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RF Test Report:

Airspan AirSynergy 4.9 GHz

FCC ID:O2J-495AS

SC_TR_86_B

Prepared for:
Airspan Communications Ltd
Capital Point,
33 Bath Road
Slough,
Berkshire
SL1 3UF

Sulis Consultants Limited
Mead House, Longwater Road, Eversley, Hampshire, RG27 0NW, UK
Registered in England & Wales, number 05466247
http://www.sulisconsultants.com

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1 Revision History

Revision	Originator	Date	Comment
A	C Blackham	06 June 2013	1st release
B	C Blackham	12 June 2013	Corrected decimal point error in table 7

2 Purpose

This document details the Airspan AirSynergy base station, model number SYN-3N-00-0A49-000, designed for operation in the 4940-4990 MHz band.

3 Reference Documents

[Ref 1]	47CFR2	Title 47 Code of Federal Regulations Part 2: frequency allocations and radio treaty matters; general rules and regulations
[Ref 2]	47 CRF90	Title 47 Code of Federal Regulations Part 90: Private land mobile radio services
[Ref 3]	TIA-603-C	Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards
[Ref 4]	KDB 662911 D01 v01r02	Federal Communications Commission Office of Engineering and Technology Laboratory Division; Emissions Testing of Transmitters with Multiple Outputs in the Same Band (e.g., MIMO, Smart Antenna, etc)

4 Test Information

4.1 Client

Airspan Communications Ltd
Capital Point,
33 Bath Road
Slough,
SL1 3UF
UK

4.2 Test personnel

Testing was performed by Charlie Blackham of Sulis Consultants Ltd.
All tests were performed at Airspan Communications offices with the exception of Conducted Spurious Emissions above 26 GHz which were performed by UL VS Ltd, Basingstoke.

4.3 Test sample

The results herein only refer to sample detailed in section 6

5 Product Description

The Airsynergy unit supports operation with 10 MHz bandwidths, comprising 1024 subcarriers. Each of these subcarriers can be modulated in a number of modes:

- BPSK ½
- QPSK ½ and ¾
- 16 QAM ½ and ¾
- 64 QAM ½ and ¾
- 256 QAM 5/6

Based on pre-testing, the following modulation schemes will be used during testing:

- 256 QAM 5/6

The unit is fitted with two RF transceiver RF ports, RF-1 and RF-3. These support MIMO operation and are connected to a variety of external cross-polarised sectored antennas having gains of up to 18.0 dBi.

6 Test Configuration

6.1 Test sample and Operating mode

The equipment under test (EUT) was:

Manufacturer	Name	Model Number	Serial Number
Airspan	AirSynergy	SYN-3N-00-0A49-000	6BEAD5FFEFA8

Table 1: Equipment under test

6.2 Support equipment

The support equipment was:

Description	Manufacturer	Name	Serial Number
Laptop	Dell	Latitude	Airspan 005837
Mains – 48 V PSU	Powerbox	PBUS-LUV-54V/100W-SN-QNA	P1131CV022587

Table 2: Support Equipment

6.3 Test equipment

Description	Manufacturer	Name	Serial Number	Calibration certificate
Receiver	Rohde & Schwarz	FSQ 26	200022	R&S 10-300266685 05 Mar 2013
Signal Generator	Rohde & Schwarz	SMB100A03	175535	R&S 20-400919 16 Dec 2012
Attenator	Inmet	18N10W-10dB	N/A	Calibrated in-situ and loaded as Transducer Factor
RF cable	Sucoflex	104	5884/4	
Spectrum[1] Analyser	HP	8564E	3442A00262	Agilent 1-5074020836-1 26-Apr-2013
Cable[1]	Rosenberger	Micro-coax	C1364	1.7dBm @ 40 GHz

Table 3: Test Equipment

[1] CSE 26-40 GHz only. Equipment provided by UL VS Ltd. Cable and attenuator calibrated by them.

6.4 Equipment set-up

Equipment was configured as per figure 1:

- A "putty" sessions running on the laptop allows the Airsynergy unit to be controlled and set to required frequency, bandwidth, modulation and power.
- The insertion loss of the Attenuator and Co-ax cable were measured using a Signal Generator and the FSQ and their combined path-loss was programmed into the FSQ as a Transducer Factor.

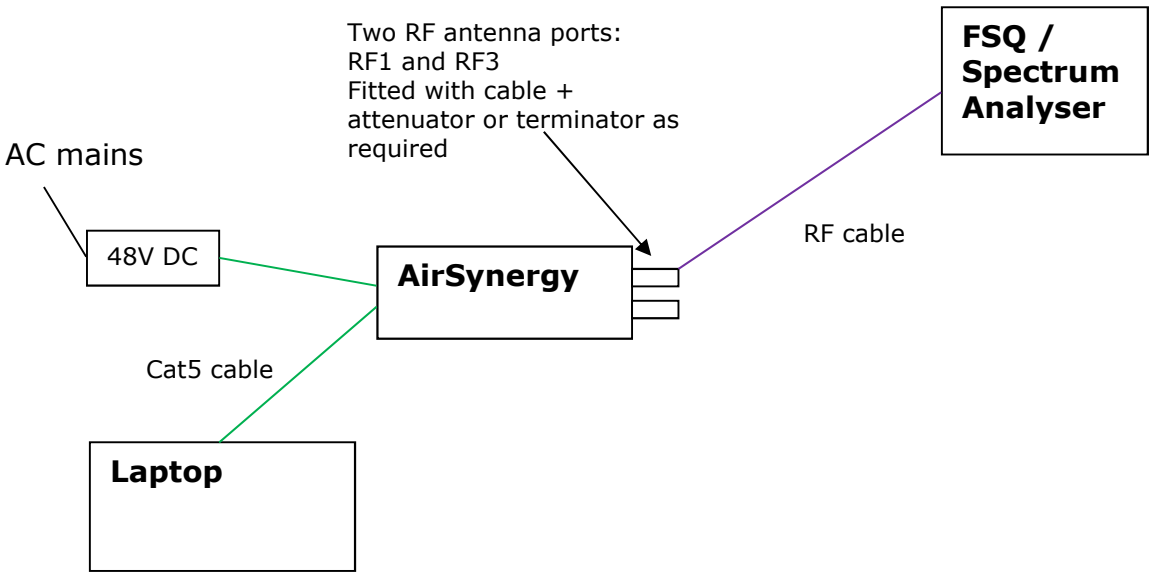


Figure 1: Airsynergy configuration for test

7 Summary of Tests performed

Test	47 CFR Part	Limit	Result	Section
Transmit Power	90.1215 / 2.1046	30 dBm	Pass	8
Spectral Power Density	90.1215 / 2.1046	21 dBm/MHz	Pass	9
Occupied Bandwidth	90.210(m) / 2.1049	None	Pass	10
Conducted Emissions masks	90.210(m) / 2.1051	As per mask	Pass	11
Conducted Spurious Emissions (out of band)	90.210(m) / 2.1051	-25 dBm	Pass	12
Radiated Spurious Emissions	90.210(m) / 2.1053	Results detailed in separate report		
Peak Excursion	90.1215(e)	13 dB	Pass	13
Frequency Stability	90.213(a) / 2.1055	Results detailed in separate report		

Table 4: Summary of tests performed

8 Transmit Power 47CFR90.1215

8.1 Requirement and test method

§ 90.1215 Power limits.

The transmitting power of stations operating in the 4940-4990 MHz band must not exceed the maximum limits in this section.

(a)(1) The maximum conducted output power should not exceed:

Channel bandwidth (MHz)	Low power maximum conducted output power (dBm)	High power maximum conducted output power (dBm)
1	7	20
5	14	27
10	17	30
15	18.8	31.8
20	20	33

The equipment was configured as per figure 1 and the measurements were made conducted using the RMS detector of the FSQ which was gated to only perform measurement during the ON time of the transmitter. The following spectrum analyser settings were used:

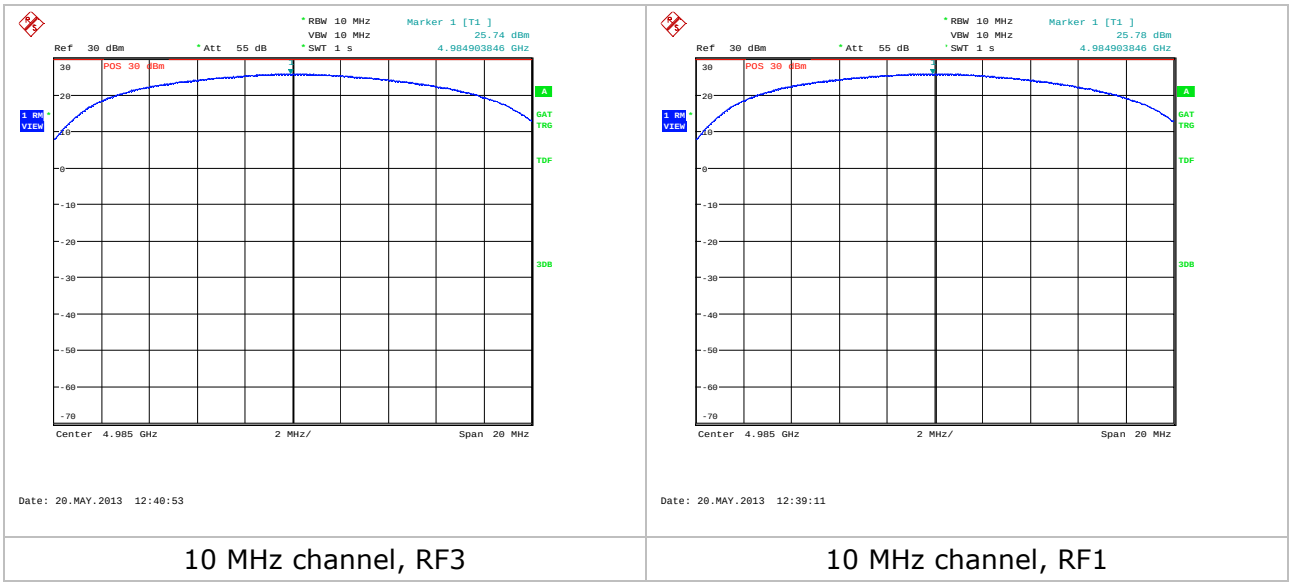
- RBW of 10 MHz and VBW of 10 MHz

The total power was summed in accordance with KDB662911D01 and the result compared against the limit.

8.2 Test results

Channel Bandwidth	TX Freq (MHz)	Port	TX power (dBm)	Summed TX power (dBm)	TX power limit (dBm)	Result
10	4985.0	RF3	25.74	28.77	30.0	Pass
		RF1	25.78			

Table 5: Transmit power



10 MHz channel, RF3	10 MHz channel, RF1

Figure 2: Transmit Power plots

9 Spectral Power Density

9.1 Requirement and test method

§ 90.1215 Power limits.

(2) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. . . . . However, high power point-to-point and point-to-multipoint operations (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the maximum conducted output power or spectral density

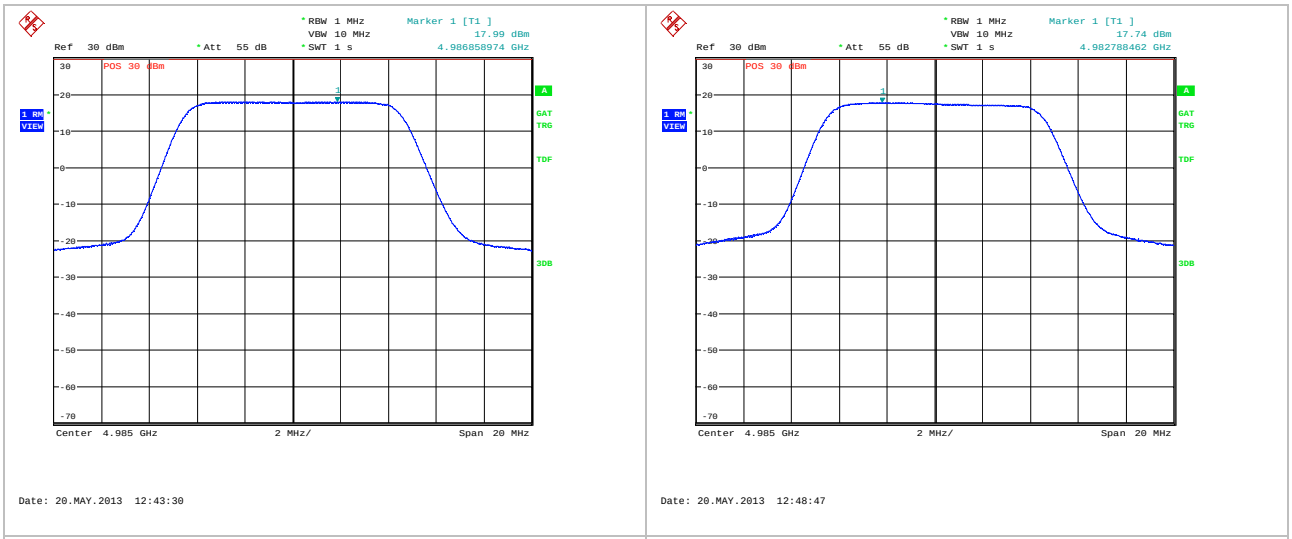
The equipment was configured as per figure 1 and the measurements were made conducted using the RMS detector of the FSQ which was gated to only perform measurement during the ON time of the transmitter. The following spectrum analyser settings were used: RBW of 1 MHz and VBW of 10 MHz.

The total power was summed in accordance with KDB662911D01 and the result compared against the limit.

9.2 Test results

Channel Bandwidth	TX Freq (MHz)	Port	TX power (dBm)	Summed TX power (dBm)	TX power limit (dBm)	Result
10	4985.0	RF3	17.99	20.88	21.0	Pass
		RF1	17.74			

Table 6: Transmit power spectral density



10 MHz channel, RF3	10 MHz channel, RF1

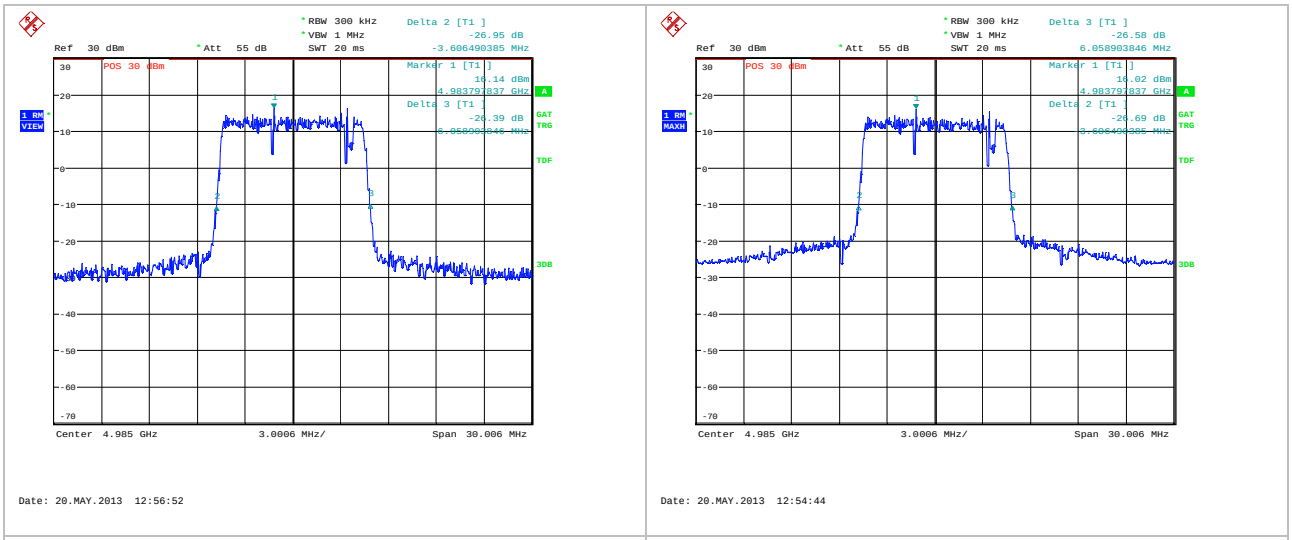
Figure 3: Transmit power spectral density plots

10 Occupied Bandwidth

The occupied bandwidth was measured using the inbuilt function on the FSQ set to measure the 99.5% (-26 dB) emission bandwidth. Measurement was made using peak detector and max hold. There is no pass/fail criterion so measurement results are reported without reference to a limit.

Channel Bandwidth	TX Freq (MHz)	Port	Occupied Bandwidth (MHz)
10	4985.0	RF3	9.665
		RF1	9.665

Table 7: Occupied Bandwidth test results



10 MHz channel, RF3	10 MHz channel, RF1

Figure 4: Occupied Bandwidth plots

11 Conducted Emissions Mask

11.1 Requirement and test method

90.210(m) *Emission Mask M.* For high power transmitters (greater than 20 dBm) operating in the 4940-4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0-45% of the authorized bandwidth (BW): 0 dB.

(2) On any frequency removed from the assigned frequency between 45-50% of the authorized bandwidth: 568 log (% of (BW)/45) dB.

(3) On any frequency removed from the assigned frequency between 50-55% of the authorized bandwidth: 26 + 145 log (% of BW/50) dB.

(4) On any frequency removed from the assigned frequency between 55-100% of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB.

(5) On any frequency removed from the assigned frequency between 100-150% of the authorized bandwidth: 40 + 57 log (% of (BW)/100) dB.

(6) On any frequency removed from the assigned frequency between above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

This test was performed at top and bottom of the band. The equipment was configured as per figure 1 and the measurements made gated using the RMS detector of the FSQ.

Note: the following method was used to ensure that mask was sat on the emission and that mask was clearly visible:

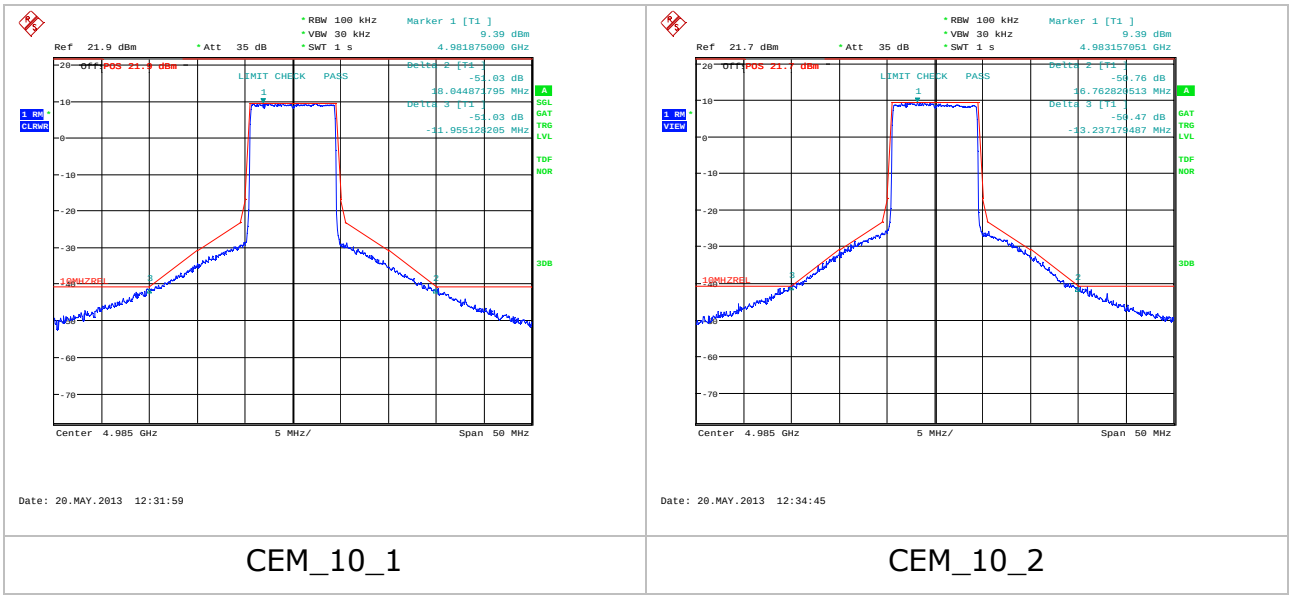
- Mask was set-up using relative values for x-axis (frequency) and absolute values for y-axis (power), referencing 9.4dBm/100 kHz (10MHz channels) as the "0dB" power.
- Emissions plot was taken, highest power determined using MKR→Peak function.
- Ref-Level offset tweaked until the mask sat on the marker
- Compliance checked automatically using in-built mask-compliance function.

Note: These plots were created using a limit of -50dBc for emissions greater than 150% authorised bandwidth which is more stringent than the "55 + 10 log (P) dB" attenuation option, but that could not be created using relative mask. Emissions further away from carrier and reported in section 12 as "Conducted Spurious Emissions" were measured against the "55 + 10 log (P) dB" derived limit.

11.2 Results

Channel Bandwidth	TX Freq (MHz)	Port	Plot	Result
10	4985.0	RF3	CEM_10_1	Pass
		RF1	CEM_10_2	Pass

Table 8: Conducted Emissions masks results



CEM_10_1	CEM_10_2

Figure 5: Conducted Emissions masks plots

12 Conducted Spurious Emissions

12.1 Requirement and test method

The requirement is contained within item 6 of paragraph 90.210(m):

> (6) On any frequency removed from the assigned frequency between above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

Testing will therefore be performed to within:

- ± 15.0 MHz for 10 MHz channels resulting in test being performed 30-4,970 and 5,000-50,000 MHz.

Determining the limit:

- Peak emission levels for conducted emissions masks as determined in section 11 is 9.39dBm (8.69 mW) for 10 MHz channels
- Spurious Emission limit is given by:

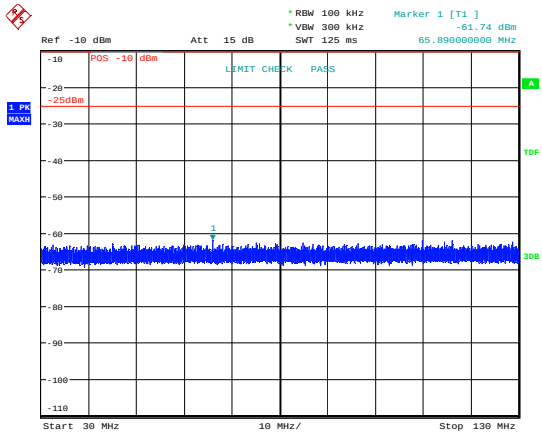
Limit = 9.39 dBm – (55 + 10*log(0.008669))
= 9.39 – 34.38
= -25.0 dBm

Initial scan was performed on top channel using peak detector and max-hold on port RF-3 which had the highest transmit power.

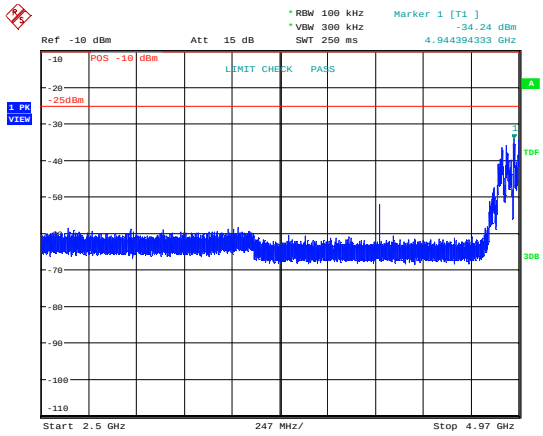
As no emissions or harmonics of note were found, determination of total spurious emission for comparing with limit line was done by adding 10 log (2), or 3dB to the emission level measured on port RF-3.

Frequency Range	Maximum emission (Measured)	Maximum emission (calculated)	Limit (dBm)	Result	Plot (Figure 6 unless stated)
30-2,500	-61.74	-58.74	-25.0	Pass	CSE-1
2,500-4,570	-34.24	-31.24	-25.0	Pass	CSE-2
5,000-6,000	-35.61	-32.61	-25.0	Pass	CSE-3
6,000-10,000	-59.21	-56.21	-25.0	Pass	CSE-4
10,000 – 15,000	-58.04	-55.04	-25.0	Pass	CSE-5
15,000-26,500	-55.08	-52.08	-25.0	Pass	CSE-6
26,000-40,000	-43.0	-40.0	-25.0	Pass	Figure 7
40,000-50,000	-41.6	-38.6	-25.0	Pass	Figure 6

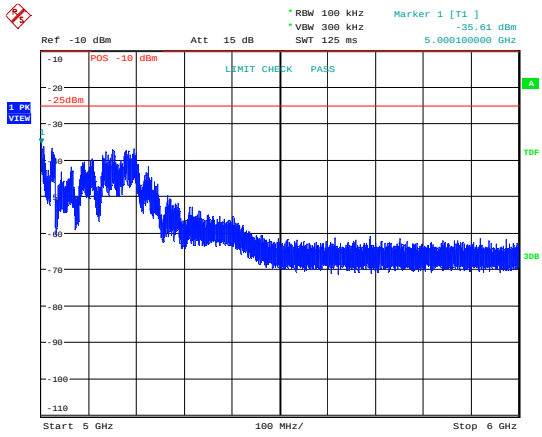
Table 9: Conducted spurious emissions RF-3



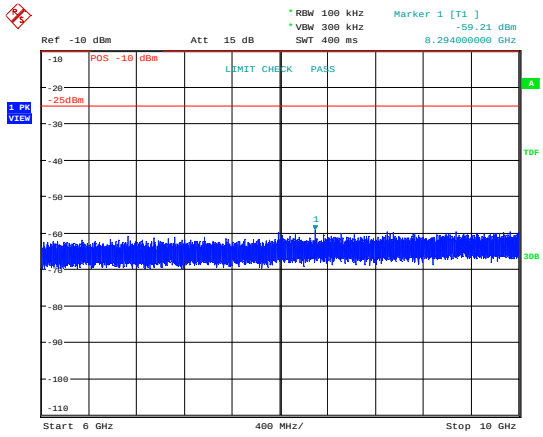
CSE-1



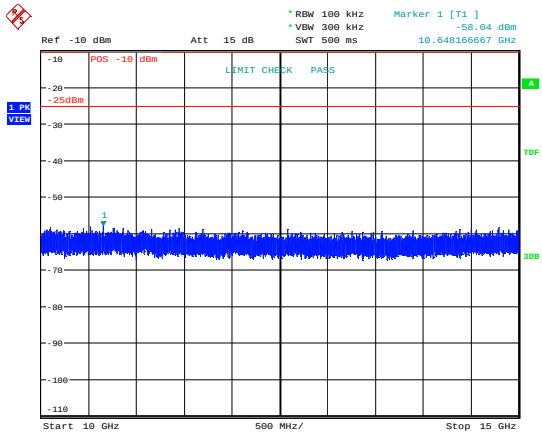
CSE-2



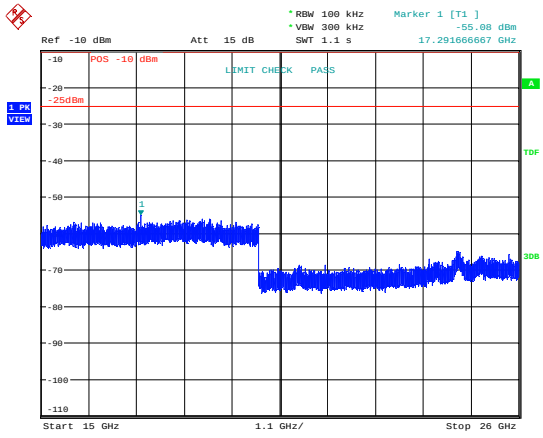
CSE-3



CSE-4

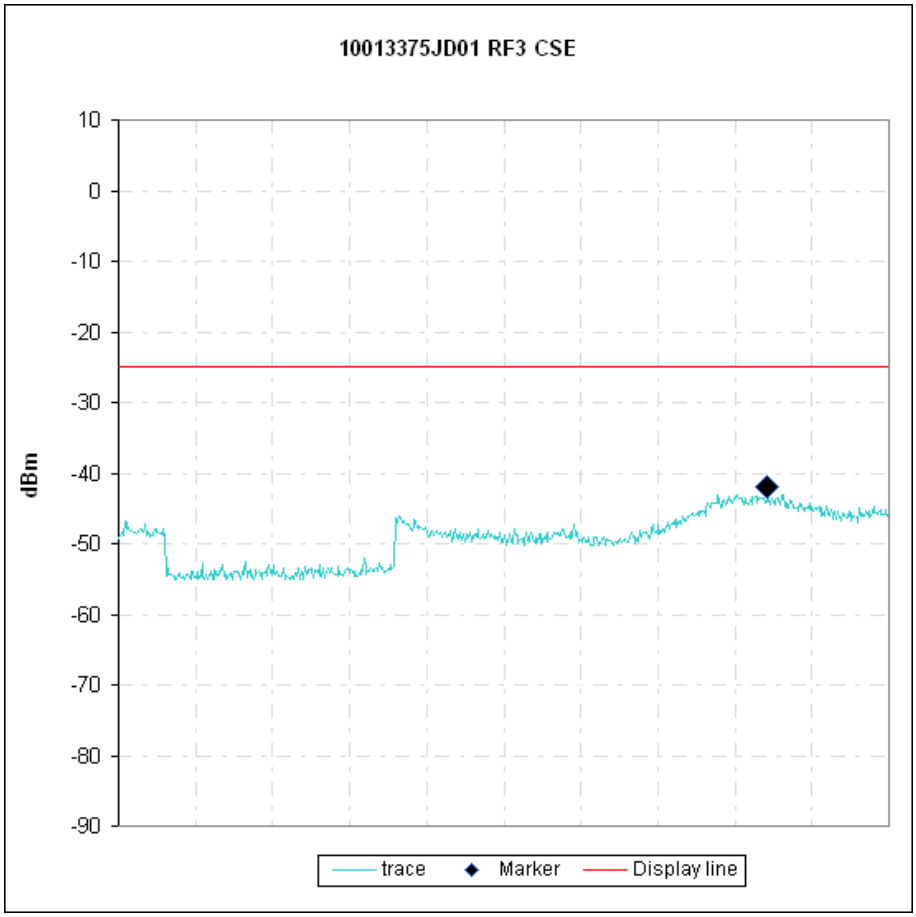


CSE-5



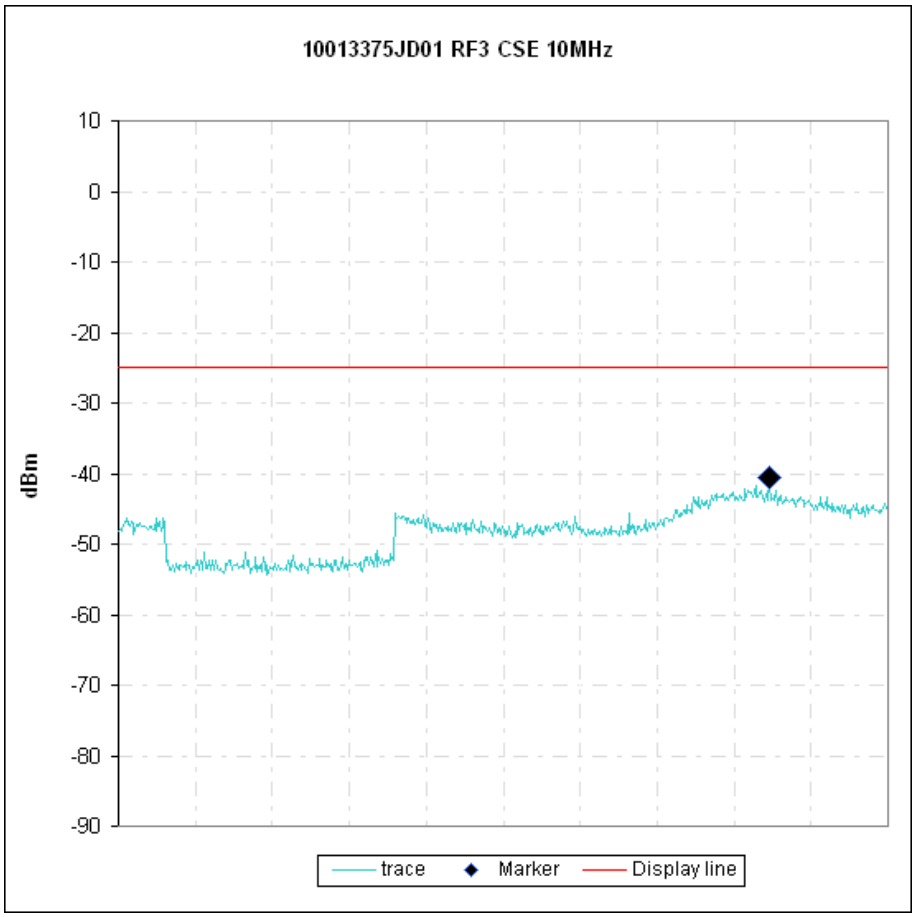
CSE-6

Figure 6: Conducted Spurious Emissions, 30 MHz to 26.5 GHz



RBW 1000 KHz; VBW 3000 KHz
Peak 37783.333 MHz; -43.0 dBm
Display line: -25 dBm
Start Freq: 26000 MHz
Stop Freq: 40000 MHz
Ref Level Offset: 11.7 dB

Figure 7: Conducted Spurious Emissions, 26.0 to 40.0 GHz



RBW 1000 KHz; VBW 3000 KHz
Peak 37830.000 MHz; -41.6 dBm
Display line: -25 dBm
Start Freq: 26000 MHz
Stop Freq: 40000 MHz
Ref Level Offset: 11.7 dB

Figure 8: Conducted Spurious Emissions, 40.0 to 50.0 GHz

13 Peak excursion

13.1 Requirement

09.1215(e) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

13.2 Test method

The equipment was configured as per figure 1 and the measurements were made conducted using two traces of the FSQ which was gated to only perform measurement during the ON time of the transmitter:

- Trace 1 was made using Peak detector
- Trace 2 was made using RMS detector

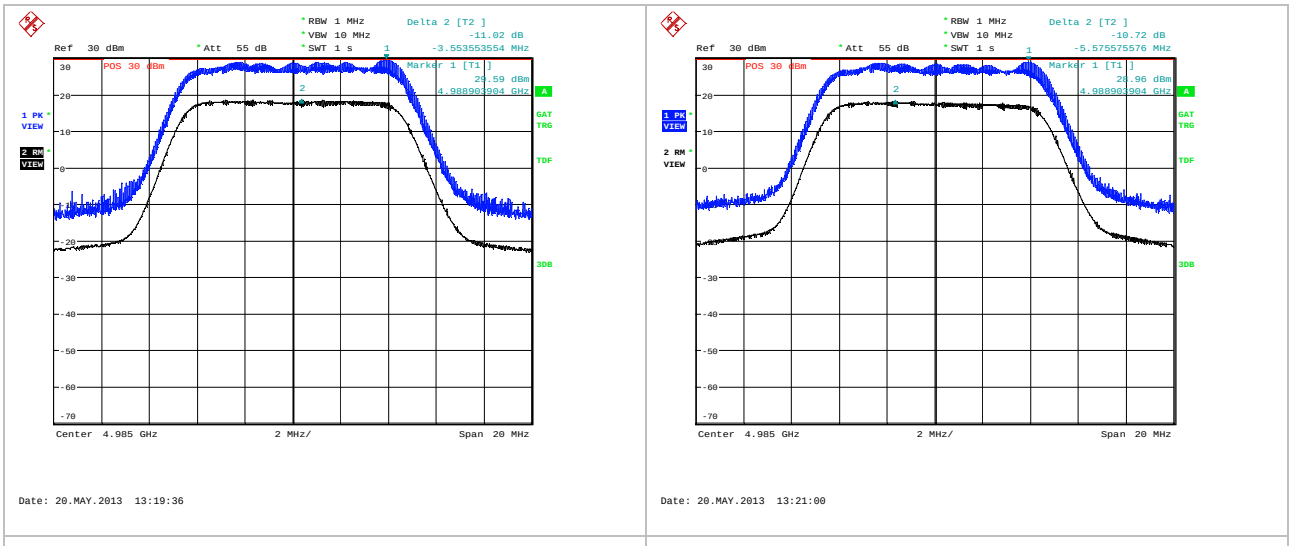
The following spectrum analyser settings were used: RBW of 1 MHz and VBW of 10 MHz.

The maximum difference was determines using trace markers and peak search and the result compared against the limit.

13.3 Test results

Channel Bandwidth	TX Freq (MHz)	Port	Peak excursion (dBm)	limit (dBm)	Result
10	4985.0	RF3	11.0	13.0	Pass
		RF1	10.7		

Table 10: Peak excursion test results



RF3, 10 MHz channel	RF1, 10 MHz channel

Figure 9: Peak Excursion plots