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RF Test Report:

Airspan AirSynergy A25a

FCC ID:O2J-255AS

SC_TR_87_B

Prepared for:
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Contents

Tables

Figures

1 Revision History

Revision	Originator	Date	Comment
A	C Blackham	07 June 2013	1st release
B	C Blackham	20 June 2013	Added radiated emissions and mains conducted emissions results

2 Purpose

This document details the Airspan AirSynergy base station, model number SYN-CN-00-0A25A-000, designed for operation in the 2500 – 2572 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 CRF27	Title 47 Code of Federal Regulations Part 27: Miscellaneous wireless communication 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

Conducted Emissions (sections 8 to 12)
Testing was performed by Charlie Blackham of Sulis Consultants Ltd at Airspan Communications offices on 6th June 2013.

Radiated Emissions and Mains Conducted emissions (sections 13 and 14)
Testing was performed by Dan Winstanley of TRaC Global Ltd at:
Chamber No.1, TRaC Global Ltd, Unit 1, Pendle Place, Skelmersdale, WN8 9PN, United Kingdom
FCC Registration number 444512

4.3 Test sample

The results herein only refer to sample detailed in section 6

5 Product Description

The Airsynergy unit supports operation with 5 and 10[1] 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
- 256QAM

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.

Frequency of operation is aligned with EBS channels and operates within the 2500 – 2572 MHz band
5 MHz channels: Centre frequencies of 2503 to 2569 MHz
10 MHz channels Centre frequencies of 2506 to 2566 MHz

[1] BRS/ERS equipment in 2500-2690 MHz band may use channel bandwidths greater than 6 MHz as permitted in 27.1220, i.e. 2x 6 MHz blocks or 12 MHz for 10 MHz channels.

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-CN-00-0A25A-000	BB board A050CAFFF4F8

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 (sections 8 to 12)

Description	Manufacturer	Name	Serial Number	Calibration certificate
Receiver	Rohde & Schwarz	FSQ 26	200108	R&S Ref 38232
Signal Generator	Rohde & Schwarz	SMB100A03	175535	R&S 20-400919 16 Dec 2012
Attenator	MCL	BW-N10W20+	1224	Calibrated in-situ and loaded as Transducer Factor
RF cable	Sucoflex	104	5884/4	

Table 3: Test Equipment for conducted tests

6.4 Test equipment (section 13 and 14)

TRaC No	Equipment Type	Equipment Description	Manufacturer	Due For Cal[2]
UH387	ATS	Chamber 1	Rainford EMC	24/06/2013
UH403	ESCI 7	Recevier	R&S	27/06/2013
UH420	CBL6112	Bilog	Chase	06/07/2014
REF909	FSU26	Spectrum Analyser	R&S	04/02/2014
L138	3115	1-18GHz Horn	EMCO	08/11/2013
L572	8449B	Pre Amp	Agilent	12/12/2014
L300	20240-20	Horn 18-26GHz (&UH330)	Flann	17/11/2013
UH330	N/A	K type transition	Maury M'wave	Calibrated with L300
UH03	ESHS10	EMI receiver	R&S	08/05/1014
UH396	ENV216	LISN	R&S	30/04/2014
Eirp Substitution				
L139	3115	1-18GHz Horn	EMCO	14/09/2013
UH345	83711B	Signal Generator	HP	Not Calibrated[3]

[2] Calibration records maintained by TRaC under UKAS accreditation.
[3] Transmit signal level is measured at input to antenna using calibrated spectrum analyser

6.5 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.

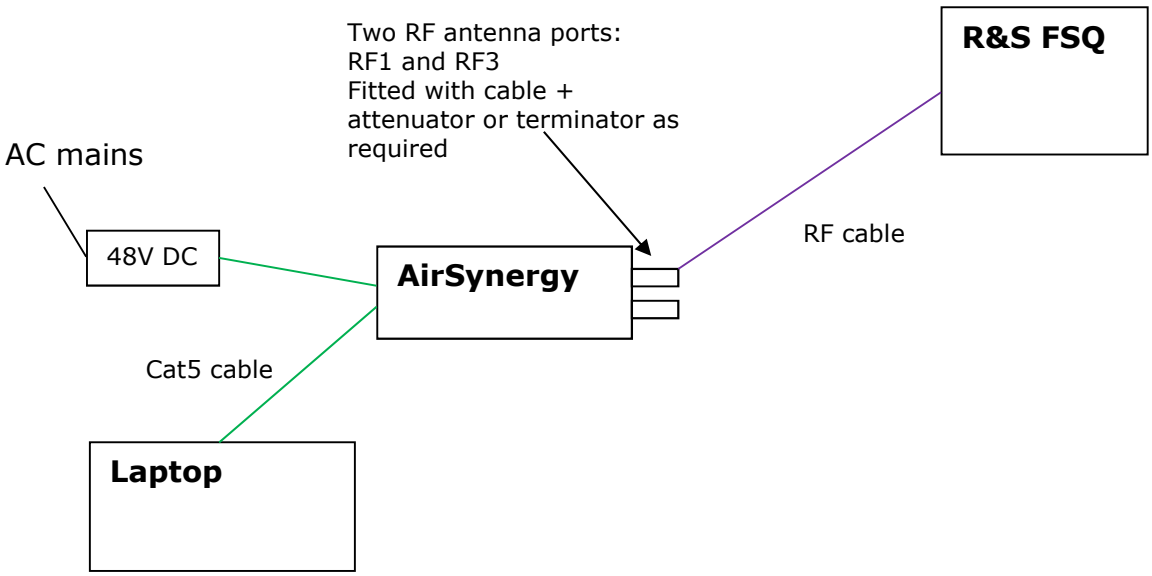


Figure 1: Airsynergy configuration for test

7 Summary of Tests performed

Test	47 CFR Part	Limit	Result	Section
Transmit Power	27.50(h)(1)	62.3 / 63.3 dBm EIRP	Pass	8
Spectral Power Density	27.50(h)(4)	45.23 dBm/MHz EIRP	Pass	9
Conducted Spurious Emissions at Band Edge	27.53(m)(2) 2.1051	-13.0 dBm	Pass	10
Conducted Spurious Emissions	27.53(m)(2) 2,1051	-13.0 dBm	Pass	11
Occupied Bandwidth	2.1049	None	Pass	12
Radiated Spurious Emission	27.53(m)(2) 2,1051	-13.0 dBm	Pass	13
Mains Conducted Emission	15.109	As per graph	Pass	14

Table 4: Summary of tests performed

8 Transmit Power 47CFR25.50(h)

8.1 Requirement and test method

(h) The following power limits shall apply in the BRS and EBS:

(1) Main, booster and base stations.

(i) The maximum EIRP of a main, booster or base station shall not exceed 33 dBW + 10log(X/Y) dBW, where X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is in the LBS and UBS following transition, except as provided in paragraph (h)(1)(ii) of this section.

(ii) If a main or booster station sectorizes or otherwise uses one or more transmitting antennas with a non-omnidirectional horizontal plane radiation pattern, the maximum EIRP in dBW in a given direction shall be determined by the following formula: EIRP = 33 dBW + 10 log(X/Y) dBW + 10 log(360/beamwidth) dBW, where X is the actual channel width in MHz, Y is either (i) 6 MHz if prior to transition or the station is in the MBS following transition or (ii) 5.5 MHz if the station is in the LBS and UBS following transition, and beamwidth is the total horizontal plane beamwidth of the individual transmitting antenna for the station or any sector measured at the half-power points

The worst case scenario is found using a value for Y of 6 MHz and not adding any additional permitted power for antenna directionality. The limits that are applied are therefore:

5 MHz channels: 33 dBW + 10log(5/6) = 33 – 0.792 = 32.31 dBW (62.31 dBm)
10 MHz channels: 33 dBW + 10log(6/6) = 33 + 0.0 = 33.00 dBW (63.00 dBm)

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.

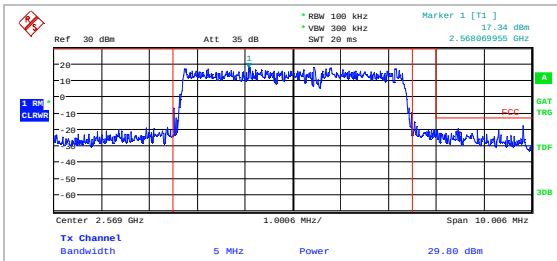
Power was measured using the in-built channel power measuring function

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

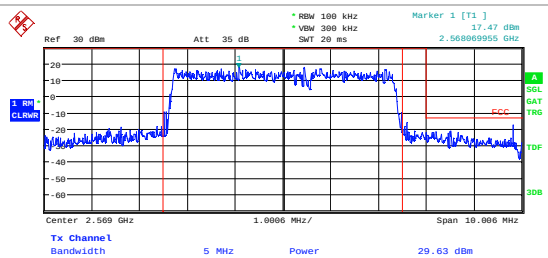
8.2 Test results

Channel Bandwidth	TX Freq (MHz)	Port	TX power (dBm)	Summed TX power (dBm)	Summed TX power EIRP[4] (dBm)	EIRP limit (dBm)	Result
5	2569.0	RF3	29.80	32.73	50.73	62.31	Pass
		RF1	29.63				
10	2566.0	RF3	30.12	33.09	51.09	63.33	Pass
		RF1	30.04				

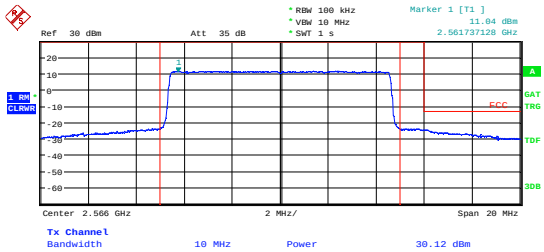
Table 5: Transmit power



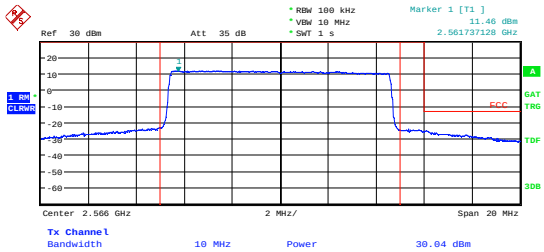
5 MHz channel, RF3



5 MHz channel, RF1



10 MHz channel, RF3



10 MHz channel, RF1

Figure 2: Transmit Power plots

[4] 18 dBi antenna

9 Spectral Power Density 27.50(h)(4)

9.1 Requirement and test method

(H)(4) For main, booster and response stations utilizing digital emissions with non-uniform power spectral density (e.g. unfiltered QPSK), the power measured within any 100 kHz resolution bandwidth within the 6 MHz channel occupied by the non-uniform emission cannot exceed the power permitted within any 100 kHz resolution bandwidth within the 6 MHz channel if it were occupied by an emission with uniform power spectral density, i.e. ……. 33.3 watts EIRP per 100 kHz bandwidth.

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 100 kHz and VBW of 300 kHz.

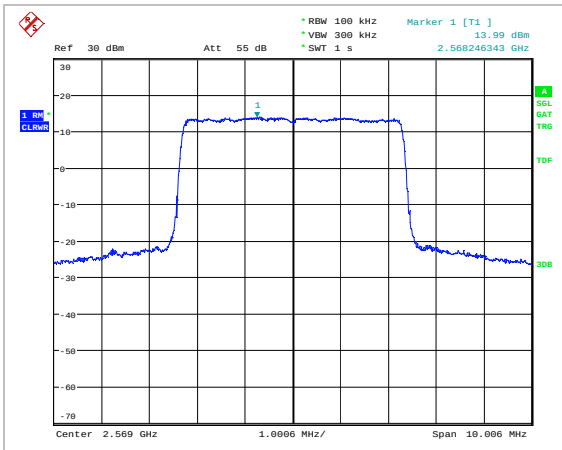
The total power was summed in accordance with KDB662911D01 and the result compared against the limit.

9.2 Test results

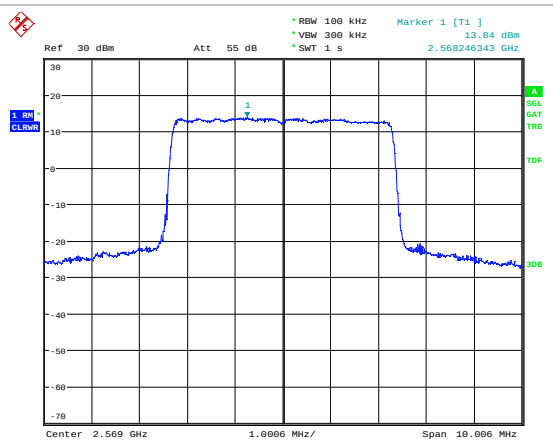
Channel Bandwidth	TX Freq (MHz)	Port	TX power (dBm)	Summed TX power (dBm)	Summed TX power EIRP[5] (dBm)	EIRP limit (dBm)	Result
5	2569.0	RF3	13.99	16.93	34.93	45.23	Pass
		RF1	13.84				
10	2566.0	RF3	11.51	14.34	32.34	45.23	Pass
		RF1	11.14				

Table 6: Transmit power spectral density

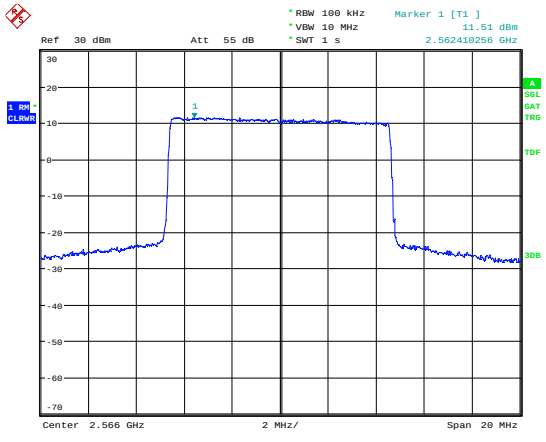
[5] 18 dBi antenna



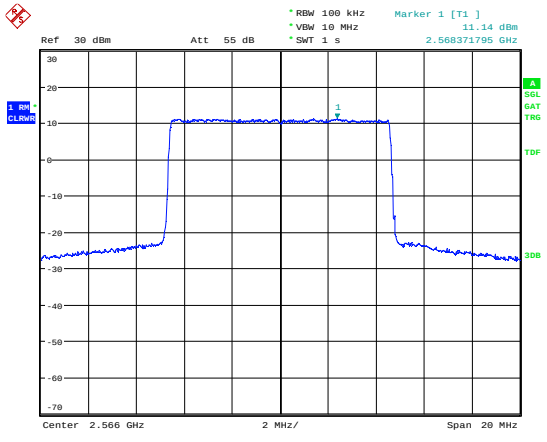
5 MHz channel, RF3



5 MHz channel, RF1



10 MHz channel, RF3



10 MHz channel, RF1

Figure 3: Transmit power spectral density plots

10 Conducted Band Edge 27.53(m)(2)

10.1 Requirement and test method

(m) For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts in accordance with the standards below. If a licensee has multiple contiguous channels, out-of-band emissions shall be measured from the upper and lower edges of the contiguous channels.

(2) For digital base stations, the attenuation shall be not less than 43 + 10 log (P) dB

Attenuation of 43+10log(P) dBm equates to an absolute limit of -13dBm. As this requirement originates as a relative limit, measurements are performed on each channel individually and compared to the limit.

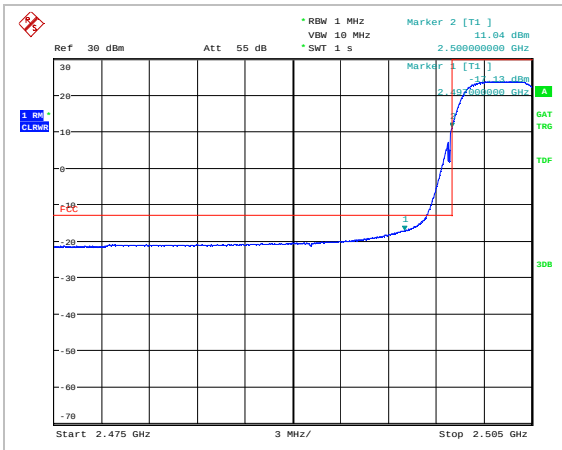
This test was performed at top and bottom of the band. The equipment was configured as per figure 1 and the measurements made gated using the RMS detector of the FSQ.

10.2 Results

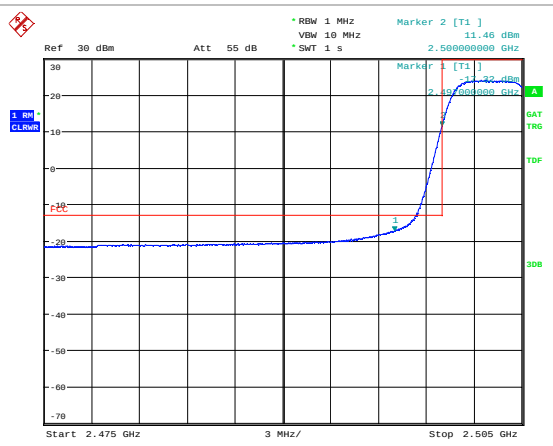
Channel	Measurement range (MHz)	Port	Max Emission (dBm)	Limit (dBm)	Graph
2503.0	2475 - 2505	3	-14.80	-13.0	CEM-5-1 CEM-5-1-CP
		1	-14.41	-13.0	CEM-5-2 CEM-5-2-CP
2569.0	2565 - 2595	3	-14.45	-13.0	CEM-5-3 CEM-5-3-CP
		1	-15.30	-13.0	CEM-5-4 CEM-5-4-CP
2506.0	2475 - 2505	3	-14.99	-13.0	CEM-10-1 CEM-10-1-CP
		1	-14.07	-13.0	CEM-10-2 CEM-10-2-CP
2566.0	2565 - 2595	3	-16.26	-13.0	CEM-10-3 CEM-10-3-CP
		1	-17.10	-13.0	CEM-10-4 CEM-10-4-CP

Table 7: Conducted Emissions masks results

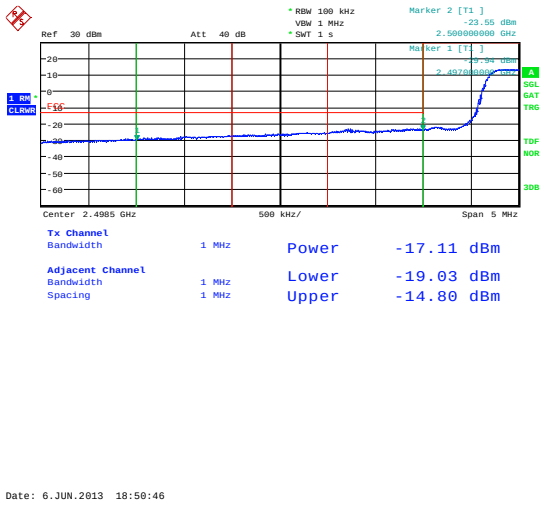
Band edge measurements failed to meet the mask when measured using a 1 MHz BW so the 3 MHz band nearest to the transmit signal was measured using the channel power measurement capability of the FSQ prior to comparing the measurement against the limit. These were performed as a channel power and two adjacent channel power measurements to measure the three 1 MHz bandwidths.



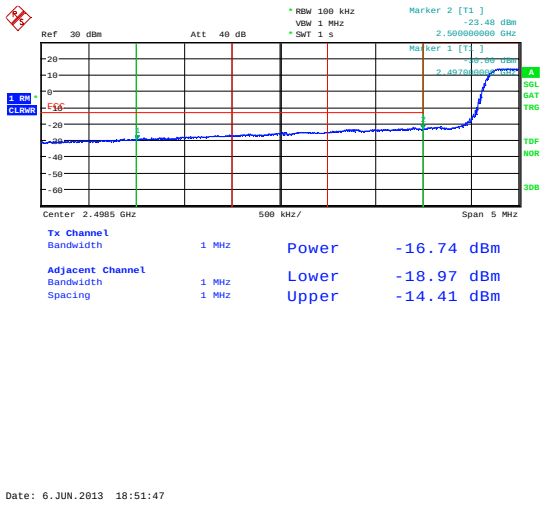
CEM-5-1



CEM-5-2

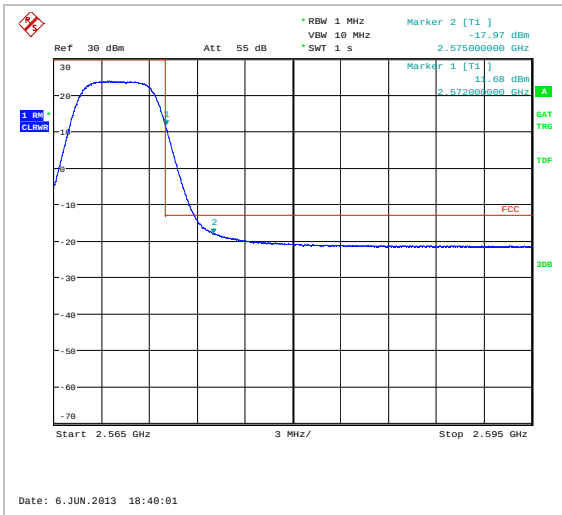


CEM-5-1-CP

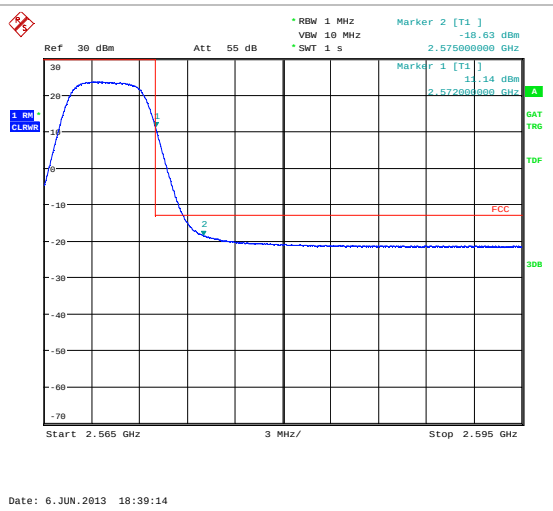


CEM-5-2-CP

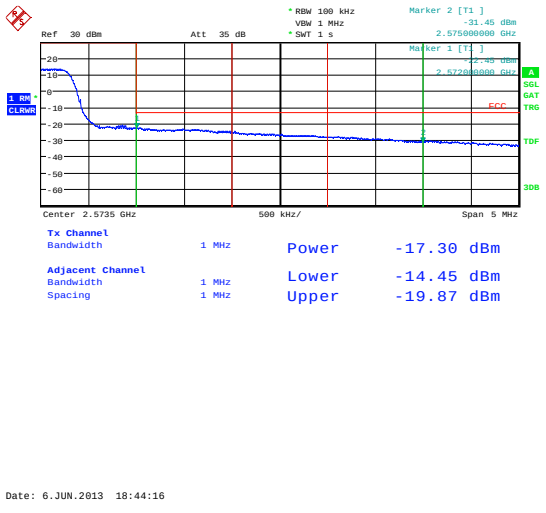
Figure 4: Conducted Emissions masks plots: 2305 MHz (5 MHz channels)



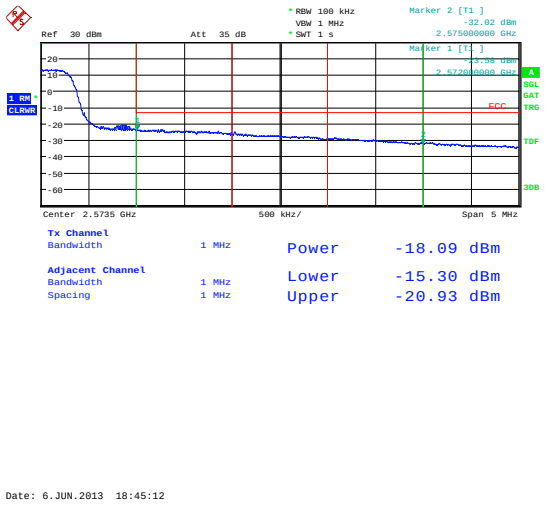
CEM-5-3



CEM-5-4

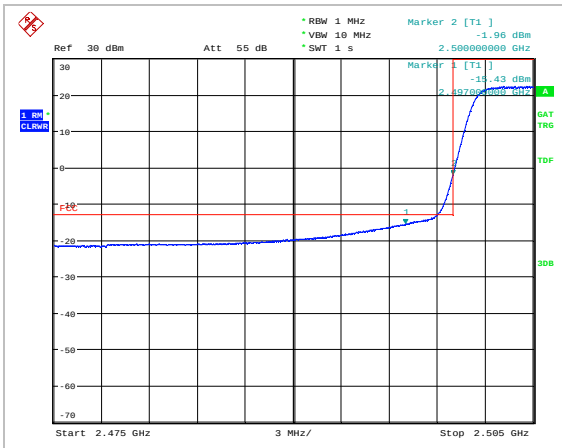


CEM-5-3-CP

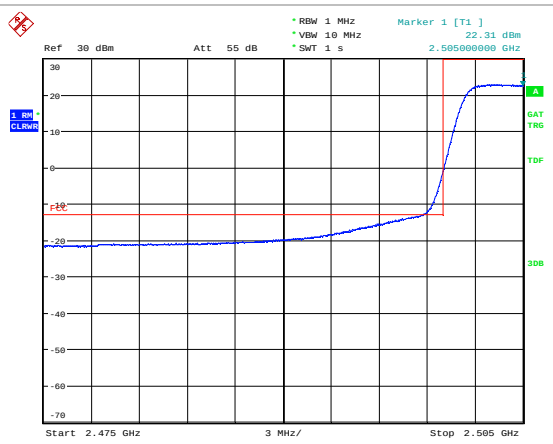


CEM-5-4-CP

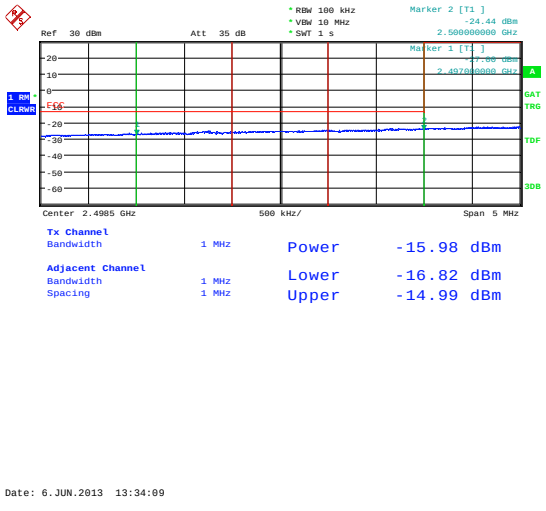
Figure 5: Conducted Emissions masks plots: 2369 MHz (5 MHz channels)



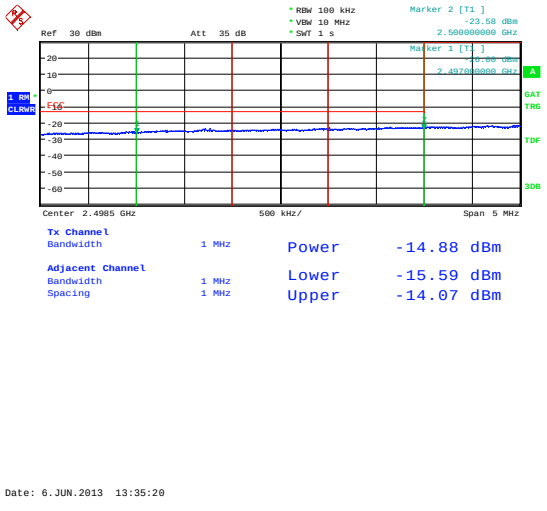
CEM-10-1



CEM-10-2

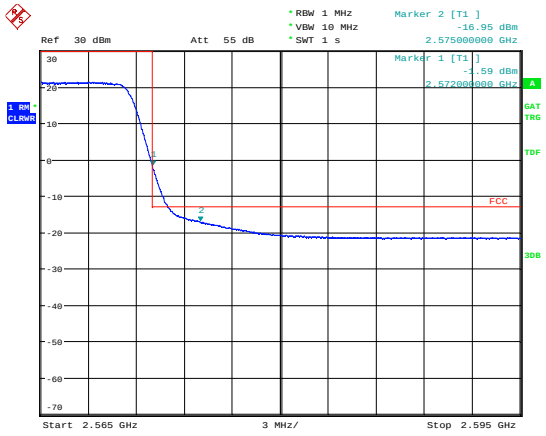


CEM-10-1-CP

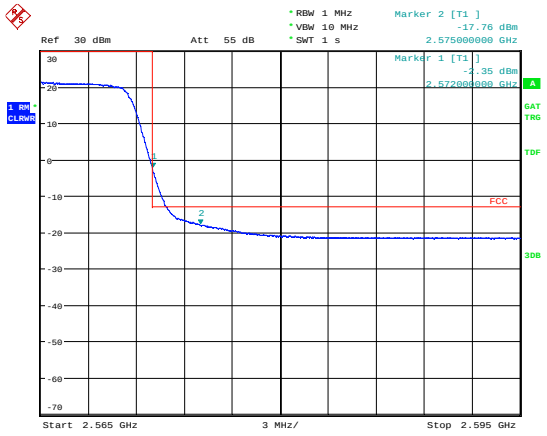


CEM-10-2-CP

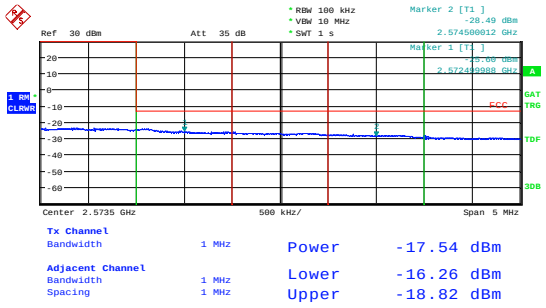
Figure 6: Conducted Emissions masks plots; 2506 MHz (10 MHz channels)



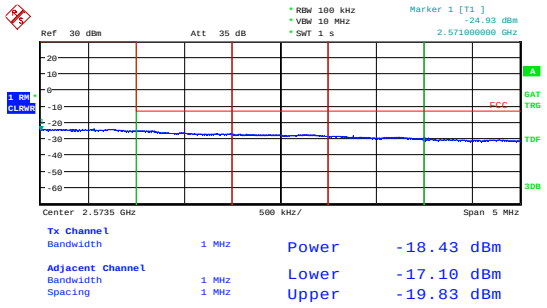
CEM-10-3



CEM-10-4



CEM-10-3-CP



CEM-10-4-CP

Figure 7: Conducted Emissions masks plots; 2566 MHz (10 MHz channels)

11 Conducted Spurious Emissions

11.1 Requirement and test method

(m) For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts in accordance with the standards below. If a licensee has multiple contiguous channels, out-of-band emissions shall be measured from the upper and lower edges of the contiguous channels.

(2) For digital base stations, the attenuation shall be not less than 43 + 10 log (P) dB

Attenuation of 43+10log(P) dBm equates to an absolute limit of -13dBm

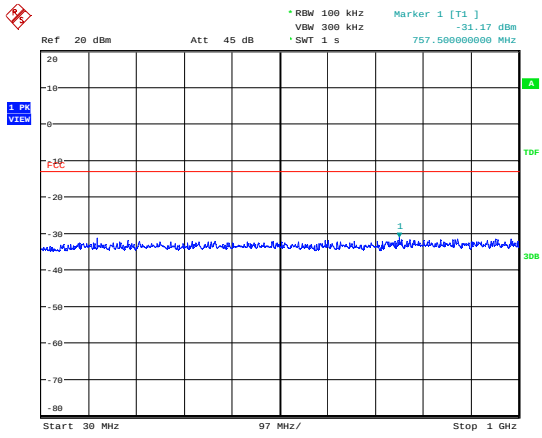
Initial scan was performed on top channel using peak detector and max-hold on port RF-3 which had the highest transmit power.

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.

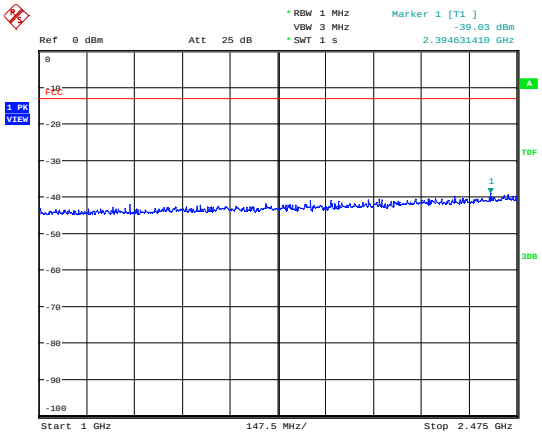
11.2 Results

Bandwidth	Frequency Range	Maximum emission (Measured)	Maximum emission (calculated)	Limit (dBm)	Result	Plot
5 MHz	30-1000 MHz	-31.17	-28.17	-13.0	Pass	CSE-1
	1000-2,475 MHz	-39.03	-36.03	-13.0	Pass	CSE-2
	2595 MHz– 5 GHz	-37.90	-34.90	-13.0	Pass	CSE-3
	5 – 15 GHz	-39.01	-36.01	-13.0	Pass	CSE-4
	15 – 26 GHz	-37.55	-34.55	-13.0	Pass	CSE-5
10 MHz	30-1000 MHz	-33.0	-30.0	-13.0	Pass	CSE-6
	1000-2,475 MHz	-39.5	-36.5	-13.0	Pass	CSE-7
	2595 MHz– 5 GHz	-38.1	-35.1	-13.0	Pass	CSE-8
	5 – 15 GHz	-40.5	-37.5	-13.0	Pass	CSE-9
	15 – 26 GHz	-32.4	-29.4	-13.0	Pass	CSE-10

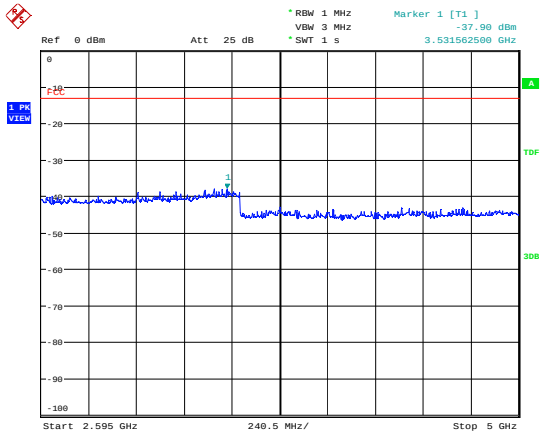
Table 8: Conducted spurious emissions RF-3



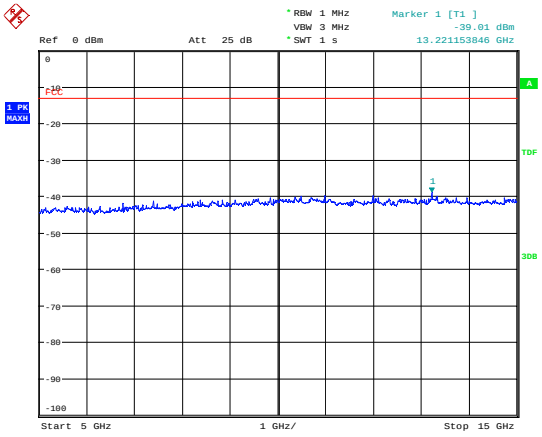
CSE-1



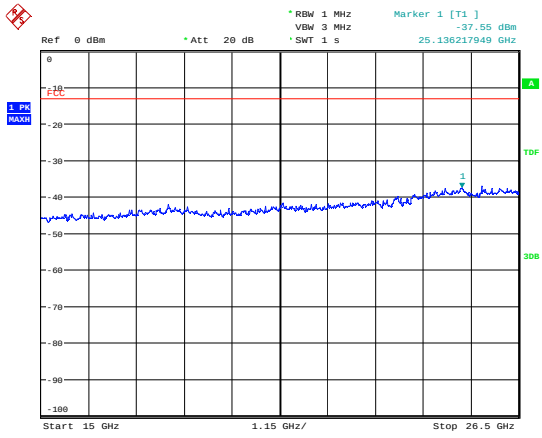
CSE-2



CSE-3

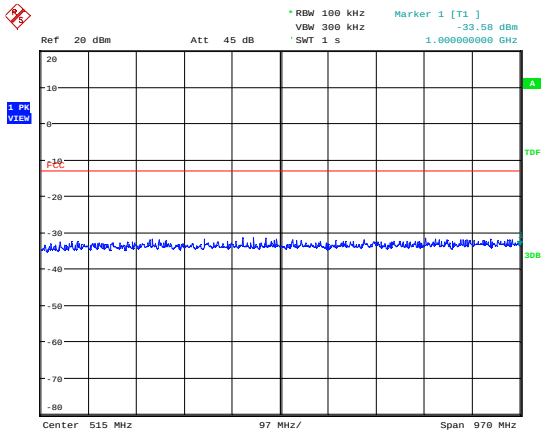


CSE-4

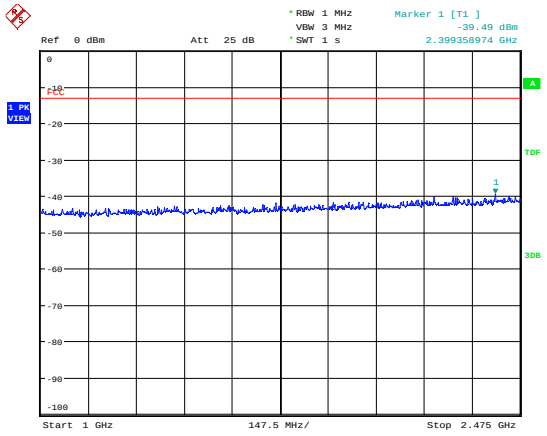


CSE-5

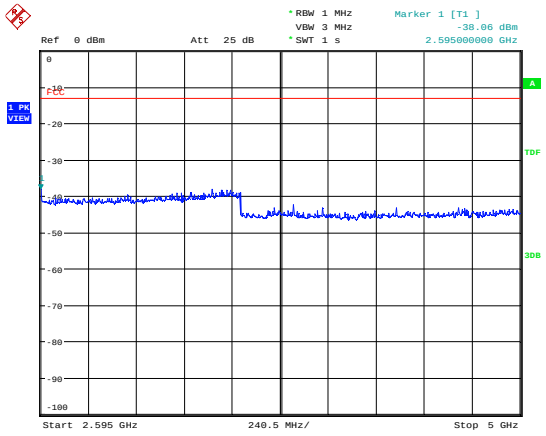
Figure 8: Conducted Spurious Emissions, 5 MHz channels



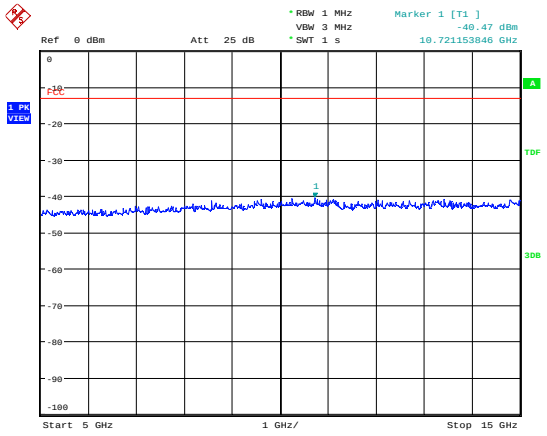
CSE-6



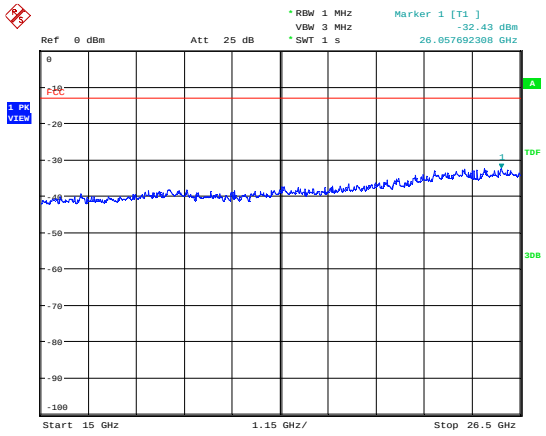
CSE-7



CSE-8



CSE-9



CSE-10

Figure 9: Conducted Spurious Emissions, 10 MHz channels

12 Occupied Bandwidth

The occupied bandwidth was measured using the inbuilt function on the FSQ. Measurement was made using RMS detector and gated measurement.

Channel Bandwidth	TX Freq (MHz)	Port	Bandwidth (MHz)	Result
5	2569.0	RF3	4.567	For information
		RF1	4.607	For information
10	2566.0	RF3	9.135	For information
		RF1	9.135	For information

Table 9: Occupied Bandwidth test results

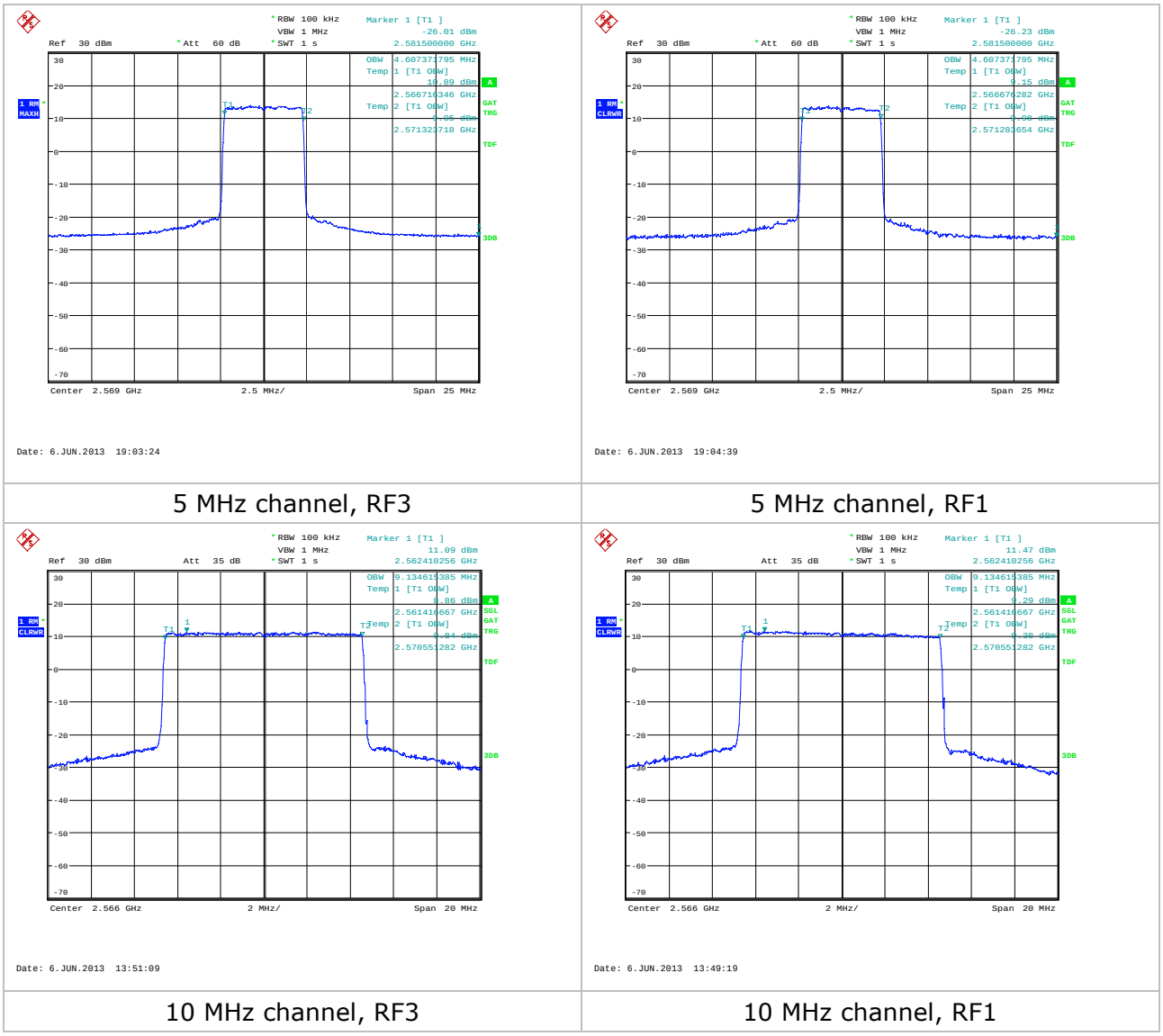


Figure 10: Occupied Bandwidths