Sulis Consultants
CE Marking and Product Approvals

RF Test Report:

Salunda "Sensor" to 47CFR15.247

FCC ID: 2ALTW1701

SC_TR_254_B

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1 Revision History

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

2 Purpose

This report details testing performed on the Salunda Sensor 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 Richard Pennell of Hursley EMC Services Ltd at their FCC Registered test facility, UK designation number UK0006, on 6th April 2017 under job number 17R162.

4.3 Test sample

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

5 Product Description

The device operates in 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 19	2445.0
Top, channel 25	2480.0

Table 1: Test frequencies

6 Test Configuration

6.1 Test sample

The equipment under test (EUT) was:

Manufacturer	Model	Serial Number
Salunda	Sensor	Ch 11 Ch 19 Ch 26

Table 2: Equipment under test

Note: 3 identical samples were pre-programmed to operate on the required channel.

6.2 Equipment set-up

Equipment was configured as per figure 1 for antenna port measurements:

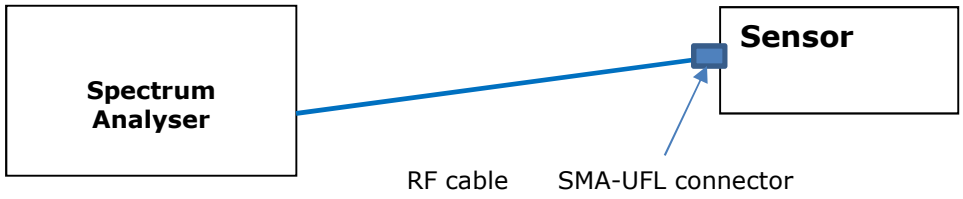


Figure 1: Test Configuration

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

6.3 Supported Antennas

The EUT supports operation with the following antennas:

Antenna type	Type	Gain
Internal	PCB mount	- 2.0 dBi

Table 3: EUT Antenna configurations

Note: The antenna is integral to the PCB, but for an MCX connector is available for making antenna port conducted 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	Not applicable Internal battery.	

Table 4: Summary of test results

8 DTS Bandwidth

8.1 Measurement method

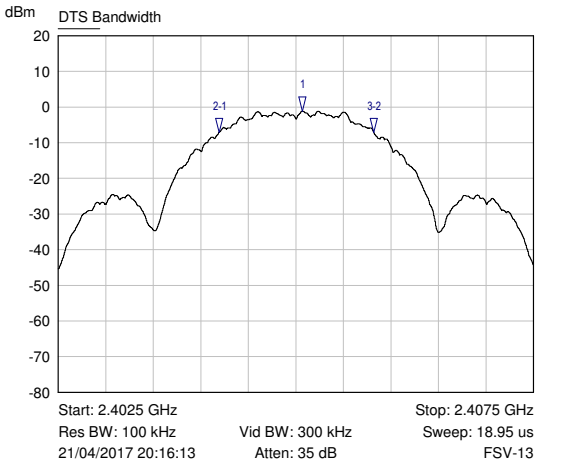
Test was conducted in accordance with KDB 558074 section 8.1 Option 1:

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

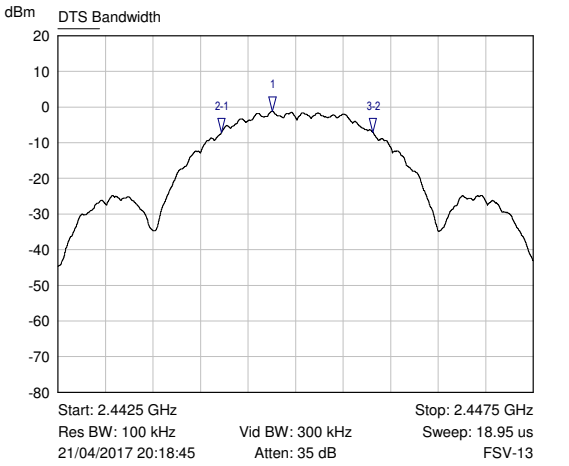
Channel	6dB DTS Bandwidth (MHz)	Requirement	Result
11	1.6244	> 500 kHz	Pass
19	1.5939	> 500 kHz	Pass
26	1.6333	> 500 kHz	Pass

Table 5: DTS Bandwidth



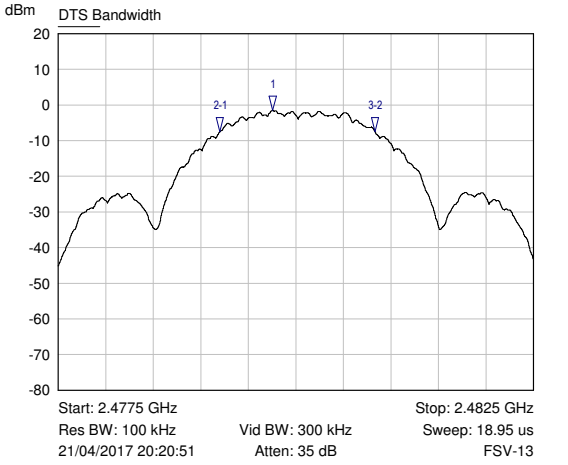
Mkr	Trace	X-Axis	Value	Notes
1	DTS Bandwidth	2.4051 GHz	-1.12 dBm	Peak
2-1	DTS Bandwidth	-876.5625 kHz	-6.00 dB	-6dB (left)
3-2	DTS Bandwidth	1.6244 MHz	0.00 dB	Relative to marker 2

Ch 11



Mkr	Trace	X-Axis	Value	Notes
1	DTS Bandwidth	2.4448 GHz	-1.15 dBm	Peak
2-1	DTS Bandwidth	-533.4375 kHz	-6.00 dB	-6dB (left)
3-2	DTS Bandwidth	1.5939 MHz	-0.00 dB	Relative to marker 2

Ch 19



Mkr	Trace	X-Axis	Value	Notes
1	DTS Bandwidth	2.4798 GHz	-1.55 dBm	Peak
2-1	DTS Bandwidth	-556.0938 kHz	-6.00 dB	-6dB (left)
3-2	DTS Bandwidth	1.6333 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

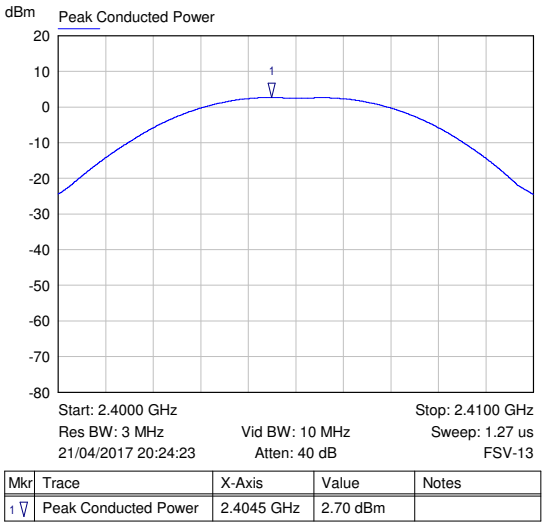
As the analyser could be set RBW ≥ DTS bandwidth, the test was conducted in accordance with KDB 558074 section 9.1.1:

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

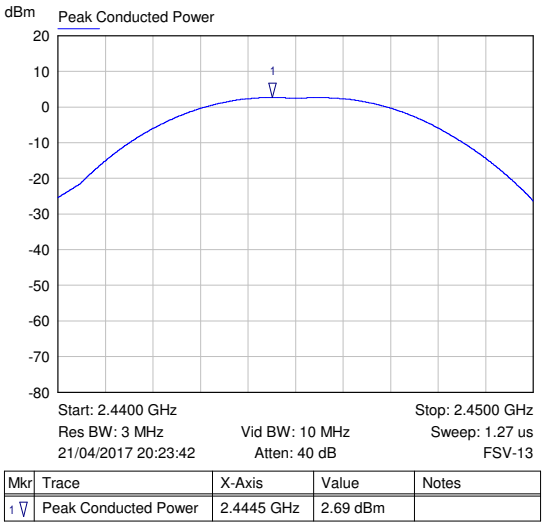
Channel	Channel Power (dBm)	Limit (dBm)	Result
11	2.70	30.0	Pass
19	2.69	30.0	Pass
26	2.80	30.0	Pass

Table 6: Channel Power



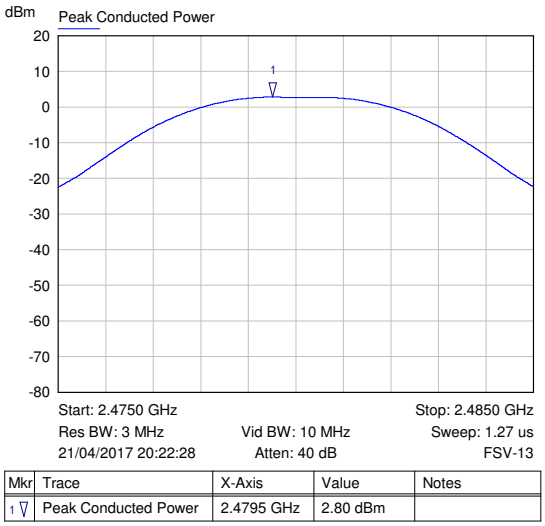
Mkr	Trace	X-Axis	Value	Notes
1	Peak Conducted Power	2.4045 GHz	2.70 dBm	

Ch 11



Mkr	Trace	X-Axis	Value	Notes
1	Peak Conducted Power	2.4445 GHz	2.69 dBm	

Ch 19



Mkr	Trace	X-Axis	Value	Notes
1	Peak Conducted Power	2.4795 GHz	2.80 dBm	

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Figure 3: Peak Conducted Power plots

10 Maximum Power Spectral Density

10.1 Measurement method

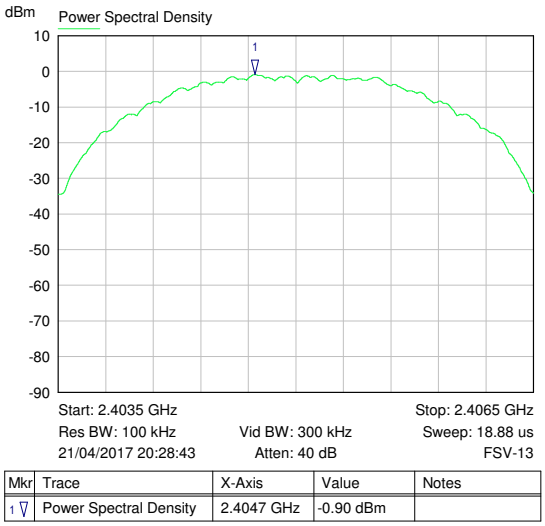
As conducted power was measured as Maximum Peak Conducted Power, measurement was performed in accordance with KDB 558074 section 10.2:

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

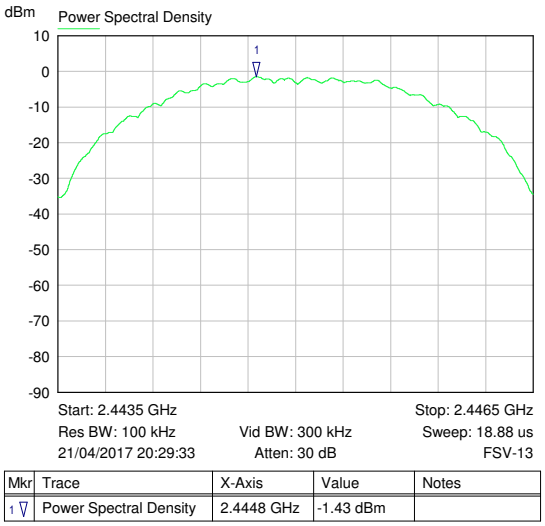
Channel	Peak Marker reading (dBm)	Limit (dBm/3kHz)	Result
11	-0.90	8.0	Pass
19	-1.43	8.0	Pass
26	-1.73	8.0	Pass

Table 7: Spectral Density results



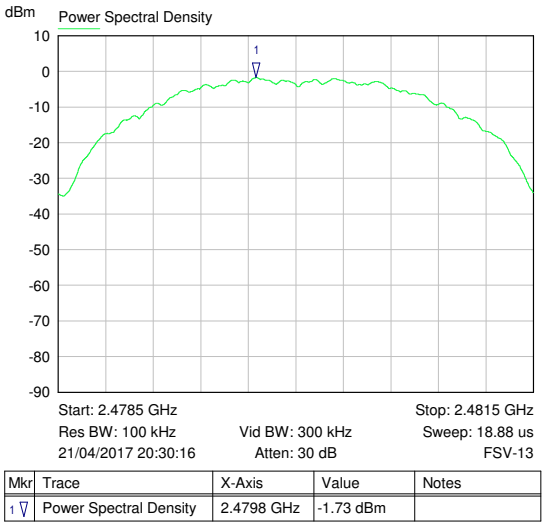
Mkr	Trace	X-Axis	Value	Notes
1	Power Spectral Density	2.4047 GHz	-0.90 dBm	

Ch 11



Mkr	Trace	X-Axis	Value	Notes
1	Power Spectral Density	2.4448 GHz	-1.43 dBm	

Ch 19



Mkr	Trace	X-Axis	Value	Notes
1	Power Spectral Density	2.4798 GHz	-1.73 dBm	

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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 ☐ 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

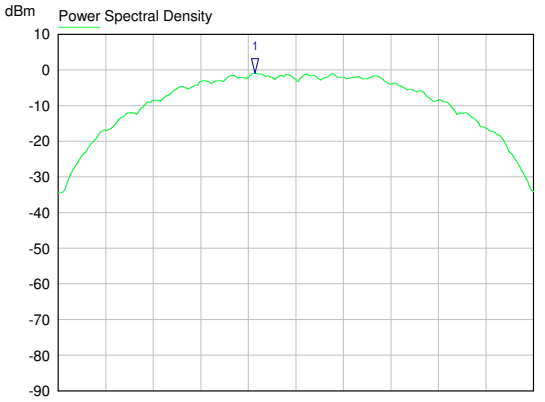
a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ 3 x RBW.
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum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

11.2 Test results

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.

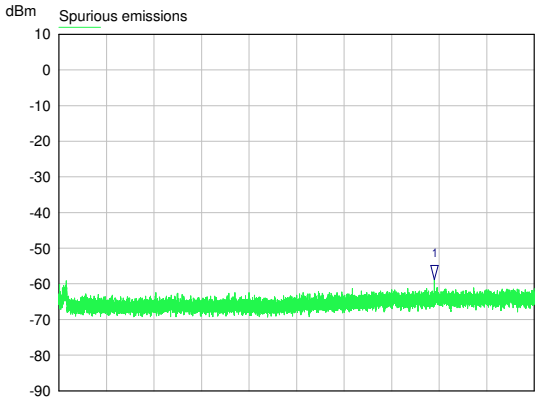
Channel	Maximum Peak level in 100 kHz RBW (dBm)	-20 dBc (dBm)	Maximum emission (dBm)	Result
11	-0.90	-19.10	-45.82	Pass
19	-1.43	-18.57	-51.70	Pass
26	-1.73	-18.27	-39.58	Pass

Table 8: Emissions in non-restricted bands



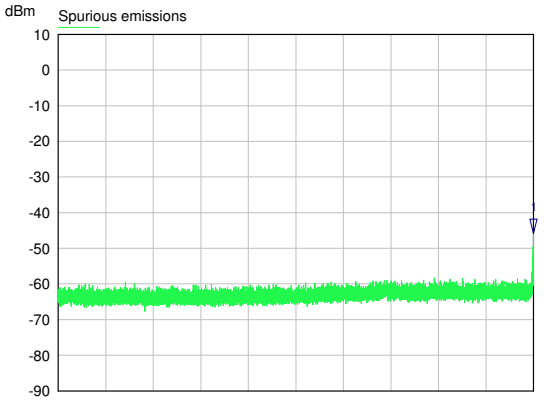
Mkr	Trace	X-Axis	Value	Notes
1	Power Spectral Density	2.4047 GHz	-0.90 dBm	

Ch 11 reference



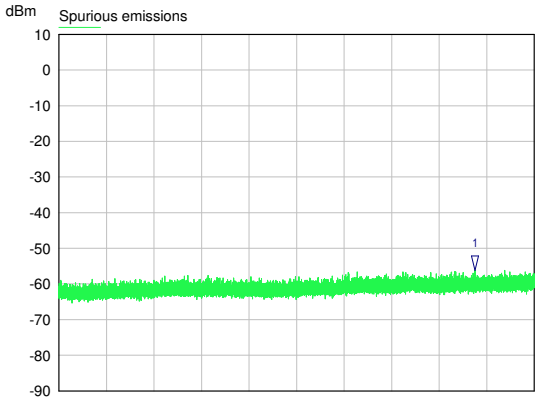
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	792.1928 MHz	-58.79 dBm	

Ch 11: trace 1



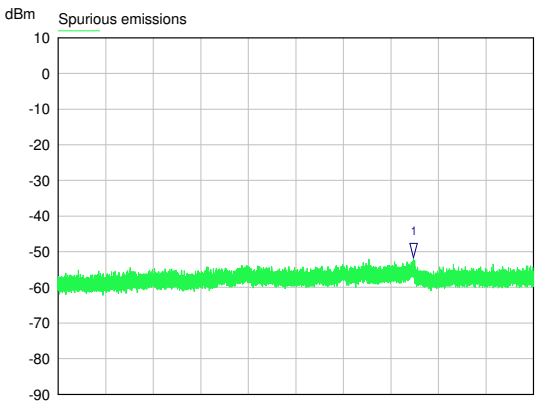
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	2.4000 GHz	-45.82 dBm	

Ch 11: trace 2



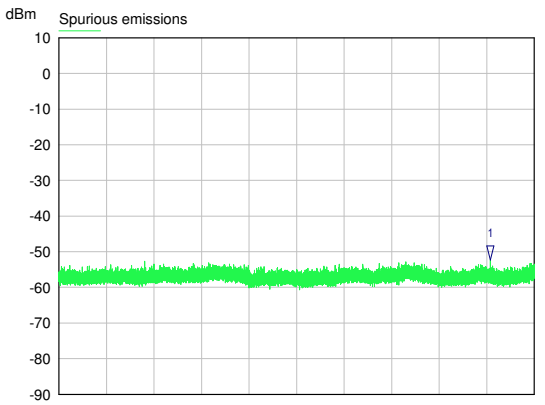
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	3.8102 GHz	-56.19 dBm	

Ch 11: trace 3



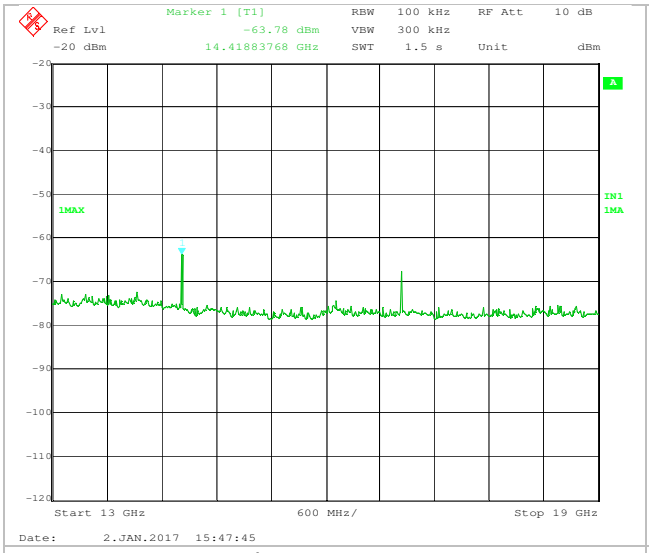
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	6.9911 GHz	-51.64 dBm	

Ch 11: trace 4

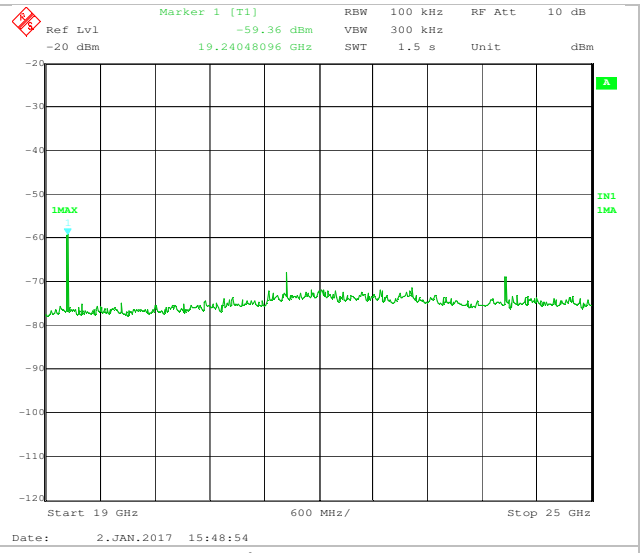


Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	12.5373 GHz	-52.36 dBm	

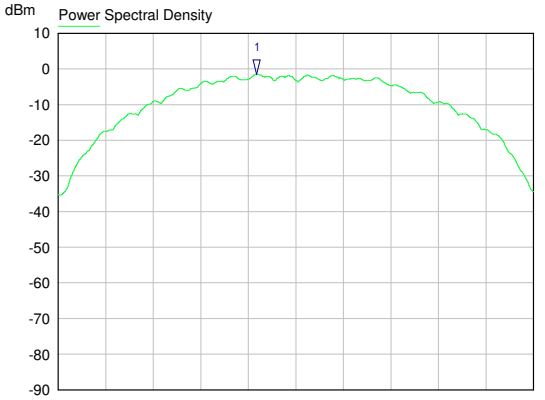
Ch 11: trace 5



Ch 11: trace 6

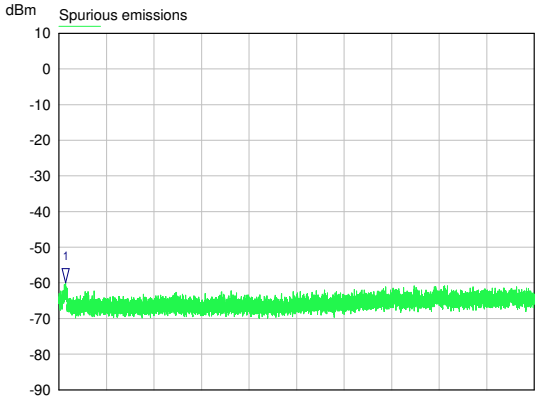


Ch 11: trace 7



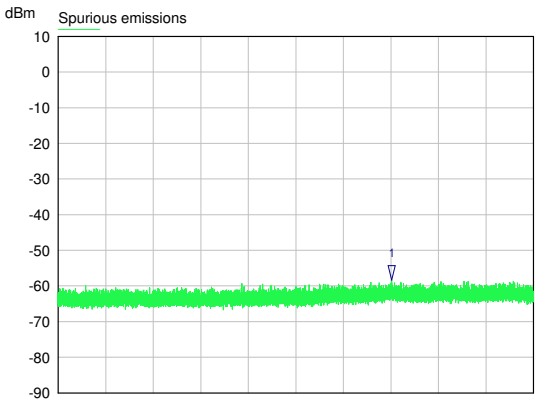
Mkr	Trace	X-Axis	Value	Notes
1	Power Spectral Density	2.4448 GHz	-1.43 dBm	

Ch 19 reference



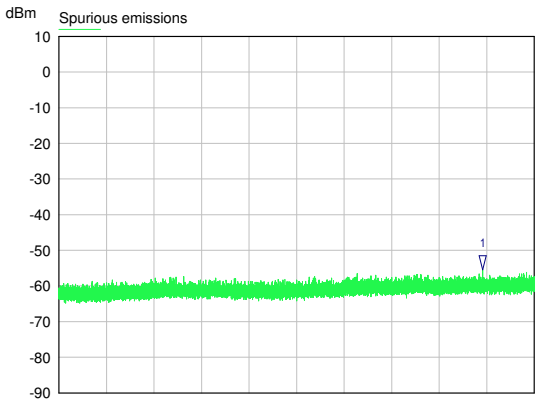
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	23.0866 MHz	-60.02 dBm	

Ch 19: trace 1



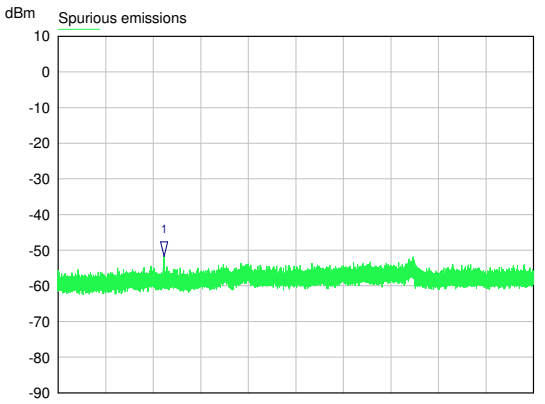
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	1.9814 GHz	-58.35 dBm	

Ch 19: trace 2



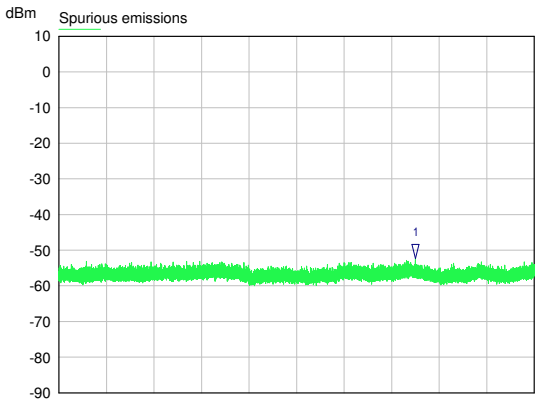
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	3.8357 GHz	-55.46 dBm	

Ch 19: trace 3



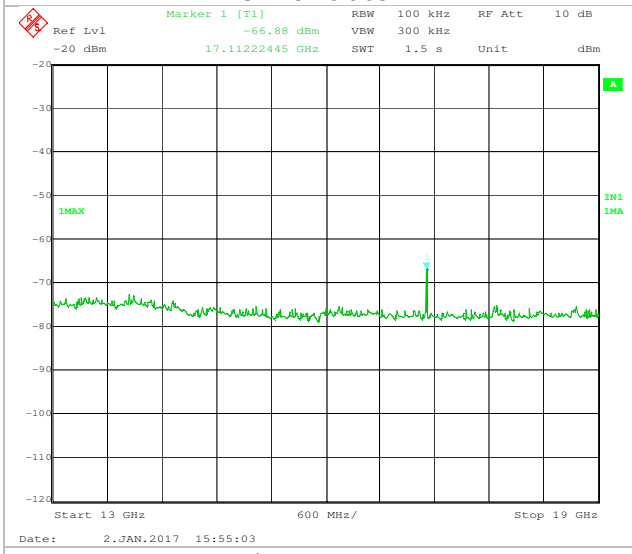
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	4.8910 GHz	-51.70 dBm	

Ch 19: trace 4

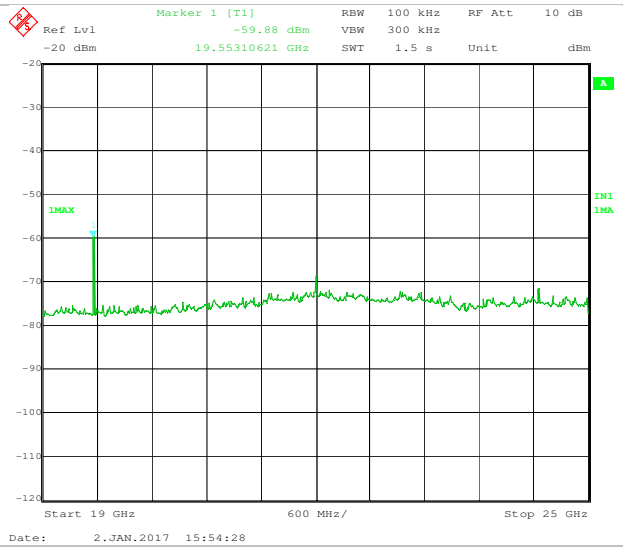


Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	11.7469 GHz	-52.36 dBm	

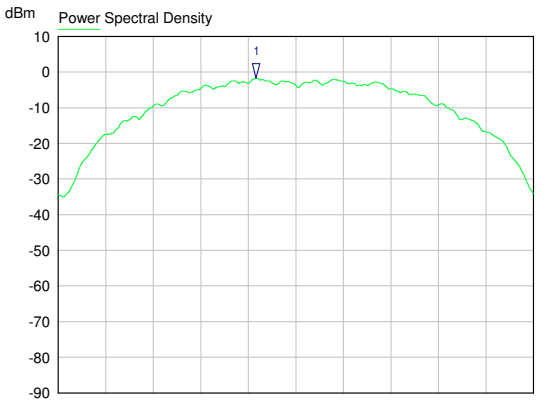
Ch 19: trace 5



Ch 19: trace 6

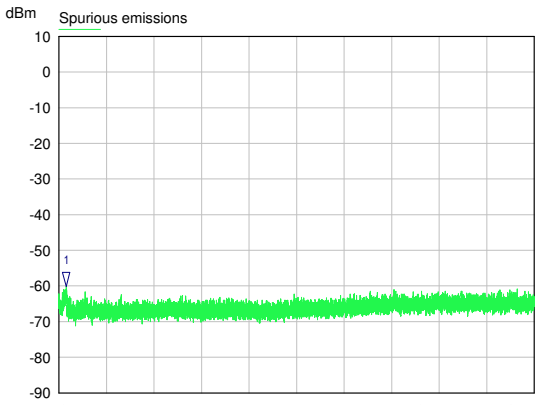


Ch 19: trace 7



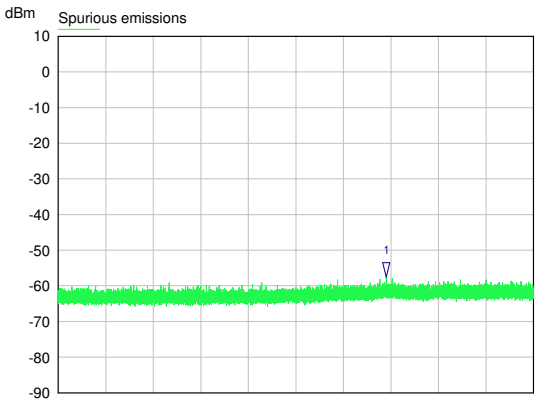
Mkr	Trace	X-Axis	Value	Notes
1	Power Spectral Density	2.4798 GHz	-1.73 dBm	

Ch 26 reference



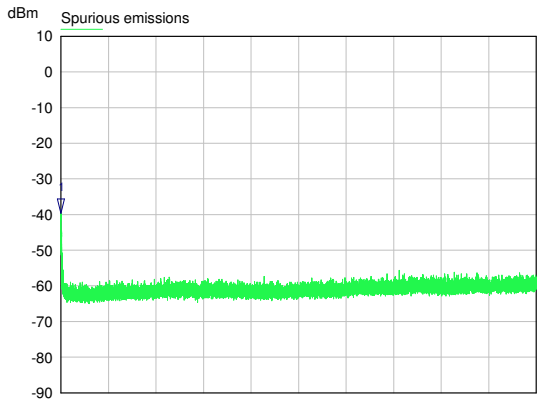
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	25.0666 MHz	-60.20 dBm	

Ch 26: trace 1



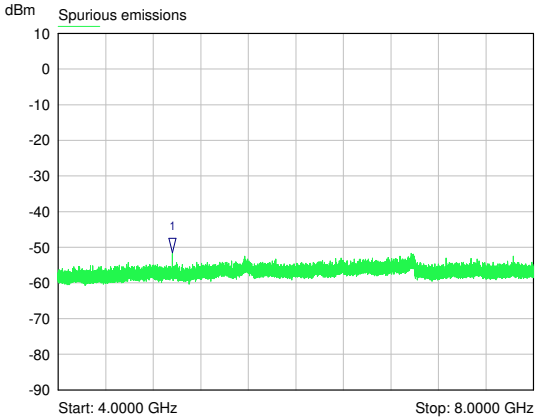
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	1.9657 GHz	-57.55 dBm	

Ch 26: trace 2



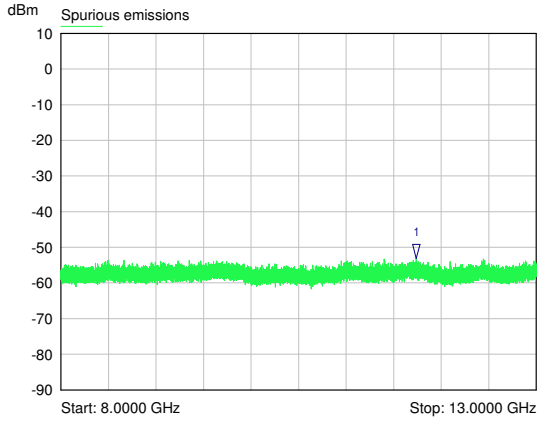
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	2.4839 GHz	-39.58 dBm	

Ch 26: trace 3



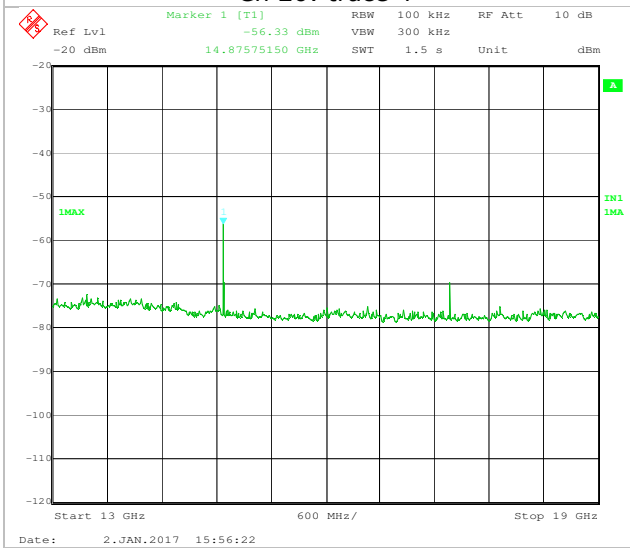
Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	4.9591 GHz	-51.49 dBm	

Ch 26: trace 4

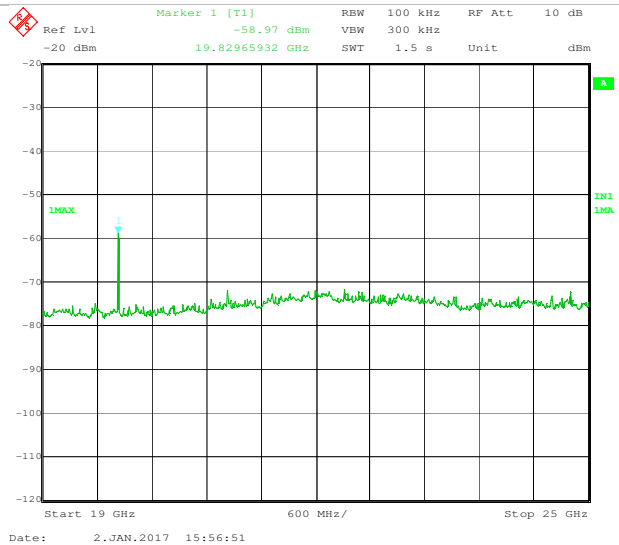


Mkr	Trace	X-Axis	Value	Notes
1	Spurious emissions	11.7388 GHz	-53.22 dBm	

Ch 26: trace 5



Ch 26: trace 6



Ch 26: 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	-57.96
88 – 216 MHz	Quasi-peak	150	43.5	9.54	-2	4.7	-54.44
216-960 MHz	Quasi-peak	200	46.0	9.54	-2	4.7	-51.94
960 – 1000 MHz	Quasi-peak	500	54.0	9.54	-2	4.7	-43.98
> 1 GHz	Average	500	54.0	9.54	-2	0	-39.28
> 1 GHz	Peak	Average + 20dB	74.0	9.54	-2	0	-19.26

Table 9: 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 the peak level exceeds the average limit, Average power measurements are taken in accordance with section 12.2.5.1

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.

Emissions at band-edge were measured using power integration method as detailed in section 13.3.1.

12.1.2 Test results

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

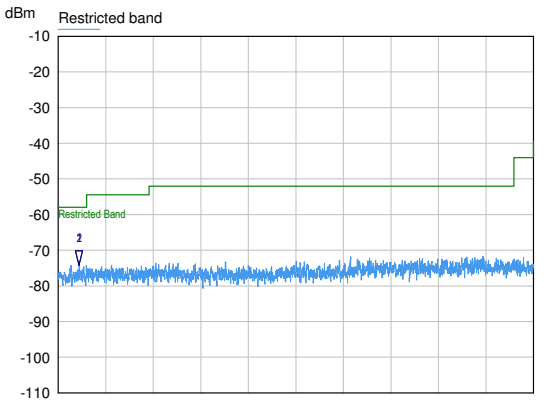
Channel	Frequency (MHz)	Detector	Level (dBm)	Maximum emission relative to peak limit (dB)	Maximum emission relative to average limit (dB)	Result
11	4811.1	Peak	-50.53	-31.25	-11.25	Pass
19	4891.3	Peak	-49.18	-29.90	-9.90	Pass
26	2483.5	Peak	-30.91	-11.63	N/A	Pass
		RMS	-42.01	N/A	2.73[2]	Pass

Table 10: Emissions in restricted bands

Checking compliance for Channel 26 band edge:

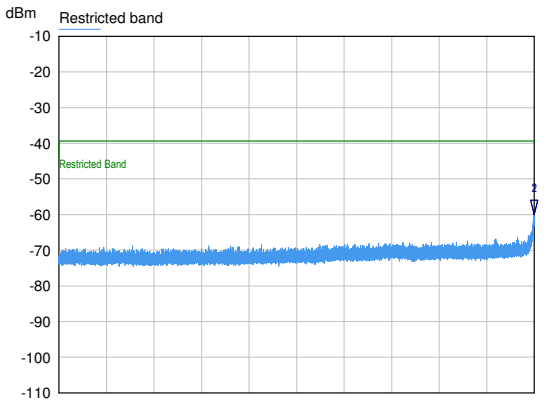
Field strength, E = -42.01 dBm + "-2 dBi" + "0 dB" – 20log(3) + 104.8
E = 51.25 dBµV/m against limit of 54 dBµV/m

[2] RMS ACP measurement



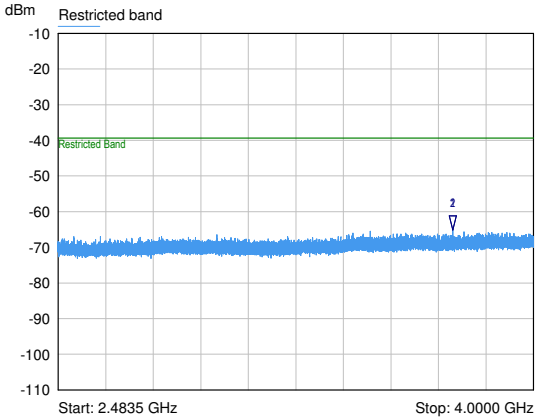
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	72.9528 MHz	-16.28 dBm	Relative to limit
2	Restricted band	72.9528 MHz	-74.24 dBm	Absolute

Ch 11: trace 1: 30 - 1000 MHz



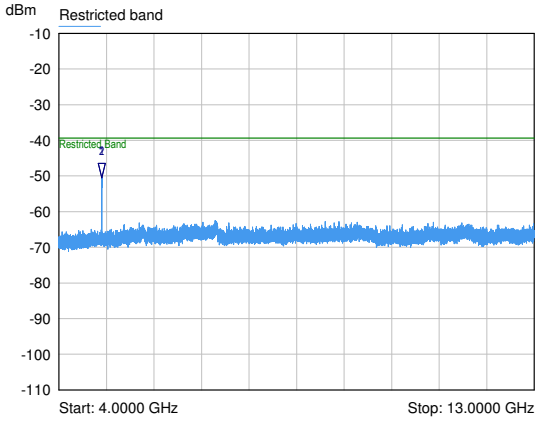
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	2.3897 GHz	-20.77 dBm	Relative to limit
2	Restricted band	2.3897 GHz	-60.05 dBm	Absolute

Ch 11: trace 2; 1000 - 2390 MHz



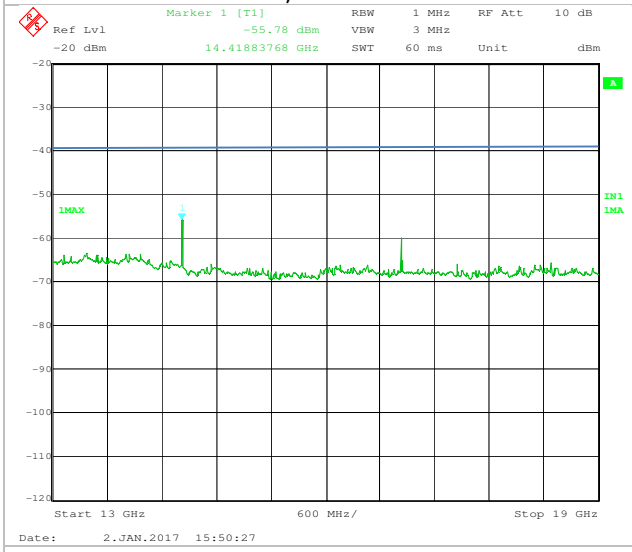
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	3.7416 GHz	-25.90 dBm	Relative to limit
2	Restricted band	3.7416 GHz	-65.18 dBm	Absolute

Ch 11: trace 3; 2483.5 – 4000 MHz

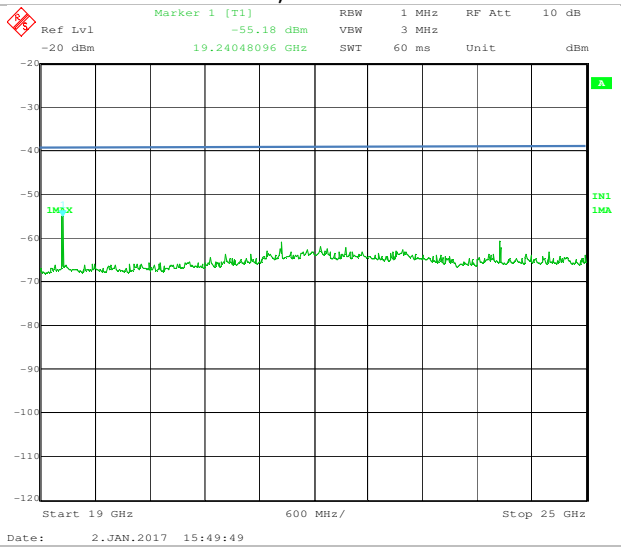


Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	4.8111 GHz	-11.25 dBm	Relative to limit
2	Restricted band	4.8111 GHz	-50.53 dBm	Absolute

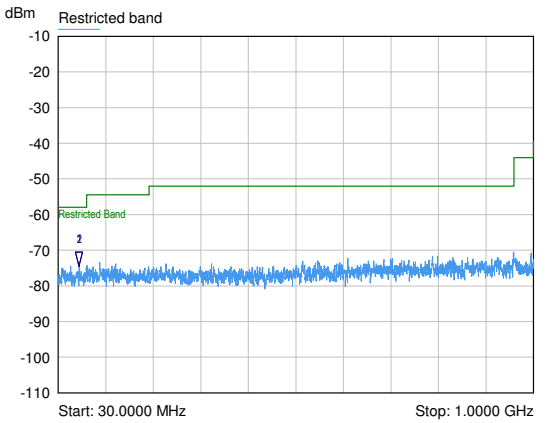
Ch 11: trace 4; 4000 – 13000 MHz



Ch 11: trace 5; 13 – 19 GHz

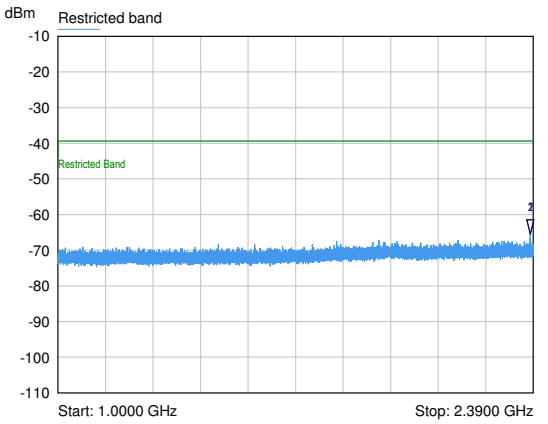


Ch 11: trace 6; 19 – 25 GHz



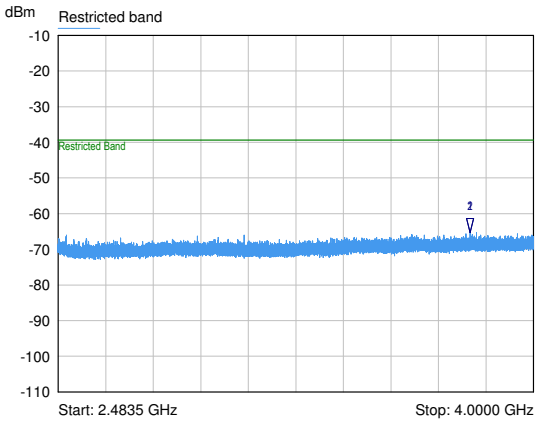
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	72.8619 MHz	-16.50 dBm	Relative to limit
2	Restricted band	72.8619 MHz	-74.46 dBm	Absolute

Ch 19: trace 1: 30 - 1000 MHz



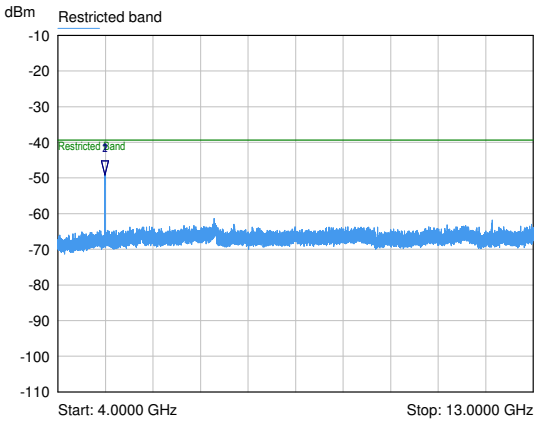
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	2.3817 GHz	-26.20 dBm	Relative to limit
2	Restricted band	2.3817 GHz	-65.48 dBm	Absolute

Ch 19: trace 2; 1000 - 2390 MHz



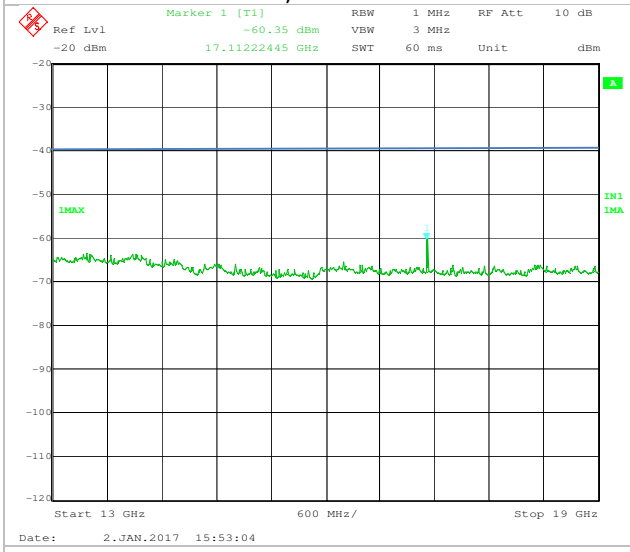
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	3.7964 GHz	-26.02 dBm	Relative to limit
2	Restricted band	3.7964 GHz	-65.30 dBm	Absolute

Ch 19: trace 3; 2483.5 – 4000 MHz

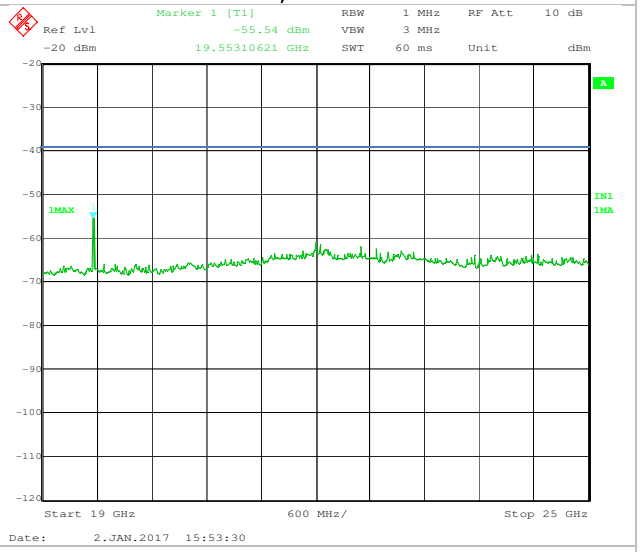


Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	4.8913 GHz	-9.90 dBm	Relative to limit
2	Restricted band	4.8913 GHz	-49.18 dBm	Absolute

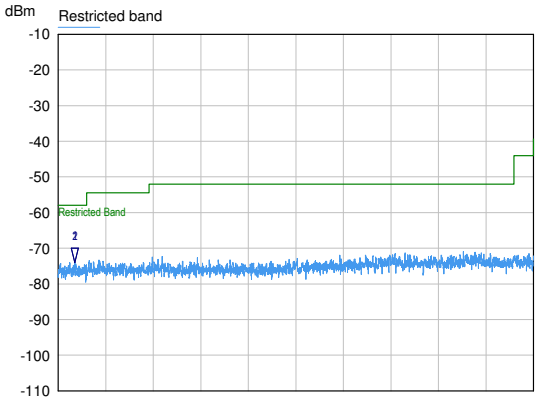
Ch 19: trace 4; 4000 – 13000 MHz



Ch 19: trace 5; 13 – 19 GHz

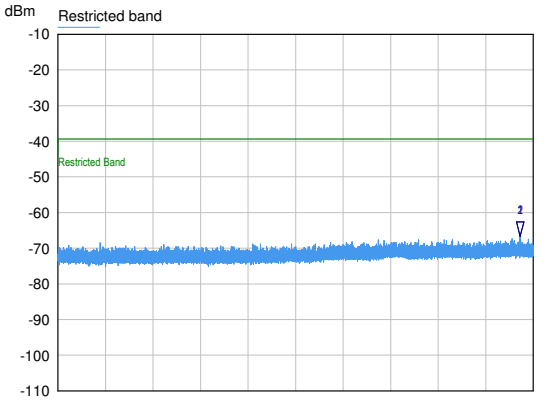


Ch 19: trace 6; 19 – 25 GHz



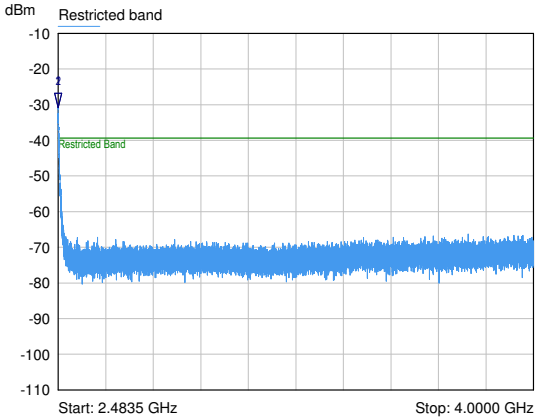
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	63.6772 MHz	-15.99 dBm	Relative to limit
2	Restricted band	63.6772 MHz	-73.95 dBm	Absolute

Ch 26: trace 1; 30 - 1000 MHz



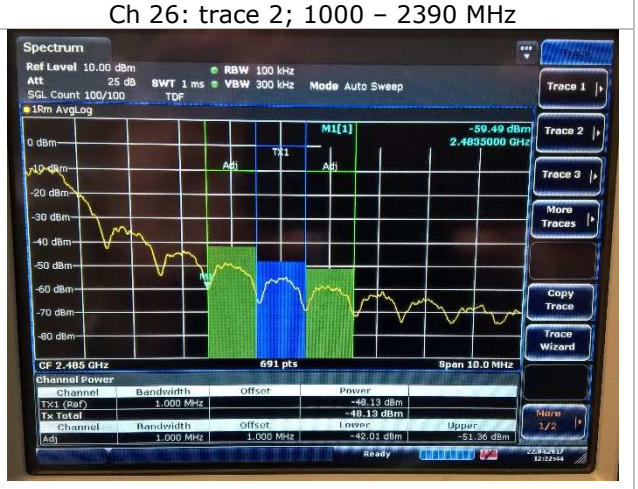
Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	2.3523 GHz	-27.40 dBm	Relative to limit
2	Restricted band	2.3523 GHz	-66.68 dBm	Absolute

Ch 26: trace 2; 1000 – 2390 MHz

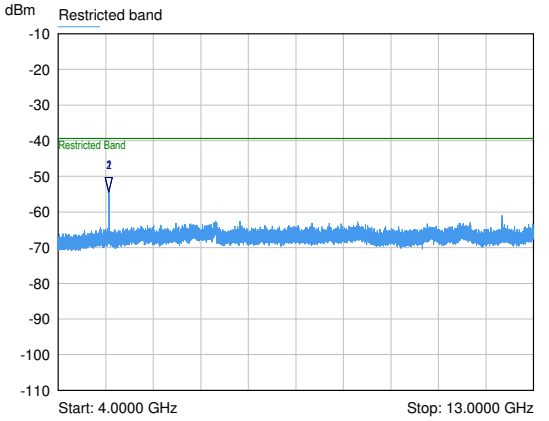


Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	2.4835 GHz	8.37 dBm	Relative to limit
2	Restricted band	2.4835 GHz	-30.91 dBm	Absolute

Ch 26: trace 3; 2483.5 – 2500 MHz

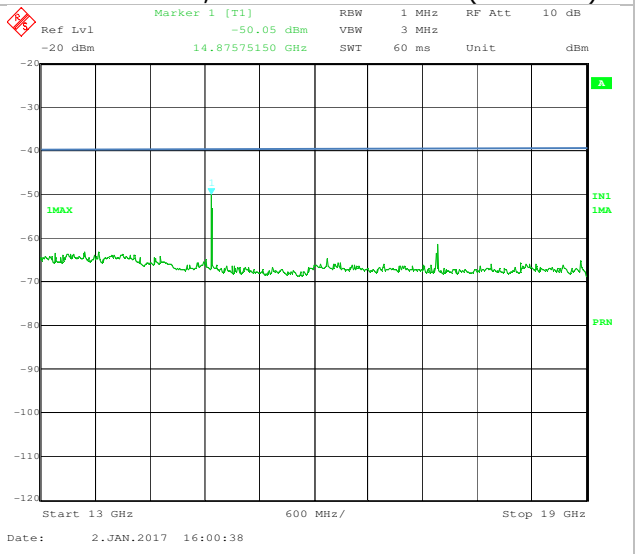


Ch 26: trace 3; 2483.5 – 4000 MHz (RMS ACP)

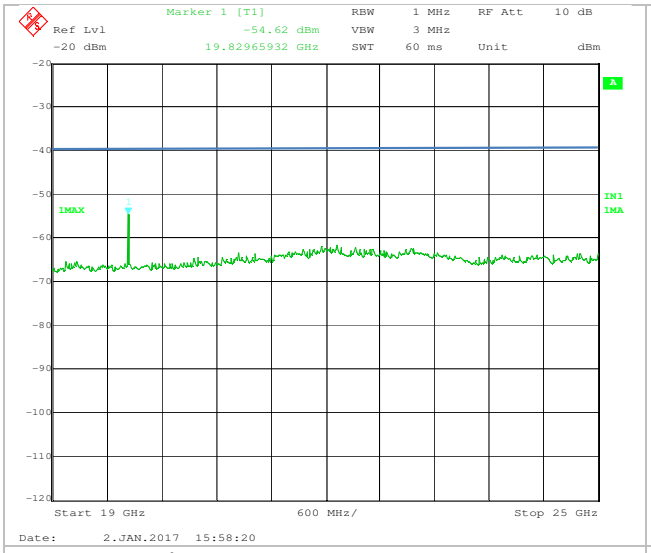


Mkr	Trace	X-Axis	Value	Notes
1	Restricted band	4.9613 GHz	-15.09 dBm	Relative to limit
2	Restricted band	4.9613 GHz	-54.37 dBm	Absolute

Ch 26: trace 4; 2500 – 13000 MHz



Ch 26: trace 5; 13 – 19 GHz



Ch 26: trace 6; 19 – 25 GHz

12.2 Radiated test results for antenna terminated

12.2.1 Measurement method

It is noted that the sensor is professional install and designed to be placed in a specific type of bracket. This bracket may be positioned so that the device is vertical or horizontal and the device was tested in both these orientations.

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

Measurement distance was 3m for emissions 1-18 GHz and 1m for emissions above 18 GHz.

12.2.2 Results

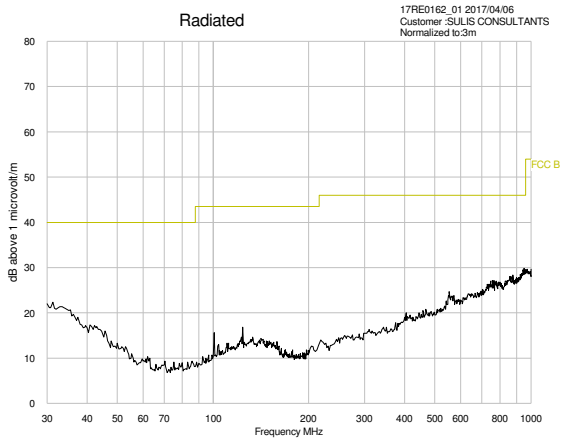
Channel	Frequency (MHz)	EUT orientation	Detector	Level (dBm)	Maximum emission relative to peak limit (dBµV/m)	Maximum emission relative to Quasi-peak (dBµV/m)	Result
11	30-1000 MHz	Horizontal and Vertical	Peak	No emissions within 20 dB of limit			Pass
19	30-1000 MHz	Horizontal and Vertical	Peak	No emissions within 20 dB of limit			Pass
26	30-1000 MHz	Horizontal and Vertical	Peak	No emissions within 20 dB of limit			Pass

Table 11: 30-1000 MHz Restricted Band RSE results with antenna terminated

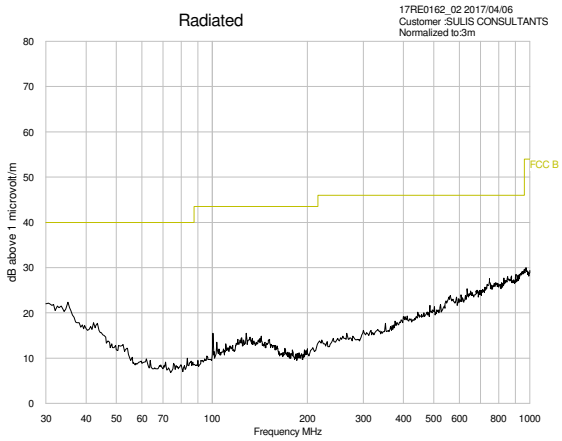
Channel	Frequency (MHz)	EUT orientation	Detector	Level (dBµV/m)	Peak limit (dBµV/m)	Average limit (dBµV/m)	Result
11	2483.5	Vertical and Horizontal	No emissions to measure				Pass
19	2483.5	Vertical and Horizontal	No emissions to measure				Pass
26	2483.5	Vertical	Peak	41.9	74.0	-	Pass
			RMS	29.07	-	54.0	Pass
26	2483.5	Horizontal	Peak	39.13	74.0	-	Pass
			RMS	26.50	-	54.0	Pass
19	12222	Vertical	Peak	57.96	74.0	-	Pass
			RMS	45.36	-	54.0	Pass
11	14430	Vertical	Peak	55.24	74.0	-	Pass
			RMS	42.45	-	54.0	Pass
19	14674	Vertical	Peak	56.02	74.0	-	Pass
			RMS	44.02	-	54.0	Pass
26	14880	Vertical	Peak	59.08	74.0	-	Pass
			RMS	46.10	-	54.0	Pass
11	19234	Horizontal	Peak	50.45	84.0	64.0	Pass
19	19549	Vertical	Peak	51.88	84.0	64.0	Pass
26	19824	Vertical	Peak	51.14	84.0	64.0	Pass

Table 12: 1-25 GHz Restricted Band RSE results with antenna terminated

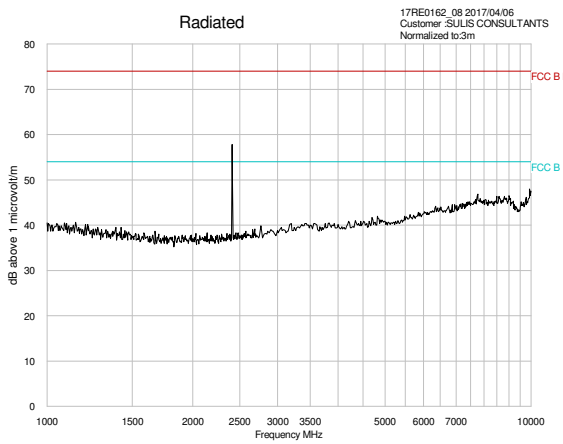
Channel 11



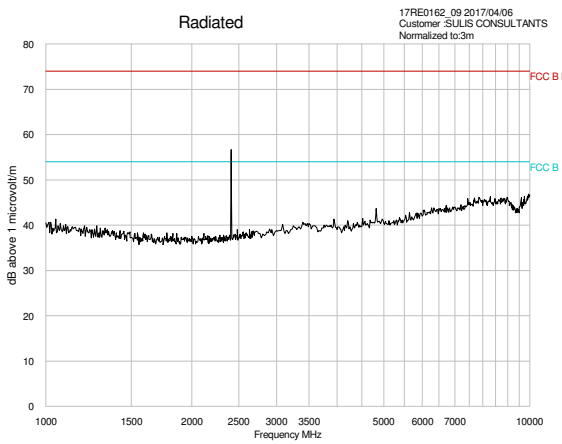
EUT Horizontal



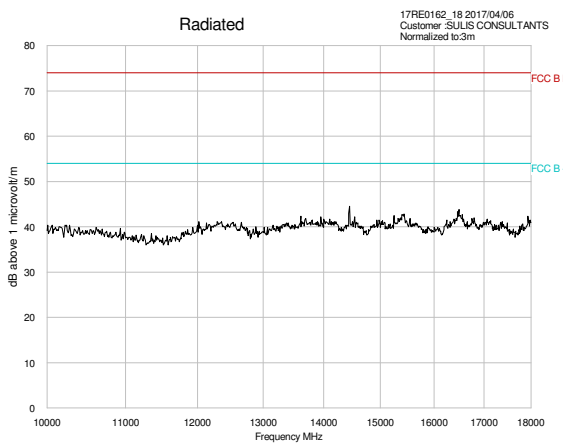
EUT vertical



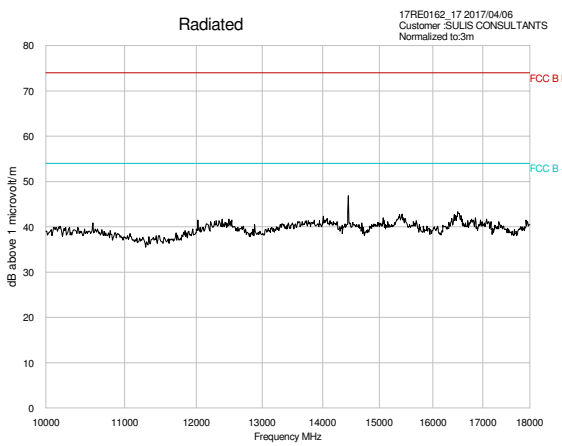
EUT Horizontal



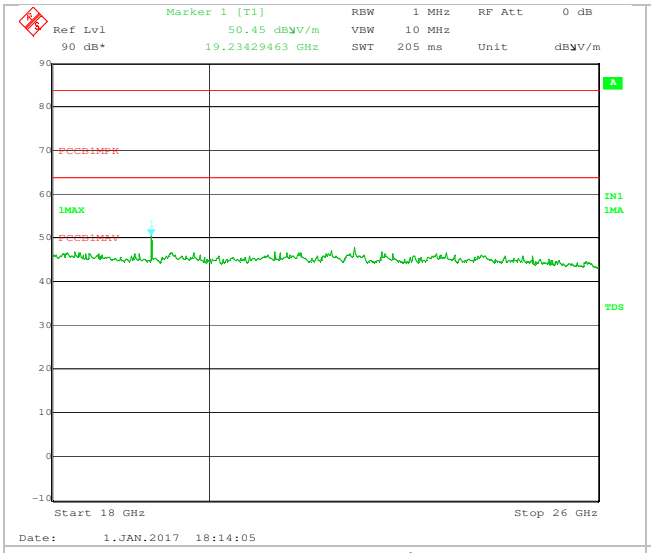
EUT vertical



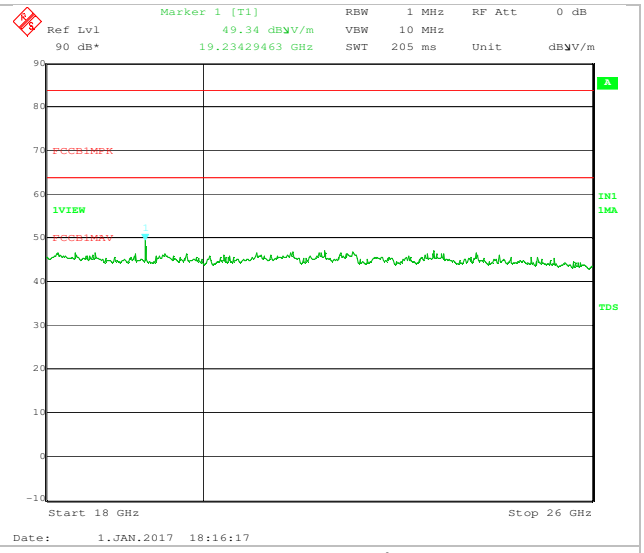
EUT Horizontal



EUT vertical



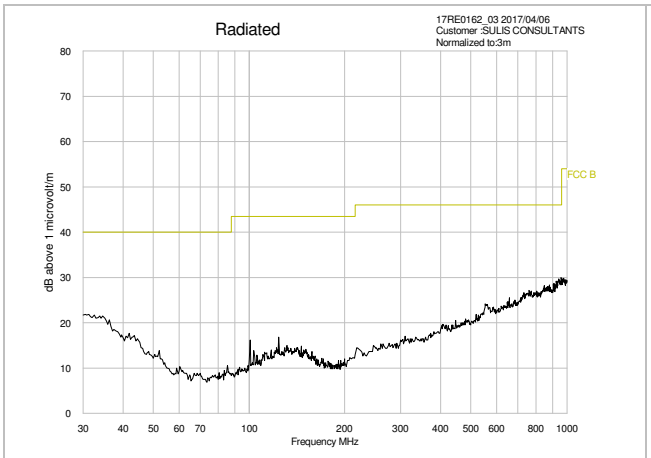
EUT Horizontal



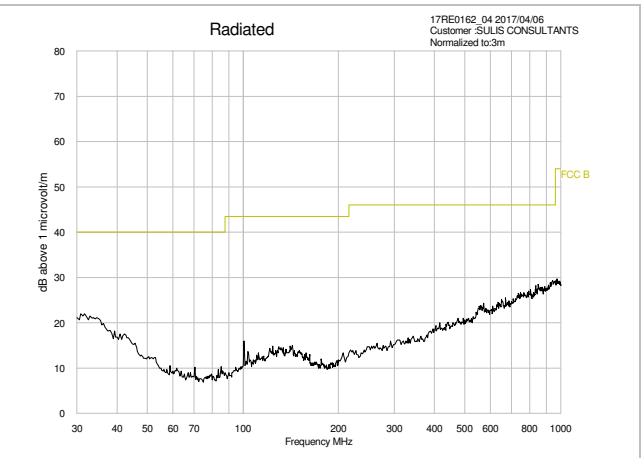
EUT vertical

Figure 6: Radiated Spurious Emissions; Channel 11

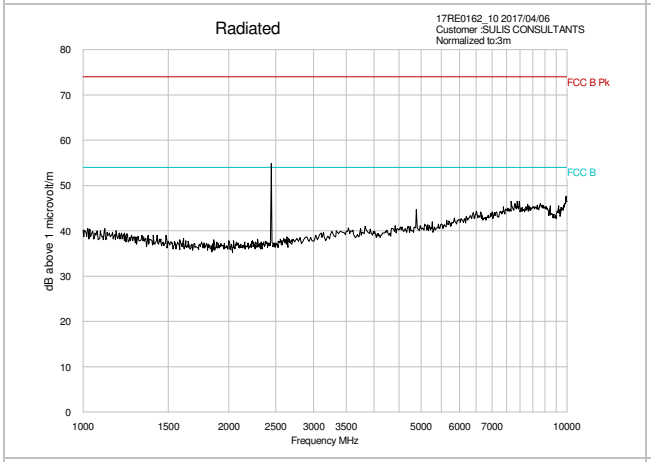
Channel 19



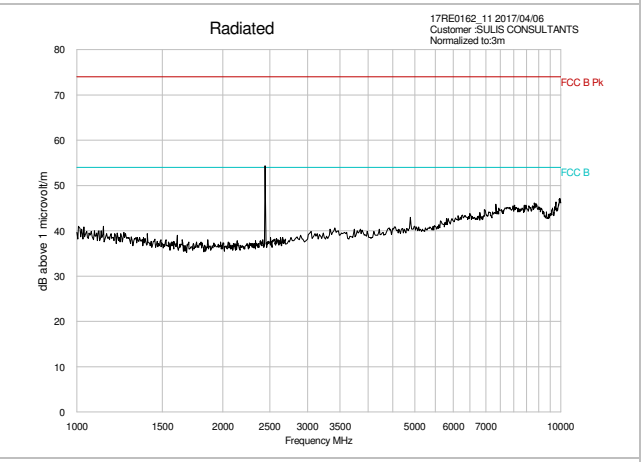
EUT Horizontal



EUT vertical



EUT Horizontal



EUT vertical

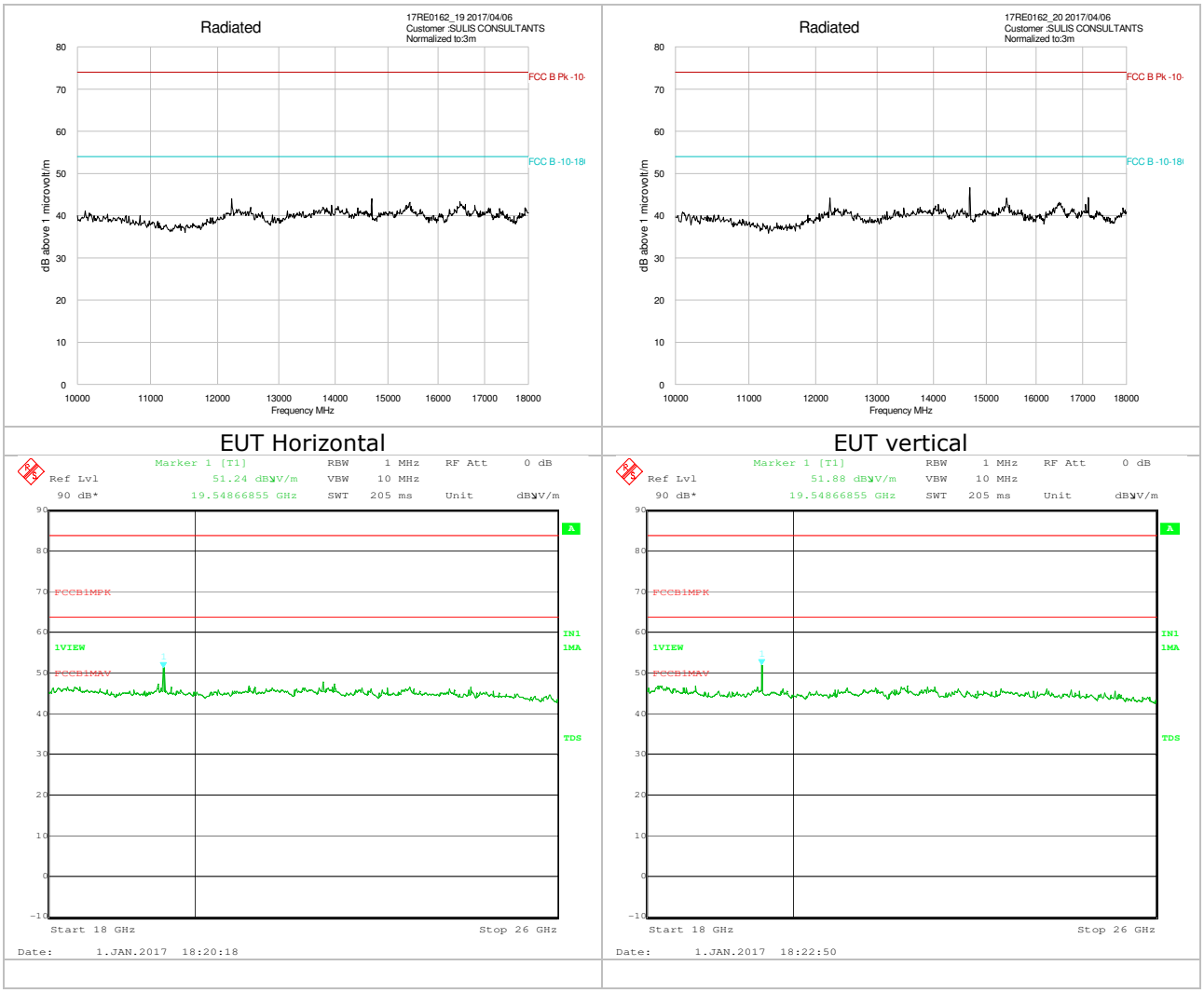
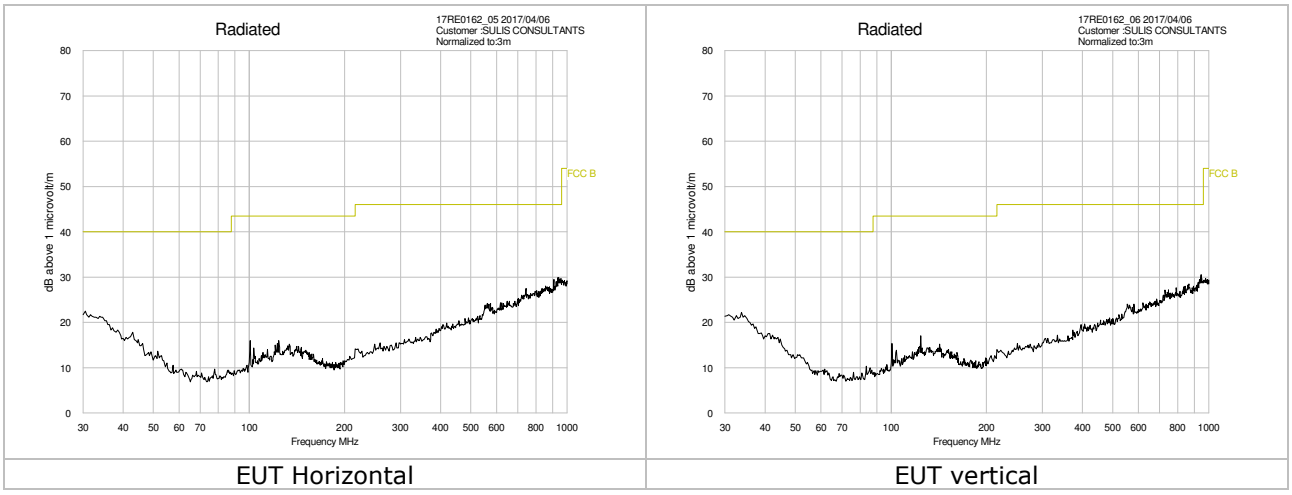


Figure 7: Radiated Spurious Emissions; Channel 19

Channel 26



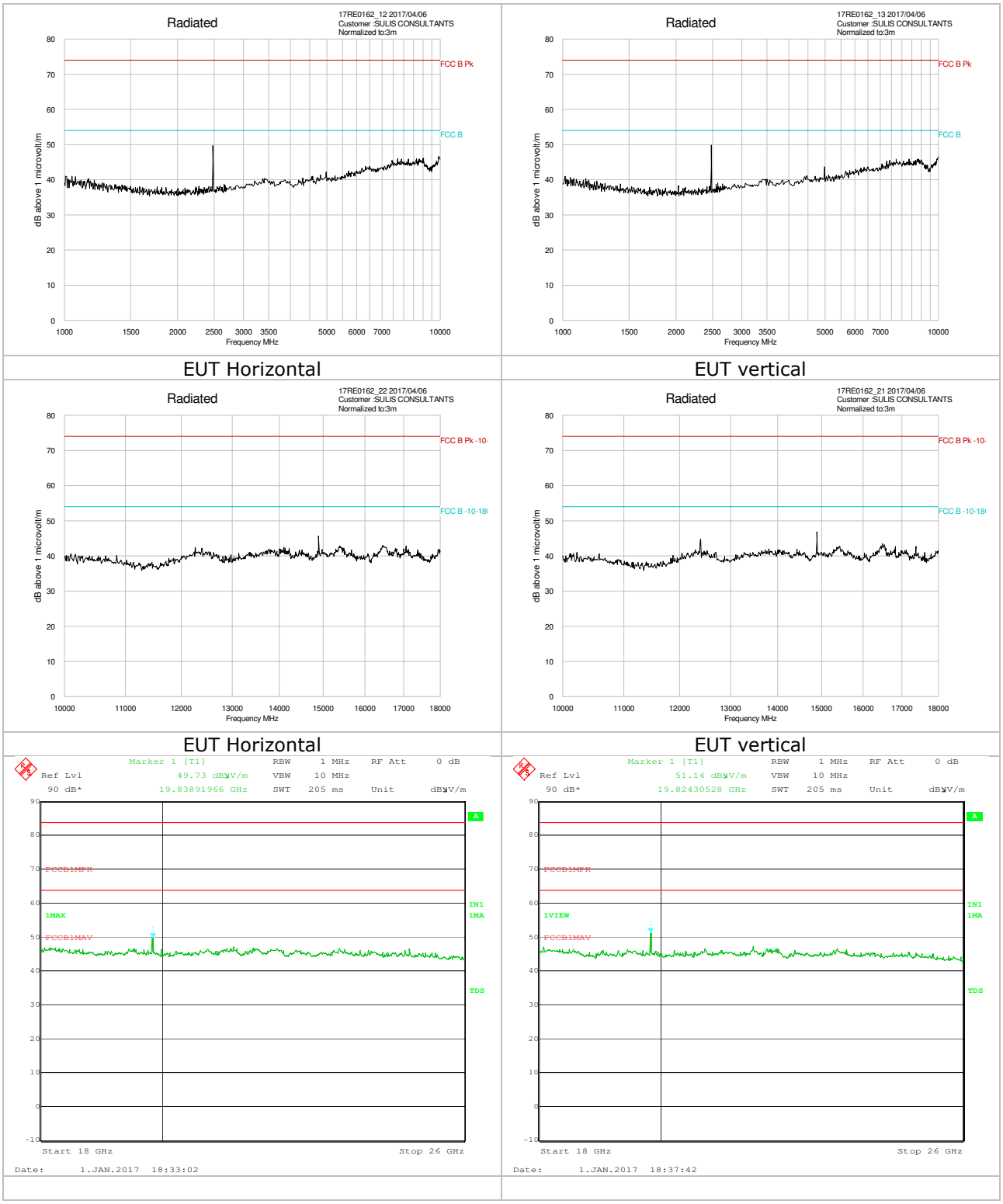


Figure 8: Radiated Spurious Emissions; Channel 26

13 Occupied bandwidth

The 99% occupied bandwidth was measured using the inbuilt function in the analyser

Channel	Occupied Bandwidth (MHz)	Requirement	Result
11	2.320	None	For information
19	2.340	None	For information
26	2.330	None	For information

Table 13: Occupied Bandwidth

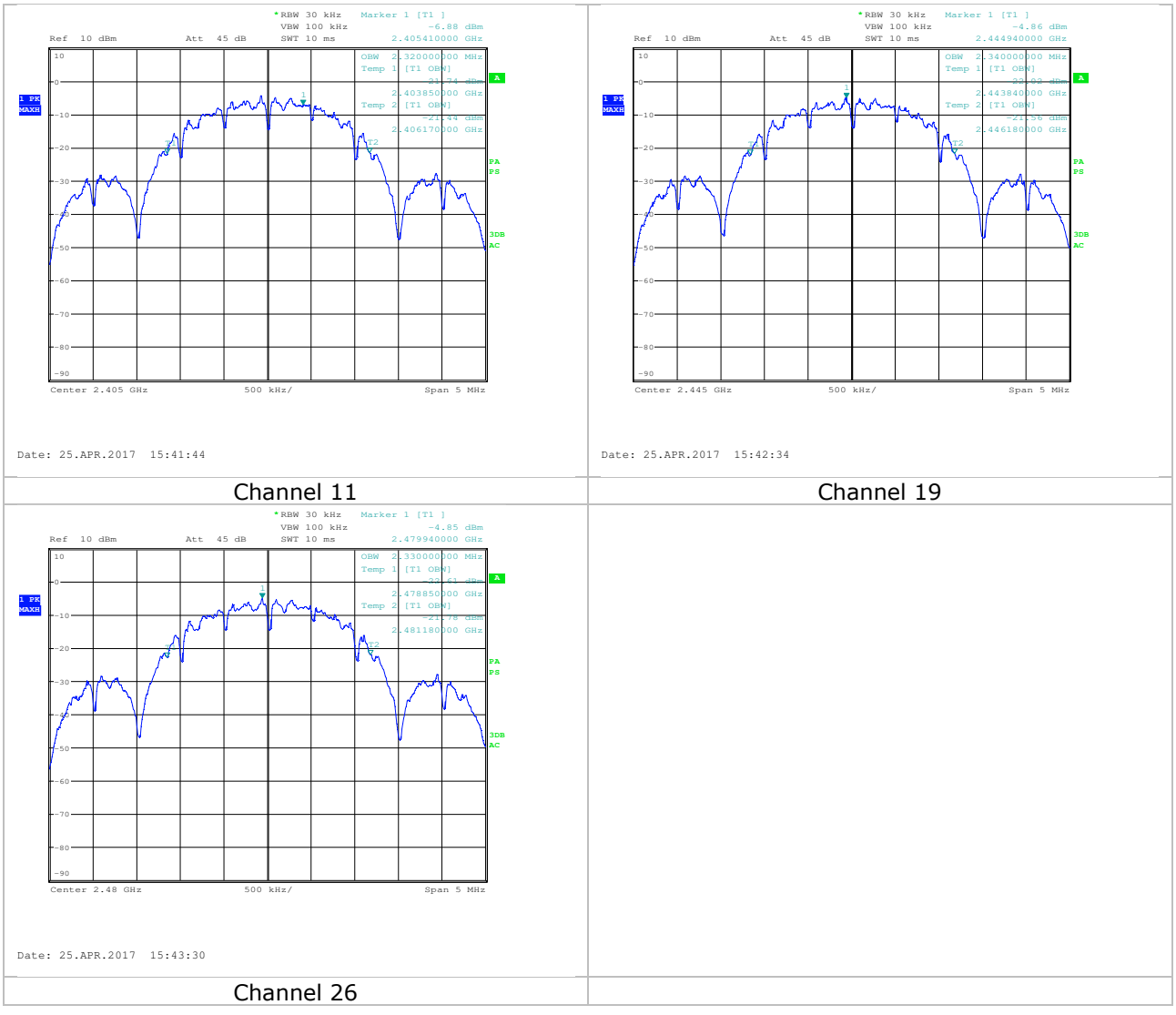


Figure 9: Occupied Bandwidth

14 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 14: Test Equipment