of Engineering and Technology Laboratory Division: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247. April 5, 2017

[1] Reference herein as "KDB 558074"

4 Test Information

4.1 Client

Salunda Limited
Unit 6
Avonbury Business Park
Bicester
OX26 2UA
UK

4.2 Test personnel

4.2.1 Antenna port tests

Testing was performed by Charlie Blackham of Sulis Consultants Ltd at their offices, and at Hursley EMC services Ltd, between 12th and 25th April 2017.

4.2.2 Radiated Emissions

Testing was performed by Hursley EMC Services Ltd test engineers at their FCC Registered test facility, UK designation number UK0006, on 7th April 2017 under job number 17R0162 and on 25th April 2017 under job 17R0180

4.3 Test sample

The results herein only refer to sample detailed in section 6.

5 Product Description

The device operates inside the 2400 – 2483.5 MHz band with a single bandwidth and single modulation.
The following test frequencies were used to cover the full band of operation of the device:

Test Channel	Centre Frequency (MHz)
Bottom, channel 11	2405.0
Middle, channel 18	2440.0
Top, channel 25	2475.0

Table 1: Test frequencies

6 Test Configuration

6.1 Test sample

The equipment under test (EUT) was:

Manufacturer	Model	Serial Number
Salunda	Sensor	Ch11 Ch18 Ch25

Table 2: Equipment under test

Note: three samples were used for testing, each one pre-programmed to operate on the required channel

6.2 Support equipment

The support equipment was:

Description	Manufacturer	Name	Serial Number
POE injector			

Table 3: Support Equipment

6.3 Equipment set-up

Equipment was configured as per figure 1:

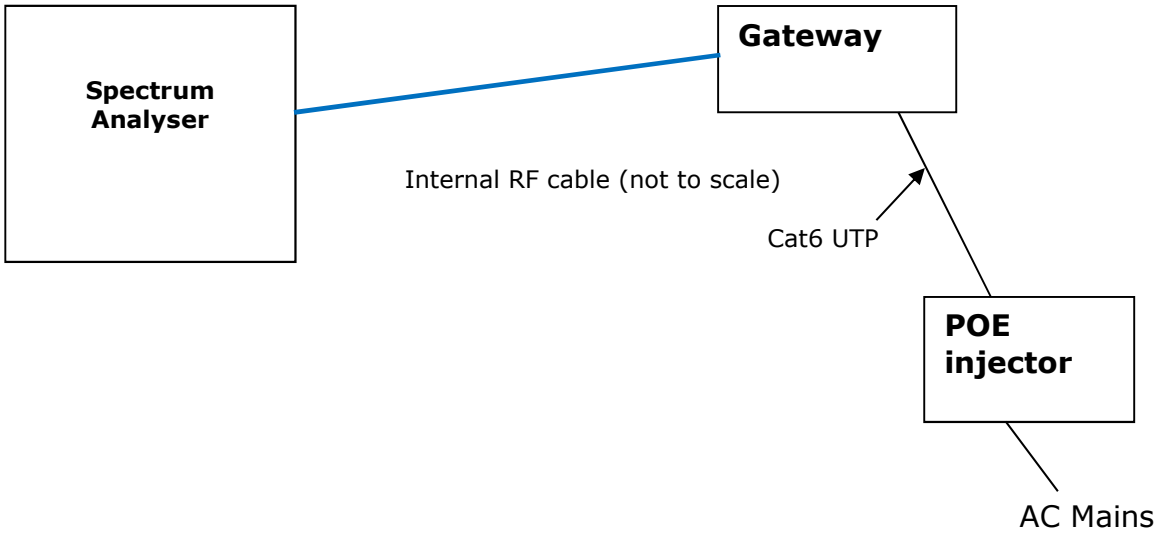


Figure 1: Test Configuration

For the purposes of testing, the EUT was configured with test firmware that transmitted continuously with a 100% duty cycle.

6.4 Supported Antennas

The EUT supports operation with the following antennas:

Antenna type	Type	Gain
Internal	PCB mount	2.0 dBi

Table 4: EUT Antenna configurations

Note: The antenna is integral to the unit, but is connected to the main PCB via an F-type to SMA cable. The SMA cable is connected direct to Spectrum Analyser when making antenna port measurements

7 Summary of tests performed

Test	Clause	Limit / Requirement	Result
6dB bandwidth	15.247(a)(2)	> 500 kHz	Pass
Occupied bandwidth		None	Noted
Max peak conducted TX power	15.247(b)(3)	1 W	Pass
Power Spectral Density	15.247(e)	8dBm / 3 kHz	Pass
Out of Band Emissions Non-restricted bands	15.247(d)	-20 dBc (peak power)	Pass
Out of Band Emissions Restricted-band: Conducted	15.247(d) / 15.205(a) and 15.209(a)	15.209(a) table	Pass
Max antenna gain	15.247(b)(4)(11)	≤ 6dBi	Pass
AC Mains Conducted emission	15.207	Class B	Pass

Table 5: Summary of test results

8 DTS Bandwidth

8.1 Measurement method

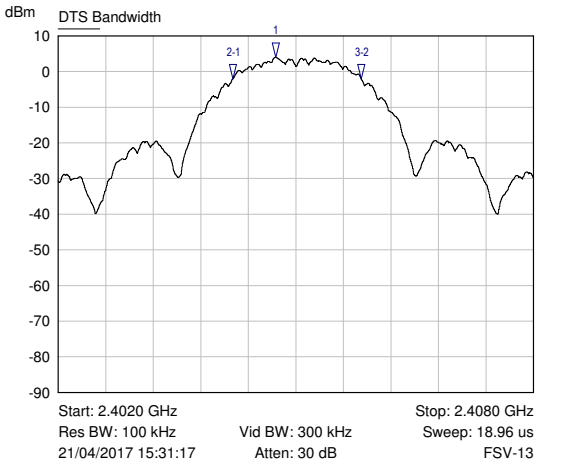
Test was conducted in accordance with KDB 558074 section 8.1 Option 1:

a) Set resolution bandwidth to 100 kHz
b) Set the video bandwidth to ≥ 3 x RBW
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

8.2 Test results

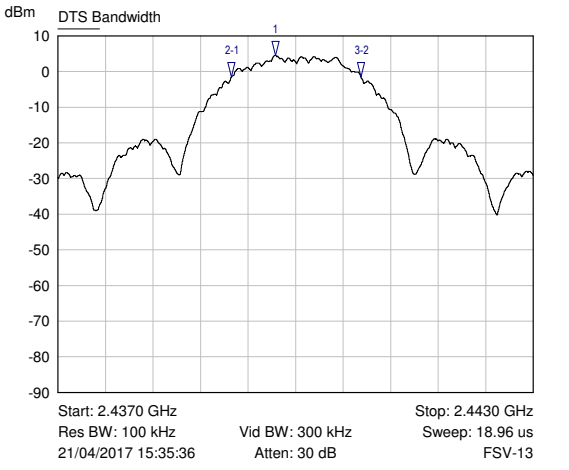
Channel	6dB DTS Bandwidth (MHz)	Requirement	Result
11	1.6140	> 500 kHz	Pass
18	1.6329	> 500 kHz	Pass
25	1.6232	> 500 kHz	Pass

Table 6: DTS Bandwidth



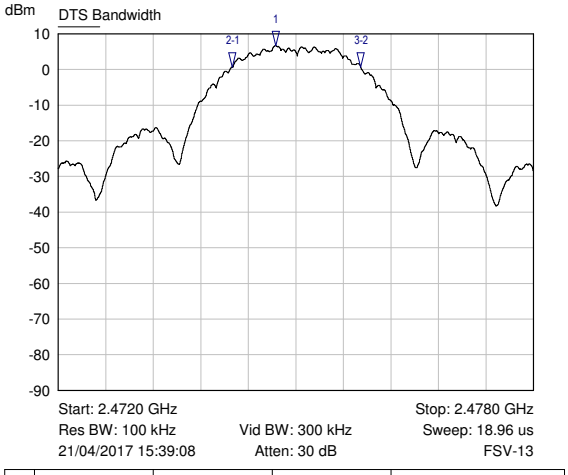
Mkr	Trace	X-Axis	Value	Notes
1	DTS Bandwidth	2.4047 GHz	4.07 dBm	Peak
2-1	DTS Bandwidth	-537.3750 kHz	-6.00 dB	-6dB (left)
3-2	DTS Bandwidth	1.6140 MHz	0.00 dB	Relative to marker 2

Ch 11



Mkr	Trace	X-Axis	Value	Notes
1	DTS Bandwidth	2.4397 GHz	4.50 dBm	Peak
2-1	DTS Bandwidth	-553.6875 kHz	-6.00 dB	-6dB (left)
3-2	DTS Bandwidth	1.6329 MHz	0.00 dB	Relative to marker 2

Ch 18



Mkr	Trace	X-Axis	Value	Notes
1	DTS Bandwidth	2.4747 GHz	6.72 dBm	Peak
2-1	DTS Bandwidth	-548.0625 kHz	-6.00 dB	-6dB (left)
3-2	DTS Bandwidth	1.6232 MHz	-0.00 dB	Relative to marker 2

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Figure 2: DTS Bandwidth plots

9 Maximum Peak Conducted Output Power

9.1 Measurement method

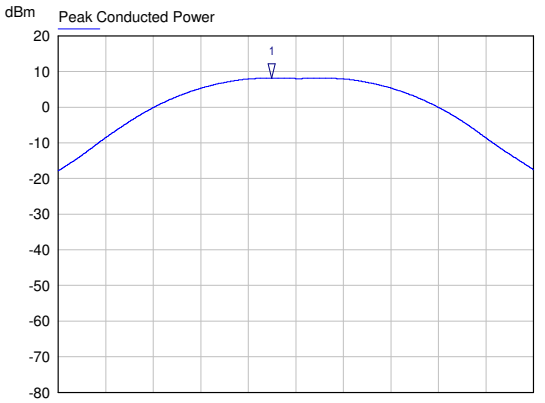
As the analyser could be set RBW ≥ DTS bandwidth, the test was conducted in accordance with KDB 558074 section 9.1.1:

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ 3 x RBW.
c) Set span ≥ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

9.2 Test results

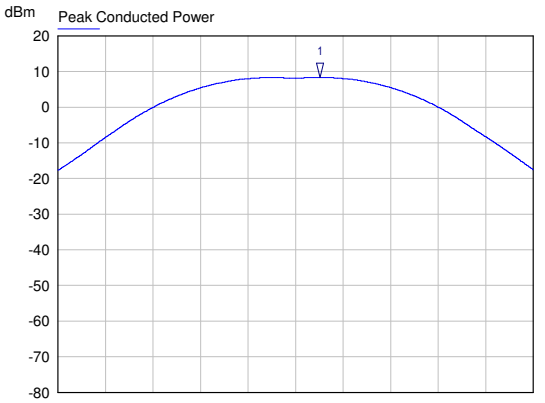
Channel	Channel Power (dBm)	Limit (dBm)	Result
11	8.23	30.0	Pass
18	8.35	30.0	Pass
25	10.67	30.0	Pass

Table 7: Channel Power



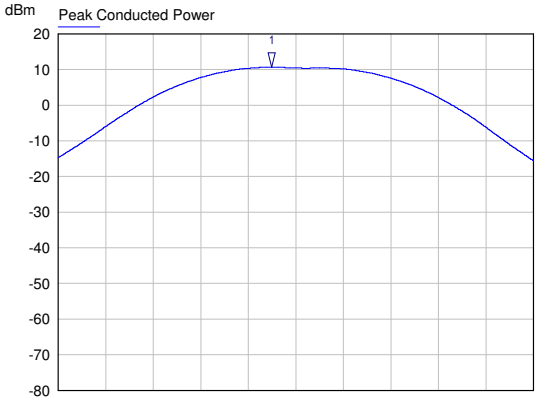
Mkr	Trace	X-Axis	Value	Notes
1	Peak Conducted Power	2.4045 GHz	8.23 dBm	

Ch 11



Mkr	Trace	X-Axis	Value	Notes
1	Peak Conducted Power	2.4405 GHz	8.35 dBm	

Ch 18



Mkr	Trace	X-Axis	Value	Notes
1	Peak Conducted Power	2.4745 GHz	10.67 dBm	

Ch 25

Figure 3: Peak Conducted Power plots

10 Maximum Power Spectral Density

10.1 Measurement method

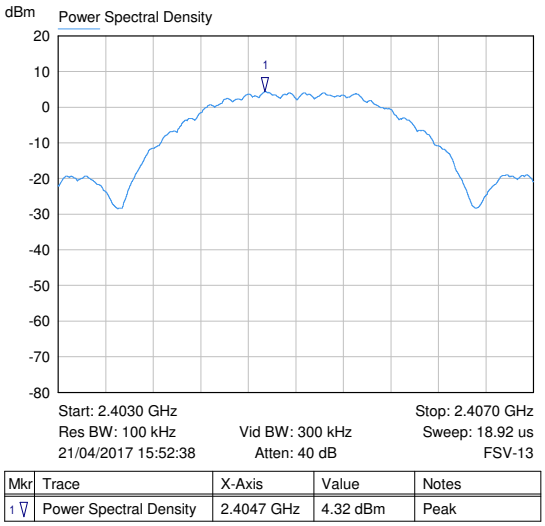
As conducted power was measured as Maximum Peak Conducted Power, measurement was performed in accordance with KDB 558074 section 10.2:

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 x DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

10.2 Test results

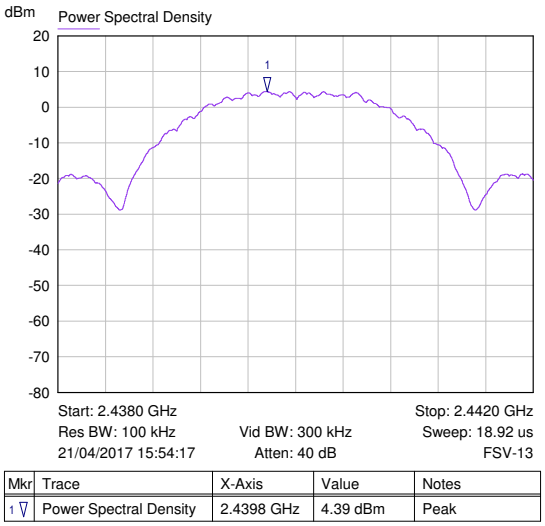
Channel	Peak Marker reading (dBm)	Limit (dBm/3kHz)	Result
11	4.32	8.0	Pass
18	4.39	8.0	Pass
25	6.38	8.0	Pass

Table 8: Spectral Density results



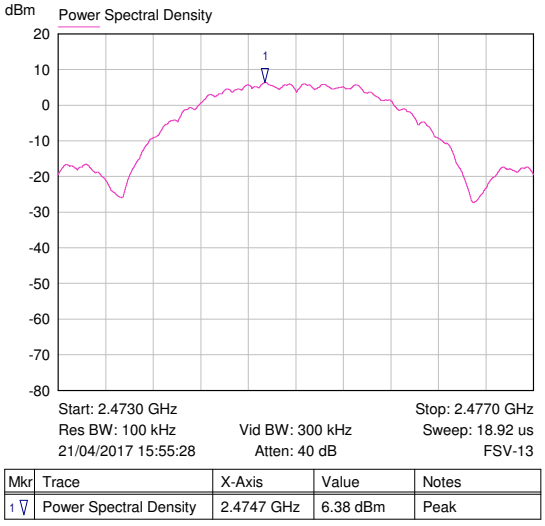
Mkr	Trace	X-Axis	Value	Notes
1	Power Spectral Density	2.4047 GHz	4.32 dBm	Peak

Ch 11



Mkr	Trace	X-Axis	Value	Notes
1	Power Spectral Density	2.4398 GHz	4.39 dBm	Peak

Ch 18



Mkr	Trace	X-Axis	Value	Notes
1	Power Spectral Density	2.4747 GHz	6.38 dBm	Peak

Ch 25

Figure 4: Spectral Density plots

11 Emissions in non-restricted frequency bands

11.1 Measurement method

Since peak power measurements were made using a peak detector, the same detector will be used for unwanted emissions. The unwanted emissions shall be at least 20dB lower than the wanted emission.

First, establish a reference level in accordance with KDB 558074 section 11.2:

a) Set instrument center frequency to DTS channel center frequency.
b) Set the span to ≥ 1.5 x DTS bandwidth.
c) Set the RBW = 100 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum PSD level.

Then measure the emission levels in accordance with KDB 558074 section 11.3

a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ 3 x RBW.
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum amplitude level.

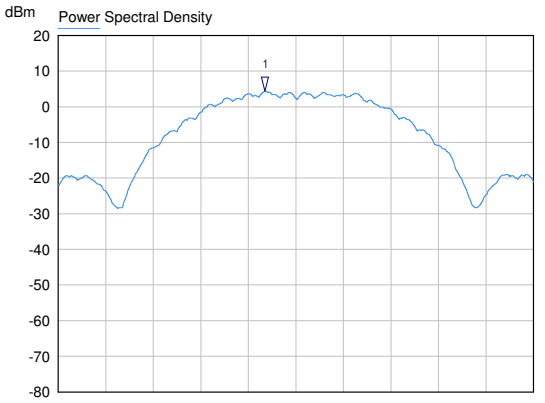
11.2 Test results

The reference trace was taken from the Power Spectral Density Measurement which used the same settings.

For ease of measurement, maximum values are reported anywhere in the frequency band of investigation, whether or not it is outside a restricted band. Further measurements in restricted bands are in the next section.

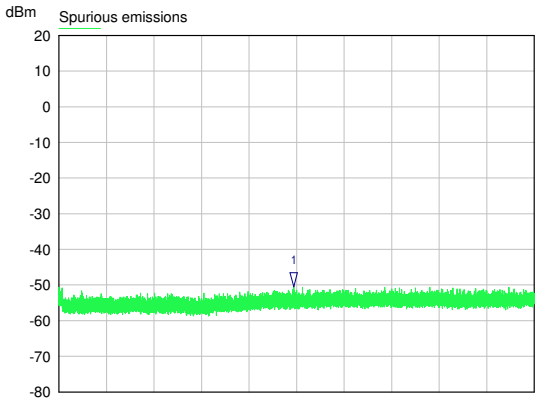
Channel	Maximum Peak level in 100 kHz RBW (dBm)	-20 dBc (dBm)	Maximum emission (dBm)	Result
11	4.32	-15.68	-38.21	Pass
18	4.39	-15.61	-42.21	Pass
25	6.38	-13.62	-44.00	Pass

Table 9: Emissions in non-restricted bands



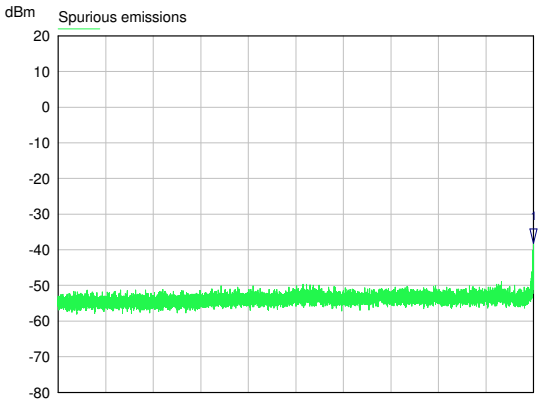
Mkr	Trace	X-Axis	Value	Notes
1	Power Spectral Density	2.4047 GHz	4.32 dBm	Peak

Ch 11 reference



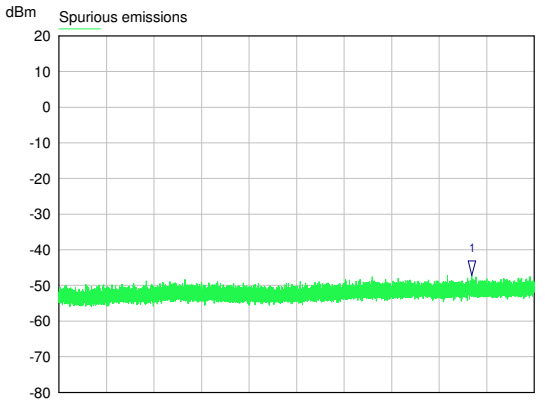
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	746.3394 MHz	-50.52 dBm	

Ch 11: trace 1



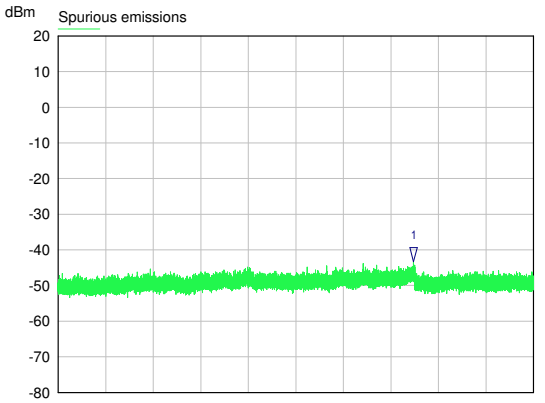
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	2.3999 GHz	-38.21 dBm	

Ch 11: trace 2



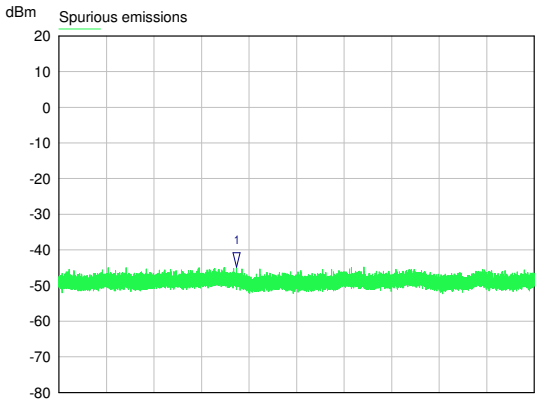
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	3.8005 GHz	-47.19 dBm	

Ch 11: trace 3



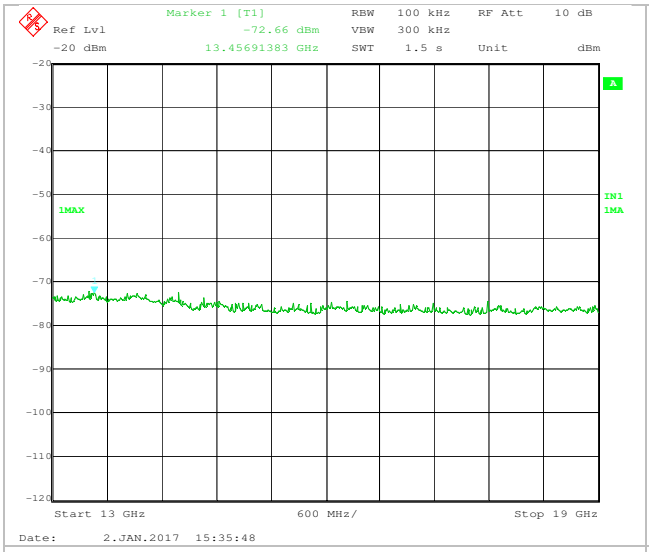
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	6.9885 GHz	-43.41 dBm	

Ch 11: trace 4

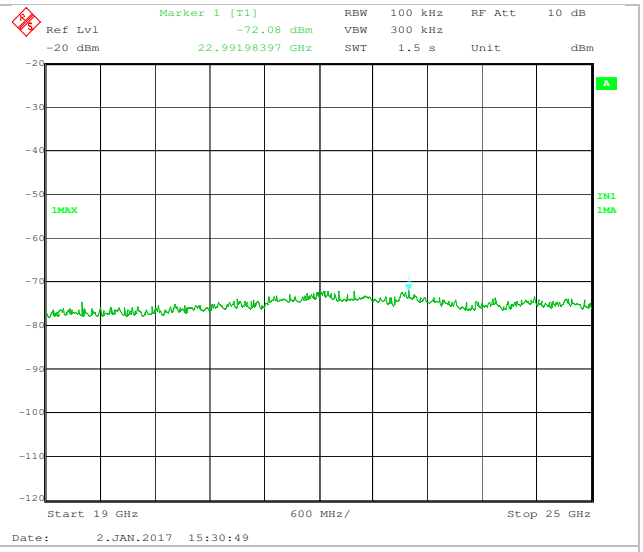


Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	9.8664 GHz	-44.76 dBm	

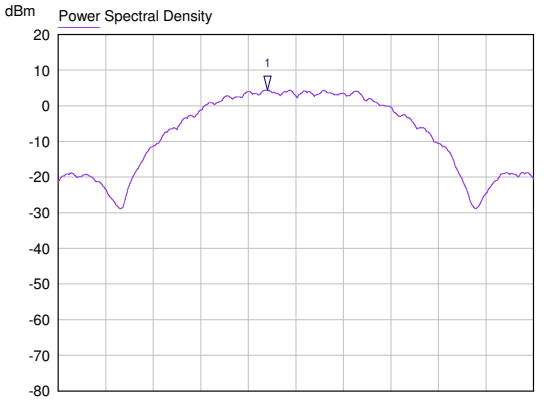
Ch 11: trace 5



Ch 11: trace 6

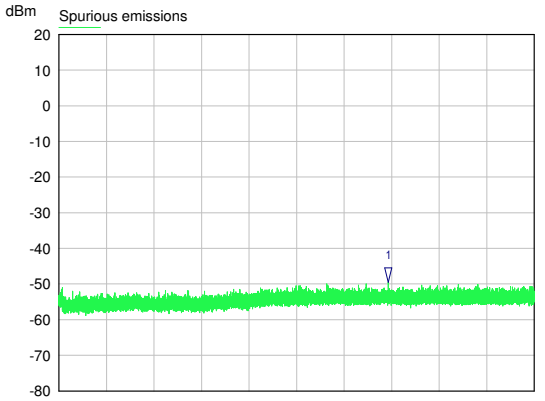


Ch 11: trace 7



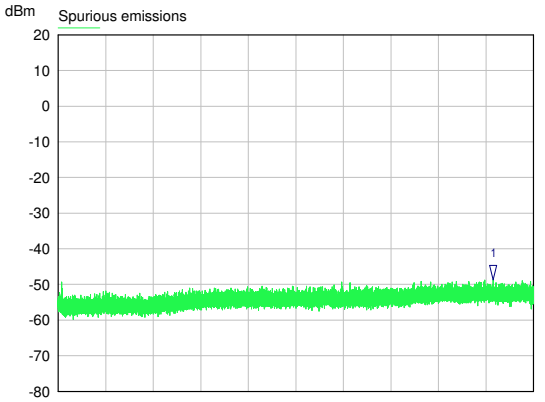
Mkr	Trace	X-Axis	Value	Notes
1	Power Spectral Density	2.4398 GHz	4.39 dBm	Peak

Ch 17 reference



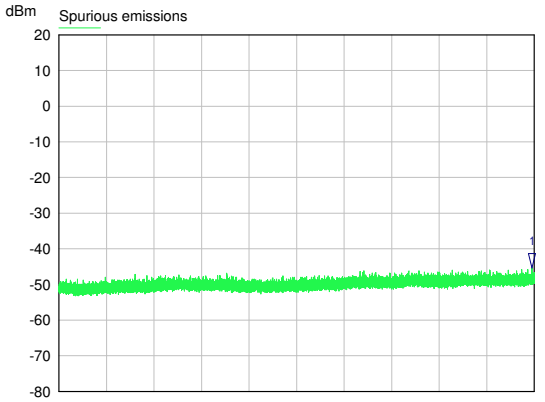
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	1.0427 GHz	-49.45 dBm	

Ch 18: trace 1



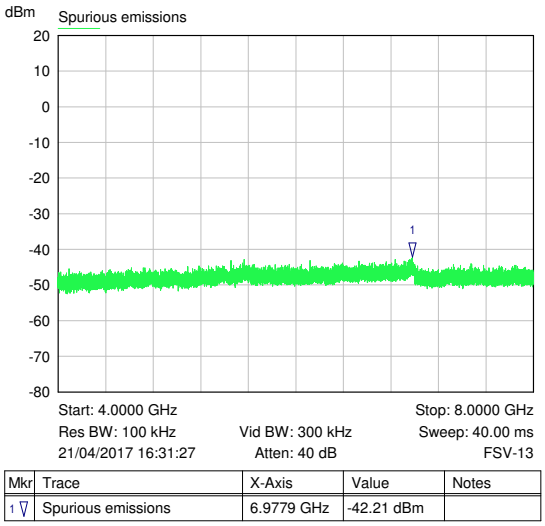
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	2.1970 GHz	-48.59 dBm	

Ch 18: trace 2



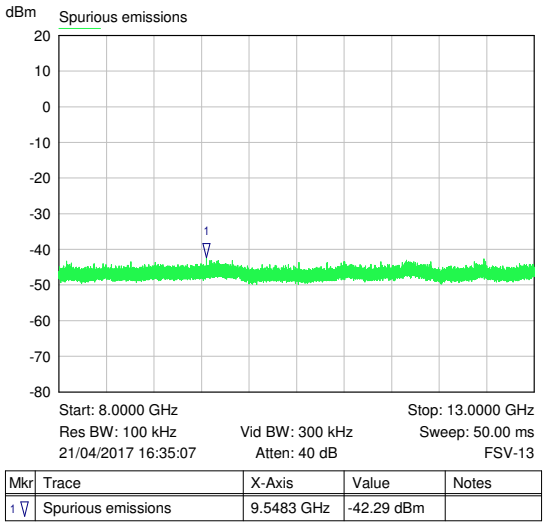
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	3.9921 GHz	-45.38 dBm	

Ch 18: trace 3



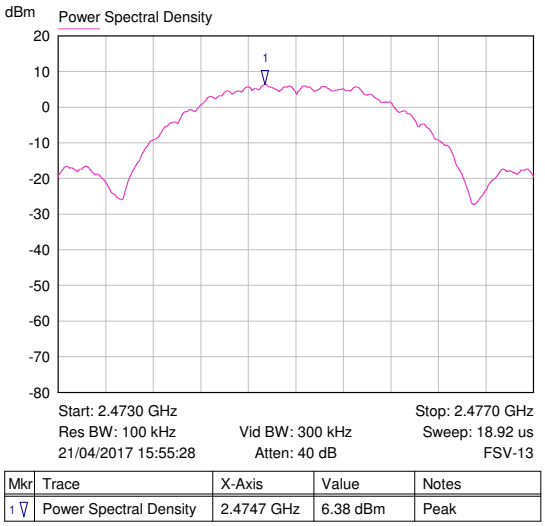
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	6.9779 GHz	-42.21 dBm	

Ch 18: trace 4



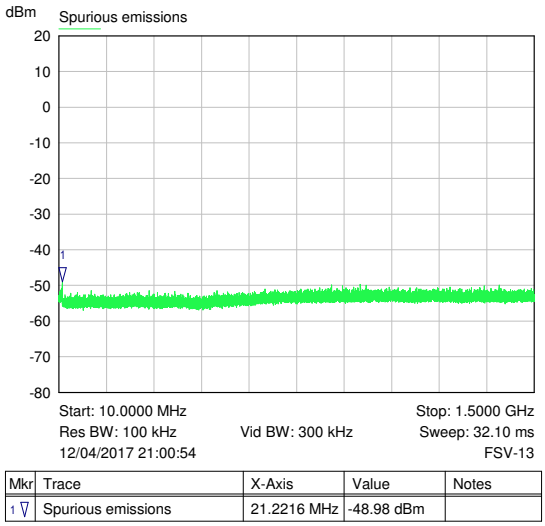
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	9.5483 GHz	-42.29 dBm	

Ch 18: trace 5



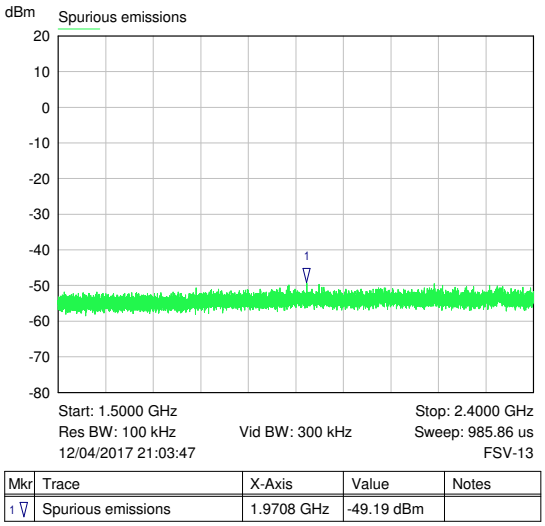
Mkr	Trace	X-Axis	Value	Notes
1	Power Spectral Density	2.4747 GHz	6.38 dBm	Peak

Ch 25 reference



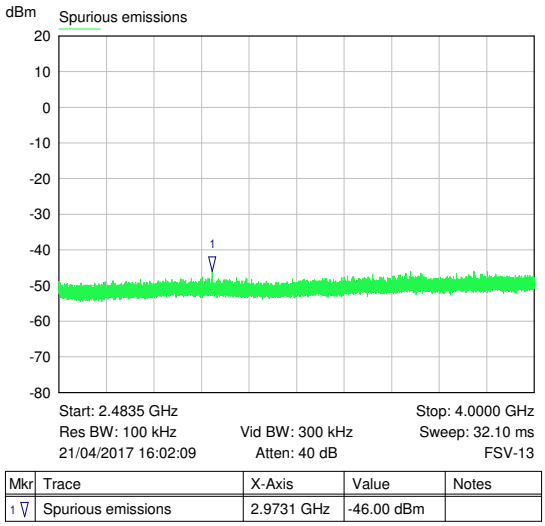
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	21.2216 MHz	-48.98 dBm	

Ch 25: trace 1



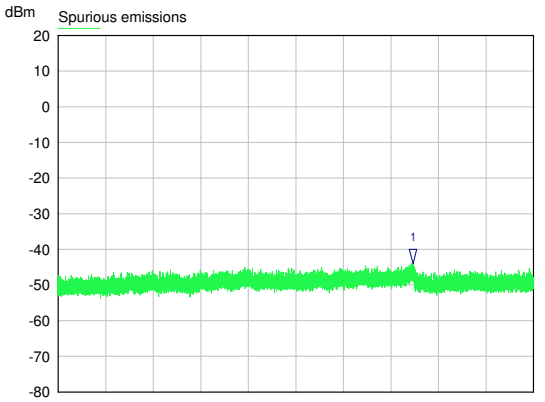
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	1.9708 GHz	-49.19 dBm	

Ch 25: trace 2



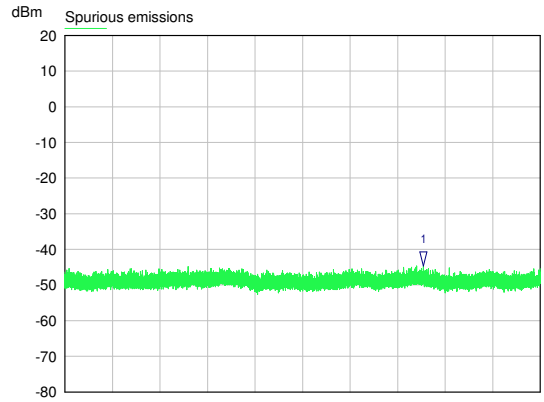
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	2.9731 GHz	-46.00 dBm	

Ch 25: trace 3



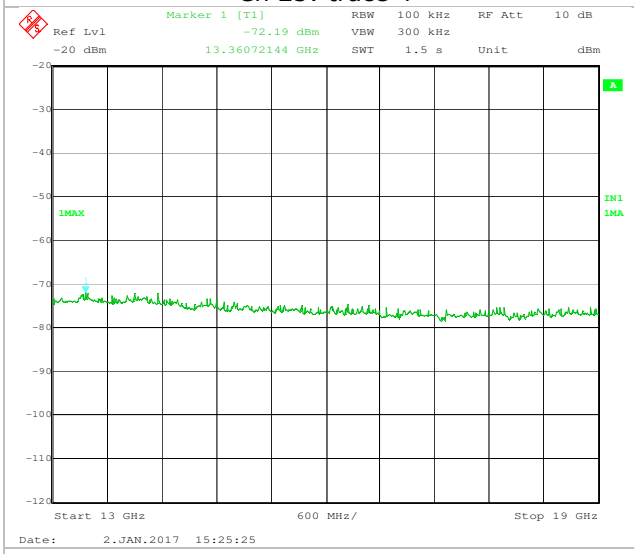
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	6.9841 GHz	-44.00 dBm	

Ch 25: trace 4

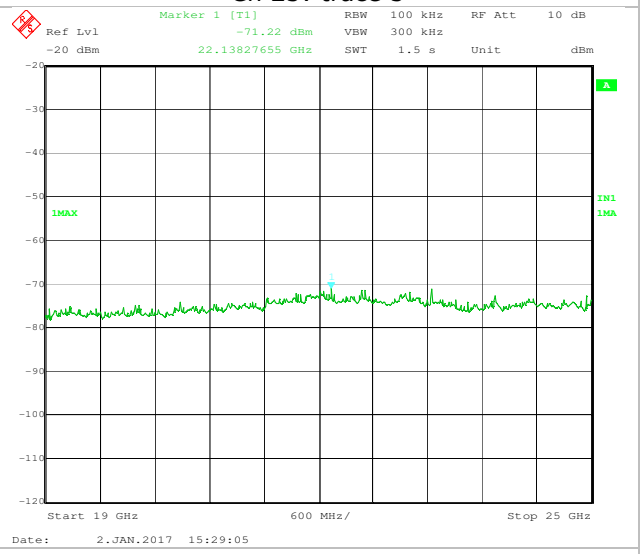


Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	11.7664 GHz	-44.65 dBm	

Ch 25: trace 5



Ch 25: trace 6



Ch 25: trace 7

Figure 5: Emissions in non-restricted frequency bands

12 Maximum Emissions in Restricted Band

This testing is done in two parts:

- Antenna port conducted measurement
- Radiated measurement with antenna port terminated

12.1 Conducted Antenna port

12.1.1 Measurement method

The conducted antenna port power is converted to a radiated emissions field strength limit specified in 15.209(a) as per KDB 558074 12.2.2:

Electric field strength, E = EIRP – 20log D + 104.8

Which can be re-written as EIRP = E + 20logD – 104.8

Since EIRP = conducted power + antenna gain + ground reflection
This can be re-written:

Max. conducted power = E + 20logD – 104.8 - antenna gain - ground reflection

If "E" is the limit, and the measurement distance taken as 3 m, the maximum conducted power can be determined as shown in the table:

Frequency range	Limit	Field strength (µV/m)	Field Strength (dBµV/m)	20logD	Antenna gain (dBi)	Ground reflection	Limit
30 -88 MHz	Quasi-peak	100	40.0	9.54	2	4.7	-61.96
88 – 216 MHz	Quasi-peak	150	43.5	9.54	2	4.7	-58.44
216-960 MHz	Quasi-peak	200	46.0	9.54	2	4.7	-55.94
960 – 1000 MHz	Quasi-peak	500	54.0	9.54	2	4.7	-47.98
> 1 GHz	Average	500	54.0	9.54	2	0	-43.28
> 1 GHz	Peak	Average + 20dB	74.0	9.54	2	0	-23.26

Table 10: Restricted band limits at antenna port

Initial measurement of antenna port emissions were performed with a peak detector as per KDB 558074 section 12.2.4:

a) RBW = as specified in Table 1.
b) VBW ≥ 3 x RBW.
c) Detector = Peak.
d) Sweep time = auto.
e) Trace mode = max hold.
f) Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be longer for low duty cycle applications).

Where emissions above 1 GHz were close to the limit, these were re-measured using trace-averaging and RMS detector as per section 12.2.5.1:

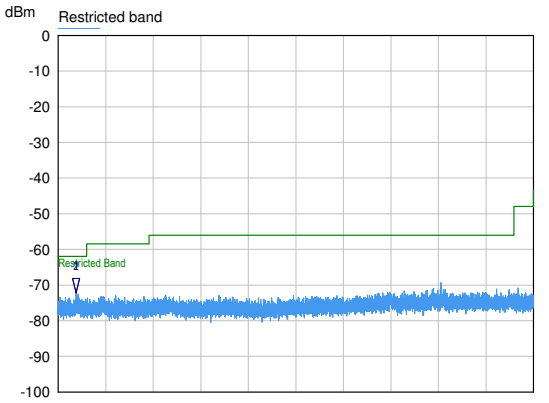
a) RBW = 1 MHz (unless otherwise specified).
b) VBW ≥ 3 x RBW.
c) Detector = RMS, if span/(# of points in sweep) ≤ (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak. (Note: 32001 measurement points used)
d) Averaging type = power (i.e., RMS).
    1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
    2) Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
e) Sweep time = auto.
f) Perform a trace average of at least 100 traces.

12.1.2 Test results

Maximum values for each frequency range are shown on the plots, and the worst case emissions for each channel were re-measured using RMS detector and are detailed in the table below:

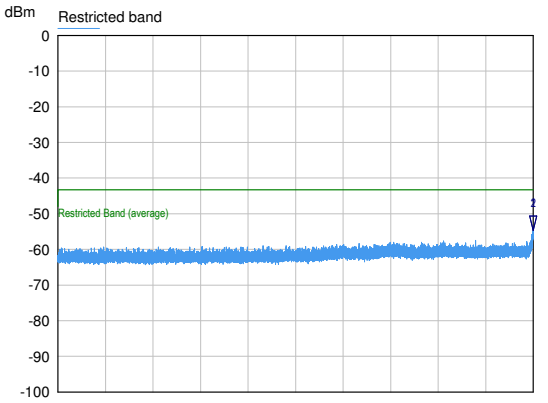
Channel	Frequency (MHz)	Detector	Level (dBm)	Maximum emission relative to peak limit (dB)	Maximum emission relative to average limit (dB)	Result
11	6949.5	Peak	-52.05	-28.77	-8.77	Pass
18	4880.9	Peak	-52.68	-9.40	N/A	Pass
		RMS	-62.41	N/A	-19.13	
25	2483.6	Peak	-43.89	-20.61	N/A	Pass
		RMS	-52.90	N/A	-9.62	Pass
25	4949.2	Peak	-50.76	-27.48	N/A	
		RMS	-58.70	N/A	-15.42	

Table 11: Emissions in restricted bands



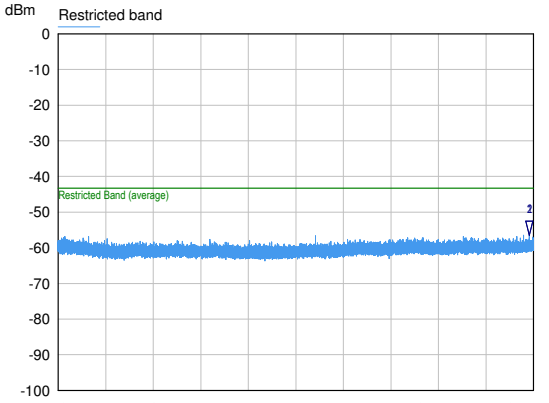
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	65.9506 MHz	-10.22 dBm	Relative to limit
2	Restricted band	65.9506 MHz	-72.18 dBm	Absolute

Ch 11: trace 1: 30 - 1000 MHz



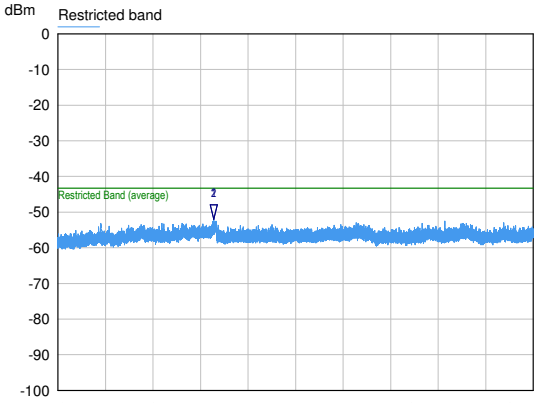
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	2.3896 GHz	-11.42 dBm	Relative to limit
2	Restricted band	2.3896 GHz	-54.70 dBm	Absolute

Ch 11: trace 2; 1000 - 2390 MHz



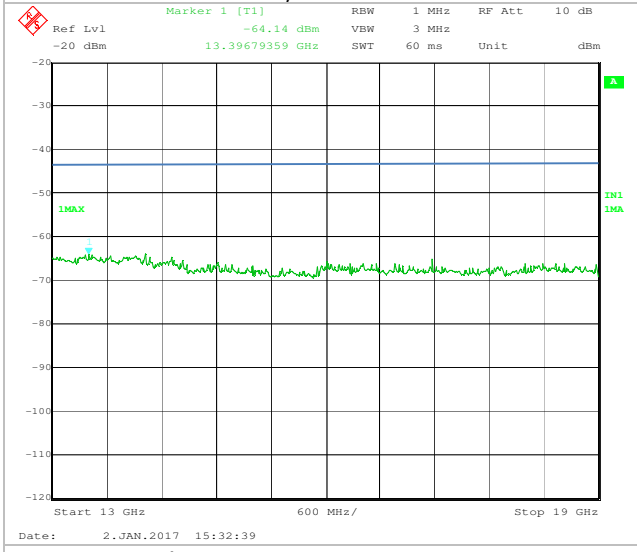
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	3.9860 GHz	-13.27 dBm	Relative to limit
2	Restricted band	3.9860 GHz	-56.55 dBm	Absolute

Ch 11: trace 3; 2483.5 – 4000 MHz

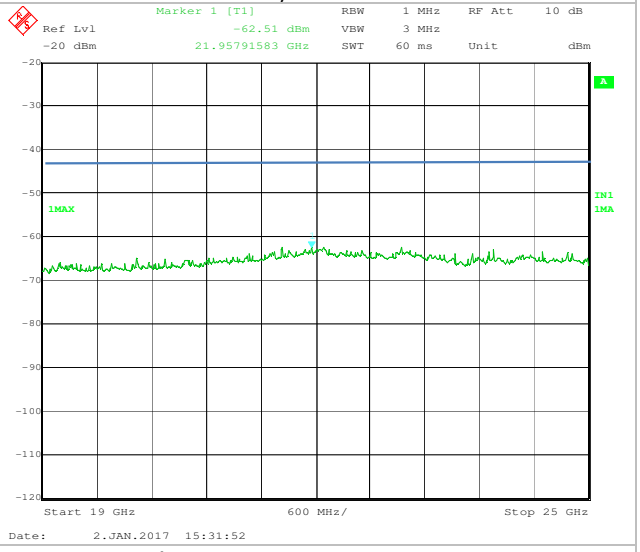


Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	6.9495 GHz	-8.77 dBm	Relative to limit
2	Restricted band	6.9495 GHz	-52.05 dBm	Absolute

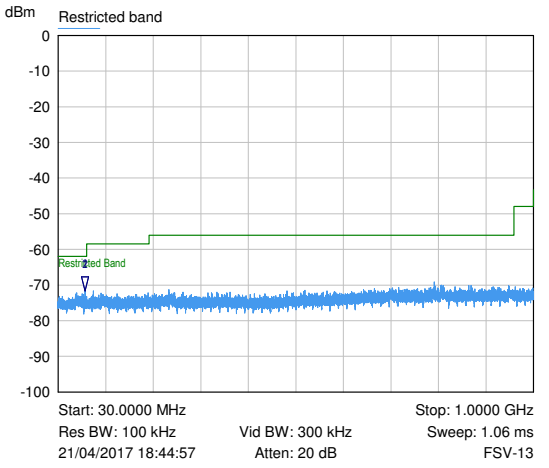
Ch 11: trace 4; 4000 – 13000 MHz



Ch 11: trace 5; 13 – 19 GHz

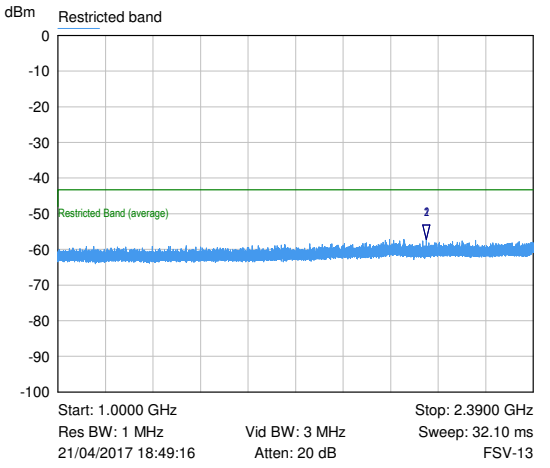


Ch 11: trace 6; 19 – 25 GHz



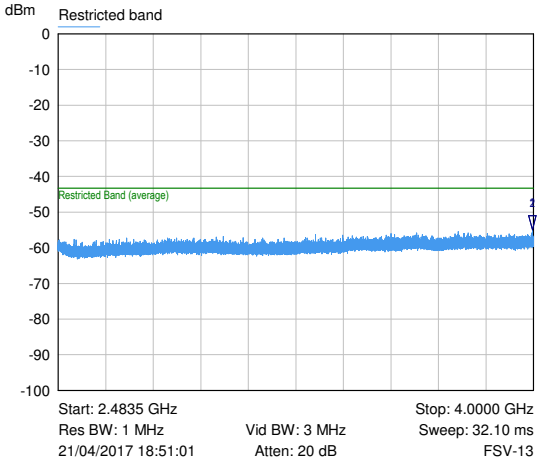
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	84.3200 MHz	-9.65 dBm	Relative to limit
2	Restricted band	84.3200 MHz	-71.61 dBm	Absolute

Ch 18: trace 1; 30 - 1000 MHz



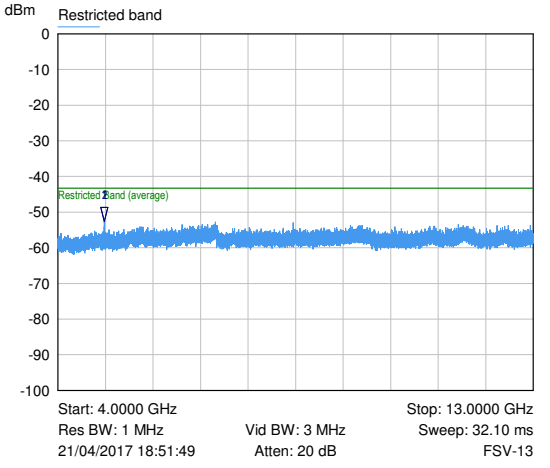
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	2.0779 GHz	-13.84 dBm	Relative to limit
2	Restricted band	2.0779 GHz	-57.12 dBm	Absolute

Ch 18: trace 2; 1000 – 2390 MHz



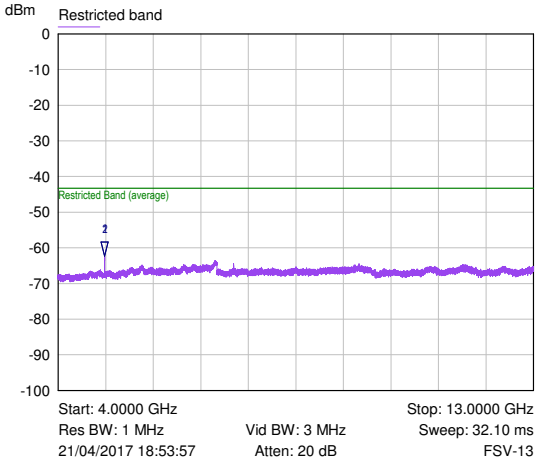
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	3.9958 GHz	-11.65 dBm	Relative to limit
2	Restricted band	3.9958 GHz	-54.93 dBm	Absolute

Ch 18: trace 3; 2483.5 – 4000 MHz



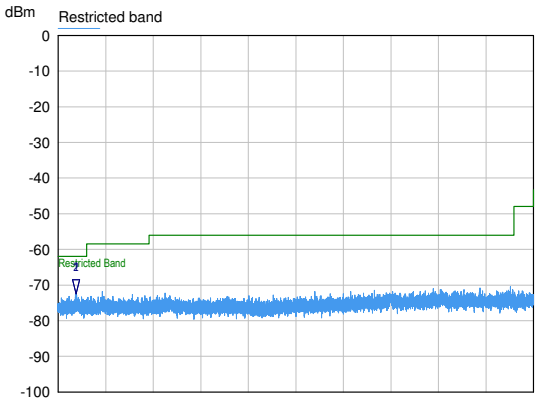
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	4.8809 GHz	-9.40 dBm	Relative to limit
2	Restricted band	4.8809 GHz	-52.68 dBm	Absolute

Ch 18: trace 4; 4000 – 13000 MHz



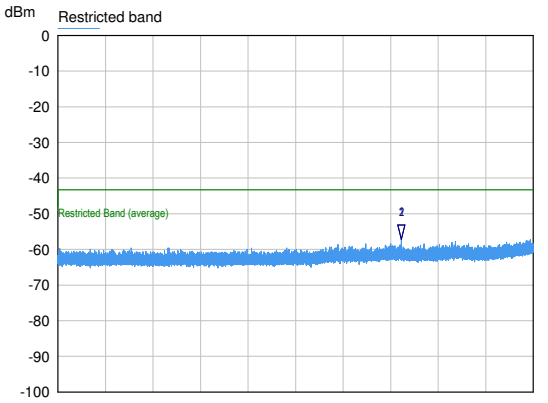
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	4.8792 GHz	-19.13 dBm	Relative to limit
2	Restricted band	4.8792 GHz	-62.41 dBm	Absolute

Ch 18: trace 5; 4000 – 13000 MHz (RMS)



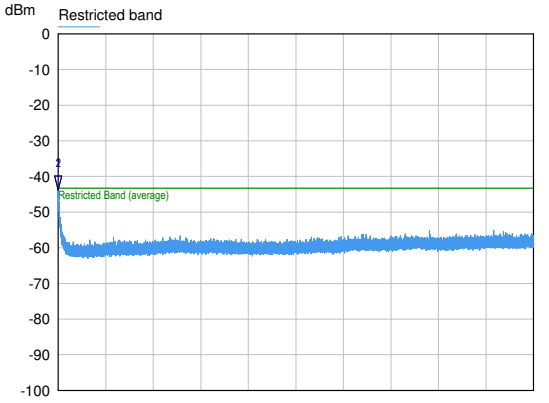
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	66.1325 MHz	-10.52 dBm	Relative to limit
2	Restricted band	66.1325 MHz	-72.48 dBm	Absolute

Ch 25: trace 1; 30 - 1000 MHz



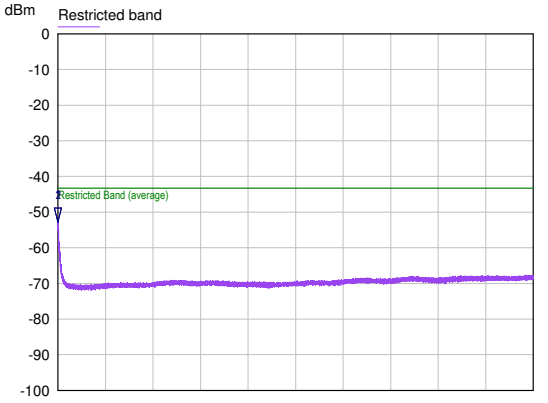
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	2.0035 GHz	-13.90 dBm	Relative to limit
2	Restricted band	2.0035 GHz	-57.18 dBm	Absolute

Ch 25: trace 2; 1000 – 2390 MHz



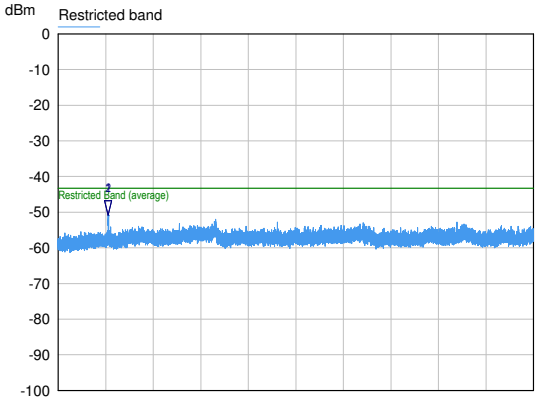
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	2.4836 GHz	-0.61 dBm	Relative to limit
2	Restricted band	2.4836 GHz	-43.89 dBm	Absolute

Ch 25: trace 3; 2483.5 – 4000 MHz (Peak)



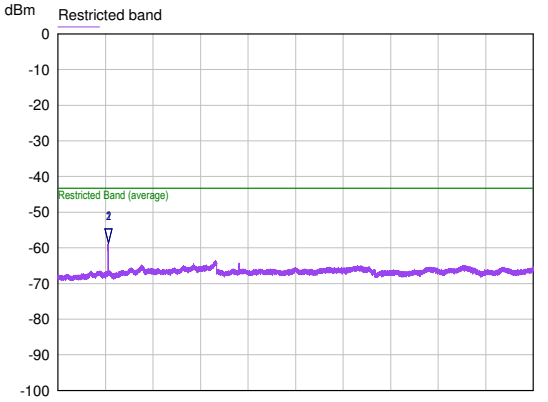
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	2.4836 GHz	-9.62 dBm	Relative to limit
2	Restricted band	2.4836 GHz	-52.90 dBm	Absolute

Ch 25: trace 3; 2483.5 – 4000 MHz (RMS)



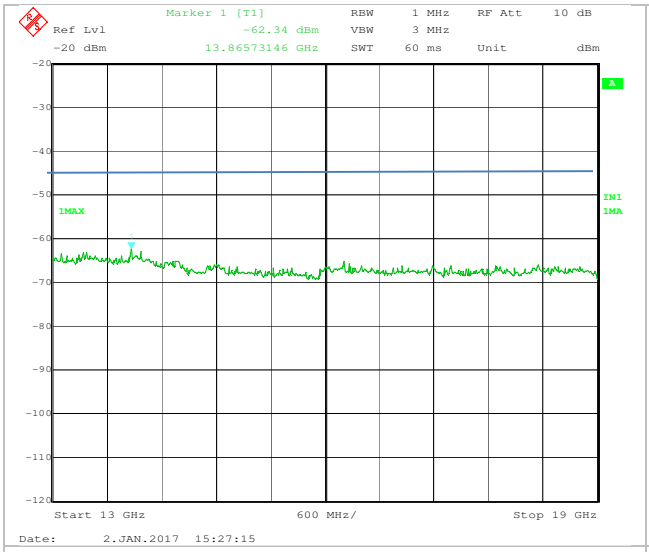
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	4.9492 GHz	-7.48 dBm	Relative to limit
2	Restricted band	4.9492 GHz	-50.76 dBm	Absolute

Ch 25: trace 5; 4000 – 13000 MHz (Peak)

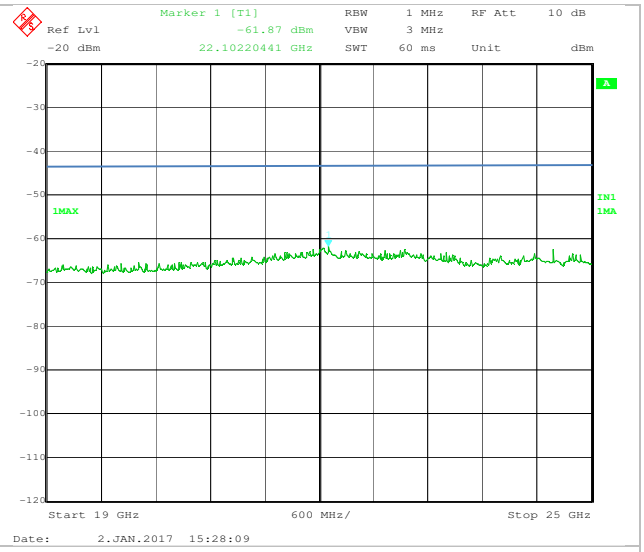


Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	4.9509 GHz	-15.42 dBm	Relative to limit
2	Restricted band	4.9509 GHz	-58.70 dBm	Absolute

Ch 25: trace 5; 4000 – 13000 MHz (RMS)



Ch 25: trace 5; 13 – 19 GHz



Ch 25: trace 6; 19 – 25 GHz

12.2 Radiated test results for antenna terminated

12.2.1 Measurement method

Measurements were made in a semi-anechoic chamber and the EUT was positioned:

- On a 0.8m polystyrene table for emissions below 1 GHz
- On a 1.5m polystyrene support for emissions above 1 GHz

12.2.2 Results

Channel	Frequency (MHz)	Antenna Polarisation	Detector	Level (dBµV/m)	Limit (dBµV/m)	Result
11	69.904	Vertical	Quasi-Peak	16.1	40.0	Pass
19	45.039	Vertical	Quasi-Peak	20.5	40.0	Pass
	55.055	Vertical	Quasi-Peak	17.77	40.0	Pass
	69.980	Vertical	Quasi-Peak	18.48	40.0	Pass
	190.075	Vertical	Quasi-Peak	20.61	43.5	Pass
	295.648	Horizontal	Quasi-Peak	24.39	46.0	Pass
26	30-1000 MHz	Vertical and Horizontal	No additional frequencies needed final measurement			Pass

Table 12: 30-1000 MHz Restricted Band RSE results with antenna terminated

Channel	Frequency (MHz)	Detector	Level (dBµV/m)	Peak limit (dBµV/m)	Average limit (dBµV/m)	Result
11	2483.5	RMS	No emissions to measure			Pass
19	2483.5	RMS	No emissions to measure			Pass
25	2483.5	Peak	38.42	74.0	-	Pass
		RMS	25.72	-	54.0	Pass
25	4949.2	Peak	>20 dB below limit (see note)			Pass
		RMS	>20 dB below limit (see note)			Pass
11	19824	Peak	52.06	84.0	64.0	Pass

Table 13: 1-25 GHz Restricted Band RSE results with antenna terminated

Note: 2nd harmonic on plots was artefact from measurement pre-amp – further investigation showed no emission to measure above noise floor.

Channel 11

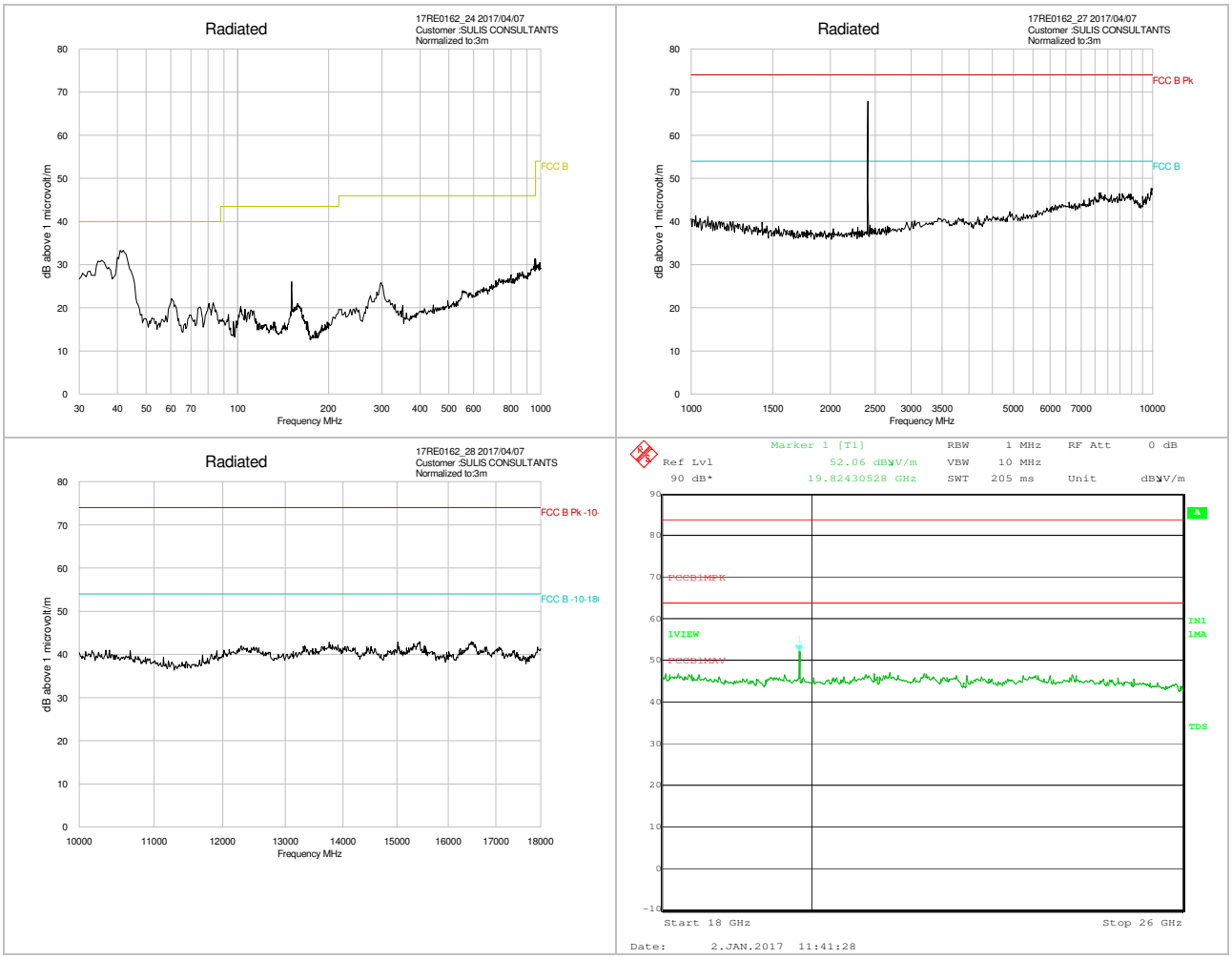


Figure 6: Radiated Spurious Emissions; Channel 11

Channel 18

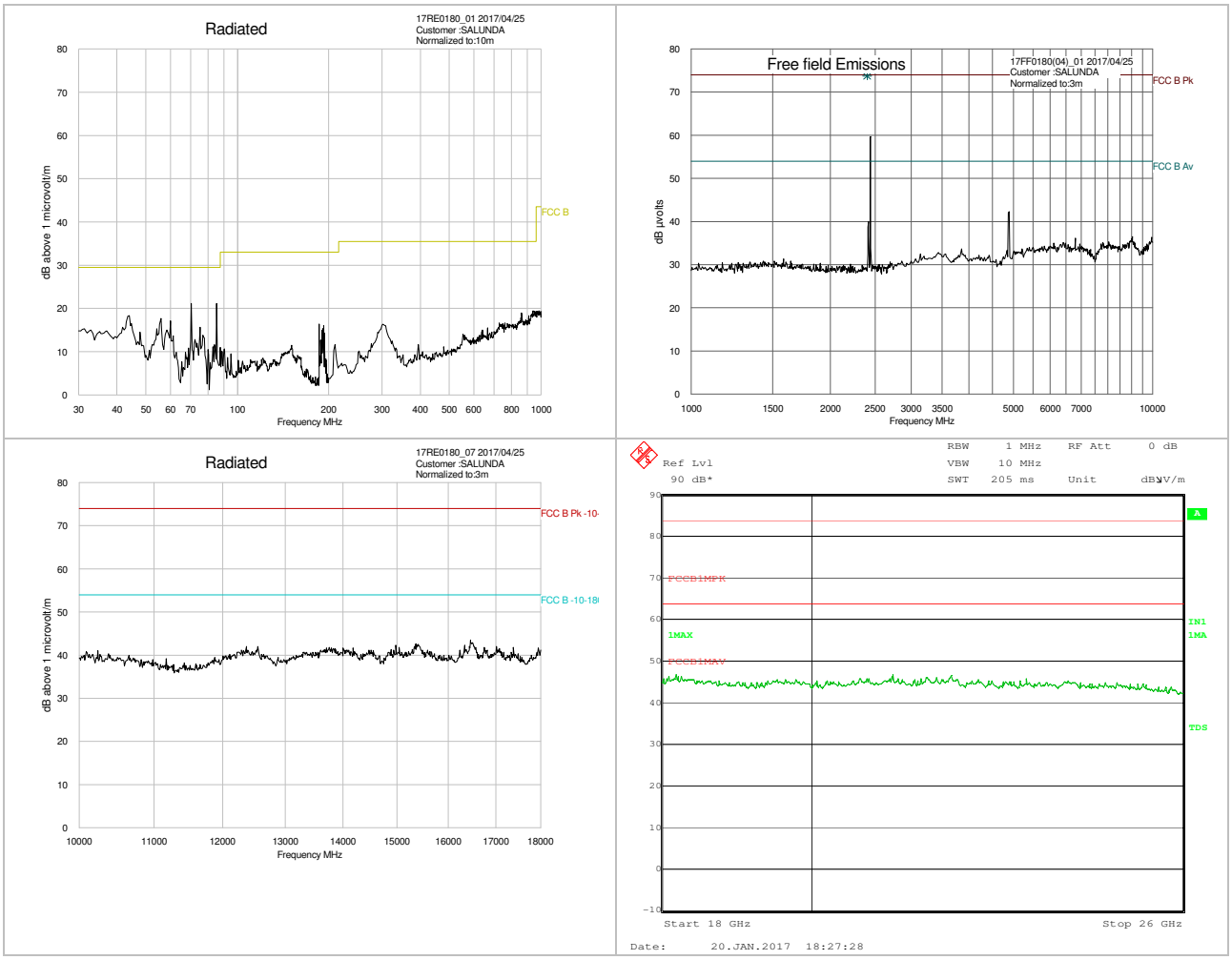


Figure 7: Radiated Spurious Emissions; Channel 18

Channel 25

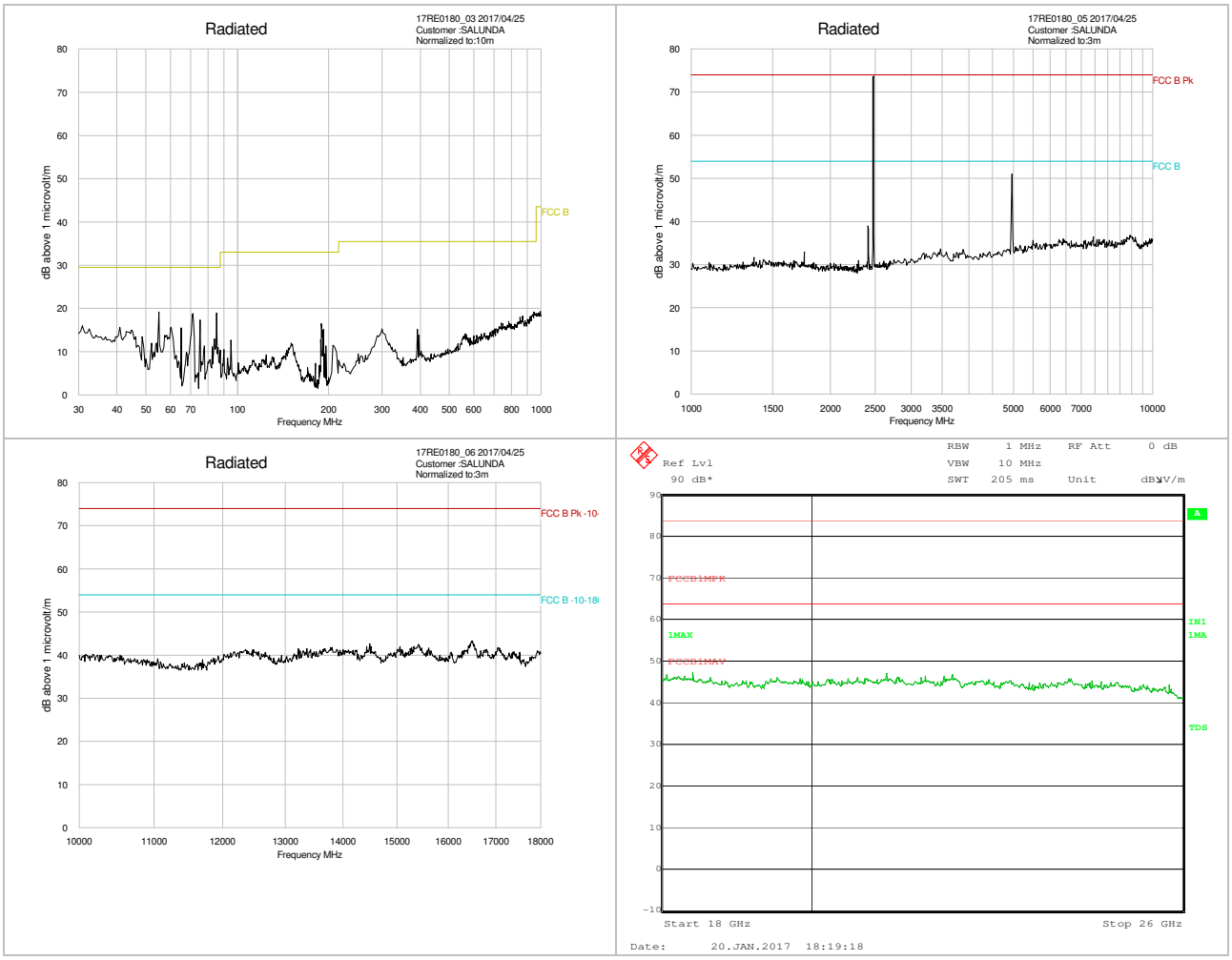


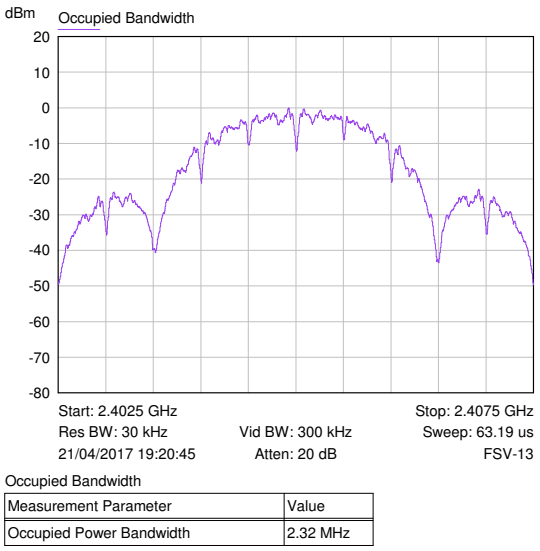
Figure 8: Radiated Spurious Emissions; Channel 25

13 Occupied bandwidth

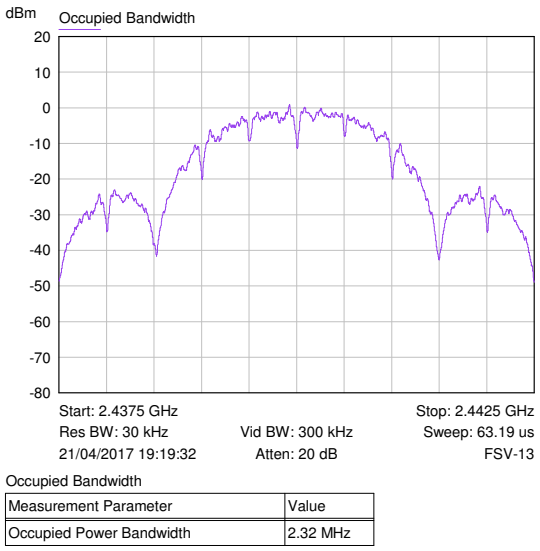
99% occupied bandwidth measured using the inbuilt function in the spectrum analyser

Channel	Occupied Bandwidth (MHz)	Requirement	Result
11	2.320	None	For information
19	2.320	None	For information
26	2.320	None	For information

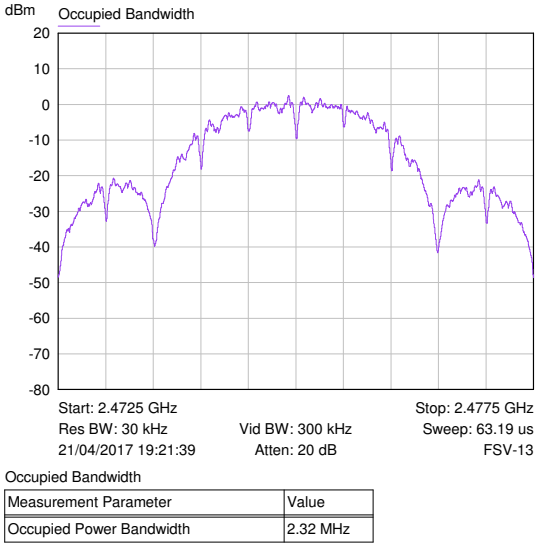
Table 14: Occupied Bandwidth



Channel 11



Channel 18

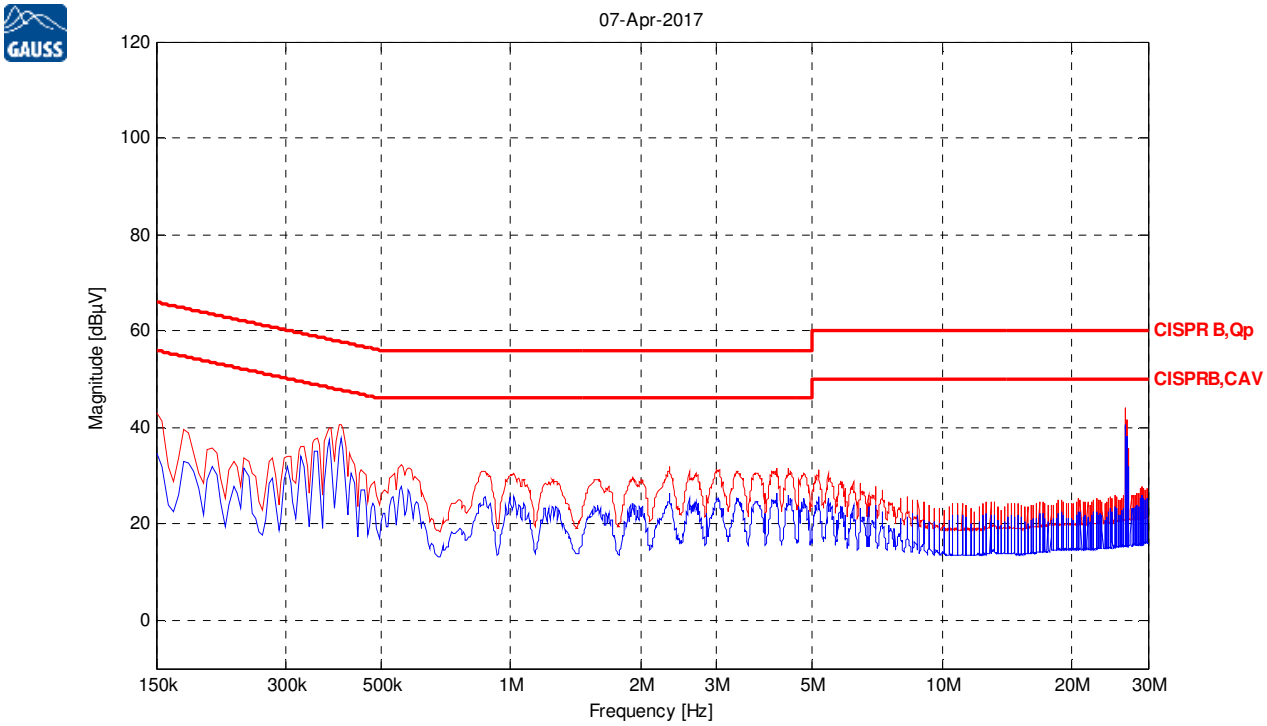


Channel 25

Figure 9: Occupied Bandwidth

14 AC mains conducted emissions

14.1 Live line



Receiver Model: TDEMI_v5.00_1510002
Protocol Number: 17R162
Serial Number: Sulanda Gateway
Operation State: 115v 60Hz Line
Notes: R Pennell

Traces:

Trace	Start	Step	Stop	IF Bandwidth	Detector	Dwell time	Attenuation	Transducer	LISN	Notes
Scan 1	150.0 kHz	5.0 kHz	30.0 MHz	9kHz	QP	1.0 s	Auto	TDF1, TDF2, TDF3	None-	
Scan 2	150.0 kHz	5.0 kHz	30.0 MHz	9kHz	CAV	1.0 s	Auto	TDF1, TDF2, TDF3	None-	

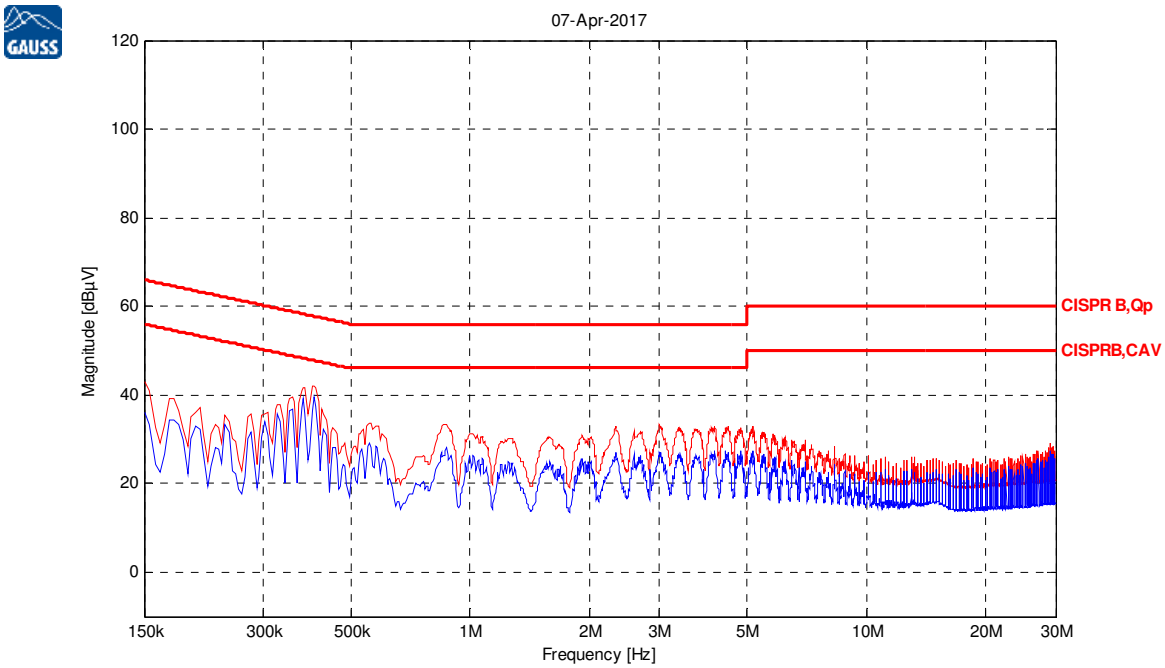
Scan1: 150.0 kHz, 5.0 kHz, 30.0 MHz; IF:9kHz, 1.0 s QP, Att AutodB

f	Magnitude [dBµV]	Quasi-peak Limit	Difference	Name	Comment
398.159 kHz	40.60	57.89	17.29	CISPR B,Qp	Pass
5.176 MHz	31.05	60.00	28.95	CISPR B,Qp	Pass
12.681 MHz	24.60	60.00	35.40	CISPR B,Qp	Pass
18.895 MHz	25.05	60.00	34.95	CISPR B,Qp	Pass
24.588 MHz	25.58	60.00	34.42	CISPR B,Qp	Pass
26.495 MHz	44.20	60.00	15.80	CISPR B,Qp	Pass

Scan2: 150.0 kHz, 5.0 kHz, 30.0 MHz; IF:9kHz, 1.0 s CAV, Att AutodB

f	Magnitude [dBµV]	Average Limit	Difference	Name	Comment
402.927 kHz	37.95	47.79	9.85	CISPRB,CAV	Pass
5.176 MHz	25.53	50.00	24.47	CISPRB,CAV	Pass
12.681 MHz	22.25	50.00	27.75	CISPRB,CAV	Pass
18.895 MHz	22.54	50.00	27.46	CISPRB,CAV	Pass
24.588 MHz	23.05	50.00	26.95	CISPRB,CAV	Pass
26.495 MHz	40.48	50.00	9.52	CISPRB,CAV	Pass

14.2 Neutral line



Receiver Model: TDEMI_v5.00_1510002
Protocol Number: 17R162
Serial Number: Sulanda Gateway
Operation State: 115v 60Hz Neutral
Notes: R Pennell

Traces:

Trace	Start	Step	Stop	IF Bandwidth	Detector	Dwell time	Attenuation	Transducer	LISN	Notes
Scan 1	150.0 kHz	5.0 kHz	30.0 MHz	9kHz	QP	1.0 s	Auto	TDF1, TDF2, TDF3	None-	
Scan 2	150.0 kHz	5.0 kHz	30.0 MHz	9kHz	CAV	1.0 s	Auto	TDF1, TDF2, TDF3	None-	

Scan1: 150.0 kHz, 5.0 kHz, 30.0 MHz; IF:9kHz, 1.0 s QP, Att AutodB

f	Magnitude [dBµV]	Quasi-peak Limit	Difference	Name	Comment
402.927 kHz	42.11	57.79	15.68	CISPR B,Qp	Pass
5.176 MHz	32.78	60.00	27.22	CISPR B,Qp	Pass
10.097 MHz	26.18	60.00	33.82	CISPR B,Qp	Pass
18.642 MHz	25.61	60.00	34.39	CISPR B,Qp	Pass
24.598 MHz	26.39	60.00	33.61	CISPR B,Qp	Pass
28.999 MHz	29.02	60.00	30.98	CISPR B,Qp	Pass

Scan2: 150.0 kHz, 5.0 kHz, 30.0 MHz; IF:9kHz, 1.0 s CAV, Att AutodB

f	Magnitude [dBµV]	Average Limit	Difference	Name	Comment
402.927 kHz	39.52	47.79	8.27	CISPRB,CAV	Pass
5.176 MHz	27.24	50.00	22.76	CISPRB,CAV	Pass
12.944 MHz	23.30	50.00	26.70	CISPRB,CAV	Pass
18.642 MHz	23.54	50.00	26.46	CISPRB,CAV	Pass
24.598 MHz	24.35	50.00	25.65	CISPRB,CAV	Pass
28.999 MHz	27.34	50.00	22.66	CISPRB,CAV	Pass

15 Test equipment

Description	Manufacturer	Name	Serial Number	Calibration certificate
Receiver	Rohde & Schwarz	FSV13	101389	R&S 1400-58009 Cal date: 2017-02-10
Pink 30M-2G Antenna	CHASE	CBL 6141	4013	Calibration data held by Hursley EMC Services Ltd under their UKAS accreditation, no. 1871
Spectrum analyser	HP	8593EM	3726U00203	
7GHz Receiver	Rohde & Schwarz	ESCI7	1166595007	
Pre-amplifier (30-1000MHz)	HP	8447D	1937A02341	
1-10GHz Horn	Schwarzbeck	BBHA 9120 571	571	
Pre-amp, 1-18GHz 55dB	HEMCS	PA XVIII	001	
Horn antenna (2-18GHz)	Q-par Angus	WBH218HN	5367	
18 to 40GHz Horn	Q-par Angus	WBH18-40k	10300	
40GHz receiver	Rohde & Schwarz	ESIB 40 no.2	100262	
20-300MHz Bicon	Rohde & Schwarz	HK 116	835291/003	

Table 15: Test Equipment